

## **Appendix RF Test Data for BT**

**Company:** : Dongguan Ruige Electronics Co., LTD

**EUT** : True Wireless Earphones

**FCC ID:** : 2BC8W-M136

**Model Number** : M136

**Report No.** : HTT202605491F01

**Reviewed By** : Heber He

## 1. Duty Cycle

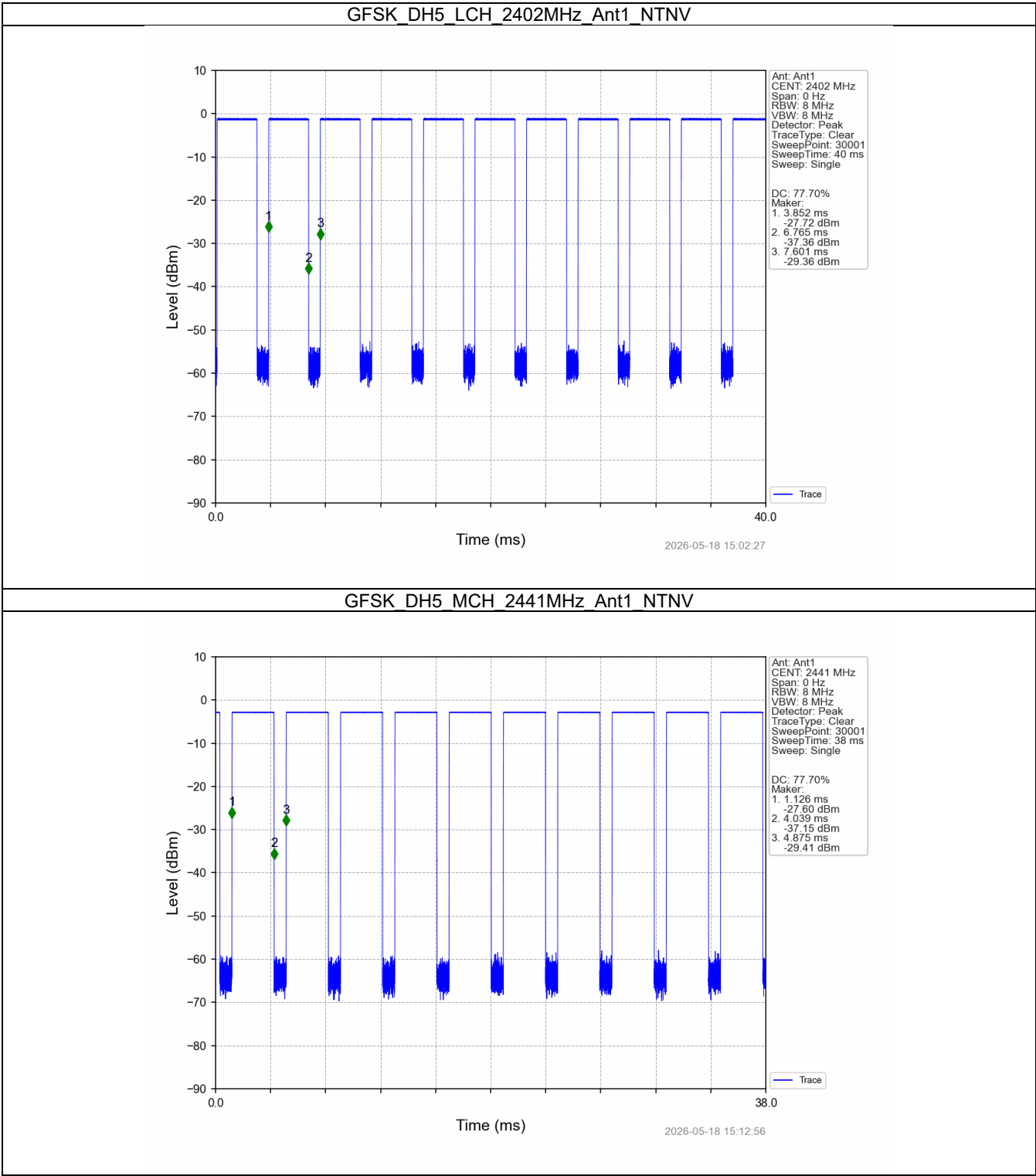
### 1.1 Test Result

#### 1.1.1 Ant1

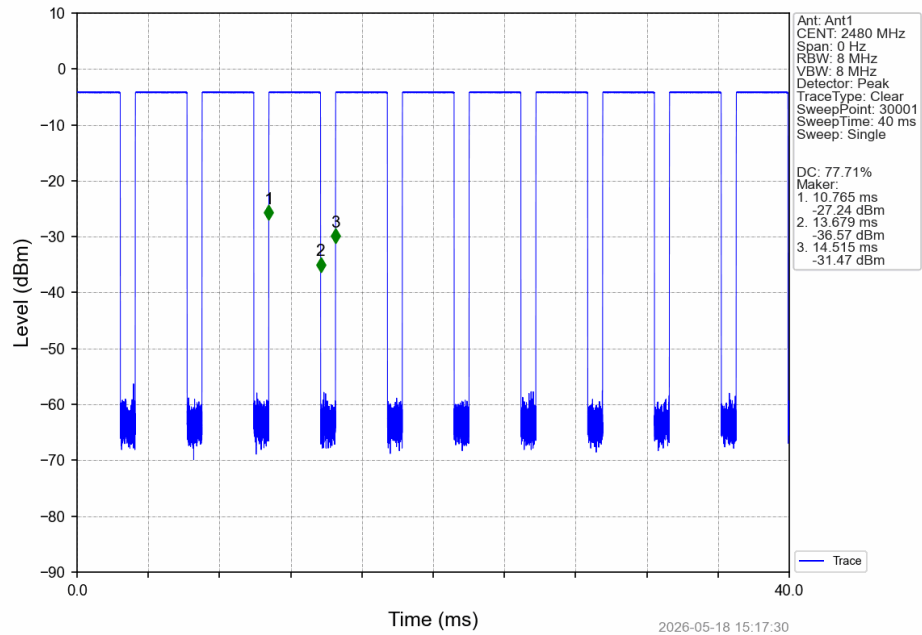
| Ant1      |         |                 |             |           |             |                |                                   |                       |
|-----------|---------|-----------------|-------------|-----------|-------------|----------------|-----------------------------------|-----------------------|
| Mode      | TX Type | Frequency (MHz) | Packet Type | T_on (ms) | Period (ms) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) | Max. DC Variation (%) |
| GFSK      | SISO    | 2402            | DH5         | 2.913     | 3.749       | 77.70          | 1.10                              | 0.04                  |
|           |         | 2441            | DH5         | 2.913     | 3.749       | 77.70          | 1.10                              | 0.03                  |
|           |         | 2480            | DH5         | 2.914     | 3.750       | 77.71          | 1.10                              | 0.04                  |
| Pi/4DQPSK | SISO    | 2402            | 2DH5        | 2.920     | 3.751       | 77.85          | 1.09                              | 0.03                  |
|           |         | 2441            | 2DH5        | 2.920     | 3.751       | 77.85          | 1.09                              | 0.04                  |
|           |         | 2480            | 2DH5        | 2.920     | 3.751       | 77.85          | 1.09                              | 0.04                  |
| 8DPSK     | SISO    | 2402            | 3DH5        | 2.923     | 3.750       | 77.95          | 1.08                              | 0.03                  |
|           |         | 2441            | 3DH5        | 2.922     | 3.749       | 77.94          | 1.08                              | 0.03                  |
|           |         | 2480            | 3DH5        | 2.923     | 3.751       | 77.93          | 1.08                              | 0.04                  |

# 1.2 Test Graph

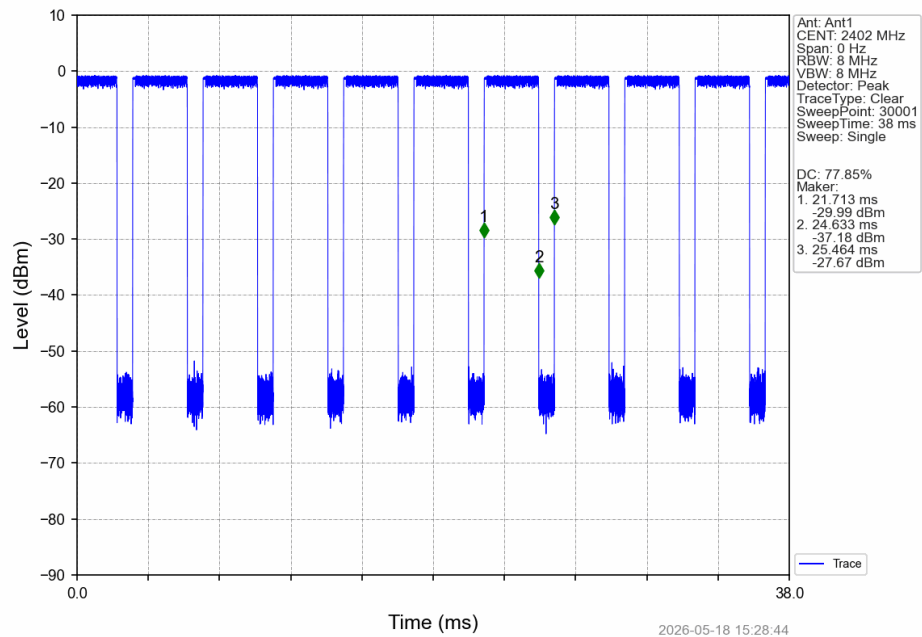
## 1.2.1 Ant1



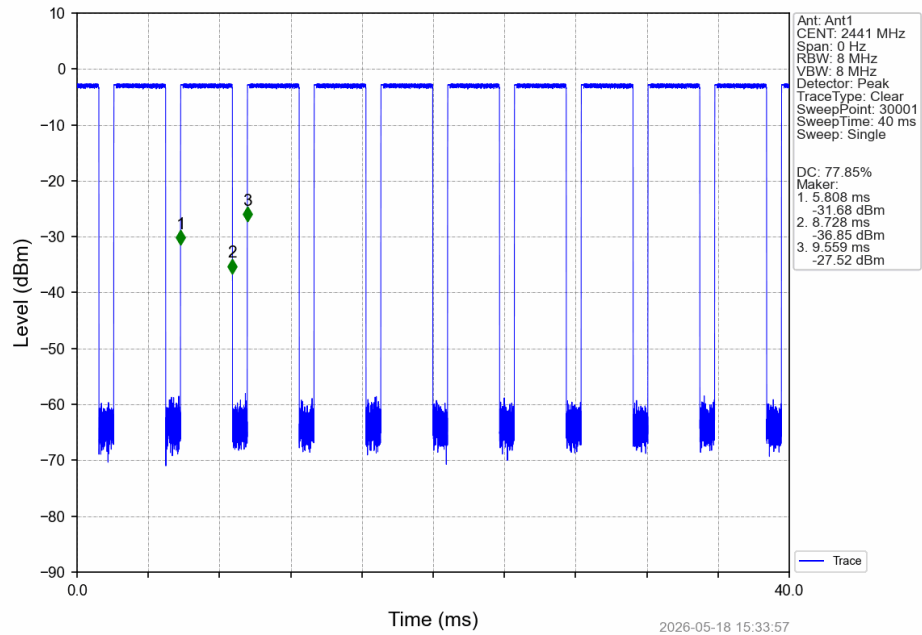
# GFSK DH5\_HCH\_2480MHz\_Ant1\_NTNV



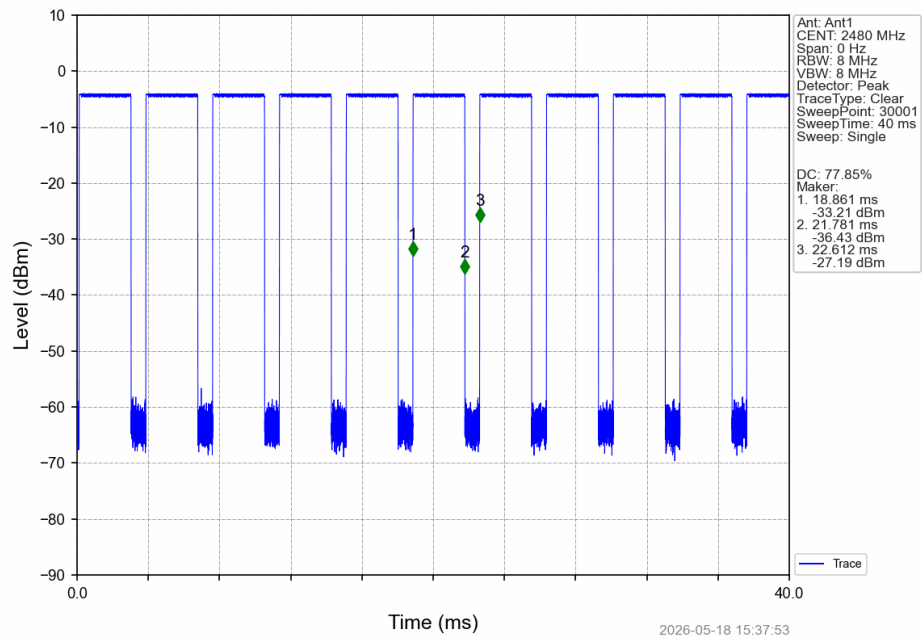
# Pi/4DQPSK\_2DH5\_LCH\_2402MHz\_Ant1\_NTNV



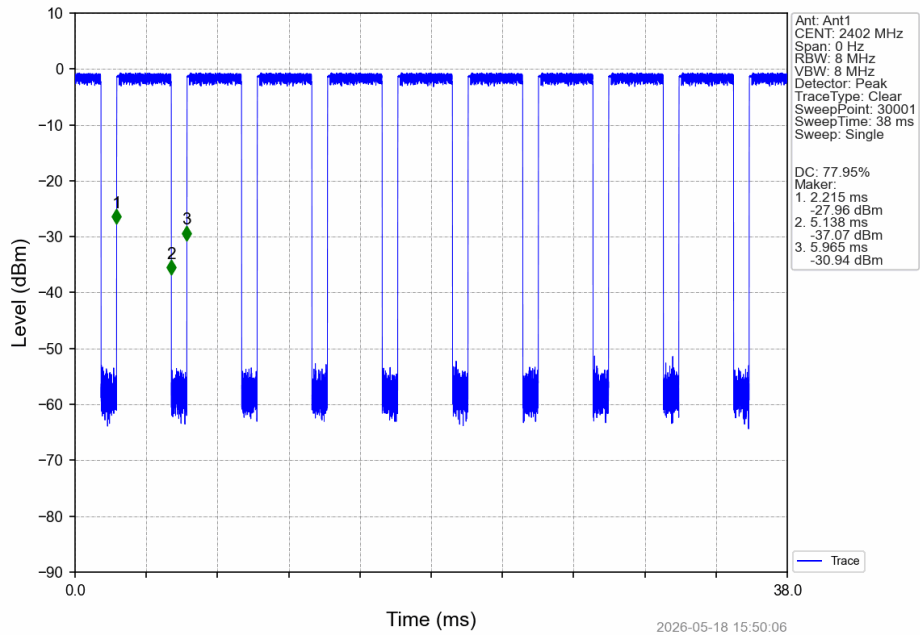
# Pi/4DQPSK\_2DH5\_MCH\_2441MHz\_Ant1\_NTNV



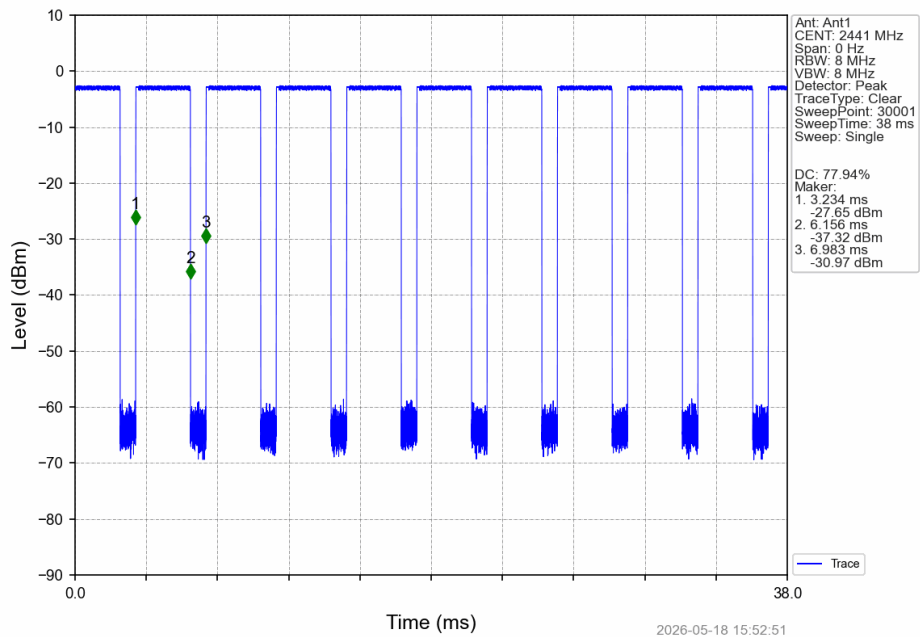
# Pi/4DQPSK\_2DH5\_HCH\_2480MHz\_Ant1\_NTNV



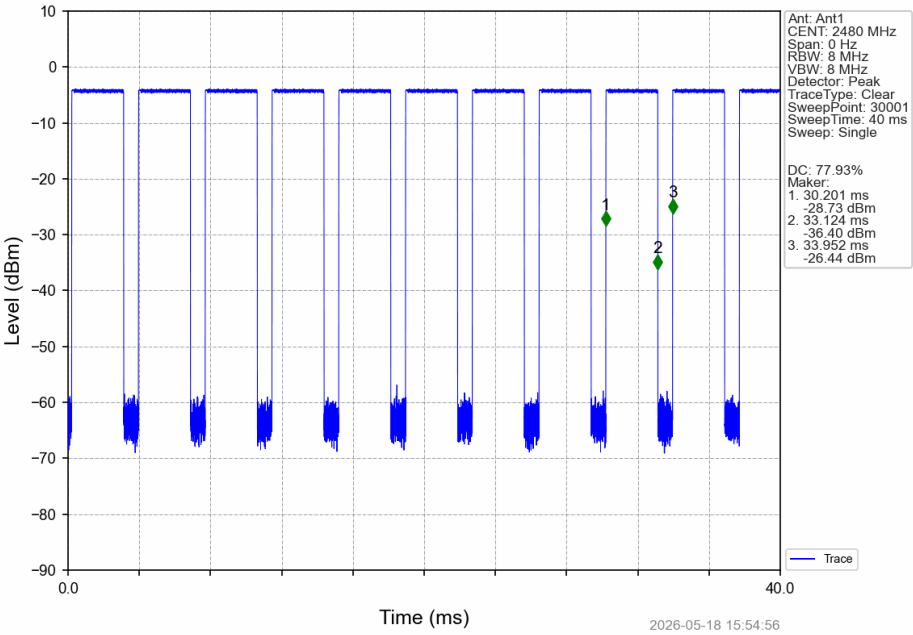
# 8DPSK\_3DH5\_LCH\_2402MHz\_Ant1\_NTNV



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



8DPSK\_3DH5\_HCH\_2480MHz\_Ant1\_NTNV



## 2. Bandwidth

### 2.1 Test Result

#### 2.1.1 OBW

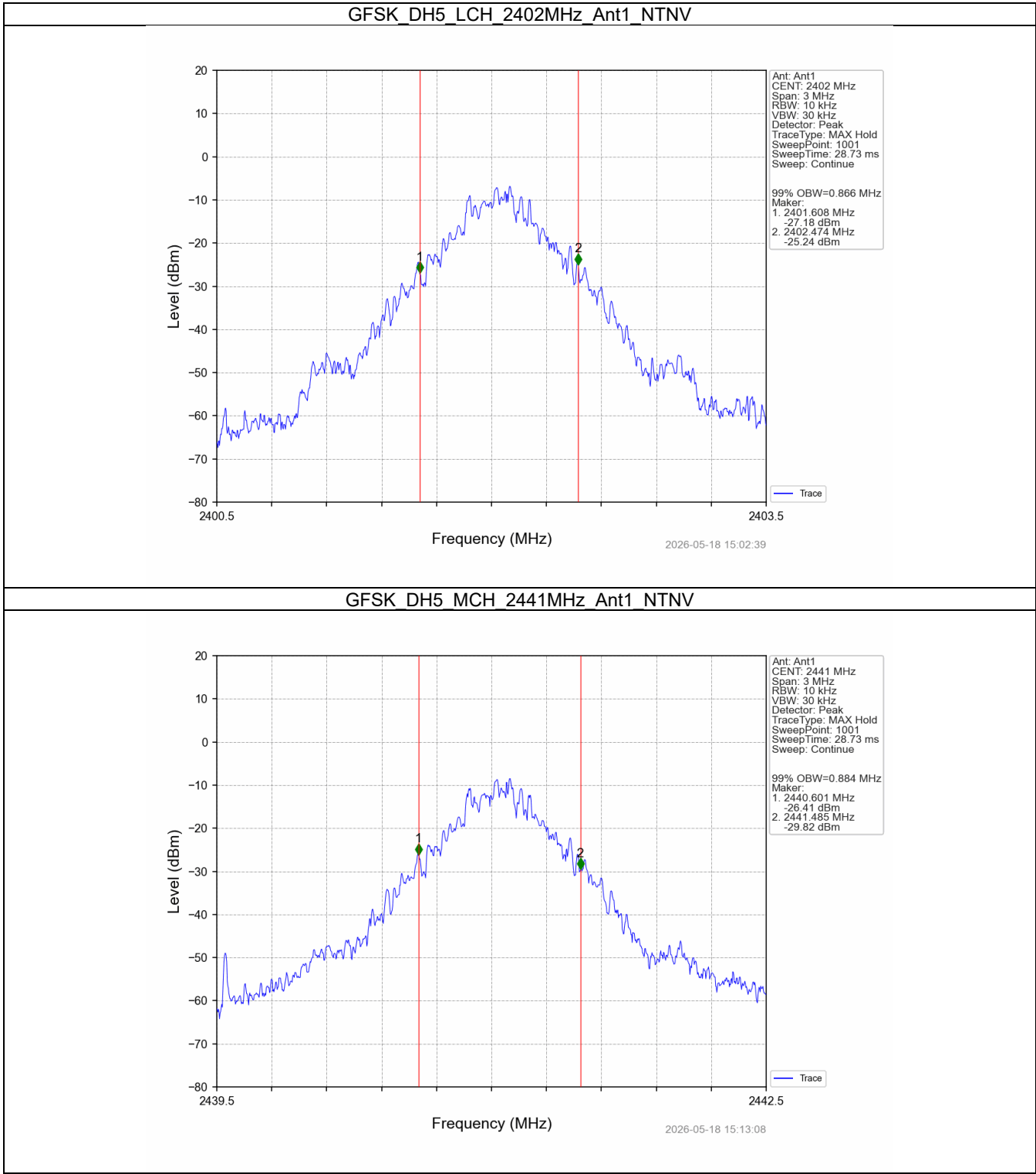
| Mode      | TX Type | Frequency (MHz) | Packet Type | ANT | 99% Occupied Bandwidth (MHz) |       | Verdict |
|-----------|---------|-----------------|-------------|-----|------------------------------|-------|---------|
|           |         |                 |             |     | Result                       | Limit |         |
| GFSK      | SISO    | 2402            | DH5         | 1   | 0.866                        | /     | Pass    |
|           |         | 2441            | DH5         | 1   | 0.884                        | /     | Pass    |
|           |         | 2480            | DH5         | 1   | 0.888                        | /     | Pass    |
| Pi/4DQPSK | SISO    | 2402            | 2DH5        | 1   | 1.217                        | /     | Pass    |
|           |         | 2441            | 2DH5        | 1   | 1.351                        | /     | Pass    |
|           |         | 2480            | 2DH5        | 1   | 1.436                        | /     | Pass    |
| 8DPSK     | SISO    | 2402            | 3DH5        | 1   | 1.217                        | /     | Pass    |
|           |         | 2441            | 3DH5        | 1   | 1.310                        | /     | Pass    |
|           |         | 2480            | 3DH5        | 1   | 1.369                        | /     | Pass    |

#### 2.1.2 20dB BW

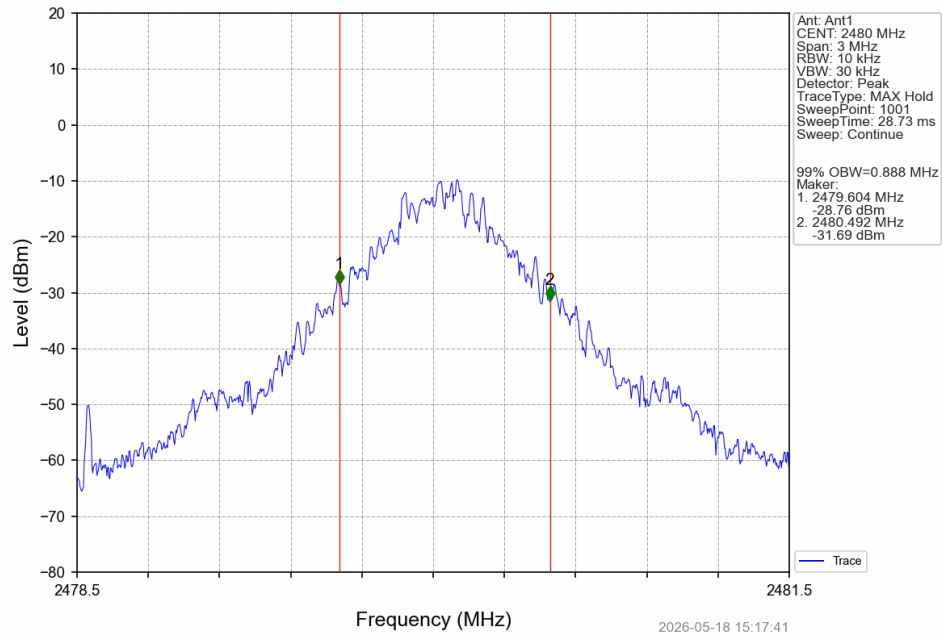
| Mode      | TX Type | Frequency (MHz) | Packet Type | ANT | 20dB Bandwidth (MHz) |       | Verdict |
|-----------|---------|-----------------|-------------|-----|----------------------|-------|---------|
|           |         |                 |             |     | Result               | Limit |         |
| GFSK      | SISO    | 2402            | DH5         | 1   | 1.103                | /     | Pass    |
|           |         | 2441            | DH5         | 1   | 1.106                | /     | Pass    |
|           |         | 2480            | DH5         | 1   | 1.102                | /     | Pass    |
| Pi/4DQPSK | SISO    | 2402            | 2DH5        | 1   | 1.363                | /     | Pass    |
|           |         | 2441            | 2DH5        | 1   | 1.434                | /     | Pass    |
|           |         | 2480            | 2DH5        | 1   | 1.480                | /     | Pass    |
| 8DPSK     | SISO    | 2402            | 3DH5        | 1   | 1.385                | /     | Pass    |
|           |         | 2441            | 3DH5        | 1   | 1.429                | /     | Pass    |
|           |         | 2480            | 3DH5        | 1   | 1.463                | /     | Pass    |

2.2 Test Graph

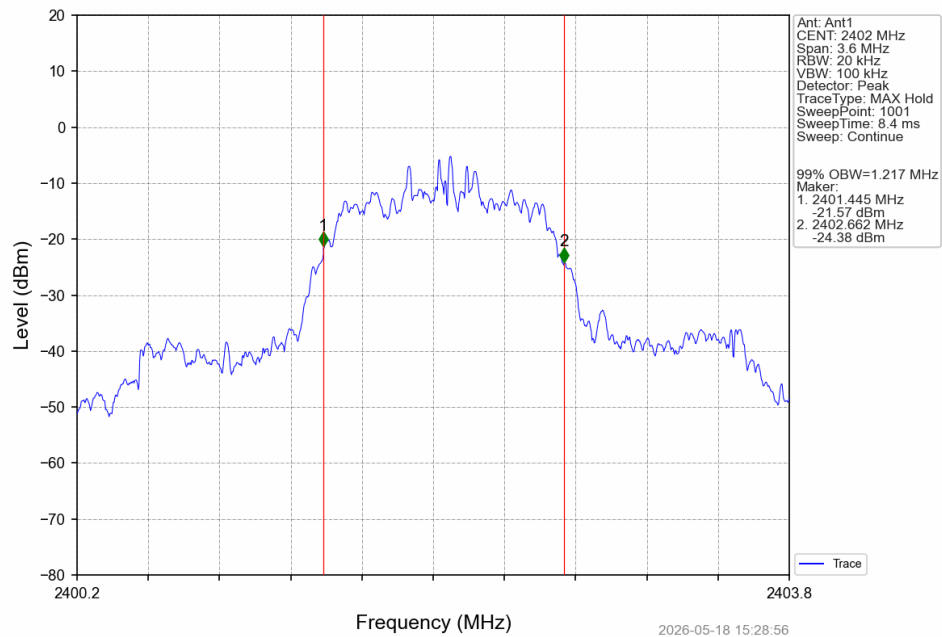
2.2.1 OBW



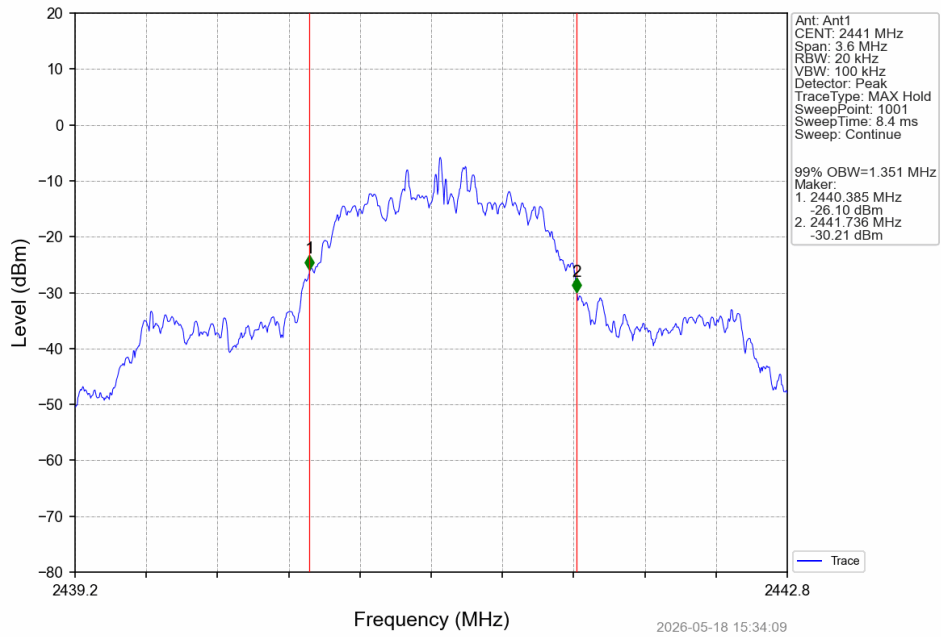
# GFSK DH5\_HCH\_2480MHz\_Ant1\_NTNV



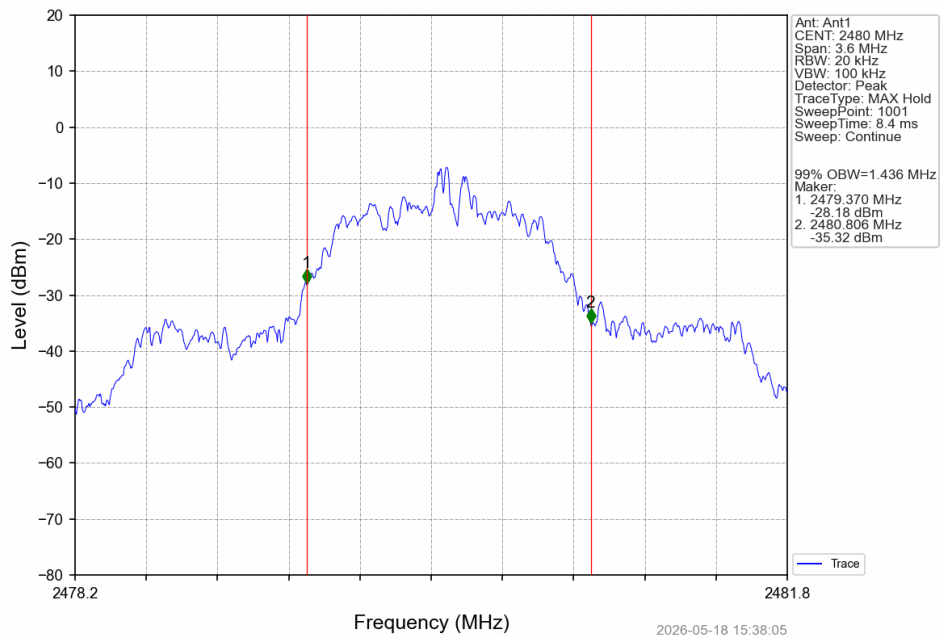
# Pi/4DQPSK\_2DH5\_LCH\_2402MHz\_Ant1\_NTNV



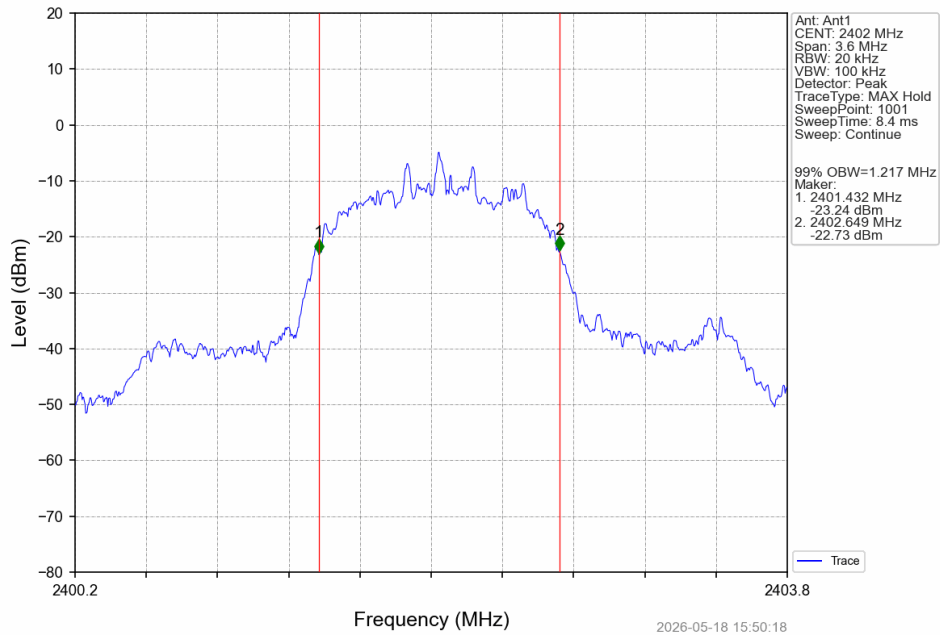
# Pi/4DQPSK\_2DH5\_MCH\_2441MHz\_Ant1\_NTNV



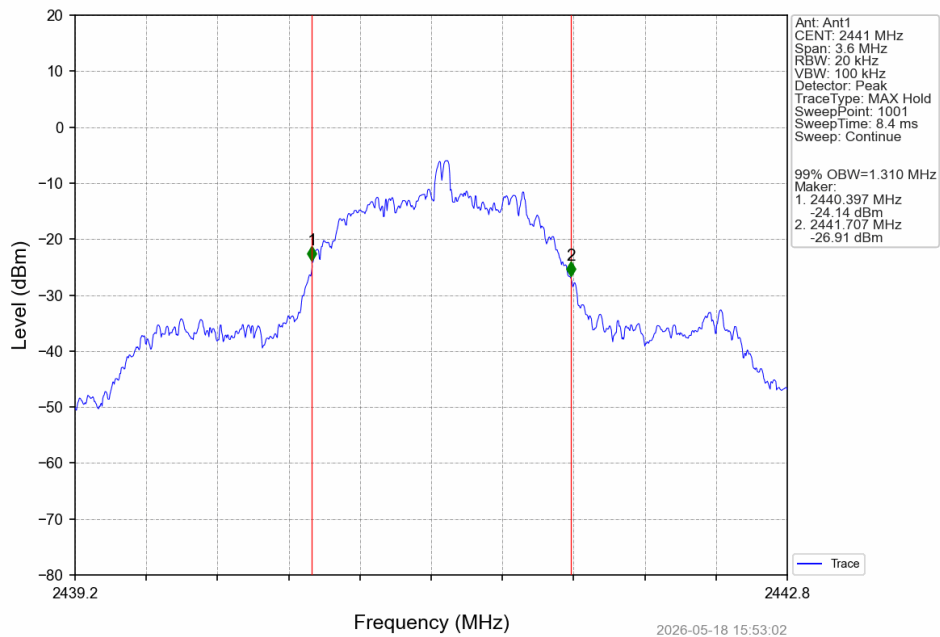
# Pi/4DQPSK\_2DH5\_HCH\_2480MHz\_Ant1\_NTNV



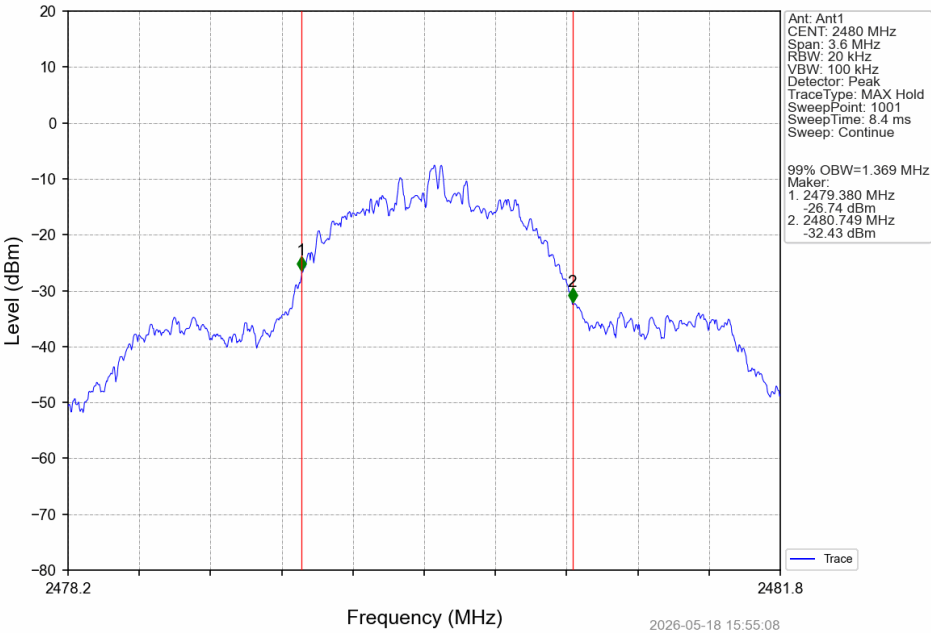
# 8DPSK\_3DH5\_LCH\_2402MHz\_Ant1\_NTNV



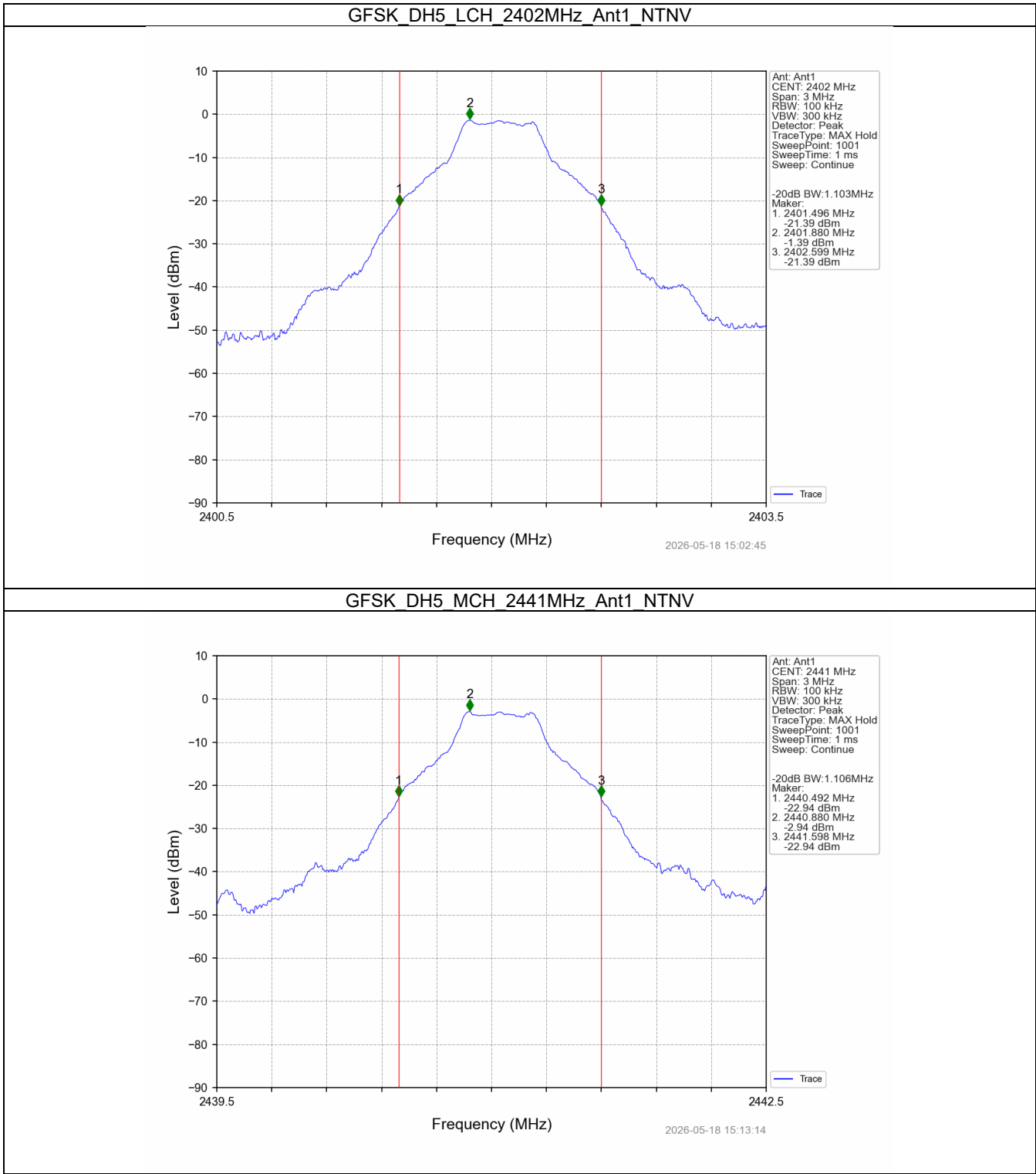
# 8DPSK\_3DH5\_MCH\_2441MHz\_Ant1\_NTNV



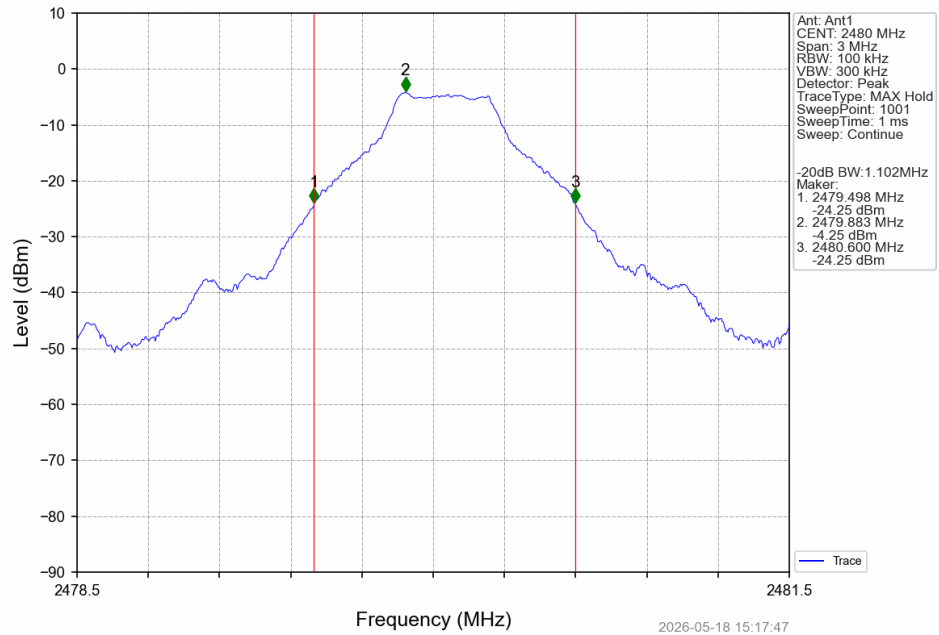
8DPSK\_3DH5\_HCH\_2480MHz\_Ant1\_NTNV



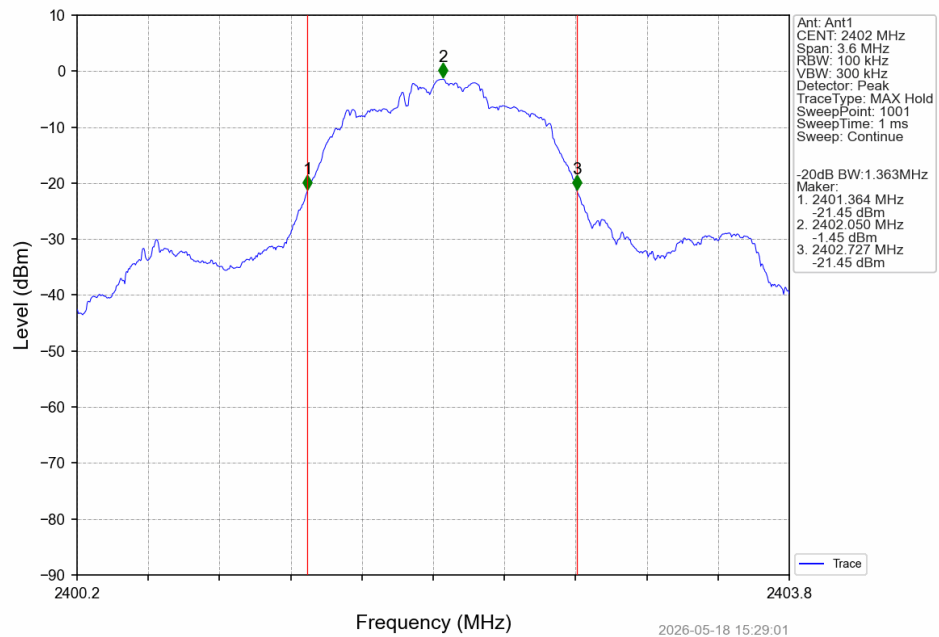
2.2.2 20dB BW



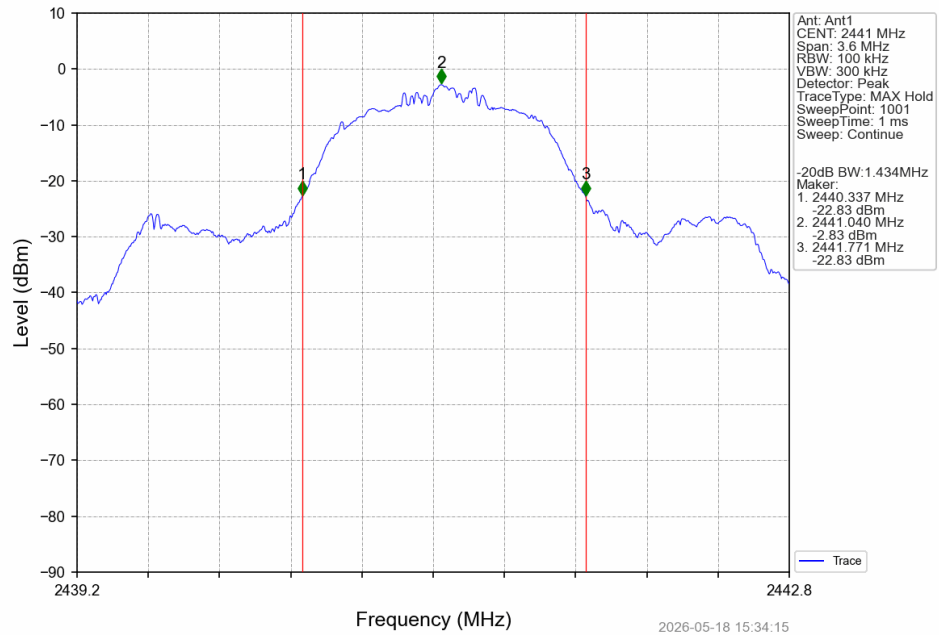
# GFSK DH5\_HCH\_2480MHz\_Ant1\_NTNV



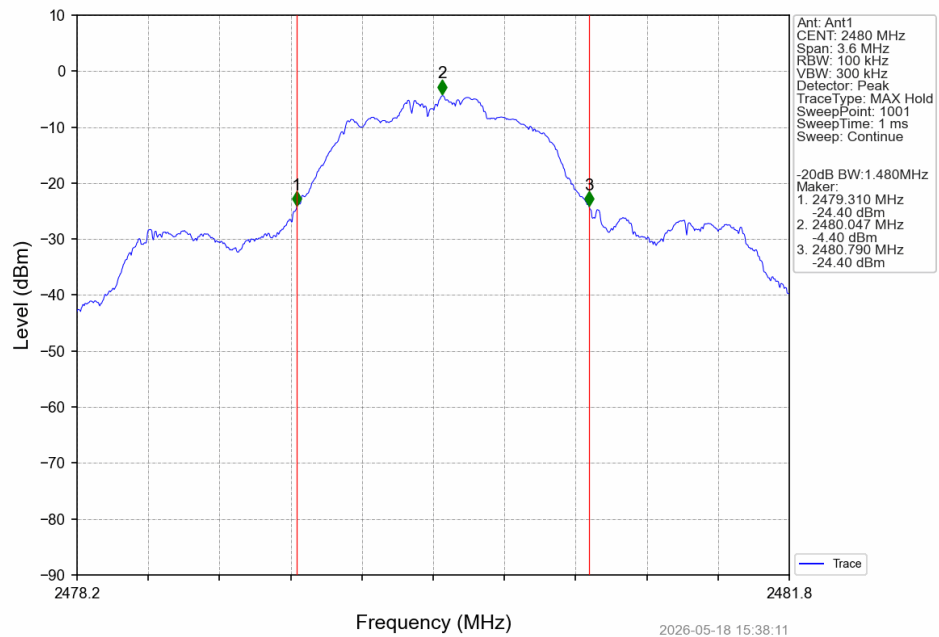
# PI/4DQPSK\_2DH5\_LCH\_2402MHz\_Ant1\_NTNV



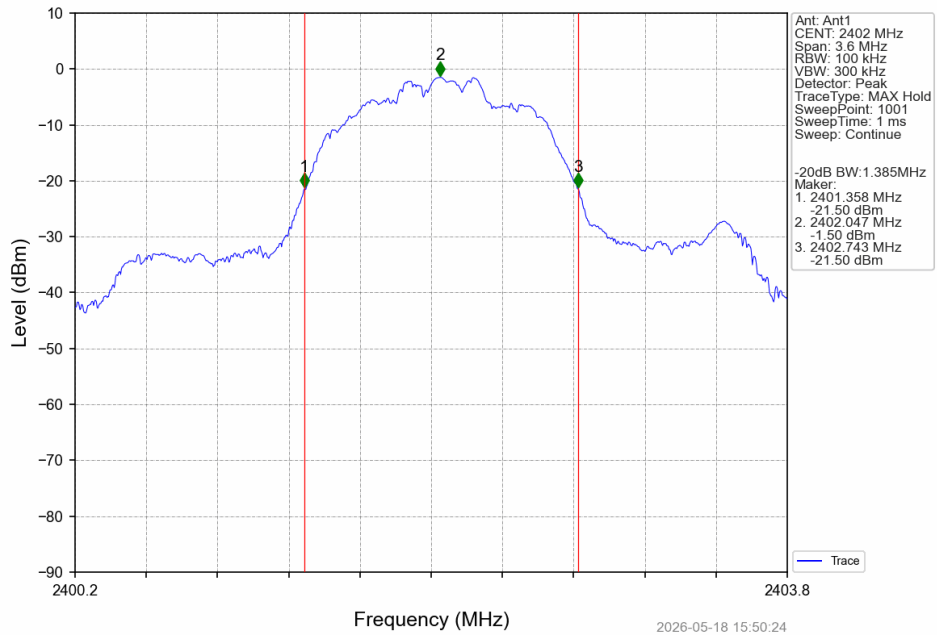
# Pi/4DQPSK\_2DH5\_MCH\_2441MHz\_Ant1\_NTNV



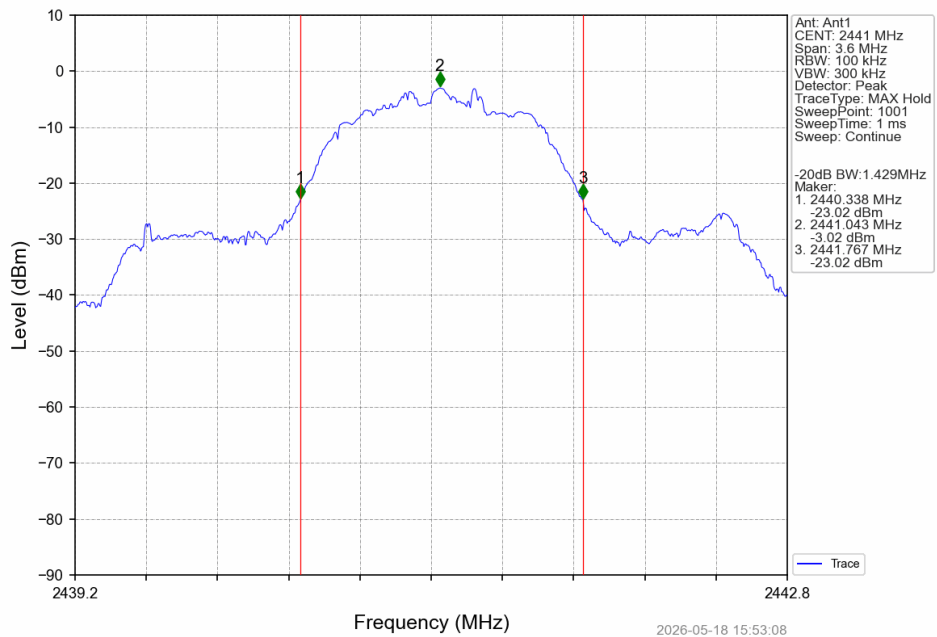
# Pi/4DQPSK\_2DH5\_HCH\_2480MHz\_Ant1\_NTNV



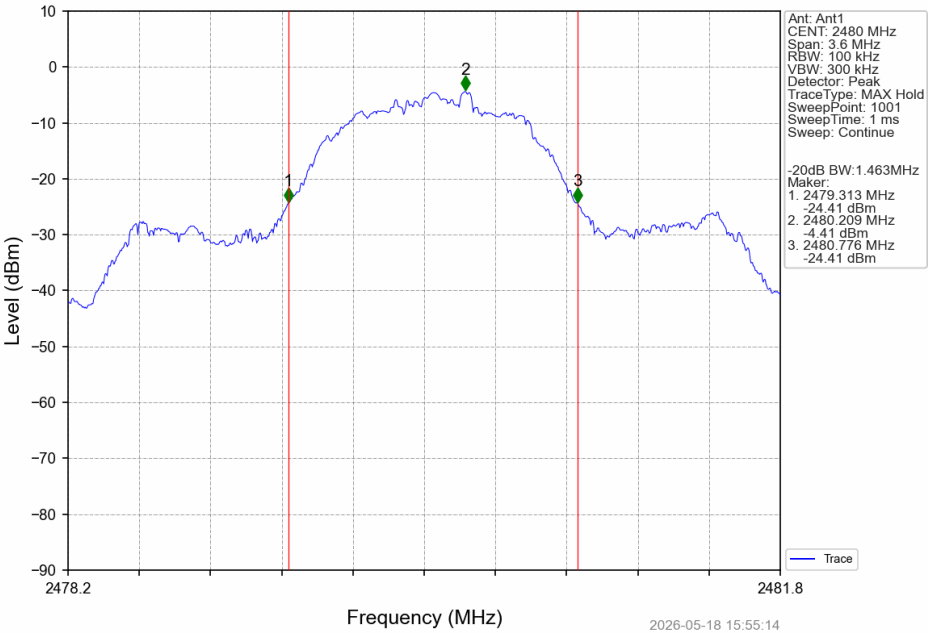
### 8DPSK\_3DH5\_LCH\_2402MHz\_Ant1\_NTNV



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



8DPSK\_3DH5\_HCH\_2480MHz\_Ant1\_NTNV



### 3. Maximum Conducted Output Power

#### 3.1 Test Result

##### 3.1.1 Power

| Mode      | TX Type | Frequency (MHz) | Packet Type | Maximum Peak Conducted Output Power (dBm) |              | Verdict |
|-----------|---------|-----------------|-------------|-------------------------------------------|--------------|---------|
|           |         |                 |             | ANT1                                      | Limit        |         |
| GFSK      | SISO    | 2402            | DH5         | -1.17                                     | $\leq 20.97$ | Pass    |
|           |         | 2441            | DH5         | -2.84                                     | $\leq 20.97$ | Pass    |
|           |         | 2480            | DH5         | -4.16                                     | $\leq 20.97$ | Pass    |
| Pi/4DQPSK | SISO    | 2402            | 2DH5        | -0.83                                     | $\leq 20.97$ | Pass    |
|           |         | 2441            | 2DH5        | -2.44                                     | $\leq 20.97$ | Pass    |
|           |         | 2480            | 2DH5        | -4.04                                     | $\leq 20.97$ | Pass    |
| 8DPSK     | SISO    | 2402            | 3DH5        | -0.78                                     | $\leq 20.97$ | Pass    |
|           |         | 2441            | 3DH5        | -2.63                                     | $\leq 20.97$ | Pass    |
|           |         | 2480            | 3DH5        | -3.98                                     | $\leq 20.97$ | Pass    |

## 4. Carrier Frequency Separation

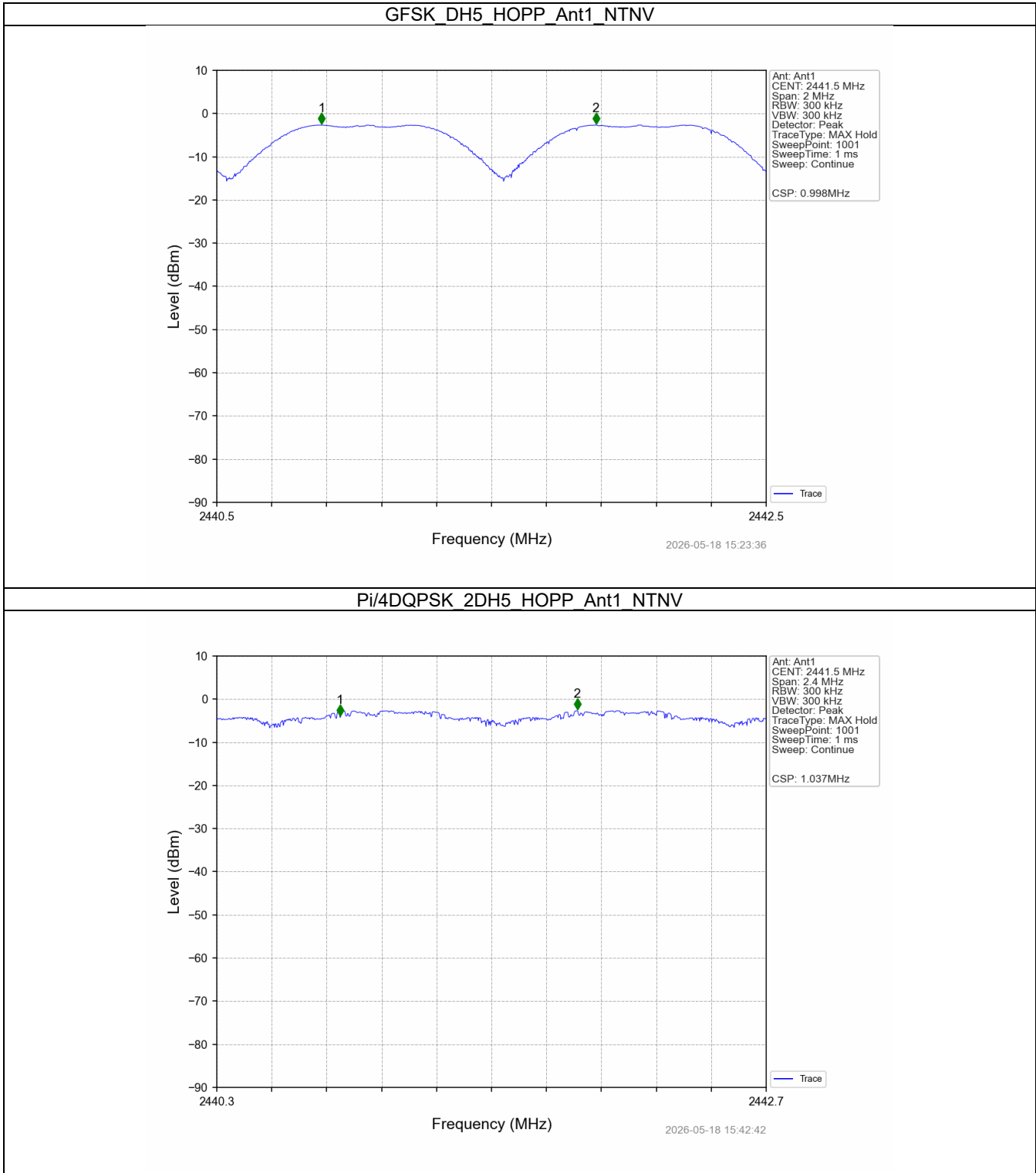
### 4.1 Test Result

#### 4.1.1 Ant1

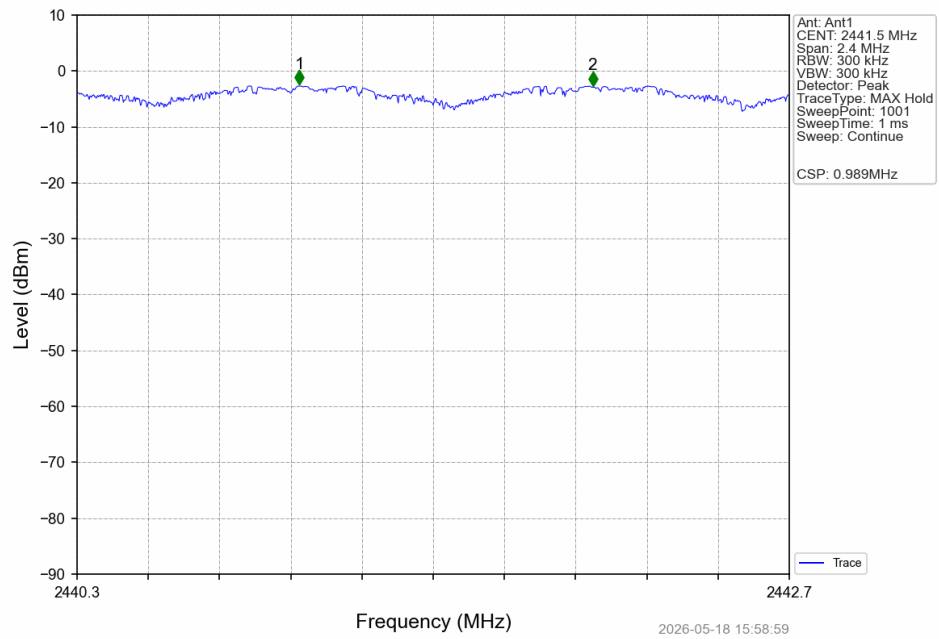
| Ant1      |         |                 |             |                          |                      |              |         |
|-----------|---------|-----------------|-------------|--------------------------|----------------------|--------------|---------|
| Mode      | TX Type | Frequency (MHz) | Packet Type | Channel Separation (MHz) | 20dB Bandwidth (MHz) | Limit (MHz)  | Verdict |
| GFSK      | SISO    | HOPP            | DH5         | 0.998                    | 1.106                | $\geq 0.737$ | Pass    |
| Pi/4DQPSK | SISO    | HOPP            | 2DH5        | 1.037                    | 1.480                | $\geq 0.987$ | Pass    |
| 8DPSK     | SISO    | HOPP            | 3DH5        | 0.989                    | 1.463                | $\geq 0.975$ | Pass    |

4.2 Test Graph

4.2.1 Ant1



# 8DPSK\_3DH5\_HOPP\_Ant1\_NTNV



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## 5. Number of Hopping Frequencies

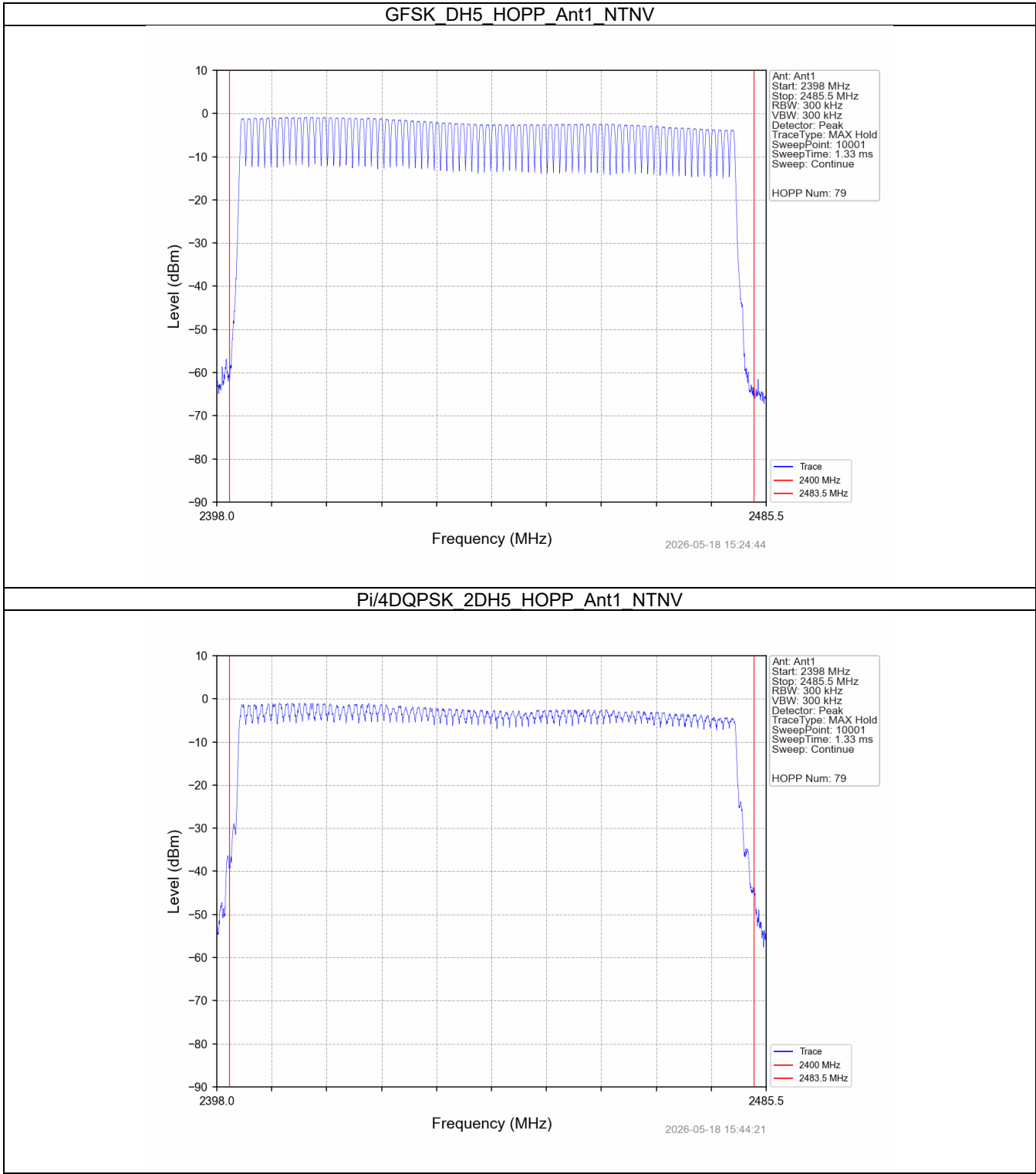
### 5.1 Test Result

#### 5.1.1 HoppNum

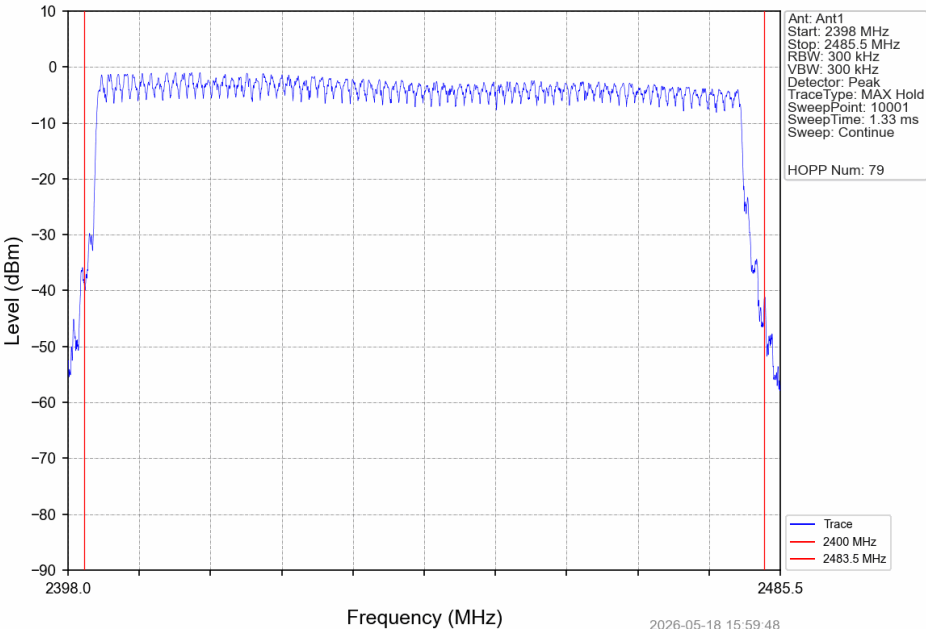
| Mode      | TX Type | Frequency (MHz) | Packet Type | Num of Hopping Frequencies |       | Verdict |
|-----------|---------|-----------------|-------------|----------------------------|-------|---------|
|           |         |                 |             | ANT1                       | Limit |  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

5.2 Test Graph

5.2.1 HoppNum



8DPSK\_3DH5\_HOPP\_Ant1\_NTNV



## 6. Time of Occupancy (Dwell Time)

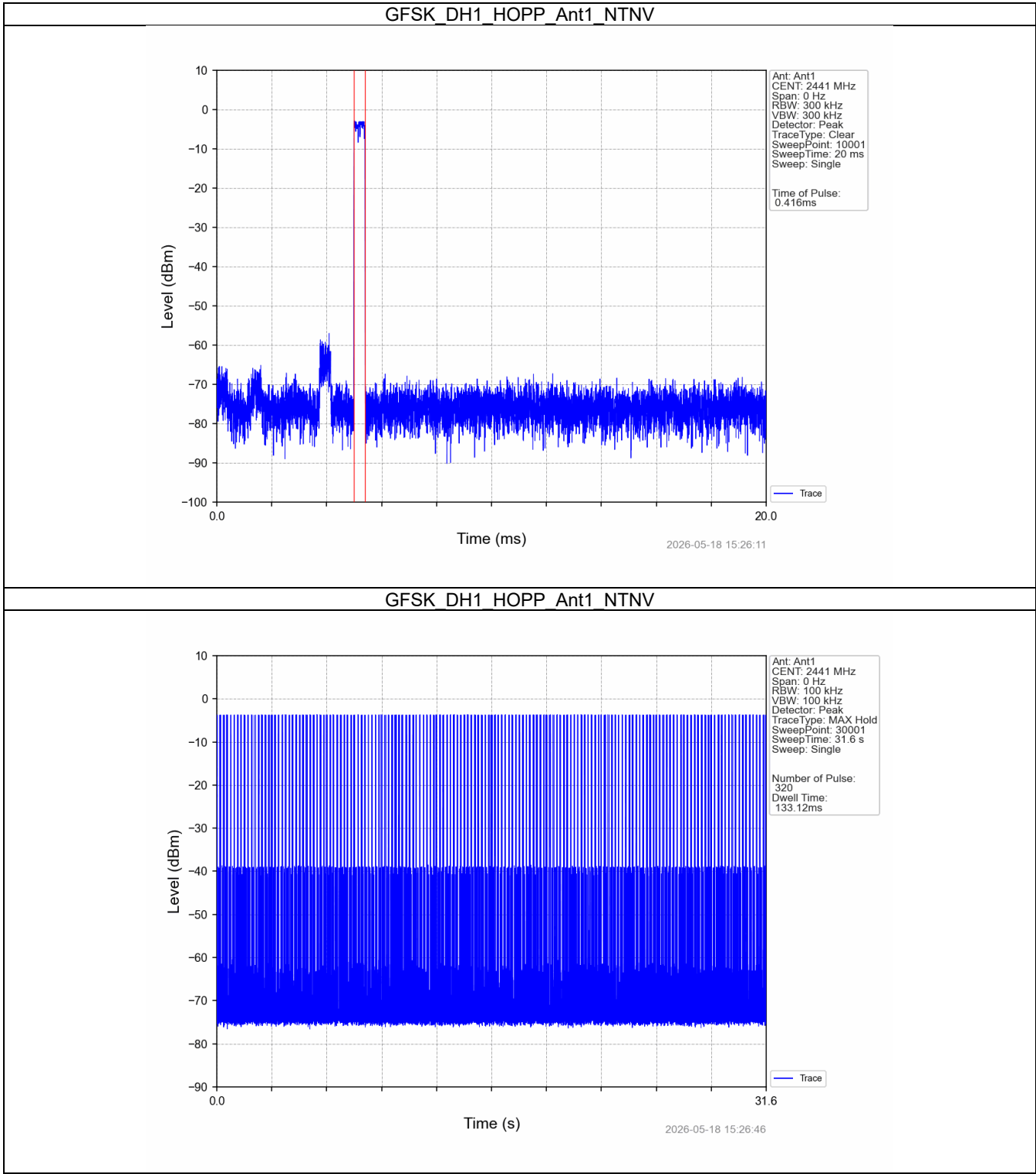
### 6.1 Test Result

#### 6.1.1 Ant1

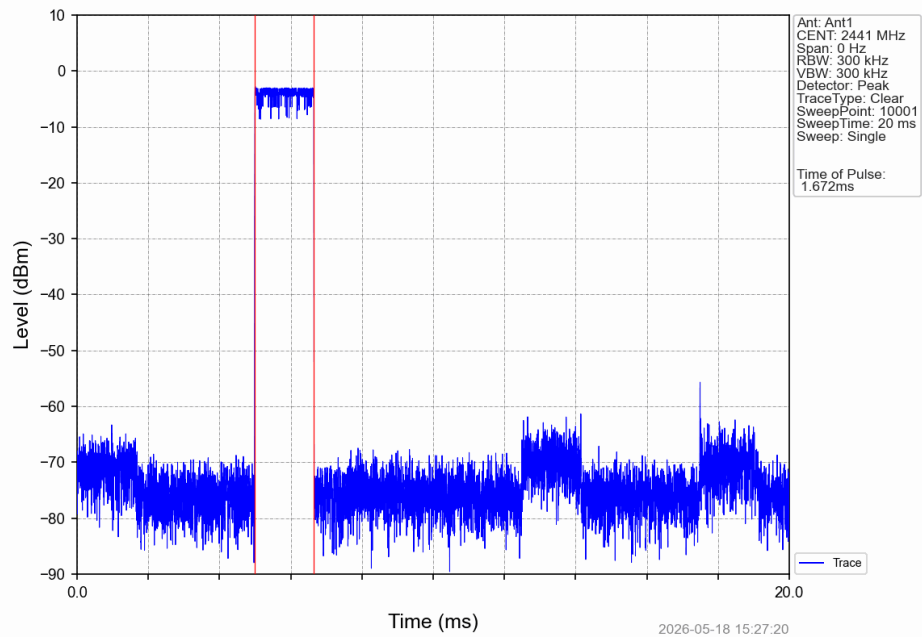
| Ant1      |         |                 |             |                               |                        |                                    |                 |            |         |
|-----------|---------|-----------------|-------------|-------------------------------|------------------------|------------------------------------|-----------------|------------|---------|
| 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         | 0.416                         | 31.600                 | 320                                | 133.120         | <=400      | Pass    |
|           |         |                 | DH3         | 1.672                         | 31.600                 | 165                                | 275.880         | <=400      | Pass    |
|           |         |                 | DH5         | 2.920                         | 31.600                 | 108                                | 315.360         | <=400      | Pass    |
| Pi/4DQPSK | SISO    | HOPP            | 2DH1        | 0.418                         | 31.600                 | 319                                | 133.342         | <=400      | Pass    |
|           |         |                 | 2DH3        | 1.674                         | 31.600                 | 155                                | 259.470         | <=400      | Pass    |
|           |         |                 | 2DH5        | 2.922                         | 31.600                 | 102                                | 298.044         | <=400      | Pass    |
| 8DPSK     | SISO    | HOPP            | 3DH1        | 0.424                         | 31.600                 | 320                                | 135.680         | <=400      | Pass    |
|           |         |                 | 3DH3        | 1.674                         | 31.600                 | 164                                | 274.536         | <=400      | Pass    |
|           |         |                 | 3DH5        | 2.924                         | 31.600                 | 101                                | 295.324         | <=400      | Pass    |

6.2 Test Graph

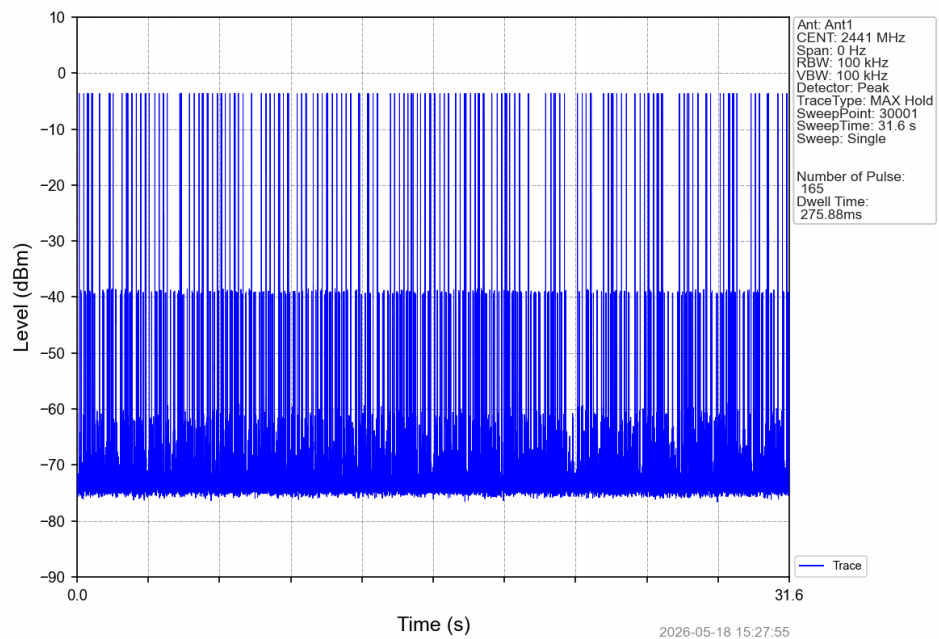
6.2.1 Ant1



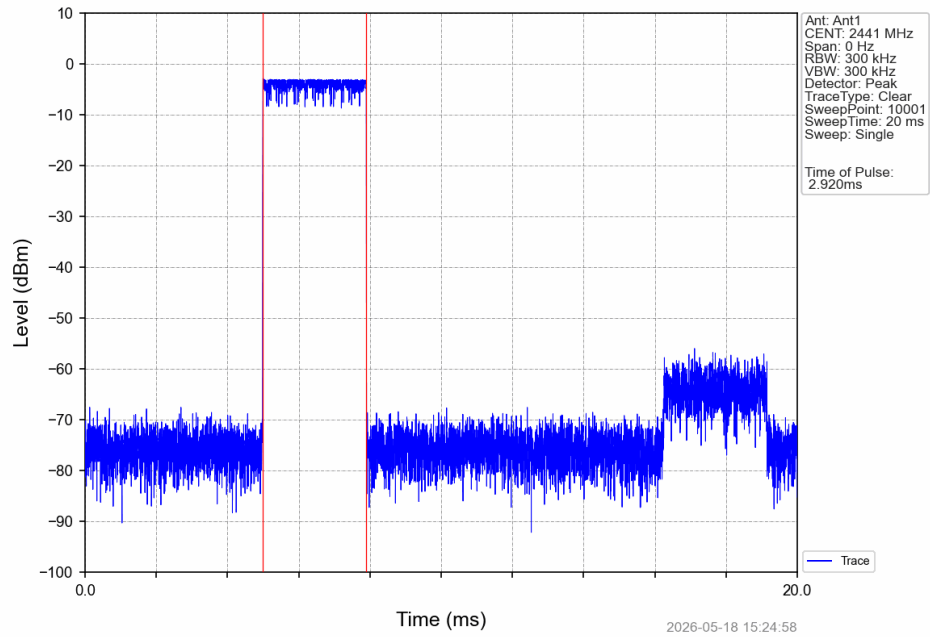
# GFSK\_DH3\_HOPP\_Ant1\_NTNV



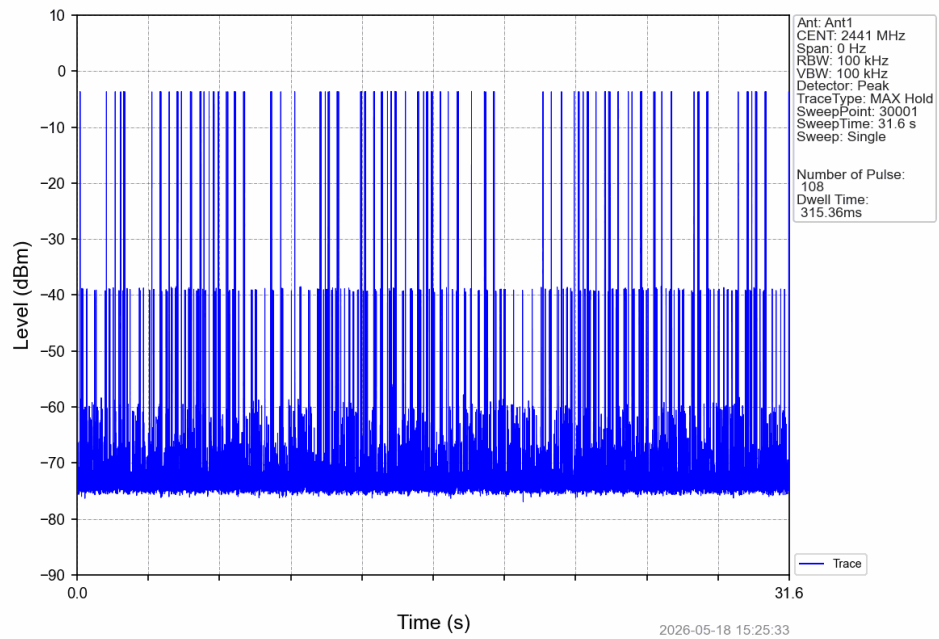
# GFSK\_DH3\_HOPP\_Ant1\_NTNV



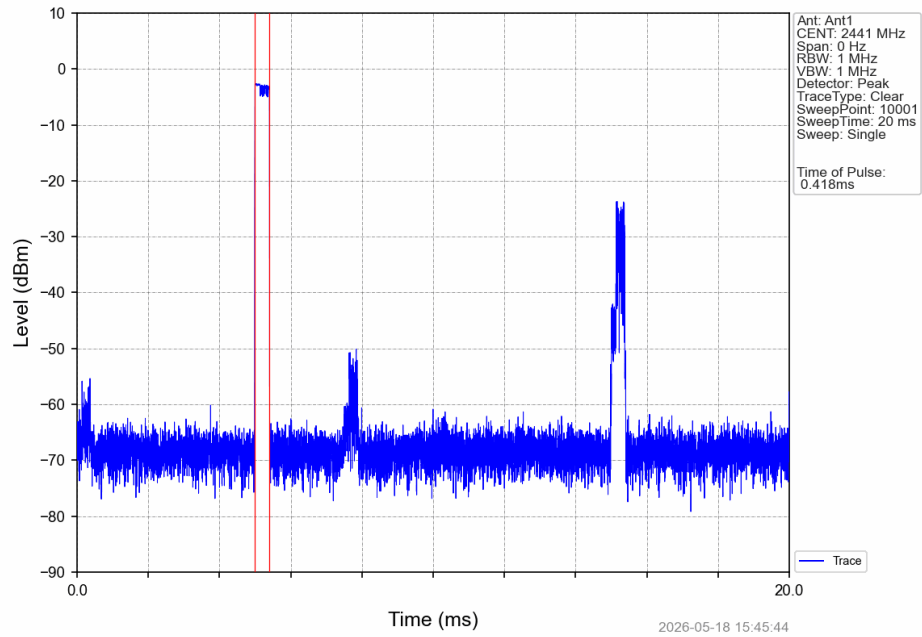
# GFSK\_DH5\_HOPP\_Ant1\_NTNV



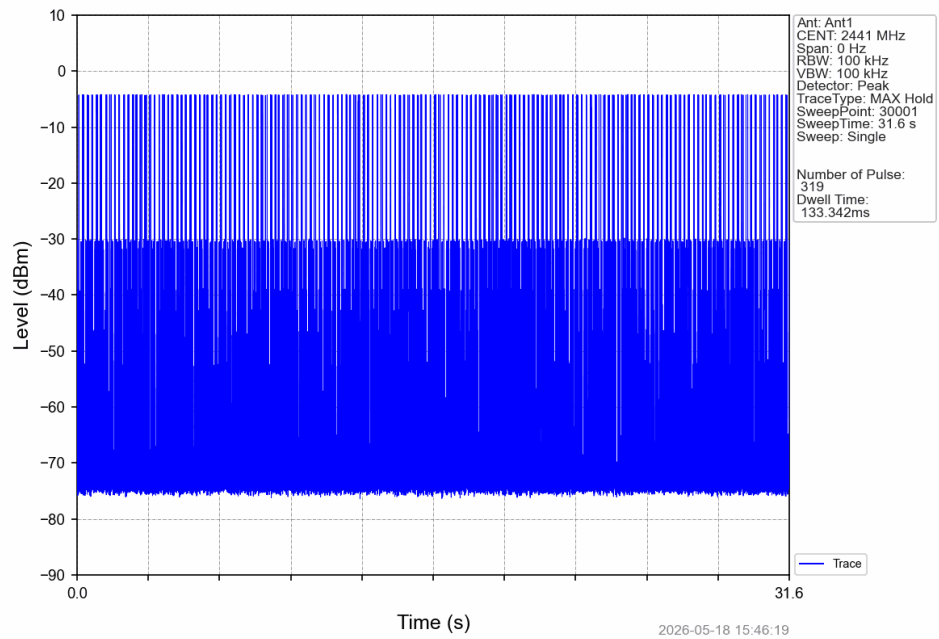
# GFSK\_DH5\_HOPP\_Ant1\_NTNV



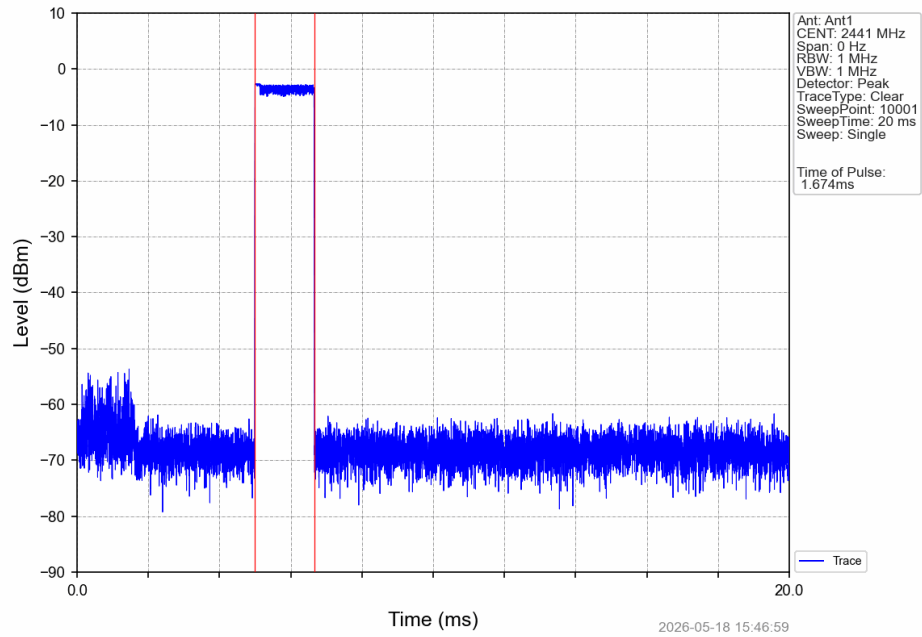
# Pi/4DQPSK\_2DH1\_HOPP\_Ant1\_NTNV



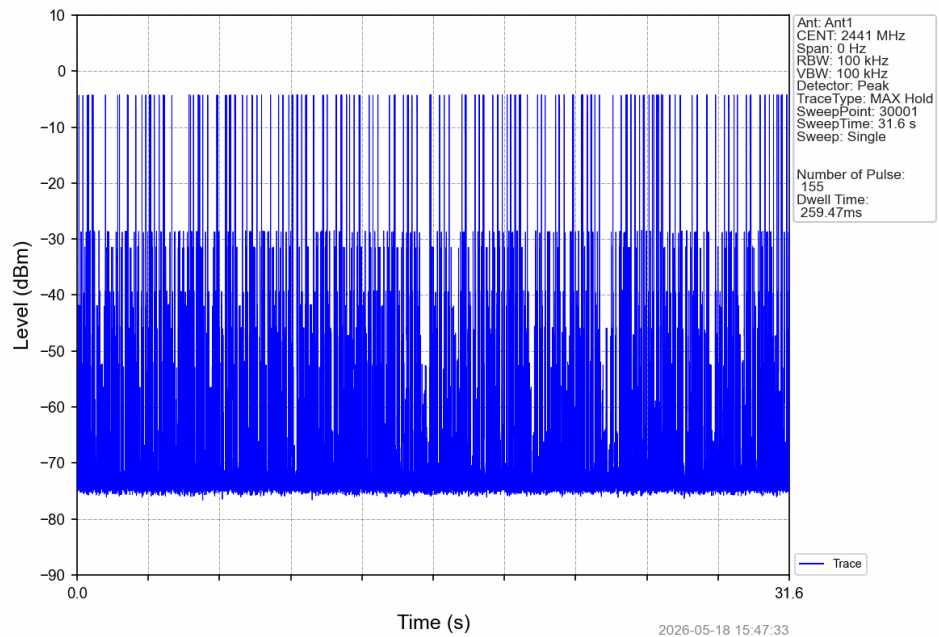
# Pi/4DQPSK\_2DH1\_HOPP\_Ant1\_NTNV



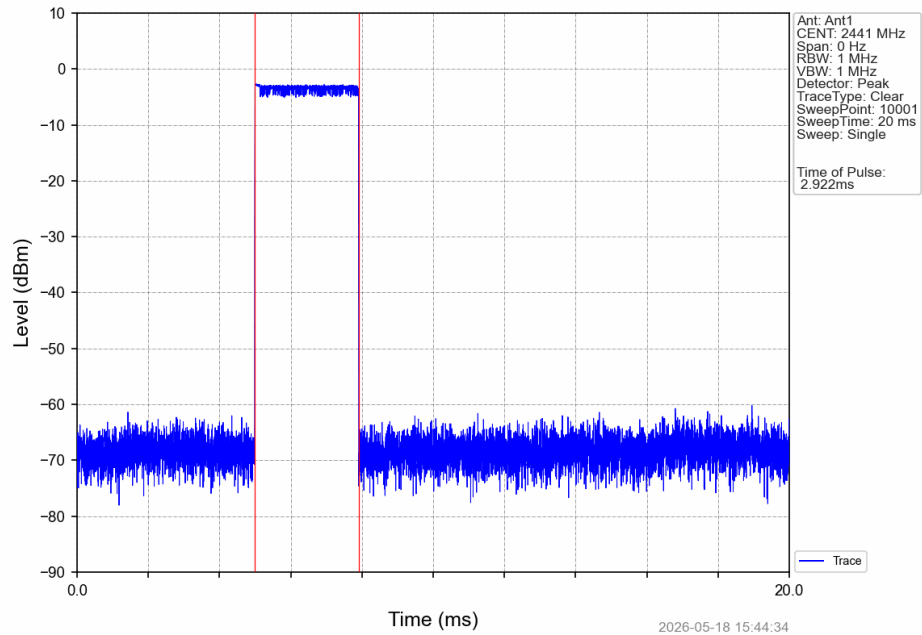
# Pi/4DQPSK\_2DH3\_HOPP\_Ant1\_NTNV



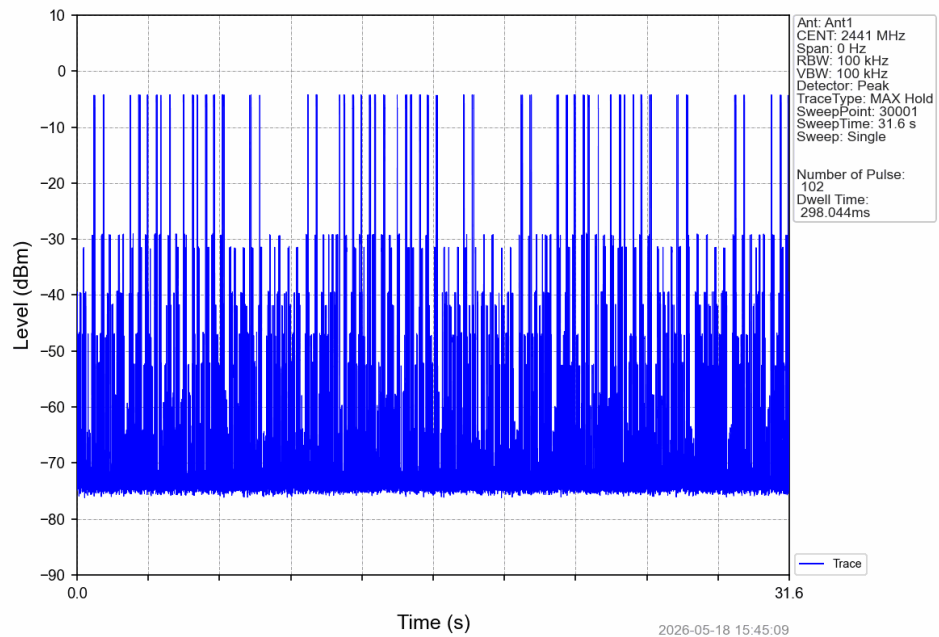
# Pi/4DQPSK\_2DH3\_HOPP\_Ant1\_NTNV



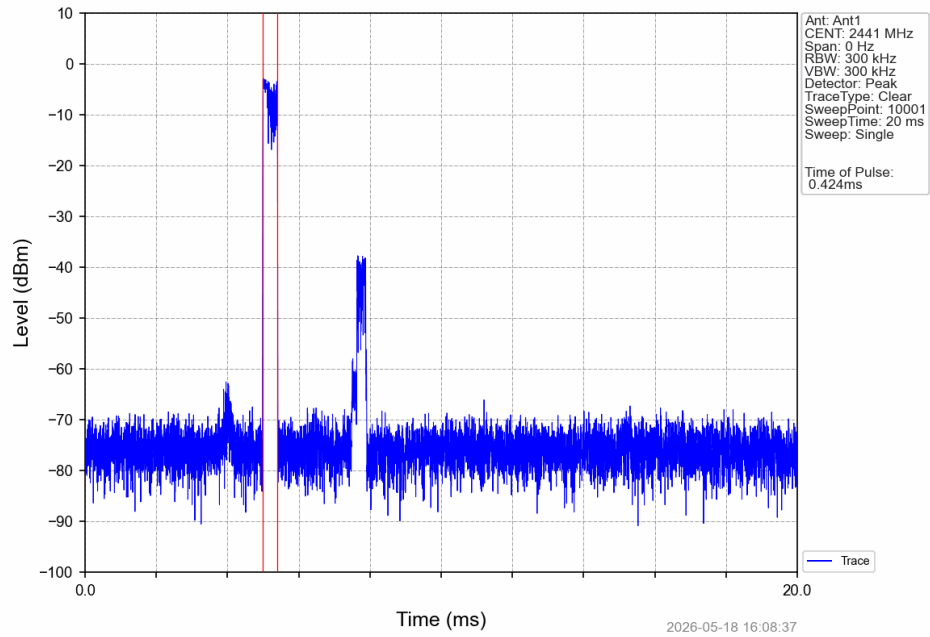
# Pi/4DQPSK\_2DH5\_HOPP\_Ant1\_NTNV



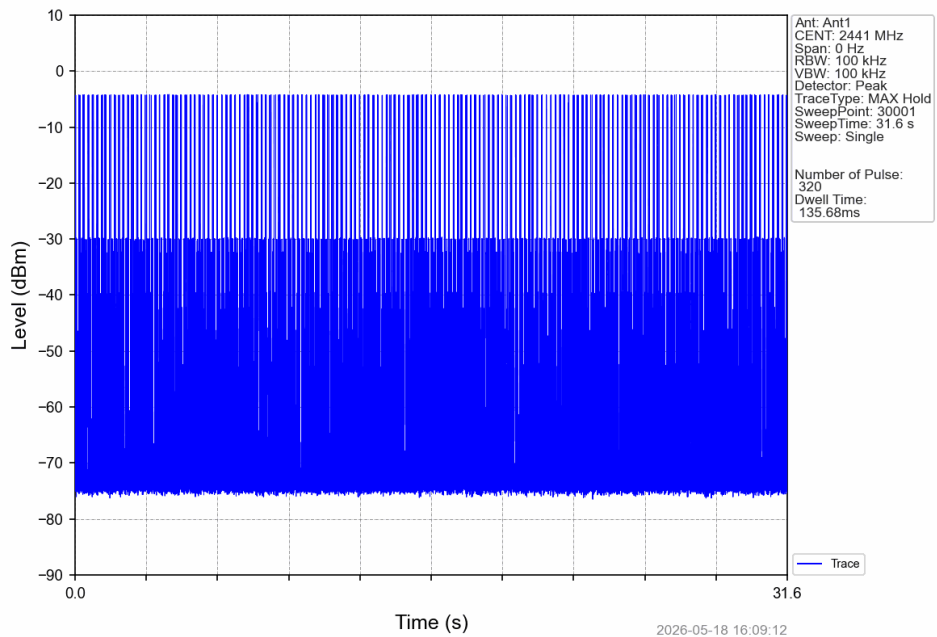
# Pi/4DQPSK\_2DH5\_HOPP\_Ant1\_NTNV



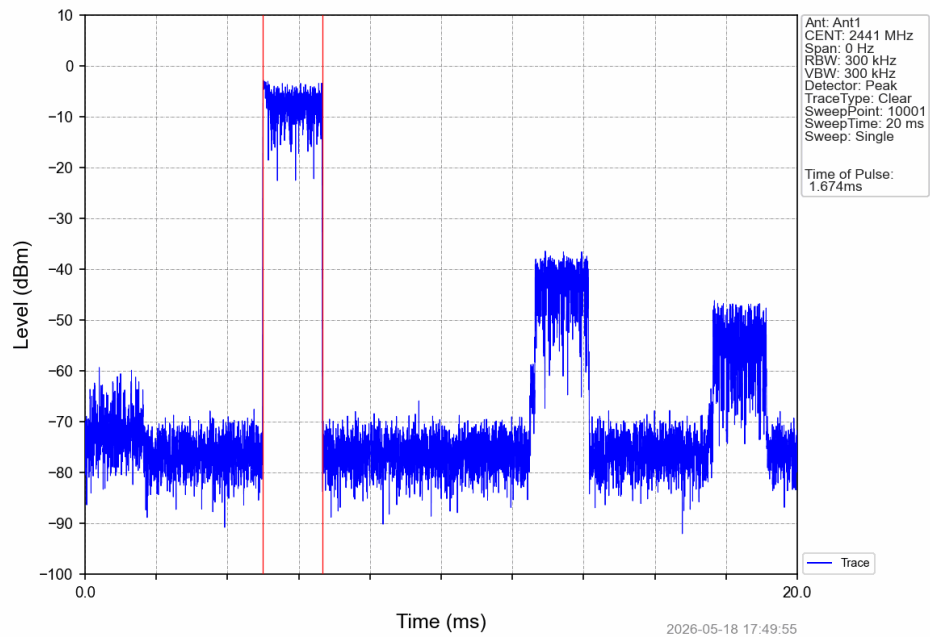
# 8DPSK\_3DH1\_HOPP\_Ant1\_NTNV



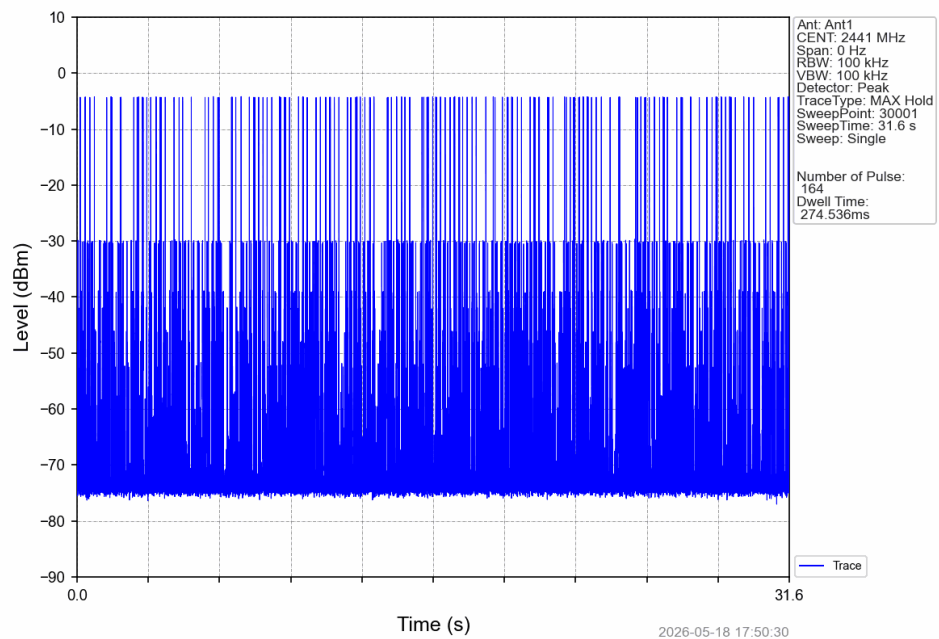
# 8DPSK\_3DH1\_HOPP\_Ant1\_NTNV



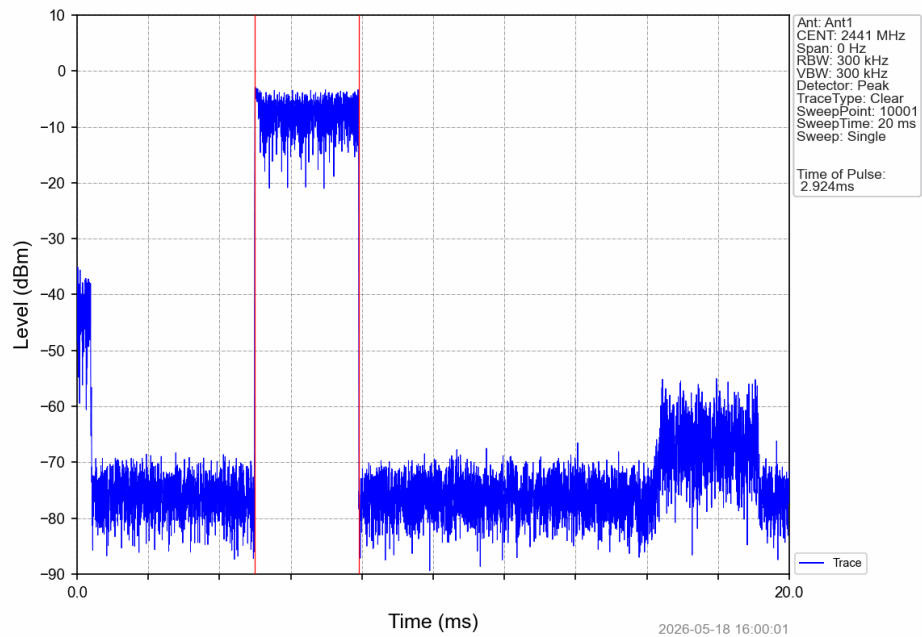
# 8DPSK\_3DH3\_HOPP\_Ant1\_NTNV



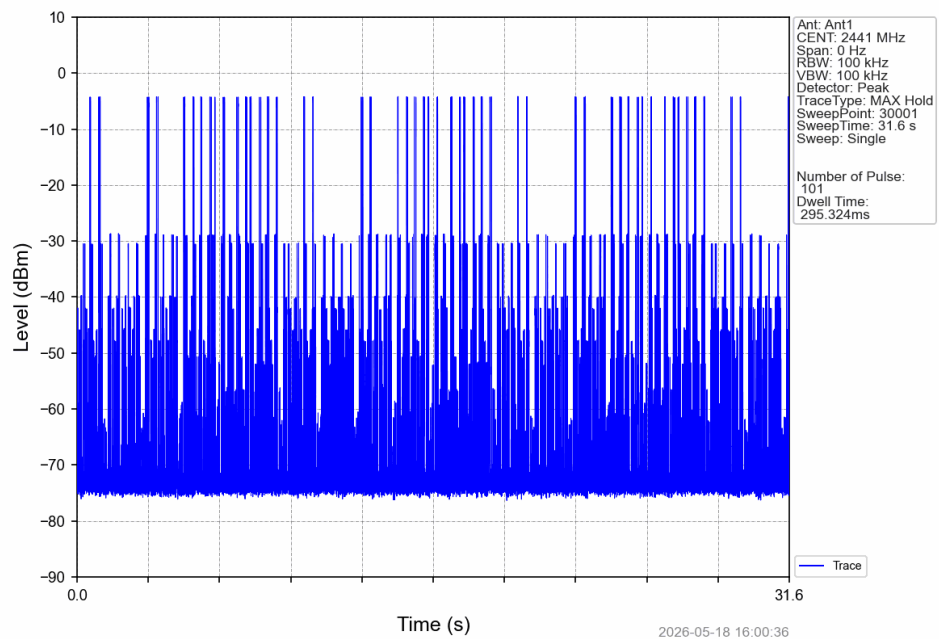
# 8DPSK\_3DH3\_HOPP\_Ant1\_NTNV



# 8DPSK\_3DH5\_HOPP\_Ant1\_NTNV



# 8DPSK\_3DH5\_HOPP\_Ant1\_NTNV



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

### 7.1 Test Result

#### 7.1.1 Ref

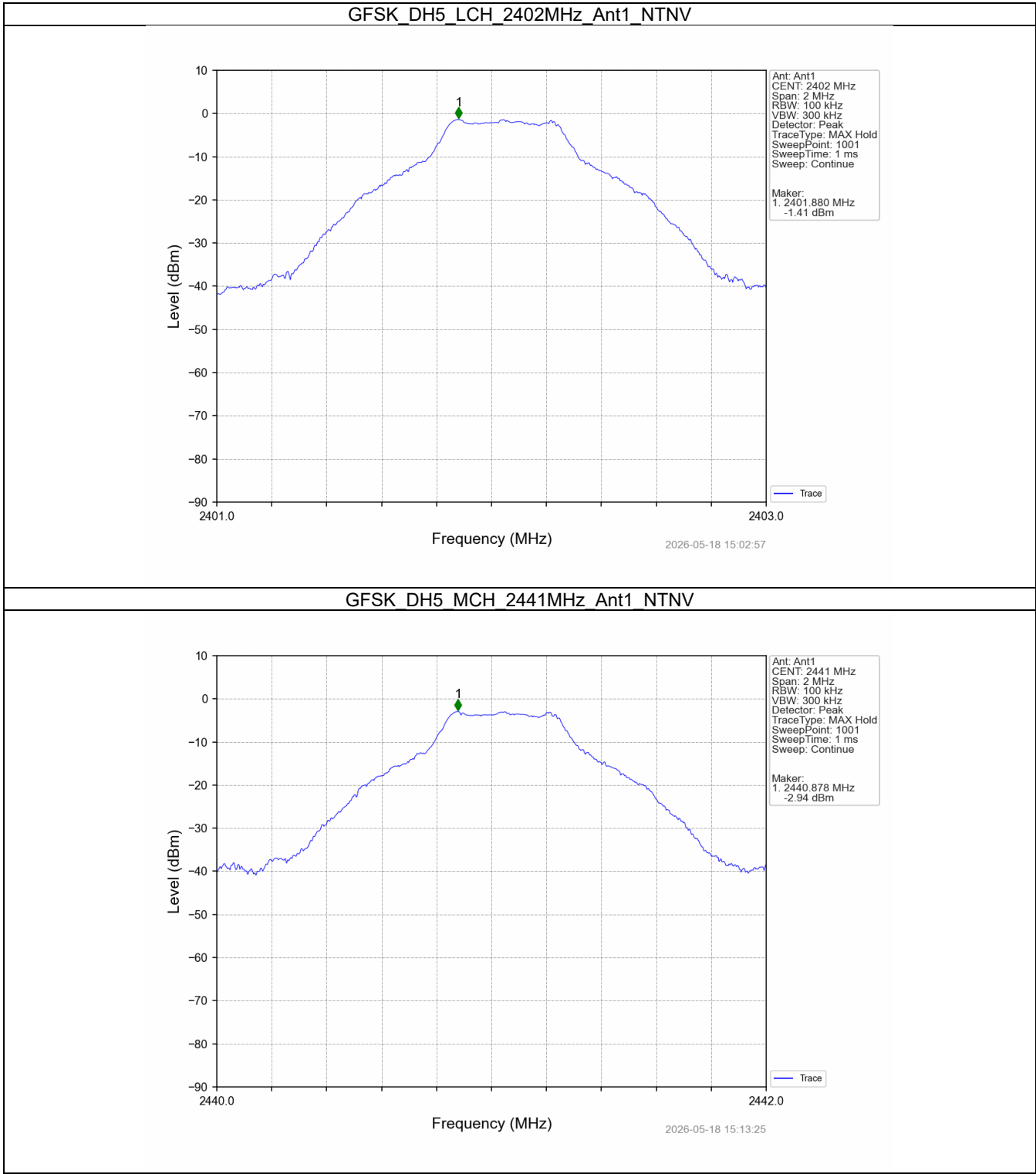
| Mode      | TX Type | Frequency (MHz) | Packet Type | ANT | Level of Reference (dBm) |
|-----------|---------|-----------------|-------------|-----|--------------------------|
| GFSK      | SISO    | 2402            | DH5         | 1   | -1.41                    |
|           |         | 2441            | DH5         | 1   | -2.94                    |
|           |         | 2480            | DH5         | 1   | -4.25                    |
|           |         | HOPP            | DH5         | 1   | -1.10                    |
|           |         |                 |             |     | -1.10                    |
| Pi/4DQPSK | SISO    | 2402            | 2DH5        | 1   | -2.11                    |
|           |         | 2441            | 2DH5        | 1   | -2.87                    |
|           |         | 2480            | 2DH5        | 1   | -4.37                    |
|           |         | HOPP            | 2DH5        | 1   | -1.44                    |
|           |         |                 |             |     | -1.44                    |
| 8DPSK     | SISO    | 2402            | 3DH5        | 1   | -1.52                    |
|           |         | 2441            | 3DH5        | 1   | -3.01                    |
|           |         | 2480            | 3DH5        | 1   | -4.42                    |
|           |         | HOPP            | 3DH5        | 1   | -1.09                    |
|           |         |                 |             |     | -1.09                    |

#### 7.1.2 CSE

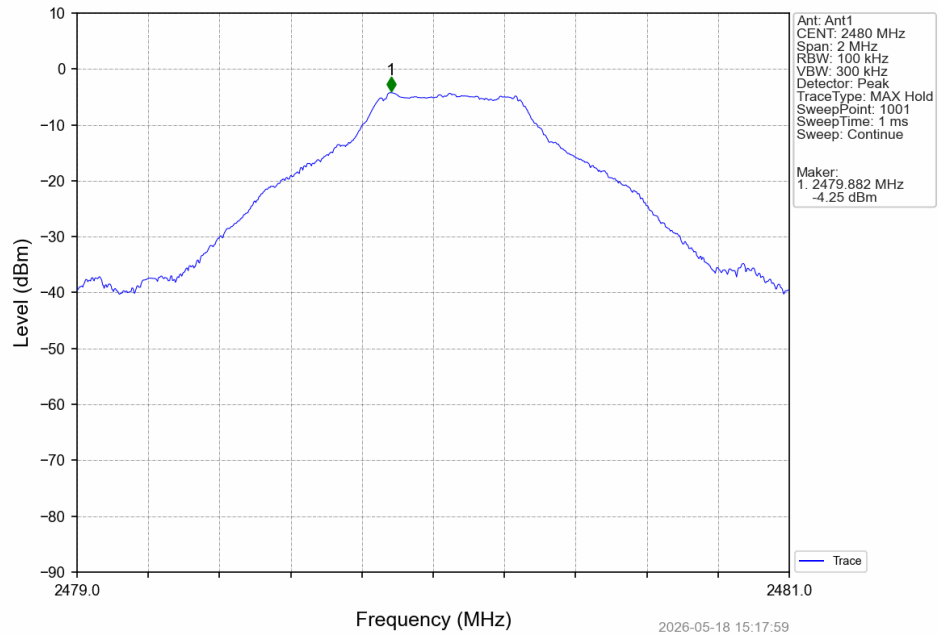
| Mode      | TX Type | Frequency (MHz) | Packet Type | ANT | Level of Reference (dBm) | Limit (dBm) | Verdict |
|-----------|---------|-----------------|-------------|-----|--------------------------|-------------|---------|
| GFSK      | SISO    | 2402            | DH5         | 1   | -1.41                    | -21.41      | Pass    |
|           |         | 2441            | DH5         | 1   | -2.94                    | -22.94      | Pass    |
|           |         | 2480            | DH5         | 1   | -4.25                    | -24.25      | Pass    |
|           |         | HOPP            | DH5         | 1   | -1.10                    | -21.10      | Pass    |
|           |         |                 |             |     | -1.10                    | -21.10      | Pass    |
| Pi/4DQPSK | SISO    | 2402            | 2DH5        | 1   | -2.11                    | -22.11      | Pass    |
|           |         | 2441            | 2DH5        | 1   | -2.87                    | -22.87      | Pass    |
|           |         | 2480            | 2DH5        | 1   | -4.37                    | -24.37      | Pass    |
|           |         | HOPP            | 2DH5        | 1   | -1.44                    | -21.44      | Pass    |
|           |         |                 |             |     | -1.44                    | -21.44      | Pass    |
| 8DPSK     | SISO    | 2402            | 3DH5        | 1   | -1.52                    | -21.52      | Pass    |
|           |         | 2441            | 3DH5        | 1   | -3.01                    | -23.01      | Pass    |
|           |         | 2480            | 3DH5        | 1   | -4.42                    | -24.42      | Pass    |
|           |         | HOPP            | 3DH5        | 1   | -1.09                    | -21.09      | Pass    |
|           |         |                 |             |     | -1.09                    | -21.09      | Pass    |

7.2 Test Graph

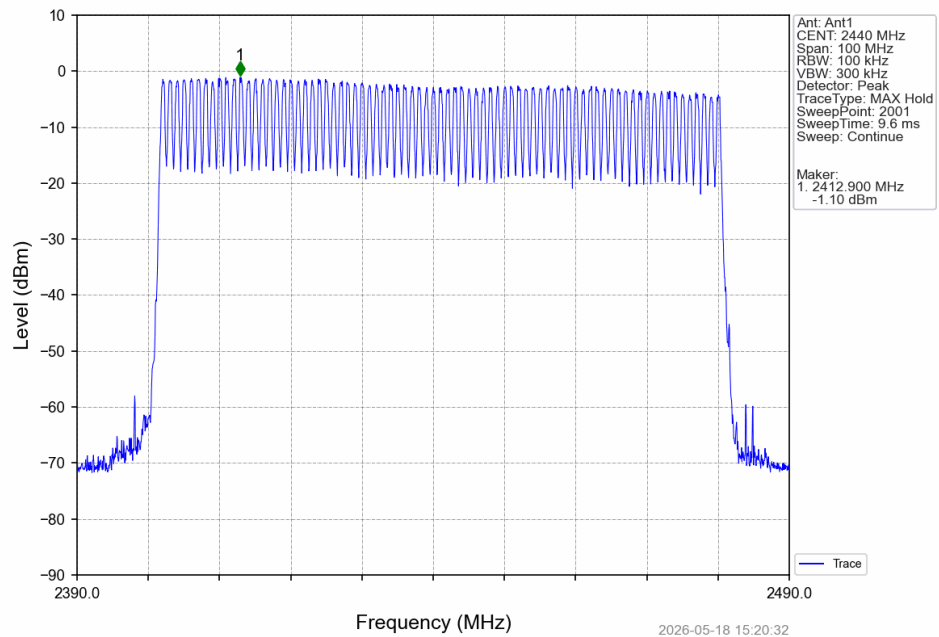
7.2.1 Ref



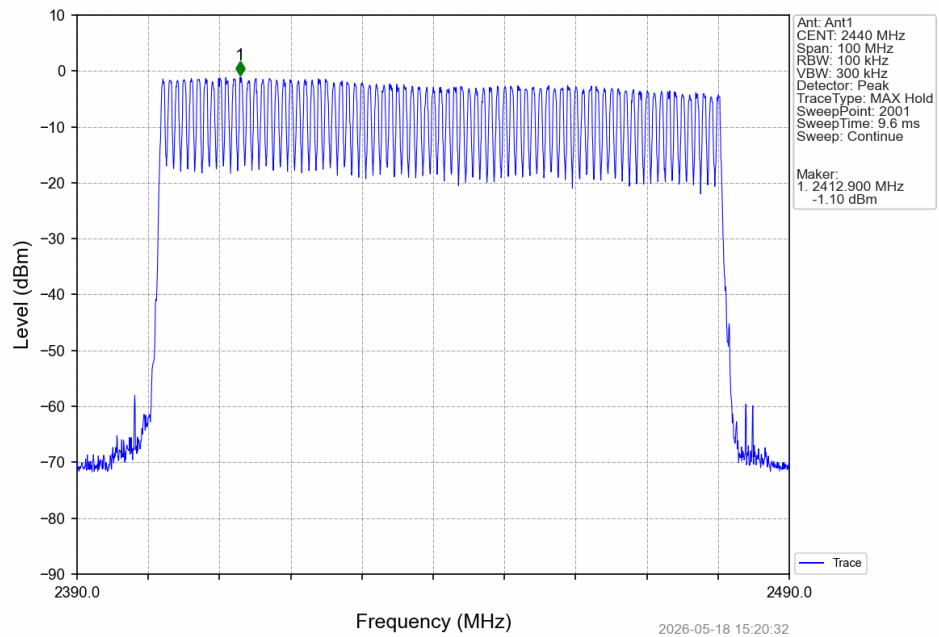
# GFSK DH5\_HCH\_2480MHz\_Ant1\_NTNV



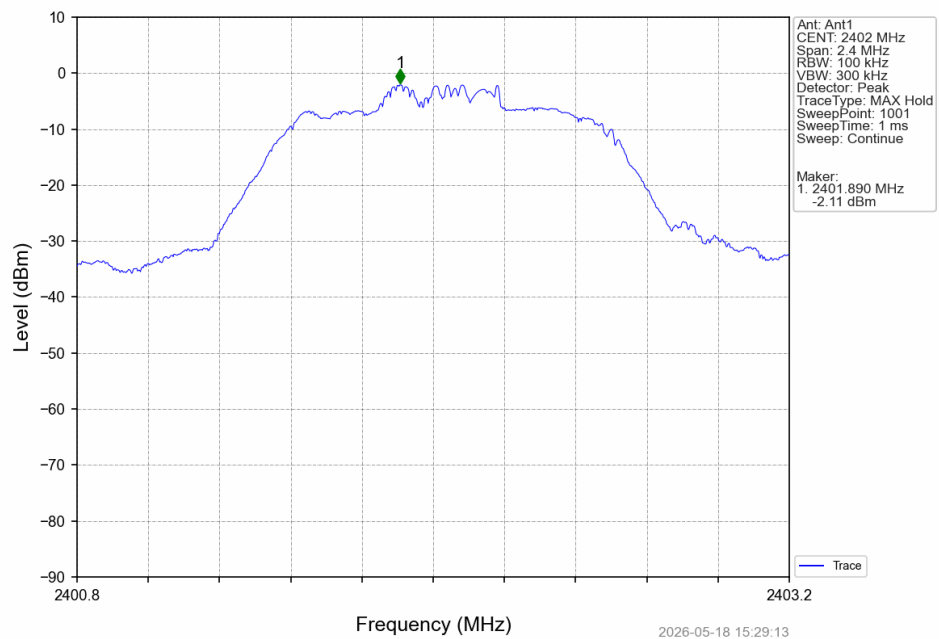
# GFSK DH5\_HOPP\_Ant1\_NTNV



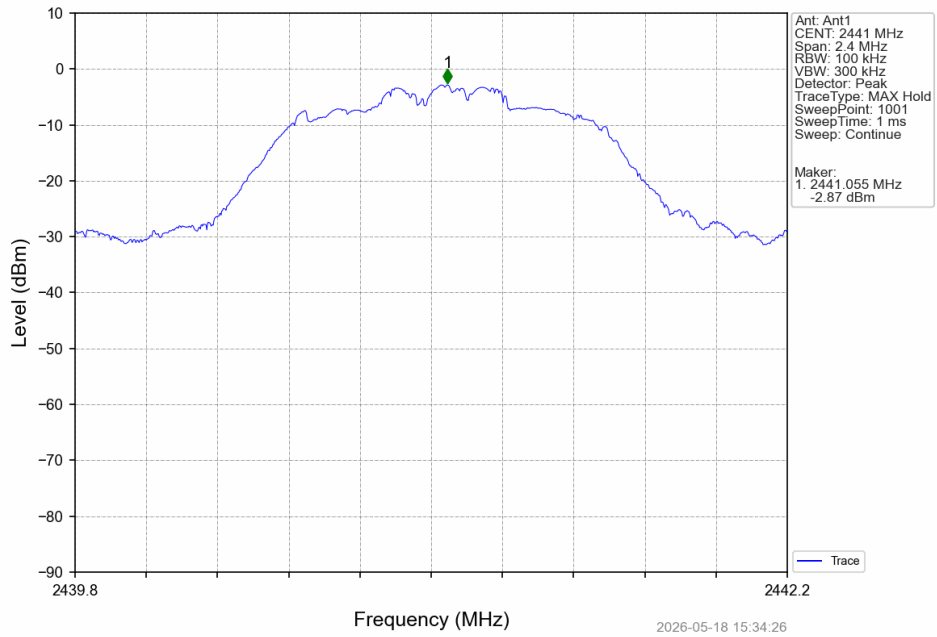
# GFSK\_DH5\_HOPP\_Ant1\_NTNV



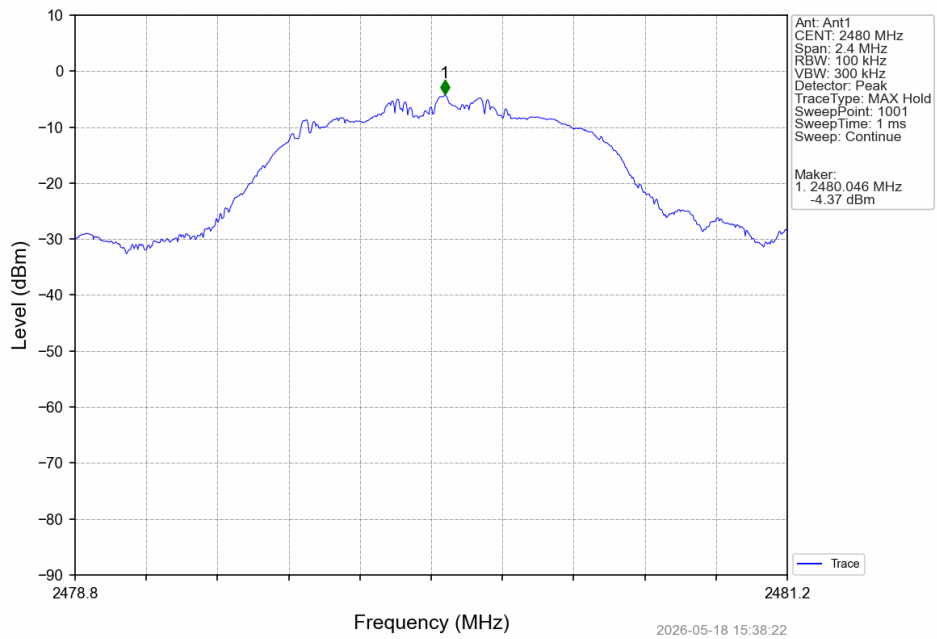
# Pi/4DQPSK\_2DH5\_LCH\_2402MHz\_Ant1\_NTNV



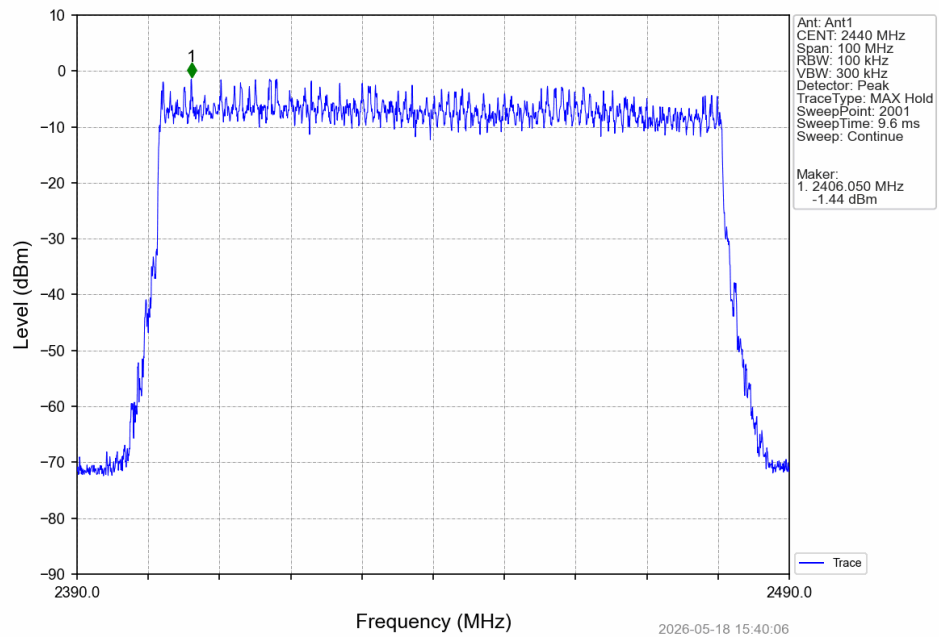
# Pi/4DQPSK\_2DH5\_MCH\_2441MHz\_Ant1\_NTNV



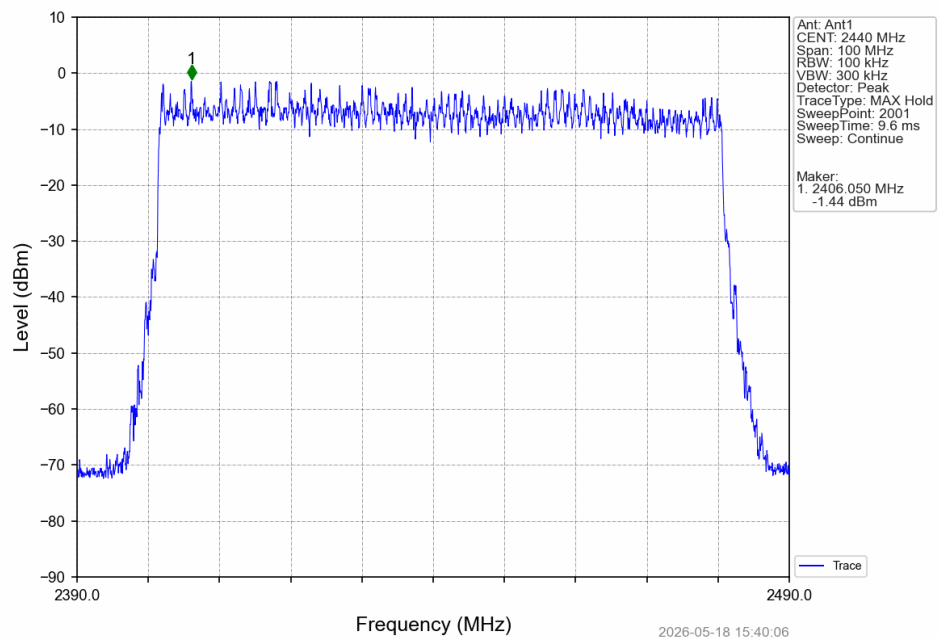
# Pi/4DQPSK\_2DH5\_HCH\_2480MHz\_Ant1\_NTNV



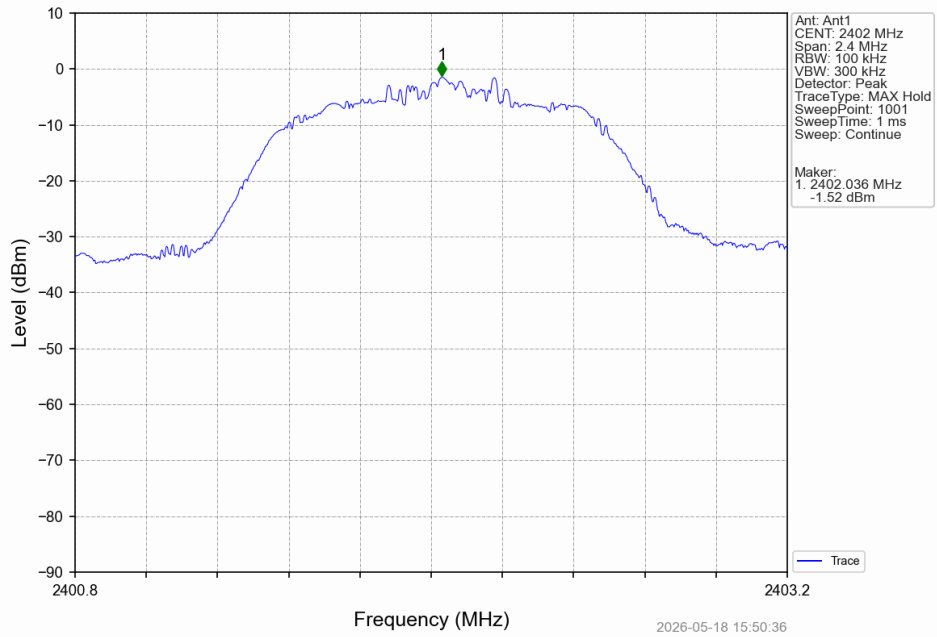
# Pi/4DQPSK\_2DH5\_HOPP\_Ant1\_NTNV



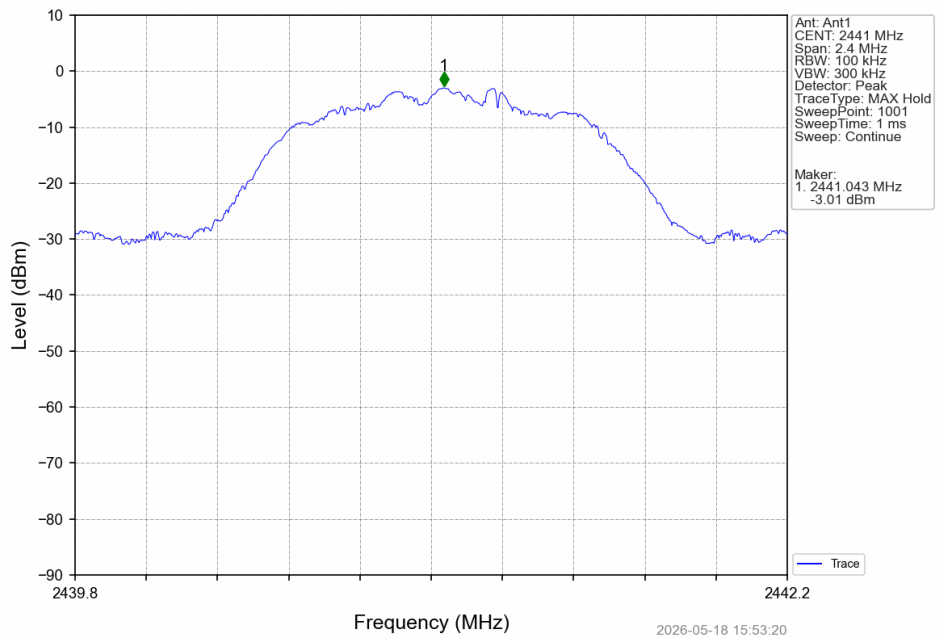
# Pi/4DQPSK\_2DH5\_HOPP\_Ant1\_NTNV



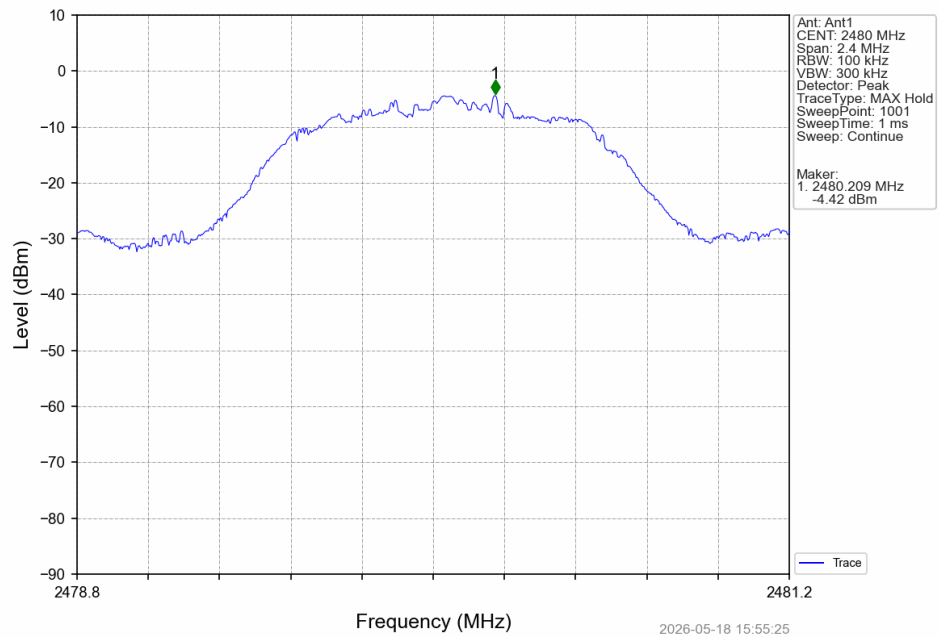
# 8DPSK\_3DH5\_LCH\_2402MHz\_Ant1\_NTNV



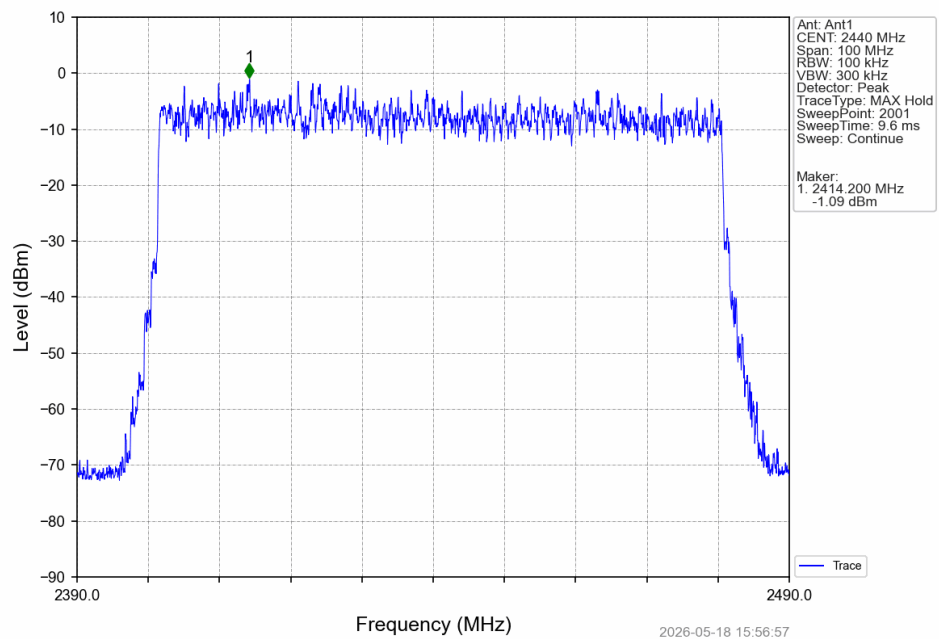
# 8DPSK\_3DH5\_MCH\_2441MHz\_Ant1\_NTNV



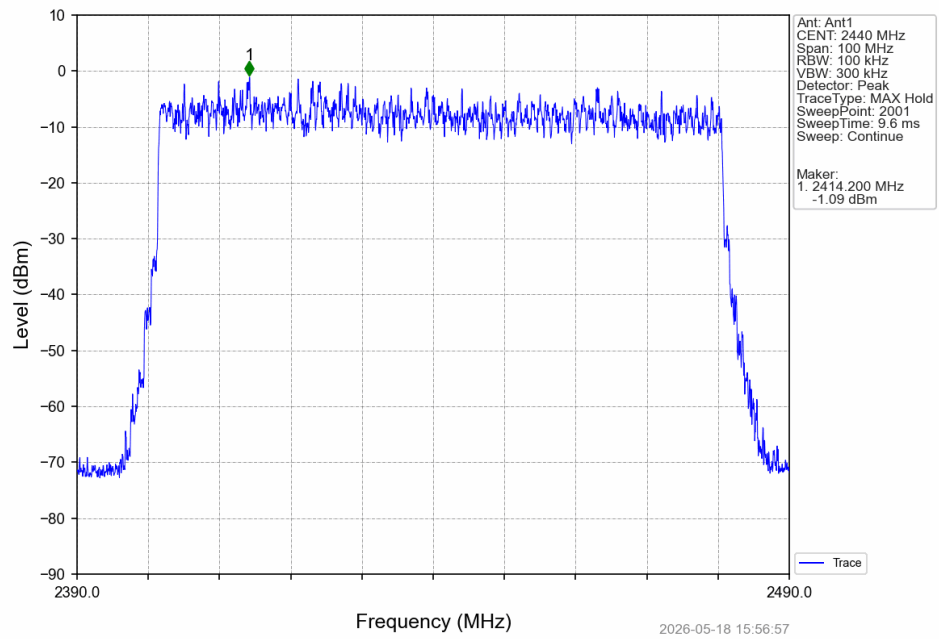
### 8DPSK\_3DH5\_HCH\_2480MHz\_Ant1\_NTNV



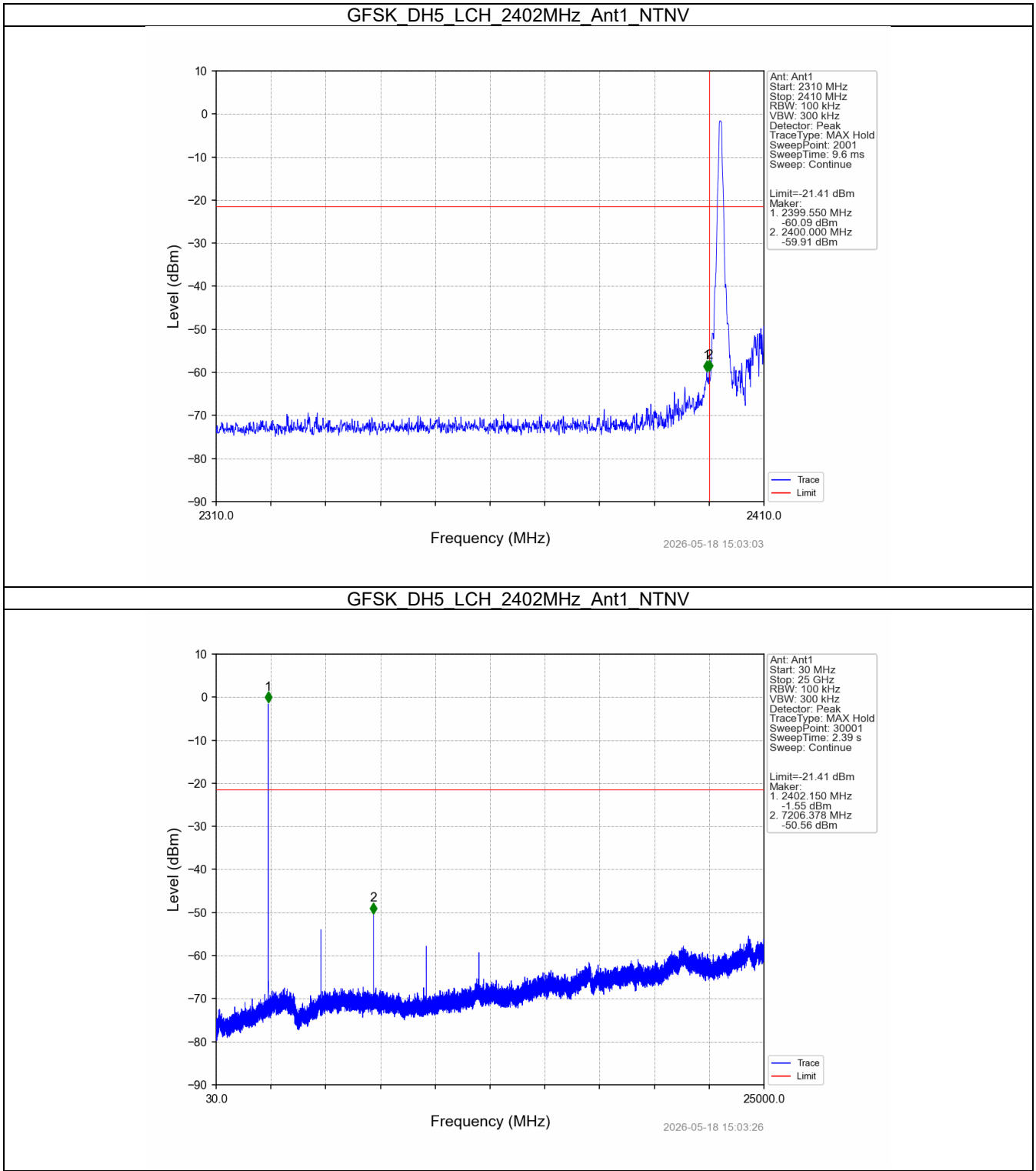
### 8DPSK\_3DH5\_HOPP\_Ant1\_NTNV



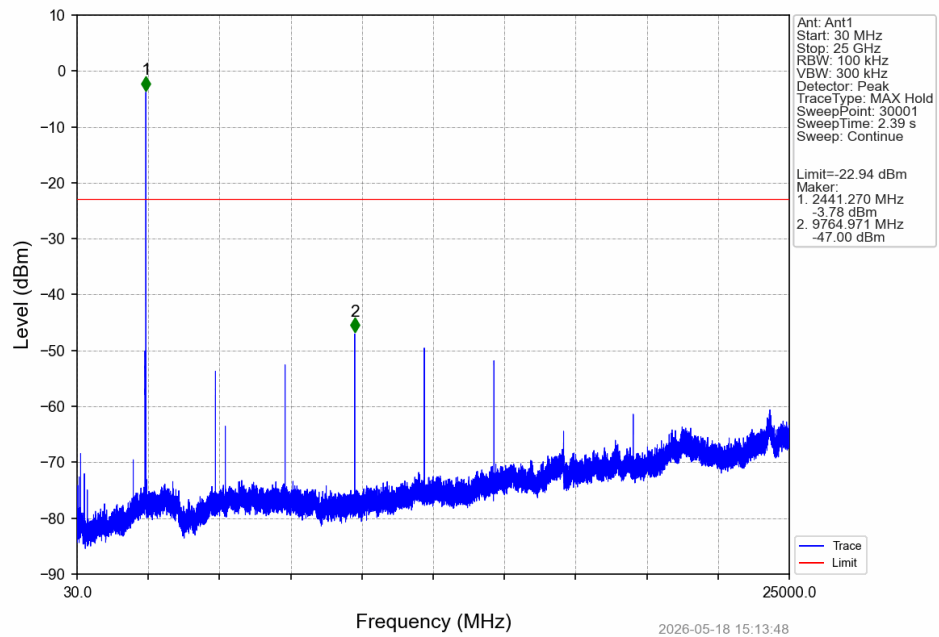
# 8DPSK\_3DH5\_HOPP\_Ant1\_NTNV



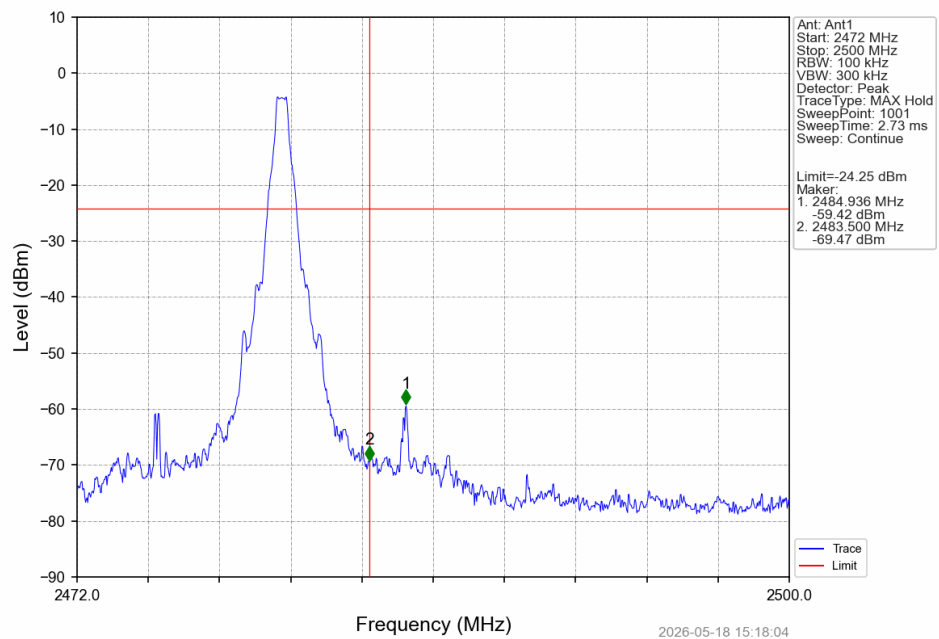
7.2.2 CSE



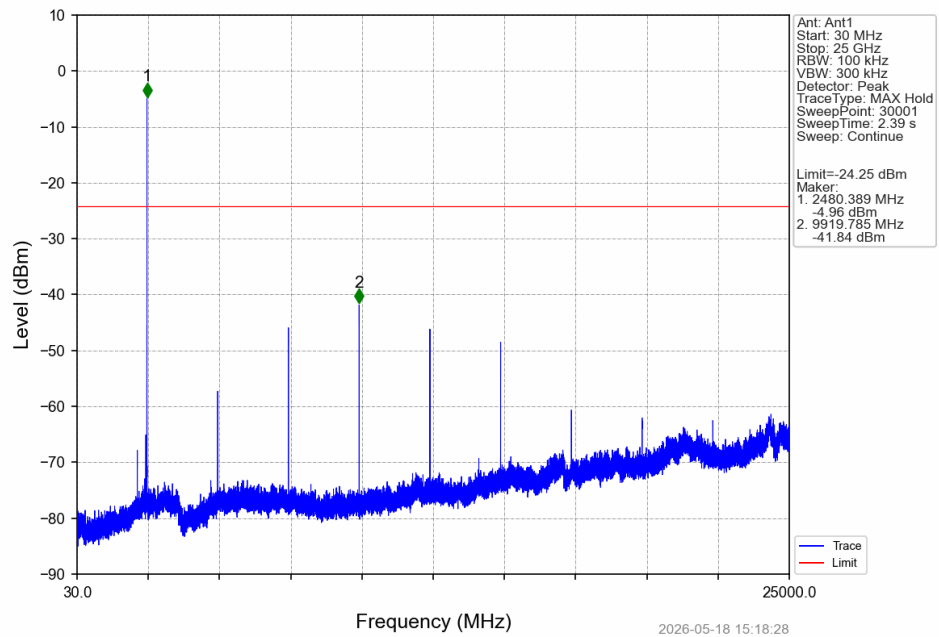
### GFSK\_DH5\_MCH\_2441MHz\_Ant1\_NTNV



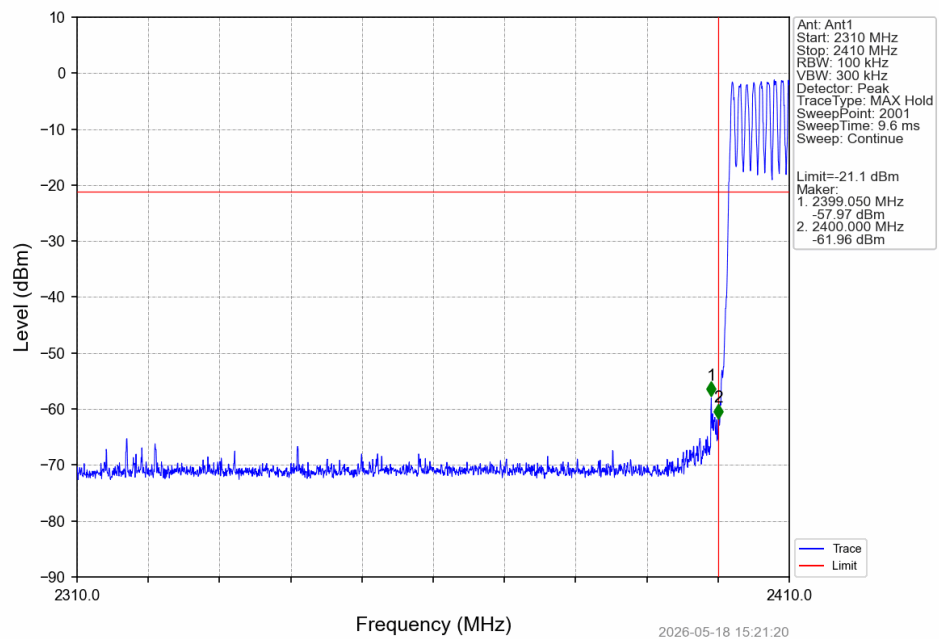
### GFSK\_DH5\_HCH\_2480MHz\_Ant1\_NTNV



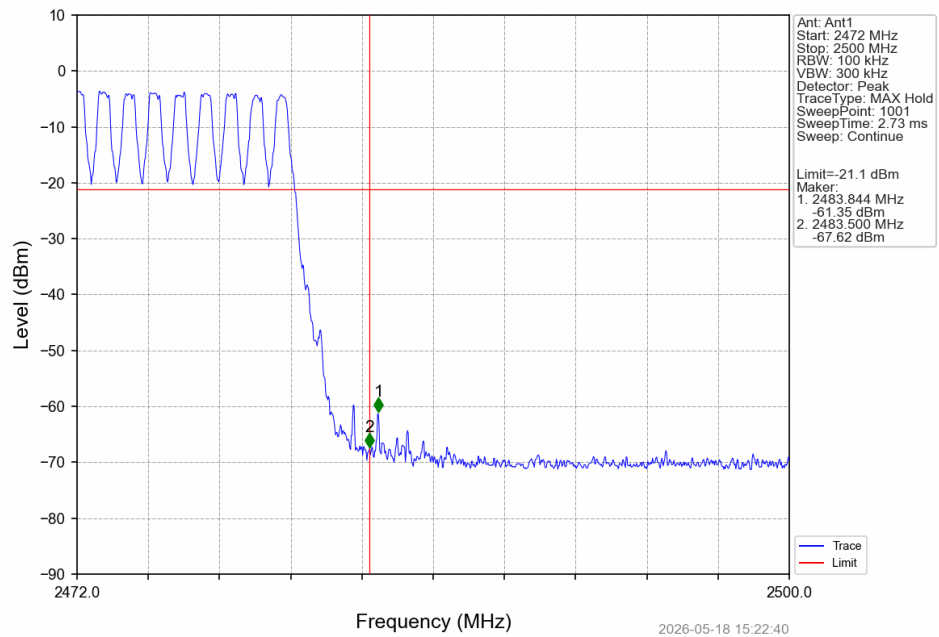
# GFSK\_DH5\_HCH\_2480MHz\_Ant1\_NTNV



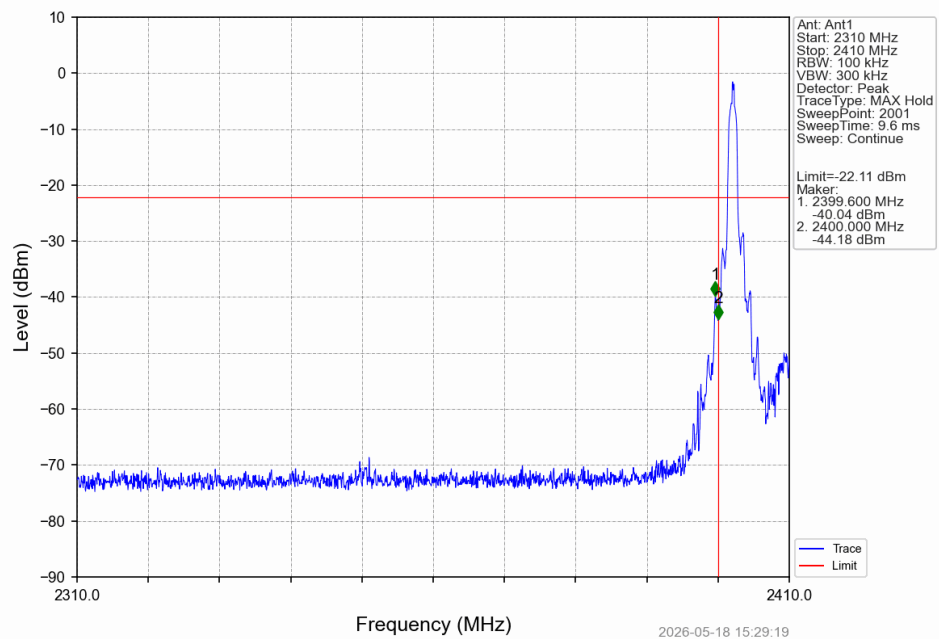
# GFSK\_DH5\_HOPP\_Ant1\_NTNV



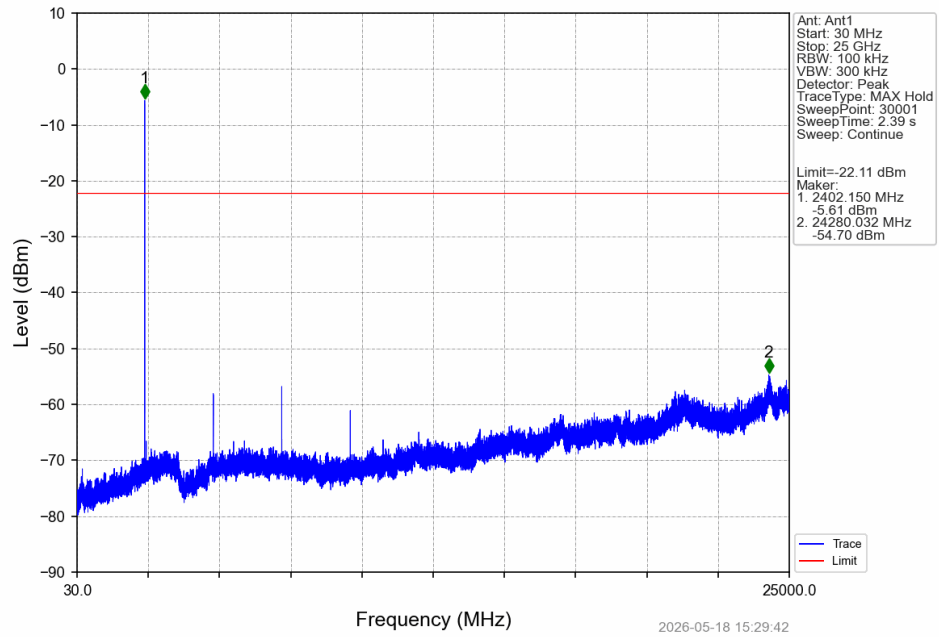
# GFSK\_DH5\_HOPP\_Ant1\_NTNV



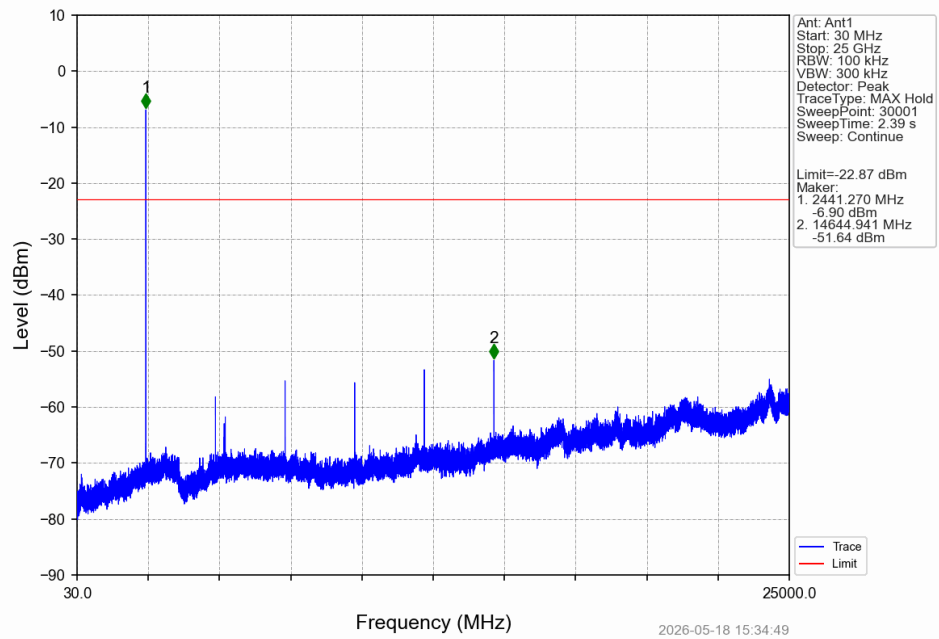
# Pi/4DQPSK\_2DH5\_LCH\_2402MHz\_Ant1\_NTNV



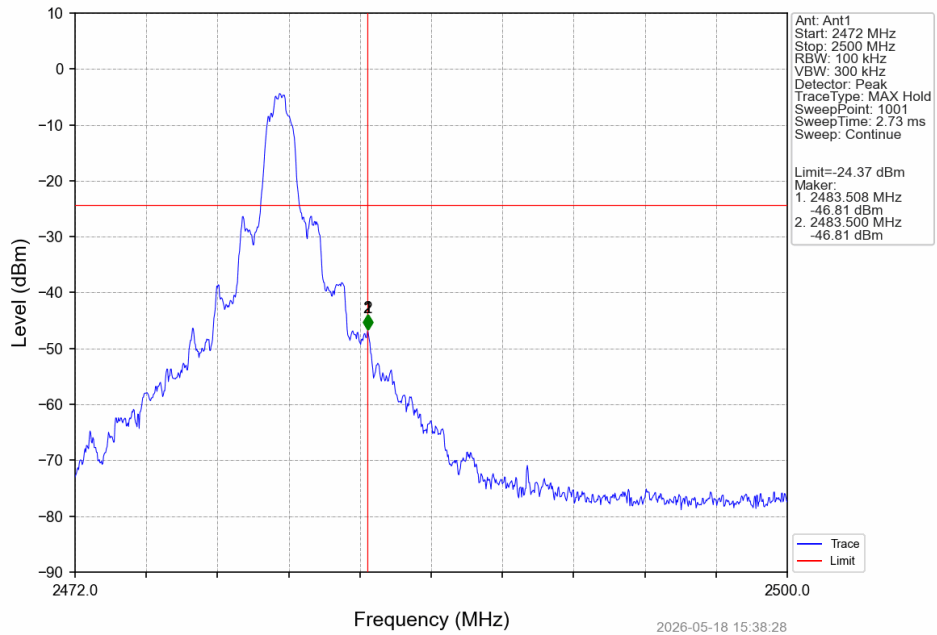
# Pi/4DQPSK\_2DH5\_LCH\_2402MHz\_Ant1\_NTNV



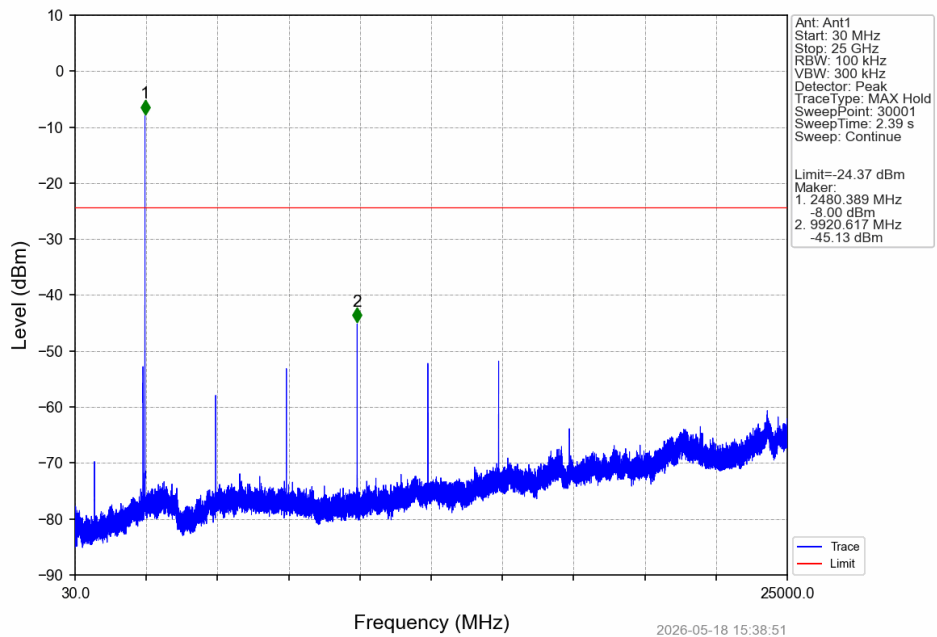
# Pi/4DQPSK\_2DH5\_MCH\_2441MHz\_Ant1\_NTNV



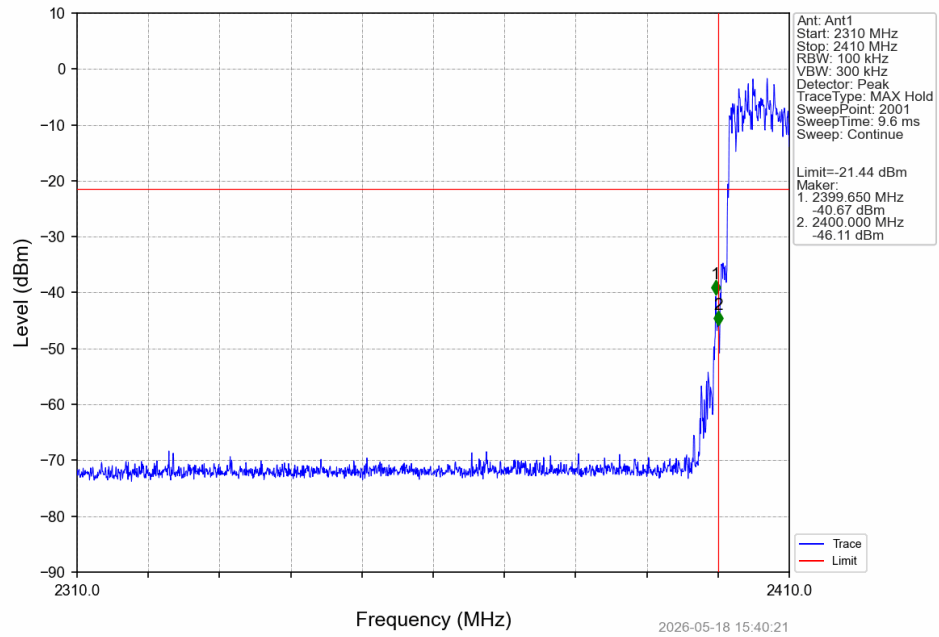
# Pi/4DQPSK\_2DH5\_HCH\_2480MHz\_Ant1\_NTNV



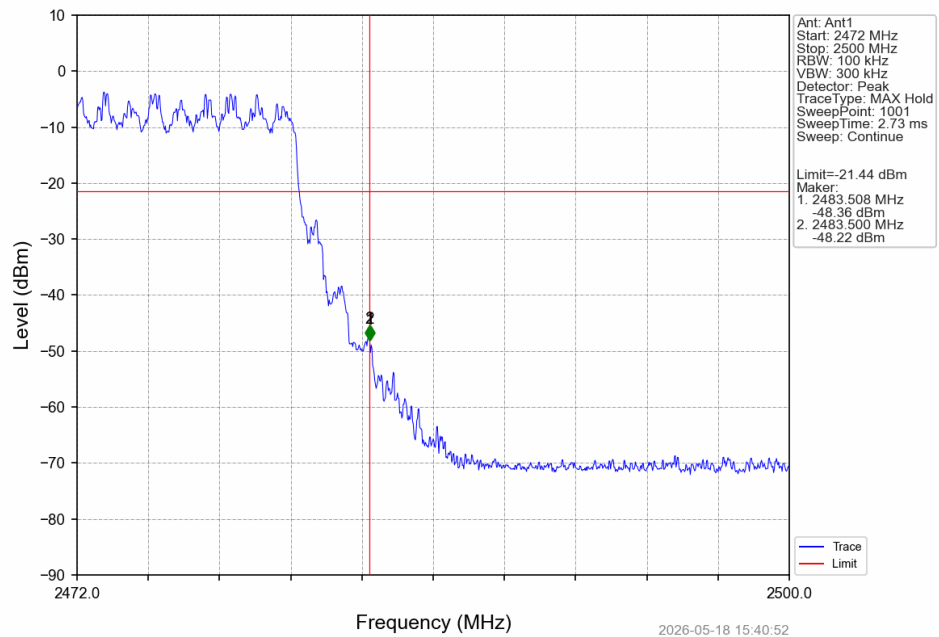
# Pi/4DQPSK\_2DH5\_HCH\_2480MHz\_Ant1\_NTNV



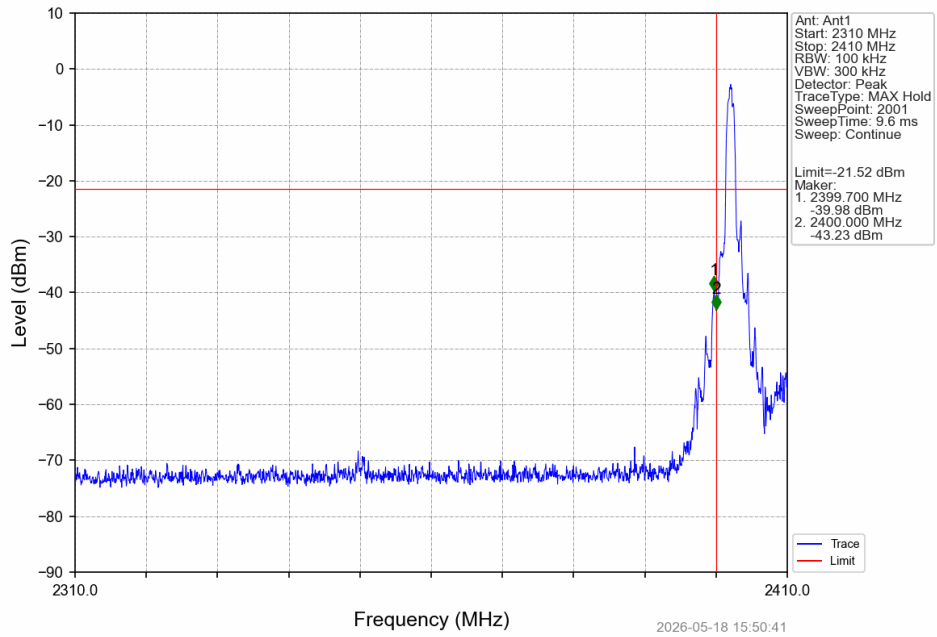
# Pi/4DQPSK\_2DH5\_HOPP\_Ant1\_NTNV



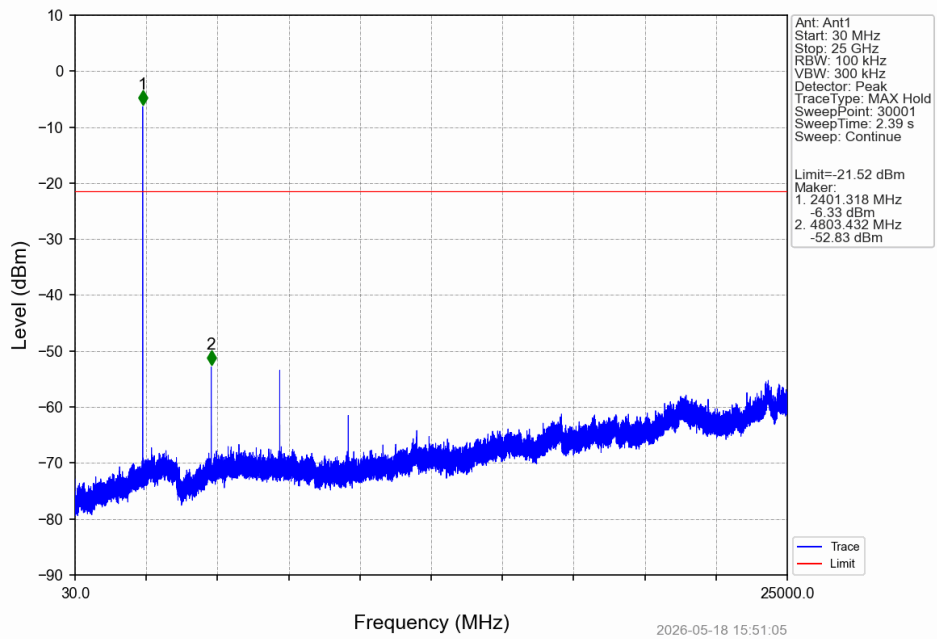
# Pi/4DQPSK\_2DH5\_HOPP\_Ant1\_NTNV



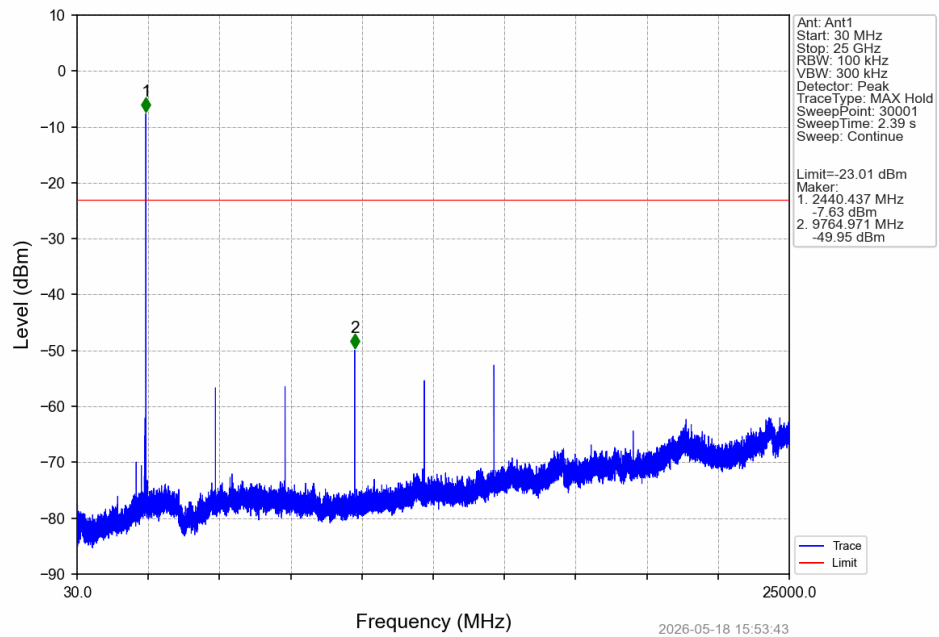
# 8DPSK\_3DH5\_LCH\_2402MHz\_Ant1\_NTNV



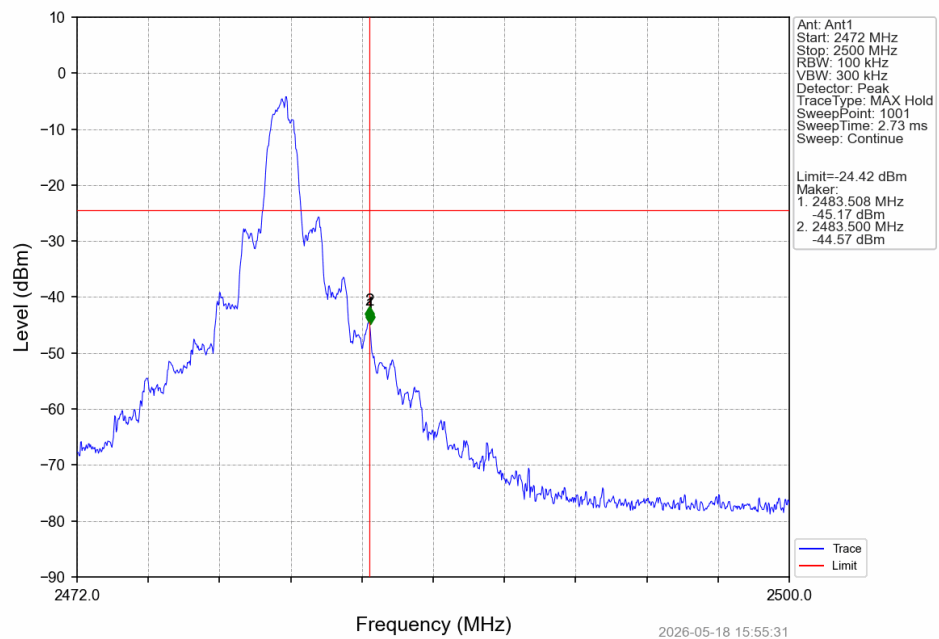
# 8DPSK\_3DH5\_LCH\_2402MHz\_Ant1\_NTNV



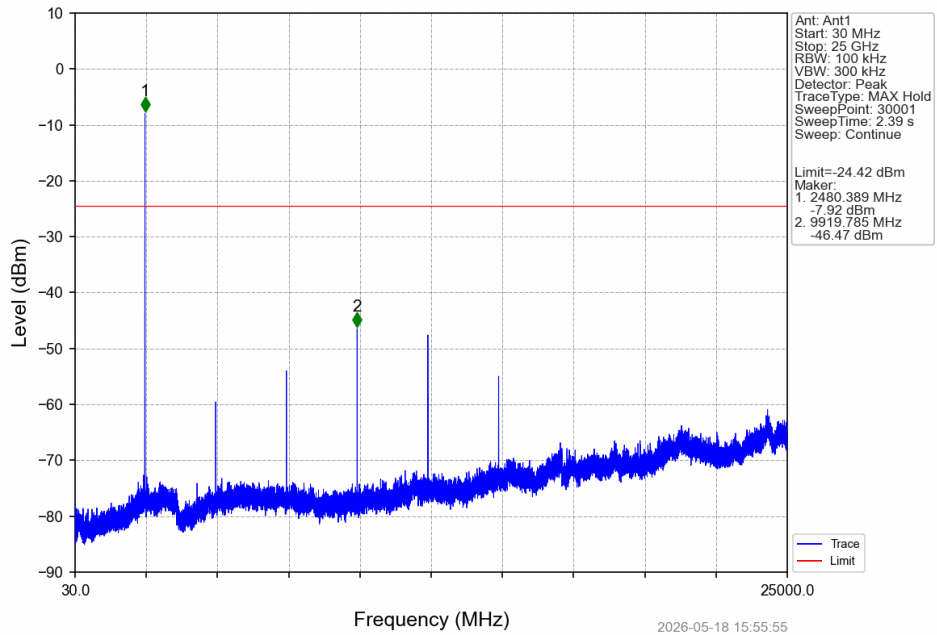
# 8DPSK\_3DH5\_MCH\_2441MHz\_Ant1\_NTNV



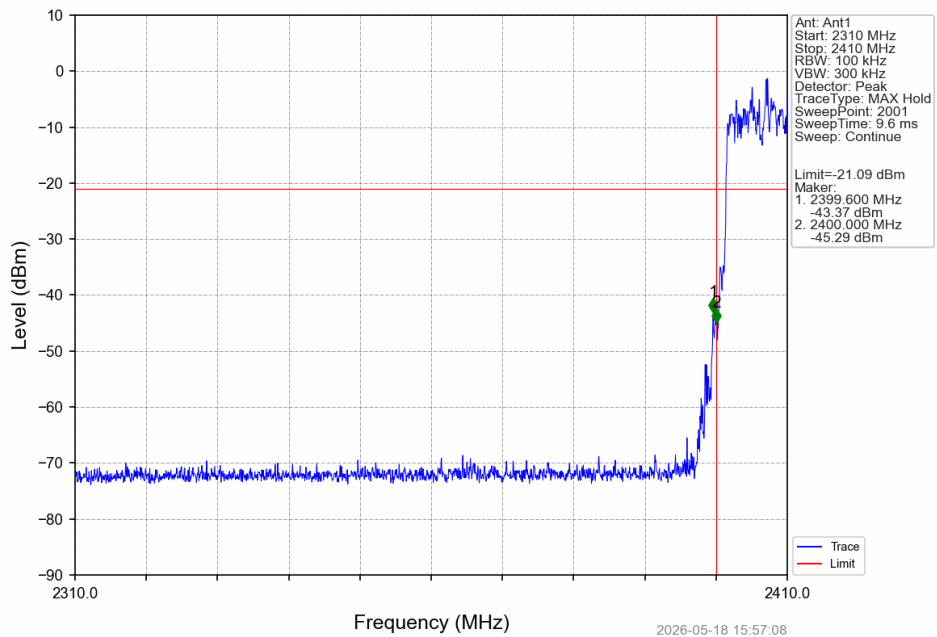
# 8DPSK\_3DH5\_HCH\_2480MHz\_Ant1\_NTNV



# 8DPSK\_3DH5\_HCH\_2480MHz\_Ant1\_NTNV



# 8DPSK\_3DH5\_HOPP\_Ant1\_NTNV



8DPSK\_3DH5\_HOPP\_Ant1\_NTNV

