



**BUREAU  
VERITAS**

Test Report No.: RF161117N050-3



Test Lab  
Cert 2951.01

## TEST REPORT

|           |                                                                        |
|-----------|------------------------------------------------------------------------|
| Applicant | Asian Express Holdings Limited                                         |
| Address   | RM1702, Sino Centre, 582-592 Nathan Road, Mongkok, Kowloon, Hong Kong. |

|                                     |                                                                        |
|-------------------------------------|------------------------------------------------------------------------|
| Manufacturer or Supplier            | Asian Express Holdings Limited                                         |
| Address                             | RM1702, Sino Centre, 582-592 Nathan Road, Mongkok, Kowloon, Hong Kong. |
| Product                             | X-Wing (controller)                                                    |
| Additional Product                  | Speed Bike(controller), Tie Fighter(controller)                        |
| Model                               | SW-1977                                                                |
| Additional Model & Model Difference | SW-1983, SW-0327, see item 3.1                                         |
| Date of tests                       | Nov. 17, 2016 ~ Nov. 21, 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                                                               |
|  | <br><br>Date: Nov. 28, 2016 |

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## RELEASE CONTROL RECORD

| ISSUE NO.      | REASON FOR CHANGE | DATE ISSUED   |
|----------------|-------------------|---------------|
| RF161117N050-3 | Original release  | Nov. 28, 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      | 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              | N/A    | 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 | 3.83dB      |
|                    | 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>               | X-Wing (controller)                                                  |
| <b>ADDITIONAL PRODUCT</b>    | Speed Bike(controller), Tie Fighter(controller)                      |
| <b>MODEL NO.</b>             | SW-1977                                                              |
| <b>ADDITIONAL MODELS</b>     | SW-1983, SW-0327                                                     |
| <b>FCC ID</b>                | VLESW-1977T                                                          |
| <b>NOMINAL VOLTAGE</b>       | DC 6V(1.5V*AA*4) from Battery and DC3.7V from Li-ion Battery(Note 4) |
| <b>MODULATION TYPE</b>       | DTS                                                                  |
| <b>MODULATION TECHNOLOGY</b> | BT-LE(GFSK)                                                          |
| <b>OPERATING FREQUENCY</b>   | 2402-2480MHz                                                         |
| <b>MAX. OUTPUT POWER</b>     | 0.0951mW (Max. Measured)                                             |
| <b>ANTENNA TYPE</b>          | Integral PCB Antenna, -0.48dBi Gain for bluetooth modular            |
| <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. The product owns three RF modular, the test results show in this report for BT modular.
4. The 3.7V Li-ion battery is for music board power supply only.
5. Please refer to the EUT photo document (Reference No.: 161117N050-3) for detailed product photo.
6. Additional models SW-1983, SW-0327 are identical with the test model SW-1977 except the model number and appearance color for marketing purpose.



### 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 6V from New Battery |

Where **RE<1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission

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

**TEST CONDITION:**

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | TEST VOLTAGE           | TESTED BY    |
|---------------|--------------------------|------------------------|--------------|
| RE<1G         | 25deg. C, 53%RH          | DC 6V from New Battery | Eric Fang    |
| RE≥1G         | 25deg. C, 53%RH          | DC 6V from New Battery | Eric Fang    |
| PLC           | N/A                      | N/A                    | N/A          |
| APCM          | 25deg. C, 60%RH          | DC 6V from New Battery | Breeze Jiang |



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### 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   | N/A     | N/A   | N/A       | N/A        | N/A    |

| NO. | SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS |
|-----|-----------------------------------------------------|
| 1   | N/A                                                 |



## 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                                |

**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.



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#### 4.1.2 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. 04,16  | Nov. 03,17  |
| Bilog Antenna                | Teseq         | CBL 6111D                | 30643       | Jul. 16, 16 | Jul. 15, 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, 15 | 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. 04,16  | Nov. 03,17  |
| 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 are 12, 24 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 494399.



#### 4.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 1.5meters (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. 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:

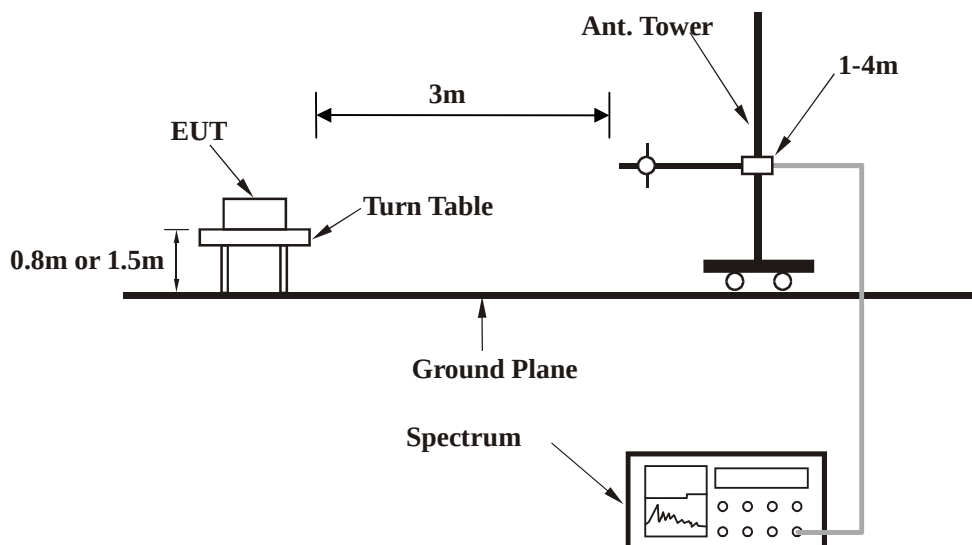
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz 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



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

**Note:** Above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground and below 1GHz the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters semi-anechoic chamber.

#### 4.1.6 EUT OPERATING CONDITIONS

- Set the EUT under 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:

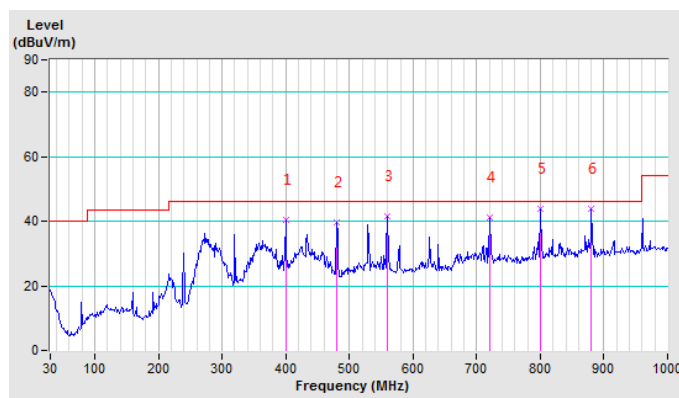
## BT-LE (GFSK)

|                 |               |                   |                 |
|-----------------|---------------|-------------------|-----------------|
| CHANNEL         | TX Channel 39 | DETECTOR 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                                                   | 399.72         | 40.26 QP                      | 46.00             | -5.74          | 2.00 H                    | 0                          | 48.98                  | -8.72                          |
| 2                                                   | 479.86         | 39.76 QP                      | 46.00             | -6.24          | 2.00 H                    | 0                          | 46.67                  | -6.91                          |
| 3                                                   | 559.99         | 41.71 QP                      | 46.00             | -4.29          | 2.00 H                    | 0                          | 45.47                  | -3.76                          |
| 4                                                   | 720.25         | 41.33 QP                      | 46.00             | -4.67          | 2.00 H                    | 0                          | 43.27                  | -1.94                          |
| 5                                                   | 800.38         | 43.77 QP                      | 46.00             | -2.23          | 2.00 H                    | 0                          | 44.30                  | -0.53                          |
| 6                                                   | 880.51         | 43.68 QP                      | 46.00             | -2.32          | 2.00 H                    | 0                          | 43.37                  | 0.31                           |

## 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 other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.





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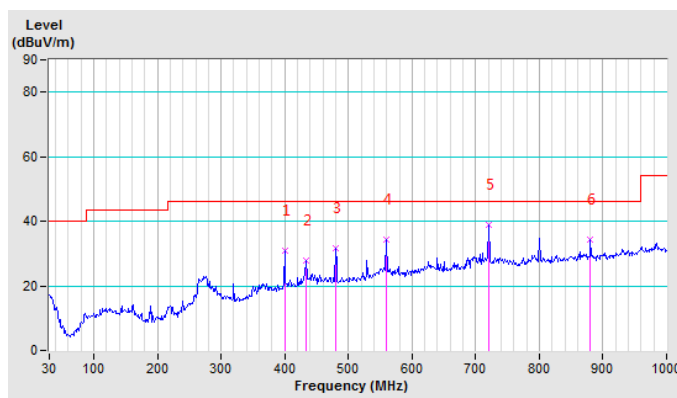
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|                 |               |                      |                 |
|-----------------|---------------|----------------------|-----------------|
| CHANNEL         | TX Channel 39 | DETECTOR<br>FUNCTION | Quasi-Peak (QP) |
| FREQUENCY RANGE | 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) | CORRECTION<br>FACTOR<br>(dB/m) |
| 1                                                 | 399.72         | 30.79 QP                      | 46.00             | -15.21         | 1.00 V                    | 0                          | 39.51                  | -8.72                          |
| 2                                                 | 433.46         | 27.98 QP                      | 46.00             | -18.02         | 1.00 V                    | 0                          | 36.76                  | -8.78                          |
| 3                                                 | 479.86         | 31.68 QP                      | 46.00             | -14.32         | 1.00 V                    | 0                          | 38.59                  | -6.91                          |
| 4                                                 | 559.99         | 34.19 QP                      | 46.00             | -11.81         | 1.00 V                    | 0                          | 37.95                  | -3.76                          |
| 5                                                 | 720.25         | 38.76 QP                      | 46.00             | -7.24          | 1.00 V                    | 0                          | 40.70                  | -1.94                          |
| 6                                                 | 880.51         | 34.47 QP                      | 46.00             | -11.53         | 1.00 V                    | 0                          | 34.16                  | 0.31                           |

**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 other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.





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# 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. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1                                                   | 2390.00     | 37.45 PK                | 74.00          | -36.55      | 1.00 H             | 215                  | 27.59            | 9.86                     |
| 2                                                   | 2390.00     | 22.53 AV                | 54.00          | -31.47      | 1.00 H             | 215                  | 12.67            | 9.86                     |
| 3                                                   | *2402.00    | 76.88 PK                |                |             | 1.00 H             | 215                  | 67.02            | 9.86                     |
| 4                                                   | *2402.00    | 75.56 AV                |                |             | 1.00 H             | 215                  | 65.70            | 9.86                     |
| 5                                                   | 4804.00     | 45.14 PK                | 74.00          | -28.86      | 1.00 H             | 324                  | 35.18            | 9.96                     |
| 6                                                   | 4804.00     | 39.67 AV                | 54.00          | -14.33      | 1.00 H             | 324                  | 29.71            | 9.96                     |
| 7                                                   | #7206.00    | 46.51 PK                | 74.00          | -27.49      | 1.00 H             | 210                  | 36.55            | 9.96                     |
| 8                                                   | #7206.00    | 42.91 AV                | 54.00          | -11.09      | 1.00 H             | 210                  | 32.95            | 9.96                     |
| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M   |             |                         |                |             |                    |                      |                  |                          |
| NO.                                                 | FREQ. (MHz) | EMISSION LEVEL (dBuV/m) | LIMIT (dBuV/m) | MARGIN (dB) | ANTENNA HEIGHT (m) | TABLE ANGLE (Degree) | RAW VALUE (dBuV) | CORRECTION FACTOR (dB/m) |
| 1                                                   | 2390.00     | 57.26 PK                | 74.00          | -16.74      | 1.00 V             | 350                  | 47.40            | 9.86                     |
| 2                                                   | 2390.00     | 36.62 AV                | 54.00          | -17.38      | 1.00 V             | 350                  | 26.76            | 9.86                     |
| 3                                                   | *2402.00    | 87.19 PK                |                |             | 1.00 V             | 350                  | 77.33            | 9.86                     |
| 4                                                   | *2402.00    | 82.29 AV                |                |             | 1.00 V             | 350                  | 72.43            | 9.86                     |
| 5                                                   | 4804.00     | 57.88 PK                | 74.00          | -16.12      | 1.00 V             | 214                  | 47.92            | 9.96                     |
| 6                                                   | 4804.00     | 48.00 AV                | 54.00          | -6.00       | 1.00 V             | 214                  | 38.04            | 9.96                     |
| 7                                                   | #7206.00    | 53.03 PK                | 74.00          | -20.97      | 1.10 V             | 300                  | 43.07            | 9.96                     |
| 8                                                   | #7206.00    | 38.46 AV                | 54.00          | -15.54      | 1.10 V             | 300                  | 28.50            | 9.96                     |

## 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.
6. " # ": The radiated frequency is out of the restricted band.



|                        |               |                              |              |
|------------------------|---------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 19 | <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                                                              | *2440.00               | 75.75 PK                               |                           |                        | 1.26 H                            | 153                                 | 65.89                           | 9.86                                    |
| 2                                                              | *2440.00               | 68.67 AV                               |                           |                        | 1.26 H                            | 153                                 | 58.81                           | 9.86                                    |
| 3                                                              | 4880.00                | 43.76 PK                               | 74.00                     | -30.24                 | 1.22 H                            | 10                                  | 33.80                           | 9.96                                    |
| 4                                                              | 4880.00                | 37.81 AV                               | 54.00                     | -16.19                 | 1.22 H                            | 10                                  | 27.85                           | 9.96                                    |
| 5                                                              | 7320.00                | 45.88 PK                               | 74.00                     | -28.12                 | 1.00 H                            | 122                                 | 35.92                           | 9.96                                    |
| 6                                                              | 7320.00                | 38.84 AV                               | 54.00                     | -15.16                 | 1.00 H                            | 122                                 | 28.88                           | 9.96                                    |
| <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                                                              | *2440.00               | 75.16 PK                               |                           |                        | 1.00 V                            | 199                                 | 65.30                           | 9.86                                    |
| 2                                                              | *2440.00               | 68.45 AV                               |                           |                        | 1.00 V                            | 199                                 | 58.59                           | 9.86                                    |
| 3                                                              | 4880.00                | 41.64 PK                               | 74.00                     | -32.36                 | 1.00 V                            | 250                                 | 31.68                           | 9.96                                    |
| 4                                                              | 4880.00                | 35.75 AV                               | 54.00                     | -18.25                 | 1.00 V                            | 250                                 | 25.79                           | 9.96                                    |
| 5                                                              | 7320.00                | 45.46 PK                               | 74.00                     | -28.54                 | 2.10 V                            | 264                                 | 35.50                           | 9.96                                    |
| 6                                                              | 7320.00                | 38.11 AV                               | 54.00                     | -15.89                 | 2.10 V                            | 264                                 | 28.15                           | 9.96                                    |

**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.



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|                        |               |                              |              |
|------------------------|---------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 39 | <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                                                   | *2480.00       | 72.59 PK                      |                   |                | 1.00 H                   | 163                        | 62.73                  | 9.86                           |
| 2                                                   | *2480.00       | 65.24 AV                      |                   |                | 1.00 H                   | 163                        | 55.38                  | 9.86                           |
| 3                                                   | 2483.50        | 40.57 PK                      | 74.00             | -33.43         | 1.00 H                   | 163                        | 30.71                  | 9.86                           |
| 4                                                   | 2483.50        | 24.81 AV                      | 54.00             | -29.19         | 1.00 H                   | 163                        | 14.95                  | 9.86                           |
| 5                                                   | 4960.00        | 45.40 PK                      | 74.00             | -28.60         | 1.20 H                   | 110                        | 35.44                  | 9.96                           |
| 6                                                   | 4960.00        | 34.74 AV                      | 54.00             | -19.26         | 1.20 H                   | 110                        | 24.78                  | 9.96                           |
| 7                                                   | 7440.00        | 47.48 PK                      | 74.00             | -26.52         | 1.44 H                   | 120                        | 37.52                  | 9.96                           |
| 8                                                   | 7440.00        | 36.49 AV                      | 54.00             | -17.51         | 1.44 H                   | 120                        | 26.53                  | 9.96                           |
| 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       | 73.55 PK                      |                   |                | 1.61 V                   | 142                        | 63.69                  | 9.86                           |
| 2                                                   | *2480.00       | 66.26 AV                      |                   |                | 1.61 V                   | 142                        | 56.40                  | 9.86                           |
| 3                                                   | 2483.50        | 41.65 PK                      | 74.00             | -32.35         | 1.61 V                   | 142                        | 31.79                  | 9.86                           |
| 4                                                   | 2483.50        | 23.60 AV                      | 54.00             | -30.40         | 1.61 V                   | 142                        | 13.74                  | 9.86                           |
| 5                                                   | 4960.00        | 47.55 PK                      | 74.00             | -26.45         | 1.55 V                   | 241                        | 37.59                  | 9.96                           |
| 6                                                   | 4960.00        | 37.11 AV                      | 54.00             | -16.89         | 1.55 V                   | 241                        | 27.15                  | 9.96                           |
| 7                                                   | 7440.00        | 47.59 PK                      | 74.00             | -26.41         | 1.55 V                   | 41                         | 37.63                  | 9.96                           |
| 8                                                   | 7440.00        | 34.55 AV                      | 54.00             | -19.45         | 1.55 V                   | 41                         | 24.59                  | 9.96                           |

**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.



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## 4.2 6dB BANDWIDTH MEASUREMENT

### 4.2.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

### 4.2.2 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. 13, 16 | Oct.12, 17  |
| Humid & Temp Programmable Tester | Haida           | HD-2257   | 110807201  | Sep.05,16   | Sep. 04,17  |
| Oscilloscope                     | Agilent         | DSO9254A  | MY51260160 | Nov. 04,16  | Nov. 03,17  |
| Signal Analyzer                  | Rohde & Schwarz | FSV7      | 102331     | Nov. 04,16  | Nov. 03,17  |
| Signal Generator                 | Agilent         | N5183A    | MY50140980 | Nov. 04,16  | Nov. 03,17  |
| 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.



#### 4.2.3 TEST PROCEDURE

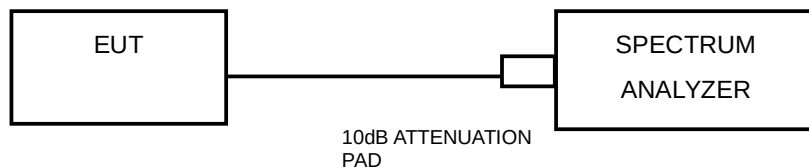
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW)  $\geq 3$  RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude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

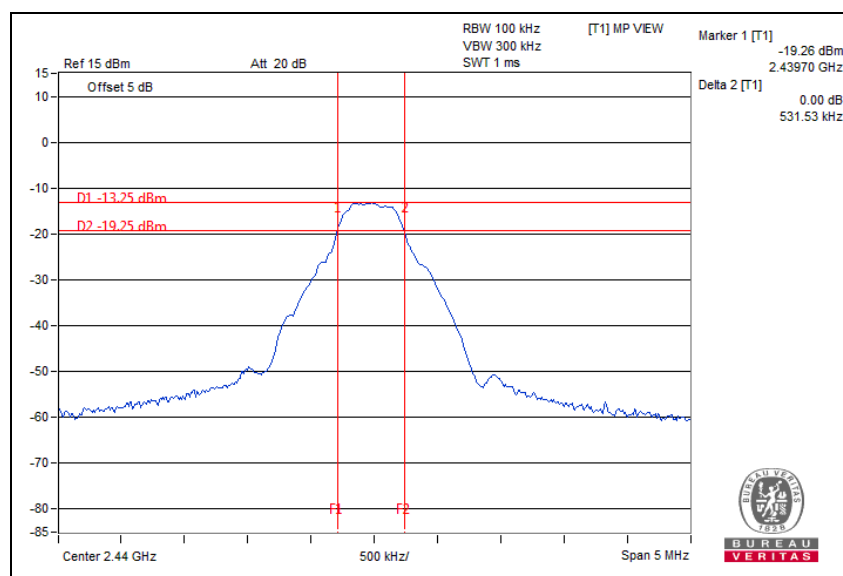


## 4.2.7 TEST RESULTS

### BT-LE (GFSK)

| CHANNEL | CHANNEL<br>FREQUENCY<br>(MHz) | 6dB<br>BANDWIDTH<br>(MHz) | MINIMUM LIMIT<br>(MHz) | PASS / FAIL |
|---------|-------------------------------|---------------------------|------------------------|-------------|
| 0       | 2402                          | 0.525                     | 0.5                    | PASS        |
| 19      | 2440                          | 0.531                     | 0.5                    | PASS        |
| 39      | 2480                          | 0.529                     | 0.5                    | PASS        |

### WORSE PLOT



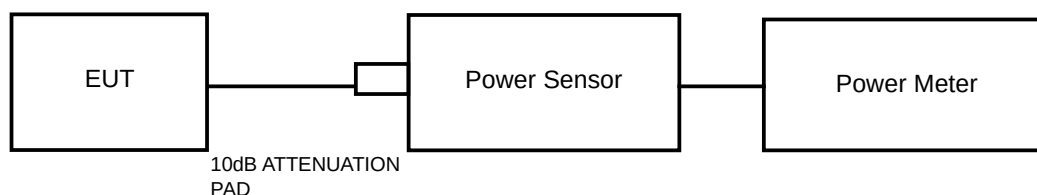


### 4.3 CONDUCTED OUTPUT POWER

#### 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 | May 04,16   | May 03,17   |
| Power Sensor                     | Keysight        | U2021XA   | MY55060018 | May 04,16   | May 03,17   |
| Digital Multimeter               | FLUKE           | 15B       | A1220010DG | Oct. 13, 16 | Oct.12, 17  |
| Humid & Temp Programmable Tester | Haida           | HD-2257   | 110807201  | Sep.05,16   | Sep. 04,17  |
| Oscilloscope                     | Agilent         | DSO9254A  | MY51260160 | Nov. 04,16  | Nov. 03,17  |
| Signal Analyzer                  | Rohde & Schwarz | FSV7      | 102331     | Nov. 04,16  | Nov. 03,17  |
| Signal Generator                 | Agilent         | N5183A    | MY50140980 | Nov. 04,16  | Nov. 03,17  |
| 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.



#### 4.3.5 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                          | -10.22                 | 0.0951                | 1                          | PASS      |
| 19      | 2440                          | -11.34                 | 0.0735                | 1                          | PASS      |
| 39      | 2480                          | -12.61                 | 0.0548                | 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<br>(MHz) | AVERAGE<br>POWER<br>(dBm) | AVERAGE<br>POWER<br>(mW) |
|---------|-------------------------------|---------------------------|--------------------------|
| 0       | 2402                          | -11.67                    | 0.068                    |
| 19      | 2440                          | -12.78                    | 0.053                    |
| 39      | 2480                          | -14.07                    | 0.039                    |

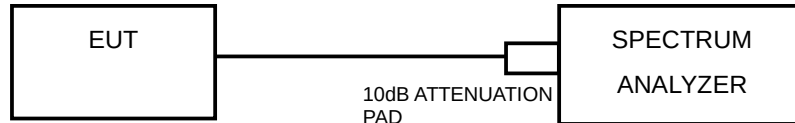


#### 4.4 POWER SPECTRAL DENSITY MEASUREMENT

##### 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 4.3.2 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.

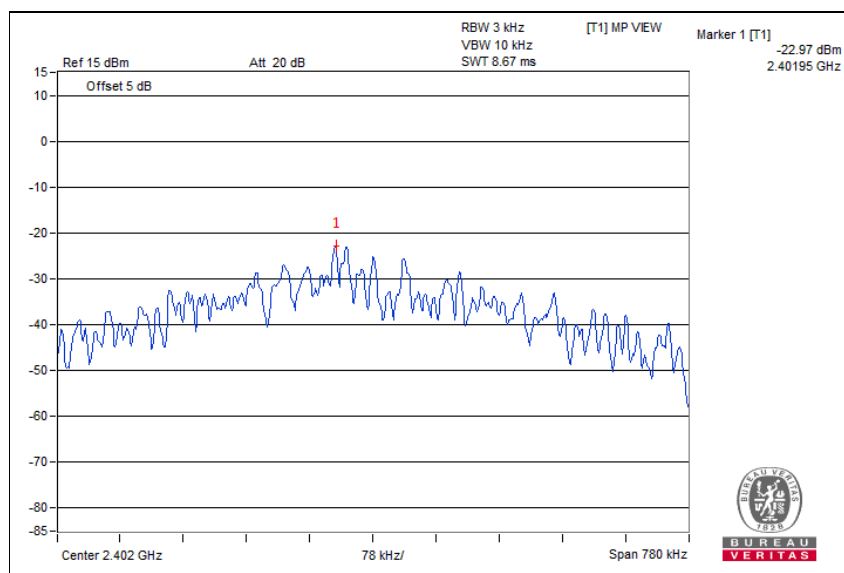


#### 4.4.7 TEST RESULTS

##### BT-LE (GFSK)

| Channel | FREQ.<br>(MHz) | PSD<br>(dBm/3kHz) | Limit<br>(dBm/3kHz) | PASS<br>/FAIL |
|---------|----------------|-------------------|---------------------|---------------|
| 0       | 2402           | -22.97            | 8                   | PASS          |
| 19      | 2440           | -23.95            | 8                   | PASS          |
| 39      | 2480           | -25.20            | 8                   | PASS          |

##### WORSE PLOT



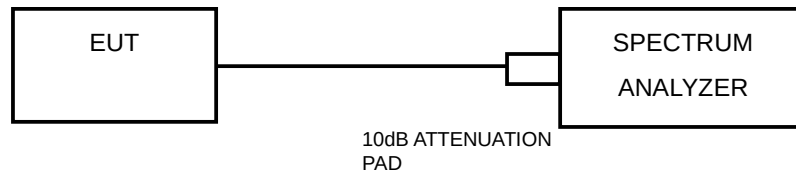


## 4.5 OUT OF BAND EMISSION MEASUREMENT

### 4.5.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

Below -20dB 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 4.3.2 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**

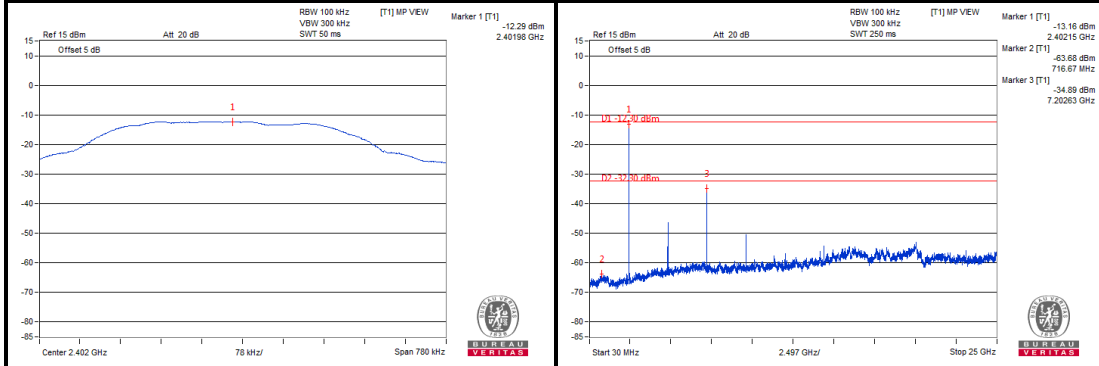
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



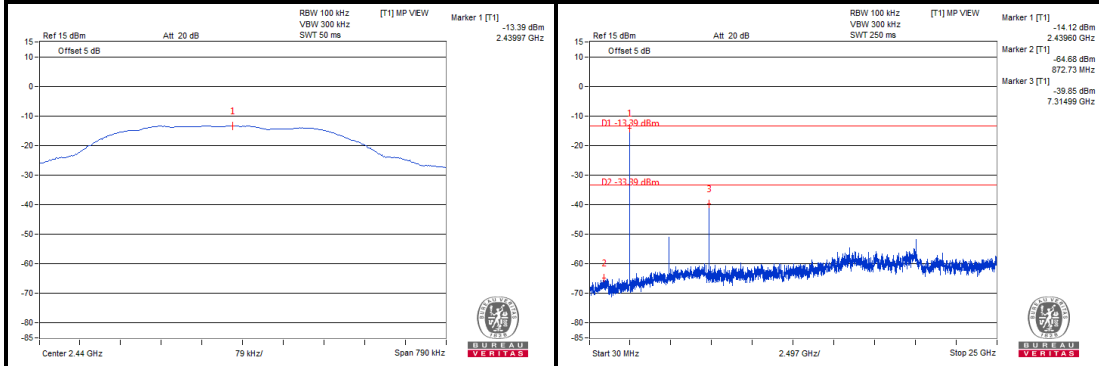
## 4.5.7 TEST RESULTS

### BT-LE (GFSK)

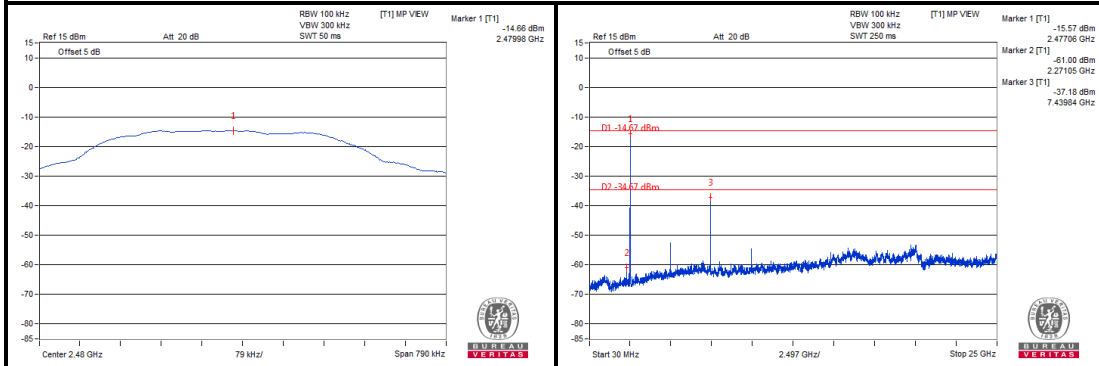
#### CH 0



#### CH 19



#### CH 39

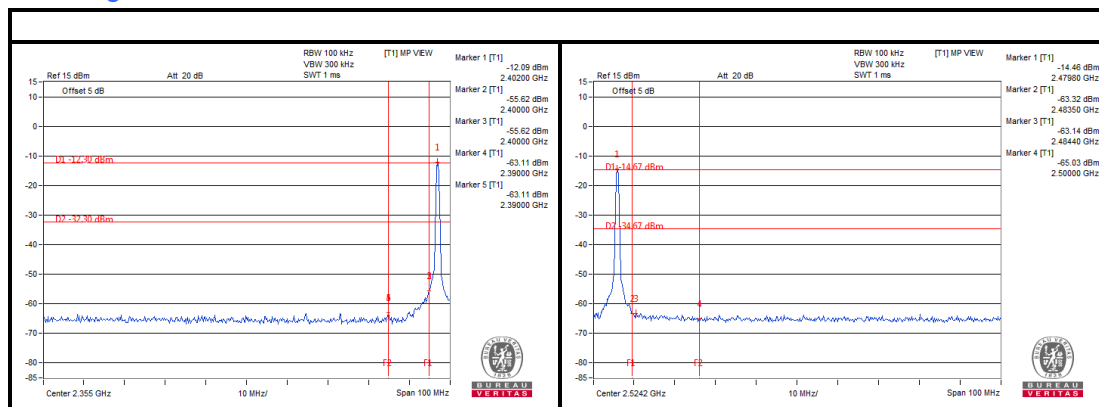




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### Band Edge:





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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---