# FCC RADIO TEST REPORT

| | | |
|---|---|---|
| **FCC ID** | : | **I28-WYSBHVDXP** |
| **Equipment** | : | **WLAN/BTLE module** |
| **Brand Name** | : | **ZEBRA** |
| **Model Name** | : | **WYSBHVDXP** |
| **Applicant** | : | **Zebra Technologies Corporation**<br>**3 Overlook Point, Lincolnshire, IL 60069, United States** |
| **Manufacturer** | : | **Zebra Technologies Corporation**<br>**3 Overlook Point, Lincolnshire, IL 60069, United States** |
| **Standard** | : | **FCC Part 15 Subpart C §15.247** |

**The product was received on Jun. 24, 2021 and testing was started from Jul. 05, 2021 and completed on Jul. 14, 2021. 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 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.**

Louis Wu

**Reviewed by: Louis Wu**

***Sporton International Inc. EMC & Wireless Communications Laboratory***
*No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)*

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# History of this test report

| Report No. | Version | Description | Issued Date |
|---|---|---|---|
| FR0D2423-01A | 01 | Initial issue of report | Jul. 22, 2021 |
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# Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|---|---|---|---|---|
| - | 15.247(a)(1) | Number of Channels | Not Required | - |
| - | 15.247(a)(1) | Hopping Channel Separation | Not Required | - |
| - | 15.247(a)(1) | Dwell Time of Each Channel | Not Required | - |
| - | 15.247(a)(1) | 20dB Bandwidth | Not Required | - |
| - | 2.1049 | 99% Occupied Bandwidth | Not Required | - |
| 3.1 | 15.247(b)(1) | Peak Output Power | Pass | - |
| - | 15.247(d) | Conducted Band Edges | Not Required | - |
| - | 15.247(d) | Conducted Spurious Emission | Not Required | - |
| 3.2 | 15.247(d) | Radiated Band Edges and Radiated Spurious Emission | Pass | Under limit 10.09 dB at 382.110 MHz |
| - | 15.207 | AC Conducted Emission | Not Required | - |
| 3.3 | 15.203 & 15.247(b) | Antenna Requirement | Pass | - |

**Note:**

1. Not required means after assessing, test items are not necessary to carry out.
2. This is a variant report by changing Bluetooth RF trace. All the test cases were performed on original report which can be referred to Sporton Report Number FR0D2423A. Based on the original report, the test cases were verified.

| **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: Wei Chen**

**Report Producer: Cindy Liu**

# 1 General Description

## 1.1 Product Feature of Equipment Under Test

| Product Feature | |
|---|---|
| **Equipment** | WLAN/BTLE module |
| **Brand Name** | ZEBRA |
| **Model Name** | WYSBHVDXP |
| **FCC ID** | I28-WYSBHVDXP |
| **EUT supports Radios application** | WLAN 11a/b/g/n HT20/HT40<br>WLAN 11ac VHT20/VHT40/VHT80<br>WLAN 11ax HE20/HE40/HE80<br>Bluetooth BR/EDR/LE |
| **HW Version** | Revision F |
| **SW Version** | 17.68.01.p13 |
| **EUT Stage** | Identical Prototype |

**Remark:** The above EUT's information was declared by manufacturer.

| Supported Unit Used in Test Configuration and System | | | | |
|---|---|---|---|---|
| **Printer** | **Brand Name** | ZEBRA | **Model Name** | ZQ521 |
| **Battery** | **Brand Name** | ZEBRA | **Part Number** | P1089503-003 |
| **AC Adapter** | **Brand Name** | ZEBRA | **Model Name** | FSP025-DYAA3 |
| **Bluetooth Antenna 1** | **Brand Name** | gigaAnt | **Model Name** | 3030A5645-01 |
| **Bluetooth Antenna 2** | **Brand Name** | TAIYO YUDEN | **Model Name** | AH 168M245001 |
| **Bluetooth Antenna 3** | **Brand Name** | Johanson Technology | **Model Name** | 2450AT07A0100 |
| **WLAN Antenna 1** | **Brand Name** | Laird | **Model Name** | RD2458-5 |
| **WLAN Antenna 2** | **Brand Name** | Pulse | **Model Name** | W3006 |
| **WLAN Antenna 3** | **Brand Name** | Auden | **Model Name** | 220370-09 |
| **WLAN Antenna 4** | **Brand Name** | Auden | **Model Name** | B91882-30 |

## 1.2 Product Specification of Equipment Under Test

| Product Specification subjective to this standard | |
|---|---|
| **Tx/Rx Frequency Range** | 2402 MHz ~ 2480 MHz |
| **Number of Channels** | 79 |
| **Carrier Frequency of Each Channel** | 2402+n*1 MHz; n=0~78 |
| **Maximum Output Power to Antenna** | Bluetooth BR (1Mbps): 11.75 dBm / 0.0150 W<br>Bluetooth EDR (2Mbps): 11.06 dBm / 0.0128 W<br>Bluetooth EDR (3Mbps): 11.33 dBm / 0.0136 W |
| **Antenna Type / Gain** | **<3030A5645-01>:** Monopole Antenna with gain 2.7 dBi<br>**<AH 168M245001>:** Monopole Antenna with gain 3.0 dBi<br>**<2450AT07A0100>:** Monopole Antenna with gain 1.0 dBi |
| **Type of Modulation** | Bluetooth BR (1Mbps) : GFSK<br>Bluetooth EDR (2Mbps) : $\pi$ /4-DQPSK<br>Bluetooth EDR (3Mbps) : 8-DPSK |

**Remark:** The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

## 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. EMC & Wireless Communications Laboratory |
| **Test Site Location** | No.52, Huaya 1st Rd., Guishan Dist.,<br>Taoyuan City 333, Taiwan (R.O.C.)<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |
| **Test Site No.** | **Sporton Site No.** |
| | TH02-HY |

| | |
|---|---|
| **Test Site** | Sporton International Inc. Wensan Laboratory |
| **Test Site Location** | No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist.,<br>Taoyuan City 333010, Taiwan (R.O.C.)<br>TEL: +886-3-327-0868<br>FAX: +886-3-327-0855 |
| **Test Site No.** | **Sporton Site No.** |
| | 03CH13-HY (TAF Code: 3786) |
| **Remark** | The Radiated Spurious Emission test item subcontracted to Sporton International Inc. Wensan Laboratory |

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

FCC designation No.: TW1190 and TW3786

## 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 v05r02
- 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. The TAF code is not including all the FCC KDB listed without accreditation.

# 2 Test Configuration of Equipment Under Test

## 2.1 Carrier Frequency Channel

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

## 2.2 Test Mode

| Channel | Frequency | Bluetooth Average Output Power | | |
|---|---|---|---|---|
| | | GFSK / 1Mbps | | |
| | | DH1 | DH3 | DH5 |
| Ch00 | 2402MHz | **11.69 dBm** | 11.67 dBm | 11.67 dBm |
| Ch39 | 2441MHz | 11.45 dBm | 11.44 dBm | 11.44 dBm |
| Ch78 | 2480MHz | 11.36 dBm | 11.33 dBm | 11.32 dBm |

| Channel | Frequency | Bluetooth Average Output Power | | |
|---|---|---|---|---|
| | | π/4-DQPSK / 2Mbps | | |
| | | 2DH1 | 2DH3 | 2DH5 |
| Ch00 | 2402MHz | **8.66 dBm** | 8.64 dBm | 8.64 dBm |
| Ch39 | 2441MHz | 8.38 dBm | 8.37 dBm | 8.37 dBm |
| Ch78 | 2480MHz | 8.31 dBm | 8.30 dBm | 8.29 dBm |

| Channel | Frequency | Bluetooth Average Output Power | | |
|---|---|---|---|---|
| | | 8-DPSK / 3Mbps | | |
| | | 3DH1 | 3DH3 | 3DH5 |
| Ch00 | 2402MHz | **8.68 dBm** | 8.67 dBm | 8.66 dBm |
| Ch39 | 2441MHz | 8.40 dBm | 8.39 dBm | 8.39 dBm |
| Ch78 | 2480MHz | 8.32 dBm | 8.31 dBm | 8.30 dBm |

| Channel | Frequency | Bluetooth Peak Output Power | | |
|---|---|---|---|---|
| | | GFSK / 1Mbps | | |
| | | DH1 | DH3 | DH5 |
| Ch00 | 2402MHz | **11.75 dBm** | 11.74 dBm | 11.74 dBm |
| Ch39 | 2441MHz | 11.51 dBm | 11.50 dBm | 11.50 dBm |
| Ch78 | 2480MHz | 11.42 dBm | 11.41 dBm | 11.40 dBm |

| Channel | Frequency | Bluetooth Peak Output Power | | |
|---|---|---|---|---|
| | | π/4-DQPSK / 2Mbps | | |
| | | 2DH1 | 2DH3 | 2DH5 |
| Ch00 | 2402MHz | **11.06 dBm** | 11.05 dBm | 11.05 dBm |
| Ch39 | 2441MHz | 10.80 dBm | 10.79 dBm | 10.79 dBm |
| Ch78 | 2480MHz | 10.69 dBm | 10.68 dBm | 10.67 dBm |

| Channel | Frequency | Bluetooth Peak Output Power | | |
|---|---|---|---|---|
| | | 8-DPSK / 3Mbps | | |
| | | 3DH1 | 3DH3 | 3DH5 |
| Ch00 | 2402MHz | **11.33 dBm** | 11.32 dBm | 11.32 dBm |
| Ch39 | 2441MHz | 11.07 dBm | 11.06 dBm | 11.06 dBm |
| Ch78 | 2480MHz | 10.97 dBm | 10.96 dBm | 10.96 dBm |

**Remark:** The data rate was set in 1Mbps for all the test items due to the highest RF output power.

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). The measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in two antenna polarization (Horizontal and Vertical), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find Ant. Horizontal as worst plane, and the worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded in this report.

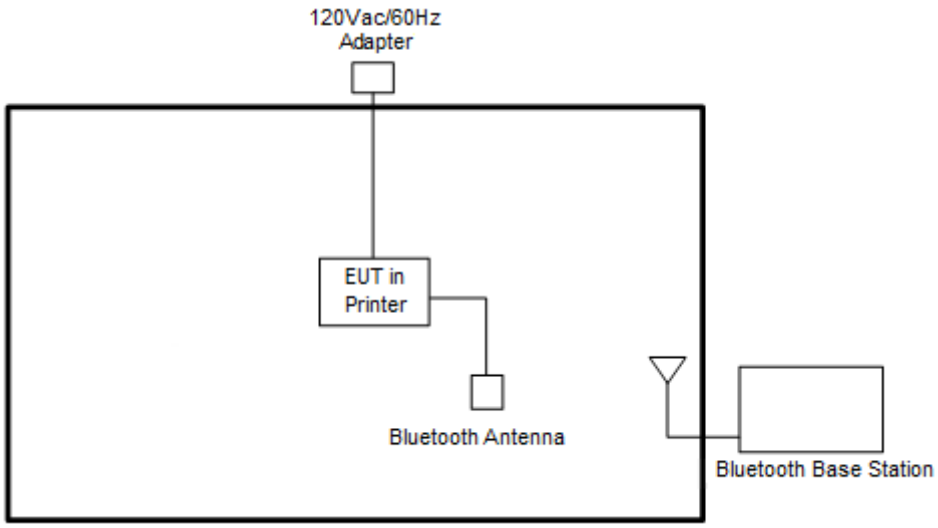
The following summary table is showing all test modes to demonstrate in compliance with the standard.

| Summary table of Test Cases | |
|---|---|
| **Test Item** | **Data Rate / Modulation** |
| **Radiated Test Cases** | **Bluetooth BR 1Mbps GFSK** |
| | Mode 1: CH00_2402 MHz |
| | Mode 2: CH39_2441 MHz |
| | Mode 3: CH78_2480 MHz |

**Remark:**
1. For Radiated Test Cases, the worst mode data rate 1Mbps was reported only since the highest RF output power in the preliminary tests. The conducted spurious emissions and conducted band edge measurement for other data rates were not worse than 1Mbps, and no other significantly frequencies found in conducted spurious emission.
2. For Radiated Test Cases, the tests were performed with Bluetooth Antenna (AH 168M245001).

## 2.3 Connection Diagram of Test System

**<Bluetooth Tx Mode>**




## 2.4 Support Unit used in test configuration and system

| Item | Equipment | Brand Name | Model Name | FCC ID | Data Cable | Power Cord |
|---|---|---|---|---|---|---|
| 1. | Bluetooth Base Station | R&S | CBT32 | N/A | N/A | Unshielded, 1.8 m |

## 2.5 EUT Operation Test Setup

The RF test items, utility “Toolbox_Version 1.84” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to contact with base station to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

# 3 Test Result

## 3.1 Output Power Measurement

### 3.1.1 Limit of Output Power

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

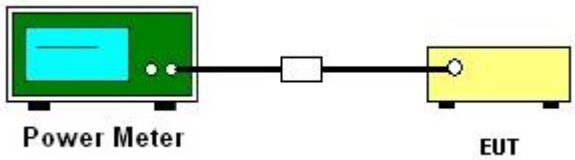
### 3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

### 3.1.3 Test Procedures

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

### 3.1.4 Test Setup



### 3.1.5 Test Result of Peak Output Power

| Test Engineer : | Eason Huang | Temperature : | 21~25℃ |
|---|---|---|---|
| | | Relative Humidity : | 51~54% |

| DH | CH. | NTX | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|---|---|---|---|---|---|
| DH1 | 0 | 1 | **11.75** | 20.97 | Pass |
| | 39 | 1 | 11.51 | 20.97 | Pass |
| | 78 | 1 | 11.42 | 20.97 | Pass |

| 2DH | CH. | NTX | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|---|---|---|---|---|---|
| 2DH1 | 0 | 1 | **11.06** | 20.97 | Pass |
| | 39 | 1 | 10.80 | 20.97 | Pass |
| | 78 | 1 | 10.69 | 20.97 | Pass |

| 3DH | CH. | NTX | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|---|---|---|---|---|---|
| 3DH1 | 0 | 1 | **11.33** | 20.97 | Pass |
| | 39 | 1 | 11.07 | 20.97 | Pass |
| | 78 | 1 | 10.97 | 20.97 | Pass |

### 3.1.6 Test Result of Average Output Power (Reporting Only)

| Test Engineer : | Eason Huang | Temperature : | 21~25℃ |
|---|---|---|---|
| | | Relative Humidity : | 51~54% |

| DH | CH. | NTX | Average Power (dBm) | Duty Factor (dB) |
|---|---|---|---|---|
| DH1 | 0 | 1 | **11.69** | 5.13 |
| | 39 | 1 | 11.45 | 5.13 |
| | 78 | 1 | 11.36 | 5.13 |

| 2DH | CH. | NTX | Average Power (dBm) | Duty Factor (dB) |
|---|---|---|---|---|
| 2DH1 | 0 | 1 | **8.66** | 5.08 |
| | 39 | 1 | 8.38 | 5.08 |
| | 78 | 1 | 8.31 | 5.08 |

| 3DH | CH. | NTX | Average Power (dBm) | Duty Factor (dB) |
|---|---|---|---|---|
| 3DH1 | 0 | 1 | **8.68** | 5.08 |
| | 39 | 1 | 8.40 | 5.08 |
| | 78 | 1 | 8.32 | 5.08 |

## 3.2 Radiated Band Edges and Spurious Emission Measurement

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

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

| Frequency (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 |

### 3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

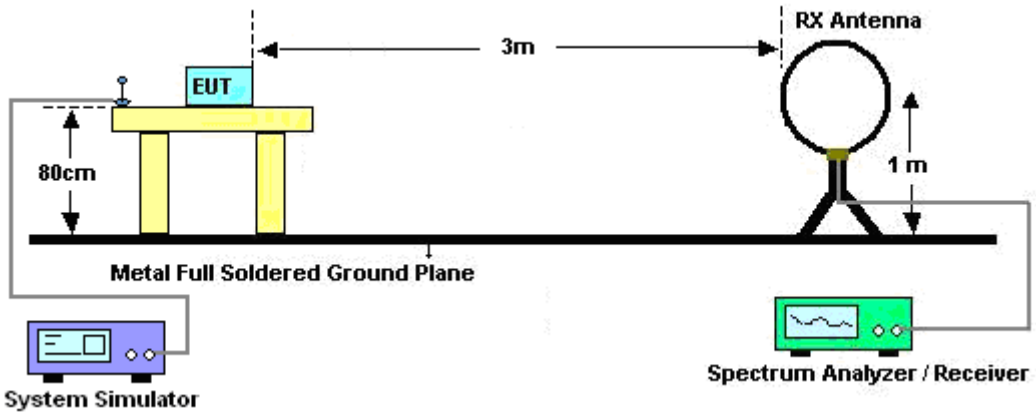
### 3.2.3 Test Procedures

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

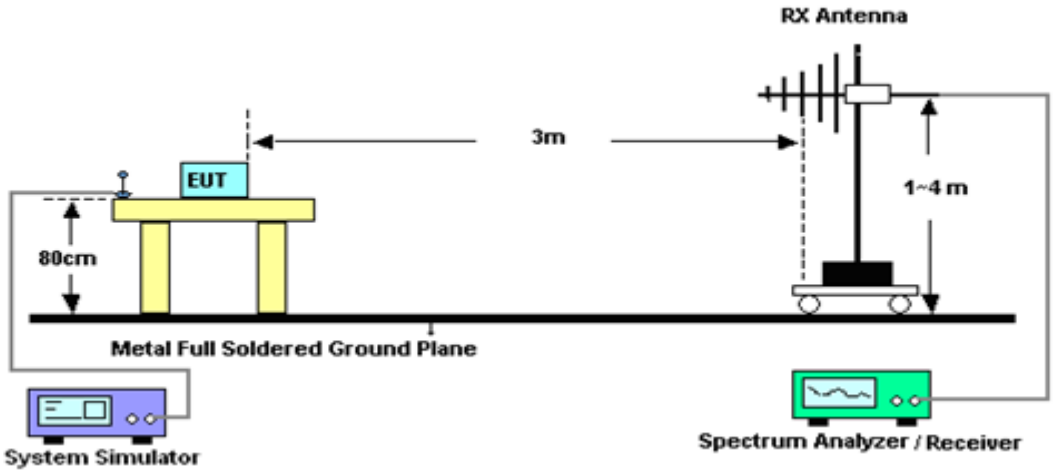
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.76dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

### 3.2.4 Test Setup

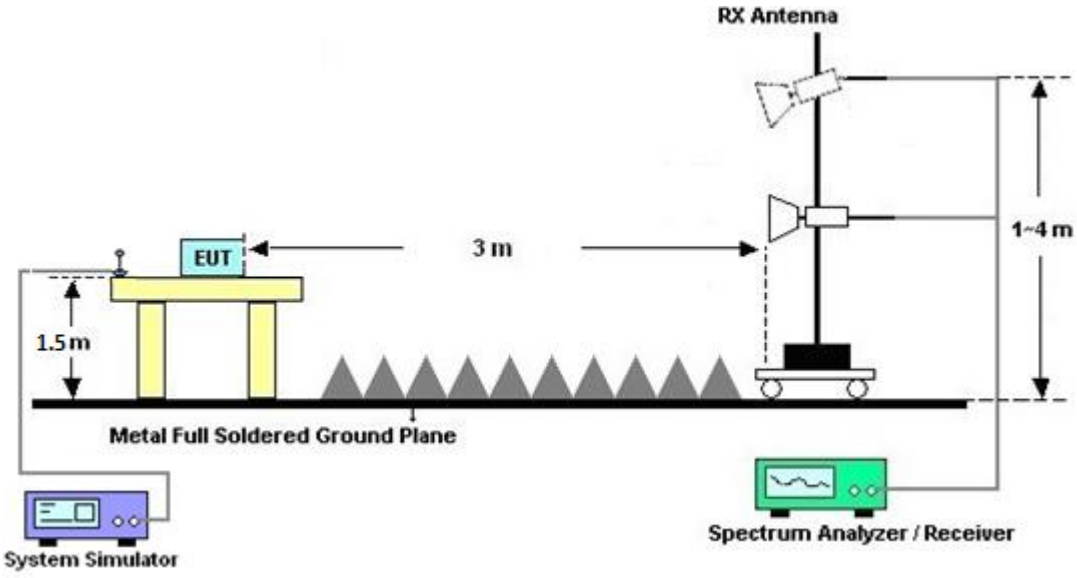
**For radiated test below 30MHz**




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



**For radiated test above 1GHz**




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

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

There is adequate comparison measurement 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.

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

Please refer to Appendix A and B.

### 3.2.7 Duty Cycle

Please refer to Appendix C.

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

Please refer to Appendix A and B.

## 3.3 Antenna Requirements

### 3.3.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. 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.

### 3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

### 3.3.3 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 | Brand Name | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|---|---|---|---|---|---|---|---|---|
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100315 | 9 kHz~30 MHz | Jan. 04, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | Jan. 03, 2022 | Radiation (03CH13-HY) |
| Amplifier | Sonoma-Instrument | 310 N | 187282 | 9KHz~1GHz | Dec. 16, 2020 | Jul. 13, 2021~ Jul. 14, 2021 | Dec. 15, 2021 | Radiation (03CH13-HY) |
| Horn Antenna | SCHWARZBECK | BBHA 9120 D | 9120D-02294 | 1GHz ~ 18GHz | Jun. 23, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | Jun. 22, 2022 | Radiation (03CH13-HY) |
| Preamplifier | MITEQ | AMF-7D-00101800-30-10P | 1590074 | 1GHz~18GHz | May 18, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | May 17, 2022 | Radiation (03CH13-HY) |
| Preamplifier | Keysight | 83017A | MY53270147 | 1GHz~26.5GHz | Oct. 28, 2020 | Jul. 13, 2021~ Jul. 14, 2021 | Oct. 27, 2021 | Radiation (03CH13-HY) |
| Signal Generator | Anritsu | MG3694C | 163401 | 0.1Hz~40GHz | Jan. 31, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | Jan. 30, 2022 | Radiation (03CH13-HY) |
| Spectrum Analyzer | Keysight | N9010A | MY55370526 | 10Hz~44GHz | Mar. 18, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | Mar. 17, 2022 | Radiation (03CH13-HY) |
| Controller | EMEC | EM1000 | N/A | Control Turn table & Ant Mast | N/A | Jul. 13, 2021~ Jul. 14, 2021 | N/A | Radiation (03CH13-HY) |
| Antenna Mast | EMEC | AM-BS-4500-B | N/A | 1m~4m | N/A | Jul. 13, 2021~ Jul. 14, 2021 | N/A | Radiation (03CH13-HY) |
| Turn Table | EMEC | TT2000 | N/A | 0~360 Degree | N/A | Jul. 13, 2021~ Jul. 14, 2021 | N/A | Radiation (03CH13-HY) |
| Software | Audix | E3 6.2009-8-24 | RK-000992 | N/A | N/A | Jul. 13, 2021~ Jul. 14, 2021 | N/A | Radiation (03CH13-HY) |
| Preamplifier | EMEC | EM18G40G | 060715 | 18GHz ~ 40GHz | Dec. 11, 2020 | Jul. 13, 2021~ Jul. 14, 2021 | Dec. 10, 2021 | Radiation (03CH13-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 126E | 0030/126E | 30M-18G | Feb. 10, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | Feb. 09, 2022 | Radiation (03CH13-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | 804793/4 | 30M-18G | Feb. 10, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | Feb. 09, 2022 | Radiation (03CH13-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 505134/2 | 30M~40GHz | Feb. 22, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | Feb. 21, 2022 | Radiation (03CH13-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | MY4274/2 | 30MHz~40GHz | Mar. 11, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | Mar. 10, 2022 | Radiation (03CH13-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY24961/4 | 30M-18G | Feb. 10, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | Feb. 09, 2022 | Radiation (03CH13-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY9837/4PE | 9kHz~30MHz | Mar. 11, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | Mar. 10, 2022 | Radiation (03CH13-HY) |
| SHF-EHF Horn Antenna | SCHWARZBECK | BBHA 9170 | BBHA9170584 | 18GHz- 40GHz | Dec. 11, 2020 | Jul. 13, 2021~ Jul. 14, 2021 | Dec. 10, 2021 | Radiation (03CH13-HY) |
| Hygrometer | TECPEL | DTM-303B | TP200879 | N/A | Oct. 22, 2020 | Jul. 13, 2021~ Jul. 14, 2021 | Oct. 21, 2021 | Radiation (03CH13-HY) |
| Filter | Wainwright | WHKX8-5872.5-6750-18000-40ST | Sn5 | 6.75GHz High Pass Filter | Mar. 11, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | Mar. 10, 2022 | Radiation (03CH13-HY) |
| Filter | Wainwright | WHKX12-2700-3000-18000-60SS | SN2 | 3GHz High Pass Filter | Jul. 12, 2021 | Jul. 13, 2021~ Jul. 14, 2021 | Jul. 11, 2022 | Radiation (03CH13-HY) |

| Instrument | Brand Name | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|---|---|---|---|---|---|---|---|---|
| Hygrometer | Testo | 608-H1 | 34893241 | N/A | Mar. 02, 2021 | Jul. 05, 2021 | Mar. 01, 2022 | Conducted (TH02-HY) |
| Power Meter | Agilent | E4416A | GB41292344 | N/A | Jan. 14, 2021 | Jul. 05, 2021 | Jan. 13, 2022 | Conducted (TH02-HY) |
| Power Sensor | Agilent | E9327A | US40441548 | 50MHz~18GHz | Jan. 14, 2021 | Jul. 05, 2021 | Jan. 13, 2022 | Conducted (TH02-HY) |
| Signal Analyzer | Rohde & Schwarz | FSV40 | 101566 | 10Hz ~ 40GHz | Jul. 22, 2020 | Jul. 05, 2021 | Jul. 21, 2021 | Conducted (TH02-HY) |
| BT Base Station | Rohde & Schwarz | CBT | 101135 | BT 3.0 | Sep. 15, 2020 | Jul. 05, 2021 | Sep. 14, 2022 | Conducted (TH02-HY) |
| Switch Box & RF Cable | EM Electronics | EMSW18SE | SW200302 | N/A | Mar. 17, 2021 | Jul. 05, 2021 | Mar. 16, 2022 | Conducted (TH02-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))** | **5.3 dB** |

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

| | |
|---|---|
| **Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))** | **5.8 dB** |

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

| | |
|---|---|
| **Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))** | **3.9 dB** |

# Appendix A. Radiated Spurious Emission

| Test Engineer : | Daniel Lee, Jacky Hung and Wilson Wu | Temperature : | 20~25°C |
|---|---|---|---|
| | | Relative Humidity : | 50~60% |

**2.4GHz 2400~2483.5MHz**

**BT (Band Edge @ 3m)**

| BT | Note | Frequency | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Path Loss | Preamp 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) |
| BT CH00 2402MHz | | 2324.7 | 45.76 | -28.24 | 74 | 42.4 | 27.1 | 4.12 | 27.86 | 393 | 20 | P | H |
| | | 2324.7 | 21 | -33 | 54 | - | - | - | - | - | - | A | H |
| | * | 2402 | 98.95 | - | - | 95.28 | 27.31 | 4.2 | 27.84 | 393 | 20 | P | H |
| | * | 2402 | 74.19 | - | - | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 2324.49 | 46.66 | -27.34 | 74 | 43.3 | 27.1 | 4.12 | 27.86 | 368 | 219 | P | V |
| | | 2324.49 | 21.9 | -32.1 | 54 | - | - | - | - | - | - | A | V |
| | * | 2402 | 99.32 | - | - | 95.65 | 27.31 | 4.2 | 27.84 | 368 | 219 | P | V |
| | * | 2402 | 74.56 | - | - | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| BT CH 39 2441MHz | | 2363.76 | 46.65 | -27.35 | 74 | 43.18 | 27.16 | 4.16 | 27.85 | 370 | 39 | P | H |
| | | 2363.76 | 21.89 | -32.11 | 54 | - | - | - | - | - | - | A | H |
| | * | 2441 | 97.59 | - | - | 93.73 | 27.46 | 4.23 | 27.83 | 370 | 39 | P | H |
| | * | 2441 | 72.83 | - | - | - | - | - | - | - | - | A | H |
| | | 2495.03 | 44.27 | -29.73 | 74 | 40.13 | 27.68 | 4.28 | 27.82 | 370 | 39 | P | H |
| | | 2495.03 | 19.51 | -34.49 | 54 | - | - | - | - | - | - | A | H |
| | | 2363.62 | 47.42 | -26.58 | 74 | 43.96 | 27.15 | 4.16 | 27.85 | 361 | 221 | P | V |
| | | 2363.62 | 22.66 | -31.34 | 54 | - | - | - | - | - | - | A | V |
| | * | 2441 | 100.06 | - | - | 96.2 | 27.46 | 4.23 | 27.83 | 361 | 221 | P | V |
| | * | 2441 | 75.3 | - | - | - | - | - | - | - | - | A | V |
| | | 2494.33 | 43.96 | -30.04 | 74 | 39.82 | 27.68 | 4.28 | 27.82 | 361 | 221 | P | V |
| | | 2494.33 | 19.2 | -34.8 | 54 | - | - | - | - | - | - | A | V |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BT CH 78 2480MHz** | * | 2480 | 95.6 | - | - | 91.54 | 27.62 | 4.26 | 27.82 | 398 | 45 | P | H |
| | * | 2480 | 70.84 | - | - | - | - | - | - | - | - | A | H |
| | | 2496.68 | 45.16 | -28.84 | 74 | 41.01 | 27.69 | 4.28 | 27.82 | 398 | 45 | P | H |
| | | 2496.68 | 20.4 | -33.6 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 97.38 | - | - | 93.32 | 27.62 | 4.26 | 27.82 | 400 | 223 | P | V |
| | * | 2480 | 72.62 | - | - | - | - | - | - | - | - | A | V |
| | | 2484 | 45.4 | -28.6 | 74 | 41.31 | 27.64 | 4.27 | 27.82 | 400 | 223 | P | V |
| | | 2484 | 20.64 | -33.36 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| **Remark** | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |

## 2.4GHz 2400~2483.5MHz

## BT (Harmonic @ 3m)

| BT | 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BT CH 00 2402MHz | | 4804 | 49.83 | -24.17 | 74 | 68.22 | 32.22 | 6.48 | 57.09 | 100 | 0 | P | H |
| | | 4804 | 25.07 | -28.93 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4804 | 48.55 | -25.45 | 74 | 66.94 | 32.22 | 6.48 | 57.09 | 100 | 0 | P | V |
| | | 4804 | 23.79 | -30.21 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| BT CH 39 2441MHz | | 4882 | 50.9 | -23.1 | 74 | 68.45 | 32.59 | 6.81 | 56.95 | 100 | 0 | P | H |
| | | 4882 | 26.14 | -27.86 | 54 | - | - | - | - | - | - | A | H |
| | | 7323 | 43.88 | -30.12 | 74 | 55.41 | 36.75 | 8.64 | 56.92 | 100 | 0 | P | H |
| | | 7323 | 19.12 | -34.88 | 54 | - | - | - | - | - | - | A | H |
| | | 4882 | 48.88 | -25.12 | 74 | 66.43 | 32.59 | 6.81 | 56.95 | 100 | 0 | P | V |
| | | 4882 | 24.12 | -29.88 | 54 | - | - | - | - | - | - | A | V |
| | | 7323 | 44.04 | -29.96 | 74 | 55.57 | 36.75 | 8.64 | 56.92 | 100 | 0 | P | V |
| | | 7323 | 19.28 | -34.72 | 54 | - | - | - | - | - | - | A | V |
| BT CH 78 2480MHz | | 4960 | 47.92 | -26.08 | 74 | 64.57 | 33.02 | 7.14 | 56.81 | 100 | 0 | P | H |
| | | 4960 | 23.16 | -30.84 | 54 | - | - | - | - | - | - | A | H |
| | | 7440 | 44.04 | -29.96 | 74 | 56.37 | 36.22 | 8.62 | 57.17 | 100 | 0 | P | H |
| | | 7440 | 19.28 | -34.72 | 54 | - | - | - | - | - | - | A | H |
| | | 4960 | 47.61 | -26.39 | 74 | 64.26 | 33.02 | 7.14 | 56.81 | 100 | 0 | P | V |
| | | 4960 | 22.85 | -31.15 | 54 | - | - | - | - | - | - | A | V |
| | | 7440 | 44.23 | -29.77 | 74 | 56.56 | 36.22 | 8.62 | 57.17 | 100 | 0 | P | V |
| | | 7440 | 19.47 | -34.53 | 54 | - | - | - | - | - | - | A | V |
| Remark | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |

## Emission below 1GHz

## 2.4GHz BT (LF)

| BT | Note | Frequency | Level | Over | Limit | Read | Antenna | 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 BT LF | | 107.6 | 28.16 | -15.34 | 43.5 | 42.77 | 16.65 | 0.97 | 32.23 | - | - | P | H |
| | | 263.77 | 33.98 | -12.02 | 46 | 44.79 | 19.71 | 1.49 | 32.01 | - | - | P | H |
| | | 382.11 | 35.91 | -10.09 | 46 | 44.74 | 21.05 | 1.72 | 31.6 | 100 | 0 | P | H |
| | | 593.57 | 35.53 | -10.47 | 46 | 40.5 | 25.39 | 2.18 | 32.54 | - | - | P | H |
| | | 726.46 | 32.7 | -13.3 | 46 | 35.4 | 26.76 | 2.42 | 31.88 | - | - | P | H |
| | | 957.32 | 33.34 | -12.66 | 46 | 30.6 | 30.67 | 2.82 | 30.75 | - | - | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 35.82 | 28.45 | -11.55 | 40 | 38.62 | 21.5 | 0.57 | 32.24 | 100 | 0 | P | V |
| | | 120.21 | 26.86 | -16.64 | 43.5 | 40.57 | 17.5 | 1.03 | 32.24 | - | - | P | V |
| | | 395.69 | 31.12 | -14.88 | 46 | 39.37 | 21.55 | 1.75 | 31.55 | - | - | P | V |
| | | 593.57 | 34.36 | -11.64 | 46 | 39.33 | 25.39 | 2.18 | 32.54 | - | - | P | V |
| | | 875.84 | 31.5 | -14.5 | 46 | 31.15 | 28.79 | 2.68 | 31.12 | - | - | P | V |
| | | 958.29 | 32.61 | -13.39 | 46 | 29.81 | 30.73 | 2.82 | 30.75 | - | - | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>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:

| BT | 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) |
| BT 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

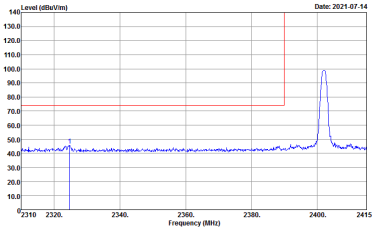
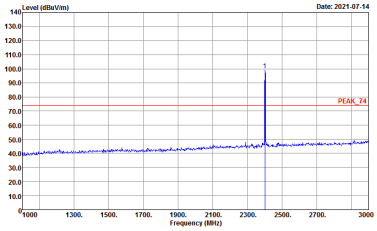
| | | | |
|---|---|---|---|
| **Test Engineer :** | Daniel Lee, Jacky Hung and Wilson Wu | **Temperature :** | 20~25°C |
| | | **Relative Humidity :** | 50~60% |

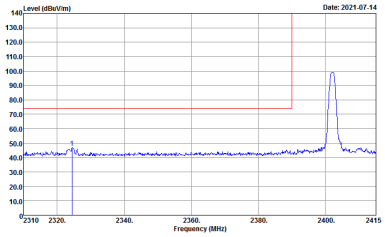
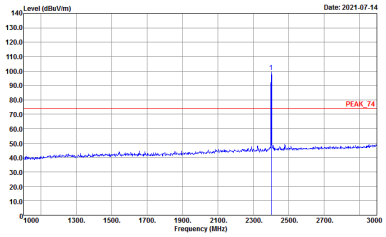
**Note symbol**

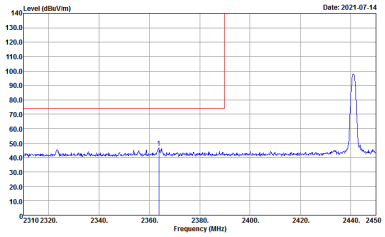
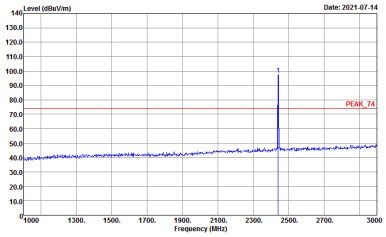
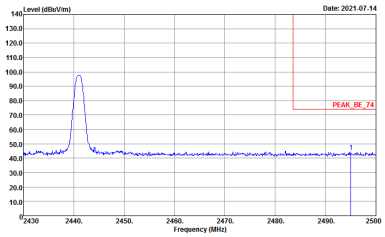
| | |
|---|---|
| -L | **Low channel location** |
| -R | **High channel location** |

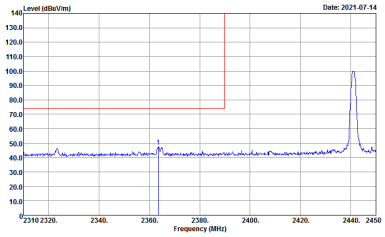
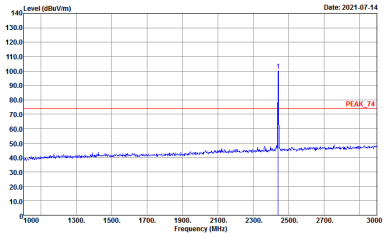
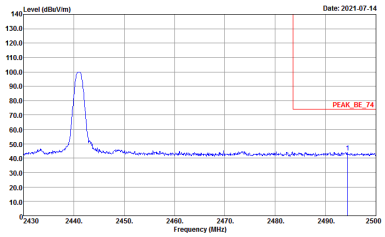
## 2.4GHz 2400~2483.5MHz

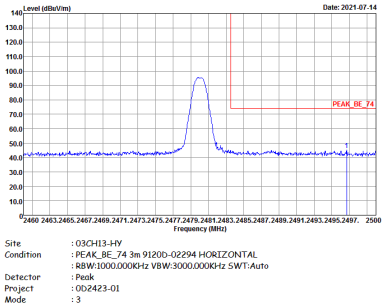
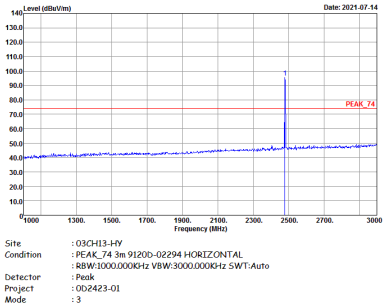
## BT (Band Edge @ 3m)

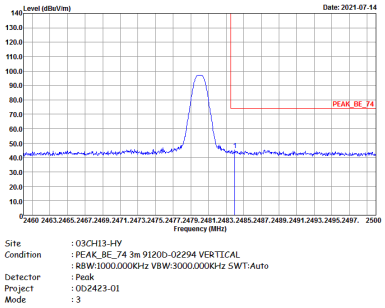
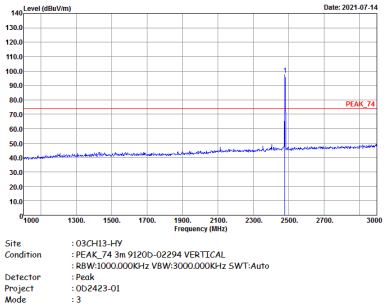
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| | BT CH00 2402MHz | |
| | Horizontal | Fundamental |
| Peak |  <br>Site : 03CH13-HY<br>Condition : PEAK_BE_74 3m 9120D-02294 HORIZONTAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 1 |  <br>Site : 03CH13-HY<br>Condition : PEAK_74 3m 9120D-02294 HORIZONTAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 1 |

| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| | BT CH00 2402MHz | |
| | Vertical | Fundamental |
| Peak |  <br>Site : 03CH13-HY<br>Condition : PEAK_BE_74 3m 9120D-02294 VERTICAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 1 |  <br>Site : 03CH13-HY<br>Condition : PEAK_74 3m 9120D-02294 VERTICAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 1 |

| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| | BT CH39 2441MHz | |
| | Horizontal | Fundamental |
| Peak |  <br>Site : 03CH13-HY<br>Condition : PEAK_BE_74 3m 9120D-02294 HORIZONTAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 2 |  <br>Site : 03CH13-HY<br>Condition : PEAK_74 3m 9120D-02294 HORIZONTAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 2 |
| Peak |  <br>Site : 03CH13-HY<br>Condition : PEAK_BE_74 3m 9120D-02294 HORIZONTAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 2 | Left blank |

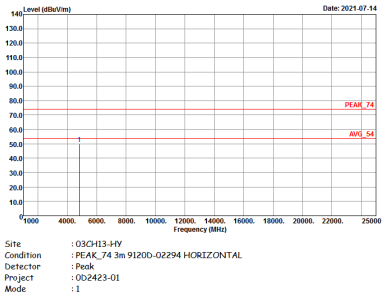
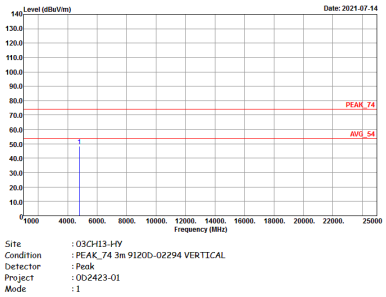
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| | BT CH39 2441MHz | |
| | Vertical | Fundamental |
| Peak |  <br>Site : 03CH13-HY<br>Condition : PEAK_BE_74 3m 9120D-02294 VERTICAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 2 |  <br>Site : 03CH13-HY<br>Condition : PEAK_74 3m 9120D-02294 VERTICAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 2 |
| Peak |  <br>Site : 03CH13-HY<br>Condition : PEAK_BE_74 3m 9120D-02294 VERTICAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 2 | Left blank |

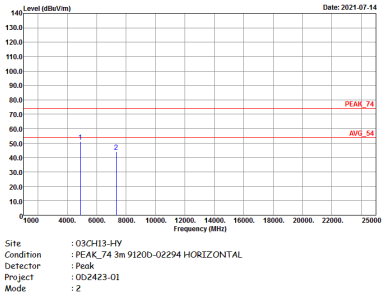
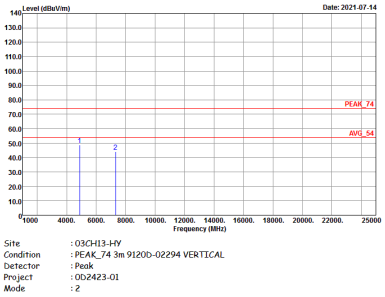
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| | BT CH78 2480MHz | |
| | Horizontal | Fundamental |
| Peak |  |  |

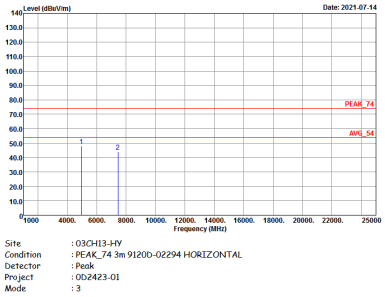
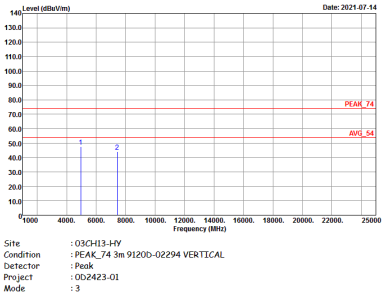
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| | BT CH78 2480MHz | |
| | Vertical | Fundamental |
| Peak |  |  |

## 2.4GHz 2400~2483.5MHz

## BT (Harmonic @ 3m)

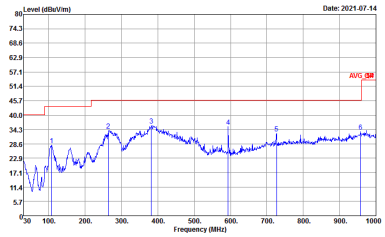
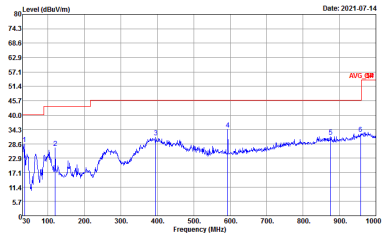
| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---|---|---|
| | BT CH00 2402MHz | |
| | Horizontal | Vertical |
| Peak<br>Avg. |  |  |

| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---|---|---|
| | BT CH39 2441MHz | |
| | Horizontal | Vertical |
| Peak<br>Avg. |  <br>Site : 03CH13-HY<br>Condition : PEAK_74 3m 9120D-02294 HORIZONTAL<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 2 |  <br>Site : 03CH13-HY<br>Condition : PEAK_74 3m 9120D-02294 VERTICAL<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 2 |

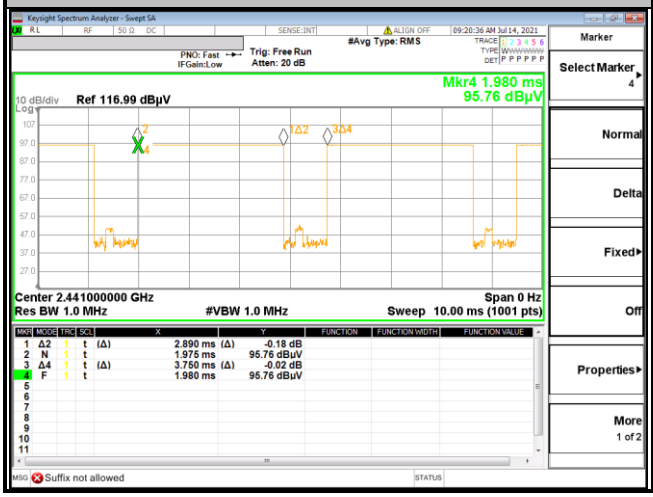
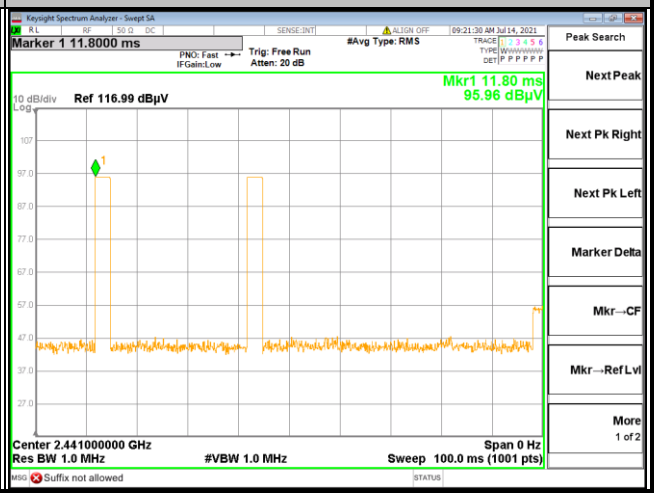
| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---|---|---|
| | BT CH78 2480MHz | |
| | Horizontal | Vertical |
| Peak<br>Avg. |  <br>Site : 03CH13-HY<br>Condition : PEAK_74 3m 9120D-02294 HORIZONTAL<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 3 |  <br>Site : 03CH13-HY<br>Condition : PEAK_74 3m 9120D-02294 VERTICAL<br>Detector : Peak<br>Project : 0D2423-01<br>Mode : 3 |

## Emission below 1GHz

## 2.4GHz BT (LF)

| BT | 2.4GHz 2400~2483.5MHz | |
|---|---|---|
| | BT LF | |
| | Horizontal | Vertical |
| QP / Peak |  |  |

# Appendix C. Duty Cycle Plots

| DH5 on time (One Pulse) Plot on Channel 39 | on time (Count Pulses) Plot on Channel 39 |
|---|---|
|  |  |



**Note:**

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.89 / 100 = 5.78 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.76 dB
3. **DH5** has the highest duty cycle worst case and is reported.

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

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

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

*2.89 ms x 20 channels = 57.6 ms*

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ms / 57.6 ms ] = 2 hops

Thus, the maximum possible ON time:

*2.89 ms x 2 = 5.76 ms*

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

*20 x log(5.76 ms/100 ms) = -24.76 dB*