# FCC RADIO TEST REPORT

| | | |
|---|---|---|
| **FCC ID** | : | **J9CQSIP7180** |
| **Equipment** | : | **7c Modular Platform** |
| **Brand Name** | : | **Qualcomm** |
| **Model Name** | : | **QSIP7180** |
| **Applicant** | : | **Qualcomm Technologies, Inc.**<br>**5775 Morehouse Dr.San Diego, CA 92121-1714 (USA)** |
| **Manufacturer** | : | **Qualcomm Technologies, Inc.**<br>**5775 Morehouse Dr.San Diego, CA 92121-1714 (USA)** |
| **Standard** | : | **FCC Part 15 Subpart E §15.407** |

**The product was received on Jul. 29, 2020 and testing was started from Aug. 17, 2020 and completed on Aug. 27, 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 test results in this variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.**

Louis Wu

**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 |
|---|---|---|---|
| FR042002D | 01 | Initial issue of report | Sep. 17, 2020 |
| FR042002D | 02 | Revise the typo in the note of summary of test result | Oct. 23, 2020 |
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# Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|---|---|---|---|---|
| - | 15.403(i) | 26dB Bandwidth | Not Required | - |
| - | 2.1049 | 99% Occupied Bandwidth | Not Required | - |
| 3.1 | 15.407(a) | Maximum Conducted Output Power | Pass | - |
| - | 15.407(a) | Power Spectral Density | Not Required | - |
| 3.2 | 15.407(b) | Unwanted Emissions | Pass | Under limit 1.98 dB at 5147.420 MHz |
| - | 15.207 | AC Conducted Emission | Not Required | - |
| - | 15.407(c) | Automatically Discontinue Transmission | Not Required | - |
| 3.3 | 15.203 15.407(a) | Antenna Requirement | Pass | - |

**Note:**

1. Not required means after assessing, test items are not necessary to carry out.
2. QSIP7180 is a module including WCDMA, LTE, Wi-Fi and BT wireless communication technology. QSIP7180P is a variant module of QSIP7180, the design architecture of the two is the same, but QSIP7180P removes the WWAN functional blocks such as LTE and WCDMA. So, QSIP7180 keeps its' Wi-Fi and BT functional block with the same design and electrical characteristics as QSIP7180P. Therefore, we run spot check verification approach to confirm and certify the QSIP7180's EMC and RF performance which is theoretically equivalent to QSIP7180P.
   As presented in this report which is the result of spot check verification for QSIP7180.

| **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: Ruby Zou**

# 1 General Description

## 1.1 Product Feature of Equipment Under Test

WCDMA/LTE, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac, Wi-Fi 5GHz 802.11a/n/ac, and GNSS.

| Antenna Information | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Antenna No. | Brand | Model | Antenna Net gain | Frequency Range (MHz) | Cable Loss (dBi) | Ant. Type | Connector Type | Cable Length (mm) |
| 1 | WNC | 81.EBJ15.005 | 3.00 | 2400-2500 MHz | 1.15 | PIFA | IPEX | 300 |
| | | | 2.56 | 5150-5350 MHz | 1.7 | | | |
| | | | 4.76 | 5470-5725MHz | 1.74 | | | |
| | | | 4.76 | 5725-5825 MHz | 1.79 | | | |
| 2 | WNC | 81.EBJ15.005 | 3.62 | 2400-2500 MHz | 1.15 | PIFA | IPEX | 300 |
| | | | 3.08 | 5150-5350 MHz | 1.7 | | | |
| | | | 3.31 | 5470-5725MHz | 1.74 | | | |
| | | | 2.42 | 5725-5825 MHz | 1.79 | | | |

**Remark:**

1. Above antenna gains of antenna are Total (H+V).
2. For Bluetooth mode was fixed transmission on Chain (0)
3. The maximum gain was chosen for test.

## 1.2 Modification of EUT

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

## 1.3 Testing Location

| | |
|---|---|
| **Test Site** | SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory |
| **Test Site Location** | No.52, Huaya 1st Rd., Guishan Dist.,<br>Taoyuan City, Taiwan (R.O.C.)<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |
| **Test Site No.** | **Sporton Site No.** |
| | TH05-HY |

| | |
|---|---|
| **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.** |
| | 03CH15-HY |

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

FCC designation No.: TW1190 and TW0007

## 1.4 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 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. The TAF code is not including all the FCC KDB listed without accreditation.
3. 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 two degrees (0° or 90°). The worst cases (Degree 0) were recorded in this report.

## 2.1 Carrier Frequency and Channel

| Frequency Band | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|---|---|---|---|---|
| 5150-5250 MHz Band 1 (U-NII-1) | 36 | 5180 | 44 | 5220 |
| | 38* | 5190 | 46* | 5230 |
| | 40 | 5200 | 48 | 5240 |
| | 42# | 5210 | | |

| Frequency Band | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|---|---|---|---|---|
| 5250-5350 MHz Band 2 (U-NII-2A) | 52 | 5260 | 60 | 5300 |
| | 54* | 5270 | 62* | 5310 |
| | 56 | 5280 | 64 | 5320 |
| | 58# | 5290 | | |

| Frequency Band | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|---|---|---|---|---|
| 5470-5725 MHz Band 3 (U-NII-2C) | 100 | 5500 | 112 | 5560 |
| | 102* | 5510 | 116 | 5580 |
| | 104 | 5520 | 132 | 5660 |
| | 106# | 5530 | 134* | 5670 |
| | 108 | 5540 | 136 | 5680 |
| | 110* | 5550 | 140 | 5700 |

| Frequency Band | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|---|---|---|---|---|
| TDWR Channel | 118* | 5590 | 124 | 5620 |
| | 120 | 5600 | 126* | 5630 |
| | 122# | 5610 | 128 | 5640 |

| Frequency Band | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|---|---|---|---|---|
| Straddle Channel | 138# | 5690 | 144 | 5720 |
| | 142* | 5710 | | |

**Note:**

1. The above Frequency and Channel in "*" were 802.11n HT40 and 802.11ac VHT40.
2. The above Frequency and Channel in "#" were 802.11ac VHT80.

## 2.2 Test Mode

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

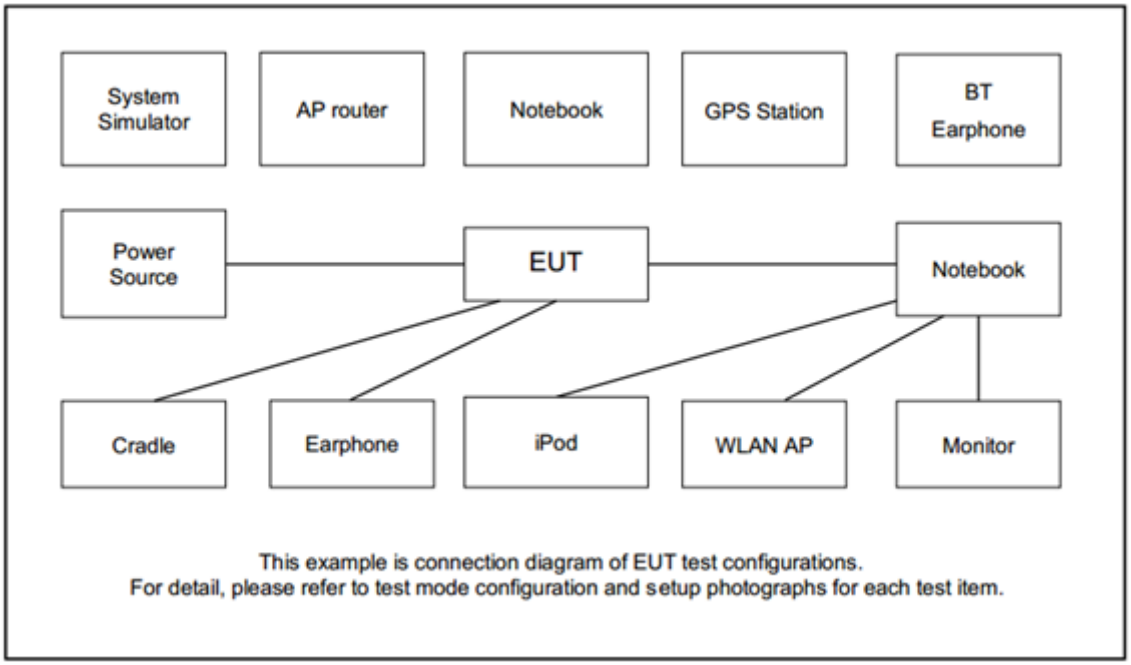
**MIMO Mode**

| Modulation | Data Rate |
|---|---|
| **802.11a** | **6 Mbps** |
| **802.11n HT20** | **MCS0** |
| **802.11n HT40** | **MCS0** |
| **802.11ac VHT20** | **MCS0** |
| **802.11ac VHT40** | **MCS0** |
| **802.11ac VHT80** | **MCS0** |

| Ch. # | | Band I：5150-5250 MHz |
|---|---|---|
| | | 802.11a |
| L | Low | 36 |
| M | Middle | - |
| H | High | - |
| Straddle | | - |

**Remark:** For radiation spurious emission, the final modulation and the worst data rate was reference the max RF conducted power.

## 2.3 Connection Diagram of Test System




## 2.4 Support Unit used in test configuration and system

| Item | Equipment | Brand Name | Model Name | FCC ID | Data Cable | Power Cord |
|---|---|---|---|---|---|---|
| 1. | Notebook | DELL | Latitude 3400 | FCC DoC | N/A | AC I/P: Unshielded, 1.2 m<br>DC O/P: Shielded, 1.8 m |
| 2. | Power Supply | GW Instek | GPE-2323 | N/A | Unshielded, 1.0 m | N/A |

## 2.5 EUT Operation Test Setup

The RF test items, utility “QRCT v 4.0.00156.0” 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 Maximum Conducted Output Power Measurement

### 3.1.1 Limit of Maximum Conducted Output Power

**<FCC 14-30 CFR 15.407>**

**For the 5.15–5.25 GHz bands:**

■ For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW. For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

**For the 5.25–5.725 GHz bands:**

■ The maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz.

For Straddle Channel, according to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, if the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note that U-NII-2 band, devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

### 3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

### 3.1.3 Test Procedures

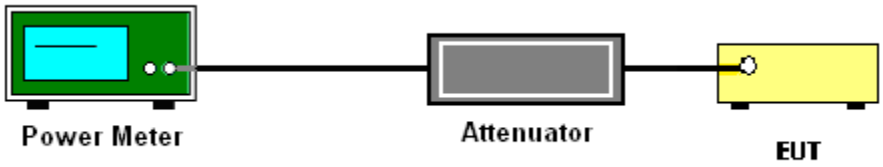
The testing follows Method PM-G of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM-G (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit at its maximum power control level.
3. Measure the average power of the transmitter
4. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

For Straddle Channel, according to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, if the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

### 3.1.4 Test Setup




### 3.1.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.

## 3.2 Unwanted Emissions Measurement

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

### 3.2.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.

For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.

For transmitters operating in the 5470-5600 MHz and 5650-5725MHz band: all emissions outside of the 5470-5600 MHz and 5650-5725MHz band shall not exceed an EIRP of -27 dBm/MHz.

(2) 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 |

(3) 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.

### 3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

### 3.2.3 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 Peak Unwanted Emissions Measurements Above 1000 MHz

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

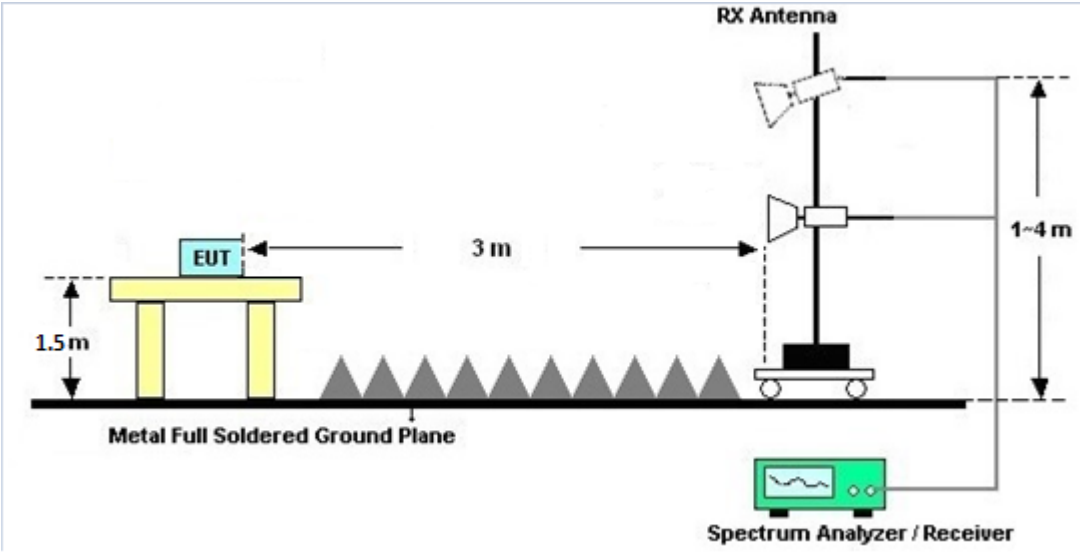
(2) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

- 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 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 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.

### 3.2.4 Test Setup

**For radiated emissions above 1GHz**




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

Please refer to Appendix B and C.

### 3.2.6 Duty Cycle

Please refer to Appendix D.

### 3.2.7 Test Result of Radiated Spurious Emissions

Please refer to Appendix B and C.

## 3.3 Antenna Requirements

### 3.3.1 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.

### 3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

### 3.3.3 Antenna Gain

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

$$Directional Gain = 10 \cdot \log \left[ \frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

*where*

Each antenna is driven by no more than one spatial stream;

$N_{SS}$ = the number of independent spatial streams of data;

$N_{ANT}$ = the total number of antennas

$g_{j,k} = 10^{G_k / 20}$ if the $k$th antenna is being fed by spatial stream $j$, or zero if it is not;

$G_k$ is the gain in dBi of the kth antenna.

The EUT supports beamforming for 802.11ac modes.

The directional gain calculation is following F)2)e)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain “DG” is calculated as following table.

| | Ant 1 (dBi) | Ant 2 (dBi) | DG for Power (dBi) | DG for PSD (dBi) | Power Limit Reduction (dB) | PSD Limit Reduction (dB) |
|---|---|---|---|---|---|---|
| **Band I** | 3.08 | 3.08 | 6.09 | 6.09 | 0.09 | 0.09 |
| **Band II** | 3.08 | 3.08 | 6.09 | 6.09 | 0.09 | 0.09 |
| **Band III** | 4.76 | 4.76 | 7.77 | 7.77 | 1.77 | 1.77 |

*Power Limit Reduction = DG(Power) – 6dBi, ( min = 0 )*

*PSD Limit Reduction = DG(PSD) – 6dBi, ( min = 0 )*

# 4 List of Measuring Equipment

| Instrument | Brand Name | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|---|---|---|---|---|---|---|---|---|
| Hygrometer | Testo | 608-H1 | 34893241 | N/A | Mar. 02, 2020 | Aug. 17, 2020 | Mar. 01, 2021 | Conducted (TH05-HY) |
| Power Sensor | DARE | RPR3006W | 16I00054SNO10 | 10MHz~6GHz | Dec. 23, 2019 | Aug. 17, 2020 | Dec. 22, 2020 | Conducted (TH05-HY) |
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 100055 | 9kHz-40GHz | Dec. 30, 2019 | Aug. 17, 2020 | Dec. 29, 2020 | Conducted (TH05-HY) |
| Switch Box & RF Cable | Burgeon | ETF-058 | EC1300484 | N/A | Aug. 22, 2019 | Aug. 17, 2020 | Aug. 21, 2020 | Conducted (TH05-HY) |
| Power Supply | GW Instek | SPS-606 | GES842931 | NA | Aug. 19, 2019 | Aug. 17, 2020 | Aug. 18, 2020 | Conducted (TH05-HY) |
| Horn Antenna | SCHWARZBECK | BBHA 9120 D | 9120D-1620 | 1-18GHz | Oct. 28, 2019 | Aug. 25, 2020~ Aug. 27, 2020 | Oct. 27, 2020 | Radiation (03CH15-HY) |
| SHF-EHF Horn Antenna | SCHWARZBECK | BBHA 9170 | BBHA9170584 | 18GHz- 40GHz | Dec. 10, 2019 | Aug. 25, 2020~ Aug. 27, 2020 | Dec. 09, 2020 | Radiation (03CH15-HY) |
| Preamplifier | Jet-Power | JPA0118-55-303 | 1710001800055006 | 1GHz~18GHz | May 07, 2020 | Aug. 25, 2020~ Aug. 27, 2020 | May 06, 2021 | Radiation (03CH15-HY) |
| Preamplifier | Keysight | 83017A | MY53270195 | 1GHz~26.5GHz | Aug. 21, 2019 | Aug. 25, 2020~ Aug. 27, 2020 | Aug. 20, 2021 | Radiation (03CH15-HY) |
| Preamplifier | EMEC | EM18G40G | 060715 | 18GHz ~ 40GHz | Dec. 13, 2019 | Aug. 25, 2020~ Aug. 27, 2020 | Dec. 12, 2020 | Radiation (03CH15-HY) |
| EMI Test Receiver | Keysight | N9038A(MXE) | MY54130085 | 20MHz~8.4GHz | Nov. 01, 2019 | Aug. 25, 2020~ Aug. 27, 2020 | Oct. 31, 2020 | Radiation (03CH15-HY |
| Spectrum Analyzer | Agilent | E4446A | MY50180136 | 3Hz~44GHz | May 04, 2020 | Aug. 25, 2020~ Aug. 27, 2020 | May 03, 2021 | Radiation (03CH15-HY) |
| Antenna Mast | ChainTek | MBS-520-1 | N/A | 1m~4m | N/A | Aug. 25, 2020~ Aug. 27, 2020 | N/A | Radiation (03CH15-HY) |
| Turn Table | ChainTek | T-200-S-1 | N/A | 0~360 Degree | N/A | Aug. 25, 2020~ Aug. 27, 2020 | N/A | Radiation (03CH15-HY) |
| Software | Audix | E3 6.2009-8-24(k5) | RK-000451 | N/A | N/A | Aug. 25, 2020~ Aug. 27, 2020 | N/A | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY36980/4 | 30M-18G | Apr. 14, 2020 | Aug. 25, 2020~ Aug. 27, 2020 | Apr. 13, 2021 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY9838/4PE | 30M-18G | Apr. 14, 2020 | Aug. 25, 2020~ Aug. 27, 2020 | Apr. 13, 2021 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY37710/4 | 30M-18G | Apr. 17, 2020 | Aug. 25, 2020~ Aug. 27, 2020 | Apr. 16, 2021 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 505134/2 | 30MHz-40GHz | Feb. 25, 2020 | Aug. 25, 2020~ Aug. 27, 2020 | Feb. 24, 2021 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 800740/2 | 30MHz-40GHz | Feb. 25, 2020 | Aug. 25, 2020~ Aug. 27, 2020 | Feb. 24, 2021 | Radiation (03CH15-HY) |
| Filter | Wainwright | WLK4-1000-1530-8000-40SS | SN4 | 1.53G Low Pass | Jul. 03, 2020 | Aug. 25, 2020~ Aug. 27, 2020 | Jul. 02, 2021 | Radiation (03CH15-HY) |
| Filter | Wainwright | WHKX8-5872.5-6750-18000-40ST | SN6 | 6.75GHz High Pass Filter | Jul. 03, 2020 | Aug. 25, 2020~ Aug. 27, 2020 | Jul. 02, 2021 | Radiation (03CH15-HY) |

# 5 Uncertainty of Evaluation

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

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

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

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

# Appendix A. Test Result of Conducted Test Items

| | | | | |
|---|---|---|---|---|
| Test Engineer: | Kathy Chen / Kai Liao / Shiming Liu | Temperature: | 21~22 | °C |
| Test Date: | 2020/8/17 | Relative Humidity: | 51~52 | % |

## ***TEST RESULTS DATA***
## ***Average Power Table***

| FCC Band I MIMO | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Average Conducted Power (dBm) | | | FCC Conducted Power Limit (dBm) | | DG (dBi) | | | Pass/Fail |
| | | | | | Ant 1 | Ant 2 | SUM | Ant 1 | Ant 2 | Ant 1 | Ant 2 | | |
| 11a | 6Mbps | 2 | 36 | 5180 | 17.40 | 17.80 | 20.61 | 23.91 | | 6.09 | | | Pass |
| 11a | 6Mbps | 2 | 44 | 5220 | 18.00 | 18.30 | 21.16 | 23.91 | | 6.09 | | | Pass |
| 11a | 6Mbps | 2 | 48 | 5240 | 18.00 | 18.40 | 21.21 | 23.91 | | 6.09 | | | Pass |
| HT20 | MCS0 | 2 | 36 | 5180 | 17.10 | 18.10 | 20.64 | 23.91 | | 6.09 | | | Pass |
| HT20 | MCS0 | 2 | 44 | 5220 | 17.40 | 18.20 | 20.83 | 23.91 | | 6.09 | | | Pass |
| HT20 | MCS0 | 2 | 48 | 5240 | 17.60 | 18.20 | 20.92 | 23.91 | | 6.09 | | | Pass |
| HT40 | MCS0 | 2 | 38 | 5190 | 14.30 | 15.10 | 17.73 | 23.91 | | 6.09 | | | Pass |
| HT40 | MCS0 | 2 | 46 | 5230 | 17.40 | 18.10 | 20.77 | 23.91 | | 6.09 | | | Pass |
| VHT20 | MCS0 | 2 | 36 | 5180 | 16.90 | 18.00 | 20.50 | 23.91 | | 6.09 | | | Pass |
| VHT20 | MCS0 | 2 | 44 | 5220 | 17.10 | 18.10 | 20.64 | 23.91 | | 6.09 | | | Pass |
| VHT20 | MCS0 | 2 | 48 | 5240 | 17.50 | 18.10 | 20.82 | 23.91 | | 6.09 | | | Pass |
| VHT40 | MCS0 | 2 | 38 | 5190 | 14.10 | 15.00 | 17.58 | 23.91 | | 6.09 | | | Pass |
| VHT40 | MCS0 | 2 | 46 | 5230 | 17.30 | 18.00 | 20.67 | 23.91 | | 6.09 | | | Pass |
| VHT80 | MCS0 | 2 | 42 | 5210 | 12.50 | 12.80 | 15.66 | 23.91 | | 6.09 | | | Pass |

## ***TEST RESULTS DATA***
## ***Average Power Table***

| FCC Band II MIMO | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Average Conducted Power (dBm) | | | FCC Conducted Power Limit (dBm) | | DG (dBi) | | EIRP Power Limit (dBm) | Pass/Fail |
| | | | | | Ant 1 | Ant 2 | SUM | Ant 1 | Ant 2 | Ant 1 | Ant 2 | | |
| 11a | 6Mbps | 2 | 52 | 5260 | 18.10 | 18.10 | 21.11 | 23.89 | | 6.09 | | 30 | Pass |
| 11a | 6Mbps | 2 | 60 | 5300 | 18.10 | 18.30 | 21.21 | 23.89 | | 6.09 | | 30 | Pass |
| 11a | 6Mbps | 2 | 64 | 5320 | 16.90 | 17.60 | 20.27 | 23.89 | | 6.09 | | 30 | Pass |
| HT20 | MCS0 | 2 | 52 | 5260 | 17.80 | 18.10 | 20.96 | 23.89 | | 6.09 | | 30 | Pass |
| HT20 | MCS0 | 2 | 60 | 5300 | 17.90 | 18.30 | 21.11 | 23.89 | | 6.09 | | 30 | Pass |
| HT20 | MCS0 | 2 | 64 | 5320 | 16.90 | 17.60 | 20.27 | 23.89 | | 6.09 | | 30 | Pass |
| HT40 | MCS0 | 2 | 54 | 5270 | 17.70 | 18.10 | 20.91 | 23.89 | | 6.09 | | 30 | Pass |
| HT40 | MCS0 | 2 | 62 | 5310 | 10.80 | 11.10 | 13.96 | 23.89 | | 6.09 | | 30 | Pass |
| VHT20 | MCS0 | 2 | 52 | 5260 | 17.70 | 18.00 | 20.86 | 23.89 | | 6.09 | | 30 | Pass |
| VHT20 | MCS0 | 2 | 60 | 5300 | 17.70 | 18.20 | 20.97 | 23.89 | | 6.09 | | 30 | Pass |
| VHT20 | MCS0 | 2 | 64 | 5320 | 16.80 | 17.50 | 20.17 | 23.89 | | 6.09 | | 30 | Pass |
| VHT40 | MCS0 | 2 | 54 | 5270 | 17.60 | 18.00 | 20.81 | 23.89 | | 6.09 | | 30 | Pass |
| VHT40 | MCS0 | 2 | 62 | 5310 | 10.60 | 11.00 | 13.81 | 23.89 | | 6.09 | | 30 | Pass |
| VHT80 | MCS0 | 2 | 58 | 5290 | 11.20 | 11.80 | 14.52 | 23.89 | | 6.09 | | 30 | Pass |

Report Number : FR042002D

## ***TEST RESULTS DATA***
## ***Average Power Table***

| FCC Band III MIMO | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Average Conducted Power (dBm) | | | FCC Conducted Power Limit (dBm) | | DG (dBi) | | EIRP Power Limit (dBm) | Pass/Fail |
| | | | | | Ant 1 | Ant 2 | SUM | Ant 1 | Ant 2 | Ant 1 | Ant 2 | | |
| 11a | 6Mbps | 2 | 100 | 5500 | 17.50 | 17.90 | 20.71 | 22.21 | | 7.77 | | 30 | Pass |
| 11a | 6Mbps | 2 | 116 | 5580 | 16.80 | 16.80 | 19.81 | 22.21 | | 7.77 | | 30 | Pass |
| 11a | 6Mbps | 2 | 140 | 5700 | 17.90 | 17.60 | 20.76 | 22.21 | | 7.77 | | 30 | Pass |
| HT20 | MCS0 | 2 | 100 | 5500 | 17.50 | 18.00 | 20.77 | 22.21 | | 7.77 | | 30 | Pass |
| HT20 | MCS0 | 2 | 116 | 5580 | 17.90 | 17.70 | 20.81 | 22.21 | | 7.77 | | 30 | Pass |
| HT20 | MCS0 | 2 | 140 | 5700 | 16.60 | 16.30 | 19.46 | 22.21 | | 7.77 | | 30 | Pass |
| HT40 | MCS0 | 2 | 102 | 5510 | 15.30 | 16.20 | 18.78 | 22.21 | | 7.77 | | 30 | Pass |
| HT40 | MCS0 | 2 | 110 | 5550 | 18.10 | 17.80 | 20.96 | 22.21 | | 7.77 | | 30 | Pass |
| HT40 | MCS0 | 2 | 134 | 5670 | 17.60 | 17.20 | 20.41 | 22.21 | | 7.77 | | 30 | Pass |
| VHT20 | MCS0 | 2 | 100 | 5500 | 17.10 | 17.60 | 20.37 | 22.21 | | 7.77 | | 30 | Pass |
| VHT20 | MCS0 | 2 | 116 | 5580 | 17.40 | 17.30 | 20.36 | 22.21 | | 7.77 | | 30 | Pass |
| VHT20 | MCS0 | 2 | 140 | 5700 | 16.50 | 16.10 | 19.31 | 22.21 | | 7.77 | | 30 | Pass |
| VHT40 | MCS0 | 2 | 102 | 5510 | 15.20 | 16.00 | 18.63 | 22.21 | | 7.77 | | 30 | Pass |
| VHT40 | MCS0 | 2 | 110 | 5550 | 18.00 | 17.70 | 20.86 | 22.21 | | 7.77 | | 30 | Pass |
| VHT40 | MCS0 | 2 | 134 | 5670 | 17.50 | 17.10 | 20.31 | 22.21 | | 7.77 | | 30 | Pass |
| VHT80 | MCS0 | 2 | 106 | 5530 | 12.60 | 13.00 | 15.81 | 22.21 | | 7.77 | | 30 | Pass |
| VHT80 | MCS0 | 2 | 122 | 5610 | 18.00 | 17.60 | 20.81 | 22.21 | | 7.77 | | 30 | Pass |

| FCC Band III straddle channel MIMO | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Average Conducted Power (dBm) | | | FCC Conducted Power Limit (dBm) | | DG (dBi) | | EIRP Power Limit (dBm) | Pass/Fail |
| | | | | | Ant 1 | Ant 2 | SUM | Ant 1 | Ant 2 | Ant 1 | Ant 2 | | |
| 11a | 6Mbps | 2 | 144 | 5720 | 17.30 | 17.10 | 20.21 | 21.60 | | 7.77 | | 30 | Pass |
| HT20 | MCS0 | 2 | 144 | 5720 | 17.70 | 17.40 | 20.56 | 21.91 | | 7.77 | | 30 | Pass |
| HT40 | MCS0 | 2 | 142 | 5710 | 18.10 | 17.50 | 20.82 | 22.21 | | 7.77 | | 30 | Pass |
| VHT20 | MCS0 | 2 | 144 | 5720 | 17.60 | 17.30 | 20.46 | 22.21 | | 7.77 | | 30 | Pass |
| VHT40 | MCS0 | 2 | 142 | 5710 | 17.80 | 17.20 | 20.52 | 22.21 | | 7.77 | | 30 | Pass |
| VHT80 | MCS0 | 2 | 138 | 5690 | 18.30 | 17.50 | 20.93 | 22.21 | | 7.77 | | 30 | Pass |

# Appendix B. Radiated Spurious Emission

| Test Engineer : | Leo Lee, Mancy Chou and Bigshow Wang | Temperature : | 21.4~22.9°C |
|---|---|---|---|
| | | Relative Humidity : | 52~61% |

**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. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0+1 | | ( MHz ) | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | (dBμV) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| 802.11a CH 36 5180MHz | | 5144.82 | 60.79 | -13.21 | 74 | 48.22 | 32.09 | 10.49 | 30.01 | 100 | 49 | P | H |
| | | 5147.42 | 52.02 | -1.98 | 54 | 39.45 | 32.09 | 10.49 | 30.01 | 100 | 49 | A | H |
| | * | 5180 | 114.51 | - | - | 102.06 | 31.92 | 10.54 | 30.01 | 100 | 49 | P | H |
| | * | 5180 | 106.93 | - | - | 94.48 | 31.92 | 10.54 | 30.01 | 100 | 49 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 5147.42 | 61.74 | -12.26 | 74 | 49.17 | 32.09 | 10.49 | 30.01 | 393 | 340 | P | V |
| | | 5148.46 | 51.85 | -2.15 | 54 | 39.27 | 32.1 | 10.49 | 30.01 | 393 | 340 | A | V |
| | * | 5180 | 113.69 | - | - | 101.24 | 31.92 | 10.54 | 30.01 | 393 | 340 | P | V |
| | * | 5180 | 106.23 | - | - | 93.78 | 31.92 | 10.54 | 30.01 | 393 | 340 | A | V |
| | | | | | | | | | | | | | 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 (Harmonic @ 3m)

| WIFI Ant. 0+1 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 802.11a CH 36 5180MHz | | 10360 | 49.37 | -18.83 | 68.2 | 55.96 | 39.9 | 14.41 | 60.9 | 100 | 0 | P | H |
| | | 15540 | 47.53 | -26.47 | 74 | 54.96 | 38 | 17.28 | 62.71 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 10360 | 48.73 | -19.47 | 68.2 | 55.32 | 39.9 | 14.41 | 60.9 | 100 | 0 | P | V |
| | | 15540 | 47.17 | -26.83 | 74 | 54.6 | 38 | 17.28 | 62.71 | 100 | 0 | P | V |
| | | | | | | | | | | | | | 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. |
| ! | 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 | Path | Preamp | Ant | Table | Peak | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| 0+1 | | ( 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. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

**For Peak Limit @ 2390MHz:**

1. Level(dBμV/m)

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

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

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

**For Average Limit @ 2390MHz:**

1. Level(dBμV/m)

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

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

= 43.54 (dBμV/m)

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

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

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

# Appendix C. Radiated Spurious Emission

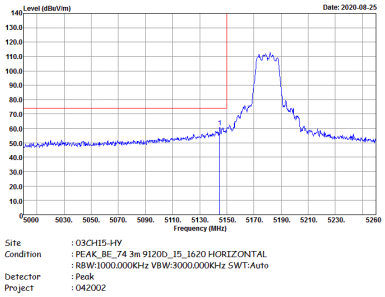
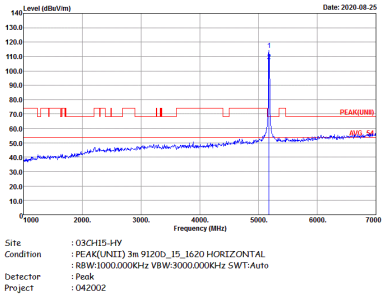
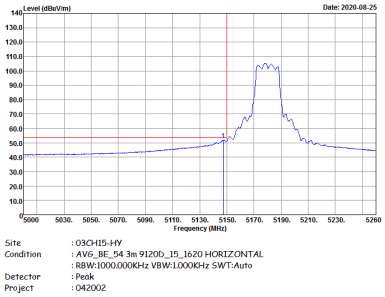
| | | | |
|---|---|---|---|
| **Test Engineer :** | Leo Lee, Mancy Chou and Bigshow Wang | **Temperature :** | 21.4~22.9°C |
| | | **Relative Humidity :** | 52~61% |

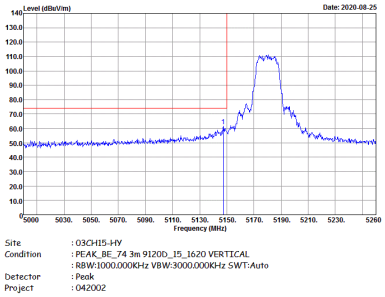
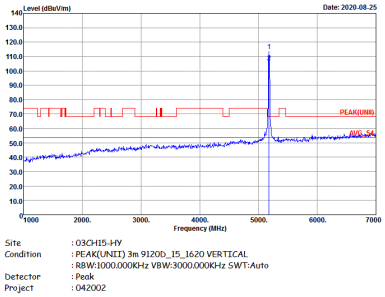
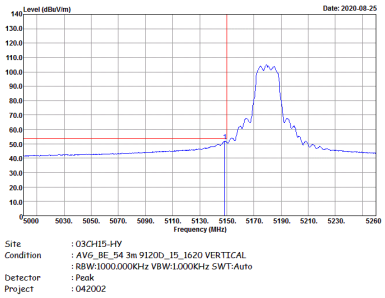
## Note symbol

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

## Band 1 - 5150~5250MHz

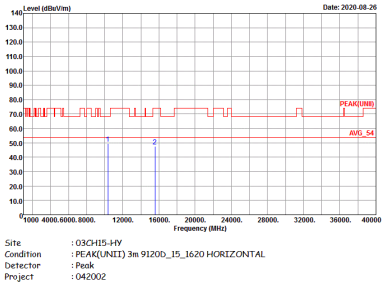
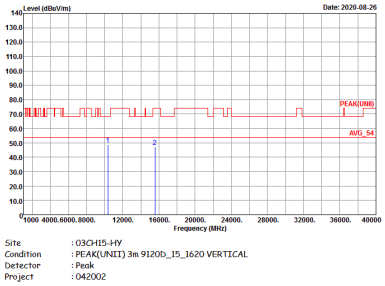
## WIFI 802.11a (Band Edge @ 3m)

| WIFI | Band 1 5150~5250MHz Band Edge @ 3m | |
|---|---|---|
| ANT | 802.11a CH36 5180MHz | |
| 0+1 | Horizontal | Fundamental |
| Peak |  |  |
| Avg. |  | Left blank |

| WIFI | Band 1 5150~5250MHz Band Edge @ 3m | |
|---|---|---|
| ANT | 802.11a CH36 5180MHz | |
| 0+1 | Vertical | Fundamental |
| Peak |  |  |
| Avg. |  | Left blank |

## Band 1 - 5150~5250MHz

## WIFI 802.11a (Harmonic @ 3m)

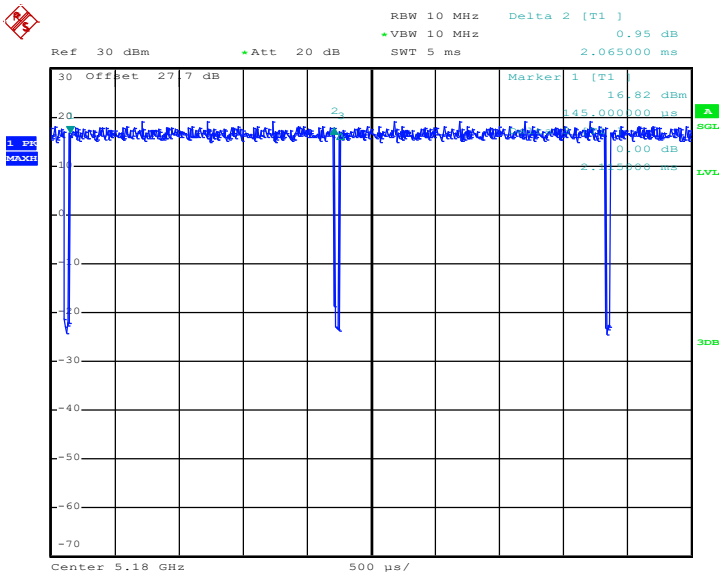
| WIFI | Band 1 5150~5250MHz Harmonic @ 3m | |
|---|---|---|
| ANT | 802.11a CH36 5180MHz | |
| 0+1 | Horizontal | Vertical |
| Peak<br>Avg. |  |  |

# Appendix D. Duty Cycle Plots

| Antenna | Band | Duty Cycle(%) | T(us) | 1/T(kHz) | VBW Setting | Duty Factor(dB) |
|---|---|---|---|---|---|---|
| 0+1 | 802.11a for Ant 0 | 97.64 | 2065 | 0.48 | 1kHz | 0.10 |
| 0+1 | 802.11a for Ant 1 | 97.87 | 2070 | 0.48 | 1kHz | 0.09 |

**MIMO <Ant. 0>**

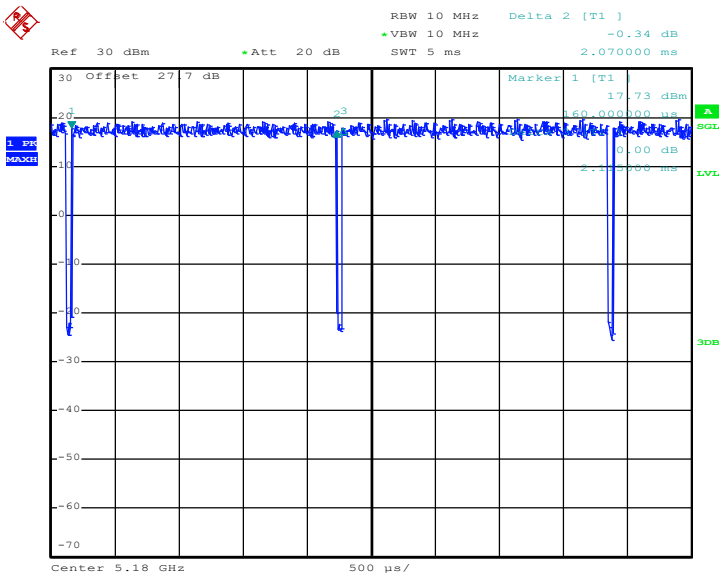
**802.11a**




Date: 11.JUN.2020 15:45:04

**MIMO <Ant. 1>**

**802.11a**

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