

# **FCC Test Report**

FCC ID : JVPCR20C

Equipment : ScreenBar Halo

Model No. : CR20\_C

Brand Name : BenQ

Qisda Ref. No : AL-27599

Applicant : BenQ Corporation

Address : 16 Jihu Road, Neihu, Taipei 114, Taiwan

Standard : 47 CFR FCC Part 15.249

Received Date : Feb. 04, 2021

Tested Date : Mar. 05 ~ Mar. 08, 2021

We, International Certification Corporation, 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.

Reviewed by: Approved by:

Along Chen / Assistant Manager Gary Chang / Manager

Testing Laboratory 2732

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## **Release Record**

| Report No. | Version | Description   | Issued Date   |
|------------|---------|---------------|---------------|
| FR120403   | Rev. 01 | Initial issue | Mar. 30, 2021 |

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## **Summary of Test Results**

| FCC Rules    | Test Items  | Measured   | Result |
|--------------|---|--|--------|
| 15.207       | AC Power Line Conducted Emissions   | [dBuV]: 0.763MHz<br>32.60 (Margin -13.40dB) - AV | Pass   |
| 15.249(a)    | Field Strength of Fundamental   | Meet the requirement of limit                    | Pass   |
| 15.249(a)(d) | Field Strength of Harmonics and Emissions<br>Radiated outside of the Specified Frequency<br>Bands | Meet the requirement of limit                    | Pass   |
| 15.215(c)    | 20dB bandwidth  | Meet the requirement of limit                    | Pass   |
| 15.203       | Antenna Requirement   | Meet the requirement of limit                    | 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.

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## 1 General Description

## 1.1 Information

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

| RF General Information                         |      |           |         |         |  |  |
|--|------|-----------|---------|---------|--|--|
| Frequency Range (MHz) Channel Number Data Rate |      |           |         |         |  |  |
| 2400-2483.5                                    | GFSK | 2405-2475 | 0-2 [3] | 125kbps |  |  |

### 1.1.2 Antenna Details

| Ant.<br>No. | Brand | Model | Туре     | Connector | Gain (dBi) |
|-------------|-------|-------|----------|-----------|------------|
| 1           | Qisda | CR20  | Monopole | No        | 2.04       |

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

| Power Supply Type | From USB port, DC 5V |
|-------------------|----------------------|
|-------------------|----------------------|

### 1.1.4 Channel List

| Channel | Frequency (MHz) |
|---------|-----------------|
| 0       | 2405            |
| 1       | 2446            |
| 2       | 2475            |

## 1.1.5 Test Tool and Duty Cycle

| Test Tool                  | Hardware control |                  |  |  |
|----------------------------|------------------|------------------|--|--|
| Duty Cycle and Duty Factor | Duty Cycle (%)   | Duty Factor (dB) |  |  |
| Duty Cycle and Duty Factor | 41.40%           | 3.83             |  |  |

### 1.1.6 Power Index of Test Tool

| Power Index     |                         |      |      |  |  |
|-----------------|-------------------------|------|------|--|--|
| Modulation Made | Test Frequency (MHz)    |      |      |  |  |
| Modulation Mode | 2405                    | 2446 | 2475 |  |  |
| GFSK            | Default Default Default |      |      |  |  |

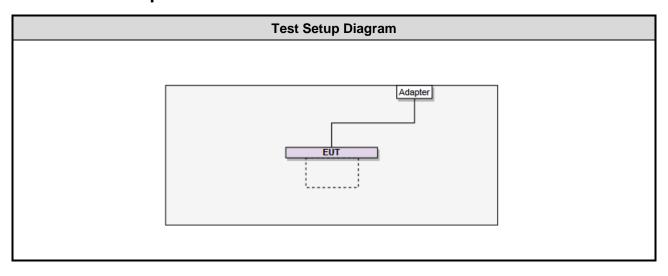
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## 1.2 Local Support Equipment List

|  | Support Equipment List |         |            |     |         |  |  |
|--|------------------------|---------|------------|-----|---------|--|--|
| No. Equipment Brand Model FCC ID Remar |                        |         |            |     | Remarks |  |  |
| 1                                      | Adapter                | Samsung | ETA-U90JWS | DoC |         |  |  |

## 1.3 Test Setup Chart



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## 1.4 The Equipment List

| Test Item               | Conducted Emission   | Conducted Emission            |               |               |               |  |  |
|-------------------------|--|-------------------------------|---------------|---------------|---------------|--|--|
| Test Site               | Conduction room 1 / (  | Conduction room 1 / (CO01-WS) |               |               |               |  |  |
| Instrument              | Instrument Brand Model No. Serial No. Calibration Date Calibration Until |                               |               |               |               |  |  |
| Receiver                | R&S  | ESR3                          | 101658        | Feb. 08, 2021 | Feb. 07, 2022 |  |  |
| LISN                    | R&S  | ENV216                        | 101579        | Mar. 12, 2020 | Mar. 11, 2021 |  |  |
| RF Cable-CON            | Woken  | CFD200-NL                     | CFD200-NL-001 | Oct. 21, 2020 | Oct. 20, 2021 |  |  |
| Measurement<br>Software | AUDIX  | e3                            | 6.120210k     | NA            | NA            |  |  |
| Note: Calibration Inte  | rval of instruments liste  | d above is one year.          | •             | •             |               |  |  |

| Test Item               | Radiated Emission   |                           |                  |                  |                   |  |
|-------------------------|---|---------------------------|------------------|------------------|-------------------|--|
| Test Site               | 966 chamber1 / (03CH01-WS)  |                           |                  |                  |                   |  |
| Instrument              | Brand   | Model No.                 | Serial No.       | Calibration Date | Calibration Until |  |
| Spectrum Analyzer       | R&S   | FSV40                     | 101498           | Dec. 04, 2020    | Dec. 03, 2021     |  |
| Receiver                | R&S   | ESR3                      | 101658           | Feb. 08, 2021    | Feb. 07, 2022     |  |
| Bilog Antenna           | SCHWARZBECK   | VULB9168                  | VULB9168-522     | Jul. 10, 2020    | Jul. 09, 2021     |  |
| Horn Antenna<br>1G-18G  | SCHWARZBECK   | BBHA 9120 D               | BBHA 9120 D 1096 | Dec. 11, 2020    | Dec. 10, 2021     |  |
| Horn Antenna<br>18G-40G | SCHWARZBECK   | BBHA 9170                 | BBHA 9170517     | Nov. 06, 2020    | Nov. 05, 2021     |  |
| Loop Antenna            | R&S   | HFH2-Z2                   | 100330           | Nov. 17, 2020    | Nov. 16, 2021     |  |
| Loop Antenna Cable      | KOAX KABEL  | 101354-BW                 | 101354-BW        | Oct. 06, 2020    | Oct. 05, 2021     |  |
| Preamplifier            | EMC   | EMC02325                  | 980225           | Jul. 03, 2020    | Jul. 02, 2021     |  |
| Preamplifier            | Agilent   | 83017A                    | MY39501308       | Sep. 26, 2020    | Sep. 25, 2021     |  |
| Preamplifier            | EMC   | EMC184045B                | 980192           | Jul. 21, 2020    | Jul. 20, 2021     |  |
| RF Cable                | EMC   | EMC104-SM-SM-80<br>00     | 181106           | Oct. 06, 2020    | Oct. 05, 2021     |  |
| RF Cable                | HUBER+SUHNER  | SUCOFLEX104               | MY16019/4        | Oct. 06, 2020    | Oct. 05, 2021     |  |
| RF Cable                | HUBER+SUHNER  | SUCOFLEX104               | MY16014/4        | Oct. 06, 2020    | Oct. 05, 2021     |  |
| LF cable 1M             | EMC   | EMCCFD400-NM-N<br>M-1000  | 160502           | Oct. 06, 2020    | Oct. 05, 2021     |  |
| LF cable 3M             | Woken   | CFD400NL-LW               | CFD400NL-001     | Oct. 06, 2020    | Oct. 05, 2021     |  |
| LF cable 11M            | EMC   | EMCCFD400-NW-N<br>W-11000 | 200801           | Oct. 06, 2020    | Oct. 05, 2021     |  |
| Measurement<br>Software | AUDIX   | e3                        | 6.120210g        | NA               | NA                |  |
| Note: Calibration Inte  | Note: Calibration Interval of instruments listed above is one year. |                           |                  |                  |                   |  |

## 1.5 Test Standards

47 CFR FCC Part 15.249 ANSI C63.10-2013

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## 1.6 Deviation from Test Standard and Measurement Procedure

None

## 1.7 Measurement Uncertainty

The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)).

| Measurement Uncertainty  |             |  |  |
|--------------------------|-------------|--|--|
| Parameters               | Uncertainty |  |  |
| Bandwidth                | ±34.130 Hz  |  |  |
| AC conducted emission    | ±2.92 dB    |  |  |
| Radiated emission ≤ 1GHz | ±3.41 dB    |  |  |
| Radiated emission > 1GHz | ±4.59 dB    |  |  |

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## 2 Test Configuration

## 2.1 Testing Facility

| Test Laboratory      | International Certification Corporation  |
|----------------------|--|
| Test Site            | CO01-WS, 03CH01-WS, TH01-WS  |
| Address of Test Site | No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.) |

FCC Designation No.: TW2732FCC site registration No.: 181692

➤ ISED#: 10807A

➤ CAB identifier: TW2732

## 2.2 The Worst Test Modes and Channel Details

| Test item                         | Mode | Test Frequency<br>(MHz) | Data Rate | Test<br>Configuration |
|-----------------------------------|------|-------------------------|-----------|-----------------------|
| AC Power Line Conducted Emissions | GFSK | 2446                    | 125kbps   |                       |
| Field Strength of Fundamental     | GFSK | 2405 / 2446 / 2475      | 125kbps   |                       |
| Radiated Emissions ≤ 1GHz         | GFSK | 2446                    | 125kbps   |                       |
| Radiated Emissions > 1GHz         | GFSK | 2405 / 2446 / 2475      | 125kbps   |                       |
| 20dB bandwidth                    | GFSK | 2405 / 2446 / 2475      | 125kbps   |                       |

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## 3 Transmitter Test Results

### 3.1 Conducted Emissions

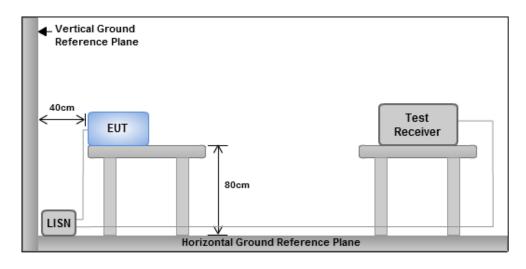
#### 3.1.1 Limit of Conducted Emissions

| Conducted Emissions Limit                                |            |           |  |
|--|------------|-----------|--|
| Frequency Emission (MHz)                                 | Quasi-Peak | Average   |  |
| 0.15-0.5   | 66 - 56 *  | 56 - 46 * |  |
| 0.5-5  | 56         | 46        |  |
| 5-30   | 60         | 50        |  |
| Note 1: * Decreases with the logarithm of the frequency. |            |           |  |

#### 3.1.2 Test Procedures

- 1. The device is placed on a test table, raised 80 cm above the reference ground plane. The vertical conducting plane is located 40 cm to the rear of the device.
- 2. The device is connected to line impedance stabilization network (LISN) and other accessories are connected to other LISN. Measured levels of AC power line conducted emission are across the 50  $\Omega$  LISN port.
- 3. AC conducted emission measurements is made over frequency range from 150 kHz to 30 MHz.
- 4. This measurement was performed with AC 120V / 60Hz.

#### 3.1.3 Test Setup



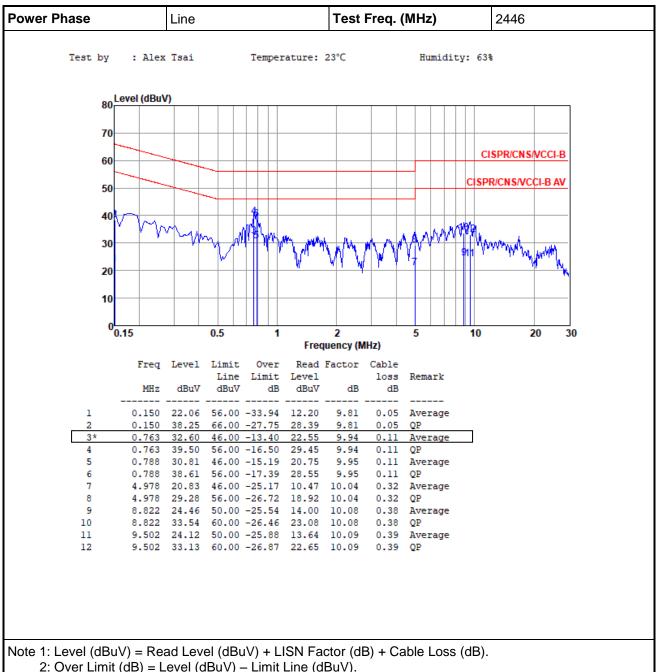
Note: 1. Support units were connected to second LISN.

Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

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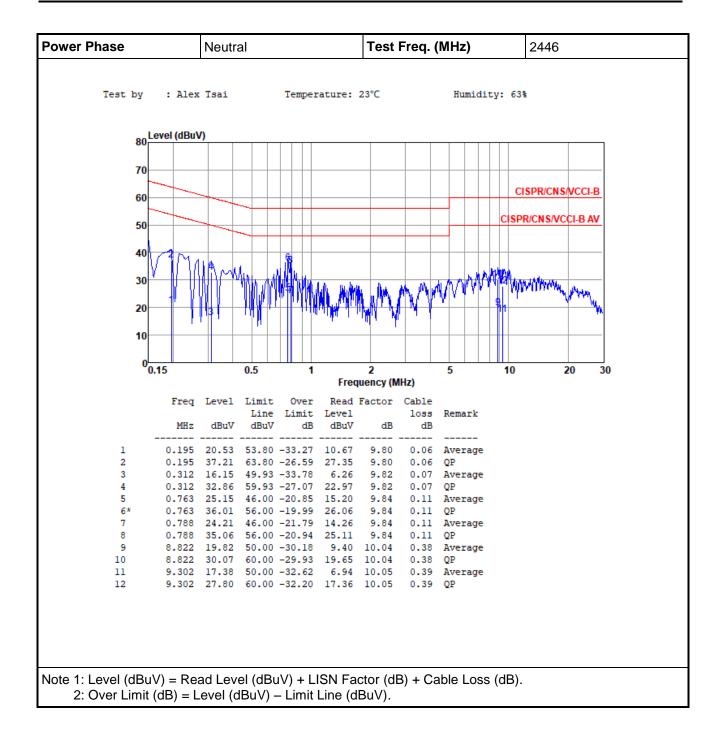
#### **Test Result of Conducted Emissions**



2: Over Limit (dB) = Level (dBuV) - Limit Line (dBuV).

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### 3.2 Radiated Emission

This section includes field strength of fundamental, field strength of harmonics and emissions radiated outside of the operating frequency bands.

### 3.2.1 Limit of field strength of fundamental and field strength of harmonics

| Fundamental Frequency | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (microvolts/meter) |  |
|-----------------------|--|--|--|
| 2400–2483.5 MHz       | 50   | 500  |  |

#### 3.2.2 Limit of Unwanted Emissions

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in below table, whichever is the lesser attenuation.

| Radiated emission limits |                       |                         |                      |
|--------------------------|-----------------------|-------------------------|----------------------|
| 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.

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#### 3.2.3 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:

- Radiated emission below 1GHz
   120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission
- Radiated emission above 1GHz / Peak value except fundamental RBW=1MHz, VBW=3MHz and Peak detector
- Radiated emission above 1GHz / Average value for field strength of fundamental and harmonics
   The average value is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:

20log (Duty cycle) = 20log 
$$\frac{0.62174 \text{ x7ms}}{100 \text{ ms}}$$
 = -27.23dB

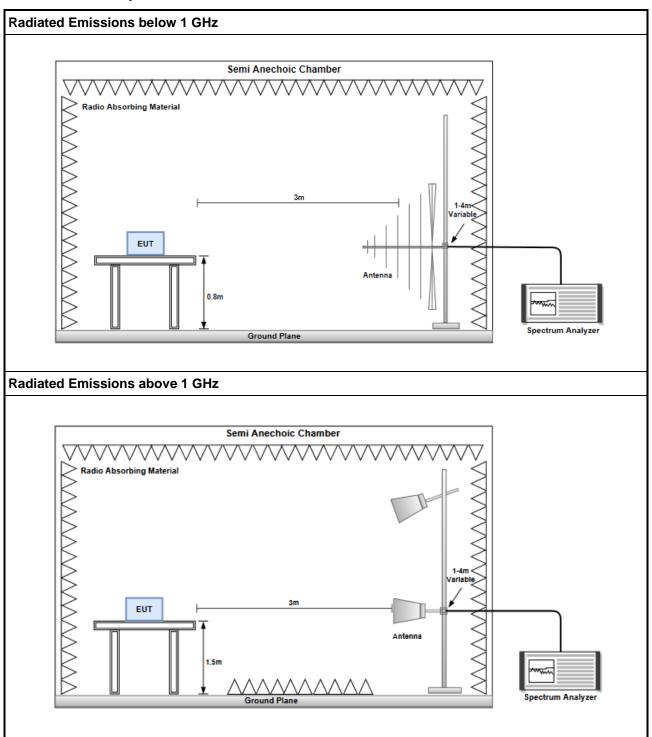
Please see page 24 for plotted duty

- 4. Radiated emission above 1GHz / Average value for other emissions RBW=1MHz, VBW=10Hz and Peak detector
- Radiated emission Peak value for fundamental RBW=3MHz, VBW=10MHz and Peak detector

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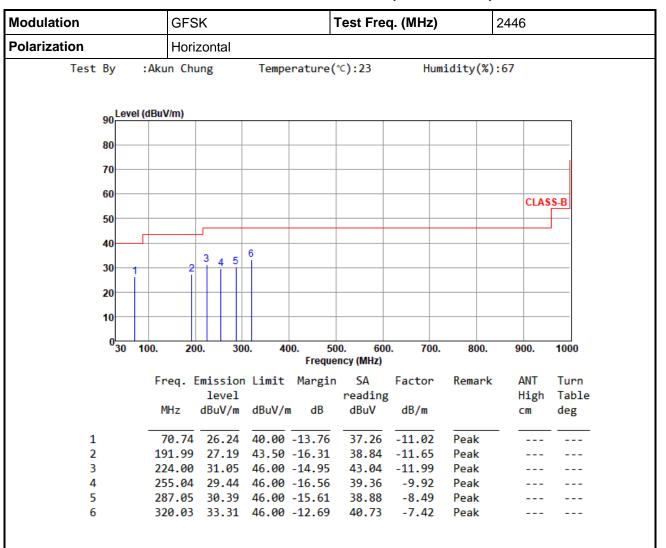
## 3.2.4 Test Setup



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



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB/m)

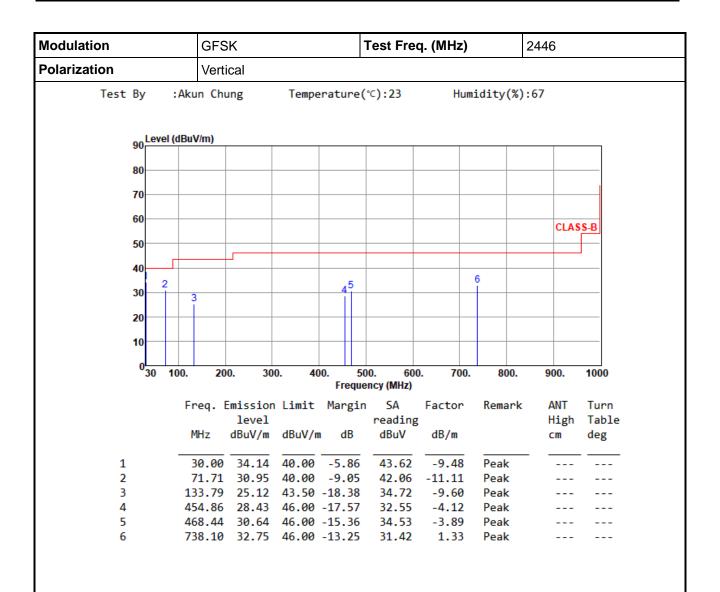
\*Factor includes antenna factor, cable loss and amplifier gain

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.

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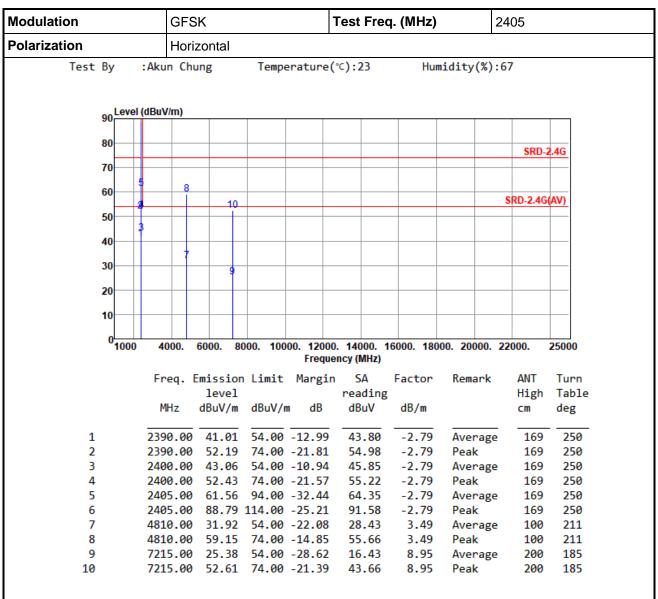
\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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



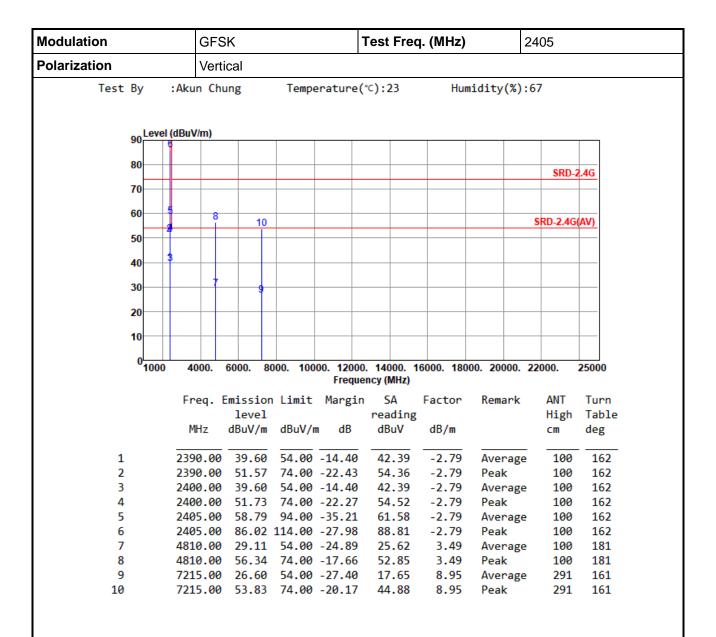
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB/m)

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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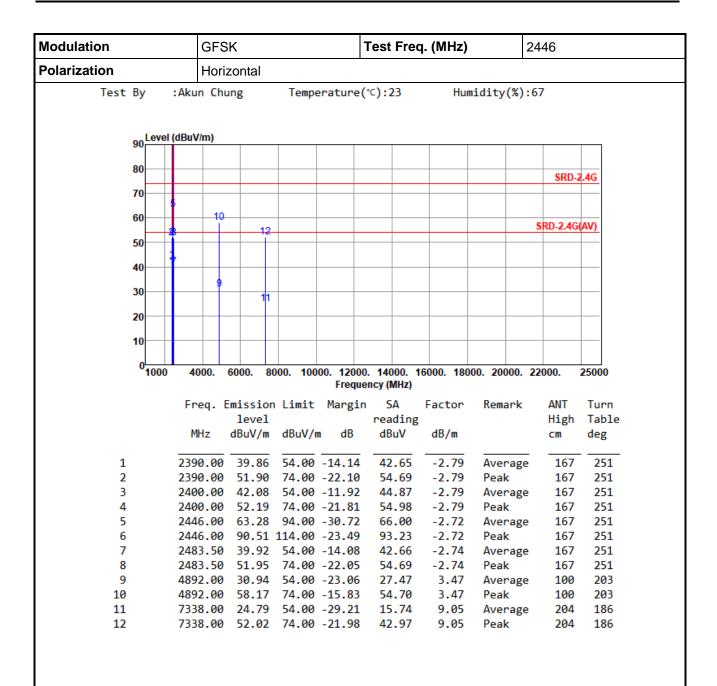


\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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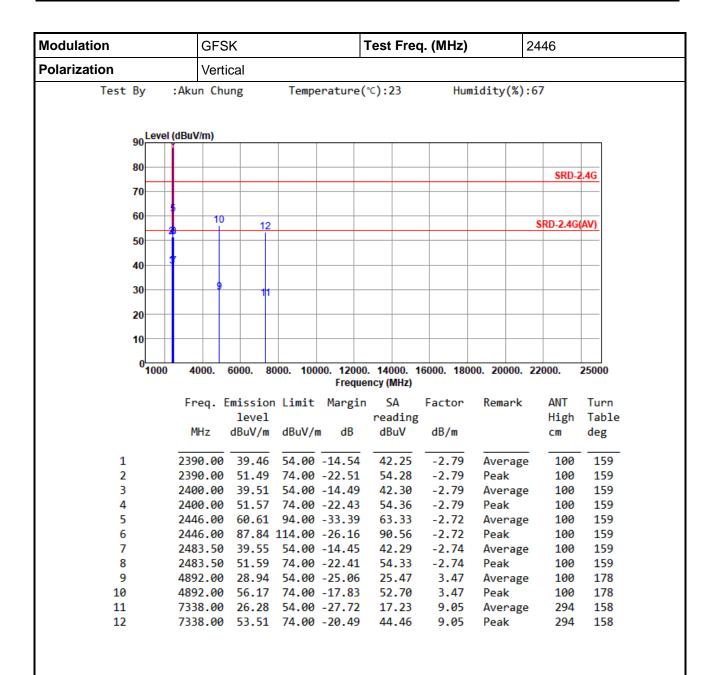


\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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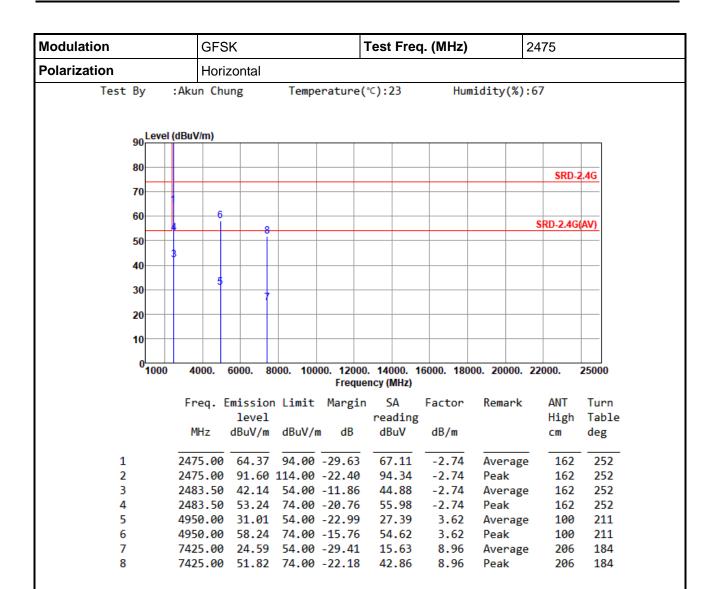


\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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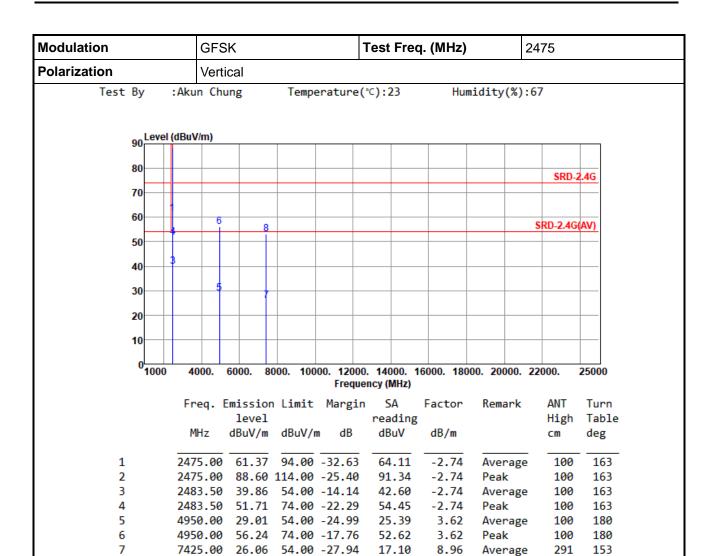


\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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44.33

8.96

Peak

291

153

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor\* (dB/m)

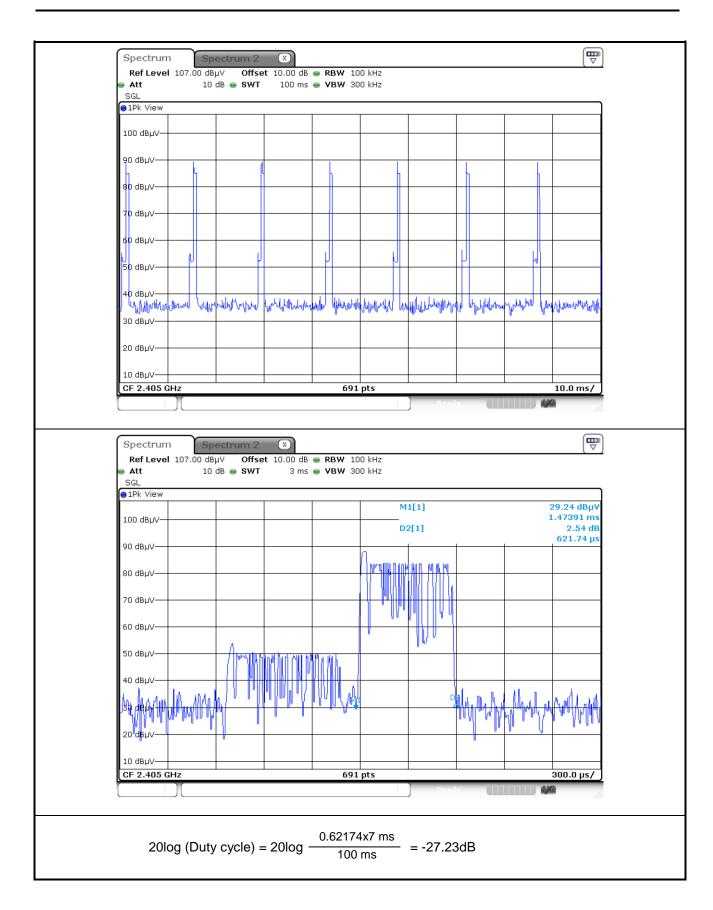
7425.00 53.29 74.00 -20.71

\*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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## 3.3 20dB and Occupied Bandwidth

### 3.3.1 Test Procedures

- 1. Set resolution bandwidth (RBW) = 20 kHz, Video bandwidth = 100 kHz.
- 2. Detector = Peak, Trace mode = max hold
- 3. Sweep = auto couple, Allow the trace to stabilize.
- 4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20dB relative to the maximum level measured in the fundamental emission.
- 5. Use the occupied measurement function of specturm analyzer to measure 99% occupied bandwidth.

### 3.3.2 Test Setup



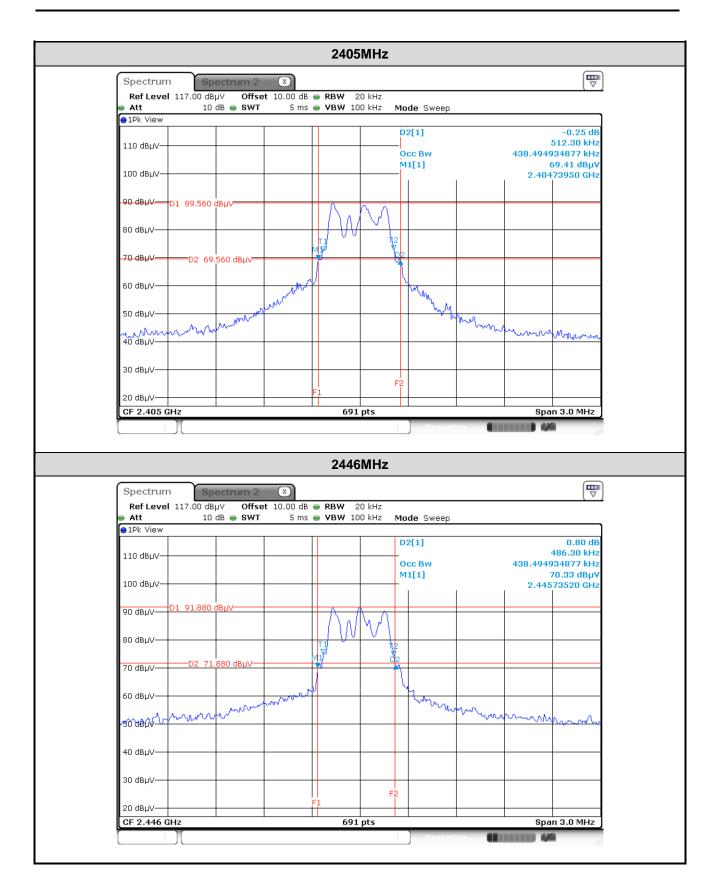
### 3.3.3 20dB and Occupied Bandwidth

| Ambient Condition | 23°C / 67% | Tested By | Akun Chung |
|-------------------|------------|-----------|------------|
|                   |            |           | ,g         |

| Frequency (MHz) | 20dB Bandwidth (MHz) | 99% Occupied BW (MHz) |
|-----------------|----------------------|-----------------------|
| 2405            | 0.512                | 0.438                 |
| 2446            | 0.486                | 0.438                 |
| 2475            | 0.456                | 0.430                 |

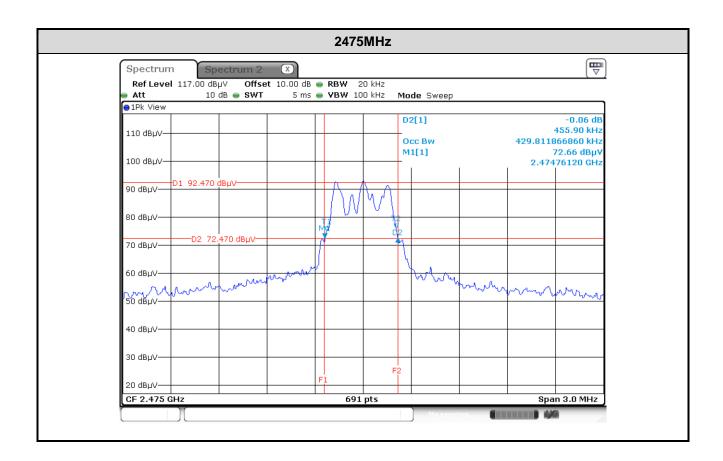
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## 4 Test laboratory information

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 Corporation (EMC and Wireless Communication Laboratory), 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 District. Location map can be found on our website <a href="http://www.icertifi.com.tw">http://www.icertifi.com.tw</a>.

Linkou

Tel: 886-2-2601-1640

No.30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan

(R.O.C.)

Kwei Shan

Tel: 886-3-271-8666

No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)

Kwei Shan Site II

Tel: 886-3-271-8640

No.14-1, Lane 19, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 333, Taiwan (R.O.C.)

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

Tel: 886-3-271-8666 Fax: 886-3-318-0155

Email: ICC\_Service@icertifi.com.tw

==END==

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