



Test report No. : 4789787917-JP-R1-V0

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Issued date : Mar. 11, 2021

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# **RADIO TEST REPORT**

**Product** : Terminal

**Model Name** : xCL\_AT-170-17W

**Test Regulation** : Article 2 paragraph 1 item 19, MIC notice 88 Appendix 43

**Received Date** : Jan. 25, 2021

**Test Date** : Jan 26, 2021 ~ Feb. 8, 2021

**Issued Date** : Mar. 11, 2021

**Applicant** : XAC Automation Corporation  
4F., No. 30 Industry E. Road IX, Science-Based Industrial Park  
Hsin-Chu, 300, Taiwan, ROC

**Issued By** : Underwriters Laboratories Taiwan Co., Ltd.  
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd.,  
Zhudong Township, Hsinchu County, Taiwan

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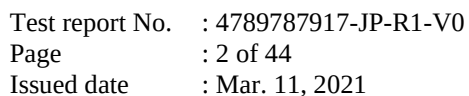
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Doc No: 17-EM-F0938 / 1.0



**Original Test Report No.: 4789787917-JP-R1-V0**

**Underwriters Laboratories Taiwan Co., Ltd.**

Doc No: 17-EM-F0938 / 1.0



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## 1. Attestation of Test Results

**APPLICANT:** XAC Automation Corporation  
4F., No. 30 Industry E. Road IX, Science-Based Industrial Park Hsin-Chu, 300, Taiwan, ROC

**EUT DESCRIPTION:** Terminal

**BRAND:** XAC

**MODEL:** xCL\_AT-170-17W

**SAMPLE STAGE:** Mass-Production

**DATE of TESTED:** Jan. 26, 2021 ~ Feb. 8, 2021

| APPLICABLE STANDARDS                                     |              |
|----------------------------------------------------------|--------------|
| STANDARD                                                 | Test Results |
| Article 2 paragraph 1 item 19, MIC notice 88 Appendix 43 | PASS         |
| ARIB STD-T66                                             | PASS         |

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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Date : Mar. 11, 2021

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Date : Mar. 11, 2021

### Underwriters Laboratories Taiwan Co., Ltd.

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## 2. Summary of Test Results

| Summary of Test Results                              |                                   |             |
|------------------------------------------------------|-----------------------------------|-------------|
| Test Items                                           | MIC Notice                        | Test Result |
| Frequency Tolerance                                  | MIC Notice No. 88 Appendix No. 43 | PASS        |
| Occupied Bandwidth<br>(99% channel power bandwidth)  |                                   | PASS        |
| Spreading Bandwidth<br>(90% channel power bandwidth) |                                   | PASS        |
| Dwell Time                                           |                                   | PASS        |
| Spurious Emission Transmitter                        |                                   | PASS        |
| Antenna Power                                        |                                   | PASS        |
| Spurious Emission Receiver                           |                                   | PASS        |
| Interference Prevention Function                     |                                   | PASS        |



### 3. Test Methodology

The tests documented in this report were performed in accordance with Article 2 paragraph 1 item 19.

### 4. Facilities and Accreditation

|                                  |                                                                                                       |
|----------------------------------|-------------------------------------------------------------------------------------------------------|
| <b>Test Location</b>             | Underwriters Laboratories Taiwan Co., Ltd.                                                            |
| <b>Address</b>                   | Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan |
| <b>Accreditation Certificate</b> | Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.                |



## 5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor  $k=2$ .

| Test Item    | Measurement Frequency Range | K | U(dB) |
|--------------|-----------------------------|---|-------|
| RF Conducted | 9 kHz - 40GHz               | 2 | 1.0   |



## 6. Equipment under Test

### 6.1. Description of EUT

|                                          |                                           |
|------------------------------------------|-------------------------------------------|
| <b>Product</b>                           | Terminal                                  |
| <b>Brand</b>                             | XAC                                       |
| <b>Model Name</b>                        | xCL_AT-170-17W                            |
| <b>Radio Technology</b>                  | Bluetooth EDR                             |
| <b>Operating Frequency</b>               | Bluetooth: 2402MHz ~ 2480MHz              |
| <b>Modulation</b>                        | GFSK, $\pi/4$ -DQPSK, 8DPSK for Bluetooth |
| <b>Transfer Rate</b>                     | Bluetooth EDR: 1/2/3 Mbps                 |
| <b>Nominal Voltage</b>                   | 100-240 Vac                               |
| <b>Number of Channel</b>                 | 79                                        |
| <b>Rated RF Output Power Density</b>     | Refer to Note                             |
| <b>Conducted RF Output Power Density</b> | Refer to Note                             |
| <b>Radiated RF Output Power Density</b>  | Refer to Note                             |
| <b>Antenna Specification</b>             | Refer to item 6.4                         |



Note:

1. The EUT contains following accessory devices

| Product          | Brand                           | Model           | Description                                      | Remark   |
|------------------|---------------------------------|-----------------|--------------------------------------------------|----------|
| AC Adapter       | Mass Power Electronic Limited   | NBS10B050200VUU | Input: 110-240Vac, 300mA<br>Output: 5Vdc, 2000mA | Optional |
| USB-Type C Cable | N/A                             | N/A             | Length:1.2m                                      | -        |
| Battery          | Shenzhen Rishengzhi Electronics | J601            | 3.8Vdc, 5200mAh                                  | -        |

2. The power table as below:

|               | Rated Power<br>(mW/MHz) | Total Conducted RF<br>Output Power<br>Density (mW/MHz) | Radiated RF<br>Output Power<br>Density (mW/MHz) |
|---------------|-------------------------|--------------------------------------------------------|-------------------------------------------------|
| Bluetooth EDR |                         |                                                        |                                                 |
| Normal mode   | 0.08884                 | 0.07528                                                | 0.08217                                         |

3. Test Environment:

Measurement temperature : 24 °C ~ 26 °C

Measurement humidity : 55% ~ 65%

4. Test Personnel: Wayne Chen



## 6.2. Description of test mode

### Bluetooth EDR

| 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           |         |                |



**NOTE 1:** By means of test software provided by manufacture, the power levels during the tests were set according to the following codes:

**NOTE 2:** Pre-Scan has been conducted to determine the worst-case mode from packet type; we found the DH5 was the worst case, and chosen for final test. Following test items were selected for the final test as listed below.

| Test Items                    |
|-------------------------------|
| Spurious Emissions            |
| Power Density (Antenna Power) |

| Modulation type: GFSK |               | Modulation type: $\pi/4$ -DQPSK |               | Modulation type: 8DPSK |               |
|-----------------------|---------------|---------------------------------|---------------|------------------------|---------------|
| Channel               | Power Setting | Channel                         | Power Setting | Channel                | Power Setting |
| 0                     | Default       | 0                               | Default       | 0                      | Default       |
| 39                    | Default       | 39                              | Default       | 39                     | Default       |
| 78                    | Default       | 78                              | Default       | 78                     | Default       |



### 6.3. Test Condition

| Test Conditions | Voltage<br>(Vdc) |
|-----------------|------------------|
| Vnormal         | 3.8              |

Note: Since the input voltage to receiver RF circuit varies below  $\pm 1\%$  when the input voltage from the external power supply to the receiver varies  $\pm 10\%$ , therefore only execute normal condition test.

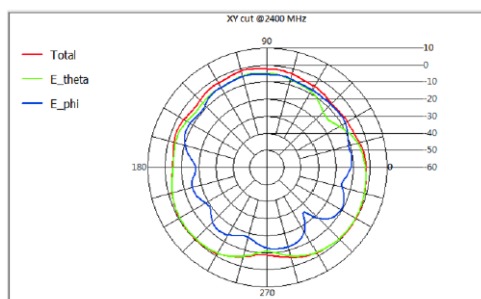


## 6.4. Description of Available Antennas

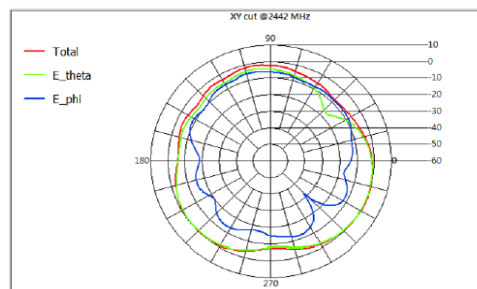
### 6.4.1. Antenna Specification

| Ant. No. | Brand Name | Model Name   | Antenna Type | Connector Type | Antenna Gain(dBi) |
|----------|------------|--------------|--------------|----------------|-------------------|
| 1        | ACON       | AEF6P-100001 | Monopole     | i-pex          | 0.38              |

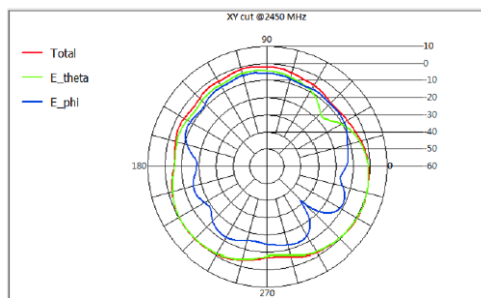
### 6.4.2 Antenna Pattern



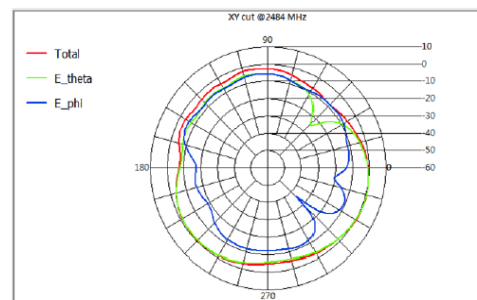
|                     |          |
|---------------------|----------|
| Center Frequency    | 2400 MHz |
| Horizontal (dBi)    | -0.49    |
| Vertical (dBi) peak | -4.63    |
| H+V (dBi) peak      | -0.09    |



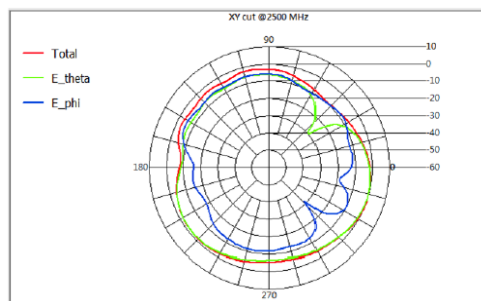
|                       |         |
|-----------------------|---------|
| Center Frequency      | 2442MHz |
| Horizontal (dBi) peak | 0.17    |
| Vertical (dBi) peak   | -5.53   |
| H+V (dBi) peak        | 0.45    |



|                       |         |
|-----------------------|---------|
| Center Frequency      | 2450MHz |
| Horizontal (dBi) peak | 0.37    |
| Vertical (dBi) peak   | -5.07   |
| H+V (dBi) peak        | 0.68    |



|                       |         |
|-----------------------|---------|
| Center Frequency      | 2484MHz |
| Horizontal (dBi) peak | 0.38    |
| Vertical (dBi) peak   | -5.57   |
| H+V (dBi) peak        | 0.63    |



|                       |         |
|-----------------------|---------|
| Center Frequency      | 2500MHz |
| Horizontal (dBi) peak | -0.36   |
| Vertical (dBi) peak   | -5.41   |
| H+V (dBi) peak        | -0.07   |



## 7. Test Instruments

| Description       | Manufacturer | Model No. | Serial No. | Calibration Authority      | Cal. Method | Cal. Date  | Expired date |
|-------------------|--------------|-----------|------------|----------------------------|-------------|------------|--------------|
| Spectrum Analyzer | Keysight     | N9010A    | MY56070834 | Electronics Testing Center | c)          | 2020/11/6  | 2021/11/5    |
| Power meter       | Anritsu      | MA2411B   | 1531202    | Electronics Testing Center | c)          | 2020/12/21 | 2021/12/20   |
| Power sensor      | Anritsu      | ML2495A   | 1645002    | Electronics Testing Center | c)          | 2020/12/21 | 2021/12/20   |
| Signal Generator  | Keysight     | N5182B    | MY56200244 | Electronics Testing Center | c)          | 2021/1/15  | 2022/1/14    |

Note: Calibration Method

- a) : Calibration conducted by the National Institute of Information and Communications Technology ~ NICT ~ or a designated calibration agency under Article 102-18 paragraph (1) ~ TELEC Engineering Center, Intertek Japan K.K., Keysight Technologies, Inc ~.
- b) : Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992) ~ Japan Calibration Service System ~
- c) : Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1) ~ TELEC Engineering Center, Intertek Japan K.K., Keysight Technologies, Inc ~.
- d) : Calibration conducted by using other equipment that listed above from a) to c)



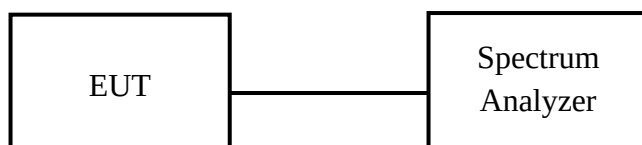
## 8. Test Results

### 8.1. Frequency Tolerance

#### 8.1.1 Requirements

The limitation of Frequency Tolerance is less than or equal to  $\pm 50\text{ppm}$ .

#### 8.1.2 Test Setup



#### 8.1.3 Test Results

##### Modulation: GFSK

| Mode | Voltage (Vdc) | Freq. (MHz) | Carrier Frequency (MHz) | Frequency Tolerance (ppm) | Limits (ppm)       |
|------|---------------|-------------|-------------------------|---------------------------|--------------------|
| BT   | Normal        | 2402        | 2401.9798               | -8.430475                 | $\pm 50\text{ppm}$ |
|      |               | 2441        | 2440.9798               | -8.295780                 | $\pm 50\text{ppm}$ |
|      |               | 2480        | 2479.9798               | -8.165323                 | $\pm 50\text{ppm}$ |

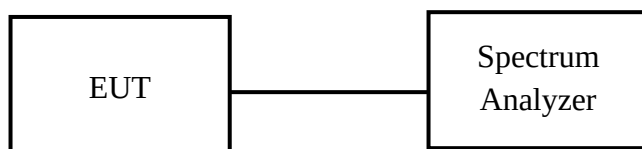


## 8.2. Occupied Bandwidth (99% Channel Power Bandwidth)

### 8.2.1 Requirements

| Item               | Limits                                                                                                                                                        |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Occupied Bandwidth | FH, FH+DS, FH+OFDM: $\leq 83.5\text{MHz}$<br>Others: $\leq 26\text{MHz}$<br>OFDM1: $\leq 26\text{MHz}$<br>OFDM2: $26\text{MHz} < \text{BW} \leq 38\text{MHz}$ |

### 8.2.2 Test Setup





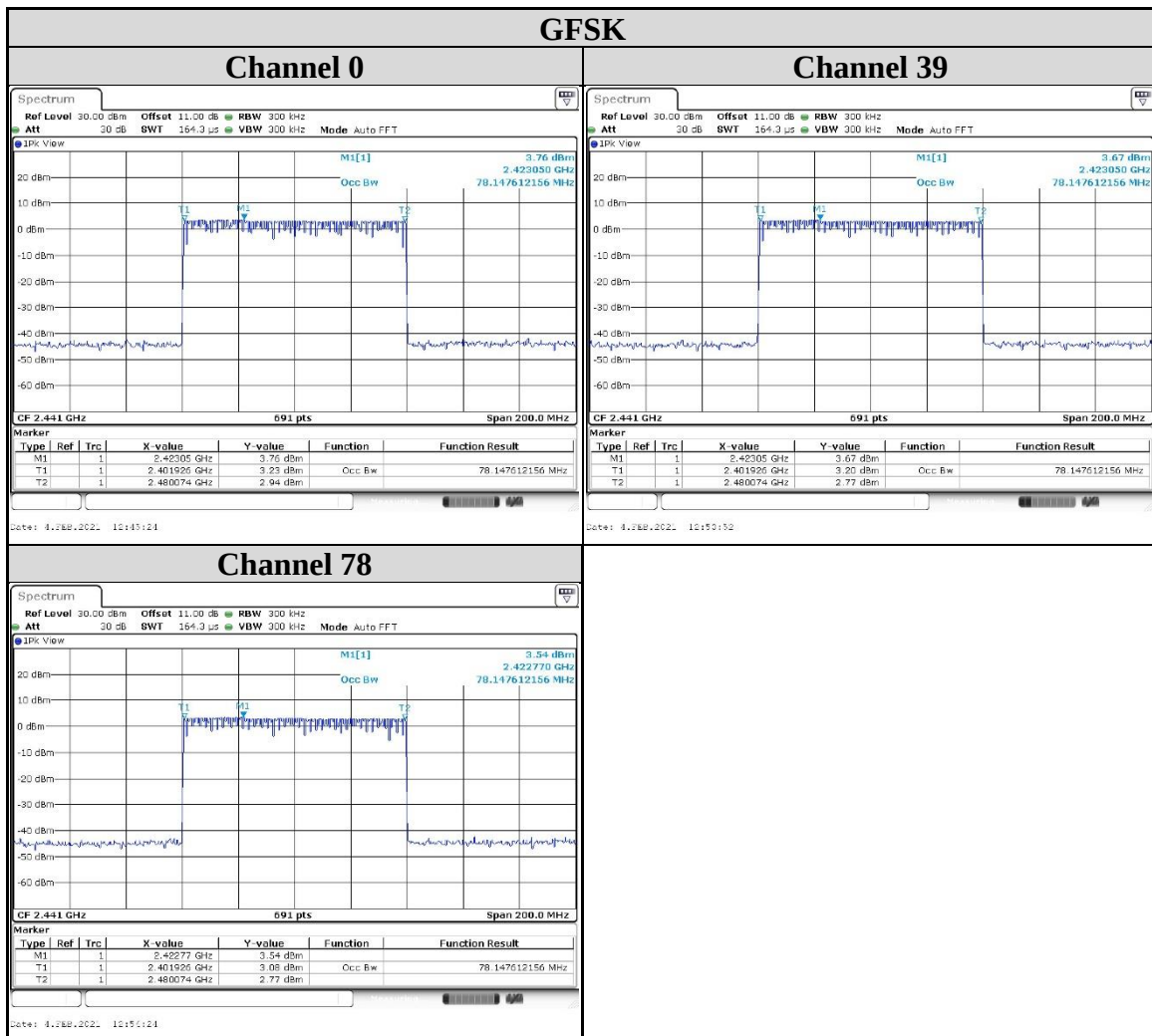
## 8.2.3 Test Results

### Bluetooth EDR

| Mode | Voltage             | Data Rate | Frequency (MHz) | 99% Bandwidth (MHz) | Limit (MHz) | Pass/Fail |
|------|---------------------|-----------|-----------------|---------------------|-------------|-----------|
| GFSK | V <sub>normal</sub> | DH1       | 2402            | 78.148              | ≤ 83.5      | Pass      |
|      |                     | DH3       | 2441            | 78.148              | ≤ 83.5      | Pass      |
|      |                     | DH5       | 2480            | 78.148              | ≤ 83.5      | Pass      |

Note:

1. For the test plots please refer to the below pages.

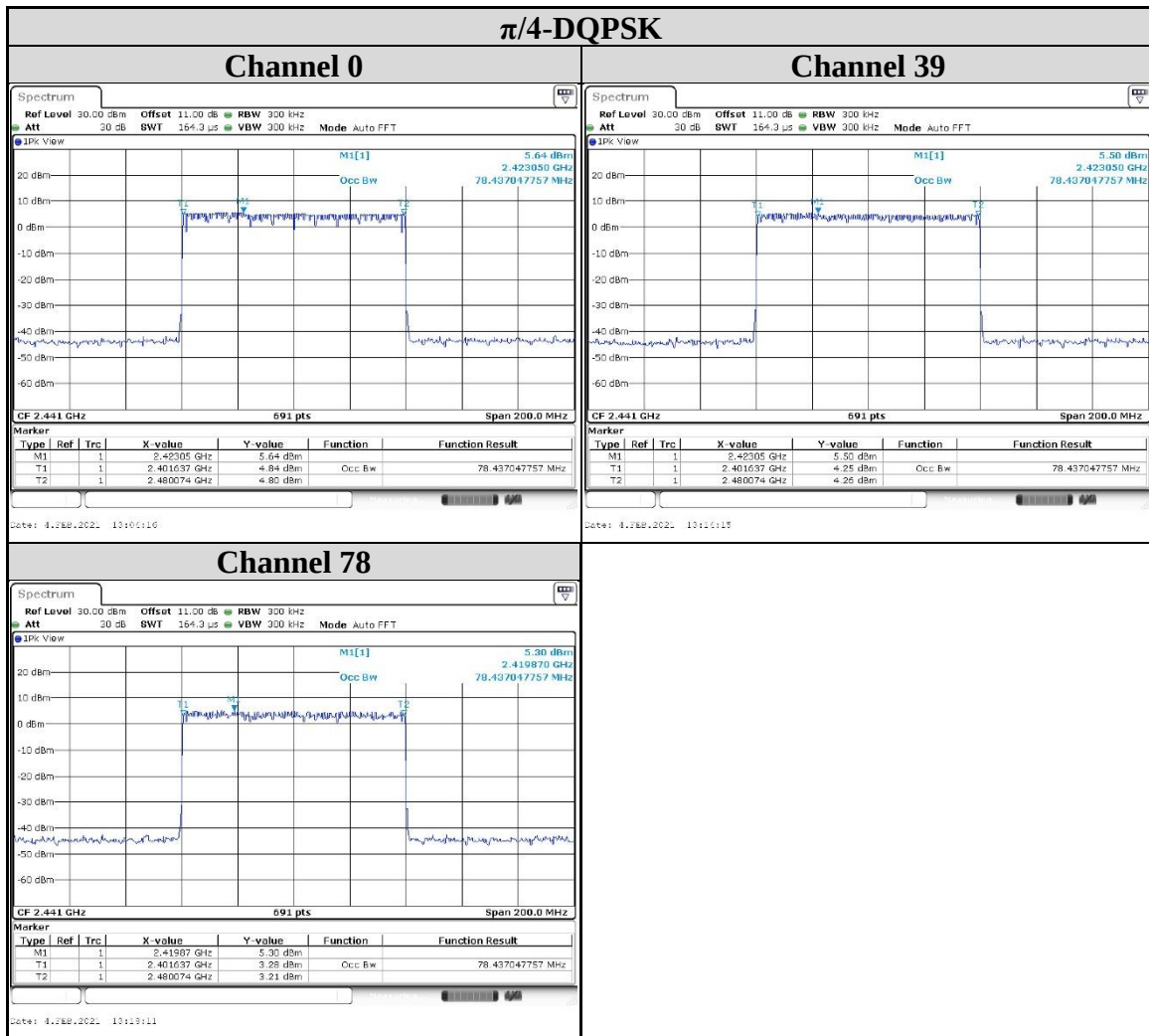




| Mode           | Voltage             | Data Rate | Frequency (MHz) | 99% Bandwidth (MHz) | Limit (MHz) | Pass/Fail |
|----------------|---------------------|-----------|-----------------|---------------------|-------------|-----------|
| $\pi/4$ -DQPSK | V <sub>normal</sub> | 2DH1      | 2402            | 78.437              | $\leq 83.5$ | Pass      |
|                |                     | 2DH3      | 2441            | 78.437              | $\leq 83.5$ | Pass      |
|                |                     | 2DH5      | 2480            | 78.437              | $\leq 83.5$ | Pass      |

Note:

1. For the test plots please refer to the below pages.

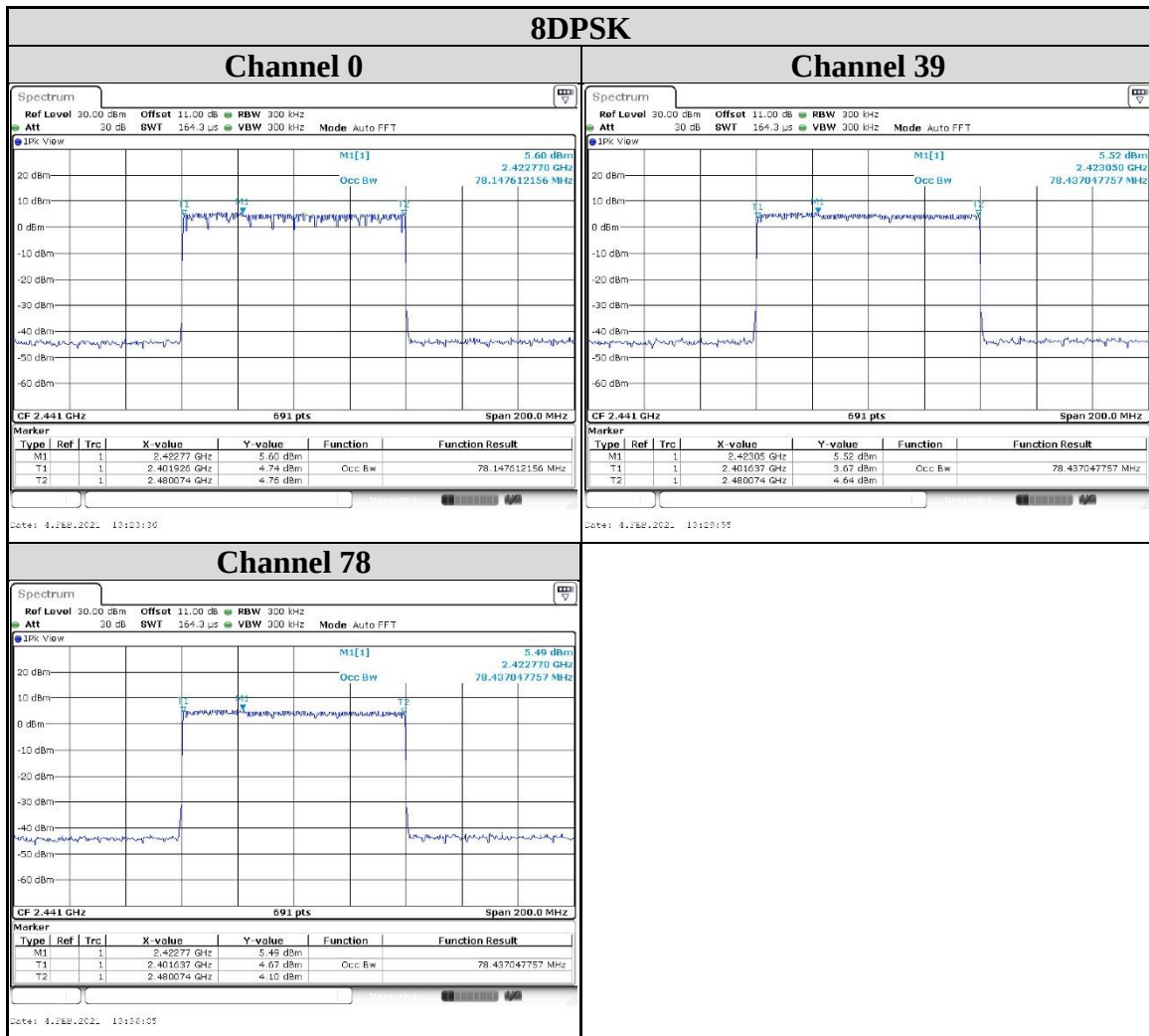




| Mode  | Voltage             | Data Rate | Frequency (MHz) | 99% Bandwidth (MHz) | Limit (MHz) | Pass/Fail |
|-------|---------------------|-----------|-----------------|---------------------|-------------|-----------|
| 8DPSK | V <sub>normal</sub> | 3DH1      | 2402            | 78.148              | ≤ 83.5      | Pass      |
|       |                     | 3DH3      | 2441            | 78.437              | ≤ 83.5      | Pass      |
|       |                     | 3DH5      | 2480            | 78.437              | ≤ 83.5      | Pass      |

Note:

1. For the test plots please refer to the below pages.



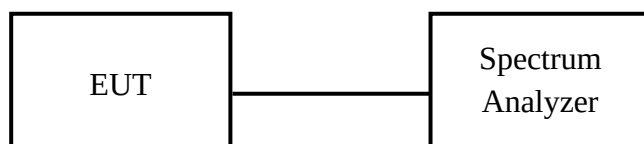


### 8.3. Spreading Bandwidth (90% Channel Power Bandwidth)

#### 8.3.1 Requirements

| Item                | Limit          | Remark                                 |
|---------------------|----------------|----------------------------------------|
| Spreading Bandwidth | $\geq 500$ kHz | (For DSSS, FHSS)                       |
| Spreading Factor    | $\geq 5$       | Operating frequency 2400 to 2483.5 MHz |

#### 8.3.2 Test Setup





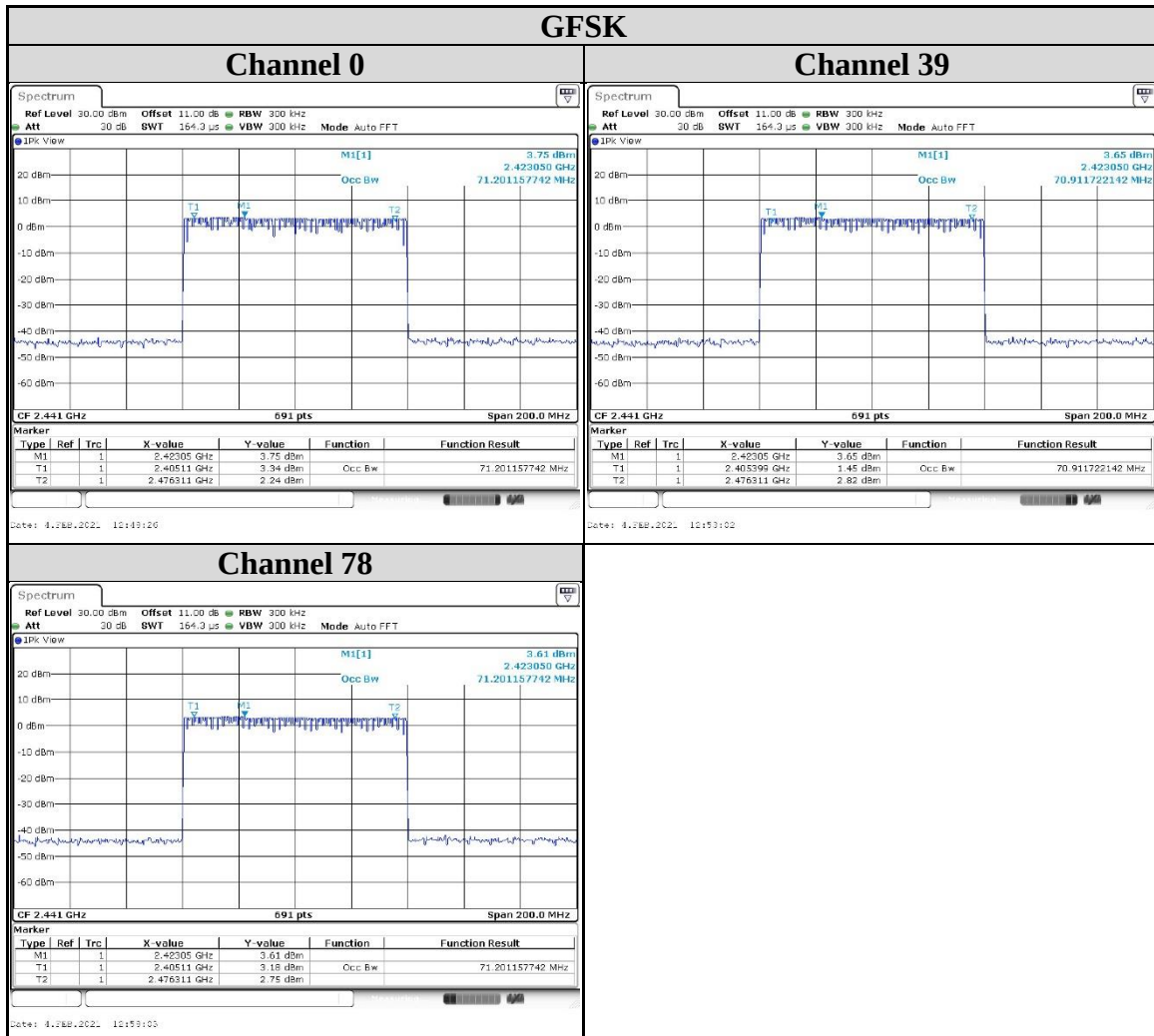
## 8.3.3 Test Data

## Bluetooth EDR

| Mode | Voltage | Data Rate | Frequency (MHz) | Occupied Bandwidth (MHz) | Spreading Factor | Limit    | Pass/Fail |
|------|---------|-----------|-----------------|--------------------------|------------------|----------|-----------|
| GFSK | Vnormal | DH1       | 2402            | 71.201                   | 71.20            | $\geq 5$ | Pass      |
|      |         | DH3       | 2441            | 70.912                   | 70.91            | $\geq 5$ | Pass      |
|      |         | DH5       | 2480            | 71.201                   | 71.20            | $\geq 5$ | Pass      |

Note:

1. For the test plots please refer to the below pages.
2. Spreading Factor: 90% channel power bandwidth / 1.

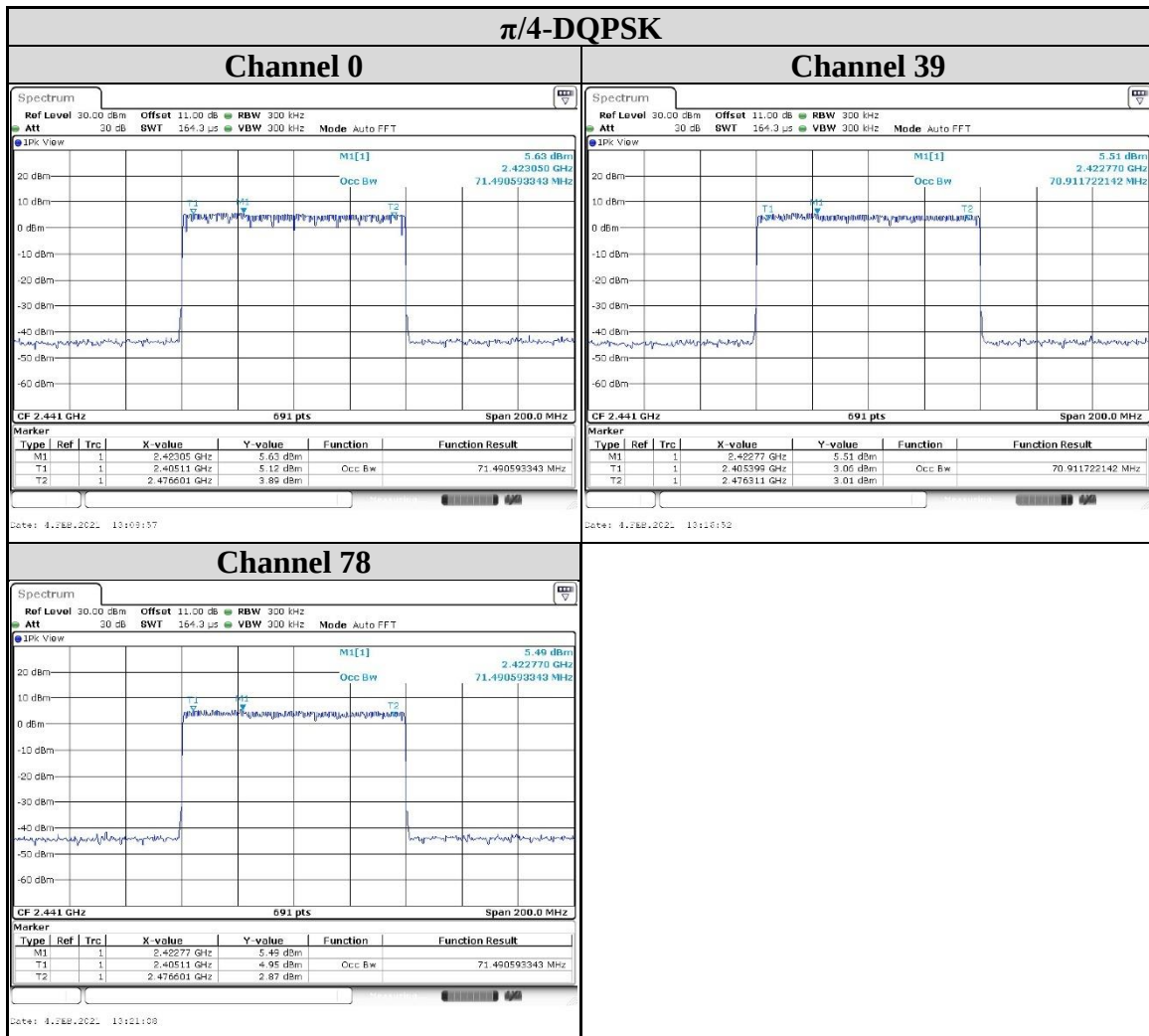




| Mode           | Voltage | Data Rate | Frequency (MHz) | Occupied Bandwidth (MHz) | Spreading Factor | Limit    | Pass/Fail |
|----------------|---------|-----------|-----------------|--------------------------|------------------|----------|-----------|
| $\pi/4$ -DQPSK | Vnormal | 2DH1      | 2402            | 71.491                   | 71.49            | $\geq 5$ | Pass      |
|                |         | 2DH3      | 2441            | 70.912                   | 70.91            | $\geq 5$ | Pass      |
|                |         | 2DH5      | 2480            | 71.491                   | 71.49            | $\geq 5$ | Pass      |

Note:

1. For the test plots please refer to the below pages.
2. Spreading Factor: 90% channel power bandwidth / 1.

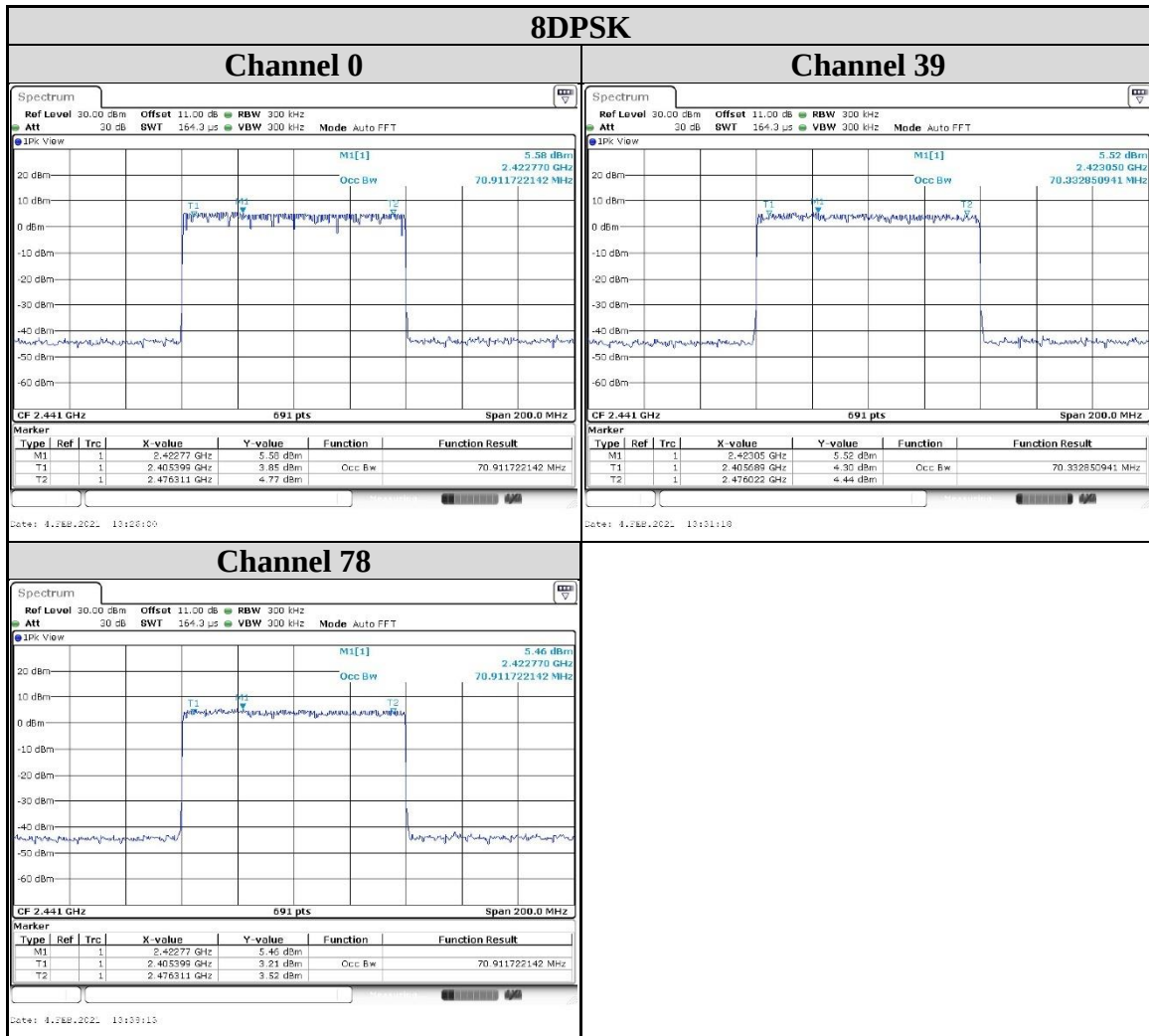




| Mode  | Voltage | Data Rate | Frequency (MHz) | Occupied Bandwidth (MHz) | Spreading Factor | Limit    | Pass/Fail |
|-------|---------|-----------|-----------------|--------------------------|------------------|----------|-----------|
| 8DPSK | Vnormal | 3DH1      | 2402            | 70.912                   | 70.91            | $\geq 5$ | Pass      |
|       |         | 3DH3      | 2441            | 70.333                   | 70.33            | $\geq 5$ | Pass      |
|       |         | 3DH5      | 2480            | 70.912                   | 70.91            | $\geq 5$ | Pass      |

Note:

1. For the test plots please refer to the below pages.
2. Spreading Factor: 90% channel power bandwidth / 1.





## 8.4. Dwell Time

### 8.4.1 Requirements

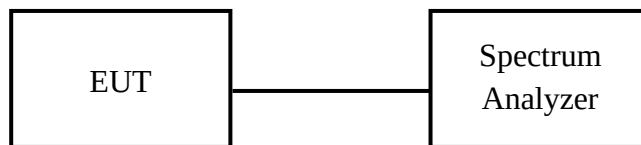
| Item       | Limits                                                                                                                                                  |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dwell Time | FH, FH+DS, FH+OFDM: $\leq 0.4$ sec<br>(The total sum of holding time at arbitrary frequencies within the time multiplied 0.4 sec by the spreading rate) |

Formula:

Dwell time with Normal mode = [diffusion rate/ 79] x duty-cycle x 0.4 seconds

Dwell time with AFH mode= [diffusion rate/20] x duty-cycle x 0.4 seconds

### 8.4.2 Test Setup





## 8.4.3 Test Results

## GFSK

## Normal Mode:

| Test Condition      | Mode | Spreading Rate | [Spreading Rate/79]*0.4 | Duty Cycle | Result (msec) | Limit (msec) |
|---------------------|------|----------------|-------------------------|------------|---------------|--------------|
| V <sub>normal</sub> | DH1  | 71.20          | 0.361                   | 0.783      | 282.14        | 400          |
|                     | DH3  | 70.91          | 0.359                   | 0.941      | 337.94        | 400          |
|                     | DH5  | 71.20          | 0.361                   | 0.966      | 348.21        | 400          |

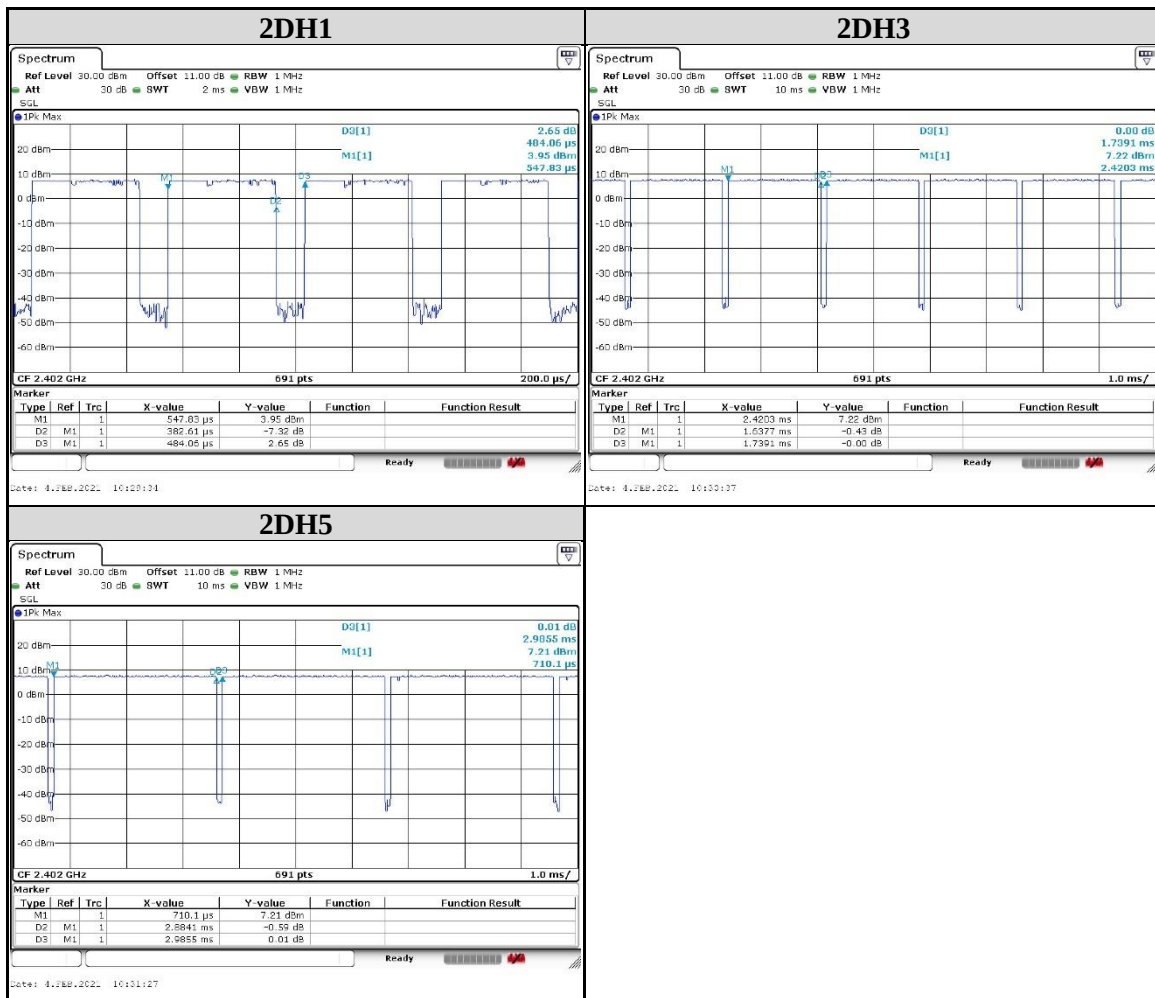




## $\pi/4$ -DQPSK

### Normal Mode:

| Test Condition      | Mode | Spreading Rate | [Spreading Rate/79]*0.4 | Duty Cycle | Result (msec) | Limit (msec) |
|---------------------|------|----------------|-------------------------|------------|---------------|--------------|
| V <sub>normal</sub> | DH1  | 71.49          | 0.362                   | 0.790      | 286.11        | 400          |
|                     | DH3  | 70.91          | 0.359                   | 0.942      | 338.11        | 400          |
|                     | DH5  | 71.49          | 0.362                   | 0.966      | 349.68        | 400          |



**8DPSK****Normal Mode:**

| Test Condition      | Mode | Spreading Rate | [Spreading Rate/79]*0.4 | Duty Cycle | Result (msec) | Limit (msec) |
|---------------------|------|----------------|-------------------------|------------|---------------|--------------|
| V <sub>normal</sub> | DH1  | 70.91          | 0.359                   | 0.792      | 284.25        | 400          |
|                     | DH3  | 70.33          | 0.356                   | 0.942      | 335.35        | 400          |
|                     | DH5  | 70.91          | 0.359                   | 0.966      | 346.85        | 400          |



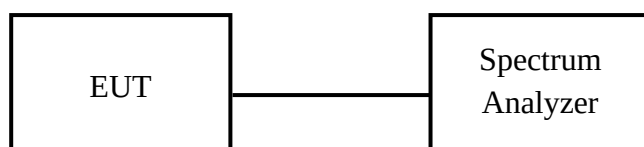


## 8.5. Spurious Emissions Transmitter

### 8.5.1 Requirements

| Frequencies(MHz)    | Limits                                |
|---------------------|---------------------------------------|
| 30MHz-1GHz          | $\leq 0.25 \mu\text{W}/100\text{kHz}$ |
| 1GHz-2.387GHz       | $\leq 2.5 \mu\text{W}/\text{MHz}$     |
| 2.387GHz-2.4GHz     | $\leq 25 \mu\text{W}/\text{MHz}$      |
| 2.4835GHz-2.4965GHz | $\leq 25 \mu\text{W}/\text{MHz}$      |
| 2.4965GHz -13GHz    | $\leq 2.5 \mu\text{W}/\text{MHz}$     |

### 8.5.2 Test Setup



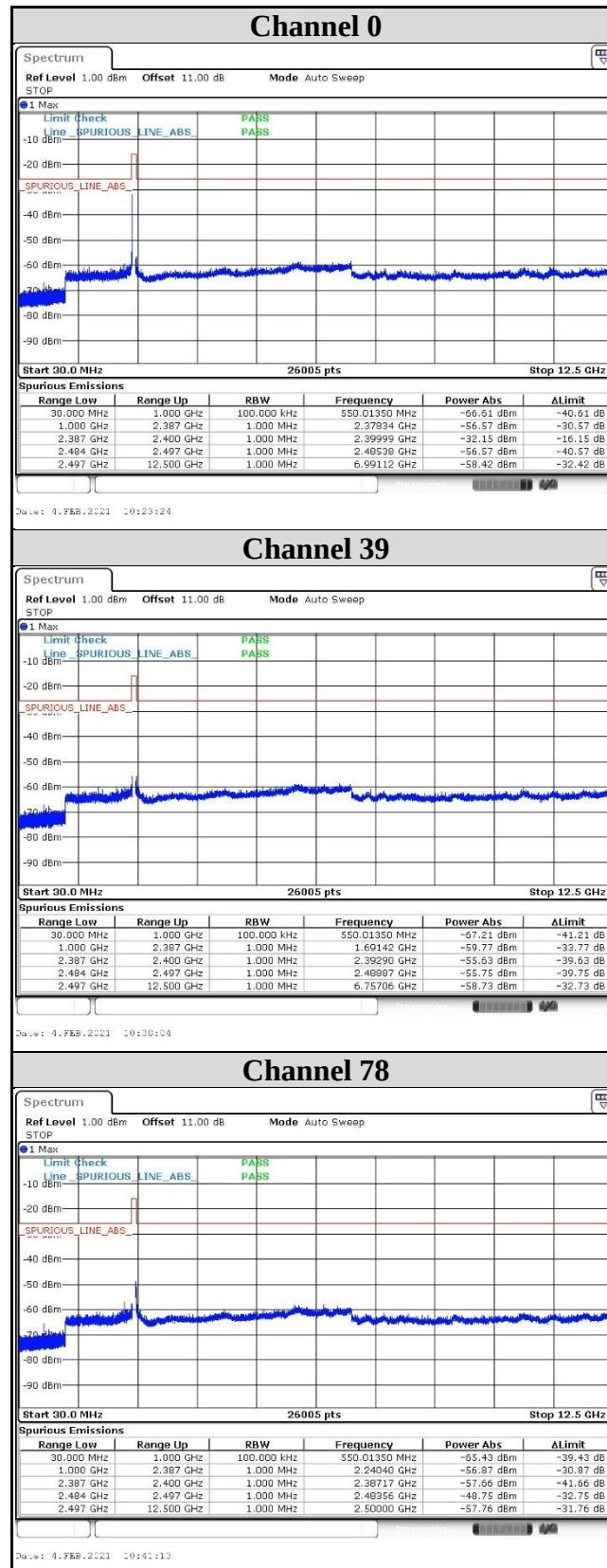


## 8.5.3 Test Results

## Modulation: GFSK

| Test Channel        |                           | Ch 0 (2402 MHz) |                | CH39 (2441 MHz) |                | Limit         | Result |
|---------------------|---------------------------|-----------------|----------------|-----------------|----------------|---------------|--------|
| Test Condition      | Frequency Range           | Frequency (MHz) | Measured Value | Frequency (MHz) | Measured Value |               |        |
| V <sub>normal</sub> | 30.0 MHz to 1000.0 MHz    | 550.0135        | 0.000218       | 550.0135        | 0.000190       | 0.25uW/100kHz | Pass   |
|                     | 1000.0 MHz to 2387.0 MHz  | 2378.34         | 0.002203       | 1691.42         | 0.001054       | 2.5 uW/MHz    | Pass   |
|                     | 2387.0 MHz to 2400.0 MHz  | 2399.99         | 0.609537       | 2392.9          | 0.002735       | 25 uW/MHz     | Pass   |
|                     | 2483.5 MHz to 2496.5 MHz  | 2485.38         | 0.002203       | 2488.87         | 0.002661       | 25 uW/MHz     | Pass   |
|                     | 2496.5 MHz to 12500.0 MHz | 6991.12         | 0.001439       | 6757.06         | 0.001340       | 2.5 uW/MHz    | Pass   |

| Test Channel        |                           | Ch 78 (2480 MHz) |                | Limit         | Result |
|---------------------|---------------------------|------------------|----------------|---------------|--------|
| Test Condition      | Frequency Range           | Frequency (MHz)  | Measured Value |               |        |
| V <sub>normal</sub> | 30.0 MHz to 1000.0 MHz    | 550.0135         | 0.000286       | 0.25uW/100kHz | Pass   |
|                     | 1000.0 MHz to 2387.0 MHz  | 2240.4           | 0.002056       | 2.5 uW/MHz    | Pass   |
|                     | 2387.0 MHz to 2400.0 MHz  | 2387.17          | 0.001714       | 25 uW/MHz     | Pass   |
|                     | 2483.5 MHz to 2496.5 MHz  | 2483.56          | 0.013335       | 25 uW/MHz     | Pass   |
|                     | 2496.5 MHz to 12500.0 MHz | 2500             | 0.001675       | 2.5 uW/MHz    | Pass   |





**Modulation:  $\pi/4$ -DQPSK**

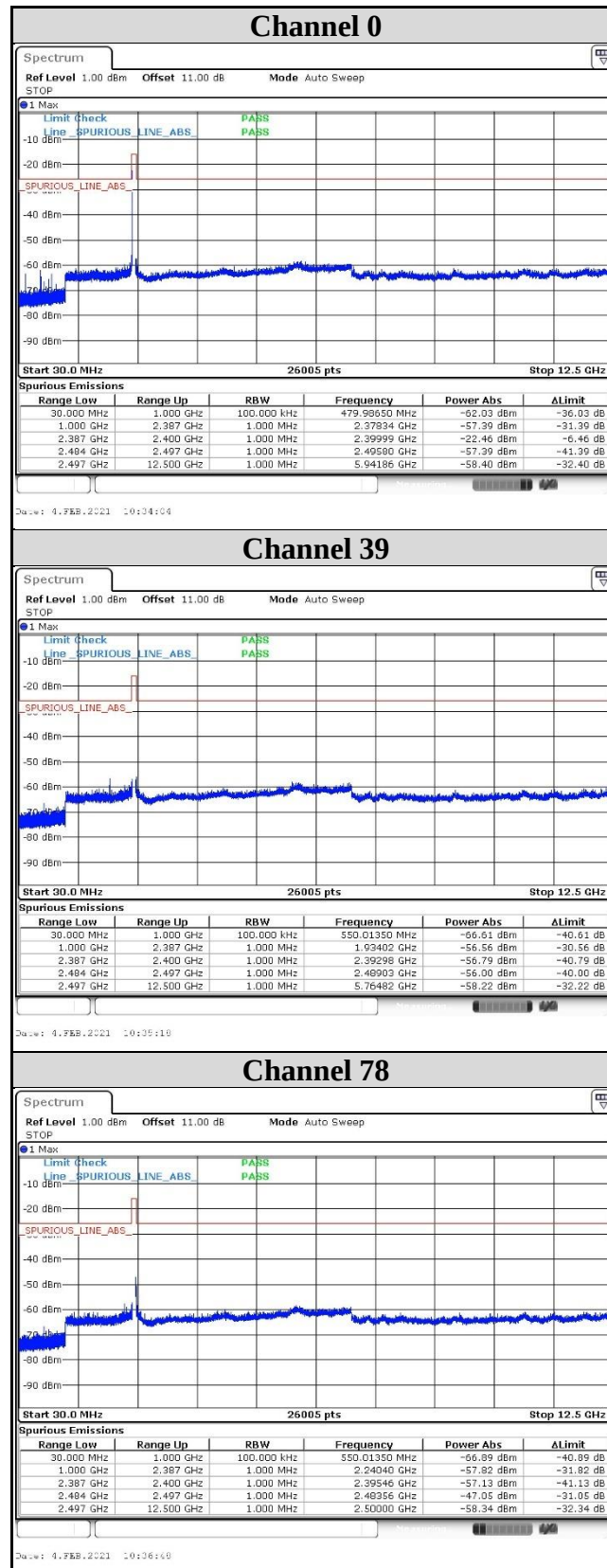
| Test Channel        |                           | Ch 0 (2402 MHz) |                | CH39 (2441 MHz) |                | Limit         | Result |
|---------------------|---------------------------|-----------------|----------------|-----------------|----------------|---------------|--------|
| Test Condition      | Frequency Range           | Frequency (MHz) | Measured Value | Frequency (MHz) | Measured Value |               |        |
| V <sub>normal</sub> | 30.0 MHz to 1000.0 MHz    | 479.9865        | 0.000627       | 550.0135        | 0.000218       | 0.25uW/100kHz | Pass   |
|                     | 1000.0 MHz to 2387.0 MHz  | 2378.34         | 0.001824       | 1934.02         | 0.002208       | 2.5 uW/MHz    | Pass   |
|                     | 2387.0 MHz to 2400.0 MHz  | 2399.99         | 5.675446       | 2392.98         | 0.002094       | 25 uW/MHz     | Pass   |
|                     | 2483.5 MHz to 2496.5 MHz  | 2495.8          | 0.001824       | 2489.03         | 0.002512       | 25 uW/MHz     | Pass   |
|                     | 2496.5 MHz to 12500.0 MHz | 5941.86         | 0.001445       | 5764.82         | 0.001507       | 2.5 uW/MHz    | Pass   |

| Test Channel        |                           | Ch 78 (2480 MHz) |                | Limit         | Result |
|---------------------|---------------------------|------------------|----------------|---------------|--------|
| Test Condition      | Frequency Range           | Frequency (MHz)  | Measured Value |               |        |
| V <sub>normal</sub> | 30.0 MHz to 1000.0 MHz    | 550.0135         | 0.000205       | 0.25uW/100kHz | Pass   |
|                     | 1000.0 MHz to 2387.0 MHz  | 2240.4           | 0.001652       | 2.5 uW/MHz    | Pass   |
|                     | 2387.0 MHz to 2400.0 MHz  | 2395.46          | 0.001936       | 25 uW/MHz     | Pass   |
|                     | 2483.5 MHz to 2496.5 MHz  | 2483.56          | 0.019724       | 25 uW/MHz     | Pass   |
|                     | 2496.5 MHz to 12500.0 MHz | 2500             | 0.001466       | 2.5 uW/MHz    | Pass   |

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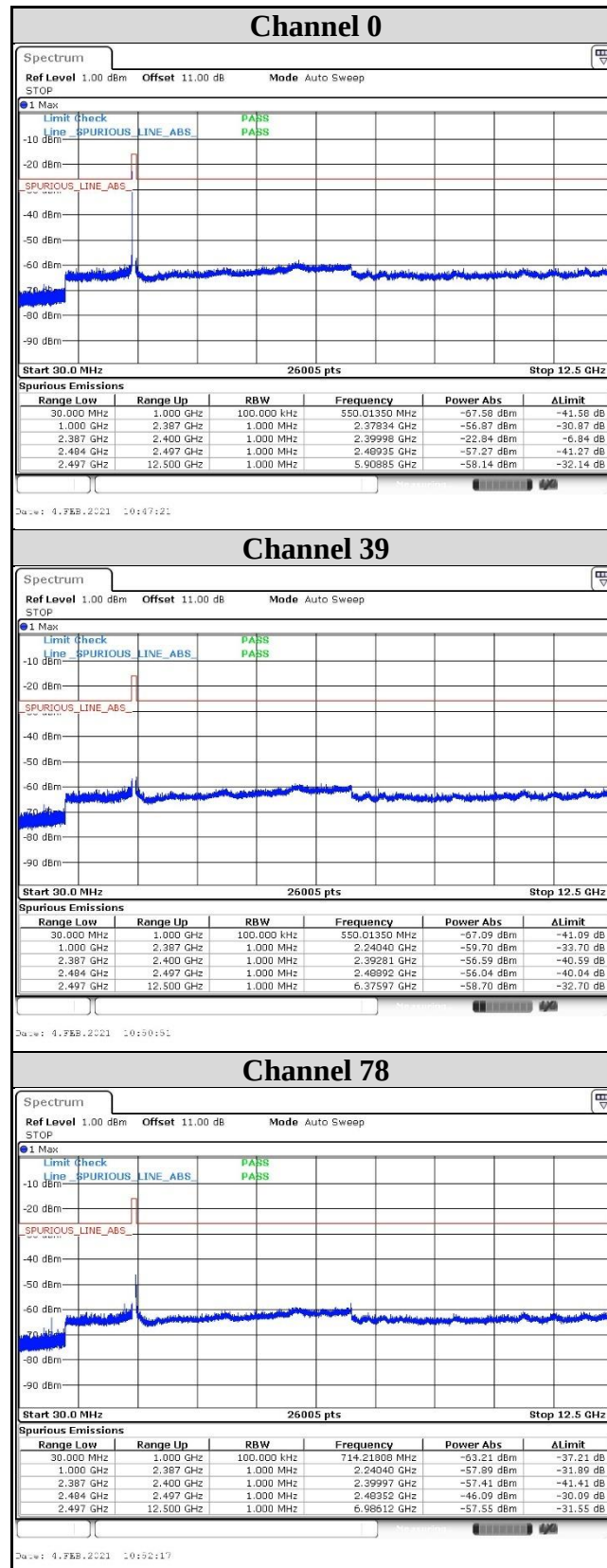
Doc No: 17-EM-F0938 / 1.0



**Modulation: 8DPSK**

| Test Channel        |                           | Ch 0 (2402 MHz) |                | CH39 (2441 MHz) |                | Limit         | Result |
|---------------------|---------------------------|-----------------|----------------|-----------------|----------------|---------------|--------|
| Test Condition      | Frequency Range           | Frequency (MHz) | Measured Value | Frequency (MHz) | Measured Value |               |        |
| V <sub>normal</sub> | 30.0 MHz to 1000.0 MHz    | 550.0135        | 0.000175       | 550.0135        | 0.000195       | 0.25uW/100kHz | Pass   |
|                     | 1000.0 MHz to 2387.0 MHz  | 2378.34         | 0.002056       | 2240.4          | 0.001072       | 2.5 uW/MHz    | Pass   |
|                     | 2387.0 MHz to 2400.0 MHz  | 2399.98         | 5.199960       | 2392.81         | 0.002193       | 25 uW/MHz     | Pass   |
|                     | 2483.5 MHz to 2496.5 MHz  | 2489.35         | 0.001875       | 2488.92         | 0.002489       | 25 uW/MHz     | Pass   |
|                     | 2496.5 MHz to 12500.0 MHz | 5908.85         | 0.001535       | 6375.97         | 0.001349       | 2.5 uW/MHz    | Pass   |

| Test Channel        |                           | Ch 78 (2480 MHz) |                | Limit         | Result |
|---------------------|---------------------------|------------------|----------------|---------------|--------|
| Test Condition      | Frequency Range           | Frequency (MHz)  | Measured Value |               |        |
| V <sub>normal</sub> | 30.0 MHz to 1000.0 MHz    | 714.21808        | 0.000478       | 0.25uW/100kHz | Pass   |
|                     | 1000.0 MHz to 2387.0 MHz  | 2240.4           | 0.001626       | 2.5 uW/MHz    | Pass   |
|                     | 2387.0 MHz to 2400.0 MHz  | 2399.97          | 0.001816       | 25 uW/MHz     | Pass   |
|                     | 2483.5 MHz to 2496.5 MHz  | 2483.52          | 0.024604       | 25 uW/MHz     | Pass   |
|                     | 2496.5 MHz to 12500.0 MHz | 6986.12          | 0.001758       | 2.5 uW/MHz    | Pass   |



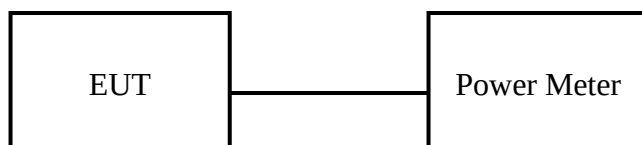


## 8.6. Antenna Power

### 8.6.1 Requirements

| Item                  | Limits                                                                                |
|-----------------------|---------------------------------------------------------------------------------------|
| Antenna Power Density | FH, FH+DS, FH+OFDM: $\leq 3 \text{ mW/MHz}$ (2427~2470.75MHz)                         |
|                       | DS: $\leq 10 \text{ mW/MHz}$                                                          |
|                       | OFDM: $\leq 10 \text{ mW/MHz}$ (Bandwidth $\leq 26\text{MHz}$ )                       |
|                       | OFDM: $\leq 5 \text{ mW/MHz}$ ( $26\text{MHz} < \text{Bandwidth} \leq 38\text{MHz}$ ) |
|                       | Others: $\leq 10 \text{ mW}$                                                          |
| Antenna Power Error   | +20%, -80% (Based on manufacturer declared antenna power density)                     |

### 8.6.2 Test Setup





### 8.6.3 Test Results

#### Modulation: GFSK

| Test Condition                | Conducted RF Output Power Density (mW/MHz) |                        |                        |                     |
|-------------------------------|--------------------------------------------|------------------------|------------------------|---------------------|
|                               | Channel 0<br>2402 MHz                      | Channel 39<br>2441 MHz | Channel 78<br>2480 MHz | Max. Limit (mW/MHz) |
| V <sub>normal</sub>           | 0.07511                                    | 0.07528                | 0.07239                | 3                   |
| Rated Power                   | 0.08884                                    |                        |                        |                     |
| Tolerance of Antenna<br>Power | 0.02 ~ 0.1066                              |                        |                        |                     |

**Note:**

1. Conducted of output power density = Conducted output power / Spread-Spectrum.
2. Highest output power tolerance (%) =  $((0.07528 - 0.08884) / 0.08884) * 100 = -14.84$  (%)
3. Lowest output power tolerance (%) =  $((0.07239 - 0.08884) / 0.08884) * 100 = -18.52$  (%)

#### Dipole antenna with 0.38 dBi gain

| Test Condition      | Radiated RF Output Power Density (mW/MHz) |                        |                        |                     |
|---------------------|-------------------------------------------|------------------------|------------------------|---------------------|
|                     | Channel 0<br>2402 MHz                     | Channel 39<br>2441 MHz | Channel 78<br>2480 MHz | Max. Limit (mW/MHz) |
| V <sub>normal</sub> | 0.08198                                   | 0.08217                | 0.07901                | 4.910               |

Note: Radiated RF output power density = Conducted RF output power density + Antenna Gain.



### Modulation: $\pi/4$ -DQPSK

| Test Condition             | Conducted RF Output Power Density (mW/MHz) |                        |                        |                     |
|----------------------------|--------------------------------------------|------------------------|------------------------|---------------------|
|                            | Channel 0<br>2402 MHz                      | Channel 39<br>2441 MHz | Channel 78<br>2480 MHz | Max. Limit (mW/MHz) |
| V <sub>normal</sub>        | 0.06146                                    | 0.06202                | 0.05951                | 3                   |
| Rated Power                | 0.08884                                    |                        |                        |                     |
| Tolerance of Antenna Power | 0.02 ~ 0.1066                              |                        |                        |                     |

**Note:**

1. Conducted of output power density = Conducted output power / Spread-Spectrum.
2. Highest output power tolerance (%) =  $((0.06202 - 0.08884) / 0.08884) * 100 = -30.19$  (%)
3. Lowest output power tolerance (%) =  $((0.05951 - 0.08884) / 0.08884) * 100 = -33.01$  (%)

### Dipole antenna with 0.38 dBi gain

| Test Condition      | Radiated RF Output Power Density (mW/MHz) |                        |                        |                     |
|---------------------|-------------------------------------------|------------------------|------------------------|---------------------|
|                     | Channel 0<br>2402 MHz                     | Channel 39<br>2441 MHz | Channel 78<br>2480 MHz | Max. Limit (mW/MHz) |
| V <sub>normal</sub> | 0.06708                                   | 0.06770                | 0.06495                | 4.910               |

Note: Radiated RF output power density = Conducted RF output power density + Antenna Gain.



### Modulation: 8DPSK

| Test Condition                | Conducted RF Output Power Density (mW/MHz) |                        |                        |                     |
|-------------------------------|--------------------------------------------|------------------------|------------------------|---------------------|
|                               | Channel 0<br>2402 MHz                      | Channel 39<br>2441 MHz | Channel 78<br>2480 MHz | Max. Limit (mW/MHz) |
| V <sub>normal</sub>           | 0.06188                                    | 0.06202                | 0.05978                | 3                   |
| Rated Power                   | 0.08884                                    |                        |                        |                     |
| Tolerance of Antenna<br>Power | 0.02 ~ 0.1066                              |                        |                        |                     |

**Note:**

1. Conducted of output power density = Conducted output power / Spread-Spectrum.
2. Highest output power tolerance (%) =  $((0.06202 - 0.08884) / 0.08884) * 100 = -30.19$  (%)
3. Lowest output power tolerance (%) =  $((0.05978 - 0.08884) / 0.08884) * 100 = -32.71$  (%)

### Dipole antenna with 0.38 dBi gain

| Test Condition      | Radiated RF Output Power Density (mW/MHz) |                        |                        |                     |
|---------------------|-------------------------------------------|------------------------|------------------------|---------------------|
|                     | Channel 0<br>2402 MHz                     | Channel 39<br>2441 MHz | Channel 78<br>2480 MHz | Max. Limit (mW/MHz) |
| V <sub>normal</sub> | 0.06754                                   | 0.06770                | 0.06525                | 4.910               |

Note: Radiated RF output power density = Conducted RF output power density + Antenna Gain.

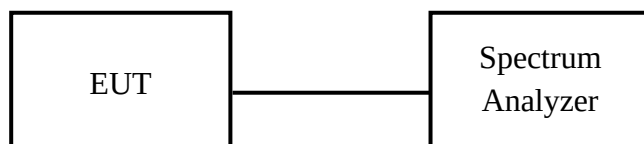


## 8.7. Spurious Emissions Receiver

### 8.7.1 Requirements

| Frequencies (MHz) | Limit                  |
|-------------------|------------------------|
| Below 1 GHz       | $\leq 4$ nW (-54 dBm)  |
| Above 1 GHz       | $\leq 20$ nW (-47 dBm) |

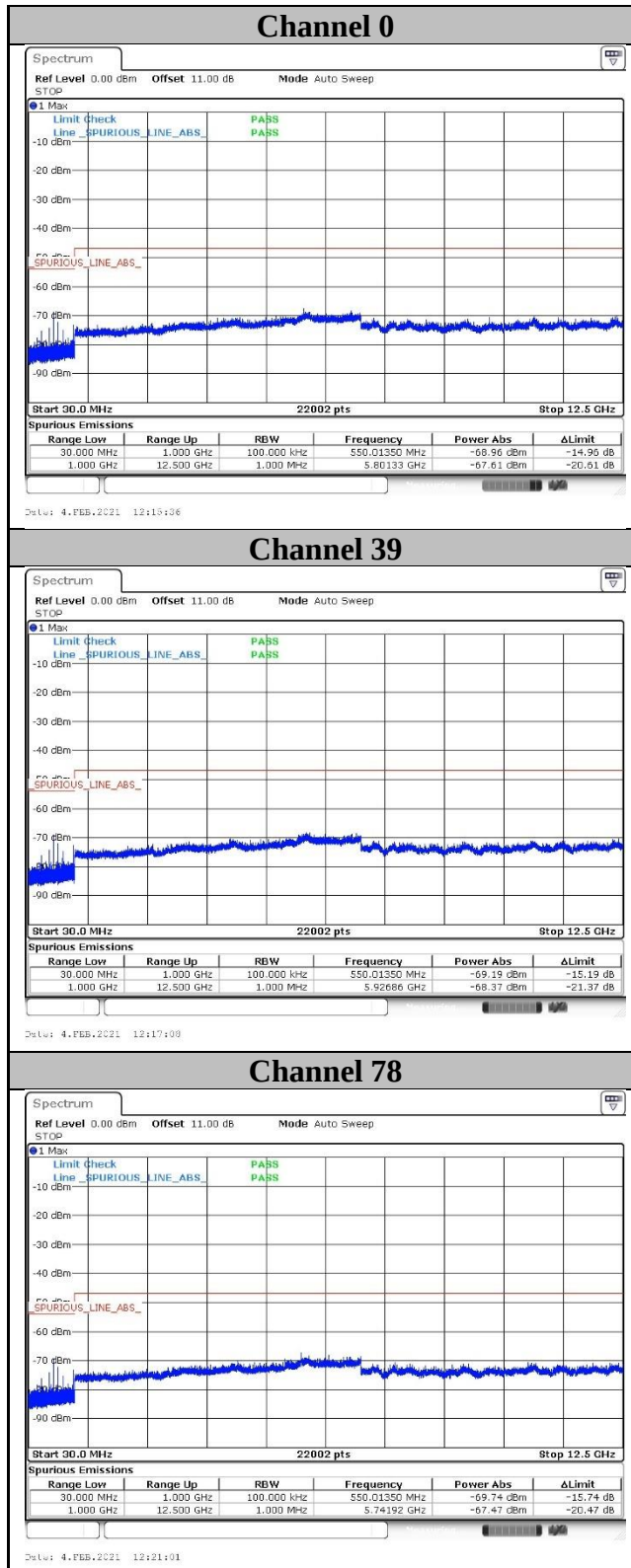
### 8.7.2 Test Setup





## 8.7.3 Test Results

| Test Channel        |                 | Channel 0 (2402 MHz)  |                | Channel 39 (2441 MHz) |                | Limit | Result |
|---------------------|-----------------|-----------------------|----------------|-----------------------|----------------|-------|--------|
| Test Condition      | Frequency Range | Frequency (MHz)       | Measured Value | Frequency (MHz)       | Measured Value |       |        |
| V <sub>normal</sub> | Below 1 GHz     | 550.0135              | 0.127057       | 550.0135              | 0.120504       | 4 nW  | Pass   |
|                     | Above 1 GHz     | 5801.33               | 0.173380       | 5926.86               | 0.145546       | 20 nW | Pass   |
| Test Channel        |                 | Channel 78 (2480 MHz) |                |                       |                | Limit | Result |
| Test Condition      | Frequency Range | Frequency (MHz)       |                | Measured Value        |                |       |        |
| V <sub>normal</sub> | Below 1 GHz     | 550.0135              |                | 0.106170              |                | 4 nW  | Pass   |
|                     | Above 1 GHz     | 5741.92               |                | 0.179061              |                | 20 nW | Pass   |





## 8.8. Interference Prevention Function

### 8.8.1 Requirements

Radio equipment used mainly on the same premises and automatically transmits or receives identification code

### 8.8.2 Test Setup



### 8.8.3 Test Results

| Link Mode     | Test Result |
|---------------|-------------|
| Bluetooth EDR | Pass        |

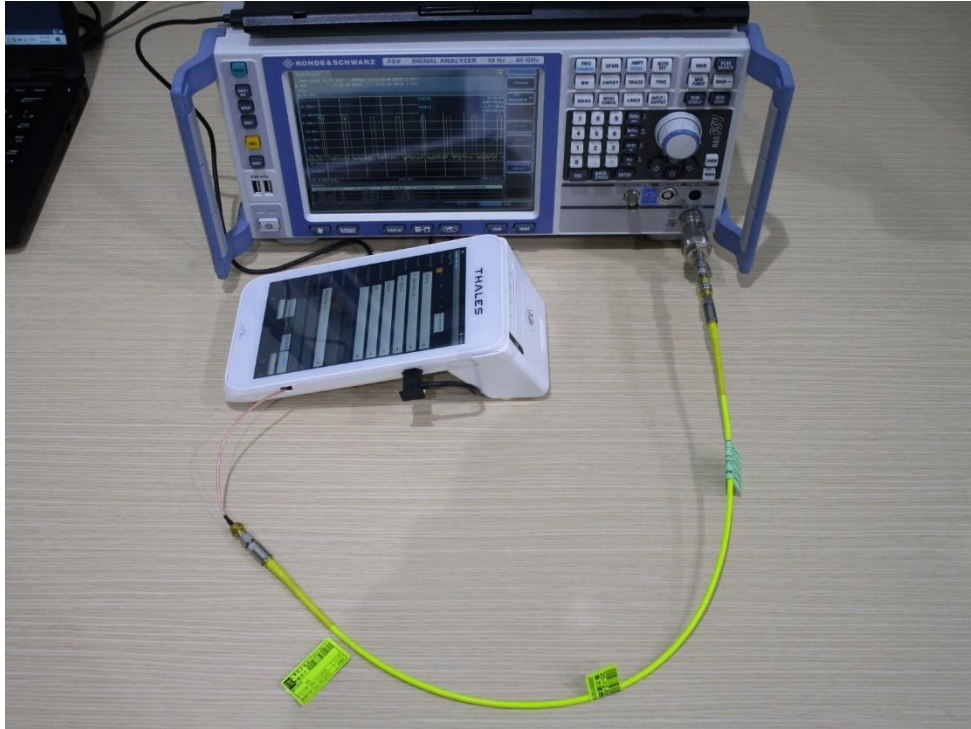


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Issued date : Mar. 11, 2021

## 9. Conducted Emission Measurement Setup Configurations



**END OF REPORT**

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