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## Annex for Bluetooth

Test Report No.: CTL2412028012-WF

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FCC ID: Q8WD8

## 1. Bandwidth

### 1.1 Test Result

#### 1.1.1 OBW

| Mode      | TX Type | Frequency (MHz) | Packet Type | ANT | 99% Occupied Bandwidth (MHz) |       | Verdict |
|-----------|---------|-----------------|-------------|-----|------------------------------|-------|---------|
|           |         |                 |             |     | Result                       | Limit |         |
| GFSK      | SISO    | 2402            | DH5         | 1   | 0.909                        | /     | Pass    |
|           |         | 2441            | DH5         | 1   | 0.918                        | /     | Pass    |
|           |         | 2480            | DH5         | 1   | 0.913                        | /     | Pass    |
| Pi/4DQPSK | SISO    | 2402            | 2DH5        | 1   | 1.180                        | /     | Pass    |
|           |         | 2441            | 2DH5        | 1   | 1.179                        | /     | Pass    |
|           |         | 2480            | 2DH5        | 1   | 1.178                        | /     | Pass    |
| 8DPSK     | SISO    | 2402            | 3DH5        | 1   | 1.176                        | /     | Pass    |
|           |         | 2441            | 3DH5        | 1   | 1.172                        | /     | Pass    |
|           |         | 2480            | 3DH5        | 1   | 1.172                        | /     | Pass    |

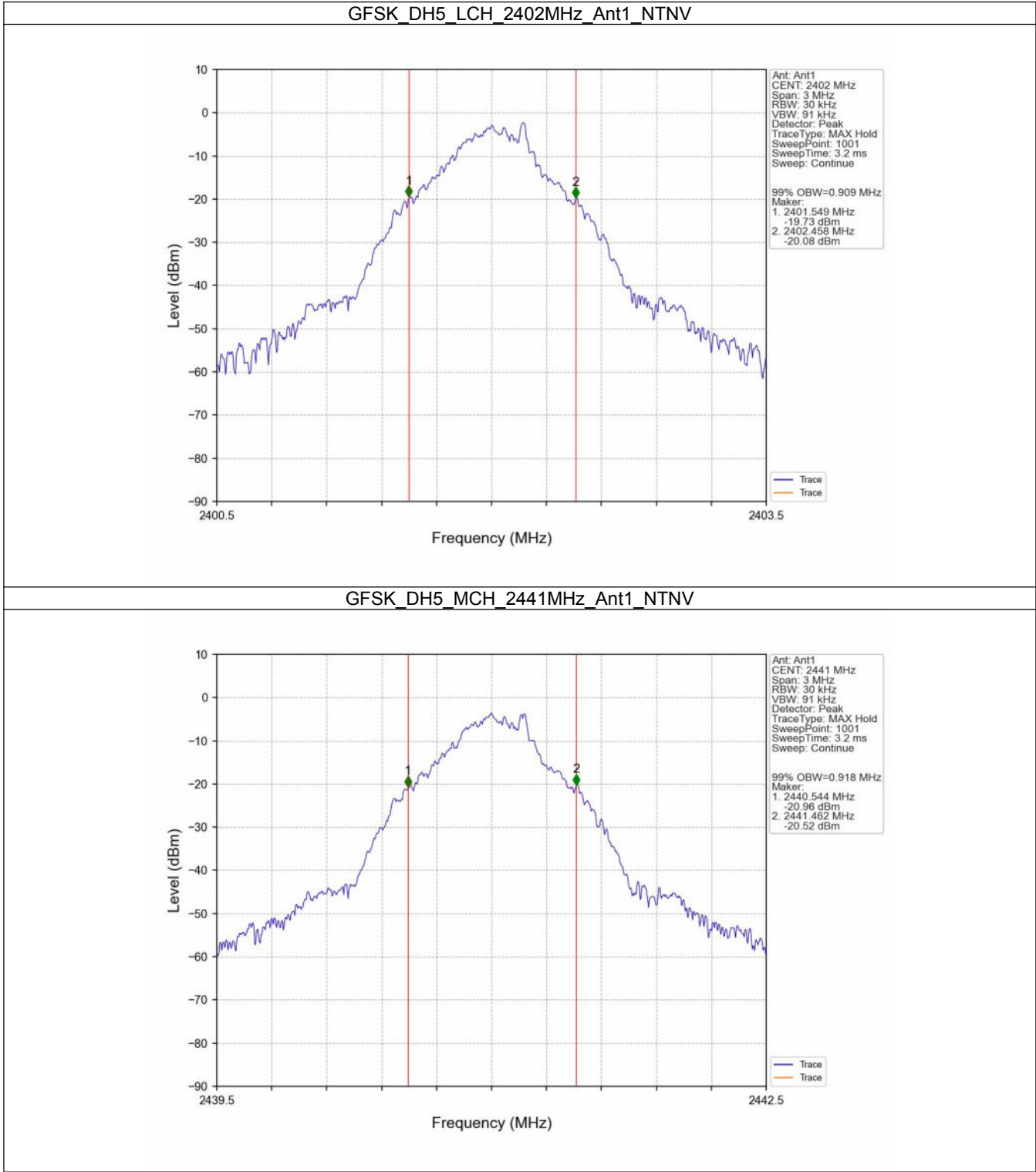
#### 1.1.2 20dB BW

| Mode      | TX Type | Frequency (MHz) | Packet Type | ANT | 20dB Bandwidth (MHz) |       | Verdict |
|-----------|---------|-----------------|-------------|-----|----------------------|-------|---------|
|           |         |                 |             |     | Result               | Limit |         |
| GFSK      | SISO    | 2402            | DH5         | 1   | 0.990                | /     | Pass    |
|           |         | 2441            | DH5         | 1   | 0.991                | /     | Pass    |
|           |         | 2480            | DH5         | 1   | 0.992                | /     | Pass    |
| Pi/4DQPSK | SISO    | 2402            | 2DH5        | 1   | 1.287                | /     | Pass    |
|           |         | 2441            | 2DH5        | 1   | 1.299                | /     | Pass    |
|           |         | 2480            | 2DH5        | 1   | 1.303                | /     | Pass    |
| 8DPSK     | SISO    | 2402            | 3DH5        | 1   | 1.295                | /     | Pass    |
|           |         | 2441            | 3DH5        | 1   | 1.293                | /     | Pass    |
|           |         | 2480            | 3DH5        | 1   | 1.294                | /     | Pass    |

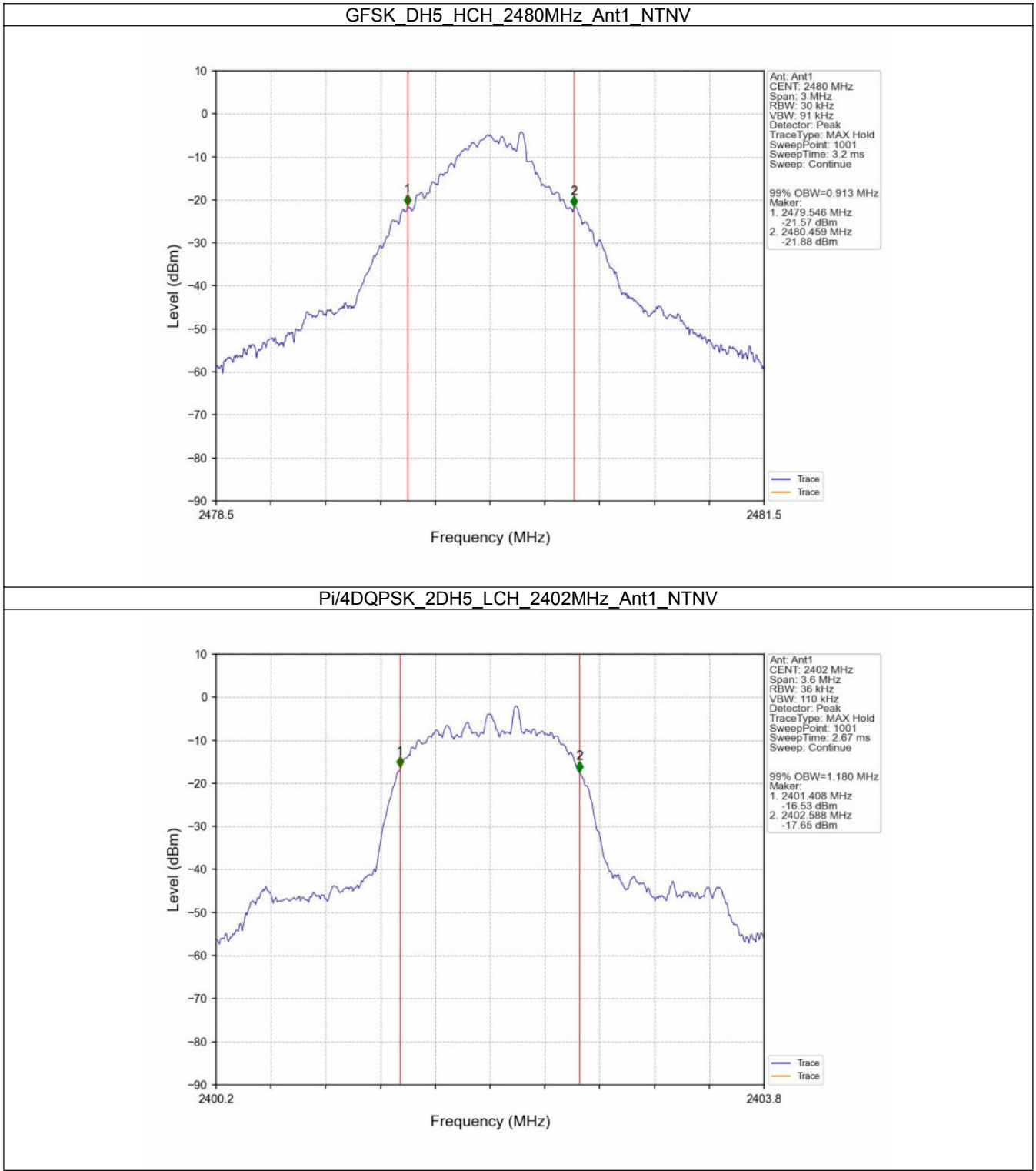
FCC ID: Q8WD8

1.2 Test Graph

1.2.1 OBW

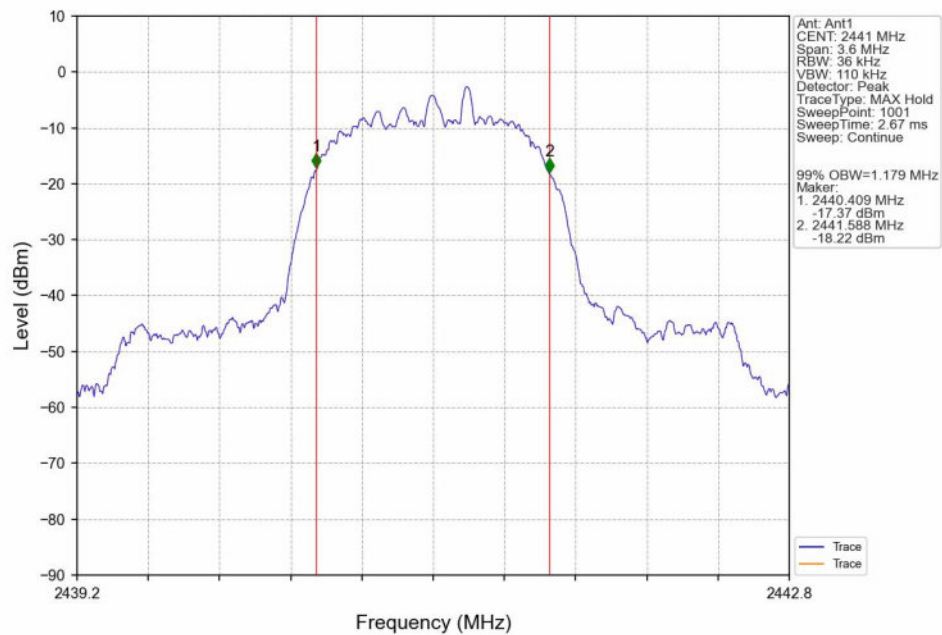


FCC ID: Q8WD8

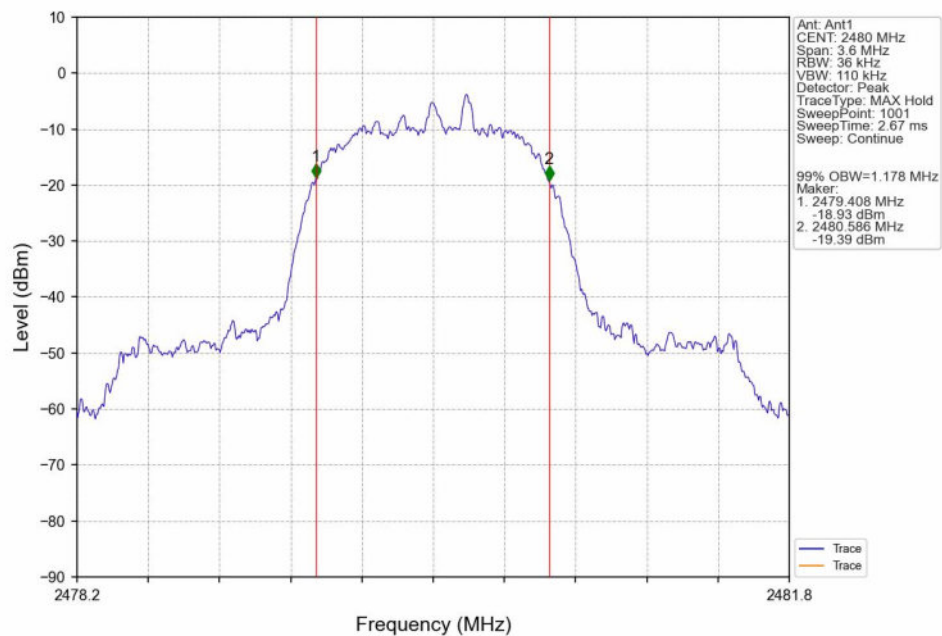


FCC ID: Q8WD8

Pi/4DQPSK\_2DH5\_MCH\_2441MHz\_Ant1\_NTNV

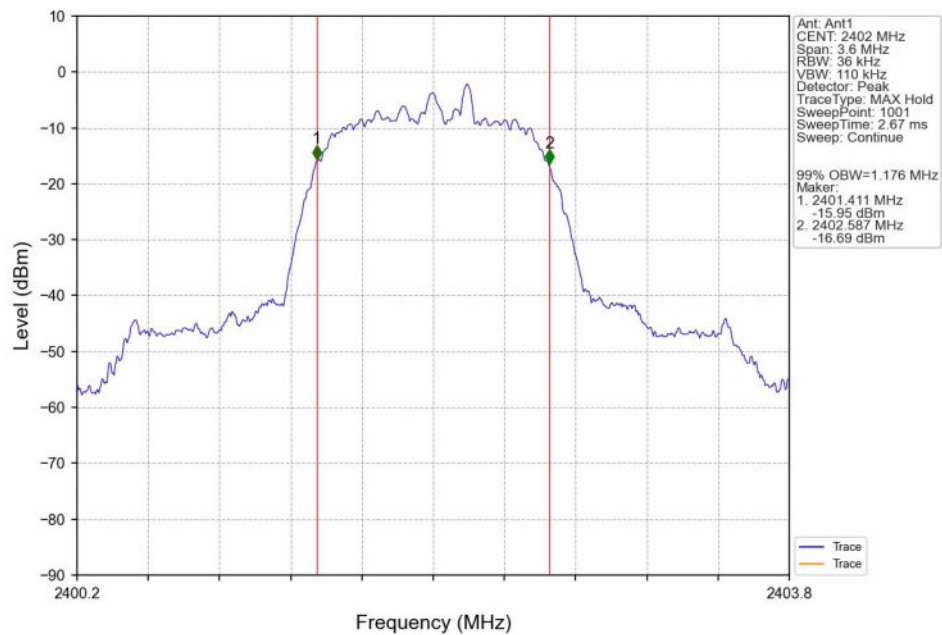


Pi/4DQPSK\_2DH5\_HCH\_2480MHz\_Ant1\_NTNV

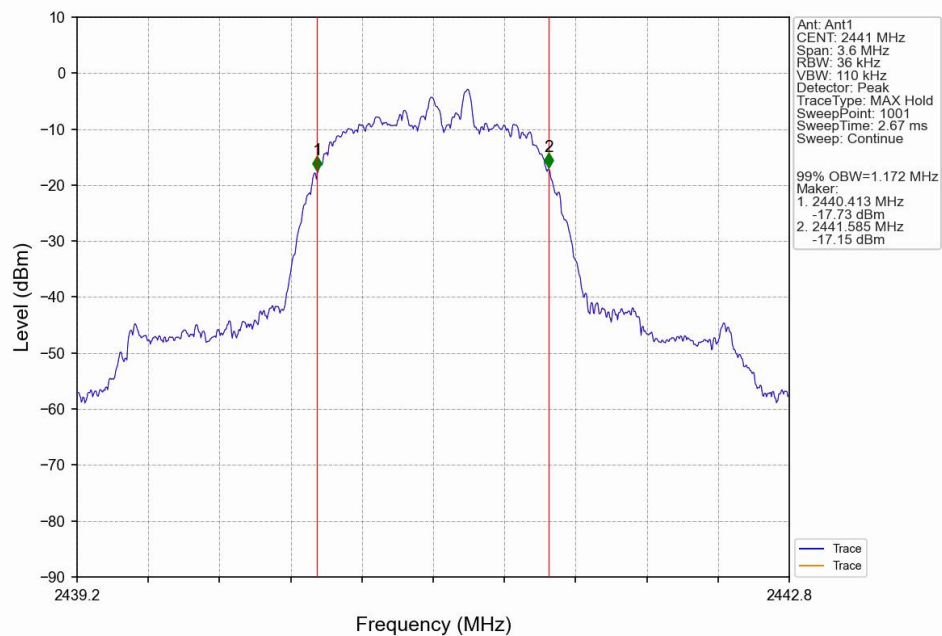


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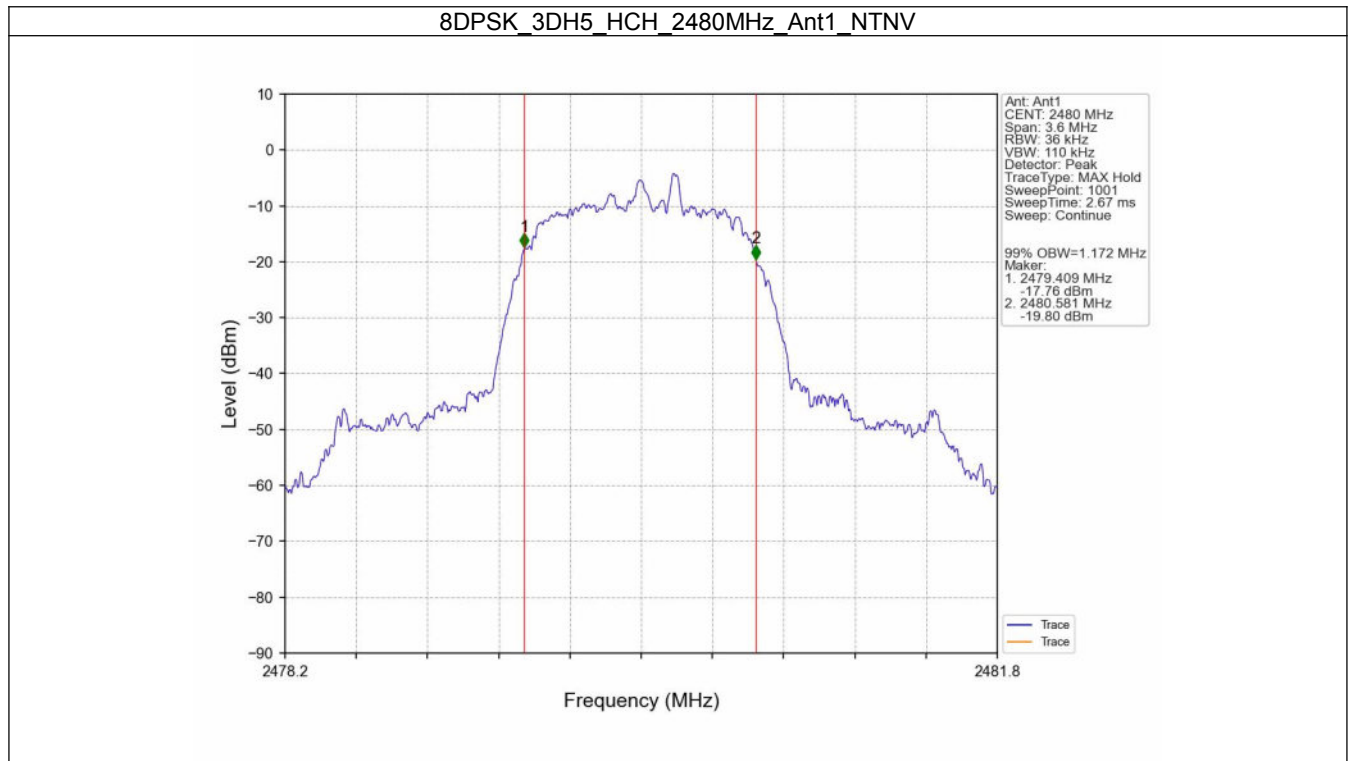
8DPSK\_3DH5\_LCH\_2402MHz\_Ant1\_NTNV



8DPSK\_3DH5\_MCH\_2441MHz\_Ant1\_NTNV

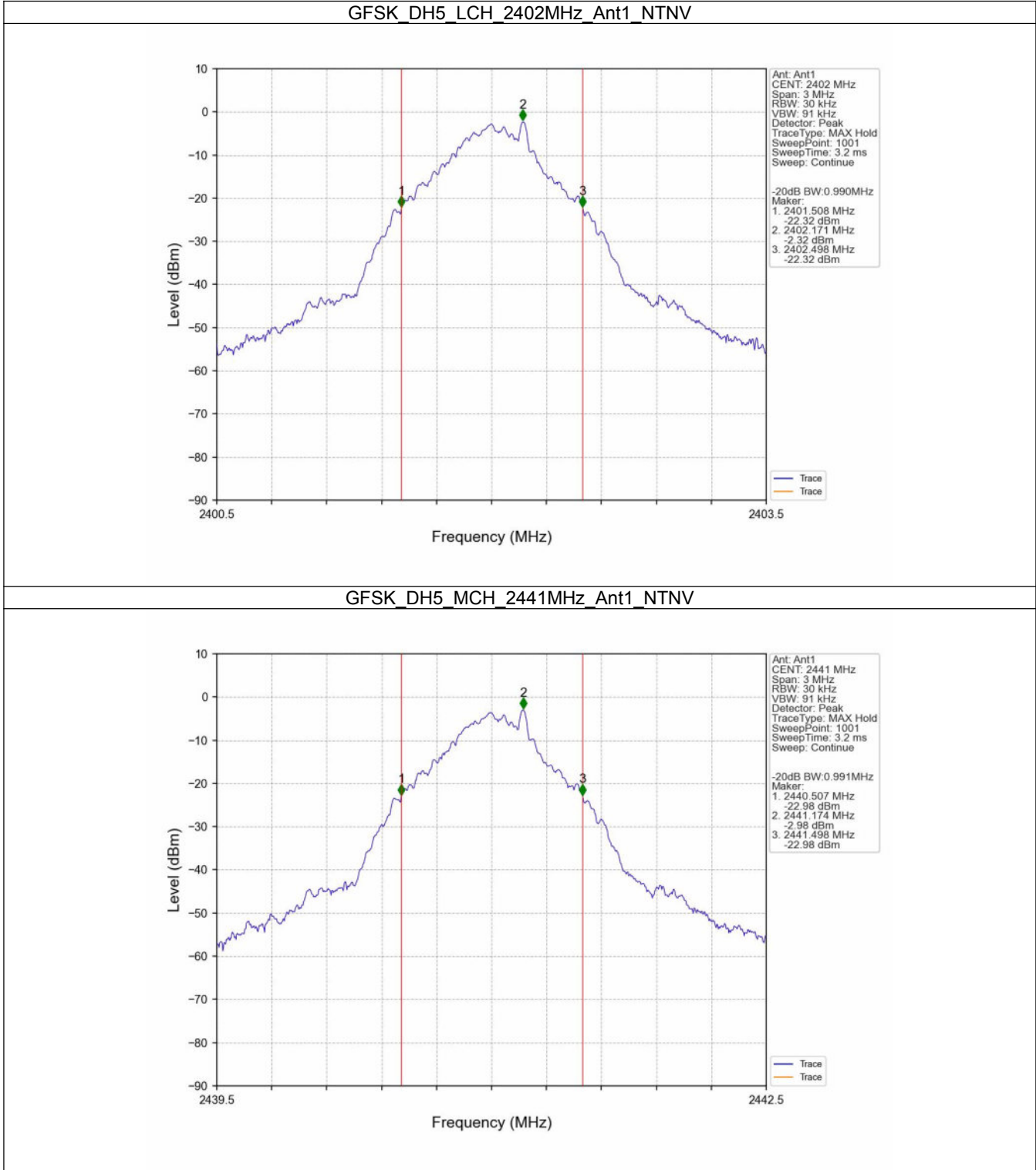


FCC ID: Q8WD8



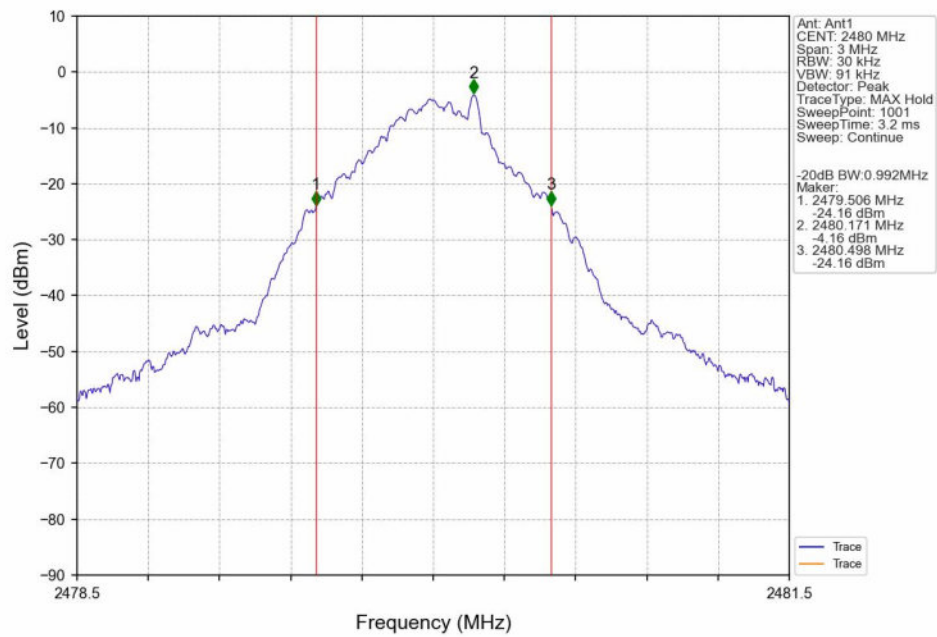
FCC ID: Q8WD8

1.2.2 20dB BW

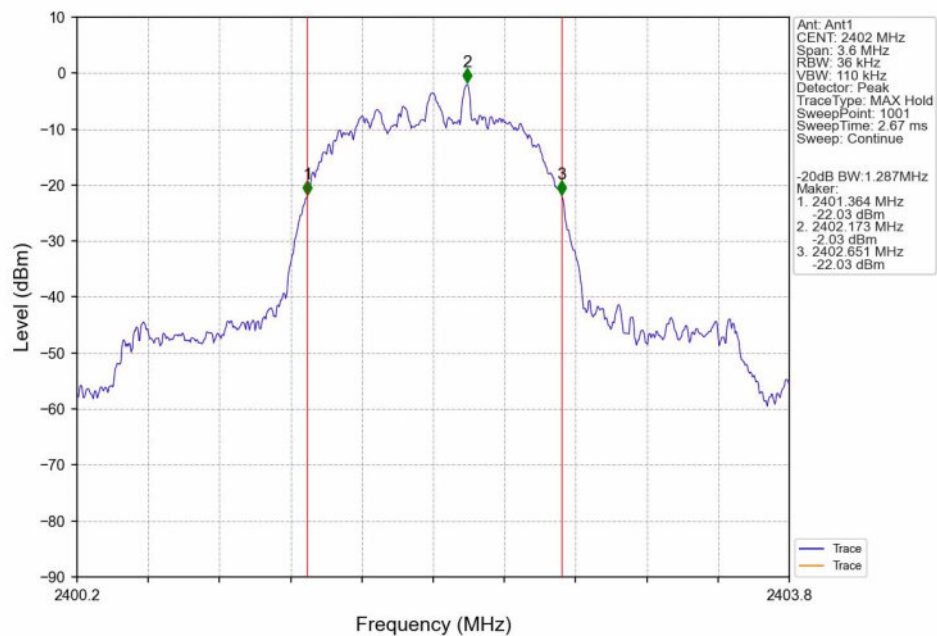


FCC ID: Q8WD8

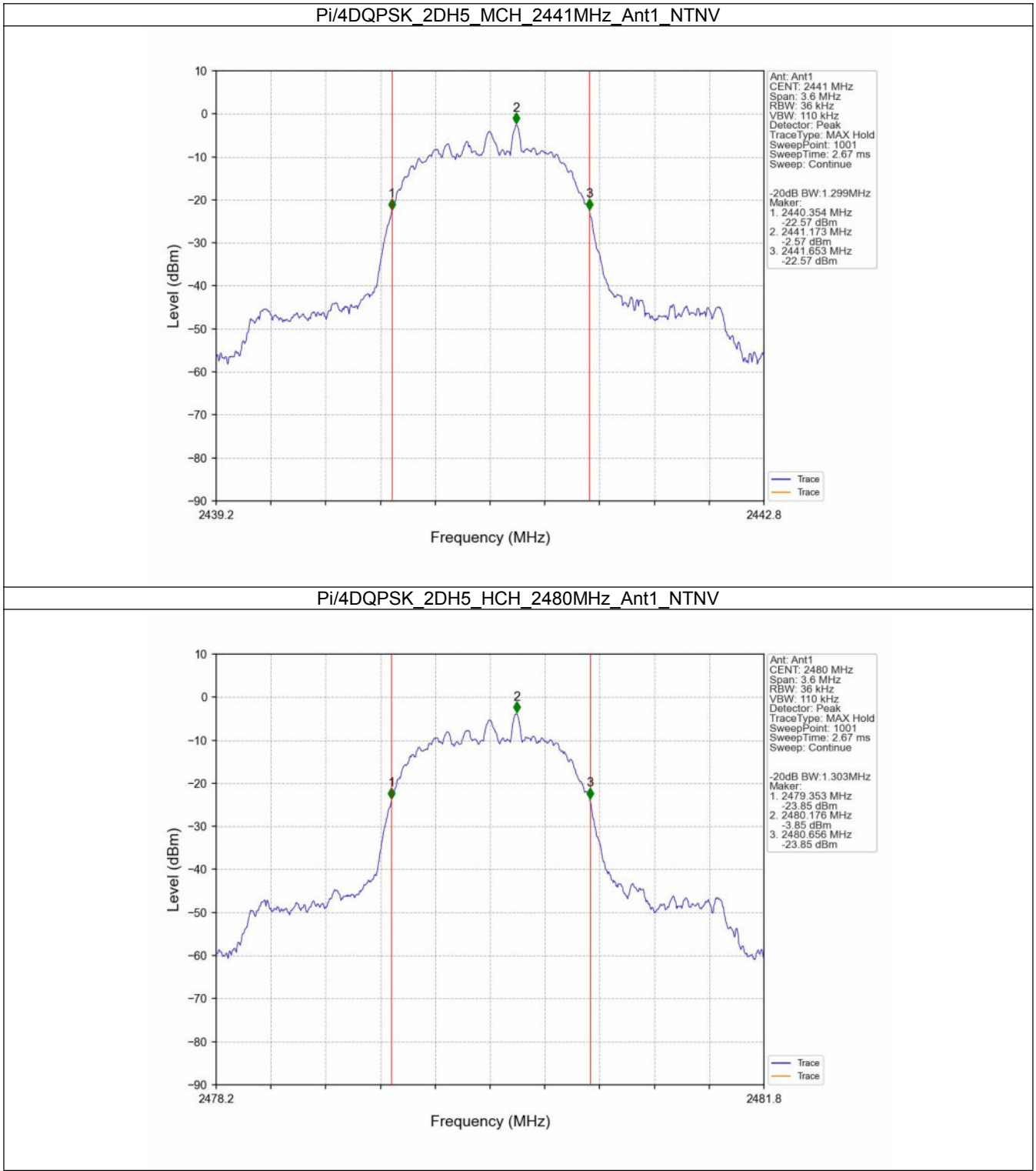
GFSK\_DH5\_HCH\_2480MHz\_Ant1\_NTNV



Pi/4DQPSK\_2DH5\_LCH\_2402MHz\_Ant1\_NTNV

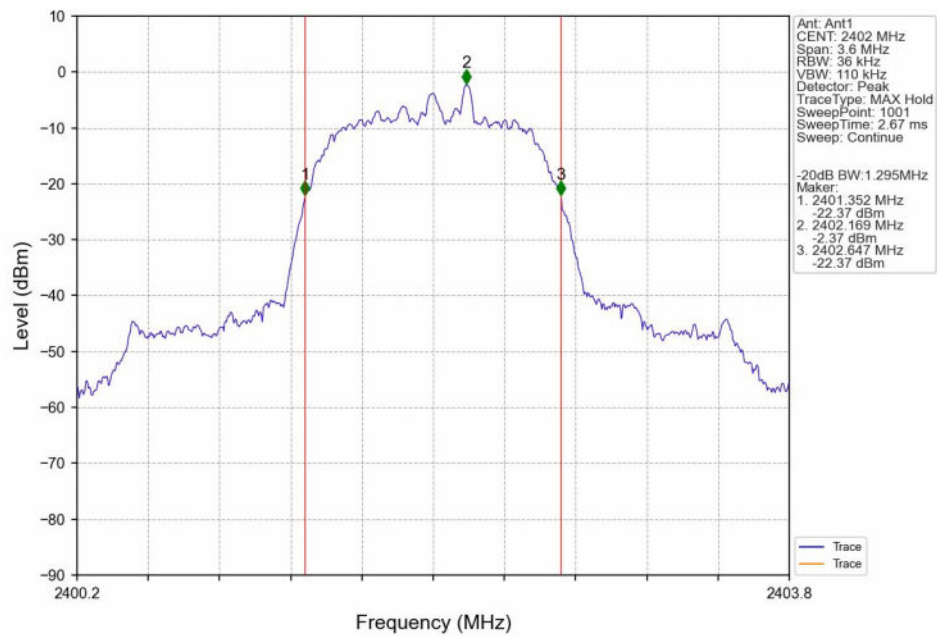


FCC ID: Q8WD8

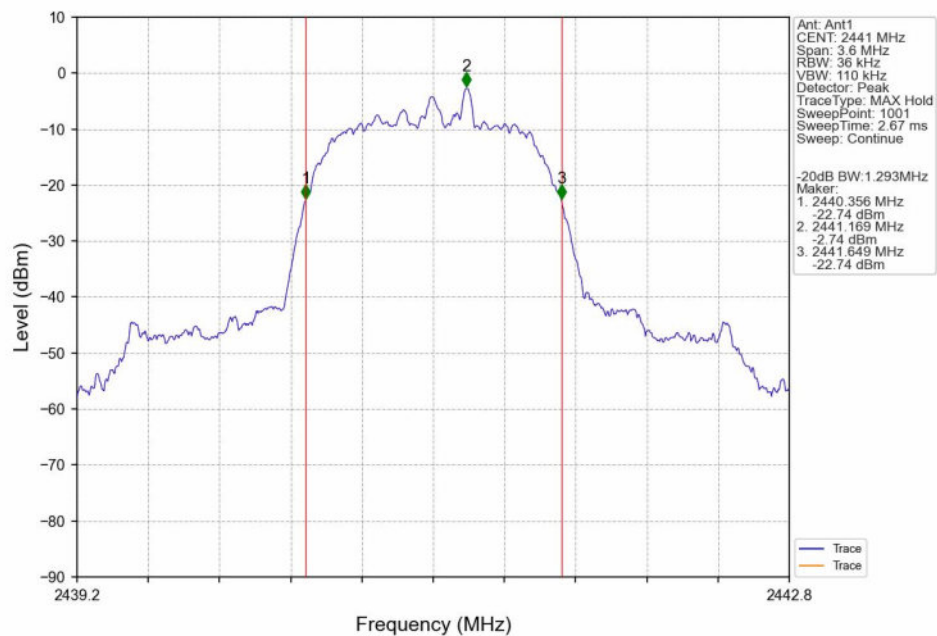


FCC ID: Q8WD8

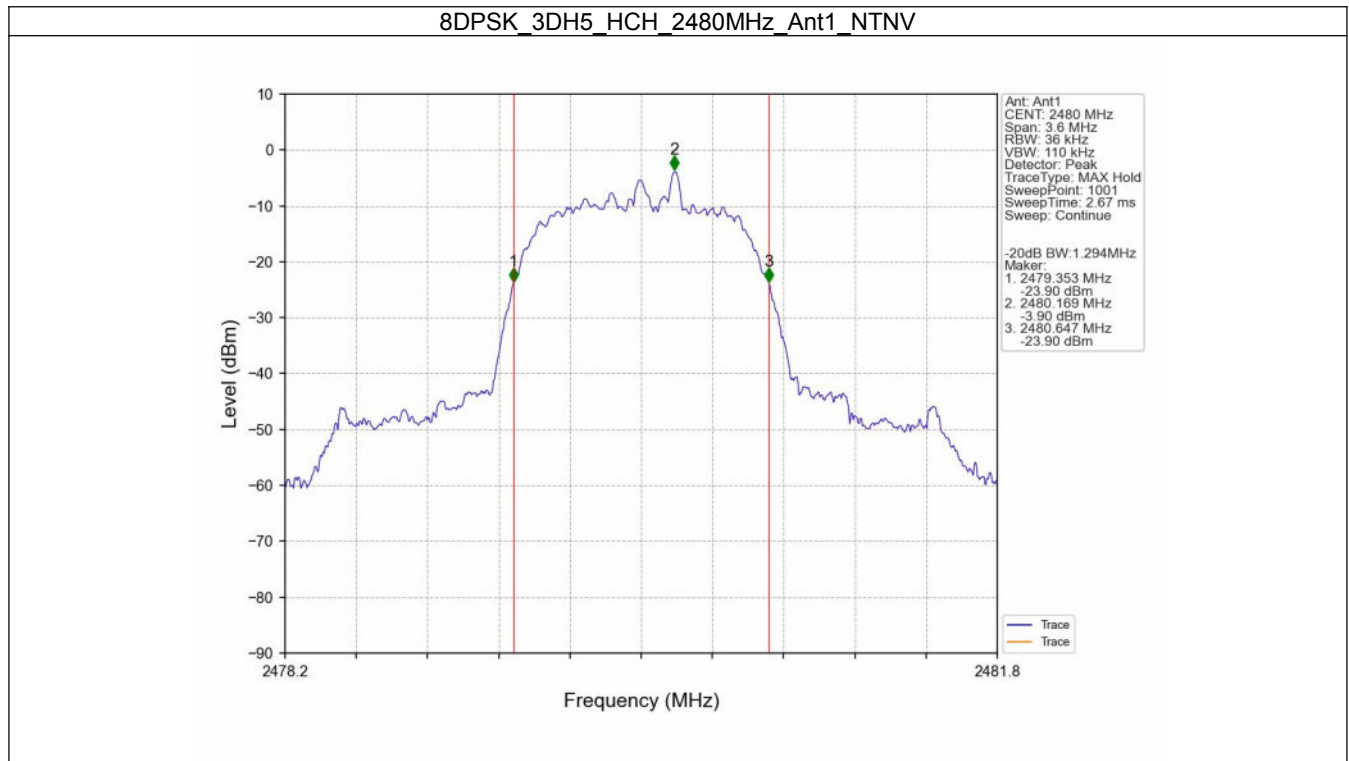
8DPSK\_3DH5\_LCH\_2402MHz\_Ant1\_NTNV



8DPSK\_3DH5\_MCH\_2441MHz\_Ant1\_NTNV



FCC ID: Q8WD8



FCC ID: Q8WD8

## 2. Maximum Conducted Output Power

### 2.1 Test Result

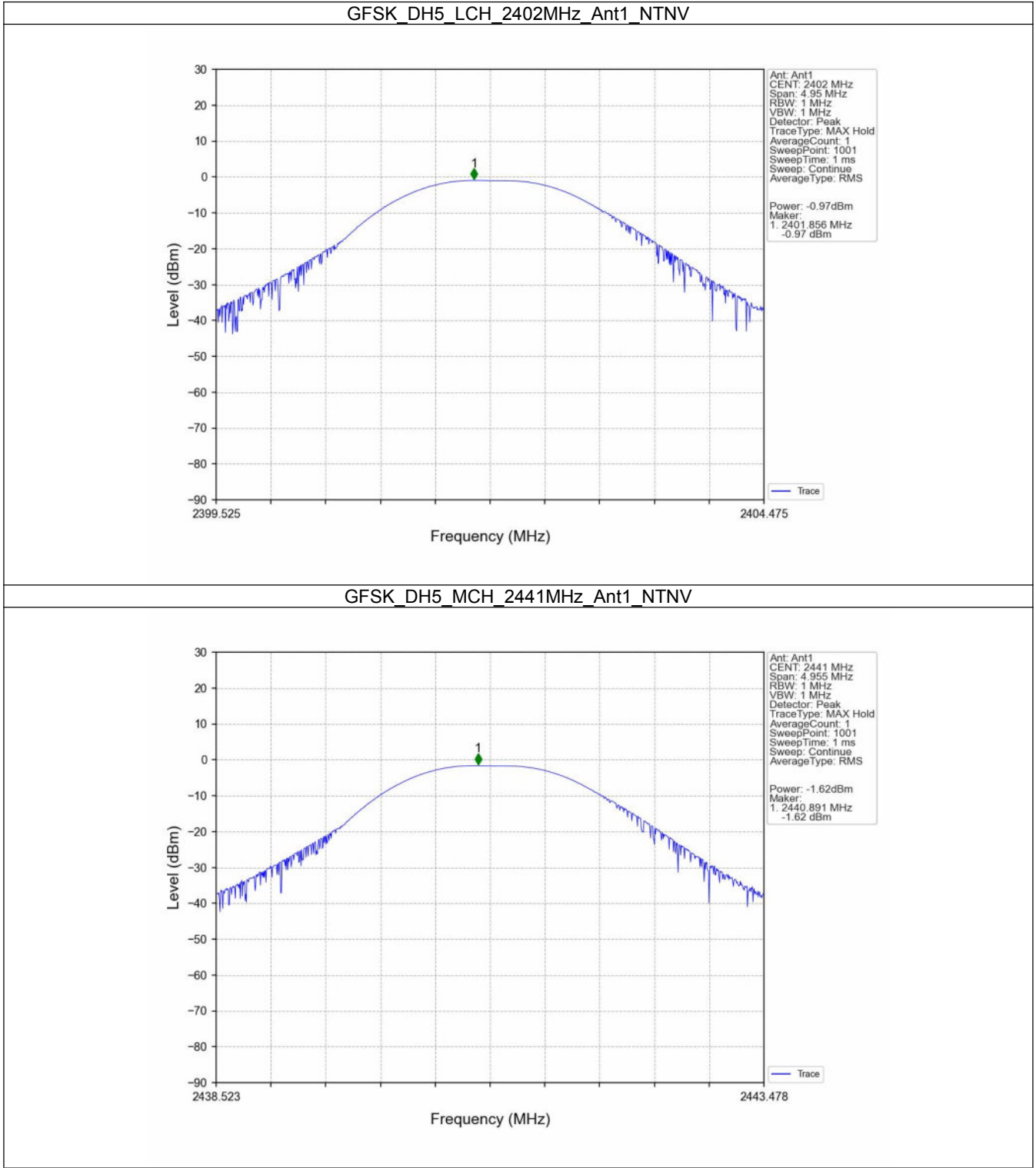
#### 2.1.1 Power

| Mode                                | TX Type | Frequency (MHz) | Packet Type | Maximum Peak Conducted Output Power (dBm) |         | Verdict |
|-------------------------------------|---------|-----------------|-------------|-------------------------------------------|---------|---------|
|                                     |         |                 |             | ANT1                                      | Limit   |         |
| GFSK                                | SISO    | 2402            | DH5         | -0.97                                     | <=30    | Pass    |
|                                     |         | 2441            | DH5         | -1.62                                     | <=30    | Pass    |
|                                     |         | 2480            | DH5         | -2.79                                     | <=30    | Pass    |
| Pi/4DQPSK                           | SISO    | 2402            | 2DH5        | 0.22                                      | <=20.97 | Pass    |
|                                     |         | 2441            | 2DH5        | -0.29                                     | <=20.97 | Pass    |
|                                     |         | 2480            | 2DH5        | -1.41                                     | <=20.97 | Pass    |
| 8DPSK                               | SISO    | 2402            | 3DH5        | 0.39                                      | <=20.97 | Pass    |
|                                     |         | 2441            | 3DH5        | -0.15                                     | <=20.97 | Pass    |
|                                     |         | 2480            | 3DH5        | -1.27                                     | <=20.97 | Pass    |
| Note1: Antenna Gain: Ant1: 2.39dBi; |         |                 |             |                                           |         |         |

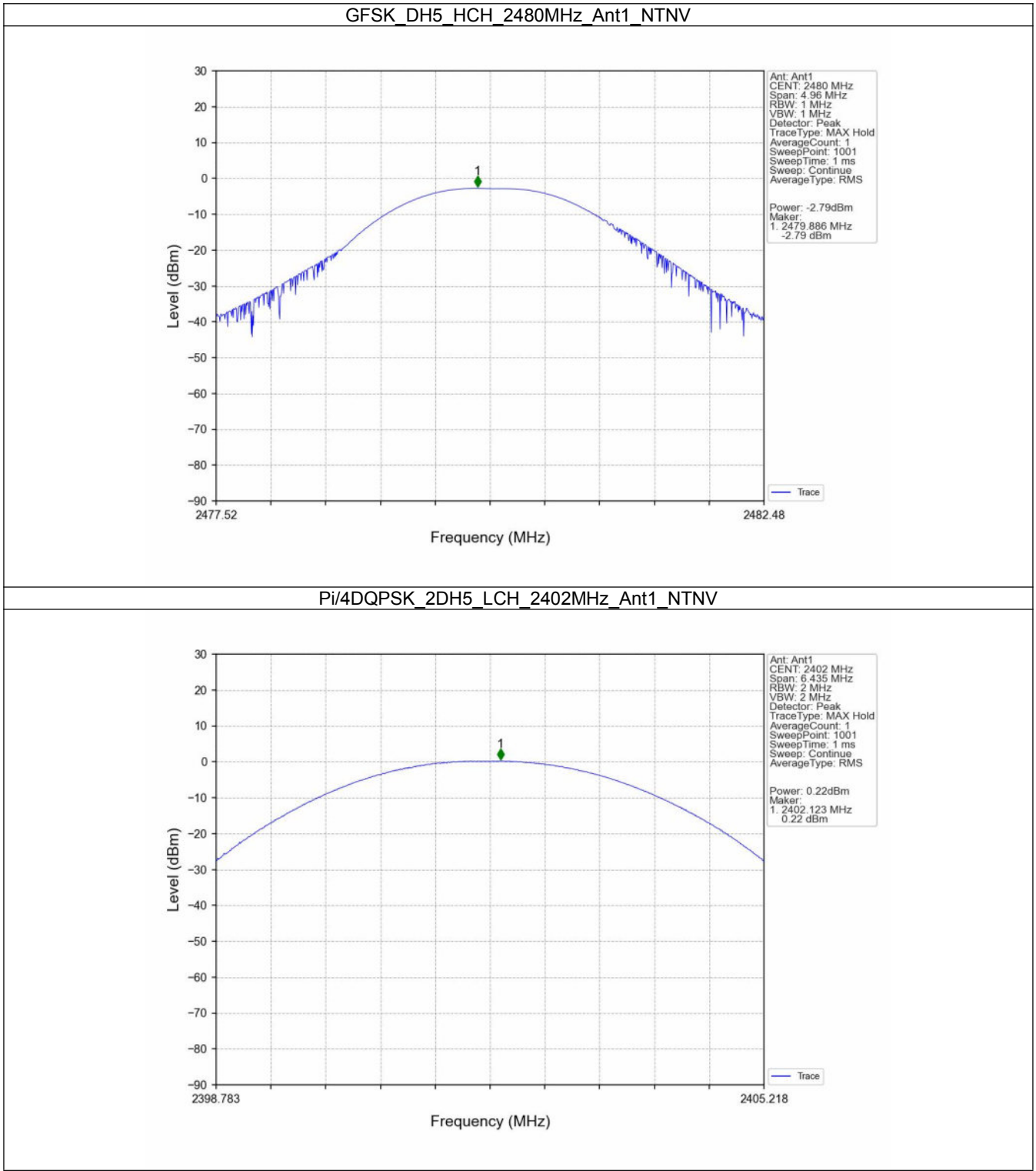
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2.2 Test Graph

2.2.1 Power

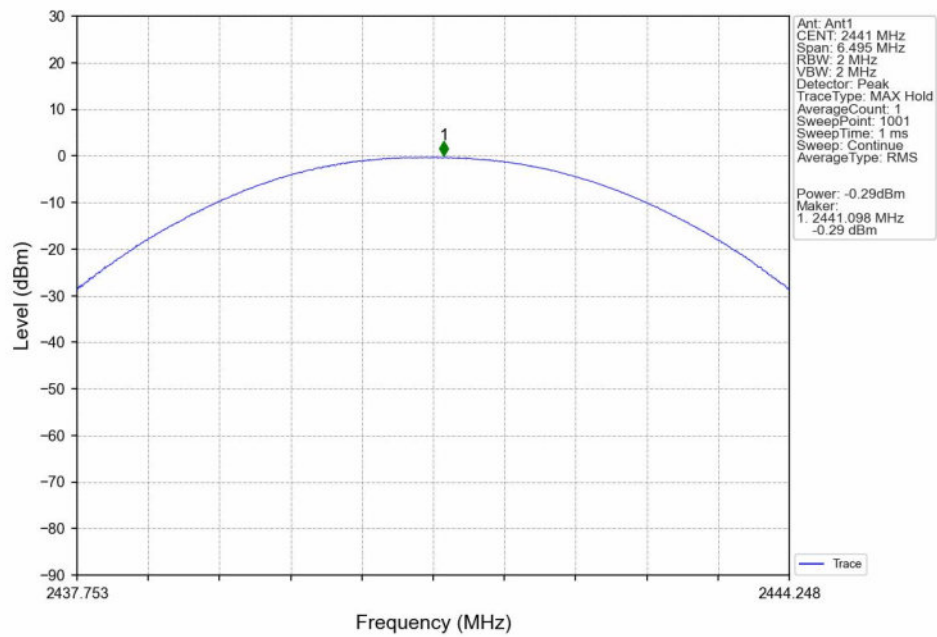


FCC ID: Q8WD8

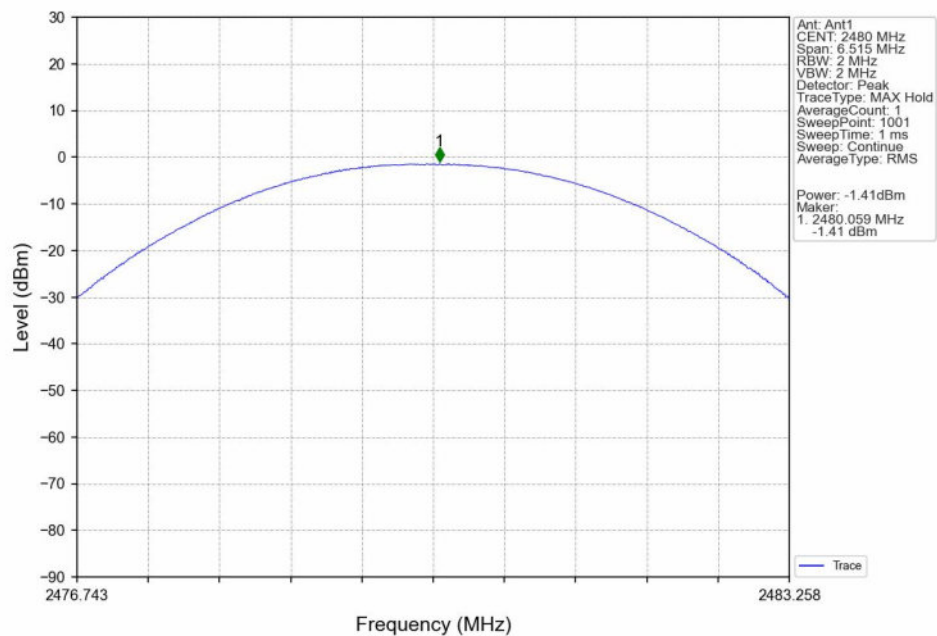


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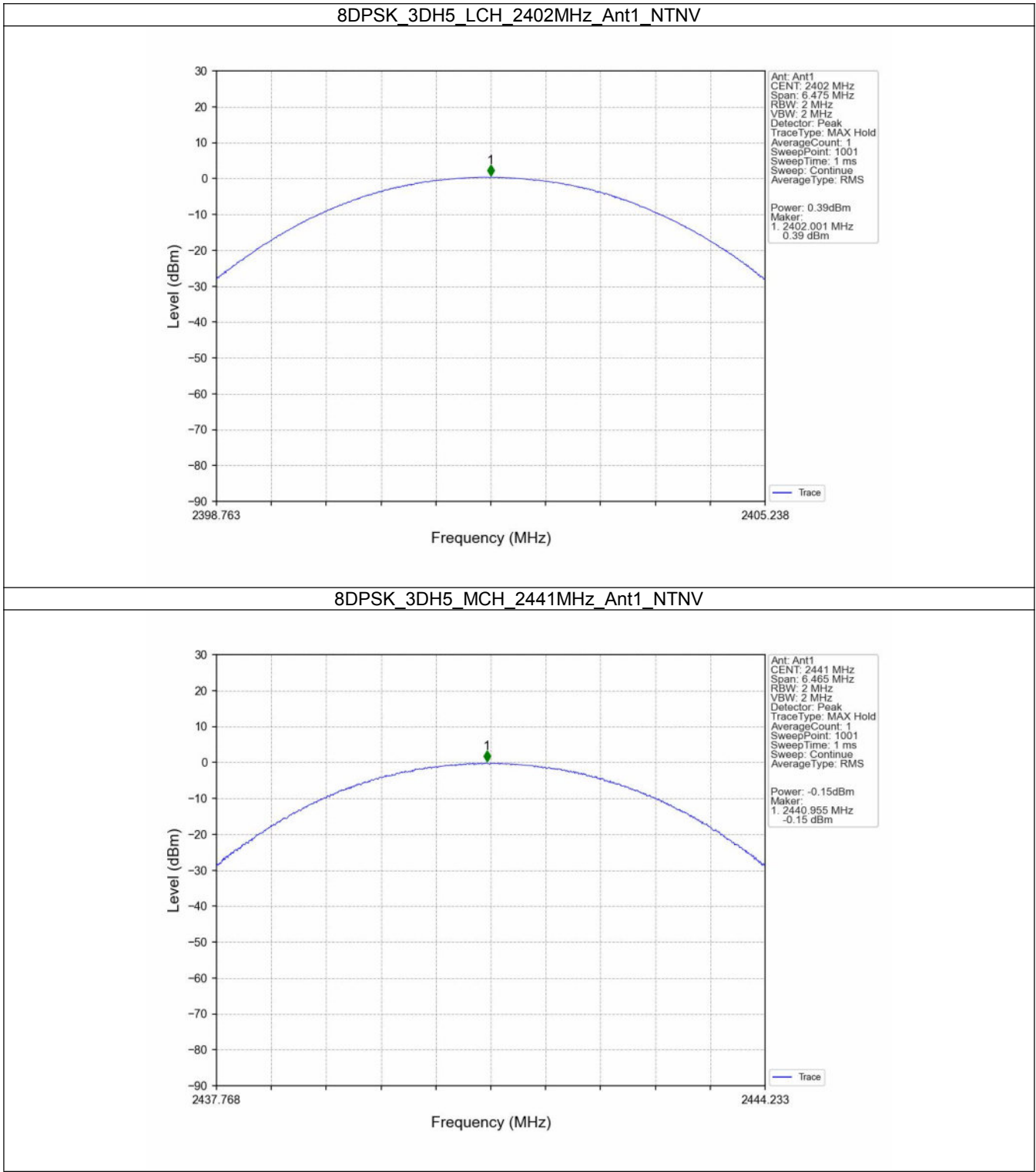
Pi/4DQPSK\_2DH5\_MCH\_2441MHz\_Ant1\_NTNV



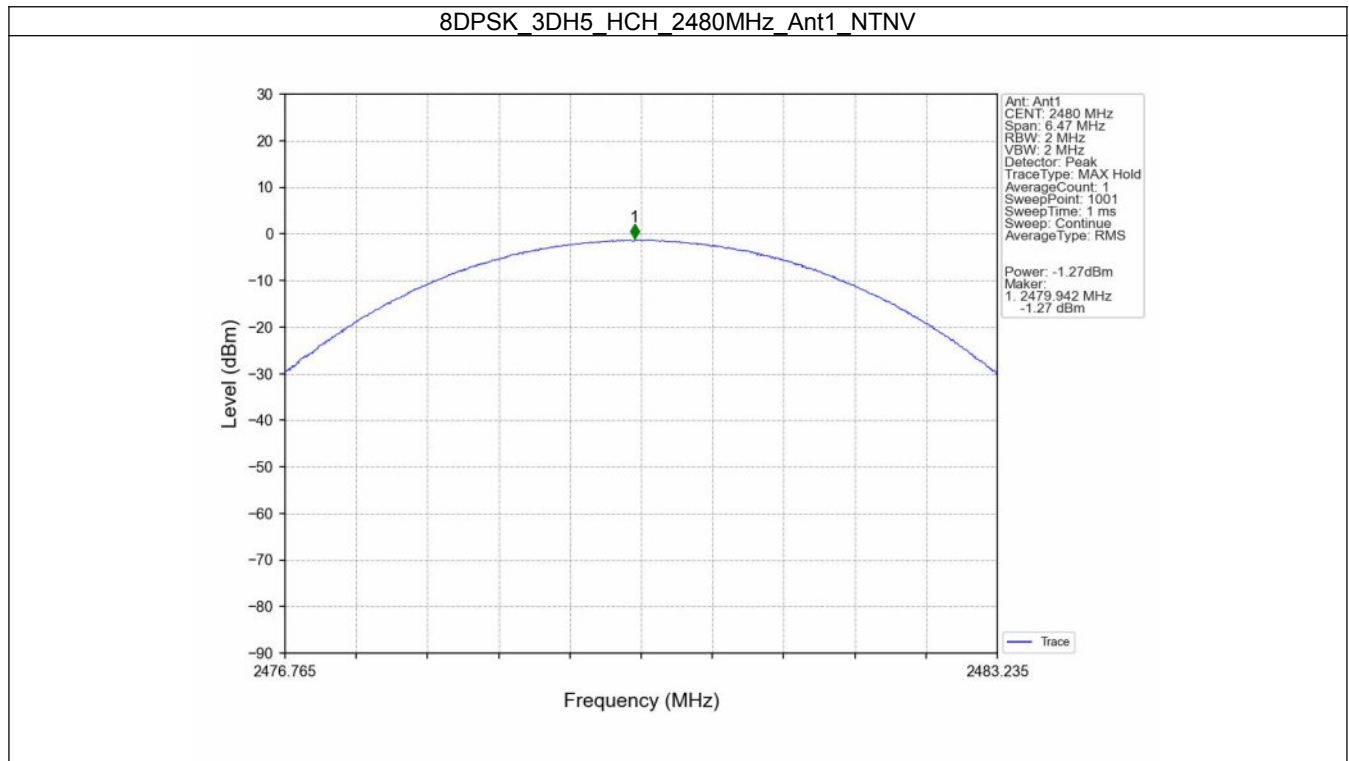
Pi/4DQPSK\_2DH5\_HCH\_2480MHz\_Ant1\_NTNV



FCC ID: Q8WD8



FCC ID: Q8WD8



FCC ID: Q8WD8

### 3. Carrier Frequency Separation

#### 3.1 Test Result

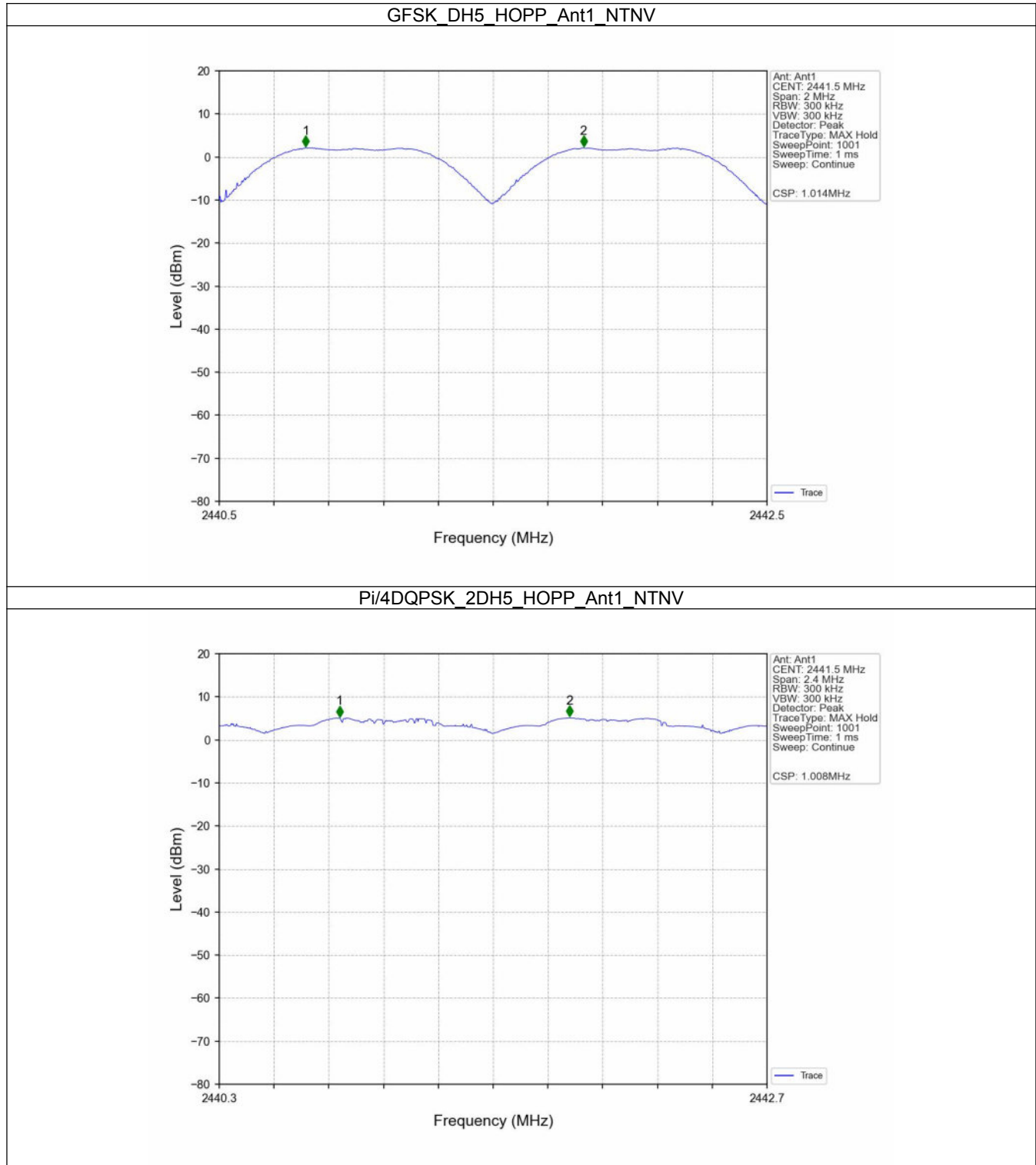
##### 3.1.1 Ant1

| Ant1      |         |                 |             |                          |                      |              |         |
|-----------|---------|-----------------|-------------|--------------------------|----------------------|--------------|---------|
| Mode      | TX Type | Frequency (MHz) | Packet Type | Channel Separation (MHz) | 20dB Bandwidth (MHz) | Limit (MHz)  | Verdict |
| GFSK      | SISO    | HOPP            | DH5         | 1.014                    | 0.992                | $\geq 0.992$ | Pass    |
| Pi/4DQPSK | SISO    | HOPP            | 2DH5        | 1.008                    | 1.303                | $\geq 0.869$ | Pass    |
| 8DPSK     | SISO    | HOPP            | 3DH5        | 1.008                    | 1.295                | $\geq 0.863$ | Pass    |

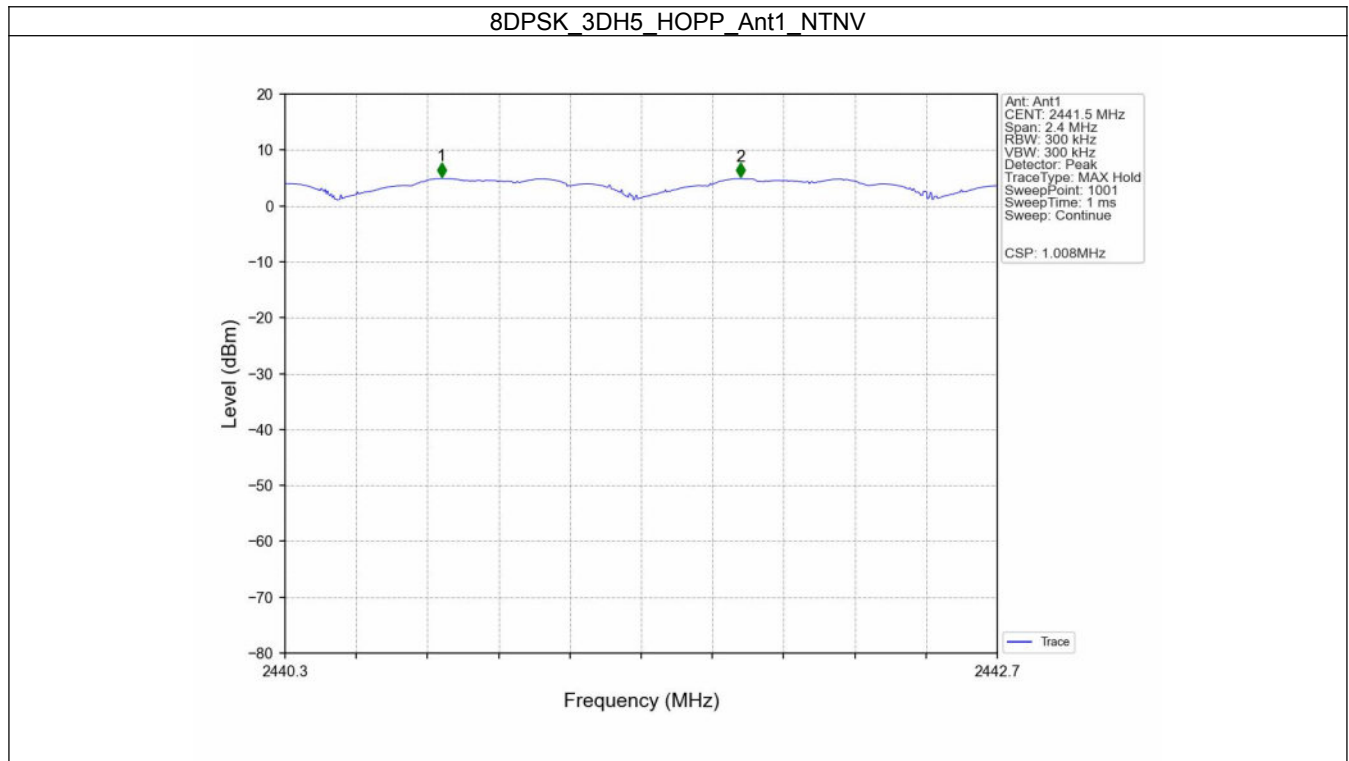
FCC ID: Q8WD8

## 3.2 Test Graph

### 3.2.1 Ant1



FCC ID: Q8WD8



FCC ID: Q8WD8

## 4. Number of Hopping Frequencies

### 4.1 Test Result

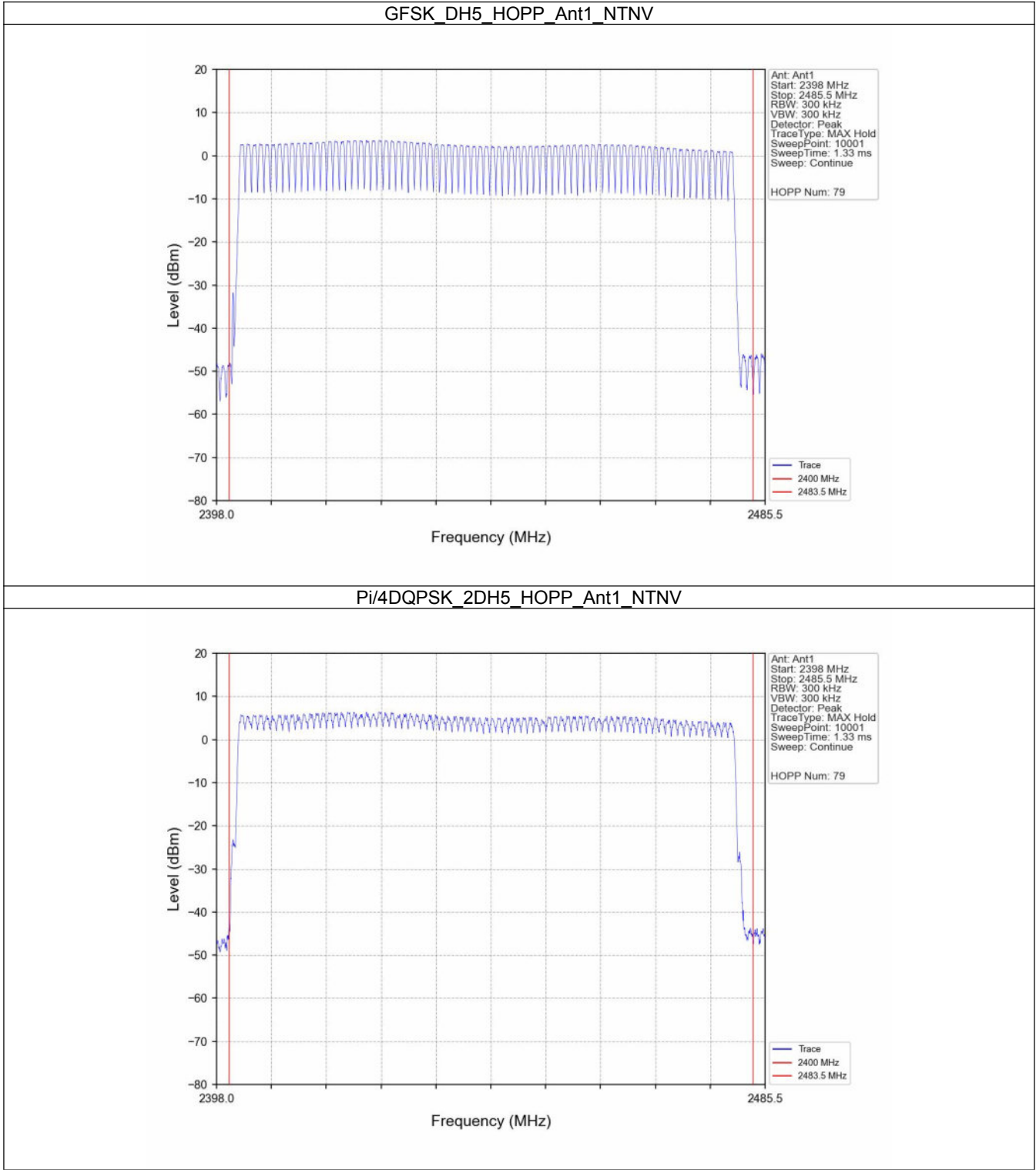
#### 4.1.1 HoppNum

| Mode      | TX Type | Frequency (MHz) | Packet Type | Num of Hopping Frequencies |           | Verdict |
|-----------|---------|-----------------|-------------|----------------------------|-----------|---------|
|           |         |                 |             | ANT1                       | Limit     |         |
| GFSK      | SISO    | HOPP            | DH5         | 79                         | $\geq 15$ | Pass    |
| Pi/4DQPSK | SISO    | HOPP            | 2DH5        | 79                         | $\geq 15$ | Pass    |
| 8DPSK     | SISO    | HOPP            | 3DH5        | 79                         | $\geq 15$ | Pass    |

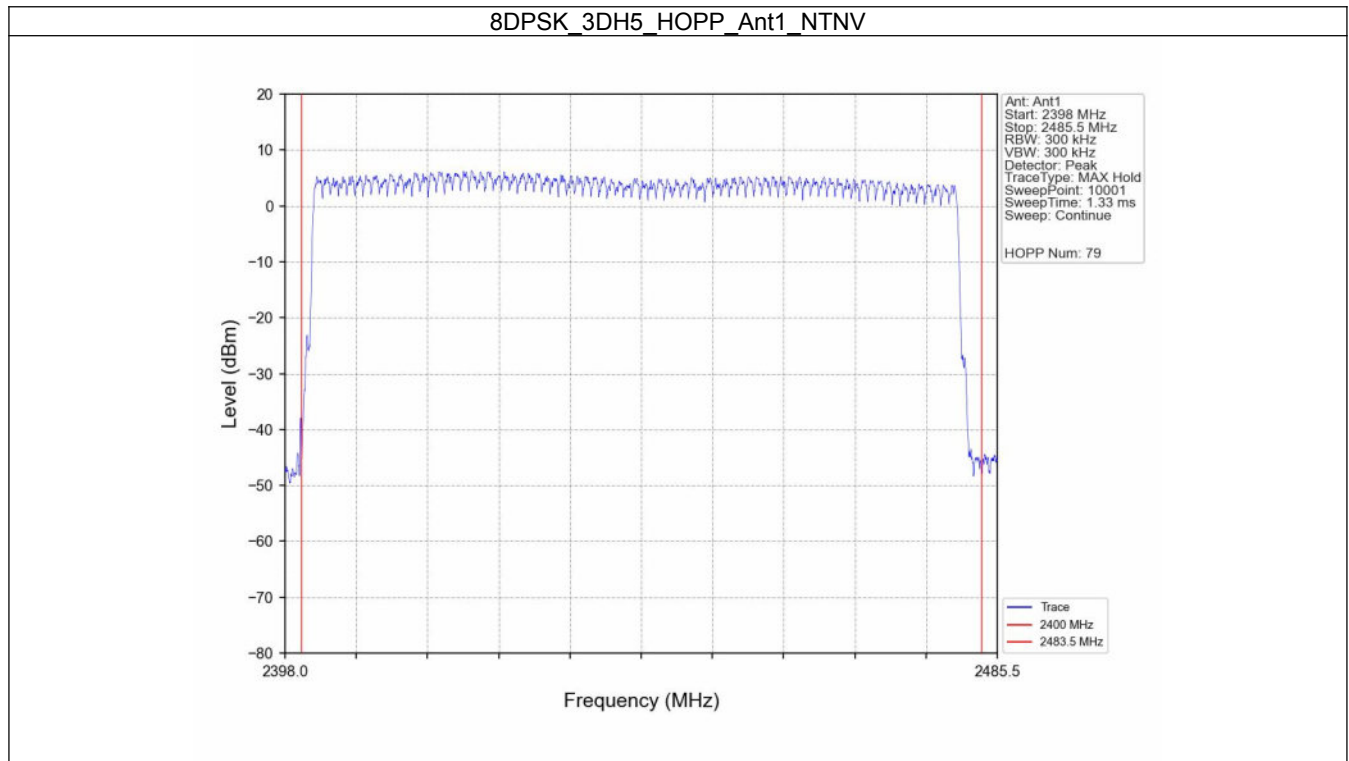
FCC ID: Q8WD8

4.2 Test Graph

4.2.1 HoppNum



FCC ID: Q8WD8



FCC ID: Q8WD8

## 5. Time of Occupancy (Dwell Time)

### 5.1 Test Result

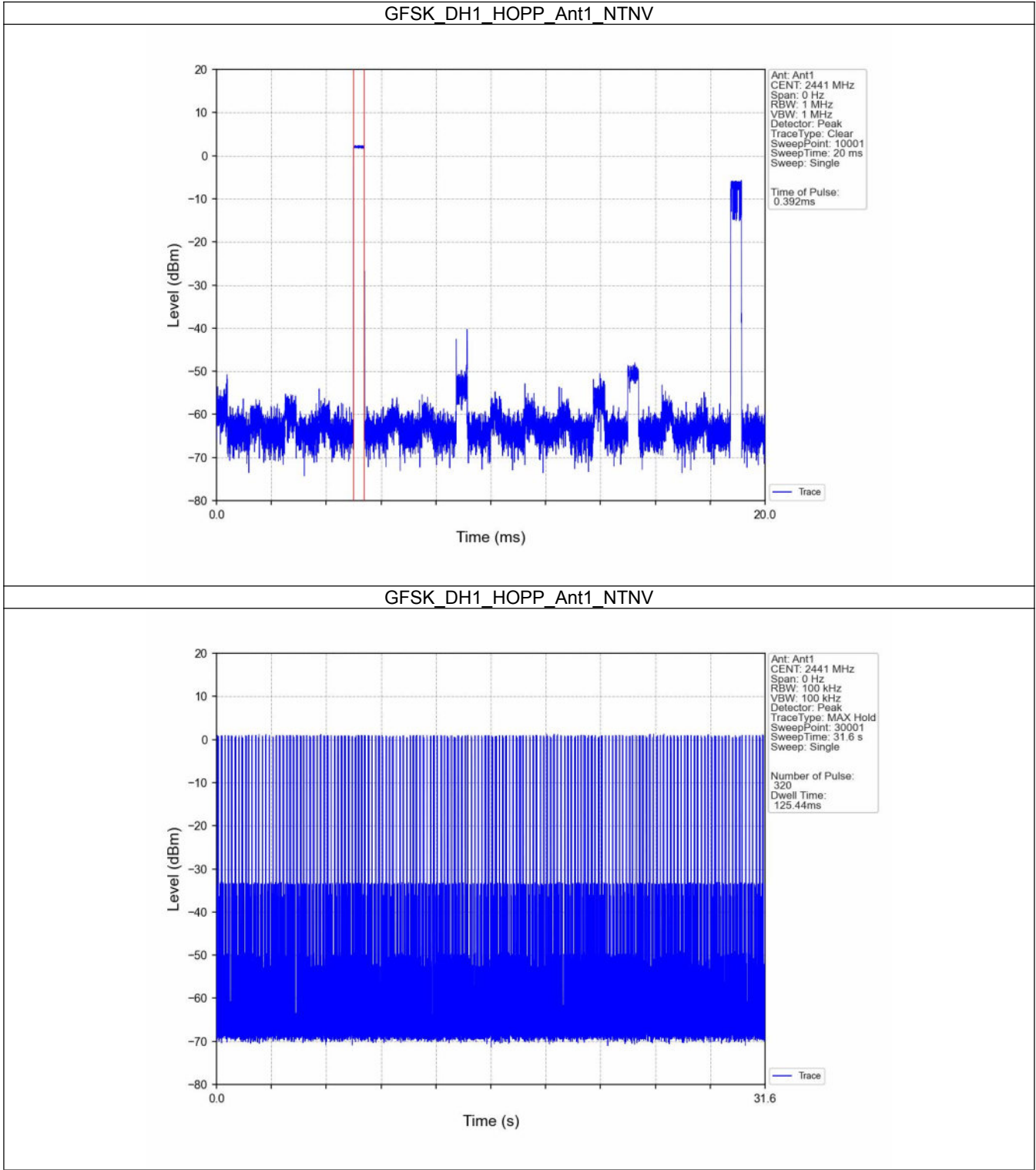
#### 5.1.1 Ant1

| Ant1      |         |                 |             |                               |                        |                                    |                 |            |         |
|-----------|---------|-----------------|-------------|-------------------------------|------------------------|------------------------------------|-----------------|------------|---------|
| Mode      | Tx Type | Frequency (MHz) | Packet Type | Duration of Single Pulse (ms) | Observation Period (s) | Num of Pulse in Observation Period | Dwell Time (ms) | Limit (ms) | Verdict |
| GFSK      | SISO    | HOPP            | DH1         | 0.392                         | 31.600                 | 320                                | 125.440         | <=400      | Pass    |
|           |         |                 | DH3         | 1.662                         | 31.600                 | 162                                | 269.244         | <=400      | Pass    |
|           |         |                 | DH5         | 2.912                         | 31.600                 | 116                                | 337.792         | <=400      | Pass    |
| Pi/4DQPSK | SISO    | HOPP            | 2DH1        | 0.404                         | 31.600                 | 319                                | 128.876         | <=400      | Pass    |
|           |         |                 | 2DH3        | 1.654                         | 31.600                 | 153                                | 253.062         | <=400      | Pass    |
|           |         |                 | 2DH5        | 2.918                         | 31.600                 | 115                                | 335.570         | <=400      | Pass    |
| 8DPSK     | SISO    | HOPP            | 3DH1        | 0.404                         | 31.600                 | 319                                | 128.876         | <=400      | Pass    |
|           |         |                 | 3DH3        | 1.654                         | 31.600                 | 151                                | 249.754         | <=400      | Pass    |
|           |         |                 | 3DH5        | 2.918                         | 31.600                 | 95                                 | 277.210         | <=400      | Pass    |

FCC ID: Q8WD8

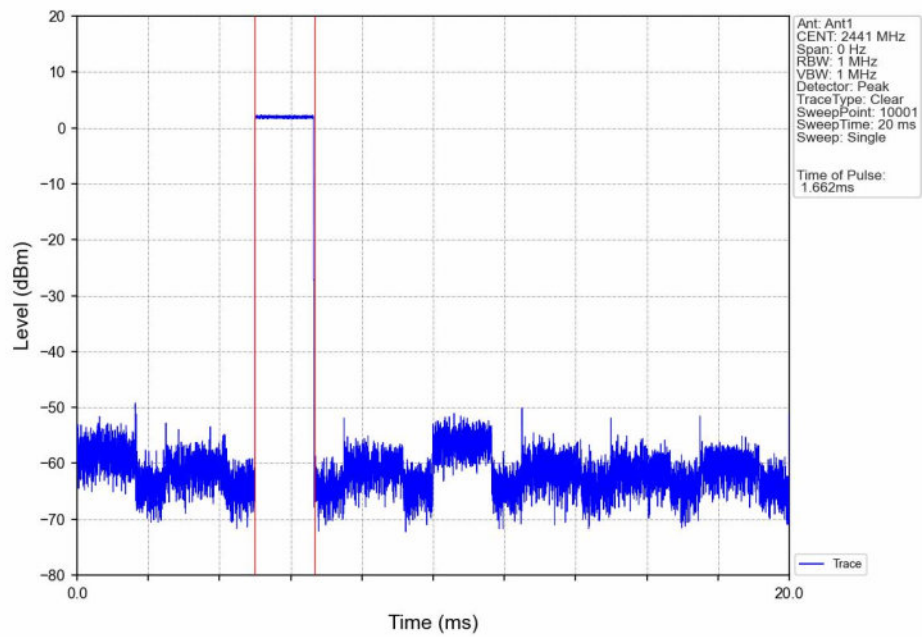
5.2 Test Graph

5.2.1 Ant1

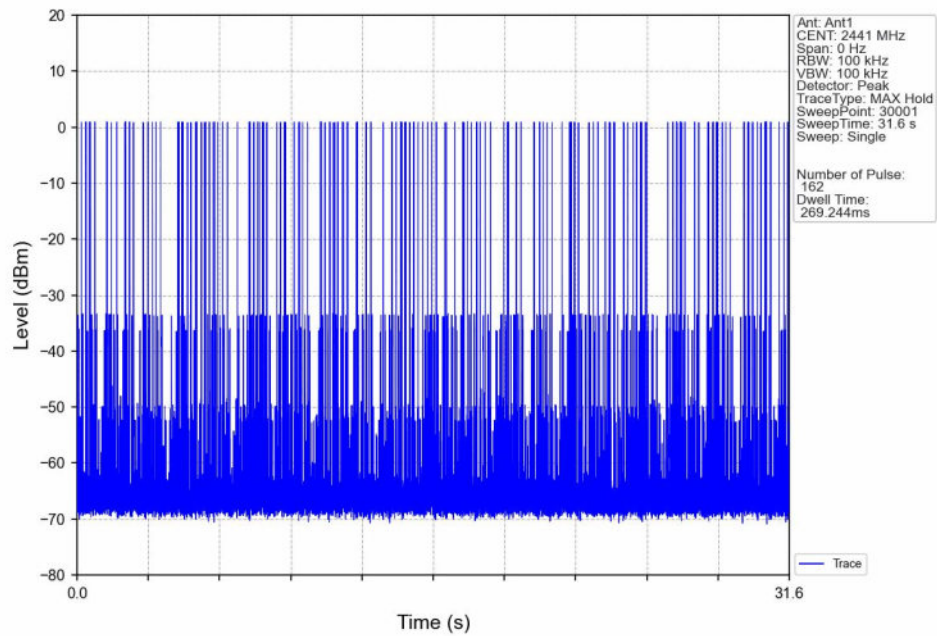


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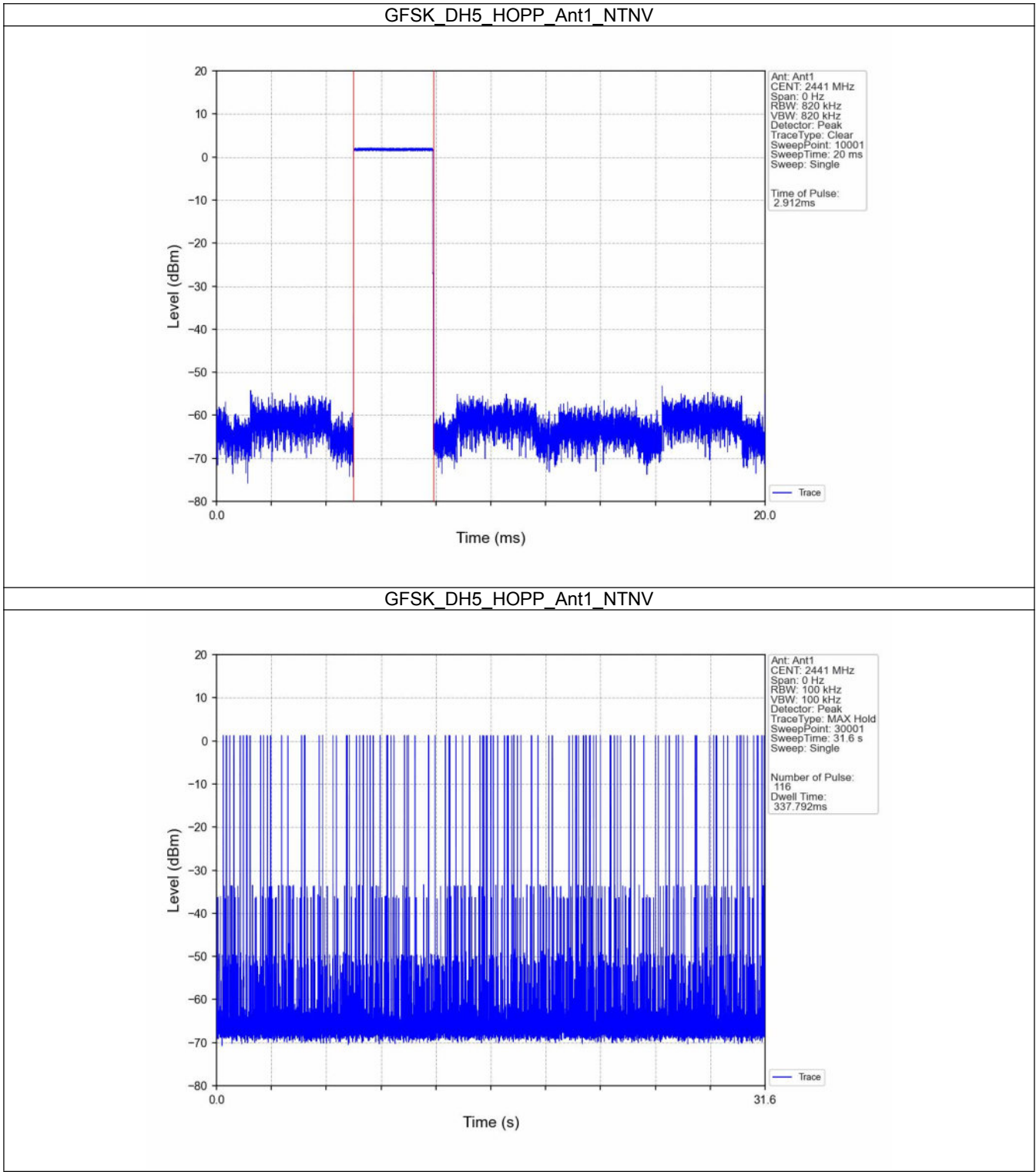
GFSK\_DH3\_HOPP\_Ant1\_NTNV



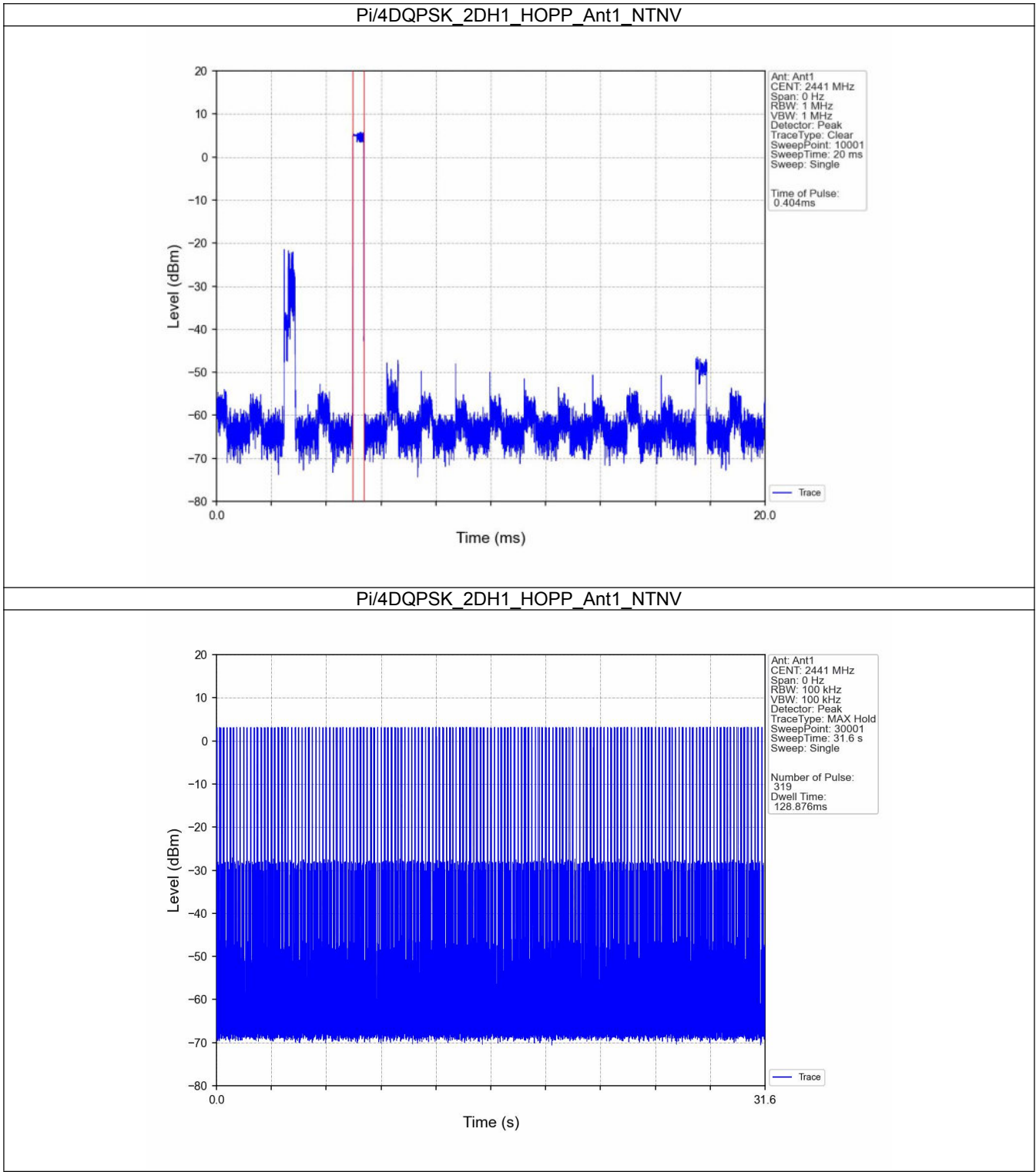
GFSK\_DH3\_HOPP\_Ant1\_NTNV



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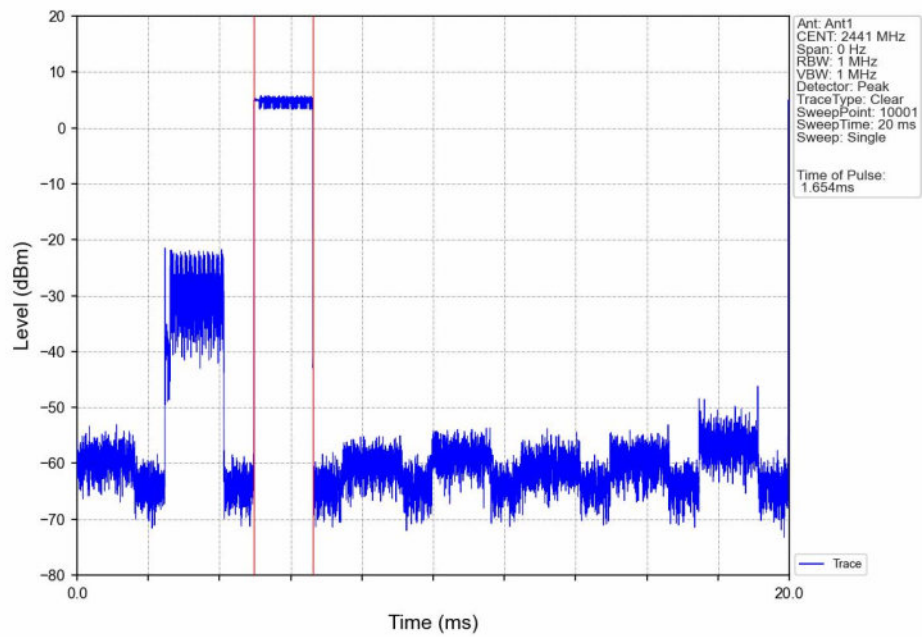


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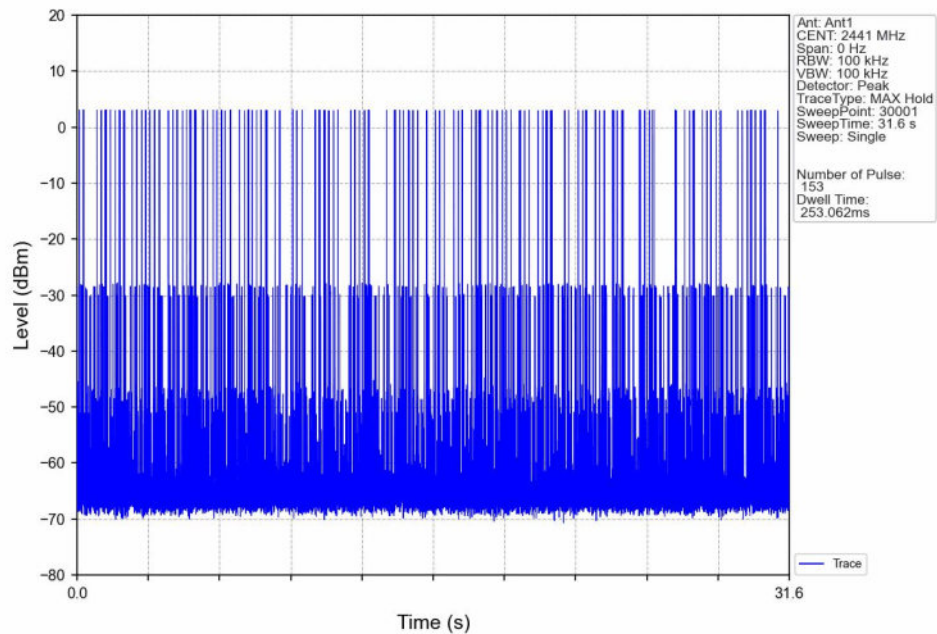


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Pi/4DQPSK\_2DH3\_HOPP\_Ant1\_NTNV

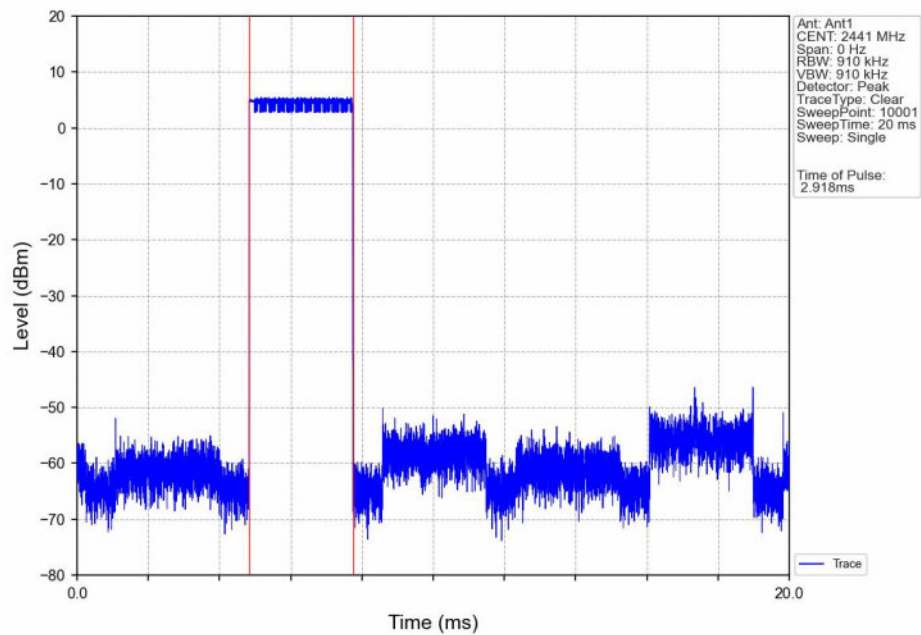


Pi/4DQPSK\_2DH3\_HOPP\_Ant1\_NTNV

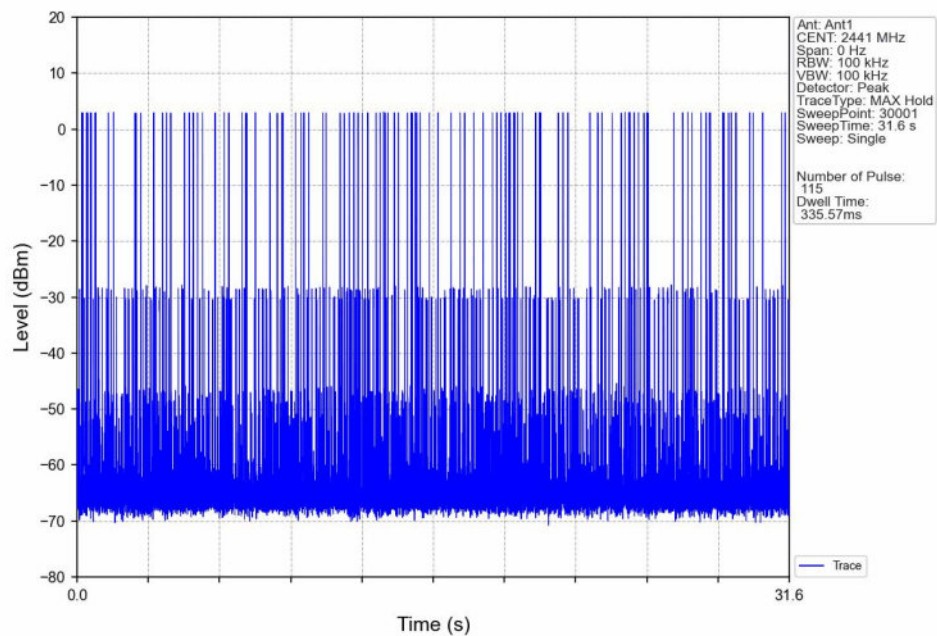


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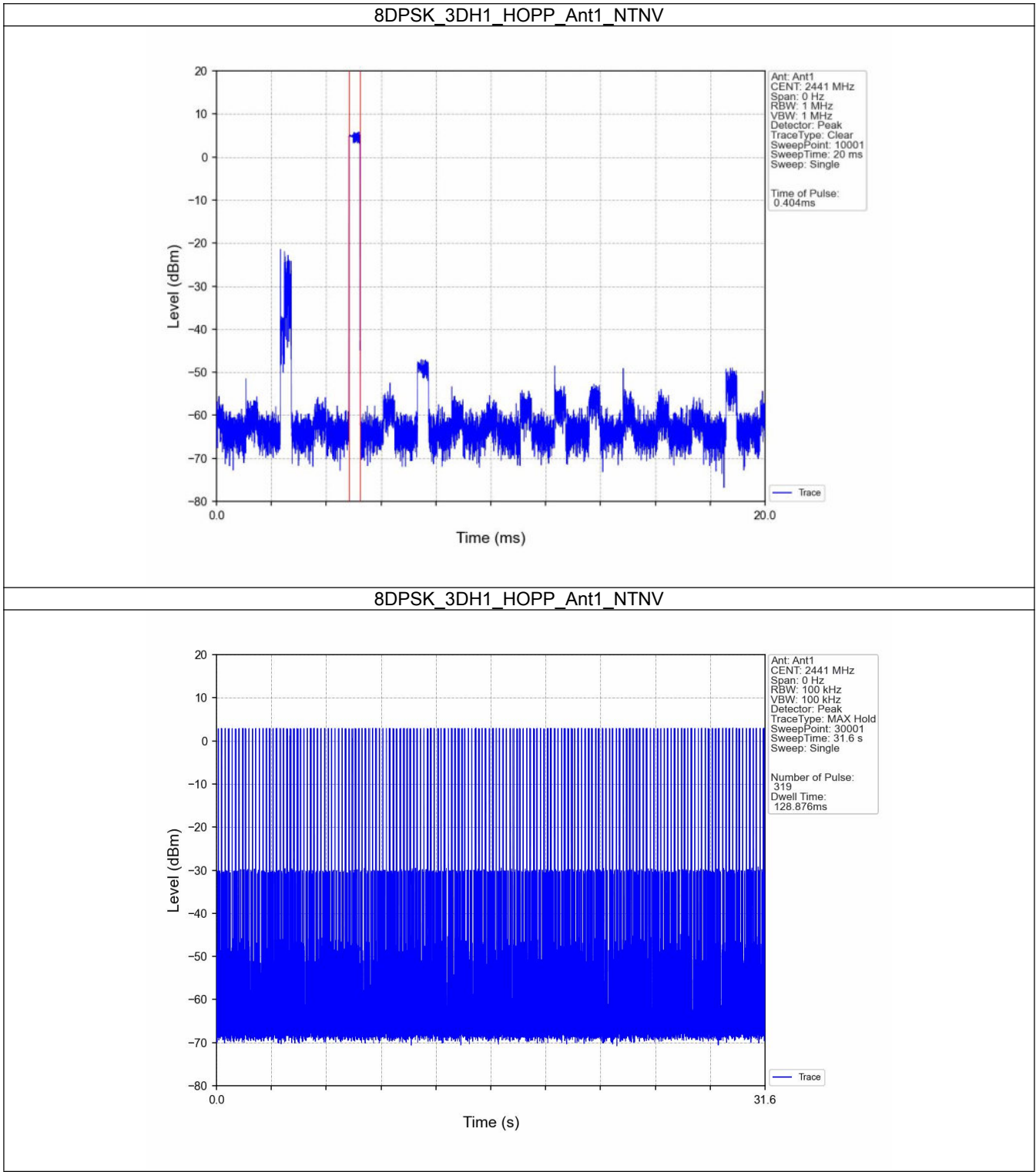
Pi/4DQPSK\_2DH5\_HOPP\_Ant1\_NTNV



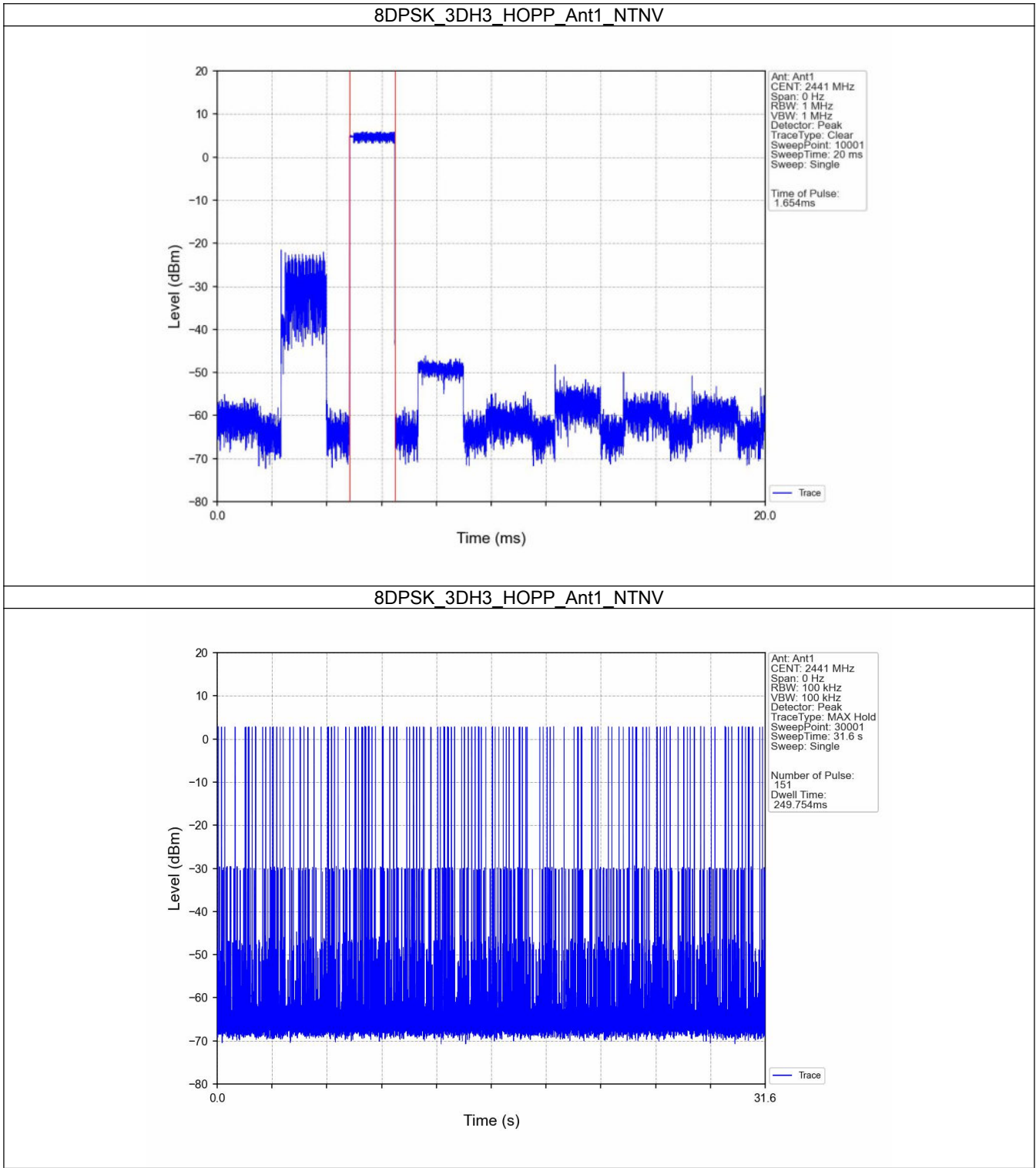
Pi/4DQPSK\_2DH5\_HOPP\_Ant1\_NTNV



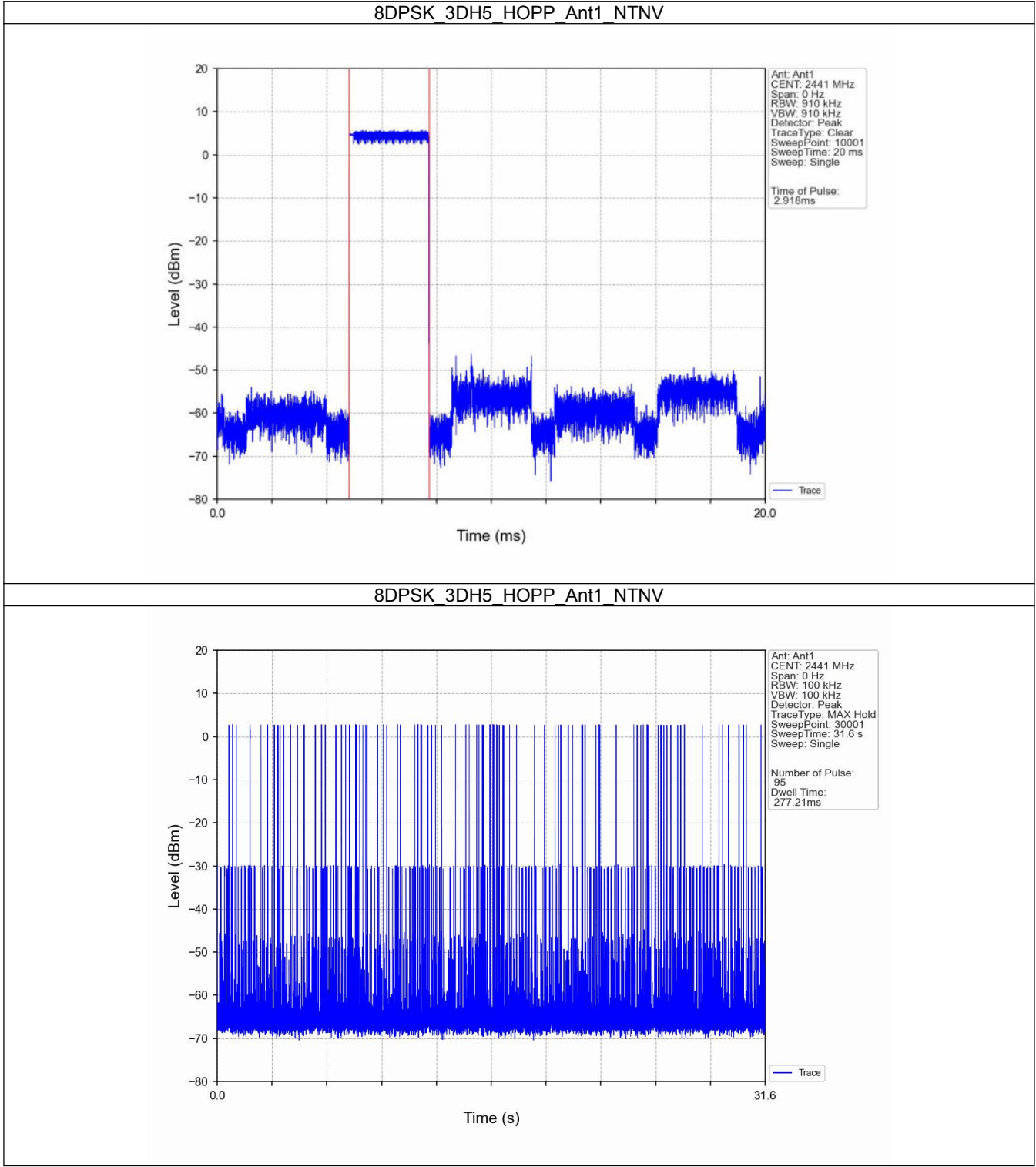
FCC ID: Q8WD8



FCC ID: Q8WD8



FCC ID: Q8WD8



FCC ID: Q8WD8

## 6. Unwanted Emissions In Non-restricted Frequency Bands

### 6.1 Test Result

#### 6.1.1 Ref

| Mode      | TX Type | Frequency (MHz) | Packet Type | ANT | Level of Reference (dBm) |
|-----------|---------|-----------------|-------------|-----|--------------------------|
| GFSK      | SISO    | 2402            | DH5         | 1   | -1.49                    |
|           |         | 2441            | DH5         | 1   | -2.12                    |
|           |         | 2480            | DH5         | 1   | -3.30                    |
| Pi/4DQPSK | SISO    | 2402            | 2DH5        | 1   | -1.64                    |
|           |         | 2441            | 2DH5        | 1   | -2.18                    |
|           |         | 2480            | 2DH5        | 1   | -3.30                    |
| 8DPSK     | SISO    | 2402            | 3DH5        | 1   | -1.79                    |
|           |         | 2441            | 3DH5        | 1   | -2.29                    |
|           |         | 2480            | 3DH5        | 1   | -3.45                    |

Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.

#### 6.1.2 CSE

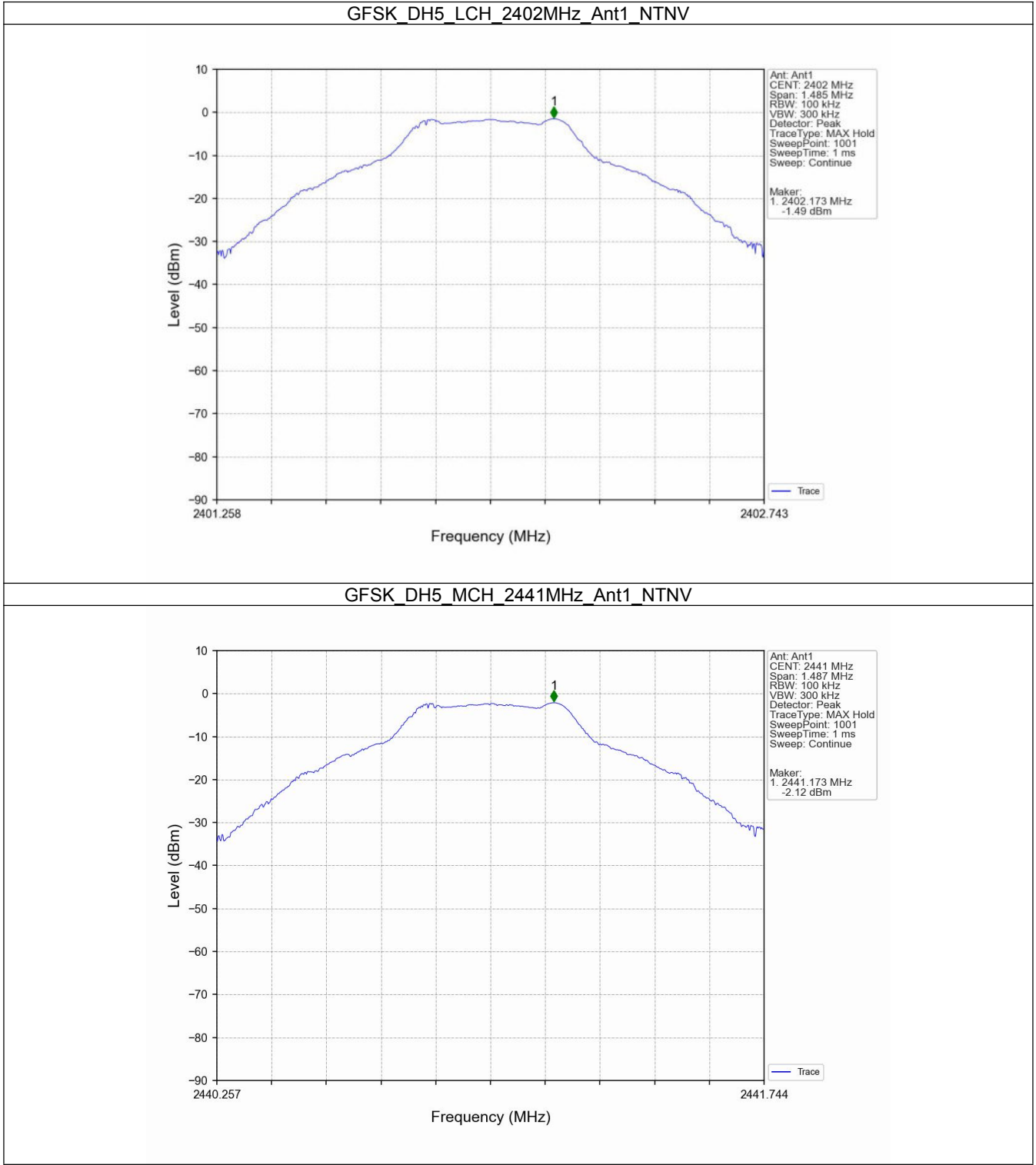
| Mode      | TX Type | Frequency (MHz) | Packet Type | ANT | Level of Reference (dBm) | Limit (dBm) | Verdict |
|-----------|---------|-----------------|-------------|-----|--------------------------|-------------|---------|
| GFSK      | SISO    | 2402            | DH5         | 1   | -1.49                    | -21.49      | Pass    |
|           |         | 2441            | DH5         | 1   | -1.49                    | -21.49      | Pass    |
|           |         | 2480            | DH5         | 1   | -1.49                    | -21.49      | Pass    |
|           |         | HOPP            | DH5         | 1   | -1.49                    | -21.49      | Pass    |
|           |         |                 |             |     | -1.49                    | -21.49      | Pass    |
| Pi/4DQPSK | SISO    | 2402            | 2DH5        | 1   | -1.64                    | -21.64      | Pass    |
|           |         | 2441            | 2DH5        | 1   | -1.64                    | -21.64      | Pass    |
|           |         | 2480            | 2DH5        | 1   | -1.64                    | -21.64      | Pass    |
|           |         | HOPP            | 2DH5        | 1   | -1.64                    | -21.64      | Pass    |
|           |         |                 |             |     | -1.64                    | -21.64      | Pass    |
| 8DPSK     | SISO    | 2402            | 3DH5        | 1   | -1.79                    | -21.79      | Pass    |
|           |         | 2441            | 3DH5        | 1   | -1.79                    | -21.79      | Pass    |
|           |         | 2480            | 3DH5        | 1   | -1.79                    | -21.79      | Pass    |
|           |         | HOPP            | 3DH5        | 1   | -1.79                    | -21.79      | Pass    |
|           |         |                 |             |     | -1.79                    | -21.79      | Pass    |

Note1: Refer to FCC Part 15.247 (d) and ANSI C63.10-2013, the channel contains the maximum PSD level was used to establish the reference level.

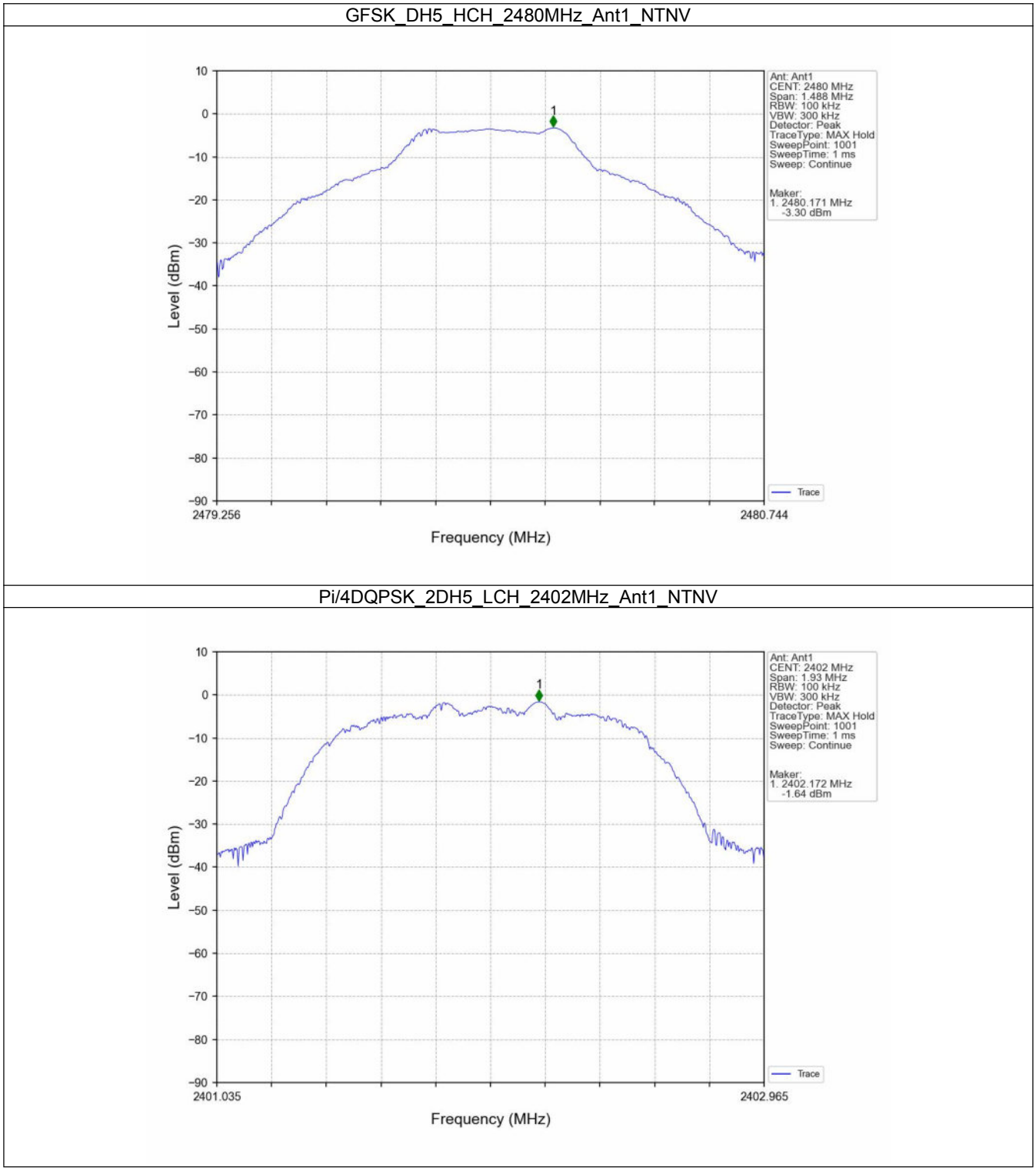
FCC ID: Q8WD8

6.2 Test Graph

6.2.1 Ref

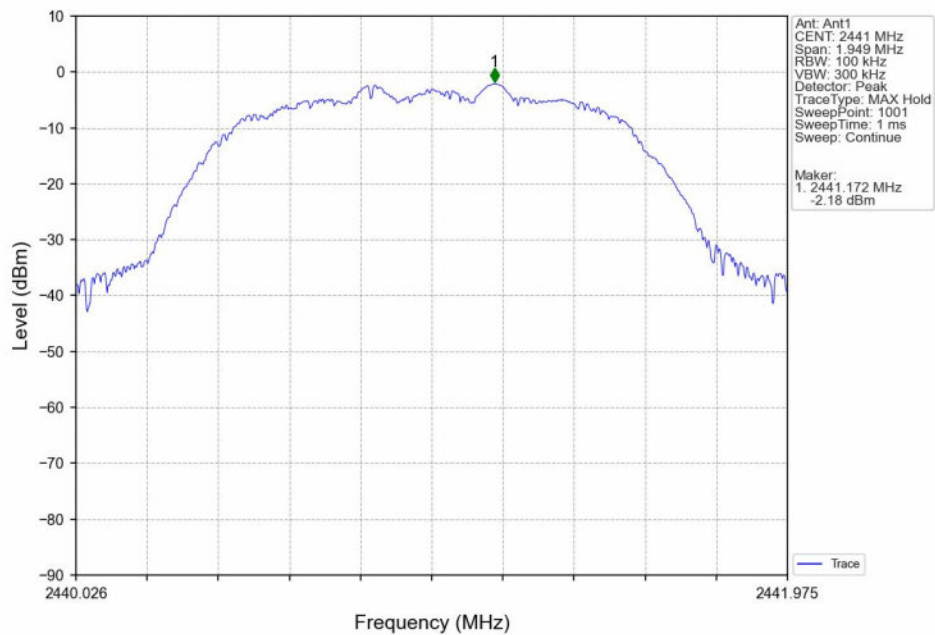


FCC ID: Q8WD8

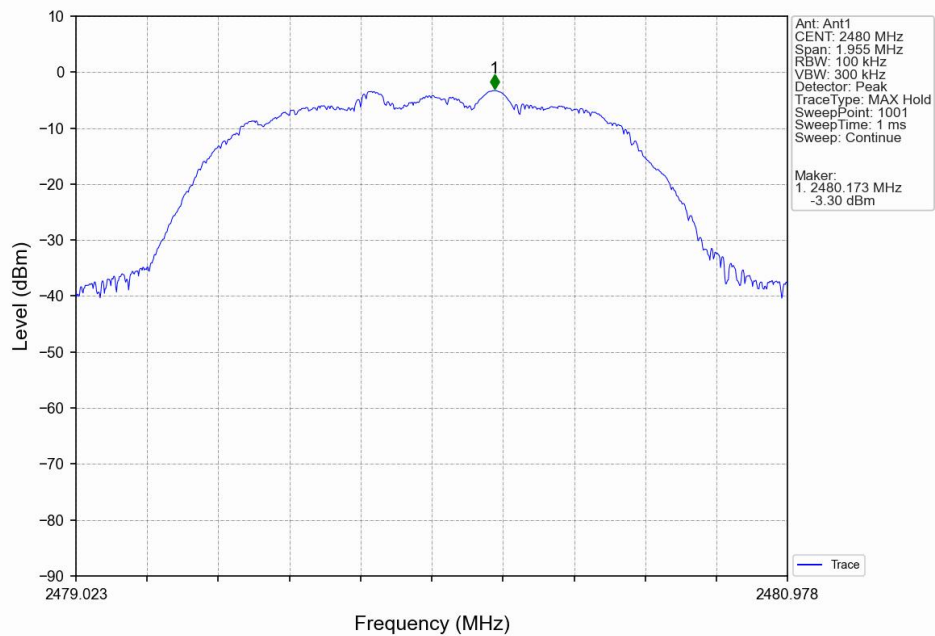


FCC ID: Q8WD8

Pi/4DQPSK\_2DH5\_MCH\_2441MHz\_Ant1\_NTNV

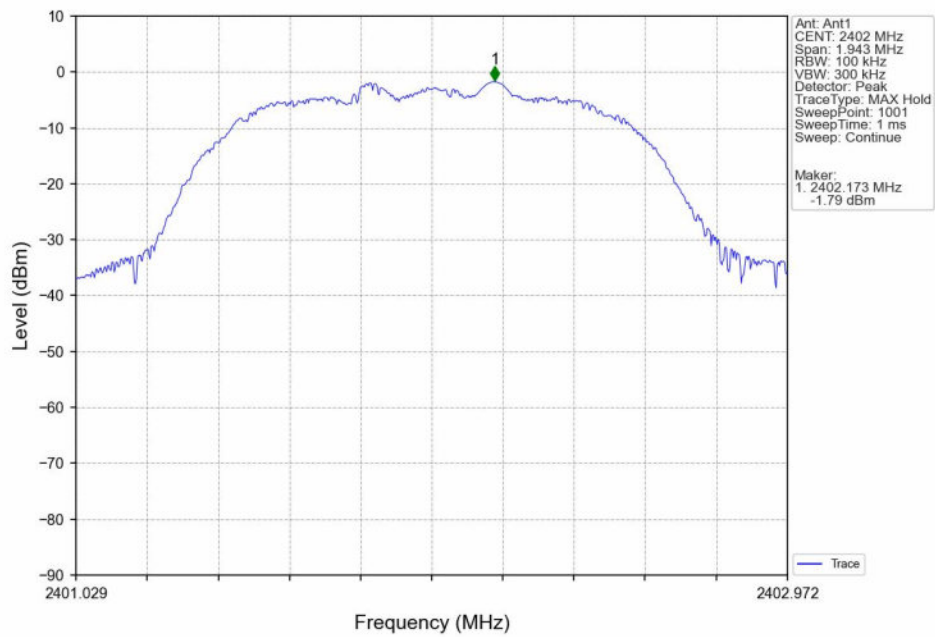


Pi/4DQPSK\_2DH5\_HCH\_2480MHz\_Ant1\_NTNV

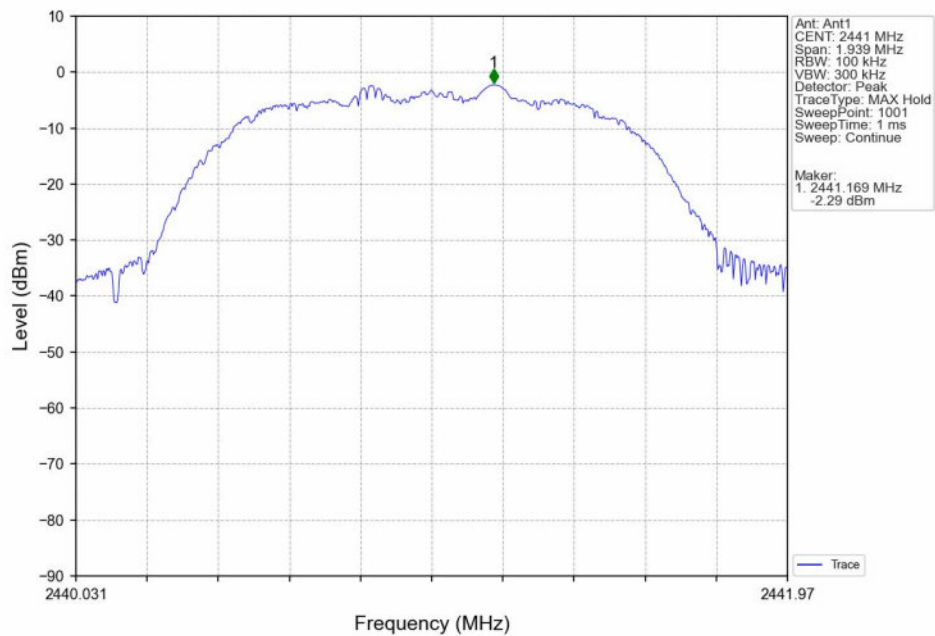


FCC ID: Q8WD8

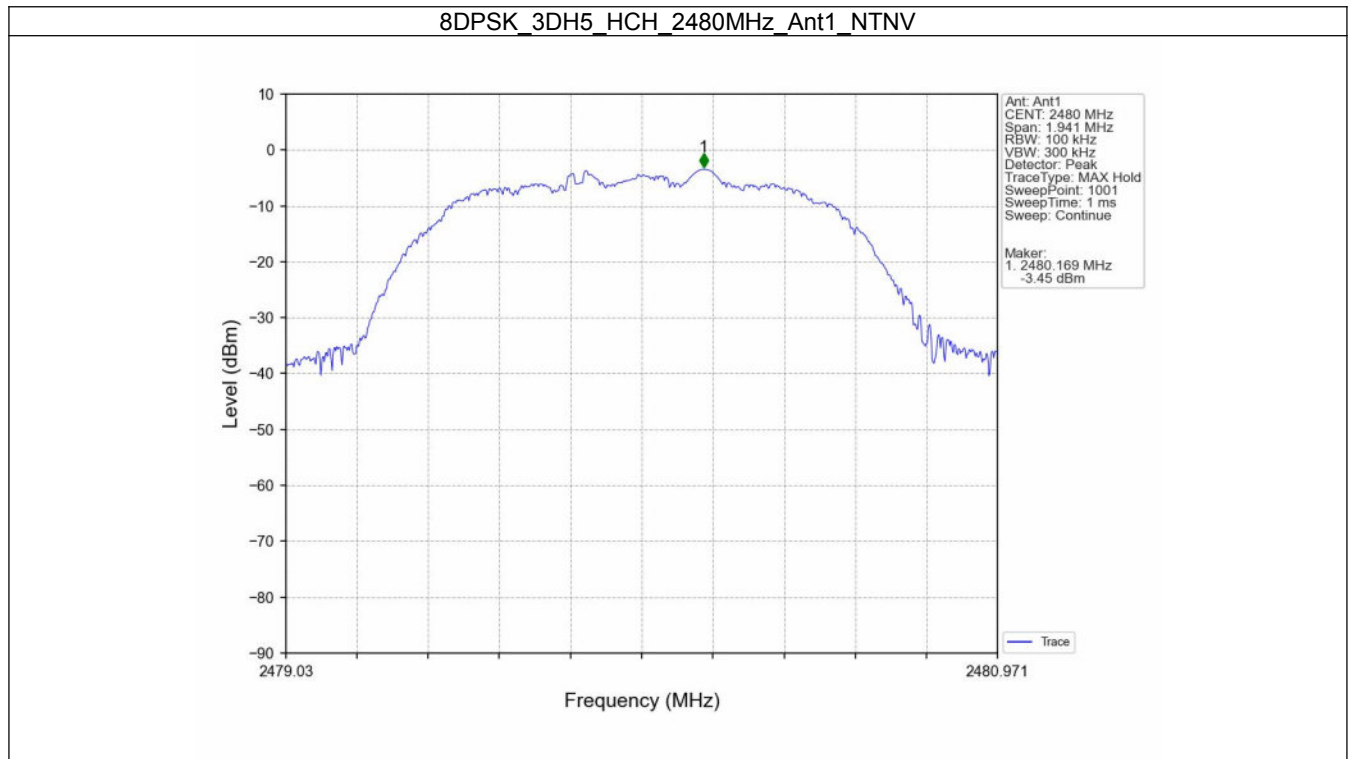
8DPSK\_3DH5\_LCH\_2402MHz\_Ant1\_NTNV



8DPSK\_3DH5\_MCH\_2441MHz\_Ant1\_NTNV

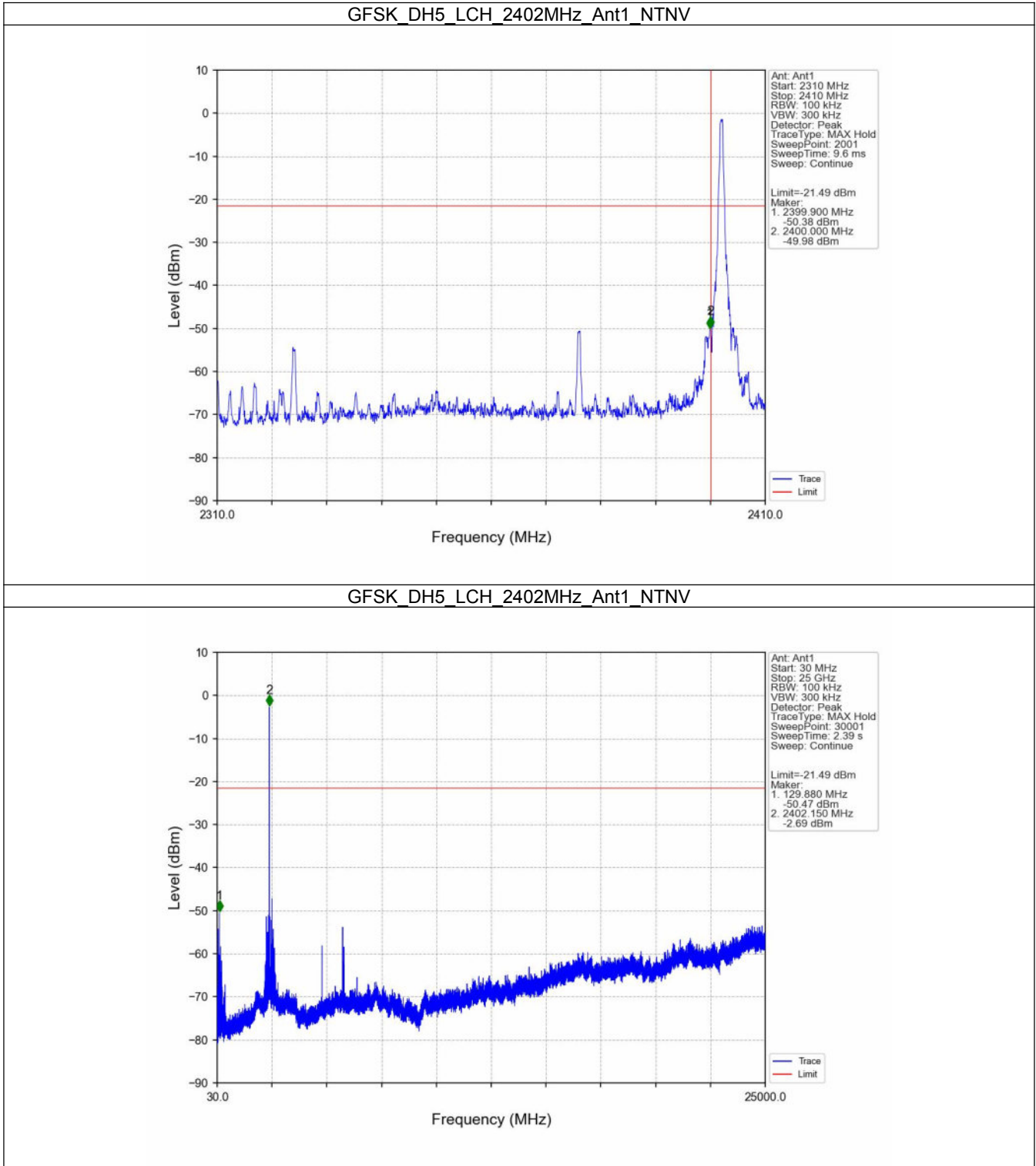


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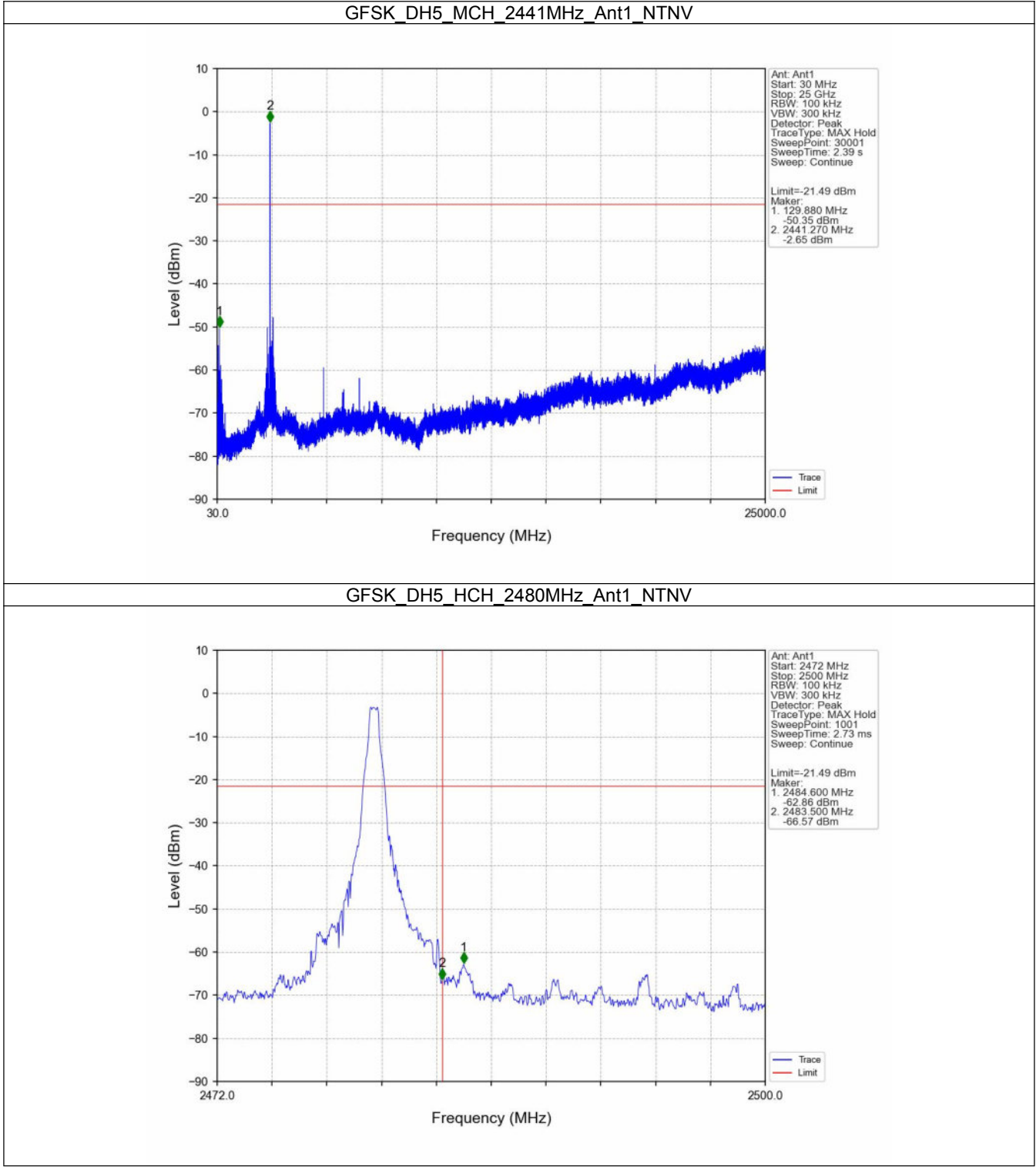


FCC ID: Q8WD8

6.2.2 CSE

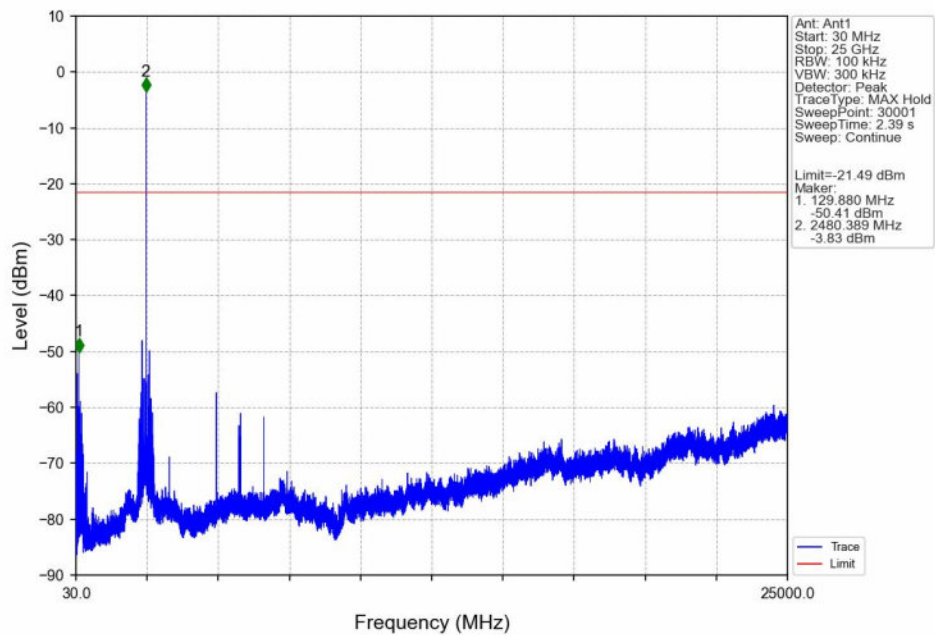


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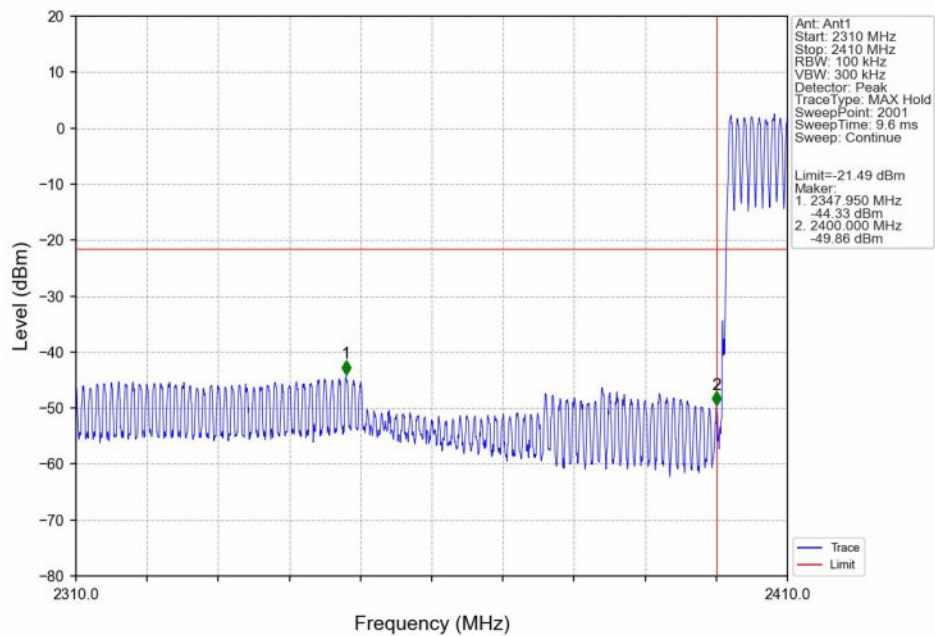


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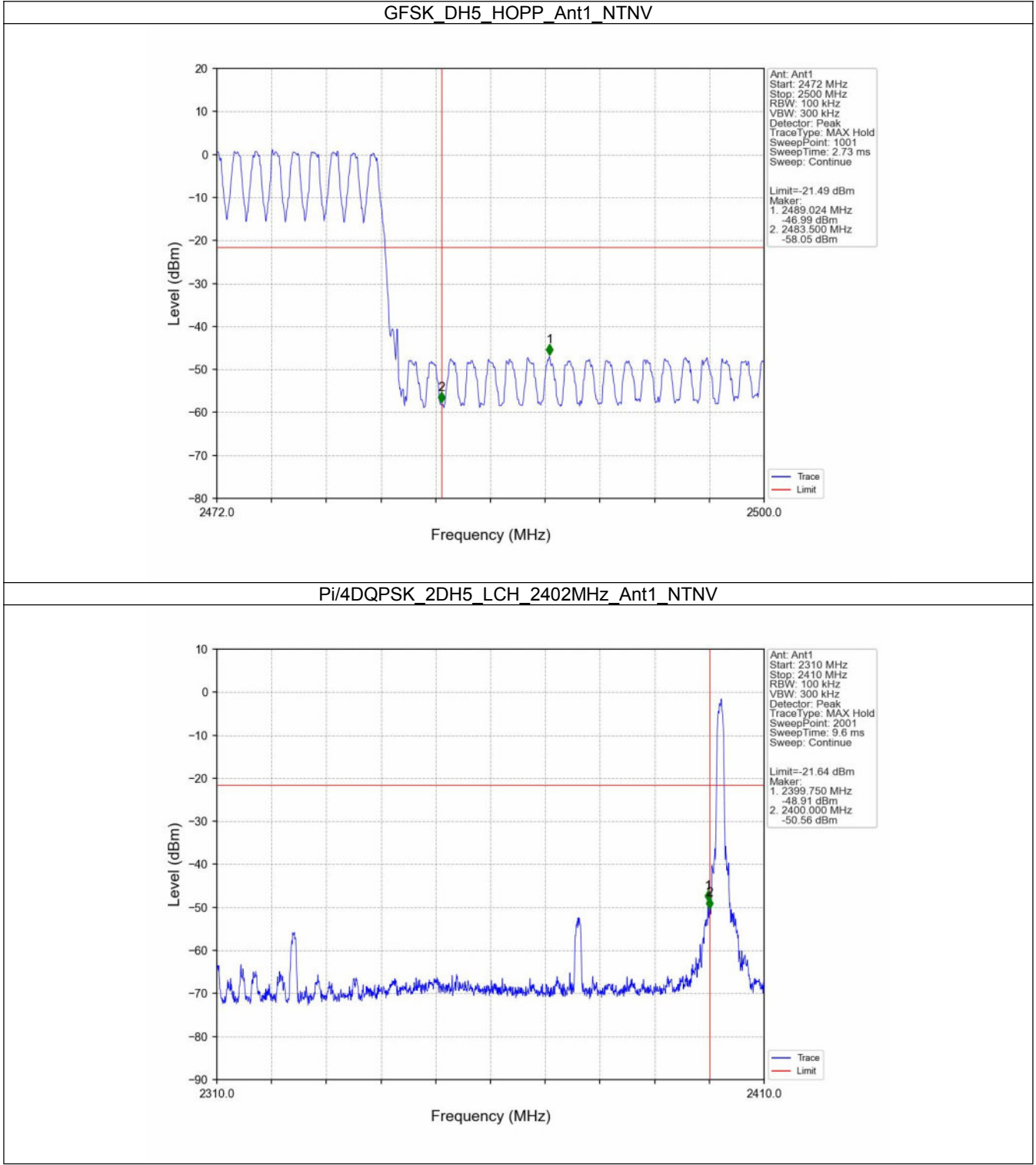
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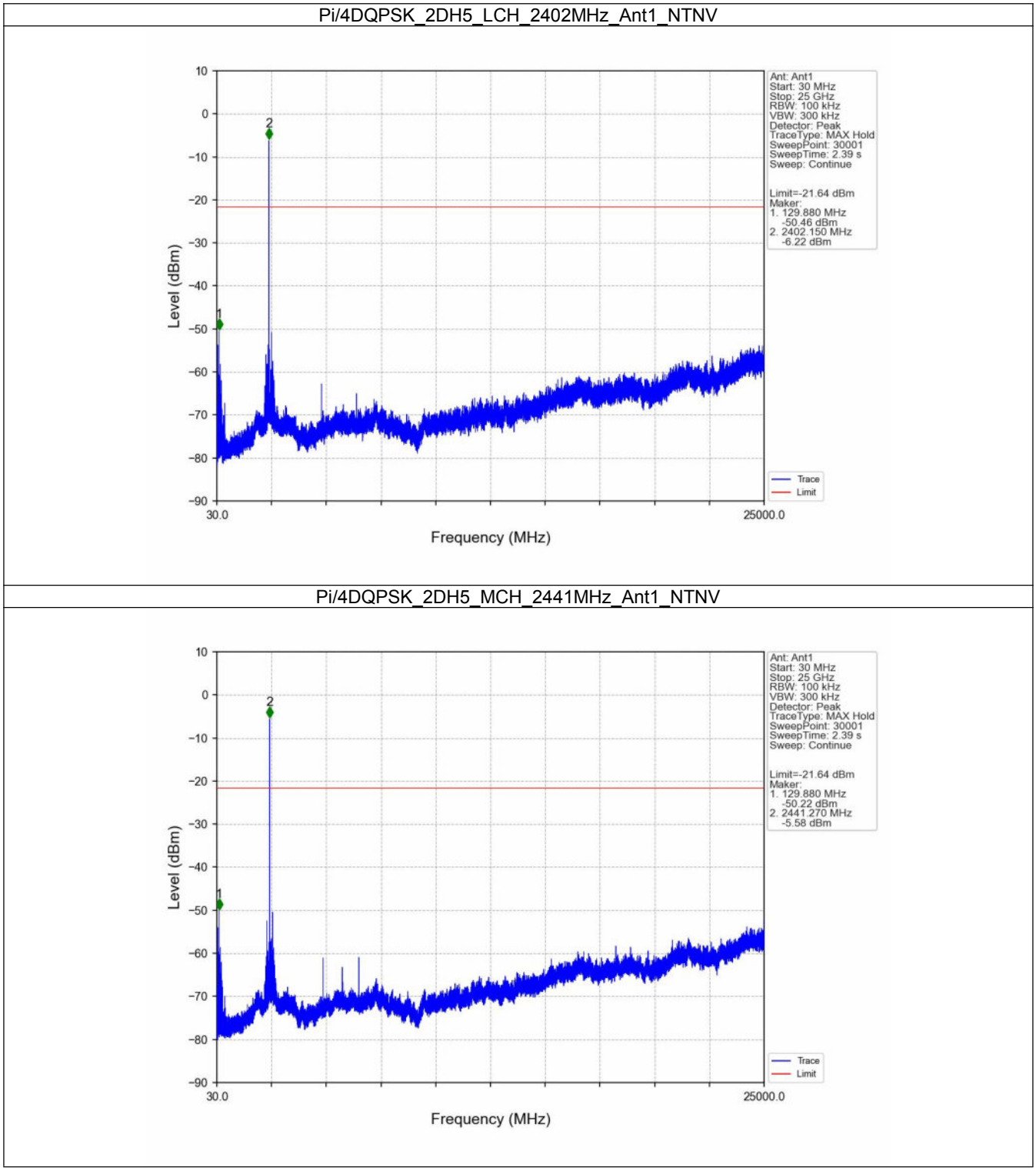
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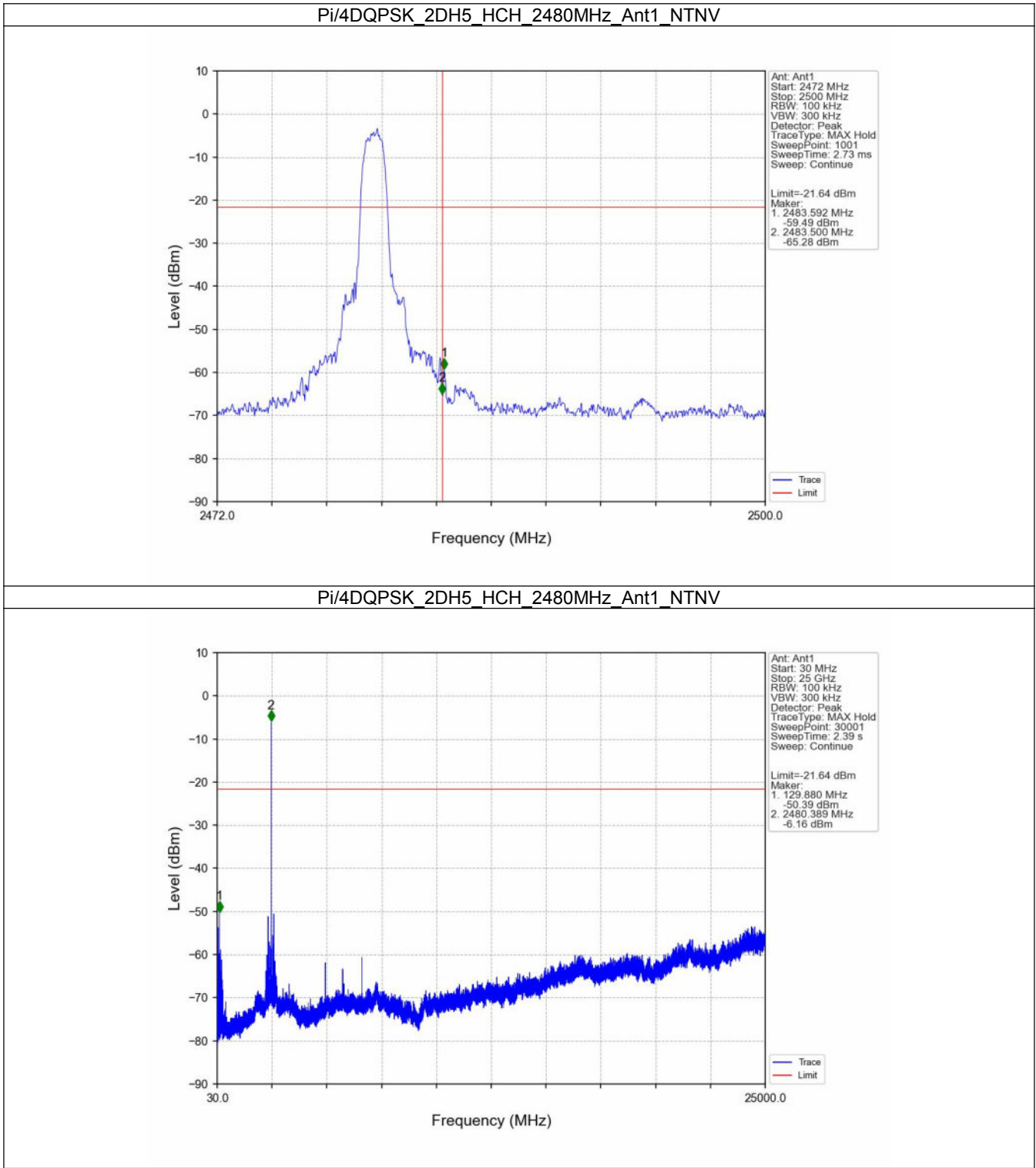
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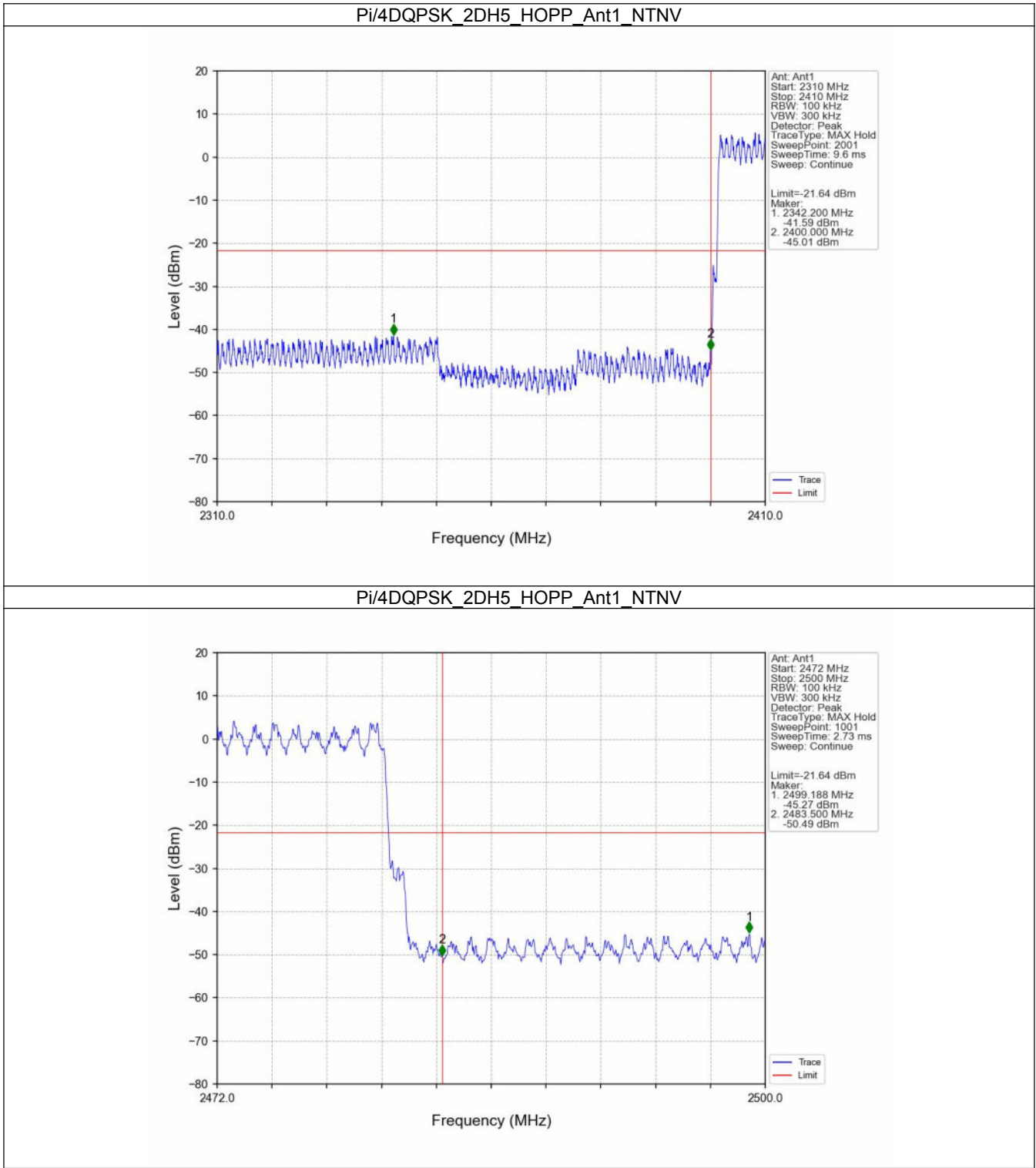
FCC ID: Q8WD8



FCC ID: Q8WD8

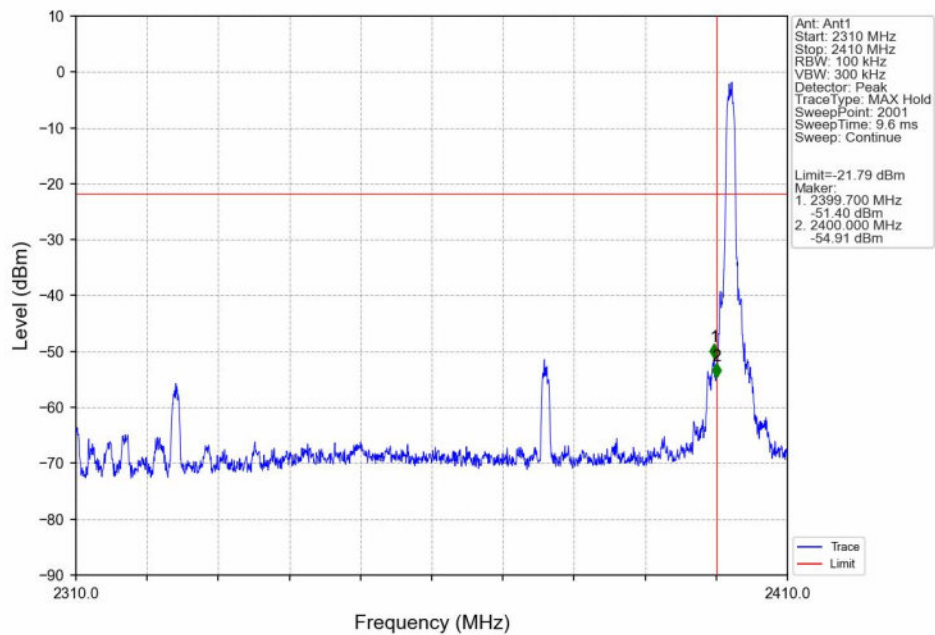


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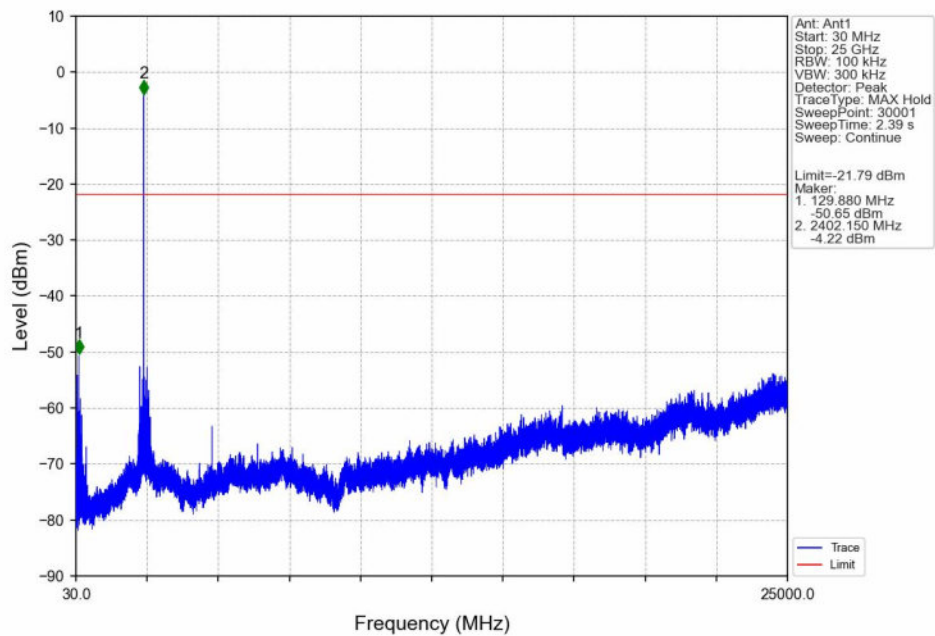


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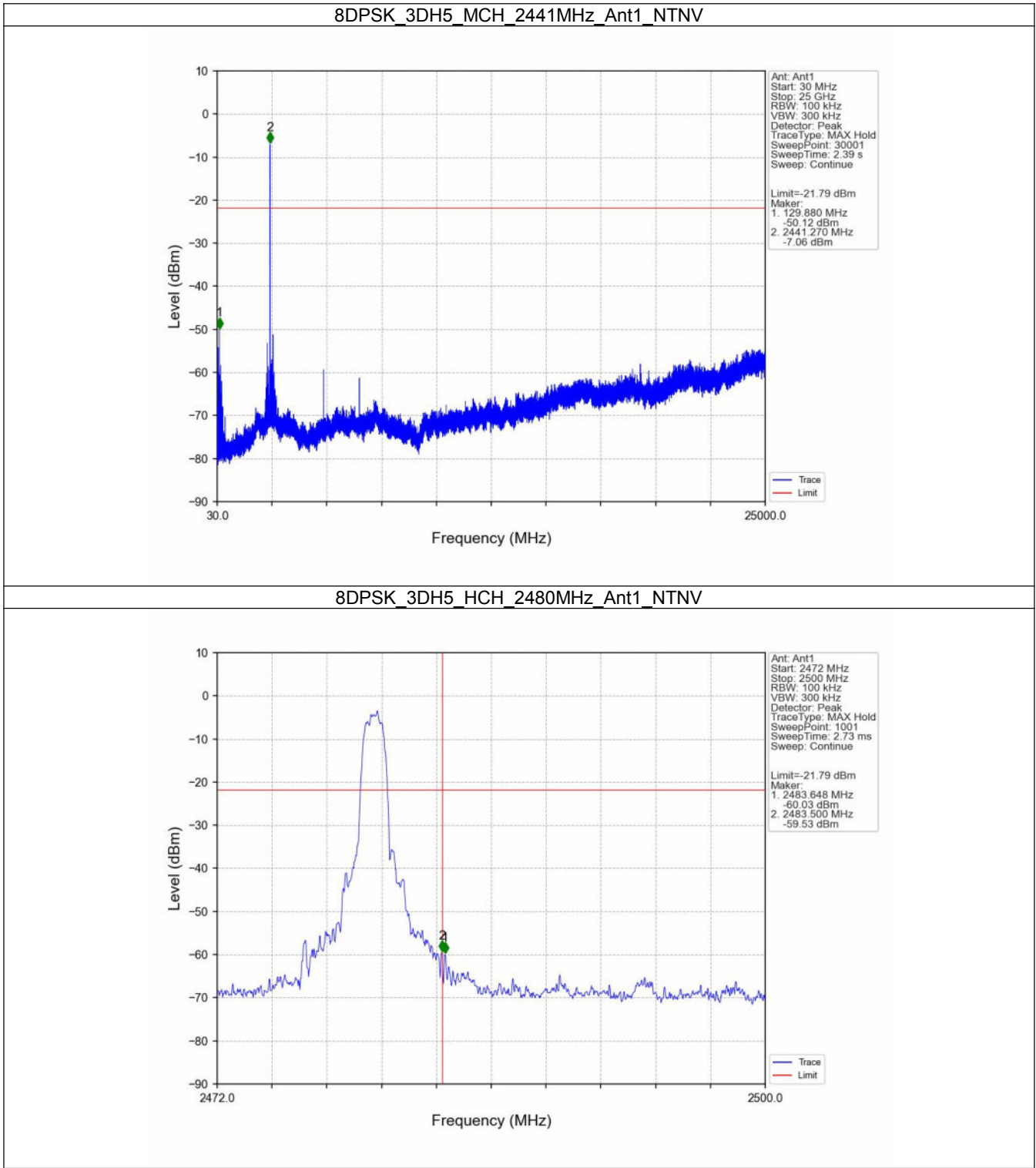
8DPSK\_3DH5\_LCH\_2402MHz\_Ant1\_NTNV



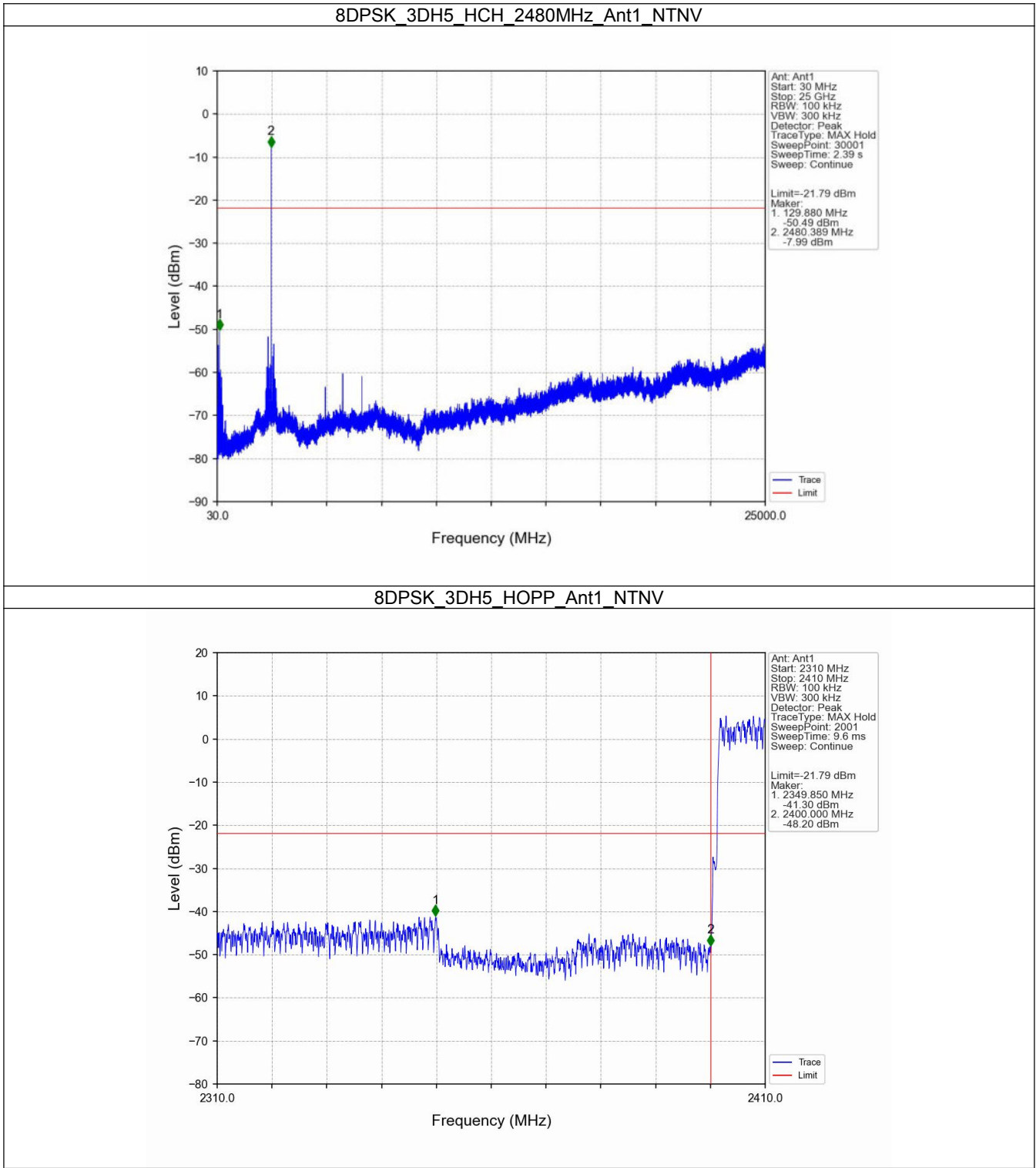
8DPSK\_3DH5\_LCH\_2402MHz\_Ant1\_NTNV



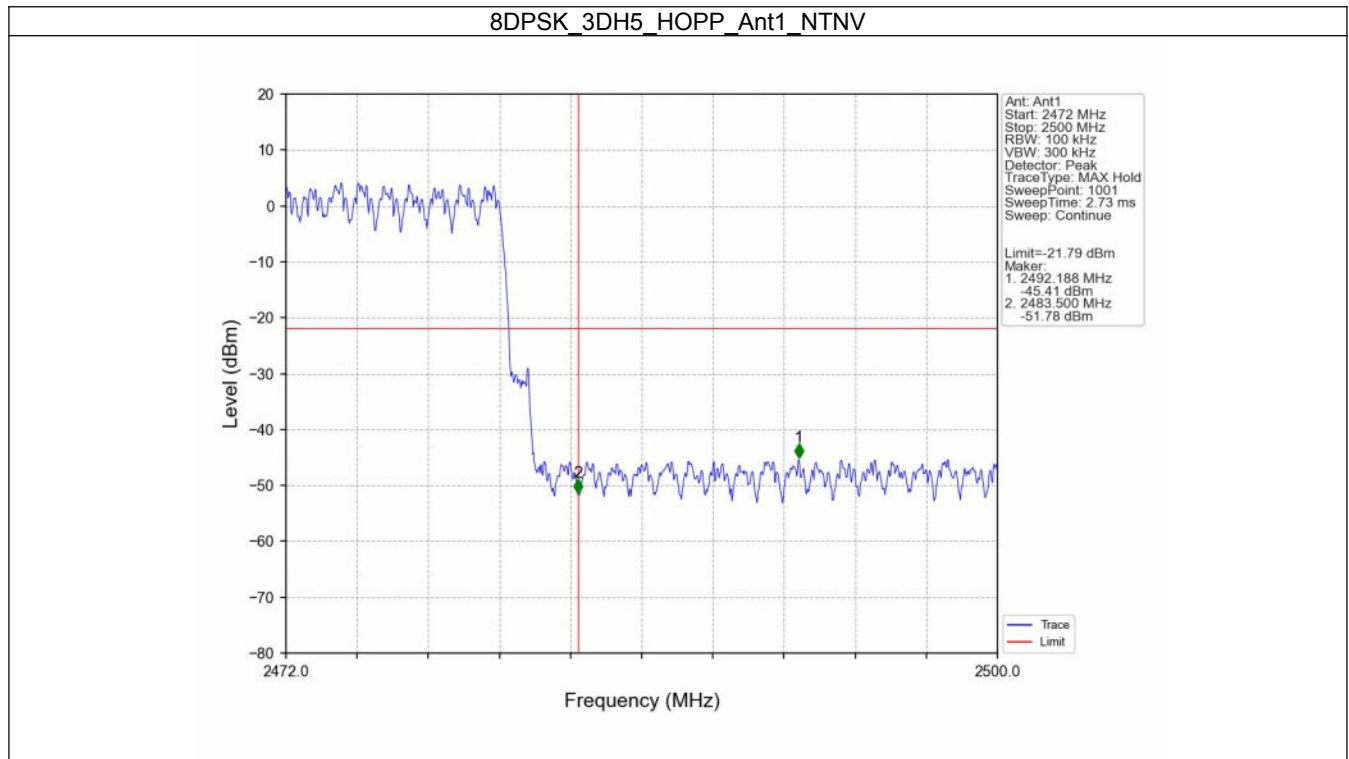
FCC ID: Q8WD8



FCC ID: Q8WD8



FCC ID: Q8WD8



FCC ID: Q8WD8

## 7. Form731

### 7.1 Test Result

#### 7.1.1 Form731

| Lower Freq (MHz) | High Freq (MHz) | MAX Power (W) | MAX Power (dBm) |
|------------------|-----------------|---------------|-----------------|
| 2402             | 2480            | 0.0011        | 0.39            |