



# FCC RF Test Report

**APPLICANT** : Sony Mobile Communications Inc.  
**EQUIPMENT** : GSM/WCDMA/LTE Phone+Bluetooth, DTS/UNII  
a/b/g/n/ac and NFC  
**BRAND NAME** : Sony  
**FCC ID** : PY7-67442A  
**STANDARD** : FCC Part 15 Subpart C §15.247  
**CLASSIFICATION** : (DTS) Digital Transmission System

This is a variant report which is only valid together with the original test report. The product was received on Jun. 27, 2017 and testing was completed on Oct. 31, 2017. We, SPORTON INTERNATIONAL 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 INC., the test report shall not be reproduced except in full.

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Reviewed by: Joseph Lin / Supervisor

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Approved by: Jones Tsai / Manager



## **SPORTON INTERNATIONAL INC.**

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FCC ID : PY7-67442A

Page Number : 1 of 17

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## REVISION HISTORY

| REPORT NO.   | VERSION | DESCRIPTION             | ISSUED DATE   |
|--------------|---------|-------------------------|---------------|
| FR762714-01B | Rev. 01 | Initial issue of report | Nov. 07, 2017 |
|              |         |                         |               |
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|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |



## SUMMARY OF TEST RESULT

| Report Section | FCC Rule           | Description                               | Limit                 | Result | Remark                                  |
|----------------|--------------------|-------------------------------------------|-----------------------|--------|-----------------------------------------|
| 3.1            | 15.247(d)          | Radiated Band Edges and Spurious Emission | 15.209(a) & 15.247(d) | Pass   | Under limit<br>3.77 dB at<br>49.440 MHz |
| 3.2            | 15.203 & 15.247(b) | Antenna Requirement                       | N/A                   | Pass   | -                                       |



# 1 General Description

## 1.1 Applicant

Sony Mobile Communications Inc.

4-12-3 Higashi-Shinagawa, Shinagawa-ku, Tokyo, 140-0002, Japan

## 1.2 Manufacturer

Sony Mobile Communications Inc.

4-12-3 Higashi-Shinagawa, Shinagawa-ku, Tokyo, 140-0002, Japan

## 1.3 Product Feature of Equipment Under Test

GSM/WCDMA/LTE, Bluetooth, DTS/UNII a/b/g/n/ac, FM Receiver, NFC, and GPS.

| Standards-related Product Specification |                                      |
|-----------------------------------------|--------------------------------------|
| Antenna Type / Gain                     | Monopole Antenna with gain -1.50 dBi |

**Remark:** This is a variant report. All the test cases were performed on original report which can be referred to Sporton Report Number FR762713-01B.

| EUT Information List |            |            |                            |
|----------------------|------------|------------|----------------------------|
| HW Version           | SW Version | S/N        | Performed Test Item        |
| A                    | 2.27       | CQ300000A4 | RF conducted measurement   |
|                      |            | CQ300001SC | Radiated Spurious Emission |

| Accessory List |                    |
|----------------|--------------------|
| AC Adapter     | Model Name: UCH12  |
|                | S/N: VB17W34100228 |
| Earphone 1     | Model Name: MH410c |
|                | S/N: N/A           |
| USB Cable      | Model Name: UCB20  |
|                | S/N: N/A           |

**Note:**

1. Above EUT list and accessory list used are electrically identical per declared by manufacturer.
2. Above the accessories list are used to exercise the EUT during test.
3. For other wireless features of this EUT, test report will be issued separately.

## 1.4 Modification of EUT

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

## 1.5 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1190 and TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

|                           |                                                                                                                                                                  |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Site</b>          | SPORTON INTERNATIONAL INC.                                                                                                                                       |
| <b>Test Site Location</b> | No. 52, Hwa Ya 1 <sup>st</sup> Rd., Hwa Ya Technology Park,<br>Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |
| <b>Test Site No.</b>      | <b>Sporton Site No.</b>                                                                                                                                          |
|                           | TH05-HY                                                                                                                                                          |

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

|                           |                                                                                                                                        |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Site</b>          | SPORTON INTERNATIONAL INC.                                                                                                             |
| <b>Test Site Location</b> | No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd. Guishan Dist,<br>Taoyuan City, Taiwan (R.O.C.)<br>TEL: +886-3-327-0868<br>FAX: +886-3-327-0855 |
| <b>Test Site No.</b>      | <b>Sporton Site No.</b>                                                                                                                |
|                           | 03CH13-HY                                                                                                                              |

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

## 1.6 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
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
- ♦ 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 Carrier Frequency Channel

| Frequency Band  | Channel | Freq.<br>(MHz) | Channel | Freq.<br>(MHz) |
|-----------------|---------|----------------|---------|----------------|
| 2400-2483.5 MHz | 0       | 2402           | 21      | 2444           |
|                 | 1       | 2404           | 22      | 2446           |
|                 | 2       | 2406           | 23      | 2448           |
|                 | 3       | 2408           | 24      | 2450           |
|                 | 4       | 2410           | 25      | 2452           |
|                 | 5       | 2412           | 26      | 2454           |
|                 | 6       | 2414           | 27      | 2456           |
|                 | 7       | 2416           | 28      | 2458           |
|                 | 8       | 2418           | 29      | 2460           |
|                 | 9       | 2420           | 30      | 2462           |
|                 | 10      | 2422           | 31      | 2464           |
|                 | 11      | 2424           | 32      | 2466           |
|                 | 12      | 2426           | 33      | 2468           |
|                 | 13      | 2428           | 34      | 2470           |
|                 | 14      | 2430           | 35      | 2472           |
|                 | 15      | 2432           | 36      | 2474           |
|                 | 16      | 2434           | 37      | 2476           |
|                 | 17      | 2436           | 38      | 2478           |
|                 | 18      | 2438           | 39      | 2480           |
|                 | 19      | 2440           | -       | -              |
|                 | 20      | 2442           | -       | -              |

## 2.2 Descriptions of Test Mode

The RF output power was recorded in the following table:

| Channel | Frequency | Bluetooth – LE RF Output Power |                 |
|---------|-----------|--------------------------------|-----------------|
|         |           | Data Rate / Modulation         |                 |
|         |           | GFSK                           |                 |
|         |           | 1Mbps                          | 2Mbps           |
| Ch00    | 2402MHz   | -0.29 dBm                      | 0.28 dBm        |
| Ch19    | 2440MHz   | -0.39 dBm                      | 0.06 dBm        |
| Ch39    | 2480MHz   | 0.65 dBm                       | <b>0.90</b> dBm |

- 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: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). Pre-scanned tests, X, Y, Z in three orthogonal panels, and different data rates were conducted to determine the final configuration (Z plane as worst plane) from all possible combinations.

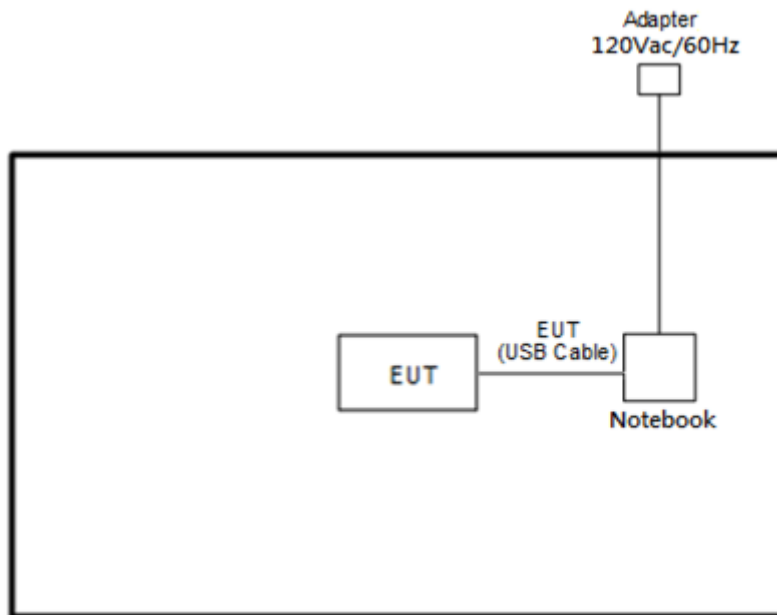
## 2.3 Test Mode

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                   |
|                             | Bluetooth – LE / GFSK                    |
| Radiated TCs                | Mode 1: Bluetooth Tx CH39_2480 MHz_1Mbps |

## 2.4 Connection Diagram of Test System

<Bluetooth LE Tx Mode>



## 2.5 EUT Operation Test Setup

The RF test items, an engineering test program was provided and enabled to make EUT transmitting signals.

### 3 Test Result

#### 3.1 Radiated Band Edges and Spurious Emission Measurement

##### 3.1.1 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. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. 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                                |

##### 3.1.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

### 3.1.3 Test Procedures

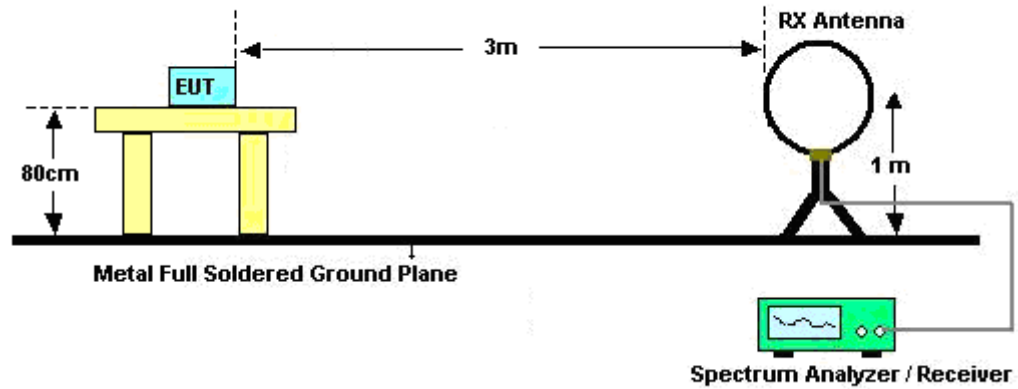
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. 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.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. 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.
7. 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.
8. 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; VBW  $\geq$  RBW; Sweep = auto; Detector function = peak; Trace = max hold;
  - (3) Set RBW = 1 MHz, VBW= 3MHz for  $f \geq 1$  GHz for peak measurement.

For average measurement:

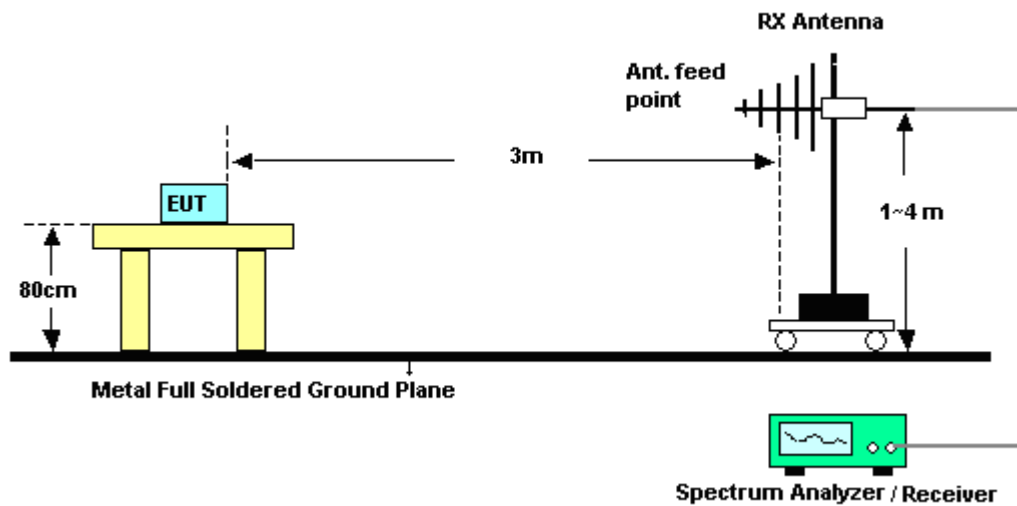
    - VBW = 10 Hz, when duty cycle is no less than 98 percent.
    - VBW  $\geq 1/T$ , when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

### 3.1.4 Test Setup

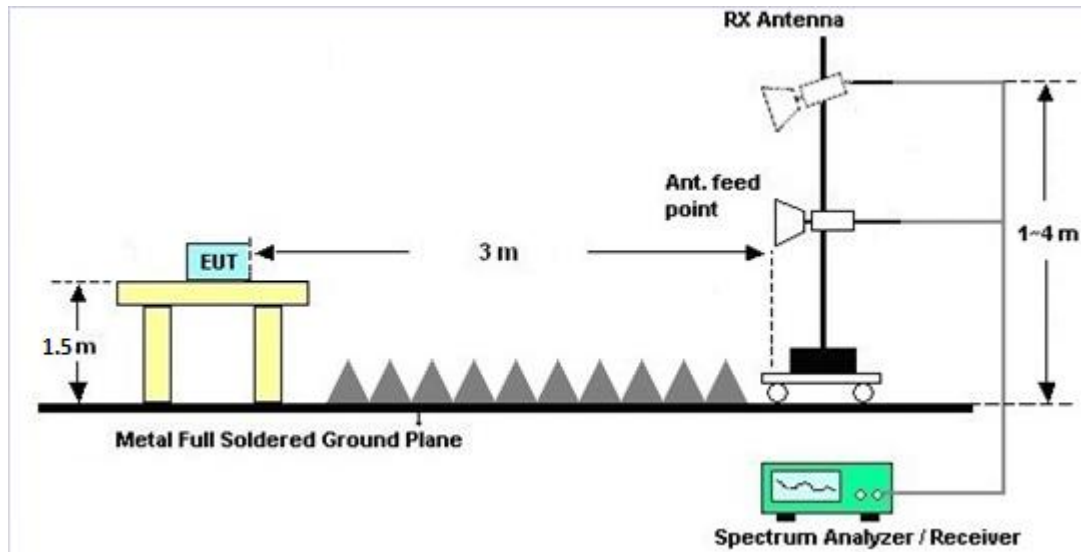
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



### 3.1.5 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.

### 3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

### 3.1.7 Duty Cycle

Please refer to Appendix C.

### 3.1.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix A and B.



## **3.2 Antenna Requirements**

### **3.2.1 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.

### **3.2.2 Antenna Anti-Replacement Construction**

An embedded-in antenna design is used.

### **3.2.3 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                |
|----------------------|-------------------|---------------------------|-------------|-------------------------------|------------------|---------------------------------|---------------|-----------------------|
| Power Meter          | Agilent           | E4416A                    | GB41292344  | N/A                           | Dec. 26, 2016    | Oct. 31, 2017                   | Dec. 25, 2017 | Conducted (TH05-HY)   |
| Power Sensor         | Agilent           | E9327A                    | US40441548  | 50MHz~18GHz                   | Dec. 26, 2016    | Oct. 31, 2017                   | Dec. 25, 2017 | Conducted (TH05-HY)   |
| Spectrum Analyzer    | Rohde & Schwarz   | FSP30                     | 101067      | 9kHz ~ 30GHz                  | Nov. 17, 2016    | Oct. 31, 2017                   | Nov. 16, 2017 | Conducted (TH05-HY)   |
| Hygrometer           | TECEP             | DTM-303B                  | TP157151    | N/A                           | Mar. 20, 2017    | Oct. 31, 2017                   | Mar. 19, 2018 | Conducted (TH05-HY)   |
| RF Cable             | HUBER + SUHNER    | SUCOFLEX 104              | MY84209521  | 1GHz~26GHz                    | Dec. 02, 2016    | Oct. 31, 2017                   | Dec. 01, 2017 | Conducted (TH05-HY)   |
| Loop Antenna         | Rohde & Schwarz   | HFH2-Z2                   | 100315      | 9 kHz~30 MHz                  | May 15, 2017     | Oct. 19, 2017~<br>Oct. 20, 2017 | May 14, 2019  | Radiation (03CH13-HY) |
| Bilog Antenna        | TESEQ             | CBL 6111D&00800 N1D01N-06 | 40103&04    | 30MHz to 1GHz                 | Jan. 07, 2017    | Oct. 19, 2017~<br>Oct. 20, 2017 | Jan. 06, 2018 | Radiation (03CH13-HY) |
| Horn Antenna         | SCHWARZBECK       | BBHA 9120 D               | 9120D-1241  | 1GHz ~ 18GHz                  | May 02, 2017     | Oct. 19, 2017~<br>Oct. 20, 2017 | May 01, 2018  | Radiation (03CH13-HY) |
| SHF-EHF Horn Antenna | SCHWARZBECK       | BBHA 9170                 | BBHA9170584 | 18GHz- 40GHz                  | Nov. 08, 2016    | Oct. 19, 2017~<br>Oct. 20, 2017 | Nov. 07, 2017 | Radiation (03CH13-HY) |
| Spectrum Analyzer    | Keysight          | N9010A                    | MY55370526  | N/A                           | Mar. 15, 2017    | Oct. 19, 2017~<br>Oct. 20, 2017 | Mar. 14, 2018 | Radiation (03CH13-HY) |
| EMI Test Receiver    | Agilent           | N9038A(MXE)               | MY53290053  | 20Hz to 26.5GHz               | Jan. 12, 2017    | Oct. 19, 2017~<br>Oct. 20, 2017 | Jan. 11, 2018 | Radiation (03CH13-HY) |
| Amplifier            | Sonoma-Instrument | 310 N                     | 187282      | 9KHz~1GHz                     | Dec. 21, 2016    | Oct. 19, 2017~<br>Oct. 20, 2017 | Dec. 20, 2017 | Radiation (03CH13-HY) |
| Preamplifier         | MITEQ             | AMF-7D-0010 1800-30-10P   | 1590074     | 1GHz~18GHz                    | May 22, 2017     | Oct. 19, 2017~<br>Oct. 20, 2017 | May 21, 2018  | Radiation (03CH13-HY) |
| Preamplifier         | Keysight          | 83017A                    | MY53270147  | 1GHz~26.5GHz                  | Jan. 09, 2017    | Oct. 19, 2017~<br>Oct. 20, 2017 | Jan. 08, 2018 | Radiation (03CH13-HY) |
| Amplifier            | MITEQ             | TTA1840-35-HG             | 1871923     | 18GHz~40GHz, VSWR : 2.5:1 max | Jul. 18, 2017    | Oct. 19, 2017~<br>Oct. 20, 2017 | Jul. 17, 2018 | Radiation (03CH13-HY) |



| Instrument    | Manufacturer      | Model No.                           | Serial No.                         | Characteristics                  | Calibration Date | Test Date                       | Due Date      | Remark                   |
|---------------|-------------------|-------------------------------------|------------------------------------|----------------------------------|------------------|---------------------------------|---------------|--------------------------|
| Hygrometer    | TECEPIL           | DTM-303B                            | TP140320                           | N/A                              | Nov. 14, 2016    | Oct. 19, 2017~<br>Oct. 20, 2017 | Nov. 13, 2017 | Radiation<br>(03CH13-HY) |
| RF Cable      | HUBER +<br>SUHNER | SUCOFLEX<br>104                     | MY335041/4<br>MY9840/4<br>MY9838/4 | 26GHz~40GHz                      | Mar. 27, 2017    | Oct. 19, 2017~<br>Oct. 20, 2017 | Mar. 26, 2018 | Radiation<br>(03CH13-HY) |
| RF Cable      | HUBER +<br>SUHNER | SUCOFLEX<br>104                     | MY335041/4<br>MY9840/4<br>MY9838/4 | 30MHz~1GHz                       | Jan. 27, 2017    | Oct. 19, 2017~<br>Oct. 20, 2017 | Jan. 26, 2018 | Radiation<br>(03CH13-HY) |
| RF Cable      | HUBER +<br>SUHNER | SUCOFLEX<br>104                     | MY335041/4<br>MY9840/4<br>MY9838/4 | 1GHz~26GHz                       | Jan. 27, 2017    | Oct. 19, 2017~<br>Oct. 20, 2017 | Jan. 26, 2018 | Radiation<br>(03CH13-HY) |
| Controller    | EMEC              | EM1000                              | N/A                                | Control Turn<br>table & Ant Mast | N/A              | Oct. 19, 2017~<br>Oct. 20, 2017 | N/A           | Radiation<br>(03CH13-HY) |
| Antenna Mast  | EMEC              | AM-BS-450<br>0-B                    | N/A                                | 1m~4m                            | N/A              | Oct. 19, 2017~<br>Oct. 20, 2017 | N/A           | Radiation<br>(03CH13-HY) |
| Turn Table    | EMEC              | TT2000                              | N/A                                | 0~360 Degree                     | N/A              | Oct. 19, 2017~<br>Oct. 20, 2017 | N/A           | Radiation<br>(03CH13-HY) |
| Test Software | Audix             | E3                                  | 6.2009-8-24                        | N/A                              | N/A              | Oct. 19, 2017~<br>Oct. 20, 2017 | N/A           | Radiation<br>(03CH13-HY) |
| Filter        | Wainwright        | WLKS1200-<br>12SS                   | SN2                                | 1.2G Low Pass                    | Sep. 18, 2017    | Oct. 19, 2017~<br>Oct. 20, 2017 | Sep. 17, 2018 | Radiation<br>(03CH13-HY) |
| Filter        | Wainwright        | WHKX12-27<br>00-3000-18<br>000-60SS | SN2                                | 3G High Pass                     | Sep. 18, 2017    | Oct. 19, 2017~<br>Oct. 20, 2017 | Sep. 17, 2018 | Radiation<br>(03CH13-HY) |



## 5 Uncertainty of Evaluation

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

|                                                                            |      |
|----------------------------------------------------------------------------|------|
| Measuring Uncertainty for a Level of Confidence<br>of 95% ( $U = 2Uc(y)$ ) | 4.90 |
|----------------------------------------------------------------------------|------|

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

|                                                                            |      |
|----------------------------------------------------------------------------|------|
| Measuring Uncertainty for a Level of Confidence<br>of 95% ( $U = 2Uc(y)$ ) | 5.40 |
|----------------------------------------------------------------------------|------|

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

|                                                                            |      |
|----------------------------------------------------------------------------|------|
| Measuring Uncertainty for a Level of Confidence<br>of 95% ( $U = 2Uc(y)$ ) | 4.30 |
|----------------------------------------------------------------------------|------|



## Appendix A. Radiated Spurious Emission

|                 |                          |                     |             |
|-----------------|--------------------------|---------------------|-------------|
| Test Engineer : | Bill Chang and Wilson Wu | Temperature :       | 25.0~25.1°C |
|                 |                          | Relative Humidity : | 56~59%      |

### 2.4GHz 2400~2483.5MHz

#### BLE 1Mbps (Band Edge @ 3m)

| BLE                     | Note                                                         | Frequency | Level      | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Ant Pos | Table Pos | Peak Avg. | Pol.    |
|-------------------------|--------------------------------------------------------------|-----------|------------|------------|------------|------------|----------------|------------|---------------------|---------|-----------|-----------|---------|
|                         |                                                              | ( MHz )   | ( dBμV/m ) | ( dB )     | ( dBμV/m ) | ( dBμV )   | ( dB/m )       | ( dB )     | ( dB )              | ( cm )  | ( deg )   | ( P/A )   | ( H/V ) |
| BLE<br>CH 39<br>2480MHz | *                                                            | 2480      | 90.07      | -          | -          | 79.04      | 27.15          | 4.92       | 30.97               | 116     | 139       | P         | H       |
|                         | *                                                            | 2480      | 89.62      | -          | -          | 78.59      | 27.15          | 4.92       | 30.97               | 116     | 139       | A         | H       |
|                         |                                                              | 2496.8    | 51.18      | -22.82     | 74         | 40.08      | 27.2           | 4.93       | 30.96               | 116     | 139       | P         | H       |
|                         |                                                              | 2485.96   | 43.68      | -10.32     | 54         | 32.64      | 27.15          | 4.93       | 30.97               | 116     | 139       | A         | H       |
|                         |                                                              |           |            |            |            |            |                |            |                     |         |           |           | H       |
|                         |                                                              |           |            |            |            |            |                |            |                     |         |           |           | H       |
|                         | *                                                            | 2480      | 89.93      | -          | -          | 78.9       | 27.15          | 4.92       | 30.97               | 266     | 112       | P         | V       |
|                         | *                                                            | 2480      | 89.48      | -          | -          | 78.45      | 27.15          | 4.92       | 30.97               | 266     | 112       | A         | V       |
|                         |                                                              | 2492.48   | 51.65      | -22.35     | 74         | 40.55      | 27.2           | 4.93       | 30.96               | 266     | 112       | P         | V       |
|                         |                                                              | 2488.84   | 43.97      | -10.03     | 54         | 32.87      | 27.2           | 4.93       | 30.96               | 266     | 112       | A         | V       |
|                         |                                                              |           |            |            |            |            |                |            |                     |         |           |           | V       |
|                         |                                                              |           |            |            |            |            |                |            |                     |         |           |           | V       |
| Remark                  | 1. No other spurious found.                                  |           |            |            |            |            |                |            |                     |         |           |           |         |
|                         | 2. All results are PASS against Peak and Average limit line. |           |            |            |            |            |                |            |                     |         |           |           |         |



## 2.4GHz 2400~2483.5MHz

## BLE 1Mbps (Harmonic @ 3m)

| BLE                     | 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 ) |
|-------------------------|---------------------------------------------------------------------------------------------|----------------------|---------------------|-------------------------|-----------------------------|---------------------------|-------------------------------|-------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|
| BLE<br>CH 39<br>2480MHz |                                                                                             | 4960                 | 38.75               | -35.25                  | 74                          | 55.97                     | 31.75                         | 7.59                    | 57.05                      | 100                  | 0                       | P                       | H               |
|                         |                                                                                             | 7440                 | 43.63               | -30.37                  | 74                          | 54.99                     | 36.41                         | 9.21                    | 57.44                      | 100                  | 0                       | P                       | H               |
|                         |                                                                                             |                      |                     |                         |                             |                           |                               |                         |                            |                      |                         |                         | H               |
|                         |                                                                                             |                      |                     |                         |                             |                           |                               |                         |                            |                      |                         |                         | H               |
|                         |                                                                                             | 4960                 | 38.95               | -35.05                  | 74                          | 56.17                     | 31.75                         | 7.59                    | 57.05                      | 100                  | 0                       | P                       | V               |
|                         |                                                                                             | 7440                 | 43.45               | -30.55                  | 74                          | 54.81                     | 36.41                         | 9.21                    | 57.44                      | 100                  | 0                       | P                       | V               |
|                         |                                                                                             |                      |                     |                         |                             |                           |                               |                         |                            |                      |                         |                         | V               |
|                         |                                                                                             |                      |                     |                         |                             |                           |                               |                         |                            |                      |                         |                         | V               |
| Remark                  | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. |                      |                     |                         |                             |                           |                               |                         |                            |                      |                         |                         |                 |

## Emission below 1GHz

## 2.4GHz BLE (LF)

| BLE                         | 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><br>BLE<br><br>LF |                                                                            | 49.44     | 36.23      | -3.77  | 40         | 56.76  | 11.03    | 0.74   | 32.32  | 100    | 0       | P     | H     |
|                             |                                                                            | 87.24     | 35.23      | -4.77  | 40         | 56.45  | 10.09    | 0.95   | 32.3   |        |         | P     | H     |
|                             |                                                                            | 223.32    | 38.12      | -7.88  | 46         | 56.54  | 12.21    | 1.53   | 32.24  |        |         | P     | H     |
|                             |                                                                            | 400.1     | 35.59      | -10.41 | 46         | 46.98  | 18.7     | 1.97   | 32.15  |        |         | P     | H     |
|                             |                                                                            | 562.5     | 30.66      | -15.34 | 46         | 37.66  | 22.75    | 2.36   | 32.21  |        |         | P     | H     |
|                             |                                                                            | 799.8     | 33.67      | -12.33 | 46         | 37.75  | 25.01    | 2.78   | 31.99  |        |         | P     | H     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         |       | H     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         |       | H     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         |       | H     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         |       | H     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         |       | H     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         |       | H     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         |       | H     |
|                             |                                                                            | 71.85     | 33.82      | -6.18  | 40         | 55.95  | 9.23     | 0.84   | 32.31  | 100    | 0       | P     | V     |
|                             |                                                                            | 107.22    | 32.28      | -11.22 | 43.5       | 49.12  | 14.33    | 1      | 32.29  |        |         | P     | V     |
|                             |                                                                            | 228.18    | 33.53      | -12.47 | 46         | 51.6   | 12.55    | 1.53   | 32.23  |        |         | P     | V     |
|                             |                                                                            | 400.1     | 31.38      | -14.62 | 46         | 42.77  | 18.7     | 1.97   | 32.15  |        |         | P     | V     |
|                             |                                                                            | 640.2     | 27.68      | -18.32 | 46         | 33.76  | 23.51    | 2.48   | 32.19  |        |         | P     | V     |
|                             |                                                                            | 899.9     | 32.21      | -13.79 | 46         | 34.2   | 26.47    | 2.94   | 31.51  |        |         | P     | V     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         |       | V     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         |       | V     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         |       | V     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         |       | V     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         |       | V     |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         | V     |       |
|                             |                                                                            |           |            |        |            |        |          |        |        |        |         | 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>over limit</b> line.                                                                                                                   |
| 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”.**



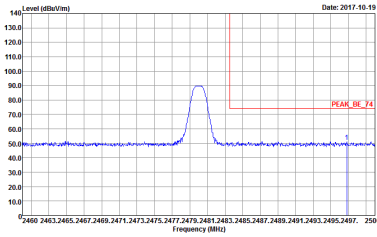
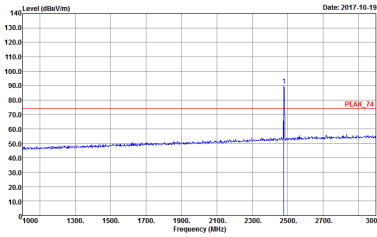
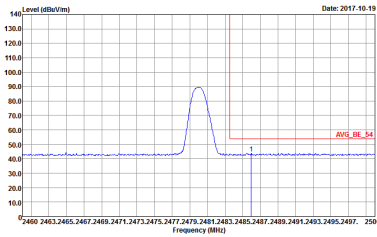
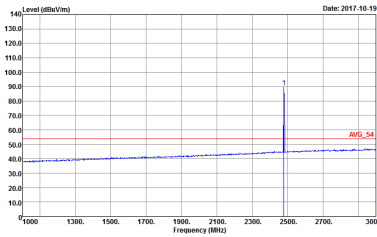
## Appendix B. Radiated Spurious Emission Plots

|                 |                          |                     |             |
|-----------------|--------------------------|---------------------|-------------|
| Test Engineer : | Bill Chang and Wilson Wu | Temperature :       | 25.0~25.1°C |
|                 |                          | Relative Humidity : | 56~59%      |

### Note symbol

|    |                       |
|----|-----------------------|
| -L | Low channel location  |
| -R | High channel location |

**2.4GHz 2400~2483.5MHz**  
**BLE 1Mbps (Band Edge @ 3m)**

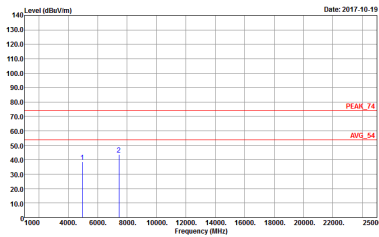
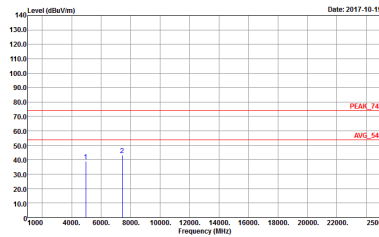
| BLE         | 2.4GHz 2400~2483.5MHz Band Edge @ 3m                                                                                                                                |                                                                                                                                                                   |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ANT         | BLE CH39 2480MHz                                                                                                                                                    |                                                                                                                                                                   |
| 1           | Horizontal                                                                                                                                                          | Fundamental                                                                                                                                                       |
| <b>Peak</b> |  <p>Site : 03CH13-HY<br/>Condition : PEAK BE 74 3m HORN 9120D 1241 HORIZONTAL</p>  |  <p>Site : 03CH13-HY<br/>Condition : PEAK 74 3m HORN 9120D 1241 HORIZONTAL</p>  |
| <b>Avg.</b> |  <p>Site : 03CH13-HY<br/>Condition : AVG BE 54 3m HORN 9120D 1241 HORIZONTAL</p> |  <p>Site : 03CH13-HY<br/>Condition : AVG 54 3m HORN 9120D 1241 HORIZONTAL</p> |



| BLE  | 2.4GHz 2400~2483.5MHz Band Edge @ 3m                                           |                                                                             |
|------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| ANT  | BLE CH39 2480MHz                                                               |                                                                             |
| 1    | Vertical                                                                       | Fundamental                                                                 |
| Peak | <p>Site : 03CH13-HY<br/>Condition : PEAK BE 74 3m HORN 9120D 1241 VERTICAL</p> | <p>Site : 03CH13-HY<br/>Condition : PEAK 74 3m HORN 9120D 1241 VERTICAL</p> |
| Avg. | <p>Site : 03CH13-HY<br/>Condition : AVG BE 54 3m HORN 9120D 1241 VERTICAL</p>  | <p>Site : 03CH13-HY<br/>Condition : AVG 54 3m HORN 9120D 1241 VERTICAL</p>  |



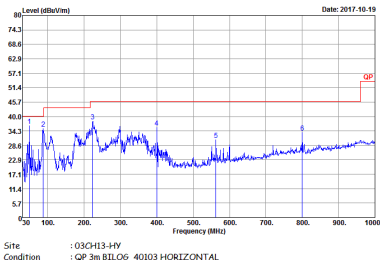
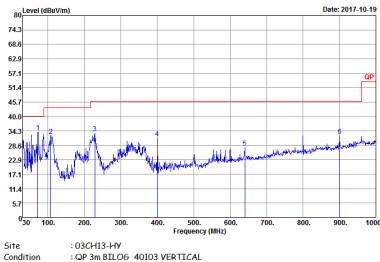
2.4GHz 2400~2483.5MHz  
BLE 1Mbps (Harmonic @ 3m)

| BLE  | 2.4GHz 2400~2483.5MHz Harmonic @ 3m                                                                                                                           |                                                                                                                                                              |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ANT  | BLE CH39 2480MHz                                                                                                                                              |                                                                                                                                                              |
| 1    | Horizontal                                                                                                                                                    | Vertical                                                                                                                                                     |
| Peak |  <p>Site : 03CH13-14Y<br/>Condition : PEAK 74 3m SHF HORN 584 HORIZONTAL</p> |  <p>Site : 03CH13-14Y<br/>Condition : PEAK 74 3m SHF HORN 584 VERTICAL</p> |



Emission below 1GHz

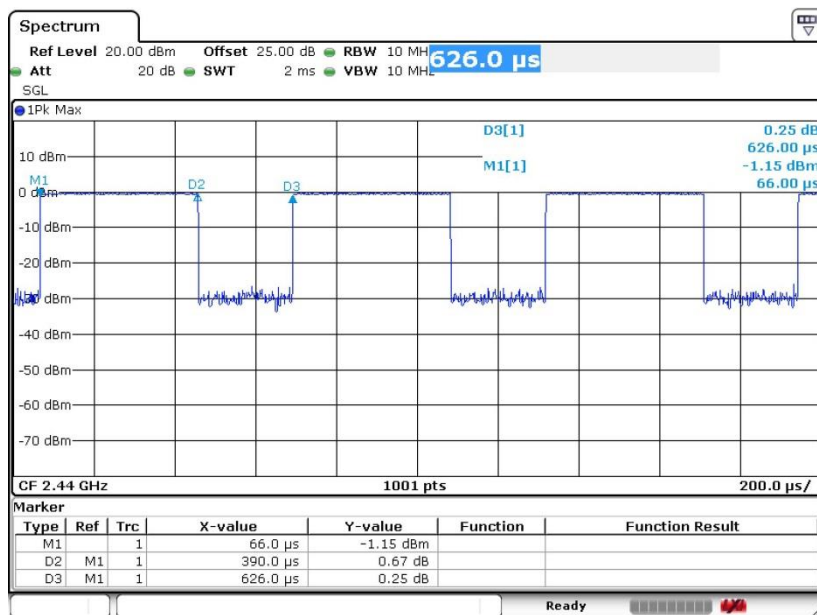
2.4GHz BLE (LF)

| BLE          | 2.4GHz 2400~2483.5MHz                                                             |                                                                                    |
|--------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| ANT          | BLE LF                                                                            |                                                                                    |
| 1            | Horizontal                                                                        | Vertical                                                                           |
| QP /<br>Peak |  |  |
|              |                                                                                   |                                                                                    |

## Appendix C. Duty Cycle Plots

| Band                    | Duty Cycle(%) | T(us) | 1/T(kHz) | VBW Setting |
|-------------------------|---------------|-------|----------|-------------|
| Bluetooth –LE for 1Mbps | 61.78         | 388   | 2.58     | 3kHz        |

### Bluetooth – LE for 1Mbps



Date: 26.OCT.2017 15:32:47



## **Appendix D. Original Report**

Please refer to Sporton report number FR762713-01B