



**BUREAU  
VERITAS**

Test Report No.: RF160824N051-2



Test Lab  
Cert 2951.01

## TEST REPORT

|           |                                           |
|-----------|-------------------------------------------|
| Applicant | Stacked Power LLC                         |
| Address   | 7819 Beverly Blvd., Los Angeles, CA 90036 |

|                                     |                                           |
|-------------------------------------|-------------------------------------------|
| Manufacturer or Supplier            | Stacked Power LLC                         |
| Address                             | 7819 Beverly Blvd., Los Angeles, CA 90036 |
| Product                             | AUDIO PACK                                |
| Brand Name                          | N/A                                       |
| Model                               | SPDBST                                    |
| Additional Model & Model Difference | N/A                                       |
| Date of tests                       | Sep. 01, 2016 ~ Sep. 12, 2016             |

the tests have been carried out according to the requirements of the following standard:

☒ **FCC Part 15, Subpart C, Section 15.247**

**CONCLUSION: The submitted sample was found to COMPLY with the test requirement**

|                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Tested by Breeze Jiang<br>Project Engineer / EMC Department                         | Approved by Glyn He<br>Supervisor / EMC Department                                   |
|  |  |
|                                                                                     | Date: Nov. 10, 2016                                                                  |

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification



## TABLE OF CONTENTS

|                                                               |           |
|---------------------------------------------------------------|-----------|
| <b>RELEASE CONTROL RECORD .....</b>                           | <b>4</b>  |
| <b>1 SUMMARY OF TEST RESULTS.....</b>                         | <b>5</b>  |
| <b>2 MEASUREMENT UNCERTAINTY .....</b>                        | <b>5</b>  |
| <b>3 GENERAL INFORMATION .....</b>                            | <b>6</b>  |
| 3.1 GENERAL DESCRIPTION OF EUT .....                          | 6         |
| 3.2 DESCRIPTION OF TEST MODES .....                           | 7         |
| 3.2.1. CONFIGURATION OF SYSTEM UNDER TEST .....               | 7         |
| 3.2.2. TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL..... | 7         |
| 3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS .....            | 10        |
| 3.4 DESCRIPTION OF SUPPORT UNITS .....                        | 10        |
| <b>4 TEST TYPES AND RESULTS.....</b>                          | <b>11</b> |
| 4.1 CONDUCTED EMISSION MEASUREMENT .....                      | 11        |
| 4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT .....          | 11        |
| 4.1.2 TEST INSTRUMENTS.....                                   | 11        |
| 4.1.3 TEST PROCEDURES .....                                   | 12        |
| 4.1.4 DEVIATION FROM TEST STANDARD.....                       | 12        |
| 4.1.5 TEST SETUP .....                                        | 13        |
| 4.1.6 EUT OPERATING CONDITIONS .....                          | 13        |
| 4.1.7 TEST RESULTS.....                                       | 14        |
| 4.2 RADIATED EMISSION MEASUREMENT .....                       | 16        |
| 4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT.....            | 16        |
| 4.2.2 TEST INSTRUMENTS.....                                   | 17        |
| 4.2.3 TEST PROCEDURES .....                                   | 18        |
| 4.2.4 DEVIATION FROM TEST STANDARD.....                       | 18        |
| 4.2.5 TEST SETUP .....                                        | 19        |
| 4.2.6 EUT OPERATING CONDITIONS .....                          | 19        |
| 4.2.7 TEST RESULTS.....                                       | 20        |
| 4.3 6dB BANDWIDTH MEASUREMENT.....                            | 25        |
| 4.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT .....               | 25        |
| 4.3.2 TEST INSTRUMENTS.....                                   | 25        |
| 4.3.3 TEST PROCEDURE .....                                    | 25        |
| 4.3.4 DEVIATION FROM TEST STANDARD.....                       | 26        |
| 4.3.5 TEST SETUP .....                                        | 26        |
| 4.3.6 EUT OPERATING CONDITIONS .....                          | 26        |



|         |                                                                                             |    |
|---------|---------------------------------------------------------------------------------------------|----|
| 4.3.7   | TEST RESULTS .....                                                                          | 27 |
| 4.4     | CONDUCTED OUTPUT POWER.....                                                                 | 28 |
| 4.4.1   | LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT .....                                          | 28 |
| 4.4.2   | TEST SETUP .....                                                                            | 28 |
| 4.4.3   | TEST INSTRUMENTS .....                                                                      | 28 |
| 4.3.4   | TEST PROCEDURES.....                                                                        | 28 |
| 4.4.5   | DEVIATION FROM TEST STANDARD .....                                                          | 29 |
| 4.3.6   | EUT OPERATING CONDITIONS .....                                                              | 29 |
| 4.4.7   | TEST RESULTS.....                                                                           | 29 |
| 4.4.7.1 | MAXIMUM PEAK OUTPUT POWER.....                                                              | 29 |
| 4.4.7.2 | AVERAGE OUTPUT POWER (FOR REFERENCE) .....                                                  | 29 |
| 4.5     | POWER SPECTRAL DENSITY MEASUREMENT .....                                                    | 30 |
| 4.5.1   | LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT .....                                          | 30 |
| 4.5.2   | TEST SETUP .....                                                                            | 30 |
| 4.5.3   | TEST INSTRUMENTS.....                                                                       | 30 |
| 4.5.4   | TEST PROCEDURE .....                                                                        | 30 |
| 4.5.5   | DEVIATION FROM TEST STANDARD.....                                                           | 30 |
| 4.5.6   | EUT OPERATING CONDITION.....                                                                | 30 |
| 4.5.7   | TEST RESULTS.....                                                                           | 31 |
| 4.6     | OUT OF BAND EMISSION MEASUREMENT .....                                                      | 32 |
| 4.6.1   | LIMITS OF OUT OF BAND EMISSION MEASUREMENT .....                                            | 32 |
| 4.6.2   | TEST SETUP .....                                                                            | 32 |
| 4.6.3   | TEST INSTRUMENTS.....                                                                       | 32 |
| 4.6.4   | TEST PROCEDURE .....                                                                        | 32 |
| 4.6.5   | DEVIATION FROM TEST STANDARD.....                                                           | 33 |
| 4.6.6   | EUT OPERATING CONDITION.....                                                                | 33 |
| 4.6.7   | TEST RESULTS.....                                                                           | 34 |
| 5       | PHOTOGRAPHS OF THE TEST CONFIGURATION .....                                                 | 36 |
| 6       | APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT<br>BY THE LAB ..... | 37 |



Test Report No.: RF160824N051-2

## RELEASE CONTROL RECORD

| ISSUE NO.      | REASON FOR CHANGE | DATE ISSUED   |
|----------------|-------------------|---------------|
| RF160824N051-2 | Original release  | Nov. 10, 2016 |



## 1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247) |                                  |        |                                |
|-----------------------------------------------------------|----------------------------------|--------|--------------------------------|
| STANDARD SECTION                                          | TEST TYPE AND LIMIT              | RESULT | REMARK                         |
| 15.207                                                    | AC Power Conducted Emission      | PASS   | Meet the requirement of limit. |
| 15.205<br>15.209                                          | Radiated Emission                | PASS   | Meet the requirement of limit. |
| 15.247(d)                                                 | Out of band Emission Measurement | PASS   | Meet the requirement of limit. |
| 15.247(a)(2)                                              | 6dB bandwidth                    | PASS   | Meet the requirement of limit. |
| 15.247(b)                                                 | Conducted Output power           | PASS   | Meet the requirement of limit. |
| 15.247(e)                                                 | Power Spectral Density           | PASS   | Meet the requirement of limit. |
| 15.203                                                    | Antenna Requirement              | PASS   | No antenna connector is used   |

## 2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| MEASUREMENT         | FREQUENCY     | UNCERTAINTY |
|---------------------|---------------|-------------|
| Conducted emissions | 9kHz~30MHz    | 2.70dB      |
| Radiated emissions  | 9KHz ~ 30MHz  | 2.90dB      |
|                     | 30MHz ~ 1GMHz | 3.83dB      |
|                     | 1GHz ~ 18GHz  | 4.93dB      |
|                     | 18GHz ~ 40GHz | 4.80dB      |

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .



### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

|                              |                                                                                  |
|------------------------------|----------------------------------------------------------------------------------|
| <b>PRODUCT</b>               | AUDIO PACK                                                                       |
| <b>MODEL NO.</b>             | SPDBST                                                                           |
| <b>FCC ID</b>                | 2AJ5U-SPDBST                                                                     |
| <b>NOMINAL VOLTAGE</b>       | DC 3.7V from Lithium-Polymer Rechargeable Battery or<br>DC 5V from USB Host Unit |
| <b>MODULATION TYPE</b>       | DTS                                                                              |
| <b>MODULATION TECHNOLOGY</b> | BT-LE(GFSK)                                                                      |
| <b>OPERATING FREQUENCY</b>   | 2402-2480MHz                                                                     |
| <b>MAX. OUTPUT POWER</b>     | 5.058mW (Maximum)                                                                |
| <b>ANTENNA TYPE</b>          | Integral PCB Antenna, 0dBi Gain                                                  |
| <b>I/O PORTS</b>             | Refer to user's manual                                                           |
| <b>CABLE SUPPLIED</b>        | N/A                                                                              |

**NOTE:**

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions, but only the worst case was shown in test report.
3. Please refer to the EUT photo document (Reference No.: 160824N051) for detailed product photo.



### 3.2 DESCRIPTION OF TEST MODES

40 channels are provided for BT-LE(GFSK):

| CHANNEL | FREQ.<br>(MHZ) | CHANNEL | FREQ.<br>(MHZ) | CHANNEL | FREQ.<br>(MHZ) | CHANNEL | FREQ.<br>(MHZ) |
|---------|----------------|---------|----------------|---------|----------------|---------|----------------|
| 0       | 2402           | 10      | 2422           | 20      | 2442           | 30      | 2462           |
| 1       | 2404           | 11      | 2424           | 21      | 2444           | 31      | 2464           |
| 2       | 2406           | 12      | 2426           | 22      | 2446           | 32      | 2466           |
| 3       | 2408           | 13      | 2428           | 23      | 2448           | 33      | 2468           |
| 4       | 2410           | 14      | 2430           | 24      | 2450           | 34      | 2470           |
| 5       | 2412           | 15      | 2432           | 25      | 2452           | 35      | 2472           |
| 6       | 2414           | 16      | 2434           | 26      | 2454           | 36      | 2474           |
| 7       | 2416           | 17      | 2436           | 27      | 2456           | 37      | 2476           |
| 8       | 2418           | 18      | 2438           | 28      | 2458           | 38      | 2478           |
| 9       | 2420           | 19      | 2440           | 29      | 2460           | 39      | 2480           |

#### 3.2.1. CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photographs of the test configuration for reference.

#### 3.2.2. TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports

The worst case was found when positioned on X axis for radiated emission. Following test modes were selected for the final test, and the final worst case is marked in boldface and recorded in the report:

| EUT CONFIGURE<br>MODE | APPLICABLE TO |       |     |      | DESCRIPTION              |
|-----------------------|---------------|-------|-----|------|--------------------------|
|                       | RE<1G         | RE≥1G | PLC | APCM |                          |
| <b>A</b>              | -             | -     | -   | √    | Powered By Fully Battery |
| <b>B</b>              | √             | √     | √   | -    | Powered By USB Host Unit |

Where

**RE<1G**: Radiated Emission below 1GHz

**PLC**: Power Line Conducted Emission

**RE≥1G**: Radiated Emission above 1GHz

**APCM**: Antenna Port Conducted Measurement

**RADIATED EMISSION TEST (BELOW 1GHz):**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| MODE  | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|-------|-------------------|----------------|-----------------------|-----------------|------------------|
| BT-LE | 0 to 39           | 39             | DTS                   | GFSK            | 1                |

For the test results, only the worst case was shown in test report.

**RADIATED EMISSION TEST (ABOVE 1GHz):**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports (if EUT with antenna diversity architecture).

- ☒ Following channel(s) was (were) selected for the final test as listed below.

| MODE  | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|-------|-------------------|----------------|-----------------------|-----------------|------------------|
| BT-LE | 0 to 39           | 0,19, 39       | DTS                   | GFSK            | 1                |

**POWER LINE CONDUCTED EMISSION TEST:**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| MODE  | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|-------|-------------------|----------------|-----------------------|-----------------|------------------|
| BT-LE | 0 to 39           | 39             | DTS                   | GFSK            | 1                |

**ANTENNA PORT CONDUCTED MEASUREMENT:**

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| MODE  | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|-------|-------------------|----------------|-----------------------|-----------------|------------------|
| BT-LE | 0 to 39           | 0, 19, 39      | DTS                   | GFSK            | 1                |

**TEST CONDITION:**

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | TEST VOLTAGE             | TESTED BY    |
|---------------|--------------------------|--------------------------|--------------|
| RE<1G         | 25deg. C, 50%RH          | DC 5V from USB Host Unit | Cheng Zhong  |
| RE≥1G         | 25deg. C, 50%RH          | DC 5V from USB Host Unit | Cheng Zhong  |
| PLC           | 25deg. C, 60%RH          | DC 5V from USB Host Unit | Cheng Zhong  |
| APCM          | 20deg. C, 55%RH          | DC 3.7V from Battery     | Breeze Jiang |



### 3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C, Section 15.247**

**558074 D01 DTS Meas Guidance v03r05**

**ANSI C63.10-2013**

Note: All test items have been performed and recorded as per the above standards.

### 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| NO. | PRODUCT      | BRAND  | MODEL NO.        | SERIAL NO.               | FCC ID |
|-----|--------------|--------|------------------|--------------------------|--------|
| 1   | Notebook     | DELL   | Inspiron 14-3442 | 4Q3WB12                  | N/A    |
| 2   | Mobile Phone | APPLE  | A1332            | CP7P0NTT79X9TN1          | N/A    |
| 3   | Printer      | Lenovo | LJ2200L          | LP02857415 48001408      | N/A    |
| 4   | Mouse        | DELL   | MS111-L          | CN-09RRC7-48729-39E-0C7Y | N/A    |

| NO. | CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS                                                                         |
|-----|----------------------------------------------------------------------------------------------------------------------|
| 1   | AC Line: Unshielded, Detachable 0.8m; DC Line: Unshielded, Detachable 1.8m;<br>USB Line: Unshielded, Detachable 1.2m |
| 2   | N/A                                                                                                                  |
| 3   | AC Line: Unshielded, Detachable 1.5m; USB Line: Unshielded, Detachable 1.5m;                                         |
| 4   | USB Line: Unshielded, Detachable 1.8m                                                                                |



## 4 TEST TYPES AND RESULTS

### 4.1 CONDUCTED EMISSION MEASUREMENT

#### 4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

| FREQUENCY OF EMISSION (MHz) | CONDUCTED LIMIT (dB $\mu$ V) |          |
|-----------------------------|------------------------------|----------|
|                             | Quasi-peak                   | Average  |
| 0.15 ~ 0.5                  | 66 to 56                     | 56 to 46 |
| 0.5 ~ 5                     | 56                           | 46       |
| 5 ~ 30                      | 60                           | 50       |

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
  2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
  3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

#### 4.1.2 TEST INSTRUMENTS

| Equipment                | Manufacturer  | Model No.       | Serial No.     | Last Cal.  | Next Cal.  |
|--------------------------|---------------|-----------------|----------------|------------|------------|
| EMI Test Receiver        | Rohde&Schwarz | ESR7            | 101588         | Jan. 22,16 | Jan. 21,17 |
| Artificial Mains Network | Rohde&Schwarz | ENV216          | 101173         | Mar. 04,16 | Mar. 03,17 |
| Artificial Mains Network | Rohde&Schwarz | ESH3-Z5         | 100317         | Apr. 05,16 | Apr. 04,17 |
| Voltage probe            | SCHWARZBECK   | TK 9421         | TK<br>9421-176 | Jan. 08,16 | Jan. 07,17 |
| Test software            | ADT           | ADT_Cond_V7.3.7 | N/A            | N/A        | N/A        |

- NOTE:**
1. The test was performed in shielded room 553.
  2. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.



#### 4.1.3 TEST PROCEDURES

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

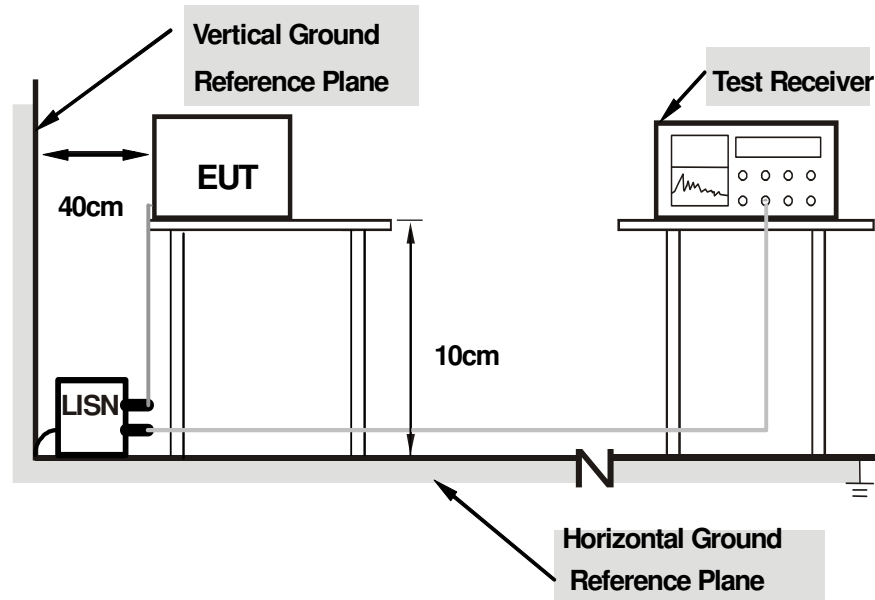
**NOTE:** All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 DEVIATION FROM TEST STANDARD

No deviation.



#### 4.1.5 TEST SETUP



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

**2.Both of LISNs (AMN) are 80 cm from EUT and at least 10cm from other units and other metal planes**

For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.1.6 EUT OPERATING CONDITIONS

- a. Turned on the power and connected of all equipment.
- b. EUT was operated according to the type used was description in manufacturer's specifications or the User's Manual.



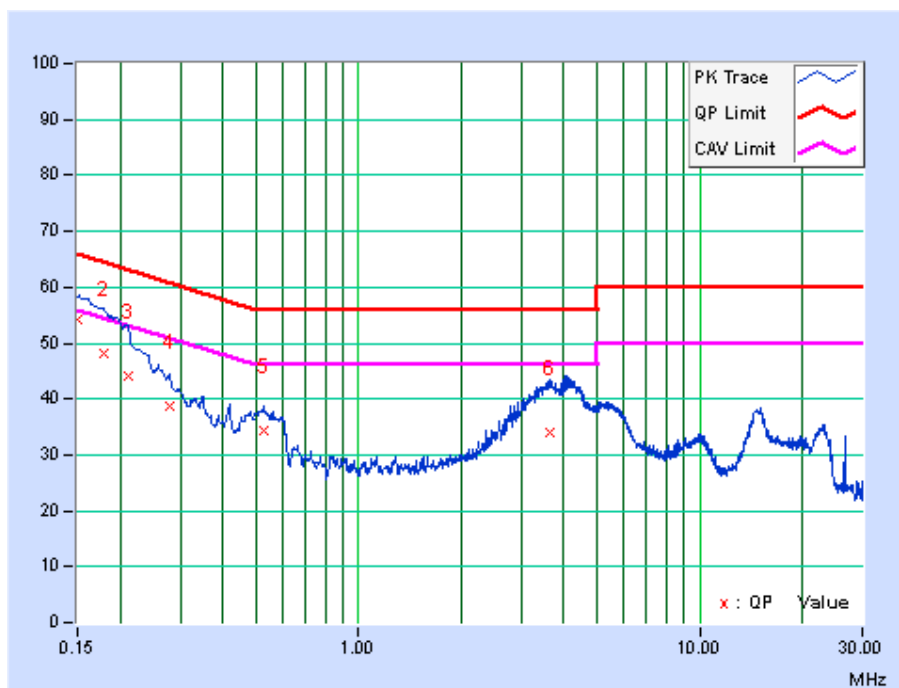
## 4.1.7 TEST RESULTS

## CONDUCTED WORST-CASE DATA: BT-LE(GFSK) CH39

| PHASE | Line | 6dB BANDWIDTH | 9kHz |
|-------|------|---------------|------|
|-------|------|---------------|------|

| No | Freq.<br>[MHz] | Corr.<br>Factor<br>(dB) | Reading Value<br>[dB (uV)] |       | Emission Level<br>[dB (uV)] |       | Limit<br>[dB (uV)] |       | Margin<br>(dB) |        |
|----|----------------|-------------------------|----------------------------|-------|-----------------------------|-------|--------------------|-------|----------------|--------|
|    |                |                         | Q.P.                       | AV.   | Q.P.                        | AV.   | Q.P.               | AV.   | Q.P.           | AV.    |
| 1  | 0.15000        | 10.04                   | 44.12                      | 26.32 | 54.16                       | 36.36 | 66.00              | 56.00 | -11.84         | -19.64 |
| 2  | 0.17925        | 10.04                   | 37.96                      | 20.93 | 48.00                       | 30.97 | 64.52              | 54.52 | -16.52         | -23.55 |
| 3  | 0.21075        | 10.04                   | 34.19                      | 18.37 | 44.23                       | 28.41 | 63.18              | 53.18 | -18.94         | -24.76 |
| 4  | 0.27797        | 10.07                   | 28.49                      | 11.99 | 38.56                       | 22.06 | 60.88              | 50.88 | -22.32         | -28.82 |
| 5  | 0.52575        | 10.14                   | 24.29                      | 17.46 | 34.43                       | 27.60 | 56.00              | 46.00 | -21.57         | -18.40 |
| 6  | 3.62846        | 10.15                   | 23.71                      | 16.52 | 33.86                       | 26.67 | 56.00              | 46.00 | -22.14         | -19.33 |

- REMARKS:** 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.  
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.  
3. The emission levels of other frequencies were very low against the limit.  
4. Margin value = Emission level - Limit value  
5. Correction factor = Insertion loss + Cable loss  
6. Emission Level = Correction Factor + Reading Value.





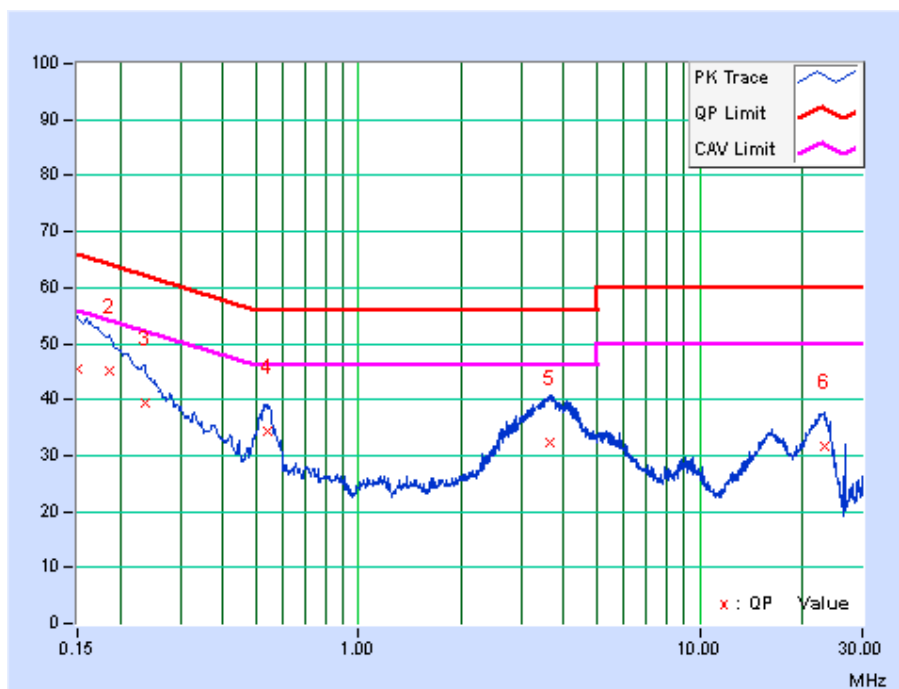
**BUREAU  
VERITAS**

**Test Report No.: RF160824N051-2**

|              |         |                      |      |
|--------------|---------|----------------------|------|
| <b>PHASE</b> | Neutral | <b>6dB BANDWIDTH</b> | 9kHz |
|--------------|---------|----------------------|------|

| No | Freq.<br>[MHz] | Corr.<br>Factor<br>(dB) | Reading Value<br>[dB (uV)] |       | Emission Level<br>[dB (uV)] |       | Limit<br>[dB (uV)] |       | Margin<br>(dB) |        |
|----|----------------|-------------------------|----------------------------|-------|-----------------------------|-------|--------------------|-------|----------------|--------|
|    |                |                         | Q.P.                       | AV.   | Q.P.                        | AV.   | Q.P.               | AV.   | Q.P.           | AV.    |
| 1  | 0.15000        | 9.84                    | 35.50                      | 19.43 | 45.34                       | 29.27 | 66.00              | 56.00 | -20.66         | -26.73 |
| 2  | 0.18600        | 9.84                    | 35.35                      | 15.58 | 45.19                       | 25.42 | 64.21              | 54.21 | -19.02         | -28.79 |
| 3  | 0.23550        | 9.84                    | 29.67                      | 15.67 | 39.51                       | 25.51 | 62.25              | 52.25 | -22.74         | -26.74 |
| 4  | 0.54357        | 9.84                    | 24.66                      | 18.89 | 34.50                       | 28.73 | 56.00              | 46.00 | -21.50         | -17.27 |
| 5  | 3.65100        | 9.91                    | 22.45                      | 15.81 | 32.36                       | 25.72 | 56.00              | 46.00 | -23.64         | -20.28 |
| 6  | 23.2035        | 10.32                   | 21.21                      | 15.95 | 31.53                       | 26.27 | 60.00              | 50.00 | -28.47         | -23.73 |

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
  2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
  3. The emission levels of other frequencies were very low against the limit.
  4. Margin value = Emission level - Limit value
  5. Correction factor = Insertion loss + Cable loss
  6. Emission Level = Correction Factor + Reading Value.



**Bureau Veritas Shenzhen Co., Ltd.  
Dongguan Branch**

No. 34, Chenwulu Section, Guantai Rd., Houjie  
Town, Dongguan City,  
Guangdong 523942, China

Tel: +86 769 8593 5656  
Fax: +86 769 8593 1080  
Email: [customerservice.dg@cn.bureauveritas.com](mailto:customerservice.dg@cn.bureauveritas.com)



## **4.2 RADIATED EMISSION MEASUREMENT**

### **4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT**

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

| <b>FREQUENCIES<br/>(MHz)</b> | <b>FIELD STRENGTH<br/>(microvolts/meter)</b> | <b>MEASUREMENT DISTANCE<br/>(meters)</b> |
|------------------------------|----------------------------------------------|------------------------------------------|
| 0.009 ~ 0.490                | 2400/F(kHz)                                  | 300                                      |
| 0.490 ~ 1.705                | 24000/F(kHz)                                 | 30                                       |
| 1.705 ~ 30.0                 | 30                                           | 30                                       |
| 30 ~ 88                      | 100                                          | 3                                        |
| 88 ~ 216                     | 150                                          | 3                                        |
| 216 ~ 960                    | 200                                          | 3                                        |
| Above 960                    | 500                                          | 3                                        |

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



Test Report No.: RF160824N051-2

#### 4.2.2 TEST INSTRUMENTS

| Equipment                    | Manufacturer  | Model No.                | Serial No.  | Last Cal.   | Next Cal.   |
|------------------------------|---------------|--------------------------|-------------|-------------|-------------|
| EMI Test Receiver            | Rohde&Schwarz | ESR7                     | 101494      | Apr. 05,16  | Apr. 04,17  |
| Signal and Spectrum Analyzer | Rohde&Schwarz | FSV7                     | 102331      | Nov. 09,15  | Nov. 08,16  |
| Bilog Antenna                | Teseq         | CBL 6111D                | 30643       | Jul. 14, 16 | Jul. 13, 17 |
| Horn Antenna (1GHz -18GHz)   | ETS -Lindgren | 3117                     | 00062558    | May 18,16   | May 17,17   |
| GPS Generator+ Antenna       | TOJOIN        | GNSS-5000A               | E1-010119   | Aug. 08, 16 | Aug. 07, 17 |
| 3m Semi-anechoic Chamber     | ETS-LINDGREN  | 9m*6m*6m                 | NSEMC003    | Mar. 12,16  | Mar. 11,18  |
| Test Software                | ADT           | ADT_Radiated_V7.6.15.9.2 | N/A         | N/A         | N/A         |
| Horn Antenna                 | SCHWARZBECK   | BBHA 9170                | BBHA9170242 | Mar. 12,16  | Mar. 11,17  |
| Amplifier (9kHz-1GHz)        | SONOMA        | 310D                     | 186955      | Mar. 04,16  | Mar. 03, 17 |
| Pre-Amplifier(1-18G)         | HP            | 8449B                    | 3008A00409  | Apr. 25,16  | Apr. 24,17  |
| Pre-Amplifier (18GHz-40GHz)  | EMCI          | EMC 184045               | 980102      | Nov. 20,15  | Nov. 19,16  |
| Test Software                | ADT           | ADT_Radiated_V7.6.15.9.2 | N/A         | N/A         | N/A         |
| BLUETOOTH TESTER             | Rohde&Schwarz | CBT32                    | 100811      | Aug. 08,16  | Aug. 07,17  |

#### NOTE:

1. The test was performed in 966 Chamber.
2. The calibration interval of the above test instruments is 12 months or 24 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 494399.



#### 4.2.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 1.5meters above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

**NOTE:**

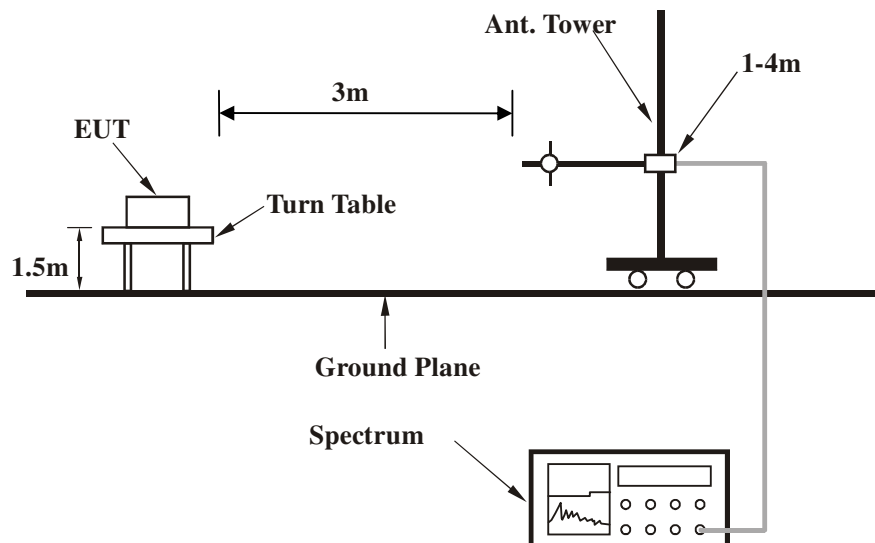
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
- 4.All modes of operation were investigated and the worst-case emissions are reported.
- 5.The testing of the EUT was performed on all 3 orthogonal axes; the worst-case test configuration was reported on the file test setup photo.

#### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation.



#### 4.2.5 TEST SETUP



For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.2.6 EUT OPERATING CONDITIONS

- Set the EUT under full load condition and placed them on a testing table.
- Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the EUT in full functions.



## 4.2.7 TEST RESULTS

## BELOW 1GHz WORST-CASE DATA:

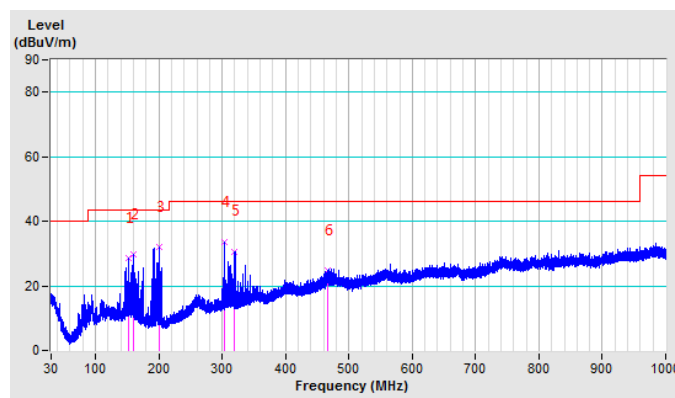
## BT-LE (GFSK)

|                 |               |                   |                 |
|-----------------|---------------|-------------------|-----------------|
| CHANNEL         | TX Channel 39 | DETECTOR FUNCTION | Quasi-Peak (QP) |
| FREQUENCY RANGE | 30MHz ~ 1GHz  |                   |                 |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                           |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|---------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(cm) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | 151.89         | 28.75                         | 43.50             | -14.75         | 200                       | 0                          | 45.23                  | -16.48                         |
| 2                                                   | 159.98         | 29.61                         | 43.50             | -13.89         | 200                       | 0                          | 46.65                  | -17.04                         |
| 3                                                   | 200.24         | 32.02                         | 43.50             | -11.48         | 200                       | 0                          | 51.10                  | -19.08                         |
| 4                                                   | 304.02         | 33.68                         | 46.00             | -12.32         | 200                       | 0                          | 46.44                  | -12.76                         |
| 5                                                   | 320.03         | 30.66                         | 46.00             | -15.34         | 200                       | 0                          | 43.68                  | -13.02                         |
| 6                                                   | 466.53         | 24.87                         | 46.00             | -21.13         | 200                       | 0                          | 32.10                  | -7.23                          |

## REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.





**BUREAU  
VERITAS**

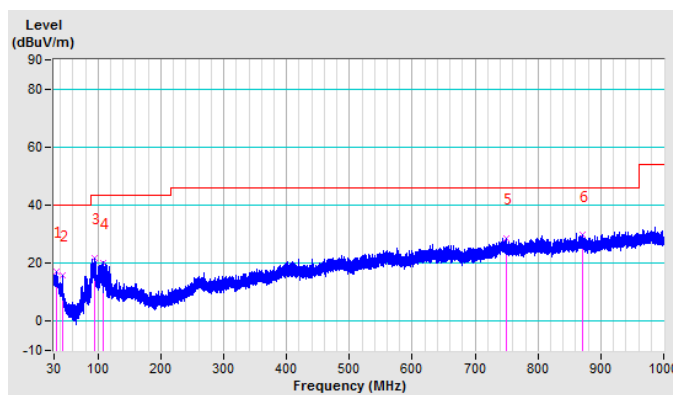
**Test Report No.: RF160824N051-2**

|                        |               |                              |                 |
|------------------------|---------------|------------------------------|-----------------|
| <b>CHANNEL</b>         | TX Channel 39 | <b>DETECTOR<br/>FUNCTION</b> | Quasi-Peak (QP) |
| <b>FREQUENCY RANGE</b> | 30MHz ~ 1GHz  |                              |                 |

| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M |                |                               |                   |                |                           |                            |                        |                                 |
|---------------------------------------------------|----------------|-------------------------------|-------------------|----------------|---------------------------|----------------------------|------------------------|---------------------------------|
| NO.                                               | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(cm) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTIO<br>N FACTOR<br>(dB/m) |
| 1                                                 | 34.09          | 17.10                         | 40.00             | -22.90         | 100                       | 0                          | 29.90                  | -12.80                          |
| 2                                                 | 42.94          | 15.90                         | 40.00             | -24.10         | 100                       | 0                          | 33.45                  | -17.55                          |
| 3                                                 | 93.96          | 21.91                         | 43.50             | -21.59         | 100                       | 0                          | 40.73                  | -18.82                          |
| 4                                                 | 107.42         | 20.18                         | 43.50             | -23.32         | 100                       | 0                          | 38.02                  | -17.84                          |
| 5                                                 | 749.92         | 28.50                         | 46.00             | -17.50         | 100                       | 0                          | 29.04                  | -0.54                           |
| 6                                                 | 870.81         | 29.70                         | 46.00             | -16.30         | 100                       | 0                          | 28.77                  | 0.93                            |

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.



**Bureau Veritas Shenzhen Co., Ltd.  
Dongguan Branch**

No. 34, Chenwulu Section, Guantai Rd., Houjie  
Town, Dongguan City,  
Guangdong 523942, China

Tel: +86 769 8593 5656  
Fax: +86 769 8593 1080  
Email: [customerservice.dg@cn.bureauveritas.com](mailto:customerservice.dg@cn.bureauveritas.com)



## ABOVE 1GHz TEST DATA:

## BT-LE (GFSK)

|                 |              |                   |              |
|-----------------|--------------|-------------------|--------------|
| CHANNEL         | TX Channel 0 | DETECTOR FUNCTION | Peak (PK)    |
| FREQUENCY RANGE | 1GHz ~ 25GHz |                   | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | 2390.00        | 32.04 PK                      | 74.00             | -41.96         | 1.86 H                   | 56                         | 28.17                  | 3.87                           |
| 2                                                   | 2390.00        | 19.90 AV                      | 54.00             | -34.10         | 1.86 H                   | 56                         | 16.03                  | 3.87                           |
| 3                                                   | *2402.00       | 87.21 PK                      |                   |                | 1.86 H                   | 56                         | 83.31                  | 3.90                           |
| 4                                                   | *2402.00       | 63.89 AV                      |                   |                | 1.86 H                   | 56                         | 59.99                  | 3.90                           |
| 5                                                   | 4804.00        | 49.33 PK                      | 74.00             | -24.67         | 1.20 H                   | 340                        | 41.35                  | 7.98                           |
| 6                                                   | 4804.00        | 38.06 AV                      | 54.00             | -15.94         | 1.20 H                   | 340                        | 30.08                  | 7.98                           |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | 2390.00        | 41.36 PK                      | 74.00             | -32.64         | 1.00 V                   | 280                        | 37.49                  | 3.87                           |
| 2                                                   | 2390.00        | 28.60 AV                      | 54.00             | -25.40         | 1.00 V                   | 280                        | 24.73                  | 3.87                           |
| 3                                                   | *2402.00       | 83.40 PK                      |                   |                | 1.00 V                   | 280                        | 79.50                  | 3.90                           |
| 4                                                   | *2402.00       | 72.40 AV                      |                   |                | 1.00 V                   | 280                        | 68.50                  | 3.90                           |
| 5                                                   | 4804.00        | 48.97 PK                      | 74.00             | -25.03         | 1.00 V                   | 108                        | 40.99                  | 7.98                           |
| 6                                                   | 4804.00        | 37.14 AV                      | 54.00             | -16.86         | 1.00 V                   | 108                        | 29.16                  | 7.98                           |

## REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " \* ": Fundamental frequency.



**BUREAU  
VERITAS**

**Test Report No.: RF160824N051-2**

|                        |               |                              |              |
|------------------------|---------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 19 | <b>DETECTOR<br/>FUNCTION</b> | Peak (PK)    |
| <b>FREQUENCY RANGE</b> | 1GHz ~ 25GHz  |                              | Average (AV) |

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M |                |                               |                   |                |                          |                            |                        |                                |
|-----------------------------------------------------|----------------|-------------------------------|-------------------|----------------|--------------------------|----------------------------|------------------------|--------------------------------|
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *2440.00       | 87.89 PK                      |                   |                | 1.10 H                   | 208                        | 83.87                  | 4.02                           |
| 2                                                   | *2440.00       | 64.03 AV                      |                   |                | 1.10 H                   | 208                        | 60.01                  | 4.02                           |
| 3                                                   | 4880.00        | 48.74 PK                      | 74.00             | -25.26         | 1.70 H                   | 340                        | 40.65                  | 8.09                           |
| 4                                                   | 4880.00        | 37.54 AV                      | 54.00             | -16.46         | 1.70 H                   | 340                        | 29.45                  | 8.09                           |
| 5                                                   | 7320.00        | 53.87 PK                      | 74.00             | -20.13         | 2.00 H                   | 260                        | 39.73                  | 14.14                          |
| 6                                                   | 7320.00        | 41.10 AV                      | 54.00             | -12.90         | 2.00 H                   | 260                        | 26.96                  | 14.14                          |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |                |                               |                   |                |                          |                            |                        |                                |
| NO.                                                 | FREQ.<br>(MHz) | EMISSION<br>LEVEL<br>(dBuV/m) | LIMIT<br>(dBuV/m) | MARGIN<br>(dB) | ANTENNA<br>HEIGHT<br>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | *2440.00       | 83.44 PK                      |                   |                | 1.00 V                   | 256                        | 79.42                  | 4.02                           |
| 2                                                   | *2440.00       | 61.39 AV                      |                   |                | 1.00 V                   | 256                        | 57.37                  | 4.02                           |
| 3                                                   | 4880.00        | 48.64 PK                      | 74.00             | -25.36         | 1.00 V                   | 112                        | 40.55                  | 8.09                           |
| 4                                                   | 4880.00        | 37.05 AV                      | 54.00             | -16.95         | 1.00 V                   | 112                        | 28.96                  | 8.09                           |
| 5                                                   | 7320.00        | 53.25 PK                      | 74.00             | -20.75         | 1.00 V                   | 325                        | 39.11                  | 14.14                          |
| 6                                                   | 7320.00        | 40.10 AV                      | 54.00             | -13.90         | 1.00 V                   | 325                        | 25.96                  | 14.14                          |

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " \* ": Fundamental frequency.

**Bureau Veritas Shenzhen Co., Ltd.  
Dongguan Branch**

No. 34, Chenwulu Section, Guantai Rd., Houjie  
Town, Dongguan City,  
Guangdong 523942, China

Tel: +86 769 8593 5656  
Fax: +86 769 8593 1080  
Email: [customerservice.dg@cn.bureauveritas.com](mailto:customerservice.dg@cn.bureauveritas.com)



**BUREAU  
VERITAS**

**Test Report No.: RF160824N051-2**

|                        |               |                              |              |
|------------------------|---------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 39 | <b>DETECTOR<br/>FUNCTION</b> | Peak (PK)    |
| <b>FREQUENCY RANGE</b> | 1GHz ~ 25GHz  |                              | Average (AV) |

| <b>ANTENNA POLARITY &amp; TEST DISTANCE: HORIZONTAL AT 3 M</b> |                        |                                        |                           |                        |                                   |                                     |                                 |                                         |
|----------------------------------------------------------------|------------------------|----------------------------------------|---------------------------|------------------------|-----------------------------------|-------------------------------------|---------------------------------|-----------------------------------------|
| <b>NO.</b>                                                     | <b>FREQ.<br/>(MHz)</b> | <b>EMISSION<br/>LEVEL<br/>(dBuV/m)</b> | <b>LIMIT<br/>(dBuV/m)</b> | <b>MARGIN<br/>(dB)</b> | <b>ANTENNA<br/>HEIGHT<br/>(m)</b> | <b>TABLE<br/>ANGLE<br/>(Degree)</b> | <b>RAW<br/>VALUE<br/>(dBuV)</b> | <b>CORRECTION<br/>FACTOR<br/>(dB/m)</b> |
| 1                                                              | *2480.00               | 90.16 PK                               |                           |                        | 2.15 H                            | 62                                  | 86.01                           | 4.15                                    |
| 2                                                              | *2480.00               | 66.43 AV                               |                           |                        | 2.15 H                            | 62                                  | 62.28                           | 4.15                                    |
| 3                                                              | 2483.50                | 47.51 PK                               | 74.00                     | -26.49                 | 2.15 H                            | 62                                  | 43.35                           | 4.16                                    |
| 4                                                              | 2483.50                | 28.31 AV                               | 54.00                     | -25.69                 | 2.15 H                            | 62                                  | 24.15                           | 4.16                                    |
| 5                                                              | 4960.00                | 48.18 PK                               | 74.00                     | -25.82                 | 1.00 H                            | 144                                 | 39.99                           | 8.19                                    |
| 6                                                              | 4960.00                | 36.32 AV                               | 54.00                     | -17.68                 | 1.00 H                            | 144                                 | 28.13                           | 8.19                                    |
| 7                                                              | 7440.00                | 54.00 PK                               | 74.00                     | -20.00                 | 1.21 H                            | 12                                  | 39.66                           | 14.34                                   |
| 8                                                              | 7440.00                | 40.82 AV                               | 54.00                     | -13.18                 | 1.21 H                            | 12                                  | 26.48                           | 14.34                                   |
| <b>ANTENNA POLARITY &amp; TEST DISTANCE: VERTICAL AT 3 M</b>   |                        |                                        |                           |                        |                                   |                                     |                                 |                                         |
| <b>NO.</b>                                                     | <b>FREQ.<br/>(MHz)</b> | <b>EMISSION<br/>LEVEL<br/>(dBuV/m)</b> | <b>LIMIT<br/>(dBuV/m)</b> | <b>MARGIN<br/>(dB)</b> | <b>ANTENNA<br/>HEIGHT<br/>(m)</b> | <b>TABLE<br/>ANGLE<br/>(Degree)</b> | <b>RAW<br/>VALUE<br/>(dBuV)</b> | <b>CORRECTION<br/>FACTOR<br/>(dB/m)</b> |
| 1                                                              | *2480.00               | 81.83 PK                               |                           |                        | 1.00 V                            | 254                                 | 77.68                           | 4.15                                    |
| 2                                                              | *2480.00               | 60.18 AV                               |                           |                        | 1.00 V                            | 254                                 | 56.03                           | 4.15                                    |
| 3                                                              | 2483.50                | 40.55 PK                               | 74.00                     | -33.45                 | 1.00 V                            | 254                                 | 36.39                           | 4.16                                    |
| 4                                                              | 2483.50                | 24.47 AV                               | 54.00                     | -29.53                 | 1.00 V                            | 254                                 | 20.31                           | 4.16                                    |
| 5                                                              | 4960.00                | 46.24 PK                               | 74.00                     | -27.76                 | 1.00 V                            | 159                                 | 38.05                           | 8.19                                    |
| 6                                                              | 4960.00                | 34.24 AV                               | 54.00                     | -19.76                 | 1.00 V                            | 159                                 | 26.05                           | 8.19                                    |
| 7                                                              | 7440.00                | 54.89 PK                               | 74.00                     | -19.11                 | 1.20 V                            | 315                                 | 40.55                           | 14.34                                   |
| 8                                                              | 7440.00                | 41.46 AV                               | 54.00                     | -12.54                 | 1.20 V                            | 315                                 | 27.12                           | 14.34                                   |

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " \* " : Fundamental frequency.

**Bureau Veritas Shenzhen Co., Ltd.  
Dongguan Branch**

No. 34, Chenwulu Section, Guantai Rd., Houjie  
Town, Dongguan City,  
Guangdong 523942, China

Tel: +86 769 8593 5656  
Fax: +86 769 8593 1080  
Email: [customerservice.dg@cn.bureauveritas.com](mailto:customerservice.dg@cn.bureauveritas.com)



### 4.3 6dB BANDWIDTH MEASUREMENT

#### 4.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

#### 4.3.2 TEST INSTRUMENTS

| Equipment                        | Manufacturer    | Model No. | Serial No. | Last Cal.   | Next Cal.   |
|----------------------------------|-----------------|-----------|------------|-------------|-------------|
| Power Sensor                     | Keysight        | U2021XA   | MY55060016 | May 04,16   | May 03,17   |
| Power Sensor                     | Keysight        | U2021XA   | MY55060018 | May 04,16   | May 03,17   |
| Digital Multimeter               | FLUKE           | 15B       | A1220010DG | Oct. 12, 15 | Oct.11, 16  |
| Humid & Temp Programmable Tester | Haida           | HD-2257   | 110807201  | Sep.07,16   | Sep. 06,17  |
| Oscilloscope                     | Agilent         | DSO9254A  | MY51260160 | Nov. 28,15  | Nov. 27,16  |
| Signal Analyzer                  | Rohde & Schwarz | FSV7      | 102331     | Nov. 09,15  | Nov. 08,16  |
| Signal Generator                 | Agilent         | N5183A    | MY50140980 | Nov. 09,15  | Nov. 08,16  |
| Agile Signal Generator           | Agilent         | 8645A     | Agilent    | Aug.08, 16  | Aug.07, 17  |
| ESG Vector Signal Generator      | Agilent         | E4438C    | MY49072505 | Apr. 22, 16 | Apr. 21, 17 |
| BLUETOOTH TESTER                 | Rohde&Schwarz   | CBT32     | 100811     | Aug.08, 16  | Aug.07, 17  |

**NOTE:**

1. The test was performed in RF Oven room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

#### 4.3.3 TEST PROCEDURE

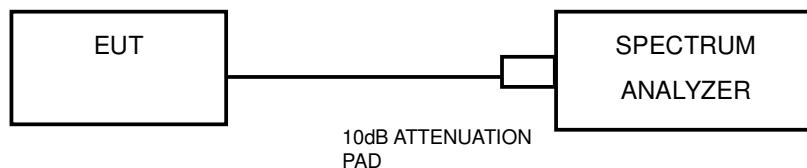
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW)  $\geq 3$  RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



#### 4.3.4 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.3.5 TEST SETUP



#### 4.3.6 EUT OPERATING CONDITIONS

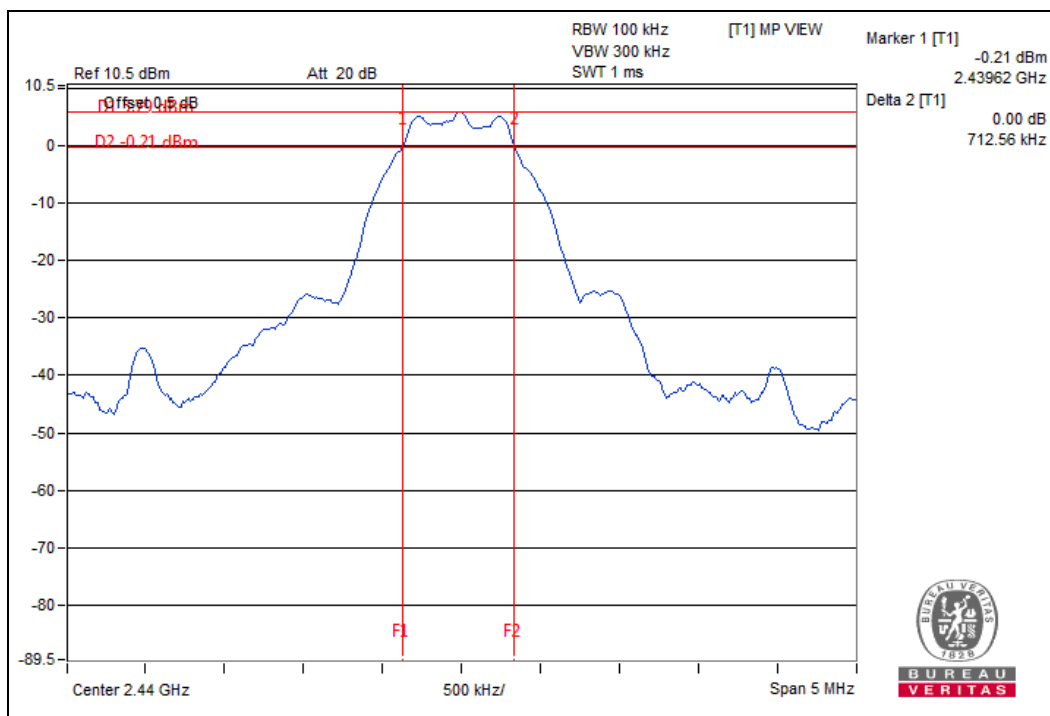
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



#### 4.3.7 TEST RESULTS

##### BT-LE (GFSK)

| CHANNEL | CHANNEL<br>FREQUENCY<br>(MHz) | 6dB<br>BANDWIDTH<br>(MHz) | MINIMUM LIMIT<br>(MHz) | PASS / FAIL |
|---------|-------------------------------|---------------------------|------------------------|-------------|
| 0       | 2402                          | 0.711                     | 0.5                    | PASS        |
| 19      | 2440                          | 0.713                     | 0.5                    | PASS        |
| 39      | 2480                          | 0.711                     | 0.5                    | PASS        |



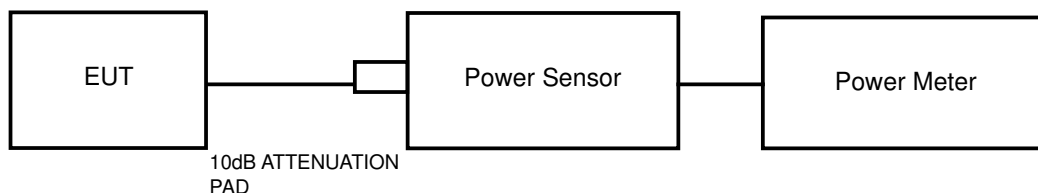


#### 4.4 CONDUCTED OUTPUT POWER

##### 4.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 2400–2483.5 MHz band: 1 Watt (30dBm)

##### 4.4.2 TEST SETUP



##### 4.4.3 TEST INSTRUMENTS

| Equipment                        | Manufacturer    | Model No. | Serial No. | Last Cal.   | Next Cal.   |
|----------------------------------|-----------------|-----------|------------|-------------|-------------|
| Power Sensor                     | Keysight        | U2021XA   | MY55060016 | May 04,16   | May 03,17   |
| Power Sensor                     | Keysight        | U2021XA   | MY55060018 | May 04,16   | May 03,17   |
| Digital Multimeter               | FLUKE           | 15B       | A1220010DG | Oct. 12, 15 | Oct.11, 16  |
| Humid & Temp Programmable Tester | Haida           | HD-2257   | 110807201  | Sep.07,16   | Sep. 06,17  |
| Oscilloscope                     | Agilent         | DSO9254A  | MY51260160 | Nov. 28,15  | Nov. 27,16  |
| Signal Analyzer                  | Rohde & Schwarz | FSV7      | 102331     | Nov. 09,15  | Nov. 08,16  |
| Signal Generator                 | Agilent         | N5183A    | MY50140980 | Nov. 09,15  | Nov. 08,16  |
| Agile Signal Generator           | Agilent         | 8645A     | Agilent    | Aug.08, 16  | Aug.07, 17  |
| ESG Vector Signal Generator      | Agilent         | E4438C    | MY49072505 | Apr. 22, 16 | Apr. 21, 17 |
| BLUETOOTH TESTER                 | Rohde&Schwarz   | CBT32     | 100811     | Aug.08, 16  | Aug.07, 17  |

**NOTE:**

1. The test was performed in RF Oven room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

##### 4.3.4 TEST PROCEDURES

A peak sensor was used on the output port of the EUT. A peak power meter was used to read the response of the peak power sensor. Record the peak power level.



#### 4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

#### 4.4.7 TEST RESULTS

##### 4.4.7.1 MAXIMUM PEAK OUTPUT POWER

###### BT-LE (GFSK)

| CHANNEL | CHANNEL<br>FREQUENCY<br>(MHz) | PEAK<br>POWER<br>(dBm) | PEAK<br>POWER<br>(mW) | PEAK<br>POWER LIMIT<br>(W) | PASS/FAIL |
|---------|-------------------------------|------------------------|-----------------------|----------------------------|-----------|
| 0       | 2402                          | 5.01                   | 3.170                 | 1                          | PASS      |
| 19      | 2440                          | 6.23                   | 4.198                 | 1                          | PASS      |
| 39      | 2480                          | <b>7.04</b>            | <b>5.058</b>          | 1                          | PASS      |

##### 4.4.7.2 AVERAGE OUTPUT POWER (FOR REFERENCE)

The average power sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

###### BT-LE (GFSK)

| CHANNEL | CHANNEL<br>FREQUENCY<br>(MHz) | AVERAGE<br>POWER<br>(dBm) | AVERAGE<br>POWER (mW) |
|---------|-------------------------------|---------------------------|-----------------------|
| 0       | 2402                          | 1.72                      | 1.486                 |
| 19      | 2440                          | 3.16                      | 2.070                 |
| 39      | 2480                          | <b>3.93</b>               | <b>2.472</b>          |

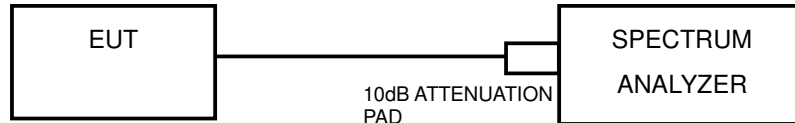


## 4.5 POWER SPECTRAL DENSITY MEASUREMENT

### 4.5.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm/3KHz.

### 4.5.2 TEST SETUP



### 4.5.3 TEST INSTRUMENTS

Refer to section 4.3.2 to get information of above instrument.

### 4.5.4 TEST PROCEDURE

1. Set the span to 1.5 times the DTS bandwidth
2. Set the RBW = 3 kHz, VBW  $\geq 3 \times$  RBW, Detector = peak.
3. Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
4. Use the peak marker function to determine the maximum amplitude level.

### 4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

### 4.5.6 EUT OPERATING CONDITION

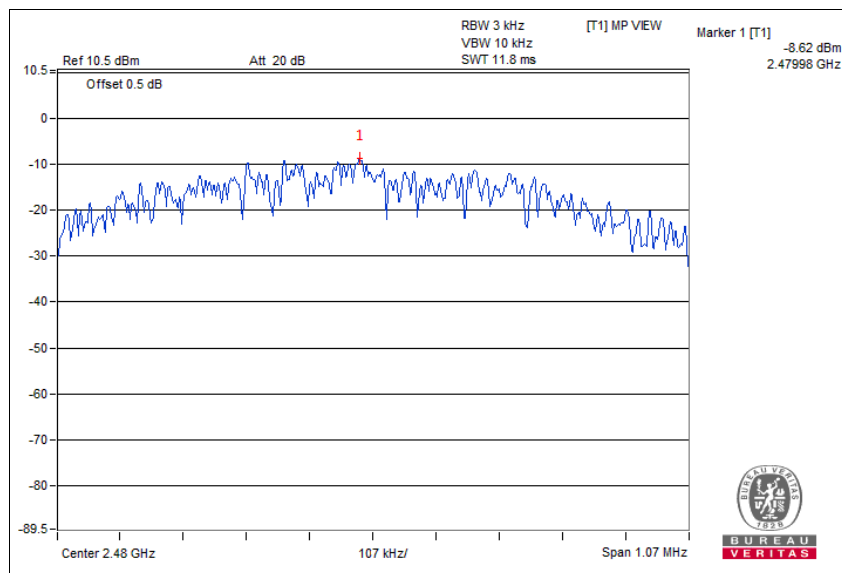
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



## 4.5.7 TEST RESULTS

### BT-LE (GFSK)

| Channel | FREQ.<br>(MHz) | PSD<br>(dBm/3kHz) | Limit<br>(dBm/3kHz) | PASS<br>/FAIL |
|---------|----------------|-------------------|---------------------|---------------|
| 0       | 2402           | -10.72            | 8                   | PASS          |
| 19      | 2440           | -9.47             | 8                   | PASS          |
| 39      | 2480           | -8.62             | 8                   | PASS          |



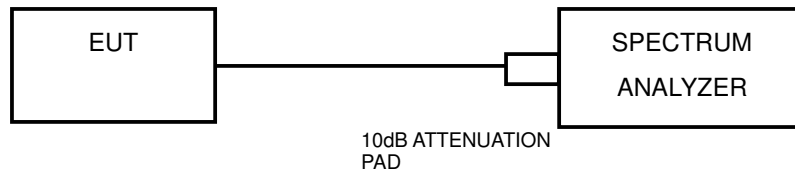


## 4.6 OUT OF BAND EMISSION MEASUREMENT

### 4.6.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

Below  $-20\text{dB}$  of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

### 4.6.2 TEST SETUP



### 4.6.3 TEST INSTRUMENTS

Refer to section 4.3.2 to get information of above instrument.

### 4.6.4 TEST PROCEDURE

#### MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.



## **MEASUREMENT PROCEDURE OOB**

1. Set RBW = 100 kHz.
2. Set VBW  $\geq$  300 kHz.
3. Set span to encompass the spectrum to be examined
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

### **4.6.5 DEVIATION FROM TEST STANDARD**

No deviation.

### **4.6.6 EUT OPERATING CONDITION**

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

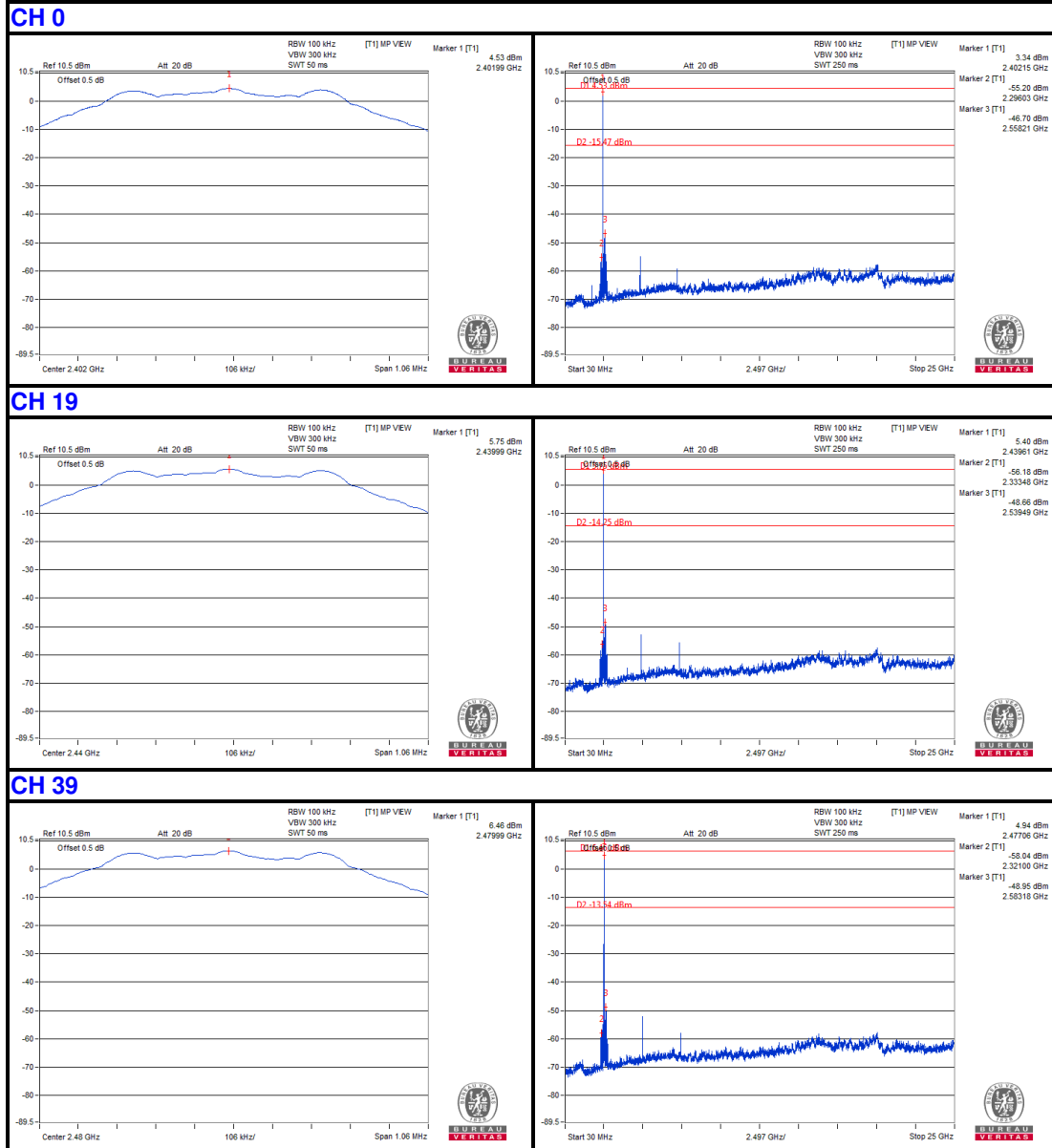


BUREAU  
VERITAS

Test Report No.: RF160824N051-2

## 4.6.7 TEST RESULTS

### BT-LE (GFSK)

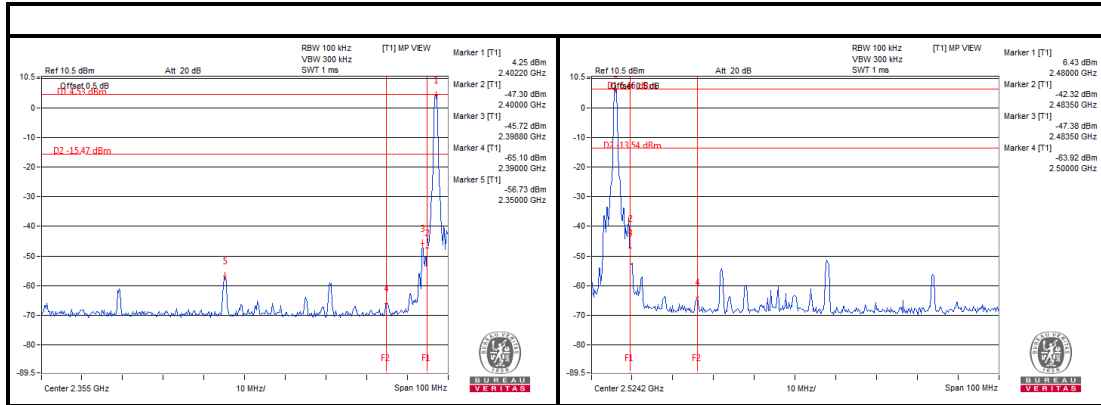




BUREAU  
VERITAS

Test Report No.: RF160824N051-2

### Band Edge:



Bureau Veritas Shenzhen Co., Ltd.  
Dongguan Branch

No. 34, Chenwulu Section, Guantai Rd., Houjie  
Town, Dongguan City,  
Guangdong 523942, China

Tel: +86 769 8593 5656  
Fax: +86 769 8593 1080  
Email: [customerservice.dg@cn.bureauveritas.com](mailto:customerservice.dg@cn.bureauveritas.com)



Test Report No.: RF160824N051-2

## 5 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



Test Report No.: RF160824N051-2

## 6 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

---END---