



# FCC CO-LOCATION RADIO TEST REPORT

| FCC ID       | : APYHRO00283  |
|--------------|--|
| Equipment    | : Wireless router  |
| Applicant    | : SHARP CORPORATION  |
|              | 1 Takumi-cho, Sakai-ku, Sakai City,<br>Osaka, Japan 590-8522   |
| Manufacturer | : SHARP CORPORATION<br>2-13-1, HACHIHONMATSU-IIDA,<br>HIGASHI-HIROSHIMA-SHI, HIROSHIMA<br>PREFECTURE 739-0192, JAPAN |
| Standard     | : 47 CFR Part 2, 22(H), 24(E), 27  |

The product was received on Dec. 10, 2019 and testing was started from Dec. 18, 2019 and completed on Feb. 05, 2020. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA-603-E and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Lunis Wu

Approved by: Louis Wu SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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# History of this test report

| Report No.   | Version | Description             | Issued Date   |
|--------------|---------|-------------------------|---------------|
| FG900422-06D | 01      | Initial issue of report | Feb. 10, 2020 |
|              |         |                         |               |
|              |         |                         |               |
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|              |         |                         |               |
|              |         |                         |               |
|              |         |                         |               |



# Summary of Test Result

| Report<br>Clause | Ref Std.<br>Clause   | Test Items  | Result<br>(PASS/FAIL) | Remark                                    |
|------------------|--|---|-----------------------|---|
| 3.2              | §2.1053<br>§22.917 (a)<br>§24.238 (a)<br>§27.53 (c)(2)<br>§27.53 (f)<br>§27.53 (g)<br>§27.53 (h) | Radiated Spurious Emission<br>(Band 2) (Band 4) (Band 5)<br>(Band 12) (Band 13) (Band 17) | Pass                  | Under limit<br>4.90 dB at<br>1560.000 MHz |
|                  | §2.1051<br>§27.53 (m)(4)   | Radiated Spurious Emission<br>(Band 7) (Band 38) (Band 41)                                |                       |   |

#### Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

#### **Comments and Explanations:**

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

#### **Reviewed by: Wii Chang**

**Report Producer: Dara Chiu** 

# **1** General Description

## **1.1 Product Feature of Equipment Under Test**

WCDMA/LTE and Wi-Fi 2.4GHz 802.11b/g/n/ax

| Product Specification subjective to this standard |   |  |  |  |
|---|---|--|--|--|
| Antenna Type                                      | WWAN<br><ant.1>: PIFA Antenna<br/><ant.2>: Coupling type (LDS) Antenna<br/>WLAN<br/><ant.1>: Loop Antenna<br/><ant.2>: Loop Antenna</ant.2></ant.1></ant.2></ant.1> |  |  |  |

## **1.2 Modification of EUT**

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

## 1.3 Testing Location

| Test Site               | SPORTON INTERNATIONAL INC. EMC & Wireless Communications<br>Laboratory  |  |  |  |
|-------------------------|---|--|--|--|
| Test Site Location      | No.58, Huaya 1st Rd., Guishan Dist.,<br>Taoyuan City, Taiwan (R.O.C.)<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |  |  |  |
| Taat Sita No            | Sporton Site No.  |  |  |  |
| Test Site No.           | 03CH11-HY   |  |  |  |
| Test Engineer           | Cookie Ku, Fu Chen, and Troye Hsieh   |  |  |  |
| Temperature 18.7~26.5°C |   |  |  |  |
| Relative Humidity       | 40.8~70%  |  |  |  |

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

FCC Designation No.: TW0007

## **1.4 Applicable Standards**

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

- ANSI C63.26-2015
- ANSI / TIA-603-E
- 47 CFR Part 2, 22(H), 24(E), 27
- + FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02.

#### 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 Test Mode

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

For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Z plane) were recorded in this report.

| Testheme   | Band  |     | Bandwidth (MHz) |          |        | Modulation |         |        | RB #       |           |       | Test Channel |      |      |   |   |   |
|------------|---|-----|-----------------|----------|--------|------------|---------|--------|------------|-----------|-------|--------------|------|------|---|---|---|
| lest items |   |     | 1.4             | 3        | 5      | 10         | 15      | 20     | QPSK       | 16QAM     | 64QAM | 1            | Half | Full | L | м | н |
| Radiated   |   |     |                 |          |        |            |         |        |            |           |       |              |      |      |   |   |   |
| Spurious   | i 13 Worst Case   |     |                 |          |        |            |         |        |            |           | v     |              |      |      |   |   |   |
| Emission   |   |     |                 |          |        |            |         |        |            |           |       |              |      |      |   |   |   |
|            | 1. The mark "v " means that this configuration is chosen for testing  |     |                 |          |        |            |         |        |            |           |       |              |      |      |   |   |   |
|            | 2. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test und  |     |                 |          |        |            | nder    |        |            |           |       |              |      |      |   |   |   |
| Remark     | amark different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are |     |                 |          |        |            |         | s are  |            |           |       |              |      |      |   |   |   |
|            |   | rep | orted.          |          |        |            |         |        |            |           |       |              |      |      |   |   |   |
|            | 3.  | Dur | ing the         | test, th | ne EUT | turn or    | n the W | LAN fu | nction sim | ultaneous | ly.   |              |      |      |   |   |   |

# 2.2 Connection Diagram of Test System





## 2.3 Support Unit used in test configuration and system

| Itom | Equipment        | Trade Name  | Model No |     |     | Power Cord        |
|------|------------------|-------------|----------|-----|-----|-------------------|
| item | Equipment        | I aue Maine |          |     |     | rower coru        |
| 1.   | System Simulator | Anritsu     | 8821C    | N/A | N/A | Unshielded, 1.8 m |

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

| LTE Band 13 Channel and Frequency List |                        |        |        |         |  |  |  |
|--|------------------------|--------|--------|---------|--|--|--|
| BW [MHz]                               | Channel/Frequency(MHz) | Lowest | Middle | Highest |  |  |  |
| 10                                     | Channel                | -      | 23230  | -       |  |  |  |
| 10                                     | Frequency              | -      | 782    | -       |  |  |  |
| 5                                      | Channel                | 23205  | 23230  | 23255   |  |  |  |
|  | Frequency              | 779.5  | 782    | 784.5   |  |  |  |



## 3 Radiated Test Items

## 3.1 Measuring Instruments

See list of measuring instruments of this test report.

## 3.1.1 Test Setup

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



For radiated test above 1GHz



## 3.1.2 Test Result of Radiated Test

Please refer to Appendix A.

| TEL : 886-3-327-3456                       | Page Number    | : 8 of 11       |
|--|----------------|-----------------|
| FAX : 886-3-328-4978                       | Issued Date    | : Feb. 10, 2020 |
| Report Template No.: BU5-FGLTE Version 2.4 | Report Version | : 01            |

## 3.2 Radiated Spurious Emission Measurement 3.2.1 Description of Radiated Spurious Emission Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB.

For LTE Band 13

For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

### 3.2.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 7 and ANSI / TIA-603-E Section 2.2.12.

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

The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)

EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain

ERP (dBm) = EIRP - 2.15

# 4 List of Measuring Equipment

| la stana sa t           | Manufacture        | MadalNa                             | Ormint Nin          |                                  | Calibration   | Test Dete                       | Dura Data     | Dements                  |
|-------------------------|--------------------|-------------------------------------|---------------------|----------------------------------|---------------|---------------------------------|---------------|--------------------------|
| Instrument              | Manufacturer       | Model No.                           | Serial No.          | Characteristics                  | Date          | lest Date                       | Due Date      | Remark                   |
| Preamplifier            | EMEC               | EM18G40G                            | 060715              | 18GHz ~<br>40GHz                 | Dec. 13, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Dec. 12, 2020 | Radiation<br>(03CH11-HY) |
| Amplifier               | SONOMA             | 310N                                | 187312              | 9kHz~1GHz                        | Dec. 03, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Dec. 02, 2020 | Radiation<br>(03CH11-HY) |
| SHF-EHF Horn<br>Antenna | SCHWARZBE<br>CK    | BBHA 9170                           | BBHA917058<br>4     | 18GHz- 40GHz                     | Dec. 10, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Dec. 09, 2020 | Radiation<br>(03CH11-HY) |
| Bilog Antenna           | TESEQ              | CBL 6111D & N-6-06                  | 35414 &<br>AT-N0602 | 30MHz~1GHz                       | Oct. 12, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Oct. 11, 2020 | Radiation<br>(03CH11-HY) |
| Horn Antenna            | SCHWARZBE<br>CK    | BBHA 9120 D                         | 9120D-1326          | 1GHz ~ 18GHz                     | Nov. 04, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Nov. 03, 2020 | Radiation<br>(03CH11-HY) |
| Preamplifier            | Keysight           | 83017A                              | MY53270080          | 1GHz~26.5GHz                     | Nov. 13, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Nov. 12, 2020 | Radiation<br>(03CH11-HY) |
| Spectrum<br>Analyzer    | Keysight           | N9010A                              | MY54200486          | 10Hz~44GHz                       | Oct. 28, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Oct. 27, 2020 | Radiation<br>(03CH11-HY) |
| Filter                  | Wainwright         | WHKX12-1080<br>-1200-15000-6<br>0SS | SN2                 | 1.2GHz High<br>Pass Filter       | Sep. 15, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Sep. 14, 2020 | Radiation<br>(03CH11-HY) |
| Filter                  | Wainwright         | WHKX12-2700<br>-3000-18000-6<br>0SS | SN3                 | 3GHz High<br>Pass Filter         | Sep. 15, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Sep. 14, 2020 | Radiation<br>(03CH11-HY) |
| Controller              | EMEC               | EM 1000                             | N/A                 | Control Turn<br>table & Ant Mast | N/A           | Dec. 18, 2019~<br>Feb. 05, 2020 | N/A           | Radiation<br>(03CH11-HY) |
| Antenna Mast            | EMEC               | AM-BS-4500-B                        | N/A                 | 1~4m                             | N/A           | Dec. 18, 2019~<br>Feb. 05, 2020 | N/A           | Radiation<br>(03CH11-HY) |
| Turn Table              | EMEC               | TT 2000                             | N/A                 | 0~360 Degree                     | N/A           | Dec. 18, 2019~<br>Feb. 05, 2020 | N/A           | Radiation<br>(03CH11-HY) |
| EMI Test<br>Receiver    | Keysight           | N9038A(MXE)                         | MY55420170          | 20MHz~8.4GHz                     | Mar. 08, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Mar. 07, 2020 | Radiation<br>(03CH11-HY) |
| Software                | Audix              | E3<br>6.2009-8-24                   | RK-001053           | N/A                              | N/A           | Dec. 18, 2019~<br>Feb. 05, 2020 | N/A           | Radiation<br>(03CH11-HY) |
| Hygrometer              | TECPEL             | DTN-303B                            | TP140325            | N/A                              | Nov. 07, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Nov. 06, 2020 | Radiation<br>(03CH11-HY) |
| Hygrometer              | TECPEL             | DTN-303B                            | TP161237            | N/A                              | Oct. 25, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Oct. 24, 2020 | Radiation<br>(03CH11-HY) |
| RF Cable                | HUBER +<br>SUHNER  | SUCOFLEX<br>104                     | MY9837/4PE          | 9kHz-30MHz                       | Mar. 13, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Mar. 12, 2020 | Radiation<br>(03CH11-HY) |
| RF Cable                | HUBER +<br>SUHNER  | SUCOFLEX<br>102                     | MY2859/2            | 30MHz-40GHz                      | Mar. 13, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Mar. 12, 2020 | Radiation<br>(03CH11-HY) |
| RF Cable                | HUBER +<br>SUHNER  | SUCOFLEX<br>104                     | MY9837/4PE          | 30M-18G                          | Mar. 13, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Mar. 12, 2020 | Radiation<br>(03CH11-HY) |
| RF Cable                | HUBER +<br>SUHNER  | SUCOFLEX<br>102                     | MY4274/2            | 30MHz-40GHz                      | Mar. 13, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Mar. 12, 2020 | Radiation<br>(03CH11-HY) |
| Signal<br>Generator     | Rohde &<br>Schwarz | SMF100A                             | 101107              | 100kHz~40GHz                     | Aug. 27, 2019 | Dec. 18, 2019~<br>Feb. 05, 2020 | Aug. 26, 2020 | Radiation<br>(03CH11-HY) |



# 5 Uncertainty of Evaluation

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

| Measuring Uncertainty for a Level of | 2.00 |
|--------------------------------------|------|
| Confidence of 95% (U = 2Uc(y))       | 5.09 |

#### Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

| Measuring Uncertainty for a Level of  |      |
|---------------------------------------|------|
| Confidence of $95\%$ (II – $2Uc(y)$ ) | 3.44 |
|                                       |      |

#### Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

| Measuring Uncertainty for a Level of | 2.05 |  |  |  |
|--------------------------------------|------|--|--|--|
| Confidence of 95% (U = 2Uc(y))       | 3.95 |  |  |  |



# Appendix A. Test Results of Radiated Test

| LTE Band 13 / 5MHz / QPSK + 802. 11g(n20)_Ch01 |                    |                |                  |                         |                         |                          |                            |                             |                       |  |  |
|--|--------------------|----------------|------------------|-------------------------|-------------------------|--------------------------|----------------------------|-----------------------------|-----------------------|--|--|
| Channel  | Frequency<br>(MHz) | ERP<br>( dBm ) | Limit<br>( dBm ) | Over<br>Limit<br>( dB ) | SPA<br>Reading<br>(dBm) | S.G.<br>Power<br>( dBm ) | TX Cable<br>loss<br>( dB ) | TX Antenna<br>Gain<br>(dBi) | Polarization<br>(H/V) |  |  |
| Middle   | 1560               | -47.05         | -42.15           | -4.90                   | -58.12                  | -53.82                   | 0.51                       | 9.43                        | Н                     |  |  |
|  | 1632               | -56.30         | -13              | -43.30                  | -66.71                  | -63.22                   | 0.52                       | 9.59                        | н                     |  |  |
|  | 2336               | -49.53         | -13              | -36.53                  | -64.16                  | -57.43                   | 0.62                       | 10.67                       | Н                     |  |  |
|  | 3192               | -36.01         | -13              | -23.01                  | -52.46                  | -44.79                   | 0.74                       | 11.68                       | Н                     |  |  |
|  | 4048               | -56.00         | -13              | -43.00                  | -73.82                  | -65.35                   | 0.88                       | 12.38                       | н                     |  |  |
|  | 4824               | -48.27         | -13              | -35.27                  | -69.85                  | -58.24                   | 0.08                       | 12.20                       | Н                     |  |  |
|  |                    |                |                  |                         |                         |                          |                            |                             | н                     |  |  |
|  | 1560               | -51.38         | -42.15           | -9.23                   | -61.88                  | -58.15                   | 0.51                       | 9.43                        | V                     |  |  |
|  | 1632               | -54.95         | -13              | -41.95                  | -65.18                  | -61.87                   | 0.52                       | 9.59                        | V                     |  |  |
|  | 2336               | -58.16         | -13              | -45.16                  | -73.31                  | -66.06                   | 0.62                       | 10.67                       | V                     |  |  |
|  | 3192               | -39.88         | -13              | -26.88                  | -56.75                  | -48.66                   | 0.74                       | 11.68                       | V                     |  |  |
|  | 4048               | -56.49         | -13              | -43.49                  | -75.42                  | -65.84                   | 0.88                       | 12.38                       | V                     |  |  |
|  | 4824               | -53.32         | -13              | -40.32                  | -74.97                  | -63.29                   | 0.08                       | 12.20                       | V                     |  |  |
|  |                    |                |                  |                         |                         |                          |                            |                             | V                     |  |  |

# LTE Band 13

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