# FCC CO-LOCATION RADIO TEST REPORT

| | | |
|---|---|---|
| **FCC ID** | : | **A4RG025J** |
| **Equipment** | : | **Phone** |
| **Model Name** | : | **G025J, G025N, G025M** |
| **Applicant** | : | **Google LLC**<br>**1600 Amphitheatre Parkway,**<br>**Mountain View, California, 94043 USA** |
| **Standard** | : | **FCC Part 15 Subpart E §15.407** |

**The product was received on Jan. 20, 2020 and testing was started from Jan. 23, 2020 and completed on Feb. 17, 2020. We, SPORTON INTERNATIONAL INC., EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.**

**The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.**

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

Louis Wu

**Approved by: Louis Wu**

***SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory***
*No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)*

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# History of this test report

| Report No. | Version | Description | Issued Date |
|---|---|---|---|
| FR9D0616-05G | 01 | Initial issue of report | Mar. 24, 2020 |
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# Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|---|---|---|---|---|
| 3.1 | 15.407(b) | Unwanted Emissions | Pass | Under limit 1.83 dB at 2483.520 MHz |
| 3.2 | 15.203<br>15.407(a) | Antenna Requirement | Pass | - |

| **Declaration of Conformity:** |
|---|
| The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. |
| **Comments and Explanations:** |
| The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification. |

**Reviewed by: Wii Chang**

**Report Producer: Vivian Hsu**

# 1 General Description

## 1.1 Product Feature of Equipment Under Test

| Product Feature | |
|---|---|
| **Equipment** | Phone |
| **Model Name** | G025J, G025N, G025M |
| **FCC ID** | A4RG025J |
| **EUT supports Radios application** | CDMA/EV-DO/GSM/EGPRS/WCDMA/HSPA/LTE/NFC/GNSS<br>WLAN 11b/g/n HT20<br>WLAN 11a/n HT20/HT40<br>WLAN 11ac VHT20/VHT40/VHT80<br>Bluetooth BR/EDR/LE |
| **EUT Stage** | Identical Prototype |

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

| EUT Information List | |
|---|---|
| S/N | Performed Test Item |
| 01021FQC200294 | Radiated Spurious Emission |

## 1.2 Product Specification of Equipment Under Test

| Standards-related Product Specification | |
|---|---|
| **Tx/Rx Frequency Range** | 2400 MHz ~ 2483.5 MHz<br>5180 MHz ~ 5240 MHz<br>5260 MHz ~ 5320 MHz<br>5500 MHz ~ 5720 MHz<br>5745 MHz ~ 5825 MHz |
| **Antenna Type / Gain** | **WLAN:**<br>**<2400 MHz ~ 2483.5 MHz>**<br>Ant. 4 : PIFA Antenna with gain 0.50 dBi<br>Ant. 3 : PIFA Antenna with gain -0.60 dBi<br>**<5180 MHz ~ 5240 MHz>**<br>Ant. 4 : PIFA Antenna with gain -2.40 dBi<br>Ant. 3 : PIFA Antenna with gain -1.50 dBi<br>**<5260 MHz ~ 5320 MHz>**<br>Ant. 4 : PIFA Antenna with gain 0.20 dBi<br>Ant. 3 : PIFA Antenna with gain -1.00 dBi<br>**<5500 MHz ~ 5720 MHz>**<br>Ant. 4 : PIFA Antenna with gain -0.70 dBi<br>Ant. 3 : PIFA Antenna with gain -0.90 dBi<br>**<5745 MHz ~ 5825 MHz>**<br>Ant. 4 : PIFA Antenna with gain -1.70 dBi<br>Ant. 3 : PIFA Antenna with gain -0.50 dBi<br>**Bluetooth:** PIFA Antenna with gain 0.50 dBi |
| **Type of Modulation** | 802.11g : OFDM (BPSK / QPSK / 16QAM / 64QAM)<br>802.11a : OFDM (BPSK / QPSK / 16QAM / 64QAM) |

## 1.3 Modification of EUT

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

## 1.4 Testing Location

| | |
|---|---|
| **Test Site** | SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory |
| **Test Site Location** | No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist.,<br>Taoyuan City, Taiwan (R.O.C.)<br>TEL: +886-3-327-0868<br>FAX: +886-3-327-0855 |
| **Test Site No.** | **Sporton Site No.** |
| | 03CH16-HY |

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

FCC designation No.: TW0007

## 1.5 Applicable Standards

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

- FCC Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- 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

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report.

## 2.1 Carrier Frequency and Channel

| 2400-2483.5 MHz Bluetooth | | 2400-2483.5 MHz Bluetooth-LE | | 2400-2483.5 MHz 802.11g | | 5150-5250 MHz 802.11a | |
|---|---|---|---|---|---|---|---|
| Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
| 78 | 2480 | 39 | 2480 | 11 | 2462 | 36 | 5180 |

## 2.2 Test Mode

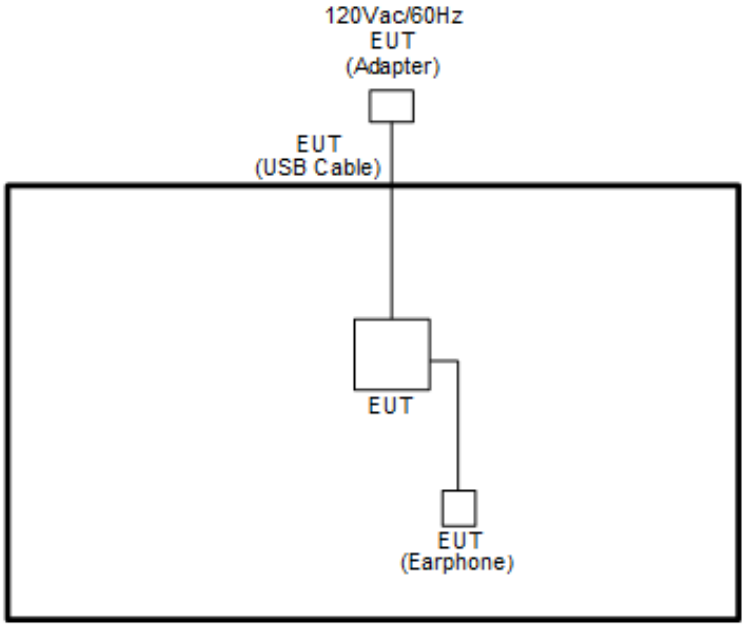
**Final test modes are considering the modulation and worse data rates as below table.**

**<Co-Location>**

| Modulation | Data Rate |
|---|---|
| **Bluetooth Ant. 4 + 5GHz 802.11a for MIMO Ant. 4+3** | **1Mbps + 6Mbps** |
| **Bluetooth LE Ant. 4 + 5GHz 802.11a for MIMO Ant. 4+3** | **1Mbps + 6Mbps** |
| **WLAN 2.4GHz Ant. 4 + 5GHz 802.11a for Ant. 3** | **1Mbps + 6Mbps** |

**Remark:** All the tests were performed with Adapter 1, Battery 1 and USB Cable 1.

## 2.3 Connection Diagram of Test System




## 2.4 EUT Operation Test Setup

The RF test items, utility “QRCT v3.0.298.0” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

# 3 Test Result

## 3.1 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

### 3.1.1 Limit of Unwanted Emissions

(1) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table:

| 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 |

**Note:** The following formula is used to convert the EIRP to field strength.

$$E=\frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts)

| EIRP (dBm) | Field Strength at 3m (dBμV/m) |
|---|---|
| - 27 | 68.3 |

(2) KDB789033 D02 v02r01 G)2)c)

(i) Sections 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of −27 dBm/MHz.

(ii) Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are based on the use of a peak detector.

### 3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

### 3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.

   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz

   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

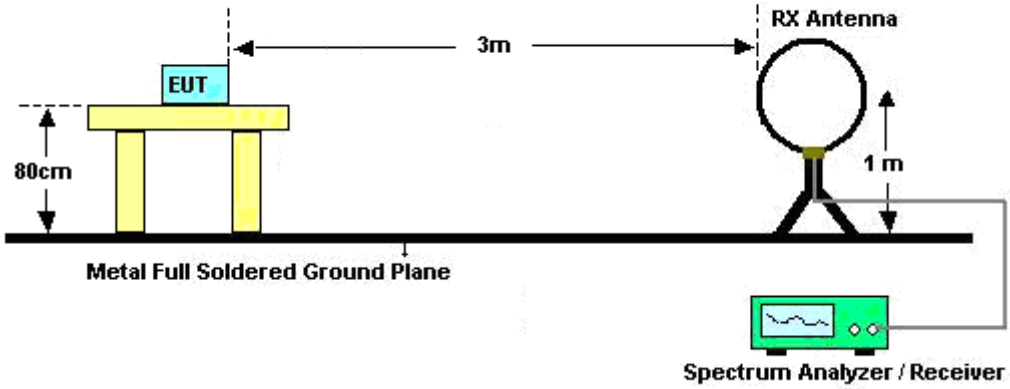
   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

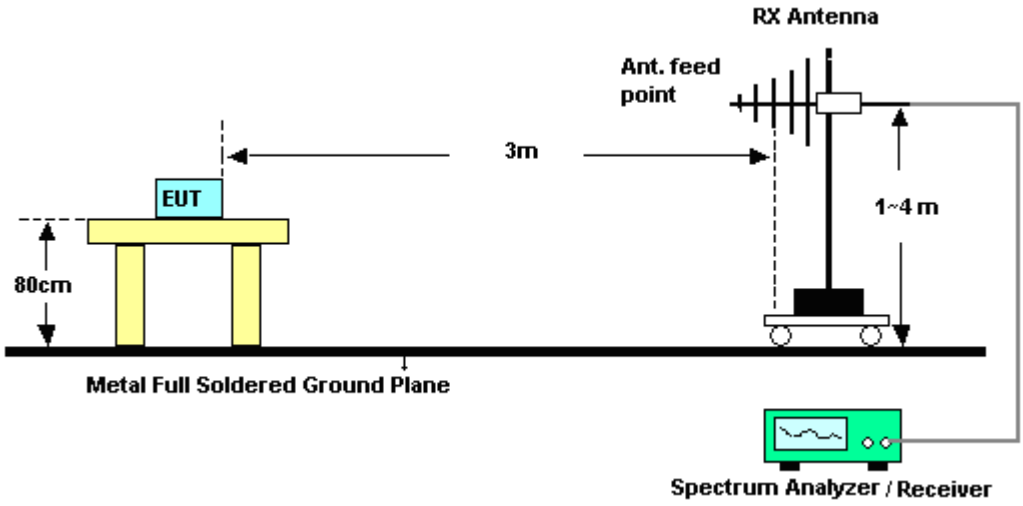
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. 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.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
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.

### 3.1.4 Test Setup

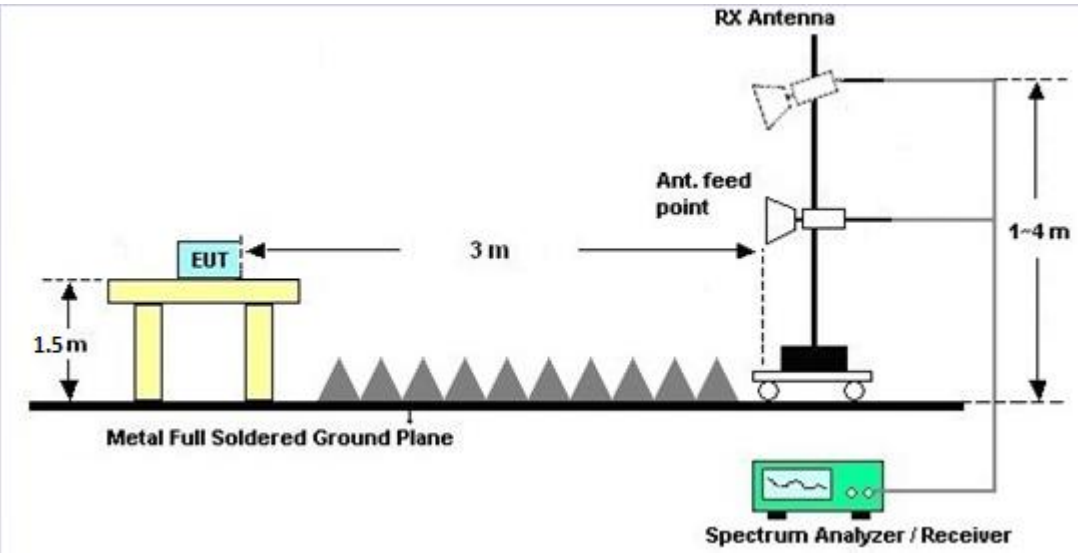
**For radiated emissions below 30MHz**




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



**For radiated emissions above 1GHz**




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

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

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

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

Please refer to Appendix A and B.

### 3.1.7 Duty Cycle

Please refer to Appendix C.

### 3.1.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix A and B.

## 3.2 Antenna Requirements

### 3.2.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 3.2.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

### 3.2.3 Antenna Gain

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

# 4 List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|---|---|---|---|---|---|---|---|---|
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100488 | 9 kHz~30 MHz | Dec. 26, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Dec. 25, 2020 | Radiation (03CH16-HY) |
| Bilog Antenna | TESEQ | CBL6111D&00802N1D01N-06 | 47020&06 | 30MHz to 1GHz | Oct. 13, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Oct. 12, 2020 | Radiation (03CH16-HY) |
| Horn Antenna | SCHWARZBECK | BBHA 9120 D | 9120D-1522 | 1G~18GHz | Sep. 19, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Sep. 18, 2020 | Radiation (03CH16-HY) |
| Amplifier | SONOMA | 310N | 371607 | 9kHz~1000MHz | Oct. 01, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Sep. 30, 2020 | Radiation (03CH16-HY) |
| Preamplifier | Jet-Power | JPA0118-55-303 | 1710001800054001 | 1GHz~18GHz | May 19, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | May 18, 2020 | Radiation (03CH16-HY) |
| Preamplifier | EMEC | EMC184045B | 980192 | 18GHz ~40GHz | Jul. 10, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Jul. 09, 2020 | Radiation (03CH16-HY) |
| Preamplifier | Keysight | 83017A | MY53270264 | 1GHz~26.5GHz | Dec. 11, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Dec.10, 2020 | Radiation (03CH16-HY) |
| EMI Test Receiver | Keysight | N9038A (MXE) | MY55420170 | 20MHz~8.4GHz | Mar. 08, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Mar. 07, 2020 | Radiation (03CH16-HY) |
| Spectrum Analyzer | Agilent | E4446A | MY50180136 | 3Hz~44GHz | Apr. 29, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Apr. 28, 2020 | Radiation (03CH16-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY11680/4PE | NA | Aug. 30, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Aug. 29, 2020 | Radiation (03CH16-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY11688/4PE | NA | Aug. 30, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Aug. 29, 2020 | Radiation (03CH16-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | EC-A5-300-5757 | NA | Aug. 30, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Aug. 29, 2020 | Radiation (03CH16-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 505134/2 | 30MHz~40GHz | Feb. 26, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Feb. 25, 2020 | Radiation (03CH16-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 800740/2 | 30MHz~40GHz | Feb. 26, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Feb. 25, 2020 | Radiation (03CH16-HY) |
| SHF-EHF Horn Antenna | SCHWARZBECK | BBHA 9170 | BBHA9170576 | 18GHz~40GHz | May 14, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | May 13, 2020 | Radiation (03CH16-HY) |
| Preamplifier | EMEC | EM18G40G | 060715 | 18GHz~40GHz | Dec. 13, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Dec. 12, 2020 | Radiation (03CH16-HY) |
| Hygrometer | TECPEL | DTM-303B | TP161243 | N/A | Oct. 25, 2019 | Jan. 23, 2020~ Feb. 17, 2020 | Oct. 24, 2020 | Radiation (03CH16-HY) |
| Software | Audix | E3 6.2009-8-24 | RK-001136 | N/A | N/A | Jan. 23, 2020~ Feb. 17, 2020 | N/A | Radiation (03CH16-HY) |

# 5 Uncertainty of Evaluation

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

| | |
|---|---|
| **Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))** | **4.9** |

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

| | |
|---|---|
| **Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))** | **6.7** |

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

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

# Appendix A. Radiated Spurious Emission

| Test Engineer : | Jacky Hung, Andy Yang and CR Liao | Temperature : | 20~25°C |
|---|---|---|---|
| | | Relative Humidity : | 50~60% |

**Band 1 - 5150~5250MHz**

**WIFI 802.11a (Band Edge @ 3m)**

| WIFI Ant. | Note | Frequency | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Path Loss | Preamp Factor | Ant Pos | Table Pos | Peak Avg. | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Simultaneously | | ( MHz ) | ( dBµV/m ) | ( dB ) | ( dBµV/m ) | (dBµV) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| BT CH78 2480 MHz Ant. 4 + 802.11a CH36 5180 MHz Ant. 4+3 | | 5146.64 | 58.37 | -15.63 | 74 | 43.19 | 31.71 | 12.32 | 28.85 | 101 | 1 | P | H |
| | | 5149.24 | 48.06 | -5.94 | 54 | 32.89 | 31.7 | 12.32 | 28.85 | 101 | 1 | A | H |
| | * | 5180 | 110.51 | - | - | 95.44 | 31.58 | 12.36 | 28.87 | 101 | 1 | P | H |
| | * | 5180 | 102.8 | - | - | 87.73 | 31.58 | 12.36 | 28.87 | 101 | 1 | A | H |
| | | | | | | | | | | | | P | H |
| | | | | | | | | | | | | A | H |
| | | 5149.5 | 56.57 | -17.43 | 74 | 41.4 | 31.7 | 12.32 | 28.85 | 101 | 104 | P | V |
| | | 5149.76 | 45.24 | -8.76 | 54 | 30.07 | 31.7 | 12.32 | 28.85 | 101 | 104 | A | V |
| | * | 5180 | 104.12 | - | - | 89.05 | 31.58 | 12.36 | 28.87 | 101 | 104 | P | V |
| | * | 5180 | 96.9 | - | - | 81.83 | 31.58 | 12.36 | 28.87 | 101 | 104 | A | V |
| | | | | | | | | | | | | P | V |
| | | | | | | | | | | | | 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 (Band Edge @ 3m)**

| WIFI | Note | Frequency | Level | Over | Limit | Read | Antenna | Path | Preamp | Ant | Table | Peak | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| Simultaneously | | ( MHz ) | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | (dBμV) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| | * | 2480 | 104.52 | - | - | 98.48 | 27.54 | 8.32 | 29.82 | 347 | 52 | P | H |
| | * | 2480 | 79.76 | - | - | - | - | - | - | - | - | A | H |
| | | 2483.76 | 54.66 | -19.34 | 74 | 48.63 | 27.53 | 8.32 | 29.82 | 347 | 52 | P | H |
| BT | | 2483.76 | 29.9 | -24.1 | 54 | - | - | - | - | - | - | A | H |
| CH78 | | | | | | | | | | | | | H |
| 2480 MHz | | | | | | | | | | | | | H |
| Ant. 4 | | | | | | | | | | | | | H |
| + | | | | | | | | | | | | | H |
| 802.11a | * | 2480 | 111.91 | - | - | 105.87 | 27.54 | 8.32 | 29.82 | 257 | 293 | P | V |
| CH36 | * | 2480 | 87.15 | - | - | - | - | - | - | - | - | A | V |
| 5180 MHz | | 2483.52 | 62.23 | -11.77 | 74 | 56.2 | 27.53 | 8.32 | 29.82 | 257 | 293 | P | V |
| Ant. 4+3 | | 2483.52 | 37.47 | -16.53 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |

| Remark | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. |
|---|---|

**2.4GHz 2400~2483.5MHz and 5GHz Band 1 5150~5250MHz (Harmonic @ 3m)**

| WIFI Ant. Simultaneously | Note | Frequency ( MHz ) | Level ( dBμV/m ) | Over Limit ( dB ) | Limit Line ( dBμV/m ) | Read Level (dBμV) | Antenna Factor ( dB/m ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BT CH78 2480 MHz Ant. 4 + 802.11a CH36 5180 MHz Ant. 4+3 | | 4960 | 63.49 | -10.51 | 74 | 47.18 | 31.26 | 13.8 | 28.75 | 100 | 0 | P | H |
| | | 4960 | 38.73 | -15.27 | 54 | - | - | - | - | - | - | A | H |
| | | 7440 | 43.44 | -30.56 | 74 | 48.01 | 36.58 | 16.18 | 57.33 | 100 | 0 | P | H |
| | | 7440 | 18.68 | -35.32 | 54 | - | - | - | - | - | - | A | H |
| | | 10360 | 47.16 | -21.04 | 68.2 | 47.64 | 39.64 | 19.17 | 59.29 | 100 | 0 | P | H |
| | | 15540 | 45.79 | -28.21 | 74 | 43.42 | 37.94 | 24.38 | 59.95 | 100 | 0 | P | H |
| | | 4960 | 60.63 | -13.37 | 74 | 44.32 | 31.26 | 13.8 | 28.75 | 100 | 0 | P | V |
| | | 4960 | 35.87 | -18.13 | 54 | - | - | - | - | - | - | A | V |
| | | 7440 | 43.23 | -30.77 | 74 | 47.8 | 36.58 | 16.18 | 57.33 | 100 | 0 | P | V |
| | | 7440 | 18.47 | -35.53 | 54 | - | - | - | - | - | - | A | V |
| | | 10360 | 46.56 | -21.64 | 68.2 | 47.04 | 39.64 | 19.17 | 59.29 | 100 | 0 | P | V |
| | | 15540 | 45.1 | -28.9 | 74 | 42.73 | 37.94 | 24.38 | 59.95 | 100 | 0 | P | V |
| **Remark** | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |

**Band 1 - 5150~5250MHz**

**WIFI 802.11a (Band Edge @ 3m)**

| WIFI | Note | Frequency | Level | Over | Limit | Read | Antenna | Path | Preamp | Ant | Table | Peak | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| Simultaneously | | ( MHz ) | ( dBµV/m ) | ( dB ) | ( dBµV/m ) | (dBµV) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| BLE CH39 2480 MHz Ant. 4 + 802.11a CH36 5180 MHz Ant. 4+3 | | 5148.72 | 63.12 | -10.88 | 74 | 47.95 | 31.7 | 12.32 | 28.85 | 104 | 12 | P | H |
| | | 5149.24 | 51.62 | -2.38 | 54 | 36.45 | 31.7 | 12.32 | 28.85 | 104 | 12 | A | H |
| | * | 5180 | 110.95 | - | - | 95.88 | 31.58 | 12.36 | 28.87 | 104 | 12 | P | H |
| | * | 5180 | 103.48 | - | - | 88.41 | 31.58 | 12.36 | 28.87 | 104 | 12 | A | H |
| | | | | | | | | | | | | P | H |
| | | | | | | | | | | | | A | H |
| | | 5149.5 | 59.69 | -14.31 | 74 | 44.52 | 31.7 | 12.32 | 28.85 | 108 | 4 | P | V |
| | | 5149.5 | 47.6 | -6.4 | 54 | 32.43 | 31.7 | 12.32 | 28.85 | 108 | 4 | A | V |
| | * | 5180 | 106.27 | - | - | 91.2 | 31.58 | 12.36 | 28.87 | 108 | 4 | P | V |
| | * | 5180 | 99.02 | - | - | 83.95 | 31.58 | 12.36 | 28.87 | 108 | 4 | A | V |
| | | | | | | | | | | | | P | V |
| | | | | | | | | | | | | 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 (Band Edge @ 3m)**

| WIFI | Note | Frequency | Level | Over | Limit | Read | Antenna | Path | Preamp | Ant | Table | Peak | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| Simultaneously | | ( MHz ) | ( dBµV/m ) | ( dB ) | ( dBµV/m ) | (dBµV) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| | * | 2480 | 105.05 | - | - | 89.09 | 27.54 | 18.24 | 29.82 | 104 | 187 | P | H |
| | * | 2480 | 103.9 | - | - | 87.94 | 27.54 | 18.24 | 29.82 | 104 | 187 | A | H |
| | | 2488.76 | 57.59 | -16.41 | 74 | 41.65 | 27.52 | 18.25 | 29.83 | 104 | 187 | P | H |
| BLE | | 2487.12 | 47.06 | -6.94 | 54 | 31.1 | 27.53 | 18.25 | 29.82 | 104 | 187 | A | H |
| CH39 | | | | | | | | | | | | | H |
| 2480 MHz | | | | | | | | | | | | | H |
| Ant. 4 | | | | | | | | | | | | | H |
| + | | | | | | | | | | | | | H |
| 802.11a | * | 2480 | 98.29 | - | - | 82.33 | 27.54 | 18.24 | 29.82 | 295 | 74 | P | V |
| CH36 | * | 2480 | 97.63 | - | - | 81.67 | 27.54 | 18.24 | 29.82 | 295 | 74 | A | V |
| 5180 MHz | | 2489.56 | 56.61 | -17.39 | 74 | 40.67 | 27.52 | 18.25 | 29.83 | 295 | 74 | P | V |
| Ant. 4+3 | | 2484.12 | 47.02 | -6.98 | 54 | 31.07 | 27.53 | 18.24 | 29.82 | 295 | 74 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| **Remark** | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |

**2.4GHz 2400~2483.5MHz and 5GHz Band 1 5150~5250MHz (Harmonic @ 3m)**

| WIFI Ant. Simultaneously | Note | Frequency ( MHz ) | Level ( dBμV/m ) | Over Limit ( dB ) | Limit Line ( dBμV/m ) | Read Level (dBμV) | Antenna Factor ( dB/m ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BLE CH39 2480 MHz Ant. 4 + 802.11a CH36 5180 MHz Ant. 4+3 | | 4960 | 57.95 | -16.05 | 74 | 41.64 | 31.26 | 13.8 | 28.75 | 100 | 164 | P | H |
| | | 4960 | 50.29 | -3.71 | 54 | 33.98 | 31.26 | 13.8 | 28.75 | 100 | 164 | A | H |
| | | 7440 | 44.85 | -29.15 | 74 | 49.42 | 36.58 | 16.18 | 57.33 | 100 | 0 | P | H |
| | | 10360 | 48.83 | -19.37 | 68.2 | 49.31 | 39.64 | 19.17 | 59.29 | 100 | 0 | P | H |
| | | 15540 | 47.41 | -26.59 | 74 | 45.04 | 37.94 | 24.38 | 59.95 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4960 | 57.29 | -16.71 | 74 | 40.98 | 31.26 | 13.8 | 28.75 | 100 | 358 | P | V |
| | | 4960 | 48.55 | -5.45 | 54 | 32.24 | 31.26 | 13.8 | 28.75 | 100 | 358 | A | V |
| | | 7440 | 44.47 | -29.53 | 74 | 49.04 | 36.58 | 16.18 | 57.33 | 100 | 0 | P | V |
| | | 10360 | 50.63 | -17.57 | 68.2 | 51.11 | 39.64 | 19.17 | 59.29 | 100 | 0 | P | V |
| | | 15540 | 46.94 | -27.06 | 74 | 44.57 | 37.94 | 24.38 | 59.95 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| **Remark** | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |

**Band 1 - 5150~5250MHz**

**WIFI 802.11a (Band Edge @ 3m)**

| WIFI | Note | Frequency | Level | Over | Limit | Read | Antenna | Path | Preamp | Ant | Table | Peak | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| Simultaneously | | ( MHz ) | ( dBµV/m ) | ( dB ) | ( dBµV/m ) | (dBµV) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| 802.11g CH11 2462 MHz Ant. 4 + 802.11a CH36 5180 MHz Ant 3 | | 5149.24 | 62.59 | -11.41 | 74 | 47.42 | 31.7 | 12.32 | 28.85 | 129 | 353 | P | H |
| | | 5150 | 51.88 | -2.12 | 54 | 36.71 | 31.7 | 12.32 | 28.85 | 129 | 353 | A | H |
| | * | 5180 | 110.28 | - | - | 95.21 | 31.58 | 12.36 | 28.87 | 129 | 353 | P | H |
| | * | 5180 | 103.21 | - | - | 88.14 | 31.58 | 12.36 | 28.87 | 129 | 353 | A | H |
| | | | | | | | | | | | | P | H |
| | | | | | | | | | | | | A | H |
| | | 5149.5 | 57.24 | -16.76 | 74 | 42.07 | 31.7 | 12.32 | 28.85 | 102 | 101 | P | V |
| | | 5149.76 | 47.88 | -6.12 | 54 | 32.71 | 31.7 | 12.32 | 28.85 | 102 | 101 | A | V |
| | * | 5180 | 104.78 | - | - | 89.71 | 31.58 | 12.36 | 28.87 | 102 | 101 | P | V |
| | * | 5180 | 97.51 | - | - | 82.44 | 31.58 | 12.36 | 28.87 | 102 | 101 | A | V |
| | | | | | | | | | | | | P | V |
| | | | | | | | | | | | | 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

## WIFI 802.11g (Band Edge @ 3m)

| WIFI Ant. Simultaneously | Note | Frequency ( MHz ) | Level ( dBµV/m ) | Over Limit ( dB ) | Limit Line ( dBµV/m ) | Read Level (dBµV) | Antenna Factor ( dB/m ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 802.11g CH11 2462 MHz Ant. 4 + 802.11a CH36 5180 MHz Ant. 3 | * | 2462 | 106.75 | - | - | 90.77 | 27.58 | 18.21 | 29.81 | 110 | 101 | P | H |
| | * | 2462 | 99.78 | - | - | 83.8 | 27.58 | 18.21 | 29.81 | 110 | 101 | A | H |
| | | 2484.16 | 63.27 | -10.73 | 74 | 47.32 | 27.53 | 18.24 | 29.82 | 110 | 101 | P | H |
| | | 2483.52 | 52.17 | -1.83 | 54 | 36.22 | 27.53 | 18.24 | 29.82 | 110 | 101 | A | H |
| | | | | | | | | | | | | P | H |
| | | | | | | | | | | | | A | H |
| | * | 2462 | 102.36 | - | - | 86.38 | 27.58 | 18.21 | 29.81 | 390 | 60 | P | V |
| | * | 2462 | 95.63 | - | - | 79.65 | 27.58 | 18.21 | 29.81 | 390 | 60 | A | V |
| | | 2483.92 | 59.16 | -14.84 | 74 | 43.21 | 27.53 | 18.24 | 29.82 | 390 | 60 | P | V |
| | | 2483.68 | 48.53 | -5.47 | 54 | 32.58 | 27.53 | 18.24 | 29.82 | 390 | 60 | A | V |
| | | | | | | | | | | | | P | V |
| | | | | | | | | | | | | 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 and 5GHz Band 1 5150~5250MHz (Harmonic @ 3m)

| WIFI Ant. Simultaneously | Note | Frequency ( MHz ) | Level ( dBμV/m ) | Over Limit ( dB ) | Limit Line ( dBμV/m ) | Read Level (dBμV) | Antenna Factor ( dB/m ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 802.11g CH11 2462 MHz Ant. 4 + 802.11a CH36 5180 MHz Ant. 3 | | 4924 | 58.66 | -15.34 | 74 | 41.14 | 31.1 | 15.17 | 28.75 | 100 | 62 | P | H |
| | | 4924 | 48.19 | -5.81 | 54 | 30.67 | 31.1 | 15.17 | 28.75 | 100 | 62 | A | H |
| | | 7386 | 45.78 | -28.22 | 74 | 50.55 | 36.53 | 16.1 | 57.4 | 100 | 0 | P | H |
| | | 10360 | 46.14 | -22.06 | 68.2 | 46.62 | 39.64 | 19.17 | 59.29 | 100 | 0 | P | H |
| | | 15540 | 45.78 | -28.22 | 74 | 43.41 | 37.94 | 24.38 | 59.95 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4924 | 58.15 | -15.85 | 74 | 40.63 | 31.1 | 15.17 | 28.75 | 100 | 88 | P | V |
| | | 4924 | 46.59 | -7.41 | 54 | 29.07 | 31.1 | 15.17 | 28.75 | 100 | 88 | A | V |
| | | 7386 | 42.86 | -31.14 | 74 | 47.63 | 36.53 | 16.1 | 57.4 | 100 | 0 | P | V |
| | | 10360 | 46.12 | -22.08 | 68.2 | 46.6 | 39.64 | 19.17 | 59.29 | 100 | 0 | P | V |
| | | 15540 | 46.3 | -27.7 | 74 | 43.93 | 37.94 | 24.38 | 59.95 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>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. |
| - | The signal is **Unintentional Radiators**. |
| 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 Ant. Simultaneously | Note | Frequency ( MHz ) | Level ( dBμV/m ) | Over Limit ( dB ) | Limit Line ( dBμV/m ) | Read Level ( dBμV ) | Antenna Factor ( dB/m ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

**For Peak Limit @ 2390MHz:**

1. Level(dBμV/m)

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

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

**For Average Limit @ 2390MHz:**

1. Level(dBμV/m)

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

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

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

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

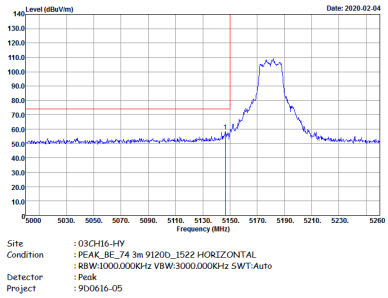
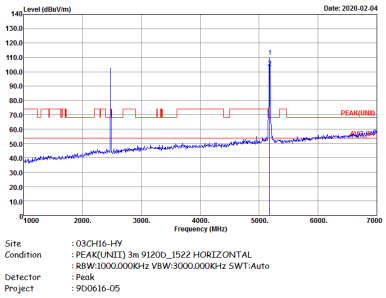
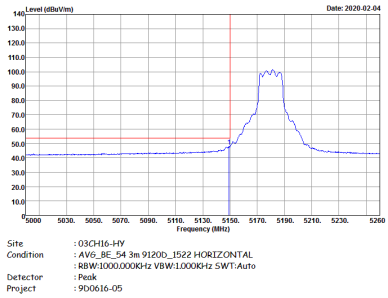
**Both peak and average measured complies with the limit line, so test result is "PASS".**

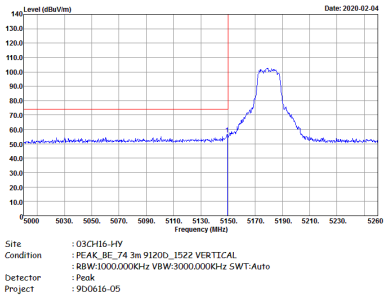
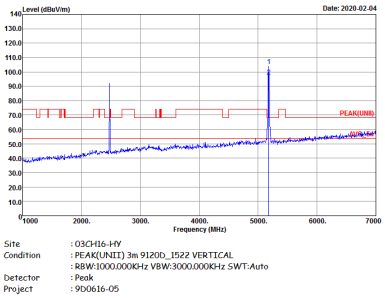
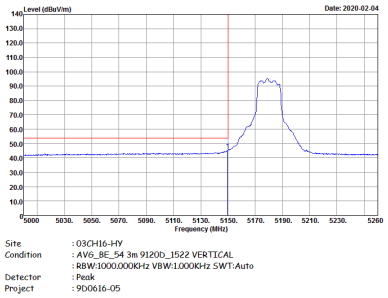
# Appendix B. Radiated Spurious Emission

| | | | |
|---|---|---|---|
| **Test Engineer :** | Jacky Hung, Andy Yang and CR Liao | **Temperature :** | 20~25°C |
| | | **Relative Humidity :** | 50~60% |

**Band 1 - 5150~5250MHz**

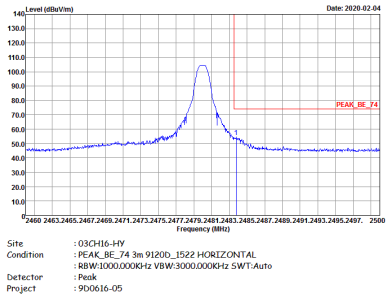
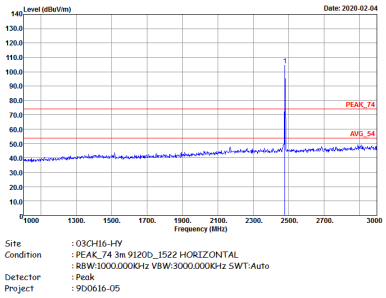
**WIFI 802.11a (Band Edge @ 3m)**

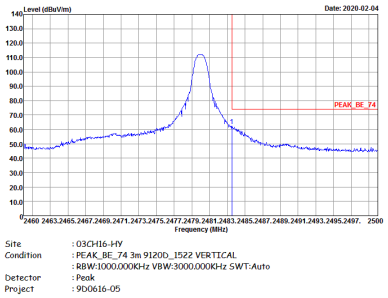
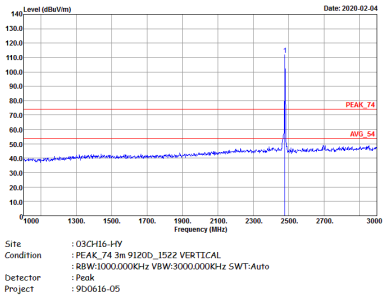
| **ANT** | **BT_Ch78_Ant 4 + WIFI 802. 11a_Tx_CH36 ANT 4+3** | |
|---|---|---|
| **Simultaneously** | **Horizontal** | **Fundamental** |
| **Peak** |  |  |
| **Avg.** |  | Left blank |

| ANT | BT_Ch78_Ant 4 + WIFI 802. 11a_Tx_CH36 ANT 4+3 | |
|---|---|---|
| **Simultaneously** | **Horizontal** | **Fundamental** |
| **Peak** |  |  |
| **Avg.** |  | Left blank |

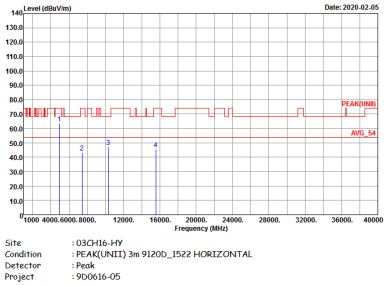
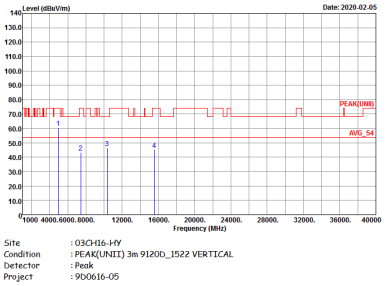
## 2.4GHz 2400~2483.5MHz

## BT (Band Edge @ 3m)

| ANT | BT_Ch78_Ant 4 + WIFI 802. 11a_Tx_CH36 ANT 4+3 | |
|---|---|---|
| Simultaneously | Horizontal | Fundamental |
| Peak |  |  |

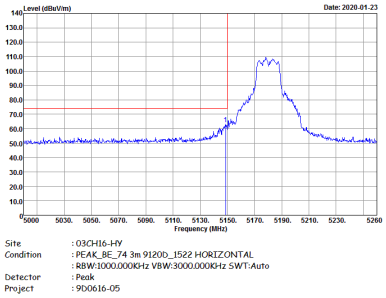
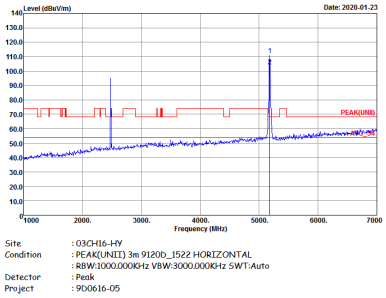
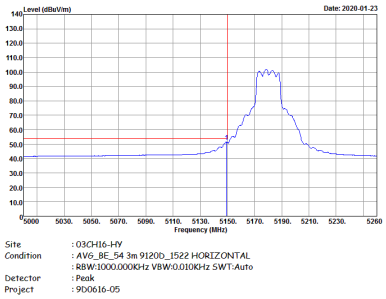
| ANT | BT_Ch78_Ant 4 + WIFI 802. 11a_Tx_CH36 ANT 4+3 | |
|---|---|---|
| Simultaneously | Vertical | Fundamental |
| Peak |  |  |

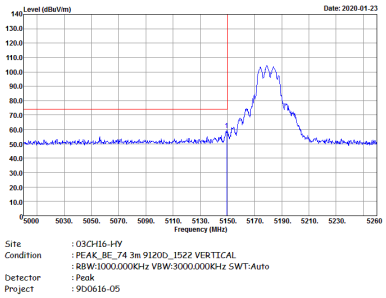
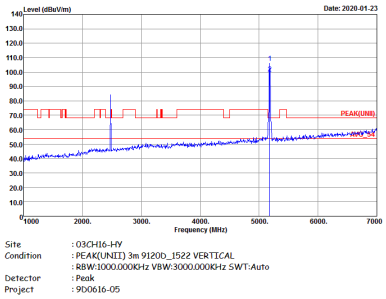
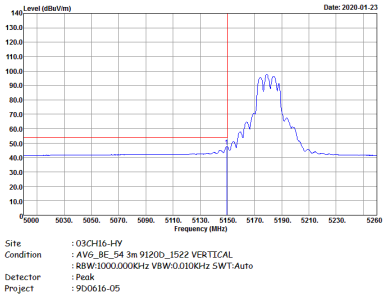
## 2.4GHz 2400~2483.5MHz and 5GHz Band 1 5150~5250MHz (Harmonic @ 3m)

| ANT | BT_Ch78_Ant 4 + WIFI 802. 11a_Tx_CH36 ANT 4+3 | |
|---|---|---|
| Simultaneously | Horizontal | Vertical |
| Peak<br>Avg. |  |  |

## Band 1 - 5150~5250MHz

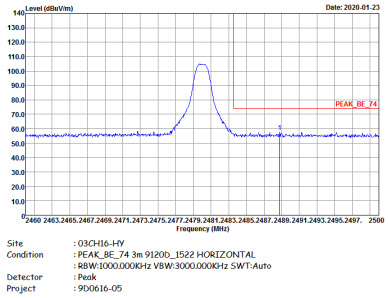
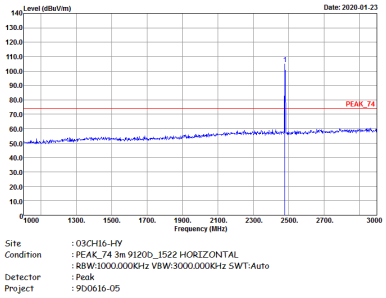
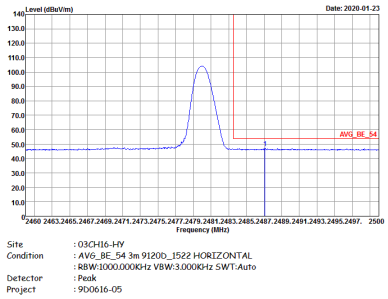
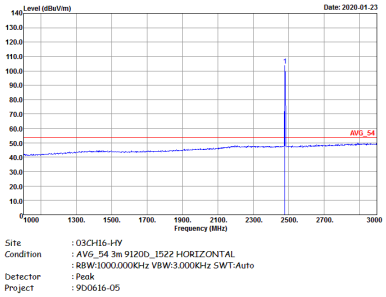
## WIFI 802.11a (Band Edge @ 3m)

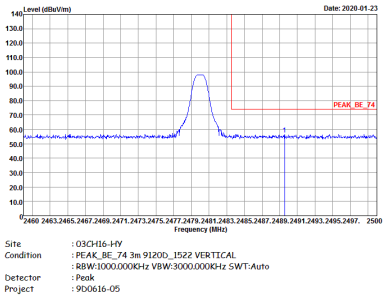
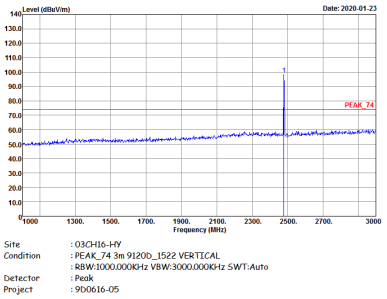
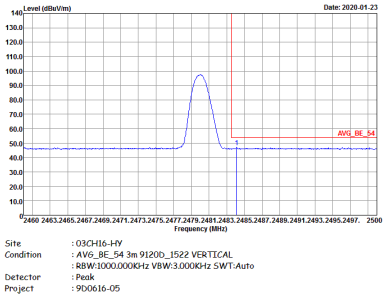
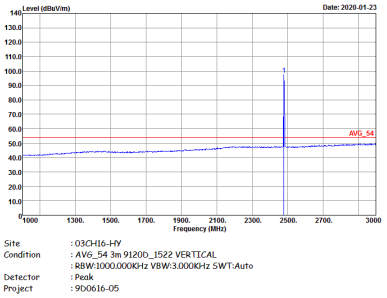
| ANT | BLE_Ch39_Ant 4 + WIFI 802.11a_Ch36_Ant 4+3 | |
|---|---|---|
| Simultaneously | Horizontal | Fundamental |
| Peak |  |  |
| Avg. |  | Left blank |

| ANT | BLE_Ch39_Ant 4 + WIFI 802.11a_Ch36_Ant 4+3 | |
|---|---|---|
| **Simultaneously** | **Vertical** | **Fundamental** |
| **Peak** |  |  |
| **Avg.** |  | Left blank |

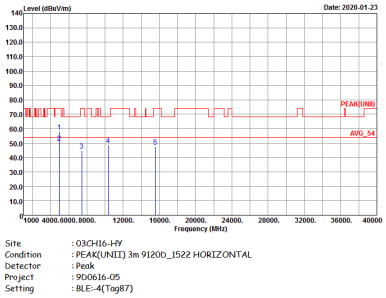
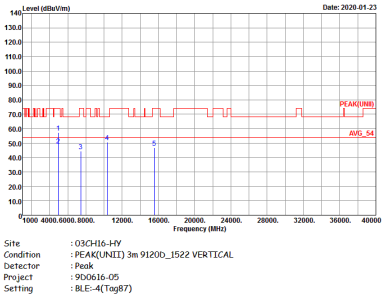
## 2.4GHz 2400~2483.5MHz

## BT (Band Edge @ 3m)

| ANT | BLE_Ch39_Ant 4 + WIFI 802.11a_Ch36_Ant 4+3 | |
|---|---|---|
| Simultaneously | Horizontal | Fundamental |
| Peak |  |  |
| Avg. |  |  |

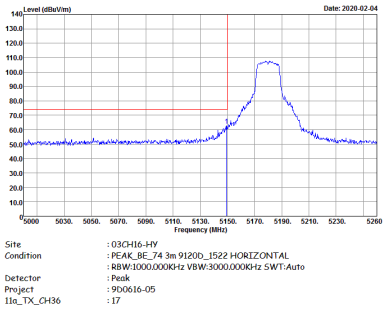
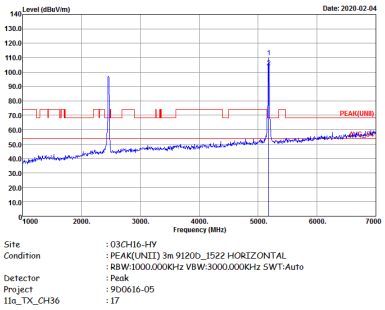
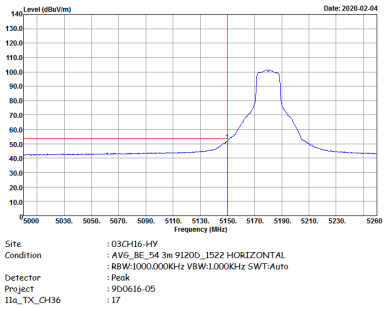
| ANT | BLE_Ch39_Ant 4 + WIFI 802.11a_Ch36_Ant 4+3 | |
|---|---|---|
| Simultaneously | Vertical | Fundamental |
| Peak |  |  |
| Avg. |  |  |

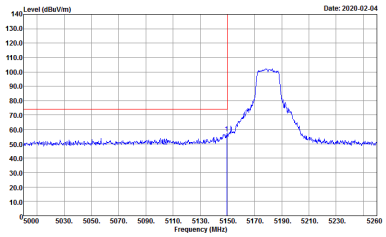
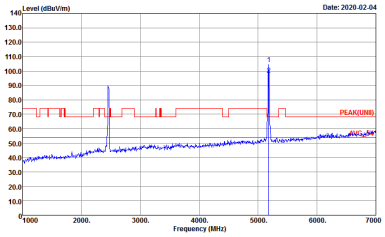
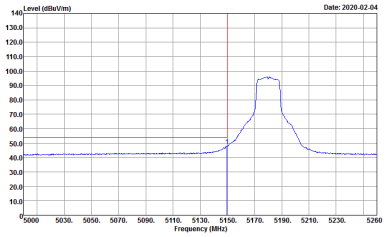
## 2.4GHz 2400~2483.5MHz and 5GHz Band 1 5150~5250MHz (Harmonic @ 3m)

| ANT | BLE_Ch39_Ant 4 + WIFI 802.11a_Ch36_Ant 4+3 | |
|---|---|---|
| Simultaneously | Horizontal | Vertical |
| Peak<br>Avg. |  |  |

## Band 1 - 5150~5250MHz

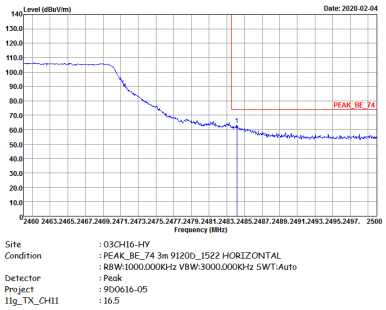
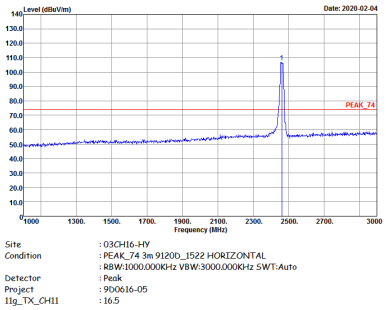
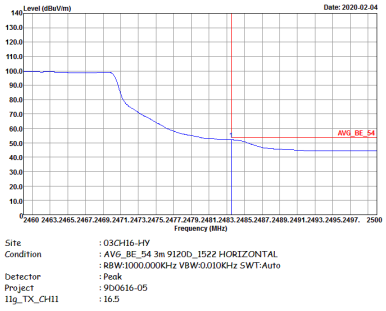
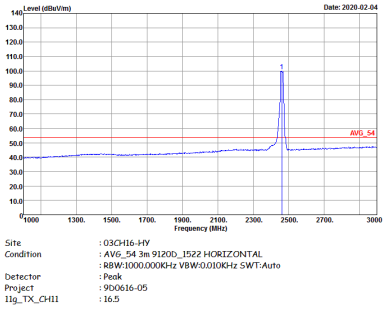
## WIFI 802.11a (Band Edge @ 3m)

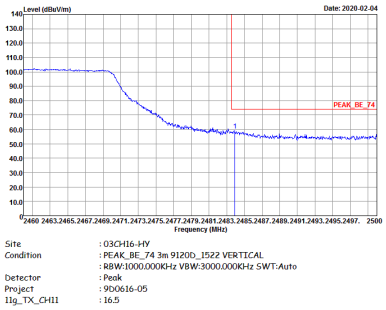
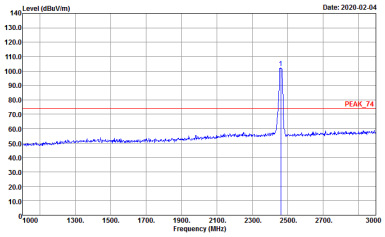
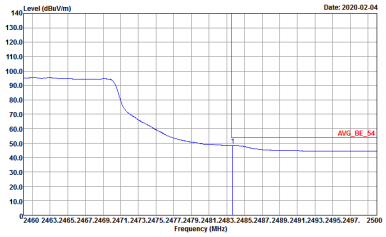
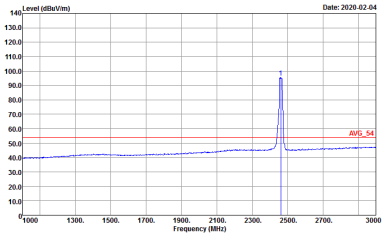
| ANT | 11g _Ch11_Ant 4 + WIFI 802.11a_Ch36_Ant 3 | |
|---|---|---|
| Simultaneously | Horizontal | Fundamental |
| Peak |  |  |
| Avg. |  | Left blank |

| ANT | 11g _Ch11_Ant 4 + WIFI 802.11a_Ch36_Ant 3 | |
|---|---|---|
| Simultaneously | Vertical | Fundamental |
| Peak |  |  |
| Avg. |  | Left blank |

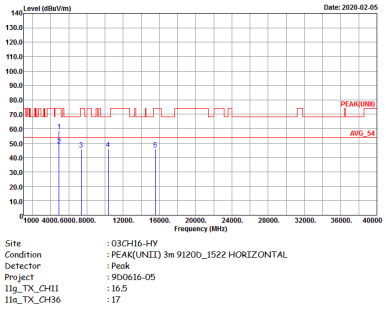
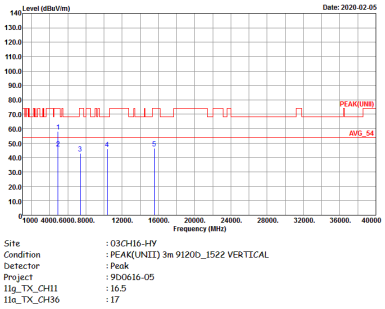
## 2.4GHz 2400~2483.5MHz

## WIFI 802.11g (Band Edge @ 3m)

| ANT | 11g _Ch11_Ant 4 + WIFI 802.11a_Ch36_Ant 3 | |
|---|---|---|
| Simultaneously | Horizontal | Fundamental |
| Peak |  |  |
| Avg. |  |  |

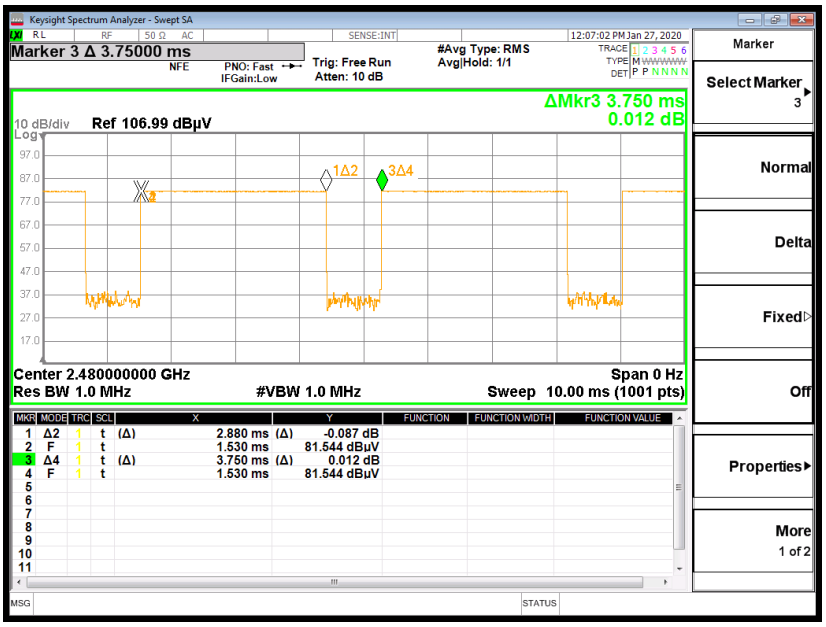
| ANT | 11g _Ch11_Ant 4 + WIFI 802.11a_Ch36_Ant 3 | |
|---|---|---|
| Simultaneously | Vertical | Fundamental |
| Peak |  <br>Site : 03CH16-HY<br>Condition : PEAK_BE_74 3m 9120D_1522 VERTICAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 9D0616-05<br>11g_TX_CH11 : 16.5 |  <br>Site : 03CH16-HY<br>Condition : PEAK_74 3m 9120D_1522 VERTICAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 9D0616-05<br>11g_TX_CH11 : 16.5 |
| Avg. |  <br>Site : 03CH16-HY<br>Condition : AVG_BE_54 3m 9120D_1522 VERTICAL<br>: RBW:1000.000KHz VBW:0.010KHz SWT:Auto<br>Detector : Peak<br>Project : 9D0616-05<br>11g_TX_CH11 : 16.5 |  <br>Site : 03CH16-HY<br>Condition : AVG_54 3m 9120D_1522 VERTICAL<br>: RBW:1000.000KHz VBW:0.010KHz SWT:Auto<br>Detector : Peak<br>Project : 9D0616-05<br>11g_TX_CH11 : 16.5 |

## 2.4GHz 2400~2483.5MHz and 5GHz Band 1 5150~5250MHz (Harmonic @ 3m)

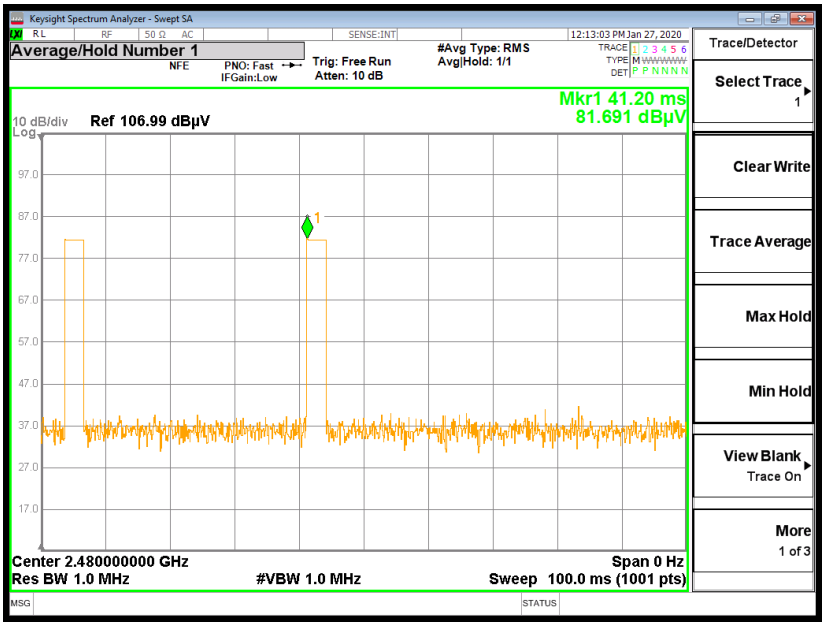
| ANT | 11g _Ch11_Ant 4 + WIFI 802.11a_Ch36_Ant 3 | |
|---|---|---|
| Simultaneously | Horizontal | Vertical |
| Peak<br>Avg. |  |  |

# Appendix C. Duty Cycle Plots

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




**on time (Count Pulses) Plot on Channel 39**




**Note:**

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.88 / 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.

**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 ms x 20 channels = 57.6 ms*

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

Thus, the maximum possible ON time:

*2.88 ms x 2 = 5.76 ms*

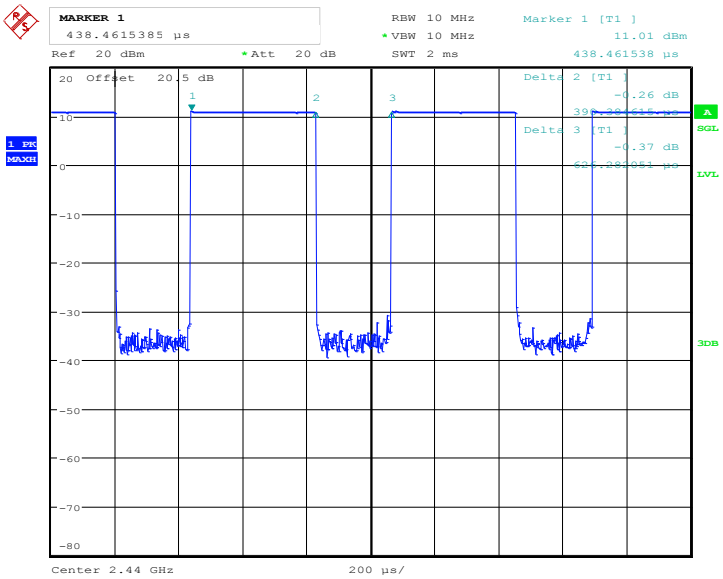
Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

*20 x log(5.76 ms/100ms) = -24.79 dB*

| Antenna | Band | Duty Cycle(%) | T(us) | 1/T(kHz) | VBW Setting | Duty Factor(dB) |
|---|---|---|---|---|---|---|
| 4 | Bluetooth LE for 1 Mbps | 62.33 | 390.38 | 2.56 | 3kHz | 2.05 |
| 4 | 802.11g for Ant 4 | 98.36 | - | - | 10Hz | 0.07 |
| 3 | 802.11a | 98.39 | - | - | 10Hz | 0.07 |
| 4+3 | 802.11a for Ant 4 | 97.92 | 2032 | 0.49 | 1kHz | 0.09 |
| 4+3 | 802.11a for Ant 3 | 97.78 | 2032 | 0.49 | 1kHz | 0.10 |

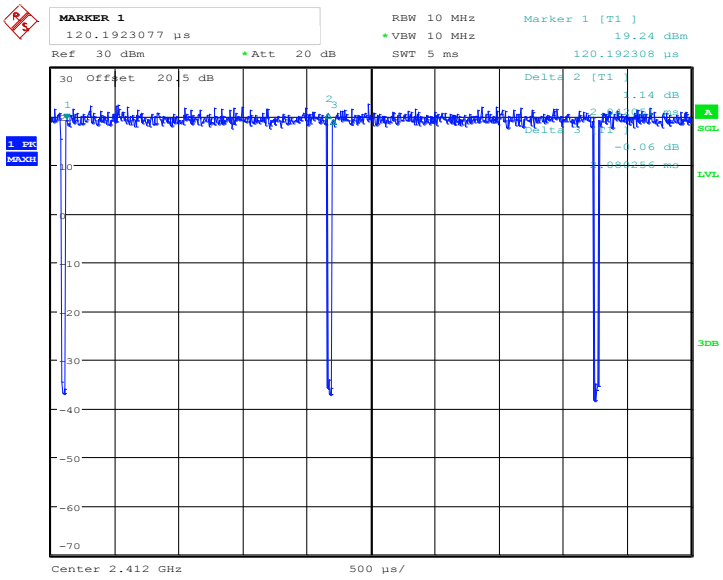
**<Ant. 4>**

**Bluetooth - LE for 1Mbps**




Date: 1.JAN.2003 01:28:45

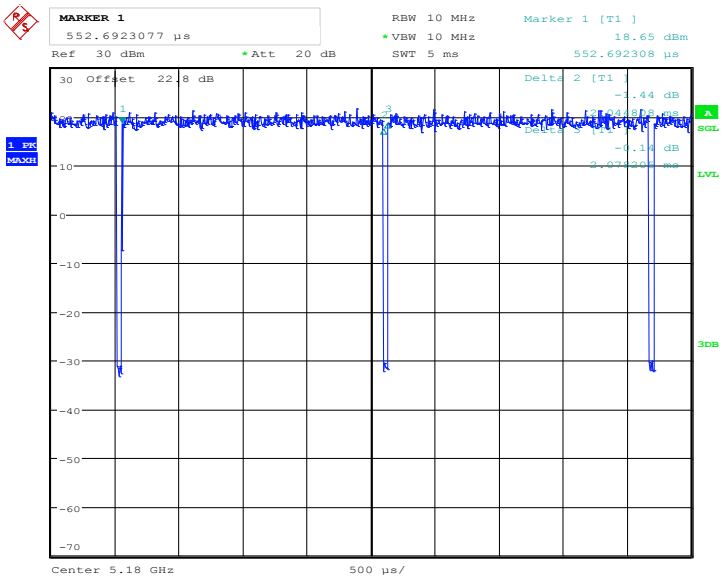
### 802.11g




Date: 1.JAN.2003 08:18:32

**<Ant. 3>**

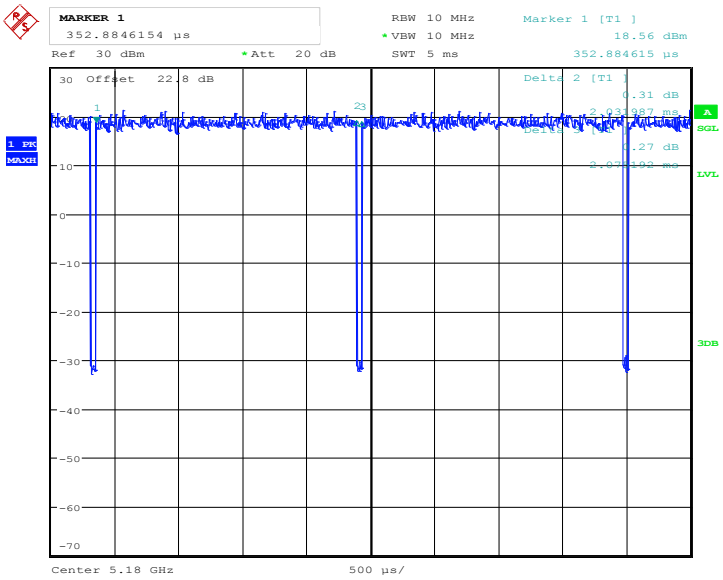
### 802.11a




Date: 1.JAN.2003 04:58:43

**MIMO <Ant. 4>**

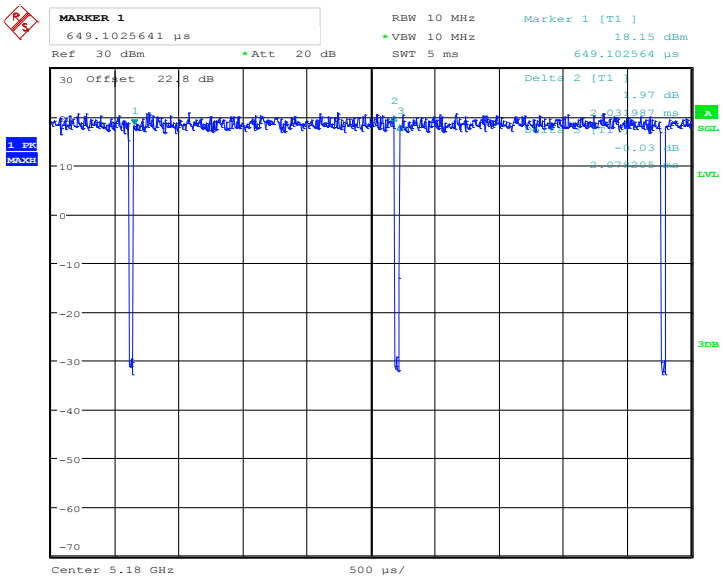
**802.11a**




Date: 1.JAN.2003 04:59:52

**MIMO <Ant. 3>**

**802.11a**




Date: 1.JAN.2003 05:00:33

THE END