



# FCC Test Report

**Product Name: LTE CPE**

**Model Number: B593u-12**

**Report No: SYBH(Z-RF)004052012-2003**
**FCC ID: QISB593U-12**

**Reliability Laboratory of Huawei Technologies Co., Ltd.**

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# Notice

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| | |
|---|---|
| **REGULATION** | **FCC CFR47 Part 2:2010: Subpart J;** |
| | **FCC CFR47 Part 15:2010: Subpart C;** |
| | **ANSI C63.10:2009** |
| | |
| | |
| | |
| | |
| | |
| **START OF TEST** | **Apr.27, 2012** |
| **END OF TEST** | **May.05, 2012** |
| | |
| **Final Judgement:** | **Pass** |

Approved By Senior Engineer May.07, 2012 (Date) Dai Linjun (Name) (Signature)

Reviewed By May.07, 2012 (Date) Cousy Xu (Name) Cousy XU (Signature)

Operator May.07, 2012 (Date) Huang Qiuliang (Name) Huang Qiuliang (Signature)

# Contents

# 1 Summary

The table below summarizes the measurements and results for the EUT. Detailed results and descriptions are shown in the following pages.

Table 1 Summary of results

| FCC Measurement Specification | Description | Result |
|---|---|---|
| 15.247 (a) (2) | 6dB bandwidth measurement | PASS |
| 15.247 (b) (3) | Conducted Peak output power | PASS |
| 15.247 (d) | Band edge compliance measurement | PASS |
| 15.247 (d) | Conducted RF spurious | PASS |
| 15.247 (e) | Power spectral density | PASS |
| 15.247 (d) / 15.205 & 15.209 | Radiated spurious emission & Radiated restricted band measurement | PASS |
| 15.207 | Conducted emission test for power port | PASS |

# 2 Product Description

## 2.1 Product Information

### 2.1.1 General Description

B593u-12 LTE/WCDMA/GSM three mode 11 bands CPE is subscriber equipment in the LTE/UMTS/GSM system. B593u-12 implement such functions as RF signal receiving/transmitting, LTE/WCDMA/GSM protocol processing, data service etc. WIFI including 11b/g/n provides an wireless access. Externally it provides USB interface (to connect to the printer etc.), USIM card interface, RJ45 Ethernet interface and RJ11 telephone interface. B593u-12 has two internal antenna and two External Antenna，can automatic switch.

**Note: Only WIFI function was considered in this report.**

### 2.1.2 Support function and Service

The EUT support the function and service as follows:

Table 2 Service and Test mode List

| Service Name | mode | Characteristic |
|---|---|---|
| Data | 11b | IEEE 802.11b with data rate of 11 Mbps |
| Data | 11g | IEEE 802.11g with data rate of 54 Mbps |
| Data | 11n20 | IEEE 802.11n with 20 MHz bandwidth and data rate of MCS-7, not using MIMO |
| Data | 11n40 | IEEE 802.11n with 40 MHz bandwidth and data rate of MCS-7, not using MIMO |
| Data | 11n20-mimo | IEEE 802.11n with 20 MHz bandwidth and data rate of MCS-15, using MIMO |
| Data | 11n40-mimo | IEEE 802.11n with 40 MHz bandwidth and data rate of MCS-15, using MIMO |

## 2.2 Modification Information

For original equipment, following table is not application.

Table 3 Modification Information

| Model Number | Board/Module | Original Version | New Version | Modify Information |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Not applicable!

# 3 Test Site Description

The test site of:

***Huawei Technologies Co. Ltd.***
***P.O. Box 518129***
***Huawei base, bantian,***
***Longgang District, Shenzhen, China***

## 3.1 Testing Period

The test have been performed during the period of

**Apr.27, 2012 – May.5, 2012**

## 3.2 Test Modes

NOTE: Typical working modes for each IEEE 802.11 mode are selected to perform tests.

| Test Mode | Test Modes Description |
|---|---|
| TM1 | IEEE 802.11b with data rate of 11 Mbps |
| TM2 | IEEE 802.11g with data rate of 54 Mbps |
| TM3 | IEEE 802.11n with 20 MHz bandwidth and data rate of MCS-7, not using MIMO |
| TM4 | IEEE 802.11n with 40 MHz bandwidth and data rate of MCS-7, not using MIMO |
| TM5 | IEEE 802.11n with 20 MHz bandwidth and data rate of MCS-15, using MIMO |
| TM6 | IEEE 802.11n with 40 MHz bandwidth and data rate of MCS-15, using MIMO |

NOTE: All relevant operation modes have been tested, and the worst case data is included in this report.

# 4 Product Description

## 4.1 Technical Characteristics

### 4.1.1 Frequency Range

Table 4 Frequency Range

| | | |
|---|---|---|
| Uplink band: | 2400 to 2483.5 MHz | |
| Downlink band: | 2400 to 2483.5 MHz | |
| Hop frequency support: | ☐ YES | ☒ NO |

### 4.1.2 Channel Spacing / Separation

Table 5 Channel Spacing / raster of 20 MHz bandwidth

| | |
|---|---|
| Channel spacing: | 22 MHz |
| Channel raster: | 5 MHz |

Table 6 Channel Spacing / raster of 40 MHz bandwidth

| | |
|---|---|
| Channel spacing: | 40 MHz |
| Channel raster: | 5 MHz |

### 4.1.3 Antenna Information

Table 7 Antenna Information

| | |
|---|---|
| Type: | Integrated / Internal |
| Maximum Gain(dBi): | 2.0 (from 2400MHz to 2500MHz) |

### 4.1.4 Environmental Requirements

Table 8 Environmental Requirements

| | |
|---|---|
| Minimum temperature: | - 10 °C |
| Maximum temperature: | + 55 °C |

| | |
|---|---|
| Relative Humidity: | 5%-95% |

### 4.1.5 Tune-up Procedure

According to CFR (FCC) part 2, subpart 2, section 2.1033(c) (9).

Please reference the document Tune-up Procedure in TCF.

## 4.2 EUT Identification List

### 4.2.1 Board Information

Table 9 Board Information

| LTE CPE | | |
|---|---|---|
| B593u-12 | | |
| Board and Module | | |
| Router Board | Software Version | Modem Board |
| B593RW2A | V100R001 | MD1EM92012UM |

### 4.2.2 Adapter Technical Data

| | |
|---|---|
| AC/DCAdapter Model | HW-120200U1W |
| Manufacturer | FUHUA |
| Input Voltage | 90Vac~270Vac 50/60Hz 0.8A |
| Output Voltage | +12V 2.0A |
| Rated Power | 24W(max) |

| | |
|---|---|
| AC/DCAdapter Model | HW-120200U1W |
| Manufacturer | HuntKey |
| Input Voltage | 90Vac~270Vac 50/60Hz 0.8A |
| Output Voltage | +12V 2.0A |
| Rated Power | 24W(max) |

## 4.3 Associated Equipment Used during Test

| Cable | Quantity | Length | Type of Cable |
|---|---|---|---|
| AC Power | 2 | <3m | Unshielded |
| USB | 1 | <3m | shielded |
| LAN Cable | 4 | <3m | Unshielded |
| Phone Cable | 2 | <3m | Unshielded |

## 4.4 Associated Equipment Used during Test

| Name | Model | Manufacturer | S/N | Calibrated Deadline |
|---|---|---|---|---|
| Notebook | D630 | DELL | 0W7349 | N/A |
| Memorizer | / | R&S | / | N/A |
| Memorizer | / | SANDISK | / | N/A |
| PHONE | HCD8188 | COMIX | / | N/A |

## 4.5 FCC Identification

**Grantee Code:** **QIS**
**Product Code:** **B593U-12**
**FCC Identification:** **QISB593U-12**

# 5 Main Test Instruments

Table 10 Main Test Equipments

| Equipment Description | Manufacturer | Model | Serial Number | Calibrated until |
|---|---|---|---|---|
| Power supply | KEITHLEY | 2303 | 1288003 | Sep.27,2012 |
| Spectrum Analyzer | Agilent | E4440A | MY48250119 | Jul.17,2012 |
| Signal Analyzer | R&S | FSQ31 | 200021 | Sep.27,2012 |
| Temperature Chamber | WEISS | WKL64 | 24600294 | Feb.13,2013 |
| Signal generator | Agilent | E8257D | MY49281095 | Jul.09.2012 |
| Test receiver | R&S | ESU26 | 100150 | May.29.2012 |
| Tunable Dipole | Schwarzbeck | D69250-UHAP/D69250-VHAP | 919/1009 | Jan.29.2013 |
| Tunable Dipole | Schwarzbeck | D69250-UHAP/D69250-VHAP | 979/917 | Jan.29.2013 |
| Horn Antenna | R & S | HF906 | 100683 | May.15, 2012 |
| Horn Antenna | R & S | HF906 | 100684 | Jul.01, 2012 |
| Broadband Antenna | Schwarzbeck | VULB 9163 | 9163-357 | May.15, 2012 |
| Broadband Antenna | Schwarzbeck | VULB 9163 | 9163-356 | May.15, 2012 |

Note: All the equipments are calibrated once a year. When it's almost due, we will arrange calibration again before the calibration deadline.

# 6 Transmitter Measurements

## 6.1 Bandwidth measurement

### 6.1.1 Test Conditions

Table 11 Test Conditions

| | |
|---|---|
| Preconditioning: | 0.5 hour |
| Measured at: | Antenna connector |
| Ambient temperature: | 25°C |
| Relative humidity: | 55% |
| Test Configurations: | TM1/TM2/TM3/TM4/TM5/TM6 at channel No. B,M,T |

### 6.1.2 Test Specifications and Limits

#### 6.1.2.1 Specification

CFR 47 (FCC) part 15.247 (a) (2) and KDB 558074

#### 6.1.2.2 Supporting Standards

Table 12 Supporting Standards:

| | |
|---|---|
| ANSI C63.10-2009 | American National Standard for Testing Unlicensed Wireless Devices |

#### 6.1.2.3 Limits

Systems using digital modulation techniques may operate in the 902 - 928 MHz,
2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Table 13 Limits

| | |
|---|---|
| Limits | ≥ 500kHz |

### 6.1.3 Test Method and Setup

(a) Connect test port of EUT to spectrum analyzer.
(b) Set the EUT to transmit maximum output power at 2.4GHz, then set the measured frequency number and test the 6dB bandwidth with spectrum analyzer.

## Test setup

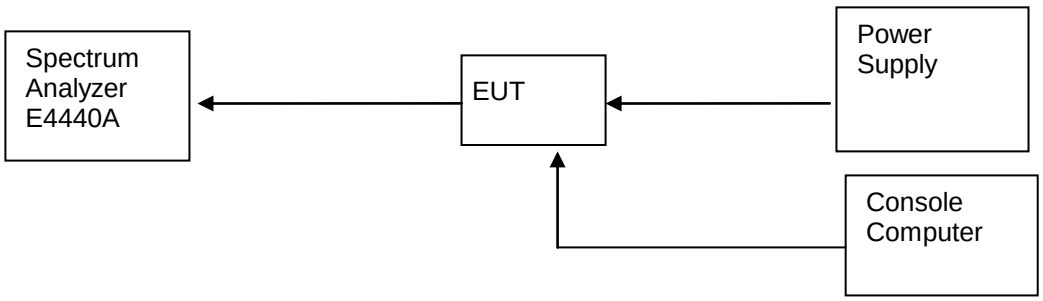


Figure 1. Test Set-up

### 6.1.4 Measurement Results

Table 14 Measurement Results

| Test condition | Chain | Channel Position | Channel Number | Frequency [MHz] | Bandwidth Type | Measured Bandwidth [MHz] | Result |
|---|---|---|---|---|---|---|---|
| TM1 | 1 | B | 1 | 2412 | 6dB | 8.611 | Pass |
| | | | | | 99% | 10.21 | |
| | | M | 6 | 2437 | 6dB | 8.20 | Pass |
| | | | | | 99% | 10.14 | |
| | | T | 11 | 2462 | 6dB | 8.225 | Pass |
| | | | | | 99% | 10.20 | |
| | 2 | B | 1 | 2412 | 6dB | 7.25 | Pass |
| | | | | | 99% | 10.09 | |
| | | M | 6 | 2437 | 6dB | 8.215 | Pass |
| | | | | | 99% | 10.10 | |
| | | T | 11 | 2462 | 6dB | 8.641 | Pass |
| | | | | | 99% | 10.15 | |
| TM2 | 1 | B | 1 | 2412 | 6dB | 15.65 | Pass |
| | | | | | 99% | 16.45 | |
| | | M | 6 | 2437 | 6dB | 14.77 | Pass |
| | | | | | 99% | 16.26 | |
| | | T | 11 | 2462 | 6dB | 15.77 | Pass |
| | | | | | 99% | 16.45 | |
| | 2 | B | 1 | 2412 | 6dB | 15.73 | Pass |
| | | | | | 99% | 16.43 | |
| | | M | 6 | 2437 | 6dB | 15.73 | Pass |
| | | | | | 99% | 16.50 | |
| | | T | 11 | 2462 | 6dB | 15.77 | Pass |
| | | | | | 99% | 16.52 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TM3 | 1 | B | 1 | 2412 | 6dB | 17.24 | Pass |
| | | | | | 99% | 17.41 | |
| | | M | 6 | 2437 | 6dB | 14.43 | |
| | | | | | 99% | 17.32 | |
| | | T | 11 | 2462 | 6dB | 17.39 | Pass |
| | | | | | 99% | 17.40 | |
| | 2 | B | 1 | 2412 | 6dB | 17.46 | Pass |
| | | | | | 99% | 17.43 | |
| | | M | 6 | 2437 | 6dB | 17.52 | Pass |
| | | | | | 99% | 17.47 | |
| | | T | 11 | 2462 | 6dB | 17.54 | Pass |
| | | | | | 99% | 17.45 | |
| TM4 | 1 | B | 3 | 2.422 | 6dB | 36.59 | Pass |
| | | | | | 99% | 36.20 | |
| | | M | 6 | 2437 | 6dB | 35.97 | Pass |
| | | | | | 99% | 35.93 | |
| | | T | 9 | 2452 | 6dB | 35.86 | Pass |
| | | | | | 99% | 36.05 | |
| | 2 | B | 3 | 2422 | 6dB | 36.44 | Pass |
| | | | | | 99% | 36.10 | |
| | | M | 6 | 2437 | 6dB | 36.46 | Pass |
| | | | | | 99% | 36.21 | |
| | | T | 9 | 2452 | 6dB | 36.16 | Pass |
| | | | | | 99% | 36.03 | |
| TM5 | 1 | B | 1 | 2412 | 6dB | 17.29 | Pass |
| | | | | | 99% | 17.41 | |
| | | M | 6 | 2437 | 6dB | 15.10 | Pass |
| | | | | | 99% | 17.32 | |
| | | T | 11 | 2462 | 6dB | 17.10 | Pass |
| | | | | | 99% | 17.42 | |
| | 2 | B | 1 | 2412 | 6dB | 17.49 | Pass |
| | | | | | 99% | 17.45 | |
| | | M | 6 | 2437 | 6dB | 17.42 | Pass |
| | | | | | 99% | 17.49 | |
| | | T | 11 | 2462 | 6dB | 16.39 | Pass |
| | | | | | 99% | 17.44 | |
| TM6 | 1 | B | 3 | 2422 | 6dB | 36.49 | Pass |
| | | | | | 99% | 36.13 | |
| | | M | 6 | 2437 | 6dB | 35.63 | Pass |
| | | | | | 99% | 35.89 | |
| | | T | 9 | 2452 | 6dB | 35.89 | Pass |
| | | | | | 99% | 36.06 | |
| | 2 | B | 3 | 2422 | 6dB | 36.35 | Pass |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | 99% | 36.08 | |
| | | M | 6 | 2437 | 6dB | 36.36 | Pass |
| | | | | | 99% | 36.08 | |
| | | T | 9 | 2452 | 6dB | 35.75 | Pass |
| | | | | | 99% | 35.99 | |

### 6.1.5 Conclusion

The equipment **PASSED** the requirement of this clause.
For the measurement results refer to appendix A.

## 6.2 Peak output power

### 6.2.1 Test Conditions

Table 15 Test Conditions

| | |
|---|---|
| Preconditioning: | 0.5 hour |
| Measured at: | Antenna connector |
| Ambient temperature: | 25°C |
| Relative humidity: | 55% |
| Test Configurations: | TM1/TM2/TM3/TM4/TM5/TM6 at channel No. B,M,T |

### 6.2.2 Test Specifications and Limits

#### 6.2.2.1 Specification

CFR 47 (FCC) part 15.247 (b) (3) and KDB 558074

#### 6.2.2.2 Supporting Standards

Table 16 Supporting Standards:

| | |
|---|---|
| ANSI C63.10-2009 | American National Standard for Testing Unlicensed Wireless Devices |

#### 6.2.2.3 Limits

Compliance with part 15.247 (b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level.

Table 17 Limits

| | |
|---|---|
| 2.4GHz and 5.8GHz system using digital modulation | 1 Watt / 30 dBm |

### 6.2.3 Test Method and Setup

(a) Connect test port of EUT to spectrum analyzer.
(b) Set the EUT to transmit maximum output power.
(c) Then set the EUT to transmit at high, middle and low frequency and measure the conducted output power separately.

**Test setup**

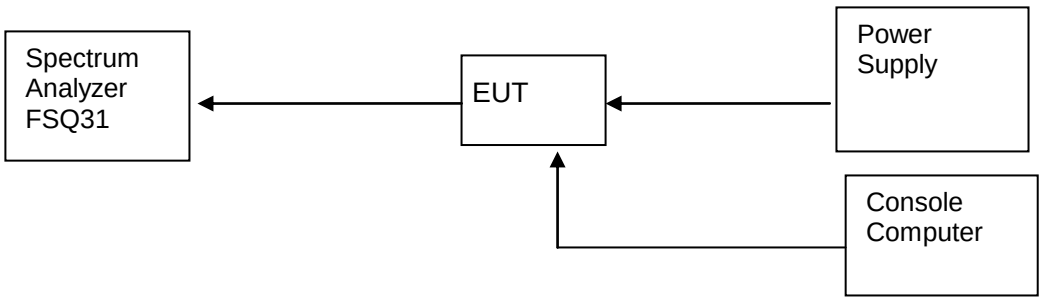


Figure 2. Test Set-up

### 6.2.4 Measurement Results

Table 18 Measurement Results

| Test condition | Chain | Channel Position | Channel Number | Frequency [MHz] | Meas. Level (Cond.) [dBm] | Limit [dBm] | Result |
|---|---|---|---|---|---|---|---|
| TM1 | 1 | B | 1 | 2412 | 18.37 | < 30 | pass |
| | | M | 6 | 2437 | 19.33 | < 30 | pass |
| | | T | 11 | 2462 | 18.47 | < 30 | pass |
| | 2 | B | 1 | 2412 | 19.37 | < 30 | pass |
| | | M | 6 | 2437 | 19.42 | < 30 | pass |
| | | T | 11 | 2462 | 19.71 | < 30 | pass |
| TM2 | 1 | B | 1 | 2412 | 21.29 | < 30 | pass |
| | | M | 6 | 2437 | 21.42 | < 30 | pass |
| | | T | 11 | 2462 | 21.09 | < 30 | pass |
| | 2 | B | 1 | 2412 | 21.39 | < 30 | pass |
| | | M | 6 | 2437 | 21.60 | < 30 | pass |
| | | T | 11 | 2462 | 21.50 | < 30 | pass |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TM3 | 1 | B | 1 | 2412 | 20.08 | < 30 | pass |
| | | M | 6 | 2437 | 19.91 | < 30 | pass |
| | | T | 11 | 2462 | 19.33 | < 30 | pass |
| | 2 | B | 1 | 2412 | 19.83 | < 30 | pass |
| | | M | 6 | 2437 | 19.95 | < 30 | pass |
| | | T | 11 | 2462 | 19.99 | < 30 | pass |
| TM4 | 1 | B | 3 | 2422 | 19.95 | < 30 | pass |
| | | M | 6 | 2437 | 20.00 | < 30 | pass |
| | | T | 9 | 2452 | 20.01 | < 30 | pass |
| | 2 | B | 3 | 2422 | 20.21 | < 30 | pass |
| | | M | 6 | 2437 | 20.43 | < 30 | pass |
| | | T | 9 | 2452 | 20.22 | < 30 | pass |
| TM5 | 1 | B | 1 | 2412 | 19.32 | --- | --- |
| | | M | 6 | 2437 | 20.08 | --- | --- |
| | | T | 11 | 2462 | 19.12 | --- | --- |
| | 2 | B | 1 | 2412 | 19.68 | --- | --- |
| | | M | 6 | 2437 | 19.57 | --- | --- |
| | | T | 11 | 2462 | 19.84 | --- | --- |
| | 1+2 | B | 1 | 2412 | 22.51 | < 30 | pass |
| | | M | 6 | 2437 | 22.84 | < 30 | pass |
| | | T | 11 | 2462 | 22.51 | < 30 | pass |
| TM6 | 1 | B | 3 | 2422 | 20.25 | --- | --- |
| | | M | 6 | 2437 | 20.38 | --- | --- |
| | | T | 9 | 2452 | 20.55 | --- | --- |
| | 2 | B | 3 | 2422 | 20.65 | --- | --- |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | M | 6 | 2437 | 20.55 | --- | --- |
| | | T | 9 | 2452 | 20.51 | --- | --- |
| | 1+2 | B | 3 | 2422 | 23.46 | < 30 | pass |
| | | M | 6 | 2437 | 23.48 | < 30 | pass |
| | | T | 9 | 2452 | 23.54 | < 30 | pass |

### 6.2.5 Conclusion

The equipment **PASSED** the requirement of this clause.
For the measurement results refer to appendix B.

# 6.3 Band edge spurious emission

## 6.3.1 Test Conditions

Table 19 Test Conditions

| | |
|---|---|
| Preconditioning: | 0.5 hour |
| Measured at: | Antenna connector |
| Ambient temperature: | 25°C |
| Relative humidity: | 55% |
| Test Configurations: | TM1/TM2/TM3/TM4/TM5/TM6 at channel No. B, T |

## 6.3.2 Test Specifications and Limits

### 6.3.2.1 Specification

CFR 47 (FCC) part 15.247(d) and KDB 558074

### 6.3.2.2 Supporting Standards

Table 20 Supporting Standards:

| | |
|---|---|
| ANSI C63.10-2009 | American National Standard for Testing Unlicensed Wireless Devices |

### 6.3.2.3 Limits

Compliance with part 15.247 (d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required.
.

Table 21 Limits

| | |
|---|---|
| Band edge spurious: | 20 dBc/100kHz |

## 6.3.3 Test Method and Setup

(a) Connect test port of EUT to spectrum analyzer
(b) Set the EUT to transmit maximum output power at 2.4GHz
(c) Then set the EUT to transmit at high, low frequency and measure the conducted band edge spurious separately.

## Test setup

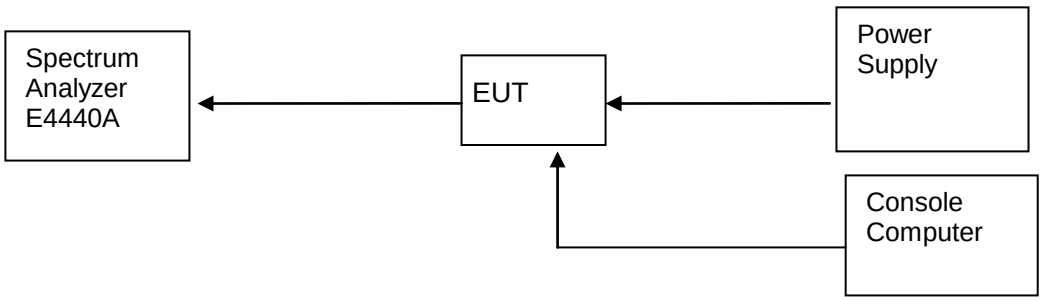


Figure 3. Test Set-up

### 6.3.4 Measurement Results

Table 22 Measurement Results

| Test condition | Chain | Channel Position | Channel Number | Frequency [MHz] | Carrier Power [dBm] | Max. Spurious Level [dBm] | Limit [dBm] | Result |
|---|---|---|---|---|---|---|---|---|
| TM1 | 1 | Low Edge | 1 | 2412 | 6.91 | -34.62 | -13.1 | pass |
| | | High Edge | 11 | 2462 | 7.00 | -29.51 | -13.0 | pass |
| | 2 | Low Edge | 1 | 2412 | 8.07 | -30.07 | -11.9 | pass |
| | | High Edge | 11 | 2462 | 8.13 | -27.11 | -11.9 | pass |
| TM2 | 1 | Low Edge | 1 | 2412 | 2.89 | -28.76 | -17.1 | pass |
| | | High Edge | 11 | 2462 | 2.94 | -29.70 | -17.1 | pass |
| | 2 | Low Edge | 1 | 2412 | 2.86 | -26.25 | -17.1 | pass |
| | | High Edge | 11 | 2462 | 3.77 | -26.45 | -16.2 | pass |
| TM3 | 1 | Low Edge | 1 | 2412 | 0.70 | -34.20 | -19.3 | pass |
| | | High Edge | 11 | 2462 | 0.83 | -36.36 | -19.2 | pass |
| | 2 | Low Edge | 1 | 2412 | 0.95 | -33.89 | -19.0 | pass |
| | | High Edge | 11 | 2462 | 1.73 | -31.57 | -18.3 | pass |
| TM4 | 1 | Low Edge | 3 | 2422 | -2.32 | -32.76 | -22.3 | pass |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | High Edge | 9 | 2452 | -1.77 | -33.12 | -21.8 | pass |
| | 2 | Low Edge | 3 | 2422 | -1.19 | -32.43 | -21.2 | pass |
| | | High Edge | 9 | 2452 | -1.47 | -34.56 | -21.5 | pass |
| TM5 | 1 | Low Edge | 1 | 2412 | 0.30 | -34.45 | -19.7 | pass |
| | | High Edge | 11 | 2462 | 0.41 | -38.47 | -19.6 | pass |
| | 2 | Low Edge | 1 | 2412 | 0.46 | -35.21 | -19.5 | pass |
| | | High Edge | 11 | 2462 | 0.86 | -30.23 | -19.1 | pass |
| TM6 | 1 | Low Edge | 3 | 2422 | -2.27 | -32.18 | -22.3 | pass |
| | | High Edge | 9 | 2452 | -2.28 | -32.46 | -22.3 | pass |
| | 2 | Low Edge | 3 | 2422 | -1.16 | -32.84 | -21.2 | pass |
| | | High Edge | 9 | 2.452 | -1.61 | -33.39 | -21.6 | pass |

### 6.3.5 Conclusion

The equipment **PASSED** the requirement of this clause.
For the measurement results refer to appendix C.

## 6.4 Conducted RF spurious

### 6.4.1 Test Conditions

Table 23 Test Conditions

| | |
|---|---|
| Preconditioning: | 0.5 hour |
| Measured at: | Antenna connector |
| Ambient temperature: | 25°C |
| Relative humidity: | 55% |
| Test Configurations: | TM1/TM2/TM3/TM4/TM5/TM6 at channel No.B, M, T |

### 6.4.2 Test Specifications and Limits

#### 6.4.2.1 Specification

CFR 47 (FCC) part 15.247 (d) and KDB 558074

#### 6.4.2.2 Supporting Standards

Table 24 Supporting Standards:

| | |
|---|---|
| ANSI C63.10-2009 | American National Standard for Testing Unlicensed Wireless Devices |

#### 6.4.2.3 Limits

Compliance with part 15.247 (d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required.
.

Table 25 Limits

| | |
|---|---|
| Band edge spurious: | 20 dBc/100kHz |

### 6.4.3 Test Method and Setup

(a) Connect test port of EUT to spectrum analyzer
(b) Set the EUT to transmit maximum output power at 2.4GHz and.
(c) Then set the EUT to transmit at high, middle and low frequency and measure the conducted band edge spurious separately.

## Test setup

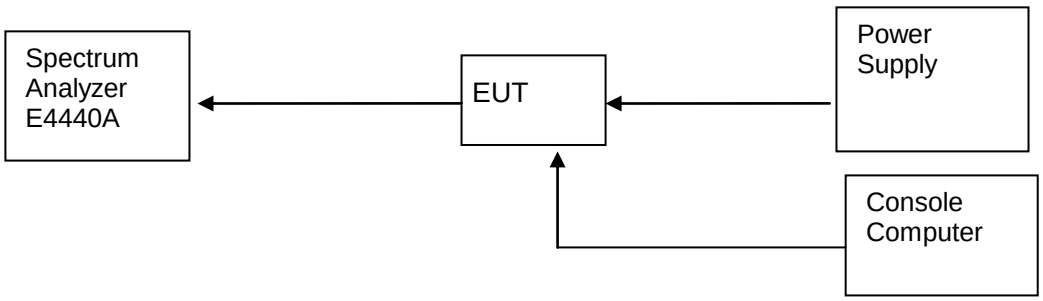


Figure 4. Test Set-up

### 6.4.4 Measurement Results

Table 26 Measurement Results

| Test condition | Chain | Test Frequency Range | Channel No. | Carrier Frequency [MHz] | Carrier Power [dBm] | Max. Spurious Level [dBm] | Limit [dBm] | Result |
|---|---|---|---|---|---|---|---|---|
| TM1 | 1 | 9KHz-26GHz | 1 | 2412 | 10.39 | -42.71 | -9.6 | Pass |
| | | 9KHz-26GHz | 6 | 2437 | 11.39 | -42.32 | -8.6 | Pass |
| | | 9KHz-26GHz | 11 | 2462 | 10.56 | -41.98 | -9.4 | Pass |
| | 2 | 9KHz-26GHz | 1 | 2412 | 11.75 | -42.86 | -8.2 | Pass |
| | | 9KHz-26GHz | 6 | 2437 | 11.98 | -41.47 | -8.0 | Pass |
| | | 9KHz-26GHz | 11 | 2462 | 11.75 | -41.42 | -8.2 | Pass |
| TM2 | 1 | 9KHz-26GHz | 1 | 2412 | 9.49 | -42.64 | -10.5 | Pass |
| | | 9KHz-26GHz | 6 | 2437 | 8.95 | -41.99 | -11.1 | Pass |
| | | 9KHz-26GHz | 11 | 2462 | 8.27 | -42.79 | -11.7 | Pass |
| | 2 | 9KHz-26GHz | 1 | 2412 | 10.53 | -42.52 | -9.5 | Pass |
| | | 9KHz-26GHz | 6 | 2437 | 11.89 | -42.17 | -8.1 | Pass |
| | | 9KHz-26GHz | 11 | 2462 | 11.20 | -42.79 | -8.8 | Pass |
| TM3 | 1 | 9KHz-26GHz | 1 | 2412 | 7.30 | -42.33 | -12.7 | Pass |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 9KHz-26GHz | 6 | 2437 | 8.43 | -43.35 | -11.6 | Pass |
| | | 9KHz-26GHz | 11 | 2462 | 8.78 | -41.01 | -11.2 | Pass |
| | 2 | 9KHz-26GHz | 1 | 2412 | 7.94 | -41.56 | -12.1 | Pass |
| | | 9KHz-26GHz | 6 | 2437 | 8.66 | -42.89 | -11.3 | Pass |
| | | 9KHz-26GHz | 11 | 2462 | 7.25 | -42.75 | -12.8 | Pass |
| TM4 | 1 | 9KHz-26GHz | 3 | 2422 | 4.07 | -42.77 | -15.9 | Pass |
| | | 9KHz-26GHz | 6 | 2437 | 6.39 | -41.93 | -13.6 | Pass |
| | | 9KHz-26GHz | 9 | 2452 | 5.88 | -42.38 | -14.1 | Pass |
| | 2 | 9KHz-26GHz | 3 | 2422 | 4.87 | -43.15 | -15.1 | Pass |
| | | 9KHz-26GHz | 6 | 2437 | 4.64 | -42.27 | -15.4 | Pass |
| | | 9KHz-26GHz | 9 | 2452 | 5.46 | -42.28 | -14.5 | Pass |
| TM5 | 1 | 9KHz-26GHz | 1 | 2422 | 7.06 | -42.44 | -12.9 | Pass |
| | | 9KHz-26GHz | 6 | 2437 | 8.48 | -43.11 | -11.5 | Pass |
| | | 9KHz-26GHz | 11 | 2452 | 6.93 | -42.55 | -13.1 | Pass |
| | 2 | 9KHz-26GHz | 1 | 2412 | 7.63 | -42.84 | -12.4 | Pass |
| | | 9KHz-26GHz | 6 | 2437 | 8.71 | -42.72 | -11.3 | Pass |
| | | 9KHz-26GHz | 11 | 2462 | 7.86 | -41.75 | -12.1 | Pass |
| TM6 | 1 | 9KHz-26GHz | 3 | 2422 | 4.95 | -42.92 | -15.1 | Pass |
| | | 9KHz-26GHz | 6 | 2437 | 5.97 | -42.36 | -14.0 | Pass |
| | | 9KHz-26GHz | 9 | 2452 | 6.69 | -42.65 | -13.3 | Pass |
| | 2 | 9KHz-26GHz | 3 | 2422 | 5.77 | -42.31 | -14.2 | Pass |
| | | 9KHz-26GHz | 6 | 2437 | 5.04 | -42.46 | -15.0 | Pass |
| | | 9KHz-26GHz | 9 | 2452 | 5.61 | -42.66 | -14.1 | Pass |

### 6.4.5 Conclusion

The equipment **PASSED** the requirement of this clause.
For the measurement results refer to appendix D.

## 6.5 Power spectral density

### 6.5.1 Test Conditions

Table 27 Test Conditions

| | |
|---|---|
| Preconditioning: | 0.5 hour |
| Measured at: | Antenna connector |
| Ambient temperature: | 25°C |
| Relative humidity: | 55% |
| Test Configurations: | TM1/TM2/TM3/TM4/TM5/TM6 at channel No.B, M, T |

### 6.5.2 Test Specifications and Limits

#### 6.5.2.1 Specification

CFR 47 (FCC) part 15.247 (e) and KDB 558074

#### 6.5.2.2 Supporting Standards

Table 28 Supporting Standards:

| | |
|---|---|
| ANSI C63.10-2009 | American National Standard for Testing Unlicensed Wireless Devices |

#### 6.5.2.3 Limits

Compliance with part 15.247 (e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. The same method of determining the conducted output power shall be used to determine the power spectral density.
.

Table 29 Limits

| | |
|---|---|
| Band edge spurious: | 8 dBm/3kHz |

### 6.5.3 Test Method and Setup

(a) Connect test port of EUT to spectrum analyzer
(b) Set the EUT to transmit maximum output power at 2.4GHz and.
(c) Then set the EUT to transmit at high, middle and low frequency and measure the conducted band edge spurious separately.

## Test setup

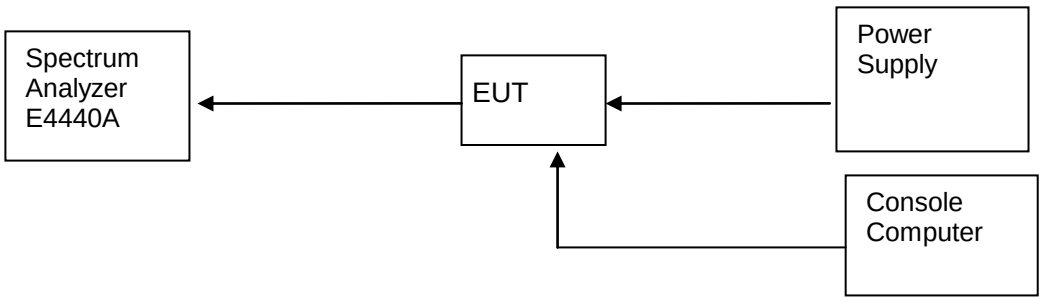


Figure 5. Test Set-up

### 6.5.4 Measurement Results

Table 30 Measurement Results

| Test condition | Chain | Channel Position | Channel Number | Frequency [MHz] | Measured Power spectral density [dBm] | Limit [dBm] | Result |
|---|---|---|---|---|---|---|---|
| TM1 | 1 | B | 1 | 2412 | 0.21 | < 8 | pass |
| | | M | 6 | 2437 | 1.82 | < 8 | pass |
| | | T | 11 | 2462 | 0.76 | < 8 | pass |
| | 2 | B | 1 | 2412 | 2.02 | < 8 | pass |
| | | M | 6 | 2437 | 2.40 | < 8 | pass |
| | | T | 11 | 2462 | 1.58 | < 8 | pass |
| TM2 | 1 | B | 1 | 2412 | -12.66 | < 8 | pass |
| | | M | 6 | 2437 | -11.98 | < 8 | pass |
| | | T | 11 | 2462 | -12.80 | < 8 | pass |
| | 2 | B | 1 | 2412 | -12.81 | < 8 | pass |
| | | M | 6 | 2437 | -12.73 | < 8 | pass |
| | | T | 11 | 2462 | -12.53 | < 8 | pass |
| TM3 | 1 | B | 1 | 2412 | -15.25 | < 8 | pass |
| | | M | 6 | 2437 | -14.10 | < 8 | pass |
| | | T | 11 | 2462 | -13.95 | < 8 | pass |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 | B | 1 | 2412 | -14.77 | < 8 | pass |
| | | M | 6 | 2437 | -14.91 | < 8 | pass |
| | | T | 11 | 2462 | -2.18 | < 8 | pass |
| TM4 | 1 | B | 3 | 2422 | -19.60 | <8 | pass |
| | | M | 6 | 2437 | -18.22 | < 8 | pass |
| | | T | 9 | 2452 | -19.18 | < 8 | pass |
| | 2 | B | 3 | 2422 | -19.48 | < 8 | pass |
| | | M | 6 | 2437 | -19.25 | < 8 | pass |
| | | T | 9 | 2452 | -18.68 | < 8 | pass |
| TM5 | 1 | B | 1 | 2412 | -15.29 | --- | --- |
| | | M | 6 | 2437 | -7.64 | --- | --- |
| | | T | 11 | 2462 | -15.37 | --- | --- |
| | 2 | B | 1 | 2412 | -15.17 | --- | --- |
| | | M | 6 | 2437 | -15.02 | --- | --- |
| | | T | 11 | 2462 | -15.07 | --- | --- |
| | 1+2 | B | 1 | 2412 | -12.22 | < 8 | pass |
| | | M | 6 | 2437 | -6.91 | < 8 | pass |
| | | T | 11 | 2462 | -12.21 | < 8 | pass |
| TM6 | 1 | B | 3 | 2422 | -20.28 | --- | --- |
| | | M | 6 | 2437 | -18.40 | --- | --- |
| | | T | 9 | 2452 | -19.71 | --- | --- |
| | 2 | B | 3 | 2422 | -20.22 | --- | --- |
| | | M | 6 | 2437 | -19.93 | --- | --- |
| | | T | 9 | 2452 | -19.69 | --- | --- |
| | 1+2 | B | 3 | 2422 | -17.24 | < 8 | pass |
| | | M | 6 | 2437 | -16.09 | < 8 | pass |
| | | T | 9 | 2452 | -16.69 | < 8 | pass |

### 6.5.5 Conclusion

The equipment **PASSED** the requirement of this clause.
For the measurement results refer to appendix E.

# 6.6 Radiated spurious emission & spurious in restricted band

## 6.6.1 Test Conditions

Table 31 Test Conditions

| | |
|---|---|
| Preconditioning: | 0.5 hour |
| Measured at: | enclosure |
| Ambient temperature: | 25. °C |
| Relative humidity: | 55% |
| Test Configurations: | TM1/TM2/TM3/TM4/TM5/TM6 at channel No.B, M, T |

## 6.6.2 Test Specifications and Limits

### 6.6.2.1 Specification

CFR 47 (FCC) part 15.247 (d), 15.205 & 15.209 and KDB 558074

### 6.6.2.2 Supporting Standards

Table 32 Supporting Standards:

| | |
|---|---|
| ANSI C63.10-2009 | American National Standard for Testing Unlicensed Wireless Devices |

Table 33

### 6.6.2.3 Limits

According to part 15.247 (d) / 15.205 & 15.209, all spurious emission in the frequency range from 30MHz to 10$^{th}$ harmonics of carrier frequency should be meet the requirement of following table.

Table 34 Limits

| Frequency (MHz) | Field Strength (μV/m) | Field Strength (dBμV/m) | Measurement Distance (meters) | Detector |
|---|---|---|---|---|
| 0.009 - 0.490 | 2400/F(kHz) | 20*lg(2400/F(kHz)) | 300 | QP |
| 0.490 - 1.705 | 24000/F(kHz) | 20*lg(24000/F(kHz)) | 30 | QP |
| 1.705 - 30 | 30 | 29.5 | 30 | QP |
| 30 – 88 | 100 | 40 | 3 | QP |
| 88 – 216 | 150 | 43.5 | 3 | QP |
| 216 – 960 | 200 | 46 | 3 | QP |
| 960 -1000 | 500 | 54 | 3 | QP |
| Above 1000 | 500 | 54 | 3 | AV |
| Above 1000 | 500 | 74 | 3 | PK |

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table 42).

### 6.6.3 Test Method and Setup

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10 (2009). The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10.The Radiated Disturbance measurements were made using a Rohde and Schwarz Test Receiver and control software.

A preliminary scan and a final scan of the emissions were made by using test script of software; the emissions were measured using a Quasi-Peak Detector below 1GHz, and AV detector above 1GHz. The maximal emission value was acquired by adjusting the antenna height, polarisation and turntable azimuth in accordance with the software setup. Normally, the height range of antenna was 1m to 4m, the azimuth range of turntable was 0°to 360°, The receive antenna has two polarizations V and H.

A portable or small unlicensed wireless device shall be placed on a non-metallic test fixture or other nonmetallic support during testing. The supporting fixture shall permit orientation of the EUT in each of three orthogonal (x, y, z axes) axis positions such that emissions from the EUT are maximized.

The EUT was communicated with the BTS simulator through Air interface. The EUT operated on the typical channel.

Measurement bandwidth: 30 MHz – 1000 MHz:120 kHz
Measurement bandwidth: 1000 MHz – 10$^{th}$ Carrier Frequency: 1 MHz

**Test set up**

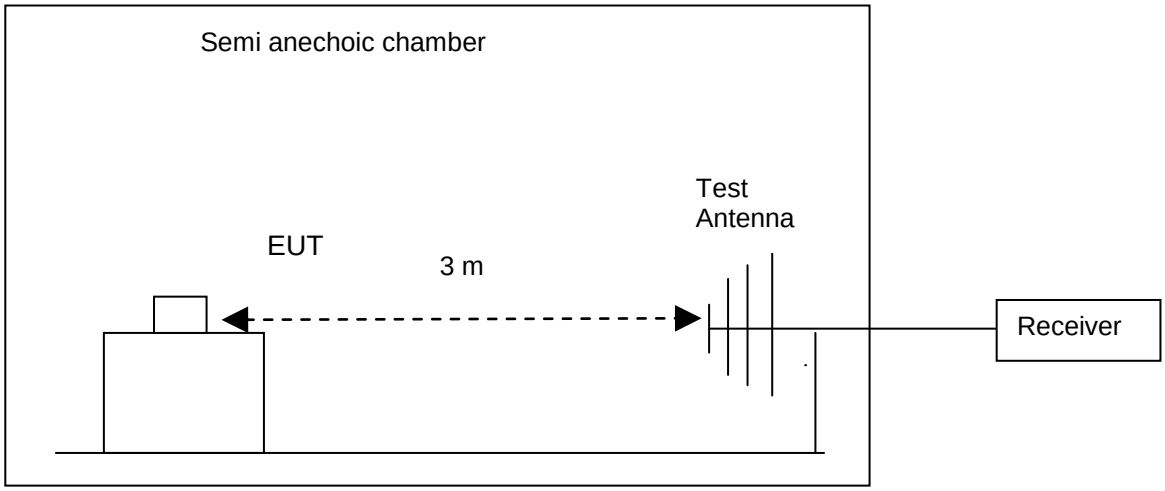


Figure 6. Test Set up

### 6.6.4 Measurement Results

Note 1: The following measurement results exceed the limit line is the carrier frequency.
Note 2: This test was carried out in all the test modes, here only the worst test result was shown.

| Test condition | Channel No. | Carrier Frequency [MHz] | Measured | Result |
|---|---|---|---|---|
| TM1 | 1 | 2412 | Refer to Appendix F | Pass |
| | 6 | 2437 | Refer to Appendix F | Pass |
| | 11 | 2462 | Refer to Appendix F | Pass |
| TM2 | 1 | 2412 | Refer to Appendix F | Pass |
| | 6 | 2437 | Refer to Appendix F | Pass |

| | | | | |
|---|---|---|---|---|
| | 11 | 2462 | Refer to Appendix F | Pass |
| TM3 | 1 | 2412 | Refer to Appendix F | Pass |
| | 6 | 2437 | Refer to Appendix F | Pass |
| | 11 | 2462 | Refer to Appendix F | Pass |
| TM4 | 3 | 2422 | Refer to Appendix F | Pass |
| | 6 | 2437 | Refer to Appendix F | Pass |
| | 9 | 2452 | Refer to Appendix F | Pass |
| TM5 | 1 | 2412 | Refer to Appendix F | Pass |
| | 6 | 2437 | Refer to Appendix F | Pass |
| | 11 | 2462 | Refer to Appendix F | Pass |
| TM6 | 3 | 2422 | Refer to Appendix F | Pass |
| | 6 | 2437 | Refer to Appendix F | Pass |
| | 9 | 2452 | Refer to Appendix F | Pass |

### 6.6.5 Conclusion

The equipment **PASSED** the requirement of this clause.
For the measurement results refer to appendix F.

# 6.7 Conducted Emission at Power Port

## 6.7.1 Test Conditions

Table 35 Test Conditions

| | |
|---|---|
| Preconditioning: | 0.5 hour |
| Measured at: | Power port |
| Ambient temperature: | 25. °C |
| Relative humidity: | 55% |
| Test Configurations: | TM1 at channel No. 6 |

## 6.7.2 Test Specifications and Limits

### 6.7.2.1 Specification

CFR 47 (FCC) part 15.207 and KDB 558074

### 6.7.2.2 Supporting Standards

Table 36 Supporting Standards:

| | |
|---|---|
| ANSI C63.10-2009 | American National Standard for Testing Unlicensed Wireless Devices |

Table 37

### 6.7.2.3 Limits

Compliance with part15.207, conducted emission must meet the requirement of following table.

Table 38 Limits

| Frequency of Emission (MHz) | Conducted Limit (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56 * | 56 to 46 * |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

Note: * Decreases with the logarithm of the frequency.

## 6.7.3 Test Method and Setup

The Table-top EUT was placed upon a non-metallic table 0.8 m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2009.

Conducted Disturbance at AC Port measurements were undertaken on the L and N Lines. The emissions were measured using a Quasi-Peak Detector and Average Detector.

The EUT was communicated with the BTS simulator through Air interface, the BTS simulator controls

the Wireless Modem to transmitter the maximum power which defined in specification of product. The Wireless Modem operated on the typical channel.

Measurement bandwidth (RBW) for 150kHz to 30 MHz: 9 kHz;

## Test Set-up

The EUT was setup in the screened chamber and operated under nominal conditions.

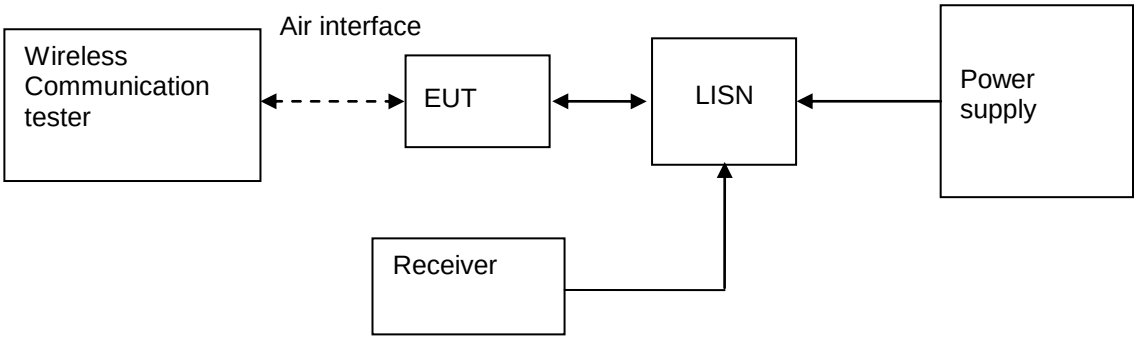


Figure 7. Test Set-up

### 6.7.4 Measurement Results

Table 39 MEASUREMENT RESULT:QP DECTER

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Line | PE |
|---|---|---|---|---|---|---|
| 0.224077 | 36.9 | 9.7 | 62.7 | 25.8 | L1 | FLO |
| 0.330252 | 41.8 | 9.7 | 59.4 | 17.6 | L1 | FLO |
| 0.335902 | 41.6 | 9.7 | 59.3 | 17.7 | L1 | FLO |
| 0.854070 | 31.4 | 9.7 | 56.0 | 24.6 | L1 | FLO |
| 0.862234 | 31.0 | 9.7 | 56.0 | 25.0 | L1 | FLO |
| 1.250021 | 28.1 | 9.7 | 56.0 | 27.9 | L1 | FLO |

Table 40 MEASUREMENT RESULT:AV DECTER

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Line | PE |
|---|---|---|---|---|---|---|
| 0.238829 | 29.3 | 9.7 | 52.1 | 22.8 | L1 | FLO |
| 0.329378 | 33.3 | 9.7 | 49.5 | 16.2 | L1 | FLO |
| 0.329396 | 33.2 | 9.7 | 49.5 | 16.3 | L1 | FLO |
| 0.806325 | 22.5 | 9.7 | 46.0 | 23.5 | L1 | FLO |
| 0.854111 | 21.4 | 9.7 | 46.0 | 24.6 | L1 | FLO |
| 1.186392 | 22.3 | 9.7 | 46.0 | 23.7 | L1 | FLO |

Table 41

### 6.7.5 Conclusion

The equipment **PASSED** the requirement of this clause.
For the measurement results refer to appendix G.

# 7 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 as following:

Table 42 System Measurement Uncertainty

| Items | | Extended Uncertainty |
|---|---|---|
| 20dB bandwidth measurement | Magnitude (%) | U=0.2%; k=2 |
| Peak output power | Power(dBm) | U=0.39dB; k=2 |
| Band edge compliance measurement | Disturbance Power(dBm) | U=2.0dB; k=2 |
| Conducted RF spurious | Disturbance Power(dBm) | U=0.4dB; k=2 |
| Power spectral density | Disturbance Power(dBm) | U=0.4dB; k=2 |
| Radiated spurious emission & Radiated restricted band measurement | Field strength (dBμV/m) | U=4.1dB; k=2<br>U=4.1dB; k=2 |
| Conducted emission test for power port | Disturbance Voltage(dBμV) | U=3.4dB; k=2 |

# 8 Appendices

| | |
|---|---|
| Appendix A | Measurement Results  Bandwidth measurement |
| Appendix B | Measurement Results Peak output power |
| Appendix C | Measurement Results Band edge compliance measurement |
| Appendix D | Measurement Results Conducted RF spurious |
| Appendix E | Measurement Results Power spectral density |
| Appendix F | Measurement Results Radiated spurious emission |
| Appendix G | Measurement Results Conducted emission test for power port |
| Appendix H | Photos of Test Setup |

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