



FCC RF Test Report

APPLICANT : FUJITSU LIMITED
EQUIPMENT : FUJITSU STYLISTIC Q series
BRAND NAME : FUJITSU
MODEL NAME : Q507
FCC ID : EJE-WB0103
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DSS) Spread Spectrum Transmitter

This is a partial report. The product was received on Mar. 28, 2017 and testing was completed on Jun. 02, 2017. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

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

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.



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SUMMARY OF TEST RESULT

| Report Section | FCC Rule | Description | Limit | Result | Remark |
|----------------|--------------------|--|-----------------------|--------|--|
| 3.1 | 15.247(b)(1) | Peak Output Power | ≤ 125 mW | Pass | - |
| 3.2 | 15.247(d) | Radiated Band Edges and Radiated Spurious Emission | 15.209(a) & 15.247(d) | Pass | Under limit 6.37 dB at 34.8500 MHz |
| 3.3 | 15.207 | AC Conducted Emission | 15.207(a) | Pass | Under limit 14.30 dB at 0.150 MHz |
| 3.4 | 15.203 & 15.247(b) | Antenna Requirement | N/A | Pass | - |



1 General Description

1.1 Applicant

FUJITSU LIMITED

1-1, Kamikodanaka 4-chome, Nakahara-ku, Kawasaki, 211-8588 Japan

1.2 Manufacturer

FUJITSU LIMITED

1-1, Kamikodanaka 4-chome, Nakahara-ku, Kawasaki, 211-8588 Japan

1.3 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, Wi-Fi 5GHz 802.11a/n/ac

| Product Specification subjective to this standard | |
|---|---|
| Integrated WLAN Module | Brand Name: Intel Model Name: 7265D2W |
| Antenna Type | WLAN: PIFA Antenna Bluetooth: PIFA Antenna |

1.4 Modification of EUT

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



1.5 Testing Location

| | | |
|---------------------------|--|---------|
| Test Site | SPORTON INTERNATIONAL INC. | |
| Test Site Location | No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978 | |
| Test Site No. | Sporton Site No. | |
| | TH05-HY | CO05-HY |

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

| | | |
|---------------------------|--|-----------------------------|
| Test Site | SPORTON INTERNATIONAL (KUNSHAN) INC. | |
| Test Site Location | No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P.R.C. TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958 | |
| Test Site No. | Sporton Site No. | FCC Registration No. |
| | 03CH03-KS | 306251 |

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

1.6 Applicable Standards

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

- FCC Part 15 Subpart C §15.247
- ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.



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 | - | - |



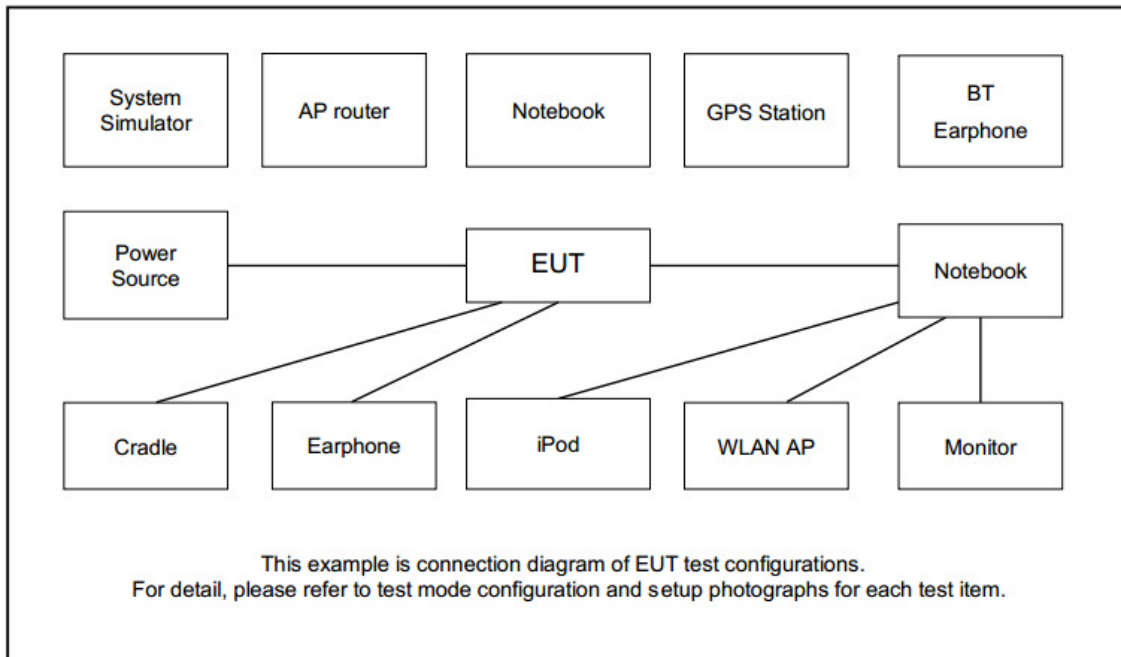
2.2 Test Mode

- 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: conduction emission (150 kHz to 30 MHz), 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, and the worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

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 2: CH39_2441 MHz Mode 3: CH78_2480 MHz | Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz | Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz |
| Radiated Test Cases | Bluetooth BR 1Mbps GFSK Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz | | |
| AC Conducted Emission | Mode 1 :WLAN (2.4GHz) Link + Bluetooth Link + TC + TF | | |
| Remark: <ol style="list-style-type: none"> TC stands for Test Configuration, and consists of Adapter, USB (USB device), SD Card, earphone, and HDMI Cable. TF stands for Test Function, and consists of H-Pattern, MPEG4 and Camera. For radiated test cases, the worst mode data rate 1Mbps was reported only, because this data rate has the highest RF output power at preliminary tests, and the conducted spurious emissions and conducted band edge measurement for each data rate are no worse than 1Mbps, and no other significantly frequencies found in conducted spurious emission. | | | |

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

| Item | Equipment | Trade Name | Model Name | FCC ID | Data Cable | Power Cord |
|------|--------------------|---------------|------------|--|-------------------|--|
| 1. | Bluetooth Earphone | Sony Ericsson | MW600 | PY7DDA-2029 | N/A | N/A |
| 2. | WLAN AP | D-Link | DIR-865L | KA2IR865LA1 | N/A | Unshielded, 1.8 m |
| 3. | Notebook | DELL | P20G | FCC DoC/ Contains FCC ID: QDS-BRCM1051 | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |
| 4. | iPod Earphone | Apple | N/A | Verification | Unshielded, 1.0 m | N/A |
| 5. | LCD Monitor | DELL | U2410 | FCC DoC | Shielded, 1.6 m | Unshielded, 1.8 m |
| 6. | USB3.0 HD | Lenovo | F310S | FCC DoC | Shielded, 0.5 m | N/A |
| 7. | SD Card | SanDisk | MicroSD HC | FCC DoC | N/A | N/A |

2.5 UT Operation Test Setup

The RF test items, programmed RF utility, “DRTU” installed in the notebook make the EUT provide functions like channel selection and power level for continuous transmitting and receiving signals.

3 Test Result

3.1 Peak Output Power Measurement

3.1.1 Limit of Peak Output Power

Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) 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. The power limit for 1Mbps, 2Mbps, 3Mbps and AFH modes are 0.125 watts.

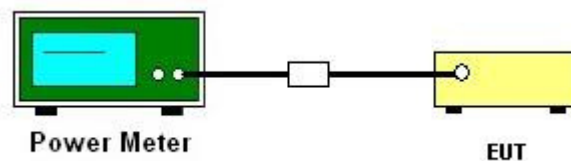
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 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

| | | | |
|-----------------|-----------|---------------------|---------|
| Test Mode : | 1Mbps | Temperature : | 24~26°C |
| Test Engineer : | Allen Lin | Relative Humidity : | 48~51% |

| Channel | Frequency (MHz) | RF Power (dBm) | | |
|---------|-----------------|----------------|-------------------|-----------|
| | | GFSK | Max. Limits (dBm) | Pass/Fail |
| | | 1 Mbps | | |
| 00 | 2402 | 6.50 | 20.97 | Pass |
| 39 | 2441 | 7.21 | 20.97 | Pass |
| 78 | 2480 | 7.70 | 20.97 | Pass |

Note: For AFH mode using 20 hopping channels, the maximum output power limit is 20.97dBm.

| | | | |
|-----------------|-----------|---------------------|---------|
| Test Mode : | 2Mbps | Temperature : | 24~26°C |
| Test Engineer : | Allen Lin | Relative Humidity : | 48~51% |

| Channel | Frequency (MHz) | RF Power (dBm) | | |
|---------|-----------------|----------------|-------------------|-----------|
| | | $\pi/4$ -DQPSK | Max. Limits (dBm) | Pass/Fail |
| | | 2 Mbps | | |
| 00 | 2402 | 3.07 | 20.97 | Pass |
| 39 | 2441 | 3.89 | 20.97 | Pass |
| 78 | 2480 | 4.56 | 20.97 | Pass |

| | | | |
|-----------------|-----------|---------------------|---------|
| Test Mode : | 3Mbps | Temperature : | 24~26°C |
| Test Engineer : | Allen Lin | Relative Humidity : | 48~51% |

| Channel | Frequency (MHz) | RF Power (dBm) | | |
|---------|-----------------|----------------|-------------------|-----------|
| | | 8-DPSK | Max. Limits (dBm) | Pass/Fail |
| | | 3 Mbps | | |
| 00 | 2402 | 3.31 | 20.97 | Pass |
| 39 | 2441 | 4.10 | 20.97 | Pass |
| 78 | 2480 | 4.76 | 20.97 | Pass |



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

The measuring equipment is listed in the section 4 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 $f < 1 \text{ GHz}$, RBW=1MHz for $f > 1\text{GHz}$; 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

<DH5>

Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (24.79dB) 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.

<2DH5>

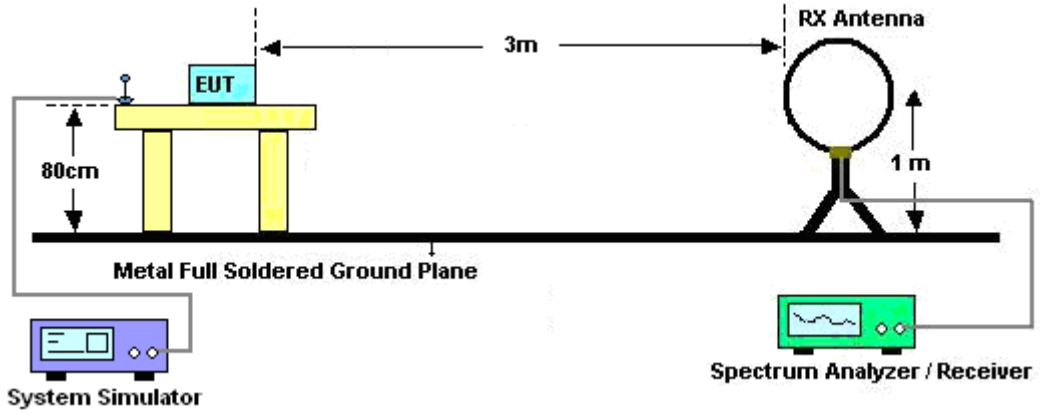
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (24.79dB) derived from $20\log(\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

<3DH5>

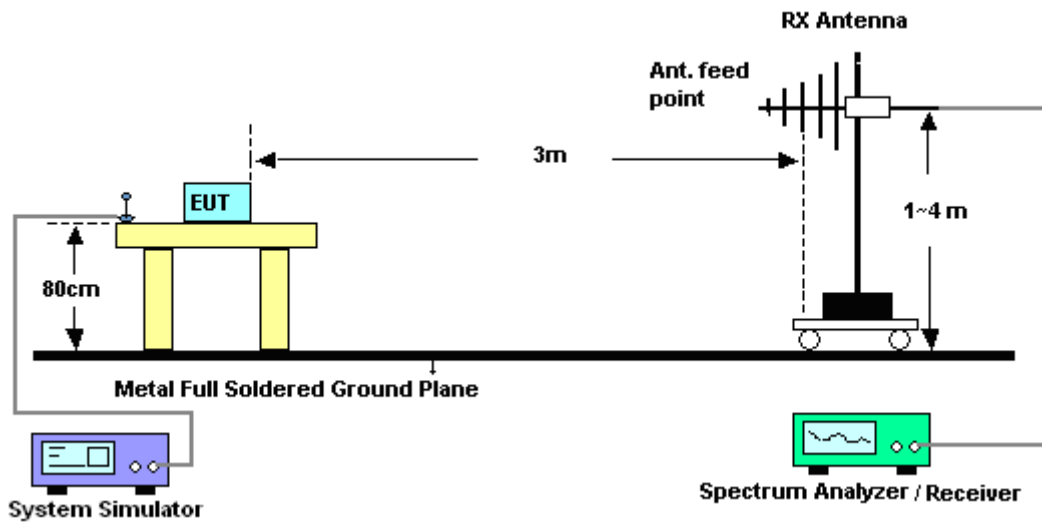
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (24.76dB) derived from $20\log(\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that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

3.2.4 Test Setup

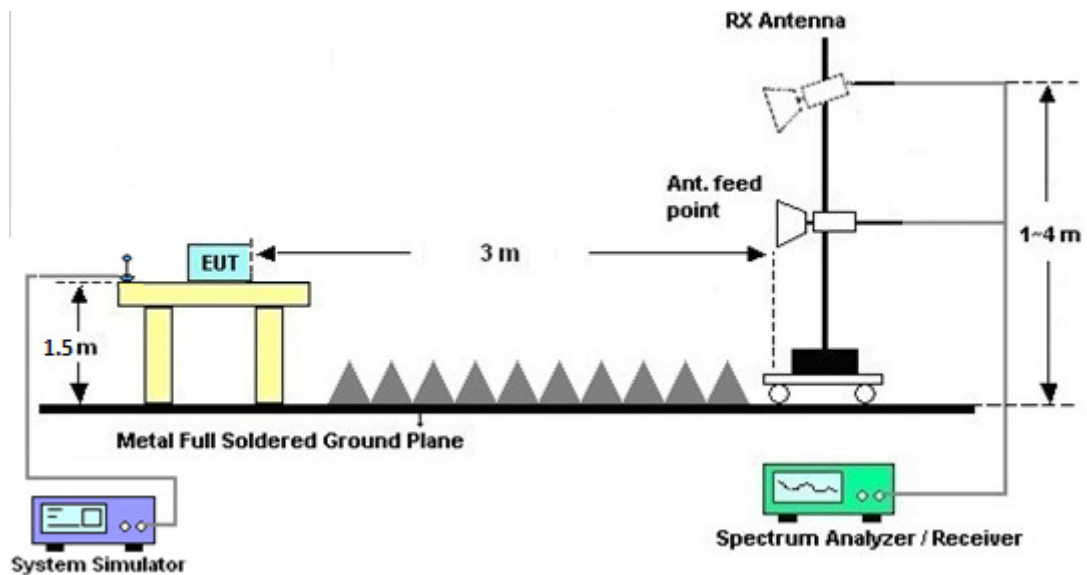
For radiated emissions below 30MHz



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 per 15.31(o) was not reported.

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 AC Conducted Emission Measurement

3.3.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

| Frequency of emission (MHz) | Conducted limit (dB μ V) | |
|-----------------------------|------------------------------|-----------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

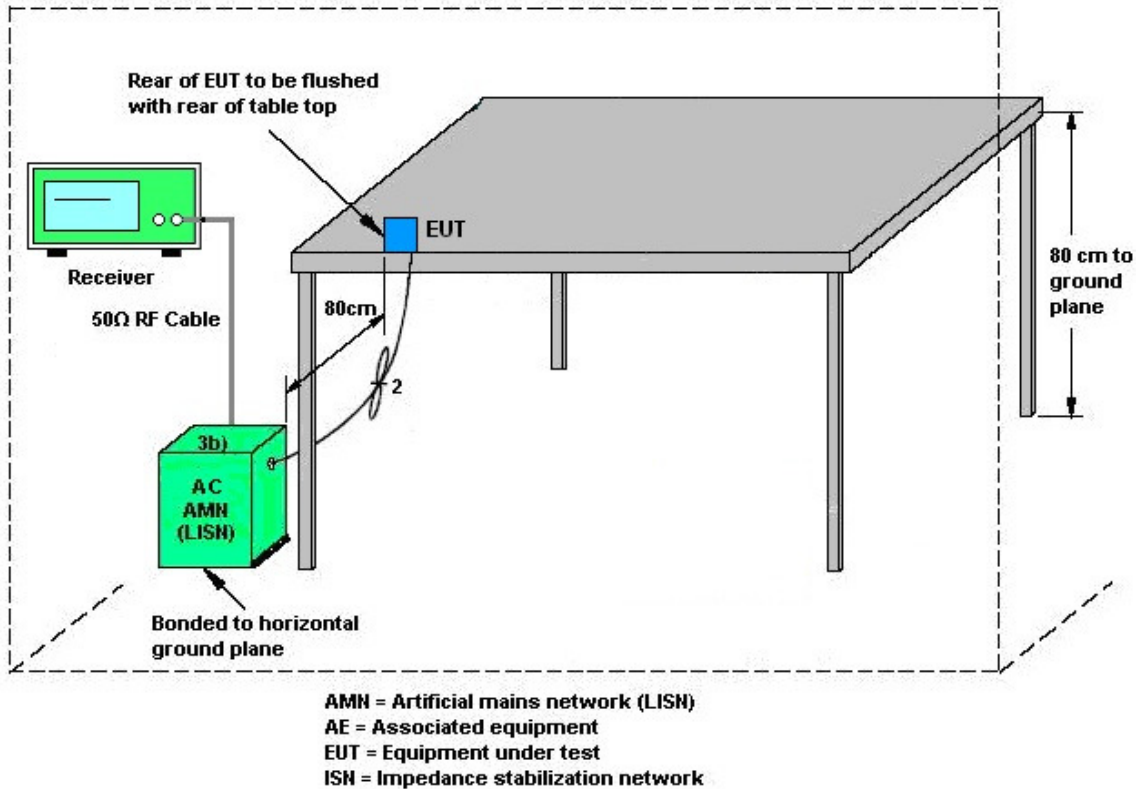
3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

7. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
8. Connect EUT to the power mains through a line impedance stabilization network (LISN).
9. All the support units are connecting to the other LISN.
10. The LISN provides 50 ohm coupling impedance for the measuring instrument.
11. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
12. Both sides of AC line were checked for maximum conducted interference.
13. The frequency range from 150 kHz to 30 MHz was searched.
14. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.3.4 Test Setup



3.3.5 Test Result of AC Conducted Emission

Please refer to Appendix A.



3.4 Antenna Requirements

3.4.1 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.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.4.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|--------------------------|-----------------|-------------------|----------------|--------------------------|------------------|--------------------------------|---------------|--------------------------|
| Power Meter | Agilent | E4416A | GB412923 44 | 300MHz~40GHz | Dec. 26, 2016 | Apr. 29, 2017 | Dec. 25, 2017 | Conducted (TH05-HY) |
| Power Sensor | Agilent | E9327A | US404415 48 | 300MHz~40GHz | Dec. 26, 2016 | Apr. 29, 2017 | Dec. 25, 2017 | Conducted (TH05-HY) |
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 100055 | 9kHz-40GHz | Jul. 17, 2016 | Apr. 29, 2017 | Jul. 16, 2017 | Conducted (TH05-HY) |
| BT Base Station(Measure) | Rohde & Schwarz | CBT | 101136 | BT 3.0 | Sep. 21, 2016 | Apr. 29, 2017 | Sep. 20, 2017 | Conducted (TH05-HY) |
| EMI Test Receiver | Keysight | N9038A | MY564000 04 | 3Hz~8.5GHz;Ma x 30dBm | Oct. 22, 2016 | May 27, 2017 ~ May 29, 2017 | Oct. 21, 2017 | Radiation (03CH03-KS) |
| EXA Spectrum Analyzer | Keysight | N9010A | MY551502 44 | 10Hz-44GHz | Apr. 18, 2017 | May 27, 2017 ~ May 29, 2017 | Apr. 17, 2018 | Radiation (03CH03-KS) |
| Loop Antenna | R&S | HFH2-Z2 | 100321 | 9kHz~30MHz | Nov. 23, 2016 | May 27, 2017 ~ May 29, 2017 | Nov. 22, 2017 | Radiation (03CH03-KS) |
| Bilog Antenna | TeseQ | CBL6112D | 35406 | 25MHz-2GHz | Apr. 22, 2017 | May 27, 2017 ~ May 29, 2017 | Apr. 21, 2018 | Radiation (03CH03-KS) |
| Horn Antenna | Schwarzbeck | BBHA9120D | 9120D-135 6 | 1GHz~18GHz | Apr. 22, 2017 | May 27, 2017 ~ May 29, 2017 | Apr. 21, 2018 | Radiation (03CH03-KS) |
| SHF-EHF Horn | com-power | AH-840 | 101070 | 18GHz ~40GHz | Oct. 19, 2016 | May 27, 2017 ~ May 29, 2017 | Oct. 18, 2017 | Radiation (03CH03-KS) |
| Amplifier | com-power | PA-103A | 161069 | 1MHz ~1000MHz / 32 dB | Apr. 18, 2017 | May 27, 2017 ~ May 29, 2017 | Apr. 17, 2018 | Radiation (03CH03-KS) |
| Amplifier | MITEQ | TTA1840-35- HG | 1887435 | 18~40GHz | Oct. 13, 2016 | May 27, 2017 ~ May 29, 2017 | Oct. 12, 2017 | Radiation (03CH03-KS) |
| Amplifier | Agilent | 8449B | 3008A023 70 | 1GHz~26.5GHz | Oct. 13, 2016 | May 27, 2017 ~ May 29, 2017 | Oct. 12, 2017 | Radiation (03CH03-KS) |
| AC Power Source | Chroma | 61601 | F1040900 04 | N/A | N/A | May 27, 2017 ~ May 29, 2017 | N/A | Radiation (03CH03-KS) |
| Turn Table | ChamPro | EM 1000-T | 060762-T | 0~360 degree | N/A | May 27, 2017 ~ May 29, 2017 | N/A | Radiation (03CH03-KS) |
| Antenna Mast | ChamPro | EM 1000-A | 060762-A | 1 m~4 m | N/A | May 27, 2017 ~ May 29, 2017 | N/A | Radiation (03CH03-KS) |
| AC Power Source | ChainTek | APC-1000W | N/A | N/A | N/A | Jun. 02, 2017 | N/A | Conduction (CO05-HY) |
| DC- LISN | Rohde & Schwarz | ESH3-Z6 | 100485 | 0.1MHz-200MHz | Jun. 04, 2016 | Jun. 02, 2017 | Jun. 03, 2017 | Conduction (CO05-HY) |
| EMI Test Receiver | Rohde & Schwarz | ESCI 7 | 100724 | 9kHz~7GHz | Aug. 30, 2016 | Jun. 02, 2017 | Aug. 29, 2017 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100080 | 9kHz~30MHz | Nov. 29, 2016 | Jun. 02, 2017 | Nov. 28, 2017 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100081 | 9kHz~30MHz | Dec. 06, 2016 | Jun. 02, 2017 | Dec. 05, 2017 | Conduction (CO05-HY) |



5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 2.7 |
|---|-----|

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

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 4.6 |
|---|-----|

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

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 4.5 |
|---|-----|

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

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 4.5 |
|---|-----|



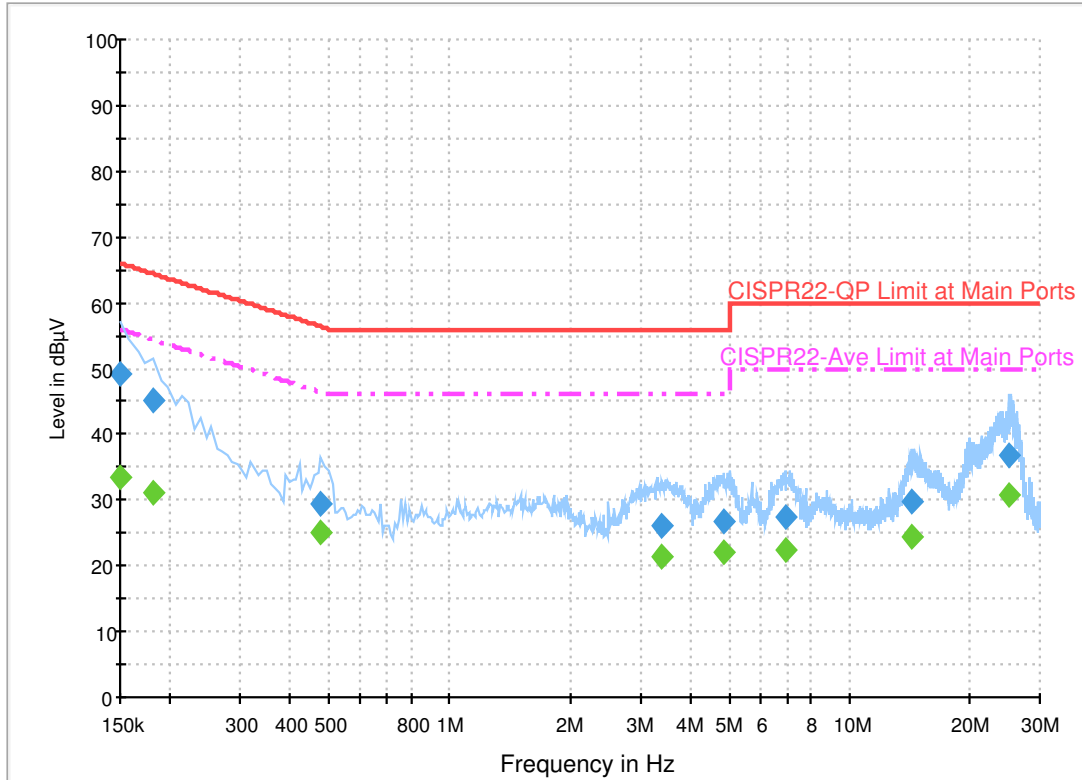
Appendix A. AC Conducted Emission Test Results

| | | | |
|-----------------|------------|---------------------|---------|
| Test Engineer : | Marlowe Ho | Temperature : | 24~25°C |
| | | Relative Humidity : | 58~60% |

EUT Information

Report NO : 732858
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Line

ENV216 Auto Test FCC Power Bar - L



Final Result 1

| Frequency (MHz) | QuasiPeak (dBµV) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|------------------|--------|------|------------|-------------|--------------|
| 0.150000 | 49.2 | Off | L1 | 19.6 | 16.8 | 66.0 |
| 0.182000 | 45.1 | Off | L1 | 19.6 | 19.3 | 64.4 |
| 0.478000 | 29.6 | Off | L1 | 19.6 | 26.8 | 56.4 |
| 3.382000 | 26.1 | Off | L1 | 19.6 | 29.9 | 56.0 |
| 4.846000 | 26.8 | Off | L1 | 19.8 | 29.2 | 56.0 |
| 6.934000 | 27.4 | Off | L1 | 19.9 | 32.6 | 60.0 |
| 14.350000 | 29.8 | Off | L1 | 20.3 | 30.2 | 60.0 |
| 25.198000 | 36.8 | Off | L1 | 20.8 | 23.2 | 60.0 |

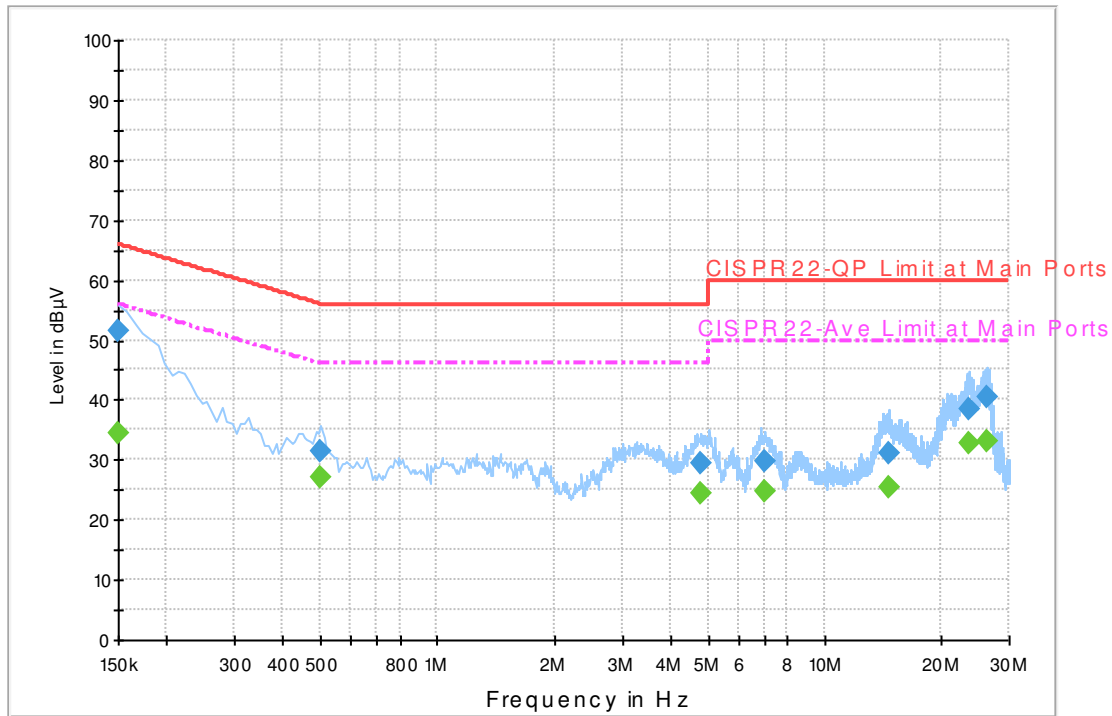
Final Result 2

| Frequency (MHz) | Average (dBµV) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|----------------|--------|------|------------|-------------|--------------|
| 0.150000 | 33.5 | Off | L1 | 19.6 | 22.5 | 56.0 |
| 0.182000 | 31.2 | Off | L1 | 19.6 | 23.2 | 54.4 |
| 0.478000 | 25.0 | Off | L1 | 19.6 | 21.4 | 46.4 |
| 3.382000 | 21.3 | Off | L1 | 19.6 | 24.7 | 46.0 |
| 4.846000 | 21.9 | Off | L1 | 19.8 | 24.1 | 46.0 |
| 6.934000 | 22.5 | Off | L1 | 19.9 | 27.5 | 50.0 |
| 14.350000 | 24.5 | Off | L1 | 20.3 | 25.5 | 50.0 |
| 25.198000 | 30.6 | Off | L1 | 20.8 | 19.4 | 50.0 |

EUT Information

Report NO : 732858
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Neutral

ENV216 Auto Test FCC Power Bar - N



Final Result 1

| Frequency (MHz) | QuasiPeak (dBµV) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|------------------|--------|------|------------|-------------|--------------|
| 0.150000 | 51.7 | Off | N | 19.5 | 14.3 | 66.0 |
| 0.502000 | 31.5 | Off | N | 19.5 | 24.5 | 56.0 |
| 4.806000 | 29.3 | Off | N | 19.7 | 26.7 | 56.0 |
| 7.014000 | 29.9 | Off | N | 19.9 | 30.1 | 60.0 |
| 14.758000 | 31.2 | Off | N | 20.4 | 28.8 | 60.0 |
| 23.534000 | 38.5 | Off | N | 20.9 | 21.5 | 60.0 |
| 26.374000 | 40.4 | Off | N | 21.0 | 19.6 | 60.0 |

Final Result 2

| Frequency (MHz) | Average (dBµV) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) |
|-----------------|----------------|--------|------|------------|-------------|--------------|
| 0.150000 | 34.3 | Off | N | 19.5 | 21.7 | 56.0 |
| 0.502000 | 27.0 | Off | N | 19.5 | 19.0 | 46.0 |
| 4.806000 | 24.6 | Off | N | 19.7 | 21.4 | 46.0 |
| 7.014000 | 24.8 | Off | N | 19.9 | 25.2 | 50.0 |
| 14.758000 | 25.4 | Off | N | 20.4 | 24.6 | 50.0 |
| 23.534000 | 32.8 | Off | N | 20.9 | 17.2 | 50.0 |
| 26.374000 | 33.2 | Off | N | 21.0 | 16.8 | 50.0 |



Appendix B. Radiated Spurious Emission

| | | | |
|-----------------|----------|---------------------|---------|
| Test Engineer : | Rich Sun | Temperature : | 21~23°C |
| | | Relative Humidity : | 41~43% |

2.4GHz 2400~2483.5MHz

BT 1Mbps (Band Edge @ 3m)

| BT | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) | |
|------------------------|------|----------------------|---------------------|-------------------------|-----------------------------|---------------------------|-------------------------------|-------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|---|
| BT CH00 2402MHz | | 2343.54 | 48.92 | -25.08 | 74 | 54.64 | 25.42 | 5.41 | 36.55 | 360 | 51 | P | H | |
| | | 2343.54 | 24.13 | -29.87 | 54 | - | - | - | - | - | - | A | H | |
| | * | 2402 | 88.44 | - | - | 93.59 | 25.8 | 5.47 | 36.42 | 360 | 51 | P | H | |
| | | 2402 | 63.65 | - | - | - | - | - | - | - | - | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | | H |
| | | | 2388.39 | 49.73 | -24.27 | 74 | 54.88 | 25.8 | 5.47 | 36.42 | 329 | 203 | P | V |
| | | | 2388.39 | 24.94 | -29.06 | 54 | - | - | - | - | - | - | A | V |
| | * | 2402 | 89.71 | - | - | 94.86 | 25.8 | 5.47 | 36.42 | 329 | 203 | P | V | |
| | | 2402 | 64.92 | - | - | - | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| BT CH 39 2441MHz | | 2378.64 | 50.24 | -23.76 | 74 | 55.58 | 25.67 | 5.45 | 36.46 | 400 | 48 | P | H | |
| | | 2378.64 | 25.45 | -28.55 | 54 | - | - | - | - | - | - | A | H | |
| | * | 2442 | 92.09 | - | - | 97.16 | 25.89 | 5.49 | 36.45 | 400 | 48 | P | H | |
| | | 2442 | 67.3 | - | - | - | - | - | - | - | - | A | H | |
| | | 2485.23 | 49.38 | -24.62 | 74 | 54.4 | 25.94 | 5.51 | 36.47 | 400 | 48 | P | H | |
| | | 2485.23 | 24.59 | -29.41 | 54 | - | - | - | - | - | - | A | H | |
| | | 2389.17 | 49.19 | -24.81 | 74 | 54.34 | 25.8 | 5.47 | 36.42 | 319 | 206 | P | V | |
| | | 2389.17 | 24.4 | -29.6 | 54 | - | - | - | - | - | - | A | V | |
| | * | 2442 | 92.21 | - | - | 97.28 | 25.89 | 5.49 | 36.45 | 319 | 206 | P | V | |
| | | 2442 | 67.42 | - | - | - | - | - | - | - | - | A | V | |
| | | 2497.34 | 49.11 | -24.89 | 74 | 54.1 | 25.97 | 5.52 | 36.48 | 319 | 206 | P | V | |
| | | 2497.34 | 24.32 | -29.68 | 54 | - | - | - | - | - | - | A | V | |



| | | | | | | | | | | | | | |
|---------------------------------|---|---------|-------|--------|----|-------|-------|------|-------|-----|-----|---|---|
| BT CH 78 2480MHz | * | 2480 | 89.49 | - | - | 94.51 | 25.94 | 5.51 | 36.47 | 362 | 52 | P | H |
| | | 2480 | 64.7 | - | - | - | - | - | - | - | - | A | H |
| | | 2484.46 | 49.98 | -24.02 | 74 | 55 | 25.94 | 5.51 | 36.47 | 362 | 52 | P | H |
| | | 2484.46 | 25.19 | -28.81 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 92.17 | - | - | 97.19 | 25.94 | 5.51 | 36.47 | 302 | 226 | P | V |
| | | 2480 | 67.38 | - | - | - | - | - | - | - | - | A | V |
| | | 2484.95 | 51.23 | -22.77 | 74 | 56.25 | 25.94 | 5.51 | 36.47 | 302 | 226 | P | V |
| | | 2484.95 | 26.44 | -27.56 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | <ol style="list-style-type: none"> 1. No other spurious found. 2. All results are PASS against Peak and Average 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:

| WIFI | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. |
|---------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| 1+2 | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| 802.11b | | 2390 | 55.45 | -18.55 | 74 | 54.51 | 32.22 | 4.58 | 35.86 | 103 | 308 | P | H |
| CH 01 | | | | | | | | | | | | | |
| 2412MHz | | 2390 | 43.54 | -10.46 | 54 | 42.6 | 32.22 | 4.58 | 35.86 | 103 | 308 | A | H |

- Level(dBμV/m) =
Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
- Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

- Level(dBμV/m)
= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)
= 55.45 (dBμV/m)
- Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 55.45(dBμV/m) – 74(dBμV/m)
= -18.55(dB)

For Average Limit @ 2390MHz:

- Level(dBμV/m)
= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)
= 43.54 (dBμV/m)
- 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”.



2.4GHz 2400~2483.5MHz

BT 2Mbps (Band Edge @ 3m)

| BT | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. | |
|------------------------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|---|
| | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) | |
| BT CH00 2402MHz | | 2357.45 | 49.37 | -24.63 | 74 | 54.9 | 25.55 | 5.43 | 36.51 | 360 | 51 | P | H | |
| | | 2357.45 | 24.58 | -29.42 | 54 | - | - | - | - | - | - | A | H | |
| | * | 2402 | 83.71 | - | - | 88.86 | 25.8 | 5.47 | 36.42 | 360 | 51 | P | H | |
| | | 2402 | 58.92 | - | - | - | - | - | - | - | - | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | | H |
| | | | 2379.29 | 49.74 | -24.26 | 74 | 55.08 | 25.67 | 5.45 | 36.46 | 329 | 203 | P | V |
| | | | 2379.29 | 24.95 | -29.05 | 54 | - | - | - | - | - | - | A | V |
| | * | | 2402 | 84.88 | - | - | 90.03 | 25.8 | 5.47 | 36.42 | 329 | 203 | P | V |
| | | | 2402 | 60.09 | - | - | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| BT CH 39 2441MHz | | 2374.35 | 50.43 | -23.57 | 74 | 55.77 | 25.67 | 5.45 | 36.46 | 400 | 48 | P | H | |
| | | 2374.35 | 25.64 | -28.36 | 54 | - | - | - | - | - | - | A | H | |
| | * | 2442 | 87.74 | - | - | 92.81 | 25.89 | 5.49 | 36.45 | 400 | 48 | P | H | |
| | | 2442 | 62.95 | - | - | - | - | - | - | - | - | A | H | |
| | | | 2489.57 | 49.58 | -24.42 | 74 | 54.57 | 25.97 | 5.52 | 36.48 | 400 | 48 | P | H |
| | | | 2489.57 | 24.79 | -29.21 | 54 | - | - | - | - | - | - | A | H |
| | | | 2377.21 | 50.1 | -23.9 | 74 | 55.44 | 25.67 | 5.45 | 36.46 | 319 | 207 | P | V |
| | | | 2377.21 | 25.31 | -28.69 | 54 | - | - | - | - | - | - | A | V |
| | * | | 2442 | 88.15 | - | - | 93.22 | 25.89 | 5.49 | 36.45 | 319 | 207 | P | V |
| | | | 2442 | 63.36 | - | - | - | - | - | - | - | - | A | V |
| | | | 2492.3 | 49.3 | -24.7 | 74 | 54.29 | 25.97 | 5.52 | 36.48 | 319 | 207 | P | V |
| | | | 2492.3 | 24.51 | -29.49 | 54 | - | - | - | - | - | - | A | V |



| | | | | | | | | | | | | | |
|---------------------------------|---|---------|-------|--------|----|-------|-------|------|-------|-----|-----|---|---|
| BT CH 78 2480MHz | * | 2480 | 84.27 | - | - | 89.29 | 25.94 | 5.51 | 36.47 | 362 | 51 | P | H |
| | | 2480 | 59.48 | - | - | - | - | - | - | - | - | A | H |
| | | 2492.65 | 49.53 | -24.47 | 74 | 54.52 | 25.97 | 5.52 | 36.48 | 362 | 51 | P | H |
| | | 2492.65 | 24.74 | -29.26 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 87.18 | - | - | 92.2 | 25.94 | 5.51 | 36.47 | 302 | 226 | P | V |
| | | 2480 | 62.39 | - | - | - | - | - | - | - | - | A | V |
| | | 2484.74 | 52.06 | -21.94 | 74 | 57.08 | 25.94 | 5.51 | 36.47 | 302 | 226 | P | V |
| | | 2484.74 | 27.27 | -26.73 | 54 | - | - | - | - | - | - | A | 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 BT (LF)

| BT | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | 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 | | 34.85 | 27.73 | -12.27 | 40 | 32.67 | 25.7 | 0.71 | 31.35 | - | - | P | H | |
| | | 46.49 | 26.41 | -13.59 | 40 | 38.79 | 18.2 | 0.84 | 31.42 | - | - | P | H | |
| | | 224.97 | 33.21 | -12.79 | 46 | 45.85 | 17.1 | 1.73 | 31.47 | - | - | P | H | |
| | | 345.25 | 36.54 | -9.46 | 46 | 43.9 | 21.58 | 2.29 | 31.23 | 100 | 36 | P | H | |
| | | 599.39 | 33.7 | -12.3 | 46 | 38.14 | 24.21 | 3.07 | 31.72 | | | P | H | |
| | | 800.18 | 33.21 | -12.79 | 46 | 32.6 | 28 | 3.59 | 30.98 | | | P | H | |
| | | | | | | | | | | | | | P | H |
| | | | | | | | | | | | | | P | H |
| | | | | | | | | | | | | | P | H |
| | | | | | | | | | | | | | P | H |
| | | | | | | | | | | | | | P | H |
| | | | | | | | | | | | | | P | H |
| | | | | | | | | | | | | | P | H |
| | | | 34.85 | 33.63 | -6.37 | 40 | 38.57 | 25.7 | 0.71 | 31.35 | 100 | 355 | P | V |
| | | | 45.52 | 26.99 | -13.01 | 40 | 38.89 | 18.7 | 0.83 | 31.43 | - | - | P | V |
| | | | 199.75 | 31.4 | -12.1 | 43.5 | 44.16 | 17 | 1.73 | 31.49 | - | - | P | V |
| | | | 233.7 | 31.71 | -14.29 | 46 | 44.31 | 17.13 | 1.73 | 31.46 | - | - | P | V |
| | | | 309.36 | 35.19 | -10.81 | 46 | 44.42 | 19.94 | 2.17 | 31.34 | - | - | P | V |
| | | | 600.36 | 30.91 | -15.09 | 46 | 35.37 | 24.2 | 3.07 | 31.73 | - | - | 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:

| WIFI | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. |
|---------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| 1+2 | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| 802.11b | | 2390 | 55.45 | -18.55 | 74 | 54.51 | 32.22 | 4.58 | 35.86 | 103 | 308 | P | H |
| CH 01 | | | | | | | | | | | | | |
| 2412MHz | | 2390 | 43.54 | -10.46 | 54 | 42.6 | 32.22 | 4.58 | 35.86 | 103 | 308 | A | H |

- Level(dBμV/m) =
Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
- Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

- Level(dBμV/m)
= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)
= 55.45 (dBμV/m)
- Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 55.45(dBμV/m) – 74(dBμV/m)
= -18.55(dB)

For Average Limit @ 2390MHz:

- Level(dBμV/m)
= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)
= 43.54 (dBμV/m)
- 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”.



2.4GHz 2400~2483.5MHz

BT 3Mbps (Band Edge @ 3m)

| BT | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. | |
|------------------------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|---|
| | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) | |
| BT CH00 2402MHz | | 2373.44 | 49.04 | -24.96 | 74 | 54.38 | 25.67 | 5.45 | 36.46 | 360 | 51 | P | H | |
| | | 2373.44 | 24.28 | -29.72 | 54 | - | - | - | - | - | - | A | H | |
| | * | 2402 | 83.66 | - | - | 88.81 | 25.8 | 5.47 | 36.42 | 360 | 51 | P | H | |
| | | 2402 | 58.9 | - | - | - | - | - | - | - | - | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | | H |
| | | | 2363.43 | 49.4 | -24.6 | 74 | 54.93 | 25.55 | 5.43 | 36.51 | 329 | 203 | P | V |
| | | | 2363.43 | 24.64 | -29.36 | 54 | - | - | - | - | - | - | A | V |
| | * | | 2402 | 84.65 | - | - | 89.8 | 25.8 | 5.47 | 36.42 | 329 | 203 | P | V |
| | | | 2402 | 59.89 | - | - | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| BT CH 39 2441MHz | | 2337.3 | 49.56 | -24.44 | 74 | 55.28 | 25.42 | 5.41 | 36.55 | 400 | 48 | P | H | |
| | | 2337.3 | 24.8 | -29.2 | 54 | - | - | - | - | - | - | A | H | |
| | * | 2442 | 87.81 | - | - | 92.88 | 25.89 | 5.49 | 36.45 | 400 | 48 | P | H | |
| | | 2442 | 63.05 | - | - | - | - | - | - | - | - | A | H | |
| | | 2495.17 | 49.91 | -24.09 | 74 | 54.9 | 25.97 | 5.52 | 36.48 | 400 | 48 | P | H | |
| | | 2495.17 | 25.15 | -28.85 | 54 | - | - | - | - | - | - | A | H | |
| | | 2338.6 | 49.35 | -24.65 | 74 | 55.07 | 25.42 | 5.41 | 36.55 | 319 | 207 | P | V | |
| | | 2338.6 | 24.59 | -29.41 | 54 | - | - | - | - | - | - | A | V | |
| | * | | 2442 | 88.36 | - | - | 93.43 | 25.89 | 5.49 | 36.45 | 319 | 207 | P | V |
| | | | 2442 | 63.6 | - | - | - | - | - | - | - | A | V | |
| | | | 2493.14 | 49.12 | -24.88 | 74 | 54.11 | 25.97 | 5.52 | 36.48 | 319 | 207 | P | V |
| | | | 2493.14 | 24.36 | -29.64 | 54 | - | - | - | - | - | A | V | |



| | | | | | | | | | | | | | |
|---------------------------------|---|---------|-------|--------|----|-------|-------|------|-------|-----|-----|---|---|
| BT CH 78 2480MHz | * | 2480 | 84.64 | - | - | 89.66 | 25.94 | 5.51 | 36.47 | 362 | 51 | P | H |
| | | 2480 | 59.88 | - | - | - | - | - | - | - | - | A | H |
| | | 2484.74 | 49.87 | -24.13 | 74 | 54.89 | 25.94 | 5.51 | 36.47 | 362 | 51 | P | H |
| | | 2484.74 | 25.11 | -28.89 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 87.6 | - | - | 92.62 | 25.94 | 5.51 | 36.47 | 302 | 226 | P | V |
| | | 2480 | 62.84 | - | - | - | - | - | - | - | - | A | V |
| | | 2485.23 | 50.59 | -23.41 | 74 | 55.61 | 25.94 | 5.51 | 36.47 | 302 | 226 | P | V |
| | | 2485.23 | 25.83 | -28.17 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average 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:

| WIFI | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. |
|---------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| 1+2 | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| 802.11b | | 2390 | 55.45 | -18.55 | 74 | 54.51 | 32.22 | 4.58 | 35.86 | 103 | 308 | P | H |
| CH 01 | | | | | | | | | | | | | |
| 2412MHz | | 2390 | 43.54 | -10.46 | 54 | 42.6 | 32.22 | 4.58 | 35.86 | 103 | 308 | A | H |

- Level(dBμV/m) =
Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
- Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

- Level(dBμV/m)
= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)
= 55.45 (dBμV/m)
- Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 55.45(dBμV/m) – 74(dBμV/m)
= -18.55(dB)

For Average Limit @ 2390MHz:

- Level(dBμV/m)
= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)
= 43.54 (dBμV/m)
- 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 : | Rich Sun | Temperature : | 21~23°C |
| | | Relative Humidity : | 41~43% |

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

| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|---|
| | BT CH00 2402MHz | |
| | Horizontal | Fundamental |
| Peak | <p>Site : 83CH00-K3 Condition : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SWT:Auto</p> | <p>Site : 83CH00-K3 Condition : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SWT:Auto</p> |



| | | |
|------|---|---|
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
| | BT CH00 2402MHz | |
| | Vertical | Fundamental |
| Peak | <p>Site Condition : : 83CH93-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SWT:Auto</p> | <p>Site Condition : : 83CH93-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SWT:Auto</p> |



| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|---|---|
| BT CH39 2441MHz | | |
| Horizontal | | Fundamental |
| Peak | <p>Site Condition : 83CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> | <p>Site Condition : 83CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |
| Peak | <p>Site Condition : 83CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> | Left blank |

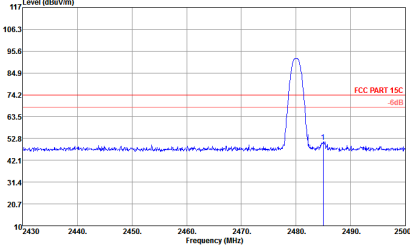
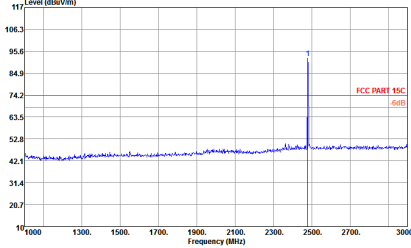


| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|---|---|
| BT CH39 2441MHz | | |
| | Vertical | Fundamental |
| Peak | <p>Site Condition : 83CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> | <p>Site Condition : 83CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |
| Peak | <p>Site Condition : 83CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> | Left blank |



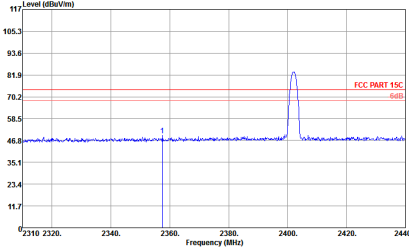
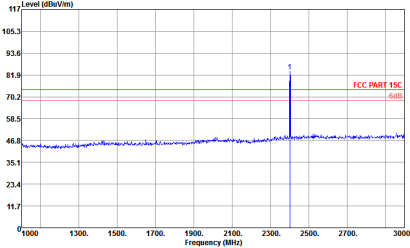
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|---|---|
| BT CH78 2480MHz | | |
| | Horizontal | Fundamental |
| Peak | <p>Site Condition : : 83CH93-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SWF:Auto</p> | <p>Site Condition : : 83CH93-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SWF:Auto</p> |



| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|---|--|
| BT CH78 2480MHz | | |
| | Vertical | Fundamental |
| Peak |  <p>Site Condition : 03SCH9-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |  <p>Site Condition : 03SCH9-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |



2.4GHz 2400~2483.5MHz
BT 2Mbps (Band Edge @ 3m)

| | | |
|------|---|--|
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
| | BT CH00 2402MHz | |
| | Horizontal | Fundamental |
| Peak |  <p>Site : 03CH03-KS Condition : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RSW:1000.000kHz VSW:1000.000kHz SWT:Auto</p> |  <p>Site : 03CH03-KS Condition : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RSW:1000.000kHz VSW:1000.000kHz SWT:Auto</p> |

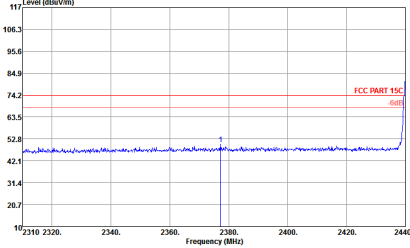
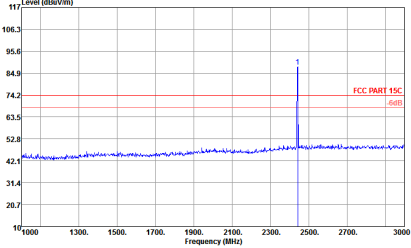
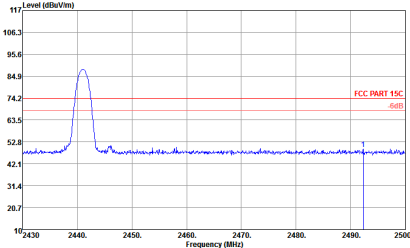


| | | |
|------|---|---|
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
| | BT CH00 2402MHz | |
| | Vertical | Fundamental |
| Peak | <p>Site Condition : : 03CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> | <p>Site Condition : : 03CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |

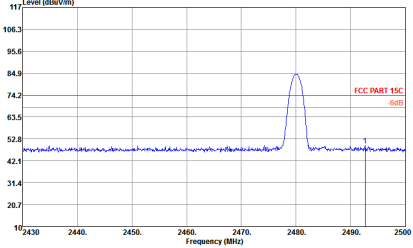
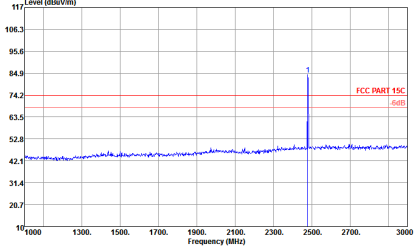


| | | |
|------|---|---|
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
| | BT CH39 2441MHz | |
| | Horizontal | Fundamental |
| Peak | <p>Site Condition : 03CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SWF:Auto</p> | <p>Site Condition : 03CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SWF:Auto</p> |
| Peak | <p>Site Condition : 03CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SWF:Auto</p> | Left blank |

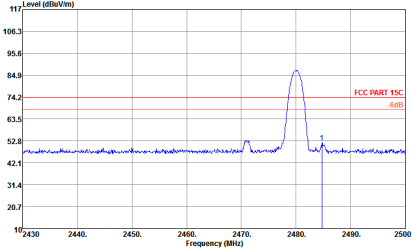
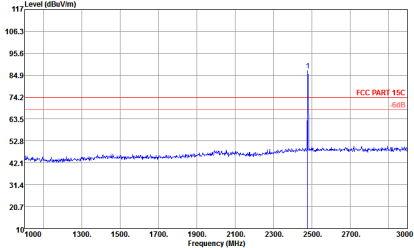


| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|---|--|
| BT CH39 2441MHz | | |
| Vertical | | Fundamental |
| Peak |  <p>Site Condition : 03CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |  <p>Site Condition : 03CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |
| Peak |  <p>Site Condition : 03CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> | Left blank |



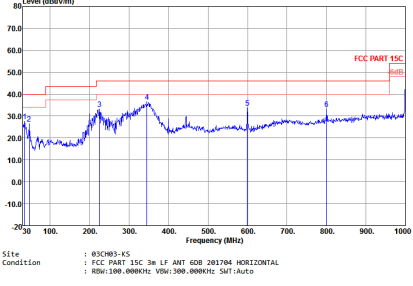
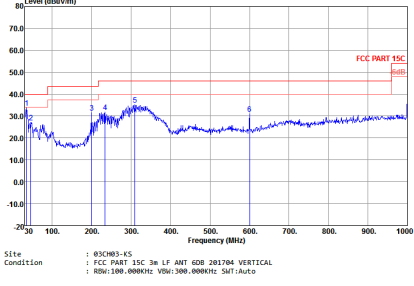
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|---|--|
| BT CH78 2480MHz | | |
| | Horizontal | Fundamental |
| Peak |  <p>Site Condition : : 03CWB3-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |  <p>Site Condition : : 03CWB3-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |



| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|---|--|
| BT CH78 2480MHz | | |
| | Vertical | Fundamental |
| Peak |  <p>Site Condition : 03CWB3-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |  <p>Site Condition : 03CWB3-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |

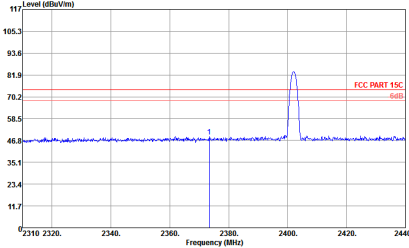
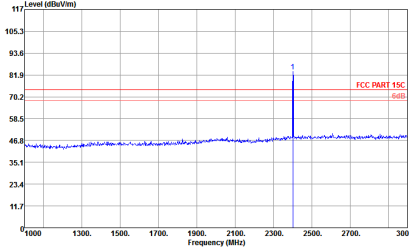


Emission below 1GHz
2.4GHz BT (LF)

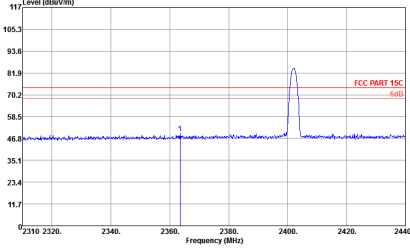
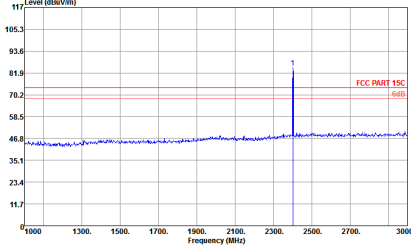
| BT | 2.4GHz 2400~2483.5MHz | |
|--------------|--|---|
| BT LF | | |
| Horizontal | | Vertical |
| QP / Peak |  <p>Site : 83CHS-KS Condition : FCC PART 15C 3m LF ANT 60B 201704 HORIZONTAL : Rbw:100.000kHz Vbw:300.000kHz SMT:Auto</p> |  <p>Site : 83CHS-KS Condition : FCC PART 15C 3m LF ANT 60B 201704 VERTICAL : Rbw:100.000kHz Vbw:300.000kHz SMT:Auto</p> |



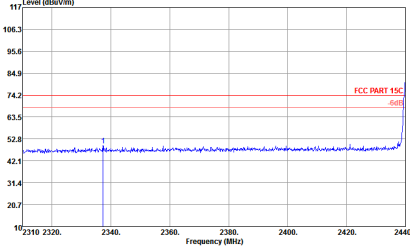
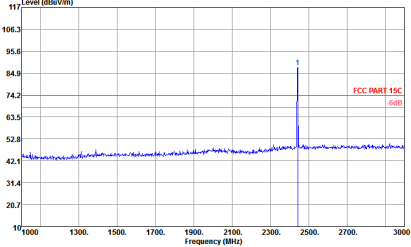
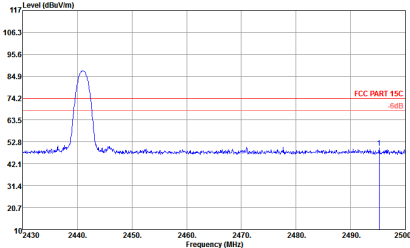
2.4GHz 2400~2483.5MHz
BT 3Mbps (Band Edge @ 3m)

| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|--|
| | BT CH00 2402MHz | |
| | Horizontal | Fundamental |
| Peak |  <p>Site : 03CH03-KS Condition : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RSW:1000.000kHz VSW:1000.000kHz SWT:Auto</p> |  <p>Site : 03CH03-KS Condition : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RSW:1000.000kHz VSW:1000.000kHz SWT:Auto</p> |

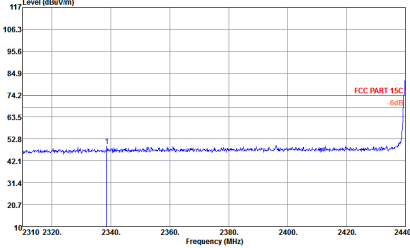
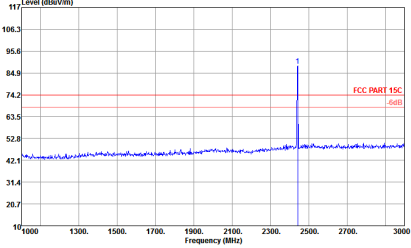
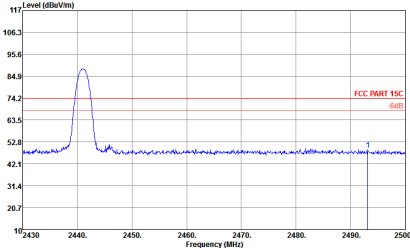


| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|--|---|
| BT CH00 2402MHz | | |
| | Vertical | Fundamental |
| Peak |  <p>Site Condition : : 83CH3-K5 : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SWT:Auto</p> |  <p>Site Condition : : 83CH3-K5 : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SWT:Auto</p> |

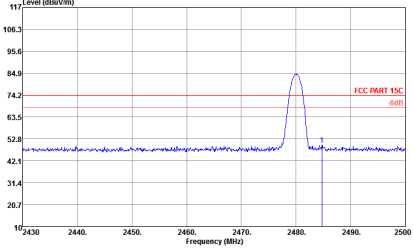
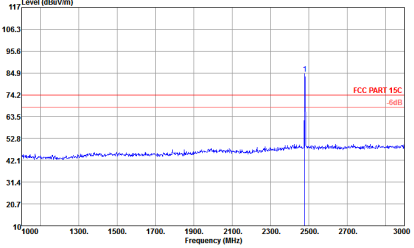


| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|--|---|
| BT CH39 2441MHz | | |
| | Horizontal | Fundamental |
| Peak |  <p>Site Condition : 03CW3-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RSN:1000.000kHz VSW:1000.000kHz SWT:Auto</p> |  <p>Site Condition : 03CW3-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RSN:1000.000kHz VSW:1000.000kHz SWT:Auto</p> |
| Peak |  <p>Site Condition : 03CW3-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RSN:1000.000kHz VSW:1000.000kHz SWT:Auto</p> | Left blank |

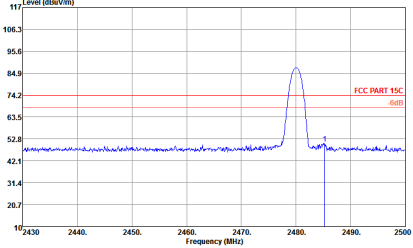
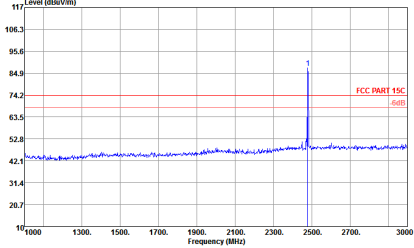


| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|---|--|
| BT CH39 2441MHz | | |
| | Vertical | Fundamental |
| Peak |  <p>Site Condition : 03CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |  <p>Site Condition : 03CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |
| Peak |  <p>Site Condition : 03CH03-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> | Left blank |



| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|---|--|
| BT CH78 2480MHz | | |
| | Horizontal | Fundamental |
| Peak |  <p>Site Condition : : 03CH93-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |  <p>Site Condition : : 03CH93-KS : FCC PART 15C 3m HF ANT-201704-91280 HORIZONTAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |

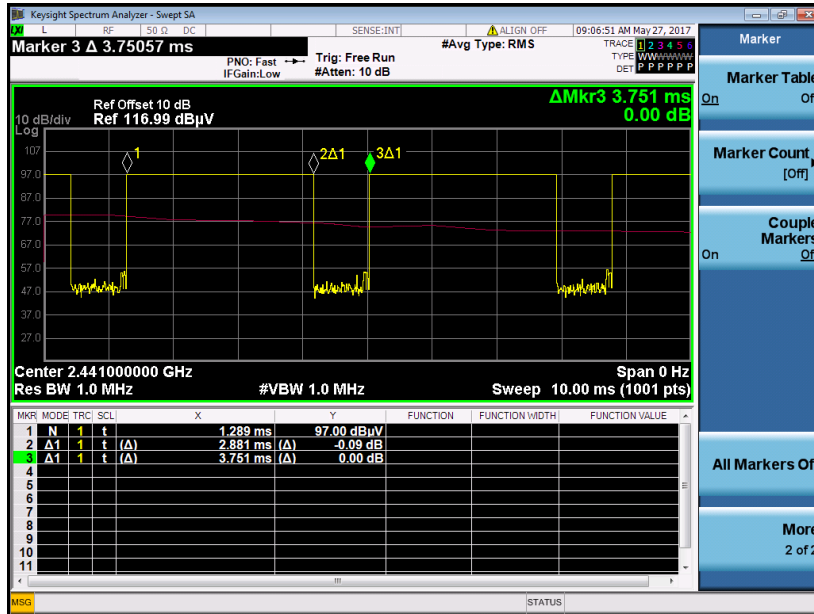


| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|---|--|
| BT CH78 2480MHz | | |
| | Vertical | Fundamental |
| Peak |  <p>Site Condition : 03CWB3-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |  <p>Site Condition : 03CWB3-KS : FCC PART 15C 3m HF ANT-201704-91280 VERTICAL : RBW:1000.000kHz VBW:1000.000kHz SMT:Auto</p> |

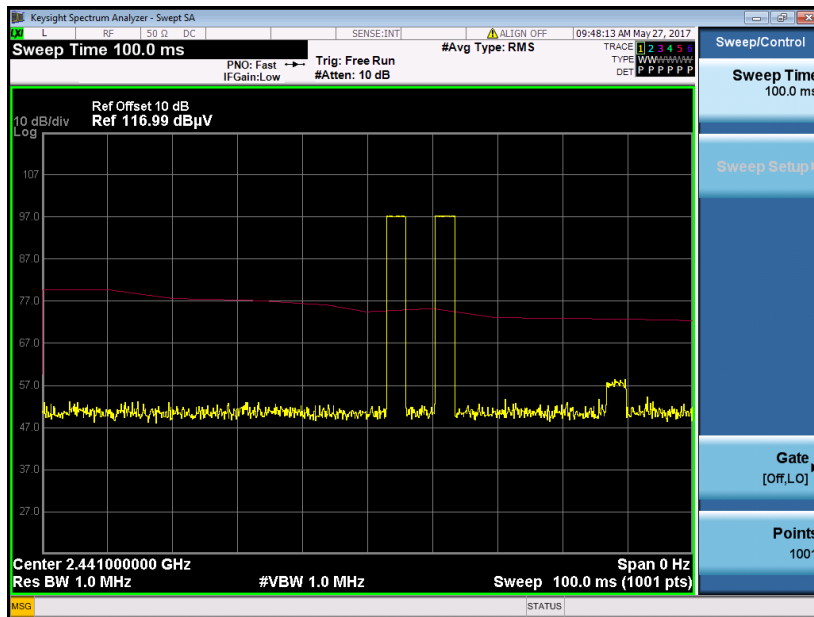


Appendix D. Duty Cycle Plots

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 = $2 * 2.88 / 100 = 5.76 \%$
2. Worst case Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -24.79 \text{ dB}$
3. DH5 as 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

$$2.88 \text{ ms} \times 20 \text{ channels} = 57.6 \text{ ms}$$

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:

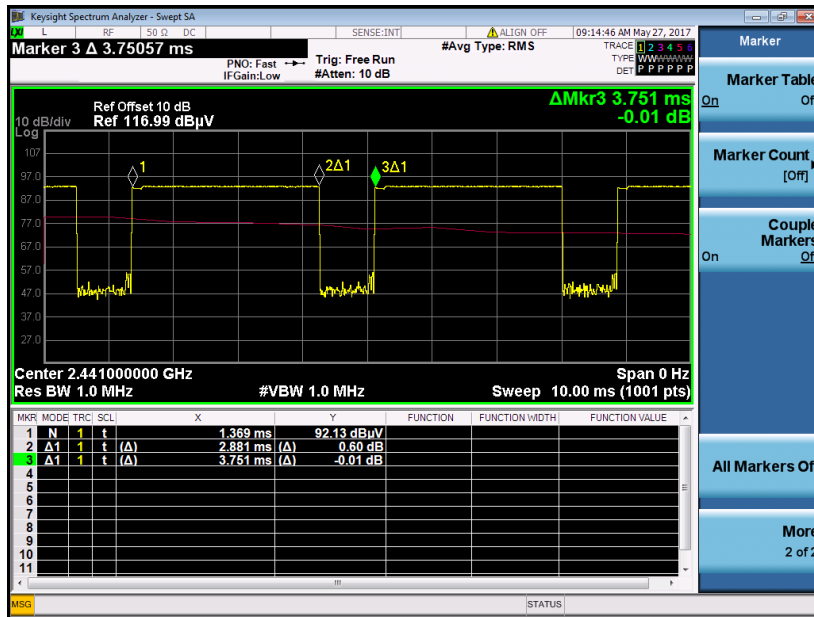
$$2.88 \text{ ms} \times 2 = 5.76 \text{ ms}$$

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

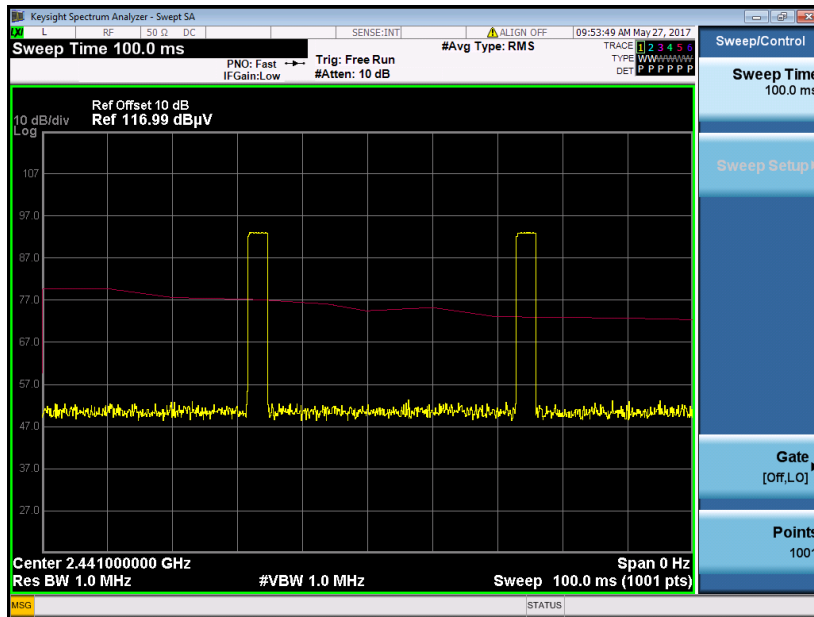
$$20 \times \log(5.76 \text{ ms}/100\text{ms}) = -24.79 \text{ dB}$$



2DH5 on time (One Pulse) Plot on Channel 39



on time (Count Pulses) Plot on Channel 39



Note:

4. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.88 / 100 = 5.76 %
5. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.79 dB
6. 2DH5 as 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

$$2.88 \text{ ms} \times 20 \text{ channels} = 57.6 \text{ ms}$$

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:

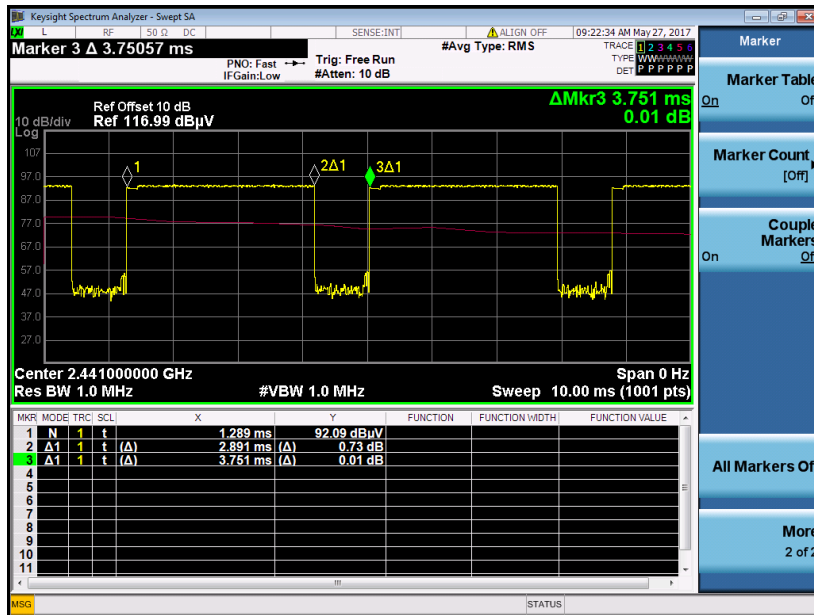
$$2.88 \text{ ms} \times 2 = 5.76 \text{ ms}$$

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

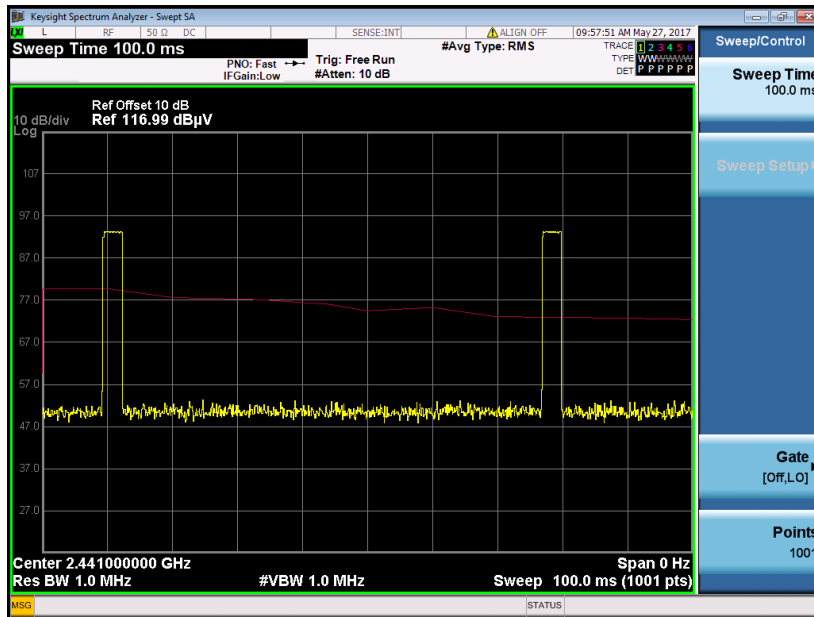
$$20 \times \log(5.76 \text{ ms}/100\text{ms}) = -24.79 \text{ dB}$$



3DH5 on time (One Pulse) Plot on Channel 39



on time (Count Pulses) Plot on Channel 39



Note:

7. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.89 / 100 = 5.78 %
8. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.76 dB
9. 3DH5 as 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

$$2.89 \text{ ms} \times 20 \text{ channels} = 57.8 \text{ ms}$$

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:

$$2.89 \text{ ms} \times 2 = 5.78 \text{ ms}$$

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

$$20 \times \log(5.78 \text{ ms}/100\text{ms}) = -24.76 \text{ dB}$$