# FCC Co-Location Test Report

| | | |
|---|---|---|
| **FCC ID** | : | **I88NBG6815** |
| **Equipment** | : | **Simultaneous Dual-Band Wireless AC2200 Gigabit Ethernet Gateway** |
| **Model No.** | : | **EMG3425-Q10A、NBG6815 (Please refer to section 1.1.1 for more details.)** |
| **Brand Name** | : | **ZyXEL** |
| **Applicant** | : | **ZyXEL Communications Corporation** |
| **Address** | : | **No. 2, Gongye E. 9th Road, Hsinchu Science Park, Hsinchu, Taiwan.** |
| **Standard** | : | **47 CFR FCC Part 15.247<br>47 CFR FCC Part 15.407** |
| **Received Date** | : | **Jun. 16, 2015** |
| **Tested Date** | : | **Aug. 10 ~ Aug. 14, 2015** |

**We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.**

**Approved & Reviewed by:**

**Gary Chang / Manager**

Testing Laboratory 2732

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# Release Record

| Report No. | Version | Description | Issued Date |
|---|---|---|---|
| FR570601-01CO | Rev. 01 | Initial issue | Nov. 26, 2015 |

# Summary of Test Results

| FCC Rules | Test Items | Measured | Result |
|---|---|---|---|
| 15.247(d)<br>15.407(b)<br>15.209 | Radiated Emissions | [dBuV/m at 3m]: 2787.00MHz 50.05 (Margin -3.95dB) – AV | Pass |

# 1 General Description

## 1.1 Information

### 1.1.1 Product Details

The following models are provided to this EUT.

| Brand Name | Model Name | Product Name | Description |
|---|---|---|---|
| ZyXEL | EMG3425-Q10A | Simultaneous Dual-Band Wireless AC2200 Gigabit Ethernet Gateway | The difference between both models is only numbers of LED of non-RF portion |
| | NBG6815 | | |
| ✦ The above models, model **EMG3425-Q10A** was selected as a representative one for the final test and only its data was recorded in this report since this model is the worst one. | | | |

### 1.1.2 Specification of the Equipment under Test (EUT)

| | |
|---|---|
| **Operating Frequency** | 802.11b/g/n: 2412 MHz ~ 2462 MHz<br>802.11a/n/ac: 5180 MHz ~ 5240 MHz; 5745 MHz ~ 5825 MHz |
| **Modulaton Type** | 802.11b: DSSS (DBPSK / DQPSK / CCK)<br>802.11a/g/n/ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM) |

### 1.1.3 Antenna Details

| Ant. No. | Type | Operating Frequency / Gain (dBi) | | Connector |
|---|---|---|---|---|
| | | 2.4GHz | 5GHz | |
| 1 | Dipole | 1.53 | 1.92 | UFL |

### 1.1.4 Power Supply Type of Equipment under Test (EUT)

| | |
|---|---|
| **Power Supply Type** | 12Vdc from AC adapter |

### 1.1.5 Accessories

| Accessories | | |
|---|---|---|
| **No.** | **Equipment** | **Description** |
| 1 | AC adapter | Brand Name: APD<br>Model Name: DA-48T12<br>Power Rating:<br>I/P: 100-240Vac, 50-60Hz, 1.4A Max<br>O/P: 12Vdc, 4A<br>Power Line:<br>AC 1.5m non-shielded cable w/o core<br>DC 1.2m non-shielded cable w/o core |
| 2 | AC adapter | Brand Name: APD<br>Model Name: WA-36A12FU<br>Power Rating:<br>I/P: 100-240Vac, 50-60Hz, 0.9A Max<br>O/P: 12Vdc, 3A<br>Power Line:<br>DC 1.5m non-shielded cable with one core |
| 3 | RJ45 cable | 1.0m non-shielded cable w/o core. |

## 1.2 The Equipment List

| Test Item | Radiated Emission | | | | |
|---|---|---|---|---|---|
| **Test Site** | 966 chamber 3 / (03CH03-WS) | | | | |
| **Instrument** | **Manufacturer** | **Model No.** | **Serial No.** | **Calibration Date** | **Calibration Until** |
| Spectrum Analyzer | Agilent | N9010A | MY53400091 | Sep. 16, 2014 | Sep. 15, 2015 |
| Receiver | Agilent | N9038A | MY53290044 | Oct. 21, 2014 | Oct. 20, 2015 |
| Bilog Antenna | SCHWARZBECK | VULB9168 | VULB9168-562 | Jan. 19, 2015 | Jan. 18, 2016 |
| Horn Antenna 1G-18G | SCHWARZBECK | BBHA 9120 D | BBHA 9120 D 1206 | Feb. 03, 2015 | Feb. 02, 2016 |
| Horn Antenna 18G-40G | SCHWARZBECK | BBHA 9170 | BBHA 9170517 | Nov. 10, 2014 | Nov. 09, 2015 |
| Loop Antenna | R&S | HFH2-Z2 | 11900 | Nov. 10, 2014 | Nov. 09, 2015 |
| Preamplifier | EMC | EMC02325 | 980187 | Sep. 26, 2014 | Sep. 25, 2015 |
| Preamplifier | Agilent | 83017A | MY53270014 | Sep. 17, 2014 | Sep. 16, 2015 |
| Preamplifier | EMC | EMC184045B | 980192 | Aug. 26, 2014 | Aug. 25, 2015 |
| RF cable-3M | HUBER+SUHNER | SUCOFLEX104 | MY22620/4 | Feb. 09, 2015 | Feb. 08, 2016 |
| RF cable-8M | HUBER+SUHNER | SUCOFLEX104 | MY22601/4 | Feb. 09, 2015 | Feb. 08, 2016 |
| RF cable-1M | HUBER+SUHNER | SUCOFLEX104 | MY22624/4 | Feb. 09, 2015 | Feb. 08, 2016 |
| LF cable-0.8M | EMC | EMC8D-NM-NM-800 | EMC8D-NM-NM-800-001 | Feb. 09, 2015 | Feb. 08, 2016 |
| LF cable-3M | EMC | EMC8D-NM-NM-3000 | 131103 | Feb. 09, 2015 | Feb. 08, 2016 |
| LF cable-13M | EMC | EMC8D-NM-NM-13000 | 131104 | Feb. 09, 2015 | Feb. 08, 2016 |
| Measurement Software | AUDIX | e3 | 6.120210g | NA | NA |
| Note: Calibration Interval of instruments listed above is one year. | | | | | |

## 1.3 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.247
47 CFR FCC Part 15.407
ANSI C63.10-2013
FCC KDB 558074 D01 DTS Meas Guidance v03r03
FCC KDB 662911 D01 Multiple Transmitter Output v02r01
FCC KDB 789033 D02 General UNII Test Procedures New Rules v01
FCC KDB 644545 D03 Guidance for IEEE 802 11ac New Rules v01
FCC KDB 412172 D01 Determining ERP and EIRP v01r01

## 1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

| Measurement Uncertainty | |
|---|---|
| **Parameters** | **Uncertainty** |
| Radiated emission ≤ 1GHz | ±3.99 dB |
| Radiated emission > 1GHz | ±5.52 dB |

# 2 Test Configuration

## 2.1 Testing Condition

| Test Item | Test Site | Ambient Condition | Tested By |
|---|---|---|---|
| Radiated Emissions | 03CH03-WS | 21-22°C / 62-67% | Anderson Hong<br>Warren Lee |

- FCC site registration No.: 390588
- IC site registration No.: 10807C-1

## 2.2 The Worst Test Modes and Channel Details

| Test item | Modulation Mode | Test Frequency (MHz) | Data Rate |
|---|---|---|---|
| Radiated Emissions | 2.4G 11g + 5G 11ac VHT40 | CH6 + CH46 | 6Mbps + MCS 0 |
| **NOTE:** Adapter 1 and Adapter 2 had been pretested and found that **Adapter 1** was the worst case and was selected for final testing. (Adapter 1: DA-48T12; Adapter 2: WA-36A12FU). | | | |

# 3 Transmitter Test Results

## 3.1 Unwanted Emissions into Restricted Frequency Bands

### 3.1.1 Limit of Unwanted Emissions into Restricted Frequency Bands

| Restricted Band Emissions Limit | | | |
|---|---|---|---|
| **Frequency Range (MHz)** | **Field Strength (uV/m)** | **Field Strength (dBuV/m)** | **Measure Distance (m)** |
| 0.009~0.490 | 2400/F(kHz) | 48.5 - 13.8 | 300 |
| 0.490~1.705 | 24000/F(kHz) | 33.8 - 23 | 30 |
| 1.705~30.0 | 30 | 29 | 30 |
| 30~88 | 100 | 40 | 3 |
| 88~216 | 150 | 43.5 | 3 |
| 216~960 | 200 | 46 | 3 |
| Above 960 | 500 | 54 | 3 |

**Note 1:**
Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit
**Note 2:**
Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

### 3.1.2 Test Procedures

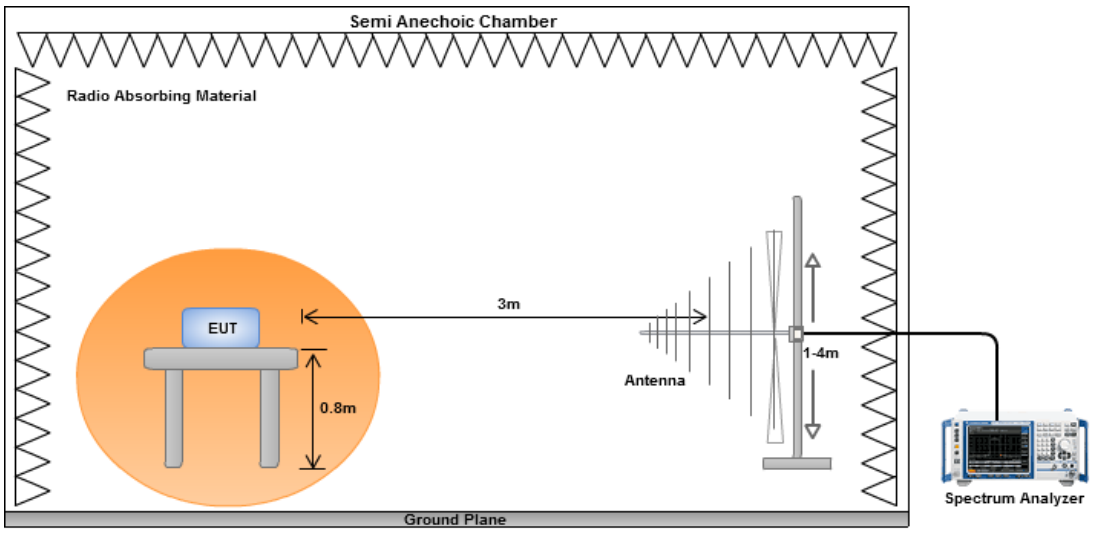
1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

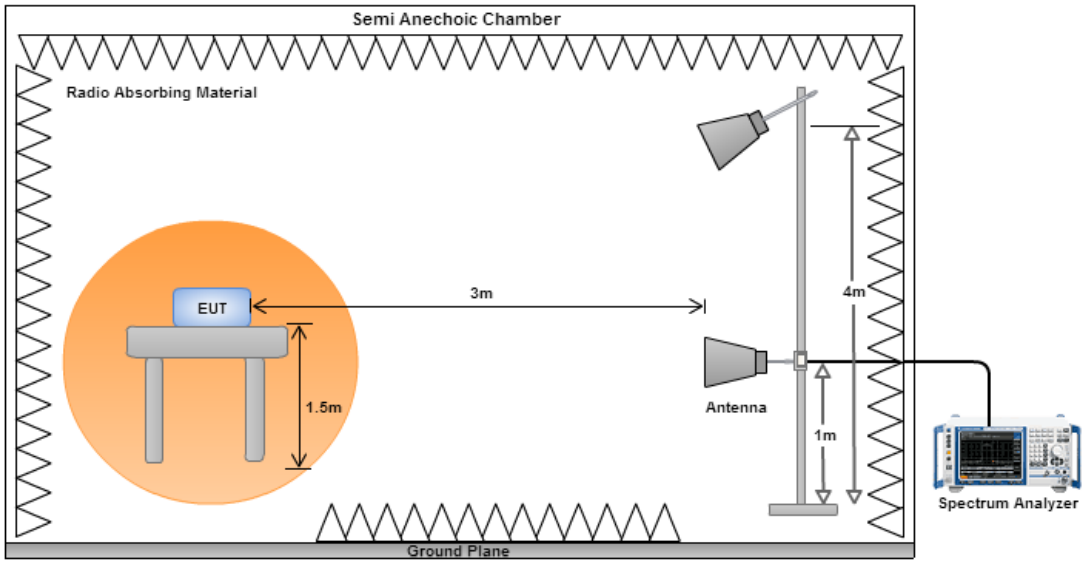
1. 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission below 1GHz.
2. RBW=1MHz, VBW=3MHz and Peak detector is for peak measured value of radiated emission above 1GHz.
3. RBW=1MHz, VBW=1/T and Peak detector is for average measured value of radiated emission above 1GHz.

### 3.1.3 Test Setup

**Radiated Emissions below 1 GHz**

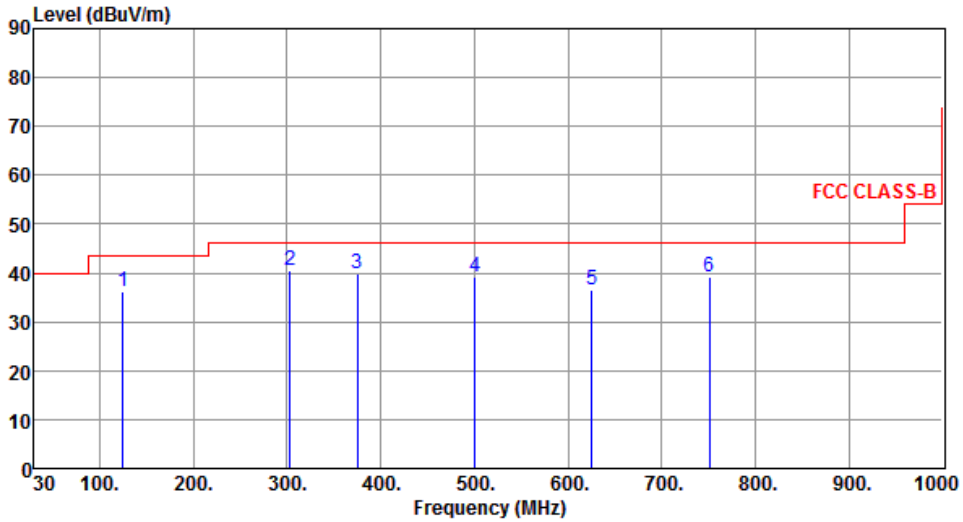



**Radiated Emissions above 1 GHz**



### 3.1.4 Transmitter Radiated Unwanted Emissions (Below 1GHz)

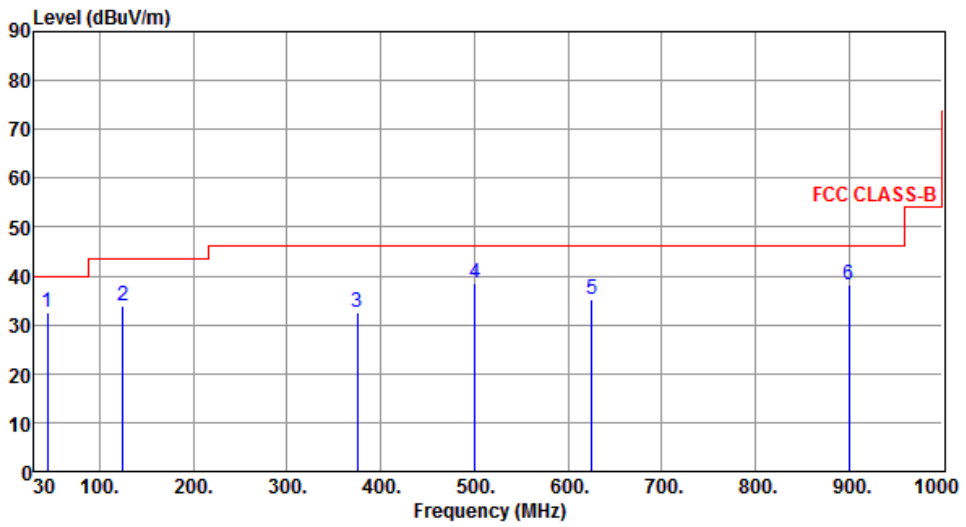
| **Modulation** | 2.4G 11g + 5G 11ac VHT40 | **Test Freq. (MHz)** | CH6 + CH46 |
|---|---|---|---|
| **Polarization** | Horizontal | | |




| | Freq. MHz | Emission level dBuV/m | Limit dBuV/m | Margin dB | SA reading dBuV | Factor dB | Remark | ANT High cm | Turn Table deg |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 125.06 | 36.20 | 43.50 | -7.30 | 51.30 | -15.10 | Peak | --- | --- |
| 2 | 303.54 | 40.42 | 46.00 | -5.58 | 52.98 | -12.56 | Peak | --- | --- |
| 3 | 375.32 | 39.74 | 46.00 | -6.26 | 50.47 | -10.73 | Peak | --- | --- |
| 4 | 500.45 | 39.30 | 46.00 | -6.70 | 46.94 | -7.64 | Peak | --- | --- |
| 5 | 625.58 | 36.46 | 46.00 | -9.54 | 41.78 | -5.32 | Peak | --- | --- |
| 6 | 750.71 | 39.11 | 46.00 | -6.89 | 42.29 | -3.18 | Peak | --- | --- |

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

| Modulation | 2.4G 11g + 5G 11ac VHT40 | Test Freq. (MHz) | CH6 + CH46 |
|---|---|---|---|
| Polarization | Vertical | | |

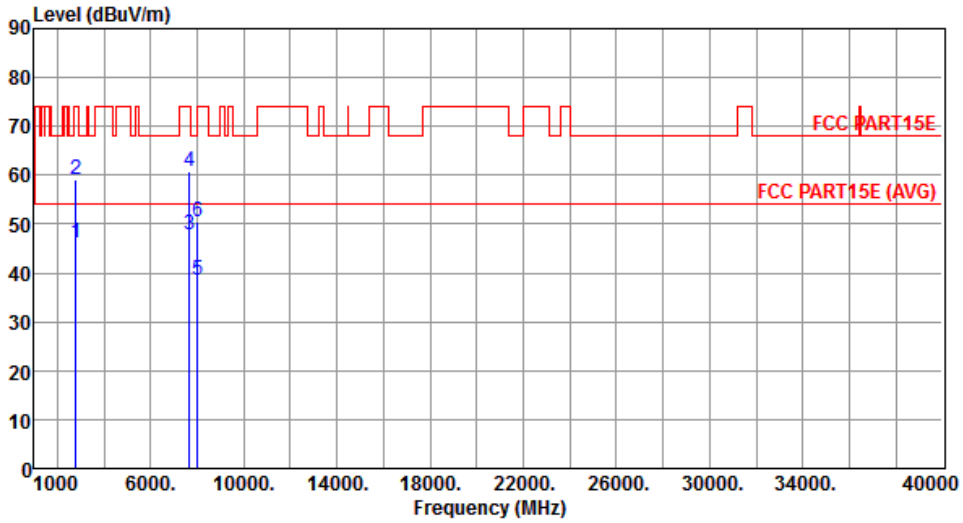



| | Freq. MHz | Emission level dBuV/m | Limit dBuV/m | Margin dB | SA reading dBuV | Factor dB | Remark | ANT High cm | Turn Table deg |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 44.55 | 32.56 | 40.00 | -7.44 | 45.40 | -12.84 | Peak | --- | --- |
| 2 | 125.06 | 33.92 | 43.50 | -9.58 | 49.02 | -15.10 | Peak | --- | --- |
| 3 | 375.32 | 32.39 | 46.00 | -13.61 | 43.12 | -10.73 | Peak | --- | --- |
| 4 | 500.45 | 38.44 | 46.00 | -7.56 | 46.08 | -7.64 | Peak | --- | --- |
| 5 | 625.58 | 35.30 | 46.00 | -10.70 | 40.62 | -5.32 | Peak | --- | --- |
| 6 | 900.09 | 38.31 | 46.00 | -7.69 | 38.98 | -0.67 | Peak | --- | --- |

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

### 3.1.5 Transmitter Radiated Unwanted Emissions (Above 1GHz)

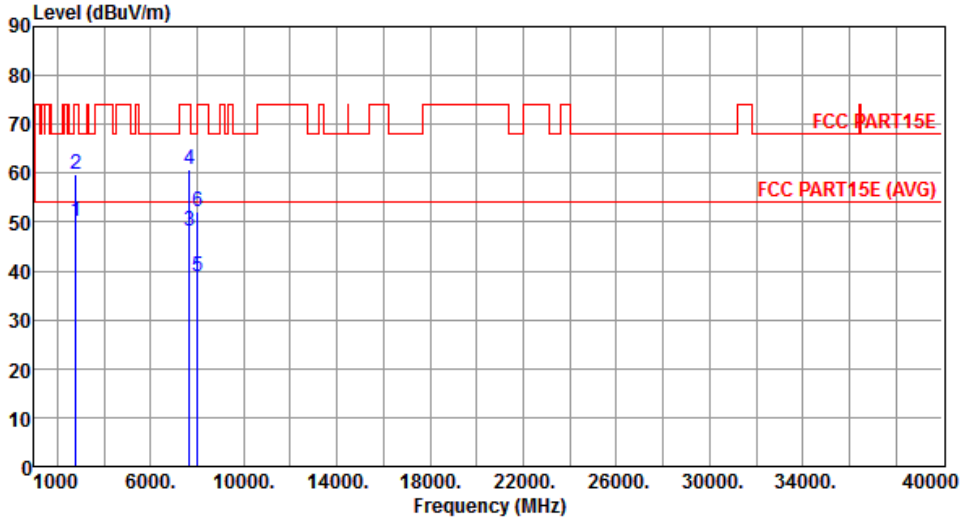
| **Modulation** | 2.4G 11g + 5G 11ac VHT40 | **Test Freq. (MHz)** | CH6 + CH46 |
|---|---|---|---|
| **Polarization** | Horizontal | | |




| | Freq. MHz | Emission level dBuV/m | Limit dBuV/m | Margin dB | SA reading dBuV | Factor dB | Remark | ANT High cm | Turn Table deg |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2787.00 | 46.29 | 54.00 | -7.71 | 46.23 | 0.06 | Average | 191 | 32 |
| 2 | 2787.00 | 59.14 | 74.00 | -14.86 | 59.08 | 0.06 | Peak | 150 | 327 |
| 3 | 7667.00 | 47.88 | 54.00 | -6.12 | 36.53 | 11.35 | Average | 244 | 268 |
| 4 | 7667.00 | 60.91 | 74.00 | -13.09 | 49.56 | 11.35 | Peak | 244 | 268 |
| 5 | 8025.00 | 38.41 | 54.00 | -15.59 | 26.62 | 11.79 | Average | 278 | 115 |
| 6 | 8025.00 | 50.40 | 74.00 | -23.60 | 38.61 | 11.79 | Peak | 278 | 115 |

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

| Modulation | 2.4G 11g + 5G 11ac VHT40 | Test Freq. (MHz) | CH6 + CH46 |
|---|---|---|---|
| Polarization | Vertical | | |




| | Freq. MHz | Emission level dBuV/m | Limit dBuV/m | Margin dB | SA reading dBuV | Factor dB | Remark | ANT High cm | Turn Table deg |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2787.00 | 50.05 | 54.00 | -3.95 | 49.99 | 0.06 | Average | 354 | 347 |
| 2 | 2787.00 | 59.68 | 74.00 | -14.32 | 59.62 | 0.06 | Peak | 354 | 347 |
| 3 | 7667.00 | 48.25 | 54.00 | -5.75 | 36.90 | 11.35 | Average | 251 | 304 |
| 4 | 7667.00 | 60.85 | 74.00 | -13.15 | 49.50 | 11.35 | Peak | 251 | 304 |
| 5 | 8025.00 | 38.91 | 54.00 | -15.09 | 27.12 | 11.79 | Average | 223 | 346 |
| 6 | 8025.00 | 52.05 | 74.00 | -21.95 | 40.26 | 11.79 | Peak | 223 | 346 |

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

# 4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp, it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan Hsiang. Location map can be found on our website http://www.icertifi.com.tw.

| **Linkou** | **Kwei Shan** | **Kwei Shan Site II** |
|---|---|---|
| Tel: 886-2-2601-1640 | Tel: 886-3-271-8666 | Tel: 886-3-271-8640 |
| No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C. | No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan Hsiang, Tao Yuan Hsien 333, Taiwan, R.O.C. | No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan Hsiang, Tao Yuan Hsien 333, Taiwan, R.O.C. |

If you have any suggestion, please feel free to contact us as below information

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