

# **FCC RADIO TEST REPORT**

FCC ID:2AT7Z-GCO2001Z

Product: Gravio CO2

Trade Name: Gravio

Page 1 of 24

Model Name: GCO2001Z

Serial Model: N/A

Report No.: UNIA20040822ER-01

## **Prepared for**

Asteria Technology Pte. Ltd.

160 ROBINSON ROAD, #19-05 SBF CENTER, SINGAPORE 068914

## Prepared by

Shenzhen United Testing Technology Co., Ltd.

2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China





No.:UNIA20040822ER-01

Report

## TEST RESULTCERTIFICATION

|  | STRESSETCERTIFICATION  |
|--|--|
| Applicant's name:  | Asteria Technology Pte. Ltd.   |
| Address:   | 160 ROBINSON ROAD, #19-05 SBF CENTER, SINGAPORE 068914   |
| Manufacture's Name:  | Asteria Technology Pte. Ltd.   |
| Address:   | 160 ROBINSON ROAD, #19-05 SBF CENTER, SINGAPORE 068914   |
| Product description  |  |
| Product name:  | Gravio CO2   |
| Trade Mark:  | Gravio   |
| Model and/or type reference .:                                       | GCO2001Z   |
| Standards  | FCC Rules and Regulations Part 15 Subpart C Section 15.249, ANSI C63.10: 2013  |
| Co., Ltd., and the test results with the FCC requirements. A report. | has been tested by Shenzhen United Testing Technology show that the equipment under test (EUT) is in compliance and it is applicable only to the tested sample identified in the |
|  | duced except in full, without the written approval of UNI, this revised by Shenzhen United Testing Technology Co., Ltd.,   |
| _  | noted in the revision of the document.   |
| JY , N   |  |
| Date of Test   |  |
| Date (s) of performance of tests.                                    |  |
| Date of Issue  | : May. 22, 2020  |
| Test Result  | : Pass   |
| Prepared by:   | Bob Lian   |

Prepared by:

Reviewer:

Bob Mao/Editor

Kahn yang/Supervisor

Approved & Authorized Signer:

Liuze/Manager





## **Table of Contents**

## Page

| 1. TEST SUMMARY                         | 4  |
|---|----|
| 2. GENERAL INFORMATION                  | 5  |
| 2.1 GENERAL DESCRIPTION OF EUT          | 5  |
| 2.2 Carrier Frequency of Channels       | 6  |
| 2.3 Operation of EUT during testing     | 6  |
| 2.4 DESCRIPTION OF TEST SETUP           | 6  |
| 2.5 MEASUREMENT INSTRUMENTS LIST        |    |
| 3. CONDUCTED EMISSIONS TEST             | 8  |
| 3.1 Conducted Power Line Emission Limit |    |
| 3.2 Test Setup                          |    |
| 3.3 Test Procedure                      |    |
| 3.4 Test Result                         |    |
| 4 RADIATED EMISSION TEST                | 11 |
| 4.1 Radiation Limit                     |    |
| 4.2 Test Setup                          |    |
| 4.3 Test Procedure                      |    |
| 4.4 Test Result                         |    |
| 5 BAND EDGE                             |    |
| 5.1 Limits                              | 18 |
| 5.2 Test Procedure                      |    |
| 5.3 Test Result                         |    |
| 6 OCCUPIED BANDWIDTH MEASUREMENT        | 20 |
| 6.1 Test Setup                          |    |
| 6.2 Test Procedure                      | 20 |
| 6.3 Measurement Equipment Used          | 20 |
| 6.4 Test Result                         |    |
| 7 ANTENNA REQUIREMENT                   | 22 |
| 8 PHOTOGRAPH OF TEST                    | 23 |
| 8.1Radiated Emission                    |    |
| 8 2Conducted Emission                   | 24 |



### 1. TEST SUMMARY

#### TEST PROCEDURES AND RESULTS

| DESCRIPTION OF TEST      | RESULT    | STANGARD               |
|--------------------------|-----------|------------------------|
| CONDUCTED EMISSIONS TEST | COMPLIANT | FCC Part 15.207        |
| RADIATED EMISSION TEST   | COMPLIANT | FCC Part 15.209/15.249 |
| BAND EDGE                | COMPLIANT | FCC Part 15.249/15.205 |
| 20dB Bandwidth           | COMPLIANT | FCC Part 15.249        |
| ANTENNA REQUIREMENT      | COMPLIANT | FCC Part 15.203        |

## TEST FACILITY

Test Firm : Shenzhen United Testing Technology Co.,Ltd.

Address :2F, Annex Bldg, JiahuangyuanTech Park, #365 Baotian 1

Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

Report

No.:UNIA20040822ER-01

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19. The testing quality system of our laboratory meets with ISO/IEC-17025 requirements, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

CNAS-LAB Code: L6964

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of testing Laboratories.

Designation Number: CN1227

Test Firm Registration Number: 674885

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files.

## MEASUREMENT UNCERTAINTY

Measurement Uncertainty

Conducted Emission Expanded Uncertainty = 2.23dB, k=2 Radiated emission expanded uncertainty(9kHz-30MHz) = 3.08dB, k=2 Radiated emission expanded uncertainty(30MHz-1000MHz) = 4.42dB, k=2 Radiated emission expanded uncertainty(Above 1GHz) = 4.06dB, k=2



## 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF EUT

| Equipment          | Gravio CO2         |
|--------------------|--------------------|
| Trade Mark         | Gravio             |
| Model Name         | GCO2001Z           |
| Serial No.         | N/A                |
| Model Difference   | N/A                |
| FCC ID             | 2AT7Z-GCO2001Z     |
| Antenna Type       | Ceramics Antenna   |
| Antenna Gain       | 0.5dBi             |
| Frequency Range    | 2405~2480MHz       |
| Number of Channels | 16CH               |
| Modulation Type    | GFSK               |
| Battery            | N/A                |
| PowerSource        | DC 5V form adapter |

No.:UNIA20040822ER-01



2.2 Carrier Frequency of Channels

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 1       | 2405            | 9       | 2445            |
| 2       | 2410            | 10      | 2450            |
| 3       | 2415            | 11      | 2455            |
| 4       | 2420            | 12      | 2460            |
| 5       | 2425            | 13      | 2465            |
| 6       | 2430            | 14      | 2470            |
| 7       | 2435            | 15      | 2475            |
| 8       | 2440            | 16      | 2480            |

## 2.3 Operation of EUT during testing

**Operating Mode** 

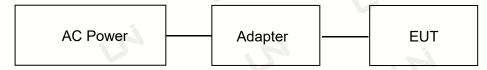
The mode is used: Transmitting mode

Low Channel: 2405MHz Middle Channel: 2440MHz High Channel: 2480MHz

Page 6 of 24

## 2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during Conducted testing:



## Operation of EUT duringRadiation testing:



## Table forauxiliary equipment:

| Equipment Description | Manufacturer | Model     | Calibration Due Date |
|-----------------------|--------------|-----------|----------------------|
| Adapter               | HUAWEI       | 050200C01 | N/A                  |



## 2.5 MEASUREMENT INSTRUMENTS LIST

Page 7 of 24

| Item | Equipment                              | Manufacturer  | Model No.          | Serial No.    | Calibrated until |  |  |  |
|------|--|---------------|--------------------|---------------|------------------|--|--|--|
|      |  | Conduction Em | issions Measuremer | nt            |                  |  |  |  |
| 1    | Conducted Emission<br>Test Software    | EZ-EMC        | Ver.CCS-3A1-CE     | N/A           | N/A              |  |  |  |
| 2    | AMN                                    | Schwarzbeck   | NNLK8121           | 8121370       | 2020.10.15       |  |  |  |
| 3    | AMN                                    | ETS           | 3810/2             | 00020199      | 2020.10.15       |  |  |  |
| 4    | AAN                                    | TESEQ         | T8-Cat6            | 38888         | 2020.10.15       |  |  |  |
| 5    | Pulse Limiter                          | CYBRTEK       | EM5010             | E115010056    | 2021.05.26       |  |  |  |
| 6    | EMI Test Receiver                      | Rohde&Schwarz | ESCI               | 101210        | 2020.10.15       |  |  |  |
|      | Radiated Emissions Measurement         |               |                    |               |                  |  |  |  |
| 1    | Radiated Emission<br>Test Software     | EZ-EMC        | Ver.CCS-03A1       | N/A           | N/A              |  |  |  |
| 2    | Horn Antenna                           | Sunol         | DRH-118            | A101415       | 2020.10.08       |  |  |  |
| 3    | Broadband Hybrid<br>Antenna            | Sunol         | JB1                | A090215       | 2020.11.15       |  |  |  |
| 4    | PREAMP                                 | HP            | 8449B              | 3008A00160    | 2020.10.21       |  |  |  |
| 5    | PREAMP                                 | HP            | 8447D              | 2944A07999    | 2021.05.26       |  |  |  |
| 6    | EMI TEST<br>RECEIVER                   | Rohde&Schwarz | ESR3               | 101891        | 2020.10.15       |  |  |  |
| 7    | VECTOR Signal<br>Generator             | Rohde&Schwarz | SMU200A            | 101521        | 2020.10.15       |  |  |  |
| 8    | Signal Generator                       | Agilent       | E4421B             | MY4335105     | 2020.10.15       |  |  |  |
| 9    | MXA Signal Analyzer                    | Agilent       | N9020A             | MY50510140    | 2020.10.15       |  |  |  |
| 10   | MXA Signal Analyzer                    | Keysight      | N9020A             | MY51110104    | 2020.10.15       |  |  |  |
| 11 ( | RF Power sensor                        | DARE          | RPR3006W           | 15I00041SNO88 | 2020.06.09       |  |  |  |
| 12   | RF Power sensor                        | DARE          | RPR3006W           | 15I00041SNO89 | 2020.06.09       |  |  |  |
| 13   | RF power divider                       | Anritsu       | K241B              | 992289        | 2020.10.28       |  |  |  |
| 14   | Wideband radio communication tester    | Rohde&Schwarz | CMW500             | 154987        | 2020.11.19       |  |  |  |
| 15   | Active Loop Antenna                    | Com-Power     | AL-130R            | 10160009      | 2021.05.28       |  |  |  |
| 16   | Broadband Hybrid<br>Antennas           | Schwarzbeck   | VULB9163           | VULB9163#958  | 2021.05.28       |  |  |  |
| 17   | Horn Antenna                           | Schwarzbeck   | BBHA9120D          | 9120D-1680    | 2021.05.28       |  |  |  |
| 18   | Horn Antenna                           | A-INFOMW      | LB-180400-KF       | J211060660    | 2020.10.23       |  |  |  |
| 19   | Microwave<br>Broadband<br>Preamplifier | Schwarzbeck   | BBV 9721           | 100472        | 2021.05.28       |  |  |  |
| 20   | Signal Generator                       | Agilent       | N5183A             | MY47420153    | 2021.05.28       |  |  |  |
| 21   | Spctrum Analyzer                       | Rohde&Schwarz | FSP 40             | 100501        | 2021.05.28       |  |  |  |
| 22   | Power Meter                            | KEYSIGHT      | N1911A             | MY50520168    | 2021.05.28       |  |  |  |
| 23   | Frequency Meter                        | VICTOR        | VC2000             | 997406086     | 2021.05.28       |  |  |  |
| 24   | DC Power Source                        | HYELEC        | HY5020E            | 055161818     | 2021.05.28       |  |  |  |



#### 3. CONDUCTED EMISSIONS TEST

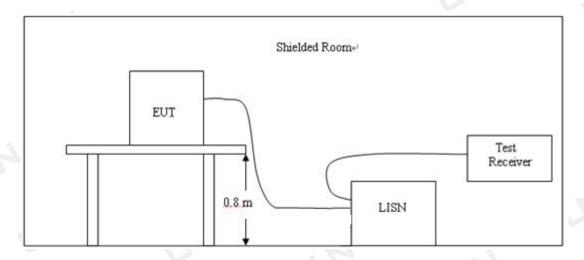
#### 3.1 Conducted Power Line Emission Limit

For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following

| Frequency | Maximum RF Line Voltage(dBμV) |      |         |        |  |  |  |  |
|-----------|-------------------------------|------|---------|--------|--|--|--|--|
|           | CLA                           | SS A | CLASS B |        |  |  |  |  |
| (MHz)     | Q.P.                          | Ave. | Q.P.    | Ave.   |  |  |  |  |
| 0.15~0.50 | 79                            | 66   | 66~56*  | 56~46* |  |  |  |  |
| 0.50~5.00 | 73                            | 60   | 56      | 46     |  |  |  |  |
| 5.00~30.0 | 73                            | 60   | 60      | 50     |  |  |  |  |

<sup>\*</sup> Decreasing linearly with the logarithm of the frequency For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

#### 3.2 Test Setup



#### 3.3 Test Procedure

- 1,The equipment was set up as per the test configuration to simulate typical actual usage per the user'smanual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed onthe ground plane as per ANSI C63.10.
- 2, Support equipment, if needed, was placed as per ANSI C63.10.
- 3, All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
- 4,If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hzpower through a Line Impedance Stabilization Network (LISN) which supplied power source and wasgrounded to the ground plane.
- 5, All support equipments received AC power from a second LISN, if any.
- 6, The EUT test program was started. Emissions were measured on each current carrying line of the EUTusing a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has twomonitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7, Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

#### 3.4 Test Result

#### Pass

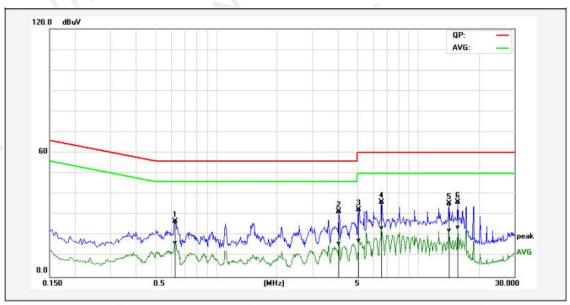
#### Remark:

- 1. All modes were tested at AC 120V and 240V, only the worst result of AC 120V was reported.
- 2. All modes of Low, Middle, and High channel were tested, only the worst result of High Channel was reported as below:



| Temperature:  | 24°C                              | Relative Humidity: | 45%     |  |  |  |  |
|---------------|-----------------------------------|--------------------|---------|--|--|--|--|
| Test Date:    | Apr. 29, 2020                     | Pressure:          | 1010hPa |  |  |  |  |
| Test Voltage: | AC 120V, 60Hz                     | Phase:             | Line    |  |  |  |  |
| Test Mode:    | Transmitting mode of GFSK 2480MHz |                    |         |  |  |  |  |

Page 9 of 24



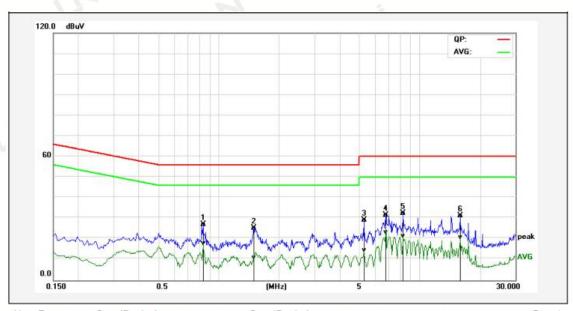
| No. | Frequency | QuasiPeak reading | Average reading | Correction factor | QuasiPeak<br>result | Average result | QuasiPeak<br>limit | Average<br>limit | QuasiPeak<br>margin | Average margin | Remark |
|-----|-----------|-------------------|-----------------|-------------------|---------------------|----------------|--------------------|------------------|---------------------|----------------|--------|
|     | (MHz)     | (dBuV)            | (dBuV)          | (dB)              | (dBuV)              | (dBuV)         | (dBuV)             | (dBuV)           | (dB)                | (dB)           |        |
| 1P  | 0.6300    | 17.15             | 6.69            | 9.69              | 26.84               | 16.38          | 56.00              | 46.00            | -29.16              | -29.62         | Pass   |
| 2P  | 4.0660    | 21.86             | 6.12            | 9.84              | 31.70               | 15.96          | 56.00              | 46.00            | -24.30              | -30.04         | Pass   |
| 3P  | 5.1020    | 22.66             | 7.85            | 9.82              | 32.48               | 17.67          | 60.00              | 50.00            | -27.52              | -32.33         | Pass   |
| 4P  | 6.5940    | 26.19             | 13.83           | 9.82              | 36.01               | 23.65          | 60.00              | 50.00            | -23.99              | -26.35         | Pass   |
| 5P  | 14.2340   | 35.12             | 22.18           | 0.28              | 35.40               | 22.46          | 60.00              | 50.00            | -24.60              | -27.54         | Pass   |
| 6*  | 15.7420   | 35.77             | 23.51           | 0.34              | 36.11               | 23.85          | 60.00              | 50.00            | -23.89              | -26.15         | Pass   |

Remark: Factor = Insertion Loss + Cable Loss, Result=Reading + Factor, Margin=Result - Limit.



| Temperature:  | 24°C                           | Relative Humidity: | 45%     |
|---------------|--------------------------------|--------------------|---------|
| Test Date:    | Apr. 29, 2020                  | Pressure:          | 1010hPa |
| Test Voltage: | AC 120V, 60Hz                  | Phase:             | Neutral |
| Test Mode:    | Transmitting mode of GFSK 2480 | MHz                | 13      |

Page 10 of 24



| No. | Frequency | QuasiPeak<br>reading | Average<br>reading | Correction<br>factor | QuasiPeak<br>result | Average<br>result | QuasiPeak<br>Iimit | Average<br>limit | QuasiPeak<br>margin | Average<br>margin | Remark |
|-----|-----------|----------------------|--------------------|----------------------|---------------------|-------------------|--------------------|------------------|---------------------|-------------------|--------|
|     | (MHz)     | (dBuV)               | (dBuV)             | (dB)                 | (dBuV)              | (dBuV)            | (dBuV)             | (dBuV)           | (dB)                | (dB)              |        |
| 1P  | 0.8380    | 17.51                | 8.24               | 9.75                 | 27.26               | 17.99             | 56.00              | 46.00            | -28.74              | -28.01            | Pass   |
| 2P  | 1.4980    | 15.47                | 1.06               | 9.77                 | 25.24               | 10.83             | 56.00              | 46.00            | -30.76              | -35.17            | Pass   |
| 3P  | 5.2980    | 19.45                | 4.77               | 9.84                 | 29.29               | 14.61             | 60.00              | 50.00            | -30.71              | -35.39            | Pass   |
| 4*  | 6.7900    | 21.87                | 13.45              | 9.84                 | 31.71               | 23.29             | 60.00              | 50.00            | -28.29              | -26.71            | Pass   |
| 5P  | 8.2860    | 22.75                | 11.74              | 9.83                 | 32.58               | 21.57             | 60.00              | 50.00            | -27.42              | -28.43            | Pass   |
| 6P  | 15.9540   | 21.27                | 10.67              | 10.09                | 31.36               | 20.76             | 60.00              | 50.00            | -28.64              | -29.24            | Pass   |
|     |           |                      |                    |                      |                     |                   |                    |                  |                     |                   |        |

Remark: Factor = Insertion Loss + Cable Loss, Result=Reading + Factor, Margin=Result - Limit.



## **4 RADIATED EMISSION TEST**

#### 4.1 Radiation Limit

For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength ofradiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Report

No.:UNIA20040822ER-01

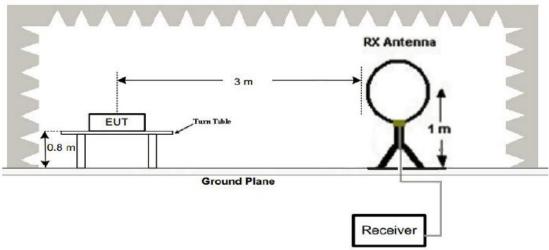
Limit calculation and transfer to 3m distance as showed in the following table:

| Frequency<br>(MHz) | Limit<br>(dBuV/m)               | Distance (m) |  |
|--------------------|---------------------------------|--------------|--|
| 0.009-0.490        | 20log(2400/F(KHz))+40log(300/3) | 3            |  |
| 0.490-1.705        | 20log(24000/F(KHz))+40log(30/3) | 3            |  |
| 1.705-30.0         | 69.5                            | 3            |  |
| 30-88              | 40.0                            | 3            |  |
| 88-216             | 43.5                            | 3            |  |
| 216-960            | 46.0                            | 3            |  |
| Above 960          | 54.0                            | 3            |  |

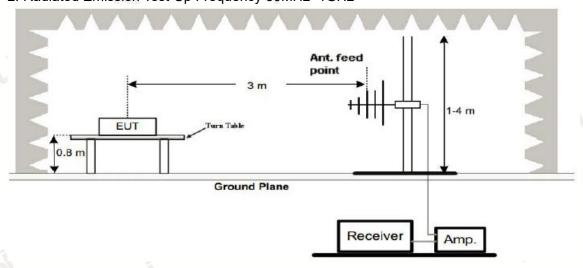
For intentional device, according to § 15.209(a), the general requirement of field strength of radiatedemissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

## 4.2 Test Setup

#### 1. Radiated Emission Test-Up Frequency Below 30MHz

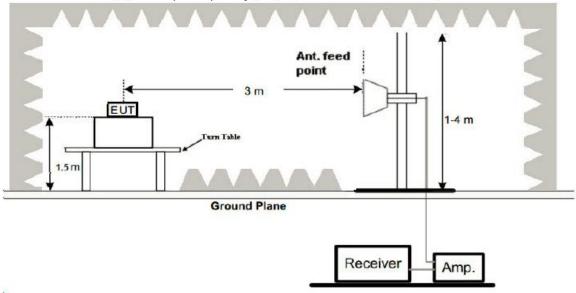


#### 2. Radiated Emission Test-Up Frequency 30MHz~1GHz



3. Radiated Emission Test-Up Frequency Above 1GHz

Page 12 of 24



#### 4.3 Test Procedure

- 1. Below 1GHz measurement the EUT is placed on turntable which is 0.8m above ground plane. And above 1GHz measurement EUT was placed on low permittivity and low tangent turn table which is 1.5m above ground plane.
- 2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highestemissions.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. And also, each emission was to be maximized by changing the polarization of receiving antenna bothhorizontal and vertical.
- 6. Repeat above procedures until the measurements for all frequencies are complete.
- 7. The test frequency range from 9KHz to25GHz per FCC PART 15.33(a).

#### Note:

For battery operated equipment, the equipment tests shall be performed using a new battery.

#### 4.4 Test Result

#### **PASS**

#### Remark:

- 1. All the test modes completed for test. The worst case of Radiated Emissionis High channel, the test data of this mode was reported.
- 2. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Z axis" position was the worst, and test data recorded in this report.
- 3. Radiated emission test from 9KHz to 10th harmonic of fundamental was verified, and Except for the noise floor of the system below 20dB from 9KHz to 30MHz, no radiation was found, so it was not recorded in this report.

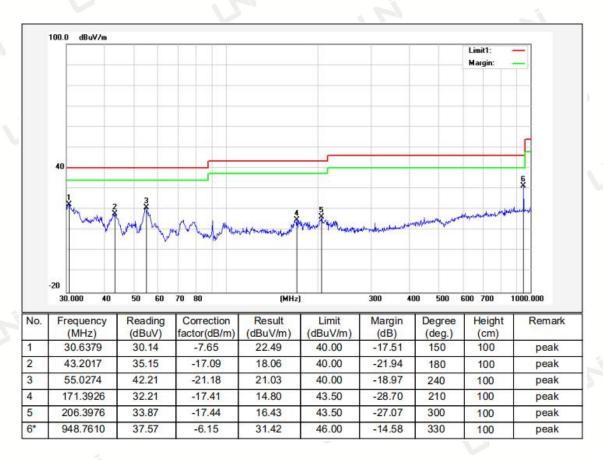


## Below 1GHz Test Results:

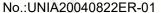
| Temperature:  | 24°C                           | Relative Humidity:              | 45%        |  |  |  |  |
|---------------|--------------------------------|---------------------------------|------------|--|--|--|--|
| Test Date:    | Apr. 29, 2020                  | Pressure:                       | 1010hPa    |  |  |  |  |
| Test Voltage: | AC 120V, 60Hz                  | Polarization:                   | Horizontal |  |  |  |  |
| Test Mode:    | Transmitting mode of GFSK2480N | ransmitting mode of GFSK2480MHz |            |  |  |  |  |

Report

No.:UNIA20040822ER-01



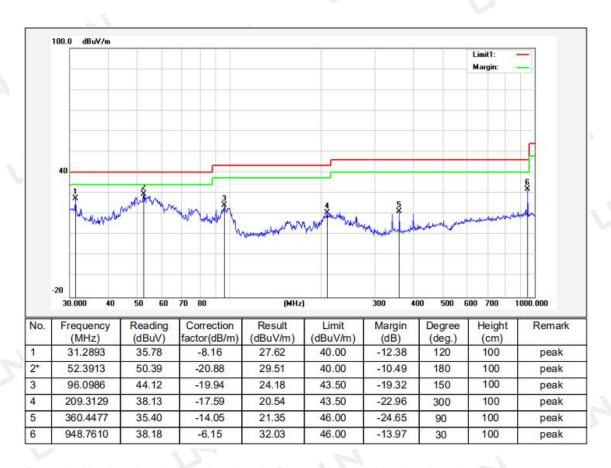
Remark: Absolute Level= Reading Level+ Factor, Margin= Absolute Level – Limit Factor=Ant. Factor + Cable Loss – Pre-amplifier





| Temperature:  | 24°C                           | Relative Humidity: | 45%      |
|---------------|--------------------------------|--------------------|----------|
| Test Date:    | Apr. 29, 2020                  | Pressure:          | 1010hPa  |
| Test Voltage: | AC 120V, 60Hz                  | Polarization:      | Vertical |
| Test Mode:    | Transmitting mode of GFSK2480N | ИНz                | , ri     |

Page 14 of 24



Remark: Absolute Level= Reading Level+ Factor, Margin= Absolute Level – Limit Factor=Ant. Factor + Cable Loss – Pre-amplifier

### Remark:

- (1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHzwas verified, and no any emission was found except system noise floor.
- (2) \* denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.



Above 1 GHz Test Results: CH Low (2405MHz)

## Horizontal:

| Frequency | Reading<br>Result | Factor | Emission Level | Limits   | Margin | Detector |
|-----------|-------------------|--------|----------------|----------|--------|----------|
| (MHz)     | (dBµV)            | (dB)   | (dBµV/m)       | (dBµV/m) | (dB)   | Туре     |
| 2405      | 109.96            | -5.84  | 104.12         | 114      | -9.88  | PK       |
| 2405      | 82.35             | -5.84  | 76.51          | 94       | -17.49 | AV       |
| 4810      | 61.62             | -3.64  | 57.98          | 74       | -16.02 | PK       |
| 4810      | 50.65             | -3.64  | 47.01          | 54       | -6.99  | AV       |
| 7215      | 57.63             | -0.95  | 56.68          | 74       | -17.32 | PK       |
| 7215      | 47.16             | -0.95  | 46.21          | 54       | -7.79  | AV       |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit

## Vertical:

|           |                   |        |                |          |        | (F)      |
|-----------|-------------------|--------|----------------|----------|--------|----------|
| Frequency | Reading<br>Result | Factor | Emission Level | Limits   | Margin | Detector |
| (MHz)     | (dBµV)            | (dB)   | (dBµV/m)       | (dBµV/m) | (dB)   | Туре     |
| 2405      | 109.01            | -5.71  | 103.30         | 114      | -10.70 | PK       |
| 2405      | 81.03             | -5.71  | 75.32          | 94       | -18.68 | AV       |
| 4810      | 60.98             | -3.51  | 57.47          | 74       | -16.53 | PK       |
| 4810      | 48.62             | -3.51  | 45.11          | 54       | -8.89  | AV       |
| 7215      | 56.85             | -0.82  | 56.03          | 74       | -17.97 | PK       |
| 7215      | 46.75             | -0.82  | 45.93          | 54       | -8.07  | AV       |
|           | ,                 | ,      | *              | ,        |        |          |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit

No.:UNIA20040822ER-01



## CH Middle (2440MHz)

## Horizontal:

| Frequency | Reading<br>Result | Factor | Emission Level | Limits   | Margin | Detector |
|-----------|-------------------|--------|----------------|----------|--------|----------|
| (MHz)     | (dBµV)            | (dB)   | (dBµV/m)       | (dBµV/m) | (dB)   | Туре     |
| 2440      | 110.32            | -5.71  | 104.61         | 114      | -9.39  | PK       |
| 2440      | 81.62             | -5.71  | 75.91          | 94       | -18.09 | AV       |
| 4880      | 61.03             | -3.51  | 57.52          | 74       | -16.48 | PK       |
| 4880      | 50.32             | -3.51  | 46.81          | 54       | -7.19  | AV       |
| 7320      | 56.52             | -0.82  | 55.70          | 74       | -18.30 | PK       |
| 7320      | 47.26             | -0.82  | 46.44          | 54       | -7.56  | AV       |
| 1         |                   |        |                |          |        |          |

Remark: Factor = Antenna Factor + Cable Loss - Pre-amplifier. Margin = Absolute Level - Limit

## Vertical:

| Frequency | Reading<br>Result | Factor | Emission Level | Limits   | Margin | Detector |
|-----------|-------------------|--------|----------------|----------|--------|----------|
| (MHz)     | (dBµV)            | (dB)   | (dBµV/m)       | (dBµV/m) | (dB)   | Туре     |
| 2440      | 109.68            | -5.65  | 104.03         | 114      | -9.97  | PK       |
| 2440      | 82.35             | -5.65  | 76.70          | 94       | -17.30 | AV       |
| 4880      | 61.21             | -3.43  | 57.78          | 74       | -16.22 | PK       |
| 4880      | 50.34             | -3.43  | 46.91          | 54       | -7.09  | AV       |
| 7320      | 57.62             | -0.75  | 56.87          | 74       | -17.13 | PK       |
| 7320      | 47.35             | -0.75  | 46.60          | 54       | -7.40  | AV       |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit

No.:UNIA20040822ER-01

|       | _   | ٠,  |   |
|-------|-----|-----|---|
| Horiz | ont | tal | : |

| Frequency | Reading<br>Result | Factor | Emission Level | Limits   | Margin | Detector |
|-----------|-------------------|--------|----------------|----------|--------|----------|
| (MHz)     | (dBµV)            | (dB)   | (dBµV/m)       | (dBµV/m) | (dB)   | Туре     |
| 2480      | 109.31            | -5.65  | 103.66         | 114      | -10.34 | PK       |
| 2480      | 82.02             | -5.65  | 76.37          | 94       | -17.63 | AV       |
| 4960      | 62.09             | -3.43  | 58.66          | 74       | -15.34 | PK       |
| 4960      | 51.31             | -3.43  | 47.88          | 54       | -6.12  | AV       |
| 7440      | 56.87             | -0.75  | 56.12          | 74       | -17.88 | PK       |
| 7440      | 47.39             | -0.75  | 46.64          | 54       | -7.36  | AV       |
| 1         |                   |        |                |          |        | •        |

Page 17 of 24

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit

#### Vertical:

| Frequency | Reading<br>Result | Factor | Emission Level | Limits   | Margin | Detector |
|-----------|-------------------|--------|----------------|----------|--------|----------|
| (MHz)     | (dBµV)            | (dB)   | (dBµV/m)       | (dBµV/m) | (dB)   | Туре     |
| 2480      | 108.67            | -5.65  | 103.02         | 114      | -10.98 | PK       |
| 2480      | 80.31             | -5.65  | 74.66          | 94       | -19.34 | AV       |
| 4960      | 61.52             | -3.43  | 58.09          | 74       | -15.91 | PK       |
| 4960      | 50.43             | -3.43  | 47.00          | 54       | -7.00  | AV       |
| 7440      | 57.32             | -0.75  | 56.57          | 74       | -17.43 | PK       |
| 7440      | 47.61             | -0.75  | 46.86          | 54       | -7.14  | AV       |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin= Absolute Level – Limit

#### Remark:

- (1) Measuring frequencies from 1 GHz to the 25 GHz.
- (2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) \* denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (4) Data of measurement within this frequency range shown "--- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHzand video bandwidth is 3MHz for peak measurement with peak detectorat frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHzand video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
- (6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
- (7)All modes of operation were investigated and the worst-case emissions are reported.
- (8)Fundamental frequency test setting, the primary frequency setting should be RBW >20dB BW VBW>=3XRBW, PK detector for PK value, RMS detector for AV value.



### **5 BAND EDGE**

#### 5.1 Limits

FCC PART 15.249(d) 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 emissionlimits in §15.209, whichever is the lesser attenuation.

#### 5.2 Test Procedure

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSIC63.10 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT issituated in three orthogonal planes (if appropriate), adjusting the measurement antenna height andpolarization etc. RBW 1MHz VBW 3MHz PK detector for PK value , RBW 1MHz VBW 10Hz PK detector for AV value .The conducted RF band edge was measured by using a spectrum analyzer. Set span wide enough to capturethe highest in-band emission and the emission at the band edge. Set RBW to 100 KHz and VBW to 300 KHz, to measure the conducted peak band edge.

#### 5.3 Test Result

#### **PASS**

### Radiated Band Edge Test:

Operation Mode: TX CH Low (2405MHz)

#### Horizontal:

| 1101120111011 |                     |               |                     |          |        |          |
|---------------|---------------------|---------------|---------------------|----------|--------|----------|
| Frequency     | Reading Result      | Factor        | Emission Level      | Limits   | Margin | Detector |
| (MHz)         | (dBµV)              | (dB)          | (dBµV/m)            | (dBµV/m) | (dB)   | Туре     |
| 2310          | 57.69               | -5.81         | 51.88               | 74       | -22.12 | PK       |
| 2310          | 1 1                 | -5.81         | 1                   | 54       | 1      | AV       |
| 2390          | 57.89               | -5.84         | 52.05               | 74       | -21.95 | PK       |
| 2390          | 1                   | -5.84         | 1                   | 54       | /      | AV       |
| 2400          | 58.26               | -5.84         | 52.42               | 74       | -21.58 | PK       |
| 2400          | 1                   | -5.84         | 1                   | 54       | 1      | AV       |
| Remark: Fact  | tor = Antenna Facto | or + Cable Lo | oss – Pre-amplifier |          | 1      | <u> </u> |

#### Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits   | Margin | Detector |
|-----------|----------------|--------|----------------|----------|--------|----------|
| (MHz)     | (dBµV)         | (dB)   | (dBµV/m)       | (dBµV/m) | (dB)   | Type     |
| 2310      | 56.81          | -5.81  | 51.00          | 74       | -23.00 | PK       |
| 2310      | 1              | -5.81  | 1              | 54       | 1      | AV       |
| 2390      | 57.06          | -5.84  | 51.22          | 74       | -22.78 | PK       |
| 2390      | 1              | -5.84  | 1              | 54       | 1      | AV       |
| 2400      | 57.64          | -5.84  | 51.80          | 74       | -22.20 | PK       |
| 2400      | 1              | -5.84  | /              | 54       | 1      | AV       |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.:UNIA20040822ER-01



Report No.:UNIA20040822ER-01

Operation Mode: TX CH High (2480MHz)

## Horizontal:

| Frequency | Reading Result | Factor | Emission Level | Limits   | Margin | Detector |
|-----------|----------------|--------|----------------|----------|--------|----------|
| (MHz)     | (dBµV)         | (dB)   | (dBµV/m)       | (dBµV/m) | (dB)   | Туре     |
| 2483.5    | 57.31          | -5.65  | 51.66          | 74       | -22.34 | PK       |
| 2483.5    | 1              | -5.65  | 1              | 54       | 1      | AV       |
| 2500      | 56.84          | -5.72  | 51.12          | 74       | -22.88 | PK       |
| 2500      | 1              | -5.72  | NI I           | 54       | 1      | AV       |

Remark: Factor = Antenna Factor + Cable Loss - Pre-amplifier.

## Vertical:

| Frequency | Reading Result | Factor | Emission Level | Limits   | Margin | Detector |
|-----------|----------------|--------|----------------|----------|--------|----------|
| (MHz)     | (dBµV)         | (dB)   | (dBµV/m)       | (dBµV/m) | (dB)   | Туре     |
| 2483.5    | 57.39          | -5.65  | 51.74          | 74       | -22.26 | PK       |
| 2483.5    | 151            | -5.65  | 1              | 54       | 1      | AV       |
| 2500      | 56.28          | -5.72  | 50.56          | 74       | -23.44 | PK       |
| 2500      | 1              | -5.72  | 1              | 54       | 1      | AV       |

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



### 6 OCCUPIED BANDWIDTH MEASUREMENT

### 6.1 Test Setup

Same asRadiated Emission Measurement

### 6.2 Test Procedure

- 1. The EUT was placed on a turn table which is 0.8m above ground plane.
- 2. Set EUT as normal operation.
- 3. Based on ANSI C63.10 section 6.9.2: RBW=30KHz. VBW=100KHz, Span=8MHz.
- 4. The useful radiated emission from the EUT was detected by the spectrum analyzer with peak detector.

Report

No.:UNIA20040822ER-01

## 6.3 Measurement Equipment Used

Same asRadiated Emission Measurement

#### 6.4 Test Result

### **PASS**

| Frequency<br>(MHz) | 20dB Bandwidth<br>(MHz) | Result |
|--------------------|-------------------------|--------|
| 2405               | 2.519                   | PASS   |
| 2440               | 2.524                   | PASS   |
| 2480               | 2.522                   | PASS   |

#### CH:2405MHz





#### CH:2440MHz



#### CH:2480MHz





## 7 ANTENNA REQUIREMENT

#### Standard Applicable:

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed toensure that no antenna other than that furnished by the responsible party shall be used with the device.

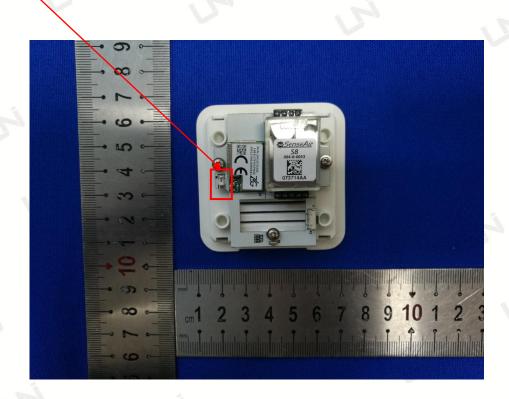
Report

No.:UNIA20040822ER-01

## **Antenna Connected Construction**

The antenna used in this product is a ceramics Antenna, The directional gains of antenna used for transmitting is 0.5dBi.

## ANTENNA:





## **8 PHOTOGRAPH OF TEST**

## 8.1Radiated Emission





No.:UNIA20040822ER-01



## 8.2Conducted Emission



\*\*\*End of Report\*\*\*

No.:UNIA20040822ER-01