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Annex for Bluetooth

Test Report No.: CTL2503202021-WF

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FCC ID: 2BRD8ZMHC-168

1. Duty Cycle

1.1 Test Result

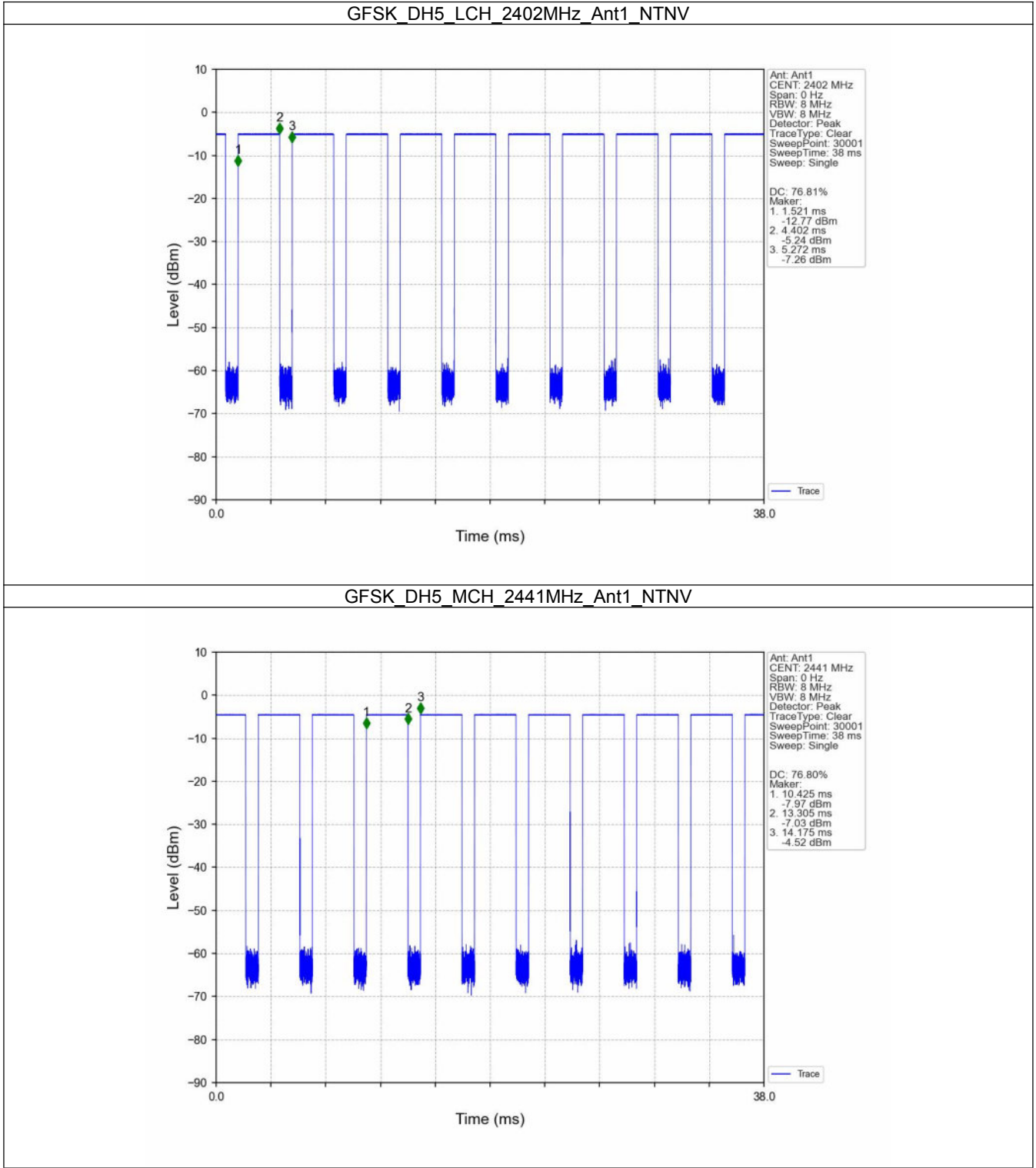
1.1.1 Ant1

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	2.881	3.751	76.81	1.15	0.03
		2441	DH5	2.880	3.750	76.80	1.15	0.03
		2480	DH5	2.880	3.751	76.78	1.15	0.03
Pi/4DQPSK	SISO	2402	2DH5	2.893	3.751	77.13	1.13	0.03
		2441	2DH5	2.893	3.750	77.15	1.13	0.03
		2480	2DH5	2.887	3.751	76.97	1.14	0.03
8DPSK	SISO	2402	3DH5	2.896	3.751	77.21	1.12	0.03
		2441	3DH5	2.895	3.750	77.20	1.12	0.01
		2480	3DH5	2.895	3.750	77.20	1.12	0.03

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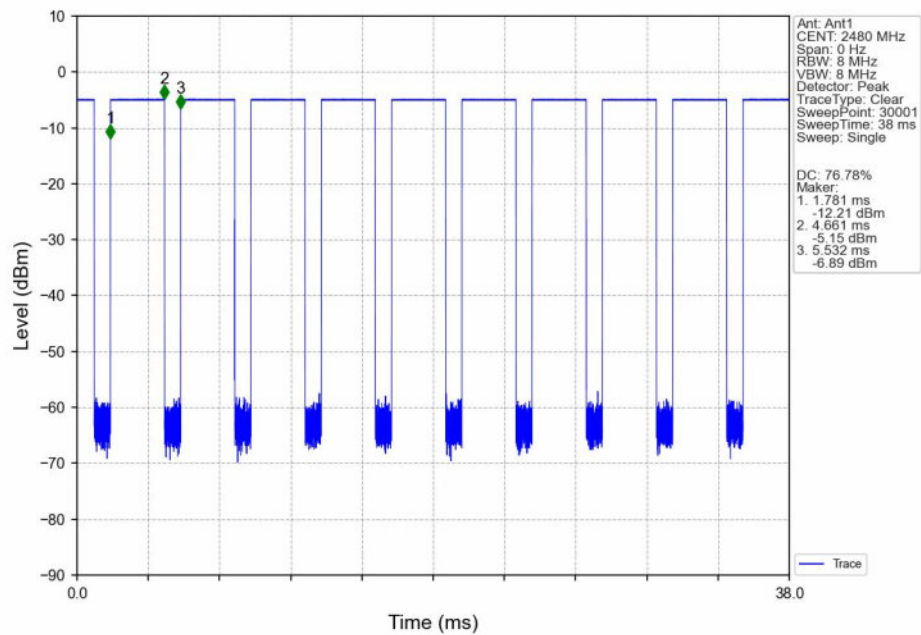
1.2 Test Graph

1.2.1 Ant1

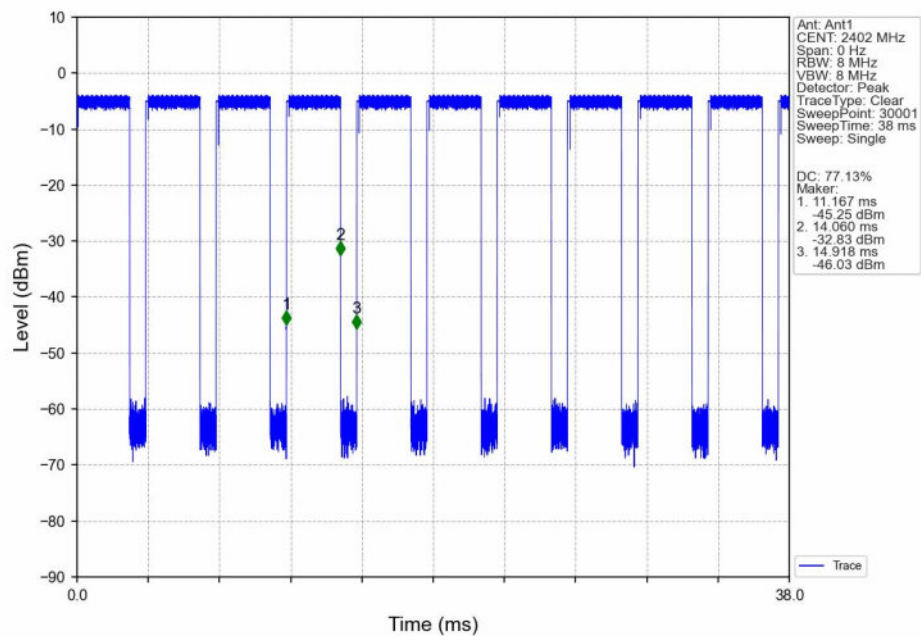


FCC ID: 2BRD8ZMHC-168

GFSK_DH5_HCH_2480MHz_Ant1_NTNV

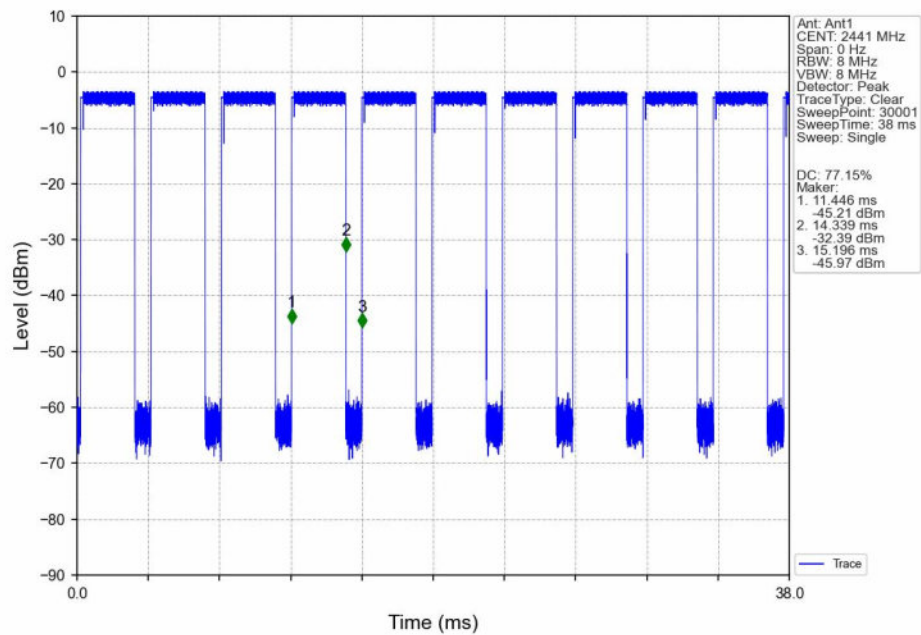


Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV

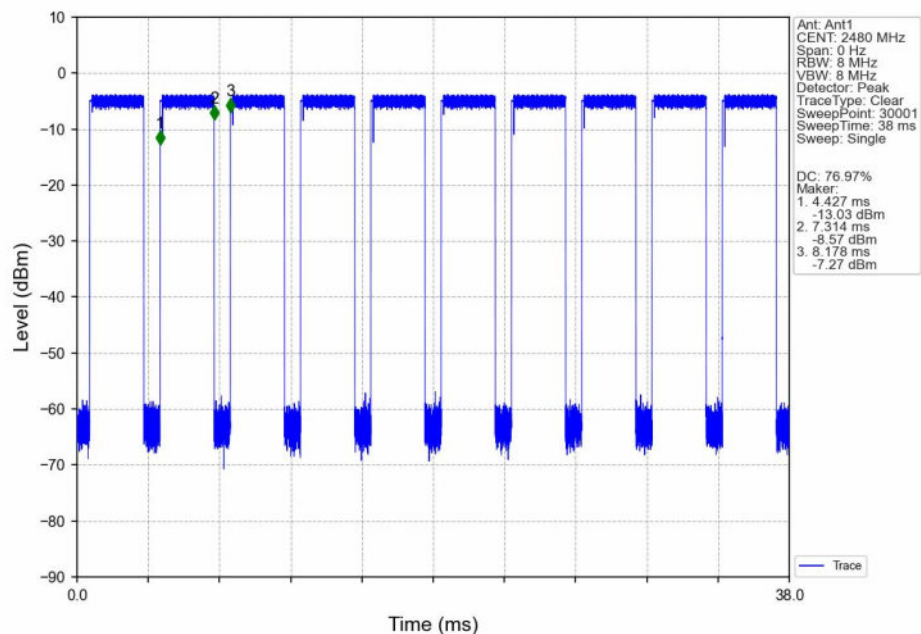


FCC ID: 2BRD8ZMHC-168

Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV

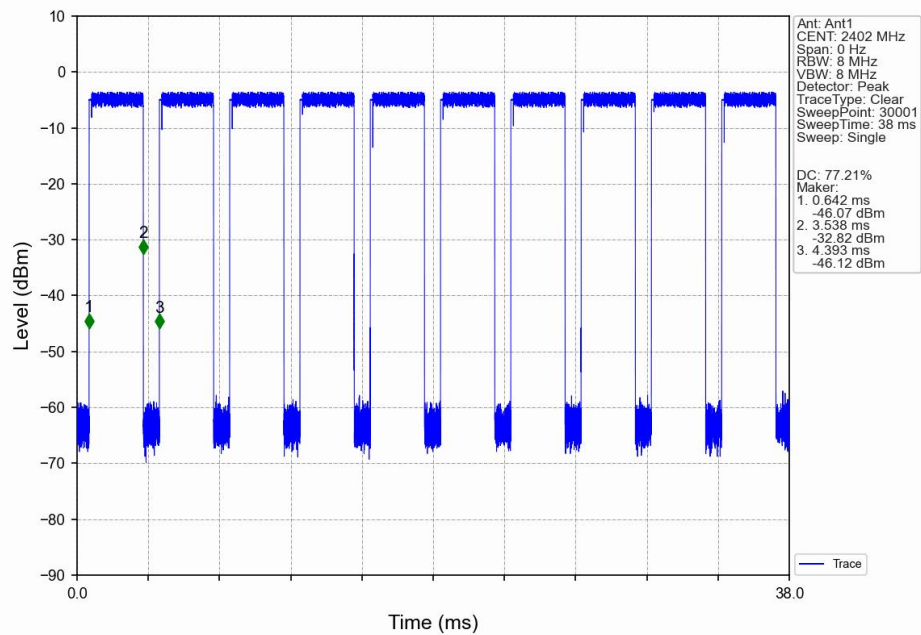


Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV

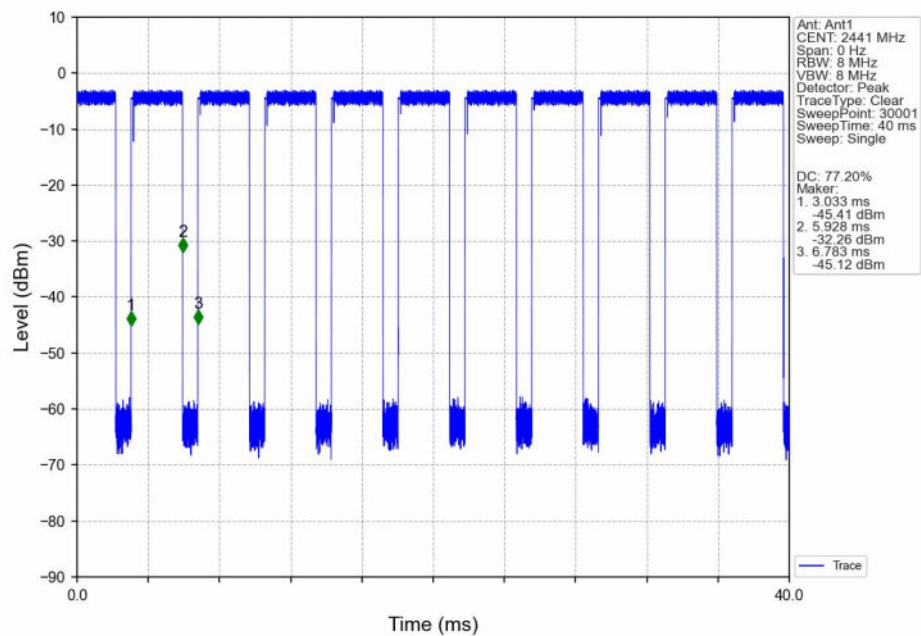


FCC ID: 2BRD8ZMHC-168

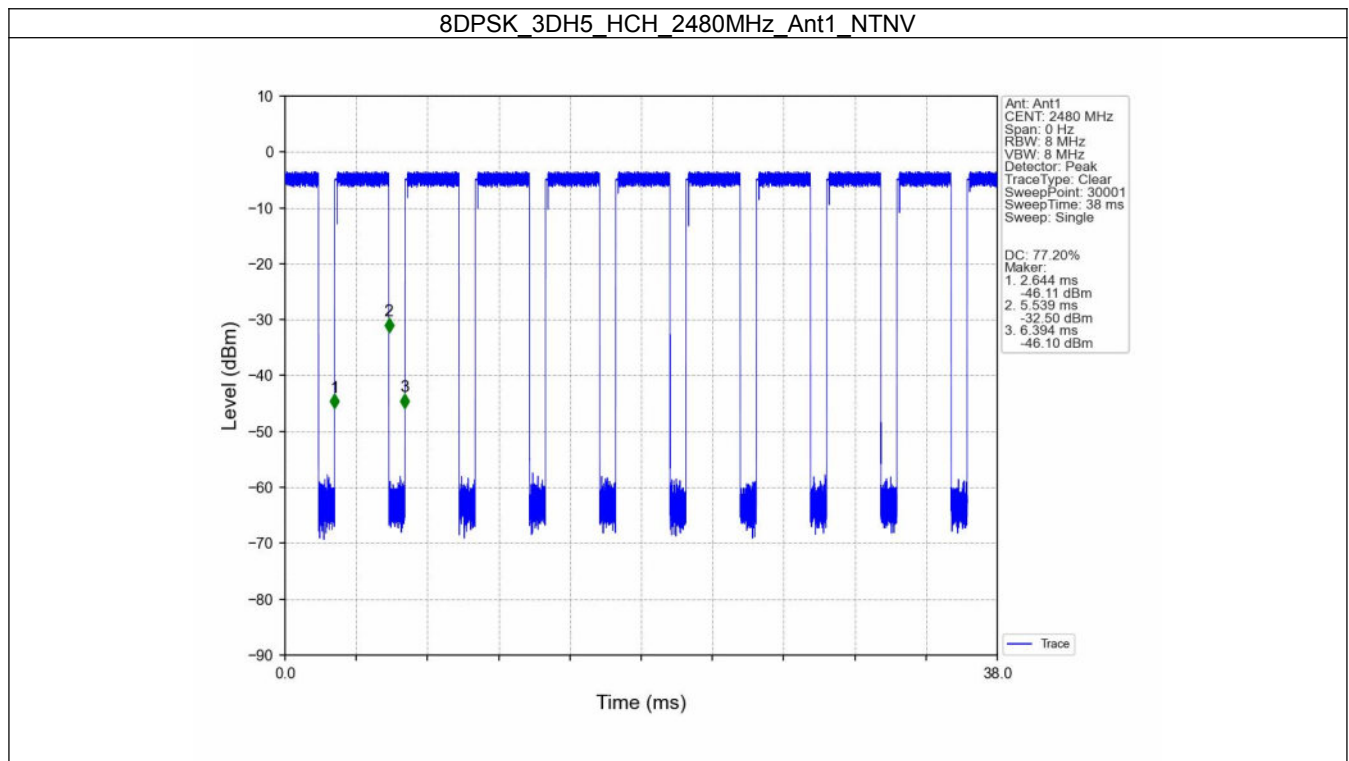
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



FCC ID: 2BRD8ZMHC-168



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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	0.906	/	Pass
		2441	DH5	1	0.912	/	Pass
		2480	DH5	1	0.916	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.189	/	Pass
		2441	2DH5	1	1.200	/	Pass
		2480	2DH5	1	1.198	/	Pass
8DPSK	SISO	2402	3DH5	1	1.190	/	Pass
		2441	3DH5	1	1.196	/	Pass
		2480	3DH5	1	1.190	/	Pass

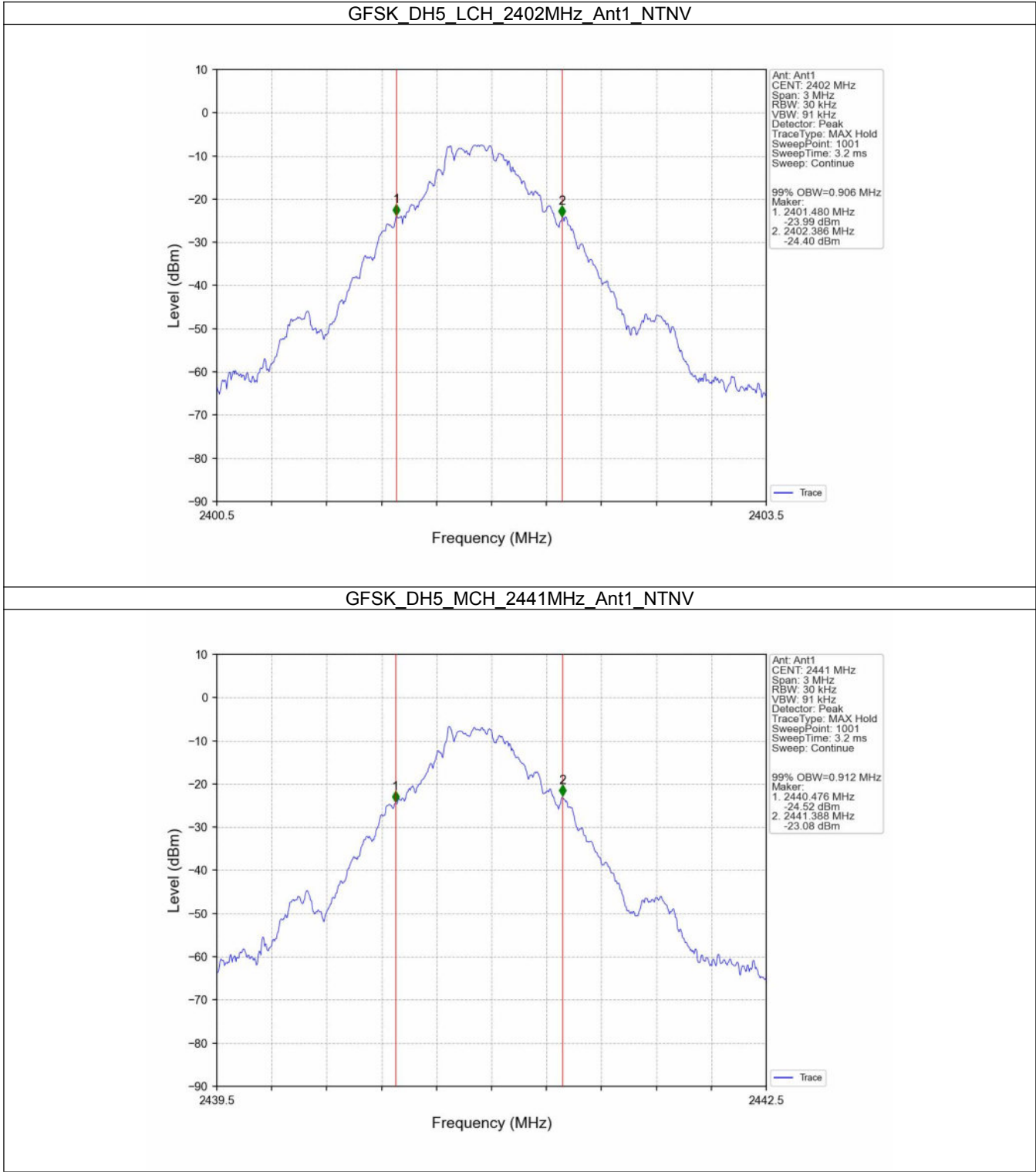
2.1.2 20dB BW

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	20dB Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	1	1.024	/	Pass
		2441	DH5	1	1.032	/	Pass
		2480	DH5	1	1.036	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.297	/	Pass
		2441	2DH5	1	1.325	/	Pass
		2480	2DH5	1	1.327	/	Pass
8DPSK	SISO	2402	3DH5	1	1.307	/	Pass
		2441	3DH5	1	1.306	/	Pass
		2480	3DH5	1	1.303	/	Pass

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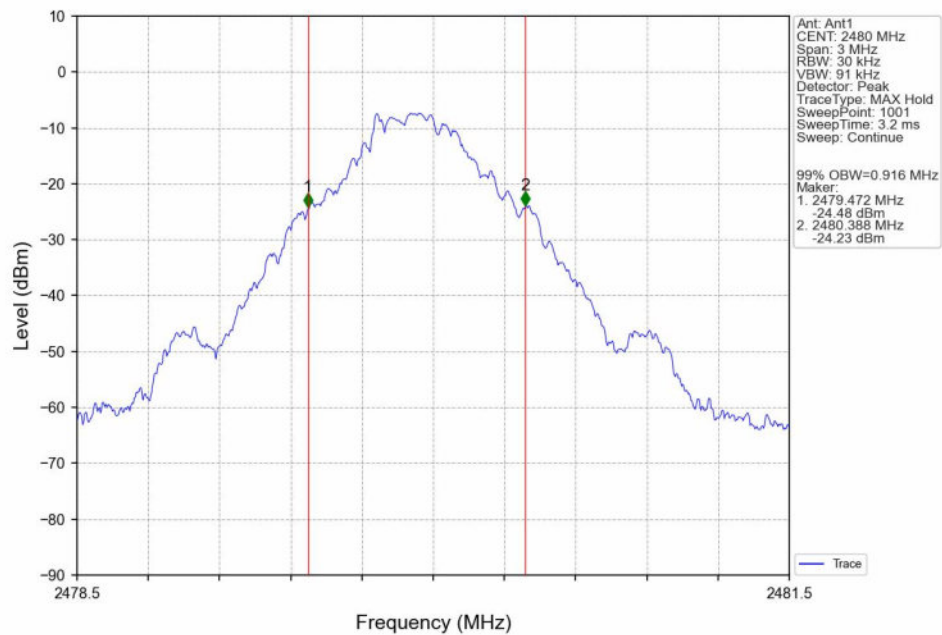
2.2 Test Graph

2.2.1 OBW

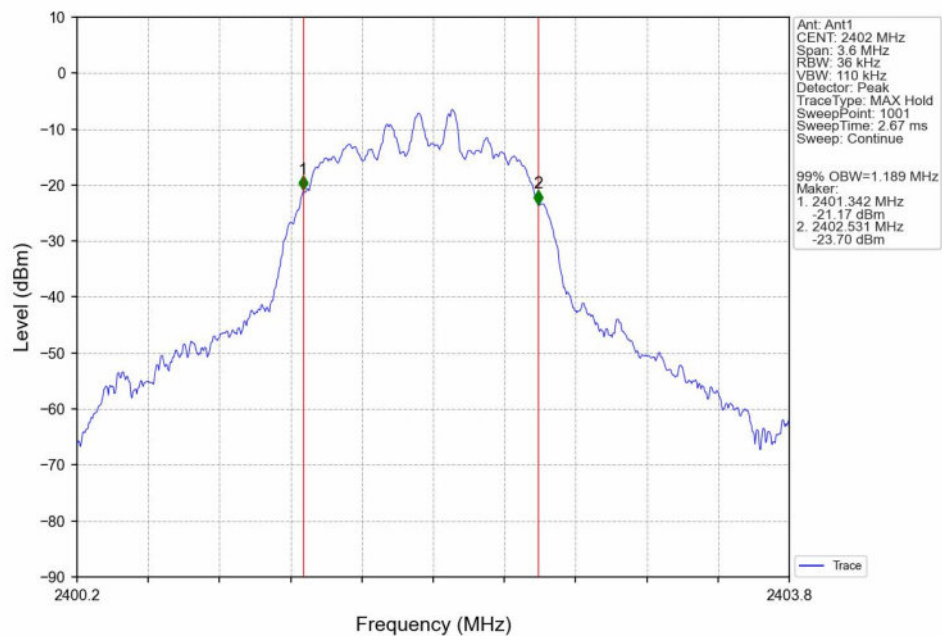


FCC ID: 2BRD8ZMHC-168

GFSK_DH5_HCH_2480MHz_Ant1_NTNV

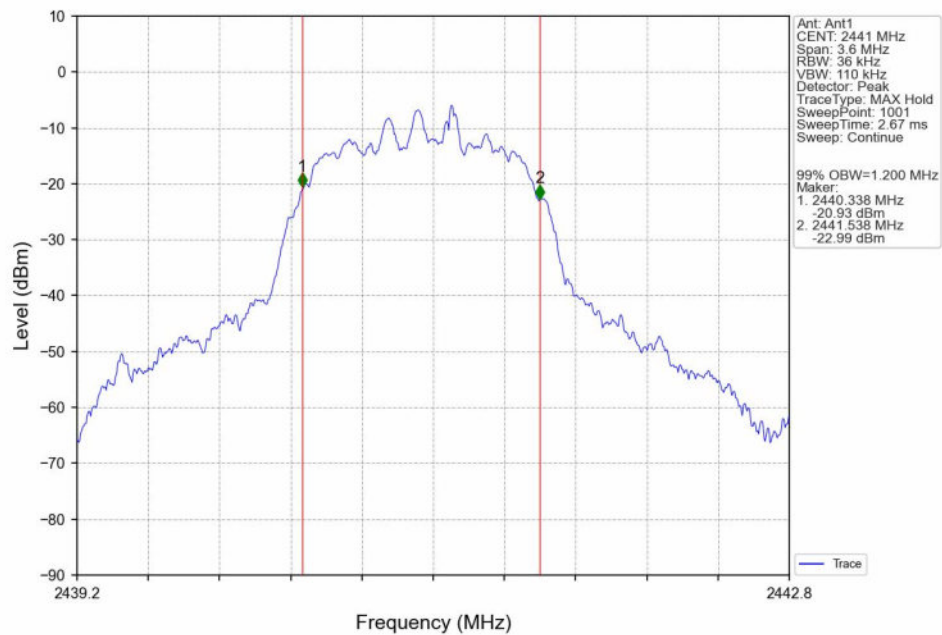


Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV

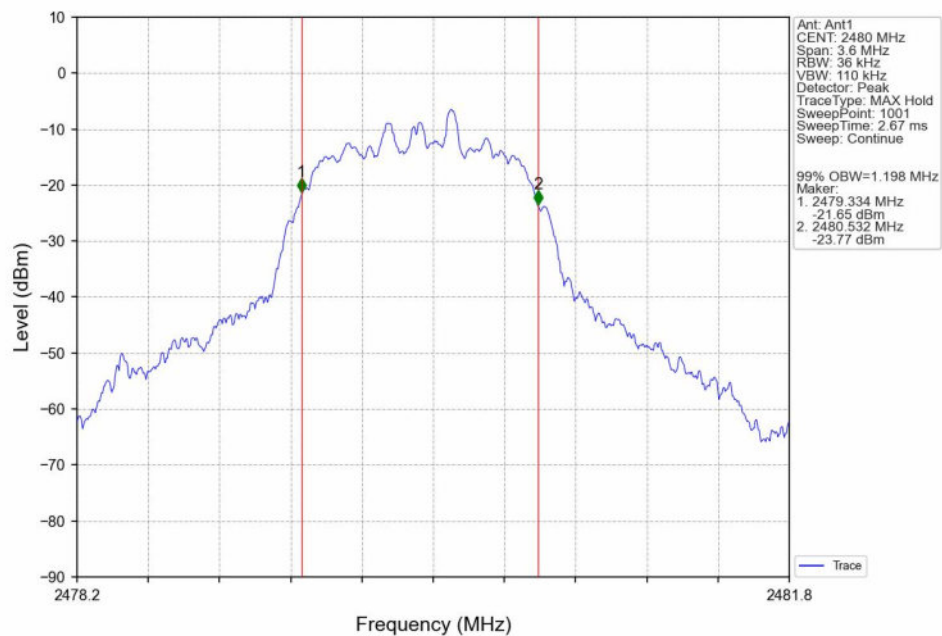


FCC ID: 2BRD8ZMHC-168

Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV

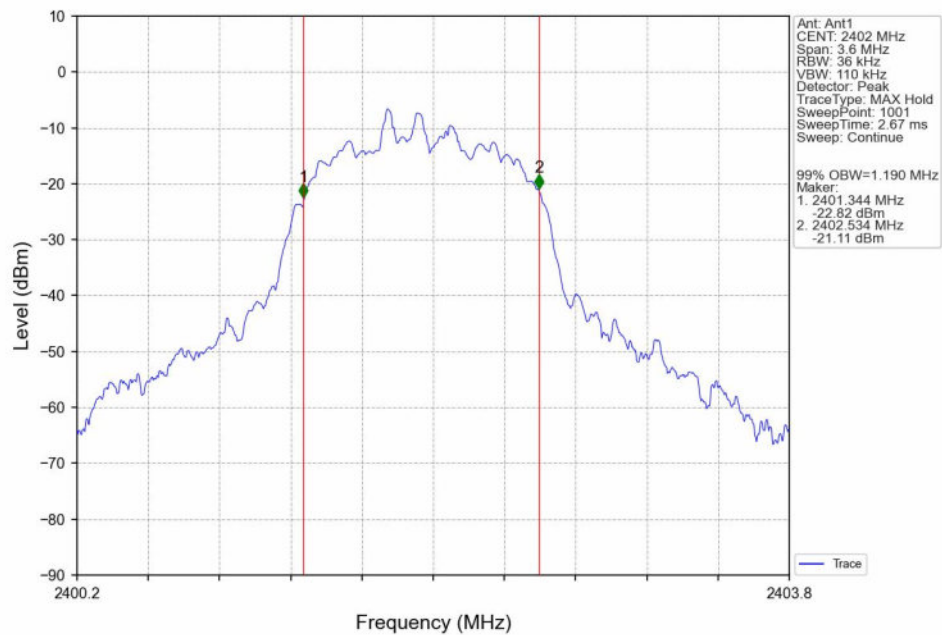


Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV

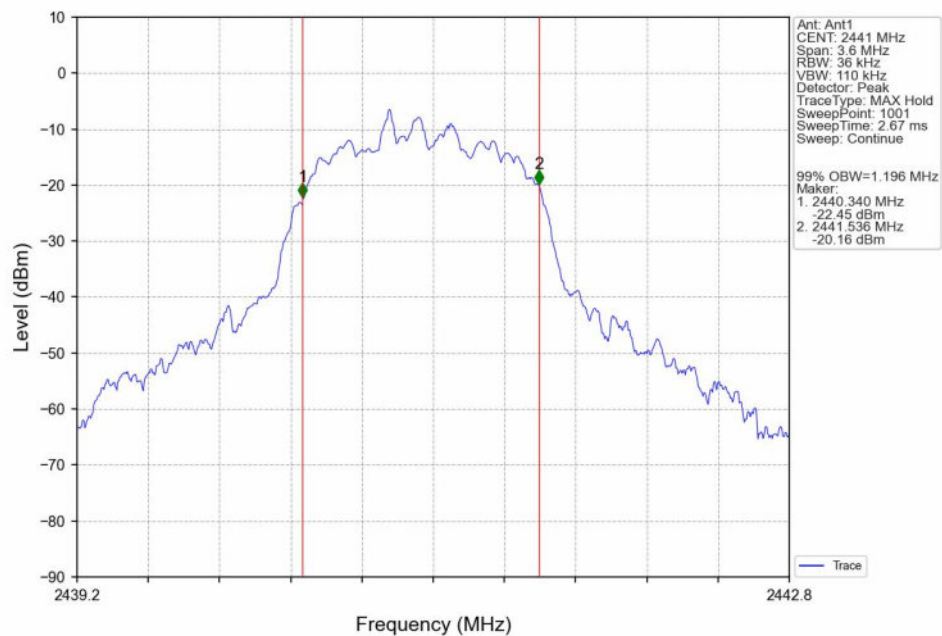


FCC ID: 2BRD8ZMHC-168

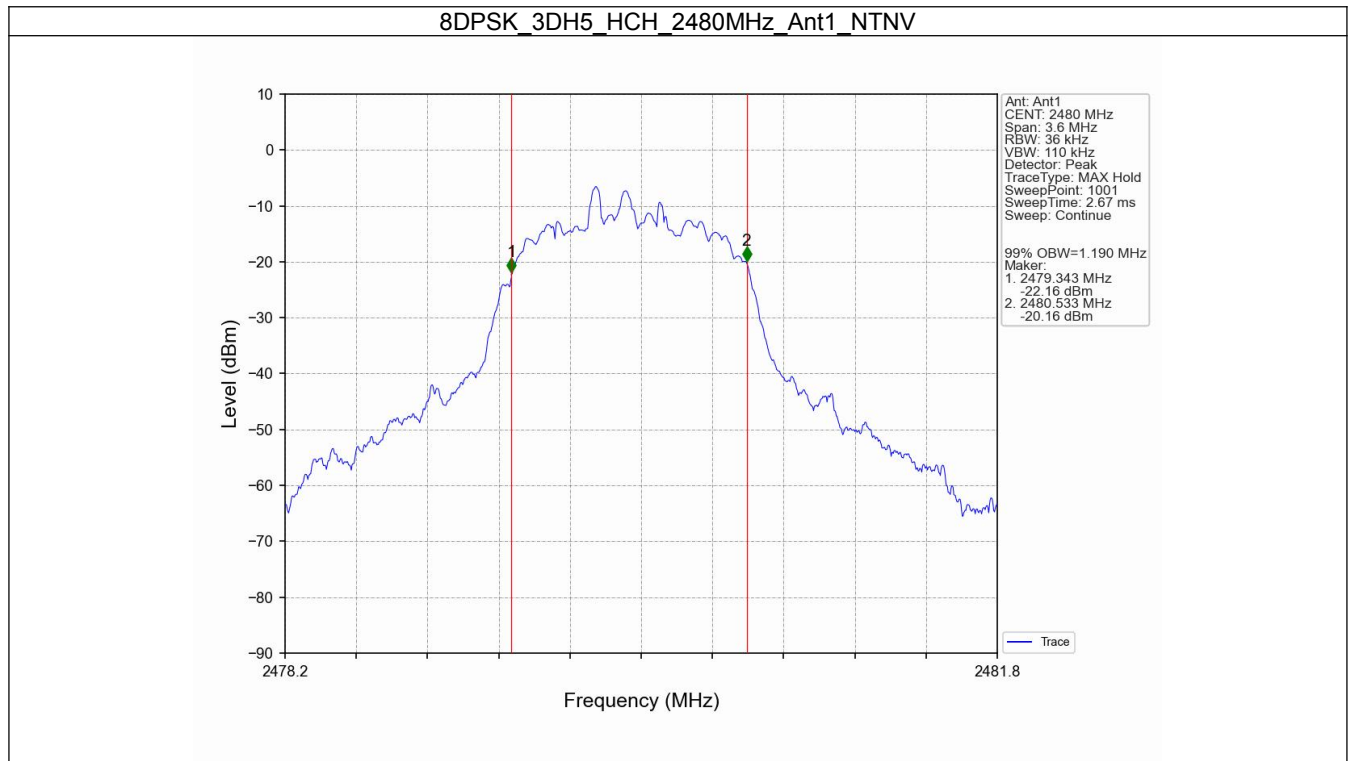
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV

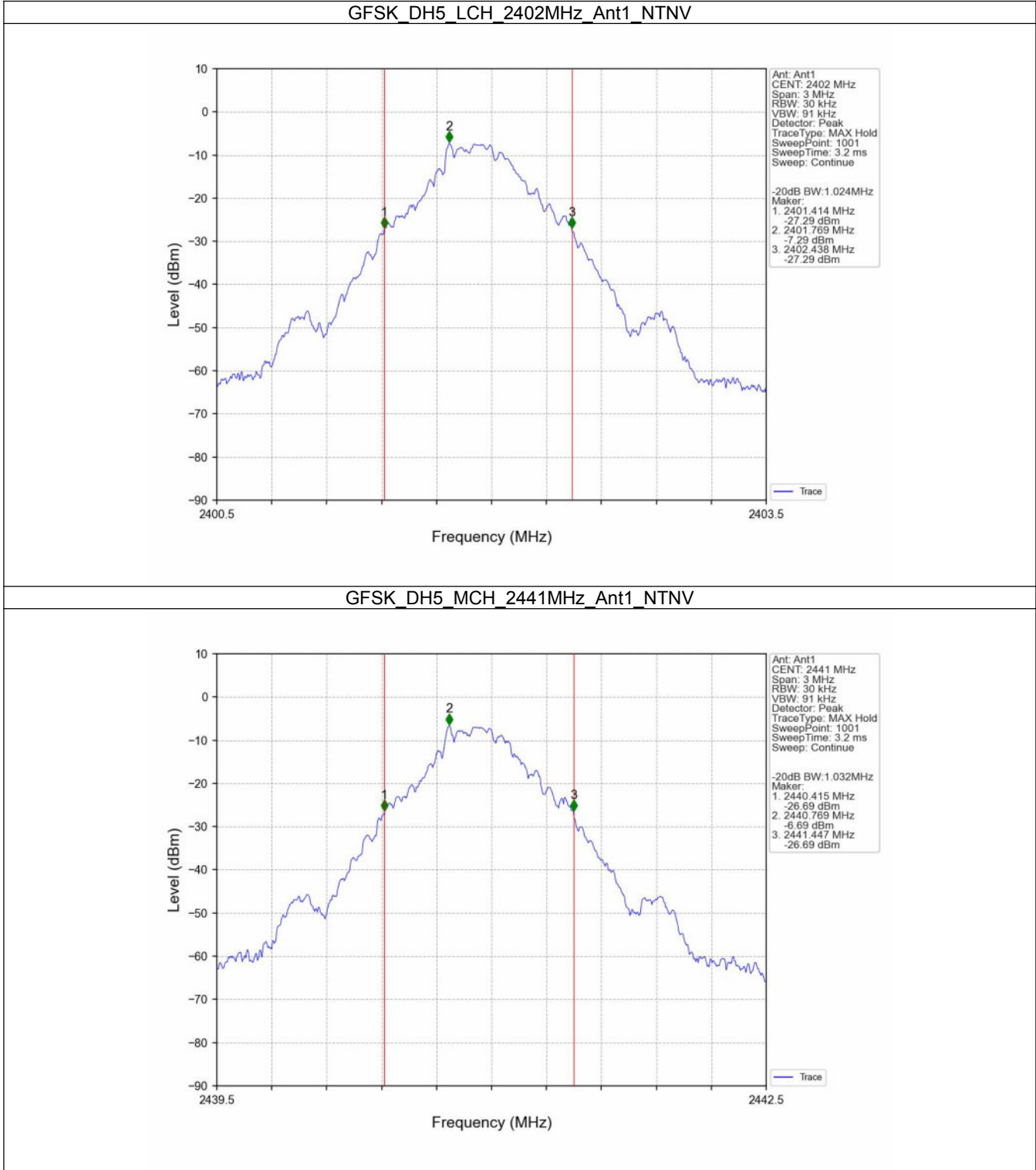


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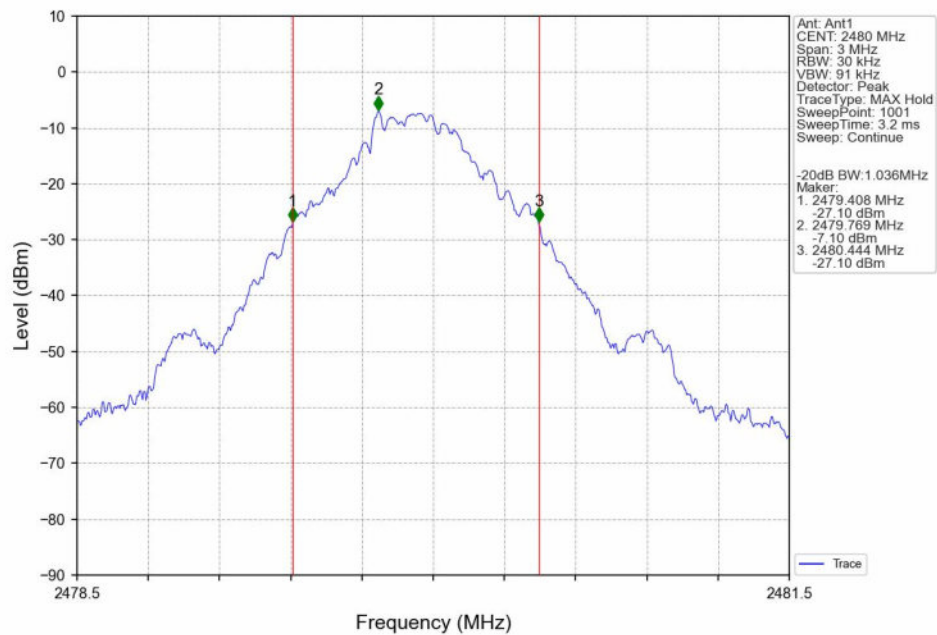
FCC ID: 2BRD8ZMHC-168

2.2.2 20dB BW

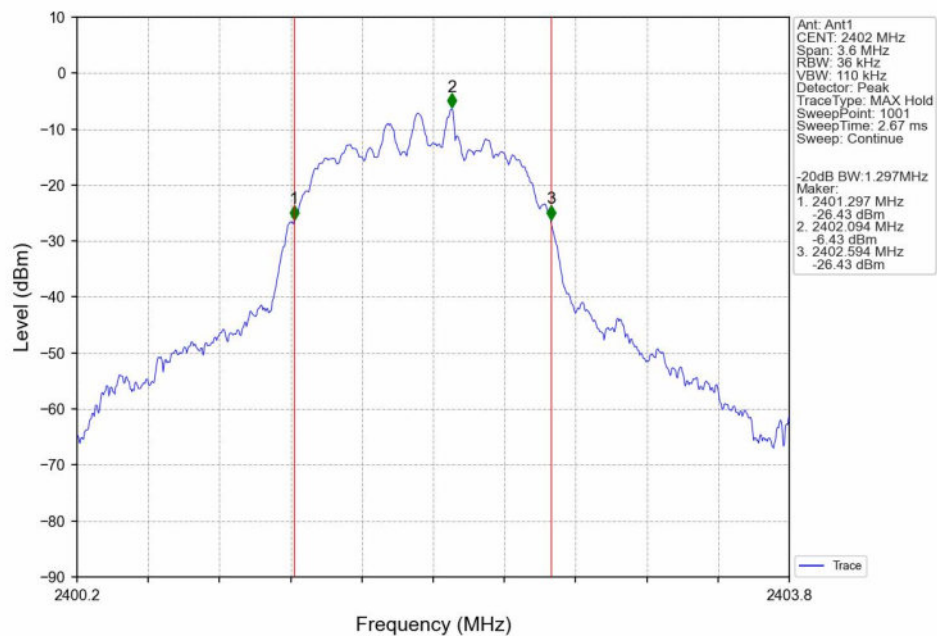


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GFSK_DH5_HCH_2480MHz_Ant1_NTNV

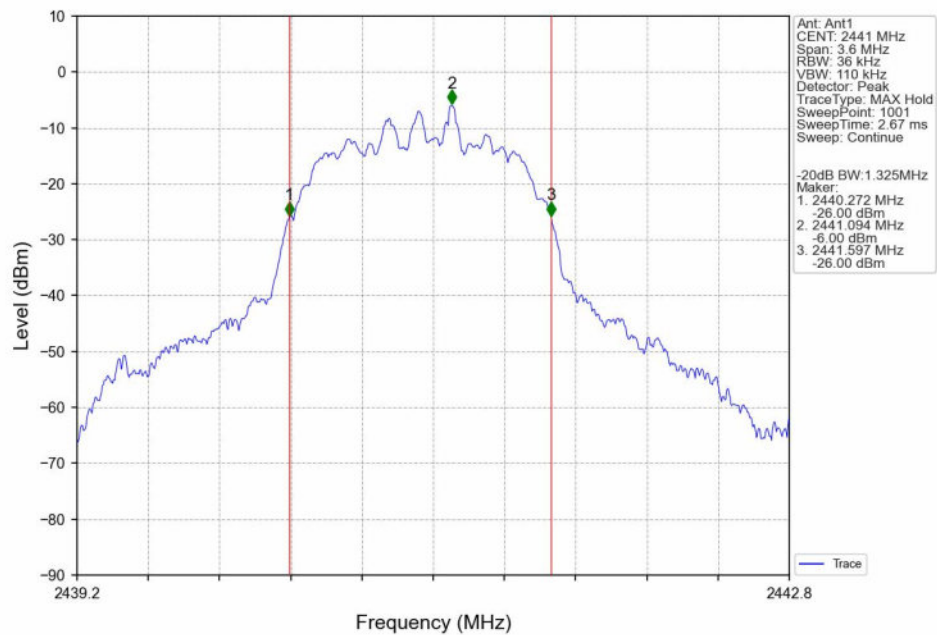


Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV

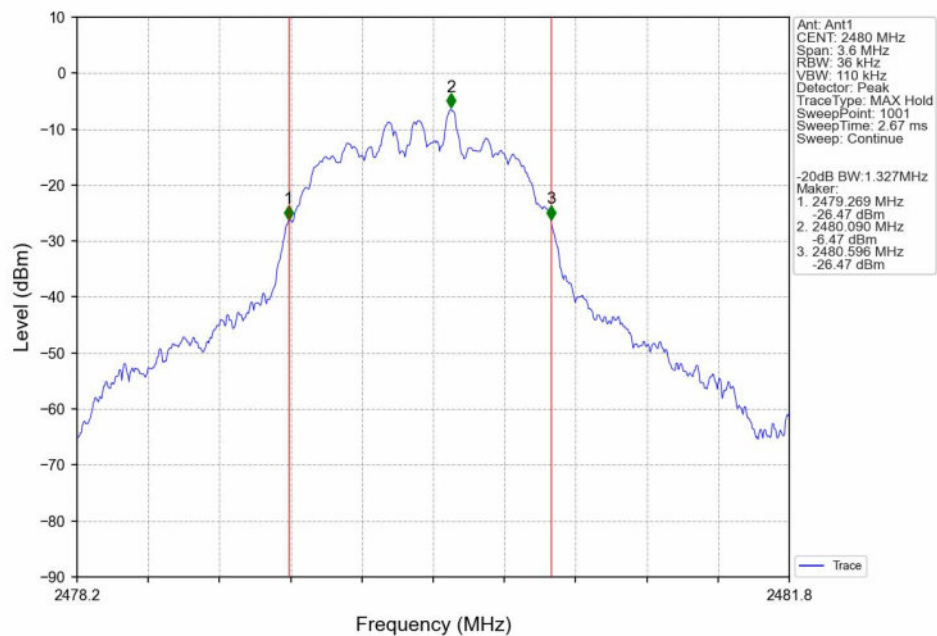


FCC ID: 2BRD8ZMHC-168

Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV

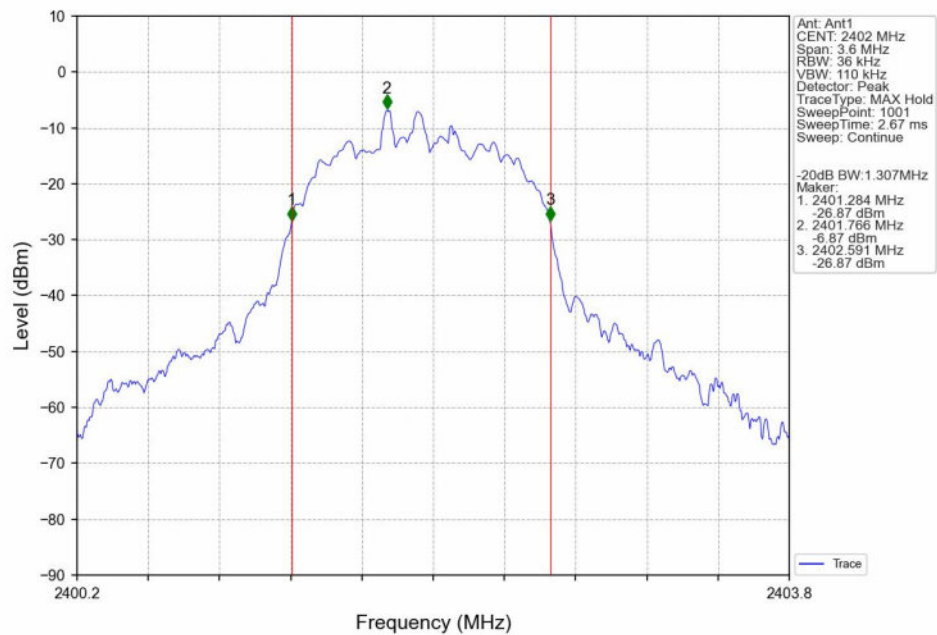


Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV

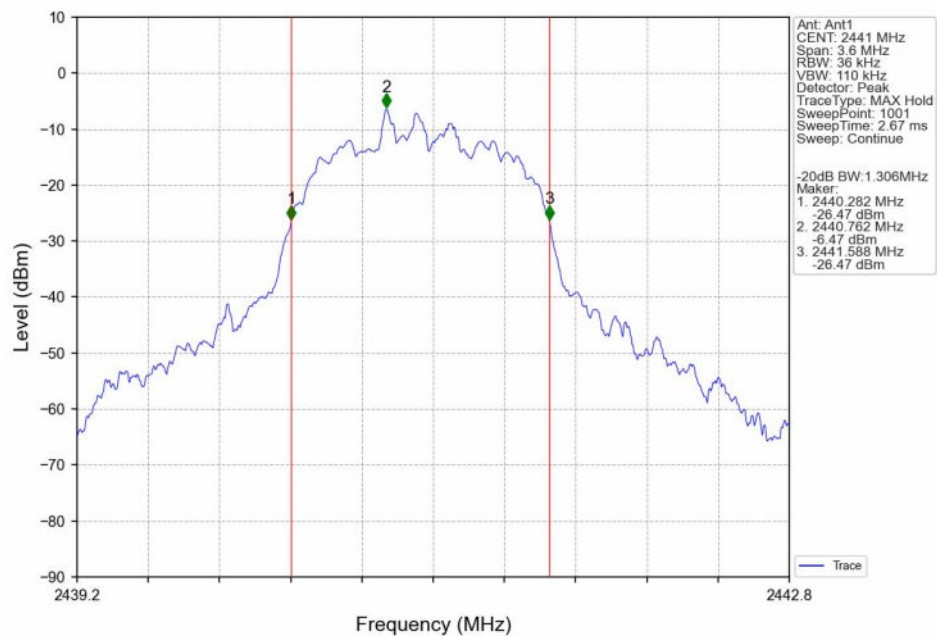


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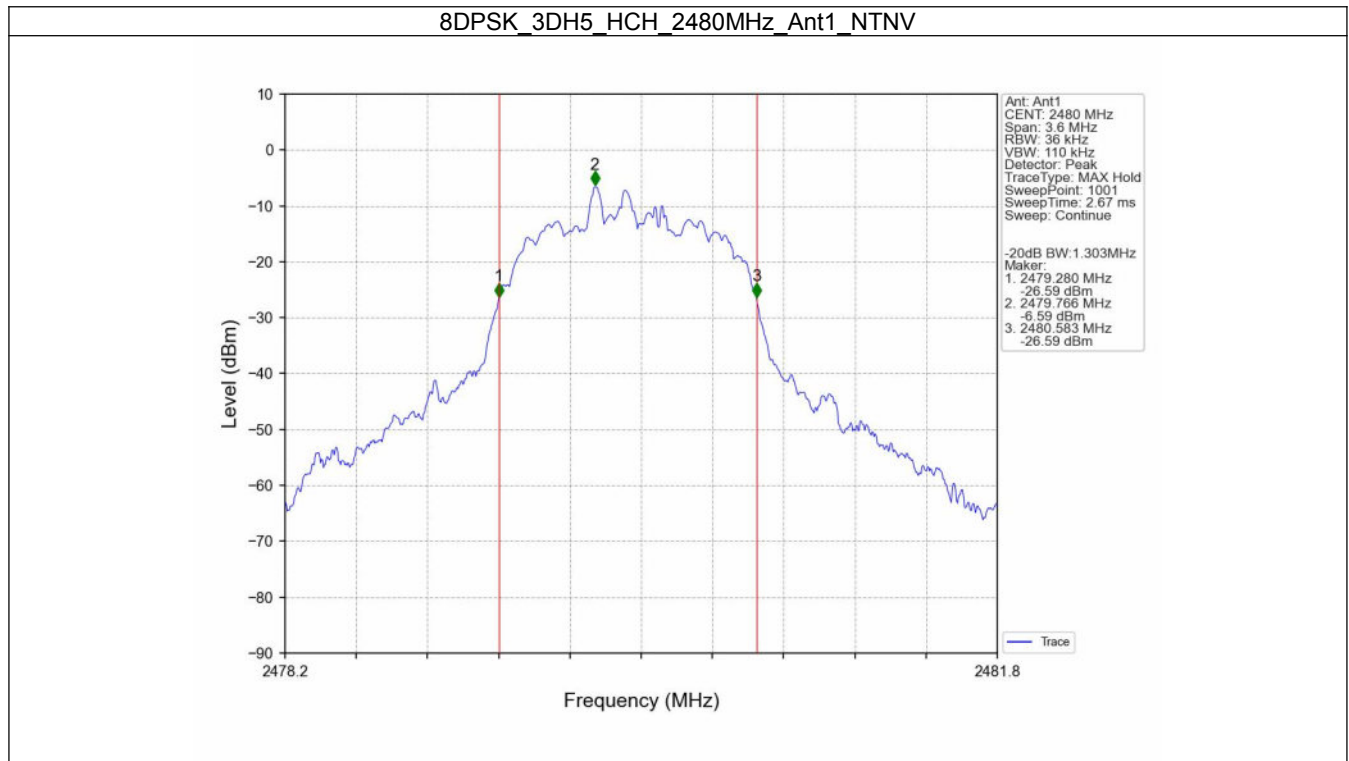
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



FCC ID: 2BRD8ZMHC-168



FCC ID: 2BRD8ZMHC-168

3. Maximum Conducted Output Power

3.1 Test Result

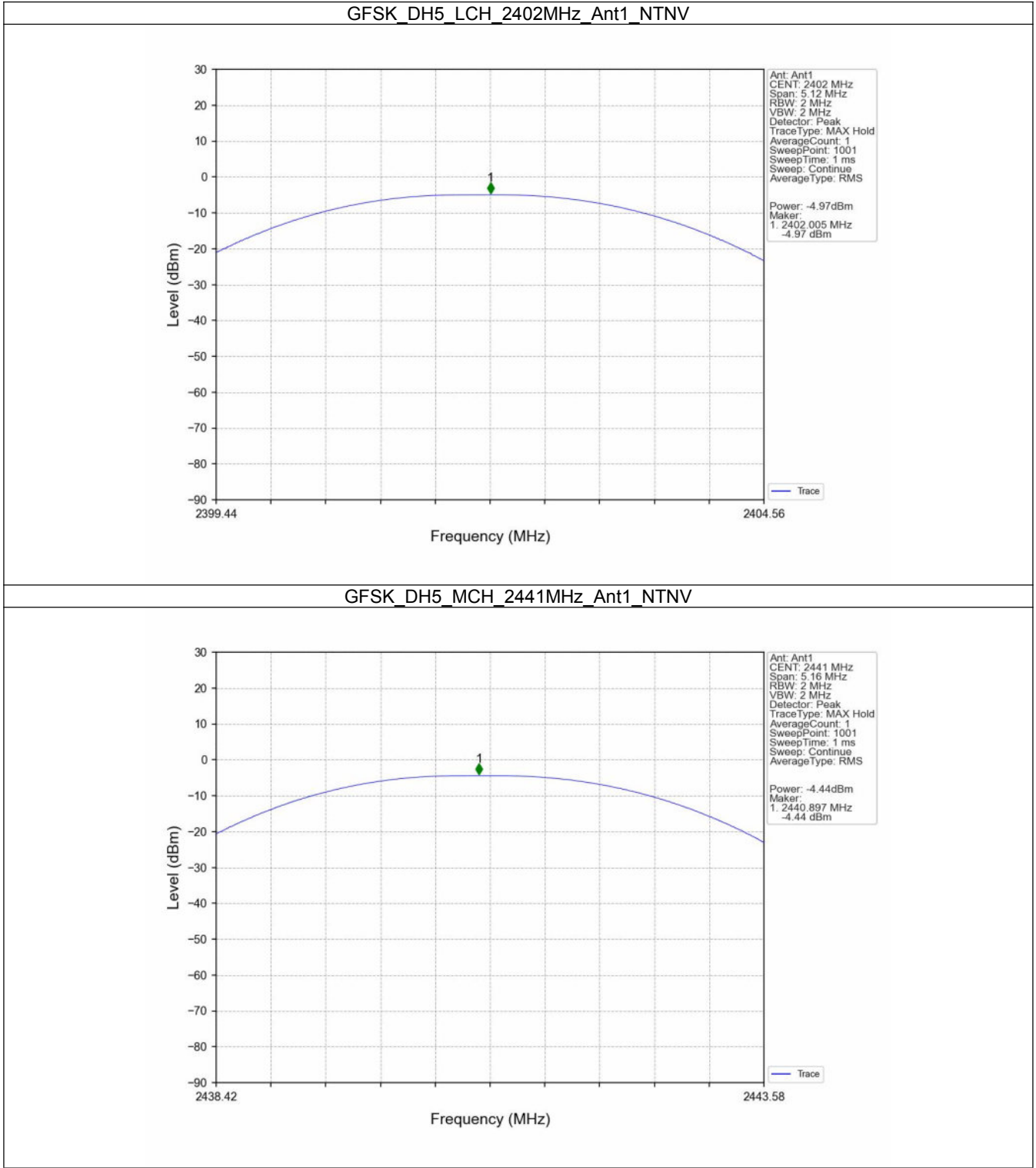
3.1.1 Power

Mode	TX Type	Frequency (MHz)	Packet Type	Maximum Peak Conducted Output Power (dBm)		Verdict
				ANT1	Limit	
GFSK	SISO	2402	DH5	-4.97	<=20.97	Pass
		2441	DH5	-4.44	<=20.97	Pass
		2480	DH5	-4.86	<=20.97	Pass
Pi/4DQPSK	SISO	2402	2DH5	-4.02	<=20.97	Pass
		2441	2DH5	-3.52	<=20.97	Pass
		2480	2DH5	-3.98	<=20.97	Pass
8DPSK	SISO	2402	3DH5	-3.68	<=20.97	Pass
		2441	3DH5	-3.16	<=20.97	Pass
		2480	3DH5	-3.58	<=20.97	Pass
Note1: Antenna Gain: Ant1: -0.58dBi;						

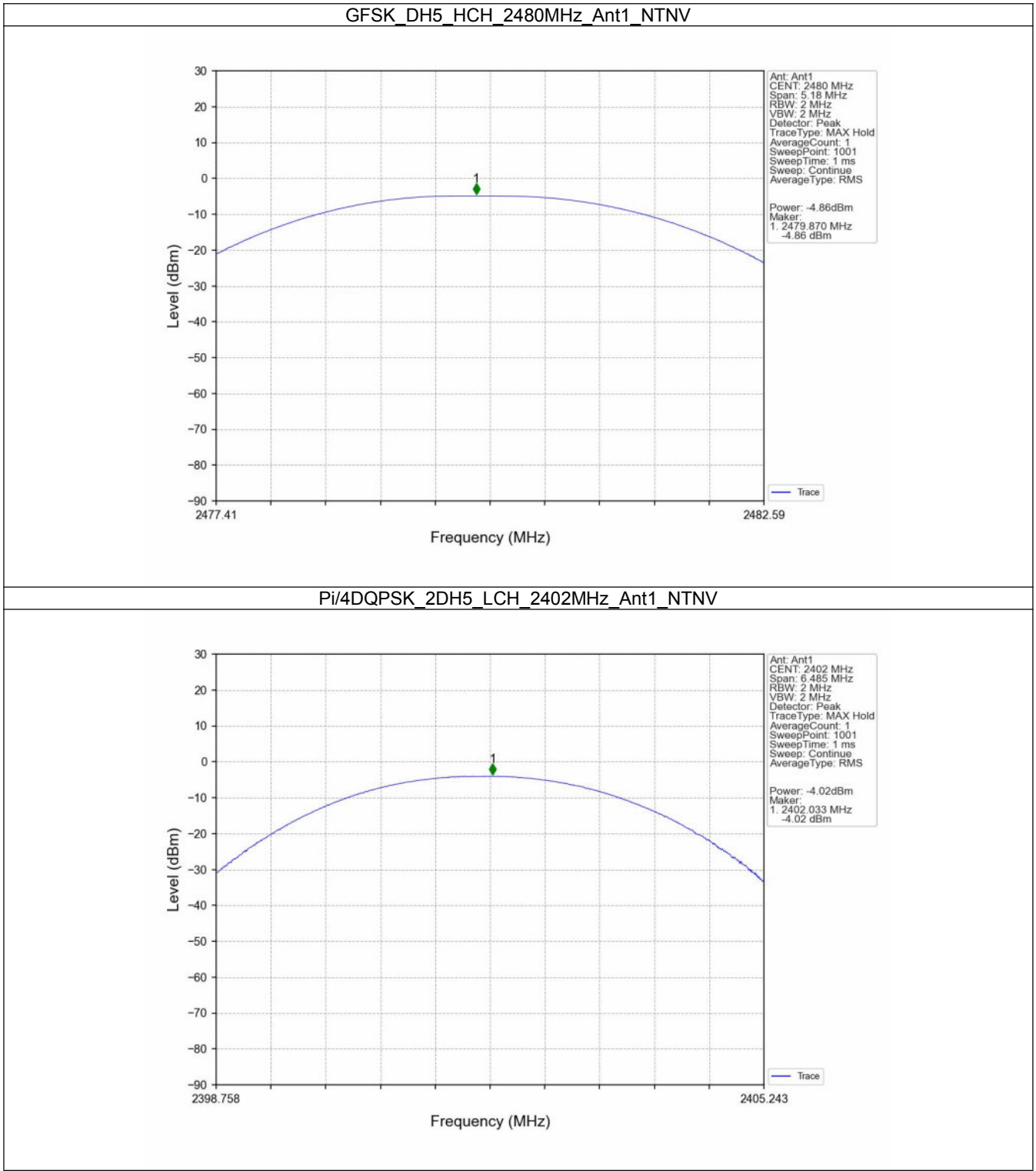
FCC ID: 2BRD8ZMHC-168

3.2 Test Graph

3.2.1 Power

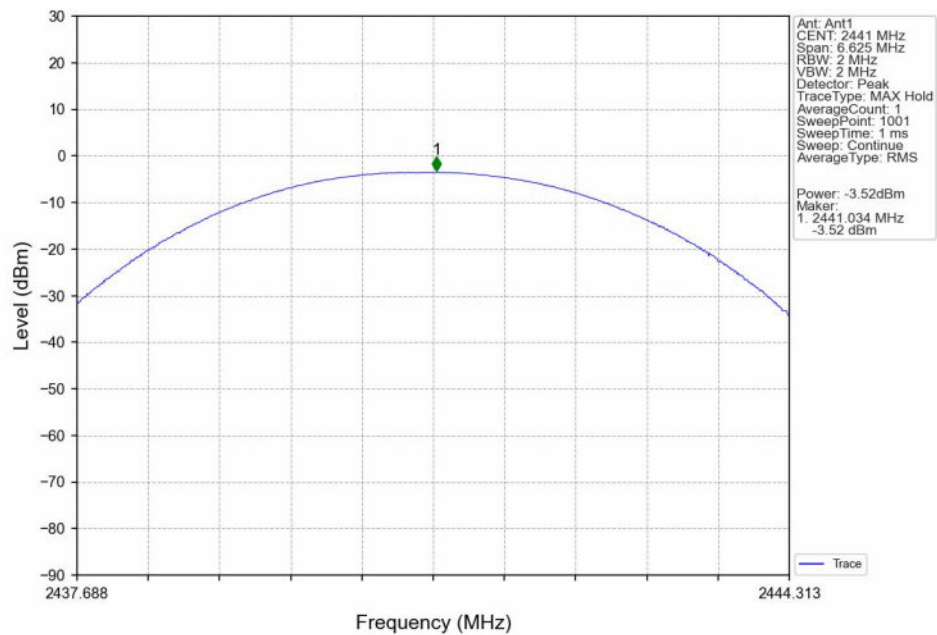


FCC ID: 2BRD8ZMHC-168

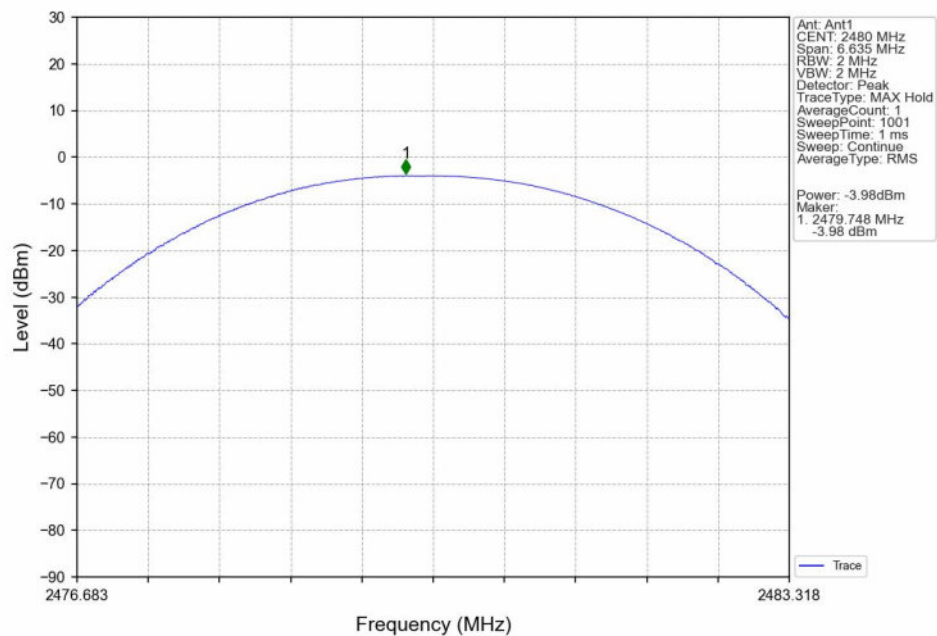


FCC ID: 2BRD8ZMHC-168

Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV

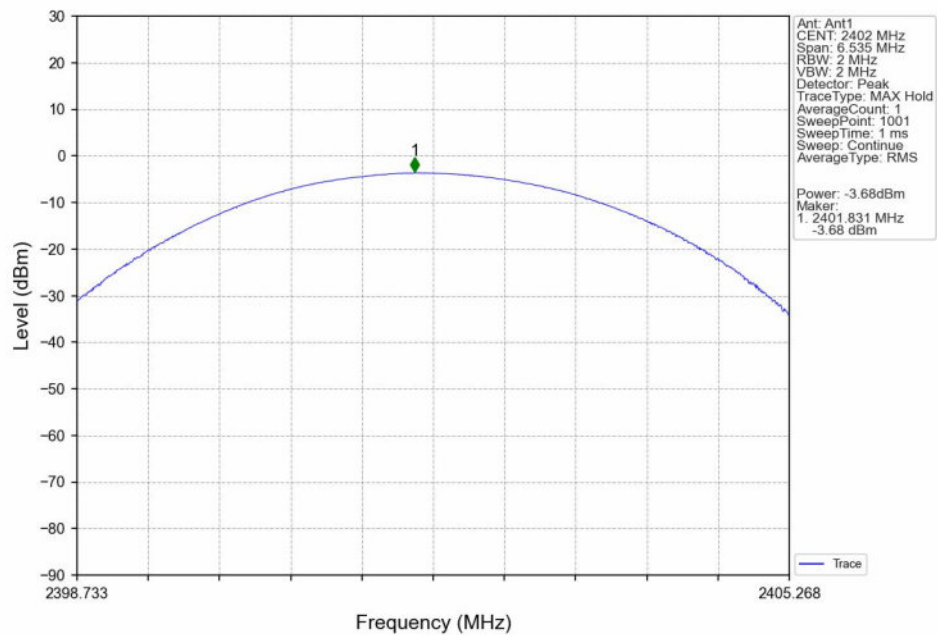


Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV

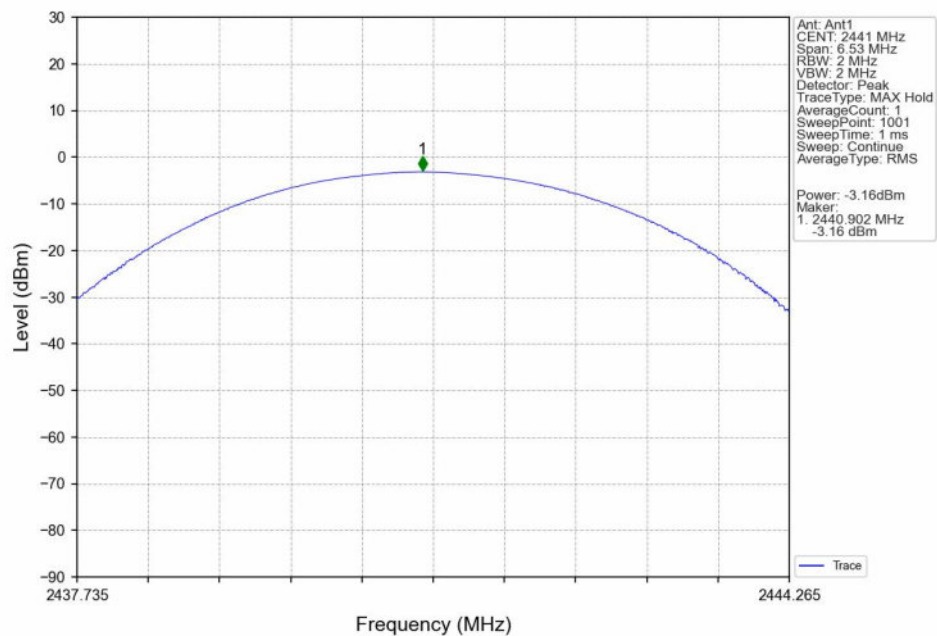


FCC ID: 2BRD8ZMHC-168

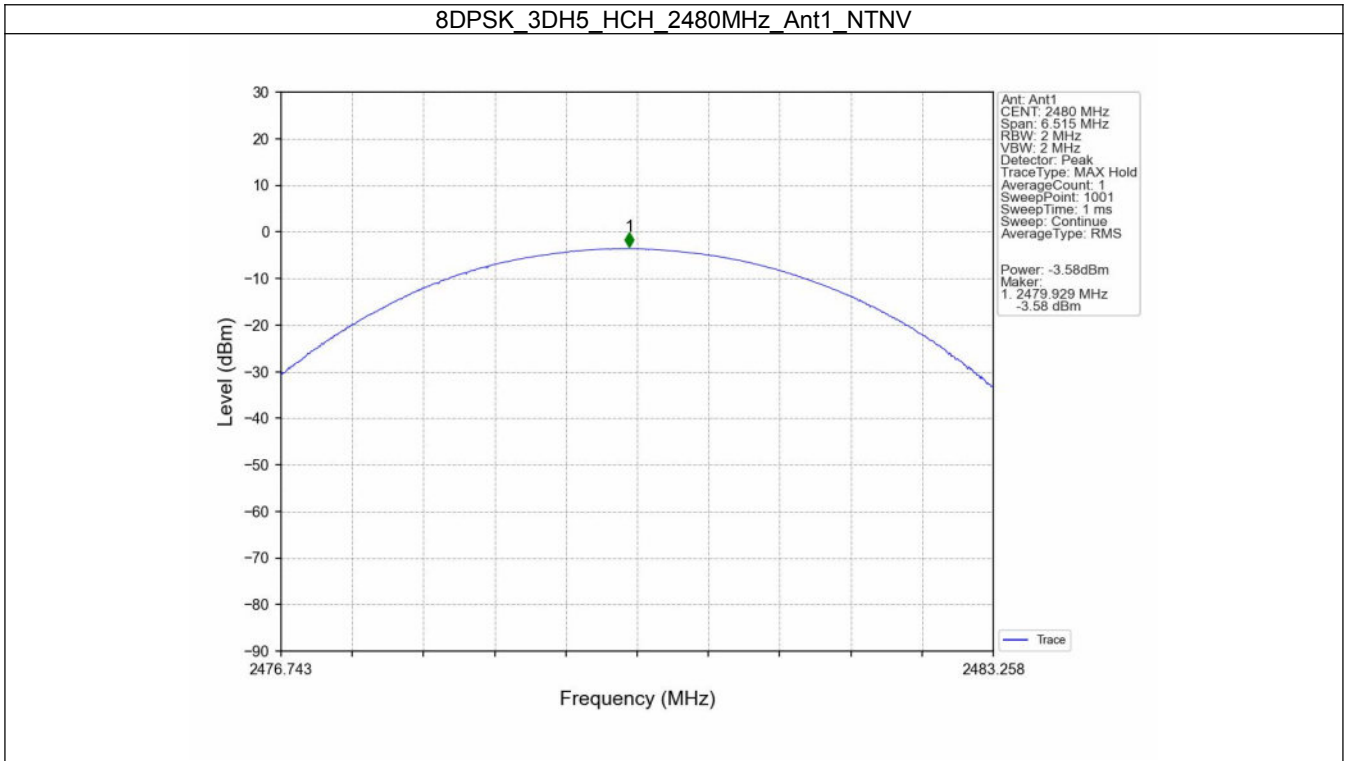
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



FCC ID: 2BRD8ZMHC-168



FCC ID: 2BRD8ZMHC-168

4. Carrier Frequency Separation

4.1 Test Result

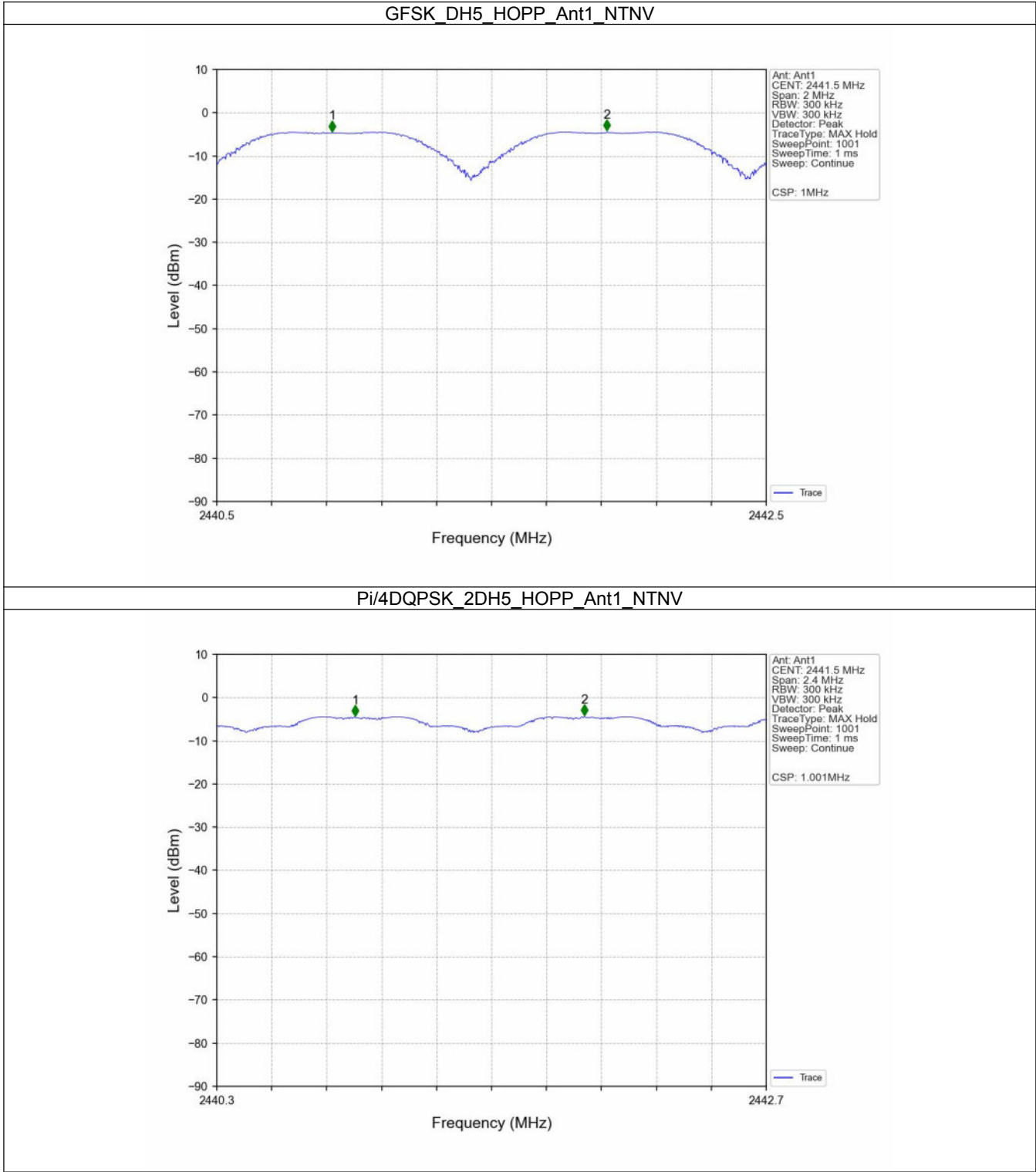
4.1.1 Ant1

Ant1							
Mode	TX Type	Frequency (MHz)	Packet Type	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict
GFSK	SISO	HOPP	DH5	1.000	1.036	≥ 0.691	Pass
Pi/4DQPSK	SISO	HOPP	2DH5	1.001	1.327	≥ 0.885	Pass
8DPSK	SISO	HOPP	3DH5	1.010	1.307	≥ 0.871	Pass

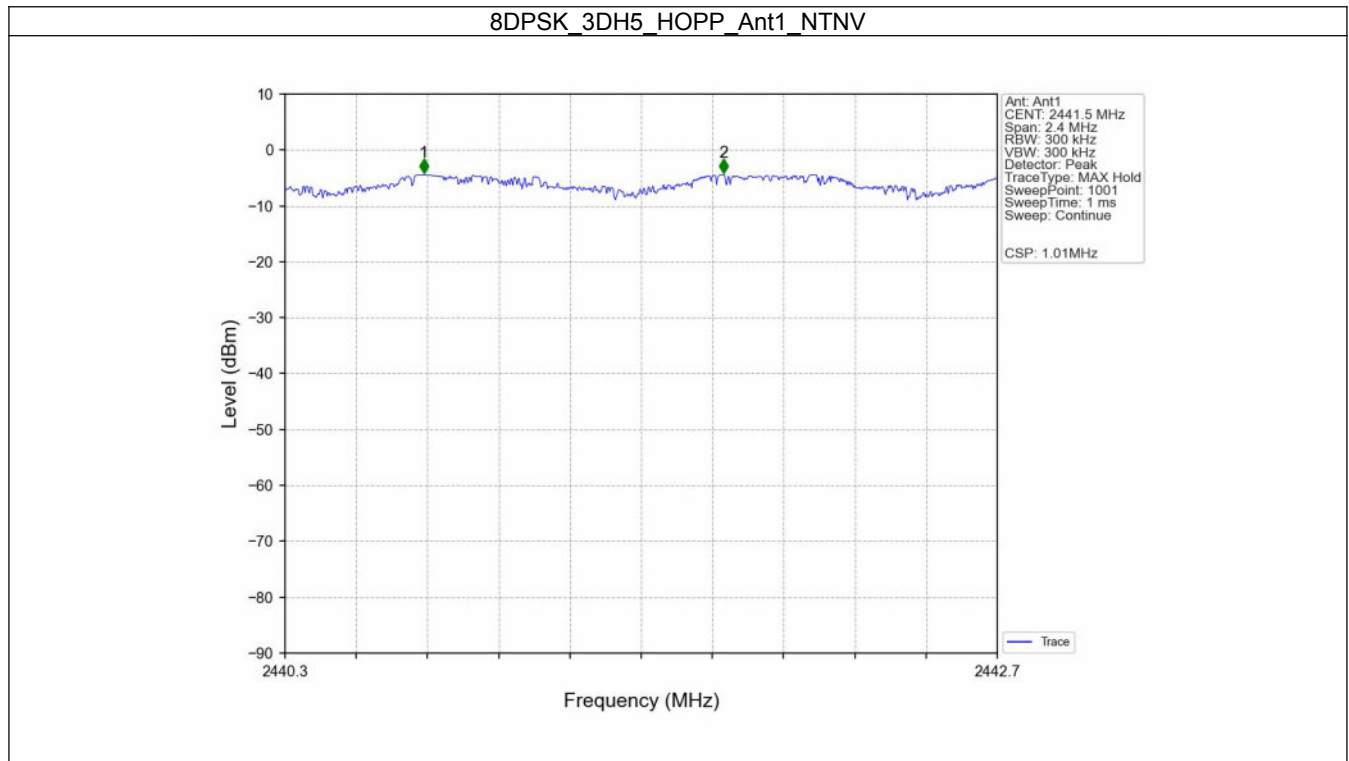
FCC ID: 2BRD8ZMHC-168

4.2 Test Graph

4.2.1 Ant1



FCC ID: 2BRD8ZMHC-168



FCC ID: 2BRD8ZMHC-168

5. Number of Hopping Frequencies

5.1 Test Result

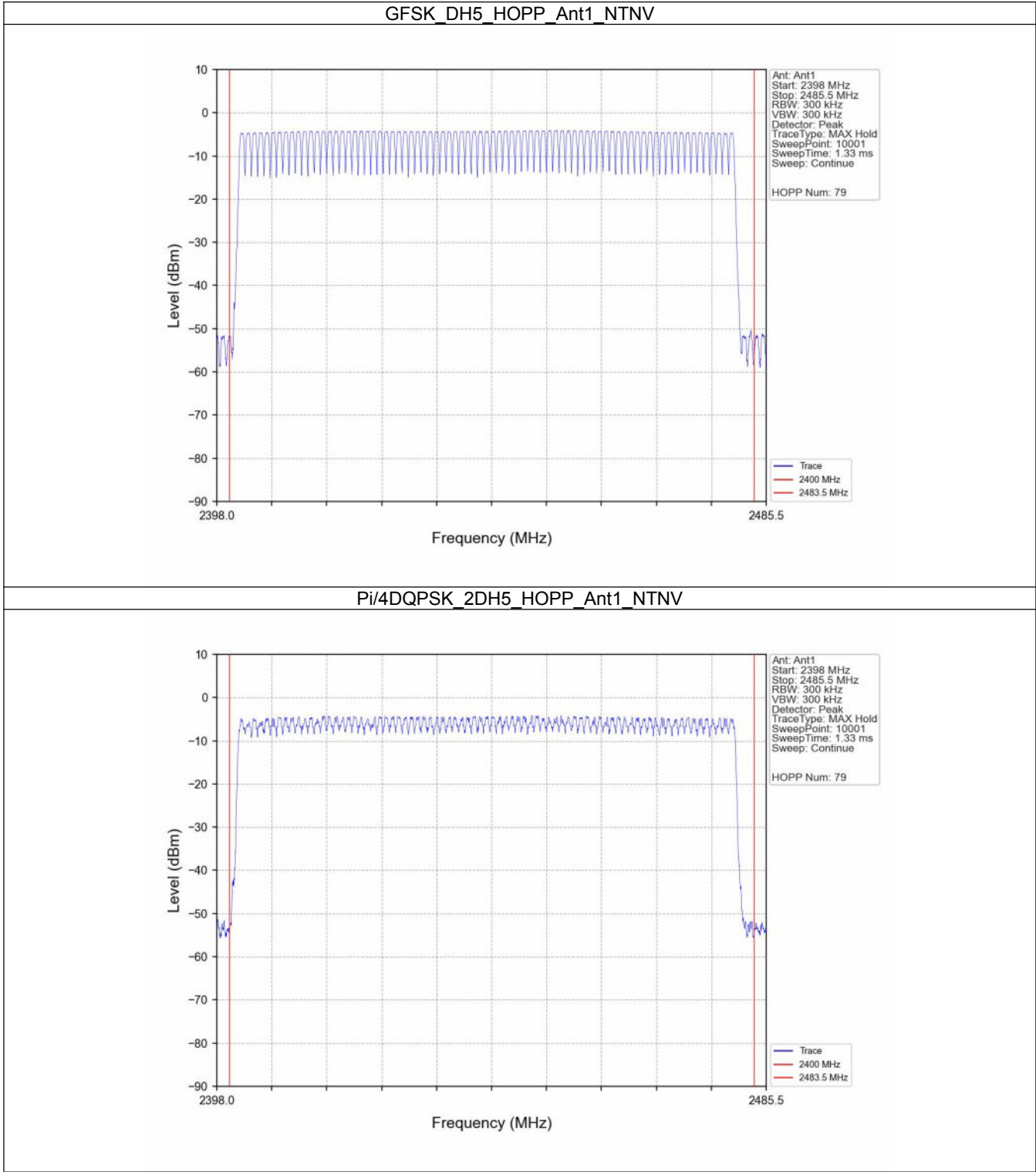
5.1.1 HoppNum

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

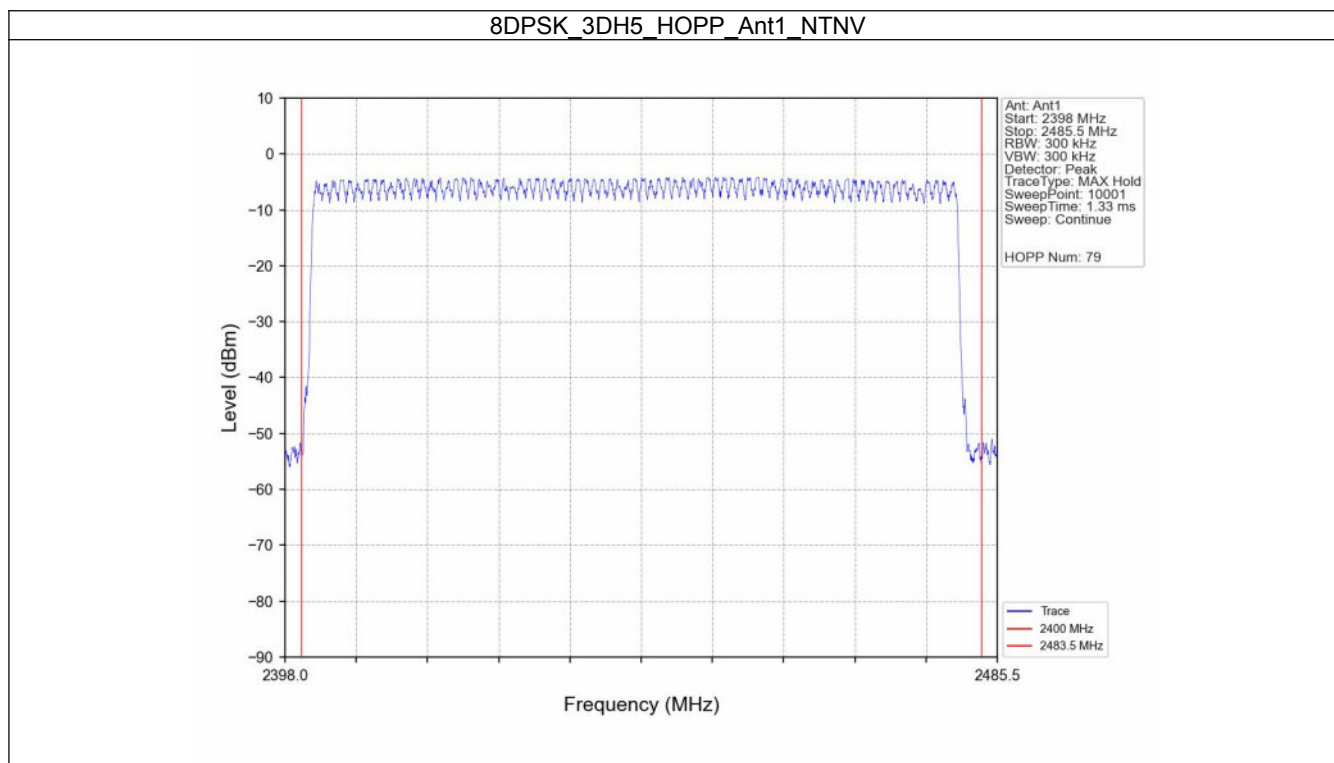
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5.2 Test Graph

5.2.1 HoppNum



FCC ID: 2BRD8ZMHC-168



FCC ID: 2BRD8ZMHC-168

6. Time of Occupancy (Dwell Time)

6.1 Test Result

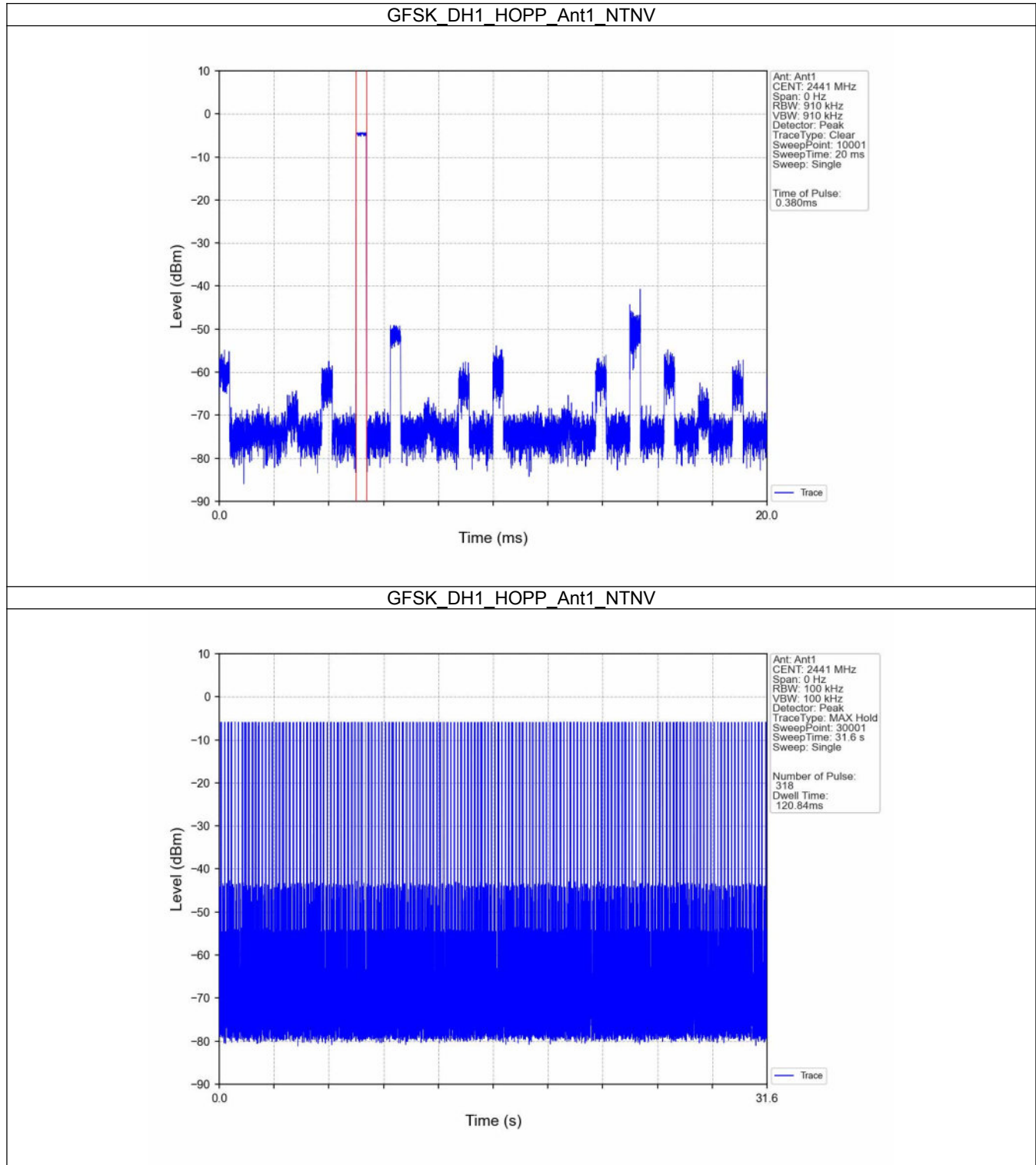
6.1.1 Ant1

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	0.380	31.600	318	120.840	<=400	Pass
			DH3	1.636	31.600	156	255.216	<=400	Pass
			DH5	2.888	31.600	107	309.016	<=400	Pass
Pi/4DQPSK	SISO	HOPP	2DH1	0.390	31.600	320	124.800	<=400	Pass
			2DH3	1.642	31.600	164	269.288	<=400	Pass
			2DH5	2.890	31.600	108	312.120	<=400	Pass
8DPSK	SISO	HOPP	3DH1	0.392	31.600	320	125.440	<=400	Pass
			3DH3	1.640	31.600	151	247.640	<=400	Pass
			3DH5	2.898	31.600	125	362.250	<=400	Pass

FCC ID: 2BRD8ZMHC-168

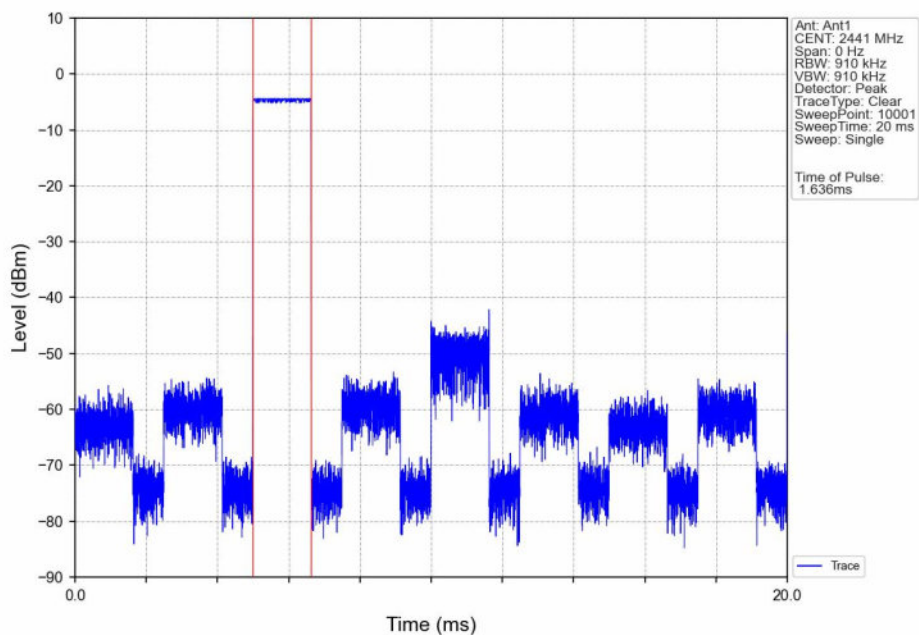
6.2 Test Graph

6.2.1 Ant1

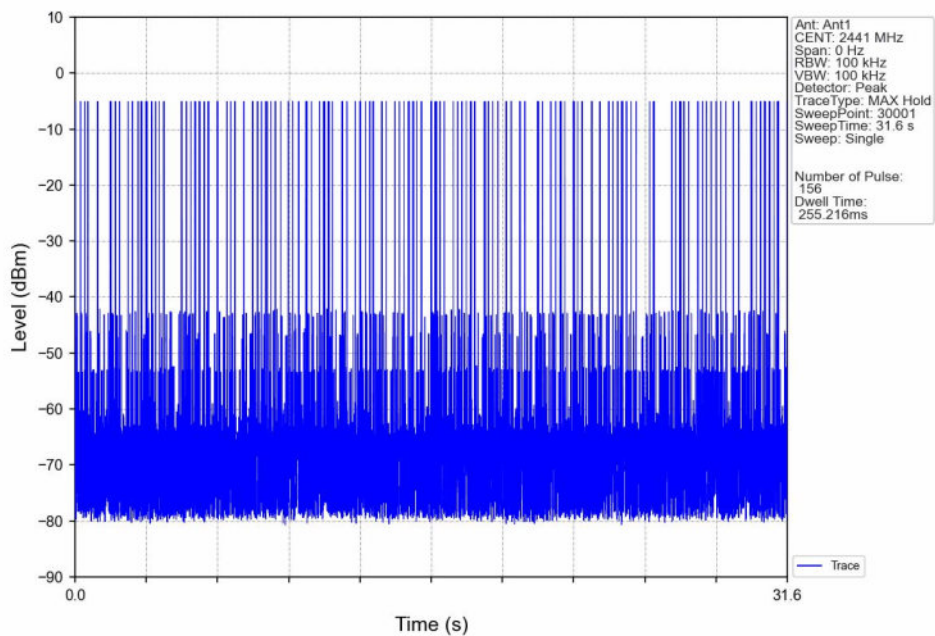


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GFSK_DH3_HOPP_Ant1_NTNV

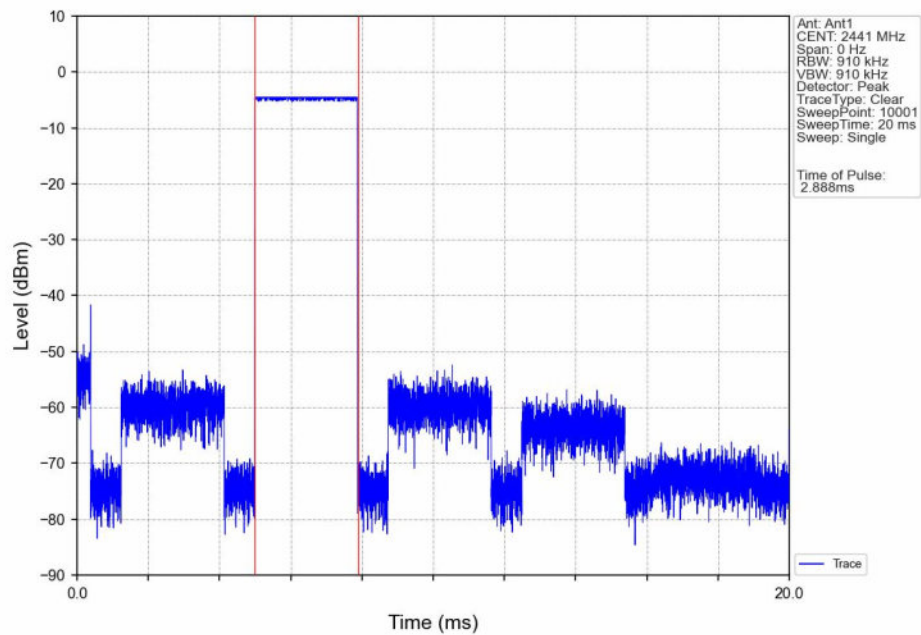


GFSK_DH3_HOPP_Ant1_NTNV

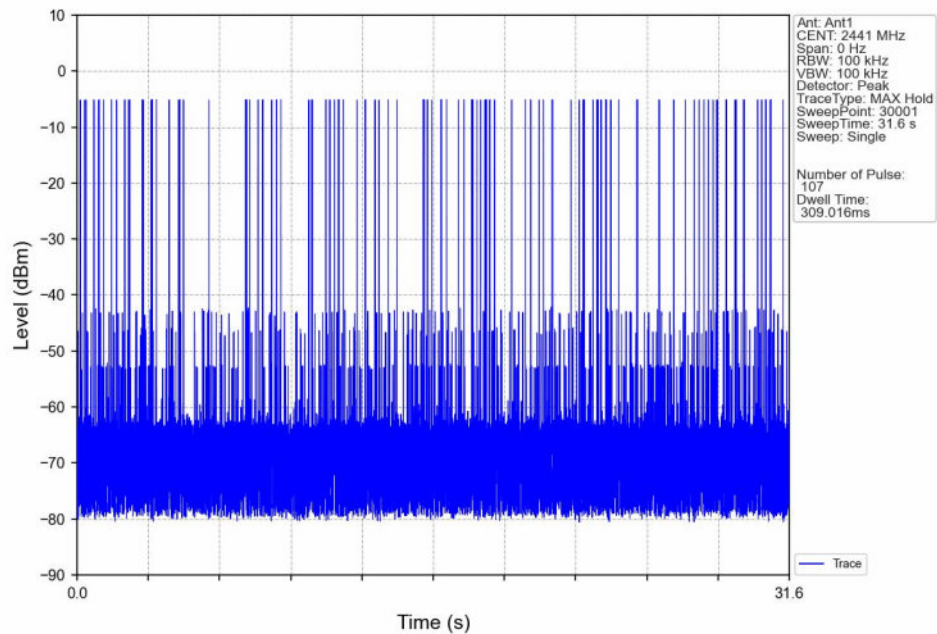


FCC ID: 2BRD8ZMHC-168

GFSK_DH5_HOPP_Ant1_NTNV

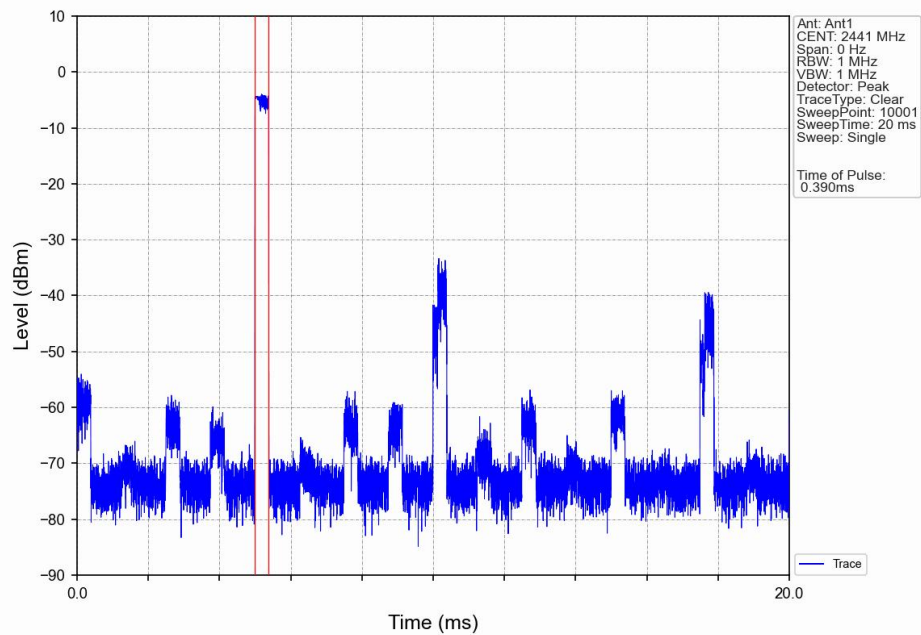


GFSK_DH5_HOPP_Ant1_NTNV

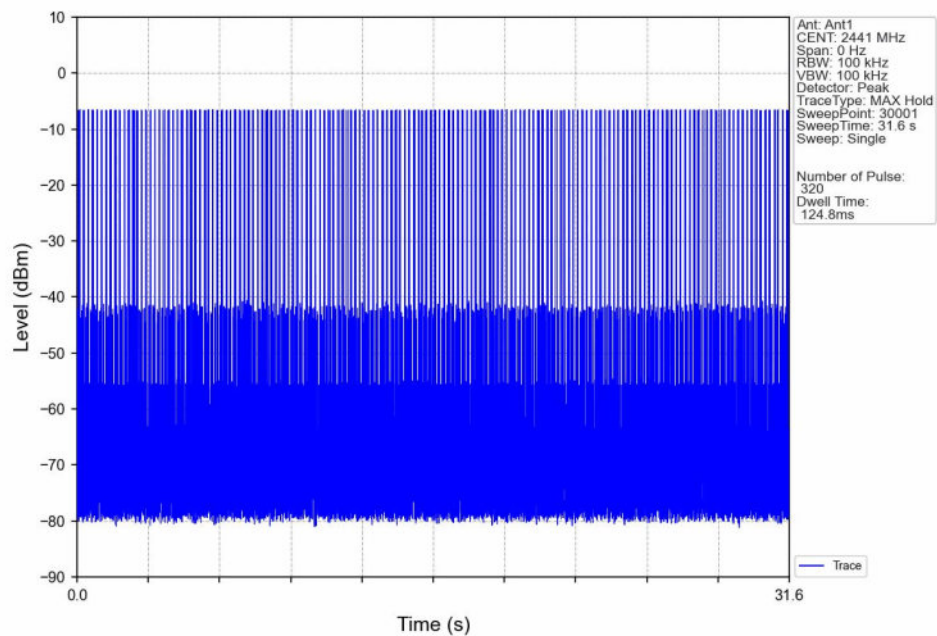


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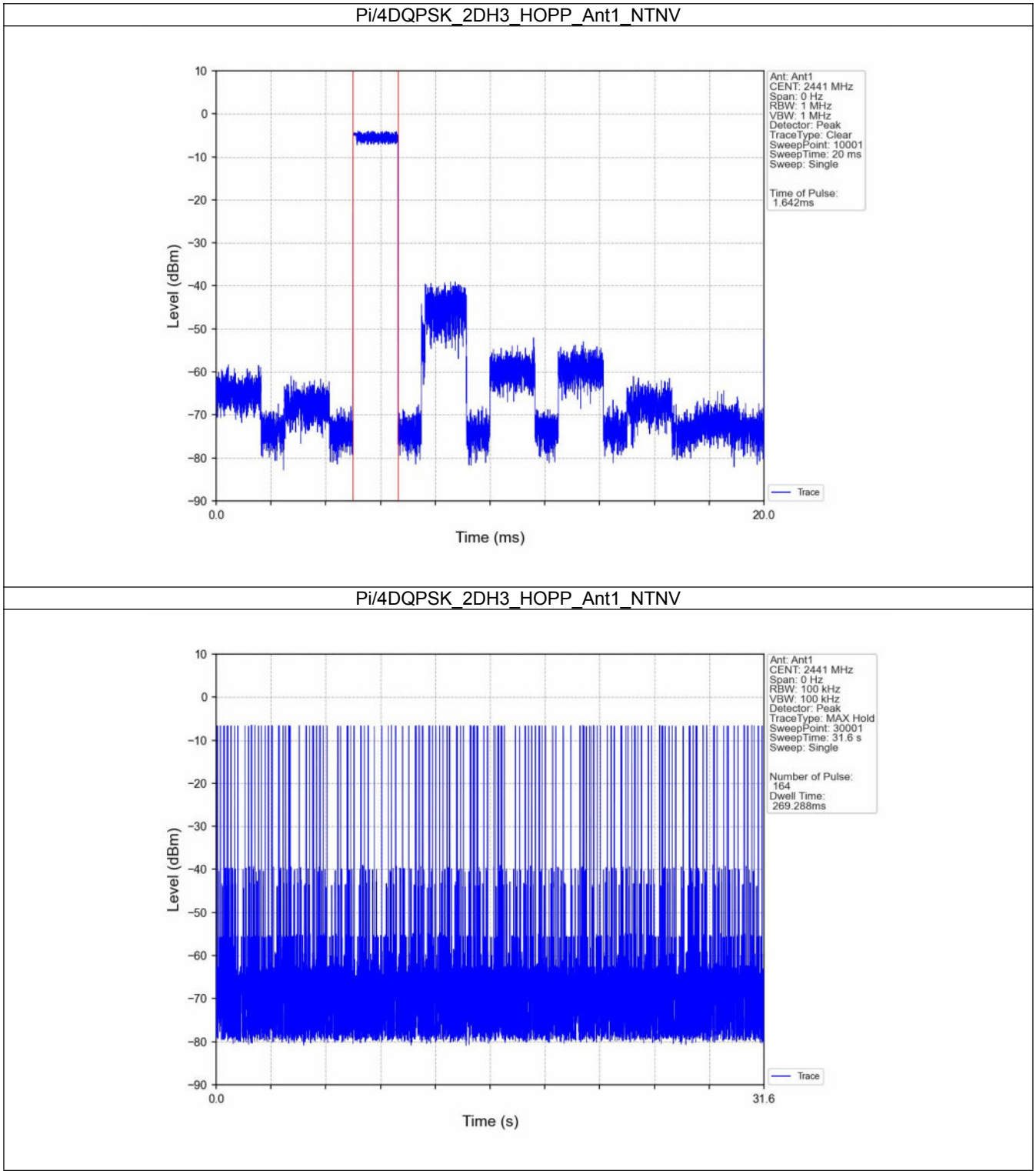
Pi/4DQPSK_2DH1_HOPP_Ant1_NTNV



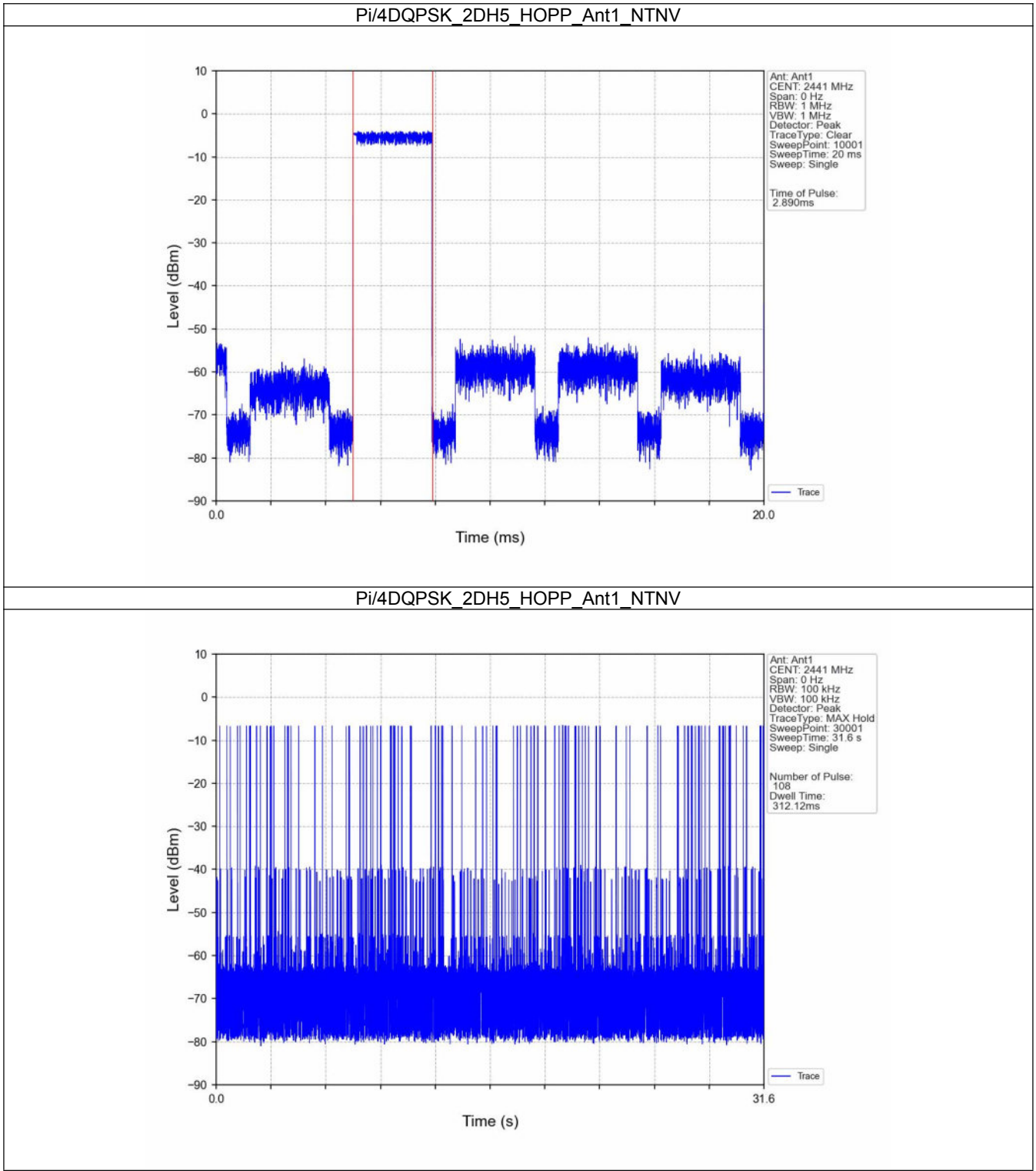
Pi/4DQPSK_2DH1_HOPP_Ant1_NTNV



FCC ID: 2BRD8ZMHC-168

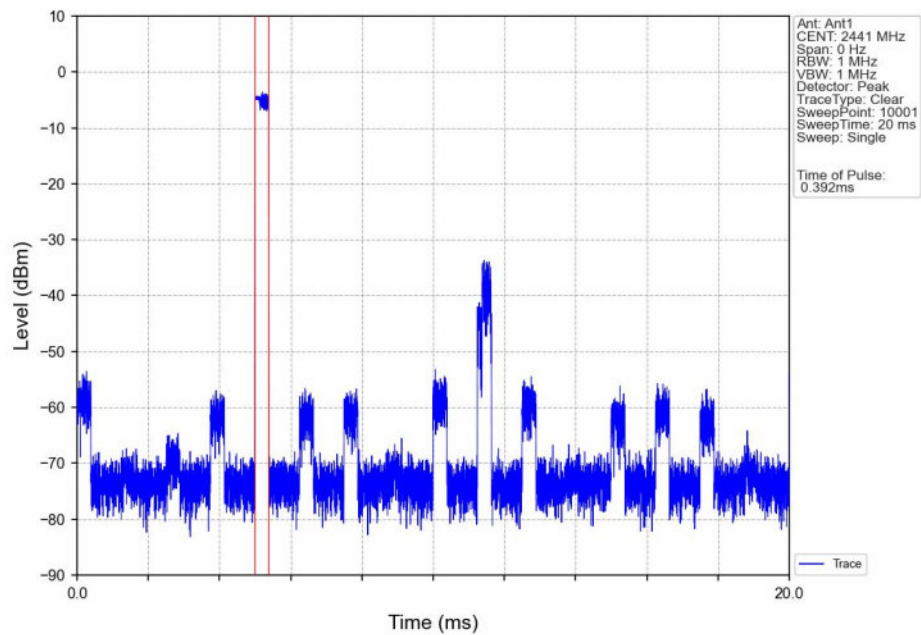


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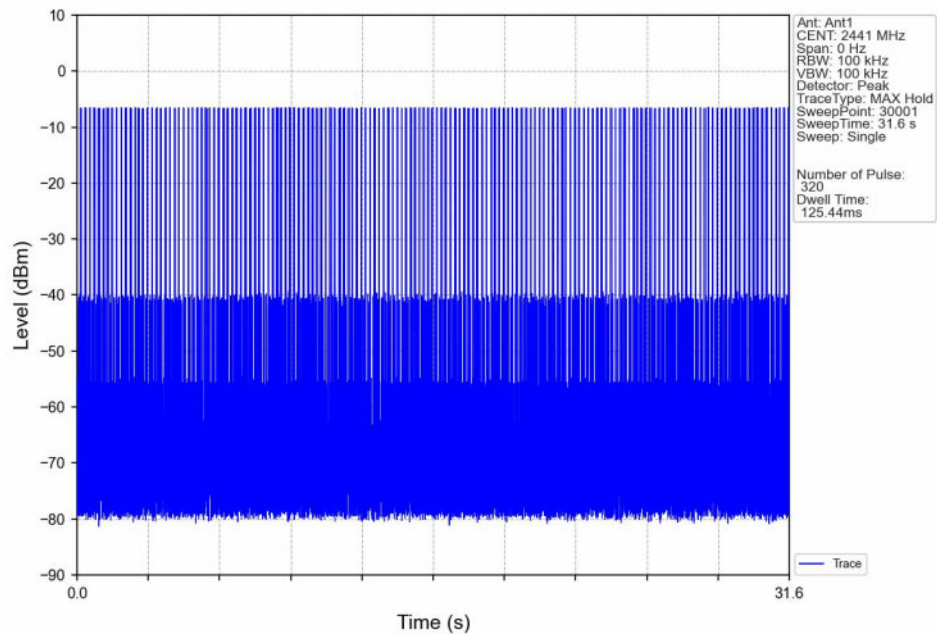


FCC ID: 2BRD8ZMHC-168

8DPSK_3DH1_HOPP_Ant1_NTNV

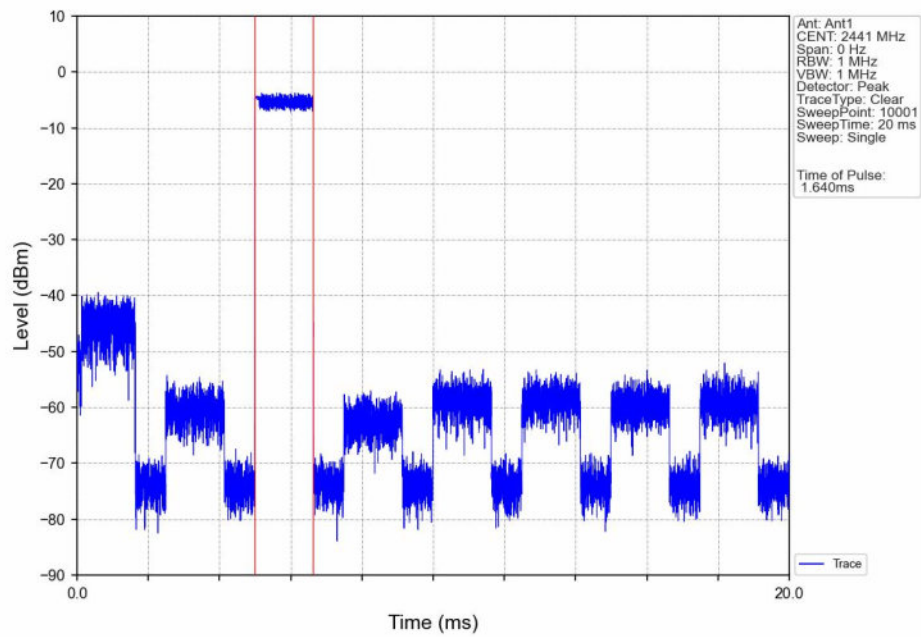


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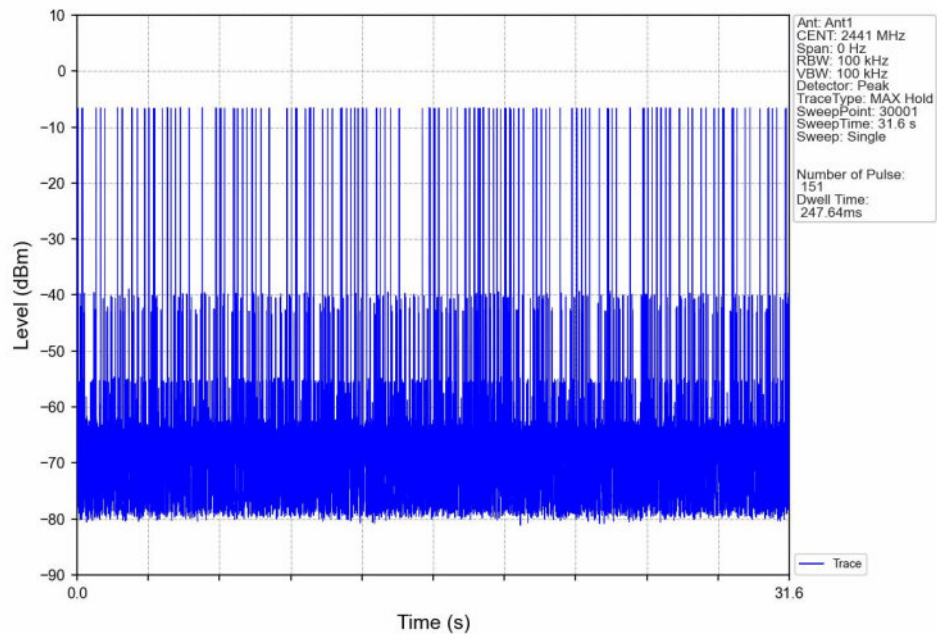


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8DPSK_3DH3_HOPP_Ant1_NTNV

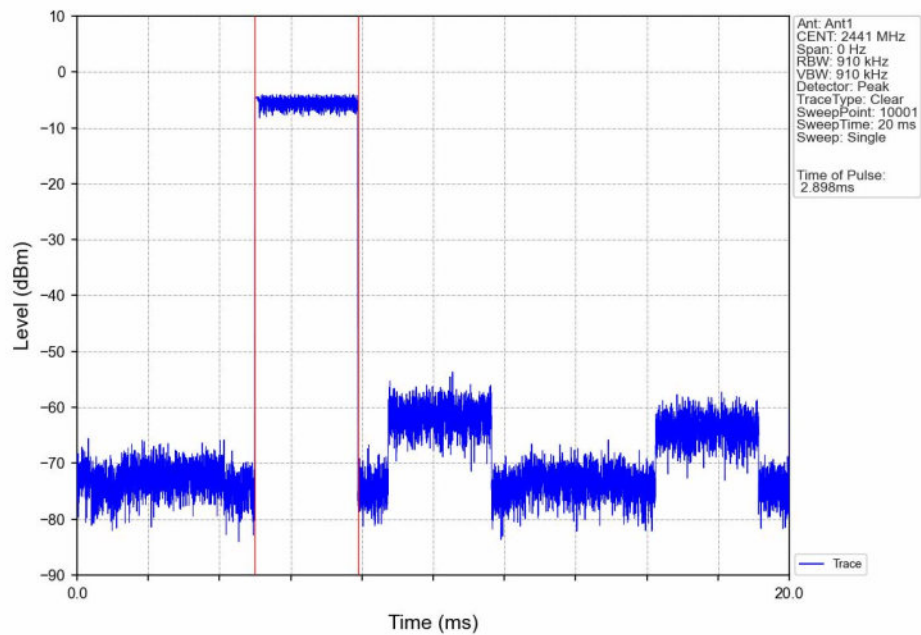


8DPSK_3DH3_HOPP_Ant1_NTNV

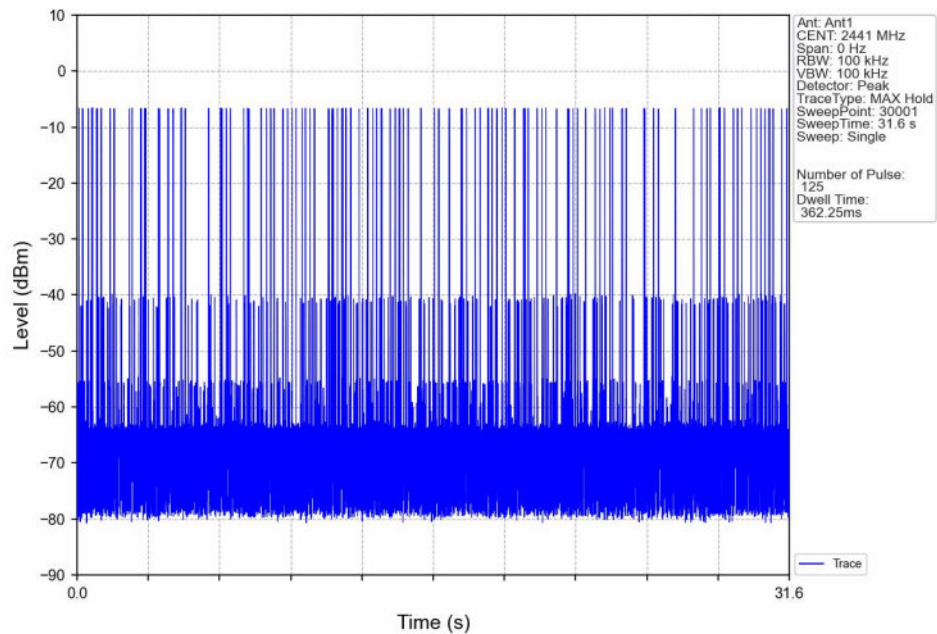


FCC ID: 2BRD8ZMHC-168

8DPSK_3DH5_HOPP_Ant1_NTNV



8DPSK_3DH5_HOPP_Ant1_NTNV



FCC ID: 2BRD8ZMHC-168

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	-5.13
		2441	DH5	1	-4.60
		2480	DH5	1	-5.00
Pi/4DQPSK	SISO	2402	2DH5	1	-5.02
		2441	2DH5	1	-4.56
		2480	2DH5	1	-4.99
8DPSK	SISO	2402	3DH5	1	-5.95
		2441	3DH5	1	-4.54
		2480	3DH5	1	-4.95

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.

7.1.2 CSE

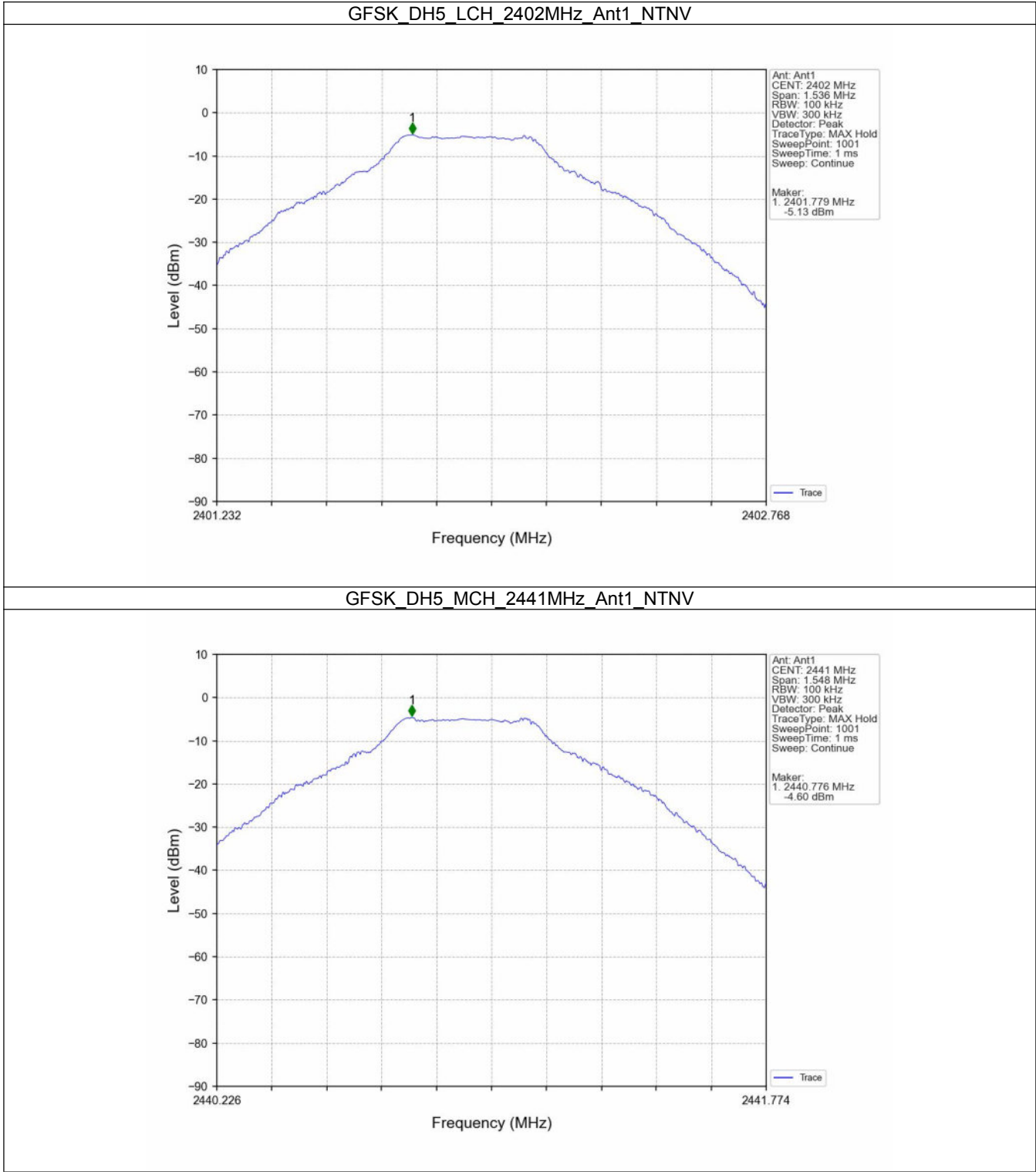
Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
GFSK	SISO	2402	DH5	1	-4.60	-24.60	Pass
		2441	DH5	1	-4.60	-24.60	Pass
		2480	DH5	1	-4.60	-24.60	Pass
		HOPP	DH5	1	-4.60	-24.60	Pass
					-4.60	-24.60	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	-4.56	-24.56	Pass
		2441	2DH5	1	-4.56	-24.56	Pass
		2480	2DH5	1	-4.56	-24.56	Pass
		HOPP	2DH5	1	-4.56	-24.56	Pass
					-4.56	-24.56	Pass
8DPSK	SISO	2402	3DH5	1	-4.54	-24.54	Pass
		2441	3DH5	1	-4.54	-24.54	Pass
		2480	3DH5	1	-4.54	-24.54	Pass
		HOPP	3DH5	1	-4.54	-24.54	Pass
					-4.54	-24.54	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: 2BRD8ZMHC-168

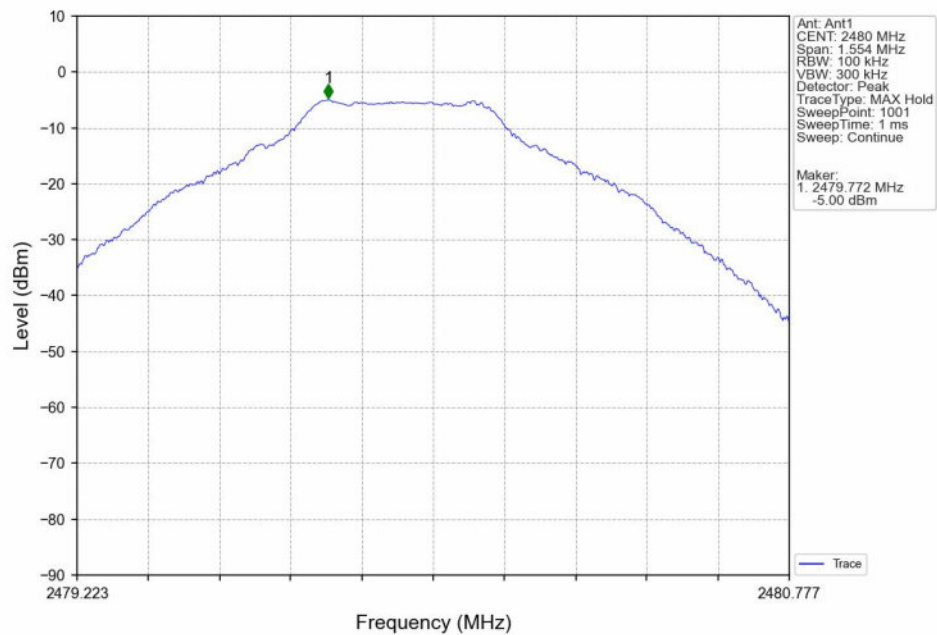
7.2 Test Graph

7.2.1 Ref

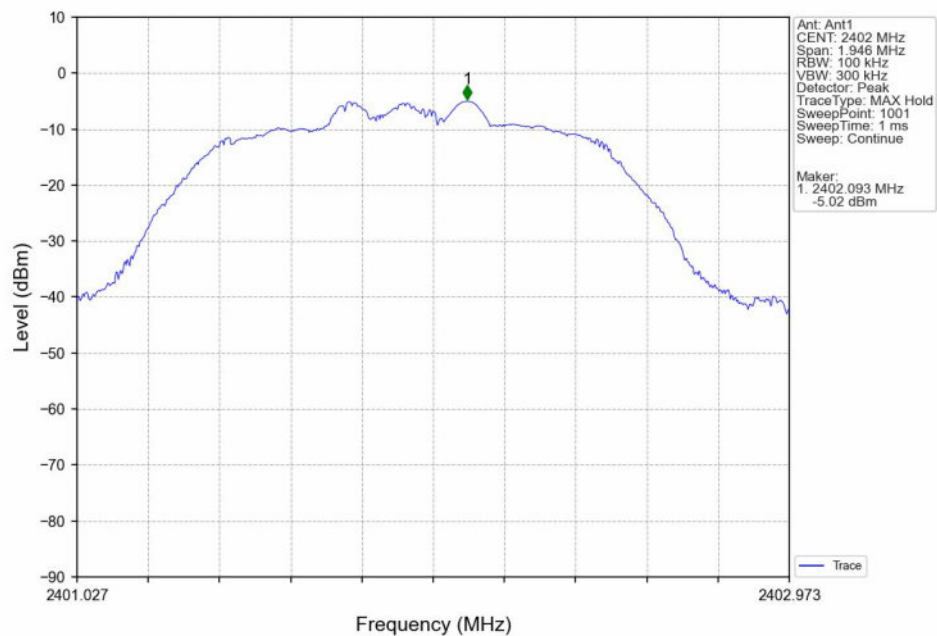


FCC ID: 2BRD8ZMHC-168

GFSK_DH5_HCH_2480MHz_Ant1_NTNV

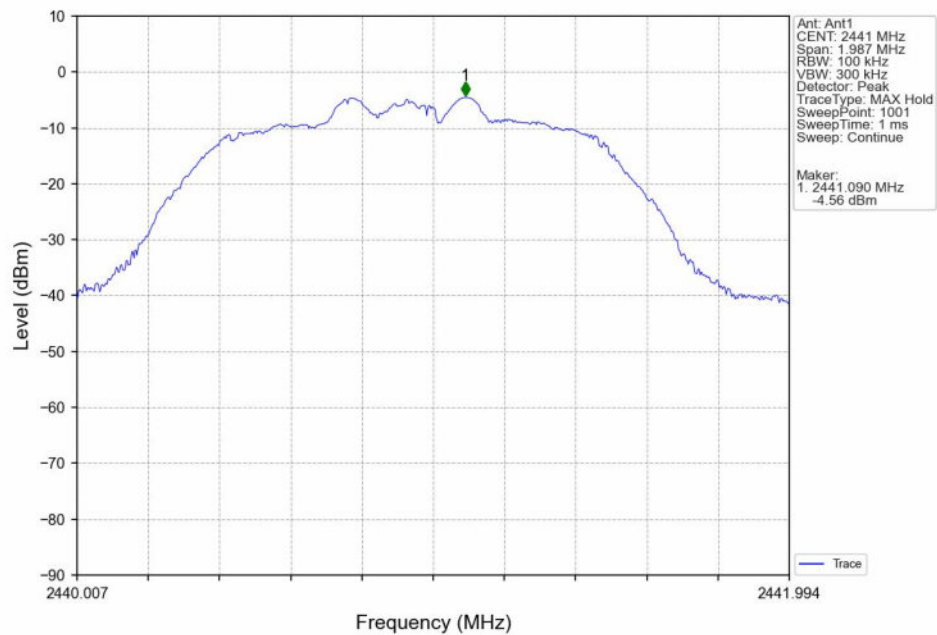


Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV

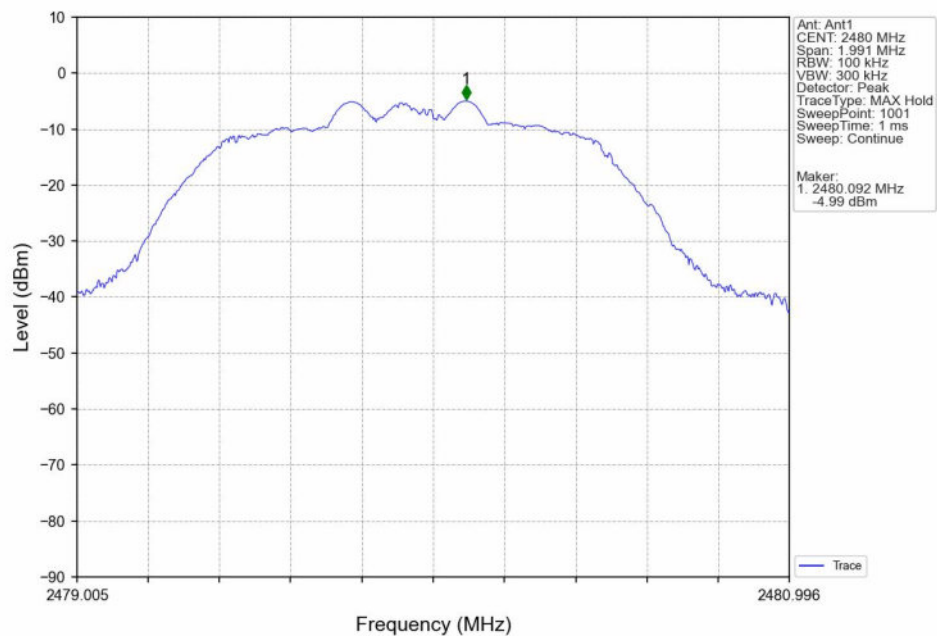


FCC ID: 2BRD8ZMHC-168

Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV

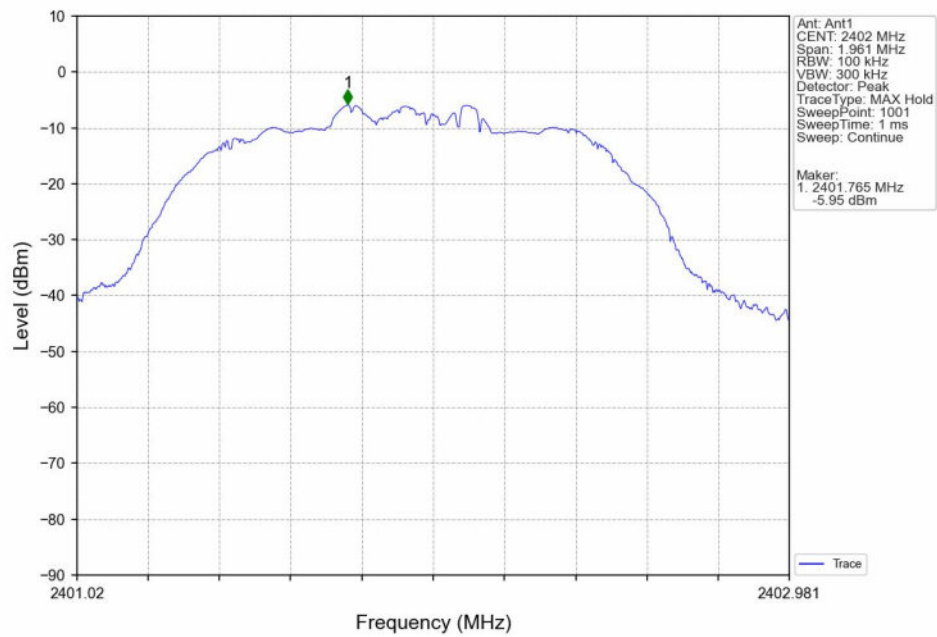


Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV

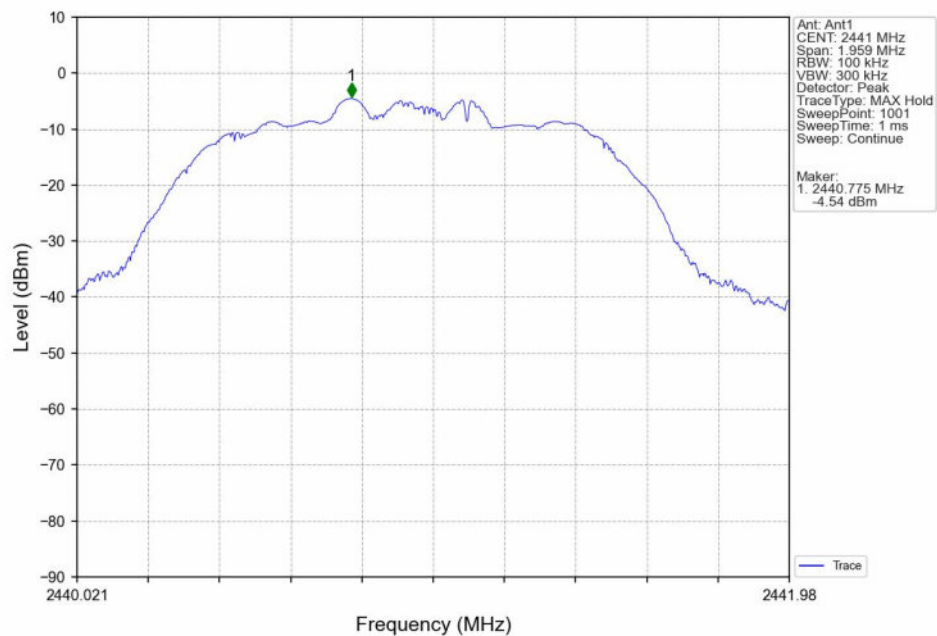


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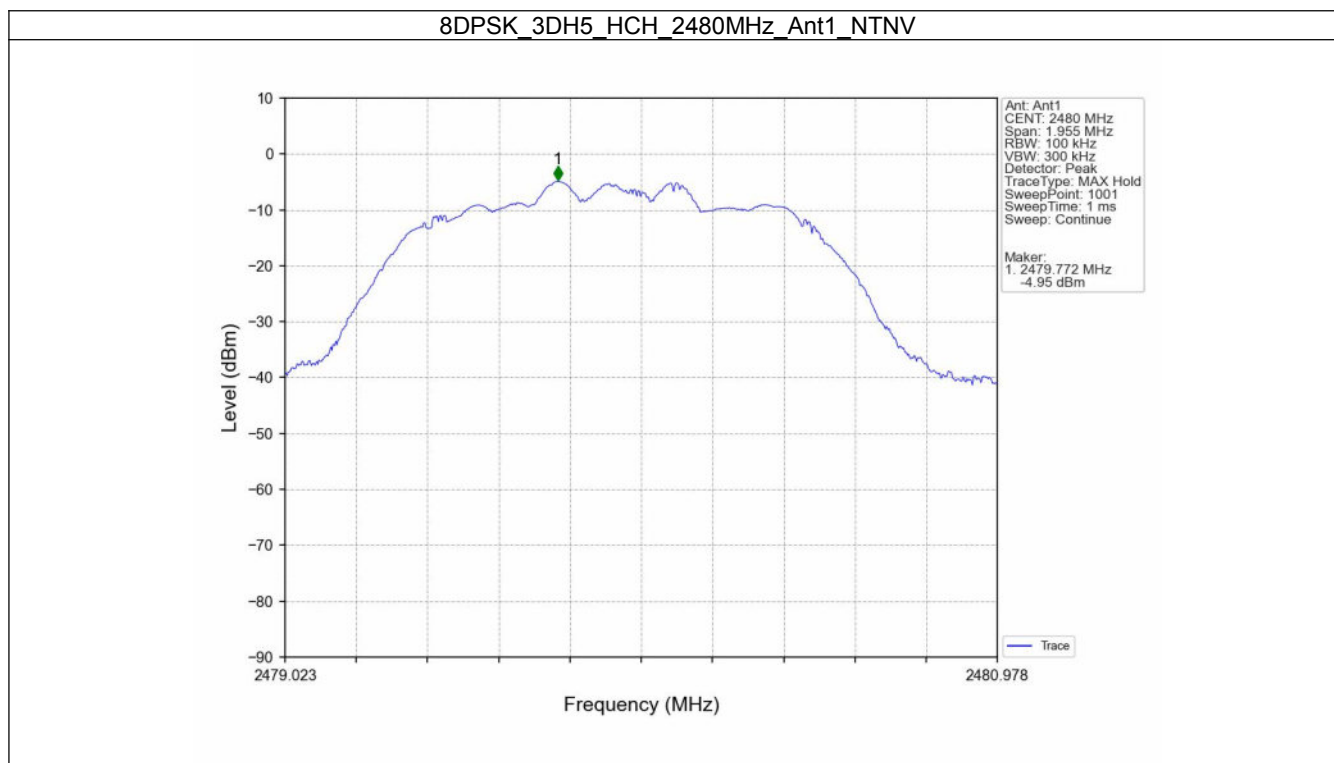
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV

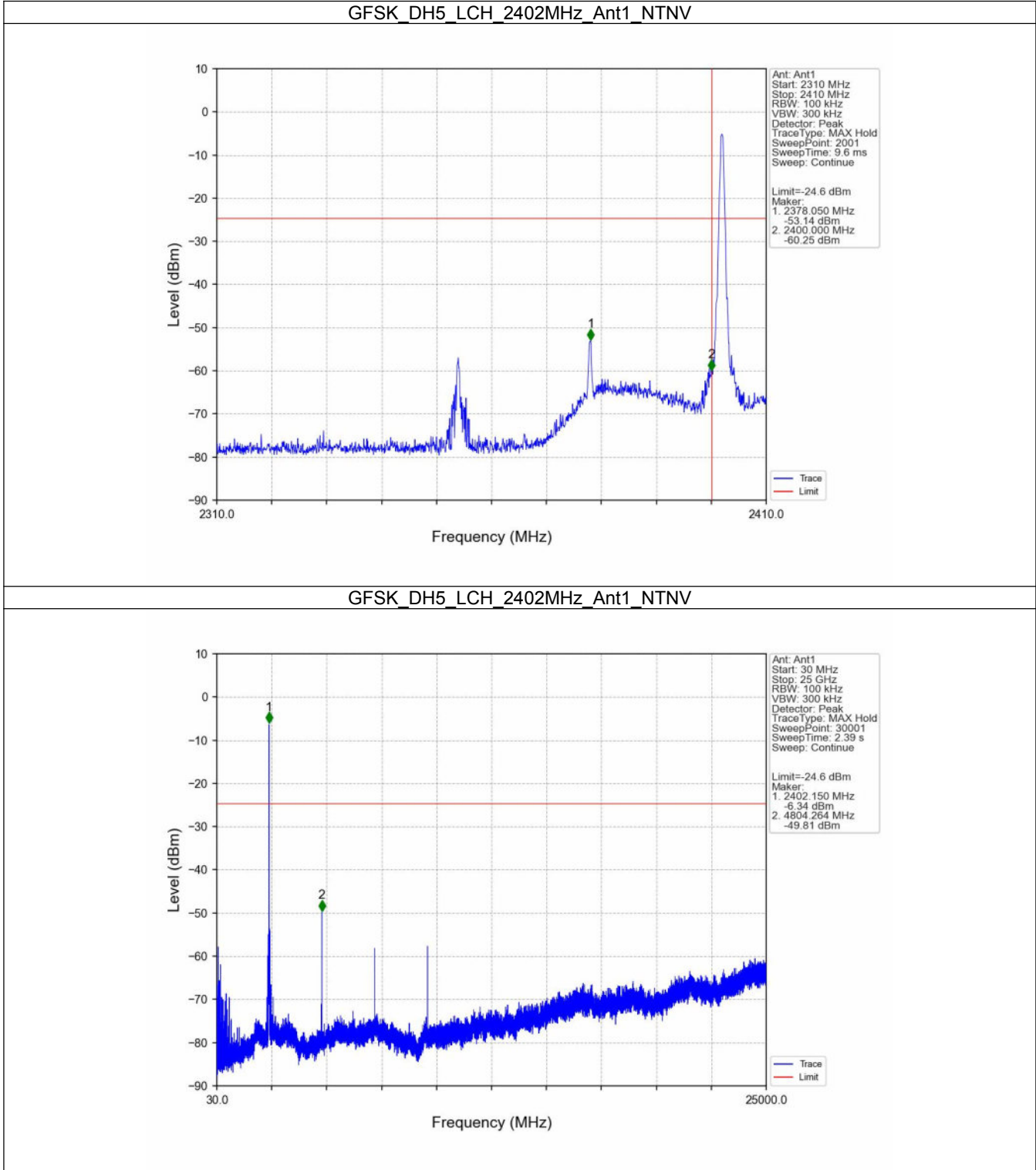


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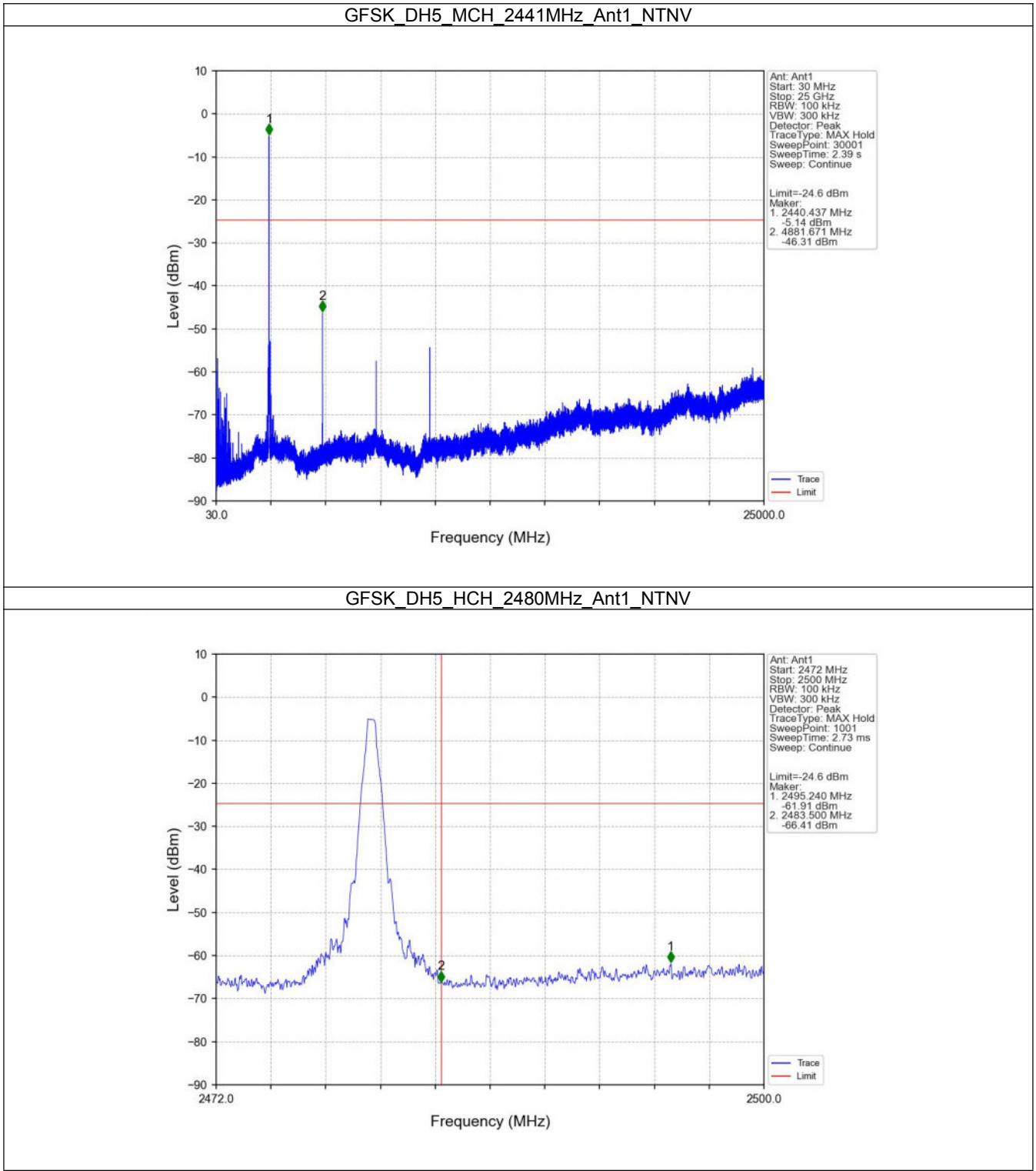


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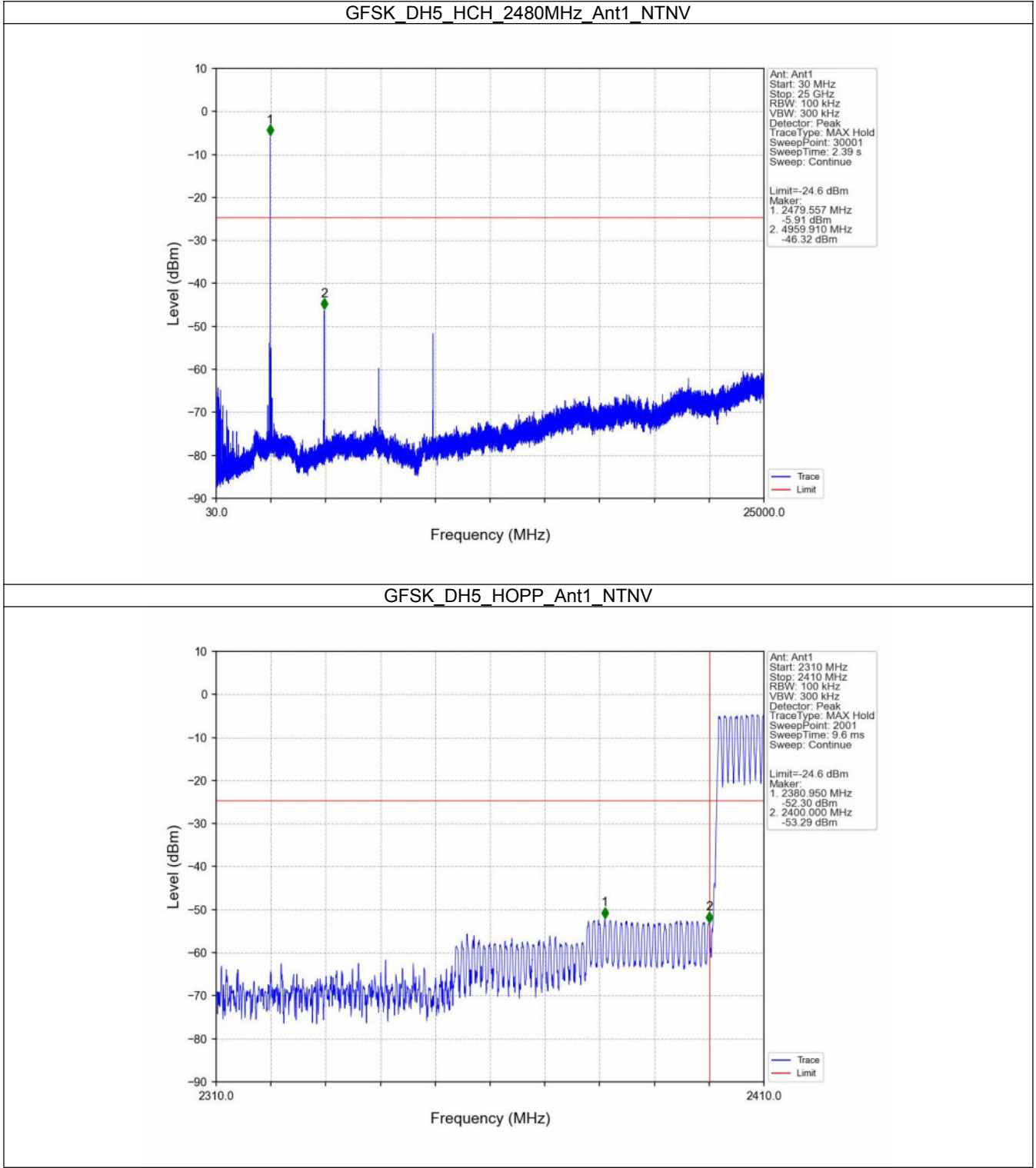
7.2.2 CSE



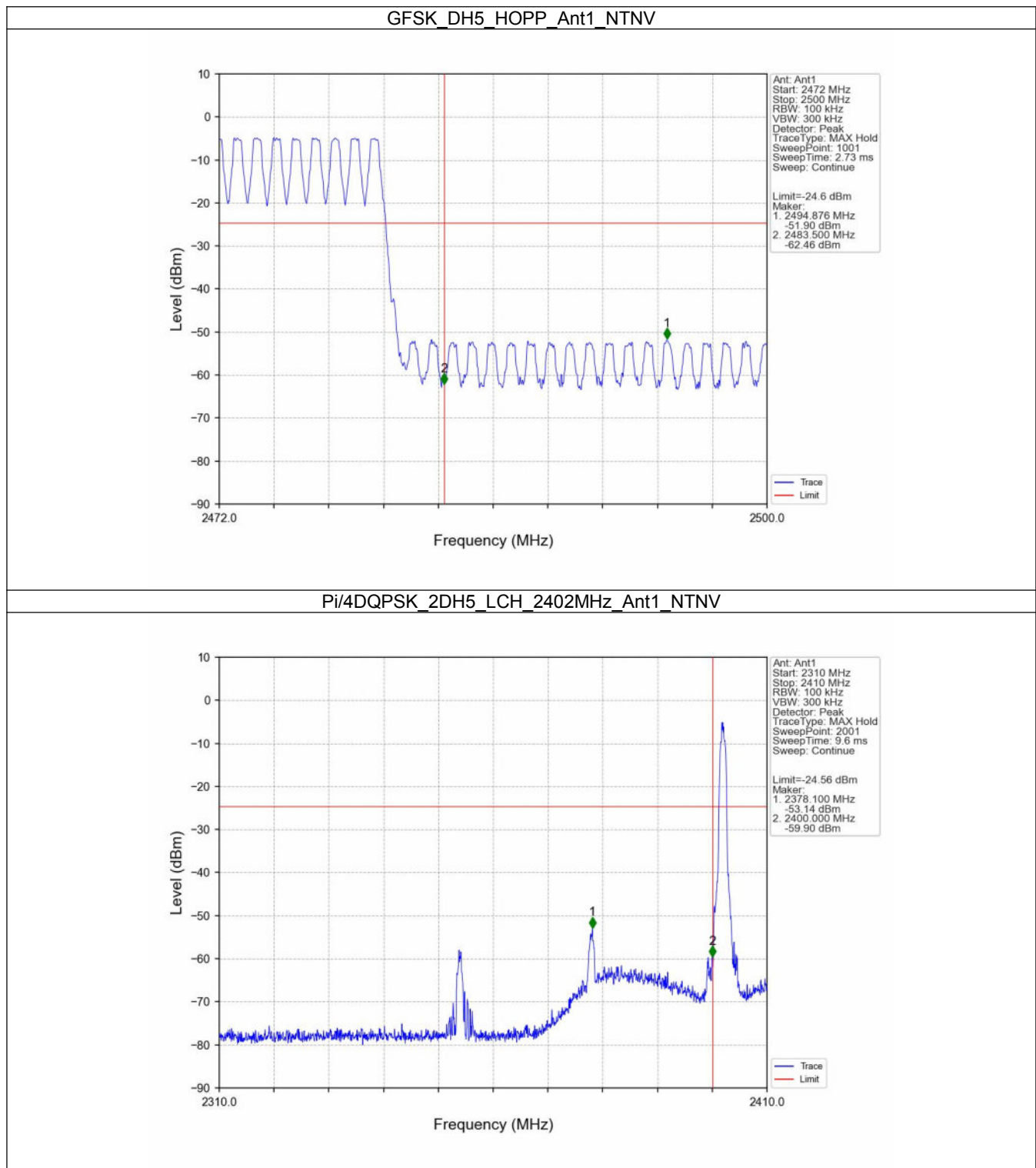
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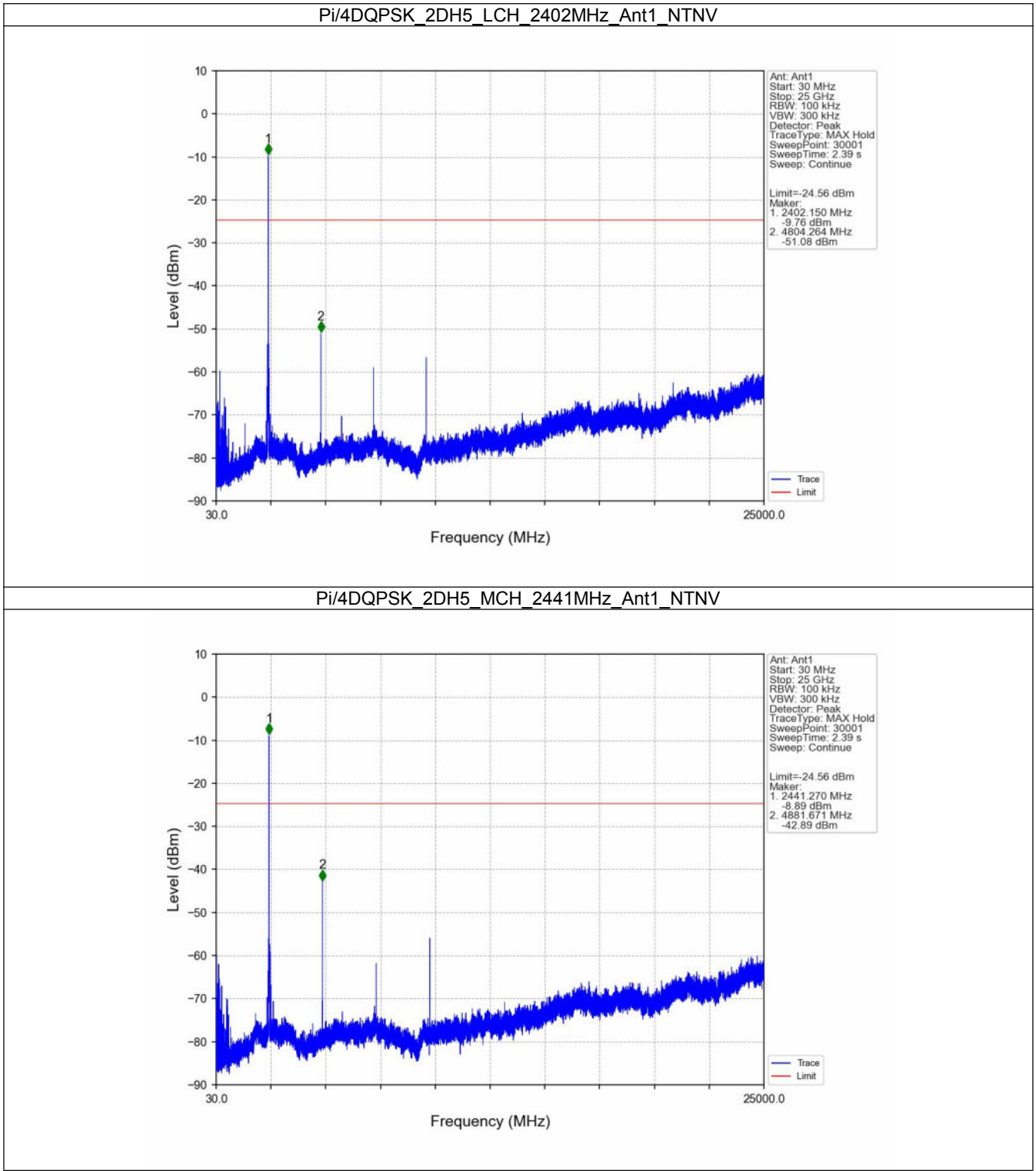
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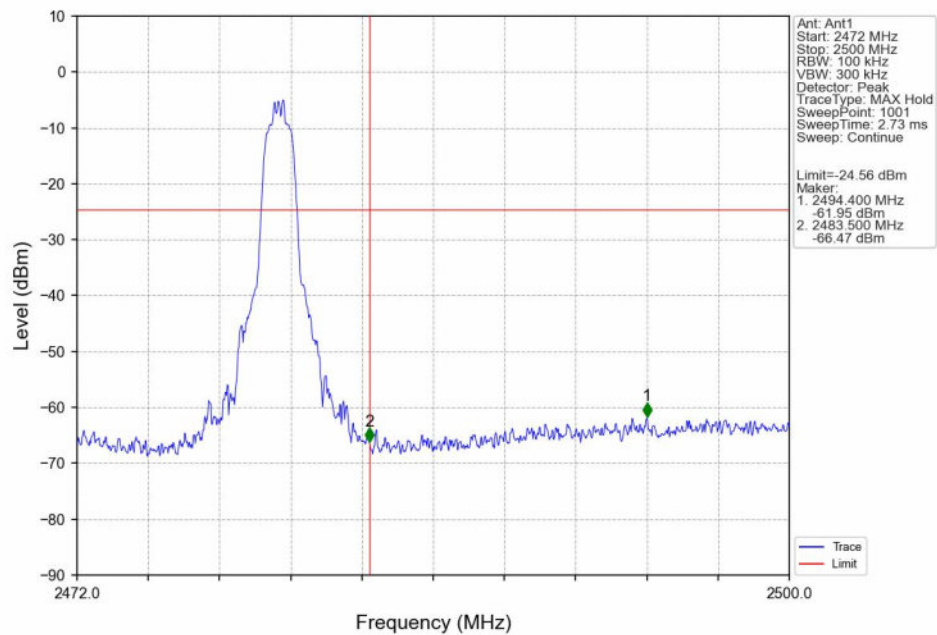


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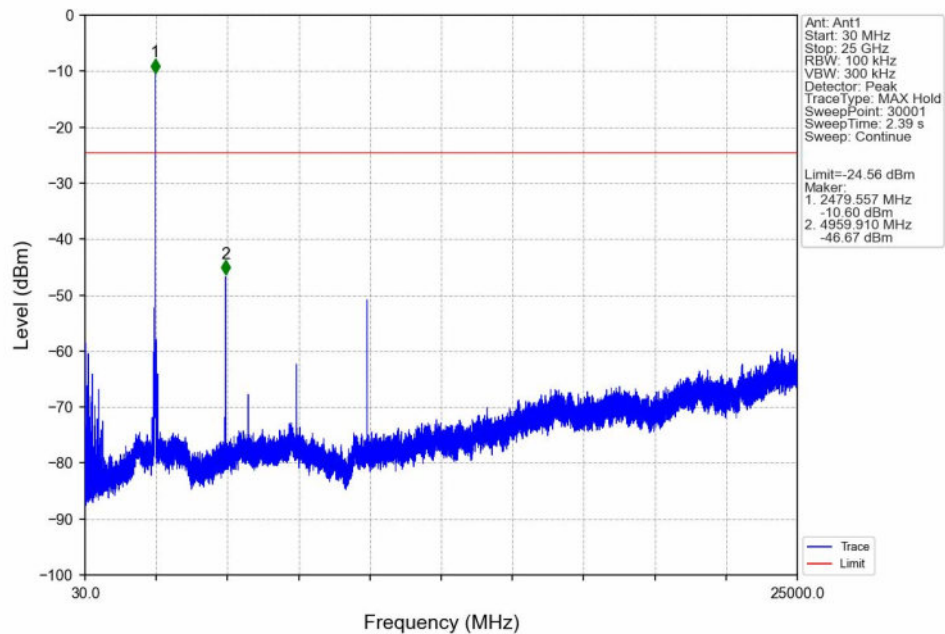


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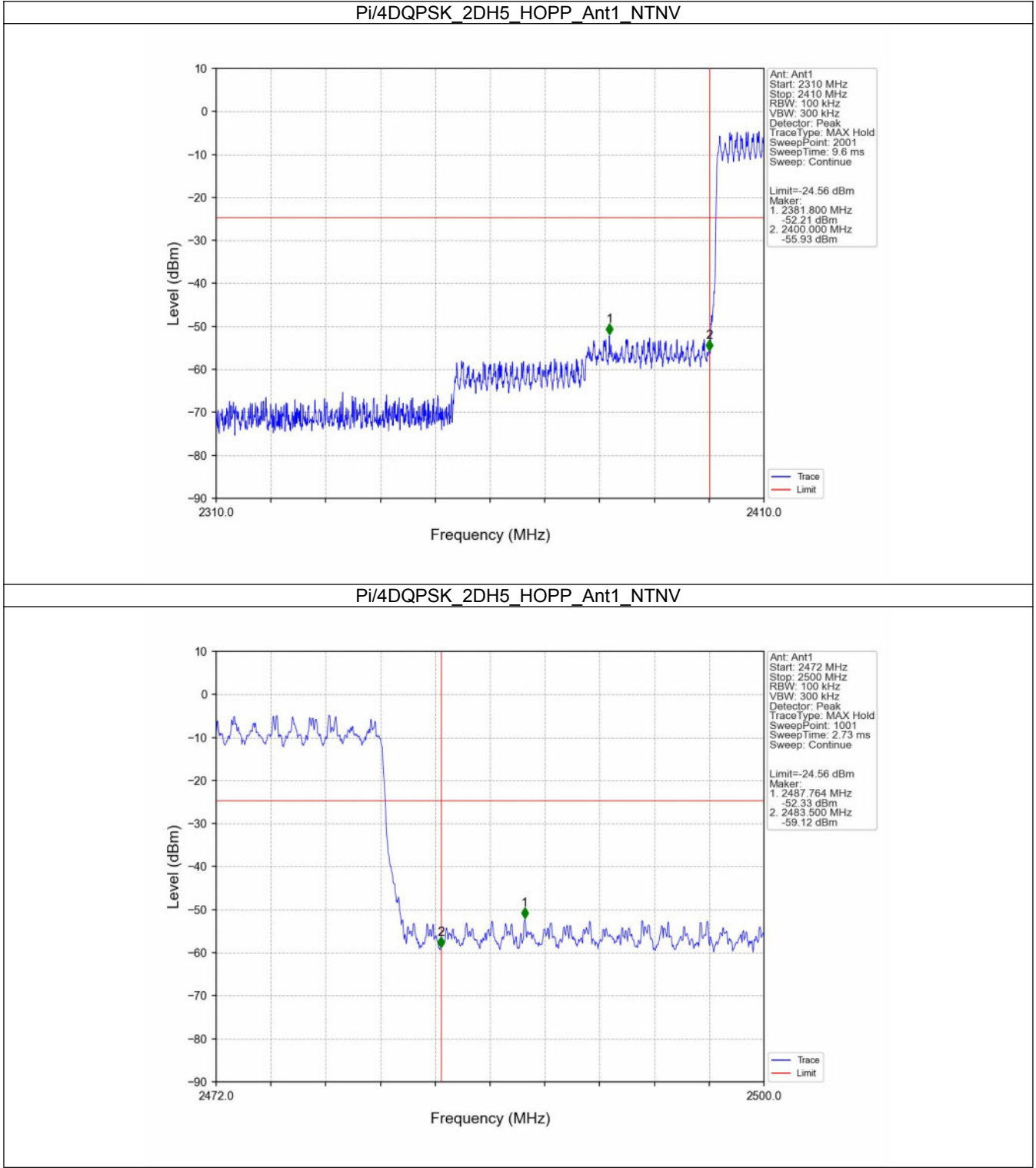
Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV



Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV

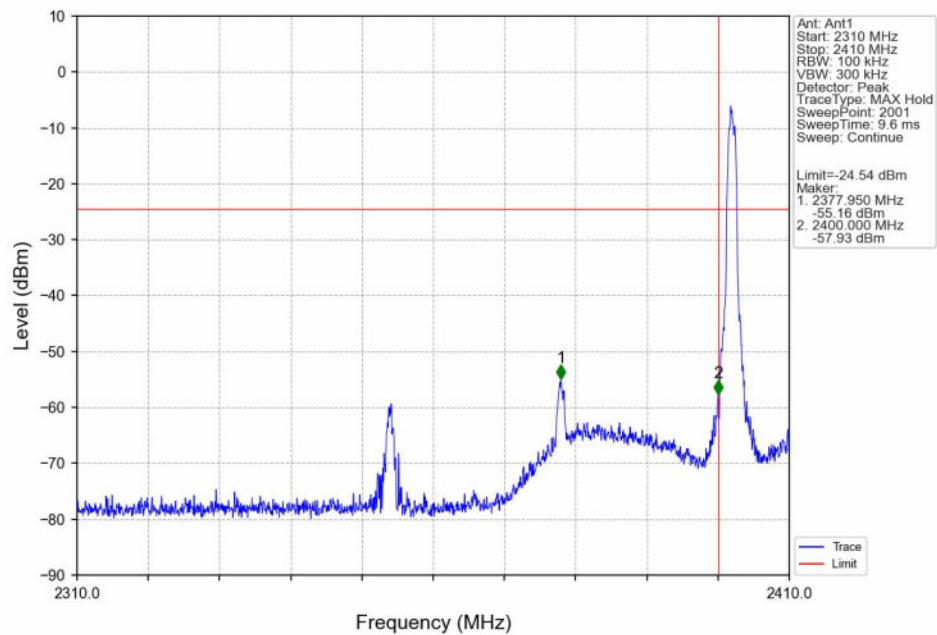


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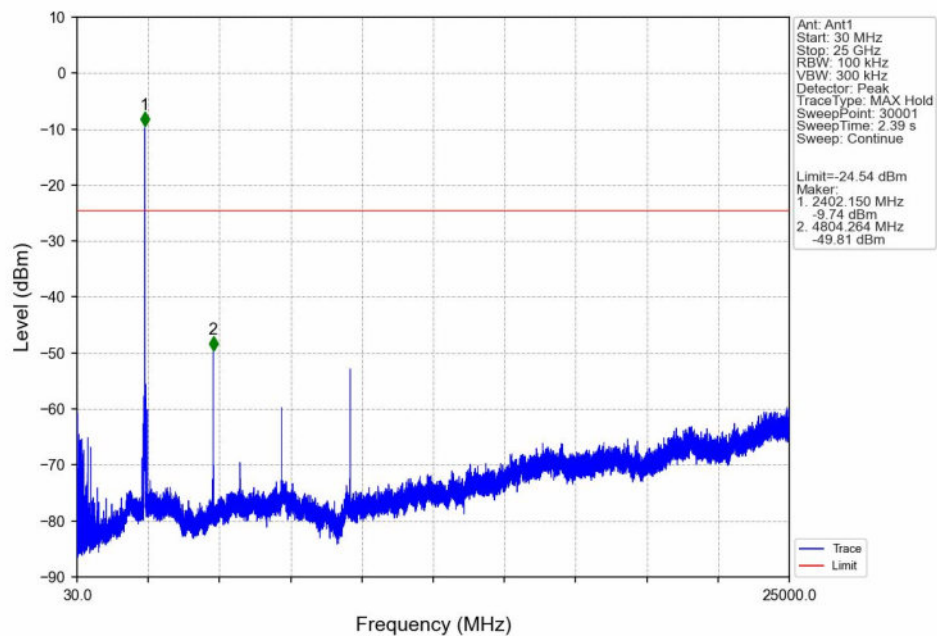


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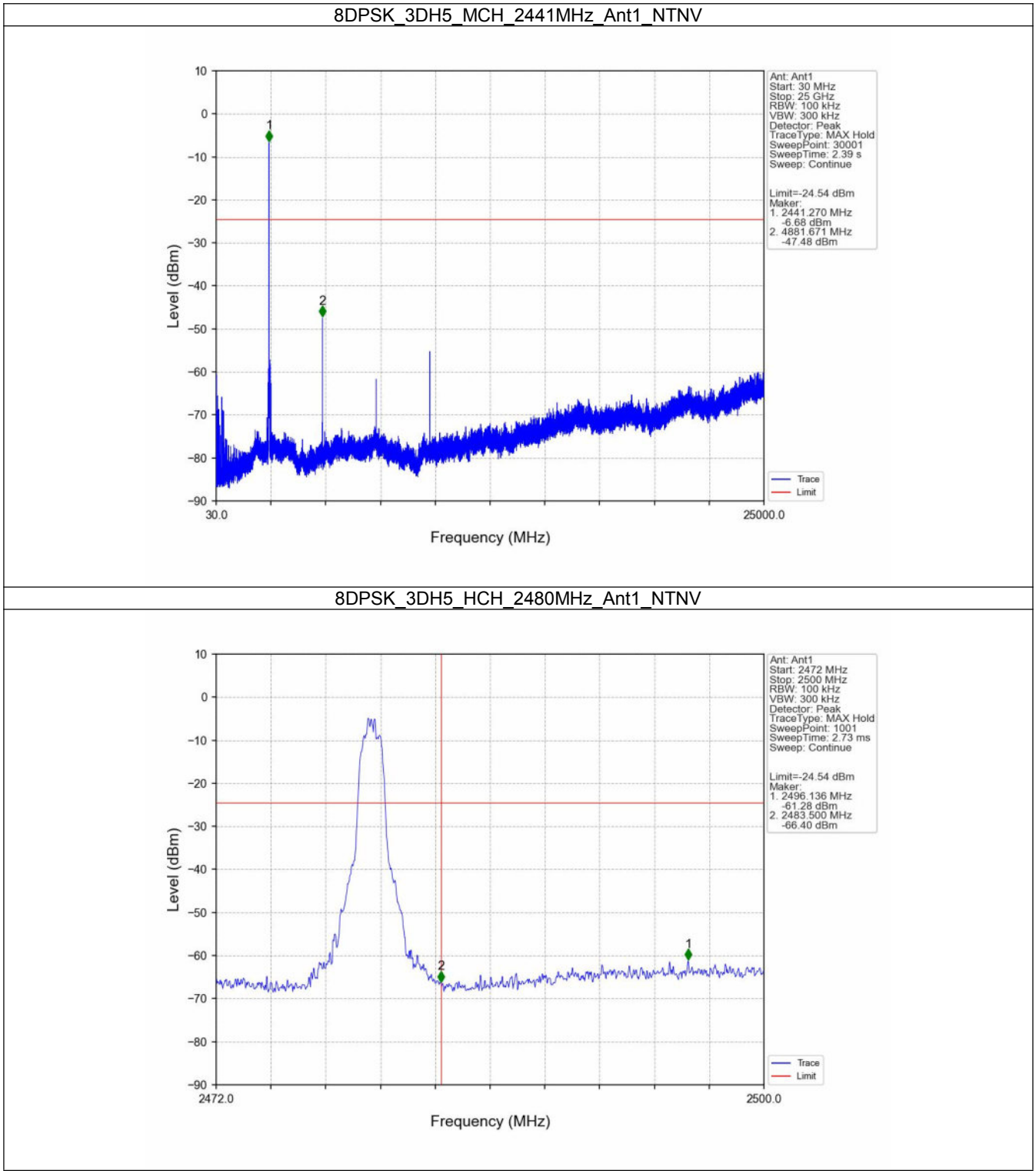
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



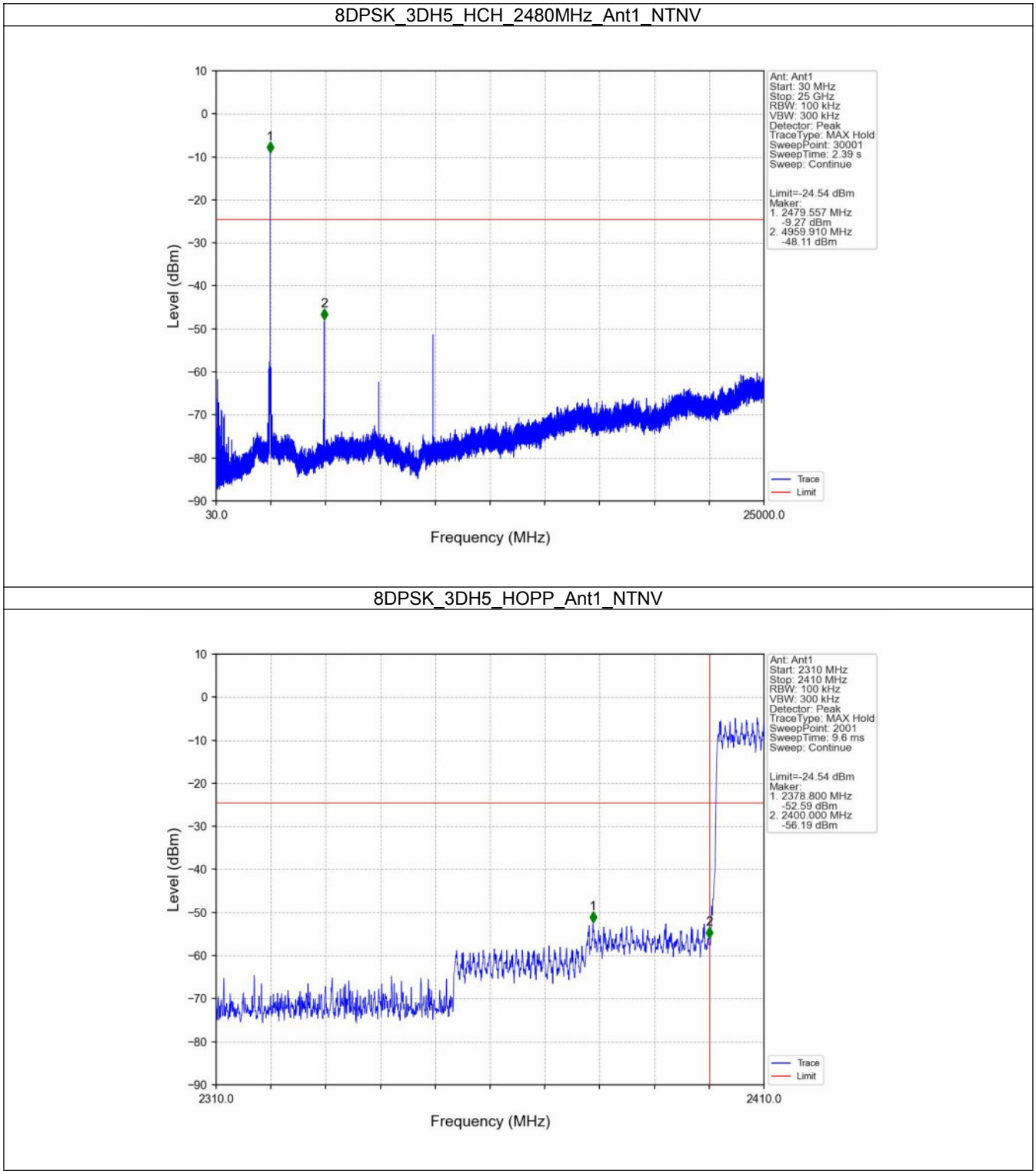
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



FCC ID: 2BRD8ZMHC-168



FCC ID: 2BRD8ZMHC-168



FCC ID: 2BRD8ZMHC-168

