



# FCC RF Test Report

**APPLICANT** : LITE-ON Technology Corp.  
**EQUIPMENT** : 802.11 a/b/g/n/ac 2T2R+BT V4.2LE combo module  
**BRAND NAME** : LITE-ON  
**MODEL NAME** : WCBN3510A  
**FCC ID** : PPQ-WCBN3510A  
**STANDARD** : FCC Part 15 Subpart C §15.247  
**CLASSIFICATION** : (DSS) Spread Spectrum Transmitter

The product was installed into Lenovo Smart Display (Brand Name: Lenovo, Model Name: Lenovo SD-8501F) during test.

The product was received on Feb. 08, 2018 and testing was completed on Apr. 23, 2018. We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been 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.

Approved by: James Huang / Manager



**Sporton International (Kunshan) Inc.**

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China



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## REVISION HISTORY

| REPORT NO. | VERSION | DESCRIPTION             | ISSUED DATE   |
|------------|---------|-------------------------|---------------|
| FR820813A  | Rev. 01 | Initial issue of report | Apr. 28, 2018 |
|            |         |                         |               |
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## SUMMARY OF TEST RESULT

| Report Section                                                                                                            | FCC Rule           | Description                                        | Limit                                  | Result | Remark                                  |
|---------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------------------|----------------------------------------|--------|-----------------------------------------|
| -                                                                                                                         | 15.247(a)(1)       | Number of Channels                                 | $\geq 15\text{Chs}$                    | Pass   | 1                                       |
| -                                                                                                                         | 15.247(a)(1)       | Hopping Channel Separation                         | $\geq 2/3$ of 20dB BW                  | Pass   | 1                                       |
| -                                                                                                                         | 15.247(a)(1)       | Dwell Time of Each Channel                         | $\leq 0.4\text{sec}$ in 31.6sec period | Pass   | 1                                       |
| -                                                                                                                         | 15.247(a)(1)       | 20dB Bandwidth                                     | NA                                     | Pass   | 1                                       |
| -                                                                                                                         | -                  | 99% Bandwidth                                      | -                                      | Pass   | 1                                       |
| 3.1                                                                                                                       | 15.247(b)(1)       | Peak Output Power                                  | $\leq 125\text{ mW}$                   | Pass   | -                                       |
| -                                                                                                                         | 15.247(d)          | Conducted Band Edges                               | $\leq 20\text{dBc}$                    | Pass   | 1                                       |
| -                                                                                                                         | 15.247(d)          | Conducted Spurious Emission                        | $\leq 20\text{dBc}$                    | Pass   | 1                                       |
| 3.2                                                                                                                       | 15.247(d)          | Radiated Band Edges and Radiated Spurious Emission | 15.209(a) & 15.247(d)                  | Pass   | Under limit<br>3.82 dB at<br>40.670 MHz |
| 3.3                                                                                                                       | 15.207             | AC Conducted Emission                              | 15.207(a)                              | Pass   | Under limit<br>18.18 dB at<br>0.479 MHz |
| 3.4                                                                                                                       | 15.203 & 15.247(b) | Antenna Requirement                                | N/A                                    | Pass   | -                                       |
| <b>Remark 1:</b> All conducted test items were leverage from module RF report which can refer to Report No. "FR7N1336AD". |                    |                                                    |                                        |        |                                         |

# 1 General Description

## 1.1 Applicant

LITE-ON Technology Corp.

Bldg. C, 90, Chien 1 Road, Chung Ho, New Taipei City 23585, Taiwan, R.O.C

## 1.2 Manufacturer

LITE-ON TECHNOLOGY (Changzhou) CO., LTD

A9 Building, No.88 Yanghu Road, Wujin Hi-Tech Industrial Development Zone, Changzhou City, Jiangsu Province 213100 China

## 1.3 Product Feature of Equipment Under Test

| Product Feature                 |                                                                                                                                                                                         |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment                       | 802.11 a/b/g/n/ac 2T2R+BT V4.2LE combo module                                                                                                                                           |
| Brand Name                      | LITE-ON                                                                                                                                                                                 |
| Model Name                      | WCBN3510A                                                                                                                                                                               |
| FCC ID                          | PPQ-WCBN3510A                                                                                                                                                                           |
| EUT supports Radios application | WLAN 2.4GHz 802.11b/g/n HT20/HT40<br>WLAN 2.4GHz 802.11ac VHT20/VHT40<br>WLAN 5GHz 802.11a/n HT20/HT40<br>WLAN 5GHz 802.11ac VHT20/VHT40/VHT80<br>Bluetooth v2.1+EDR, Bluetooth v4.2 LE |
| EUT Stage                       | Identical Prototype                                                                                                                                                                     |

| Host Feature & Specification |                                                                                                                                                           |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment                    | Lenovo Smart Display                                                                                                                                      |
| Brand Name                   | Lenovo                                                                                                                                                    |
| Model Name                   | Lenovo SD-8501F                                                                                                                                           |
| Applicant                    | <b>Lenovo (Shanghai) Electronics Technology Co., Ltd.</b><br>NO.68 BUILDING, 199 FENJU RD, China (Shanghai) Pilot Free Trade Zone, Shanghai, 200131 China |
| Manufacturer                 | <b>Lenovo PC HK Limited</b><br>23/F, Lincoln House, Taikoo Place, 979 King's Road, Quarry Bay Hong Kong                                                   |

**Remark:** The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

## 1.4 Product Specification of Equipment Under Test

| Standards-related Product Specification  |                                                                                                                                            |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Tx/Rx Frequency Range</b>             | 2402 MHz ~ 2480 MHz                                                                                                                        |
| <b>Number of Channels</b>                | 79                                                                                                                                         |
| <b>Carrier Frequency of Each Channel</b> | 2402+n*1 MHz; n=0~78                                                                                                                       |
| <b>Maximum Output Power to Antenna</b>   | Bluetooth BR(1Mbps) : 11.23 dBm (0.0133 W)<br>Bluetooth EDR (2Mbps) : 10.37 dBm (0.0109 W)<br>Bluetooth EDR (3Mbps) : 10.73 dBm (0.0118 W) |
| <b>Antenna Type / Gain</b>               | PIFA Antenna with gain 2.86 dBi                                                                                                            |
| <b>Type of Modulation</b>                | Bluetooth BR (1Mbps) : GFSK<br>Bluetooth EDR (2Mbps) : $\pi/4$ -DQPSK<br>Bluetooth EDR (3Mbps) : 8-DPSK                                    |

## 1.5 Modification of EUT

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

## 1.6 Component List

| Object      | Specifications                                | Supplier |
|-------------|-----------------------------------------------|----------|
| CPU         | APQ-8053-A-792NSP-MT-01-1-AA                  | Qualcomm |
| Memory      | EMMC04G-M627X02U ( 4G+32G )                   | Kingston |
| PANEL       | P080DDD-AB4 W134.2*H202.05*3.5MM 800*RGB*1280 | longhai  |
| Camera      | CBFH53520004950LH 2592*1994 megapixel         | chicony  |
| loudspeaker | 1.75" 6Ω 10W fullrange driver                 | sanfu    |
| PCB         | L102*W91*T0.8MM 94V0                          | tripod   |
| Module      | WCBN3510A QCA9379-3 WIFI and Bluetooth combo  | Liteon   |



## 1.7 Testing Location

Sporton International (Kunshan) Inc. is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600155-0) and the FCC designation No. is CN5013.

|                           |                                                                                                                                               |           |         |                                       |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|---------------------------------------|
| <b>Test Site</b>          | Sporton International (Kunshan) Inc.                                                                                                          |           |         |                                       |
| <b>Test Site Location</b> | No.3-2 Ping-Xiang Rd, Kunshan Development Zone Kunshan City Jiangsu Province 215335 China<br>TEL : +86-512-57900158<br>FAX : +86-512-57900958 |           |         |                                       |
| <b>Test Site No.</b>      | <b>Sporton Site No.</b>                                                                                                                       |           |         | <b>FCC Test Firm Registration No.</b> |
|                           | TH01-KS                                                                                                                                       | 03CH03-KS | CO01-KS | 630927                                |

**Note:** The test site complies with ANSI C63.4 2014 requirement.

## 1.8 Applicable Standards

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

- ♦ FCC Part 15 Subpart C §15.247
- ♦ ANSI C63.10-2013

### 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.

## 2 Test Configuration of Equipment Under Test

### 2.1 Descriptions of Test Mode

Preliminary tests were performed in different data rates and recorded the RF output power in the following table:

| Channel | Frequency | Bluetooth RF Output Power |                |           |
|---------|-----------|---------------------------|----------------|-----------|
|         |           | Data Rate / Modulation    |                |           |
|         |           | GFSK                      | $\pi/4$ -DQPSK | 8-DPSK    |
|         |           | 1Mbps                     | 2Mbps          | 3Mbps     |
| Ch00    | 2402MHz   | 9.58 dBm                  | 8.62 dBm       | 9.01 dBm  |
| Ch39    | 2441MHz   | 9.99 dBm                  | 9.07 dBm       | 9.45 dBm  |
| Ch78    | 2480MHz   | 11.23 dBm                 | 10.37 dBm      | 10.73 dBm |

**Remark:**

1. All the test data for each data rate were verified, but only the worst case was reported.
2. The data rate was set in 1Mbps for all the test items due to the highest RF output power.



## 2.2 Carrier Frequency Channel

| Frequency Band  | Channel | Freq.<br>(MHz) | Channel | Freq.<br>(MHz) | Channel | Freq.<br>(MHz) |
|-----------------|---------|----------------|---------|----------------|---------|----------------|
| 2400-2483.5 MHz | 0       | 2402           | 27      | 2429           | 54      | 2456           |
|                 | 1       | 2403           | 28      | 2430           | 55      | 2457           |
|                 | 2       | 2404           | 29      | 2431           | 56      | 2458           |
|                 | 3       | 2405           | 30      | 2432           | 57      | 2459           |
|                 | 4       | 2406           | 31      | 2433           | 58      | 2460           |
|                 | 5       | 2407           | 32      | 2434           | 59      | 2461           |
|                 | 6       | 2408           | 33      | 2435           | 60      | 2462           |
|                 | 7       | 2409           | 34      | 2436           | 61      | 2463           |
|                 | 8       | 2410           | 35      | 2437           | 62      | 2464           |
|                 | 9       | 2411           | 36      | 2438           | 63      | 2465           |
|                 | 10      | 2412           | 37      | 2439           | 64      | 2466           |
|                 | 11      | 2413           | 38      | 2440           | 65      | 2467           |
|                 | 12      | 2414           | 39      | 2441           | 66      | 2468           |
|                 | 13      | 2415           | 40      | 2442           | 67      | 2469           |
|                 | 14      | 2416           | 41      | 2443           | 68      | 2470           |
|                 | 15      | 2417           | 42      | 2444           | 69      | 2471           |
|                 | 16      | 2418           | 43      | 2445           | 70      | 2472           |
|                 | 17      | 2419           | 44      | 2446           | 71      | 2473           |
|                 | 18      | 2420           | 45      | 2447           | 72      | 2474           |
|                 | 19      | 2421           | 46      | 2448           | 73      | 2475           |
|                 | 20      | 2422           | 47      | 2449           | 74      | 2476           |
|                 | 21      | 2423           | 48      | 2450           | 75      | 2477           |
|                 | 22      | 2424           | 49      | 2451           | 76      | 2478           |
|                 | 23      | 2425           | 50      | 2452           | 77      | 2479           |
|                 | 24      | 2426           | 51      | 2453           | 78      | 2480           |
|                 | 25      | 2427           | 52      | 2454           | -       | -              |
|                 | 26      | 2428           | 53      | 2455           | -       | -              |

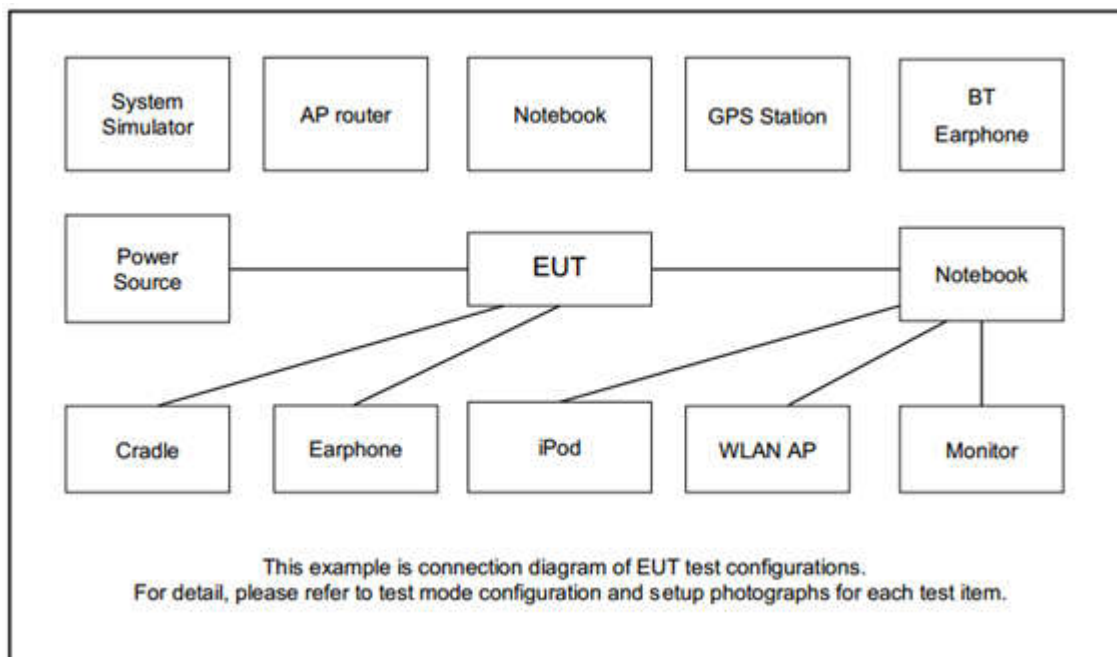
## 2.3 Test Mode

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases were recorded in this report, and the worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

| Summary table of Test Cases                                                                                                                                               |                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Test Item                                                                                                                                                                 | Data Rate / Modulation                                                                                       |
| Radiated Test Cases                                                                                                                                                       | Bluetooth BR 1Mbps GFSK                                                                                      |
|                                                                                                                                                                           | Mode 1: CH00_2402 MHz                                                                                        |
|                                                                                                                                                                           | Mode 2: CH39_2441 MHz                                                                                        |
|                                                                                                                                                                           | Mode 3: CH78_2480 MHz                                                                                        |
| Summary table of Test Cases                                                                                                                                               |                                                                                                              |
| AC Conducted Emission                                                                                                                                                     | Mode 1 :Bluetooth Idle + WLAN Idle(2.4G) + Adapter 1<br>Mode 2 :Bluetooth Idle + WLAN Idle(2.4G) + Adapter 2 |
| <b>Remark:</b><br>1. For Radiated Test Cases, The tests were performed with Adapter 1.<br>2. The worst case of AC is mode 1; only the test data of this mode is reported. |                                                                                                              |

## 2.4 Connection Diagram of Test System



## 2.5 Support Unit used in test configuration and system

| Item | Equipment          | Trade Name | Model Name | FCC ID         | Data Cable | Power Cord                                                 |
|------|--------------------|------------|------------|----------------|------------|------------------------------------------------------------|
| 1.   | BT Base Station    | R&S        | CBT        | N/A            | N/A        | Unshielded, 1.8 m                                          |
| 2.   | WLAN AP            | LINKSYS    | WRT600N    | Q87-WRT600NV11 | N/A        | Unshielded, 1.8 m                                          |
| 3.   | Notebook           | Lenovo     | G480       | N/A            | N/A        | AC I/P:<br>Unshielded, 1.8 m<br>DC O/P:<br>Shielded, 1.8 m |
| 4.   | Bluetooth Earphone | Lenovo     | LBH308     | N/A            | N/A        | N/A                                                        |

## 2.6 EUT Operation Test Setup

For Bluetooth function, the engineering test program was provided and enabled to make EUT connect with Bluetooth base station to continuous transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

### 3 Test Result

#### 3.1 Peak Output Power Measurement

##### 3.1.1 Limit of Peak Output Power

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

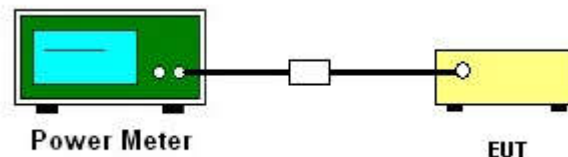
##### 3.1.2 Measuring Instruments

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

##### 3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

##### 3.1.4 Test Setup





## 3.1.5 Test Result of Peak Output Power

|                 |            |                     |         |
|-----------------|------------|---------------------|---------|
| Test Mode :     | 1Mbps      | Temperature :       | 21~25°C |
| Test Engineer : | Silent Hai | Relative Humidity : | 51~55%  |

| Channel | Frequency (MHz) | RF Power (dBm) |                   |           |
|---------|-----------------|----------------|-------------------|-----------|
|         |                 | GFSK           | Max. Limits (dBm) | Pass/Fail |
|         |                 | 1 Mbps         |                   |           |
| 00      | 2402            | 9.58           | 20.97             | Pass      |
| 39      | 2441            | 9.99           | 20.97             | Pass      |
| 78      | 2480            | 11.23          | 20.97             | Pass      |

|                 |            |                     |         |
|-----------------|------------|---------------------|---------|
| Test Mode :     | 2Mbps      | Temperature :       | 21~25°C |
| Test Engineer : | Silent Hai | Relative Humidity : | 51~55%  |

| Channel | Frequency (MHz) | RF Power (dBm) |                   |           |
|---------|-----------------|----------------|-------------------|-----------|
|         |                 | $\pi/4$ -DQPSK | Max. Limits (dBm) | Pass/Fail |
|         |                 | 2 Mbps         |                   |           |
| 00      | 2402            | 8.62           | 20.97             | Pass      |
| 39      | 2441            | 9.07           | 20.97             | Pass      |
| 78      | 2480            | 10.37          | 20.97             | Pass      |

|                 |            |                     |         |
|-----------------|------------|---------------------|---------|
| Test Mode :     | 3Mbps      | Temperature :       | 21~25°C |
| Test Engineer : | Silent Hai | Relative Humidity : | 51~55%  |

| Channel | Frequency (MHz) | RF Power (dBm) |                   |           |
|---------|-----------------|----------------|-------------------|-----------|
|         |                 | 8-DPSK         | Max. Limits (dBm) | Pass/Fail |
|         |                 | 3 Mbps         |                   |           |
| 00      | 2402            | 9.01           | 20.97             | Pass      |
| 39      | 2441            | 9.45           | 20.97             | Pass      |
| 78      | 2480            | 10.73          | 20.97             | Pass      |

## 3.2 Radiated Band Edges and Spurious Emission Measurement

### 3.2.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

| Frequency<br>(MHz) | Field Strength<br>(microvolts/meter) | Measurement Distance<br>(meters) |
|--------------------|--------------------------------------|----------------------------------|
| 0.009 – 0.490      | 2400/F(kHz)                          | 300                              |
| 0.490 – 1.705      | 24000/F(kHz)                         | 30                               |
| 1.705 – 30.0       | 30                                   | 30                               |
| 30 – 88            | 100                                  | 3                                |
| 88 – 216           | 150                                  | 3                                |
| 216 - 960          | 200                                  | 3                                |
| Above 960          | 500                                  | 3                                |

### 3.2.2 Measuring Instruments

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

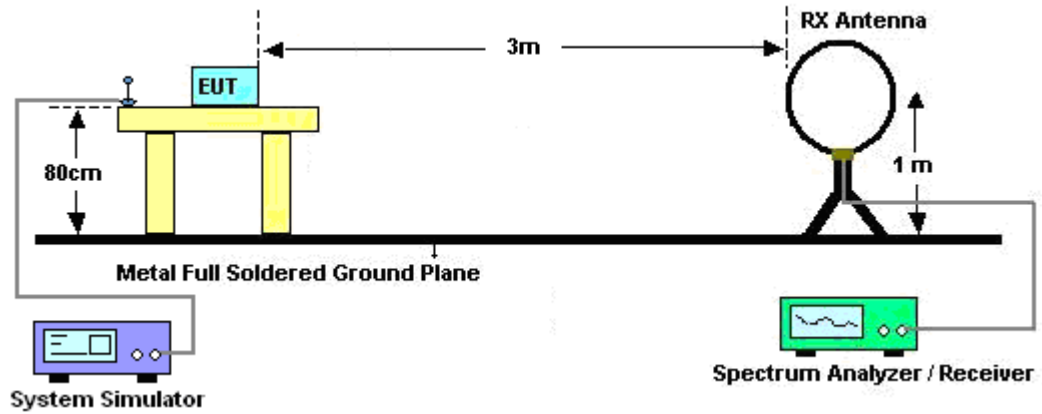
### 3.2.3 Test Procedures

1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Set RBW=100 kHz for  $f < 1$  GHz, RBW=1MHz for  $f > 1$ GHz ; VBW  $\geq$  RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
  - (3) For average measurement: use duty cycle correction factor method per 15.35(c).  
Duty cycle = On time/100 milliseconds  
$$\text{On time} = N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$$
  
Where  $N_1$  is number of type 1 pulses,  $L_1$  is length of type 1 pulses, etc.  
Average Emission Level = Peak Emission Level +  $20 * \log(\text{Duty cycle})$
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
7. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

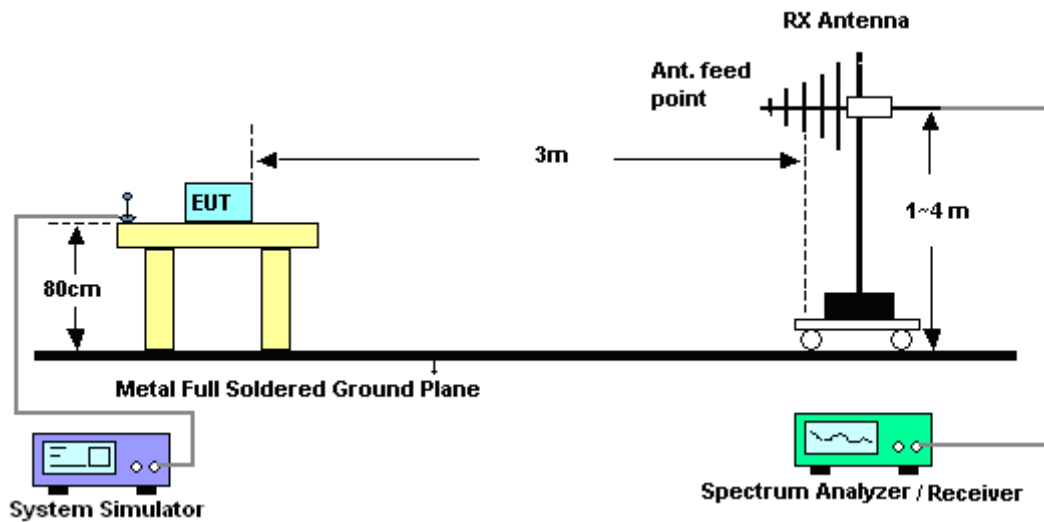
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from  $20 \log(\text{dwell time}/100\text{ms})$ . This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

### 3.2.4 Test Setup

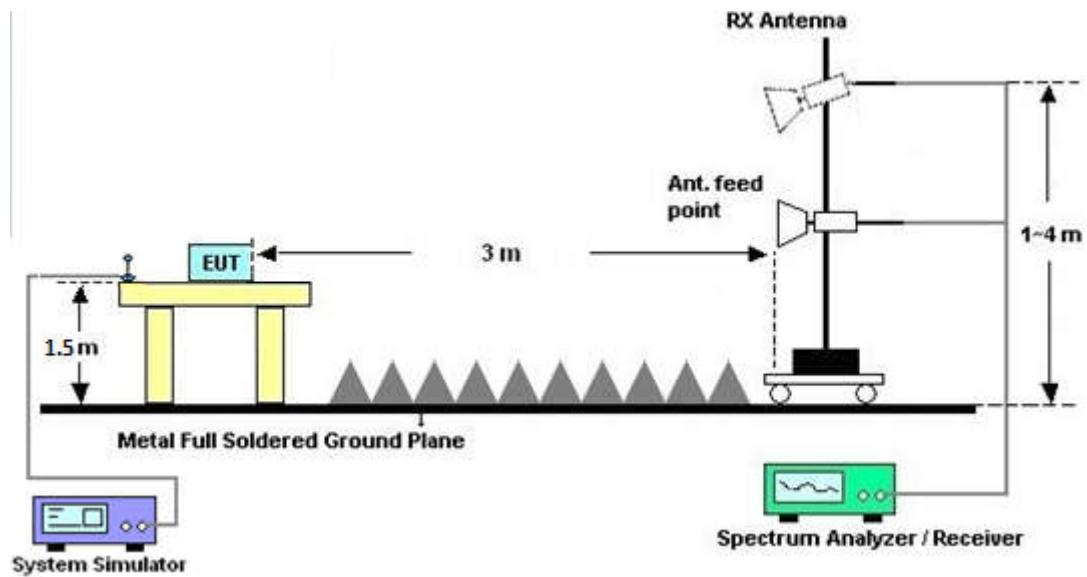
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



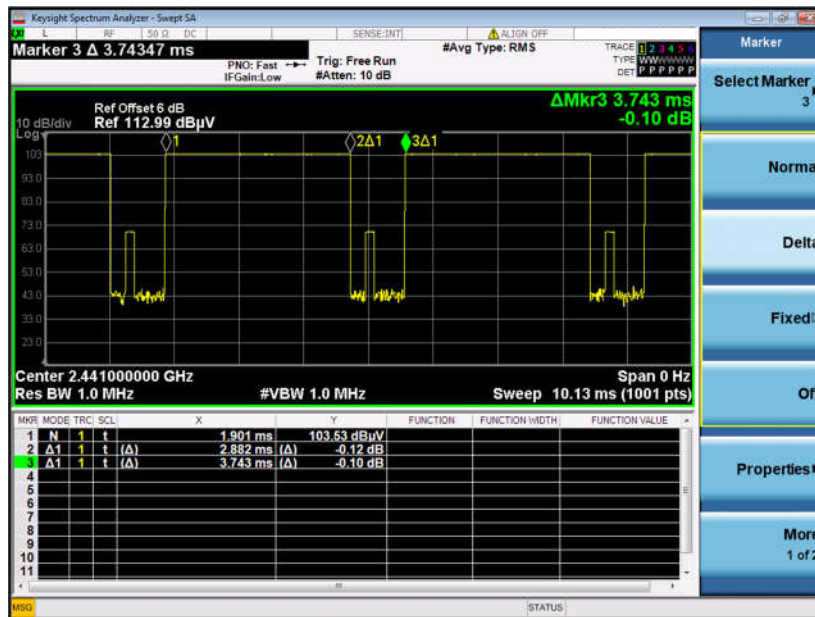
### 3.2.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

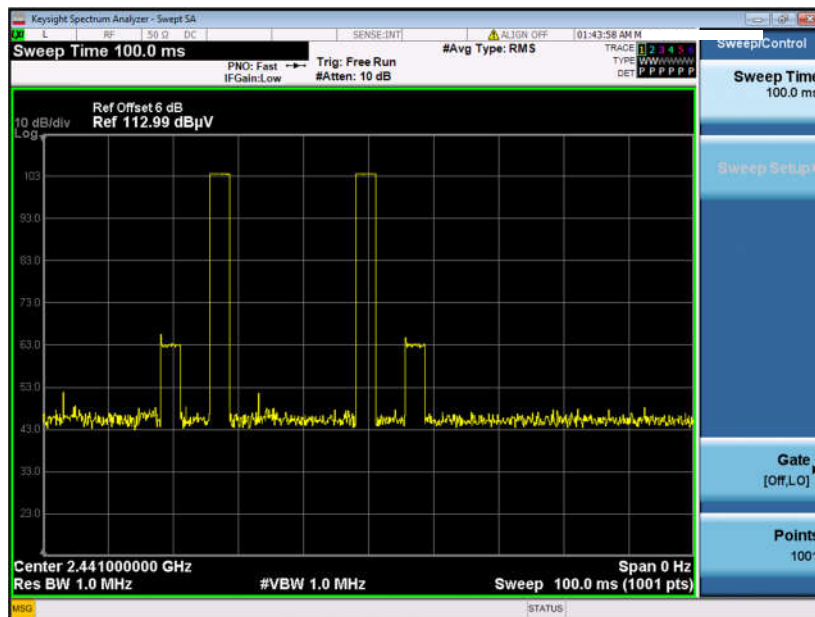
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

### 3.2.6 Duty cycle correction factor for average measurement

**DH5 on time (One Pulse) Plot on Channel 39**



**DH5 on time (Count Pulses) Plot on Channel 39**



**Note:**

1. Worst case Duty cycle = on time/100 milliseconds =  $2 * 2.88 / 100 = 5.76 \%$
2. Worst case Duty cycle correction factor =  $20 * \log(\text{Duty cycle}) = -24.79 \text{ dB}$
3. DH5 has the highest duty cycle worst case and is reported.

**Duty Cycle Correction Factor Consideration for AFH mode:**

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the period to have DH5 packet completing one hopping sequence is

$$2.88 \text{ ms} \times 20 \text{ channels} = 57.6 \text{ ms}$$

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period.  $[100\text{ms} / 57.7\text{ms}] = 2 \text{ hops}$

Thus, the maximum possible ON time:

$$2.88 \text{ ms} \times 2 = 5.76 \text{ ms}$$

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

$$20 \times \log(5.76 \text{ ms}/100\text{ms}) = -24.79 \text{ dB}$$

**3.2.7 Test Result of Radiated Spurious at Band Edges**

Please refer to Appendix A.

**3.2.8 Test Result of Radiated Spurious Emission (30MHz ~ 10<sup>th</sup> Harmonic)**

Please refer to Appendix A.

**3.2.9 Test Result of Radiated Spurious Emission (Simultaneous TX )**

Please refer to test report (FR820813C).

### 3.3 AC Conducted Emission Measurement

#### 3.3.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

| Frequency of emission (MHz) | Conducted limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15-0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5-5                       | 56                           | 46        |
| 5-30                        | 60                           | 50        |

\*Decreases with the logarithm of the frequency.

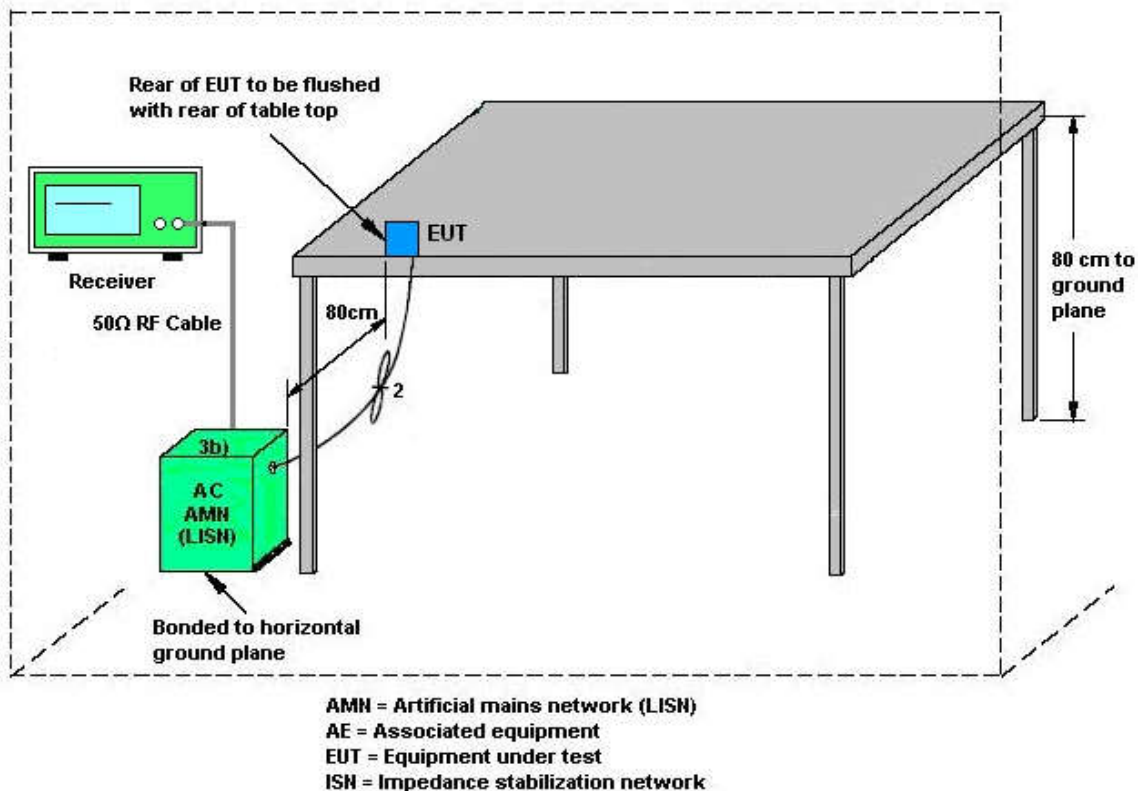
#### 3.3.2 Measuring Instruments

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

#### 3.3.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

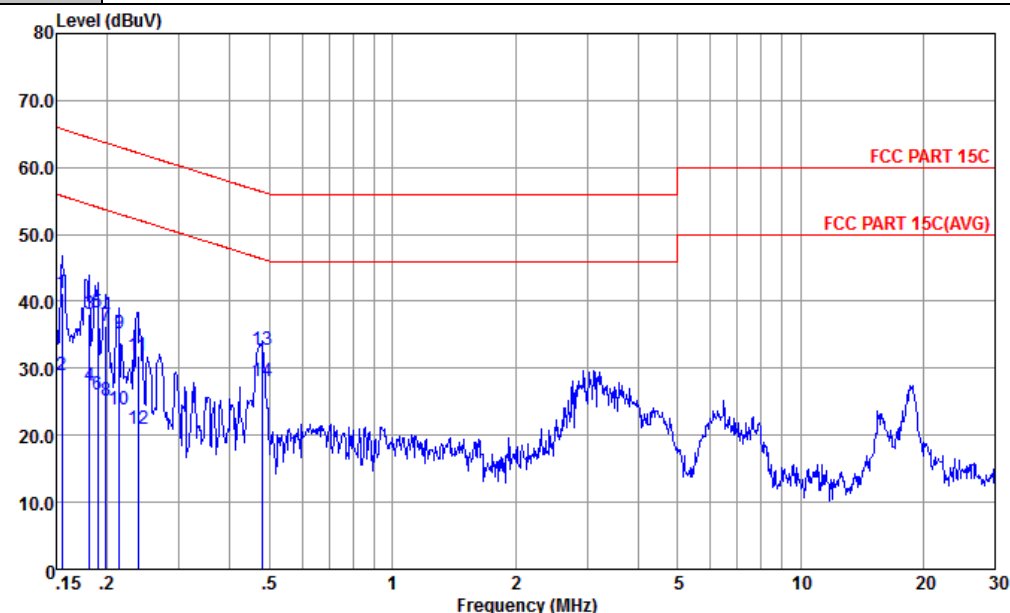
### 3.3.4 Test Setup





## 3.3.5 Test Result of AC Conducted Emission

|                 |                                              |                     |            |
|-----------------|----------------------------------------------|---------------------|------------|
| Test Mode :     | Mode 1                                       | Temperature :       | 20.7~21.2℃ |
| Test Engineer : | Amos Zhang                                   | Relative Humidity : | 41~43%     |
| Test Voltage :  | 120Vac / 60Hz                                | Phase :             | Line       |
| Function Type : | Bluetooth Idle + WLAN Idle(2.4G) + Adapter 1 |                     |            |

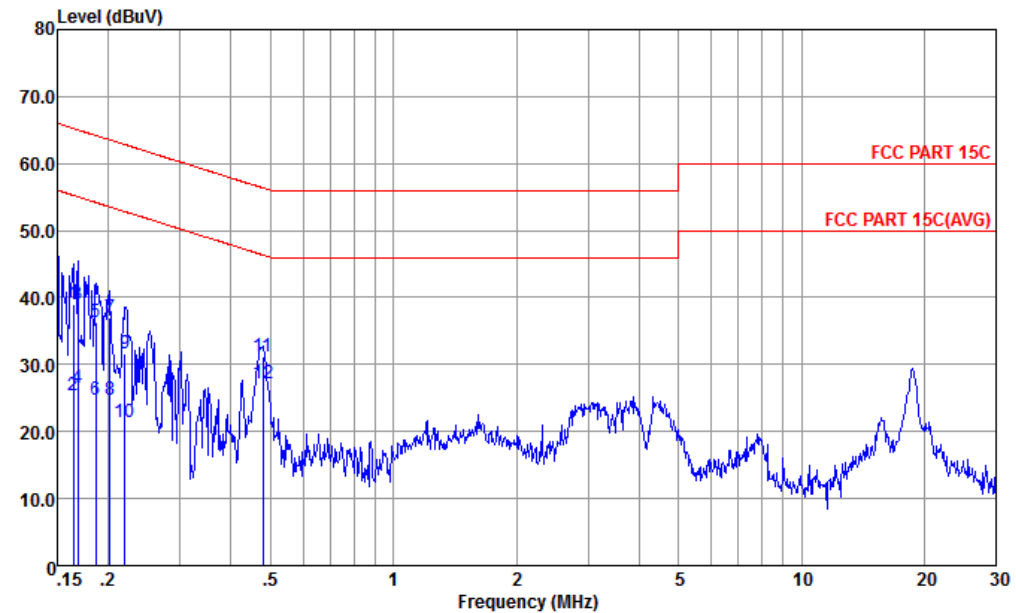


Site : CO01-KS  
Condition : FCC PART 15C LISN-L-171013-060103 LINE

|      | Freq  | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark  |
|------|-------|-------|------------|------------|------------|-------------|------------|---------|
|      | MHz   | dBuV  | dB         | dBuV       | dBuV       | dB          | dB         |         |
| 1    | 0.155 | 41.26 | -24.48     | 65.74      | 30.50      | 0.16        | 10.60      | QP      |
| 2    | 0.155 | 29.06 | -26.68     | 55.74      | 18.30      | 0.16        | 10.60      | Average |
| 3    | 0.181 | 38.20 | -26.26     | 64.46      | 27.50      | 0.19        | 10.51      | QP      |
| 4    | 0.181 | 27.30 | -27.16     | 54.46      | 16.60      | 0.19        | 10.51      | Average |
| 5    | 0.189 | 38.28 | -25.78     | 64.06      | 27.60      | 0.19        | 10.49      | QP      |
| 6    | 0.189 | 26.18 | -27.88     | 54.06      | 15.50      | 0.19        | 10.49      | Average |
| 7    | 0.199 | 36.26 | -27.41     | 63.67      | 25.60      | 0.20        | 10.46      | QP      |
| 8    | 0.199 | 25.26 | -28.41     | 53.67      | 14.60      | 0.20        | 10.46      | Average |
| 9    | 0.214 | 35.16 | -27.89     | 63.05      | 24.51      | 0.20        | 10.45      | QP      |
| 10   | 0.214 | 23.96 | -29.09     | 53.05      | 13.31      | 0.20        | 10.45      | Average |
| 11   | 0.238 | 31.85 | -30.32     | 62.17      | 21.20      | 0.21        | 10.44      | QP      |
| 12   | 0.238 | 20.95 | -31.22     | 52.17      | 10.30      | 0.21        | 10.44      | Average |
| 13   | 0.479 | 32.68 | -23.68     | 56.36      | 22.10      | 0.26        | 10.32      | QP      |
| 14 * | 0.479 | 28.18 | -18.18     | 46.36      | 17.60      | 0.26        | 10.32      | Average |



|                        |                                              |                            |            |
|------------------------|----------------------------------------------|----------------------------|------------|
| <b>Test Mode :</b>     | Mode 1                                       | <b>Temperature :</b>       | 20.7~21.2℃ |
| <b>Test Engineer :</b> | Amos Zhang                                   | <b>Relative Humidity :</b> | 41~43%     |
| <b>Test Voltage :</b>  | 120Vac / 60Hz                                | <b>Phase :</b>             | Neutral    |
| <b>Function Type :</b> | Bluetooth Idle + WLAN Idle(2.4G) + Adapter 1 |                            |            |



Site : CO01-KS  
Condition : FCC PART 15C LISN-N-171013-060103 NEUTRAL

|      | Freq  | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark  |
|------|-------|-------|------------|------------|------------|-------------|------------|---------|
|      | MHz   | dBuV  | dB         | dBuV       | dBuV       | dB          | dB         |         |
| 1    | 0.164 | 39.05 | -26.20     | 65.25      | 28.20      | 0.28        | 10.57      | QP      |
| 2    | 0.164 | 25.45 | -29.80     | 55.25      | 14.60      | 0.28        | 10.57      | Average |
| 3    | 0.169 | 39.03 | -26.00     | 65.03      | 28.20      | 0.28        | 10.55      | QP      |
| 4    | 0.169 | 26.43 | -28.60     | 55.03      | 15.60      | 0.28        | 10.55      | Average |
| 5    | 0.186 | 36.38 | -27.82     | 64.20      | 25.60      | 0.28        | 10.50      | QP      |
| 6    | 0.186 | 24.68 | -29.52     | 54.20      | 13.90      | 0.28        | 10.50      | Average |
| 7    | 0.202 | 36.93 | -26.61     | 63.54      | 26.20      | 0.28        | 10.45      | QP      |
| 8    | 0.202 | 24.63 | -28.91     | 53.54      | 13.90      | 0.28        | 10.45      | Average |
| 9    | 0.220 | 31.63 | -31.20     | 62.83      | 20.90      | 0.28        | 10.45      | QP      |
| 10   | 0.220 | 21.33 | -31.50     | 52.83      | 10.60      | 0.28        | 10.45      | Average |
| 11   | 0.479 | 31.21 | -25.15     | 56.36      | 20.60      | 0.29        | 10.32      | QP      |
| 12 * | 0.479 | 27.21 | -19.15     | 46.36      | 16.60      | 0.29        | 10.32      | Average |



## **3.4 Antenna Requirements**

### **3.4.1 Standard Applicable**

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

### **3.4.2 Antenna Anti-Replacement Construction**

An embedded-in antenna design is used.

### **3.4.3 Antenna Gain**

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



## 4 List of Measuring Equipment

| Instrument                        | Manufacturer | Model No.               | Serial No.   | Characteristics         | Calibration Date | Test Date     | Due Date      | Remark                |
|-----------------------------------|--------------|-------------------------|--------------|-------------------------|------------------|---------------|---------------|-----------------------|
| Pulse Power Sensor                | Anritsu      | MA2411B                 | 0917070      | 300MHz~40GHz            | Jan. 18, 2018    | Mar. 09, 2018 | Jan. 17, 2019 | Conducted (TH01-KS)   |
| Power Meter                       | Anritsu      | ML2495A                 | 1005002      | 50MHz Bandwidth         | Jan. 18, 2018    | Mar. 09, 2018 | Jan. 17, 2019 | Conducted (TH01-KS)   |
| EMI Receiver                      | R&S          | ESCI7                   | 100768       | 9kHz~7GHz;              | Apr. 20, 2017    | Mar. 30, 2018 | Apr. 19, 2018 | Conduction (CO01-KS)  |
| AC LISN                           | MessTec      | AN3016                  | 060103       | 9kHz~30MHz              | Oct. 13, 2017    | Mar. 30, 2018 | Oct. 12, 2018 | Conduction (CO01-KS)  |
| AC LISN (for auxiliary equipment) | MessTec      | AN3016                  | 060105       | 9kHz~30MHz              | Oct. 13, 2017    | Mar. 30, 2018 | Oct. 12, 2018 | Conduction (CO01-KS)  |
| AC Power Source                   | Chroma       | 61602                   | ABP000000811 | AC 0V~300V, 45Hz~1000Hz | Oct. 12, 2017    | Mar. 30, 2018 | Oct. 11, 2018 | Conduction (CO01-KS)  |
| EMI Test Receiver                 | Keysight     | N9038A                  | MY56400004   | 3Hz~8.5GHz; Max 30dBm   | Oct. 19, 2017    | Apr. 23, 2018 | Oct. 18, 2018 | Radiation (03CH03-KS) |
| EXA Spectrum Analyzer             | Keysight     | N9010A                  | MY55150244   | 10Hz~44GHz              | Apr. 17, 2018    | Apr. 23, 2018 | Apr. 16, 2019 | Radiation (03CH03-KS) |
| Loop Antenna                      | R&S          | HFH2-Z2                 | 100321       | 9kHz~30MHz              | Oct. 22, 2017    | Apr. 23, 2018 | Oct. 21, 2018 | Radiation (03CH03-KS) |
| Bilog Antenna                     | TeseQ        | CBL6112D                | 47610        | 30MHz~1GHz              | Sep. 12, 2017    | Apr. 23, 2018 | Sep. 11, 2018 | Radiation (03CH03-KS) |
| Double Ridge Horn Antenna         | ETS-Lindgren | 3117                    | 75959        | 1GHz~18GHz              | Jan. 21, 2018    | Apr. 23, 2018 | Jan. 20, 2019 | Radiation (03CH03-KS) |
| SHF-EHF Horn                      | Schwarzbeck  | BBHA 9170               | BBHA170249   | 15GHz~40GHz             | Feb. 07, 2018    | Apr. 23, 2018 | Feb. 06, 2019 | Radiation (03CH03-KS) |
| Amplifier                         | com-power    | PA-103A                 | 161069       | 1MHz ~1000MHz / 32 dB   | Apr. 17, 2018    | Apr. 23, 2018 | Apr. 16, 2019 | Radiation (03CH03-KS) |
| Amplifier                         | MITEQ        | TTA1840-35-HG           | 1887435      | 18~40GHz                | Oct. 12, 2017    | Apr. 23, 2018 | Oct. 11, 2018 | Radiation (03CH03-KS) |
| high gain Amplifier               | MITEQ        | AMF-7D-0010 1800-30-10P | 2025788      | 1Ghz~18Ghz              | Apr. 17, 2018    | Apr. 23, 2018 | Apr. 16, 2019 | Radiation (03CH03-KS) |
| Amplifier                         | Agilent      | 8449B                   | 3008A02370   | 1GHz~26.5GHz            | Oct. 12, 2017    | Apr. 23, 2018 | Oct. 11, 2018 | Radiation (03CH03-KS) |
| AC Power Source                   | Chroma       | 61601                   | F104090004   | N/A                     | NCR              | Apr. 23, 2018 | NCR           | Radiation (03CH03-KS) |
| Turn Table                        | ChamPro      | EM 1000-T               | 060762-T     | 0~360 degree            | NCR              | Apr. 23, 2018 | NCR           | Radiation (03CH03-KS) |
| Antenna Mast                      | ChamPro      | EM 1000-A               | 060762-A     | 1 m~4 m                 | NCR              | Apr. 23, 2018 | NCR           | Radiation (03CH03-KS) |

NCR: No Calibration Required

## 5 Uncertainty of Evaluation

### Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

|                                                                         |       |
|-------------------------------------------------------------------------|-------|
| Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ ) | 2.3dB |
|-------------------------------------------------------------------------|-------|

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

|                                                                         |       |
|-------------------------------------------------------------------------|-------|
| Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ ) | 4.5dB |
|-------------------------------------------------------------------------|-------|

### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

|                                                                         |       |
|-------------------------------------------------------------------------|-------|
| Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ ) | 4.1dB |
|-------------------------------------------------------------------------|-------|

### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

|                                                                         |       |
|-------------------------------------------------------------------------|-------|
| Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ ) | 4.5dB |
|-------------------------------------------------------------------------|-------|



## Appendix A. Radiated Spurious Emission

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

| BT                     | Note                                                         | Frequency | Level      | Over   | Limit      | Read     | Antenna  | Cable  | Preamp | Ant    | Table   | Peak    | Pol.    |
|------------------------|--------------------------------------------------------------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
|                        |                                                              |           |            | Limit  | Line       | Level    | Factor   | Loss   | Factor | Pos    | Pos     | Avg.    |         |
|                        |                                                              | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | ( P/A ) | ( H/V ) |
| BT<br>CH00<br>2402MHz  |                                                              | 2338.86   | 51.97      | -22.03 | 74         | 49.3     | 31.22    | 5.59   | 34.14  | 102    | 234     | P       | H       |
|                        |                                                              | 2338.86   | 27.18      | -26.82 | 54         | -        | -        | -      | -      | -      | -       | A       | H       |
|                        | *                                                            | 2402      | 94.66      | -      | -          | 91.85    | 31.3     | 5.65   | 34.14  | 102    | 234     | P       | H       |
|                        | *                                                            | 2402      | 69.87      | -      | -          | -        | -        | -      | -      | -      | -       | A       | H       |
|                        |                                                              | 2370.97   | 52.24      | -21.76 | 74         | 49.48    | 31.27    | 5.63   | 34.14  | 297    | 136     | P       | V       |
|                        |                                                              | 2370.97   | 27.45      | -26.55 | 54         | -        | -        | -      | -      | -      | -       | A       | V       |
|                        | *                                                            | 2402      | 99.07      | -      | -          | 96.26    | 31.3     | 5.65   | 34.14  | 297    | 136     | P       | V       |
|                        | *                                                            | 2402      | 74.28      | -      | -          | -        | -        | -      | -      | -      | -       | A       | V       |
| BT<br>CH 78<br>2480MHz | *                                                            | 2480      | 100.76     | -      | -          | 97.85    | 31.44    | 5.75   | 34.28  | 104    | 121     | P       | H       |
|                        | *                                                            | 2480      | 75.97      | -      | -          | -        | -        | -      | -      | -      | -       | A       | H       |
|                        |                                                              | 2483.69   | 56.03      | -17.97 | 74         | 53.12    | 31.44    | 5.75   | 34.28  | 104    | 121     | P       | H       |
|                        |                                                              | 2483.69   | 31.24      | -22.76 | 54         | -        | -        | -      | -      | -      | -       | A       | H       |
|                        | *                                                            | 2480      | 106.73     | -      | -          | 103.82   | 31.44    | 5.75   | 34.28  | 292    | 184     | P       | V       |
|                        | *                                                            | 2480      | 81.94      | -      | -          | -        | -        | -      | -      | -      | -       | A       | V       |
|                        |                                                              | 2484.11   | 57.6       | -16.4  | 74         | 54.69    | 31.44    | 5.75   | 34.28  | 292    | 184     | P       | V       |
|                        |                                                              | 2484.11   | 32.81      | -21.19 | 54         | -        | -        | -      | -      | -      | -       | A       | V       |
| Remark                 | 1. No other spurious found.                                  |           |            |        |            |          |          |        |        |        |         |         |         |
|                        | 2. All results are PASS against Peak and Average limit line. |           |            |        |            |          |          |        |        |        |         |         |         |



## 2.4GHz 2400~2483.5MHz

## BT (Harmonic @ 3m)

| BT                     | Note                                                                                        | Frequency<br>( MHz ) | Level<br>( dBμV/m ) | Over<br>Limit<br>( dB ) | Limit<br>Line<br>( dBμV/m ) | Read<br>Level<br>( dBμV ) | Antenna<br>Factor<br>( dB/m ) | Cable<br>Loss<br>( dB ) | Preamp<br>Factor<br>( dB ) | Ant<br>Pos<br>( cm ) | Table<br>Pos<br>( deg ) | Peak<br>Avg.<br>( P/A ) | Pol.<br>( H/V ) |
|------------------------|---------------------------------------------------------------------------------------------|----------------------|---------------------|-------------------------|-----------------------------|---------------------------|-------------------------------|-------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|
| BT<br>CH 00<br>2402MHz |                                                                                             | 4806                 | 44.37               | -29.63                  | 74                          | 62.22                     | 35.66                         | 7.84                    | 61.35                      | 150                  | 360                     | P                       | H               |
|                        |                                                                                             | 4806                 | 44.06               | -29.94                  | 74                          | 61.91                     | 35.66                         | 7.84                    | 61.35                      | 150                  | 360                     | P                       | V               |
| BT<br>CH 39<br>2441MHz |                                                                                             | 4884                 | 43.31               | -30.69                  | 74                          | 61                        | 35.61                         | 7.9                     | 61.2                       | 100                  | 360                     | P                       | H               |
|                        |                                                                                             | 7320                 | 39.77               | -34.23                  | 74                          | 57.47                     | 35.9                          | 9.51                    | 63.11                      | 100                  | 360                     | P                       | H               |
|                        |                                                                                             | 4884                 | 43.41               | -30.59                  | 74                          | 61.1                      | 35.61                         | 7.9                     | 61.2                       | 100                  | 360                     | P                       | V               |
|                        |                                                                                             | 7320                 | 40.17               | -33.83                  | 74                          | 57.87                     | 35.9                          | 9.51                    | 63.11                      | 100                  | 360                     | P                       | V               |
| BT<br>CH 78<br>2480MHz |                                                                                             | 4962                 | 43.94               | -30.06                  | 74                          | 61.44                     | 35.54                         | 7.97                    | 61.01                      | 100                  | 360                     | P                       | H               |
|                        |                                                                                             | 7440                 | 40.69               | -33.31                  | 74                          | 58.37                     | 35.97                         | 9.57                    | 63.22                      | 100                  | 360                     | P                       | H               |
|                        |                                                                                             | 4962                 | 44                  | -30                     | 74                          | 61.5                      | 35.54                         | 7.97                    | 61.01                      | 100                  | 360                     | P                       | V               |
|                        |                                                                                             | 7440                 | 41.67               | -32.33                  | 74                          | 59.35                     | 35.97                         | 9.57                    | 63.22                      | 100                  | 360                     | P                       | V               |
| Remark                 | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. |                      |                     |                         |                             |                           |                               |                         |                            |                      |                         |                         |                 |



## Emission below 1GHz

## 2.4GHz BT (LF)

| BT                 | Note                                                                       | Frequency | Level      | Over   | Limit      | Read   | Antenna  | Cable  | Preamp | Ant    | Table   | Peak  | Pol.  |
|--------------------|----------------------------------------------------------------------------|-----------|------------|--------|------------|--------|----------|--------|--------|--------|---------|-------|-------|
|                    |                                                                            |           |            | Limit  | Line       | Level  | Factor   | Loss   | Factor | Pos    | Pos     | Avg.  |       |
|                    |                                                                            | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | (dBμV) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| 2.4GHz<br>BT<br>LF |                                                                            | 40.67     | 22.73      | -17.27 | 40         | 32.04  | 22.1     | 0.64   | 32.05  | -      | -       | P     | H     |
|                    |                                                                            | 101.78    | 27.47      | -16.03 | 43.5       | 40.48  | 17.9     | 1.02   | 31.93  | 100    | 124     | P     | H     |
|                    |                                                                            | 159.01    | 18.76      | -24.74 | 43.5       | 32.04  | 17.23    | 1.3    | 31.81  | -      | -       | P     | H     |
|                    |                                                                            | 388.9     | 24.42      | -21.58 | 46         | 28.79  | 24.34    | 2.04   | 30.75  | -      | -       | P     | H     |
|                    |                                                                            | 632.37    | 25.91      | -20.09 | 46         | 27.57  | 25.12    | 2.66   | 29.44  | -      | -       | P     | H     |
|                    |                                                                            | 760.41    | 25.48      | -20.52 | 46         | 24.64  | 26.65    | 2.78   | 28.59  | -      | -       | P     | H     |
|                    | !                                                                          | 40.67     | 36.18      | -3.82  | 40         | 45.49  | 22.1     | 0.64   | 32.05  | 100    | 298     | P     | V     |
|                    |                                                                            | 99.84     | 30.9       | -12.6  | 43.5       | 44.12  | 17.7     | 1.01   | 31.93  | -      | -       | P     | V     |
|                    |                                                                            | 150.28    | 24.22      | -19.28 | 43.5       | 37.3   | 17.5     | 1.26   | 31.84  | -      | -       | P     | V     |
|                    |                                                                            | 193.93    | 21.8       | -21.7  | 43.5       | 36.07  | 16       | 1.42   | 31.69  | -      | -       | P     | V     |
|                    |                                                                            | 387.93    | 27.46      | -18.54 | 46         | 31.83  | 24.34    | 2.04   | 30.75  | -      | -       | P     | V     |
|                    |                                                                            | 649.83    | 27.63      | -18.37 | 46         | 28.87  | 25.4     | 2.68   | 29.32  | -      | -       | P     | V     |
| Remark             | 1. No other spurious found.<br>2. All results are PASS against limit line. |           |            |        |            |        |          |        |        |        |         |       |       |



**Note symbol**

|     |                                                                                                                                                          |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| *   | <b>Fundamental Frequency</b> which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency. |
| !   | Test result is <b>not under limit 6dB</b> .                                                                                                              |
| P/A | <b>P</b> eak or <b>A</b> verage                                                                                                                          |
| H/V | <b>H</b> orizontal or <b>V</b> ertical                                                                                                                   |



A calculation example for radiated spurious emission is shown as below:

| WIFI    | Note | Frequency | Level      | Over   | Limit      | Read     | Antenna  | Cable  | Preamp | Ant    | Table   | Peak    | Pol.    |
|---------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
| Ant.    |      |           |            | Limit  | Line       | Level    | Factor   | Loss   | Factor | Pos    | Pos     | Avg.    |         |
| 1+2     |      | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | ( P/A ) | ( H/V ) |
| 802.11b |      | 2390      | 55.45      | -18.55 | 74         | 54.51    | 32.22    | 4.58   | 35.86  | 103    | 308     | P       | H       |
| CH 01   |      |           |            |        |            |          |          |        |        |        |         |         |         |
| 2412MHz |      | 2390      | 43.54      | -10.46 | 54         | 42.6     | 32.22    | 4.58   | 35.86  | 103    | 308     | A       | H       |

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

**For Peak Limit @ 2390MHz:**

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

**For Average Limit @ 2390MHz:**

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

**Both peak and average measured complies with the limit line, so test result is “PASS”.**