

## TEST REPORT

|           |                                            |
|-----------|--------------------------------------------|
| Applicant | Audio-Technica Corporation                 |
| Address   | 2-46-1 Nishi-naruse, Machida, Tokyo, Japan |

|                                     |                                                                                                         |
|-------------------------------------|---------------------------------------------------------------------------------------------------------|
| Manufacturer or Supplier            | Audio-Technica Corporation                                                                              |
| Address                             | 2-46-1 Nishi-naruse, Machida, Tokyo, Japan                                                              |
| Product                             | Wireless Headphones                                                                                     |
| Brand Name                          |  <b>audio-technica</b> |
| Model                               | ATH-CKS5TW                                                                                              |
| Additional Model & Model Difference | N/A                                                                                                     |
| Date of tests                       | Mar. 27, 2019 ~ May 23, 2019                                                                            |

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

☒ **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: May 29, 2019 |

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Test Report No.: RF190327N023-1

## RELEASE CONTROL RECORD

| ISSUE NO.      | REASON FOR CHANGE | DATE ISSUED  |
|----------------|-------------------|--------------|
| RF190327N023-1 | Original release  | May 29, 2019 |

## 1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: FCC Part 15, Subpart C |                                                                                                               |        |                                |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------|--------|--------------------------------|
| STANDARD SECTION                         | TEST TYPE AND LIMIT                                                                                           | RESULT | REMARK                         |
| 15.207                                   | AC Power Conducted Emission                                                                                   | N/A    | Power by Battery               |
| 15.247(a)(1)(iii)                        | Number of Hopping Frequency Used                                                                              | PASS   | Meet the requirement of limit. |
| 15.247(a)(1)(iii)                        | Dwell Time on Each Channel                                                                                    | PASS   | Meet the requirement of limit. |
| 15.247(a)(1)                             | 1. Hopping Channel Separation<br>2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System | PASS   | Meet the requirement of limit. |
| 15.247(b)                                | Maximum Peak Output Power                                                                                     | PASS   | Meet the requirement of limit. |
| 15.247(d)&15.209                         | Transmitter Radiated Emission                                                                                 | PASS   | Meet the requirement of limit. |
| 15.247(d)                                | Out of band Emission Measurement                                                                              | 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 Headphones                                                     |
| <b>MODEL NO.</b>             | ATH-CKS5TW                                                              |
| <b>ADDITIONAL MODEL</b>      | N/A                                                                     |
| <b>FCC ID</b>                | JFZCKS5TWL                                                              |
| <b>POWER SUPPLY</b>          | DC 3.7V from Li-ion Battery,<br>Battery Charging: DC5V from Charger Box |
| <b>MODULATION TECHNOLOGY</b> | FHSS                                                                    |
| <b>MODULATION TYPE</b>       | GFSK, $\pi/4$ DQPSK, 8DPSK                                              |
| <b>OPERATING FREQUENCY</b>   | 2402MHz~2480MHz                                                         |
| <b>NUMBER OF CHANNEL</b>     | 79                                                                      |
| <b>PEAK OUTPUT POWER</b>     | 0.7638mW (Max. Measured)                                                |
| <b>ANTENNA TYPE</b>          | Integral Antenna, -0.81dBi Gain                                         |
| <b>I/O PORTS</b>             | Refer to user's manual                                                  |
| <b>CABLE SUPPLIED</b>        | USB Line: unshielded detachable 0.3m                                    |

**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.: 190327N023-1) for detailed product photo.
4. When the EUT charging that wireless function can't working, the charging mode was tested in the FCC Part 15B(sDoC) report.(report no.: FS190327N023).

### 3.2 DESCRIPTION OF TEST MODES

79 channels are provided to this EUT:

| CHANNEL | FREQ.<br>(MHz) | CHANNEL | FREQ.<br>(MHz) | CHANNEL | FREQ.<br>(MHz) | CHANNEL | FREQ.<br>(MHz) |
|---------|----------------|---------|----------------|---------|----------------|---------|----------------|
| 0       | 2402           | 20      | 2422           | 40      | 2442           | 60      | 2462           |
| 1       | 2403           | 21      | 2423           | 41      | 2443           | 61      | 2463           |
| 2       | 2404           | 22      | 2424           | 42      | 2444           | 62      | 2464           |
| 3       | 2405           | 23      | 2425           | 43      | 2445           | 63      | 2465           |
| 4       | 2406           | 24      | 2426           | 44      | 2446           | 64      | 2466           |
| 5       | 2407           | 25      | 2427           | 45      | 2447           | 65      | 2467           |
| 6       | 2408           | 26      | 2428           | 46      | 2448           | 66      | 2468           |
| 7       | 2409           | 27      | 2429           | 47      | 2449           | 67      | 2469           |
| 8       | 2410           | 28      | 2430           | 48      | 2450           | 68      | 2470           |
| 9       | 2411           | 29      | 2431           | 49      | 2451           | 69      | 2471           |
| 10      | 2412           | 30      | 2432           | 50      | 2452           | 70      | 2472           |
| 11      | 2413           | 31      | 2433           | 51      | 2453           | 71      | 2473           |
| 12      | 2414           | 32      | 2434           | 52      | 2454           | 72      | 2474           |
| 13      | 2415           | 33      | 2435           | 53      | 2455           | 73      | 2475           |
| 14      | 2416           | 34      | 2436           | 54      | 2456           | 74      | 2476           |
| 15      | 2417           | 35      | 2437           | 55      | 2457           | 75      | 2477           |
| 16      | 2418           | 36      | 2438           | 56      | 2458           | 76      | 2478           |
| 17      | 2419           | 37      | 2439           | 57      | 2459           | 77      | 2479           |
| 18      | 2420           | 38      | 2440           | 58      | 2460           | 78      | 2480           |
| 19      | 2421           | 39      | 2441           | 59      | 2461           |         |                |

### 3.2.1. CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photograph 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 channel(s) was (were) selected for the final test as listed below:

| EUT CONFIGURE<br>MODE | APPLICABLE TO |       |     |      | DESCRIPTION              |
|-----------------------|---------------|-------|-----|------|--------------------------|
|                       | RE<1G         | RE≥1G | PLC | APCM |                          |
| A                     | √             | √     | -   | √    | Powered By Fully Battery |

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

**RE≥1G**: Radiated Emission above 1GHz  
**APCM**: Antenna Port Conducted Measurement

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

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

| AVAILABLE<br>CHANNEL | TESTED<br>CHANNEL | MODULATION<br>TECHNOLOGY | MODULATION<br>TYPE | PACKET<br>TYPE |
|----------------------|-------------------|--------------------------|--------------------|----------------|
| 0 to 78              | 39                | FHSS                     | GFSK               | DH5            |

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

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

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

| AVAILABLE<br>CHANNEL | TESTED<br>CHANNEL | MODULATION<br>TECHNOLOGY | MODULATION<br>TYPE | PACKET<br>TYPE |
|----------------------|-------------------|--------------------------|--------------------|----------------|
| 0 to 78              | 0, 39, 78         | FHSS                     | GFSK               | DH5            |
| 0 to 78              | 0, 39, 78         | FHSS                     | 8DPSK              | 3DH5           |

**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, antenna ports (if EUT with antenna diversity architecture), and packet types.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | PACKET TYPE |
|-------------------|----------------|-----------------------|-----------------|-------------|
| 0 to 78           | 0, 39, 78      | FHSS                  | GFSK            | DH5         |
| 0 to 78           | 0, 39, 78      | FHSS                  | 8DPSK           | 3DH5        |

**TEST CONDITION:**

| APPLICABLE TO | ENVIRONMENTAL CONDITIONS | TEST VOLTAGE (SYSTEM)      | TESTED BY |
|---------------|--------------------------|----------------------------|-----------|
| RE<1G         | 25deg. C, 55%RH          | DC 3.7V from Fully Battery | Walker    |
| RE≥1G         | 25deg. C, 55%RH          | DC 3.7V from Fully Battery | Walker    |
| PLC           | N/A                      | N/A                        | N/A       |
| APCM          | 25deg. C, 60%RH          | DC 3.7V from Fully Battery | Eric Fang |



Test Report No.: RF190327N023-1

### 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**  
**KDB 558074 D01 15.247 Meas Guidance v05r01**  
**ANSI C63.10-2013**

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 without any other necessary accessory or support units.

## 4 TEST TYPES AND RESULTS

### 4.1. RADIATED EMISSION AND BANDEDGE MEASUREMENT

#### 4.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE 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). Other emissions shall be at least 20dB below the highest level of the desired power.

| FREQUENCIES (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_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_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, GRGT/CHINA and NIM/CHINA.
3. The horn antenna is used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 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:

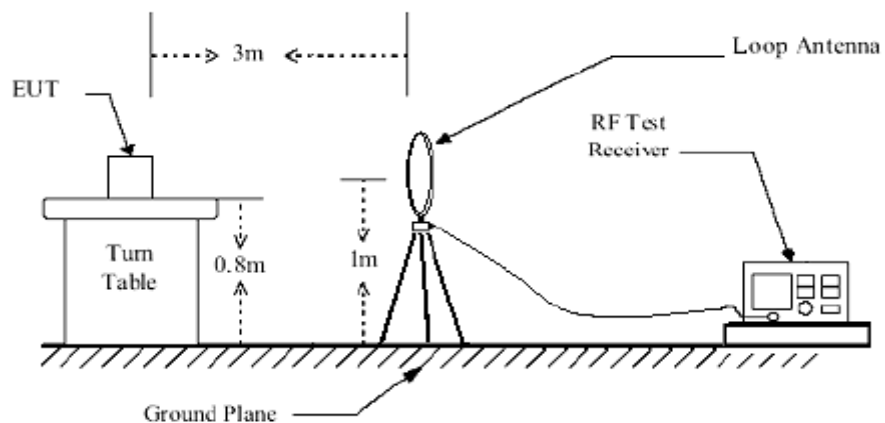
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution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

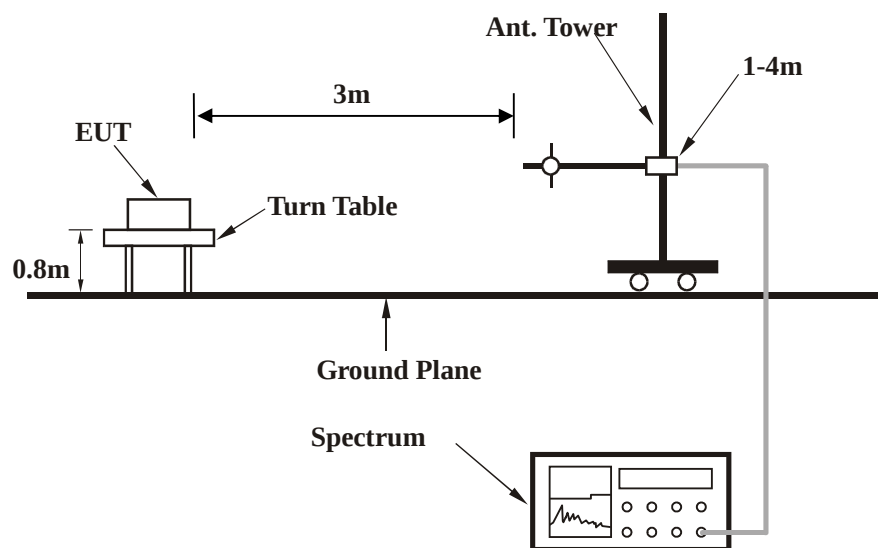
No deviation.

#### 4.1.5 TEST SETUP

##### Below 30MHz test setup

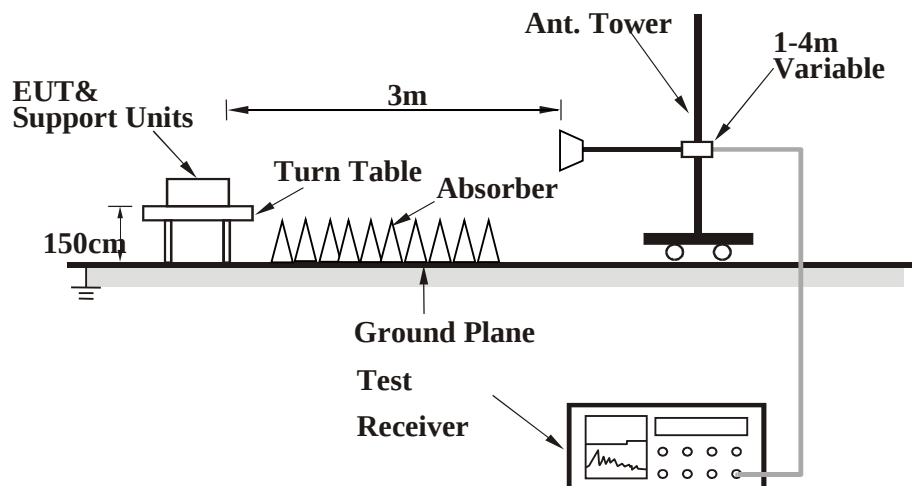


##### Below 1GHz test setup



**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:

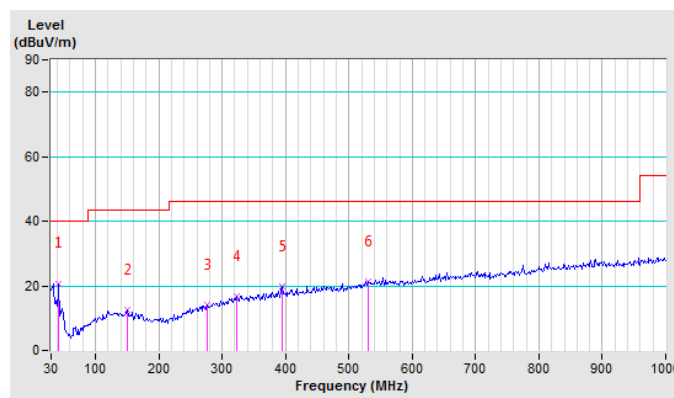
##### GFSK DH5

|                        |             |                              |                 |
|------------------------|-------------|------------------------------|-----------------|
| <b>CHANNEL</b>         | Channel 39  | <b>DETECTOR<br/>FUNCTION</b> | Quasi-Peak (QP) |
| <b>FREQUENCY RANGE</b> | 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) | CORRECTIO<br>N FACTOR<br>(dB/m) |
| 1                                                   | 42.44          | 20.75 QP                      | 40.00             | -19.25         | 1.00 H                   | 235                        | 37.87                  | -17.12                          |
| 2                                                   | 149.70         | 12.50 QP                      | 43.50             | -31.00         | 1.00 H                   | 48                         | 28.71                  | -16.21                          |
| 3                                                   | 275.61         | 14.22 QP                      | 46.00             | -31.78         | 1.00 H                   | 125                        | 28.02                  | -13.80                          |
| 4                                                   | 322.24         | 16.76 QP                      | 46.00             | -29.24         | 1.00 H                   | 85                         | 28.44                  | -11.68                          |
| 5                                                   | 395.30         | 19.80 QP                      | 46.00             | -26.20         | 1.00 H                   | 325                        | 29.29                  | -9.49                           |
| 6                                                   | 530.54         | 21.27 QP                      | 46.00             | -24.73         | 1.00 H                   | 178                        | 27.95                  | -6.68                           |

##### 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.

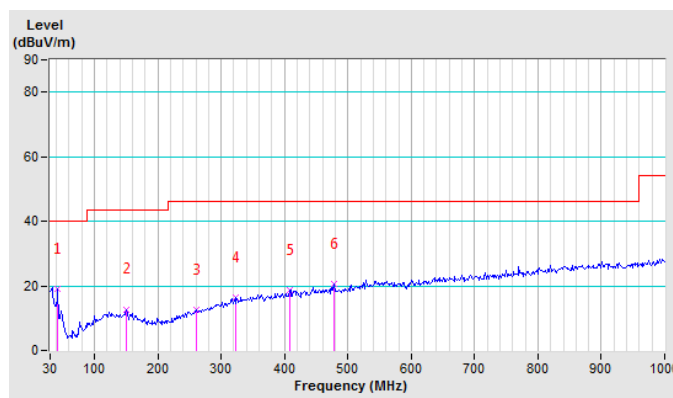


|                        |             |                              |                 |
|------------------------|-------------|------------------------------|-----------------|
| <b>CHANNEL</b>         | Channel 39  | <b>DETECTOR<br/>FUNCTION</b> | Quasi-Peak (QP) |
| <b>FREQUENCY RANGE</b> | 9KHz ~ 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) | CORRECTIO<br>N FACTOR<br>(dB/m) |
| 1                                                 | 42.44          | 18.97 QP                      | 40.00             | -21.03         | 1.00 V                   | 251                        | 36.09                  | -17.12                          |
| 2                                                 | 149.70         | 12.76 QP                      | 43.50             | -30.74         | 1.00 V                   | 69                         | 28.97                  | -16.21                          |
| 3                                                 | 261.62         | 12.43 QP                      | 46.00             | -33.57         | 1.00 V                   | 125                        | 26.89                  | -14.46                          |
| 4                                                 | 323.80         | 16.48 QP                      | 46.00             | -29.52         | 1.00 V                   | 158                        | 28.10                  | -11.62                          |
| 5                                                 | 407.74         | 18.71 QP                      | 46.00             | -27.29         | 1.00 V                   | 226                        | 27.96                  | -9.25                           |
| 6                                                 | 477.69         | 20.54 QP                      | 46.00             | -25.46         | 1.00 V                   | 234                        | 28.68                  | -8.14                           |

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.



**ABOVE 1GHz DATA**

**BT\_GFSK**

|                        |              |                              |              |
|------------------------|--------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 0 | <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                                                   | 2390.00        | 40.65 PK                      | 74.00             | -33.35         | 1.00 H                   | 290                        | 38.36                  | 2.29                           |
| 2                                                   | 2390.00        | 30.31 AV                      | 54.00             | -23.69         | 1.00 H                   | 290                        | 28.02                  | 2.29                           |
| 3                                                   | *2402.00       | 93.19 PK                      |                   |                | 1.00 H                   | 290                        | 90.81                  | 2.38                           |
| 4                                                   | *2402.00       | 92.70 AV                      |                   |                | 1.00 H                   | 290                        | 90.32                  | 2.38                           |
| 5                                                   | 4804.00        | 46.61 PK                      | 74.00             | -27.39         | 1.00 H                   | 331                        | 41.54                  | 5.07                           |
| 6                                                   | 4804.00        | 39.22 AV                      | 54.00             | -14.78         | 1.00 H                   | 331                        | 34.15                  | 5.07                           |
| 7                                                   | #7206.00       | 53.12 PK                      | 74.00             | -20.88         | 1.00 H                   | 219                        | 43.81                  | 9.31                           |
| 8                                                   | #7206.00       | 44.93 AV                      | 54.00             | -9.07          | 1.00 H                   | 219                        | 35.62                  | 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        | 40.40 PK                      | 74.00             | -33.60         | 1.00 V                   | 141                        | 38.11                  | 2.29                           |
| 2                                                   | 2390.00        | 31.29 AV                      | 54.00             | -22.71         | 1.00 V                   | 141                        | 29.00                  | 2.29                           |
| 3                                                   | *2402.00       | 89.69 PK                      |                   |                | 1.00 V                   | 141                        | 87.31                  | 2.38                           |
| 4                                                   | *2402.00       | 89.15 AV                      |                   |                | 1.00 V                   | 141                        | 86.77                  | 2.38                           |
| 5                                                   | 4804.00        | 44.98 PK                      | 74.00             | -29.02         | 1.00 V                   | 91                         | 39.91                  | 5.07                           |
| 6                                                   | 4804.00        | 33.49 AV                      | 54.00             | -20.51         | 1.00 V                   | 91                         | 28.42                  | 5.07                           |
| 7                                                   | #7206.00       | 55.11 PK                      | 74.00             | -18.89         | 1.00 V                   | 167                        | 45.80                  | 9.31                           |
| 8                                                   | #7206.00       | 48.88 AV                      | 54.00             | -5.12          | 1.00 V                   | 167                        | 39.57                  | 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 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                                                   | *2441.00       | 88.85 PK                      |                   |                | 1.00 H                   | 200                        | 86.21                  | 2.64                           |
| 2                                                   | *2441.00       | 88.35 AV                      |                   |                | 1.00 H                   | 200                        | 85.71                  | 2.64                           |
| 3                                                   | 4882.00        | 51.12 PK                      | 74.00             | -22.88         | 1.00 H                   | 294                        | 45.85                  | 5.27                           |
| 4                                                   | 4882.00        | 40.12 AV                      | 54.00             | -13.88         | 1.00 H                   | 294                        | 34.85                  | 5.27                           |
| 5                                                   | 7323.00        | 51.98 PK                      | 74.00             | -22.02         | 1.00 H                   | 154                        | 42.53                  | 9.45                           |
| 6                                                   | 7323.00        | 43.69 AV                      | 54.00             | -10.31         | 1.00 H                   | 154                        | 34.24                  | 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                                                   | *2441.00       | 88.03 PK                      |                   |                | 1.00 V                   | 144                        | 85.39                  | 2.64                           |
| 2                                                   | *2441.00       | 87.63 AV                      |                   |                | 1.00 V                   | 144                        | 84.99                  | 2.64                           |
| 3                                                   | 4882.00        | 44.26 PK                      | 74.00             | -29.74         | 1.00 V                   | 77                         | 38.99                  | 5.27                           |
| 4                                                   | 4882.00        | 36.55 AV                      | 54.00             | -17.45         | 1.00 V                   | 77                         | 31.28                  | 5.27                           |
| 5                                                   | 7323.00        | 54.12 PK                      | 74.00             | -19.88         | 1.00 V                   | 130                        | 44.67                  | 9.45                           |
| 6                                                   | 7323.00        | 47.78 AV                      | 54.00             | -6.22          | 1.00 V                   | 130                        | 38.33                  | 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 78 | 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       | 88.19 PK                      |                   |                | 1.00 H                   | 294                        | 85.28                  | 2.91                           |
| 2                                                   | *2480.00       | 87.69 AV                      |                   |                | 1.00 H                   | 294                        | 84.78                  | 2.91                           |
| 3                                                   | 2483.50        | 46.00 PK                      | 74.00             | -28.00         | 1.00 H                   | 294                        | 43.07                  | 2.93                           |
| 4                                                   | 2483.50        | 42.96 AV                      | 54.00             | -11.04         | 1.00 H                   | 294                        | 40.03                  | 2.93                           |
| 5                                                   | 4960.00        | 48.51 PK                      | 74.00             | -25.49         | 1.00 H                   | 0                          | 43.05                  | 5.46                           |
| 6                                                   | 4960.00        | 43.05 AV                      | 54.00             | -10.95         | 1.00 H                   | 0                          | 37.59                  | 5.46                           |
| 7                                                   | 7440.00        | 52.34 PK                      | 74.00             | -21.66         | 1.00 H                   | 85                         | 42.75                  | 9.59                           |
| 8                                                   | 7440.00        | 42.76 AV                      | 54.00             | -11.24         | 1.00 H                   | 85                         | 33.17                  | 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       | 86.54 PK                      |                   |                | 1.00 V                   | 141                        | 83.63                  | 2.91                           |
| 2                                                   | *2480.00       | 86.06 AV                      |                   |                | 1.00 V                   | 141                        | 83.15                  | 2.91                           |
| 3                                                   | 2483.50        | 44.16 PK                      | 74.00             | -29.84         | 1.00 V                   | 141                        | 41.23                  | 2.93                           |
| 4                                                   | 2483.50        | 41.17 AV                      | 54.00             | -12.83         | 1.00 V                   | 141                        | 38.24                  | 2.93                           |
| 5                                                   | 4960.00        | 46.64 PK                      | 74.00             | -27.36         | 1.00 V                   | 322                        | 41.18                  | 5.46                           |
| 6                                                   | 4960.00        | 38.61 AV                      | 54.00             | -15.39         | 1.00 V                   | 322                        | 33.15                  | 5.46                           |
| 7                                                   | 7440.00        | 54.20 PK                      | 74.00             | -19.80         | 1.00 V                   | 223                        | 44.61                  | 9.59                           |
| 8                                                   | 7440.00        | 45.38 AV                      | 54.00             | -8.62          | 1.00 V                   | 223                        | 35.79                  | 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.

BT\_8DPSK

|                 |              |                      |              |
|-----------------|--------------|----------------------|--------------|
| 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        | 40.82 PK                      | 74.00             | -33.18         | 1.00 H                   | 291                        | 38.53                  | 2.29                           |
| 2                                                   | 2390.00        | 30.48 AV                      | 54.00             | -23.52         | 1.00 H                   | 291                        | 28.19                  | 2.29                           |
| 3                                                   | *2402.00       | 94.88 PK                      |                   |                | 1.00 H                   | 291                        | 92.50                  | 2.38                           |
| 4                                                   | *2402.00       | 90.86 AV                      |                   |                | 1.00 H                   | 291                        | 88.48                  | 2.38                           |
| 5                                                   | 4804.00        | 48.23 PK                      | 74.00             | -25.77         | 1.00 H                   | 0                          | 43.16                  | 5.07                           |
| 6                                                   | 4804.00        | 38.09 AV                      | 54.00             | -15.91         | 1.00 H                   | 0                          | 33.02                  | 5.07                           |
| 7                                                   | #7206.00       | 52.66 PK                      | 74.00             | -21.34         | 1.00 H                   | 200                        | 43.35                  | 9.31                           |
| 8                                                   | #7206.00       | 43.00 AV                      | 54.00             | -11.00         | 1.00 H                   | 200                        | 33.69                  | 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        | 44.32 PK                      | 74.00             | -29.68         | 1.00 V                   | 129                        | 42.03                  | 2.29                           |
| 2                                                   | 2390.00        | 32.15 AV                      | 54.00             | -21.85         | 1.00 V                   | 129                        | 29.86                  | 2.29                           |
| 3                                                   | *2402.00       | 92.97 PK                      |                   |                | 1.00 V                   | 129                        | 90.59                  | 2.38                           |
| 4                                                   | *2402.00       | 88.85 AV                      |                   |                | 1.00 V                   | 129                        | 86.47                  | 2.38                           |
| 5                                                   | 4804.00        | 47.32 PK                      | 74.00             | -26.68         | 1.00 V                   | 326                        | 42.25                  | 5.07                           |
| 6                                                   | 4804.00        | 34.29 AV                      | 54.00             | -19.71         | 1.00 V                   | 326                        | 29.22                  | 5.07                           |
| 7                                                   | #7206.00       | 55.54 PK                      | 74.00             | -18.46         | 1.00 V                   | 149                        | 46.23                  | 9.31                           |
| 8                                                   | #7206.00       | 47.44 AV                      | 54.00             | -6.56          | 1.00 V                   | 149                        | 38.13                  | 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 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                                                   | *2441.00       | 91.03 PK                      |                   |                | 1.00 H                   | 201                        | 88.39                  | 2.64                           |
| 2                                                   | *2441.00       | 86.91 AV                      |                   |                | 1.00 H                   | 201                        | 84.27                  | 2.64                           |
| 3                                                   | 4882.00        | 49.39 PK                      | 74.00             | -24.61         | 1.00 H                   | 0                          | 44.12                  | 5.27                           |
| 4                                                   | 4882.00        | 39.63 AV                      | 54.00             | -14.37         | 1.00 H                   | 0                          | 34.36                  | 5.27                           |
| 5                                                   | 7323.00        | 53.17 PK                      | 74.00             | -20.83         | 1.00 H                   | 85                         | 43.72                  | 9.45                           |
| 6                                                   | 7323.00        | 42.24 AV                      | 54.00             | -11.76         | 1.00 H                   | 85                         | 32.79                  | 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                                                   | *2441.00       | 89.21 PK                      |                   |                | 1.00 V                   | 144                        | 86.57                  | 2.64                           |
| 2                                                   | *2441.00       | 86.13 AV                      |                   |                | 1.00 V                   | 144                        | 83.49                  | 2.64                           |
| 3                                                   | 4882.00        | 46.25 PK                      | 74.00             | -27.75         | 1.00 V                   | 342                        | 40.98                  | 5.27                           |
| 4                                                   | 4882.00        | 34.26 AV                      | 54.00             | -19.74         | 1.00 V                   | 342                        | 28.99                  | 5.27                           |
| 5                                                   | 7323.00        | 54.33 PK                      | 74.00             | -19.67         | 1.00 V                   | 131                        | 44.88                  | 9.45                           |
| 6                                                   | 7323.00        | 45.66 AV                      | 54.00             | -8.34          | 1.00 V                   | 131                        | 36.21                  | 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.

|                        |               |                              |              |
|------------------------|---------------|------------------------------|--------------|
| <b>CHANNEL</b>         | TX Channel 78 | <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       | 89.81 PK                      |                   |                | 1.00 H                   | 297                        | 86.90                  | 2.91                           |
| 2                                                   | *2480.00       | 86.22 AV                      |                   |                | 1.00 H                   | 297                        | 83.31                  | 2.91                           |
| 3                                                   | 2483.50        | 48.43 PK                      | 74.00             | -25.57         | 1.00 H                   | 297                        | 45.50                  | 2.93                           |
| 4                                                   | 2483.50        | 43.80 AV                      | 54.00             | -10.20         | 1.00 H                   | 297                        | 40.87                  | 2.93                           |
| 5                                                   | 4960.00        | 48.49 PK                      | 74.00             | -25.51         | 1.00 H                   | 7                          | 43.03                  | 5.46                           |
| 6                                                   | 4960.00        | 40.21 AV                      | 54.00             | -13.79         | 1.00 H                   | 7                          | 34.75                  | 5.46                           |
| 7                                                   | 7440.00        | 50.91 PK                      | 74.00             | -23.09         | 1.00 H                   | 166                        | 41.32                  | 9.59                           |
| 8                                                   | 7440.00        | 40.44 AV                      | 54.00             | -13.56         | 1.00 H                   | 166                        | 30.85                  | 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       | 88.70 PK                      |                   |                | 1.00 V                   | 132                        | 85.79                  | 2.91                           |
| 2                                                   | *2480.00       | 84.91 AV                      |                   |                | 1.00 V                   | 132                        | 82.00                  | 2.91                           |
| 3                                                   | 2483.50        | 47.24 PK                      | 74.00             | -26.76         | 1.00 V                   | 132                        | 44.31                  | 2.93                           |
| 4                                                   | 2483.50        | 43.12 AV                      | 54.00             | -10.88         | 1.00 V                   | 132                        | 40.19                  | 2.93                           |
| 5                                                   | 4960.00        | 45.37 PK                      | 74.00             | -28.63         | 1.00 V                   | 342                        | 39.91                  | 5.46                           |
| 6                                                   | 4960.00        | 34.22 AV                      | 54.00             | -19.78         | 1.00 V                   | 342                        | 28.76                  | 5.46                           |
| 7                                                   | 7440.00        | 53.30 PK                      | 74.00             | -20.70         | 1.00 V                   | 130                        | 43.71                  | 9.59                           |
| 8                                                   | 7440.00        | 43.90 AV                      | 54.00             | -10.10         | 1.00 V                   | 130                        | 34.31                  | 9.59                           |

**REMARKS:**

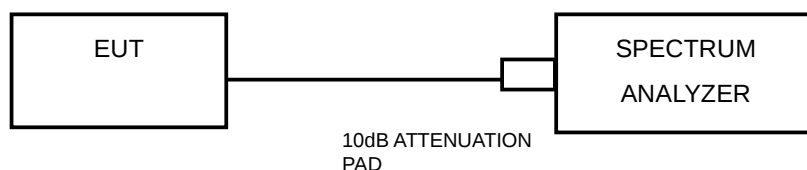
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.
5. " \* ": Fundamental frequency.

## 4.2 NUMBER OF HOPPING FREQUENCY USED

### 4.2.1 LIMIT OF HOPPING FREQUENCY USED

At least 15 channels frequencies, and should be equally spaced.

### 4.2.2 TEST SETUP



### 4.2.3 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.

#### 4.2.4 TEST PROCEDURES

- a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- d. Set the SA on View mode and then plot the result on SA screen.
- e. Repeat above procedures until all frequencies measured were completed.

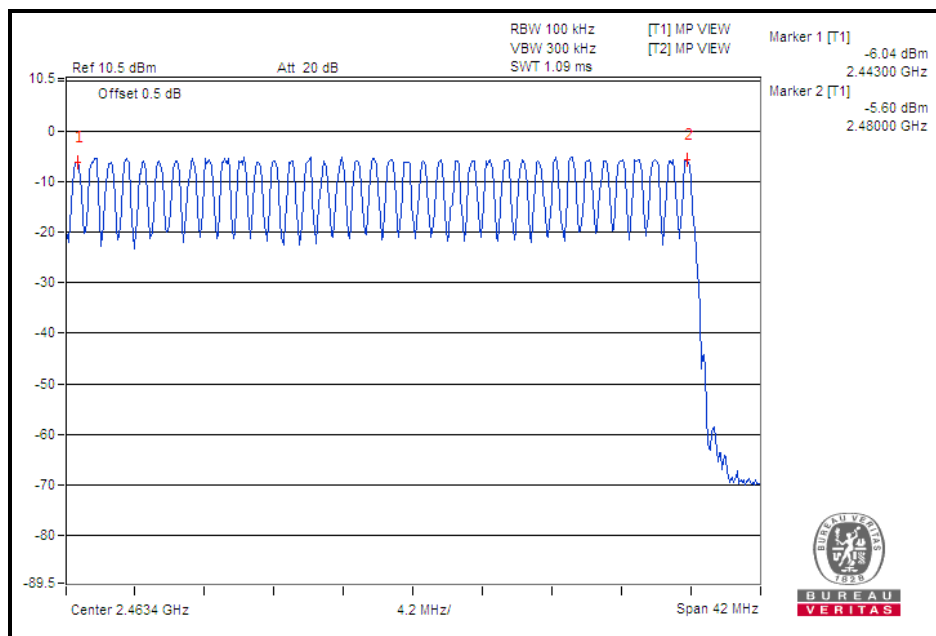
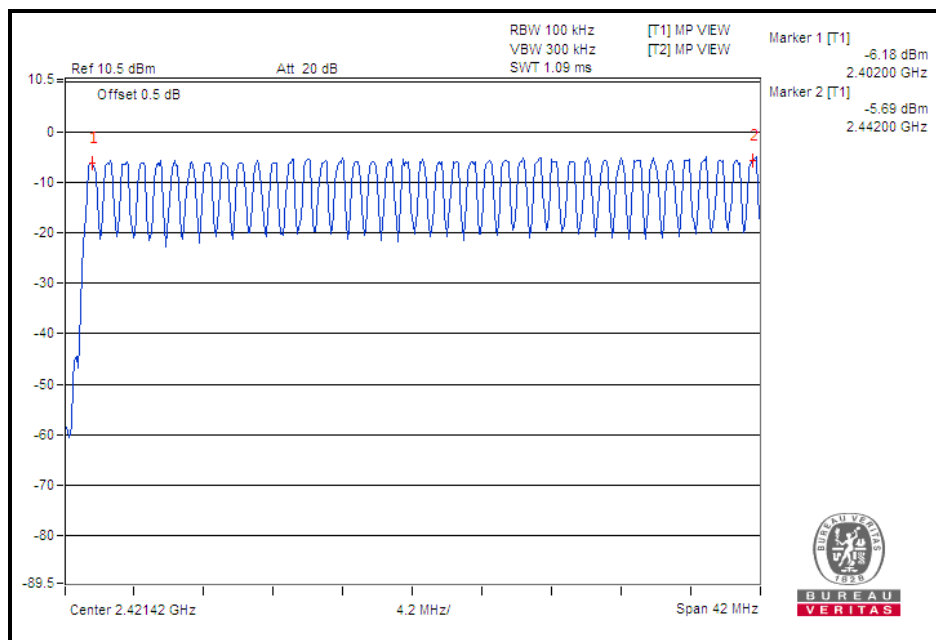
#### 4.2.5 DEVIATION FROM TEST STANDARD

No deviation.

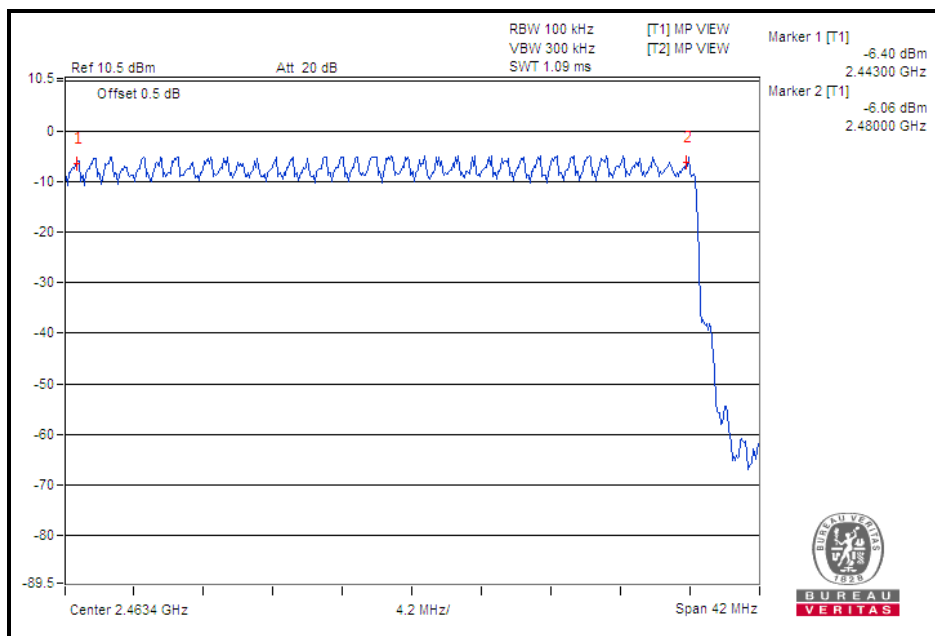
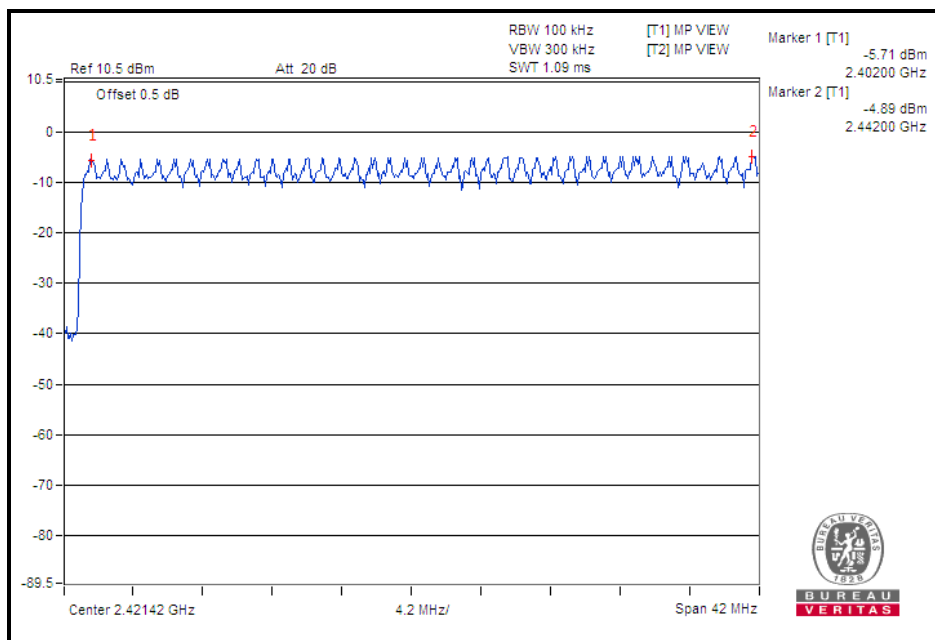
#### 4.2.6 TEST RESULTS

There are 79 hopping frequencies in the hopping mode. Please refer to next two pages for the test result. On the plots, it shows that the hopping frequencies are equally spaced.

**GFSK**



## 8DPSK

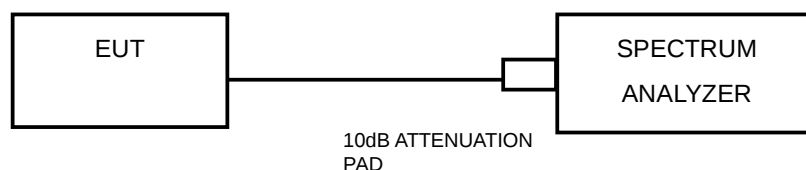


### 4.3 DWELL TIME ON EACH CHANNEL

#### 4.3.1 LIMIT OF DWELL TIME USED

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

#### 4.3.2 TEST SETUP



#### 4.3.3 TEST INSTRUMENTS

Refer to section 4.2.3 to get information of above instrument.

#### 4.3.4 TEST PROCEDURES

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- Repeat above procedures until all different time-slot modes have been completed.

#### 4.3.5 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.3.6 TEST RESULTS

##### GFSK

| Mode | Number of Hopping Channel | Number of transmission in a period(channel number*0.4 sec) |                  |                  |                   | Length of transmission time (msec) | Result (msec) | Limit (msec) | PASS / FAIL |
|------|---------------------------|------------------------------------------------------------|------------------|------------------|-------------------|------------------------------------|---------------|--------------|-------------|
|      |                           | period (sec)                                               | sweep time (sec) | times in a sweep | times in a period |                                    |               |              |             |
| DH1  | 79                        | 31.6                                                       | 5                | 50               | 316.00            | 0.462                              | 145.99        | 400          | PASS        |
| DH3  | 79                        | 31.6                                                       | 5                | 26               | 164.32            | 1.700                              | 279.34        | 400          | PASS        |
| DH5  | 79                        | 31.6                                                       | 5                | 16               | 101.12            | 3.024                              | 305.79        | 400          | PASS        |

##### 8DPSK

| Mode | Number of Hopping Channel | Number of transmission in a period(channel number*0.4 sec) |                  |                  |                   | Length of transmission time (msec) | Result (msec) | Limit (msec) | PASS / FAIL |
|------|---------------------------|------------------------------------------------------------|------------------|------------------|-------------------|------------------------------------|---------------|--------------|-------------|
|      |                           | period (sec)                                               | sweep time (sec) | times in a sweep | times in a period |                                    |               |              |             |
| 3DH1 | 79                        | 31.6                                                       | 5                | 50               | 316.00            | 0.426                              | 134.62        | 400          | PASS        |
| 3DH3 | 79                        | 31.6                                                       | 5                | 26               | 164.32            | 1.730                              | 284.27        | 400          | PASS        |
| 3DH5 | 79                        | 31.6                                                       | 5                | 16               | 101.12            | 3.024                              | 305.79        | 400          | PASS        |

**NOTE:** Test plots of the transmitting time slot are shown on next page.

## GFSK



## 8DPSK

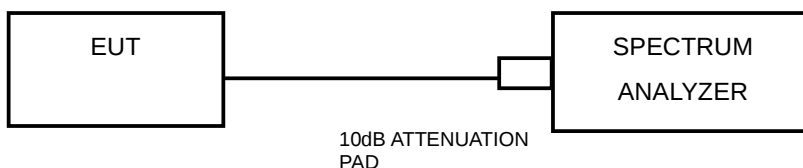


## 4.4 CHANNEL BANDWIDTH

### 4.4.1 LIMITS OF CHANNEL BANDWIDTH

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

### 4.4.2 TEST SETUP



### 4.4.3 TEST INSTRUMENTS

Refer to section 4.2.3 to get information of above instrument.

### 4.4.4 TEST PROCEDURE

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.

### 4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

### 4.4.6 EUT OPERATING CONDITION

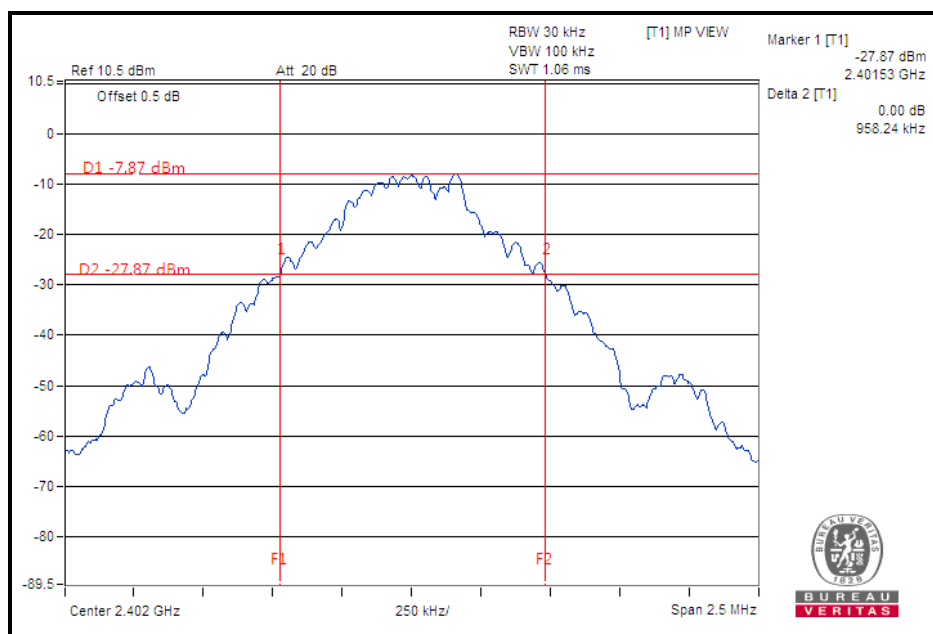
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

#### 4.4.7 TEST RESULTS

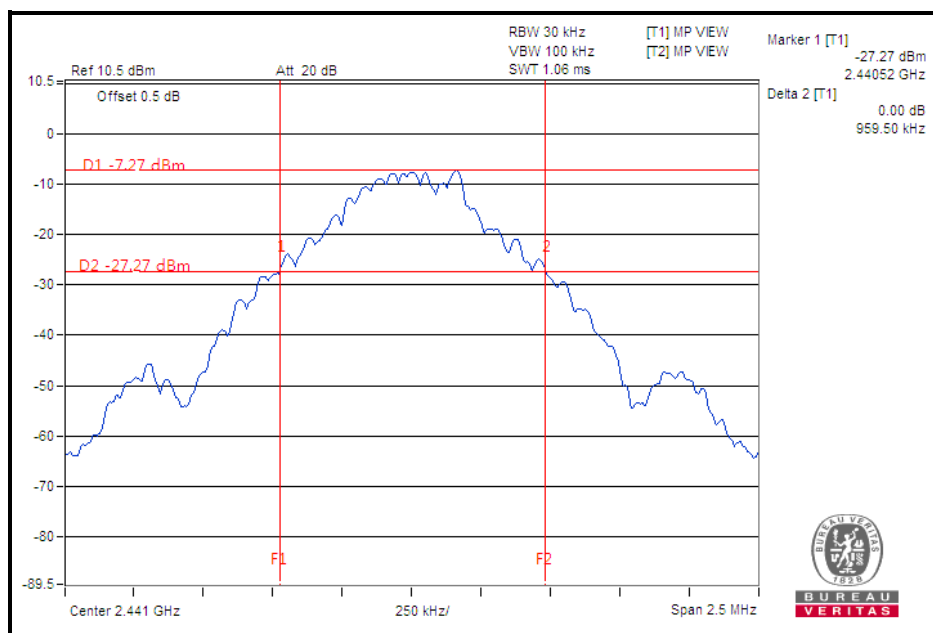
##### GFSK

| CHANNEL | CHANNEL FREQUENCY (MHz) | 20dB BANDWIDTH (MHz) |
|---------|-------------------------|----------------------|
| 0       | 2402                    | 0.958                |
| 39      | 2441                    | 0.960                |
| 78      | 2480                    | 0.960                |

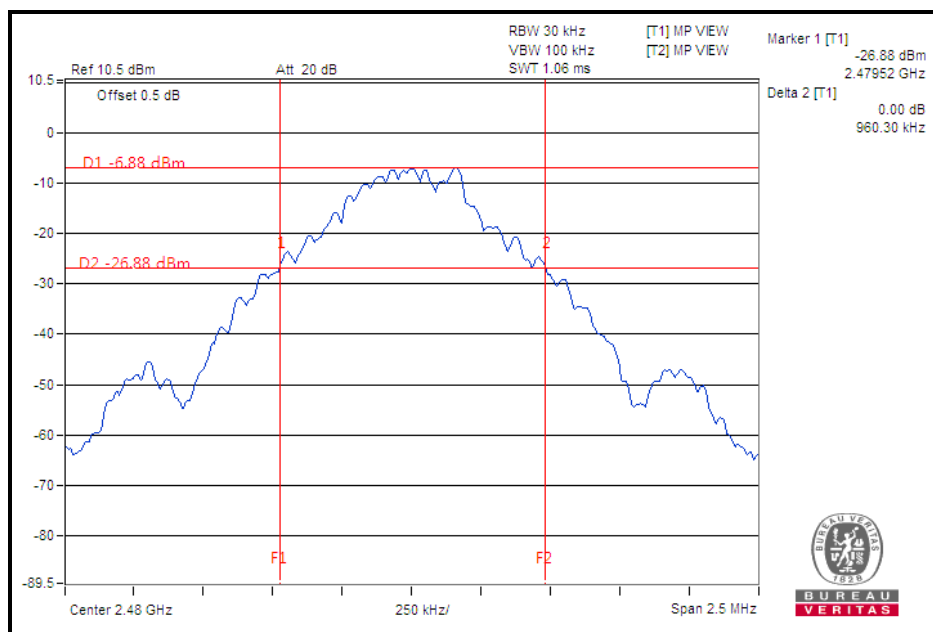
##### CH 0



CH 39



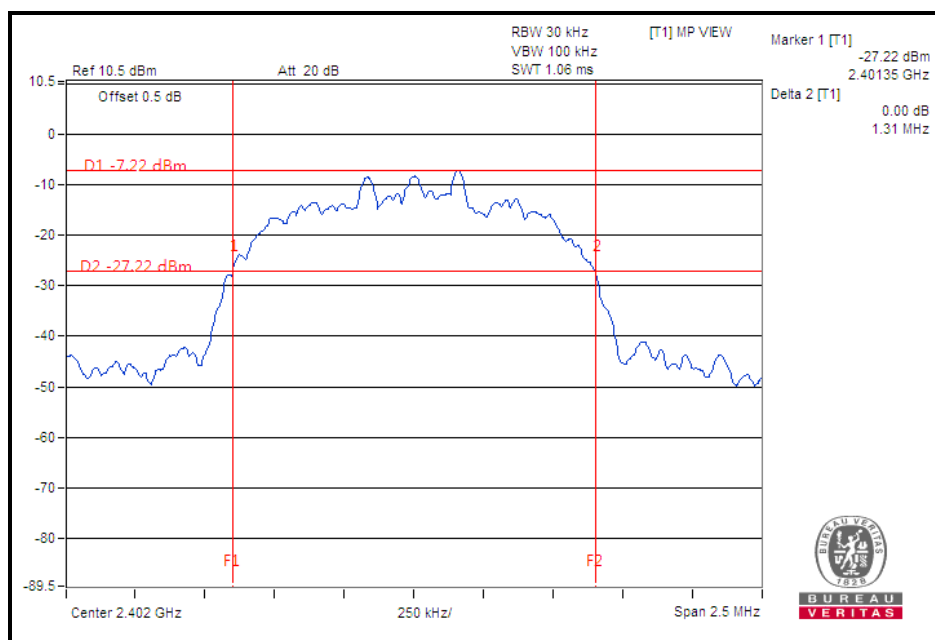
CH 78



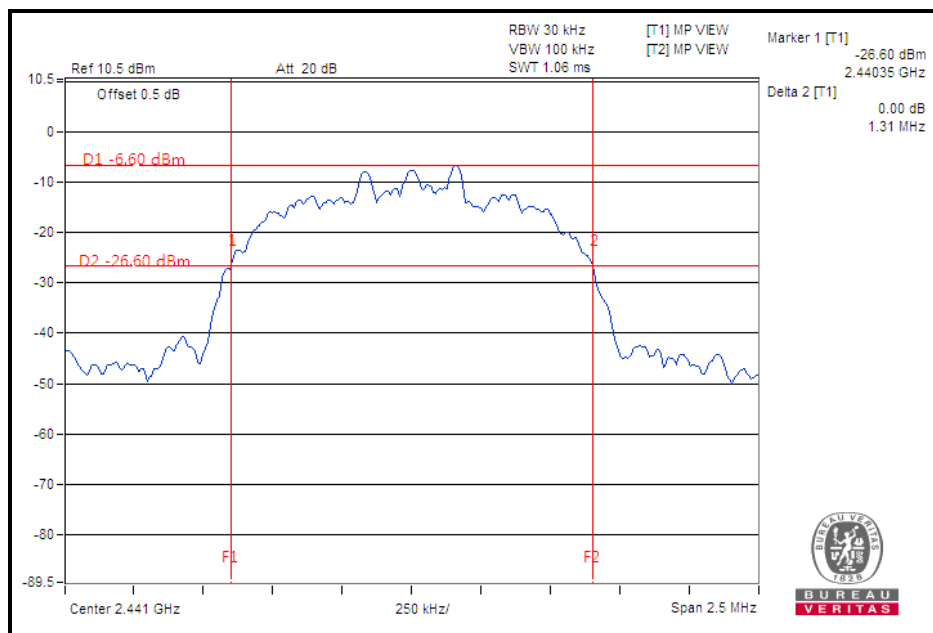
## 8DPSK

| CHANNEL | CHANNEL FREQUENCY (MHz) | 20dB BANDWIDTH (MHz) |
|---------|-------------------------|----------------------|
| 0       | 2402                    | 1.31                 |
| 39      | 2441                    | 1.31                 |
| 78      | 2480                    | 1.31                 |

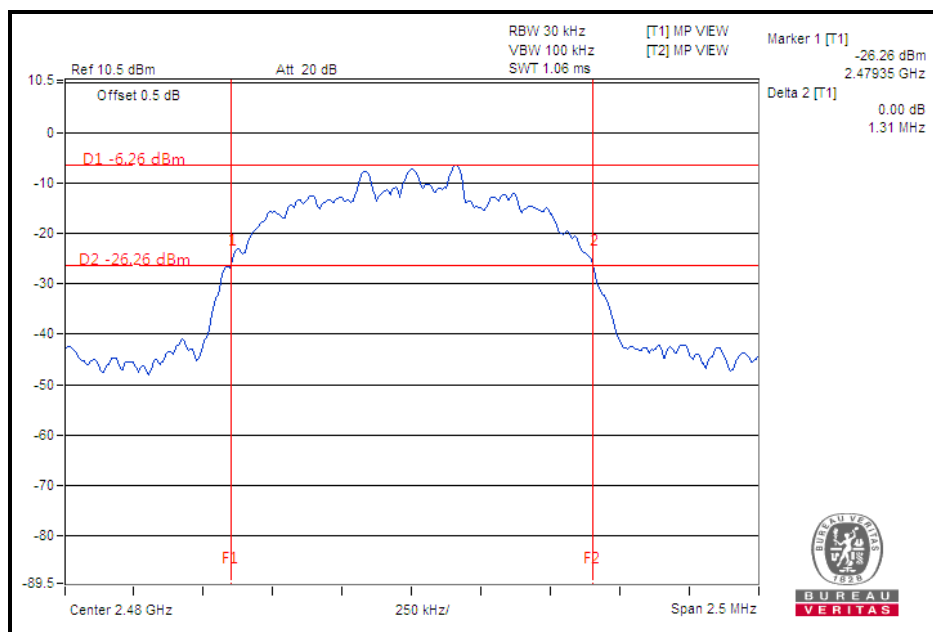
## CH 0



CH 39



CH 78

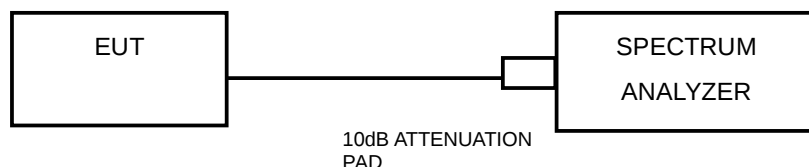


## 4.5 HOPPING CHANNEL SEPARATION

### 4.5.1 LIMIT OF HOPPING CHANNEL SEPARATION

At least 25kHz or two-third of 20dB hopping channel bandwidth (whichever is greater).

### 4.5.2 TEST SETUP



### 4.5.3 TEST INSTRUMENTS

Refer to section 4.2.3 to get information of above instrument.

### 4.5.4 TEST PROCEDURES

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

### 4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

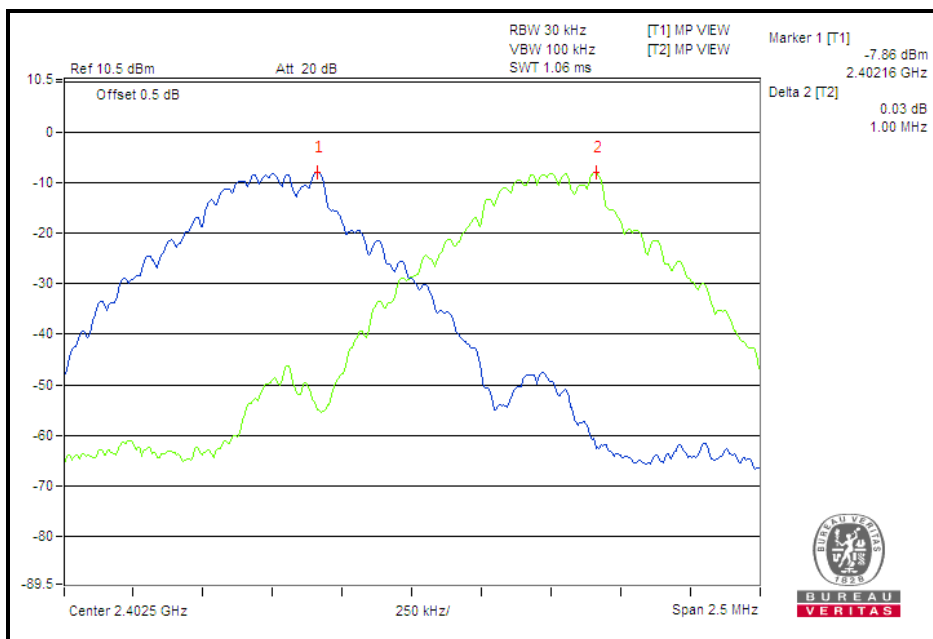
#### 4.5.6 TEST RESULTS

##### GFSK

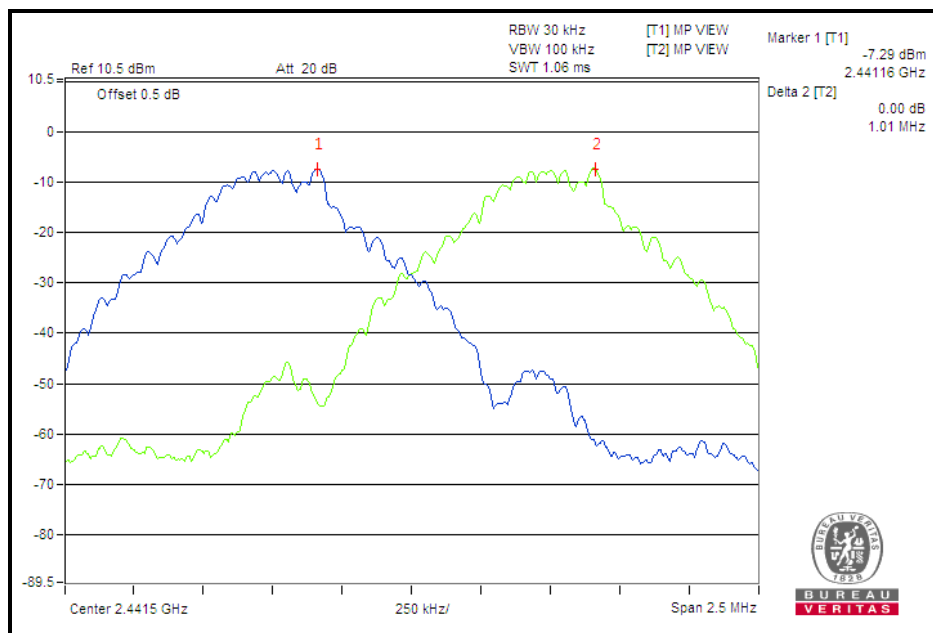
| CHANNEL | FREQUENCY<br>(MHz) | ADJACENT<br>CHANNEL<br>SEPARATION<br>(MHz) | 20dB<br>BANDWIDTH<br>(MHz) | MINIMUM<br>LIMIT (MHz) | PASS / FAIL |
|---------|--------------------|--------------------------------------------|----------------------------|------------------------|-------------|
| 0       | 2402               | 1.00                                       | 0.958                      | 0.639                  | PASS        |
| 39      | 2441               | 1.01                                       | 0.960                      | 0.640                  | PASS        |
| 78      | 2480               | 1.00                                       | 0.960                      | 0.640                  | PASS        |

**NOTE:** The minimum limit is two-third 20dB bandwidth.

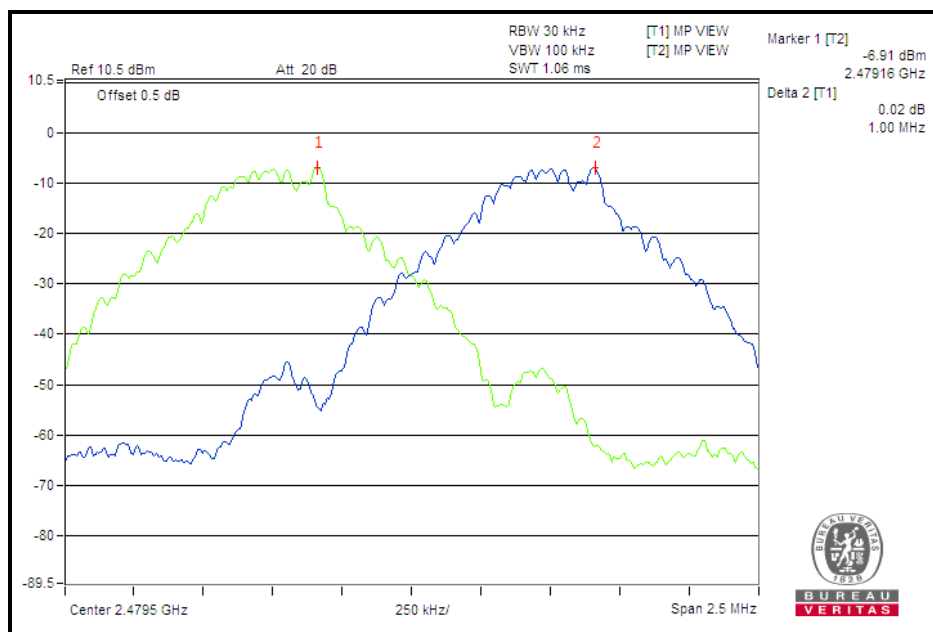
##### CH 0

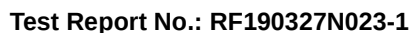


CH 39



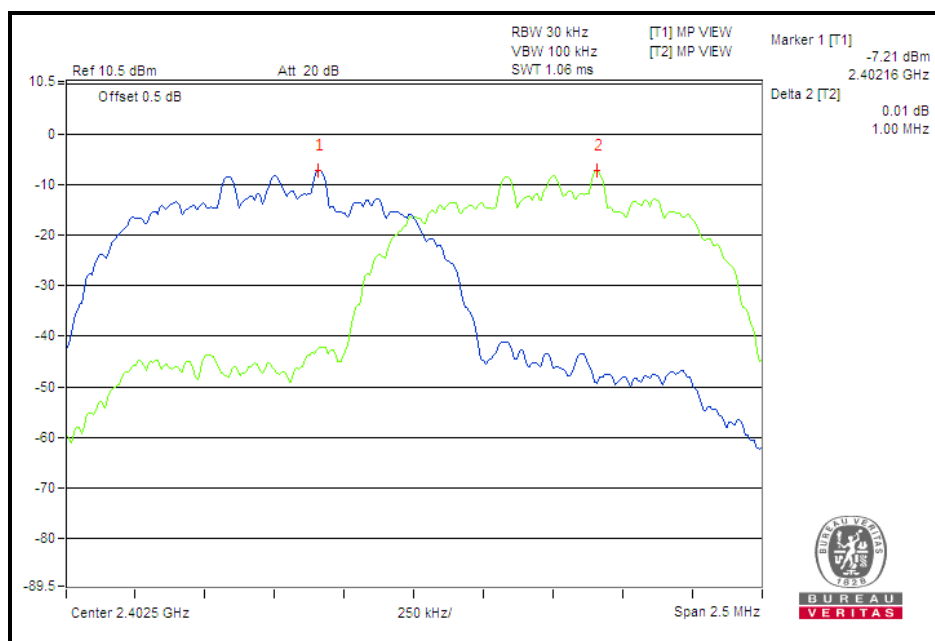
CH 78



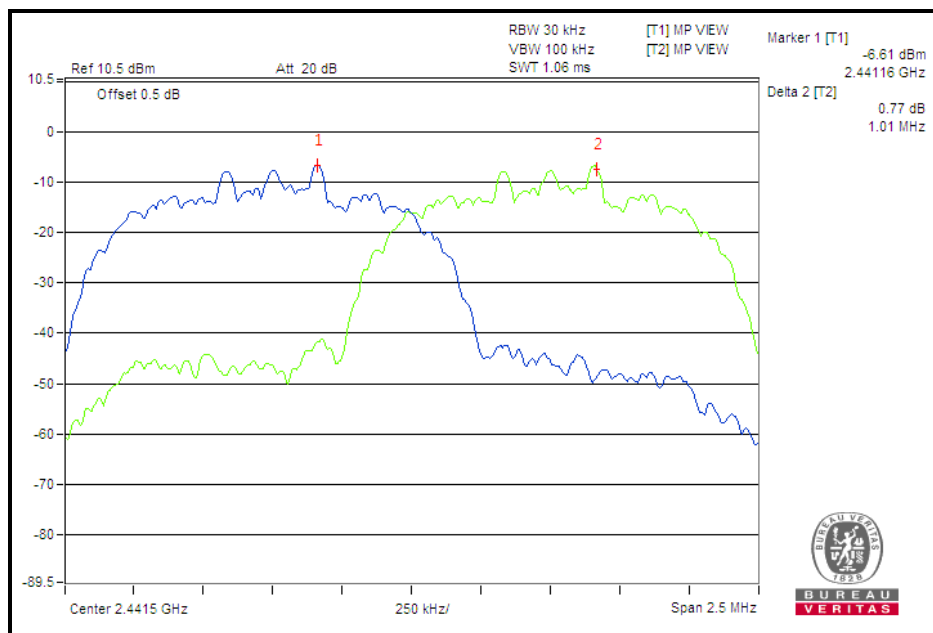


| CHANNEL | FREQUENCY (MHz) | ADJACENT CHANNEL SEPARATION (MHz) | 20dB BANDWIDTH (MHz) | MINIMUM LIMIT (MHz) | PASS / FAIL |
|---------|-----------------|-----------------------------------|----------------------|---------------------|-------------|
| 0       | 2402            | 1.00                              | 1.31                 | 0.873               | PASS        |
| 39      | 2441            | 1.01                              | 1.31                 | 0.873               | PASS        |
| 78      | 2480            | 1.00                              | 1.31                 | 0.873               | PASS        |

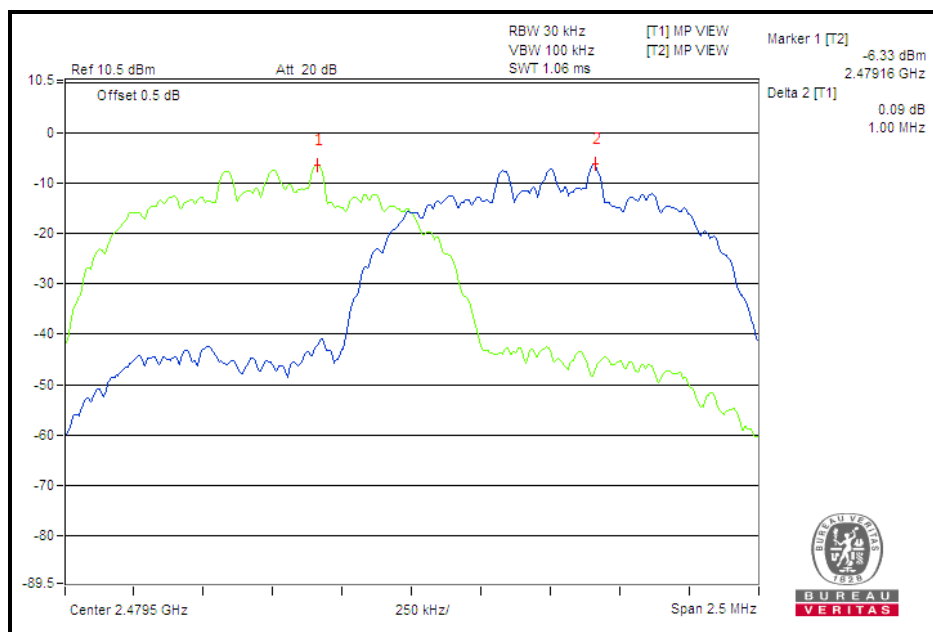
CH 0



CH 39



CH 78

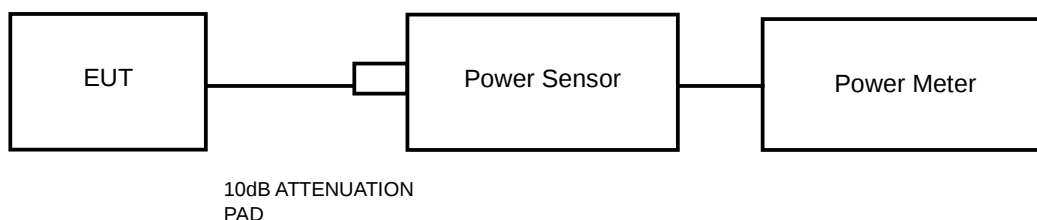


## 4.6 CONDUCTED OUTPUT POWER

### 4.6.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

The Maximum Output Power Measurement is 125mW.

### 4.6.2 TEST SETUP



### 4.6.3 TEST INSTRUMENTS

Refer to section 4.2.3 to get information of above instrument.

### 4.6.4 TEST PROCEDURES

A peak power 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.

### 4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

### 4.6.6 EUT OPERATING CONDITION

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

#### 4.6.7 TEST RESULTS

##### MAXIMUM PEAK OUTPUT POWER

###### GFSK

| CHANNEL | CHANNEL<br>FREQUENCY<br>(MHz) | PEAK POWER<br>(dBm) | PEAK POWER<br>(mW) | PEAK POWER<br>LIMIT (mW) | PASS/FAIL |
|---------|-------------------------------|---------------------|--------------------|--------------------------|-----------|
| 0       | 2402                          | -4.27               | 0.3741             | 125                      | PASS      |
| 39      | 2441                          | -3.68               | 0.4285             | 125                      | PASS      |
| 78      | 2480                          | -3.43               | 0.4539             | 125                      | PASS      |

###### 8DPSK

| CHANNEL | CHANNEL<br>FREQUENCY<br>(MHz) | PEAK POWER<br>(dBm) | PEAK POWER<br>(mW) | PEAK POWER<br>LIMIT (mW) | PASS/FAIL |
|---------|-------------------------------|---------------------|--------------------|--------------------------|-----------|
| 0       | 2402                          | -1.81               | 0.6592             | 125                      | PASS      |
| 39      | 2441                          | -1.29               | 0.7430             | 125                      | PASS      |
| 78      | 2480                          | -1.17               | 0.7638             | 125                      | PASS      |

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

###### GFSK

| CHANNEL | CHANNEL<br>FREQUENCY<br>(MHz) | AVERAGE<br>POWER<br>(dBm) | AVERAGE<br>POWER<br>(mW) |
|---------|-------------------------------|---------------------------|--------------------------|
| 0       | 2402                          | -5.46                     | 0.284                    |
| 39      | 2441                          | -4.88                     | 0.325                    |
| 78      | 2480                          | -4.62                     | 0.345                    |

###### 8DPSK

| CHANNEL | CHANNEL<br>FREQUENCY<br>(MHz) | AVERAGE<br>POWER<br>(dBm) | AVERAGE<br>POWER<br>(mW) |
|---------|-------------------------------|---------------------------|--------------------------|
| 0       | 2402                          | -5.33                     | 0.293                    |
| 39      | 2441                          | -4.79                     | 0.332                    |
| 78      | 2480                          | -4.56                     | 0.350                    |

## **4.7 OUT OF BAND EMISSION MEASUREMENT**

### **4.7.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT**

Below -20dB of the highest emission level of operating band (in 100KHz RBW).

### **4.7.2 TEST INSTRUMENTS**

Refer to section 4.2.3 to get information of above instrument.

### **4.7.3 TEST PROCEDURE**

The transmitter output was connected to the spectrum analyzer via a low loss cable. of Spectrum Analyzer was set RBW to 100 kHz and VBW to 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. Detector = PEAK and Trace mode = Max Hold. The band edges was measured and recorded.

### **4.7.4 DEVIATION FROM TEST STANDARD**

No deviation.

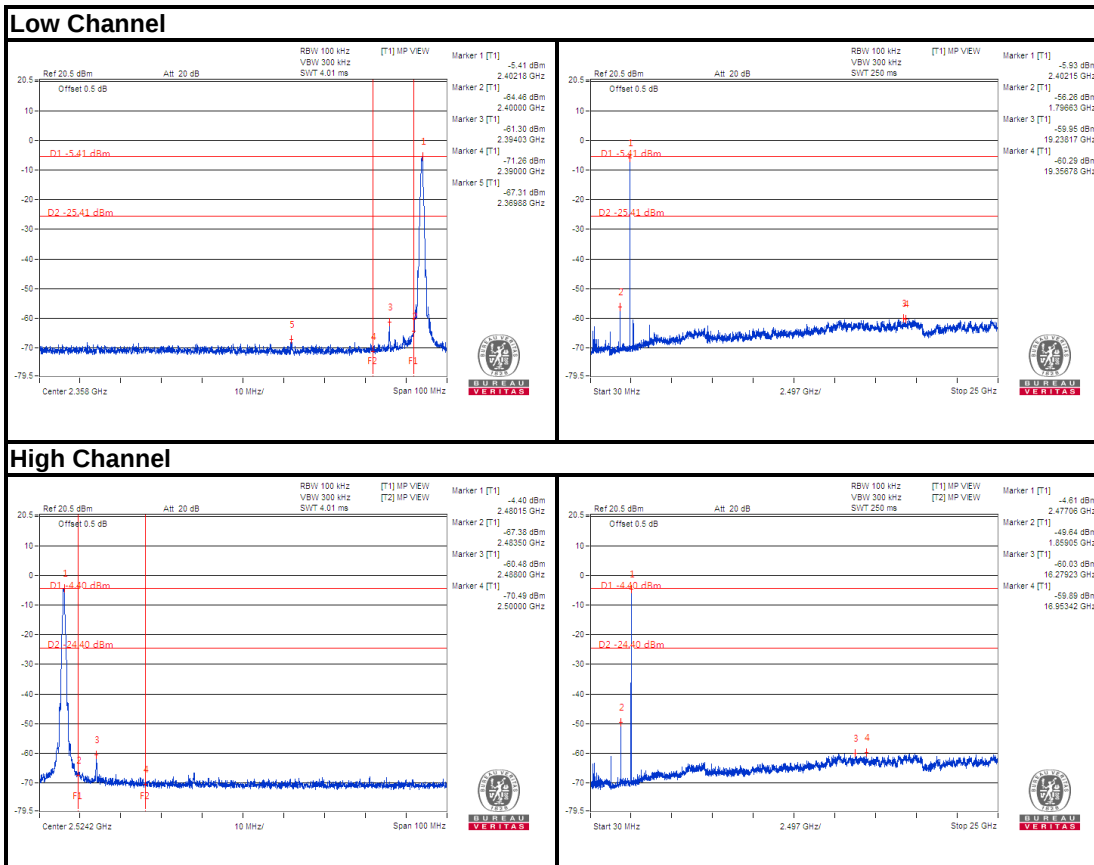
### **4.7.5 EUT OPERATING CONDITION**

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

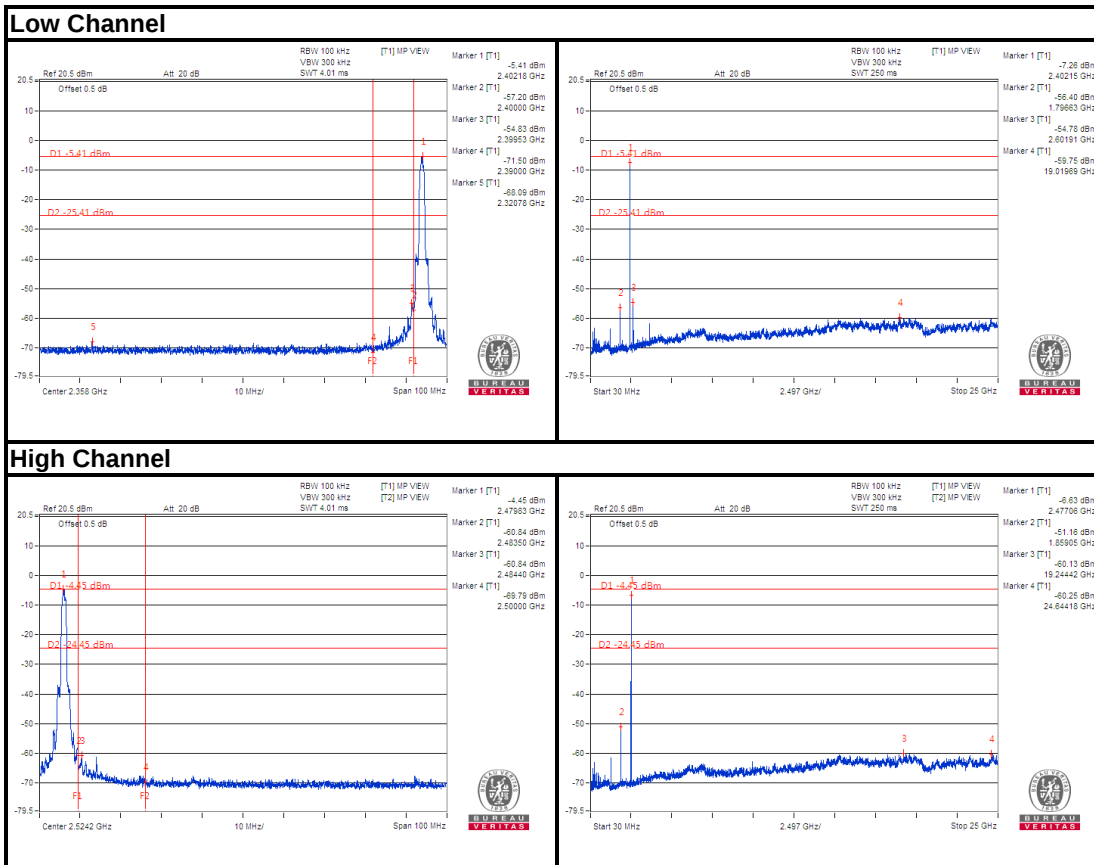
### **4.7.6 TEST RESULTS**

The spectrum plots are attached on the following images. D1 line indicates the highest level. D2 line indicates the 20dB offset below D1. It shows compliance to the requirement.

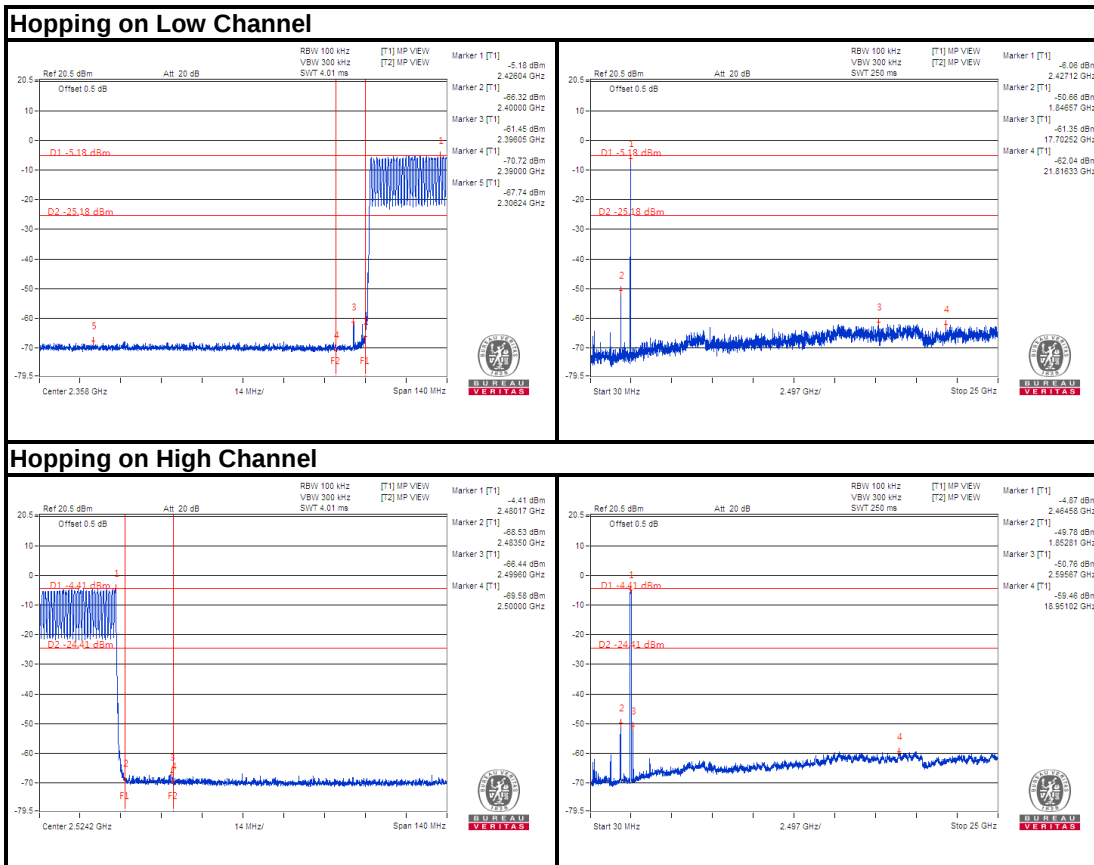
GFSK



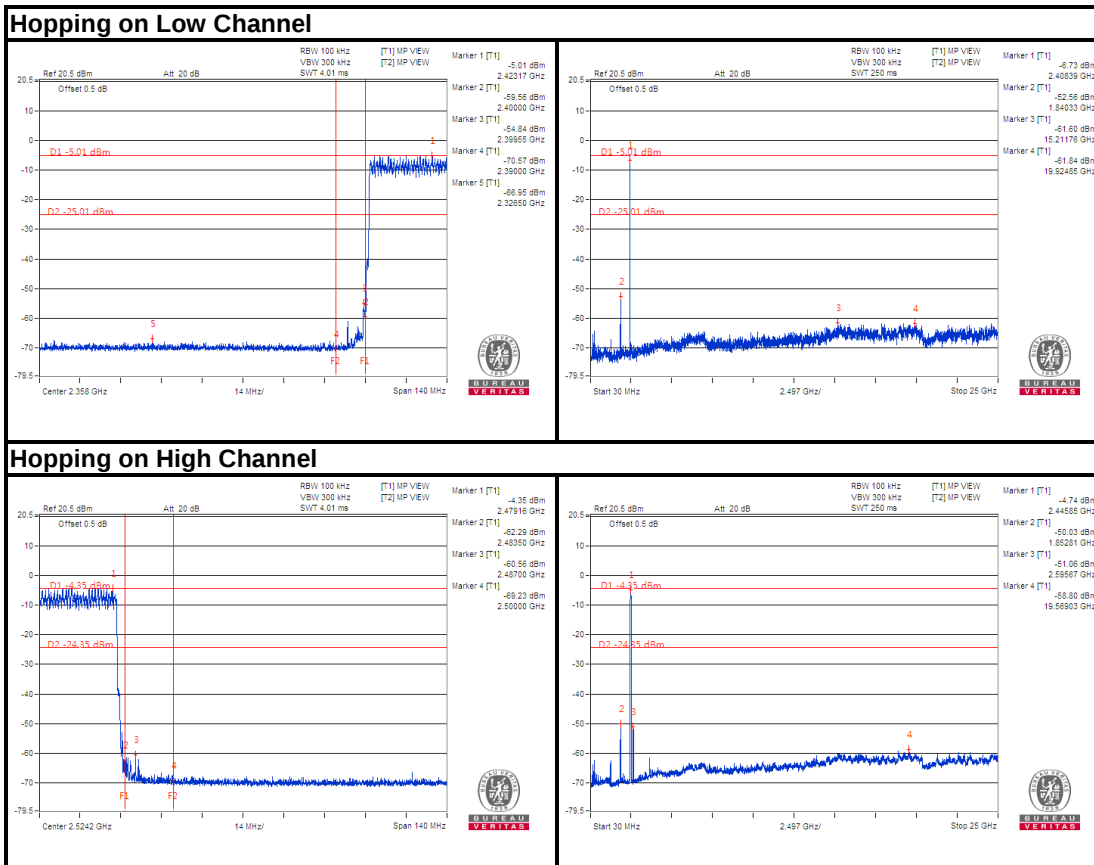
8DPSK



GFSK



8DPSK





Test Report No.: RF190327N023-1

## 5 PHOTOGRAPHS OF THE TEST CONFIGURATION

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



Test Report No.: RF190327N023-1

## 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---