



# FCC RF Test Report

**APPLICANT** : Lenovo(Shanghai) Electronics Technology Co., Ltd.  
**EQUIPMENT** : Portable Tablet Computer  
**BRAND NAME** : Lenovo  
**MODEL NAME** : Lenovo YB1-X90L  
**FCC ID** : O57YB1X90L1  
**STANDARD** : 47 CFR Part 2, 22(H), 24(E), 27(L), 27(M), 27(H)  
**CLASSIFICATION** : PCS Licensed Transmitter (PCB)

This is a data re-used report which is only valid together with the original test report. The product was received on Jan. 06, 2017 and completely tested on Mar. 22, 2017. We, Sporton International (KunShan) INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA / EIA-603-D-2010 and the testing has shown the tested sample to be in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (KunShan) INC., the test report shall not be reproduced except in full.

Prepared by: James Huang / Manager

Approved by: Jones Tsai / Manager



**Sporton International (KunShan) INC.**  
**No.3-2, Pingxiang Road, Kunshan Development Zone, Jiangsu, China**



## **TABLE OF CONTENTS**

|                                                  |                                                          |           |
|--------------------------------------------------|----------------------------------------------------------|-----------|
| <b>1</b>                                         | <b>GENERAL DESCRIPTION .....</b>                         | <b>5</b>  |
| 1.1                                              | Applicant .....                                          | 5         |
| 1.2                                              | Manufacturer .....                                       | 5         |
| 1.3                                              | Product Feature of Equipment Under Test.....             | 5         |
| 1.4                                              | Product Specification of Equipment Under Test.....       | 6         |
| 1.5                                              | Component List.....                                      | 6         |
| 1.6                                              | Modification of EUT .....                                | 6         |
| 1.7                                              | Maximum ERP Power.....                                   | 7         |
| 1.8                                              | Testing Location .....                                   | 8         |
| 1.9                                              | Applicable Standards.....                                | 8         |
| 1.10                                             | Re-use of Measured Data .....                            | 9         |
| <b>2</b>                                         | <b>TEST CONFIGURATION OF EQUIPMENT UNDER TEST .....</b>  | <b>10</b> |
| 2.1                                              | Test Mode .....                                          | 10        |
| 2.2                                              | Connection Diagram of Test System.....                   | 11        |
| 2.3                                              | Support Unit used in test configuration and system ..... | 11        |
| 2.4                                              | Frequency List of Low/Middle/High Channels .....         | 12        |
| <b>3</b>                                         | <b>RADIATED TEST ITEMS .....</b>                         | <b>13</b> |
| 3.1                                              | Measuring Instruments .....                              | 13        |
| 3.2                                              | Test Setup .....                                         | 13        |
| 3.3                                              | Test Result of Radiated Test .....                       | 13        |
| 3.4                                              | Effective Radiated Power .....                           | 14        |
| 3.5                                              | Radiated Spurious Emission .....                         | 16        |
| <b>4</b>                                         | <b>LIST OF MEASURING EQUIPMENT .....</b>                 | <b>17</b> |
| <b>5</b>                                         | <b>UNCERTAINTY OF EVALUATION .....</b>                   | <b>18</b> |
| <b>APPENDIX A. TEST RESULTS OF RADIATED TEST</b> |                                                          |           |
| <b>APPENDIX B. TEST SETUP PHOTOGRAPHS</b>        |                                                          |           |
| <b>APPENDIX C. REFERENCE REPORT</b>              |                                                          |           |



## REVISION HISTORY

| REPORT NO. | VERSION | DESCRIPTION             | ISSUED DATE   |
|------------|---------|-------------------------|---------------|
| FG710608B  | Rev. 01 | Initial issue of report | Apr. 12, 2017 |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |
|            |         |                         |               |

**SUMMARY OF TEST RESULT**

| Report Section | FCC Rule      | Description                                       | Limit                               | Result | Remark                                     |
|----------------|---------------|---------------------------------------------------|-------------------------------------|--------|--------------------------------------------|
| 3.4            | §27.50(c)(10) | Effective Radiated Power<br>(Band 12) (Band 17)   | ERP < 3 Watt                        | PASS   | -                                          |
| 3.5            | §27.53(g)     | Radiated Spurious Emission<br>(Band 12) (Band 17) | < 43+10log <sub>10</sub> (P[Watts]) | PASS   | Under limit<br>27.45 dB at<br>2116.000 MHz |



# 1 General Description

## 1.1 Applicant

**Lenovo(Shanghai) Electronics Technology Co., Ltd.**

NO.68 BUILDING, 199 FENJU RD., China (Shanghai) Pilot Free Trade Zone, 200131, CHINA

## 1.2 Manufacturer

**Lenovo PC HK Limited**

23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong

## 1.3 Product Feature of Equipment Under Test

| Product Feature                 |                                                                                                                                                                                                                               |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment                       | Portable Tablet Computer                                                                                                                                                                                                      |
| Brand Name                      | Lenovo                                                                                                                                                                                                                        |
| Model Name                      | Lenovo YB1-X90L                                                                                                                                                                                                               |
| FCC ID                          | O57YB1X90L1                                                                                                                                                                                                                   |
| EUT supports Radios application | GPRS/EGPRS/WCDMA/HSPA/DC-HSDPA/<br>HSPA+(16QAM uplink is not supported)/LTE/<br>WLAN2.4GHz 802.11b/g/n HT20/<br>WLAN5GHz 802.11a/n HT20/HT40/<br>WLAN5GHz 802.11ac VHT20/VHT40/VHT80/<br>Bluetooth v3.0+EDR/Bluetooth v4.0 LE |
| IMEI Code                       | Radiation: 868672020083264<br>ERP: 868672020083553                                                                                                                                                                            |
| HW Version                      | Lenovo YB1-X90L                                                                                                                                                                                                               |
| SW Version                      | YB1-X90L_170110                                                                                                                                                                                                               |
| EUT Stage                       | Identical Prototype                                                                                                                                                                                                           |

## 1.4 Product Specification of Equipment Under Test

| Standards-related Product Specification |                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Tx Frequency</b>                     | LTE Band 2 : 1850.7 MHz ~ 1909.3 MHz<br>LTE Band 4 : 1710.7 MHz ~ 1754.3 MHz<br>LTE Band 5 : 824.7 MHz ~ 848.3 MHz<br>LTE Band 7 : 2502.5 MHz ~ 2567.5 MHz<br>LTE Band 12 : 699.7 MHz ~ 715.3 MHz<br>LTE Band 17 : 706.5 MHz ~ 713.5 MHz<br>LTE Band 25 : 1850.7MHz ~ 1914.3 MHz<br>LTE Band 38 : 2572.5MHz ~ 2617.5MHz                                                                                  |
| <b>Rx Frequency</b>                     | LTE Band 2 : 1930.7 MHz ~ 1989.3 MHz<br>LTE Band 4 : 2110.7 MHz ~ 2154.3 MHz<br>LTE Band 5 : 869.7 MHz ~ 893.3 MHz<br>LTE Band 7 : 2622.5MHz ~ 2687.5 MHz<br>LTE Band 12 : 729.7 MHz ~ 745.3 MHz<br>LTE Band 17 : 736.5 MHz ~ 743.5 MHz<br>LTE Band 25 : 1930.7MHz ~ 1994.3 MHz<br>LTE Band 38 : 2572.5MHz ~ 2617.5MHz                                                                                   |
| <b>Bandwidth</b>                        | LTE Band 2 : 1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz<br>LTE Band 4 : 1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz<br>LTE Band 5 : 1.4MHz / 3MHz / 5MHz / 10MHz<br>LTE Band 7 : 5MHz / 10MHz / 15MHz / 20MHz<br>LTE Band 12 : 1.4MHz / 3MHz / 5MHz / 10MHz<br>LTE Band 17 : 5MHz / 10MHz<br>LTE Band 25 : 1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz<br>LTE Band 38 : 5MHz / 10MHz / 15MHz / 20MHz |
| <b>Antenna Type</b>                     | PIFA Antenna                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Type of Modulation</b>               | QPSK / 16QAM                                                                                                                                                                                                                                                                                                                                                                                             |

## 1.5 Component List

| Object              | Sample 1                                       | Sample 2                                         |
|---------------------|------------------------------------------------|--------------------------------------------------|
| <b>Flash</b>        | Toshiba :<br>THGBMFG9C4LBAIR                   | Toshiba :<br>THGBMFG9C4LBAIR                     |
| <b>LCD</b>          | AUO :<br>B101UAN07.1;10.1;IPS1200×1920MIPI;2.5 | AUO :<br>B101UAN07.1;10.1;IPS1200×1920MIPI;2.5   |
| <b>TP</b>           | GIS :<br>TP_GFF_GIS/TC101GFL11 V.A             | GIS :<br>TP_GFF_GIS/TC101GFL11 V.A               |
| <b>Front Camera</b> | Primax :<br>CCM L202V 2M OV2740 COB 24PIN BtoB | Ofilm :<br>CCM L2740F00 2M OV2740 COB 24PIN BtoB |
| <b>USB Cable</b>    | Saibao                                         | Saibao                                           |

## 1.6 Modification of EUT

No modifications are made to the EUT during all test items.



## 1.7 Maximum ERP Power

| LTE Band 12 | QPSK           | 16QAM          |
|-------------|----------------|----------------|
| BW(MHz)     | Maximum ERP(W) | Maximum ERP(W) |
| 1.4         | 0.0851         | 0.0787         |
| 3           | 0.0841         | 0.0728         |
| 5           | 0.0807         | 0.0741         |
| 10          | 0.0817         | 0.0759         |
| LTE Band 17 | QPSK           | 16QAM          |
| BW(MHz)     | Maximum ERP(W) | Maximum ERP(W) |
| 5           | 0.0813         | 0.0746         |
| 10          | 0.0830         | 0.0774         |



## 1.8 Testing Location

|                           |                                                                                                                        |                             |
|---------------------------|------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <b>Test Site</b>          | Sporton International (KunShan) INC.                                                                                   |                             |
| <b>Test Site Location</b> | No.3-2, Pingxiang Road, Kunshan Development Zone, Jiangsu, China<br>TEL: +86-0512-5790-0158<br>FAX: +86-0512-5790-0958 |                             |
| <b>Test Site No.</b>      | <b>Sporton Site No.</b>                                                                                                | <b>FCC Registration No.</b> |
|                           | 03CH03-KS                                                                                                              | 306251                      |

## 1.9 Applicable Standards

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

- 47 CFR Part 2, 22(H), 24(E), 27(L), 27(M), 27(H)
- ANSI / TIA / EIA-603-D-2010
- FCC KDB 971168 D01 Power Meas. License Digital Systems v02r02

### 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.



## 1.10 Re-use of Measured Data

### 1.9.1 Introduction Section

This application re-uses data collected on a similar device. The subject device of this application (Model: Lenovo YB1-X90L, FCC ID: O57YB1X90L1) is electrically identical to the reference device (Model: Lenovo YB1-X90L, FCC ID: O57YB1X90L) for the portions of the circuitry corresponding to the data being re-used, as treated by KDB Publication 178919 D01.

### 1.9.2 Difference Section

For details concerning the similarity with respect to component placement, mechanical/electrical design etc., please refer to the Operational Description.

The re-used RF data includes the following bands provided in Appendix C (Sporton RF Report No. FG662015B for the reference device Model: Lenovo YB1-X90L, FCC ID: O57YB1X90L):

### 1.9.3 Spot Check Verification Data Section

In order to confirm hardware similarity of the subject device with the reference device, spot check measurements were performed on the subject device for radiated spurious emission, Conducted Band-edge and Conducted spurious emission, the test result were consistent with FCC ID: O57YB1X90L and re-test ERP and radiated spurious emission of LTE Band 12/17.

Assertions concerning the similarity of these devices are based on representations by the applicant. The applicant accepts full responsibility for the validity of the similarity claim, and for the determination that verification test data are sufficient to support it.

### 1.9.4 Reference detail Section:

| Equipment Class | Reference FCC ID | Folder Test/RF Exposure                | Report Title/Section                                                                             |
|-----------------|------------------|----------------------------------------|--------------------------------------------------------------------------------------------------|
| PCB (LTE)       | O57YB1X90L       | Part22H.24E.27L.27M.27H<br>(FG662015B) | All sections applicable<br>except for ERP and radiated<br>spurious emission of LTE Band<br>12/17 |

## 2 Test Configuration of Equipment Under Test

### 2.1 Test Mode

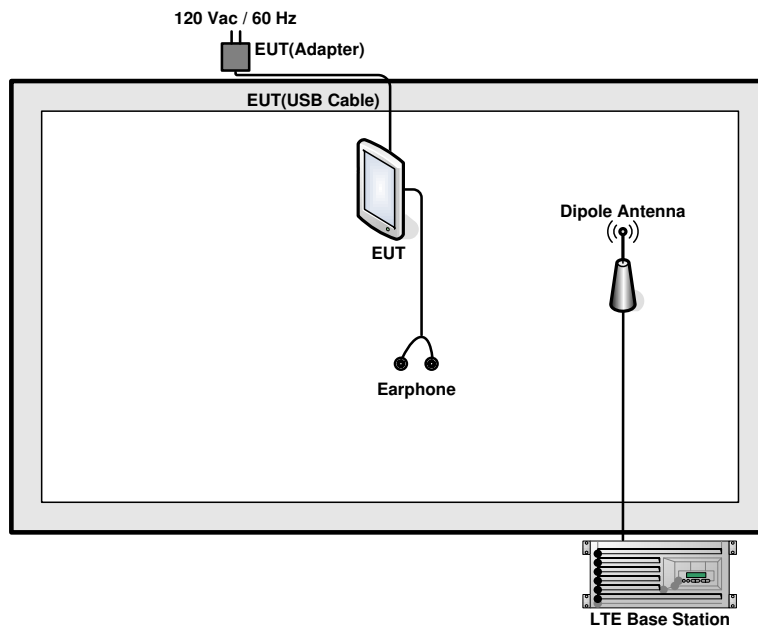
Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v02r02 with maximum output power.

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 |
| <b>E.R.P.</b>                     | <b>12</b>                                                                                                                                                                                                                                                                                                                                                                                                                               | √               | √ | √ | √  | -  | -  | √          | √     | √    | √    |      | √            | √ | √ |
|                                   | <b>17</b>                                                                                                                                                                                                                                                                                                                                                                                                                               | -               | - | √ | √  | -  | -  | √          | √     | √    |      |      | √            | √ | √ |
| <b>Radiated Spurious Emission</b> | <b>12</b>                                                                                                                                                                                                                                                                                                                                                                                                                               | √               | √ | √ | √  | -  | -  | √          |       | √    |      |      |              | √ |   |
|                                   | <b>17</b>                                                                                                                                                                                                                                                                                                                                                                                                                               | -               | - | √ | √  | -  | -  | √          |       | √    |      |      |              | √ |   |
| <b>Note</b>                       | <ol style="list-style-type: none"> <li>The mark "√" means that this configuration is chosen for testing</li> <li>The mark "-" means that this bandwidth is not supported.</li> <li>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.</li> </ol> |                 |   |   |    |    |    |            |       |      |      |      |              |   |   |

## 2.2 Connection Diagram of Test System

For LTE Band 12 / 17



## 2.3 Support Unit used in test configuration and system

| Item | Equipment        | Trade Name | Model No. | FCC ID | Data Cable       | Power Cord        |
|------|------------------|------------|-----------|--------|------------------|-------------------|
| 1.   | LTE Base Station | Anritsu    | MT8820C   | N/A    | N/A              | Unshielded, 1.8 m |
| 2.   | Earphone         | Lenovo     | SH100     | N/A    | Unshielded, 1.2m | N/A               |

## 2.4 Frequency List of Low/Middle/High Channels

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

| LTE Band 17 Channel and Frequency List |                        |        |        |         |
|----------------------------------------|------------------------|--------|--------|---------|
| BW [MHz]                               | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 10                                     | Channel                | 23780  | 23790  | 23800   |
|                                        | Frequency              | 709    | 710    | 711     |
| 5                                      | Channel                | 23755  | 23790  | 23825   |
|                                        | Frequency              | 706.5  | 710    | 713.5   |

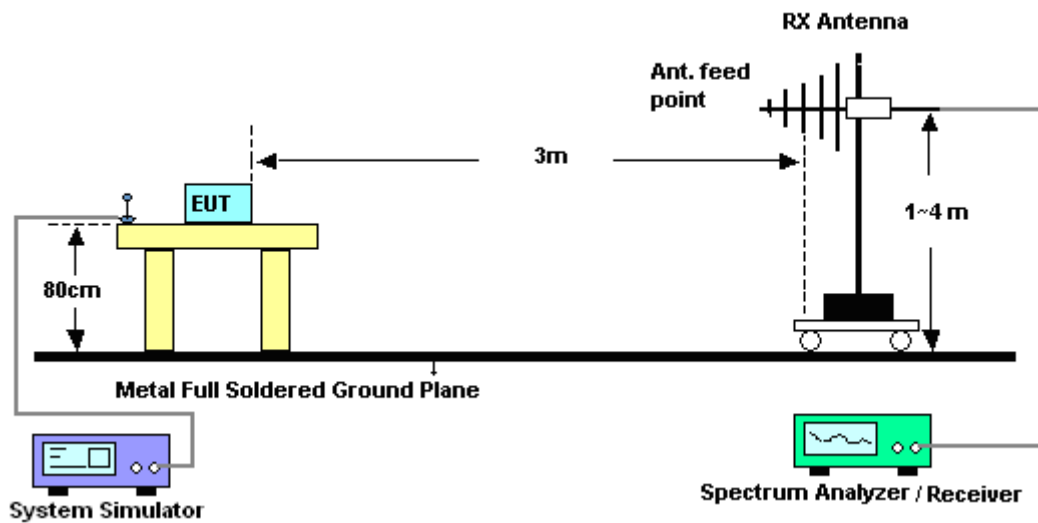
### 3 Radiated Test Items

#### 3.1 Measuring Instruments

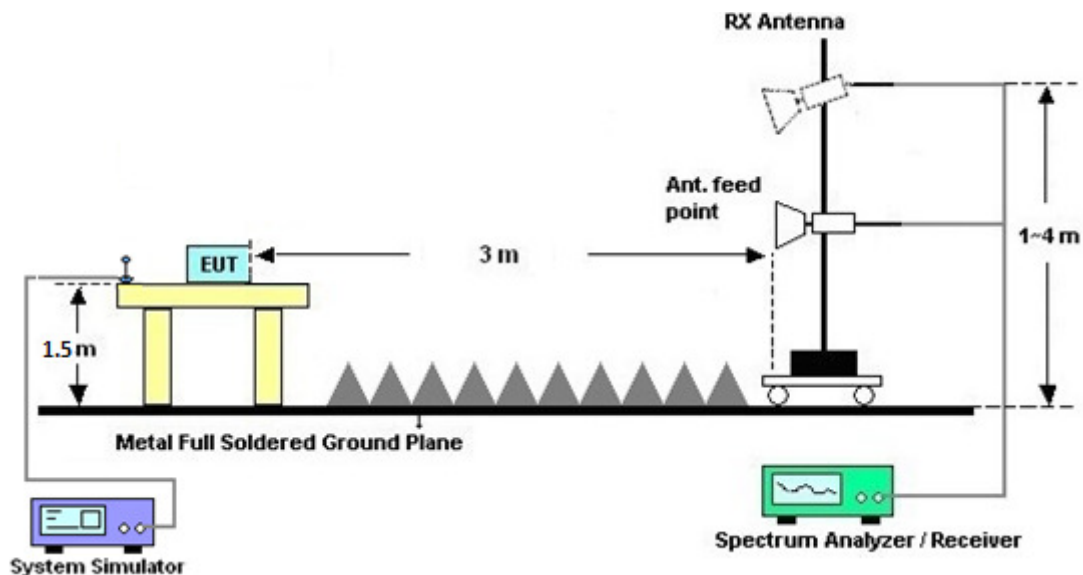
See list of measuring instruments of this test report.

#### 3.2 Test Setup

##### 3.2.1 For radiated test from 30MHz to 1GHz



##### 3.2.2 For radiated test above 1GHz



#### 3.3 Test Result of Radiated Test

Please refer to Appendix A.

### 3.4 Effective Radiated Power

#### 3.4.1 Description of the ERP Measurement

Effective radiated power output measurements by substitution method according to ANSI / TIA / EIA-603-D-2010, and the spectrum analyzer configuration follows KDB 971168 D01 Power Meas. License Digital Systems v02r02. Mobile and portable (hand-held) stations operating are limited to average ERP of 3 watts with LTE band 12 / 17.

#### 3.4.2 Test Procedures

1. The EUT was placed on a non-conductive rotating platform (0.8 meters for frequency below 1GHz and 1.5 meter for frequency above 1GHz) in a semi-anechoic chamber. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and a spectrum analyzer with RMS detector per section 5. of KDB 971168 D01.
2. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power. The maximum emission was recorded from analyzer power level (LVL) from the 360 degrees rotation of the turntable and the test antenna raised and lowered over a range from 1 to 4 meters in both horizontally and vertically polarized orientations.
3. Effective Isotropic Radiated Power (EIRP) was measured by substitution method according to TIA/EIA-603-D. The EUT was replaced by the substitution antenna at same location, and then a known power from S.G. was applied into the dipole antenna through a Tx cable, and then recorded the maximum Analyzer reading through raised and lowered the test antenna. The correction factor (in dB) = S.G. - Tx Cable loss + Substitution antenna gain - Analyzer reading. Then the EUT's EIRP was calculated with the correction factor,  $EIRP = LVL + \text{Correction factor}$  and  $ERP = EIRP - 2.15$ . Take the record of the output power at substitution antenna.



|              | LTE Average |         |         |         |         |         |
|--------------|-------------|---------|---------|---------|---------|---------|
| LTE BW       | 1.4M        | 3M      | 5M      | 10M     | 15M     | 20M     |
| Span         | 3MHz        | 6MHz    | 10MHz   | 20MHz   | 30MHz   | 40MHz   |
| RBW          | 30kHz       | 100kHz  | 100kHz  | 300kHz  | 300kHz  | 300kHz  |
| VBW          | 100kHz      | 300kHz  | 300kHz  | 1MHz    | 1MHz    | 1MHz    |
| Detector     | RMS         | RMS     | RMS     | RMS     | RMS     | RMS     |
| Trace        | Average     | Average | Average | Average | Average | Average |
| Average Type | Power       | Power   | Power   | Power   | Power   | Power   |
| Sweep Count  | 100         | 100     | 100     | 100     | 100     | 100     |

### 3.5 Radiated Spurious Emission

#### 3.5.1 Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI / TIA / EIA-603-D-2010. 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 LTE Band 12,17

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.

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

#### 3.5.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 5.8 and ANSI / TIA-603-D-2010 Section 2.2.12.
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, which was 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 one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
9. Taking the record of output power at antenna port.
10. Repeat step 7 to step 8 for another polarization.
11. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

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

12. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
13. ERP (dBm) = EIRP - 2.15



## 4 List of Measuring Equipment

| Instrument            | Manufacturer | Model No.     | Serial No. | Characteristics | Calibration Date | Test Date     | Due Date      | Remark                |
|-----------------------|--------------|---------------|------------|-----------------|------------------|---------------|---------------|-----------------------|
| EXA Spectrum Analyzer | Keysight     | N9010A        | MY55150244 | 10Hz~44GHz      | Apr. 22, 2016    | Mar. 22, 2017 | Apr. 21, 2017 | Radiation (03CH03-KS) |
| Bilog Antenna         | TeseQ        | CBL6112D      | 35406      | 25MHz~2GHz      | Apr. 16, 2016    | Mar. 22, 2017 | Apr. 15, 2017 | Radiation (03CH03-KS) |
| Horn Antenna          | Schwarzbeck  | BBHA9120D     | 9120D-1356 | 1GHz~18GHz      | Apr. 16, 2016    | Mar. 22, 2017 | Apr. 15, 2017 | Radiation (03CH03-KS) |
| SHF-EHF Horn          | Schwarzbeck  | BBHA 9170     | BBHA170249 | 15GHz~40GHz     | Feb. 15, 2017    | Mar. 22, 2017 | Feb. 14, 2018 | Radiation (03CH03-KS) |
| Amplifier             | SONOMA       | 310N          | 187289     | 9kHz~1GHz       | Aug. 09, 2016    | Mar. 22, 2017 | Aug. 08, 2017 | Radiation (03CH03-KS) |
| Amplifier             | Agilent      | 8449B         | 3008A02370 | 1GHz~26.5GHz    | Oct. 13, 2016    | Mar. 22, 2017 | Oct. 12, 2017 | Radiation (03CH03-KS) |
| Amplifier             | MITEQ        | TTA1840-35-HG | 1887435    | 18GHz~40GHz     | Oct. 13, 2016    | Mar. 22, 2017 | Oct. 12, 2017 | Radiation (03CH03-KS) |
| AC Power Source       | Chroma       | 61601         | F104090004 | N/A             | NCR              | Mar. 22, 2017 | NCR           | Radiation (03CH03-KS) |
| Turn Table            | ChamPro      | EM 1000-T     | 060762-T   | 0~360 degree    | NCR              | Mar. 22, 2017 | NCR           | Radiation (03CH03-KS) |
| Antenna Mast          | ChamPro      | EM 1000-A     | 060762-A   | 1 m~4 m         | NCR              | Mar. 22, 2017 | NCR           | Radiation (03CH03-KS) |

NCR: No Calibration Required



## 5      **Uncertainty of Evaluation**

### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

|                                                                            |       |
|----------------------------------------------------------------------------|-------|
| Measuring Uncertainty for a Level of<br>Confidence of 95% ( $U = 2Uc(y)$ ) | 2.8dB |
|----------------------------------------------------------------------------|-------|

### Uncertainty of Radiated Emission Measurement (1GHz ~ 40GHz)

|                                                                            |       |
|----------------------------------------------------------------------------|-------|
| Measuring Uncertainty for a Level of<br>Confidence of 95% ( $U = 2Uc(y)$ ) | 3.3dB |
|----------------------------------------------------------------------------|-------|

## Appendix A. Test Results of Radiated Test

### ERP

| LTE Band 12 / 1.4MHz (Average) |            |      |        |            |        |          |        |
|--------------------------------|------------|------|--------|------------|--------|----------|--------|
| Channel                        | Modulation | RB   |        | Horizontal |        | Vertical |        |
|                                |            | Size | Offset | ERP(dBm)   | ERP(W) | ERP(dBm) | ERP(W) |
| Lowest                         | QPSK       | 3    | 1      | 18.96      | 0.0787 | 19.30    | 0.0851 |
| Middle                         |            | 3    | 3      | 18.68      | 0.0738 | 19.23    | 0.0838 |
| Highest                        |            | 3    | 3      | 18.44      | 0.0698 | 19.29    | 0.0849 |
| Lowest                         | 16QAM      | 1    | 3      | 17.80      | 0.0603 | 18.05    | 0.0638 |
| Middle                         |            | 1    | 3      | 18.16      | 0.0655 | 18.96    | 0.0787 |
| Highest                        |            | 1    | 0      | 17.97      | 0.0627 | 18.95    | 0.0785 |
| Limit                          | ERP < 3W   |      |        | Result     |        | PASS     |        |

| LTE Band 12 / 3MHz (Average) |            |      |        |            |        |          |        |
|------------------------------|------------|------|--------|------------|--------|----------|--------|
| Channel                      | Modulation | RB   |        | Horizontal |        | Vertical |        |
|                              |            | Size | Offset | ERP(dBm)   | ERP(W) | ERP(dBm) | ERP(W) |
| Lowest                       | QPSK       | 1    | 8      | 18.72      | 0.0745 | 18.96    | 0.0787 |
| Middle                       |            | 1    | 14     | 18.61      | 0.0726 | 19.03    | 0.0800 |
| Highest                      |            | 1    | 14     | 18.48      | 0.0705 | 19.25    | 0.0841 |
| Lowest                       | 16QAM      | 1    | 8      | 18.38      | 0.0689 | 18.45    | 0.0700 |
| Middle                       |            | 1    | 14     | 18.07      | 0.0641 | 18.51    | 0.0710 |
| Highest                      |            | 1    | 8      | 18.02      | 0.0634 | 18.62    | 0.0728 |
| Limit                        | ERP < 3W   |      |        | Result     |        | PASS     |        |

| LTE Band 12 / 5MHz (Average) |            |      |        |            |        |          |        |
|------------------------------|------------|------|--------|------------|--------|----------|--------|
| Channel                      | Modulation | RB   |        | Horizontal |        | Vertical |        |
|                              |            | Size | Offset | ERP(dBm)   | ERP(W) | ERP(dBm) | ERP(W) |
| Lowest                       | QPSK       | 1    | 12     | 18.60      | 0.0724 | 18.99    | 0.0793 |
| Middle                       |            | 1    | 12     | 18.48      | 0.0705 | 18.96    | 0.0787 |
| Highest                      |            | 1    | 12     | 18.81      | 0.0760 | 19.07    | 0.0807 |
| Lowest                       | 16QAM      | 1    | 12     | 18.39      | 0.0690 | 18.50    | 0.0708 |
| Middle                       |            | 1    | 12     | 18.12      | 0.0649 | 18.70    | 0.0741 |
| Highest                      |            | 1    | 12     | 17.89      | 0.0615 | 18.51    | 0.0710 |
| Limit                        | ERP < 3W   |      |        | Result     |        | PASS     |        |

| LTE Band 12 / 10MHz (Average) |            |      |        |            |        |          |        |
|-------------------------------|------------|------|--------|------------|--------|----------|--------|
| Channel                       | Modulation | RB   |        | Horizontal |        | Vertical |        |
|                               |            | Size | Offset | ERP(dBm)   | ERP(W) | ERP(dBm) | ERP(W) |
| Lowest                        | QPSK       | 1    | 25     | 18.24      | 0.0667 | 19.12    | 0.0817 |
| Middle                        |            | 1    | 25     | 18.47      | 0.0703 | 19.03    | 0.0800 |
| Highest                       |            | 1    | 25     | 18.51      | 0.0710 | 19.08    | 0.0809 |
| Lowest                        | 16QAM      | 1    | 0      | 18.12      | 0.0649 | 18.44    | 0.0698 |
| Middle                        |            | 1    | 49     | 18.17      | 0.0656 | 18.47    | 0.0703 |
| Highest                       |            | 1    | 25     | 18.04      | 0.0637 | 18.80    | 0.0759 |
| Limit                         | ERP < 3W   |      |        | Result     |        | PASS     |        |



| LTE Band 17 / 5MHz (Average) |            |      |        |            |        |          |        |
|------------------------------|------------|------|--------|------------|--------|----------|--------|
| Channel                      | Modulation | RB   |        | Horizontal |        | Vertical |        |
|                              |            | Size | Offset | ERP(dBm)   | ERP(W) | ERP(dBm) | ERP(W) |
| Lowest                       | QPSK       | 1    | 12     | 18.31      | 0.0678 | 18.95    | 0.0785 |
| Middle                       |            | 1    | 12     | 18.45      | 0.0700 | 19.00    | 0.0794 |
| Highest                      |            | 1    | 12     | 18.65      | 0.0733 | 19.10    | 0.0813 |
| Lowest                       | 16QAM      | 1    | 12     | 18.06      | 0.0640 | 18.73    | 0.0746 |
| Middle                       |            | 1    | 12     | 18.14      | 0.0652 | 18.29    | 0.0675 |
| Highest                      |            | 1    | 12     | 17.94      | 0.0622 | 18.36    | 0.0685 |
| Limit                        | ERP < 3W   |      |        | Result     |        | PASS     |        |

| LTE Band 17 / 10MHz (Average) |            |      |        |            |        |          |        |
|-------------------------------|------------|------|--------|------------|--------|----------|--------|
| Channel                       | Modulation | RB   |        | Horizontal |        | Vertical |        |
|                               |            | Size | Offset | ERP(dBm)   | ERP(W) | ERP(dBm) | ERP(W) |
| Lowest                        | QPSK       | 1    | 25     | 18.64      | 0.0731 | 18.97    | 0.0789 |
| Middle                        |            | 1    | 25     | 18.62      | 0.0728 | 19.19    | 0.0830 |
| Highest                       |            | 1    | 25     | 18.56      | 0.0718 | 19.10    | 0.0813 |
| Lowest                        | 16QAM      | 1    | 25     | 18.24      | 0.0667 | 18.89    | 0.0774 |
| Middle                        |            | 1    | 25     | 17.98      | 0.0628 | 18.62    | 0.0728 |
| Highest                       |            | 1    | 25     | 18.02      | 0.0634 | 18.71    | 0.0743 |
| Limit                         | ERP < 3W   |      |        | Result     |        | PASS     |        |

**Radiated Spurious Emission**

| LTE Band 12 / 1.4MHz / QPSK / RB Size 1 Offset 0 |                   |             |               |                   |                   |                    |                      |                       |                    |
|--------------------------------------------------|-------------------|-------------|---------------|-------------------|-------------------|--------------------|----------------------|-----------------------|--------------------|
| Channel                                          | Frequency ( MHz ) | ERP ( dBm ) | Limit ( dBm ) | Over Limit ( dB ) | SPA Reading (dBm) | S.G. Power ( dBm ) | TX Cable loss ( dB ) | TX Antenna Gain (dBi) | Polarization (H/V) |
| Middle                                           | 1414              | -66.32      | -13           | -53.32            | -62.16            | -67.22             | 1.14                 | 4.19                  | H                  |
|                                                  | 2120              | -42.93      | -13           | -29.93            | -48.78            | -44.39             | 1.4                  | 5.01                  | H                  |
|                                                  | 2828              | -66.43      | -13           | -53.43            | -67.07            | -68.96             | 1.63                 | 6.31                  | H                  |
|                                                  | 1414              | -67.74      | -13           | -54.74            | -62.61            | -68.64             | 1.14                 | 4.19                  | V                  |
|                                                  | 2120              | -51.48      | -13           | -38.48            | -53.61            | -52.94             | 1.4                  | 5.01                  | V                  |
|                                                  | 2828              | -64.63      | -13           | -51.63            | -66.75            | -67.16             | 1.63                 | 6.31                  | V                  |

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

| LTE Band 12 / 3MHz / QPSK / RB Size 1 Offset 0 |                   |             |               |                   |                   |                    |                      |                       |                    |
|------------------------------------------------|-------------------|-------------|---------------|-------------------|-------------------|--------------------|----------------------|-----------------------|--------------------|
| Channel                                        | Frequency ( MHz ) | ERP ( dBm ) | Limit ( dBm ) | Over Limit ( dB ) | SPA Reading (dBm) | S.G. Power ( dBm ) | TX Cable loss ( dB ) | TX Antenna Gain (dBi) | Polarization (H/V) |
| Middle                                         | 1412              | -66.86      | -13           | -53.86            | -62.70            | -67.76             | 1.14                 | 4.19                  | H                  |
|                                                | 2118              | -41.63      | -13           | -28.63            | -47.78            | -43.09             | 1.4                  | 5.01                  | H                  |
|                                                | 2824              | -67.43      | -13           | -54.43            | -68.07            | -69.96             | 1.63                 | 6.31                  | H                  |
|                                                | 1412              | -67.68      | -13           | -54.68            | -62.55            | -68.58             | 1.14                 | 4.19                  | V                  |
|                                                | 2118              | -48.76      | -13           | -35.76            | -51.85            | -50.22             | 1.4                  | 5.01                  | V                  |
|                                                | 2824              | -65.04      | -13           | -52.04            | -67.16            | -67.57             | 1.63                 | 6.31                  | V                  |

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



| LTE Band 12 / 5MHz / QPSK / RB Size 1 Offset 0 |                   |             |               |                   |                   |                    |                      |                       |                    |
|------------------------------------------------|-------------------|-------------|---------------|-------------------|-------------------|--------------------|----------------------|-----------------------|--------------------|
| Channel                                        | Frequency ( MHz ) | ERP ( dBm ) | Limit ( dBm ) | Over Limit ( dB ) | SPA Reading (dBm) | S.G. Power ( dBm ) | TX Cable loss ( dB ) | TX Antenna Gain (dBi) | Polarization (H/V) |
| Middle                                         | 1410              | -65.25      | -13           | -52.25            | -61.09            | -66.15             | 1.14                 | 4.19                  | H                  |
|                                                | 2116              | -44.07      | -13           | -31.07            | -49.87            | -45.53             | 1.4                  | 5.01                  | H                  |
|                                                | 2822              | -67.41      | -13           | -54.41            | -68.05            | -69.94             | 1.63                 | 6.31                  | H                  |
|                                                | 1410              | -66.57      | -13           | -53.57            | -61.44            | -67.47             | 1.14                 | 4.19                  | V                  |
|                                                | 2116              | -48.54      | -13           | -35.54            | -51.7             | -50.00             | 1.4                  | 5.01                  | V                  |
|                                                | 2822              | -64.64      | -13           | -51.64            | -66.76            | -67.17             | 1.63                 | 6.31                  | V                  |

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

| LTE Band 12 / 10MHz / QPSK / RB Size 1 Offset 0 |                   |             |               |                   |                   |                    |                      |                       |                    |
|-------------------------------------------------|-------------------|-------------|---------------|-------------------|-------------------|--------------------|----------------------|-----------------------|--------------------|
| Channel                                         | Frequency ( MHz ) | ERP ( dBm ) | Limit ( dBm ) | Over Limit ( dB ) | SPA Reading (dBm) | S.G. Power ( dBm ) | TX Cable loss ( dB ) | TX Antenna Gain (dBi) | Polarization (H/V) |
| Middle                                          | 1406              | -64.98      | -13           | -51.98            | -60.82            | -65.88             | 1.14                 | 4.19                  | H                  |
|                                                 | 2108              | -45.44      | -13           | -32.44            | -50.86            | -46.90             | 1.4                  | 5.01                  | H                  |
|                                                 | 2812              | -66.88      | -13           | -53.88            | -67.52            | -69.41             | 1.63                 | 6.31                  | H                  |
|                                                 | 1406              | -65.98      | -13           | -52.98            | -60.85            | -66.88             | 1.14                 | 4.19                  | V                  |
|                                                 | 2108              | -50.41      | -13           | -37.41            | -52.91            | -51.87             | 1.4                  | 5.01                  | V                  |
|                                                 | 2812              | -64.97      | -13           | -51.97            | -67.09            | -67.50             | 1.63                 | 6.31                  | V                  |

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



| LTE Band 17 / 5MHz / QPSK / RB Size 1 Offset 0 |                   |             |               |                   |                   |                    |                      |                       |                    |
|------------------------------------------------|-------------------|-------------|---------------|-------------------|-------------------|--------------------|----------------------|-----------------------|--------------------|
| Channel                                        | Frequency ( MHz ) | ERP ( dBm ) | Limit ( dBm ) | Over Limit ( dB ) | SPA Reading (dBm) | S.G. Power ( dBm ) | TX Cable loss ( dB ) | TX Antenna Gain (dBi) | Polarization (H/V) |
| Middle                                         | 1416              | -69.38      | -13           | -56.38            | -65.22            | -70.28             | 1.14                 | 4.19                  | H                  |
|                                                | 2124              | -52.84      | -13           | -39.84            | -55.75            | -54.30             | 1.4                  | 5.01                  | H                  |
|                                                | 2832              | -66.93      | -13           | -53.93            | -67.57            | -69.46             | 1.63                 | 6.31                  | H                  |
|                                                | 1416              | -69.13      | -13           | -56.13            | -64               | -70.03             | 1.14                 | 4.19                  | V                  |
|                                                | 2122              | -55.60      | -13           | -42.60            | -55.96            | -57.06             | 1.4                  | 5.01                  | V                  |
|                                                | 2832              | -65.31      | -13           | -52.31            | -67.43            | -67.84             | 1.63                 | 6.31                  | V                  |

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

| LTE Band 17 / 10MHz / QPSK / RB Size 1 Offset 0 |                   |             |               |                   |                   |                    |                      |                       |                    |
|-------------------------------------------------|-------------------|-------------|---------------|-------------------|-------------------|--------------------|----------------------|-----------------------|--------------------|
| Channel                                         | Frequency ( MHz ) | ERP ( dBm ) | Limit ( dBm ) | Over Limit ( dB ) | SPA Reading (dBm) | S.G. Power ( dBm ) | TX Cable loss ( dB ) | TX Antenna Gain (dBi) | Polarization (H/V) |
| Middle                                          | 1410              | -63.38      | -13           | -50.38            | -59.22            | -64.28             | 1.14                 | 4.19                  | H                  |
|                                                 | 2116              | -40.45      | -13           | -27.45            | -46.78            | -41.91             | 1.4                  | 5.01                  | H                  |
|                                                 | 2822              | -66.37      | -13           | -53.37            | -67.01            | -68.90             | 1.63                 | 6.31                  | H                  |
|                                                 | 1410              | -66.69      | -13           | -53.69            | -61.56            | -67.59             | 1.14                 | 4.19                  | V                  |
|                                                 | 2116              | -45.68      | -13           | -32.68            | -49.53            | -47.14             | 1.4                  | 5.01                  | V                  |
|                                                 | 2822              | -64.03      | -13           | -51.03            | -66.15            | -66.56             | 1.63                 | 6.31                  | V                  |

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.



## **Appendix C. Reference Report**

Please refer to Sporton report number FG662015B which is issued separately.