



FCC RADIO TEST REPORT

FCC ID : IHDT56YJ2
Equipment : Mobile Cellular Phone
Brand Name : Motorola
Model Name : XT2061-3
Applicant : Motorola Mobility, LLC
222 W Merchandise Mart Plaza, Suite
1800, Chicago, IL 60654, United States
Manufacturer : Motorola Mobility, LLC
222 W Merchandise Mart Plaza, Suite
1800, Chicago, IL 60654, United States
Standard : FCC Part 15 Subpart C §15.247

The product was received on Dec. 06, 2019 and testing was started from Feb. 15, 2020 and completed on Feb. 24, 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 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.

Louis Wu

Reviewed 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 |
|--------------|---------|-------------------------|---------------|
| FR9D0635-01A | 01 | Initial issue of report | Mar. 20, 2020 |
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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 4.56 dB at 40.670 MHz |
| - | 15.207 | AC Conducted Emission | Not Required | - |
| 3.3 | 15.203 & 15.247(b) | Antenna Requirement | Pass | - |

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 Product Equality Declaration. All the test cases were performed on original report which can be referred to Sporton Report Number FR9D0635A. Based on the original report, only worst case was 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: Wii Chang

Report Producer: Ann Lee



1 General Description

1.1 Product Feature of Equipment Under Test

| Product Feature | |
|---------------------------------|---|
| Equipment | Mobile Cellular Phone |
| Brand Name | Motorola |
| Model Name | XT2061-3 |
| FCC ID | IHDT56YJ2 |
| IMEI Code | Conducted : IMEI: 359124100005862 Radiation : IMEI: 359124100005433 |
| EUT supports Radios application | CDMA/EV-DO/GSM/EGPRS/WCDMA/HSPA/LTE/5G NR/ GNSS/NFC/WPC WLAN 11b/g/n HT20 WLAN 11a/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 WLAN 11ax HE20/HE40/HE80 Bluetooth BR/EDR/LE |
| HW Version | DVT2 |
| EUT Stage | Identical Prototype |

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

| Accessory List | |
|----------------|---------------------------------|
| AC Adapter 1 | Brand Name : Motorola |
| | Model Name : SC-51 (SA18C30116) |
| | Manufacturer : Chenyang |
| AC Adapter 2 | Brand Name : Motorola |
| | Model Name : SC-51 (SA18C62985) |
| | Manufacturer : Acbel |
| Battery | Brand Name : ATL |
| | Model Name : LW50 |
| USB Cable 1 | Brand Name : Motorola |
| | Model Name : SC18C24367 |
| | Manufacturer : Saibao |
| USB Cable 2 | Brand Name : Motorola |
| | Model Name : SC18C24368 |
| | Manufacturer : Luxshare |



1.2 Product Specification of Equipment Under Test

| Standards-related Product Specification | |
|---|--|
| 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) : 17.39 dBm (0.0548 W) Bluetooth EDR (2Mbps) : 16.89 dBm (0.0489 W) Bluetooth EDR (3Mbps) : 17.25 dBm (0.0531 W) |
| Antenna Type / Gain | ILA Antenna type with gain -2.5 dBi |
| Type of Modulation | Bluetooth BR (1Mbps) : GFSK Bluetooth EDR (2Mbps) : $\pi/4$ -DQPSK Bluetooth EDR (3Mbps) : 8-DPSK |

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., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978 |
| Test Site No. | Sporton Site No. |
| | TH05-HY |

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

| | |
|--------------------|---|
| Test Site | SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory |
| Test Site Location | No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855 |
| Test Site No. | Sporton Site No. |
| | 03CH15-HY |

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

FCC designation No.: TW1190 and TW0007



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. 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) | 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

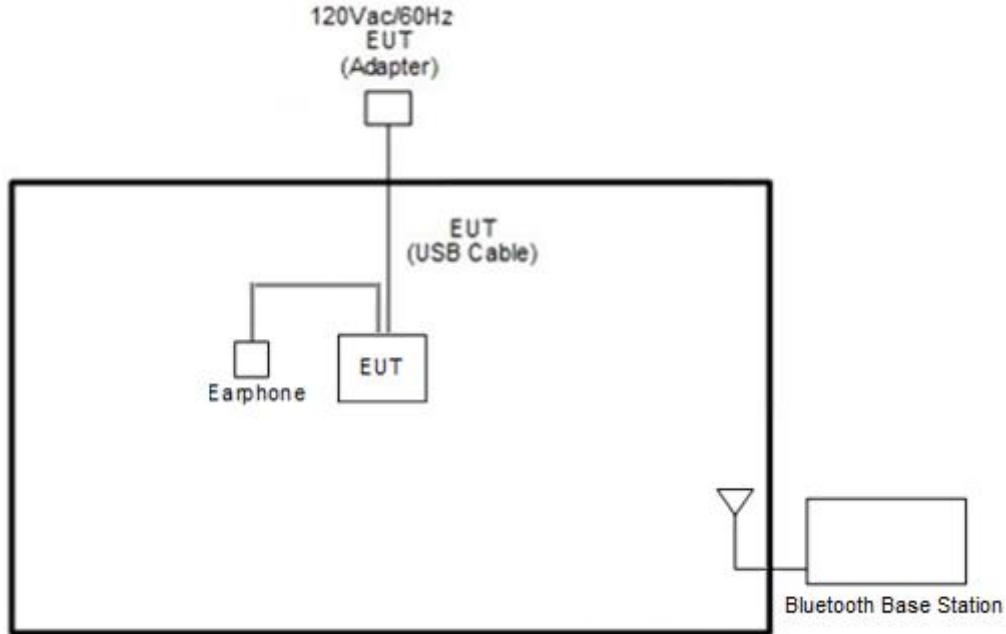
- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report, 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 | | |
| | Bluetooth BR 1Mbps GFSK | Bluetooth EDR 2Mbps $\pi/4$ -DQPSK | Bluetooth EDR 3Mbps 8-DPSK |
| Conducted Test Cases | Mode 1: CH00_2402 MHz | Mode 4: CH00_2402 MHz | Mode 7: CH00_2402 MHz |
| | Mode 2: CH39_2441 MHz | Mode 5: CH39_2441 MHz | Mode 8: CH39_2441 MHz |
| | Mode 3: CH78_2480 MHz | Mode 6: CH78_2480 MHz | Mode 9: CH78_2480 MHz |
| Radiated Test Cases | Bluetooth BR 1Mbps GFSK | | |
| | Mode 1: 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 Adapter 1 and USB Cable 1. | | | |

2.3 Connection Diagram of Test System

<Bluetooth Tx Mode>



2.4 Support Unit used in test configuration and system

| Item | Equipment | Trade 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. | Earphone | Moto | NASH38C16618 | N/A | Unshielded, 1.0 m | N/A |

2.5 EUT Operation Test Setup

The RF test items, utility "QRCT v4.0.00142.0" 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.

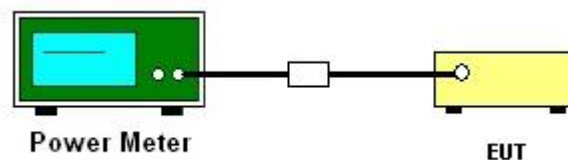
3.1.2 Measuring Instruments

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.
1. 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.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Measure the conducted output power with cable loss and record the results in the test report.
4. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.1.6 Test Result of Average Output Power (Reporting Only)

Please refer to Appendix A.



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.



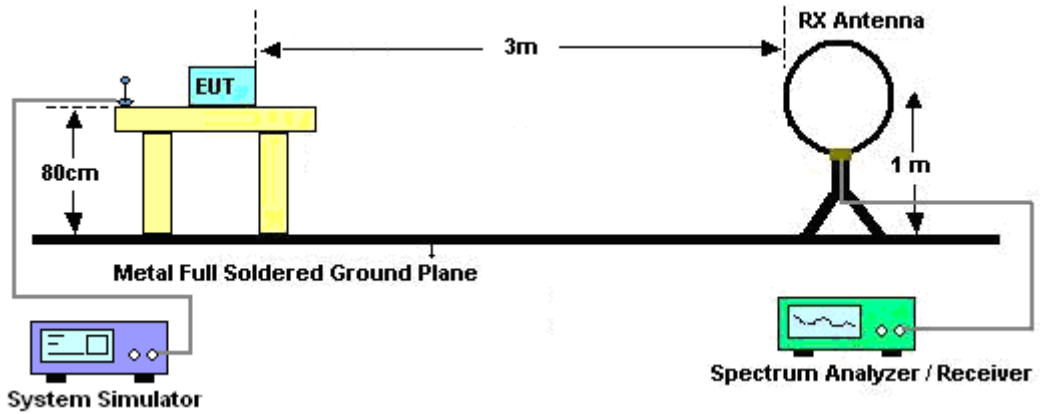
3.2.3 Test Procedures

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

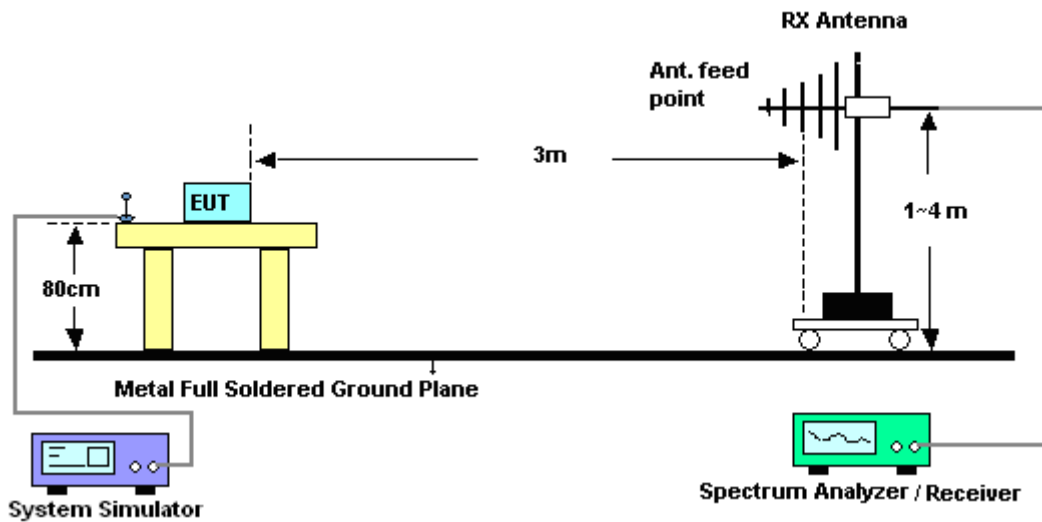
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.85dB) derived from $20 \log(\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.2.4 Test Setup

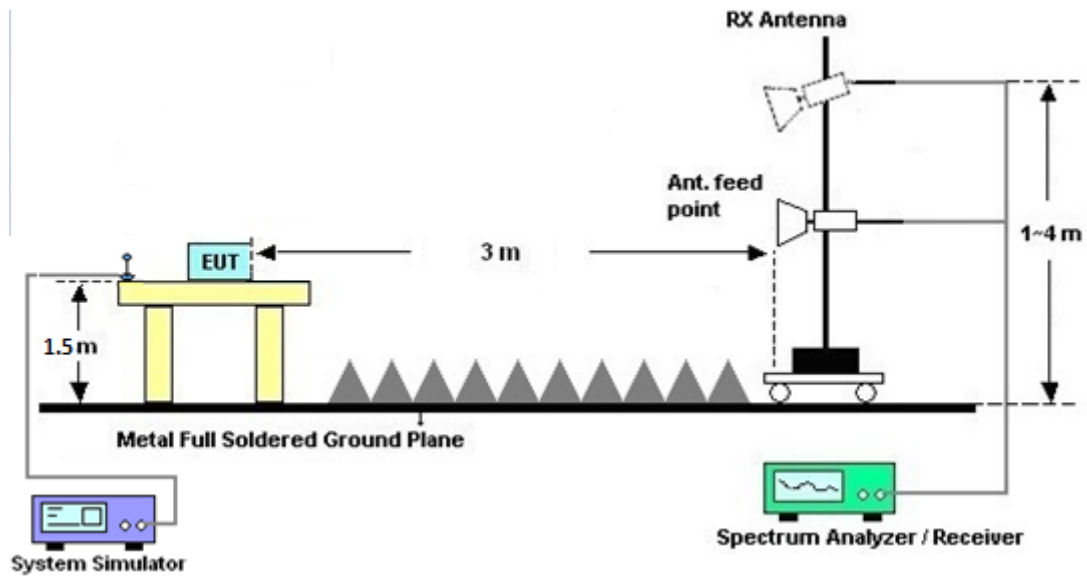
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

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

There is a comparison data of both open-field test site and 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 B and C.

3.2.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix B and C.



3.3 Antenna Requirements

3.3.1 Standard Applicable

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

3.3.2 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 | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|-------------------------|-------------------|-------------------------------------|----------------------|--------------------------|------------------|---------------------------------|---------------|--------------------------|
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100488 | 9 kHz~30 MHz | Jan. 09, 2020 | Feb. 21, 2020~ Feb. 24, 2020 | Jan. 08, 2021 | Radiation (03CH15-HY) |
| Bilog Antenna | TESEQ | CBL6111D&0 0800N1D01N- 06 | 41912&05 | 30MHz to 1GHz | Feb. 09, 2020 | Feb. 21, 2020~ Feb. 24, 2020 | Feb. 08, 2021 | Radiation (03CH15-HY) |
| Horn Antenna | SCHWARZBE CK | BBHA 9120 D | 9120D-211 4 | 1-18GHz | Jul. 31, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Jul. 30, 2020 | Radiation (03CH15-HY) |
| SHF-EHF Horn Antenna | SCHWARZBE CK | BBHA 9170 | BBHA9170 584 | 18GHz- 40GHz | Dec. 10, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Dec. 09, 2020 | Radiation (03CH15-HY) |
| Amplifier | SONOMA | 310N | 363440 | 9kHz~1GHz | Dec. 27, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Dec. 26, 2020 | Radiation (03CH15-HY) |
| Preamplifier | Jet-Power | JPA0118-55-3 03 | 171000180 0055007 | 1GHz~18GHz | Apr. 01, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Mar. 31, 2020 | Radiation (03CH15-HY) |
| Preamplifier | Keysight | 83017A | MY532701 95 | 1GHz~26.5GHz | Aug. 23, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Aug. 22, 2020 | Radiation (03CH15-HY) |
| Preamplifier | EMEC | EM18G40G | 060715 | 18GHz ~ 40GHz | Dec. 13, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Dec. 12, 2020 | Radiation (03CH15-HY) |
| EMI Test Receiver | Keysight | N9038A(MXE) | MY554201 70 | 20MHz~8.4GHz | Mar. 08, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Mar. 07, 2020 | Radiation (03CH15-HY) |
| Spectrum Analyzer | Agilent | E4446A | MY501801 36 | 3Hz~44GHz | Apr. 29, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Apr. 28, 2020 | Radiation (03CH15-HY) |
| Antenna Mast | ChainTek | MBS-520-1 | N/A | 1m~4m | N/A | Feb. 21, 2020~ Feb. 24, 2020 | N/A | Radiation (03CH15-HY) |
| Turn Table | ChainTek | T-200-S-1 | N/A | 0~360 Degree | N/A | Feb. 21, 2020~ Feb. 24, 2020 | N/A | Radiation (03CH15-HY) |
| Software | Audix | E3 6.2009-8-24(k 5) | RK-00045 1 | N/A | N/A | Feb. 21, 2020~ Feb. 24, 2020 | N/A | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY36980/ 4 | 30M-18G | Apr. 15, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Apr. 14, 2020 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY9838/4 PE | 30M-18G | Apr. 15, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Apr. 14, 2020 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY802430 /4 | 30M~18GHz | May 13, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | May 12, 2020 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 505134/2 | 30MHz-40GHz | Feb. 26, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Feb. 25, 2020 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 800740/2 | 30MHz-40GHz | Feb. 26, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Feb. 25, 2020 | Radiation (03CH15-HY) |
| Filter | Wainwright | WLK4-1000-1 530-8000-40S S | SN4 | 1.53G Low Pass | Jul. 04, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Jul. 03, 2020 | Radiation (03CH15-HY) |
| Filter | Wainwright | WHKX12-270 0-3000-18000 -60ST | SN2 | 3GHz High Pass Filter | Jul. 17, 2019 | Feb. 21, 2020~ Feb. 24, 2020 | Jul. 14, 2020 | Radiation (03CH15-HY) |



| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|-----------------------|-----------------|-----------|----------------|-----------------|------------------|---------------|---------------|---------------------|
| Hygrometer | Testo | 608-H2 | 41410069 | N/A | Jun. 17, 2019 | Feb. 15, 2020 | Jun. 16, 2020 | Conducted (TH05-HY) |
| Power Meter | Agilent | E4416A | GB412923 44 | N/A | Dec. 27, 2018 | Feb. 15, 2020 | Dec. 26, 2019 | Conducted (TH05-HY) |
| Power Sensor | Agilent | E9327A | US404415 48 | 50MHz~18GHz | Dec. 27, 2018 | Feb. 15, 2020 | Dec. 26, 2019 | Conducted (TH05-HY) |
| Power Meter | Agilent | E4416A | GB412923 44 | N/A | Dec. 27, 2019 | Feb. 15, 2020 | Dec. 26, 2020 | Conducted (TH05-HY) |
| Power Sensor | Agilent | E9327A | US404415 48 | 50MHz~18GHz | Dec. 27, 2019 | Feb. 15, 2020 | Dec. 26, 2020 | Conducted (TH05-HY) |
| Signal Analyzer | Rohde & Schwarz | FSV40 | 101566 | 10Hz~40GHz | Jul. 15, 2019 | Feb. 15, 2020 | Jul. 14, 2020 | Conducted (TH05-HY) |
| BT Base Station | Rohde & Schwarz | CBT | 100815 | BT 3.0 | Feb. 10, 2020 | Feb. 15, 2020 | Feb. 09, 2021 | Conducted (TH05-HY) |
| Switch Box & RF Cable | Burgeon | ETF-058 | EC120838 2 | N/A | Mar. 27, 2019 | Feb. 15, 2020 | Mar. 26, 2020 | Conducted (TH05-HY) |



5 Uncertainty of Evaluation

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

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.0 |
|---|-----|

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

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.4 |
|---|-----|

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

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.0 |
|---|-----|

Appendix A. Test Result of Conducted Test Items

| | | | | |
|----------------|------------|--------------------|-------|----|
| Test Engineer: | Kathy Chen | Temperature: | 21~25 | °C |
| Test Date: | 2020/2/15 | Relative Humidity: | 51~54 | % |

TEST RESULTS DATA

Peak Power Table

| DH | CH. | NTX | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|------|-----|-----|------------------|-------------------|-------------|
| DH1 | 0 | 1 | 16.30 | 20.97 | Pass |
| | 39 | 1 | 17.39 | 20.97 | Pass |
| | 78 | 1 | 16.36 | 20.97 | Pass |
| 2DH1 | 0 | 1 | 15.78 | 20.97 | Pass |
| | 39 | 1 | 16.89 | 20.97 | Pass |
| | 78 | 1 | 15.92 | 20.97 | Pass |
| 3DH1 | 0 | 1 | 16.19 | 20.97 | Pass |
| | 39 | 1 | 17.25 | 20.97 | Pass |
| | 78 | 1 | 16.28 | 20.97 | Pass |

TEST RESULTS DATA

Average Power Table

(Reporting Only)

| DH | CH. | NTX | Average Power (dBm) | Duty Factor (dB) |
|------|-----|-----|---------------------|------------------|
| DH1 | 0 | 1 | 15.71 | 5.21 |
| | 39 | 1 | 16.91 | 5.21 |
| | 78 | 1 | 15.87 | 5.21 |
| 2DH1 | 0 | 1 | 13.14 | 5.19 |
| | 39 | 1 | 14.43 | 5.19 |
| | 78 | 1 | 13.52 | 5.19 |
| 3DH1 | 0 | 1 | 12.88 | 5.21 |
| | 39 | 1 | 14.26 | 5.21 |
| | 78 | 1 | 13.27 | 5.21 |



Appendix B. Radiated Spurious Emission

| | | | |
|-----------------|--------------------------------------|---------------------|-------------|
| Test Engineer : | Leo Lee, Mancy Chou and Bigshow Wang | Temperature : | 24.2~24.8°C |
| | | Relative Humidity : | 55~61% |

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 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 78 2480MHz | * | 2480 | 107.05 | - | - | 104.28 | 27.54 | 6.33 | 31.1 | 270 | 19 | P | H | |
| | * | 2480 | 82.2 | - | - | - | - | - | - | - | - | A | H | |
| | | 2483.56 | 54.35 | -19.65 | 74 | 51.59 | 27.53 | 6.33 | 31.1 | 270 | 19 | P | H | |
| | | 2483.56 | 29.5 | -24.5 | 54 | - | - | - | - | - | - | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | * | 2480 | 98.45 | - | - | 95.68 | 27.54 | 6.33 | 31.1 | 190 | 342 | P | V | |
| | * | 2480 | 73.6 | - | - | - | - | - | - | - | - | - | A | V |
| | | 2483.56 | 47.34 | -26.66 | 74 | 44.58 | 27.53 | 6.33 | 31.1 | 190 | 342 | P | V | |
| | | 2483.56 | 22.49 | -31.51 | 54 | - | - | - | - | - | - | 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
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 78 2480MHz | | 4960 | 36.46 | -37.54 | 74 | 54.46 | 31.54 | 9.65 | 59.19 | 100 | 0 | P | H |
| | | 4960 | 11.61 | -42.39 | 54 | - | - | - | - | - | - | A | H |
| | | 7440 | 41.87 | -32.13 | 74 | 52.67 | 36.56 | 11.76 | 59.12 | 100 | 0 | P | H |
| | | 7440 | 17.02 | -36.98 | 54 | - | - | - | - | - | - | A | H |
| | | 4960 | 35.81 | -38.19 | 74 | 53.81 | 31.54 | 9.65 | 59.19 | 100 | 0 | P | V |
| | | 4960 | 10.96 | -43.04 | 54 | - | - | - | - | - | - | A | V |
| | | 7440 | 41.35 | -32.65 | 74 | 52.15 | 36.56 | 11.76 | 59.12 | 100 | 0 | P | V |
| | | 7440 | 16.5 | -37.5 | 54 | - | - | - | - | - | - | A | V |
| Remark | 1. No other spurious found. 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. | |
|--------------------|--|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|---|
| | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) | |
| 2.4GHz BT LF | | 40.67 | 27.68 | -12.32 | 40 | 40.08 | 19.11 | 0.83 | 32.34 | - | - | P | H | |
| | | 198.78 | 28.57 | -14.93 | 43.5 | 43.91 | 15.1 | 1.94 | 32.38 | - | - | P | H | |
| | | 271.53 | 33.56 | -12.44 | 46 | 45.09 | 18.73 | 2.2 | 32.46 | - | - | P | H | |
| | | 298.69 | 39.48 | -6.52 | 46 | 50.64 | 19.08 | 2.28 | 32.52 | 100 | 0 | P | H | |
| | | 325.85 | 34.11 | -11.89 | 46 | 44.69 | 19.55 | 2.35 | 32.48 | | | P | H | |
| | | 897.18 | 36.31 | -9.69 | 46 | 35.73 | 28.57 | 3.96 | 31.95 | | | P | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | 40.67 | 35.44 | -4.56 | 40 | 47.84 | 19.11 | 0.83 | 32.34 | 100 | 314 | Q | V |
| | | | 49.4 | 25.08 | -14.92 | 40 | 41.53 | 15 | 0.93 | 32.38 | - | - | P | V |
| | | | 94.99 | 24.36 | -19.14 | 43.5 | 39.81 | 15.52 | 1.32 | 32.29 | - | - | P | V |
| | | | 298.69 | 33.12 | -12.88 | 46 | 44.28 | 19.08 | 2.28 | 32.52 | - | - | P | V |
| | | | 716.76 | 35.93 | -10.07 | 46 | 38.16 | 26.73 | 3.46 | 32.42 | - | - | P | V |
| | | | 903 | 37.65 | -8.35 | 46 | 36.99 | 28.6 | 3.97 | 31.91 | - | - | P | 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 | Peak or Average |
| H/V | Horizontal or Vertical |



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. |
|---------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
| | | (MHz) | (dBμV/m) | (dB) | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| | | | | | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| BT | | 2390 | 55.45 | -18.55 | 74 | 54.51 | 32.22 | 4.58 | 35.86 | 103 | 308 | P | H |
| CH 00 | | 2390 | 43.54 | -10.46 | 54 | 42.6 | 32.22 | 4.58 | 35.86 | 103 | 308 | A | H |
| 2402MHz | | | | | | | | | | | | | |

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 C. Radiated Spurious Emission Plots

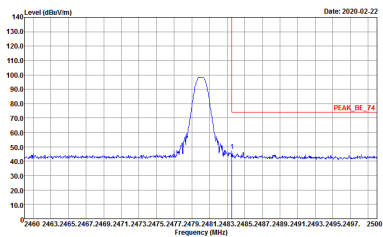
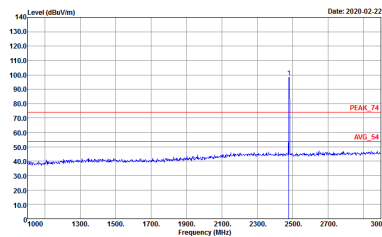
| | | | |
|-----------------|--------------------------------------|---------------------|-------------|
| Test Engineer : | Leo Lee, Mancy Chou and Bigshow Wang | Temperature : | 24.2~24.8°C |
| | | Relative Humidity : | 55~61% |

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|---|
| | BT CH78 2480MHz | |
| | Horizontal | Fundamental |
| Peak | <p>Site : 03CH15-HY Condition : PEAK_BE_74 3m 91200_15_1620 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Detector : Peak Project : 9D0635</p> | <p>Site : 03CH15-HY Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Detector : Peak Project : 9D0635</p> |

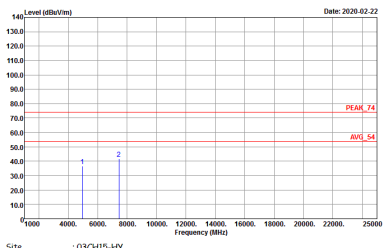
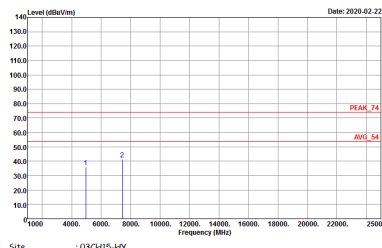


| | | |
|-----------------|--|--|
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
| BT CH78 2480MHz | | |
| Vertical | | Fundamental |
| Peak |  <p>Site : 03CH15-11Y Condition : PEAK_BE_74 3m 91200_15_1620 VERTICAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : 900635</p> |  <p>Site : 03CH15-11Y Condition : PEAK_74 3m 91200_15_1620 VERTICAL Detector : Peak Project : 900635</p> |



2.4GHz 2400~2483.5MHz

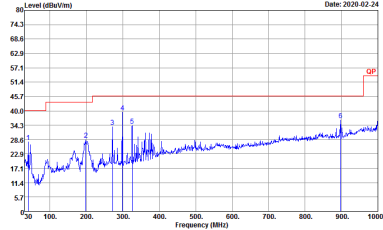
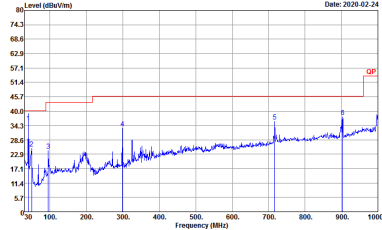
BT (Harmonic @ 3m)

| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|--------------|---|--|
| | BT CH78 2480MHz | |
| | Horizontal | Vertical |
| Peak Avg. |  <p>Site : 03CH15-HY Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL Detector : Peak Project : 9D0635-01</p> |  <p>Site : 03CH15-HY Condition : PEAK_74 3m 91200_15_1620 VERTICAL Detector : Peak Project : 9D0635-01</p> |



Emission below 1GHz

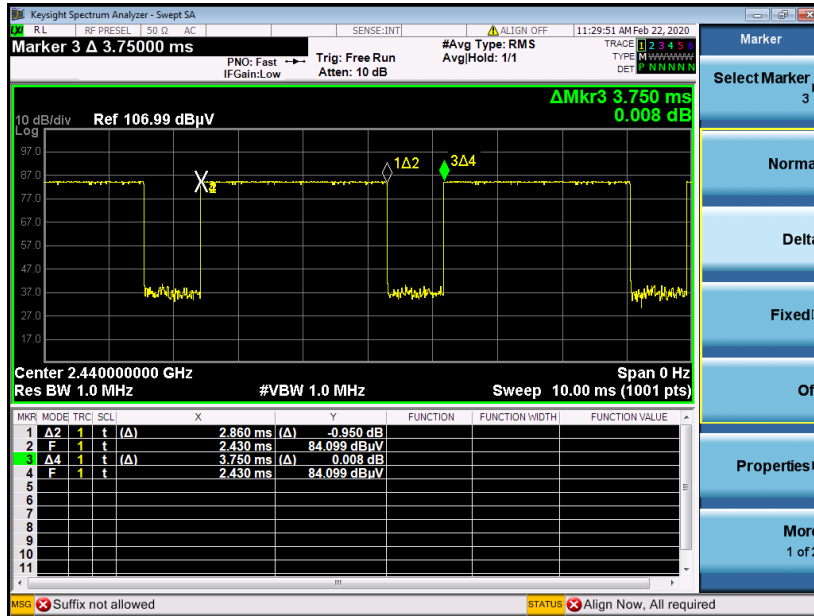
2.4GHz BT (LF)

| BT | 2.4GHz 2400~2483.5MHz | |
|--------------|---|---|
| | BT LF | |
| | Horizontal | Vertical |
| QP / Peak |  <p data-bbox="430 878 667 927">Site : 03CH15-HY Condition : QP 3m 81LOG_15_41912 HORIZONTAL Detector : Peak Project : 9D0635-01</p> |  <p data-bbox="904 878 1141 927">Site : 03CH15-HY Condition : QP 3m 81LOG_15_41912 VERTICAL Detector : Peak Project : 9D0635-01</p> |

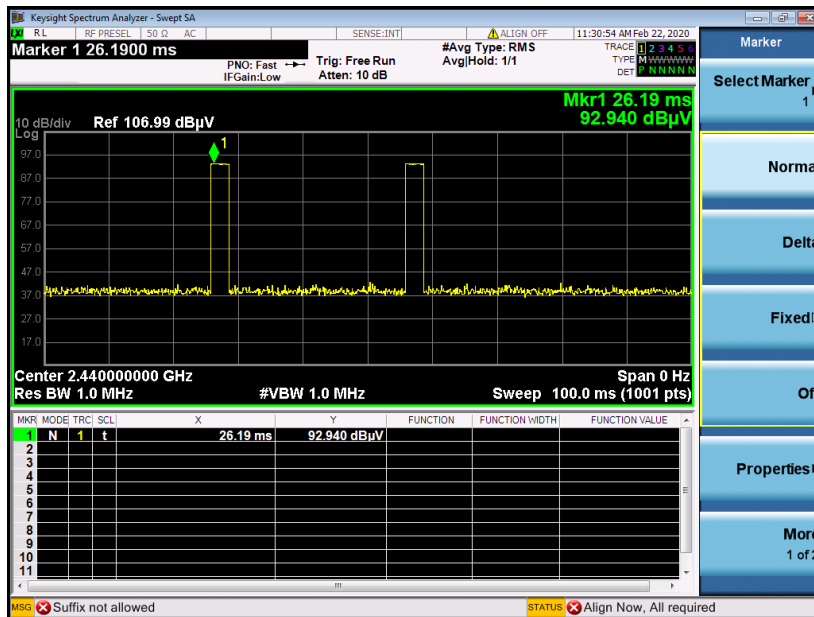


Appendix D. Duty Cycle Plots

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 = $2 * 2.86 / 100 = 5.72 \%$
2. Worst case Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -24.85 \text{ dB}$
3. DH5 has the highest duty cycle worst case and is reported.



Duty Cycle Correction Factor Consideration for AFH mode:

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

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

$$2.86 \text{ ms} \times 20 \text{ channels} = 57.2 \text{ ms}$$

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

Thus, the maximum possible ON time:

$$2.86 \text{ ms} \times 2 = 5.72 \text{ ms}$$

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

$$20 \times \log(5.72 \text{ ms}/100\text{ms}) = -24.85 \text{ dB}$$

—————THE END—————