



RF TEST REPORT

Report No.: SET2018-06849

Product: Handheld Data Terminal

FCC ID: HLEEA500BTNFL

Model No.: EA500, EA502, EA506, EA508

Applicant: Unitech Electronics Co., Ltd.

Address: 5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan.

Dates of Testing: 05/16/2018 — 06/07/2018

Issued by: CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd.

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Test Report

Product..... : Handheld Data Terminal

Brand Name : unitech

Trade Name..... : N.A

Applicant..... : Unitech Electronics Co., Ltd.

Applicant Address..... : 5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist.,
New Taipei City, Taiwan.

Manufacturer..... : Unitech Electronics Co., Ltd.

Manufacturer Address : 5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist.,
New Taipei City, Taiwan.

Test Standards..... : 47 CFR Part 2: Frequency Allocations and Radio Treaty
Matters; General Rules and Regulations
47 CFR FCC Part 22(H): Cellular Radiotelephone Service
47 CFR Part 24(E): Personal Communications Services
47 CFR Part 27(L) 27(H) 27(M): Miscellaneous wireless
communications services

Test Result : PASS

Tested by : Shallwe Yang
2018.06.07
Shallwe Yang, Test Engineer

Reviewed by : Zhu Qi
2018.06.07
Zhu Qi, Senior Engineer

Approved by..... : Smart Li
2018.06.07
Smart Li, Manager



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| Change History | | |
|----------------|------------|-------------------|
| Issue | Date | Reason for change |
| 1.0 | 2018.06.06 | First edition |
| | | |
| | | |



1. GENERAL INFORMATION

1.1 EUT Description

| | |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EUT Type | Handheld Data Terminal |
| Hardware Version | SQ52W_MB_V1.00 |
| Software Version | SQ52W_P1_UTE_D0_180503_01 |
| Frequency Range | LTE Band 2 Tx: 1850.7MHz~1909.3MHz Rx: 1930.7MHz~1989.3MHz LTE Band 4 Tx: 1710.7MHz~1754.3MHz Rx: 2110.7MHz~2154.3MHz LTE Band 5 Tx: 824.7MHz~848.3MHz Rx: 869.7MHz~893.3MHz LTE Band 7 Tx: 2502.5MHz~2567.5MHz Rx: 2622.5MHz~2687.5MHz |
| Maximum Output Power to Antenna | LTE Band 2: 22.02dBm LTE Band 4: 22.10dBm LTE Band 5: 22.14dBm LTE Band 7: 22.20dBm |
| Bandwidth | LTE Band 2: 1.4MHz/3MHz/5MHz/10MHz/15MHz/20MHz LTE Band 4: 1.4MHz/3MHz/5MHz/10MHz/15MHz/20MHz LTE Band 5: 1.4MHz/3MHz/5MHz/10MHz LTE Band 7: 5MHz/10MHz/15MHz/20MHz |
| Modulation Type | QPSK/16QAM |
| Antenna Type | PIFA |
| Antenna Gain | LTE Band 2: -1dBi LTE Band 4: -1dBi LTE Band 5: -1dBi LTE Band 7: -1.8dBi |

1.2 Maximum ERP/EIRP Power, Frequency Tolerance, and Emission Designator

| FCC Rule | System | Type of Modulation | BW (MHz) | Emission Designator | Frequency Tolerance (ppm) | Maximum ERP/EIRP(W) |
|----------|------------|--------------------|----------|---------------------|---------------------------|---------------------|
| Part 24 | LTE Band 2 | QPSK | 1.4 | 1M09G7D | — | 0.211 |
| Part 24 | LTE Band 2 | 16QAM | 1.4 | 1M09W7D | — | 0.148 |
| Part 24 | LTE Band 2 | QPSK | 3 | 2M68G7D | — | 0.207 |
| Part 24 | LTE Band 2 | 16QAM | 3 | 2M68W7D | — | 0.152 |
| Part 24 | LTE Band 2 | QPSK | 5 | 4M49G7D | — | 0.207 |
| Part 24 | LTE Band 2 | 16QAM | 5 | 4M49W7D | — | 0.183 |
| Part 24 | LTE Band 2 | QPSK | 10 | 8M92G7D | 0.004 | 0.208 |
| Part 24 | LTE Band 2 | 16QAM | 10 | 8M91W7D | — | 0.147 |
| Part 24 | LTE Band 2 | QPSK | 15 | 13M4G7D | — | 0.206 |
| Part 24 | LTE Band 2 | 16QAM | 15 | 13M4W7D | — | 0.152 |
| Part 24 | LTE Band 2 | QPSK | 20 | 17M8G7D | — | 0.216 |
| Part 24 | LTE Band 2 | 16QAM | 20 | 17M8W7D | — | 0.160 |
| Part 27 | LTE Band 4 | QPSK | 1.4 | 1M08G7D | — | 0.211 |
| Part 27 | LTE Band 4 | 16QAM | 1.4 | 1M08W7D | — | 0.151 |
| Part 27 | LTE Band 4 | QPSK | 3 | 2M68G7D | — | 0.209 |
| Part 27 | LTE Band 4 | 16QAM | 3 | 2M68W7D | — | 0.149 |
| Part 27 | LTE Band 4 | QPSK | 5 | 4M49G7D | — | 0.211 |
| Part 27 | LTE Band 4 | 16QAM | 5 | 4M49W7D | — | 0.150 |
| Part 27 | LTE Band 4 | QPSK | 10 | 8M92G7D | 0.002 | 0.211 |
| Part 27 | LTE Band 4 | 16QAM | 10 | 8M91W7D | — | 0.150 |
| Part 27 | LTE Band 4 | QPSK | 15 | 13M4G7D | — | 0.215 |
| Part 27 | LTE Band 4 | 16QAM | 15 | 13M4W7D | — | 0.152 |
| Part 27 | LTE Band 4 | QPSK | 20 | 17M8G7D | — | 0.213 |
| Part 27 | LTE Band 4 | 16QAM | 20 | 17M8W7D | — | 0.148 |



| | | | | | | |
|---------|------------|-------|-----|---------|-------|-------|
| Part 22 | LTE Band 5 | QPSK | 1.4 | 1M09G7D | — | 0.270 |
| Part 22 | LTE Band 5 | 16QAM | 1.4 | 1M09W7D | — | 0.189 |
| Part 22 | LTE Band 5 | QPSK | 3 | 2M68G7D | — | 0.269 |
| Part 22 | LTE Band 5 | 16QAM | 3 | 2M68W7D | — | 0.182 |
| Part 22 | LTE Band 5 | QPSK | 5 | 4M49G7D | — | 0.268 |
| Part 22 | LTE Band 5 | 16QAM | 5 | 4M49W7D | — | 0.187 |
| Part 22 | LTE Band 5 | QPSK | 10 | 8M92G7D | 0.004 | 0.175 |
| Part 22 | LTE Band 5 | 16QAM | 10 | 8M92W7D | — | 0.114 |
| Part 27 | LTE Band 7 | QPSK | 5 | 4M48G7D | — | 0.204 |
| Part 27 | LTE Band 7 | 16QAM | 5 | 4M48W7D | — | 0.131 |
| Part 27 | LTE Band 7 | QPSK | 10 | 8M91G7D | 0.003 | 0.202 |
| Part 27 | LTE Band 7 | 16QAM | 10 | 8M90W7D | — | 0.140 |
| Part 27 | LTE Band 7 | QPSK | 15 | 13M4G7D | — | 0.210 |
| Part 27 | LTE Band 7 | 16QAM | 15 | 13M4W7D | — | 0.139 |
| Part 27 | LTE Band 7 | QPSK | 20 | 17M8G7D | — | 0.186 |
| Part 27 | LTE Band 7 | 16QAM | 20 | 17M8W7D | — | 0.124 |

1.3 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 2, Part 24, and Part 27 for the EUT FCC ID Certification:

1.47 CFR Part 2, 22(H), 24(E), 27(L) 27(M)

2. ANSI/TIA/EIA-603-D-2010

3. FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01

Test detailed items/section required by FCC rules and results are as below:

| No. | Section | Description | Limit | Result |
|-----|-------------------------------------------------------------------------------|---------------------------------------------|------------------------------------|--------|
| 1 | 2.1046 | Conducted RF Output Power | Reporting Only | PASS |
| 2 | 24.232(d) 27.50(d)(5) | Peak to Average Ratio | < 13dB | PASS |
| 3 | 27.50(h)(2) 24.232(c) | Effective Radiated Power(Band 2/7) | EIRP<2Watt | PASS |
| | 27.50(d)(4) | Effective Radiated Power(Band 4) | EIRP<1Watt | PASS |
| | 22.913(a)(2) | Effective Radiated Power(Band 5) | ERP<7Watt | PASS |
| 4 | 2.1049 22.917(b) 24.238(b) 27.53(h)(3) 27.53(g)(3) 27.53(i)(6) | Occupied Bandwidth | Reporting Only | PASS |
| 5 | 2.1051 22.917(a) 24.238(b) 27.53(g) 27.53(h) | Conducted Band Edge(Band 2/4/5) | <43+10log10(P[watt]) | PASS |
| | 2.1051 27.53(i)(4) | Conducted Band Edge(Band 7) | <5.5MHz: -13dBm ≥5.5MHz: -25dBm | PASS |
| 6 | 2.1051 22.917(a) 24.238(a) 27.53(g) | Conducted Spurious Emission (Band 2/4/5) | <43+10log10(P[watt]) | PASS |



| | | | | |
|---|----------------------------------------------------------|--------------------------------------------|-----------------------------------|------|
| | 27.53(h) | | | |
| | 2.1051 27.53(i)(4) | Conducted Spurious Emission (Band 7) | $<55+10\log_{10}(P[\text{watt}])$ | PASS |
| 7 | 2.1053 22.917(a) 24.238(a) 27.53(g) 27.53(h) | Radiated Spurious Emission (Band 2/4/5) | $<43+10\log_{10}(P[\text{watt}])$ | PASS |
| | 2.1053 27.53(i)(4) | Radiated Spurious Emission (Band 7) | $<55+10\log_{10}(P[\text{watt}])$ | PASS |
| 8 | 2.1055, 22.355 24.235 27.54 | Frequency Stability | $<2.5\text{ppm}$ | PASS |

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.



1.4 Test Configuration of Equipment Under Test

1.4.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power.

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes to find the maximum emission.

| Test Items | Band | Bandwidth(MHz) | | | | | | Modulation | | RB# | | | Test Channel | | |
|-----------------------------|------|----------------|---|---|----|----|----|------------|-------|-----|------|------|--------------|---|---|
| | | 1.4 | 3 | 5 | 10 | 15 | 20 | QPSK | 16QAM | 1 | Half | Full | L | M | H |
| Max. Output Power | 2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | 4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | 5 | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | 7 | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Peak-to-Average Ratio | 2 | | | | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ |
| | 4 | | | | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ |
| | 5 | | | | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ |
| | 7 | | | | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ |
| 26dB and 99% Bandwidth | 2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | |
| | 4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | |
| | 5 | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | ✓ | | ✓ | |
| | 7 | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | |
| Conducted Band Edge | 2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| | 4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| | 5 | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| | 7 | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ |
| Conducted Spurious Emission | 2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| | 4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| | 5 | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| | 7 | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| Frequency Stability | 2 | | | | ✓ | | | ✓ | | | | ✓ | | ✓ | |
| | 4 | | | | ✓ | | | ✓ | | | | ✓ | | ✓ | |
| | 5 | | | | ✓ | | | ✓ | | | | ✓ | | ✓ | |
| | 7 | | | | ✓ | | | ✓ | | | | ✓ | | ✓ | |
| ERP/EIRP | 2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| | 4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| | 5 | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |



| | | | | | | | | | | | | | | | |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|--|--|---|---|---|
| | 7 | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| Radiated Spurious Emission | 2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ | ✓ | ✓ |
| | 4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ | ✓ | ✓ |
| | 5 | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | | ✓ | ✓ | ✓ |
| | 7 | | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ | ✓ | ✓ |
| Note | <p>1. The mark “ ✓ ” means that this configuration is chosen for testing.</p> <p>2. The device is investigated from 30MHz 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.</p> <p>3. For E.R.P/E.I.R.P. measurement, the widest bandwidth and the bandwidth with the highest conducted power of each band is chosen for testing. Besides, the lowest bandwidth of each band is also measured for reporting only.</p> | | | | | | | | | | | | | | |

1.5 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 7dB and 10dB attenuator.

Example:

$$\begin{aligned}\text{Offset (dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 7 + 10 = 17(\text{dB})\end{aligned}$$



1.6 Facilities and Accreditations

1.6.1 Test Facilities

CNAS-Lab Code: L1659

CCIC-SET is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659.

FCC-Registration No.: CN5031

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Designation Number: CN5031, valid time is until December 31, 2018.

ISED Registration: 11185A-1

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on Aug. 04, 2016, valid time is until Aug. 03, 2019.

NVLAP Lab Code: 201008-0

CCIC-SET is a third party testing organization accredited by NVLAP according to ISO/IEC 17025. The accreditation certificate number is 201008-0.

1.6.2 Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

| | |
|-----------------------------|--------------|
| Temperature (°C): | 15°C - 35°C |
| Relative Humidity (%): | 30% -60% |
| Atmospheric Pressure (kPa): | 86KPa-106KPa |

2. 47 CFR PART 2, PART 27H REQUIREMENTS

2.1 Conducted RF Output Power

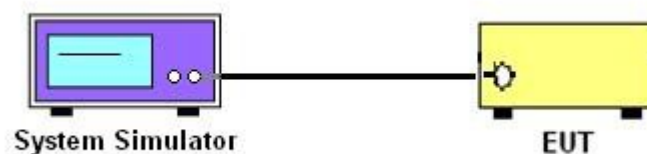
2.1.1 Requirement

According to FCC section 2.1046(a), for transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in FCC section 2.1033(c)(8).

2.1.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.1.3 Test Setup



2.1.4 Test Procedures

1. The transmitter output port was connected to the system simulator.
2. Set EUT at maximum power through system simulator.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure and record the power level from the system simulator.



2.1.5 Test Results

Please refer to Appendix A for detail

2.2 Peak to Average Ratio

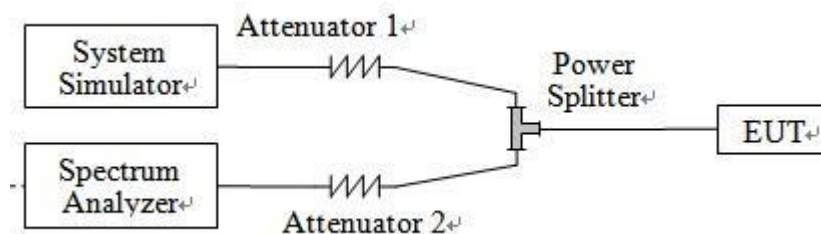
2.2.1 Definition

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. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

2.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

2.2.3 Test Description



2.2.4 Test Procedures

1. The EUT was connected to spectrum and system simulator via a power divider.
2. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
3. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
4. Record the deviation as Peak to Average Ratio.



2.2.5 Test Results of Peak-to-Average Ratio

Please refer to Appendix A for detail

2.3 99% Occupied Bandwidth and 26dB Bandwidth

2.3.1 Definition

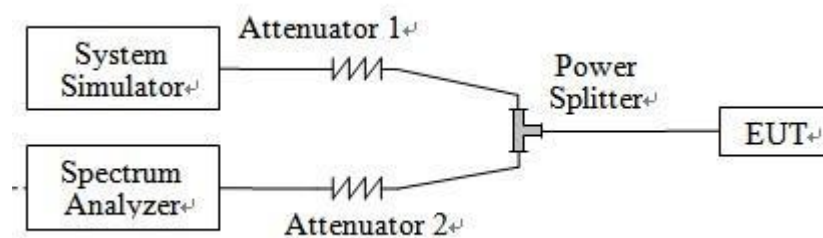
According to FCC section 2.1049, the occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

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.

2.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

2.3.3 Test Setup



2.3.4 Test Procedures

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The 26dB and 99% occupied bandwidth (BW) of the middle channel for the highest RF power with full RB sizes were measured.



2.3.5 Test Result of 99% Occupied Bandwidth and 26dB Bandwidth

Please refer to Appendix A for detail

2.4 Frequency Stability

2.4.1 Requirement

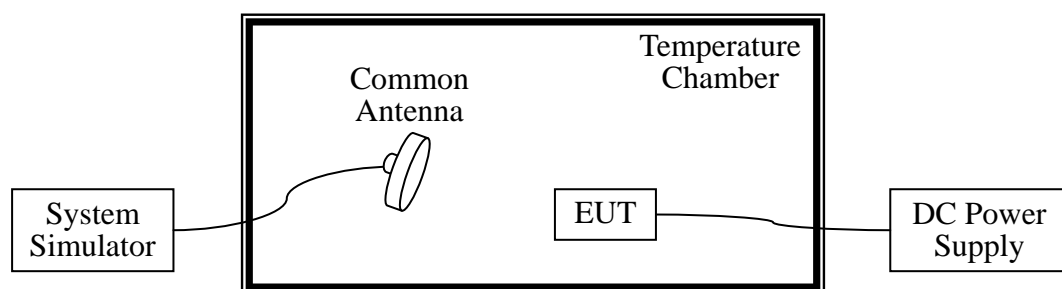
According to FCC section 27.54, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental 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. According to FCC section 2.1055, the test conditions are:

- (a) The temperature is varied from -30°C to $+50^{\circ}\text{C}$ at intervals of not more than 10°C .
- (b) For hand carried battery powered equipment, the primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacture. The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

2.4.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.4.3 Test Setup



2.4.4 Test Procedures

1. The EUT was set up in the thermal chamber and connected with the system simulator.
2. 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.

3. 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.
4. The nominal, highest and lowest extreme voltages are separately 3.8VDC, 4.2VDC and 3.6VDC, which are specified by the applicant; the normal temperature here used is 25°C.
5. The variation in frequency was measured for the worst case.



2.4.5 Test Result of Frequency Stability

Please refer to Appendix A for detail

2.5 Conducted Out of Band Emissions

2.5.1 Requirement

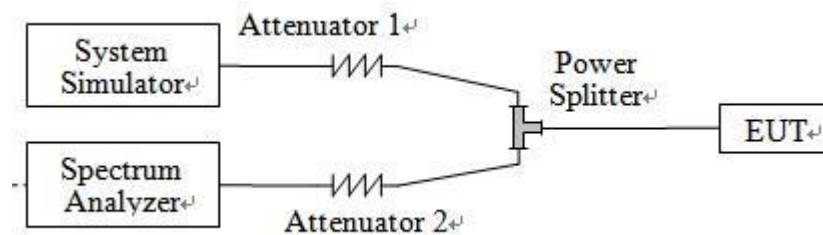
According to FCC section 27.53(h), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43+10*\log(P)$ dB. This calculated to be -13dBm.

It is measured by means of a calibrated spectrum analyzer and scanned from 30MHz up to a frequency including its 10th harmonic.

2.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

2.5.3 Test Setup



2.5.4 Test Procedures

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. 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.
3. The middle channel for the highest RF power within the transmitting frequency was measured.
4. The conducted spurious emission for the whole frequency range was taken.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.

6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
7. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)
$$= P(W) - [43 + 10\log(P)] \text{ (dB)}$$
$$= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$$
$$= -13\text{dBm}.$$



2.5.5 Test Result of Conducted Spurious Emission

Please refer to Appendix A for detail

2.6 Conducted Band Edge

2.6.1 Description of Conducted Band Edge Measurement

24.238(a) for Band 2

For operations in the 1850 -1910 MHz band, the FCC limit is $43 + 10\log_{10}(P[\text{Watts}])$ dB below the transmitter power $P(\text{Watts})$ in a 1MHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

27.53(h) for Band 4

For operations in the 1710 – 1755 MHz band, the FCC limit is $43 + 10\log_{10}(P[\text{Watts}])$ dB below the transmitter power $P(\text{Watts})$ in a 1 MHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

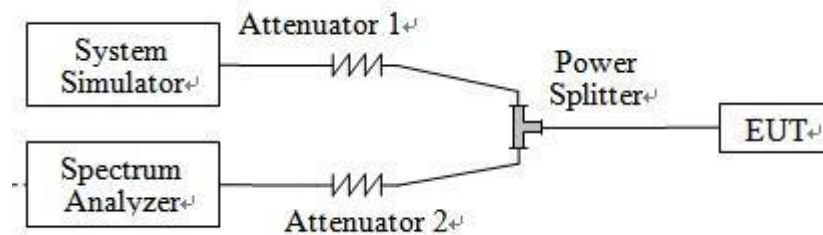
27.53 (m)(4) for Band 7

For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

2.6.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.6.3 Test Setup



2.6.4 Test Procedures

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The band edges of low and high channels for the highest RF powers were measured. Set $RBW \geq 1\%$ EBW in the 1MHz band immediately outside and adjacent to the band edge.
3. Set spectrum analyzer with RMS detector.
4. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
5. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)

$$= P(W) - [43 + 10\log(P)] \text{ (dB)}$$

$$= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$$

$$= -13\text{dBm.}$$

<For Band 7>

The limit line is derived from $55 + 10\log(P)$ dB below the transmitter power P(Watts)

$$= P(W) - [55 + 10\log(P)] \text{ (dB)}$$

$$= [30 + 10\log(P)] \text{ (dBm)} - [55 + 10\log(P)] \text{ (dB)}$$

$$= -25\text{dBm.}$$



2.6.5 Test Result of Conducted Band Edge

Please refer to Appendix A for detail

2.7 Transmitter Radiated Power (EIRP/ERP)

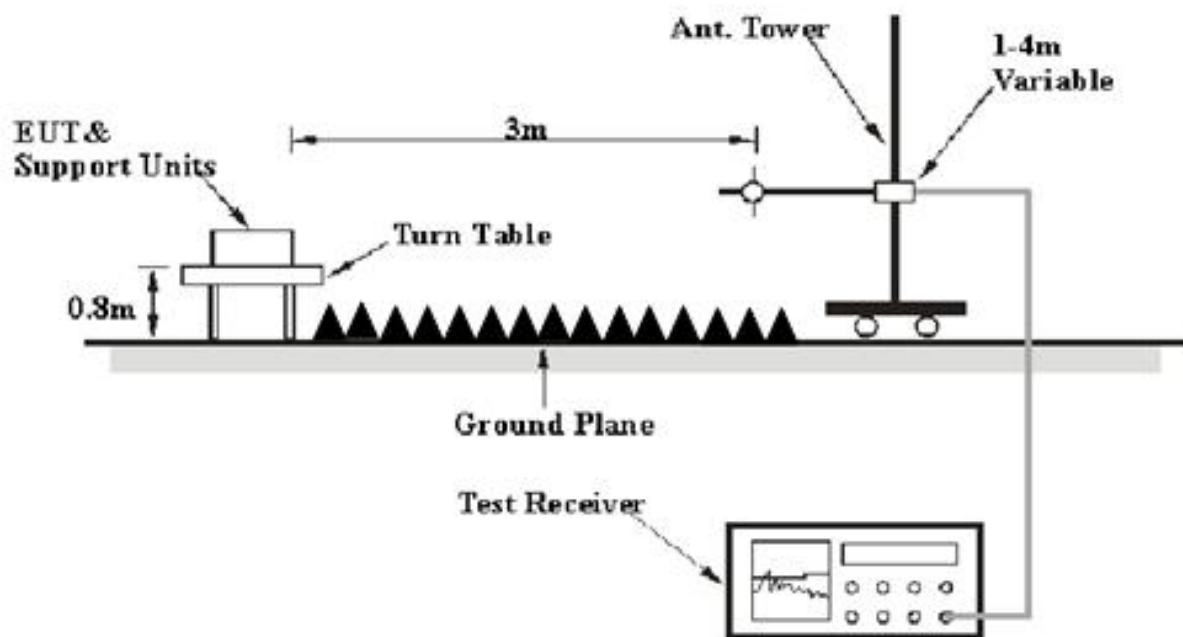
2.7.1 Requirement

Equivalent isotropic radiated power output measurements by substitution method according to ANSI /TIA / EIA-603-C-2004, and the spectrum analyzer configuration follows KDB 971168 D01 Power Meas. License Digital Systems v03r01. Mobile and portable (hand-held) stations operating are limited to average EIRP of 2 watts with LTE band 2 / 7 and 1 watt with LTE band 4.

2.7.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.7.3 Test Setup



2.7.4 Test Procedures

1. The EUT was placed on a turntable with 1.5 meter height in a fully anechoic chamber.
2. The EUT was set at 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and a spectrum analyzer which used a channel power option across EUT's signal

bandwidth per section 4.0 of KDB 971168 D01 v03r01.

4. The table was rotated 360 degrees to determine the position of the highest radiated power.
5. The height of the receiving antenna is adjusted to look for the maximum ERP/EIRP.
6. Taking the record of maximum ERP/EIRP.
7. A dipole antenna was substituted in place of the EUT and was driven by a signal generator.
8. The conducted power at the terminal of the dipole antenna is measured.
9. Repeat step 3 to step 5 to get the maximum ERP/EIRP of the substitution antenna.
10. $ERP/EIRP = P_s + E_t - E_s + G_s = P_s + R_t - R_s + G_s$

P_s (dBm): Input power to substitution antenna.

G_s (dBi or dBd): Substitution antenna Gain.

$E_t = R_t + AF$

$E_s = R_s + AF$

AF (dB/m): Receive antenna factor

R_t : The highest received signal in spectrum analyzer for EUT.

R_s : The highest received signal in spectrum analyzer for substitution antenna.

**2.7.5 Test Result of ERP/EIRP****1. LTE Band 2 Test Verdict:**

| LTE Band | BW (MHz) | Modulation | RB Configuration | | Freq. (MHz) | EIRP (dBm) | H/V | Verdict |
|----------|----------|------------|------------------|-----------|-------------|--------------|-----|---------|
| | | | RB Size | RB Offset | | | | |
| 2 | 1.4 | QPSK | 1 | 2 | 1850.7 | 23.25 | H | PASS |
| 2 | 1.4 | QPSK | 1 | 5 | 1880 | 23.18 | H | PASS |
| 2 | 1.4 | QPSK | 3 | 2 | 1909.3 | 23.21 | H | PASS |
| 2 | 1.4 | QPSK | 1 | 2 | 1850.7 | 22.62 | V | PASS |
| 2 | 1.4 | QPSK | 1 | 5 | 1880 | 22.52 | V | PASS |
| 2 | 1.4 | QPSK | 3 | 2 | 1909.3 | 22.54 | V | PASS |
| 2 | 1.4 | 16QAM | 1 | 0 | 1850.7 | 21.61 | H | PASS |
| 2 | 1.4 | 16QAM | 1 | 2 | 1880 | 21.62 | H | PASS |
| 2 | 1.4 | 16QAM | 3 | 2 | 1909.3 | 21.70 | H | PASS |
| 2 | 1.4 | 16QAM | 1 | 0 | 1850.7 | 20.99 | V | PASS |
| 2 | 1.4 | 16QAM | 1 | 2 | 1880 | 20.94 | V | PASS |
| 2 | 1.4 | 16QAM | 3 | 2 | 1909.3 | 21.02 | V | PASS |
| 2 | 3 | QPSK | 1 | 7 | 1851.5 | 23.16 | H | PASS |
| 2 | 3 | QPSK | 1 | 14 | 1880 | 23.14 | H | PASS |
| 2 | 3 | QPSK | 1 | 0 | 1908.5 | 23.17 | H | PASS |
| 2 | 3 | QPSK | 1 | 7 | 1851.5 | 22.69 | V | PASS |
| 2 | 3 | QPSK | 1 | 14 | 1880 | 22.61 | V | PASS |
| 2 | 3 | QPSK | 1 | 0 | 1908.5 | 22.64 | V | PASS |
| 2 | 3 | 16QAM | 1 | 14 | 1851.5 | 21.76 | H | PASS |
| 2 | 3 | 16QAM | 1 | 0 | 1880 | 21.80 | H | PASS |
| 2 | 3 | 16QAM | 1 | 0 | 1908.5 | 21.83 | H | PASS |
| 2 | 3 | 16QAM | 1 | 14 | 1851.5 | 20.89 | V | PASS |
| 2 | 3 | 16QAM | 1 | 0 | 1880 | 21.12 | V | PASS |
| 2 | 3 | 16QAM | 1 | 0 | 1908.5 | 20.97 | V | PASS |
| 2 | 5 | QPSK | 1 | 0 | 1852.5 | 23.15 | H | PASS |
| 2 | 5 | QPSK | 1 | 0 | 1880 | 23.09 | H | PASS |
| 2 | 5 | QPSK | 1 | 24 | 1907.5 | 23.16 | H | PASS |
| 2 | 5 | QPSK | 1 | 0 | 1852.5 | 22.60 | V | PASS |
| 2 | 5 | QPSK | 1 | 0 | 1880 | 22.57 | V | PASS |
| 2 | 5 | QPSK | 1 | 24 | 1907.5 | 22.63 | V | PASS |
| 2 | 5 | 16QAM | 1 | 12 | 1852.5 | 21.74 | H | PASS |
| 2 | 5 | 16QAM | 1 | 0 | 1880 | 21.67 | H | PASS |
| 2 | 5 | 16QAM | 1 | 12 | 1907.5 | 21.75 | H | PASS |
| 2 | 5 | 16QAM | 1 | 12 | 1852.5 | 21.03 | V | PASS |
| 2 | 5 | 16QAM | 1 | 0 | 1880 | 21.02 | V | PASS |
| 2 | 5 | 16QAM | 1 | 12 | 1907.5 | 20.97 | V | PASS |



| LTE Band | BW (MHz) | Modulation | RB Configuration | | Freq. (MHz) | EIRP (dBm) | H/V | Verdict |
|----------|----------|------------|------------------|-----------|-------------|--------------|-----|---------|
| | | | RB Size | RB Offset | | | | |
| 2 | 10 | QPSK | 1 | 0 | 1855 | 23.18 | H | PASS |
| 2 | 10 | QPSK | 1 | 0 | 1880 | 23.07 | H | PASS |
| 2 | 10 | QPSK | 1 | 49 | 1905 | 23.16 | H | PASS |
| 2 | 10 | QPSK | 1 | 0 | 1855 | 22.58 | V | PASS |
| 2 | 10 | QPSK | 1 | 0 | 1880 | 22.67 | V | PASS |
| 2 | 10 | QPSK | 1 | 49 | 1905 | 22.61 | V | PASS |
| 2 | 10 | 16QAM | 1 | 0 | 1855 | 21.67 | H | PASS |
| 2 | 10 | 16QAM | 1 | 0 | 1880 | 21.65 | H | PASS |
| 2 | 10 | 16QAM | 1 | 24 | 1905 | 21.68 | H | PASS |
| 2 | 10 | 16QAM | 1 | 0 | 1855 | 20.84 | V | PASS |
| 2 | 10 | 16QAM | 1 | 0 | 1880 | 20.85 | V | PASS |
| 2 | 10 | 16QAM | 1 | 24 | 1905 | 20.78 | V | PASS |
| 2 | 15 | QPSK | 1 | 0 | 1857.5 | 23.04 | H | PASS |
| 2 | 15 | QPSK | 1 | 0 | 1880 | 23.14 | H | PASS |
| 2 | 15 | QPSK | 1 | 74 | 1902.5 | 23.08 | H | PASS |
| 2 | 15 | QPSK | 1 | 0 | 1857.5 | 22.65 | V | PASS |
| 2 | 15 | QPSK | 1 | 0 | 1880 | 22.74 | V | PASS |
| 2 | 15 | QPSK | 1 | 74 | 1902.5 | 22.73 | V | PASS |
| 2 | 15 | 16QAM | 1 | 0 | 1857.5 | 21.78 | H | PASS |
| 2 | 15 | 16QAM | 1 | 0 | 1880 | 21.80 | H | PASS |
| 2 | 15 | 16QAM | 1 | 74 | 1902.5 | 21.82 | H | PASS |
| 2 | 15 | 16QAM | 1 | 0 | 1857.5 | 20.92 | V | PASS |
| 2 | 15 | 16QAM | 1 | 0 | 1880 | 20.95 | V | PASS |
| 2 | 15 | 16QAM | 1 | 74 | 1902.5 | 21.03 | V | PASS |
| 2 | 20 | QPSK | 1 | 0 | 1860 | 23.19 | H | PASS |
| 2 | 20 | QPSK | 1 | 0 | 1880 | 23.30 | H | PASS |
| 2 | 20 | QPSK | 1 | 0 | 1900 | 23.34 | H | PASS |
| 2 | 20 | QPSK | 1 | 0 | 1860 | 22.83 | V | PASS |
| 2 | 20 | QPSK | 1 | 0 | 1880 | 22.77 | V | PASS |
| 2 | 20 | QPSK | 1 | 0 | 1900 | 22.76 | V | PASS |
| 2 | 20 | 16QAM | 1 | 0 | 1860 | 22.01 | H | PASS |
| 2 | 20 | 16QAM | 1 | 0 | 1880 | 21.96 | H | PASS |
| 2 | 20 | 16QAM | 1 | 49 | 1900 | 22.03 | H | PASS |
| 2 | 20 | 16QAM | 1 | 0 | 1860 | 20.49 | V | PASS |
| 2 | 20 | 16QAM | 1 | 0 | 1880 | 20.44 | V | PASS |
| 2 | 20 | 16QAM | 1 | 49 | 1900 | 20.52 | V | PASS |



2. LTE Band 4 Test Verdict:

| LTE Band | BW (MHz) | Modulation | RB Configuration | | Freq. (MHz) | EIRP (dBm) | H/V | Verdict |
|----------|----------|------------|------------------|-----------|-------------|--------------|-----|---------|
| | | | RB Size | RB Offset | | | | |
| 4 | 1.4 | QPSK | 1 | 0 | 1710.7 | 23.24 | H | PASS |
| 4 | 1.4 | QPSK | 1 | 0 | 1732.5 | 23.23 | H | PASS |
| 4 | 1.4 | QPSK | 1 | 0 | 1754.3 | 23.16 | H | PASS |
| 4 | 1.4 | QPSK | 1 | 0 | 1710.7 | 22.76 | V | PASS |
| 4 | 1.4 | QPSK | 1 | 0 | 1732.5 | 22.84 | V | PASS |
| 4 | 1.4 | QPSK | 1 | 0 | 1754.3 | 22.77 | V | PASS |
| 4 | 1.4 | 16QAM | 1 | 0 | 1710.7 | 21.79 | H | PASS |
| 4 | 1.4 | 16QAM | 1 | 0 | 1732.5 | 21.80 | H | PASS |
| 4 | 1.4 | 16QAM | 1 | 0 | 1754.3 | 21.77 | H | PASS |
| 4 | 1.4 | 16QAM | 1 | 0 | 1710.7 | 20.97 | V | PASS |
| 4 | 1.4 | 16QAM | 1 | 0 | 1732.5 | 20.88 | V | PASS |
| 4 | 1.4 | 16QAM | 1 | 0 | 1754.3 | 21.02 | V | PASS |
| 4 | 3 | QPSK | 1 | 0 | 1711.5 | 23.19 | H | PASS |
| 4 | 3 | QPSK | 1 | 0 | 1732.5 | 23.21 | H | PASS |
| 4 | 3 | QPSK | 1 | 0 | 1753.5 | 23.15 | H | PASS |
| 4 | 3 | QPSK | 1 | 0 | 1711.5 | 22.75 | V | PASS |
| 4 | 3 | QPSK | 1 | 0 | 1732.5 | 22.64 | V | PASS |
| 4 | 3 | QPSK | 1 | 0 | 1753.5 | 22.76 | V | PASS |
| 4 | 3 | 16QAM | 1 | 14 | 1711.5 | 21.72 | H | PASS |
| 4 | 3 | 16QAM | 1 | 14 | 1732.5 | 21.74 | H | PASS |
| 4 | 3 | 16QAM | 1 | 14 | 1753.5 | 21.71 | H | PASS |
| 4 | 3 | 16QAM | 1 | 14 | 1711.5 | 20.97 | V | PASS |
| 4 | 3 | 16QAM | 1 | 14 | 1732.5 | 21.02 | V | PASS |
| 4 | 3 | 16QAM | 1 | 14 | 1753.5 | 20.95 | V | PASS |
| 4 | 5 | QPSK | 1 | 24 | 1712.5 | 23.25 | H | PASS |
| 4 | 5 | QPSK | 1 | 24 | 1732.5 | 23.22 | H | PASS |
| 4 | 5 | QPSK | 1 | 24 | 1752.5 | 23.17 | H | PASS |
| 4 | 5 | QPSK | 1 | 24 | 1712.5 | 22.81 | V | PASS |
| 4 | 5 | QPSK | 1 | 24 | 1732.5 | 22.70 | V | PASS |
| 4 | 5 | QPSK | 1 | 24 | 1752.5 | 22.76 | V | PASS |
| 4 | 5 | 16QAM | 1 | 24 | 1712.5 | 21.75 | H | PASS |
| 4 | 5 | 16QAM | 1 | 0 | 1732.5 | 21.68 | H | PASS |
| 4 | 5 | 16QAM | 1 | 0 | 1752.5 | 21.76 | H | PASS |
| 4 | 5 | 16QAM | 1 | 0 | 1712.5 | 20.92 | V | PASS |
| 4 | 5 | 16QAM | 1 | 0 | 1732.5 | 21.05 | V | PASS |
| 4 | 5 | 16QAM | 1 | 0 | 1752.5 | 20.98 | V | PASS |



| LTE Band | BW (MHz) | Modulation | RB Configuration | | Freq. (MHz) | EIRP (dBm) | H/V | Verdict |
|----------|----------|------------|------------------|-----------|-------------|--------------|-----|---------|
| | | | RB Size | RB Offset | | | | |
| 4 | 10 | QPSK | 1 | 0 | 1715 | 23.21 | H | PASS |
| 4 | 10 | QPSK | 1 | 0 | 1732.5 | 23.19 | H | PASS |
| 4 | 10 | QPSK | 1 | 0 | 1750 | 23.24 | H | PASS |
| 4 | 10 | QPSK | 1 | 0 | 1715 | 22.83 | V | PASS |
| 4 | 10 | QPSK | 1 | 0 | 1732.5 | 22.78 | V | PASS |
| 4 | 10 | QPSK | 1 | 0 | 1750 | 22.79 | V | PASS |
| 4 | 10 | 16QAM | 1 | 24 | 1715 | 21.73 | H | PASS |
| 4 | 10 | 16QAM | 1 | 0 | 1732.5 | 21.75 | H | PASS |
| 4 | 10 | 16QAM | 1 | 24 | 1750 | 21.69 | H | PASS |
| 4 | 10 | 16QAM | 1 | 24 | 1715 | 20.88 | V | PASS |
| 4 | 10 | 16QAM | 1 | 0 | 1732.5 | 20.81 | V | PASS |
| 4 | 10 | 16QAM | 1 | 24 | 1750 | 20.89 | V | PASS |
| 4 | 15 | QPSK | 1 | 74 | 1717.5 | 23.33 | H | PASS |
| 4 | 15 | QPSK | 1 | 74 | 1732.5 | 23.27 | H | PASS |
| 4 | 15 | QPSK | 1 | 0 | 1747.5 | 23.23 | H | PASS |
| 4 | 15 | QPSK | 1 | 74 | 1717.5 | 22.79 | V | PASS |
| 4 | 15 | QPSK | 1 | 74 | 1732.5 | 22.71 | V | PASS |
| 4 | 15 | QPSK | 1 | 0 | 1747.5 | 22.85 | V | PASS |
| 4 | 15 | 16QAM | 1 | 74 | 1717.5 | 21.80 | H | PASS |
| 4 | 15 | 16QAM | 1 | 0 | 1732.5 | 21.78 | H | PASS |
| 4 | 15 | 16QAM | 1 | 0 | 1747.5 | 21.81 | H | PASS |
| 4 | 15 | 16QAM | 1 | 74 | 1717.5 | 20.92 | V | PASS |
| 4 | 15 | 16QAM | 1 | 0 | 1732.5 | 20.97 | V | PASS |
| 4 | 15 | 16QAM | 1 | 0 | 1747.5 | 20.85 | V | PASS |
| 4 | 20 | QPSK | 1 | 0 | 1720 | 23.19 | H | PASS |
| 4 | 20 | QPSK | 1 | 0 | 1732.5 | 23.26 | H | PASS |
| 4 | 20 | QPSK | 1 | 0 | 1745 | 23.28 | H | PASS |
| 4 | 20 | QPSK | 1 | 0 | 1720 | 22.75 | V | PASS |
| 4 | 20 | QPSK | 1 | 0 | 1732.5 | 22.80 | V | PASS |
| 4 | 20 | QPSK | 1 | 0 | 1745 | 22.74 | V | PASS |
| 4 | 20 | 16QAM | 1 | 0 | 1720 | 21.69 | H | PASS |
| 4 | 20 | 16QAM | 1 | 0 | 1732.5 | 21.66 | H | PASS |
| 4 | 20 | 16QAM | 1 | 0 | 1745 | 21.71 | H | PASS |
| 4 | 20 | 16QAM | 1 | 0 | 1720 | 20.89 | V | PASS |
| 4 | 20 | 16QAM | 1 | 0 | 1732.5 | 20.82 | V | PASS |
| 4 | 20 | 16QAM | 1 | 0 | 1745 | 20.90 | V | PASS |



3. LTE Band 5 Test Verdict:

| LTE Band | BW (MHz) | Modulation | RB Configuration | | Freq. (MHz) | ERP (dBm) | H/V | Verdict |
|----------|----------|------------|------------------|-----------|-------------|--------------|-----|---------|
| | | | RB Size | RB Offset | | | | |
| 5 | 1.4 | QPSK | 1 | 5 | 824.7 | 24.32 | H | PASS |
| 5 | 1.4 | QPSK | 1 | 2 | 836.5 | 24.22 | H | PASS |
| 5 | 1.4 | QPSK | 1 | 5 | 848.3 | 24.29 | H | PASS |
| 5 | 1.4 | QPSK | 1 | 5 | 824.7 | 23.56 | V | PASS |
| 5 | 1.4 | QPSK | 1 | 2 | 836.5 | 23.60 | V | PASS |
| 5 | 1.4 | QPSK | 1 | 5 | 848.3 | 23.59 | V | PASS |
| 5 | 1.4 | 16QAM | 1 | 5 | 824.7 | 22.75 | H | PASS |
| 5 | 1.4 | 16QAM | 1 | 2 | 836.5 | 22.68 | H | PASS |
| 5 | 1.4 | 16QAM | 1 | 0 | 848.3 | 22.77 | H | PASS |
| 5 | 1.4 | 16QAM | 1 | 5 | 824.7 | 21.82 | V | PASS |
| 5 | 1.4 | 16QAM | 1 | 2 | 836.5 | 21.75 | V | PASS |
| 5 | 1.4 | 16QAM | 1 | 0 | 848.3 | 21.89 | V | PASS |
| 5 | 3 | QPSK | 1 | 5 | 825.5 | 24.27 | H | PASS |
| 5 | 3 | QPSK | 1 | 5 | 836.5 | 24.29 | H | PASS |
| 5 | 3 | QPSK | 1 | 5 | 848.3 | 24.26 | H | PASS |
| 5 | 3 | QPSK | 1 | 5 | 825.5 | 23.47 | V | PASS |
| 5 | 3 | QPSK | 1 | 5 | 836.5 | 23.38 | V | PASS |
| 5 | 3 | QPSK | 1 | 5 | 848.3 | 23.43 | V | PASS |
| 5 | 3 | 16QAM | 1 | 5 | 825.5 | 22.59 | H | PASS |
| 5 | 3 | 16QAM | 1 | 14 | 836.5 | 22.48 | H | PASS |
| 5 | 3 | 16QAM | 1 | 5 | 848.3 | 22.53 | H | PASS |
| 5 | 3 | 16QAM | 1 | 5 | 825.5 | 21.82 | V | PASS |
| 5 | 3 | 16QAM | 1 | 14 | 836.5 | 21.75 | V | PASS |
| 5 | 3 | 16QAM | 1 | 5 | 848.3 | 21.83 | V | PASS |
| 5 | 5 | QPSK | 1 | 14 | 826.5 | 24.27 | H | PASS |
| 5 | 5 | QPSK | 1 | 14 | 836.5 | 24.22 | H | PASS |
| 5 | 5 | QPSK | 1 | 14 | 846.5 | 24.28 | H | PASS |
| 5 | 5 | QPSK | 1 | 14 | 826.5 | 23.56 | V | PASS |
| 5 | 5 | QPSK | 1 | 14 | 836.5 | 23.60 | V | PASS |
| 5 | 5 | QPSK | 1 | 14 | 846.5 | 23.55 | V | PASS |
| 5 | 5 | 16QAM | 1 | 12 | 826.5 | 22.72 | H | PASS |
| 5 | 5 | 16QAM | 1 | 24 | 836.5 | 22.68 | H | PASS |
| 5 | 5 | 16QAM | 1 | 0 | 846.5 | 22.71 | H | PASS |
| 5 | 5 | 16QAM | 1 | 12 | 826.5 | 21.62 | V | PASS |
| 5 | 5 | 16QAM | 1 | 24 | 836.5 | 21.75 | V | PASS |
| 5 | 5 | 16QAM | 1 | 0 | 846.5 | 21.69 | V | PASS |



| LTE Band | BW (MHz) | Modulation | RB Configuration | | Freq. (MHz) | ERP (dBm) | H/V | Verdict |
|----------|----------|------------|------------------|-----------|-------------|--------------|-----|---------|
| | | | RB Size | RB Offset | | | | |
| 5 | 10 | QPSK | 1 | 24 | 829 | 22.39 | H | PASS |
| 5 | 10 | QPSK | 1 | 24 | 836.5 | 22.41 | H | PASS |
| 5 | 10 | QPSK | 1 | 24 | 844 | 22.43 | H | PASS |
| 5 | 10 | QPSK | 1 | 24 | 829 | 21.59 | V | PASS |
| 5 | 10 | QPSK | 1 | 24 | 836.5 | 21.54 | V | PASS |
| 5 | 10 | QPSK | 1 | 24 | 844 | 21.45 | V | PASS |
| 5 | 10 | 16QAM | 1 | 24 | 829 | 20.51 | H | PASS |
| 5 | 10 | 16QAM | 1 | 49 | 836.5 | 20.47 | H | PASS |
| 5 | 10 | 16QAM | 1 | 24 | 844 | 20.55 | H | PASS |
| 5 | 10 | 16QAM | 1 | 24 | 829 | 19.74 | V | PASS |
| 5 | 10 | 16QAM | 1 | 49 | 836.5 | 19.87 | V | PASS |
| 5 | 10 | 16QAM | 1 | 24 | 844 | 19.85 | V | PASS |



4. LTE Band 7 Test Verdict:

| LTE Band | BW (MHz) | Modulation | RB Configuration | | Freq. (MHz) | EIRP (dBm) | H/V | Verdict |
|----------|----------|------------|------------------|-----------|-------------|--------------|-----|---------|
| | | | RB Size | RB Offset | | | | |
| 7 | 5 | QPSK | 1 | 12 | 2502.5 | 23.06 | H | PASS |
| 7 | 5 | QPSK | 1 | 0 | 2535 | 23.00 | H | PASS |
| 7 | 5 | QPSK | 1 | 24 | 2567.5 | 23.09 | H | PASS |
| 7 | 5 | QPSK | 1 | 12 | 2502.5 | 22.16 | V | PASS |
| 7 | 5 | QPSK | 1 | 0 | 2535 | 22.20 | V | PASS |
| 7 | 5 | QPSK | 1 | 24 | 2567.5 | 22.26 | V | PASS |
| 7 | 5 | 16QAM | 1 | 24 | 2502.5 | 21.15 | H | PASS |
| 7 | 5 | 16QAM | 1 | 24 | 2535 | 21.08 | H | PASS |
| 7 | 5 | 16QAM | 1 | 0 | 2567.5 | 21.17 | H | PASS |
| 7 | 5 | 16QAM | 1 | 24 | 2502.5 | 20.32 | V | PASS |
| 7 | 5 | 16QAM | 1 | 24 | 2535 | 20.25 | V | PASS |
| 7 | 5 | 16QAM | 1 | 0 | 2567.5 | 20.30 | V | PASS |
| 7 | 10 | QPSK | 1 | 24 | 2505 | 22.97 | H | PASS |
| 7 | 10 | QPSK | 1 | 49 | 2535 | 23.05 | H | PASS |
| 7 | 10 | QPSK | 1 | 24 | 2565 | 23.01 | H | PASS |
| 7 | 10 | QPSK | 1 | 24 | 2505 | 22.23 | V | PASS |
| 7 | 10 | QPSK | 1 | 49 | 2535 | 22.18 | V | PASS |
| 7 | 10 | QPSK | 1 | 24 | 2565 | 22.13 | V | PASS |
| 7 | 10 | 16QAM | 1 | 24 | 2505 | 21.41 | H | PASS |
| 7 | 10 | 16QAM | 1 | 49 | 2535 | 21.47 | H | PASS |
| 7 | 10 | 16QAM | 1 | 24 | 2565 | 21.45 | H | PASS |
| 7 | 10 | 16QAM | 1 | 24 | 2505 | 20.54 | V | PASS |
| 7 | 10 | 16QAM | 1 | 49 | 2535 | 20.47 | V | PASS |
| 7 | 10 | 16QAM | 1 | 24 | 2565 | 20.45 | V | PASS |
| 7 | 15 | QPSK | 1 | 37 | 2507.5 | 23.23 | H | PASS |
| 7 | 15 | QPSK | 1 | 74 | 2535 | 23.18 | H | PASS |
| 7 | 15 | QPSK | 1 | 0 | 2562.5 | 23.21 | H | PASS |
| 7 | 15 | QPSK | 1 | 37 | 2507.5 | 22.35 | V | PASS |
| 7 | 15 | QPSK | 1 | 74 | 2535 | 22.37 | V | PASS |
| 7 | 15 | QPSK | 1 | 0 | 2562.5 | 22.31 | V | PASS |
| 7 | 15 | 16QAM | 1 | 37 | 2507.5 | 21.36 | H | PASS |
| 7 | 15 | 16QAM | 1 | 18 | 2535 | 21.34 | H | PASS |
| 7 | 15 | 16QAM | 1 | 0 | 2562.5 | 21.43 | H | PASS |
| 7 | 15 | 16QAM | 1 | 37 | 2507.5 | 20.48 | V | PASS |
| 7 | 15 | 16QAM | 1 | 18 | 2535 | 20.53 | V | PASS |
| 7 | 15 | 16QAM | 1 | 0 | 2562.5 | 20.51 | V | PASS |



| LTE Band | BW (MHz) | Modulation | RB Configuration | | Freq. (MHz) | EIRP (dBm) | H/V | Verdict |
|----------|----------|------------|------------------|---|-------------|--------------|-----|---------|
| 7 | 20 | QPSK | 1 | 0 | 2510 | 22.64 | H | PASS |
| 7 | 20 | QPSK | 1 | 0 | 2535 | 22.61 | H | PASS |
| 7 | 20 | QPSK | 1 | 0 | 2560 | 22.69 | H | PASS |
| 7 | 20 | QPSK | 1 | 0 | 2510 | 21.95 | V | PASS |
| 7 | 20 | QPSK | 1 | 0 | 2535 | 22.03 | V | PASS |
| 7 | 20 | QPSK | 1 | 0 | 2560 | 22.01 | V | PASS |
| 7 | 20 | 16QAM | 1 | 0 | 2510 | 20.89 | H | PASS |
| 7 | 20 | 16QAM | 1 | 0 | 2535 | 20.95 | H | PASS |
| 7 | 20 | 16QAM | 1 | 0 | 2560 | 20.91 | H | PASS |
| 7 | 20 | 16QAM | 1 | 0 | 2510 | 19.99 | V | PASS |
| 7 | 20 | 16QAM | 1 | 0 | 2535 | 20.12 | V | PASS |
| 7 | 20 | 16QAM | 1 | 0 | 2560 | 20.05 | V | PASS |

2.8 Radiated Out of Band Emissions

2.8.1 Requirement

The radiated spurious emission was measured by substitution method according to ANSI / TIA /EIA-603-C-2004. 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.

For Band 7

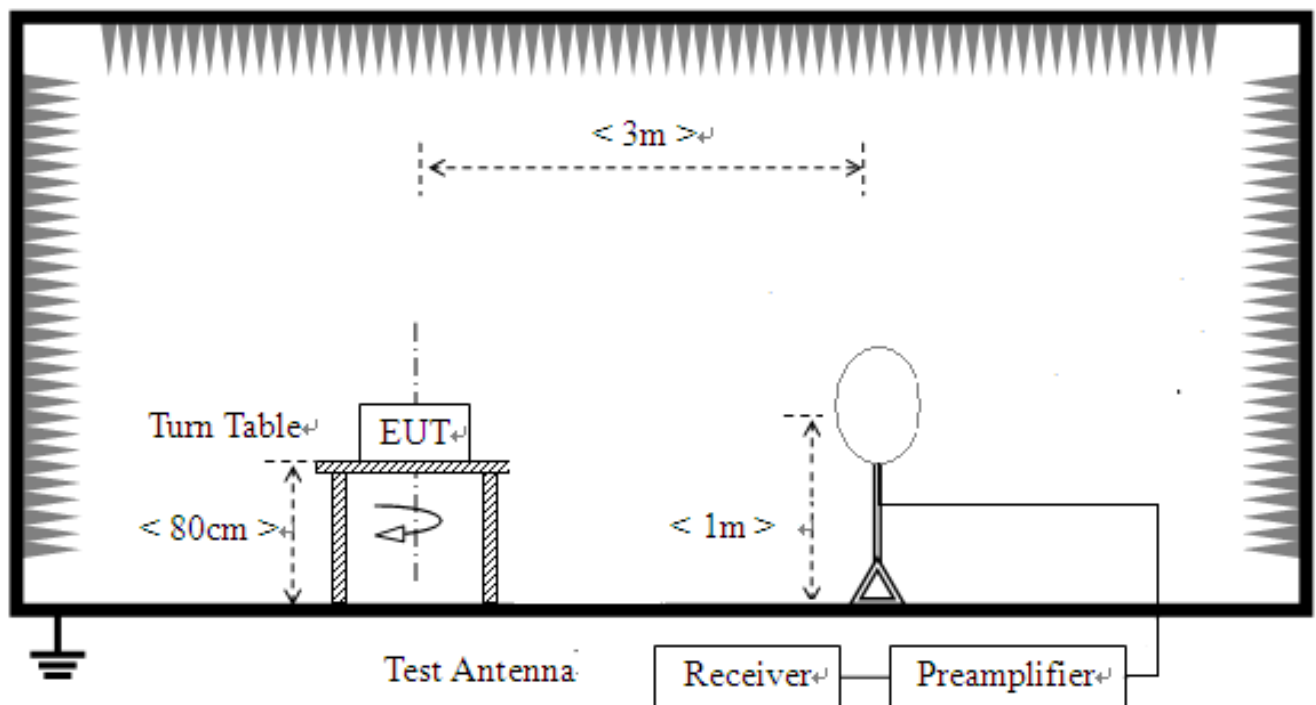
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $55 + 10 \log (P)$ dB.

2.8.2 Measuring Instruments

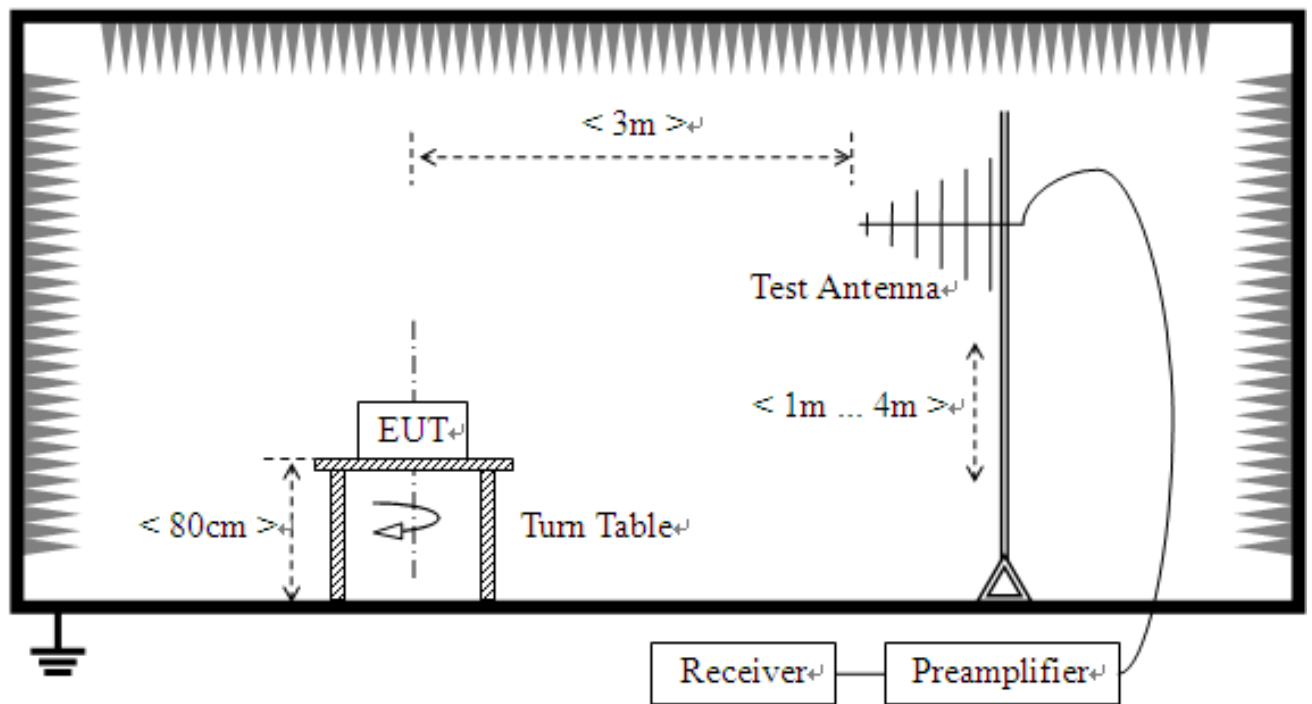
The measuring equipment is listed in the section 3 of this test report.

2.8.3 Test Setup

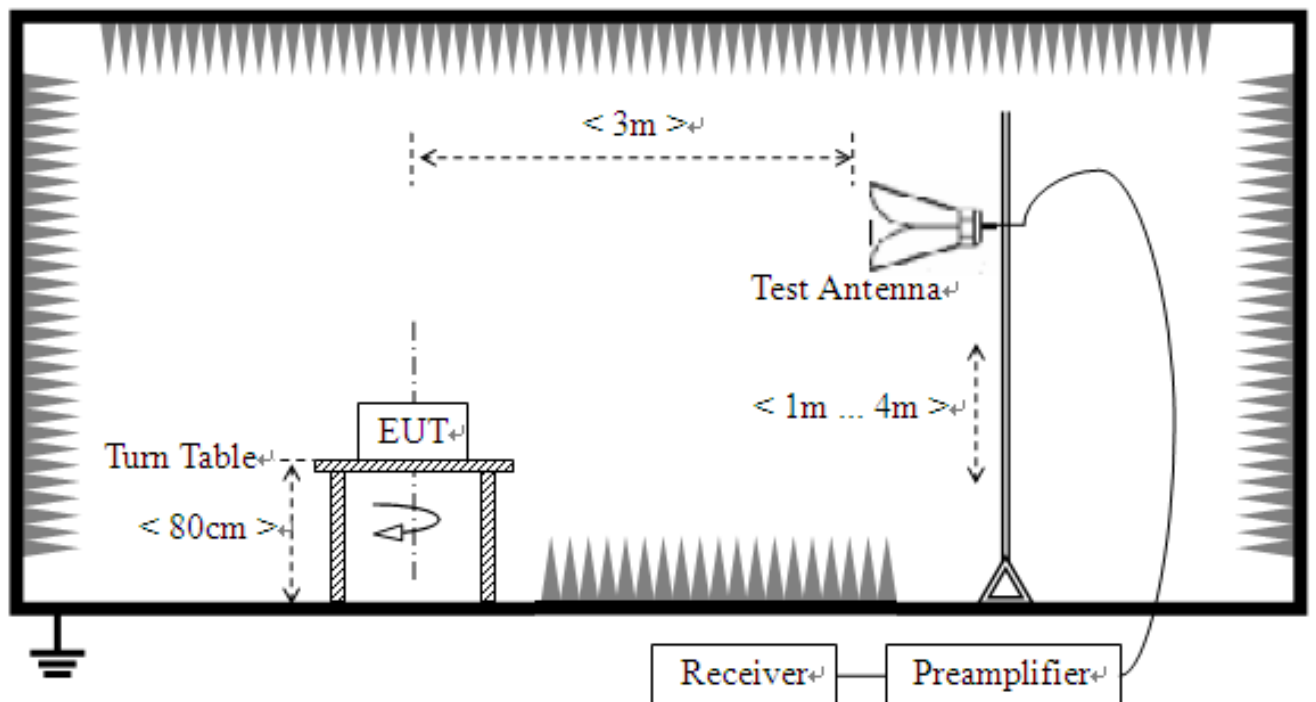
For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



For radiated emissions above 1GHz



2.8.4 Test Procedures

1. The EUT was placed on a rotatable wooden table with 0.8 meter above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

The limit line is derived from $43 + 10\log(P)\text{dB}$ below the transmitter power $P(\text{Watts})$
 $= P(W) - [43 + 10\log(P)] \text{ (dB)}$
 $= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$
 $= -13\text{dBm}.$

<For Band 7>

The limit line is derived from $55 + 10\log(P)\text{dB}$ below the transmitter power $P(\text{Watts})$
 $= P(W) - [55 + 10\log(P)] \text{ (dB)}$
 $= [30 + 10\log(P)] \text{ (dBm)} - [55 + 10\log(P)] \text{ (dB)}$
 $= -25\text{dBm}.$

11. All Spurious Emission tests were performed in X, Y, Z axis direction and low, middle, high channel. And only the worst axis test condition was recorded in this test report.
12. The spectrum is measured from 9 KHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. The worst case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.



13. For 9KHz to 30MHz: the amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
14. The maximum RB configurations of the Radiated Spurious Emissions as RB Size 1, RB Offset 0

2.8.5 Test Result (Plots) of Radiated Spurious Emission

Worst-Case test data provide as below:

30MHz~26.5GHz:

Note: 1. within 30MHz-1GHz were found more than 20dB below limit line

Note: 2. Absolute Level=Reading Level + Factor

LTE Band 2 Middle Channel QPSK 20MHz BW

| NO. | Freq. [MHz] | Reading Level [dBm] | Absolute Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Polarity |
|-----|-------------|---------------------|----------------------|-------------|-------------|-------------|------------|
| 1 | 3075.015 | -55.14 | -57.28 | -13.00 | 44.28 | -2.14 | Horizontal |
| 2 | 6141.628 | -57.10 | -57.22 | -13.00 | 44.22 | -0.12 | Horizontal |
| 3 | 10567.51 | -61.33 | -53.64 | -13.00 | 40.64 | 7.69 | Horizontal |

| NO. | Freq. [MHz] | Reading Level [dBm] | Absolute Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Polarity |
|-----|-------------|---------------------|----------------------|-------------|-------------|-------------|----------|
| 1 | 3114.022 | -54.02 | -55.29 | -13.00 | 42.29 | -1.27 | Vertical |
| 2 | 4494.298 | -54.95 | -59.21 | -13.00 | 46.21 | -4.26 | Vertical |
| 3 | 6123.624 | -56.49 | -56.60 | -13.00 | 43.60 | -0.11 | Vertical |
| 4 | 7902.980 | -58.86 | -56.82 | -13.00 | 43.82 | 2.04 | Vertical |
| 5 | 10567.51 | -60.63 | -52.26 | -13.00 | 39.26 | 8.37 | Vertical |

LTE Band 4 Middle Channel QPSK 20MHz BW

| NO. | Freq. [MHz] | Reading Level [dBm] | Absolute Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Polarity |
|-----|-------------|---------------------|----------------------|-------------|-------------|-------------|------------|
| 1 | 3087.017 | -54.47 | -56.55 | -13.00 | 43.55 | -2.08 | Horizontal |
| 2 | 4407.281 | -55.95 | -60.56 | -13.00 | 47.56 | -4.61 | Horizontal |
| 3 | 6183.636 | -57.28 | -57.26 | -13.00 | 44.26 | 0.02 | Horizontal |
| 4 | 10537.50 | -61.05 | -53.81 | -13.00 | 40.81 | 7.24 | Horizontal |

| NO. | Freq. [MHz] | Reading Level [dBm] | Absolute Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Polarity |
|-----|-------------|---------------------|----------------------|-------------|-------------|-------------|----------|
| 1 | 3132.026 | -53.94 | -55.58 | -13.00 | 42.58 | -1.64 | Vertical |
| 2 | 4515.303 | -55.91 | -60.31 | -13.00 | 47.31 | -4.40 | Vertical |
| 3 | 7239.848 | -59.04 | -57.04 | -13.00 | 44.04 | 2.00 | Vertical |
| 4 | 10549.50 | -61.38 | -53.10 | -13.00 | 40.10 | 8.28 | Vertical |

LTE Band 5 Middle Channel QPSK 10MHz BW

| NO. | Freq. [MHz] | Reading Level [dBm] | Absolute Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Polarity |
|-----|----------------|------------------------|-------------------------|----------------|----------------|----------------|------------|
| 1 | 1573.714 | -52.51 | -62.98 | -13.00 | 49.98 | -10.47 | Horizontal |
| 2 | 1824.164 | -54.71 | -63.80 | -13.00 | 50.80 | -9.09 | Horizontal |
| 3 | 2794.759 | -54.01 | -59.83 | -13.00 | 46.83 | -5.82 | Horizontal |
| 4 | 3112.822 | -54.67 | -56.81 | -13.00 | 43.81 | -2.14 | Horizontal |
| 5 | 4022.604 | -55.47 | -59.81 | -13.00 | 46.81 | -4.34 | Horizontal |
| 6 | 4556.711 | -54.77 | -59.88 | -13.00 | 46.88 | -5.11 | Horizontal |

| NO. | Freq. [MHz] | Reading Level [dBm] | Absolute Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Polarity |
|-----|----------------|------------------------|-------------------------|----------------|----------------|----------------|----------|
| 1 | 956.9823 | -88.26 | -56.85 | -13.00 | 43.85 | 31.41 | Vertical |
| 2 | 1607.721 | -53.38 | -63.70 | -13.00 | 50.70 | -10.32 | Vertical |
| 3 | 2645.929 | -53.89 | -60.50 | -13.00 | 47.50 | -6.61 | Vertical |
| 4 | 3104.420 | -53.74 | -54.81 | -13.00 | 41.81 | -1.07 | Vertical |
| 5 | 3808.961 | -55.64 | -59.20 | -13.00 | 46.20 | -3.56 | Vertical |
| 6 | 5798.959 | -56.90 | -57.59 | -13.00 | 44.59 | -0.69 | Vertical |

LTE Band 7 Middle Channel QPSK 10MHz BW

| NO. | Freq. [MHz] | Reading Level [dBm] | Absolute Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Polarity |
|-----|----------------|------------------------|-------------------------|----------------|----------------|----------------|------------|
| 1 | 3105.021 | -54.26 | -56.33 | -25.00 | 31.33 | -2.07 | Horizontal |
| 2 | 3651.130 | -53.08 | -57.84 | -25.00 | 32.84 | -4.76 | Horizontal |
| 3 | 4434.286 | -54.70 | -59.38 | -25.00 | 34.38 | -4.68 | Horizontal |
| 4 | 5826.565 | -56.21 | -57.34 | -25.00 | 31.34 | -1.13 | Horizontal |
| 5 | 7272.854 | -59.75 | -57.41 | -25.00 | 31.41 | 2.34 | Horizontal |
| 6 | 9457.291 | -60.67 | -57.69 | -25.00 | 31.69 | 2.98 | Horizontal |

| NO. | Freq. [MHz] | Reading Level [dBm] | Absolute Level [dBm] | Limit [dBm] | Margin [dB] | Factor [dB] | Polarity |
|-----|----------------|------------------------|-------------------------|----------------|----------------|----------------|------------|
| 1 | 3066.013 | -54.48 | -56.67 | -25.00 | 30.67 | -2.19 | Horizontal |
| 2 | 4314.262 | -53.99 | -59.45 | -25.00 | 33.45 | -5.46 | Horizontal |
| 3 | 6288.657 | -57.22 | -57.42 | -25.00 | 31.42 | -0.20 | Horizontal |
| 4 | 7254.851 | -59.40 | -57.25 | -25.00 | 31.25 | 2.15 | Horizontal |
| 5 | 8812.162 | -59.94 | -58.09 | -25.00 | 32.09 | 1.85 | Horizontal |
| 6 | 11389.67 | -60.40 | -51.51 | -25.00 | 26.51 | 8.89 | Horizontal |



3. LIST OF MEASURING EQUIPMENT

| Description | Manufacturer | Model | Serial No. | Cal. Date | Due Date | Remark |
|----------------------------------------------|-------------------|-------------------------|---------------|------------|------------|-----------|
| EMI Test Receiver | R&S | ESIB26 | A0304218 | 2018.05.25 | 2019.05.24 | Radiation |
| Loop Antenna | Schwarz beck | HFH2-Z2 | 100047 | 2018.05.25 | 2019.05.24 | Radiation |
| Bilog Antenna | Schwarzbeck | VULB 9163 | 9163-274 | 2018.05.25 | 2019.05.24 | Radiation |
| Broadband antenna (30MHz~1GHz) | R&S | HL562 | 101341 | 2018.05.25 | 2019.05.24 | Radiation |
| Broadband antenna (30MHz~1GHz) | R&S | HL562 | 101339 | 2018.05.25 | 2019.05.24 | Radiation |
| Double ridge horn antenna (1GHz~18GHz) | R&S | HF906 | 100150 | 2018.05.25 | 2019.05.24 | Radiation |
| Double ridge horn antenna (1GHz~18GHz) | R&S | HF906 | 100148 | 2018.05.25 | 2019.05.24 | Radiation |
| Horn antenna (18GHz~26.5GHz) | R&S | HM118 | 101286 | 2018.05.25 | 2019.05.24 | Radiation |
| Horn antenna (18GHz~26.5GHz) | R&S | HM118 | 101284 | 2018.05.25 | 2019.05.24 | Radiation |
| Amplifier 20M~3GHz | R&S | PAP-0203H | 22018 | 2018.05.25 | 2019.05.24 | Radiation |
| Ampilier 1G~18GHz | R&S | MITEQ AFS42-00101800 | 25-S-42 | 2018.05.25 | 2019.05.24 | Radiation |
| Ampilier 18G~40GHz | R&S | JS42-18002600-2 8-5A | 12111.0980.00 | 2018.05.25 | 2019.05.24 | Radiation |
| Spectrum Analyzer | R&S | FSP40 | 1164.4391.40 | 2017.11.12 | 2018.11.11 | Conducted |
| LISN | ROHDE&SCH WARZ | ESH2-Z5 | A0304221 | 2018.05.25 | 2019.05.24 | Conducted |
| Test Receiver | R&S | ESCS30 | A0304260 | 2018.05.25 | 2019.05.24 | Conducted |
| Cable | SUNHNER | SUCOFLEX 100 | / | 2018.05.25 | 2019.05.24 | Radiation |
| Cable | SUNHNER | SUCOFLEX 104 | / | 2018.05.25 | 2019.05.24 | Radiation |
| Temperature chamber | espec | SU-642 | 93008519 | 2017.08.25 | 2018.08.24 | Conducted |
| Wideband Radio Communication tester | R&S | CMW500 | 149332 | 2018.05.04 | 2019.05.03 | Conducted |
| Power Supply | R&S | NGMO1 | 101037 | 2018.05.04 | 2019.05.03 | Conducted |