





FCC Test Report

FCC ID : JVPEC3-CW

Equipment : Mouse for e-Sports

Model No. : EC3-CW

Brand Name : ZOWIE

Applicant : BENQ CORPORATION

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

Standard : 47 CFR FCC Part 15.249

Received Date : Jun. 14, 2022

Tested Date : Jun. 16 ~ Jun. 21, 2022

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 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

Report No.: FR261402 Page : 1 of 17



Table of Contents

| 1 | GENERAL DESCRIPTION | 5 |
|-----|--|----|
| 1.1 | Information | 5 |
| 1.2 | Local Support Equipment List | 7 |
| 1.3 | Test Setup Chart | 7 |
| 1.4 | The Equipment List | g |
| 1.5 | Test Standards | 10 |
| 1.6 | Deviation from Test Standard and Measurement Procedure | 10 |
| 1.7 | Measurement Uncertainty | 10 |
| 2 | TEST CONFIGURATION | 11 |
| 2.1 | Testing Facility | 11 |
| 2.2 | The Worst Test Modes and Channel Details | 11 |
| 3 | TRANSMITTER TEST RESULTS | 12 |
| 3.1 | Unwanted Emission | 12 |
| 3.2 | 20dB and Occupied Bandwidth | 15 |
| 3.3 | AC Power Line Conducted Emissions | 16 |
| 4 | TEST LABORATORY INFORMATION | 17 |

Appendix A. Unwanted Emission

Appendix B. 20dB and Occupied Bandwidth

Appendix C. AC Power Line Conducted Emissions



Release Record

| Report No. | Version | Description | Issued Date |
|------------|---------|---------------|---------------|
| FR261402 | Rev. 01 | Initial issue | Jul. 12, 2022 |

Report No.: FR261402 Page: 3 of 17



Summary of Test Results

| FCC Rules | Test Items | Measured | Result |
|--------------|---|--|--------|
| 15.207 | AC Power Line Conducted Emissions | [dBuV]: 0.779MHz 30.96 (Margin -25.04dB) - QP | Pass |
| 15.249(a) | Field Strength of Fundamental | Meet the requirement of limit | Pass |
| 15.249(a)(d) | Field Strength of Harmonics and Emissions Radiated outside of the Specified Frequency 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.

Report No.: FR261402 Page: 4 of 17



1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

| RF General Information | | | | | | |
|------------------------|------------|-----------------|----------------|-----------|--|--|
| Frequency Range (MHz) | Modulation | Ch. Freq. (MHz) | Channel Number | Data Rate | | |
| 2400-2483.5 | GFSK | 2403-2475 | 1-5 [5] | 1 Mbps | | |

1.1.2 Antenna Details

| Ant. No. | Brand | Model | Туре | Connector | Gain (dBi) |
|----------|---------------------|------------|-------------|-----------|------------|
| 1 | BENQ Corporation | EC3-CW ANT | LDS Antenna | NA | -0.50 |

1.1.3 Power Supply Type of Equipment under Test (EUT)

| 5Vdc from host | I POWAR I VNA | 3.7Vdc from battery 5Vdc from host |
|----------------|---------------|---------------------------------------|
|----------------|---------------|---------------------------------------|

1.1.4 Accessories

| No. | Equipment | Description |
|-----|-----------|--|
| 1 | Battery | Brand: Hangzhou Future Power Technology Co., Ltd Model: FT602030P/300mAh Rating: 300mAh, 3.7V |
| 2 | USB cable | Brand: Le Prestique Electronics Manufacturing Model: USB Type-C cable 2.05m non-shielded with one core |

Report No.: FR261402 Page : 5 of 17



1.1.5 Channel List

| Channel No. | Frequency (MHz) |
|-------------|-----------------|
| 1 | 2403 |
| 2 | 2423 |
| 3 | 2440 |
| 4 | 2461 |
| 5 | 2475 |

1.1.6 Test Tool and Duty Cycle

| Test Tool | Bus Hound, Version: 7.00 | | |
|----------------------------|--------------------------|------------------|--|
| Duty Cycle and Duty Factor | Duty Cycle (%) | Duty Factor (dB) | |
| Duty Cycle and Duty Factor | 33.03 | 4.81 | |

1.1.7 Power Index of Test Tool

| Modulation Mode | | Test Frequency (MHz) | ncy (MHz) | |
|-----------------|-------------|----------------------|-------------|--|
| Wodulation Wode | 2403 | 2440 | 2475 | |
| GFSK | Default(04) | Default(04) | Default(04) | |

Report No.: FR261402 Page: 6 of 17

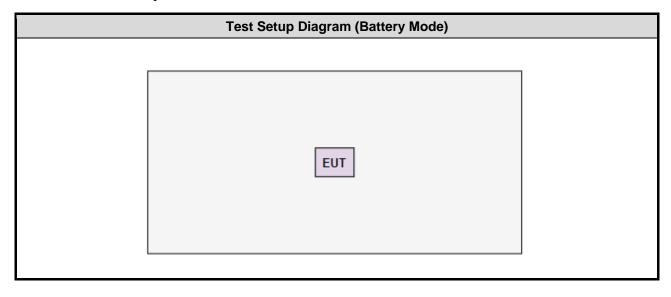


1.2 Local Support Equipment List

| | Support Equipment List | | | | | | |
|--------|---------------------------------|--|---------------------|--------|------------------------|--|--|
| No. | Equipment | Brand | Model | FCC ID | Remarks | | |
| 1 | Notebook | DELL | Latitude 5400 | DoC | | | |
| For ch | For charging mode use only | | | | | | |
| 2 | Enhance Wireless Receiver | BenQ | ER-80 | | Provided by applicant. | | |
| 3 | USB cable | Le Prestique Electronics Manufacturing | USB Type-C cable | | Provided by applicant. | | |
| 4 | Adapter | Samsung | ETA-U90JWS | | | | |

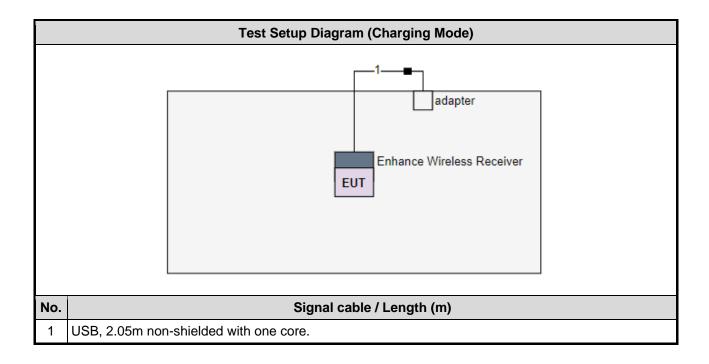
Note: The support notebook was removed from test table after sending command to control EUT to transmit continuously.

1.3 Test Setup Chart



Report No.: FR261402 Page: 7 of 17





Report No.: FR261402 Page: 8 of 17



1.4 The Equipment List

| Test Item | Conducted Emission Conduction room 1 / (CO01-WS) | | | | | |
|---|---|------------------|---------------|---------------|---------------|--|
| Test Site | | | | | | |
| Tested Date Jun. 21, 2022 | | | | | | |
| Instrument Brand Model No. Serial No. Calibration Date Calibration Unti | | | | | | |
| Receiver | R&S | ESR3 | 101658 | Feb. 16, 2022 | Feb. 15, 2023 | |
| LISN | R&S | ENV216 | 101579 | Apr. 21, 2022 | Apr. 20, 2023 | |
| LISN (Support Unit) | SCHWARZBECK | Schwarzbeck 8127 | 8127667 | Jan .07, 2022 | Jan .06, 2023 | |
| RF Cable-CON | Woken | CFD200-NL | CFD200-NL-001 | Oct. 19, 2021 | Oct. 18, 2022 | |
| 50 ohm terminal (Support Unit) | NA | 50 | 01 | May 10, 2022 | May 09, 2023 | |
| Measurement Software AUDIX e3 6.120210k NA | | | | | | |

| Test Item | Radiated Emission | | | | |
|-------------------------|----------------------------|---------------------------|------------------|------------------|-------------------|
| Test Site | 966 chamber1 / (03CH01-WS) | | | | |
| Tested Date | Jun. 16, 2022 | | | | |
| Instrument | Brand | Model No. | Serial No. | Calibration Date | Calibration Until |
| Receiver | R&S | ESR3 | 101657 | Mar. 15, 2022 | Mar. 14, 2023 |
| Spectrum Analyzer | R&S | FSV40 | 101498 | Nov. 29, 2021 | Nov. 28, 2022 |
| Loop Antenna | R&S | HFH2-Z2 | 100330 | Nov. 08, 2021 | Nov. 07, 2022 |
| Bilog Antenna | SCHWARZBECK | VULB9168 | VULB9168-522 | Jun. 30, 2021 | Jun. 29, 2022 |
| Horn Antenna 1G-18G | SCHWARZBECK | BBHA 9120 D | BBHA 9120 D 1096 | Dec. 03, 2021 | Dec. 02, 2022 |
| Horn Antenna 18G-40G | SCHWARZBECK | BBHA 9170 | BBHA 9170508 | Jan. 11, 2022 | Jan. 10, 2023 |
| Preamplifier | EMC | EMC02325 | 980225 | Jun. 29, 2021 | Jun. 28, 2022 |
| Preamplifier | Agilent | 83017A | MY39501308 | Sep. 28, 2021 | Sep. 27, 2022 |
| Preamplifier | EMC | EMC184045B | 980192 | Jul. 14, 2021 | Jul. 13, 2022 |
| Loop Antenna Cable | KOAX KABEL | 101354-BW | 101354-BW | Oct. 05, 2021 | Oct. 04, 2022 |
| LF cable 3M | Woken | CFD400NL-LW | CFD400NL-001 | Oct. 05, 2021 | Oct. 04, 2022 |
| LF cable 11M | EMC | EMCCFD400-NW-N W-11000 | 200801 | Oct. 05, 2021 | Oct. 04, 2022 |
| LF cable 1M | EMC | EMCCFD400-NM-N M-1000 | 160502 | Oct. 05, 2021 | Oct. 04, 2022 |
| RF Cable | EMC | EMC104-35M-35M- 8000 | 210920 | Oct. 05, 2021 | Oct. 04, 2022 |
| RF Cable | HUBER+SUHNER | SUCOFLEX104 | MY16019/4 | Oct. 05, 2021 | Oct. 04, 2022 |
| Measurement Software | AUDIX | e3 | 6.120210g | NA | NA |

Report No.: FR261402 Page: 9 of 17



1.5 Test Standards

47 CFR FCC Part 15.249 ANSI C63.10-2013

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 | | |
| Unwanted Emission ≤ 1GHz | ±3.41 dB | | |
| Unwanted Emission > 1GHz | ±4.59 dB | | |

Report No.: FR261402 Page: 10 of 17



2 Test Configuration

2.1 Testing Facility

| Test Laboratory | International Certification Corporation |
|----------------------|--|
| Test Site | CO01-WS, 03CH01-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 (MHz) | Data Rate | Test Configuration |
|-----------------------------------|----------|-------------------------|-----------|-----------------------|
| AC Power Line Conducted Emissions | Charging | • | - | - |
| Unwanted Emissions ≤ 1GHz | GFSK | 2440 | 1 Mbps | - |
| | Charging | - | - | - |
| Field Strength of Fundamental | | | | |
| Unwanted Emissions > 1GHz | GFSK | 2403 / 2440 / 2475 | 1 Mbps | - |
| 20dB bandwidth | | | | |

Report No.: FR261402 Page: 11 of 17



3 Transmitter Test Results

3.1 Unwanted Emission

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

3.1.1 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 | |

3.1.2 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.

Report No.: FR261402 Page: 12 of 17



3.1.3 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:

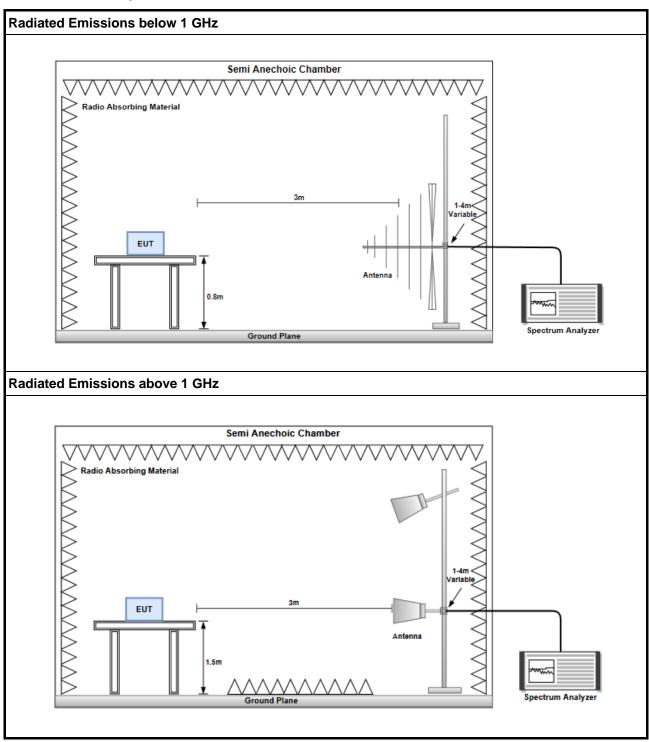
20log (Duty cycle) = 20log
$$\frac{0.128986 \times 13 \text{ms}}{100 \text{ ms}}$$
 = -35.51dB

- Radiated emission above 1GHz / Average value for other emissions RBW=1MHz, VBW=1/T and Peak detector
- Radiated emission Peak value for fundamental RBW=2MHz, VBW=10MHz and Peak detector

Report No.: FR261402 Page: 13 of 17



3.1.4 Test Setup



3.1.5 Test Results

Refer to Appendix A.

Report No.: FR261402 Page: 14 of 17



3.2 20dB and Occupied Bandwidth

3.2.1 Test Procedures

- 1. Set resolution bandwidth (RBW) = 20 kHz, Video bandwidth = 100 kHz.
- 2. Detector = Peak(20 dB bandwidth) / Sample(Occupied bandwidth), 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.

3.2.2 Test Setup



3.2.3 Test Results

| Ambient Condition | 24°C / 62% | Tested By | Roger Lu |
|-------------------|------------|-----------|----------|

Refer to Appendix B.

Report No.: FR261402 Page: 15 of 17



3.3 AC Power Line Conducted Emissions

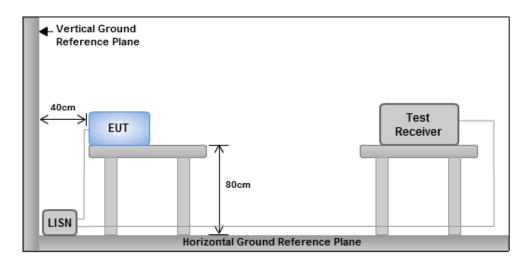
3.3.1 Limit of AC Power Line Conducted Emissions

| 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. | | | | |

3.3.2 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 Ω 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.

3.3.3 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

3.3.4 Test Results

Refer to Appendix C.

Report No.: FR261402 Page: 16 of 17



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 http://www.icertifi.com.tw.

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.)
No.2-1, 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: 886-3-318-0345

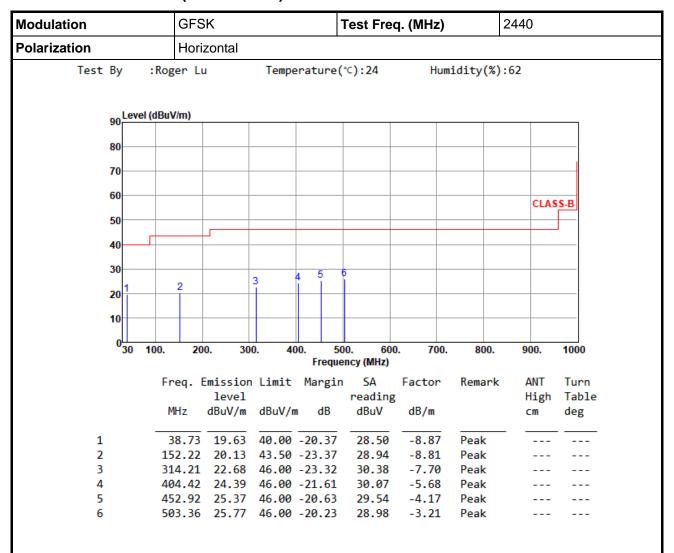
Email: ICC Service@icertifi.com.tw

==END==

Report No.: FR261402 Page: 17 of 17



Unwanted Emissions (Below 1GHz)



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

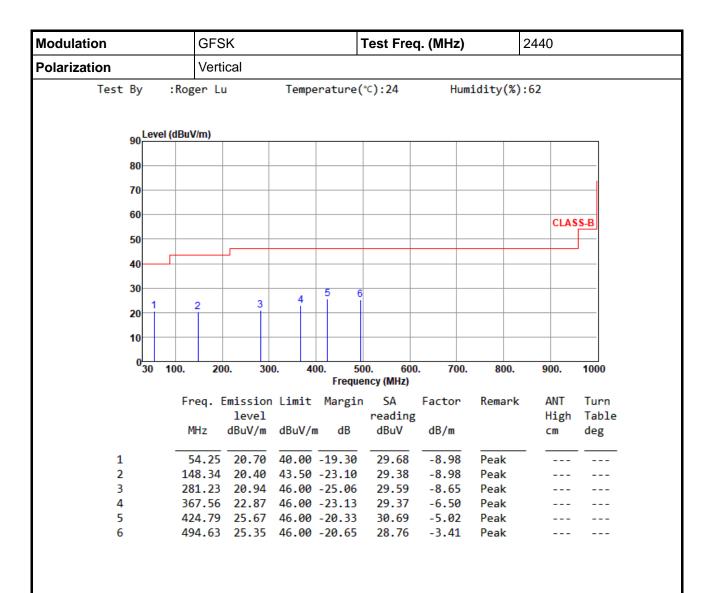
*Factor includes antenna factor, cable loss and amplifier gain

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.

Page No. : 1 of 11



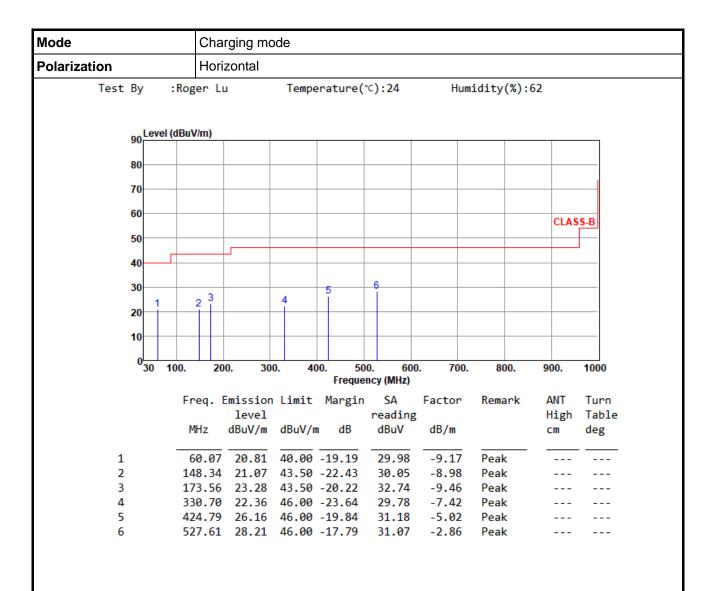


*Factor includes antenna factor, cable loss and amplifier gain

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.



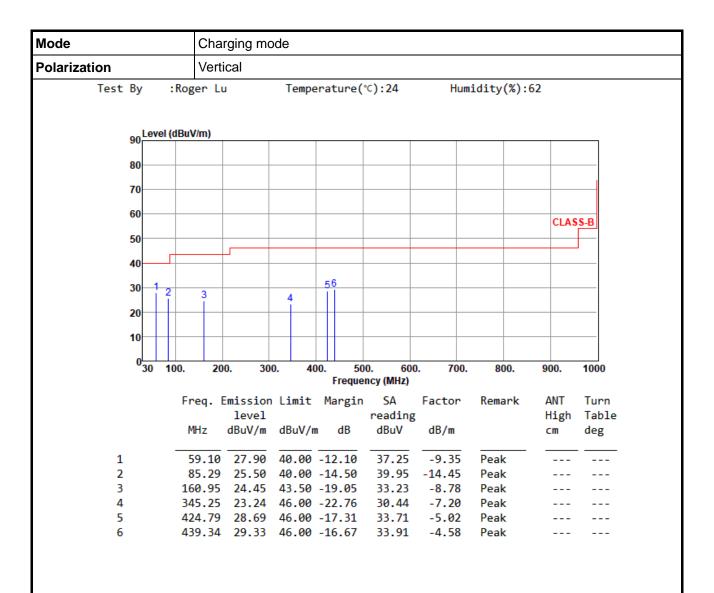


*Factor includes antenna factor, cable loss and amplifier gain

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.





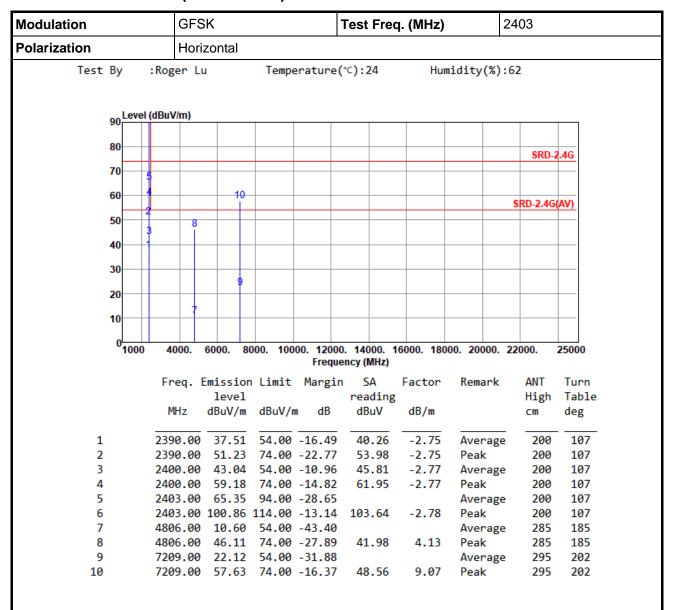
*Factor includes antenna factor, cable loss and amplifier gain

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.



Unwanted Emissions (Above 1GHz)

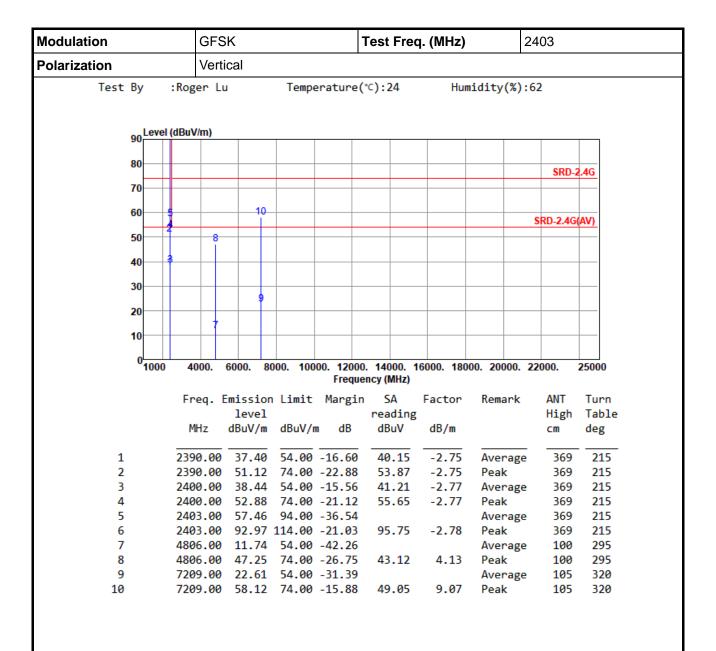


Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor* (dB/m)

*Factor includes antenna factor, cable loss and amplifier gain

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

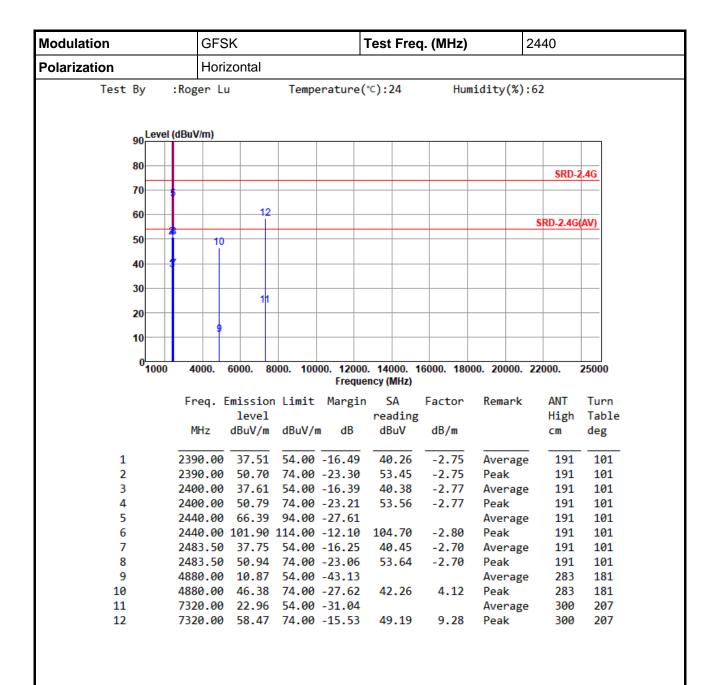




*Factor includes antenna factor, cable loss and amplifier gain

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

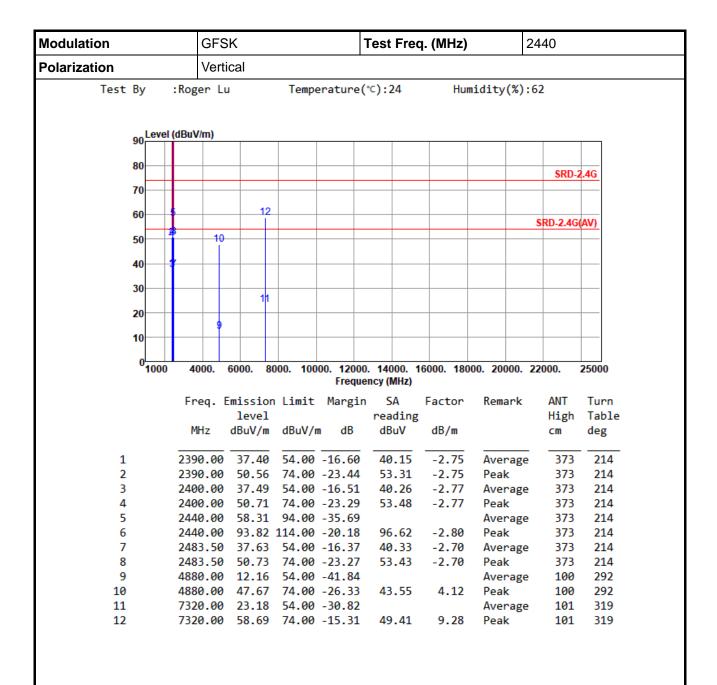




*Factor includes antenna factor, cable loss and amplifier gain

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

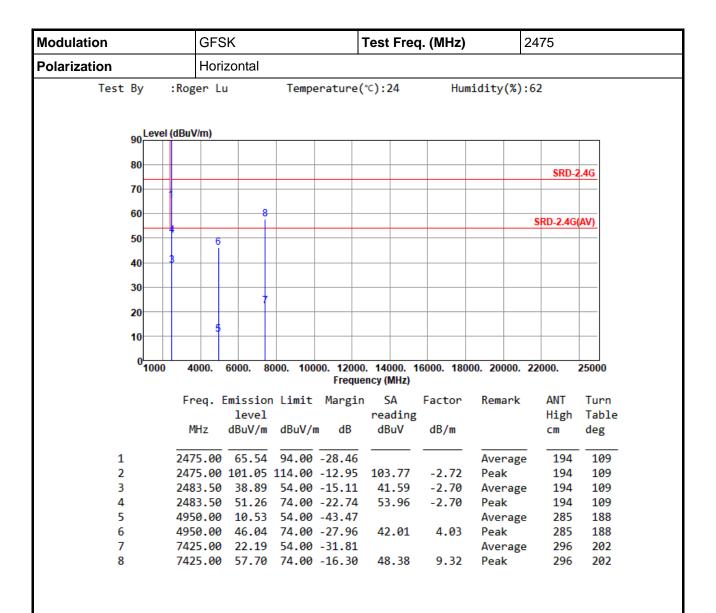




*Factor includes antenna factor, cable loss and amplifier gain

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

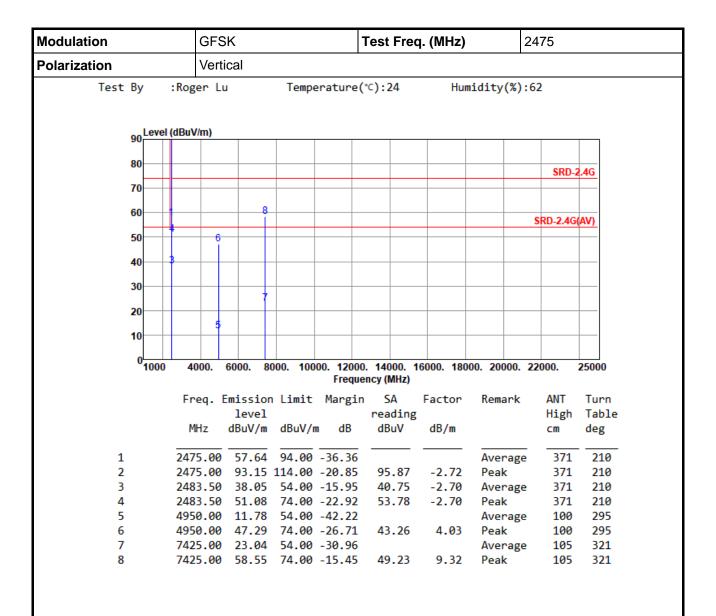




*Factor includes antenna factor, cable loss and amplifier gain

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

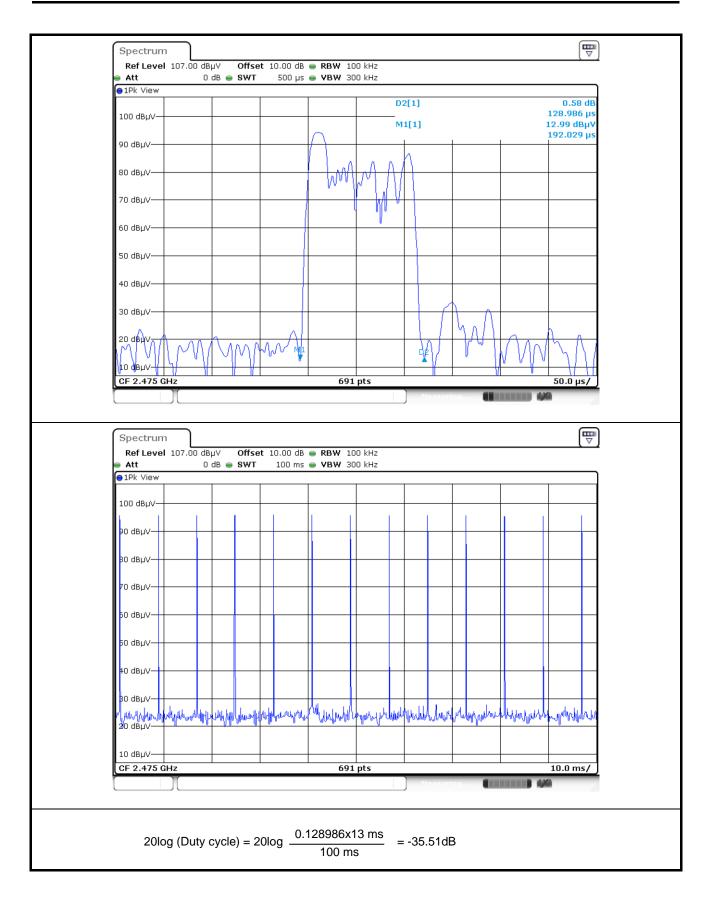




*Factor includes antenna factor, cable loss and amplifier gain

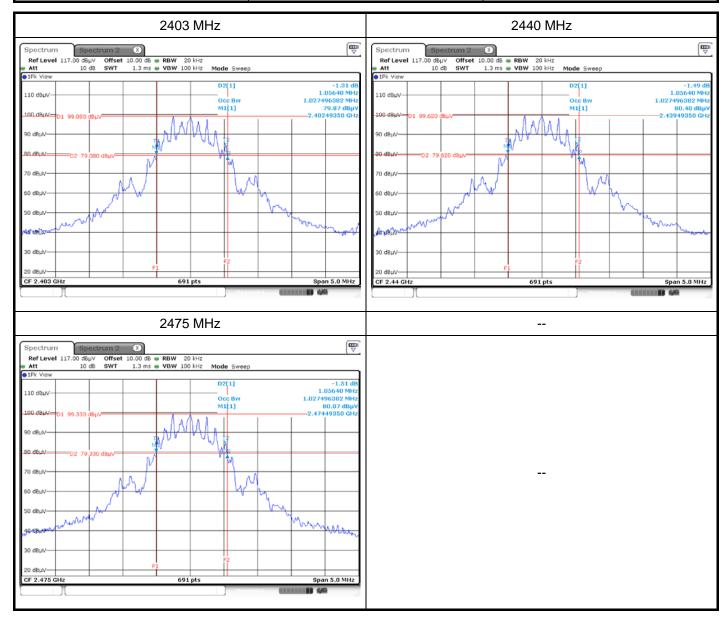
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).



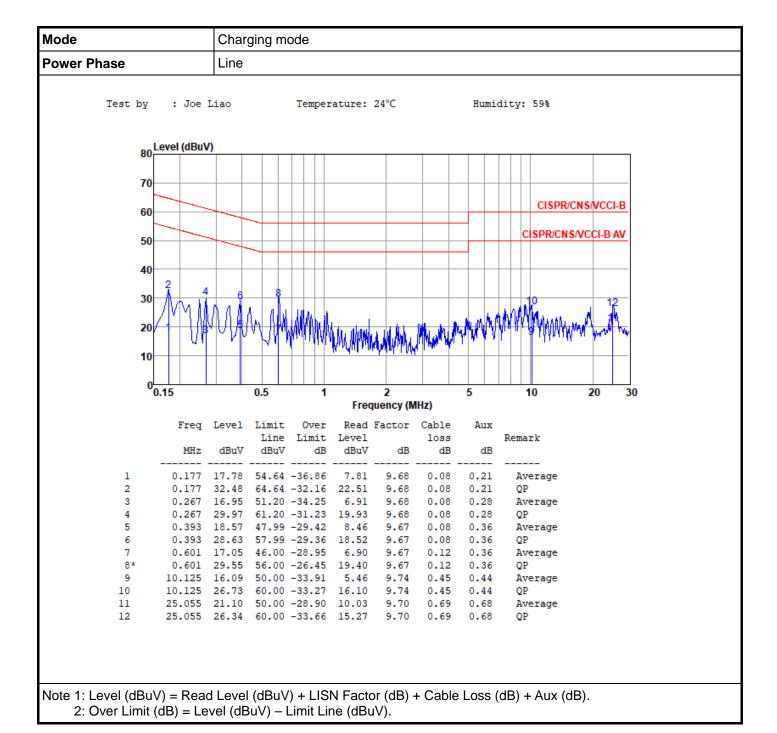




| Frequency (MHz) | 20dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) |
|-----------------|----------------------|------------------------------|
| 2403.0 | 1.056 | 1.027 |
| 2440.0 | 1.056 | 1.027 |
| 2475.0 | 1.056 | 1.027 |

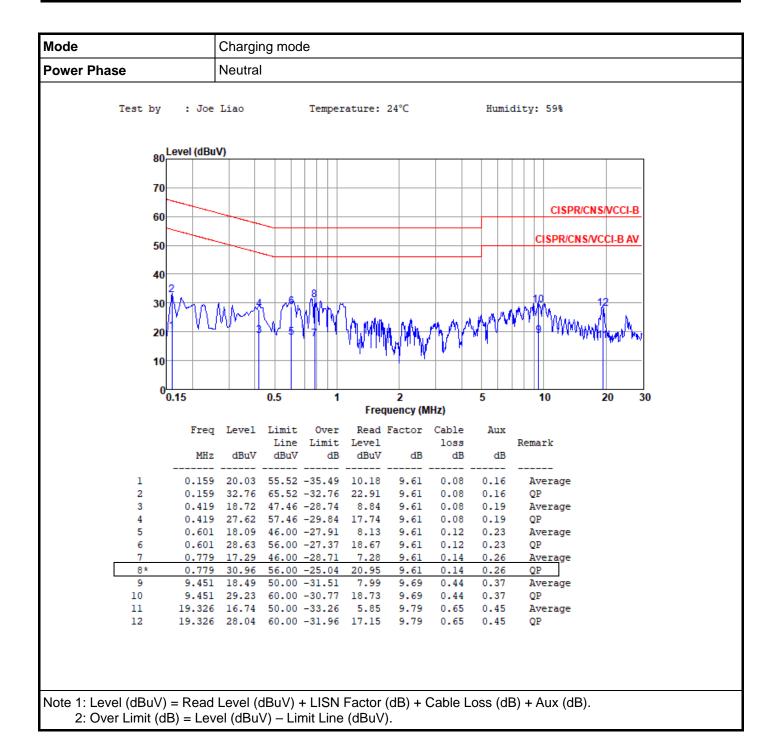






Page No. : 1 of 2





Page No. : 2 of 2