



en



# TEST REPORT

Report Number: C20T00017-SRD01

|              |                                                           |
|--------------|-----------------------------------------------------------|
| Applicant    | NetEase Youdao Information Technology (Beijing) Co., Ltd. |
| Product Name | Youdao Dictionary Pen 3                                   |
| Model Name   | YDP031                                                    |
| Brand Name   | Youdao                                                    |
| FCC ID       | 2AV6G-YDP031                                              |

Industrial Internet Innovation Center (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in FCC Part15, ANSI C63.10, KDB 558074.

|             |     |             |            |
|-------------|-----|-------------|------------|
| Prepared by | 刘艳  | Reviewed by | 范溪艳        |
| Approved by | 熊增莉 | Issue Date  | 2021-01-29 |

**Industrial Internet Innovation Center (Shanghai) Co., Ltd.**

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### Test Laboratory:

Industrial Internet Innovation Center (Shanghai) Co., Ltd.  
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### Revision Version

| Report Number   | Revision | Date       | Memo                            |
|-----------------|----------|------------|---------------------------------|
| C20T00017-SRD01 | 00       | 2021-01-29 | Initial creation of test report |

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## 1. Test Laboratory

### 1.1. Testing Location

|                      |                                                            |
|----------------------|------------------------------------------------------------|
| Company Name         | Industrial Internet Innovation Center (Shanghai) Co., Ltd. |
| Address              | Building 4, No. 766 Jingang Rd, Pudong, Shanghai, China    |
| FCC Registration No. | CN1177                                                     |

### 1.2. Testing Environment

|                    |             |
|--------------------|-------------|
| Normal Temperature | 15°C~35°C   |
| Relative Humidity  | 30%RH~60%RH |
| Supply Voltage     | 120V/60Hz   |

### 1.3. Project Information

|                    |            |
|--------------------|------------|
| Project Leader     | Xu Yuting  |
| Testing Start Date | 2020-11-17 |
| Testing End Date   | 2020-12-06 |



## 2. Client Information

### 2.1. Applicant Information

|              |                                                                                                    |
|--------------|----------------------------------------------------------------------------------------------------|
| Company Name | NetEase Youdao Information Technology (Beijing) Co., Ltd.                                          |
| Address      | No.7 Building,Zhongguancun Software Park West,No.10 Xibeiwang East RD,Haidian District,Beijing,PRC |
| Telephone    | 13586835362                                                                                        |

### 2.2. Manufacturer Information

|              |                                                                                        |
|--------------|----------------------------------------------------------------------------------------|
| Company Name | Mobiwire Mobiles(NingBo) Co.,LTD                                                       |
| Address      | Building A,No.999 Dacheng East Road,Fenghua District,Ningbo City,Zhejiang Province,PRC |
| Telephone    | 13586835362                                                                            |

### 3. Equipment under Test (EUT) and Ancillary Equipment (AE)

#### 3.1. About EUT

|                                      |                            |
|--------------------------------------|----------------------------|
| Product Name                         | Youdao Dictionary Pen 3    |
| Model name                           | YDP031                     |
| Supported Radio Technology and Bands | BT4.2<br>WLAN 802.11 b,g,n |
| BT Frequency                         | 2402MHz-2480MHz            |
| BT Channel                           | Ch0-78                     |
| BT type of modulation                | GFSK/ $\pi/4$ DQPSK/8DPSK  |
| Hardware Version                     | WM98-CHERRY-DVT2           |
| Software Version                     | V1.0.0                     |
| FCC ID                               | 2AV6G-YDP031               |
| Extreme Temperature                  | -10°C~50°C                 |
| Nominal Voltage                      | 3.85V                      |
| Extreme High Voltage                 | 4.40V                      |
| Extreme Low Voltage                  | 3.50V                      |
| Maximum of Antenna Gain              | 2.04dBi                    |

Note: Photographs of EUT are shown in ANNEX B of this test report.

#### 3.2. Internal Identification of EUT used during the test

| EUT ID* | SN or IMEI       | HW Version       | SW Version | Date of receipt |
|---------|------------------|------------------|------------|-----------------|
| N02     | 2AA1400000301960 | WM98-CHERRY-DVT2 | V1.0.0     | 2020-11-17      |
| N05     | 2AA1400000302735 | WM98-CHERRY-DVT2 | V1.0.0     | 2020-11-17      |

\*EUT ID: is internally used to identify the test sample in the lab.

#### 3.3. Internal Identification of AE used during the test

| AE ID* | Description | Model | SN/Remark |
|--------|-------------|-------|-----------|
| AE1    | RF cable    | ---   | AE1       |

\*AE ID: is internally used to identify the test sample in the lab.

## 4. Reference Documents

### 4.1. Reference Documents for testing

The following documents listed in this section are referred for testing.

| Reference   | Title                                                                                                                                                                                                                    | Version    |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| FCC Part15  | FCC CFR 47, Part 15, Subpart C:<br>15.205 Restricted bands of operation;<br>15.209 Radiated emission limits, general requirements;<br>15.247 Operation within the bands 902-928MHz,<br>2400-2483.5MHz, and 5725-5850MHz. | 2018-10-01 |
| ANSI C63.10 | American National Standard of Procedures for<br>Compliance Testing of Unlicensed Wireless Devices                                                                                                                        | 2013       |
| KDB 558074  | Guidance for Performing Compliance Measurements on<br>Frequency Hopping Spread Spectrum systems (DSS)<br>Operating Under §15.247                                                                                         | v05r02     |

## 5. Test Summary

### 5.1. Summary of Test Results

| Measurement Items                       | Sub-clause of Part15C | Verdict |
|-----------------------------------------|-----------------------|---------|
| Maximum Peak Output Power               | 15.247(b)             | Pass    |
| 20dB Occupied Bandwidth                 | 15.247(a)             | Pass    |
| Band Edges Compliance                   | 15.247(b)             | Pass    |
| Time Of Occupancy (Dwell Time)          | 15.247(a)             | Pass    |
| Carrier Frequency Separation            | 15.247(a)             | Pass    |
| Number Of Hopping Channels              | 15.247(a)             | Pass    |
| Transmitter Spurious Emission-Conducted | 15.247                | Pass    |
| Transmitter Spurious Emission-Radiated  | 15.209/15.247         | Pass    |
| AC Powerline Conducted Emission         | 15.107/15.207         | Pass    |

Note: please refer to Annex A in this test report for the detailed test results.

#### Test Conditions

|      |                    |
|------|--------------------|
| Tnom | Normal Temperature |
| Tmin | Low Temperature    |
| Tmax | High Temperature   |
| Vnom | Normal Voltage     |
| Vmin | Low Voltage        |
| Vmax | High Voltage       |
| Hnom | Norm Humidity      |
| Anom | Norm Air Pressure  |

For this report, all the test case listed above are tested under Normal Temperature and Normal Voltage, and also under norm humidity, the specific conditions as following:

|              |      |         |
|--------------|------|---------|
| Temperature  | Tnom | 25°C    |
| Voltage      | Vnom | 3.85V   |
| Humidity     | Hnom | 48%     |
| Air Pressure | Anom | 1010hPa |

**Note:**

- a. All the test data for each data were verified, but only the worst case was reported.
- b. The GFSK,  $\pi/4$  DQPSK and 8DPSK were set in DH1 for GFSK, 2-DH1 for  $\pi/4$  DQPSK, 3-DH1 for 8DPSK.
- c. The DC and low frequency voltages' measurement uncertainty is  $\pm 2\%$ .

## **5.2. Statements**

The Youdao Dictionary Pen 3, manufactured by Mobiwire Mobiles(NingBo) Co.,LTD.is a new product for testing.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. only performed test cases which identified with Pass/Fail/Inc result in section 5.1.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. has verified that the compliance of the tested device specified in section 3 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 4 of this test report.

## 6. Measurement Results

**Shielding Room1** (6.0 meters×3.0 meters×2.7 meters) did not exceed following limits along the conducted RF performance testing:

|                          |                             |
|--------------------------|-----------------------------|
| Temperature              | Min. = 15 °C , Max. = 35 °C |
| Relative humidity        | Min. = 20 % , Max. = 75 %   |
| Shielding effectiveness  | > 100 dB                    |
| Ground system resistance | < 0.5 Ω                     |

**Control room** did not exceed following limits along the EMC testing:

|                          |                             |
|--------------------------|-----------------------------|
| Temperature              | Min. = 15 °C , Max. = 35 °C |
| Relative humidity        | Min. = 30 % , Max. = 60 %   |
| Shielding effectiveness  | > 100 dB                    |
| Electrical insulation    | > 10 kΩ                     |
| Ground system resistance | < 0.5 Ω                     |

**Fully-anechoic chamber1** (6.9 meters×10.9 meters×5.4 meters) did not exceed following limits along the EMC testing:

|                              |                                            |
|------------------------------|--------------------------------------------|
| Temperature                  | Min. = 15 °C , Max. = 35 °C                |
| Relative humidity            | Min. = 25 % , Max. = 75 %                  |
| Shielding effectiveness      | > 100 dB                                   |
| Electrical insulation        | > 10 kΩ                                    |
| Ground system resistance     | < 0.5 Ω                                    |
| VSWR                         | Between 0 and 6 dB, from 1GHz to 18GHz     |
| Site Attenuation Deviation   | Between -4 and 4 dB, 30MHz to 1GHz         |
| Uniformity of field strength | Between 0 and 6 dB, from 80MHz to 3000 MHz |

## ANNEX A. Detailed Test Results

### ANNEX A.1. Peak Output Power-Conducted

#### A.1.1 Measurement Limit

| Standard                 | Limit (dBm) |
|--------------------------|-------------|
| FCC 47 Part 15.247(b)(1) | < 21        |

#### A.1.2 Test Condition:

|              |      |       |      |          |
|--------------|------|-------|------|----------|
| Hopping Mode | RBW  | VBW   | Span | Sweptime |
| Hopping OFF  | 3MHz | 10MHz | 9MHz | Auto     |

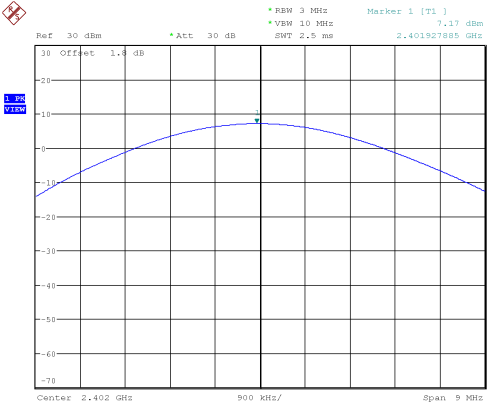
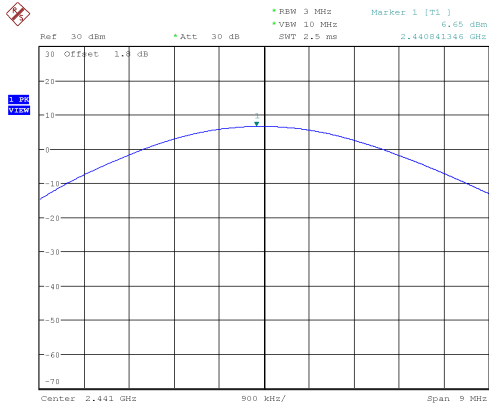
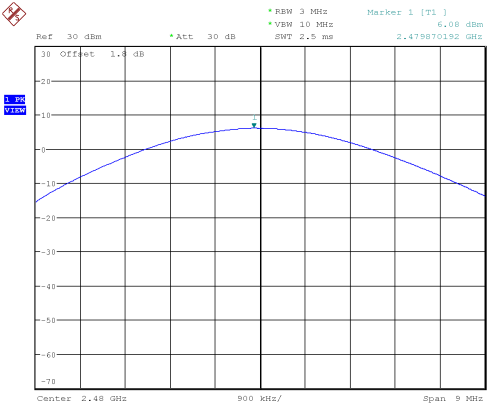
#### A.1.3 Test procedure

The measurement is according to ANSI C63.10 clause 7.8.5.

1. The output power of EUT was connected to the spectrum analyzer and CBT32 by cable and divide. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Measure the conducted output power and record the results it.

# Measurement Results:

|                                                              |             |                                                              |             |
|--------------------------------------------------------------|-------------|--------------------------------------------------------------|-------------|
| <b>Peak Conducted Output Power</b><br><b>CH0, DH5(dBm)</b>   | <b>7.27</b> | <b>Peak Conducted Output Power</b><br><b>CH39, DH5(dBm)</b>  | <b>6.71</b> |
|                                                              |             |                                                              |             |
| <b>Peak Conducted Output Power</b><br><b>CH78, DH5(dBm)</b>  | <b>6.13</b> | <b>Peak Conducted Output Power</b><br><b>CH0, 2DH5(dBm)</b>  | <b>7.21</b> |
|                                                              |             |                                                              |             |
| <b>Peak Conducted Output Power</b><br><b>CH39, 2DH5(dBm)</b> | <b>6.68</b> | <b>Peak Conducted Output Power</b><br><b>CH78, 2DH5(dBm)</b> | <b>6.09</b> |
|                                                              |             |                                                              |             |

|                                                                                    |      |                                                                                    |      |
|------------------------------------------------------------------------------------|------|------------------------------------------------------------------------------------|------|
| Peak Conducted Output Power<br>CH0, 3DH5(dBm)                                      | 7.17 | Peak Conducted Output Power<br>CH39, 3DH5(dBm)                                     | 6.65 |
|   |      |  |      |
| Peak Conducted Output Power<br>CH78, 3DH5(dBm)                                     | 6.08 | /                                                                                  |      |
|  |      |                                                                                    |      |

## ANNEX A.2. Frequency Band Edges-Conducted

### A.2.1 Measurement Limit:

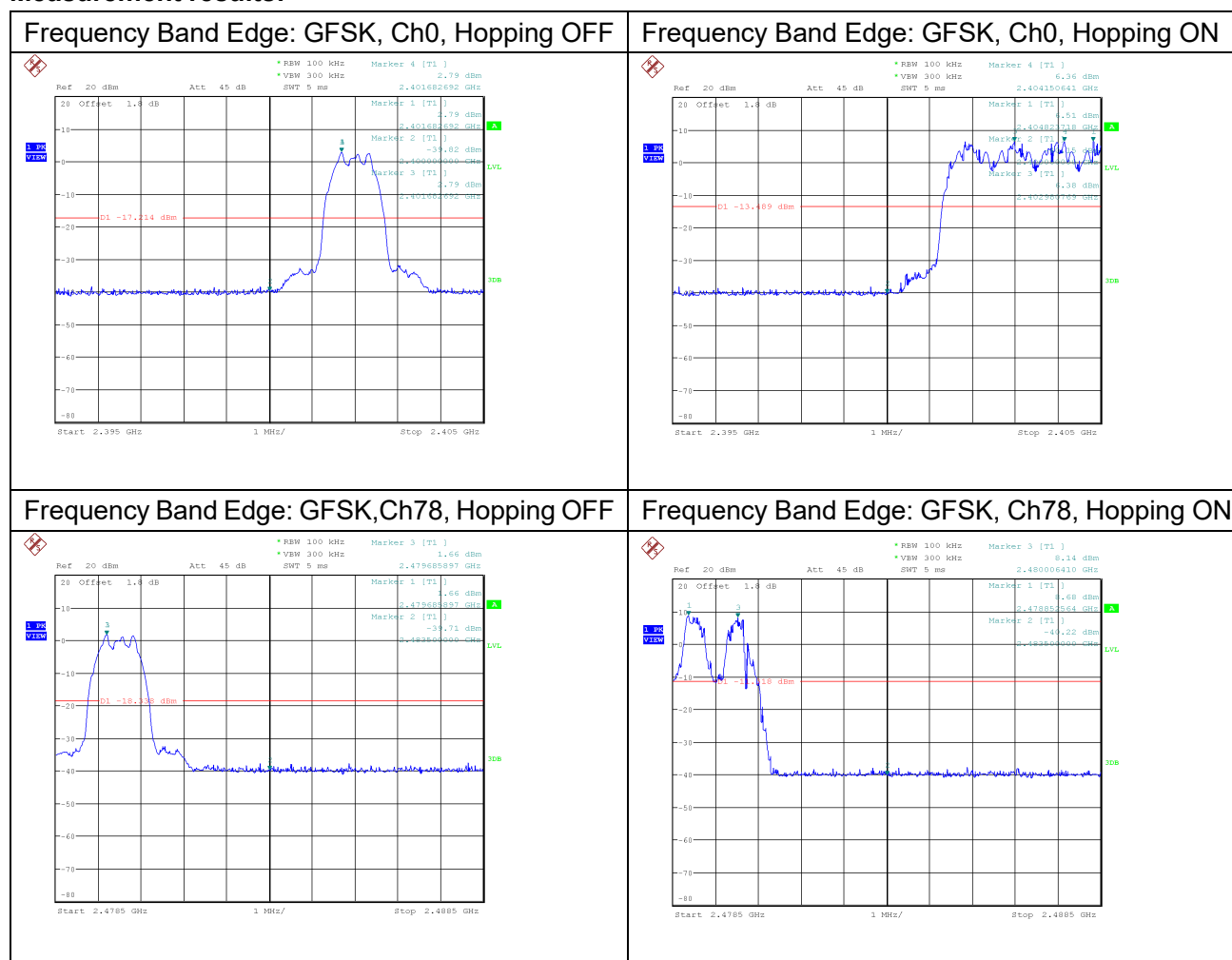
| Standard                  | Limited(dBc) |
|---------------------------|--------------|
| FCC 47 CFR Part 15.247(d) | >20          |

### A.2.2 Test procedure

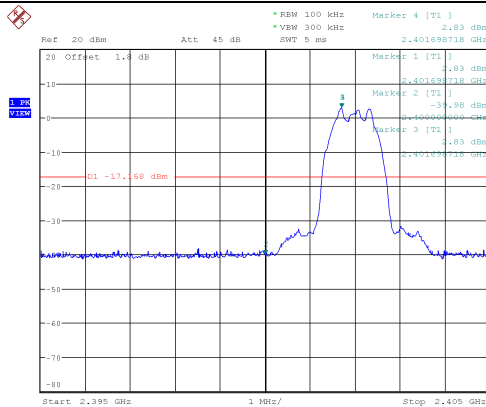
The measurement is according to ANSI C63.10 clause 7.8.6.

1. Connect the EUT to spectrum analyzer.
2. Set RBW=100KHz, VBW=300KHz, span more than 1.5 times channel bandwidth (2MHz).
3. Detector =peak, sweep time=auto couple, trace mode=max hold.
4. Allow sweep to continue until the trace stabilizes.

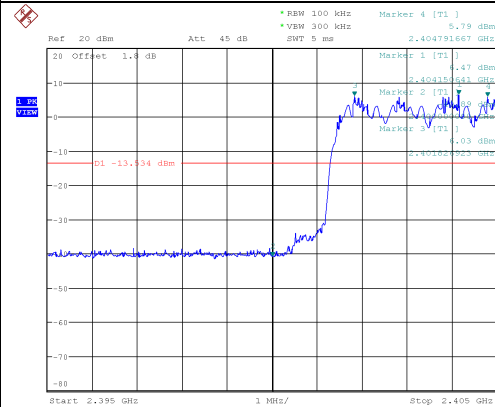
### Measurement results:



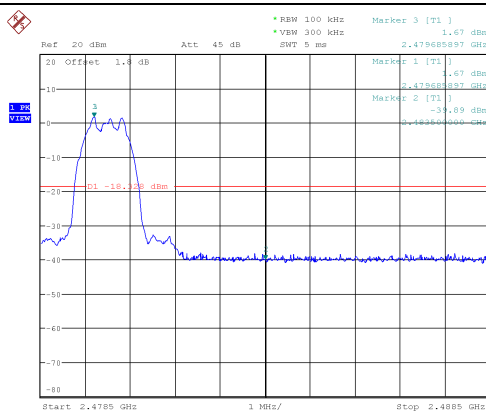
Frequency Band Edge:  $\pi/4$  DQPSK,  
Ch0, Hopping OFF



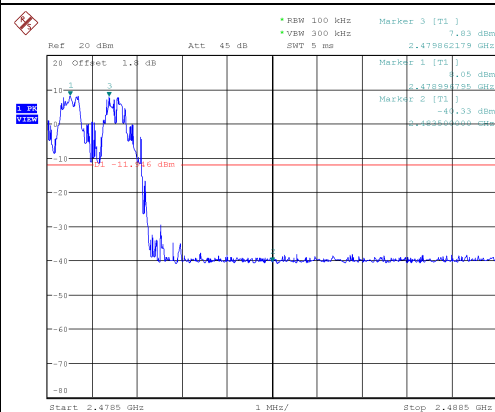
Frequency Band Edge:  $\pi/4$  DQPSK,  
Ch0, Hopping ON



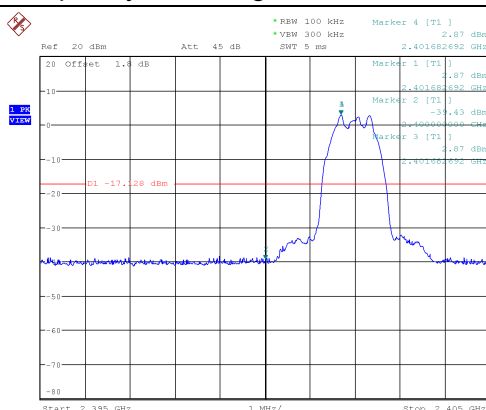
Frequency Band Edge:  $\pi/4$  DQPSK,  
Ch78, Hopping OFF



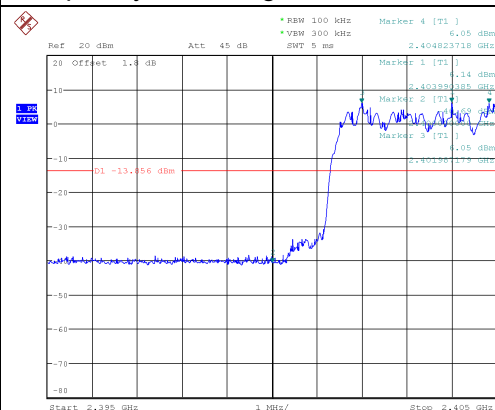
Frequency Band Edge:  $\pi/4$  DQPSK,  
Ch78, Hopping ON



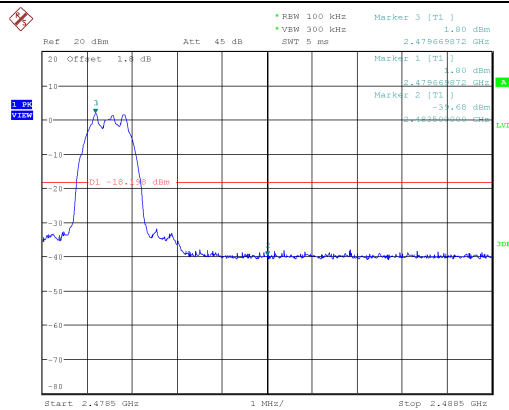
Frequency Band Edge: 8DPSK, Ch0, Hopping OFF



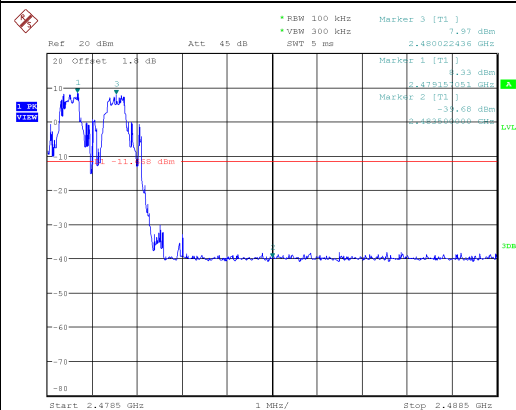
Frequency Band Edge: 8DPSK, Ch0, Hopping ON



### Frequency Band Edge: 8DPSK, Ch78, Hopping OFF



### Frequency Band Edge: 8DPSK, Ch78, Hopping ON



## ANNEX A.3. Conducted Emission

### A.3.1 Measurement Limit:

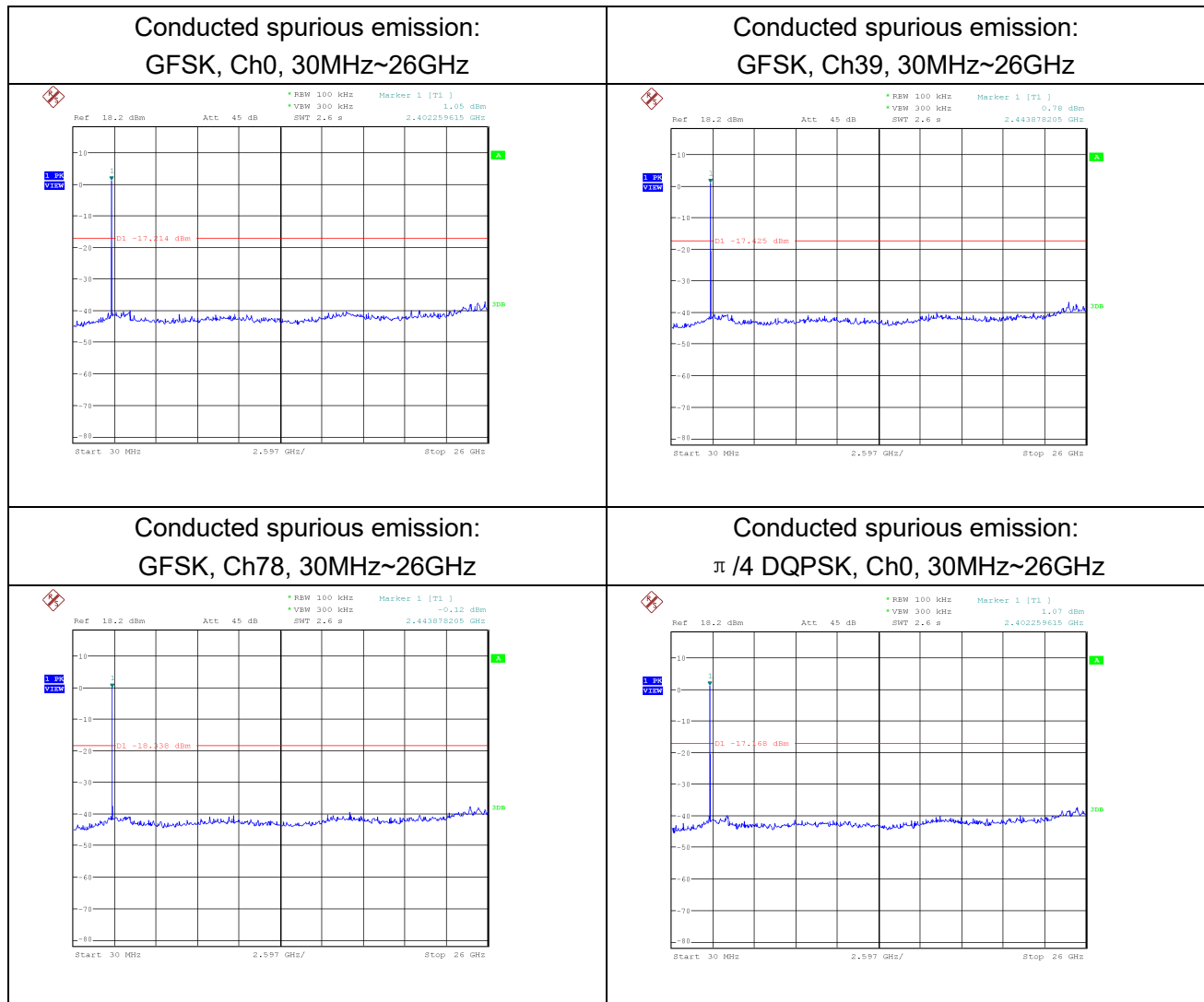
| Standard                  | Limit                                            |
|---------------------------|--------------------------------------------------|
| FCC 47 CFR Part15.247 (d) | 20dB below peak output power in 100KHz bandwidth |

### A.3.2 Test procedures

The measurement is according to ANSI C63.10 clause 7.8.8.

1. Connect the EUT to spectrum analyzer.
2. Set RBW=100KHz, VBW=300KHz.
3. Detector =peak, sweep time=auto couple, trace mode=max hold.

### Measurement Results:



|                                                                                     |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <p>Conducted spurious emission:<br/><math>\pi/4</math> DQPSK, Ch39, 30MHz~26GHz</p> | <p>Conducted spurious emission:<br/><math>\pi/4</math> DQPSK, Ch78, 30MHz~26GHz</p> |
| <p>Conducted spurious emission:<br/>8DPSK, Ch0, 30MHz~26GHz</p>                     | <p>Conducted spurious emission:<br/>8DPSK, Ch39, 30MHz~26GHz</p>                    |
| <p>Conducted spurious emission:<br/>8DPSK, Ch78, 30MHz~26GHz</p>                    | <p>/</p> <p>/</p>                                                                   |

## ANNEX A.4. Radiated Emission

### A.4.1 Measurement Limit:

| Standard                               | Limit                        |
|----------------------------------------|------------------------------|
| FCC 47 CFR Part 15.247, 15.205, 15.209 | 20dB below peak output power |

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

### Limit in restricted band:

| Frequency of emission | Field strength (uV/m) | Field strength (dBuV/m) |
|-----------------------|-----------------------|-------------------------|
| 30~88                 | 100                   | 40                      |
| 88~216                | 150                   | 43.5                    |
| 216~960               | 200                   | 46                      |
| Above 960             | 500                   | 54                      |

### A.4.2 Test Method

Portable, small, lightweight, or modular devices that may be handheld, worn on the body, or placed on a table during operation shall be positioned on a non-conducting platform, the top of which is 80 cm above the reference ground plane. The preferred area occupied by the EUT arrangement is 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. but it may be larger or smaller to accommodate various sized EUTs. For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop (see also ANSI C63.10-2013 section 6.3.4 and 6.3.5). In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

| Frequency of emission | RBW/VBW       | Sweep Time (s) |
|-----------------------|---------------|----------------|
| 30~1000               | 100KHz/300KHz | 5              |
| 1000~4000             | 1MHz/3MHz     | 15             |
| 4000~18000            | 1MHz/3MHz     | 40             |
| 18000~26500           | 1MHz/3MHz     | 20             |

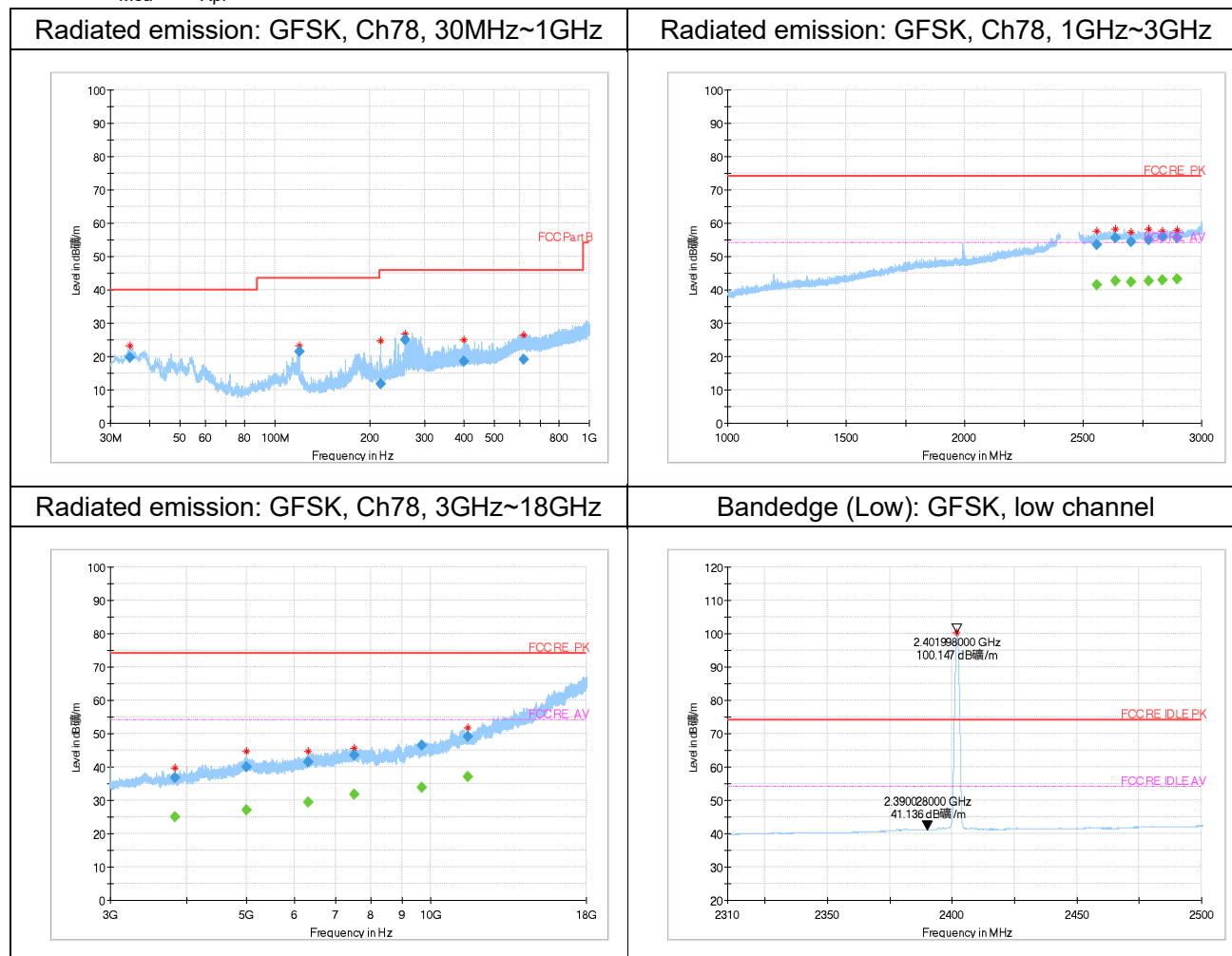
### A.4.3 Measurement Results:

A “reference path loss” is established and  $A_{Rpi}$  is the attenuation of “reference path loss”, and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

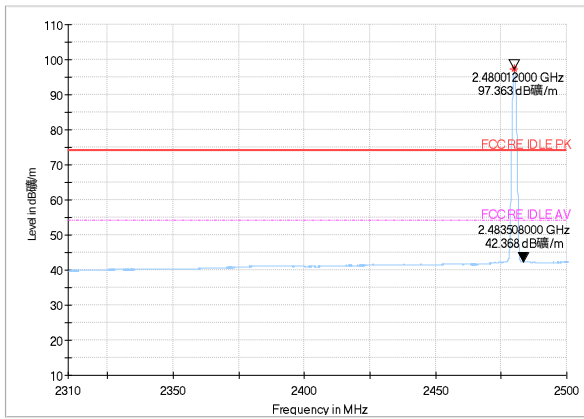
The measurement results are obtained as described below:

$A_{Rpi}$  = Cable loss + Antenna Gain - Preamplifier gain

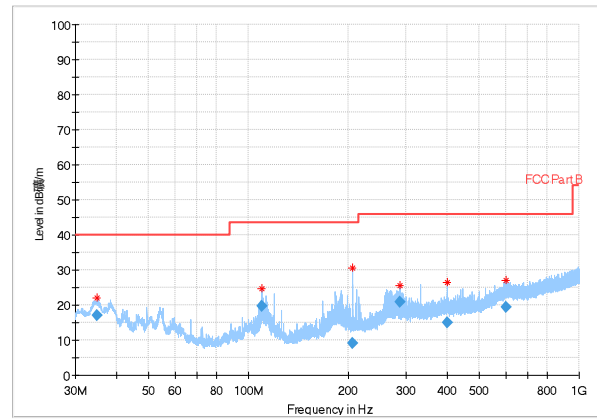
Result =  $P_{Mea} + A_{Rpi}$



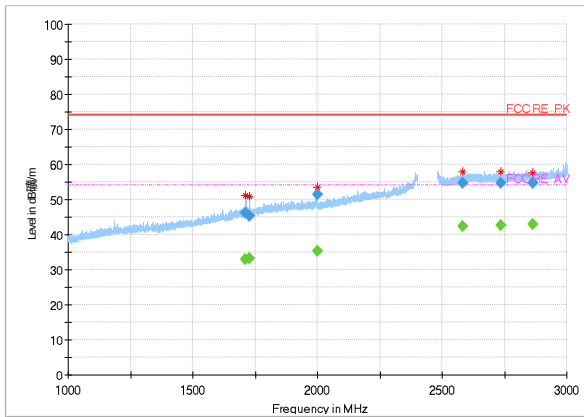
Bandedge (High): GFSK, high channel



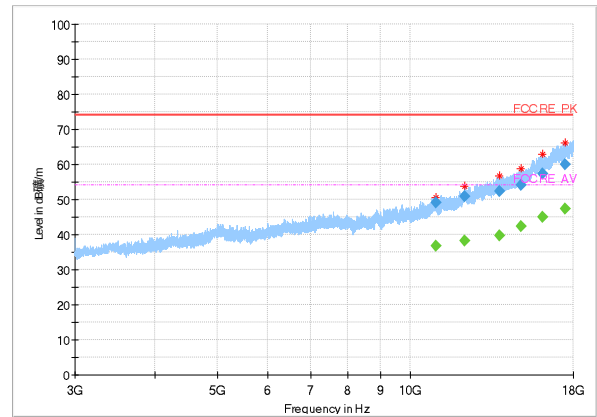
Radiated emission:  $\pi/4$  DQPSK, Ch78, 30MHz~1GHz



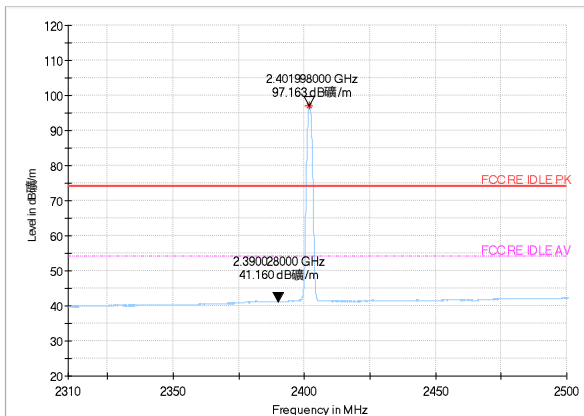
Radiated emission:  $\pi/4$  DQPSK, Ch78, 1GHz~3GHz



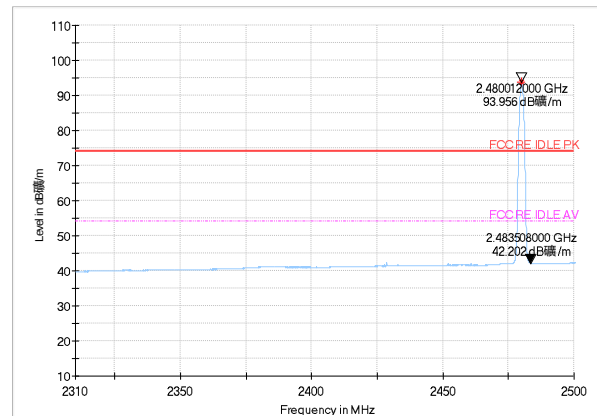
Radiated emission:  $\pi/4$  DQPSK, Ch78, 3GHz~18GHz



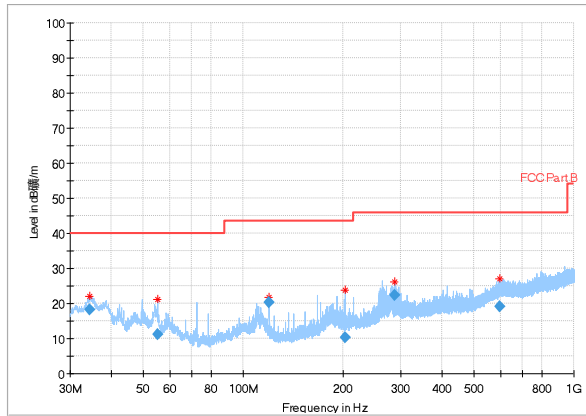
Bandedge (Low):  $\pi/4$  DQPSK, low channel



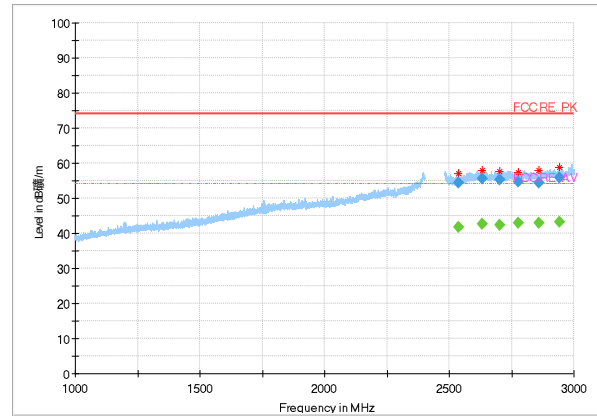
Bandedge (High):  $\pi/4$  DQPSK, high channel



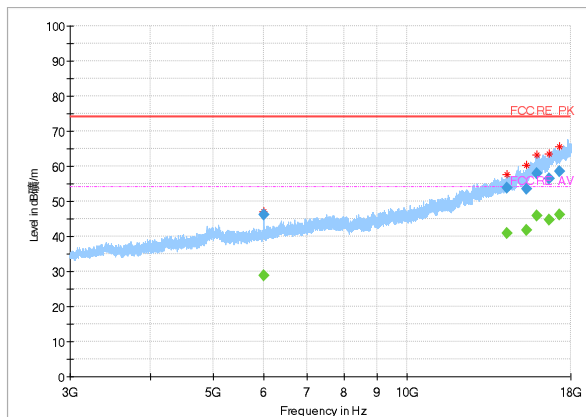
Radiated emission: 8DPSK, Ch78, 30MHz~1GHz



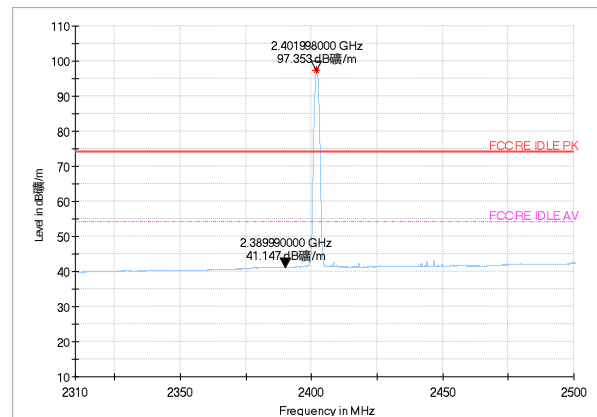
Radiated emission: 8DPSK, Ch78, 1GHz~3GHz



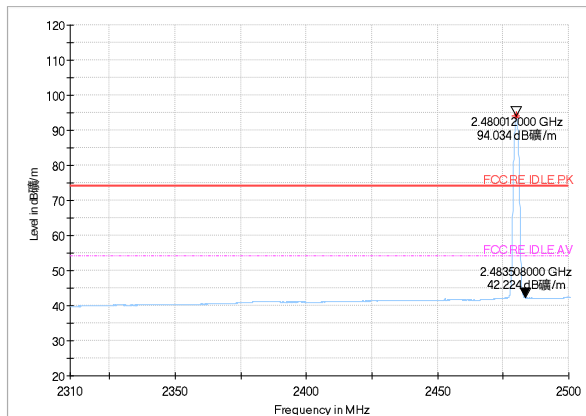
Radiated emission: 8DPSK, Ch78, 3GHz~18GHz



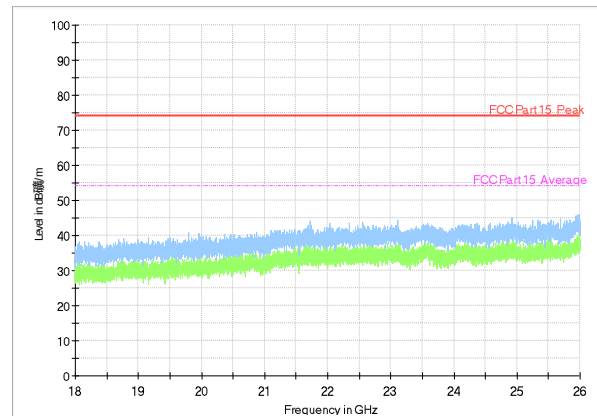
Bandedge (Low): 8DPSK, low channel



Bandedge (High): 8DPSK, high channel



ALL Channel 18GHz~26GHz



**GFSK Ch0 30MHz-1GHz**

| Frequency(MHz) | Result(dBuV/m) | ARpl(dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|----------|--------------|----------|
| 43.7           | 10.43          | -15.9    | 26.33        | V        |
| 120.0          | 22.1           | -16.6    | 38.7         | H        |
| 203.9          | 9.4            | -15.1    | 24.5         | H        |
| 273.6          | 25.65          | -11.9    | 37.55        | H        |
| 357.5          | 15.86          | -9.7     | 25.56        | V        |
| 611.4          | 19.16          | -2.8     | 21.96        | V        |

**GFSK Ch0 1GHz-3GHz (Peak)**

| Frequency(MHz) | Result(dBuV/m) | ARpl(dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|----------|--------------|----------|
| 2615.2         | 54.85          | 17.8     | 37.05        | H        |
| 2706.6         | 54.02          | 17.8     | 36.22        | V        |
| 2778.3         | 54.94          | 18.1     | 36.84        | V        |
| 2846.0         | 55.47          | 18.3     | 37.17        | V        |
| 2903.9         | 55.69          | 18.7     | 36.99        | V        |
| 2995.8         | 61.22          | 19.5     | 41.72        | V        |

**GFSK Ch0 1GHz-3GHz (Average)**

| Frequency(MHz) | Result(dBuV/m) | ARpl(dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|----------|--------------|----------|
| 2615.2         | 42.42          | 17.8     | 24.62        | H        |
| 2706.6         | 42.37          | 17.8     | 24.57        | V        |
| 2778.3         | 42.82          | 18.1     | 24.72        | V        |
| 2846.0         | 42.95          | 18.3     | 24.65        | V        |
| 2903.9         | 43.44          | 18.7     | 24.74        | V        |
| 2995.8         | 43.7           | 19.5     | 24.2         | V        |

**GFSK Ch0 3GHz-18GHz (Peak)**

| Frequency(MHz) | Result(dBuV/m) | ARpl (dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|-----------|--------------|----------|
| 3539.7         | 34.71          | -2.5      | 37.21        | H        |
| 4817.8         | 39.35          | 1.4       | 37.95        | H        |
| 5814.4         | 39.98          | 2.4       | 37.58        | V        |
| 6985.7         | 49.22          | 4.9       | 44.32        | V        |
| 9487.0         | 44.9           | 9.6       | 35.3         | V        |
| 11634.1        | 49.05          | 13        | 36.05        | V        |

**$\pi/4$  DQPSK Ch0 30MHz-1GHz**

| Frequency(MHz) | Result(dBuV/m) | ARpl (dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|-----------|--------------|----------|
| 35.0           | 19.3           | -16.7     | 36           | V        |
| 120.0          | 22.45          | -16.6     | 39.05        | H        |
| 222.2          | 10.83          | -13.8     | 24.63        | H        |
| 276.9          | 16.96          | -11.9     | 28.86        | H        |
| 436.2          | 18.62          | -8.5      | 27.12        | V        |
| 727.3          | 19.57          | -3.1      | 22.67        | V        |

**$\pi/4$  DQPSK Ch0 1GHz-3GHz (Peak)**

| Frequency(MHz) | Result(dBuV/m) | ARpl (dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|-----------|--------------|----------|
| 2519.9         | 53.98          | 16.5      | 37.48        | H        |
| 2584.8         | 54.42          | 17.5      | 36.92        | V        |
| 2665.1         | 54.81          | 17.8      | 37.01        | V        |
| 2750.1         | 55.72          | 18        | 37.72        | H        |
| 2810.7         | 55.25          | 18.2      | 37.05        | V        |
| 2866.1         | 56.96          | 18.5      | 38.46        | V        |

**$\pi/4$  DQPSK Ch0 1GHz-3GHz (Average)**

| Frequency(MHz) | Result(dBuV/m) | ARpl (dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|-----------|--------------|----------|
| 2584.8         | 42.21          | 17.5      | 24.71        | V        |
| 2665.1         | 42.41          | 17.8      | 24.61        | V        |
| 2750.1         | 42.75          | 18        | 24.75        | H        |
| 2810.7         | 42.76          | 18.2      | 24.56        | V        |
| 2866.1         | 42.78          | 18.5      | 24.28        | V        |

**$\pi/4$  DQPSK Ch0 3GHz-18GHz (Peak)**

| Frequency(MHz) | Result(dBuV/m) | ARpl (dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|-----------|--------------|----------|
| 4000.6         | 36.76          | -0.8      | 37.56        | H        |
| 5385.3         | 40.77          | 1.9       | 38.87        | H        |
| 6977.5         | 50.4           | 4.9       | 45.5         | V        |
| 8273.8         | 43.02          | 6.7       | 36.32        | H        |
| 9907.6         | 47.01          | 10        | 37.01        | H        |
| 12215.1        | 50.88          | 16        | 34.88        | H        |

### 8DPSK Ch0 30MHz-1GHz

| Frequency(MHz) | Result(dBuV/m) | ARpl (dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|-----------|--------------|----------|
| 34.7           | 18.67          | -16.7     | 35.37        | V        |
| 53.8           | 12.97          | -15.4     | 28.37        | V        |
| 120.0          | 20.22          | -16.6     | 36.82        | H        |
| 204.9          | 10.57          | -15       | 25.57        | H        |
| 268.6          | 19.46          | -12.1     | 31.56        | V        |
| 610.7          | 19.45          | -2.8      | 22.25        | V        |

### 8DPSK Ch0 1GHz-3GHz (Peak)

| Frequency(MHz) | Result(dBuV/m) | ARpl (dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|-----------|--------------|----------|
| 2573.7         | 55.19          | 17.4      | 37.79        | V        |
| 2665.9         | 54.64          | 17.8      | 36.84        | H        |
| 2738.0         | 54.93          | 18        | 36.93        | V        |
| 2804.7         | 55.2           | 18.2      | 37           | V        |
| 2882.0         | 54.95          | 18.6      | 36.35        | V        |
| 2958.5         | 56.07          | 18.9      | 37.17        | H        |

### 8DPSK Ch0 1GHz-3GHz (Average)

| Frequency(MHz) | Result(dBuV/m) | ARpl (dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|-----------|--------------|----------|
| 2573.7         | 42.41          | 17.4      | 25.01        | V        |
| 2665.9         | 42.41          | 17.8      | 24.61        | H        |
| 2738.0         | 42.84          | 18        | 24.84        | V        |
| 2804.7         | 42.82          | 18.2      | 24.62        | V        |
| 2882.0         | 42.9           | 18.6      | 24.3         | V        |
| 2958.5         | 43.39          | 18.9      | 24.49        | H        |

**8DPSK Ch0 3GHz-18GHz (Peak)**

| Frequency(MHz) | Result(dBuV/m) | ARpl (dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|-----------|--------------|----------|
| 11528.9        | 49.07          | 13.5      | 35.57        | H        |
| 12670.8        | 50.48          | 16.7      | 33.78        | H        |
| 13686.6        | 53.15          | 18.4      | 34.75        | H        |
| 14886.6        | 55.43          | 22.1      | 33.33        | V        |
| 15872.5        | 56.9           | 25        | 31.9         | H        |
| 16778.2        | 58.41          | 26.9      | 31.51        | V        |

**8DPSK Ch0 3GHz-18GHz (Average)**

| Frequency(MHz) | Result(dBuV/m) | ARpl (dB) | PMea(dBuV/m) | Polarity |
|----------------|----------------|-----------|--------------|----------|
| 14886.6        | 42.74          | 22.1      | 20.64        | V        |
| 15872.5        | 45.18          | 25        | 20.18        | H        |
| 16778.2        | 45.94          | 26.9      | 19.04        | V        |

**Note: Only the worst case is written in the report.**

## ANNEX A.5. Time Of Occupancy (Dwell Time)

### A.5.1 Measurement Limit:

| Standard                         | Limit (ms) |
|----------------------------------|------------|
| FCC 47 Part 15.247 (a) (1) (iii) | < 400      |

### A.5.2 Test procedures

The measurement is according to ANSI C63.10 clause 7.8.4

1. Connect the EUT through cable and divide with CBT32 and spectrum analyzer.
2. Enable the EUT transmit maximum power.
3. Set the spectrum analyzer as step 4 to step 8.
4. Span: Zero span, centered on a hopping channel.
5. RBW shall be  $\leq$  channel spacing and where possible RBW should be set  $\gg 1/T$ , where T is the expected dwell time per channel.
6. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
7. Detector function: Peak.
8. Trace: Max hold.
9. Use the marker-delta function, and record it.

**Note:** For AFH mode, Test Period = 0.4 (second/ channel) x 20 Channel = 8 sec,

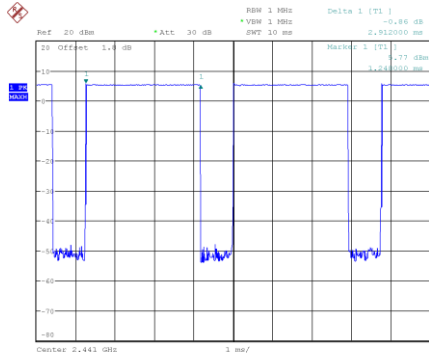
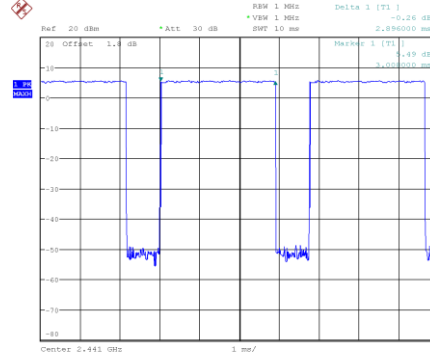
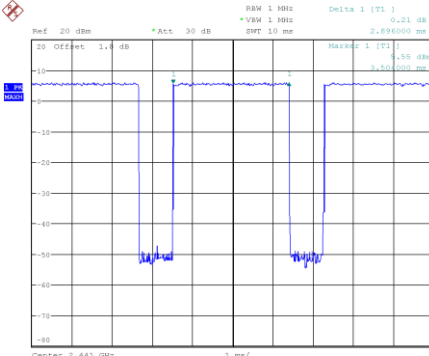
For FHSS mode, Test Period = 0.4 (second/ channel) x 79 Channel = 31.6 sec,

So the Time of Occupancy (Dwell Time) of AFH mode = Time of Occupancy (Dwell Time) of FHSS mode / 79 Channel x 20 Channel

| Modulation    | Frequency(M) | Time slot | Dwell Time | Limit(ms) | Conclusion |
|---------------|--------------|-----------|------------|-----------|------------|
| GFSK DH5      | 2402-2480    | 2.91      | 372.48     | 400       | P          |
| $\pi/4$ DQPSK | 2402-2480    | 2.90      | 371        | 400       | P          |
| 8DPSK DH5     | 2402-2480    | 2.90      | 371        | 400       | P          |

Note: Dwell time = time slot length \* hop rate \* 0.4s (hop rate=320/s)

# Measurement Result:

|                                                                                                                                                                  |                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>For GFSK, Ch39,Packet DH5<br/>Time of occupancy (Dwell Time):2.91 ms</p>     | <p>For <math>\pi/4</math> DQPSK, Ch39,Packet 2DH5<br/>Time of occupancy (Dwell Time):2.90 ms</p>  |
| <p>For 8DPSK, Ch39,Packet 3DH5<br/>Time of occupancy (Dwell Time):2.90 ms</p>  | <p>/</p> <p>/</p>                                                                                                                                                                   |

## ANNEX A.6. 20dB Bandwidth

### A.6.1 Measurement Limit:

| Standard                   | Limit |
|----------------------------|-------|
| FCC 47 Part 15.247 (a) (1) | N/A   |

### A.6.2 Test procedures

The measurement is according to ANSI C63.10 clause 7.8.7

1. Connect the EUT through cable and divide with CBT32 and spectrum analyzer.
2. Enable the EUT transmit maximum power.
3. Set the spectrum analyzer as step 4 to step 7.
4. Span: two or five times of OBW
5. RBW= 1% to 5% of the OBW; VBW is approximately three times of RBW; Max Hold.
6. Select the max peak, and N DB DOWN=20dB.
7. Record the results.

### Measurement Result:

|                                 |      |                                         |      |
|---------------------------------|------|-----------------------------------------|------|
| 20dB Bandwidth: GFSK, Ch0(MHz)  | 0.89 | 20dB Bandwidth: GFSK, Ch39(MHz)         | 0.89 |
|                                 |      |                                         |      |
| 20dB Bandwidth: GFSK, Ch78(MHz) | 0.89 | 20dB Bandwidth: $\pi/4$ DQPSK, Ch0(MHz) | 1.22 |
|                                 |      |                                         |      |
| 20dB Bandwidth: $\pi/4$ DQPSK,  | 1.22 | 20dB Bandwidth: $\pi/4$ DQPSK,          | 1.22 |

|                                               |                    |                                               |                    |
|-----------------------------------------------|--------------------|-----------------------------------------------|--------------------|
| <p><b>Ch39(MHz)</b></p>                       |                    | <p><b>Ch78(MHz)</b></p>                       |                    |
| <p><b>20dB Bandwidth: 8PSK, Ch0(MHz)</b></p>  | <p><b>1.22</b></p> | <p><b>20dB Bandwidth: 8PSK, Ch39(MHz)</b></p> | <p><b>1.22</b></p> |
|                                               |                    |                                               |                    |
| <p><b>20dB Bandwidth: 8PSK, Ch78(MHz)</b></p> | <p><b>1.22</b></p> | <p><b>/</b></p>                               |                    |
|                                               |                    | <p><b>/</b></p>                               |                    |

## ANNEX A.7. Carrier Frequency Separation

### A.7.1 Measurement Limit:

| Standard                   | Limit (KHz)                                        |
|----------------------------|----------------------------------------------------|
| FCC 47 Part 15.247 (a) (1) | Over 25KHz or $(2/3) \times 20\text{dB}$ bandwidth |

### A.7.2 Test procedures

The measurement is according to ANSI C63.10 clause 7.8.2.

1. Connect the EUT through cable and divide with CBT32 and spectrum analyzer.
2. Enable the EUT transmit in hopping mode.
3. Span: Wide enough to capture the peaks of two adjacent channels.
4. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
5. Video (or average) bandwidth (VBW)  $\geq$  RBW.
6. Sweep: Auto.
7. Detector function: Peak.
8. Trace: Max hold.
9. Allow the trace to stabilize.

# Measurement Result:

|                                                     |       |                                                             |        |
|-----------------------------------------------------|-------|-------------------------------------------------------------|--------|
| Carrier separation measurement:<br>GFSK, Ch39(KHz)  | 988.8 | Carrier separation measurement: $\pi/4$ DQPSK,<br>Ch39(KHz) | 1017.6 |
|                                                     |       |                                                             |        |
| Carrier separation measurement:<br>8DPSK, Ch39(KHz) | 1008  | /                                                           |        |
|                                                     |       | /                                                           |        |

## ANNEX A.8. Number Of Hopping Channels

### A.8.1 Measurement Limit:

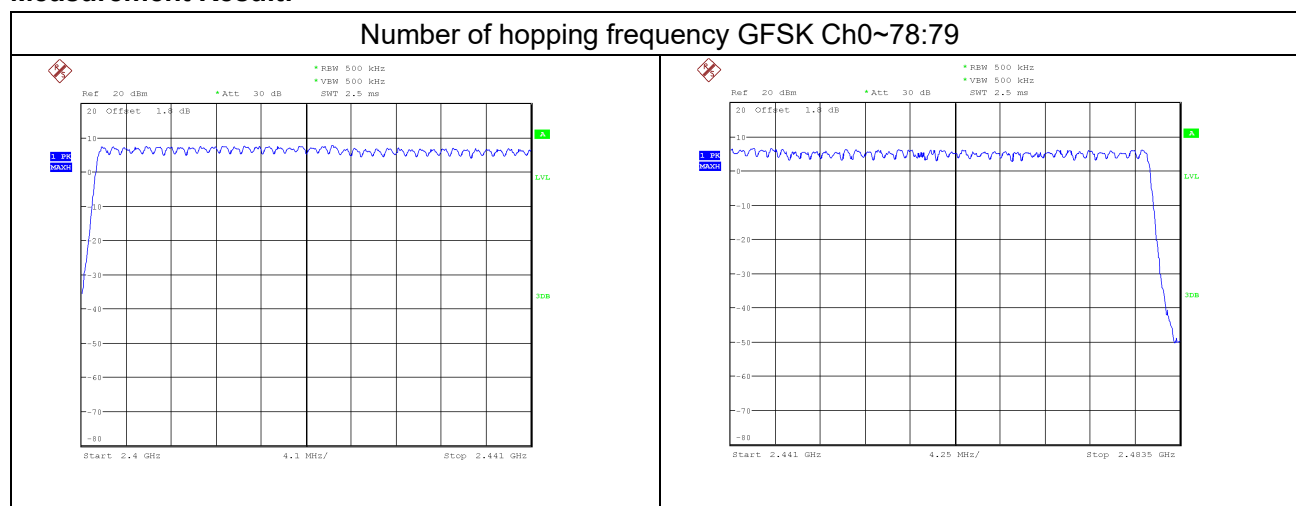
| Standard                           | Limit                                |
|------------------------------------|--------------------------------------|
| FCC 47 CFR Part 15.247 (a)(1)(iii) | At least 15 non-overlapping channels |

### A.8.2 Test procedure

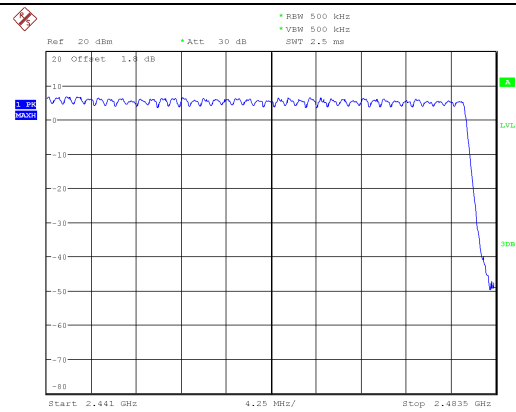
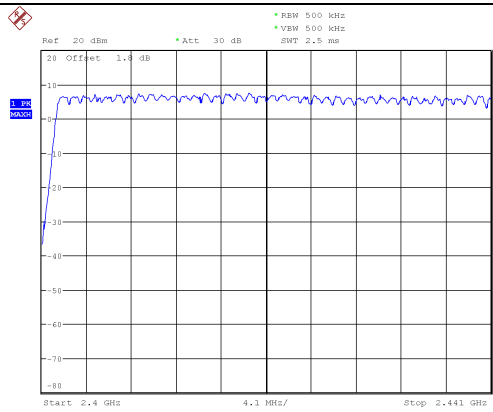
The measurement is according to ANSI C63.10 clause 7.8.3.

1. Connect the EUT through cable and divide with CBT32 and spectrum analyzer.
2. Enable the EUT transmit in hopping mode.
3. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
4. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
5. VBW  $\geq$  RBW.
6. Sweep: Auto.
7. Detector function: Peak.
8. Trace: Max hold.
9. Allow the trace to stabilize.
10. Record the test results.

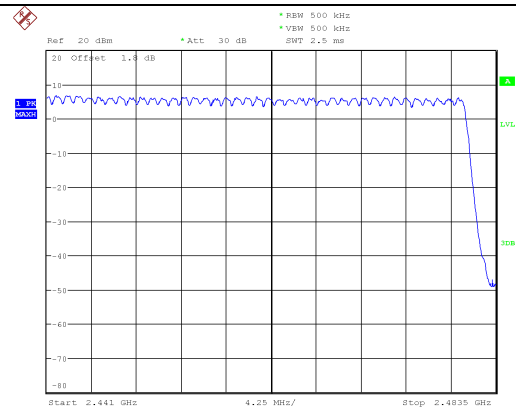
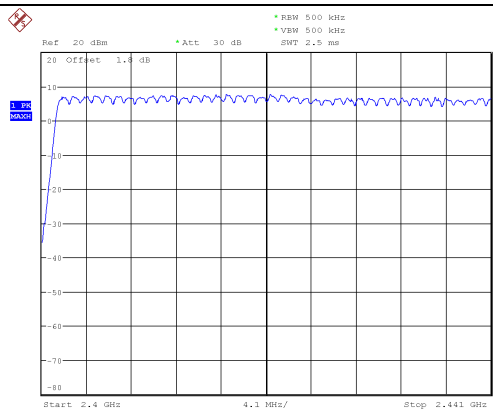
### Measurement Result:



### Number of hopping frequency $\pi/4$ DQPSK Ch0~78:79



### Number of hopping frequency 8PSK Ch0~78:79



## ANNEX A.9. AC Powerline Conducted Emission

### Method of Measurement: ANSI C63.10-2013-clause 6.2

- 1 The one EUT cable configuration and arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit is selected for the final measurement, while applying the appropriate modulating signal to the EUT.
- 2 If the EUT is relocated from an exploratory test site to a final test site, the highest emissions shall be remaximized at the final test location before final ac power-line conducted emission measurements are performed.
- 3 The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment in the system) is then performed for the full frequency range for which the EUT is being tested for compliance without further variation of the EUT arrangement, cable positions, or EUT mode of operation.
- 4 If the EUT is comprised of equipment units that have their own separate ac power connections, e.g., floor-standing equipment with independent power cords for each shelf that are able to connect directly to the ac power network, each current-carrying conductor of one unit is measured while the other units are connected to a second (or more) LISN(s). All units shall be separately measured. If a power strip is provided by the manufacturer, to supply all of the units making up the EUT, only the conductors in the power cord of the power strip shall be measured.

If the EUT uses a detachable antenna, these measurements shall be made with a suitable dummy load connected to the antenna output terminals; otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended. When measuring the ac conducted emissions from a device that operates between 150 kHz and 30 MHz a non-detachable antenna may be replaced with a dummy load for the measurements within the fundamental emission band of the transmitter, but only for those measurements.<sup>36</sup> Record the six highest EUT emissions relative to the limit of each of the current-carrying conductors of the power cords of the equipment that comprises the EUT over the frequency range specified by the procuring or regulatory agency. Diagram or photograph the test setup that was used. See Clause 8 for full reporting requirements.

### Test Condition:

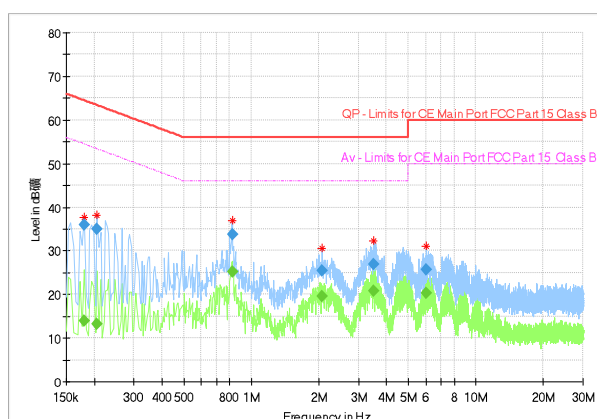
| Voltage (V) | Frequency (Hz) |
|-------------|----------------|
| 120         | 60             |

# Measurement Result and limit:

(Quasi-peak-average Limit)

| Frequency range<br>(MHz) |                                  | Average Limit<br>(dB $\mu$ V) | Conclusion |
|--------------------------|----------------------------------|-------------------------------|------------|
|                          | Quasi-peak<br>Limit (dB $\mu$ V) |                               |            |
|                          |                                  |                               |            |
| 0.15 to 0.5              | 66 to 56                         | 56 to 46                      | P          |
| 0.5 to 5                 | 56                               | 46                            |            |
| 5 to 30                  | 60                               | 50                            |            |

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.



| Frequency<br>(MHz) | QuasiPeak<br>(dB $\mu$ V) | Average<br>(dB $\mu$ V) | Limit<br>(dB $\mu$ V) | Margin<br>(dB) | Meas.<br>Time | Bandwidth<br>(kHz) | Line | Filter | Corr.<br>(dB) |
|--------------------|---------------------------|-------------------------|-----------------------|----------------|---------------|--------------------|------|--------|---------------|
| 0.179850           | 36.07                     | ---                     | 64.49                 | 28.43          | 15000.0       | 9.000              | N    | ON     | 9.7           |
| 0.179850           | ---                       | 14.00                   | 54.49                 | 40.49          | 15000.0       | 9.000              | N    | ON     | 9.7           |
| 0.205969           | ---                       | 13.19                   | 53.37                 | 40.18          | 15000.0       | 9.000              | N    | ON     | 9.7           |
| 0.205969           | 35.01                     | ---                     | 63.37                 | 28.36          | 15000.0       | 9.000              | N    | ON     | 9.7           |
| 0.821625           | ---                       | 25.31                   | 46.00                 | 20.69          | 15000.0       | 9.000              | L1   | ON     | 9.6           |
| 0.821625           | 33.65                     | ---                     | 56.00                 | 22.35          | 15000.0       | 9.000              | L1   | ON     | 9.6           |
| 2.067863           | 25.54                     | ---                     | 56.00                 | 30.46          | 15000.0       | 9.000              | L1   | ON     | 9.7           |
| 2.067863           | ---                       | 19.62                   | 46.00                 | 26.38          | 15000.0       | 9.000              | L1   | ON     | 9.7           |
| 3.519319           | ---                       | 20.75                   | 46.00                 | 25.26          | 15000.0       | 9.000              | L1   | ON     | 9.7           |
| 3.519319           | 26.98                     | ---                     | 56.00                 | 29.02          | 15000.0       | 9.000              | L1   | ON     | 9.7           |
| 5.996869           | ---                       | 20.25                   | 50.00                 | 29.75          | 15000.0       | 9.000              | L1   | ON     | 9.8           |
| 5.996869           | 25.81                     | ---                     | 60.00                 | 34.19          | 15000.0       | 9.000              | L1   | ON     | 9.8           |

## 7. Test Equipment List

### 7.1. Conducted Test System

| Item | Equipment Name         | Type                      | Serial Number    | Manufacturer | Cal. Date  | Cal. interval |
|------|------------------------|---------------------------|------------------|--------------|------------|---------------|
| 1    | Vector Signal Analyzer | FSQ26                     | 101091           | R&S          | 2020-05-10 | 1 year        |
| 2    | DC Power Supply        | ZUP60-14                  | LOC-220Z006-0007 | TDL-Lambda   | 2020-05-10 | 1 year        |
| 3    | Software Version       | Eagle V3.1<br>FCC BT/WIFI | V 3.1            | N/A          | N/A        | N/A           |

### 7.2. Radiated Emission Test System

| Item | Equipment Name                       | Type     | Serial Number | Manufacturer | Cal. Date  | Cal. interval |
|------|--------------------------------------|----------|---------------|--------------|------------|---------------|
| 1    | Universal Radio Communication Tester | CMU200   | 123123        | R&S          | 2020-05-10 | 1 year        |
| 2    | EMI Test Receiver                    | ESU40    | 100307        | R&S          | 2020-05-10 | 1 year        |
| 3    | TRILOG Broadband Antenna             | VULB9163 | VULB9163-515  | Schwarzbeck  | 2020-02-28 | 2 years       |
| 4    | Double- ridged Waveguide Antenna     | ETS-3117 | 00135890      | ETS          | 2020-02-28 | 2 years       |
| 5    | 2-Line V-Network                     | ENV216   | 101380        | R&S          | 2020-05-10 | 1 year        |
| 6    | Software Version                     | NA       | V 9.15.00     | R&S          | N/A        | N/A           |

### 7.3. Climate chamber

| Item | Equipment Name  | Type     | Serial Number | Manufacturer | Cal. Date  | Cal. interval |
|------|-----------------|----------|---------------|--------------|------------|---------------|
| 1    | Climate chamber | UT333 BT | C191995461    | UNI-T        | 2020-05-10 | 1 year        |

Anechoic chamber

Fully anechoic chamber by ETS.

## Annex A: Accreditation Certificate



### Accredited Laboratory

A2LA has accredited

**Industrial Internet Innovation Center (Shanghai) Co., Ltd.**

*Shanghai, People's Republic of China*

for technical competence in the field of

**Electrical Testing**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. This laboratory also meets the requirements of any additional program requirements in the «field» field. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



Presented this 6th day of May 2019.



Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 3682.01  
Valid to February 28, 2021  
Revised December 18, 2020

*For the tests to which this accreditation applies, please refer to the laboratory's Electrical field Scope of Accreditation.*

\*\*\*\*\*END OF REPORT\*\*\*\*\*