# FCC RF Test Report

| | | |
|---|---|---|
| **APPLICANT** | : | **PAX Technology Limited** |
| **EQUIPMENT** | : | **Smart Tablet** |
| **BRAND NAME** | : | **PAX** |
| **MODEL NAME** | : | **Aries6** |
| **FCC ID** | : | **V5PAR6LITE** |
| **STANDARD** | : | **FCC Part 15 Subpart C §15.247** |
| **CLASSIFICATION** | : | **(DSS) Spread Spectrum Transmitter** |

**The product was received on Nov. 06, 2019 and testing was completed on Nov. 29, 2019. We, Sporton International (ShenZhen) 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 (ShenZhen) Inc., the test report shall not be reproduced except in full.**

**Reviewed by: Derreck Chen / Supervisor**

**Approved by: Eric Shih / Manager**

ACCREDITED Cert #5145.01

***Sporton International (ShenZhen) Inc.***

***1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055***

***People's Republic of China***

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# REVISION HISTORY

| REPORT NO. | VERSION | DESCRIPTION | ISSUED DATE |
|---|---|---|---|
| FR941109-01A | Rev. 01 | Initial issue of report | Dec. 19, 2019 |
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# SUMMARY OF TEST RESULT

| Report Section | FCC Rule | Description | Limit | Result | Remark |
|---|---|---|---|---|---|
| - | 15.247(a)(1) | Number of Channels | ≥ 15Chs | Pass | 1 |
| - | 15.247(a)(1) | Hopping Channel Separation | ≥ 2/3 of 20dB BW | Pass | 1 |
| - | 15.247(a)(1) | Dwell Time of Each Channel | ≤ 0.4sec in 31.6sec period | Pass | 1 |
| - | 15.247(a)(1) | 20dB Bandwidth | NA | Pass | 1 |
| - | - | 99% Bandwidth | - | Pass | 1 |
| - | 15.247(b)(1) | Peak Output Power | ≤ 125 mW | Pass | 1 |
| - | 15.247(d) | Conducted Band Edges | ≤ 20dBc | Pass | 1 |
| - | 15.247(d) | Conducted Spurious Emission | ≤ 20dBc | Pass | 1 |
| 3.1 | 15.247(d) | Radiated Band Edges and Radiated Spurious Emission | 15.209(a) & 15.247(d) | Pass | Under limit 9.26 dB at 30.000 MHz |
| 3.2 | 15.207 | AC Conducted Emission | 15.207(a) | Pass | Under limit 9.83 dB at 9.200 MHz |
| 3.3 | 15.203 & 15.247(b) | Antenna Requirement | N/A | Pass | - |
| **Remark 1:** Test items are performed on original report which can be referred to Sporton report number FR941109A. | | | | | |

| **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. |

# 1 General Description

## 1.1 Applicant

**PAX Technology Limited**
Room 2416, 24/F., Sun Hung Kai Centre, 30 Harbour Road, Wanchai, Hong Kong

## 1.2 Manufacturer

**PAX Computer Technology (Shenzhen) Co., Ltd.**
4/F, No.3 Building, Software Park, Second Central Science-Tech Road, High-Tech industrial Park, Shenzhen, Guangdong, P.R.C.

## 1.3 Product Feature of Equipment Under Test

| Product Feature | |
|---|---|
| **Equipment** | Smart Tablet |
| **Brand Name** | PAX |
| **Model Name** | Aries6 |
| **FCC ID** | V5PAR6LITE |
| **EUT supports Radios application** | WLAN 2.4GHz 802.11b/g/n HT20<br>WLAN 5GHz 802.11a/n HT20/HT40<br>WLAN 5GHz 802.11ac VHT20/VHT40/VHT80<br>Bluetooth BR / EDR / LE<br>NFC |
| **HW Version** | N/A |
| **SW Version** | N/A |
| **EUT Stage** | Production Unit |

**Remark:** The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

## 1.4 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 |
| **Antenna Type / Gain** | Internal Antenna with gain 1.50 dBi |
| **Type of Modulation** | Bluetooth BR (1Mbps) : GFSK<br>Bluetooth EDR (2Mbps) : $\pi$/4-DQPSK<br>Bluetooth EDR (3Mbps) : 8-DPSK |

## 1.5 Modification of EUT

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

## 1.6 Re-use of Measured Data

### 1.6.1 Introduction Section

This application re-uses data collected on a similar device. The subject device of this application (Model: Aries6, FCC ID: V5PAR6LITE) is electrically identical to the reference device (Model: Aries6, FCC ID: V5PAR6) for the portions of the circuitry corresponding to the data being re-used, as treated by KDB Publication 484596 D01.

### 1.6.2 Difference Section

For details concerning the similarity with respect to component placement, mechanical/electrical design etc., please refer to the Product Equality Declaration.

The re-used RF data includes the following bands provided in Appendix E (Sporton RF Report No. FR941109A for the reference device Model: Aries6, FCC ID: V5PAR6).

### 1.6.3 Reference detail Section:

| Equipment Class | Reference FCC ID | Folder Test | Report Title/Section |
|---|---|---|---|
| DSS (BR/EDR) | V5PAR6 | Part15C(FR941109A) | All sections applicable except AC Conducted Emission and RSE |
| DTS (BLE) | V5PAR6 | Part15C(FR941109B) | All sections applicable except AC Conducted Emission and RSE |
| DTS (WLAN) | V5PAR6 | Part15C(FR941109C) | All sections applicable except AC Conducted Emission and RSE |
| DXX(NFC) | V5PAR6 | Part15C(FR941109D) | All sections applicable except AC Conducted Emission and RSE |

### 1.6.4 Spot Check Verification Data Section

In order to confirm hardware similarity of the subject device with the reference device, spot check measurements were performed on the subject device for the following test items, the test result were consistent with FCC ID: V5PAR6.

Assertions concerning the similarity of these devices are based on representations by the applicant. The applicant accepts full responsibility for the validity of the similarity claim, and for the determination that verification test data are sufficient to support it.

| Test Item | Mode | V5PAR6 Worst Result | V5PAR6LITE Worst Result | Difference (dB) |
|---|---|---|---|---|
| Peak Conducted Power (dBm) | Bluetooth BR | 9.90 | 7.77 | -2.13 |
| | Bluetooth LE | 3.70 | 3.50 | -0.20 |
| | WLAN 802.11b | 16.10 | 15.50 | -0.60 |
| | WLAN 802.11a | 13.80 | 13.42 | -0.38 |
| Radiated Spurious Emission (Band Edge. Haromic) (dBuV/m) | NFC | 36.99 | 37.13 | 0.14 |

## 1.7 Testing Location

Sporton International (Shenzhen) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

| | | | |
|---|---|---|---|
| **Test Firm** | Sporton International (Shenzhen) Inc. | | |
| **Test Site Location** | 1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China<br>TEL: +86-755-86379589<br>FAX: +86-755-86379595 | | |
| **Test Site No.** | **Sporton Site No.** | **FCC Designation No.** | **FCC Test Firm Registration No.** |
| | CO01-SZ | CN1256 | 421272 |

| | | | |
|---|---|---|---|
| **Test Firm** | Sporton International (Shenzhen) Inc. | | |
| **Test Site Location** | No. 3 Bldg the third floor of south, Shahe River west, Fengzeyuan Warehouse, Nanshan Shenzhen, 518055 People's Republic of China<br>TEL: +86-755-33202398 | | |
| **Test Site No.** | **Sporton Site No.** | **FCC Designation No.** | **FCC Test Firm Registration No.** |
| | 03CH02-SZ | CN1256 | 421272 |

## 1.8 Test Software

| Item | Site | Manufacture | Name | Version |
|---|---|---|---|---|
| 1. | 03CH02-SZ | AUDIX | E3 | 6.2009-8-24a |
| 2. | CO01-SZ | AUDIX | E3 | 6.120613b |

## 1.9 Applicable Standards

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

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- 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: 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.

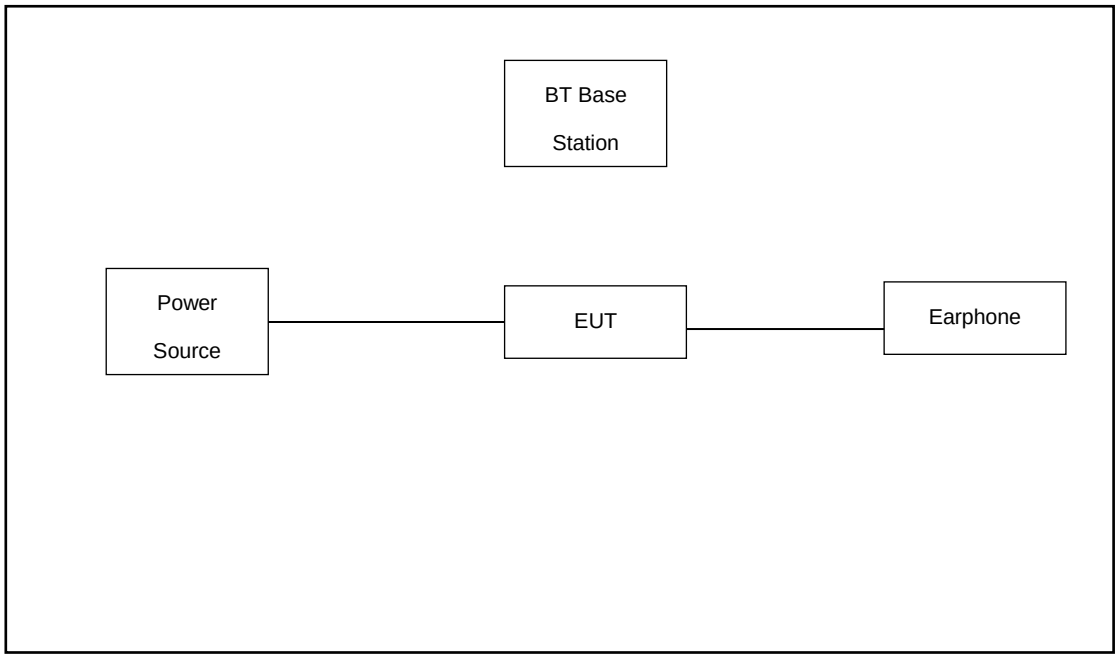
b. AC power line Conducted Emission was tested under maximum output power.

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

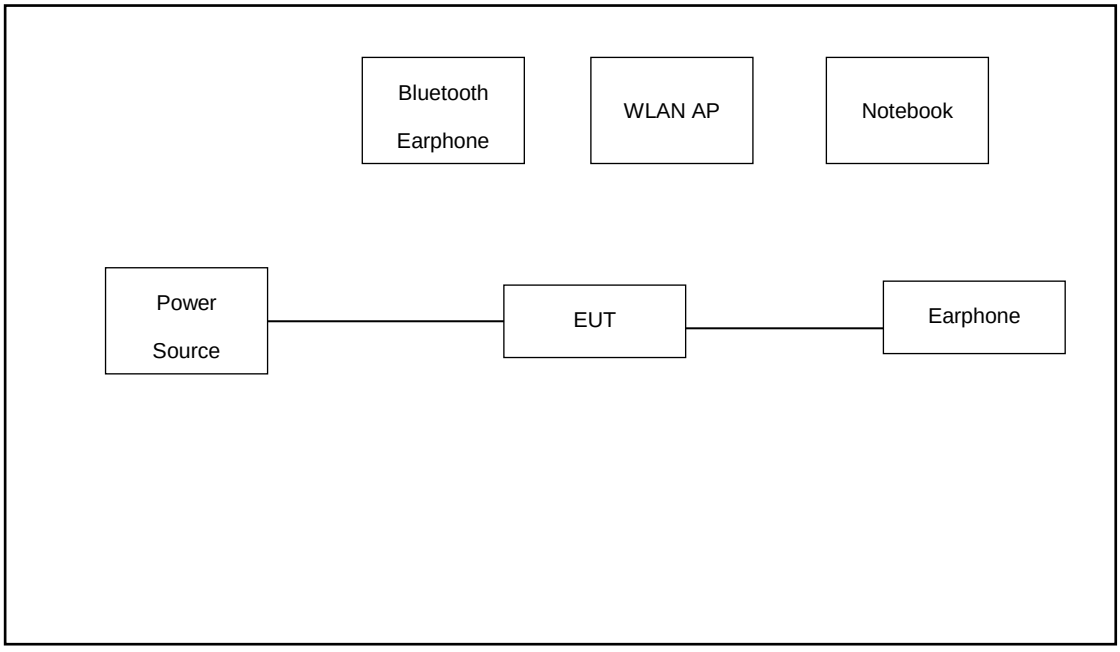
| Summary table of Test Cases | | | |
|---|---|---|---|
| **Test Item** | **Data Rate / Modulation** | | |
| | **Bluetooth BR 1Mbps GFSK** | **Bluetooth EDR 2Mbps π/4-DQPSK** | **Bluetooth EDR 3Mbps 8-DPSK** |
| **Conducted Test Cases** | Mode 1: CH00_2402 MHz<br>Mode 2: CH39_2441 MHz<br>Mode 3: CH78_2480 MHz | Mode 4: CH00_2402 MHz<br>Mode 5: CH39_2441 MHz<br>Mode 6: CH78_2480 MHz | Mode 7: CH00_2402 MHz<br>Mode 8: CH39_2441 MHz<br>Mode 9: CH78_2480 MHz |
| **Radiated Test Cases** | **Bluetooth BR 1Mbps GFSK** | | |
| | Mode 1: CH00_2402 MHz<br>Mode 2: CH39_2441 MHz<br>Mode 3: CH78_2480 MHz | | |
| **AC Conducted Emission** | Mode 1 : Bluetooth Link + WLAN Link (2.4G) + USB Cable(Charging from Adapter) + Earphone | | |
| **Remark:**<br>1. 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 no other significantly frequencies found in conducted spurious emission.<br>2. For Radiated Test Cases, The tests were performed with Adapter , Earphone and USB Cable . | | | |

## 2.3 Connection Diagram of Test System

For Radiation




For Conducted Emission



## 2.4 Support Unit used in test configuration and system

| Item | Equipment | Trade Name | Model Name | FCC ID | Data Cable | Power Cord |
|---|---|---|---|---|---|---|
| 1. | WLAN AP | Dlink | DIR-820L | KA2IR820LA1 | N/A | Unshielded,1.8m |
| 2. | Notebook | FCC DoC | FCC DoC | FCC DoC | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |
| 3. | Bluetooth Earphone | Samsung | EO-MG900 | PYAHS-107W | N/A | N/A |

## 2.5 EUT Operation Test Setup

For Bluetooth function, the engineering test program was provided and enabled to make EUT connect with Bluetooth base station to continuous transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

# 3 Test Result

## 3.1 Radiated Band Edges and Spurious Emission Measurement

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

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

| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 – 88 | 100 | 3 |
| 88 – 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

### 3.1.2 Measuring Instruments

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

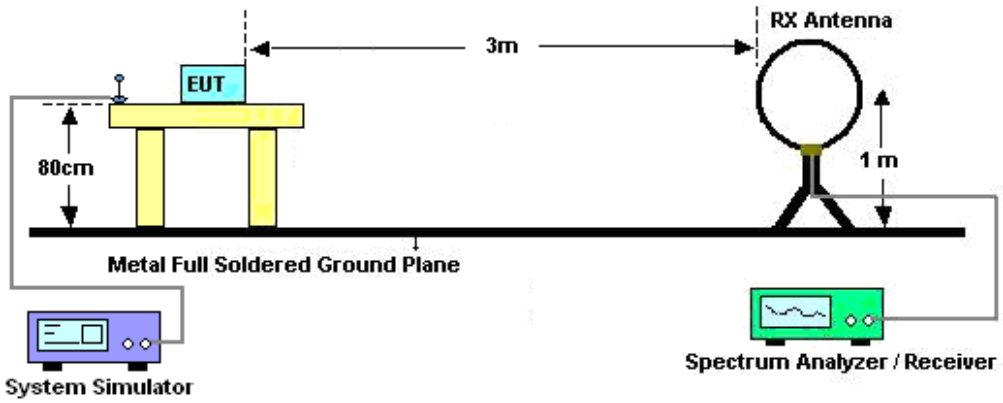
### 3.1.3 Test Procedures

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.
1. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
2. 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.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. 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>1GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement: use duty cycle correction factor method per 15.35(c).
   Duty cycle = On time/100 milliseconds
   On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+N_n*L_n$
   Where $N_1$ is number of type 1 pulses, $L_1$ is length of type 1 pulses, etc.
   Average Emission Level = Peak Emission Level + 20*log(Duty cycle)
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

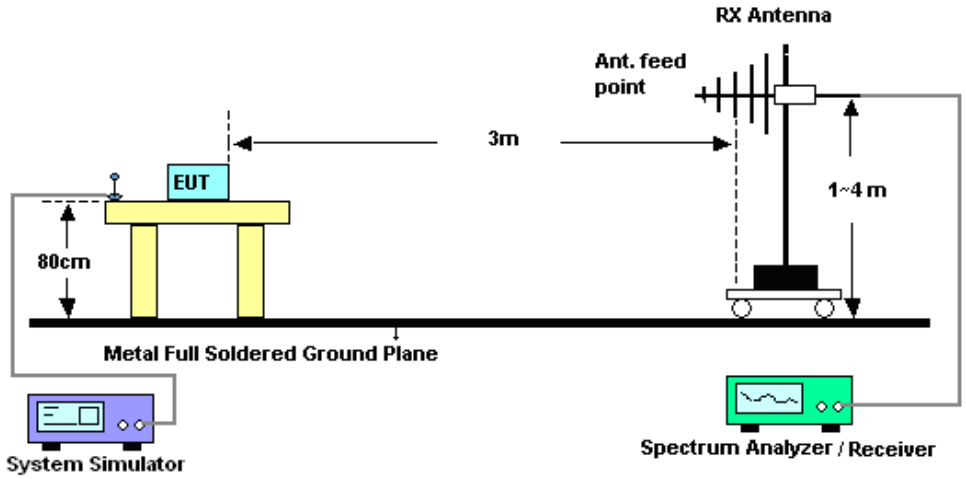
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent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

### 3.1.4 Test Setup

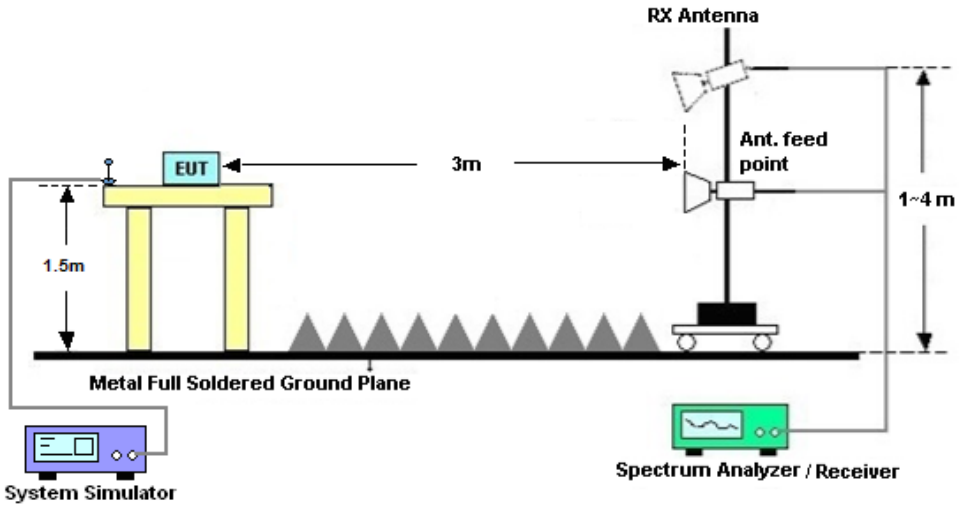
**For radiated emissions below 30MHz**




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




**For radiated emissions above 1GHz**



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

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

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

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

Please refer to Appendix B.

### 3.1.7 Test Result of Radiated Spurious Emission (30MHz ~ 10$^{th}$ Harmonic)

Please refer to Appendix B.

### 3.1.8 Duty cycle correction factor for average measurement

Please refer to Appendix C.

## 3.2 AC Conducted Emission Measurement

### 3.2.1 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 (dBμV) | |
|---|---|---|
| | 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.

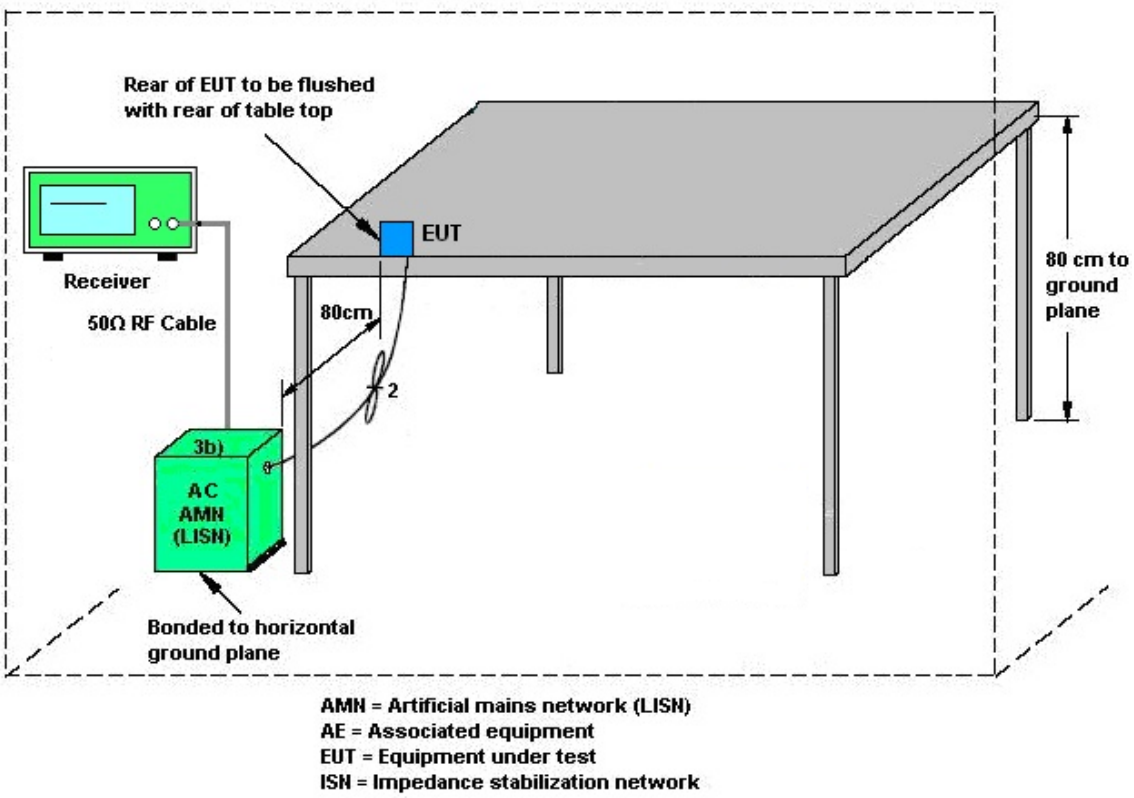
### 3.2.2 Measuring Instruments

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

### 3.2.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. 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.

### 3.2.4 Test Setup




AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

### 3.2.5 Test Result of AC Conducted Emission

Please refer to Appendix A.

## 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 |
|---|---|---|---|---|---|---|---|---|
| EXA Spectrum Analyzer | KEYSIGHT | N9010A | MY55150213 | 10Hz~44GHz | Apr. 19, 2019 | Nov. 29, 2019 | Apr. 18, 2020 | Radiation (03CH02-SZ) |
| Loop Antenna | R&S | HFH2-Z2 | 100354 | 9kHz~30MHz | May 29, 2018 | Nov. 29, 2019 | May 28, 2020 | Radiation (03CH02-SZ) |
| Bilog Antenna | TeseQ | CBL6112D | 35407 | 30MHz-2GHz | Jul. 19, 2019 | Nov. 29, 2019 | Jul. 18, 2020 | Radiation (03CH02-SZ) |
| Double Ridge Horn Antenna | SCHWARZBECK | BBHA 9120D | 9120D-1285 | 1GHz~18GHz | Jan. 07, 2019 | Nov. 29, 2019 | Jan. 06, 2020 | Radiation (03CH02-SZ) |
| HF Amplifier | MITEQ | TTA1840-35-HG | 1871923 | 18GHz~40GHz | Jul. 22, 2019 | Nov. 29, 2019 | Jul. 21, 2020 | Radiation (03CH02-SZ) |
| SHF-EHF Horn | com-power | AH-840 | 101071 | 18Ghz-40GHz | Apr. 18, 2019 | Nov. 29, 2019 | Apr. 17, 2020 | Radiation (03CH02-SZ) |
| LF Amplifier | Burgeon | BPA-530 | 102211 | 0.01~3000Mhz | Oct. 18, 2019 | Nov. 29, 2019 | Oct. 17, 2020 | Radiation (03CH02-SZ) |
| HF Amplifier | MITEQ | AMF-7D-00101800-30-10P-R | 1943528 | 1GHz~18GHz | Oct. 18, 2019 | Nov. 29, 2019 | Oct. 17, 2020 | Radiation (03CH02-SZ) |
| HF Amplifier | KEYSIGHT | 83017A | MY53270105 | 0.5GHz~26.5Ghz | Oct. 18, 2019 | Nov. 29, 2019 | Oct. 17, 2020 | Radiation (03CH02-SZ) |
| AC Power Source | Chroma | 61601 | 616010002470 | N/A | NCR | Nov. 29, 2019 | NCR | Radiation (03CH02-SZ) |
| Turn Table | Chaintek | T-200 | N/A | 0~360 degree | NCR | Nov. 29, 2019 | NCR | Radiation (03CH02-SZ) |
| Antenna Mast | Chaintek | MBS-400 | N/A | 1 m~4 m | NCR | Nov. 29, 2019 | NCR | Radiation (03CH02-SZ) |
| EMI Receiver | R&S | ESR7 | 101630 | 9kHz~7GHz; | Dec. 23, 2018 | Nov. 21, 2019 | Dec. 22, 2019 | Conduction (CO01-SZ) |
| AC LISN | EMCO | 3816/2SH | 00103912 | 9kHz~30MHz | Oct. 17, 2019 | Nov. 21, 2019 | Oct. 16, 2020 | Conduction (CO01-SZ) |
| AC LISN (for auxiliary equipment) | EMCO | 3816/2SH | 00103892 | 9kHz~30MHz | Dec. 23, 2018 | Nov. 21, 2019 | Dec. 22, 2019 | Conduction (CO01-SZ) |
| AC Power Source | Chroma | 61602 | 616020000891 | 100Vac~250Vac | Jul. 23, 2019 | Nov. 21, 2019 | Jul. 22, 2020 | Conduction (CO01-SZ) |

NCR: No Calibration Required

# 5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

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

| | |
|---|---|
| **Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))** | **2.6dB** |

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

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

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

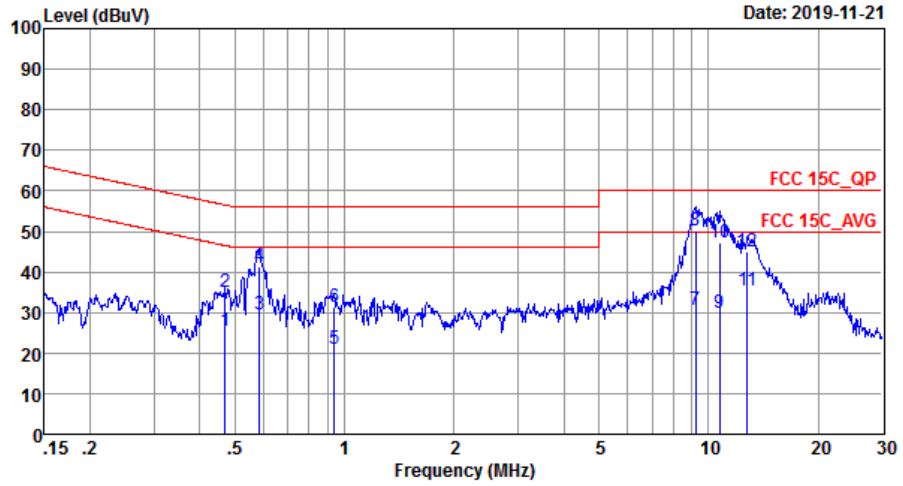
| | |
|---|---|
| **Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))** | **5.0dB** |

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

| | |
|---|---|
| **Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))** | **4.4dB** |

# Appendix A. AC Conducted Emission Test Results

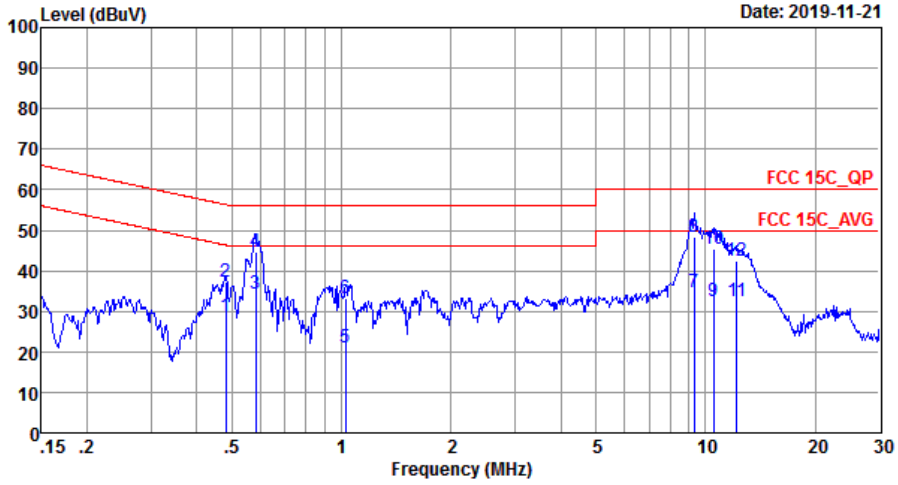
| | | | |
|---|---|---|---|
| **Test Engineer :** | Dalin Liu | **Temperature :** | 22~25℃ |
| | | **Relative Humidity :** | 50~55% |
| **Test Voltage :** | 120Vac / 60Hz | **Phase :** | Line |
| **Remark :** | All emissions not reported here are more than 10 dB below the prescribed limit. | | |




Site : CO01-SZ
Condition: FCC 15C_QP LISN_20190719_L LINE

| | | Freq | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | dB | |
| 1 | | 0.47 | 25.37 | -21.12 | 46.49 | 15.30 | 0.02 | 10.05 | Average |
| 2 | | 0.47 | 35.07 | -21.42 | 56.49 | 25.00 | 0.02 | 10.05 | QP |
| 3 | | 0.59 | 29.38 | -16.62 | 46.00 | 19.30 | 0.02 | 10.06 | Average |
| 4 | | 0.59 | 41.48 | -14.52 | 56.00 | 31.40 | 0.02 | 10.06 | QP |
| 5 | | 0.94 | 21.11 | -24.89 | 46.00 | 11.00 | 0.06 | 10.05 | Average |
| 6 | | 0.94 | 31.31 | -24.69 | 56.00 | 21.20 | 0.06 | 10.05 | QP |
| 7 | | 9.20 | 30.77 | -19.23 | 50.00 | 20.20 | 0.33 | 10.24 | Average |
| 8 | * | 9.20 | 50.17 | -9.83 | 60.00 | 39.60 | 0.33 | 10.24 | QP |
| 9 | | 10.73 | 29.94 | -20.06 | 50.00 | 19.30 | 0.38 | 10.26 | Average |
| 10 | | 10.73 | 47.14 | -12.86 | 60.00 | 36.50 | 0.38 | 10.26 | QP |
| 11 | | 12.78 | 35.42 | -14.58 | 50.00 | 24.70 | 0.45 | 10.27 | Average |
| 12 | | 12.78 | 44.92 | -15.08 | 60.00 | 34.20 | 0.45 | 10.27 | QP |

| | | | |
|---|---|---|---|
| **Test Engineer :** | Dalin Liu | **Temperature :** | 22~25℃ |
| | | **Relative Humidity :** | 50~55% |
| **Test Voltage :** | 120Vac / 60Hz | **Phase :** | Neutral |
| **Remark :** | All emissions not reported here are more than 10 dB below the prescribed limit. | | |




Site : CO01-SZ
Condition: FCC 15C_QP LISN_20190719_N NEUTRAL

| | | Freq | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV | dBuV | dB | dB | |
| 1 | | 0.48 | 28.67 | -17.65 | 46.32 | 18.60 | 0.02 | 10.05 | Average |
| 2 | | 0.48 | 37.37 | -18.95 | 56.32 | 27.30 | 0.02 | 10.05 | QP |
| 3 | | 0.58 | 34.38 | -11.62 | 46.00 | 24.30 | 0.02 | 10.06 | Average |
| 4 | * | 0.58 | 44.78 | -11.22 | 56.00 | 34.70 | 0.02 | 10.06 | QP |
| 5 | | 1.03 | 21.10 | -24.90 | 46.00 | 11.00 | 0.05 | 10.05 | Average |
| 6 | | 1.03 | 33.10 | -22.90 | 56.00 | 23.00 | 0.05 | 10.05 | QP |
| 7 | | 9.30 | 34.58 | -15.42 | 50.00 | 24.20 | 0.14 | 10.24 | Average |
| 8 | | 9.30 | 48.48 | -11.52 | 60.00 | 38.10 | 0.14 | 10.24 | QP |
| 9 | | 10.51 | 32.64 | -17.36 | 50.00 | 22.21 | 0.18 | 10.25 | Average |
| 10 | | 10.51 | 45.44 | -14.56 | 60.00 | 35.01 | 0.18 | 10.25 | QP |
| 11 | | 12.19 | 32.51 | -17.49 | 50.00 | 22.00 | 0.24 | 10.27 | Average |
| 12 | | 12.19 | 42.31 | -17.69 | 60.00 | 31.80 | 0.24 | 10.27 | QP |

Note:

1. Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
2. Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)

# Appendix B. Radiated Spurious Emission

**2.4GHz 2400~2483.5MHz**

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

| BT | Note | Frequency | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Ant Pos | Table Pos | Peak Avg. | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ( MHz ) | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| BT CH00 2402MHz | | 2387.07 | 41.61 | -32.39 | 74 | 39.17 | 27.7 | 7.54 | 32.8 | 187 | 27 | P | H |
| | | 2387.07 | 16.82 | -37.18 | 54 | - | - | - | - | 187 | 27 | A | H |
| | * | 2402 | 94.88 | - | - | 92.42 | 27.7 | 7.54 | 32.78 | 187 | 27 | P | H |
| | * | 2402 | 70.09 | - | - | - | - | - | - | 187 | 27 | A | H |
| | | 2339.29 | 41.98 | -32.02 | 74 | 39.42 | 27.9 | 7.48 | 32.82 | 114 | 246 | P | V |
| | | 2339.29 | 17.19 | -36.81 | 54 | - | - | - | - | 114 | 246 | A | V |
| | * | 2402 | 98.31 | - | - | 95.85 | 27.7 | 7.54 | 32.78 | 114 | 246 | P | V |
| | * | 2402 | 73.52 | - | - | - | - | - | - | 114 | 246 | A | V |
| BT CH 39 2441MHz | | 2361.24 | 41.48 | -32.52 | 74 | 38.96 | 27.83 | 7.51 | 32.82 | 102 | 160 | P | H |
| | | 2361.24 | 16.69 | -37.31 | 54 | - | - | - | - | 102 | 160 | A | H |
| | * | 2441 | 96.11 | - | - | 93.71 | 27.6 | 7.54 | 32.74 | 102 | 160 | P | H |
| | * | 2441 | 71.32 | - | - | - | - | - | - | 102 | 160 | A | H |
| | | 2489.01 | 40.88 | -33.12 | 74 | 38.67 | 27.4 | 7.53 | 32.72 | 102 | 160 | P | H |
| | | 2489.01 | 16.09 | -37.91 | 54 | - | - | - | - | 102 | 160 | A | H |
| | | 2389.52 | 42.3 | -31.7 | 74 | 39.86 | 27.7 | 7.54 | 32.8 | 100 | 247 | P | V |
| | | 2389.52 | 17.51 | -36.49 | 54 | - | - | - | - | 100 | 247 | A | V |
| | * | 2441 | 99.22 | - | - | 96.82 | 27.6 | 7.54 | 32.74 | 100 | 247 | P | V |
| | * | 2441 | 74.43 | - | - | - | - | - | - | 100 | 247 | A | V |
| | | 2487.33 | 42.67 | -31.33 | 74 | 40.39 | 27.47 | 7.53 | 32.72 | 100 | 247 | P | V |
| | | 2487.33 | 17.88 | -36.12 | 54 | - | - | - | - | 100 | 247 | A | V |

| 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 CH 78 2480MHz | * | 2480 | 95.36 | - | - | 93.08 | 27.47 | 7.53 | 32.72 | 145 | 24 | P | H |
| | * | 2480 | 70.57 | - | - | - | - | - | - | 145 | 24 | A | H |
| | | 2483.68 | 43.24 | -30.76 | 74 | 40.96 | 27.47 | 7.53 | 32.72 | 145 | 24 | P | H |
| | | 2483.68 | 18.45 | -35.55 | 54 | - | - | - | - | 145 | 24 | A | H |
| | * | 2480 | 96.46 | - | - | 94.18 | 27.47 | 7.53 | 32.72 | 100 | 247 | P | V |
| | * | 2480 | 71.67 | - | - | - | - | - | - | 100 | 247 | A | V |
| | | 2483.68 | 45.23 | -28.77 | 74 | 42.95 | 27.47 | 7.53 | 32.72 | 100 | 247 | P | V |
| | | 2483.68 | 20.44 | -33.56 | 54 | - | - | - | - | 100 | 247 | A | V |
| **Remark** | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |

**2.4GHz 2400~2483.5MHz**

**BT (Harmonic @ 3m)**

| BT | Note | Frequency ( MHz ) | Level ( dBμV/m ) | Over Limit ( dB ) | Limit Line ( dBμV/m ) | Read Level ( dBμV ) | Antenna Factor ( dB/m ) | Cable Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BT CH 00 2402MHz | | 4804 | 42.52 | -31.48 | 74 | 61.6 | 31.1 | 9.86 | 60.04 | 151 | 219 | P | H |
| | | 4804 | 17.73 | -36.27 | 54 | - | - | - | - | 151 | 219 | A | H |
| | | 4804 | 39.53 | -34.47 | 74 | 58.61 | 31.1 | 9.86 | 60.04 | 151 | 219 | P | V |
| | | 4804 | 14.74 | -39.26 | 54 | - | | - | | 151 | 219 | A | V |
| BT CH 39 2441MHz | | 4882 | 40.7 | -33.3 | 74 | 59.7 | 31.13 | 9.9 | 60.03 | 150 | 258 | P | H |
| | | 4882 | 15.91 | -38.09 | 54 | - | - | - | - | 150 | 258 | A | H |
| | | 7323 | 46.31 | -27.69 | 74 | 58.55 | 36.4 | 11.88 | 60.52 | 152 | 309 | P | H |
| | | 7323 | 21.52 | -32.48 | 54 | - | - | - | - | 152 | 309 | A | H |
| | | 4882 | 39.3 | -34.7 | 74 | 58.3 | 31.13 | 9.9 | 60.03 | 150 | 258 | P | V |
| | | 4882 | 14.51 | -39.49 | 54 | - | - | - | - | 150 | 258 | A | V |
| | | 7323 | 46.56 | -27.44 | 74 | 58.8 | 36.4 | 11.88 | 60.52 | 152 | 309 | P | V |
| | | 7323 | 21.77 | -32.23 | 54 | - | - | - | - | 152 | 309 | A | V |
| BT CH 78 2480MHz | | 4960 | 44.94 | -29.06 | 74 | 63.65 | 31.37 | 9.93 | 60.01 | 118 | 289 | P | H |
| | | 4960 | 20.15 | -33.85 | 54 | - | - | - | - | 118 | 289 | A | H |
| | | 7440 | 45.53 | -28.47 | 74 | 57.54 | 36.5 | 12.03 | 60.54 | 158 | 273 | P | H |
| | | 7440 | 20.74 | -33.26 | 54 | - | - | - | - | 158 | 273 | A | H |
| | | 4960 | 41.54 | -32.46 | 74 | 60.25 | 31.37 | 9.93 | 60.01 | 118 | 289 | P | V |
| | | 4960 | 16.75 | -37.25 | 54 | - | - | - | - | 118 | 289 | A | V |
| | | 7440 | 45.1 | -28.9 | 74 | 57.11 | 36.5 | 12.03 | 60.54 | 158 | 273 | P | V |
| | | 7440 | 20.31 | -33.69 | 54 | - | - | - | - | 158 | 273 | A | V |
| **Remark** | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |

## Emission below 1GHz

### 2.4GHz BT (LF)

| BT | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| | | ( MHz ) | ( dBµV/m ) | ( dB ) | ( dBµV/m ) | (dBµV) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| 2.4GHz BT LF | | 30 | 23.06 | -16.94 | 40 | 30.2 | 24.8 | 0.56 | 32.5 | 100 | 111 | P | H |
| | | 133.79 | 22.54 | -20.96 | 43.5 | 35.77 | 17.47 | 1.2 | 31.9 | - | - | P | H |
| | | 240.49 | 24.92 | -21.08 | 46 | 37.46 | 17.64 | 1.62 | 31.8 | - | - | P | H |
| | | 403.45 | 24.73 | -21.27 | 46 | 32.41 | 21.88 | 2.13 | 31.69 | - | - | P | H |
| | | 502.39 | 26.47 | -19.53 | 46 | 31.71 | 23.94 | 2.4 | 31.58 | - | - | P | H |
| | | 976.72 | 29.4 | -24.6 | 54 | 27.13 | 30.23 | 3.44 | 31.4 | - | - | P | H |
| | | 30 | 30.74 | -9.26 | 40 | 36.68 | 24.8 | 0.56 | 31.3 | 100 | 0 | P | V |
| | | 80.44 | 23.4 | -16.6 | 40 | 40.67 | 13.4 | 0.93 | 31.6 | - | - | P | V |
| | | 128.94 | 28.03 | -15.47 | 43.5 | 40.91 | 17.44 | 1.17 | 31.49 | - | - | P | V |
| | | 260.86 | 20.94 | -25.06 | 46 | 30.55 | 20.33 | 1.69 | 31.63 | - | - | P | V |
| | | 521.79 | 27.44 | -18.56 | 46 | 31.93 | 24.31 | 2.45 | 31.25 | - | - | P | V |
| | | 996.12 | 29.29 | -24.71 | 54 | 26.49 | 30.54 | 3.47 | 31.21 | - | - | P | V |
| **Remark** | 1. No other spurious found.<br>2. All results are PASS against limit line. | | | | | | | | | | | | |

**Note symbol**

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

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

| 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 CH 01 2412MHz | | 2390 | 55.45 | -18.55 | 74 | 54.51 | 32.22 | 4.58 | 35.86 | 103 | 308 | P | H |
| | | 2390 | 43.54 | -10.46 | 54 | 42.6 | 32.22 | 4.58 | 35.86 | 103 | 308 | A | H |

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

**For Peak Limit @ 2390MHz:**

1. 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)

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) + 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)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

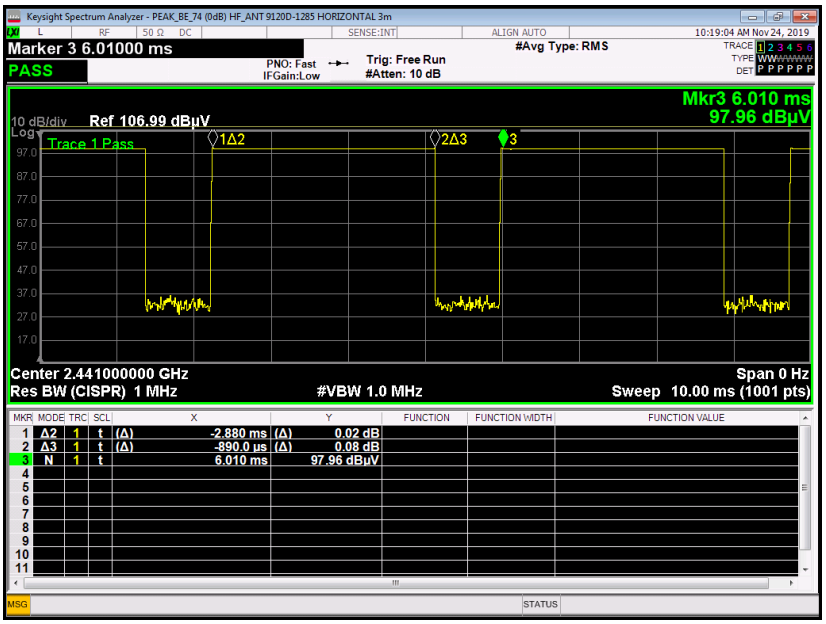
= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

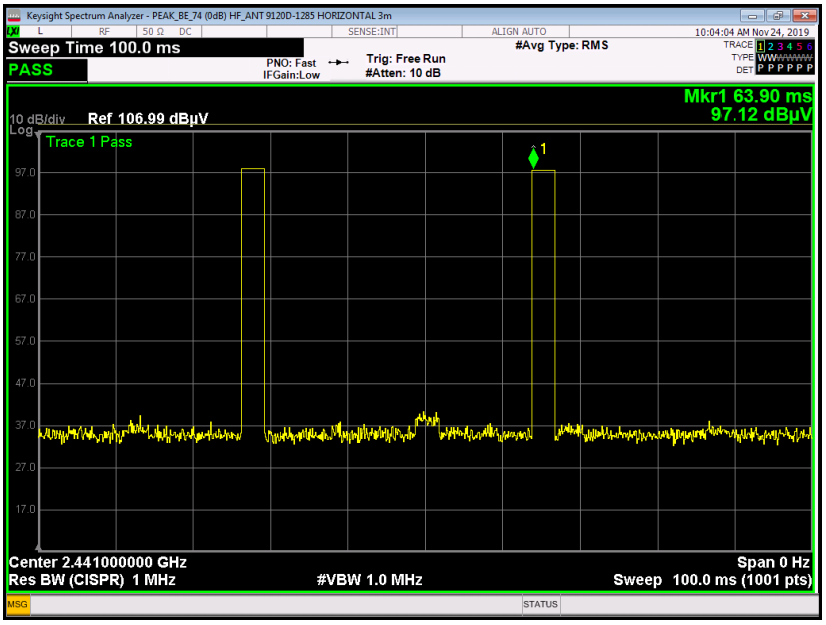
**Both peak and average measured complies with the limit line, so test result is "PASS".**

# Appendix C. Duty Cycle Plots

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




## DH5 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(Duty cycle) = -24.79 dB
3. DH5 has the highest duty cycle worst case and is reported.

# Appendix E. Reference Report

Please refer to Sporton report number FR941109A which is issued separately.