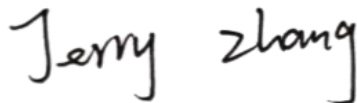


RF Test Report

Applicant: Quectel Wireless Solutions Co., Ltd.
Address: Building 5, Shanghai Business Park Phase III (Area B), No.1016
Tianlin Road, Minhang District, Shanghai, 200233 China
Product: LTE Cat1 bis Module
Model No.: EG915Q-AF
Brand Name: QUECTEL
FCC ID: XMR2024EG915QAF
Standards: 47 CFR Part 22
47 CFR Part 24
47 CFR Part 27
47 CFR Part 90
Report No.: PD20240057RF01
Issue Date: 2024/05/31
Test Result: PASS *

* The above equipment has been tested and compliance with the requirement of the relative standards by Hefei Panwin Technology Co., Ltd.



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

TEL: +86-0551-63811775

Revision History

| Report No. | Version | Description | Issue Date | Note |
|----------------|---------|----------------|------------|-------|
| PD20240057RF01 | 1 | Initial Report | 2024/05/31 | Valid |

CONTENTS

| | |
|--|-----------|
| 1 Test Laboratory | 11 |
| 1.1 Notes of the Test Report | 11 |
| 1.2 Test Facility | 11 |
| 1.3 Testing Laboratory | 11 |
| 2 General Description of Equipment under Test | 11 |
| 2.1 Details of Application | 11 |
| 2.2 Details of EUT | 12 |
| 2.3 Frequency List of Low/Middle/High Channels | 14 |
| 2.4 Applied Standards | 17 |
| 3 Test Condition | 18 |
| 3.1 Test Environmental Conditions | 18 |
| 3.2 Test Configuration | 18 |
| 3.3 Equipment List | 19 |
| 3.4 Test Uncertainty | 20 |
| 4 Test Items Description | 21 |
| 4.1 RF Output Power & Effective (Isotropic) Radiated Power | 21 |
| 4.2 EIRP Power Density | 22 |
| 4.3 Peak-to-Average Ratio | 23 |
| 4.4 Occupied Bandwidth | 24 |
| 4.5 Conducted Band Edge Measurement | 25 |
| 4.6 Spurious Emissions at Antenna Terminals | 26 |
| 4.7 Frequency Stability | 27 |
| 4.8 Radiated Spurious Emission | 28 |
| Appendixes | 30 |

Test Summary

LTE Band 2

| No. | Test Case | FCC Rules | Limit | Verdict |
|-----|--|------------------------|--|-------------|
| 1 | RF Output Power & Effective Radiated Power | §2.1046, §24.232(c) | EIRP ≤2 Watt | PASS |
| 2 | Peak-to-Average Ratio | §24.232(d) | ≤13 dB | PASS |
| 3 | Occupied Bandwidth | §2.1049 | No limit. | Report Only |
| 4 | Conducted Band Edge Measurement | §2.1051, §24.238(a) | ≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. | PASS |
| 5 | Spurious Emissions at Antenna Terminals | §2.1051, §24.238(a) | ≤ -13 dBm/1 MHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. | PASS |
| 6 | Radiated Spurious Emission | §2.1053, §24.238(a) | ≤ -13 dBm/1 MHz. | PASS |
| 7 | Frequency Stability | §2.1055 §24.235 | Within authorized bands of operation/frequency block. | PASS |

LTE Band 4 /66

| No. | Test Case | FCC Rules | Limit | Verdict |
|-----|--|--------------------------|--|-------------|
| 1 | RF Output Power & Effective Radiated Power | §2.1046, §27.50(d)(4) | EIRP ≤ 1 Watt | PASS |
| 2 | Peak-to-Average Ratio | §27.50(d)(5) | ≤13 dB | PASS |
| 3 | Occupied Bandwidth | §2.1049 | No limit. | Report Only |
| 4 | Conducted Band Edge Measurement | §2.1051, §27.53(h) | ≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. | PASS |
| 5 | Spurious Emissions at Antenna Terminals | §2.1051, §27.53(h) | ≤ -13 dBm/1 MHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. | PASS |
| 6 | Radiated Spurious Emission | §2.1053, §27.53(h) | ≤ -13 dBm/1 MHz. | PASS |
| 7 | Frequency Stability | §2.1055 §27.54 | Within authorized bands of operation/frequency block. | PASS |

LTE Band 5

| No. | Test Case | FCC Rules | Limit | Verdict |
|-----|--|---------------------------|---|-------------|
| 1 | RF Output Power & Effective Radiated Power | §2.1046 §22.913 (a)(5) | ERP ≤ 7 Watt | PASS |
| 2 | Peak-to-Average Ratio | §22.913 (d) | ≤13 dB | PASS |
| 3 | Occupied Bandwidth | §2.1049 | No limit. | Report Only |
| 4 | Conducted Band Edge Measurement | §2.1051 §22.917 (a) | ≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block. | PASS |
| 5 | Spurious Emissions at Antenna Terminals | §2.1051 §22.917(a) | FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. | PASS |
| 6 | Radiated Spurious Emission | §2.1053 §22.917(a) | FCC: ≤ -13 dBm/100 kHz. | PASS |
| 7 | Frequency Stability | §2.1055 §22.355 | < ±2.5 ppm | PASS |

LTE Band 12

| No. | Test Case | FCC Rules | Limit | Verdict |
|-----|--|---------------------------|--|-------------|
| 1 | RF Output Power & Effective Radiated Power | §2.1046, §27.50(c)(10) | ERP ≤ 3 Watt | PASS |
| 2 | Peak-to-Average Ratio | -- | ≤13 dB | PASS |
| 3 | Occupied Bandwidth | §2.1049 | No limit. | Report Only |
| 4 | Conducted Band Edge Measurement | §2.1051, §27.53(g) | For operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed. | PASS |
| 5 | Spurious Emissions at Antenna Terminals | §2.1051, §27.53(g) | FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. | PASS |
| 6 | Radiated Spurious Emission | §2.1053, §27.53(g) | FCC: ≤ -13 dBm/100 kHz. | PASS |
| 7 | Frequency Stability | §2.1055 §27.54 | Within authorized bands of operation/frequency block. | PASS |

LTE Band 13

| No. | Test Case | FCC Rules | Limit | Verdict |
|-----|--|------------------------------------|---|-------------|
| 1 | RF Output Power & Effective Radiated Power | §2.1046, §27.50(b)(10) | ERP ≤ 3 Watt | PASS |
| 2 | Peak-to-Average Ratio | -- | ≤13 dB | PASS |
| 3 | Occupied Bandwidth | §2.1049 | No limit. | Report Only |
| 4 | Conducted Band Edge Measurement | §2.1051, §27.53(c) | <p>On any frequency outside the 776–788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;</p> <p>Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;</p> | PASS |
| 5 | Spurious Emissions at Antenna Terminals | §2.1051, §27.53(c) §27.53(f) | <p>FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.</p> <p>On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;</p> <p>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 equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.</p> | PASS |
| 6 | Radiated Spurious Emission | §2.1053, §27.53(c) §27.53(f) | <p>FCC: ≤ -13 dBm/100 kHz.</p> <p>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 equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.</p> | PASS |
| 7 | Frequency Stability | §2.1055 §27.54 | Within authorized bands of operation/frequency block. | PASS |

LTE Band 14

| No. | Test Case | FCC Rules | Limit | Verdict |
|-----|--|--------------------------------------|---|-------------|
| 1 | RF Output Power & Effective Radiated Power | §2.1046, §90.542(d) | ERP ≤ 3 Watt | PASS |
| 2 | Peak-to-Average Ratio | -- | ≤13 dB | PASS |
| 3 | Occupied Bandwidth | §2.1049 | No limit. | Report Only |
| 4 | Emission Mask | §2.1051 §90.210(n) | <p>Transmitters designed for operation under this part on frequencies other than listed in this section must meet the emission mask requirements of Emission Mask B.</p> <p>Equipment operating under this part on frequencies allocated to but shared with the Federal Government, must meet the applicable Federal Government technical standards.</p> <p>Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.</p> <p>(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.</p> <p>(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.</p> | PASS |
| 5 | Conducted Band Edge Measurement | §2.1051, §90.543(e) (2)(3) | <p>(1)On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations.</p> <p>(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 65 + 10 log(P) dB in a 6.25 kHz band segment, for mobile and portable stations.</p> <p>(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10log (P) dB.</p> | PASS |
| 6 | Spurious Emissions at Antenna Terminals | §2.1051, §90.543(c) §90.543(f) | FCC: ≤ -13 dBm/100 kHz. For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to | PASS |
| 7 | Radiated Spurious Emission | §2.1053, §90.543(c) §90.543(f) | -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. | PASS |
| 8 | Frequency Stability | §2.1055 §90.213 | Within authorized bands of operation/frequency block. | PASS |

LTE Band 71

| No. | Test Case | FCC Rules | Limit | Verdict |
|-----|--|---------------------------|--|-------------|
| 1 | RF Output Power & Effective Radiated Power | §2.1046, §27.50(c)(10) | ERP ≤ 3 Watt | PASS |
| 2 | Peak-to-Average Ratio | -- | ≤13 dB | PASS |
| 3 | Occupied Bandwidth | §2.1049 | No limit. | Report Only |
| 4 | Conducted Band Edge Measurement | §2.1051, §27.53(g) | For operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed. | PASS |
| 5 | Spurious Emissions at Antenna Terminals | §2.1051, §27.53(g) | FCC: ≤ -13 dBm/1 MHz, from 9 kHz to 10 th harmonics but outside authorized operating frequency ranges. | PASS |
| 6 | Radiated Spurious Emission | §2.1053, §27.53(g) | ≤ -13 dBm/1 MHz. | PASS |
| 7 | Frequency Stability | §2.1055 §27.54 | within the authorized bands of operation. | PASS |

Conducted detection date: 2024/04/19 to 2024/05/30

Radiated detection date: 2024/04/28 to 2024/05/11

Date of Sample Received: 2024/04/19

- We, Hefei Panwin Technology Co., Ltd., would like to declare that the tested sample has been evaluated in accordance with the procedures given in applied standard(s) in **Section 2.4** of this report and shown compliance 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.

1 Test Laboratory

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

FCC (Designation Number: CN1361, Test Firm Registration Number: 473156)

Hefei Panwin Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

A2LA (Certificate Number: 6849.01)

Hefei Panwin Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

1.3 Testing Laboratory

| | |
|---------------------|--|
| Company Name | Hefei Panwin Technology Co., Ltd. |
| Address | Floor 1, Zone E, Plant 2#, Mingzhu Industrial Park, No.106 Chuangxin Avenue, High-tech Zone, Hefei City, Anhui Province, China |
| Telephone | +86-0551-63811775 |
| Post Code | 230031 |

2 General Description of Equipment under Test

2.1 Details of Application

| | |
|-----------------------------|---|
| Applicant | Quectel Wireless Solutions Co., Ltd. |
| Applicant Address | Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, 200233 China |
| Manufacturer | Quectel Wireless Solutions Co., Ltd. |
| Manufacturer Address | Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, 200233 China |

2.2 Details of EUT

| | | | | | | | | | | |
|--|------------------|--|----------|----------|-----------|----------------------|-----------|-----------------|-----------------|--------------|
| Product | | LTE Cat1 bis Module | | | | | | | | |
| Model | | EG915Q-AF | | | | | | | | |
| Hardware Version | | R1.0 | | | | | | | | |
| Software Version | | EG915QAFLGR01A01M04 | | | | | | | | |
| SN | | Conducted: E1Y24CK53000021 Radiated: E1Y24CK53000020 | | | | | | | | |
| E-UTRA Specification | | | | | | | | | | |
| Single Band | | FDD Band: 2, 4, 5, 12, 13, 14, 66, 71 | | | | | | | | |
| Power Class for LTE | | PC3 | | | | | | | | |
| Type of Modulation | | UL: QPSK, 16QAM DL: QPSK, 16QAM, 64QAM | | | | | | | | |
| Antenna Type | | <input checked="" type="checkbox"/> External <input type="checkbox"/> Integrated | | | | | | | | |
| Antenna Gain | | LTE Band 2: 1.59dBi | | | | LTE Band 13: 4.45dBi | | | | |
| | | LTE Band 4: 2.00dBi | | | | LTE Band 14: 3.63dBi | | | | |
| | | LTE Band 5: 2.29dBi | | | | LTE Band 66: 2.00dBi | | | | |
| | | LTE Band 12: 3.26dBi | | | | LTE Band 71: 1.66dBi | | | | |
| Frequency Band(s) | SISO Band | Supported Channel Bandwidth (MHz) | | | | | | Tx (MHz) | Rx (MHz) | |
| | | 1.4 | 3 | 5 | 10 | 15 | 20 | | | |
| | | LTE Band 2 | v | v | v | v | v | v | 1850 to 1910 | 1930 to 1990 |
| | | LTE Band 4 | v | v | v | v | v | v | 1710 to 1755 | 2110 to 2155 |
| | | LTE Band 5 | v | v | v | v | - | - | 824 to 849 | 869 to 894 |
| | | LTE Band 12 | v | v | v | v | - | - | 699 to 716 | 729 to 746 |
| | | LTE Band 13 | - | - | v | v | - | - | 777 to 787 | 746 to 756 |
| | | LTE Band 14 | - | - | v | v | - | - | 788 to 798 | 758 to 768 |
| | | LTE Band 66 | v | v | v | v | v | v | 1710 to 1780 | 2110 to 2200 |
| | LTE Band 71 | - | - | v | v | v | v | 663 to 698 | 617 to 652 | |
| 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. | | | | | | | | | | |

Support Equipment

| Equipment | Manufacturer | Description | Model | Serial Number |
|------------------|--------------|-------------|------------|---------------|
| EVB | QUECTEL | / | / | / |
| Power Adapter | STH | / | P12F050200 | / |
| USB cable | UGREEN | / | / | / |
| External Antenna | SDN | / | 4G-LTE | SAA30968A |

2.3 Frequency List of Low/Middle/High Channels

| LTE Band 2 Channel and Frequency List | | | | |
|---------------------------------------|------------------------|--------|--------|---------|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 1.4 | Channel | 18607 | 18900 | 19193 |
| | Frequency | 1850.7 | 1880 | 1909.3 |
| 3 | Channel | 18615 | 18900 | 19185 |
| | Frequency | 1851.5 | 1880 | 1908.5 |
| 5 | Channel | 18625 | 18900 | 19175 |
| | Frequency | 1852.5 | 1880 | 1907.5 |
| 10 | Channel | 18650 | 18900 | 19150 |
| | Frequency | 1855 | 1880 | 1905 |
| 15 | Channel | 18675 | 18900 | 19125 |
| | Frequency | 1857.5 | 1880 | 1902.5 |
| 20 | Channel | 18700 | 18900 | 19100 |
| | Frequency | 1860 | 1880 | 1900 |

| LTE Band 4 Channel and Frequency List | | | | |
|---------------------------------------|------------------------|--------|--------|---------|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 1.4 | Channel | 19957 | 20175 | 20393 |
| | Frequency | 1710.7 | 1732.5 | 1754.3 |
| 3 | Channel | 19965 | 20175 | 20385 |
| | Frequency | 1711.5 | 1732.5 | 1753.5 |
| 5 | Channel | 19975 | 20175 | 20375 |
| | Frequency | 1712.5 | 1732.5 | 1752.5 |
| 10 | Channel | 20000 | 20175 | 20350 |
| | Frequency | 1715 | 1732.5 | 1750 |
| 15 | Channel | 20025 | 20175 | 20325 |
| | Frequency | 1717.5 | 1732.5 | 1747.5 |
| 20 | Channel | 20050 | 20175 | 20300 |
| | Frequency | 1720 | 1732.5 | 1745 |

| LTE Band 5 Channel and Frequency List | | | | |
|---------------------------------------|------------------------|--------|--------|---------|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 1.4 | Channel | 20407 | 20525 | 20643 |
| | Frequency | 824.7 | 836.5 | 848.3 |
| 3 | Channel | 20415 | 20525 | 20635 |
| | Frequency | 825.5 | 836.5 | 847.5 |
| 5 | Channel | 20425 | 20525 | 20625 |
| | Frequency | 826.5 | 836.5 | 846.5 |
| 10 | Channel | 20450 | 20525 | 20600 |
| | Frequency | 829 | 836.5 | 844 |

| LTE Band 12 Channel and Frequency List | | | | |
|--|------------------------|--------|--------|---------|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 1.4 | Channel | 23017 | 23095 | 23173 |
| | Frequency | 699.7 | 707.5 | 715.3 |
| 3 | Channel | 23025 | 23095 | 23165 |
| | Frequency | 700.5 | 707.5 | 714.5 |
| 5 | Channel | 23035 | 23095 | 23155 |
| | Frequency | 701.5 | 707.5 | 713.5 |
| 10 | Channel | 23060 | 23095 | 23130 |
| | Frequency | 704 | 707.5 | 711 |

| LTE Band 13 Channel and Frequency List | | | | |
|--|------------------------|--------|--------|---------|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 5 | Channel | 23025 | 23230 | 23255 |
| | Frequency | 779.5 | 782 | 784.5 |
| 10 | Channel | 23230 | 23230 | 23230 |
| | Frequency | 782 | 782 | 782 |

| LTE Band 14 Channel and Frequency List | | | | |
|--|------------------------|--------|--------|---------|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 5 | Channel | 23305 | 23330 | 23355 |
| | Frequency | 790.5 | 793 | 795.5 |
| 10 | Channel | 23330 | 23330 | 23330 |
| | Frequency | 793 | 793 | 793 |

| LTE Band 66 Channel and Frequency List | | | | |
|--|------------------------|--------|--------|---------|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 1.4 | Channel | 131979 | 132322 | 132665 |
| | Frequency | 1710.7 | 1745 | 1779.3 |
| 3 | Channel | 131987 | 132322 | 132657 |
| | Frequency | 1711.5 | 1745 | 1778.5 |
| 5 | Channel | 131997 | 132322 | 132647 |
| | Frequency | 1712.5 | 1745 | 1777.5 |
| 10 | Channel | 132022 | 132322 | 132622 |
| | Frequency | 1715 | 1745 | 1775 |
| 15 | Channel | 132047 | 132322 | 132597 |
| | Frequency | 1717.5 | 1745 | 1772.5 |
| 20 | Channel | 132072 | 132322 | 132572 |
| | Frequency | 1720 | 1745 | 1770 |

| LTE Band 71 Channel and Frequency List | | | | |
|--|------------------------|--------|--------|---------|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 5 | Channel | 133147 | 133297 | 133447 |
| | Frequency | 665.5 | 680.5 | 695.5 |
| 10 | Channel | 133172 | 133297 | 133422 |
| | Frequency | 668 | 680.5 | 693 |
| 15 | Channel | 133197 | 133297 | 133397 |
| | Frequency | 670.5 | 680.5 | 690.5 |
| 20 | Channel | 133222 | 133297 | 133372 |
| | Frequency | 673 | 680.5 | 688 |

2.4 Applied Standards

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

47 CFR Part 2

47 CFR Part 22

47 CFR Part 24

47 CFR Part 27

47 CFR Part 90

ANSI C63.26-2015

FCC KDB 971168 D01 Power Meas License Digital Systems v03r01

FCC KDB 412172 D01 Determining ERP and EIRP v01r01

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

3 Test Condition

3.1 Test Environmental Conditions

During testing, environmental conditions are described below.

| Normal Configuration | | Extreme Configuration | | |
|----------------------|------|-----------------------|------------|-----------|
| Voltage | 3.8V | Voltage | High: 4.3V | Low: 3.3V |

3.2 Test Configuration

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.

| LTE | | | | | | | | | | |
|--|------------|------------|-------|-------|--------|----|------|----|----|----|
| Test Case | BW | Modulation | | | | RB | | CH | | |
| | | QPSK | 16QAM | 64QAM | 256QAM | 1 | full | L | M | H |
| RF Output Power & Effective (Isotropic) Radiated | all | v | v | -- | -- | v | v | v | v | v |
| Occupied Bandwidth | all | v | v | -- | -- | -- | v | -- | v | -- |
| Conducted Band Edge | all | v | -- | -- | -- | v | v | v | -- | v |
| Spurious Emissions at Antenna Terminals | all | v | -- | -- | -- | v | -- | v | v | v |
| Peak-to-Average Ratio | all | v | v | -- | -- | v | v | -- | v | -- |
| Frequency Stability | max | v | -- | -- | -- | -- | v | -- | v | -- |
| Radiated Spurious Emission | worst case | | | | | | | | | |

Note:

- 1.The mark " V " means that this configuration is chosen for testing.
- 2.The mark " -- " means that this bandwidth is not supported.
- 3.The device is investigated from 30Hz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported.
- 4.Frequency Stability : Normal Voltage = 3.8V ; Low Voltage =3.3V. ; High Voltage =4.3V
- 5.For radiation spurious emission, the worst cases were recorded for QPSK modulation in this report.

3.3 Equipment List

| Instrument | Manufacturer | Model | Asset No. | Cal. Interval | Cal. Due Date |
|-----------------------------|-------------------|---------------------|-----------|---------------|---------------|
| Conducted | | | | | |
| Base Station Simulator | R&S | CMW500 | PWC0052 | 1 Year | 2024/10/11 |
| Spectrum Analyzer | KEYSIGHT | N9020B | PWC0047 | 1 Year | 2024/10/10 |
| DC Power | KEYSIGHT | E3640A | PWC0046 | 1 Year | 2024/10/11 |
| Climate Chamber | Boyi | B-T-48C | PWC0051 | 1 Year | 2024/11/12 |
| Shielded Chamber | Mao Rui | MR534 | PWC0041 | 3 Years | 2026/08/26 |
| Coupling unit | COM-MW | Directional coupler | / | / | / |
| Test Software | Tonscend | JS1120 V3.1.46 | / | / | / |
| Radiated | | | | | |
| Receiver | R&S | ESR7 | PWB0023 | 1 Year | 2024/10/11 |
| Spectrum Analyzer | R&S | FSV3044 | PWB0024 | 1 Year | 2024/10/11 |
| TRILOG Broadband Antenna | Schwarzbeck | VULB9162 | PWB0029 | 1 Year | 2024/10/14 |
| Double-Ridged Guide Antenna | ETS-Lindgren | 3117 | PWB0031 | 1 Year | 2024/10/12 |
| Loop Antenna | R&S | HFH2-Z2E | PWB0026 | 1 Year | 2024/10/21 |
| k Type Horn Antenna | Steatite Antennas | QMS-00880 | PWB0035 | 1 Year | 2024/10/17 |
| Horn Antenna | Steatite Antennas | QMS-00208 | PWB0033 | 1 Year | 2024/10/21 |
| Pre-Amplifier | R&S | SCU08F1 | PWB0030 | 1 Year | 2024/10/11 |
| Pre-Amplifier | R&S | SCU40F1 | PWB0036 | 1 Year | 2024/10/11 |
| 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 | 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 Test Uncertainty

| No. | Parameter | Uncertainty |
|-----|---------------------------------------|---|
| 1 | Maximum transmit power | 0.677dB |
| 2 | Frequency error | 37.064Hz |
| 3 | Bandwidth occupied | 5.9kHz |
| 4 | Emission spurious, Band edge and PAPR | 10Hz-3.5GHz: 0.982dB 3.5GHz-18GHz: 1dB 18GHz-26.5GHz: 0.777dB 26.5GHz-40GHz: 1.066dB |
| 5 | Radiated Spurious Emission | Below 1GHz: 4.88 dB Above 1GH: 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] | 20.1 to 25.7 |
| Humidity [%RH] | 39 to 46 |
| Pressure [kPa] | 100.2 to 102.5 |

Anechoic Chamber

| | |
|------------------|----------------|
| Temperature [°C] | 20.3 to 24.6 |
| Humidity [%RH] | 43 to 51 |
| Pressure [kPa] | 100.3 to 102.3 |

4.1 RF Output Power & Effective (Isotropic) Radiated Power

Methods of Measurement

Base Station Simulator was used to establish communication with the EUT. Its parameters were set to force the EUT transmitting at maximum output power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

According to KDB 412172 D01 Power Approach,

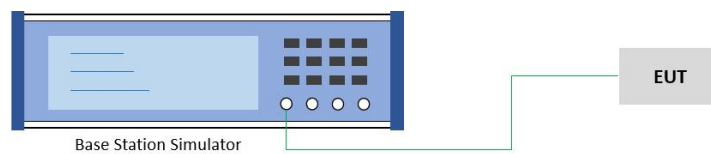
$EIRP = PT + GT - LC$, $ERP = EIRP - 2.15$, where

PT = transmitter output power in dBm

GT = gain of the transmitting antenna in dBi

LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

Test Setup



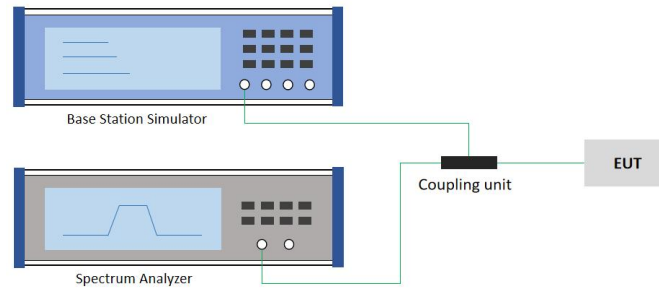
- 1.The testing follows ANSI C63.26 Section 5.2.
- 2.The transmitter output port was connected to the base station simulator.
- 3.Set EUT at maximum power through the base station simulator
- 4.Select lowest, middle, and highest channels for each band and different modulation.
- 5.Measure and record the power level from the system simulator.

4.2 EIRP Power Density

Methods of Measurement

Measurement Procedure: C63.26 -2015 section 5.2.4

Test Setup



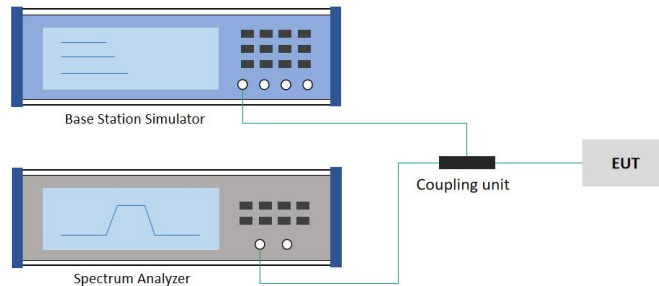
1. Set instrument center frequency to OBW center frequency.
2. Set span to at least 1.5 times the OBW.
3. Set the RBW to the specified reference bandwidth (often 1 MHz).
4. Set VBW $\geq 3 \times$ RBW.
5. Detector = RMS (power averaging).
6. Ensure that the number of measurement points in the sweep $\geq 2 \times$ span/RBW.
7. Sweep time = auto couple.
8. Employ trace averaging (RMS) mode over a minimum of 100 traces.
9. Use the peak marker function to determine the maximum amplitude level within the reference bandwidth (PSD).

4.3 Peak-to-Average Ratio

Methods of Measurement

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth.

Test Setup



- 1.The testing follows ANSI C63.26 Section 5.2.3.4 (CCDF).
- 2.The EUT was connected to spectrum and system simulator via a coupling unit.
- 3.Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
- 4.The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
- 5.Record the deviation as Peak to Average Ratio.

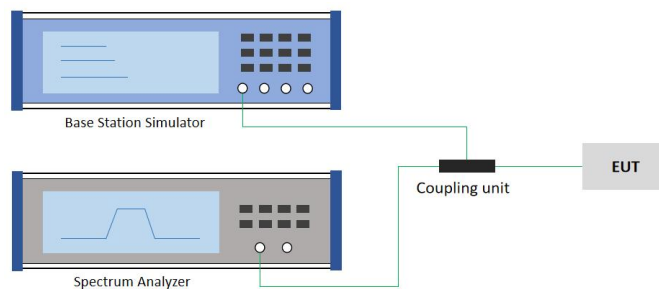
4.4 Occupied Bandwidth

Methods of Measurement

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The 26 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 26 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

Test Setup



The testing follows ANSI C63.26 Section 5.4.

The EUT was connected to spectrum analyzer and system simulator via a coupling unit.

The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.

The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.

Set the detection mode to peak, and the trace mode to max hold.

Determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace.

(this is the reference value).

Determine the '-26 dB down amplitude' as equal to (Reference Value – X).

Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the '-X dB down amplitude' determined in step 6. If a marker is below this '-X dB down amplitude' value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.

Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

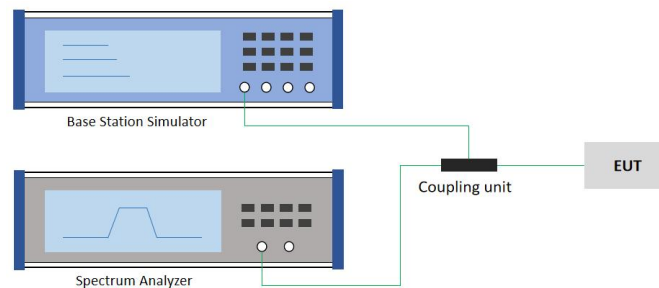
4.5 Conducted Band Edge Measurement

Methods of Measurement

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at two frequencies (low channel and high channel). In the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of 100kHz or 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed. The EUT emission bandwidth is measured as the width of the signal between two points, outside of which all emission are attenuated at least 26dB below the transmitter power. The video bandwidth of the spectrum analyzer was set at thrice the resolution bandwidth. Detector Mode was set to RMS.

Test Setup



- 1.The testing follows ANSI C63.26 section 5.7
- 2.The EUT was connected to spectrum analyzer and system simulator via a coupling unit.
- 3.The band edges of low and high channels for the highest RF powers were measured.
- 4.Set RBW \geq 1% EBW in the 1MHz band immediately outside and adjacent to the band edge.
- 5.Beyond the 1 MHz band from the band edge, RBW=1MHz was used or a narrower RBW was used and the measured power was integrated over the full required measurement bandwidth of 1 MHz.
- 6.Set spectrum analyzer with RMS detector.
- 7.The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

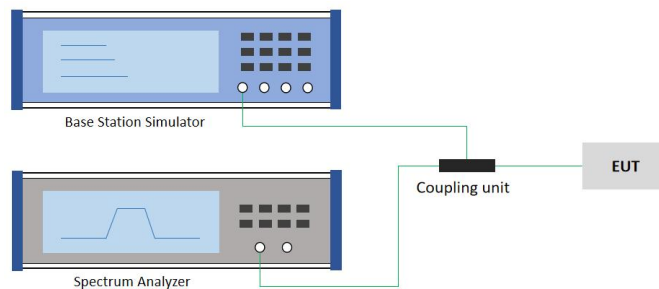
4.6 Spurious Emissions at Antenna Terminals

Methods of Measurement

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyzer, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. 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. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

Test Setup



- 1.The testing follows ANSI C63.26 section 5.7
- 2.The EUT was connected to spectrum analyzer and system simulator via a coupling unit.
- 3.The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 4.The middle channel for the highest RF power within the transmitting frequency was measured.
- 5.The conducted spurious emission for the whole frequency range was taken.
- 6.Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
- 7.Set spectrum analyzer with RMS detector.
- 8.Taking the record of maximum spurious emission.
- 9.The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

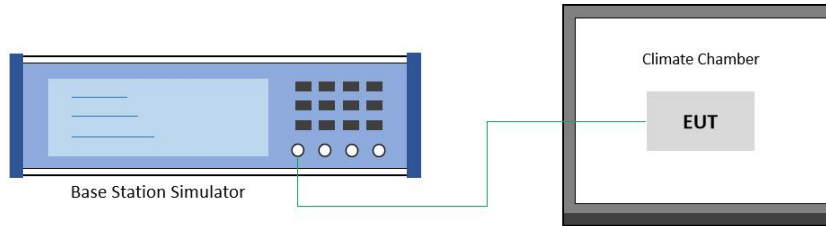
Note: As described in Section C63.26 4.2.3: Generally, the measurement must be corrected by adding $10 \log [(reference\ bandwidth) / (resolution\ or\ measurement\ bandwidth)]$ to the measured value (such bandwidth scaling is limited to cases where the measurement bandwidth used to perform the measurement is less than the reference bandwidth). Therefore, the converted limit value is the standard limit value minus the conversion factor.

4.7 Frequency Stability

Methods of Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ ($\pm 2.5\text{ppm}$) of the center frequency.

Test Setup



Test Procedures for Temperature Variation

1. The testing follows ANSI C63.26 section 5.6.4
2. The EUT was set up in the thermal chamber and connected with the system simulator.
3. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
4. With power OFF, the temperature was raised in 10°C step up to 50°C . The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

Test Procedures for Voltage Variation

1. The testing follows ANSI C63.26 section 5.6.5
2. The EUT was placed in a temperature chamber at $20\pm 5^{\circ}\text{C}$ and connected with the system simulator.
3. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value for other than hand carried battery equipment.
4. For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.
5. The variation in frequency was measured for the worst case.

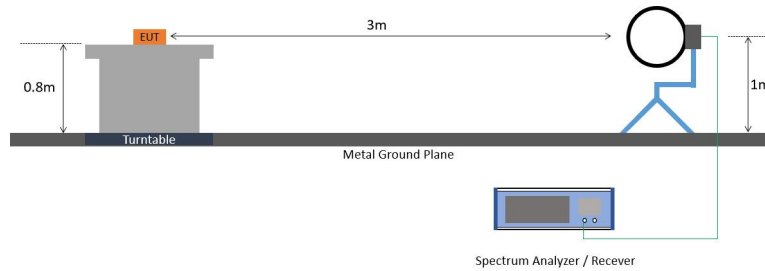
4.8 Radiated Spurious Emission

Methods of Measurement

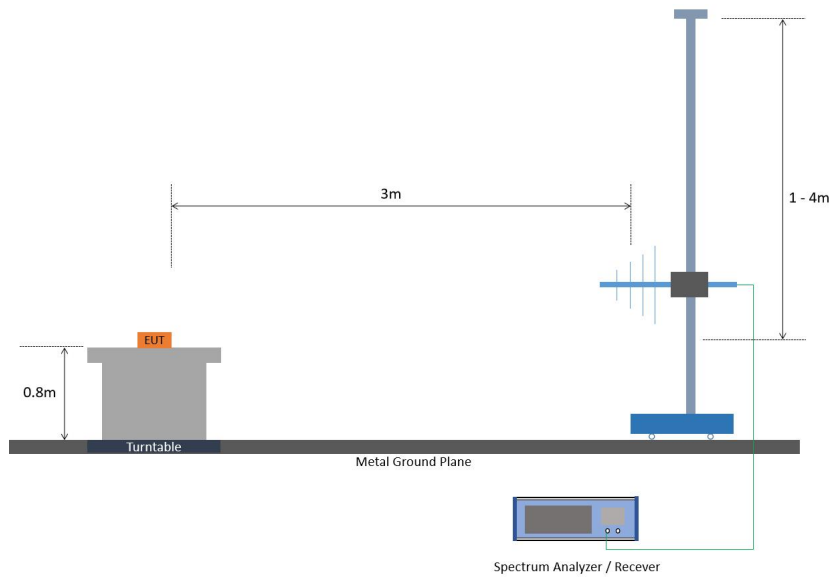
The radiated spurious emission was measured by substitution method according to ANSI C63.26. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

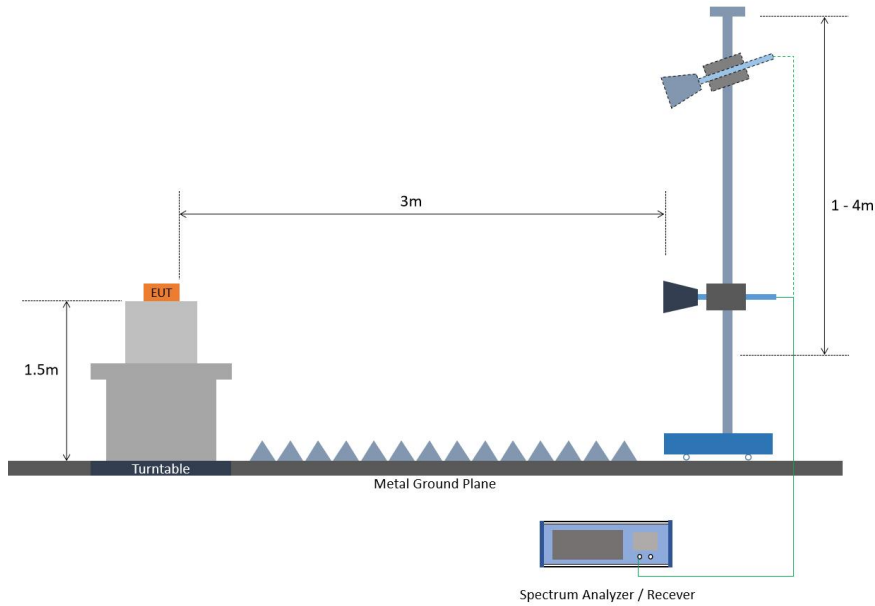
Test Setup



For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz

- 1.The testing follows ANSI C63.26 Section 5.5
- 2.The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1GHz respectively above ground.
- 3.The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
- 4.The table was rotated 360 degrees to determine the position of the highest spurious emission.
- 5.The height of the receiving antenna is varied between 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
- 6.During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
- 7.Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
- 8.A horn antenna was substituted in place of the EUT and was driven by a signal generator.
- 9.Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
- 10.EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
- 11.ERP (dBm) = EIRP - 2.15
- 12.The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

Remark: 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.

Appendixes

| | |
|-----------------------|---|
| External Photograph | Refer to "Attachment A.1: External Photograph" file. |
| Internal Photograph | Refer to "Attachment A.2: Internal Photograph" file. |
| Test Setup Photograph | Refer to "Attachment A.4: RF Test Setup Photograph" file. |

Test Results of Conducted Test

| | |
|-------------|---------------------------------|
| LTE Band 2 | Refer to "Attachment B.1" file. |
| LTE Band 4 | Refer to "Attachment B.2" file. |
| LTE Band 5 | Refer to "Attachment B.3" file. |
| LTE Band 12 | Refer to "Attachment B.4" file. |
| LTE Band 13 | Refer to "Attachment B.5" file. |
| LTE Band 14 | Refer to "Attachment B.6" file. |
| LTE Band 66 | Refer to "Attachment B.7" file. |
| LTE Band 71 | Refer to "Attachment B.8" file. |

Test Results of Radiated Test

| | |
|------------------------------|-------------------------------|
| Radiation spurious test data | Refer to "Attachment C" file. |
|------------------------------|-------------------------------|

***** End of the Report *****