

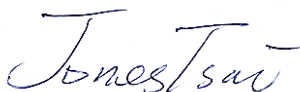
FCC RADIO TEST REPORT

FCC ID : UZ7MC930B
Equipment : Mobile computer
Brand Name : Zebra
Model Name : MC930B
Applicant : Zebra Technologies Corporation
1 Zebra Plaza, Holtsville, NY 11742
Manufacturer : Zebra Technologies Corporation
1 Zebra Plaza, Holtsville, NY 11742
Standard : FCC Part 15 Subpart C §15.247

The product was received on Nov. 26, 2018 and testing was started from Feb. 07, 2019 and completed on Mar. 07, 2019. 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 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 variant 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.



Approved by: Jones Tsai

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 |
|------------|---------|-------------------------|---------------|
| FR8N2627B | 01 | Initial issue of report | Mar. 12, 2019 |
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Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|--|--------------------|--|--------------------|--|
| - | 15.247(a)(2) | 6dB Bandwidth | Not Required | - |
| - | 2.1049 | 99% Occupied Bandwidth | Not Required | - |
| - | 15.247(b)(3) | Peak Output Power | Not Required | - |
| - | 15.247(e) | Power Spectral Density | Not Required | - |
| - | 15.247(d) | Conducted Band Edges and Spurious Emission | Not Required | - |
| 3.1 | 15.247(d) | Radiated Band Edges and Spurious Emission | Pass | Under limit 3.15 dB at 530.300 MHz |
| - | 15.207 | AC Conducted Emission | Not Required | - |
| - | 15.203 & 15.247(b) | Antenna Requirement | Not Required | - |
| Remark: 1. Not required means after assessing, test items are not necessary to carry out. 2. This is a variant report which can be referred to Product Equality Declaration. Since the test result is not affected by the changes, all the test cases were performed on original report which can be referred to Sporton Report Number FR8N2626B. | | | | |

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

| Product Feature | |
|---------------------------------|--|
| Equipment | Mobile computer |
| Brand Name | Zebra |
| Model Name | MC930B |
| FCC ID | UZ7MC930B |
| Sample 1 | EUT with SKU 1 |
| Sample 2 | EUT with SKU 2 |
| Sample 3 | EUT with SKU 3 |
| Sample 4 | EUT with SKU 4 |
| Sample 5 | EUT with SKU 5 |
| Sample 6 | EUT with SKU 6 |
| Sample 7 | EUT with SKU 7 |
| EUT supports Radios application | WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE |
| HW Version | EV1 |
| SW Version | 01-14-11.00-OG |
| MFD | 28OCT18 |
| EUT Stage | Engineering Sample |

Remark:

1. The above EUT's information was declared by manufacturer.
2. The tests were performed with Sample 1.

| Specification of Accessories | | | | |
|------------------------------|------------|-------|-------------|--------------------|
| Adapter (5V/2.5A) | Brand Name | Zebra | Part Number | PWR-WUA5V12W0US |
| USB-C Adapter | Brand Name | Zebra | Part Number | CBL-MC93-USBCHG-01 |
| USB-C cable | Brand Name | Zebra | Part Number | CBL-TC2X-USBC-01 |
| Std Battery | Brand Name | Zebra | Part Number | BT-000370-00 |
| Holster | Brand Name | Zebra | Part Number | 051607-79N1-18 |

<Sample Information>

| Model Name | MC930P | | | | | MC930B | |
|---------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | SKU3 | SKU4 | SKU5 | SKU6 | SKU7 | SKU1 | SKU2 |
| Organization / Function / Group | EV1a-G21 | EV1a-G22 | EV1a-G23 | EV1a-F11 | EV1a-F13 | EV1a-G02 | EV1a-G03 |
| nm | G-2S-1D-53k | G-2S-2D-53k | G-2S-LRI-53k | G-1F-1D-53k | G-1F-LRI-53k | G-BS-2D-53k | G-BS-LRI-53k |
| Product Number | MC930P-GS BDG4NA | MC930P-GS DDG4NA | MC930P-GS FDG4NA | MC930P-GF ADG4NA | MC930P-GF EDG4NA | MC930B-GS CDG4NA | MC930B-GSE DG4NA |
| Form factor | Gun | Gun | Gun | Gun | Gun | Gun | Gun |
| Package/Component Category | Pkg2 | Pkg2 | Pkg2 | Pkg1 CS | Pkg 1 CS | Base | Base |
| NFC | YES | YES | YES | YES | YES | NO | NO |
| Vib | YES | YES | YES | YES | YES | NO | NO |
| Camera | YES | YES | YES | NO | NO | NO | NO |
| NI | NO | NO | NO | NO | NO | NO | NO |
| Side Trigger | NO | NO | NO | NO | NO | NO | NO |
| Display + TP Stackup | Option2 | Option2 | Option2 | Option5 | Option5 | Option 2 | Option 2 |
| Scanner | SE965 | SE4750SR | SE4850 | SE965 | SE4850 | SE4750SR | SE4850 |
| Battery | Std | Std | Std | Fzr | Fzr | Std | Std |
| Keyboard | 53 Key | 53 Key | 53 Key | 53 Key | 53 Key | 53 Key | 53 Key |
| Build Date | Oct 2018 | Oct 2018 | Oct 2018 | Nov 2018 | Nov 2018 | Oct 2018 | Oct 2018 |

1.2 Product Specification of Equipment Under Test

| Standards-related Product Specification | |
|---|--|
| Tx/Rx Frequency Range | 2402 MHz ~ 2480 MHz |
| Number of Channels | 40 |
| Carrier Frequency of Each Channel | 40 Channel(37 hopping + 3 advertising channel) |
| Antenna Type / Gain | Patch Antenna with gain 3.85 dBi |
| Type of Modulation | Bluetooth LE : GFSK |

1.3 Modification of EUT

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



1.4 Testing Location

| | |
|---------------------------|---|
| Test Site | SPORTON INTERNATIONAL INC. |
| Test Site Location | No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978 |
| Test Site No. | Sporton Site No. |
| | 03CH07-HY |

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

FCC Designation No. TW1190

1.5 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 v05
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ 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. (MHz) | Channel | Freq. (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 | - | - |



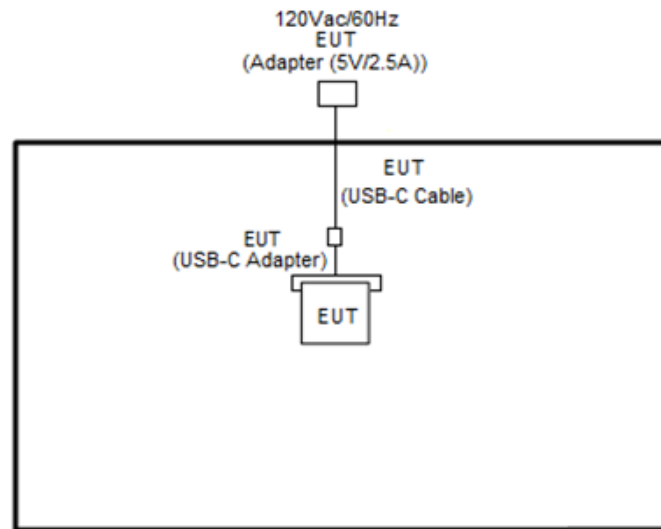
2.2 Test Mode

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

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 Test Cases | Mode 1: Bluetooth Tx CH39_2480 MHz_2Mbps |

2.3 Connection Diagram of Test System



2.4 EUT Operation Test Setup

The RF test items, utility "QRCT" was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous 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 (MHz) | Field Strength (microvolts/meter) | Measurement Distance (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

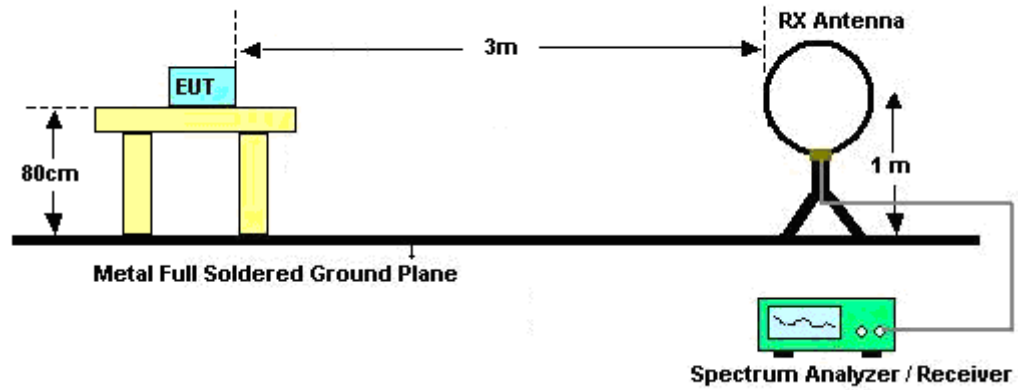
See list of measuring equipment of this test report.

3.1.3 Test Procedures

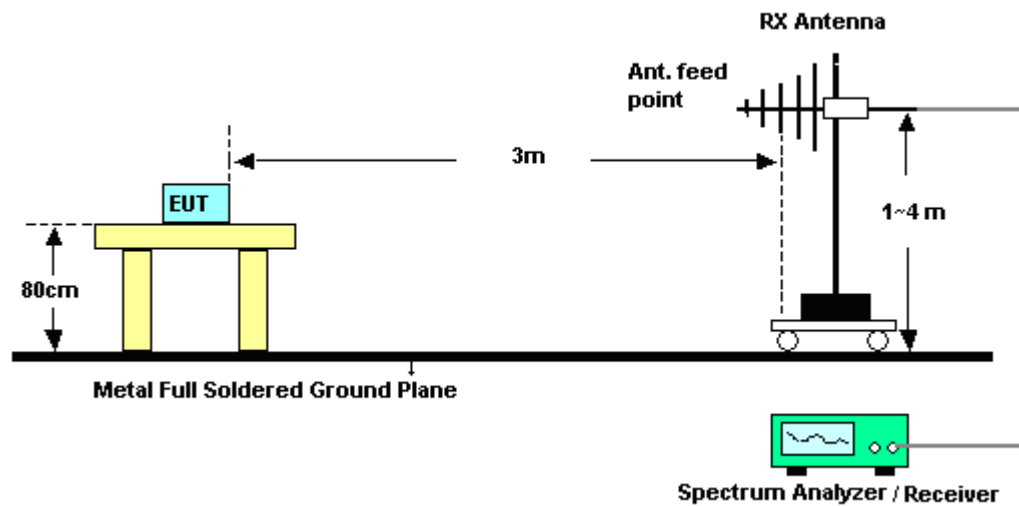
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the 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

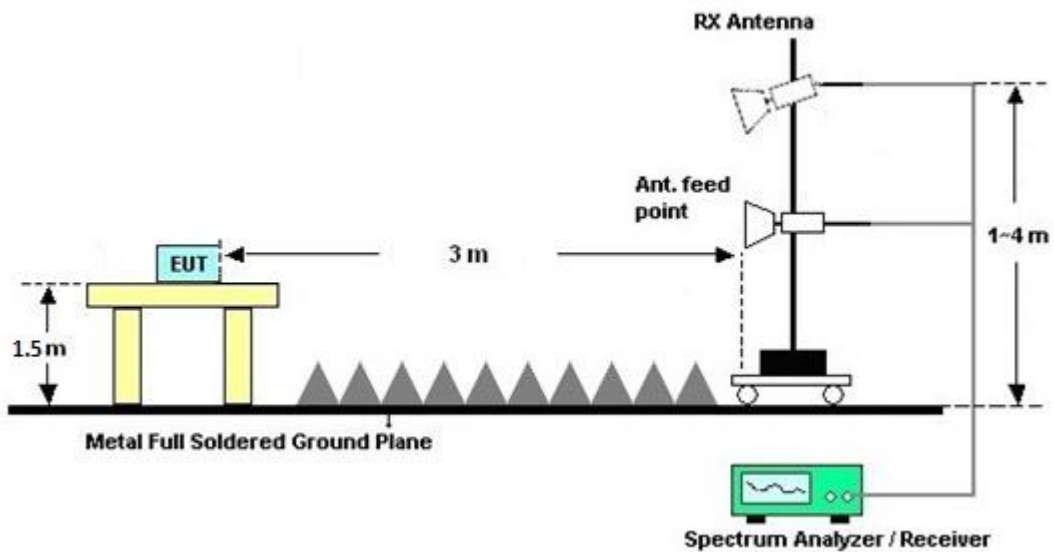
For radiated emissions below 30MHz



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 alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, 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.



4 List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|------------------------------|--------------------|---------------------------------|---------------------------------------|-------------------------------------|------------------|----------------------------------|---------------|--------------------------|
| Preamplifier | Agilent | 8449B | 3008A01917 | 1GHz~26.5GHz | Apr. 23, 2018 | Feb. 07, 2019 ~ Mar. 07, 2019 | Apr. 22, 2019 | Radiation (03CH07-HY) |
| Bilog Antenna | TESEQ | CBL 6111D&00800 N1D01N-06 | 35419&03 | 30MHz to 1GHz | Dec. 16, 2018 | Feb. 07, 2019 ~ Mar. 07, 2019 | Dec. 15, 2019 | Radiation (03CH07-HY) |
| Double Ridge Horn Antenna | ESCO | 3117 | 00075962 | 1GHz ~ 18GHz | Dec. 02, 2018 | Feb. 07, 2019 ~ Mar. 07, 2019 | Dec. 01, 2019 | Radiation (03CH07-HY) |
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100315 | 9 kHz~30 MHz | May 15, 2017 | Feb. 07, 2019 ~ Mar. 07, 2019 | May 14, 2019 | Radiation (03CH07-HY) |
| Preamplifier | MITEQ | AMF-7D-0010 1800-30-10P | 1590075 | 1GHz ~ 18GHz | Apr. 25, 2018 | Feb. 07, 2019 ~ Mar. 07, 2019 | Apr. 24, 2019 | Radiation (03CH07-HY) |
| Preamplifier | COM-POWER | PA-103A | 161241 | 10MHz-1GHz | May 21, 2018 | Feb. 07, 2019 ~ Mar. 07, 2019 | May 20, 2019 | Radiation (03CH07-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY28655/4, MY24971/4, MY15682/4 | 30MHz~1GHz | Feb. 27, 2018 | Feb. 07, 2019 ~ Feb. 23, 2019 | Feb. 26, 2019 | Radiation (03CH07-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY28655/4, MY24971/4, MY15682/4 | 30MHz~1GHz | Feb. 26, 2019 | Mar. 07, 2019 | Feb. 25, 2020 | Radiation (03CH07-HY) |
| RF Cable | HUBER + SUHNER | SF102/2*11SK 252 | MY4278/2 | 9kHz~40GHz | May 17, 2018 | Feb. 07, 2019 ~ Feb. 23, 2019 | May 16, 2019 | Radiation (03CH07-HY) |
| RF Cable | HUBER + SUHNER | SF102/2*11SK 252 | MY4278/2 | 9kHz~40GHz | Feb. 26, 2019 | Mar. 07, 2019 | Feb. 25, 2020 | Radiation (03CH07-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY28655/4, MY24971/4, MY15682/4 | 1GHz~18GHz | Feb. 27, 2018 | Feb. 07, 2019 ~ Feb. 23, 2019 | Feb. 26, 2019 | Radiation (03CH07-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY28655/4, MY24971/4, MY15682/4 | 1GHz~18GHz | Feb. 26, 2019 | Mar. 07, 2019 | Feb. 25, 2020 | Radiation (03CH07-HY) |
| Antenna Mast | Max-Full | MFA520BS | N/A | 1m~4m | N/A | Feb. 07, 2019 ~ Mar. 07, 2019 | N/A | Radiation (03CH07-HY) |
| Turn Table | ChainTek | Chaintek 3000 | N/A | 0~360 Degree | N/A | Feb. 07, 2019 ~ Mar. 07, 2019 | N/A | Radiation (03CH07-HY) |
| Amplifier | MITEQ | TTA1840-35-H G | 1871923 | 18GHz~40GHz, VSWR : 2.5:1 max | Jul. 16, 2018 | Feb. 07, 2019 ~ Mar. 07, 2019 | Jul. 15, 2019 | Radiation (03CH07-HY) |
| Software | Audix | E3 6.2009-8-24 | RK-001042 | N/A | N/A | Feb. 07, 2019 ~ Mar. 07, 2019 | N/A | Radiation (03CH07-HY) |
| SHF-EHF Horn Antenna | SCHWARZBE CK | BBHA 9170 | BBHA917025 1 | 18GHz- 40GHz | Nov. 20, 2018 | Feb. 07, 2019 ~ Mar. 07, 2019 | Nov. 19, 2019 | Radiation (03CH07-HY) |
| Spectrum Analyzer | Agilent | N9010A | MY53470118 | 10Hz~44GHz | Apr. 17, 2018 | Feb. 07, 2019 ~ Mar. 07, 2019 | Apr. 16, 2019 | Radiation (03CH07-HY) |

5 Uncertainty of Evaluation

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

| | |
|--|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.7 |
|--|-----|

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

| | |
|--|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.5 |
|--|-----|

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

| | |
|--|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.2 |
|--|-----|



Appendix A. Radiated Spurious Emission

| | | | |
|-----------------|---|---------------------|---------|
| Test Engineer : | Jesse Wang, Stan Hsieh, and Troye Hsieh | Temperature : | 20~25°C |
| | | Relative Humidity : | 55~60% |

2.4GHz 2400~2483.5MHz

BLE_2Mbps (Band Edge @ 3m)

| BLE | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Path Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|-------------------------|---|----------------------|---------------------|-------------------------|-----------------------------|---------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|
| BLE CH 39 2480MHz | * | 2480 | 105.9 | - | - | 90.83 | 32.2 | 17.84 | 34.97 | 185 | 18 | P | H |
| | * | 2480 | 104.51 | - | - | 89.44 | 32.2 | 17.84 | 34.97 | 185 | 18 | A | H |
| | | 2485.2 | 56.04 | -17.96 | 74 | 40.97 | 32.2 | 17.84 | 34.97 | 185 | 18 | P | H |
| | | 2483.52 | 47.95 | -6.05 | 54 | 32.88 | 32.2 | 17.84 | 34.97 | 185 | 18 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 101.23 | - | - | 86.16 | 32.2 | 17.84 | 34.97 | 100 | 320 | P | V |
| | * | 2480 | 100.04 | - | - | 84.97 | 32.2 | 17.84 | 34.97 | 100 | 320 | P | V |
| | | 2486.88 | 55.58 | -18.42 | 74 | 40.51 | 32.2 | 17.84 | 34.97 | 100 | 320 | P | V |
| | | 2486.68 | 47.61 | -6.39 | 54 | 32.54 | 32.2 | 17.84 | 34.97 | 100 | 320 | 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_2Mbps (Harmonic @ 3m)**

| BLE | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Path Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|----------------------------------|---|----------------------|---------------------|-------------------------|-----------------------------|---------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|
| BLE CH 39 2480MHz | | 4960 | 41.95 | -32.05 | 74 | 55.41 | 34.13 | 11.48 | 59.07 | 100 | 0 | P | H |
| | | 7440 | 43.49 | -30.51 | 74 | 52.23 | 35.5 | 14.09 | 58.33 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4960 | 42.29 | -31.71 | 74 | 55.75 | 34.13 | 11.48 | 59.07 | 100 | 0 | P | V |
| | | 7440 | 43.63 | -30.37 | 74 | 52.37 | 35.5 | 14.09 | 58.33 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |

Emission below 1GHz

2.4GHz BLE_2Mbps (LF)

| BLE | Note | Frequency | Level | Over | Limit | Read | Antenna | Path | 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 BLE LF | | 30 | 29.31 | -10.69 | 40 | 33.56 | 24.6 | 1.33 | 30.18 | - | - | P | H |
| | | 47.82 | 24.99 | -15.01 | 40 | 38.32 | 15.48 | 1.34 | 30.15 | - | - | P | H |
| | | 142.05 | 26.99 | -16.51 | 43.5 | 37.45 | 17.33 | 2.24 | 30.03 | - | - | P | H |
| | | 436.5 | 39.9 | -6.1 | 46 | 43.55 | 22.78 | 3.48 | 29.91 | - | - | P | H |
| | | 519.8 | 42.13 | -3.87 | 46 | 44.36 | 23.94 | 3.72 | 29.89 | - | - | P | H |
| | | 530.3 | 42.85 | -3.15 | 46 | 45.02 | 23.98 | 3.73 | 29.88 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 30 | 31.85 | -8.15 | 40 | 36.1 | 24.6 | 1.33 | 30.18 | 100 | 0 | P | V |
| | | 40.8 | 27.1 | -12.9 | 40 | 37.12 | 18.81 | 1.34 | 30.17 | - | - | P | V |
| | | 60.51 | 24.32 | -15.68 | 40 | 40.86 | 11.89 | 1.7 | 30.13 | - | - | P | V |
| | | 434.4 | 33.36 | -12.64 | 46 | 37.03 | 22.76 | 3.48 | 29.91 | - | - | P | V |
| | | 868.4 | 33.36 | -12.64 | 46 | 28.54 | 28.98 | 4.88 | 29.04 | - | - | P | V |
| | | 967.1 | 34.53 | -19.47 | 54 | 27.04 | 30.87 | 5.06 | 28.44 | - | - | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | V | |
| | | | | | | | | | | | | V | |
| Remark | 1. No other spurious found. 2. All results are PASS against limit line. | | | | | | | | | | | | |



Note symbol

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

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

| BLE | Note | Frequency | Level | Over | Limit | Read | Antenna | Path | 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) |
| BLE CH 00 2402MHz | | 2390 | 55.45 | -18.55 | 74 | 54.51 | 32.22 | 4.58 | 35.86 | 103 | 308 | P | H |
| | | 2390 | 43.54 | -10.46 | 54 | 42.6 | 32.22 | 4.58 | 35.86 | 103 | 308 | A | H |

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =
Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)
= Antenna Factor(dB/m) + Path 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) + Path 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”.

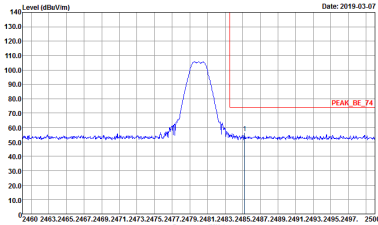
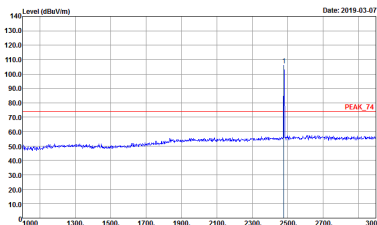
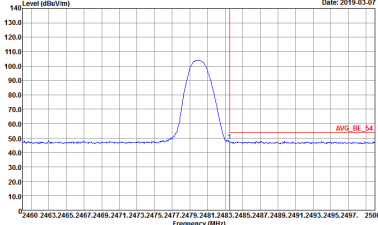
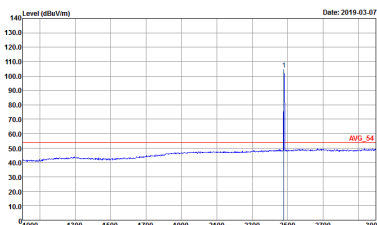


Appendix B. Radiated Spurious Emission Plots

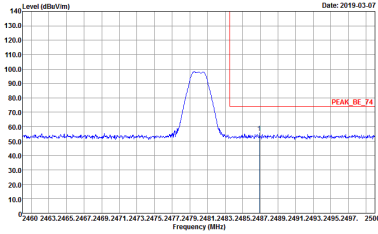
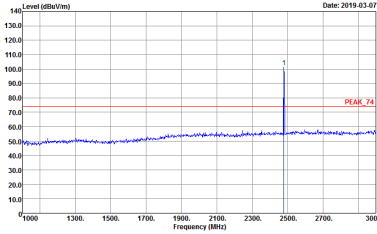
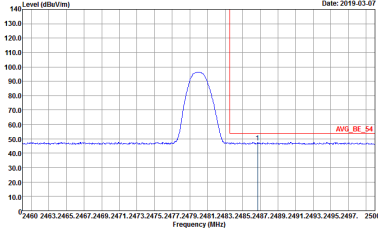
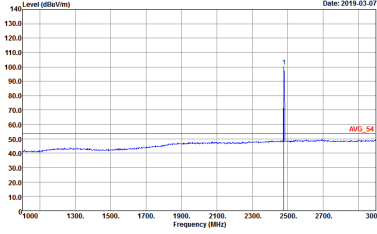
| | | | |
|-----------------|---|---------------------|---------|
| Test Engineer : | Jesse Wang, Stan Hsieh, and Troye Hsieh | Temperature : | 20~25°C |
| | | Relative Humidity : | 55~60% |

2.4GHz 2400~2483.5MHz

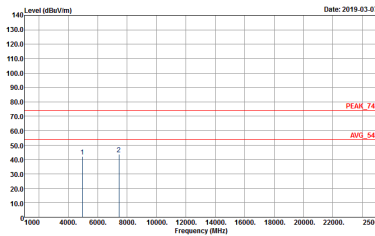
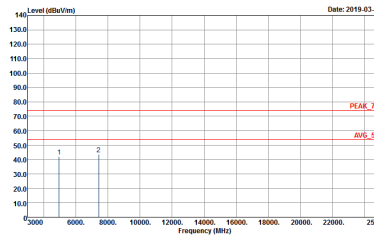
BLE_2Mbps (Band Edge @ 3m)

| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|---|
| | BLE CH39 2480MHz | |
| | Horizontal | Fundamental |
| Peak |  <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL Detector : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Project : 8N2627 Mode : 8</p> |  <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 HORIZONTAL Detector : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Project : 8N2627 Mode : 8</p> |
| Avg. |  <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL Detector : RBW:1000.000kHz VBW:10.000kHz SWT:Auto Project : 8N2627 Mode : 8</p> |  <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 HORIZONTAL Detector : RBW:1000.000kHz VBW:10.000kHz SWT:Auto Project : 8N2627 Mode : 8</p> |



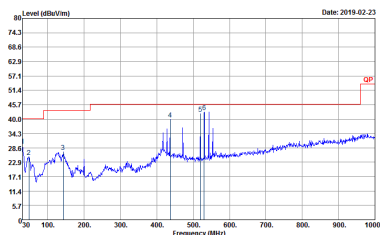
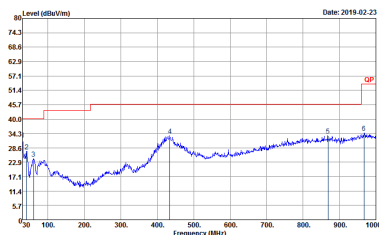
| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|--|
| | BLE CH39 2480MHz | |
| | Vertical | Fundamental |
| Peak | <div><p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : Peak Mode : 8</p></div> | <div><p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 VERTICAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : Peak Mode : 8</p></div> |
| Avg. | <div><p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL Detector : RBW:1000.000KHz VBW:10.000KHz SWT:Auto Project : Peak Mode : 8</p></div> | <div><p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 VERTICAL Detector : RBW:1000.000KHz VBW:10.000KHz SWT:Auto Project : Peak Mode : 8</p></div> |

**2.4GHz 2400~2483.5MHz
BLE_2Mbps (Harmonic @ 3m)**

| BLE | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|-------------|--|---|
| | BLE CH39 2480MHz | |
| | Horizontal | Vertical |
| Peak |  <p>Site : 03CH07-HY Condition : PEAK_74 3m SHF-EHF_131029 HORIZONTAL Detector : Peak Project : 8N2627 Mode : 8</p> |  <p>Site : 03CH07-HY Condition : PEAK_74 3m SHF-EHF_131029 VERTICAL Detector : Peak Project : 8N2627 Mode : 8</p> |



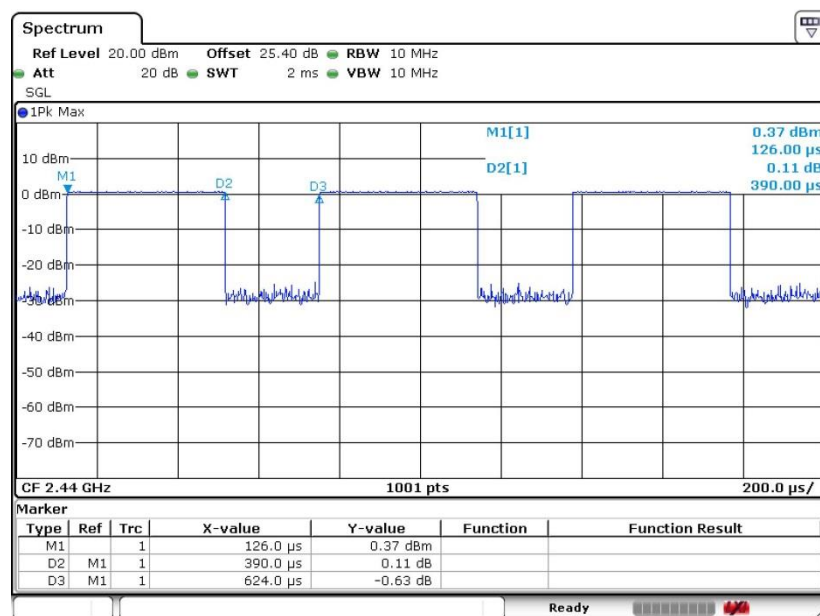
Emission below 1GHz
2.4GHz BLE_2Mbps (LF)

| BLE | 2.4GHz 2400~2483.5MHz | |
|--------------|---|--|
| | BLE LF | |
| | Horizontal | Vertical |
| QP / Peak |  <p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) HORIZONTAL Detector : Peak Project : 8N2627 Mode : 11</p> |  <p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) VERTICAL Detector : Peak Project : 8N2627 Mode : 11</p> |

Appendix C. Duty Cycle Plots

| Band | Duty Cycle (%) | T(us) | 1/T(kHz) | VBW Setting | Duty Factor (dB) |
|----------------------|----------------|--------|----------|-------------|------------------|
| Bluetooth – LE 1Mbps | 62.50 | 390.00 | 2.56 | 3kHz | 2.04 |
| Bluetooth – LE 2Mbps | 32.91 | 206.00 | 4.85 | 10kHz | 4.83 |

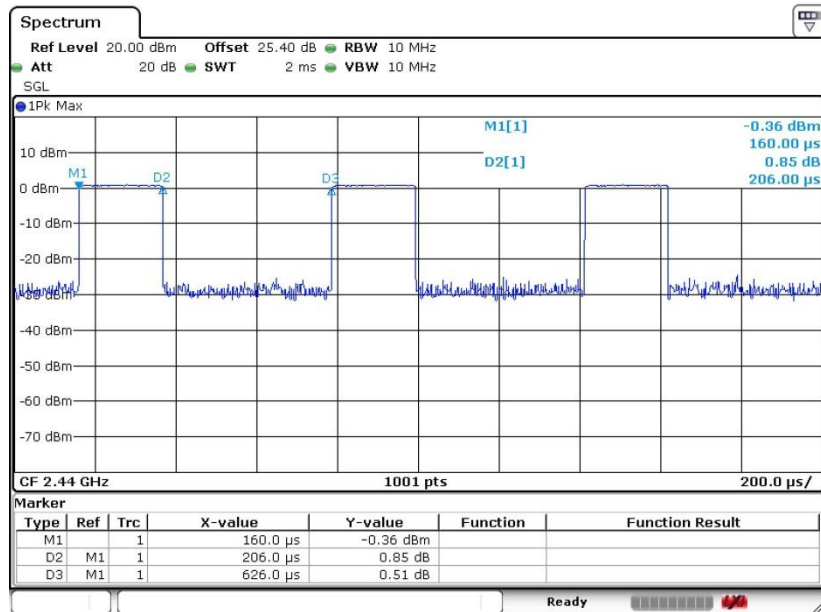
<1 Mbps>



Date: 7.FEB.2019 01:13:55



<2 Mbps>



Date: 7.FEB.2019 01:16:06