

## TEST REPORT

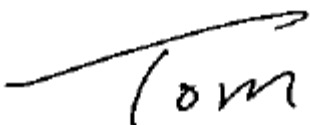
|           |                                                                                                             |
|-----------|-------------------------------------------------------------------------------------------------------------|
| Applicant | MMD Hong Kong Holding Limited                                                                               |
| Address   | Units 1006-1007, 10th Floor, C-Bons International Center, 108 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong |

|                                     |                                                                                                             |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Manufacturer or Supplier            | MMD Hong Kong Holding Limited                                                                               |
| Address                             | Units 1006-1007, 10th Floor, C-Bons International Center, 108 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong |
| Product                             | Wireless Bluetooth neckband headphones                                                                      |
| Brand Name                          | Philips                                                                                                     |
| Model                               | TAPN402                                                                                                     |
| Additional Model & Model Difference | TAPN402xx/yy, See item 3.1                                                                                  |
| Date of tests                       | May 05, 2019 ~ Jun. 03, 2019                                                                                |

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 Tom Chen<br>Project Engineer / EMC Department                             | Approved by Glyn He<br>Supervisor / EMC Department                                                          |
|  | <br>Date: Jun. 27, 2019 |

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**BUREAU**  
**VERITAS**

Test Report No.: RF190505N041R1-2

## RELEASE CONTROL RECORD

| ISSUE NO.        | REASON FOR CHANGE                                                                                                           | DATE ISSUED   |
|------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------|
| RF190505N041-2   | Original release                                                                                                            | Jun. 17, 2019 |
| RF190505N041R1-2 | Based on original report RF190505N041-2, changed the product name. It doesn't need to be retested after engineer evaluated. | Jun. 27, 2019 |



## 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      | N/A    | Powered from battery           |
| 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 |
|--------------------|---------------|-------------|
| Radiated emissions | 9KHz ~ 30MHz  | 2.90dB      |
|                    | 30MHz ~ 1GMHz | 3.76dB      |
|                    | 1GHz ~ 18GHz  | 4.84dB      |
|                    | 18GHz ~ 40GHz | 4.96dB      |

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>               | Wireless Bluetooth neckband headphones                                             |
| <b>MODEL NO.</b>             | TAPN402                                                                            |
| <b>ADDITIONAL MODELS</b>     | TAPN402xx/yy                                                                       |
| <b>FCC ID</b>                | 2AR2STAPN402                                                                       |
| <b>NOMINAL VOLTAGE</b>       | DC 3.7V from Li-ion Battery or DC 5V From USB Host Unit                            |
| <b>MODULATION TECHNOLOGY</b> | DTS                                                                                |
| <b>MODULATION TYPE</b>       | BT-LE(GFSK)                                                                        |
| <b>OPERATING FREQUENCY</b>   | 2402-2480MHz                                                                       |
| <b>PEAK OUTPUT POWER</b>     | 2.6mW (Max. Measured)                                                              |
| <b>ANTENNA TYPE</b>          | Ceramic Antenna, 2dBi Gain                                                         |
| <b>I/O PORTS</b>             | Refer to user's manual                                                             |
| <b>CABLE SUPPLIED</b>        | USB cable: Unshielded, detachable, 0.2m<br>Aux cable: Unshielded, detachable, 1.0m |

**NOTES:**

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.: 190505N041) for detailed product photo.
4. Additional model TAPN402xx/yy (xx=colour, yy=country destination) is identical with the test model TAPN402 except the color of the appearance and model number for trading purpose.
5. When the EUT in charging mode that BT function doesn't working.



### 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 |                            |
| A                     | √             | √     | -   | √    | DC 3.7V From Fully Batetry |

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

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

**PLC**: Power Line Conducted Emission

**APCM**: Antenna Port Conducted Measurement

**NOTE**: No need to concern of Conducted Emission due to the EUT is powered by battery.

**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                |

**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, 55%RH          | DC 3.7V From Fully Battery | Daniel    |
| RE≥1G         | 25deg. C, 55%RH          | DC 3.7V From Fully Battery | Daniel    |
| PLC           | N/A                      | N/A                        | -         |
| APCM          | 25deg. C, 60%RH          | DC 3.7V From Fully Battery | Eric Fang |



### 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 15.247 Meas Guidance v05r01**

**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 a dependent unit together without any other necessary accessories or support units.



## 4 TEST TYPES AND RESULTS

### 4.1 RADIATED EMISSION MEASUREMENT

#### 4.1.1 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).

| FREQUENCIES<br>(MHz) | FIELD STRENGTH<br>(microvolts/meter) | MEASUREMENT DISTANCE<br>(meters) |
|----------------------|--------------------------------------|----------------------------------|
| 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                                |

**NOTES:**

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.



#### 4.1.2 TEST INSTRUMENTS

| Equipment                           | Manufacturer  | Model No.                    | Serial No.  | Last Cal.   | Next Cal.   |
|-------------------------------------|---------------|------------------------------|-------------|-------------|-------------|
| EMI Test Receiver                   | Rohde&Schwarz | ESU40                        | 100449      | Mar. 12,19  | Mar. 11,20  |
| Signal and Spectrum Analyzer        | Rohde&Schwarz | FSV7                         | 102331      | Aug. 02,18  | Aug. 01,19  |
| Active Loop Antenna (9KHz -30MHz)   | SCHWARZBECK   | FMZB 1519B                   | 1519B-045   | May 04,19   | May 03,20   |
| Amplifier (9KHz -1GHz)              | Burgeon       | BPA-530                      | 100210      | Apr. 17,19  | Apr. 18,20  |
| Bilog Antenna (20MHz -2GHz)         | Teseq         | CBL 6111D                    | 30643       | Aug. 11, 18 | Aug. 10, 19 |
| Horn Antenna (1GHz -18GHz)          | ETS -Lindgren | 3117                         | 00062558    | Jul. 21, 18 | Jul. 20, 19 |
| Horn Antenna (18GHz -40GHz)         | SCHWARZBECK   | BBHA 9170                    | BBHA9170242 | May 05,19   | May 04,20   |
| 3m Semi-anechoic Chamber            | ETS-LINDGREN  | 9m*6m*6m                     | NSEMC003    | Feb. 10,19  | Feb. 09,20  |
| Test Software                       | ADT           | ADT_Radiated<br>_V7.6.15.9.2 | N/A         | N/A         | N/A         |
| Broadband Preamplifier (1GHz~18GHz) | SCHWARZBECK   | BBV9718                      | 305         | Apr. 17,19  | Apr. 18,20  |
| Pre-Amplifier (18GHz-40GHz)         | EMCI          | EMC 184045                   | 980102      | Nov. 09,18  | Nov. 08,19  |
| Test Software                       | ADT           | ADT_Radiated<br>_V7.6.15.9.2 | N/A         | N/A         | N/A         |
| BLUETOOTH TESTER                    | Rohde&Schwarz | CBT32                        | 100811      | Jul. 06, 18 | Jul. 05, 19 |

**NOTES:**

1. The test was performed in 966 Chamber.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GREGT/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 749762.



#### 4.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 1.5 meters (above 1GHz) and 0.8 meters (below 1GHz) 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. For below 1GHz was used bilog antenna, and above 1GHz was used horn 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. For below 30MHz, a loop antenna with its vertical plane is place 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1m above the ground.
- g. 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.

#### NOTES:

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.

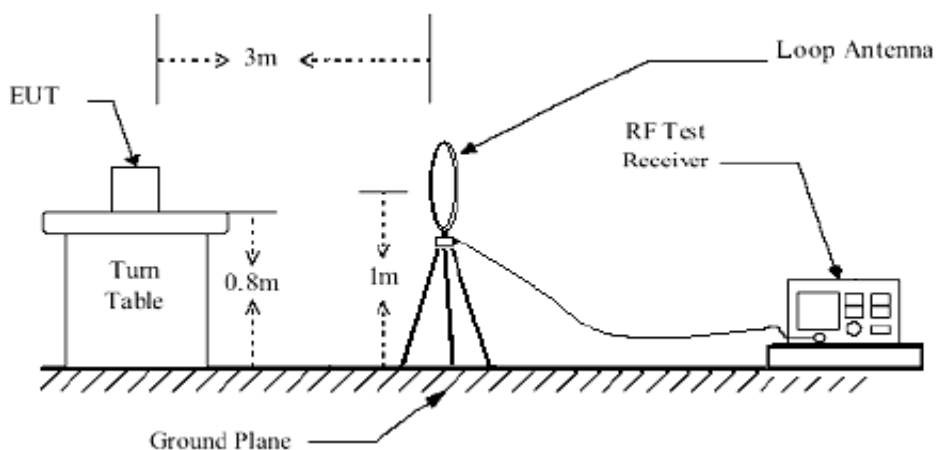


#### 4.1.4 DEVIATION FROM TEST STANDARD

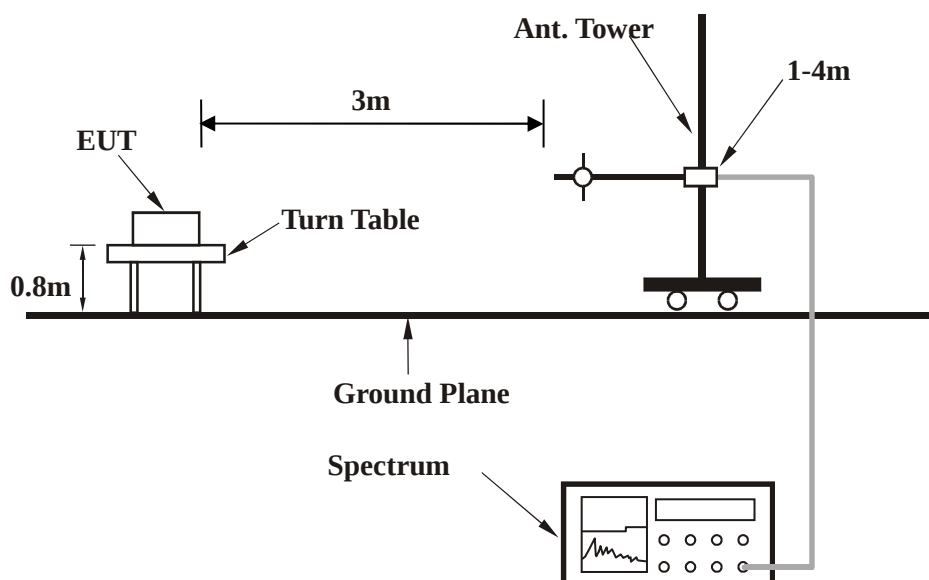
No deviation.

#### 4.1.5 TEST SETUP

##### Below 30MHz test setup



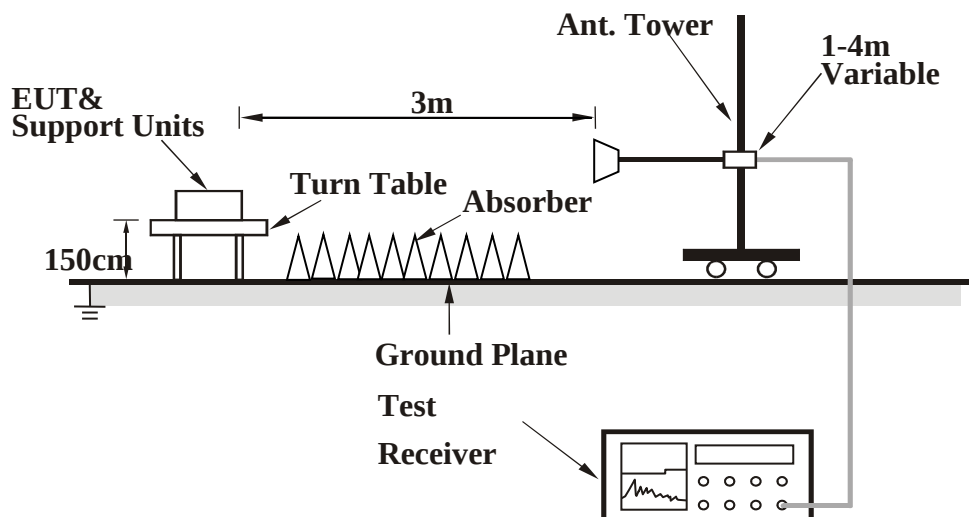
##### Below 1GHz test setup



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



### Above 1GHz test setup



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

#### 4.1.6 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.



## 4.1.7 TEST RESULTS

## BELOW 1GHz WORST-CASE DATA:

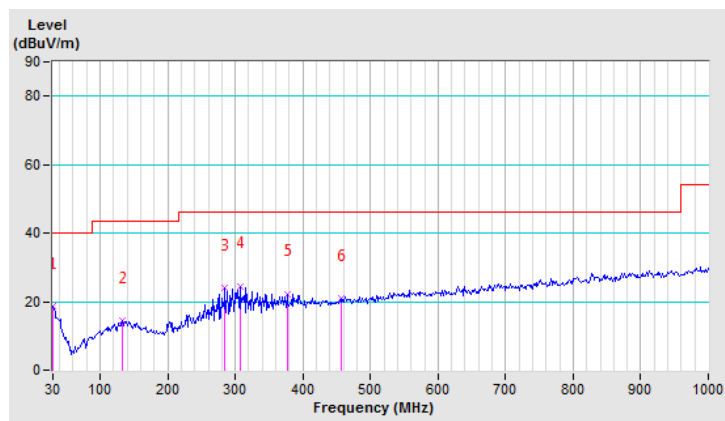
## BT-LE (GFSK)

|                 |               |                      |                 |
|-----------------|---------------|----------------------|-----------------|
| CHANNEL         | TX Channel 39 | DETECTOR<br>FUNCTION | Quasi-Peak (QP) |
| FREQUENCY RANGE | 9KHz ~ 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>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                   | 30.00          | 18.75 QP                      | 40.00             | -21.25         | 1.00 H                   | 145                        | 28.85                  | -10.10                         |
| 2                                                   | 132.60         | 14.35 QP                      | 43.50             | -29.15         | 1.00 H                   | 173                        | 30.48                  | -16.13                         |
| 3                                                   | 284.94         | 23.90 QP                      | 46.00             | -22.10         | 1.00 H                   | 180                        | 37.27                  | -13.37                         |
| 4                                                   | 306.70         | 24.59 QP                      | 46.00             | -21.41         | 1.00 H                   | 137                        | 36.95                  | -12.36                         |
| 5                                                   | 376.65         | 22.29 QP                      | 46.00             | -23.71         | 1.00 H                   | 240                        | 32.22                  | -9.93                          |
| 6                                                   | 455.93         | 21.11 QP                      | 46.00             | -24.89         | 1.00 H                   | 175                        | 29.58                  | -8.47                          |

## 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 emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.





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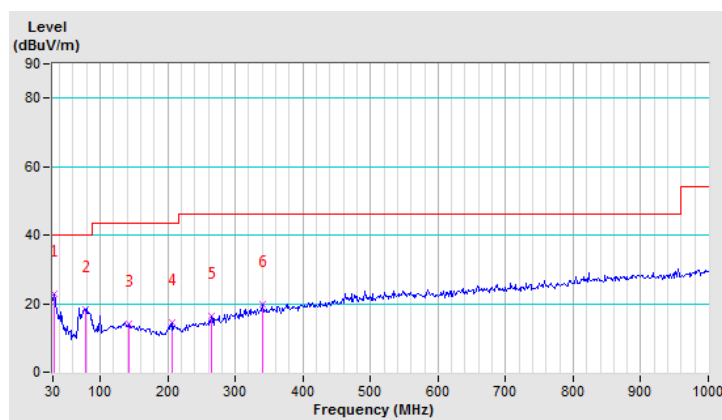
Test Report No.: RF190505N041R1-2

|                        |               |                              |                 |
|------------------------|---------------|------------------------------|-----------------|
| <b>CHANNEL</b>         | TX Channel 39 | <b>DETECTOR<br/>FUNCTION</b> | Quasi-Peak (QP) |
| <b>FREQUENCY RANGE</b> | 9KHz ~ 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>(m) | TABLE<br>ANGLE<br>(Degree) | RAW<br>VALUE<br>(dBuV) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                 | 31.55          | 22.85 QP                      | 40.00             | -17.15         | 1.00 V                   | 137                        | 33.86                  | -11.01                         |
| 2                                                 | 78.19          | 18.45 QP                      | 40.00             | -21.55         | 1.00 V                   | 57                         | 39.88                  | -21.43                         |
| 3                                                 | 143.48         | 14.05 QP                      | 43.50             | -29.45         | 1.00 V                   | 175                        | 30.08                  | -16.03                         |
| 4                                                 | 207.21         | 14.50 QP                      | 43.50             | -29.00         | 1.00 V                   | 156                        | 32.26                  | -17.76                         |
| 5                                                 | 264.73         | 16.37 QP                      | 46.00             | -29.63         | 1.00 V                   | 195                        | 30.68                  | -14.31                         |
| 6                                                 | 340.90         | 19.71 QP                      | 46.00             | -26.29         | 1.00 V                   | 147                        | 30.72                  | -11.01                         |

**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 emission levels of other frequencies were less than 20dB margin 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 8998 2098  
Fax: +86 769 8593 1080  
Email: [customerservice.dg@cn.bureauveritas.com](mailto:customerservice.dg@cn.bureauveritas.com)



## ABOVE 1GHz TEST DATA:

## BT-LF (GFSK)

|                 |              |                      |              |
|-----------------|--------------|----------------------|--------------|
| CHANNEL         | TX Channel 0 | DETECTOR<br>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        | 43.93 PK                      | 74.00             | -30.07         | 1.00 H                   | 146                        | 41.64                  | 2.29                           |
| 2                                                   | 2390.00        | 31.91 AV                      | 54.00             | -22.09         | 1.00 H                   | 146                        | 29.62                  | 2.29                           |
| 3                                                   | *2402.00       | 96.59 PK                      |                   |                | 1.00 H                   | 146                        | 94.21                  | 2.38                           |
| 4                                                   | *2402.00       | 86.44 AV                      |                   |                | 1.00 H                   | 146                        | 84.06                  | 2.38                           |
| 5                                                   | 4804.00        | 56.40 PK                      | 74.00             | -17.60         | 1.00 H                   | 248                        | 51.33                  | 5.07                           |
| 6                                                   | 4804.00        | 43.26 AV                      | 54.00             | -10.74         | 1.00 H                   | 248                        | 38.19                  | 5.07                           |
| 7                                                   | #7206.00       | 55.38 PK                      | 74.00             | -18.62         | 1.00 H                   | 197                        | 46.07                  | 9.31                           |
| 8                                                   | #7206.00       | 47.55 AV                      | 54.00             | -6.45          | 1.00 H                   | 197                        | 38.24                  | 9.31                           |
| 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        | 49.55 PK                      | 74.00             | -24.45         | 1.00 V                   | 238                        | 47.26                  | 2.29                           |
| 2                                                   | 2390.00        | 32.86 AV                      | 54.00             | -21.14         | 1.00 V                   | 238                        | 30.57                  | 2.29                           |
| 3                                                   | *2402.00       | 93.42 PK                      |                   |                | 1.00 V                   | 238                        | 91.04                  | 2.38                           |
| 4                                                   | *2402.00       | 83.81 AV                      |                   |                | 1.00 V                   | 238                        | 81.43                  | 2.38                           |
| 5                                                   | 4804.00        | 51.78 PK                      | 74.00             | -22.22         | 1.00 V                   | 258                        | 46.71                  | 5.07                           |
| 6                                                   | 4804.00        | 39.12 AV                      | 54.00             | -14.88         | 1.00 V                   | 258                        | 34.05                  | 5.07                           |
| 7                                                   | #7206.00       | 54.01 PK                      | 74.00             | -19.99         | 1.00 V                   | 242                        | 44.70                  | 9.31                           |
| 8                                                   | #7206.00       | 46.47 AV                      | 54.00             | -7.53          | 1.00 V                   | 242                        | 37.16                  | 9.31                           |

## 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 emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.



|                 |               |                      |              |
|-----------------|---------------|----------------------|--------------|
| CHANNEL         | TX Channel 19 | DETECTOR<br>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                                                   | *2440.00       | 95.45 PK                      |                   |                | 1.00 H                   | 150                        | 92.81                  | 2.64                           |
| 2                                                   | *2440.00       | 84.85 AV                      |                   |                | 1.00 H                   | 150                        | 82.21                  | 2.64                           |
| 3                                                   | 4880.00        | 59.77 PK                      | 74.00             | -14.23         | 1.00 H                   | 208                        | 54.51                  | 5.26                           |
| 4                                                   | 4880.00        | 50.29 AV                      | 54.00             | -3.71          | 1.00 H                   | 208                        | 45.03                  | 5.26                           |
| 5                                                   | 7320.00        | 57.74 PK                      | 74.00             | -16.26         | 1.00 H                   | 253                        | 48.29                  | 9.45                           |
| 6                                                   | 7320.00        | 49.59 AV                      | 54.00             | -4.41          | 1.00 H                   | 253                        | 40.14                  | 9.45                           |
| 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       | 93.73 PK                      |                   |                | 1.00 V                   | 237                        | 91.09                  | 2.64                           |
| 2                                                   | *2440.00       | 82.25 AV                      |                   |                | 1.00 V                   | 237                        | 79.61                  | 2.64                           |
| 3                                                   | 4880.00        | 56.07 PK                      | 74.00             | -17.93         | 1.00 V                   | 113                        | 50.81                  | 5.26                           |
| 4                                                   | 4880.00        | 46.56 AV                      | 54.00             | -7.44          | 1.00 V                   | 113                        | 41.30                  | 5.26                           |
| 5                                                   | 7320.00        | 53.64 PK                      | 74.00             | -20.36         | 1.00 V                   | 221                        | 44.19                  | 9.45                           |
| 6                                                   | 7320.00        | 44.46 AV                      | 54.00             | -9.54          | 1.00 V                   | 221                        | 35.01                  | 9.45                           |

**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 emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " \* ": Fundamental frequency.



|                 |               |                      |              |
|-----------------|---------------|----------------------|--------------|
| CHANNEL         | TX Channel 39 | DETECTOR<br>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                                                   | *2480.00       | 95.21 PK                      |                   |                | 1.00 H                   | 206                        | 92.30                  | 2.91                           |
| 2                                                   | *2480.00       | 85.13 AV                      |                   |                | 1.00 H                   | 206                        | 82.22                  | 2.91                           |
| 3                                                   | 2483.50        | 61.40 PK                      | 74.00             | -12.60         | 1.00 H                   | 206                        | 58.47                  | 2.93                           |
| 4                                                   | 2483.50        | 44.94 AV                      | 54.00             | -9.06          | 1.00 H                   | 206                        | 42.01                  | 2.93                           |
| 5                                                   | 4960.00        | 62.13 PK                      | 74.00             | -11.87         | 1.00 H                   | 209                        | 56.67                  | 5.46                           |
| 6                                                   | 4960.00        | 51.83 AV                      | 54.00             | -2.17          | 1.00 H                   | 209                        | 46.37                  | 5.46                           |
| 7                                                   | 7440.00        | 60.14 PK                      | 74.00             | -13.86         | 1.00 H                   | 251                        | 50.55                  | 9.59                           |
| 8                                                   | 7440.00        | 50.35 AV                      | 54.00             | -3.65          | 1.00 H                   | 251                        | 40.76                  | 9.59                           |
| 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                                                   | *2480.00       | 90.81 PK                      |                   |                | 1.00 V                   | 239                        | 87.90                  | 2.91                           |
| 2                                                   | *2480.00       | 81.87 AV                      |                   |                | 1.00 V                   | 239                        | 78.96                  | 2.91                           |
| 3                                                   | 2483.50        | 59.09 PK                      | 74.00             | -14.91         | 1.00 V                   | 239                        | 56.16                  | 2.93                           |
| 4                                                   | 2483.50        | 41.85 AV                      | 54.00             | -12.15         | 1.00 V                   | 239                        | 38.92                  | 2.93                           |
| 5                                                   | 4960.00        | 56.65 PK                      | 74.00             | -17.35         | 1.00 V                   | 281                        | 51.19                  | 5.46                           |
| 6                                                   | 4960.00        | 47.19 AV                      | 54.00             | -6.81          | 1.00 V                   | 281                        | 41.73                  | 5.46                           |
| 7                                                   | 7440.00        | 55.30 PK                      | 74.00             | -18.70         | 1.00 V                   | 90                         | 45.71                  | 9.59                           |
| 8                                                   | 7440.00        | 45.32 AV                      | 54.00             | -8.68          | 1.00 V                   | 90                         | 35.73                  | 9.59                           |

**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 emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " \* ": Fundamental frequency.



## 4.2 6dB BANDWIDTH MEASUREMENT

### 4.2.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

### 4.2.2 TEST INSTRUMENTS

| Equipment                        | Manufacturer    | Model No. | Serial No.  | Last Cal.   | Next Cal.   |
|----------------------------------|-----------------|-----------|-------------|-------------|-------------|
| Power Sensor                     | Keysight        | U2021XA   | MY55060016  | Jun. 13,18  | Jun. 12,19  |
| Power Sensor                     | Keysight        | U2021XA   | MY55060018  | Jun. 13,18  | Jun. 12,19  |
| Power Meter                      | Anritsu         | ML2495A   | 1139001     | Mar. 12,19  | Mar. 11,20  |
| Power Sensor                     | Anritsu         | MA2411B   | 1531155     | Mar. 12,19  | Mar. 11,20  |
| Digital Multimeter               | FLUKE           | 15B       | A1220010DG  | Oct. 17, 18 | Oct.16, 19  |
| Humid & Temp Programmable Tester | Haida           | HD-2257   | 110807201   | Nov.15,18   | Nov. 14,19  |
| Oscilloscope                     | Agilent         | DSO9254A  | MY51260160  | Nov. 09,18  | Nov. 08,19  |
| Signal Analyzer                  | Rohde & Schwarz | FSV7      | 102331      | Aug. 02,18  | Aug. 01,19  |
| Signal Generator                 | Agilent         | N5183A    | MY50140980  | Dec. 07,18  | Dec. 06,19  |
| Agile Signal Generator           | Agilent         | 8645A     | Agilent     | Oct.27, 18  | Oct.26, 19  |
| Spectrum Analyzer                | Keysight        | N9020A    | MY55400499  | Mar. 12,19  | Mar. 11,20  |
| MXG-B RF Vector Signal Generator | Keysight        | N5182B    | MY56200288  | Dec. 07, 18 | Dec. 06, 19 |
| BLUETOOTH TESTER                 | Rohde&Schwarz   | CBT32     | 100811      | Jul.06, 18  | Jul. 05, 19 |
| Attenuator                       | MINI            | BW-S10W2+ | S130129FGE2 | N/A         | N/A         |
| DC Source                        | Keysight        | E3642A    | MY56146098  | N/A         | N/A         |

#### NOTES:

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.



#### 4.2.3 TEST PROCEDURE

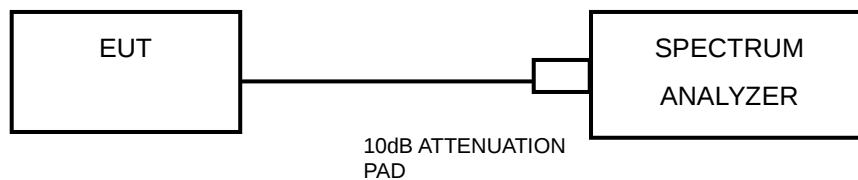
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW)  $\geq 3$  RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude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

#### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation.



#### 4.2.5 TEST SETUP



#### 4.2.6 EUT OPERATING CONDITIONS

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

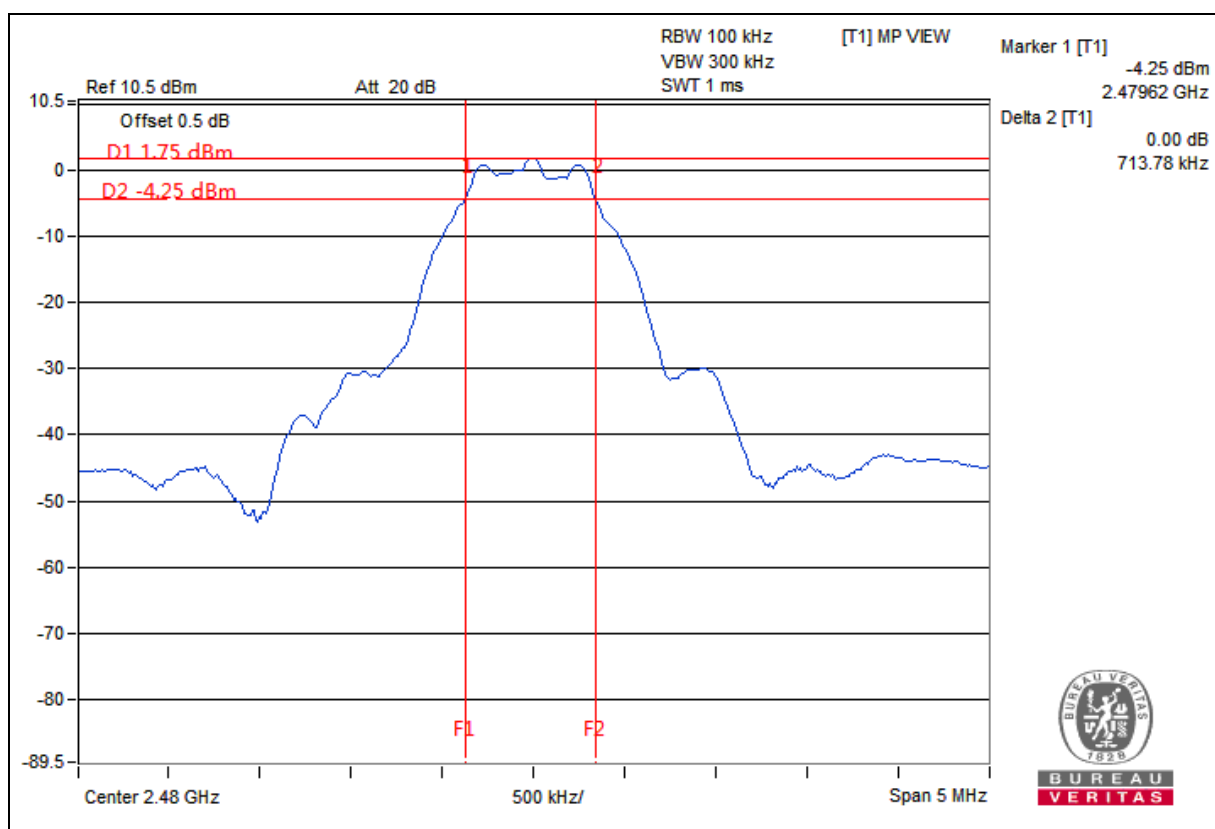


## 4.2.7 TEST RESULTS

### BT-LE (GFSK)

| CHANNEL | CHANNEL<br>FREQUENCY<br>(MHz) | 6dB<br>BANDWIDTH<br>(MHz) | MINIMUM LIMIT<br>(MHz) | PASS / FAIL |
|---------|-------------------------------|---------------------------|------------------------|-------------|
| 0       | 2402                          | 0.710                     | 0.5                    | PASS        |
| 19      | 2440                          | 0.713                     | 0.5                    | PASS        |
| 39      | 2480                          | 0.713                     | 0.5                    | PASS        |

### WORSE PLOT



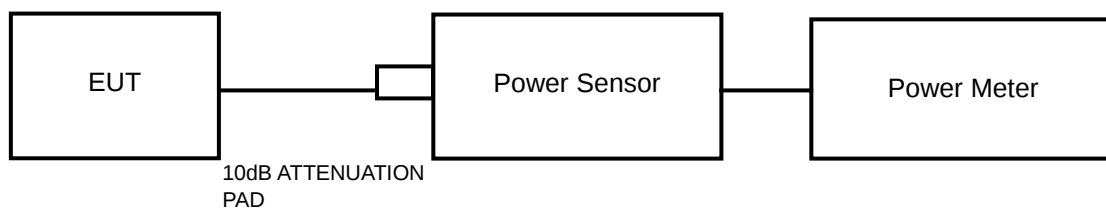


### 4.3 CONDUCTED OUTPUT POWER

#### 4.3.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

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

#### 4.3.2 TEST SETUP



#### 4.3.3 TEST INSTRUMENTS

| Equipment                        | Manufacturer    | Model No. | Serial No.  | Last Cal.   | Next Cal.   |
|----------------------------------|-----------------|-----------|-------------|-------------|-------------|
| Power Sensor                     | Keysight        | U2021XA   | MY55060016  | Jun. 13,18  | Jun. 12,19  |
| Power Sensor                     | Keysight        | U2021XA   | MY55060018  | Jun. 13,18  | Jun. 12,19  |
| Power Meter                      | Anritsu         | ML2495A   | 1139001     | Mar. 12,19  | Mar. 11,20  |
| Power Sensor                     | Anritsu         | MA2411B   | 1531155     | Mar. 12,19  | Mar. 11,20  |
| Digital Multimeter               | FLUKE           | 15B       | A1220010DG  | Oct. 17, 18 | Oct.16, 19  |
| Humid & Temp Programmable Tester | Haida           | HD-2257   | 110807201   | Nov.15,18   | Nov. 14,19  |
| Oscilloscope                     | Agilent         | DSO9254A  | MY51260160  | Nov. 09,18  | Nov. 08,19  |
| Signal Analyzer                  | Rohde & Schwarz | FSV7      | 102331      | Aug. 02,18  | Aug. 01,19  |
| Signal Generator                 | Agilent         | N5183A    | MY50140980  | Dec. 07,18  | Dec. 06,19  |
| Agile Signal Generator           | Agilent         | 8645A     | Agilent     | Oct.27, 18  | Oct.26, 19  |
| Spectrum Analyzer                | Keysight        | N9020A    | MY55400499  | Mar. 12,19  | Mar. 11,20  |
| MXG-B RF Vector Signal Generator | Keysight        | N5182B    | MY56200288  | Dec. 07, 18 | Dec. 06, 19 |
| BLUETOOTH TESTER                 | Rohde&Schwarz   | CBT32     | 100811      | Jul.06, 18  | Jul. 05, 19 |
| Attenuator                       | MINI            | BW-S10W2+ | S130129FGE2 | N/A         | N/A         |
| DC Source                        | Keysight        | E3642A    | MY56146098  | N/A         | N/A         |

**NOTES:** 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.

#### 4.3.5 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.

#### 4.3.7 TEST RESULTS

##### 4.3.7.1 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                          | 3.53                   | 2.254                 | 1                          | PASS      |
| 19      | 2440                          | <b>4.15</b>            | <b>2.600</b>          | 1                          | PASS      |
| 39      | 2480                          | 3.90                   | 2.455                 | 1                          | PASS      |

##### 4.3.7.2 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 (MHz) | AVERAGE<br>POWER (dBm) |
|---------|----------------------------|------------------------|
| 0       | 2402                       | 1.65                   |
| 19      | <b>2440</b>                | <b>2.26</b>            |
| 39      | 2480                       | 2.04                   |

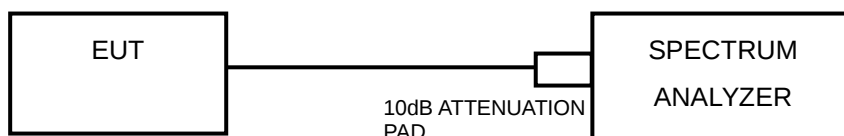


## 4.4 POWER SPECTRAL DENSITY MEASUREMENT

### 4.4.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

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

### 4.4.2 TEST SETUP



### 4.4.3 TEST INSTRUMENTS

Refer to section 4.3.3 to get information of above instrument.

### 4.4.4 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.

### 4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

### 4.4.6 EUT OPERATING CONDITION

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

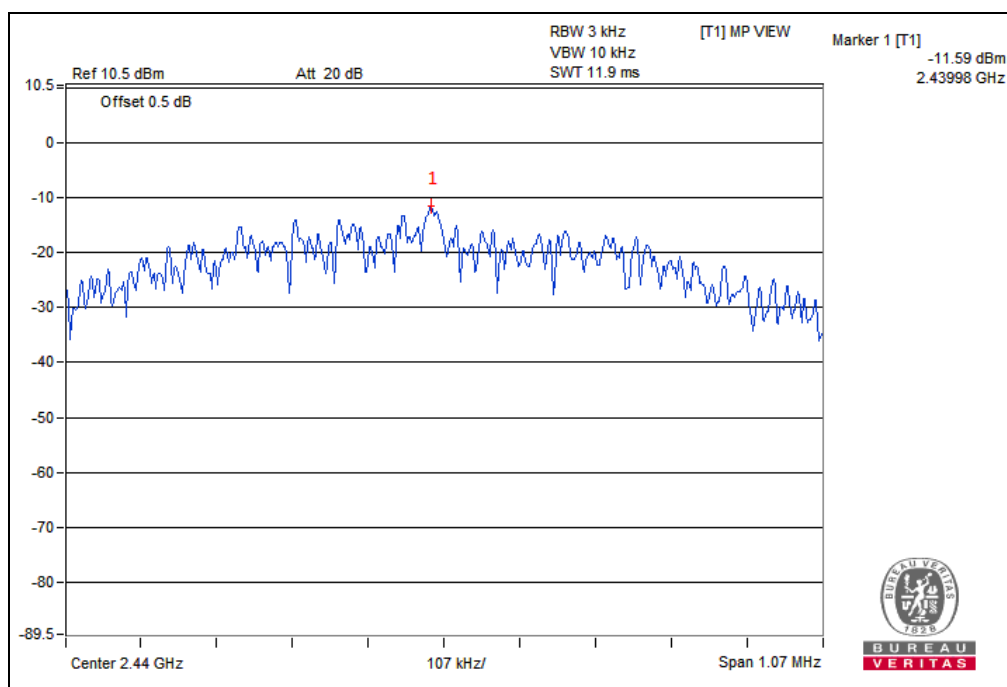


## 4.4.7 TEST RESULTS

### BT-LE (GFSK)

| Channel | FREQ.<br>(MHz) | PSD<br>(dBm/3kHz) | Limit<br>(dBm/3kHz) | PASS<br>/FAIL |
|---------|----------------|-------------------|---------------------|---------------|
| 0       | 2402           | -12.27            | 8                   | PASS          |
| 19      | 2440           | -11.59            | 8                   | PASS          |
| 39      | 2480           | -11.74            | 8                   | PASS          |

### WORSE PLOT



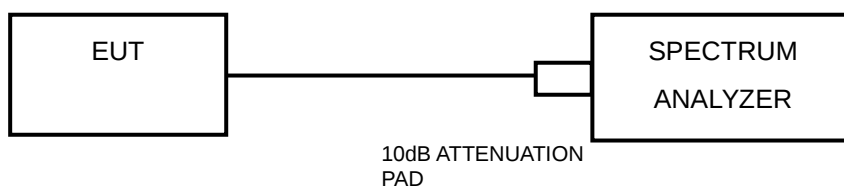


## 4.5 OUT OF BAND EMISSION MEASUREMENT

### 4.5.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

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

### 4.5.2 TEST SETUP



### 4.5.3 TEST INSTRUMENTS

Refer to section 4.3.3 to get information of above instrument.

### 4.5.4 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.

### 4.5.5 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.

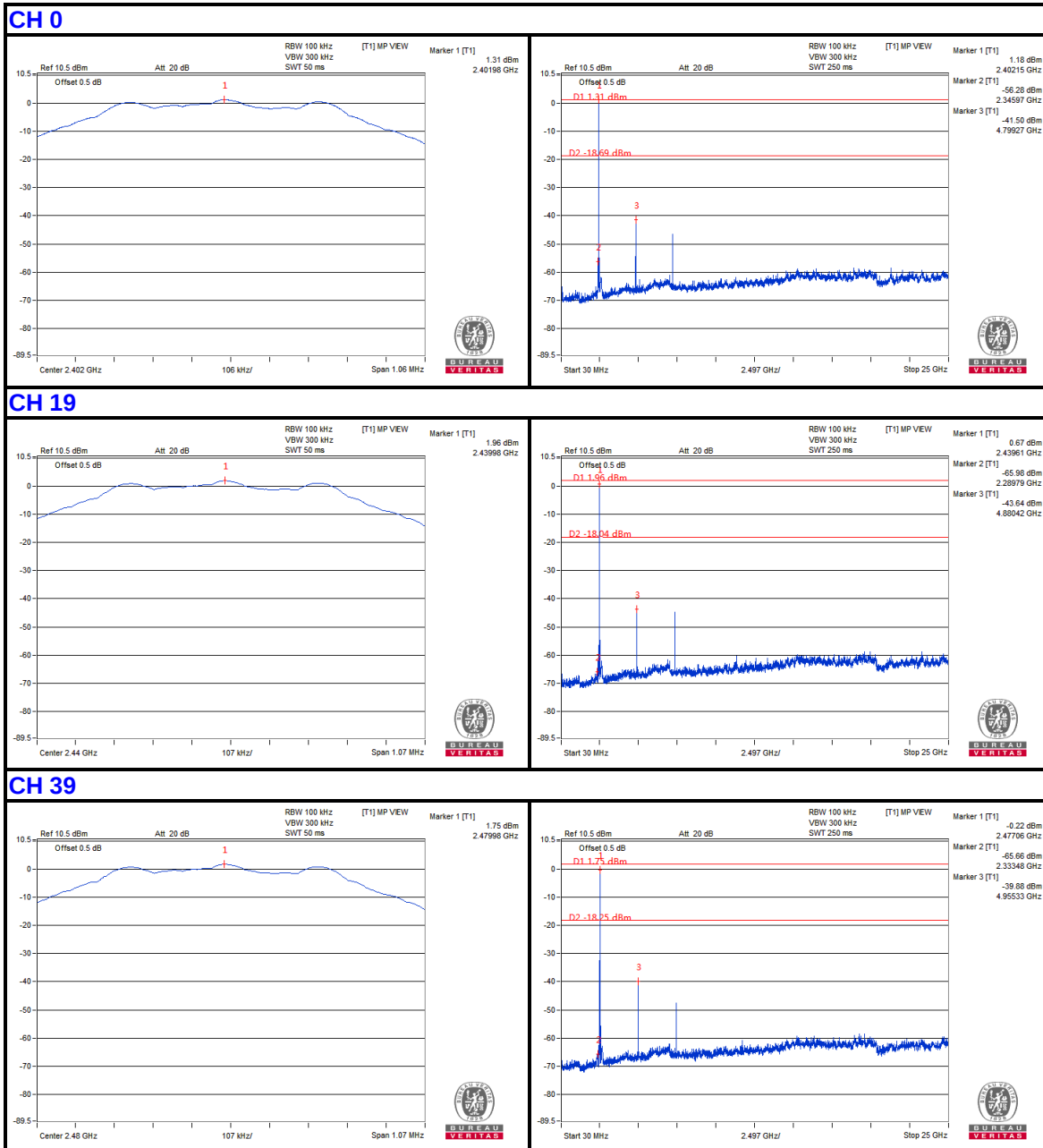


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VERITAS

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## 4.5.7 TEST RESULTS

### BT-LE (GFSK)

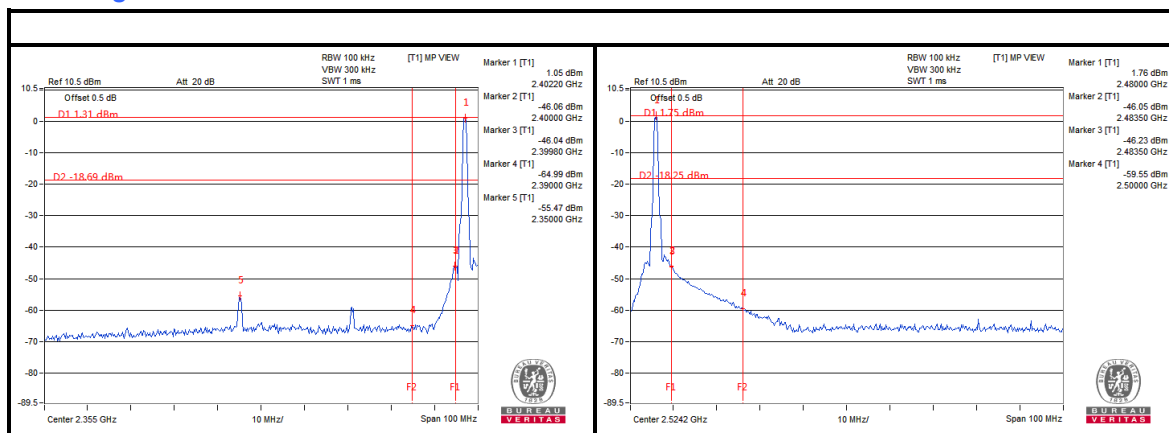




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### Band Edge:



Bureau Veritas Shenzhen Co., Ltd.  
Dongguan Branch

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

Tel: +86 769 8998 2098  
Fax: +86 769 8593 1080  
Email: [customerservice.dg@cn.bureauveritas.com](mailto:customerservice.dg@cn.bureauveritas.com)



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## 5 PHOTOGRAPHS OF THE TEST CONFIGURATION

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



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## 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---