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Annex for BT

Test Report No.: CTL2407117051-WF

TABLE OF CONTENTS

Annex for BT	1
1. Bandwidth	2
2. Maximum Conducted Output Power	13
3. Carrier Frequency Separation	19
4. Number of Hopping Frequencies	22
5. Time of Occupancy (Dwell Time)	25
6. Unwanted Emissions In Non-restricted Frequency Bands	35

FCC ID: 2BHFP-RUMBLE

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	0.892	/	Pass
		2441	DH5	1	0.904	/	Pass
		2480	DH5	1	0.912	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.182	/	Pass
		2441	2DH5	1	1.188	/	Pass
		2480	2DH5	1	1.191	/	Pass
8DPSK	SISO	2402	3DH5	1	1.189	/	Pass
		2441	3DH5	1	1.195	/	Pass
		2480	3DH5	1	1.196	/	Pass

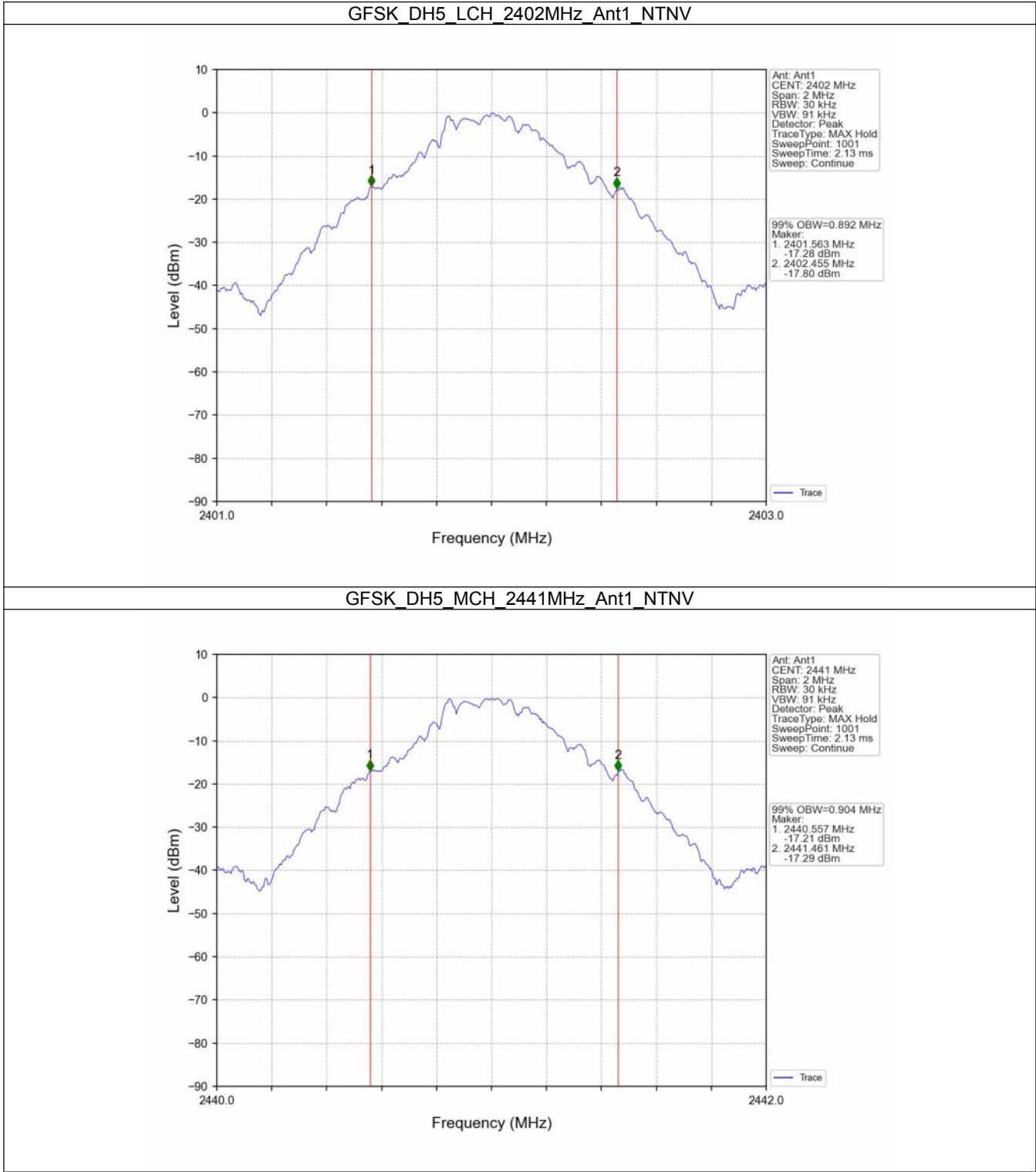
1.1.2 20dB BW

Mode	TX Type	Frequency (MHz)	Packet Type	ANT	20dB Bandwidth (MHz)		Verdict
					Result	Limit	
GFSK	SISO	2402	DH5	1	1.015	/	Pass
		2441	DH5	1	1.031	/	Pass
		2480	DH5	1	1.039	/	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	1.295	/	Pass
		2441	2DH5	1	1.320	/	Pass
		2480	2DH5	1	1.323	/	Pass
8DPSK	SISO	2402	3DH5	1	1.317	/	Pass
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		2480	3DH5	1	1.319	/	Pass

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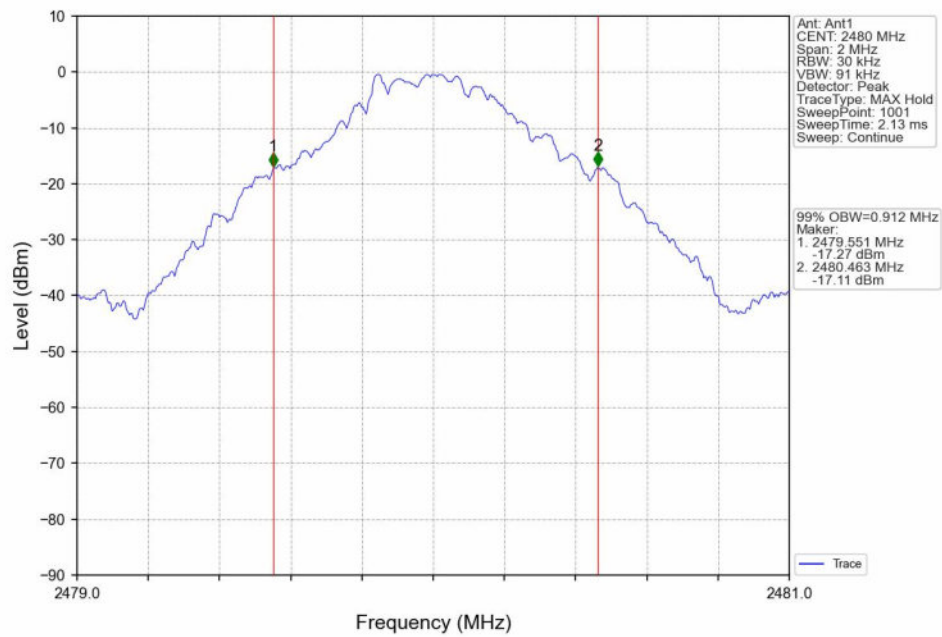
1.2 Test Graph

1.2.1 OBW

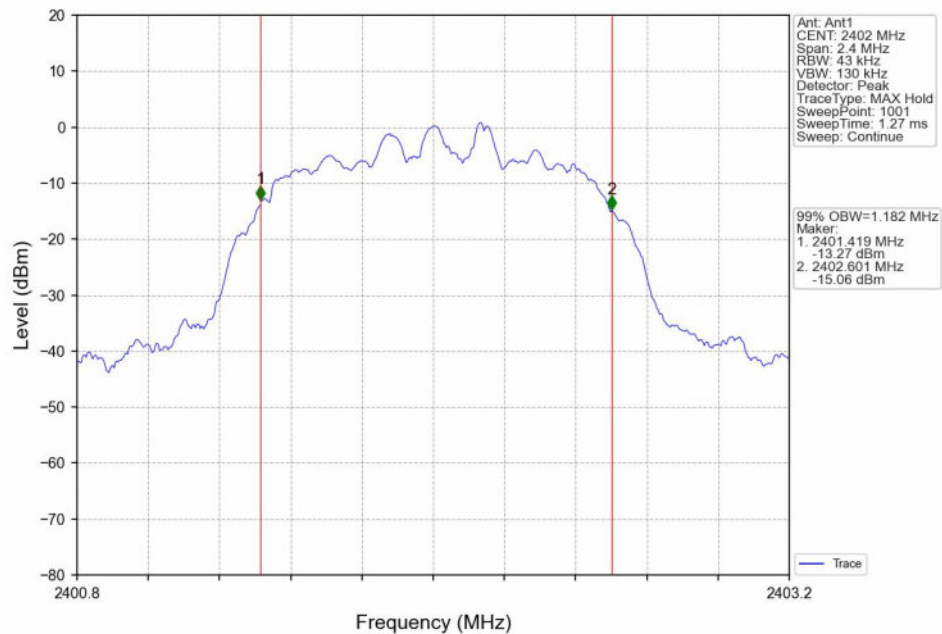


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GFSK_DH5_HCH_2480MHz_Ant1_NTNV

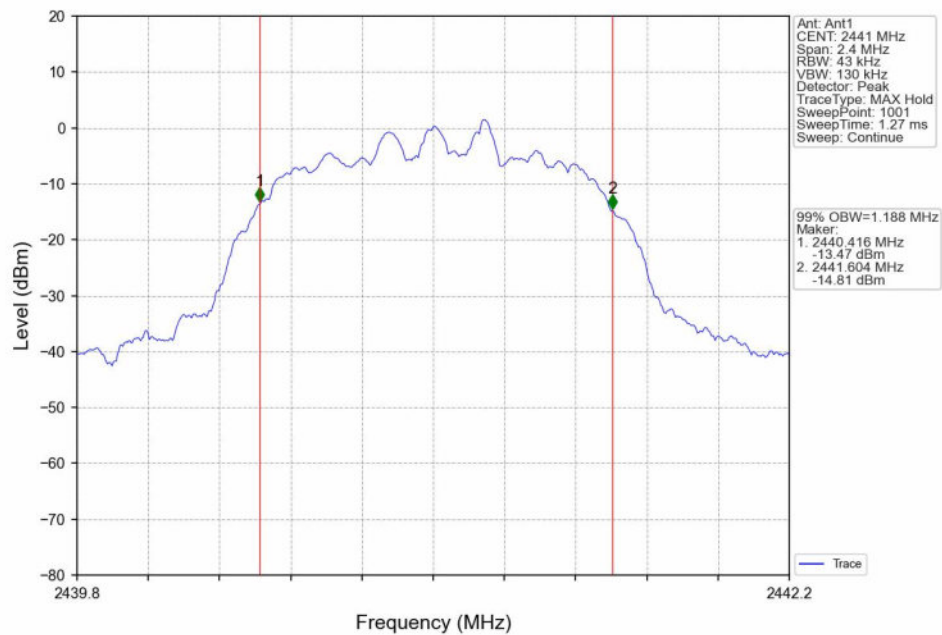


Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV

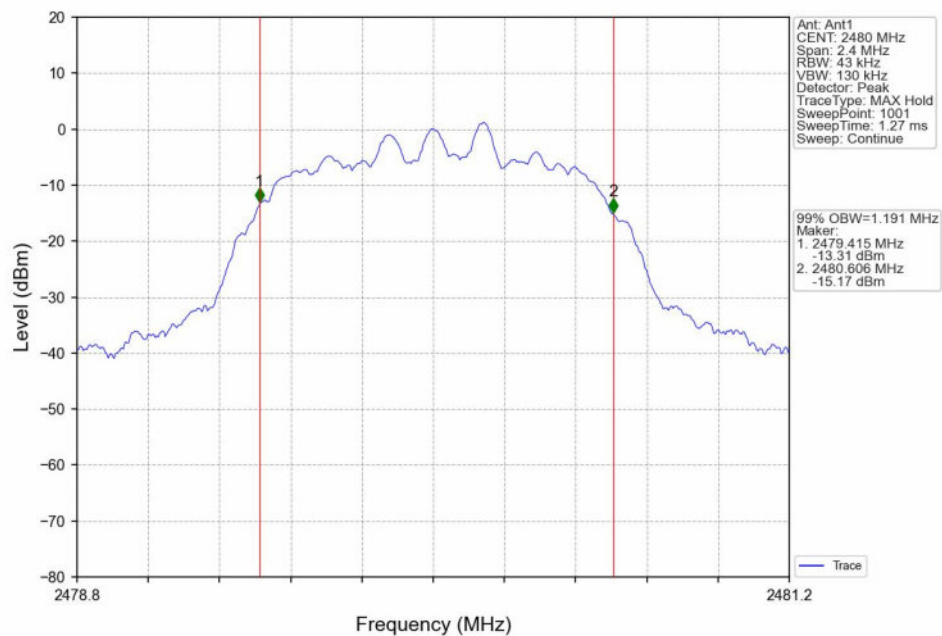


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Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV

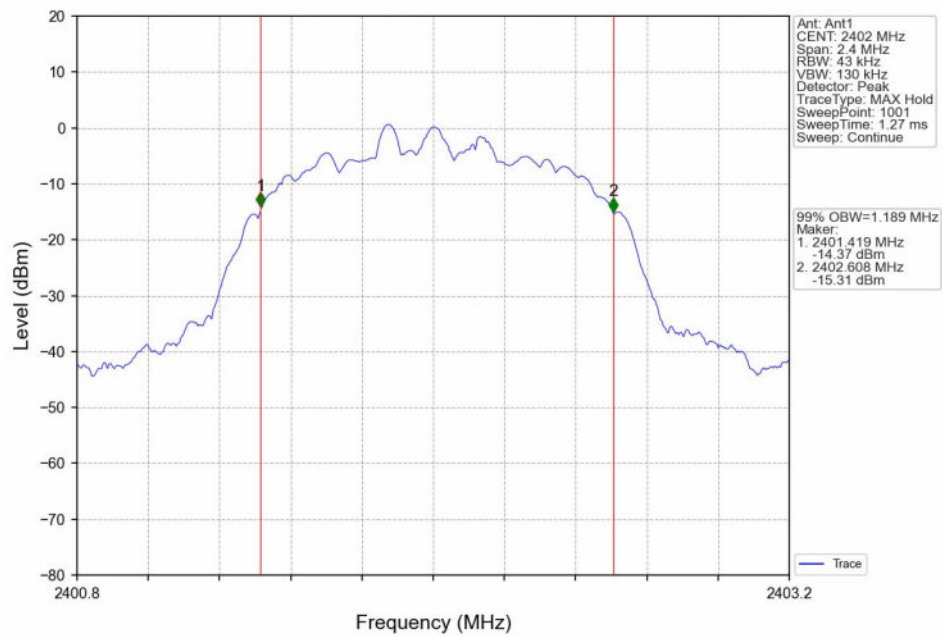


Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV

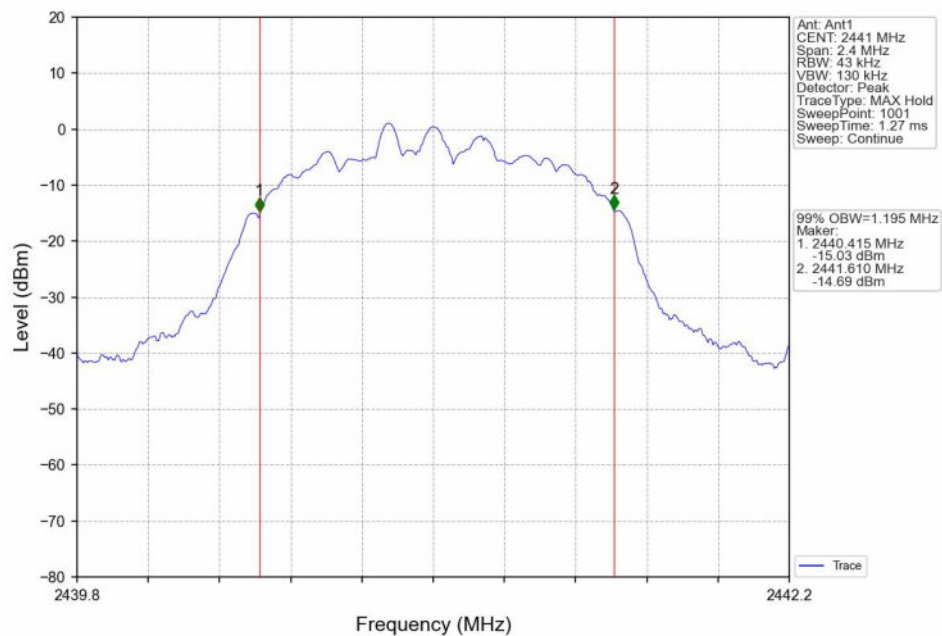


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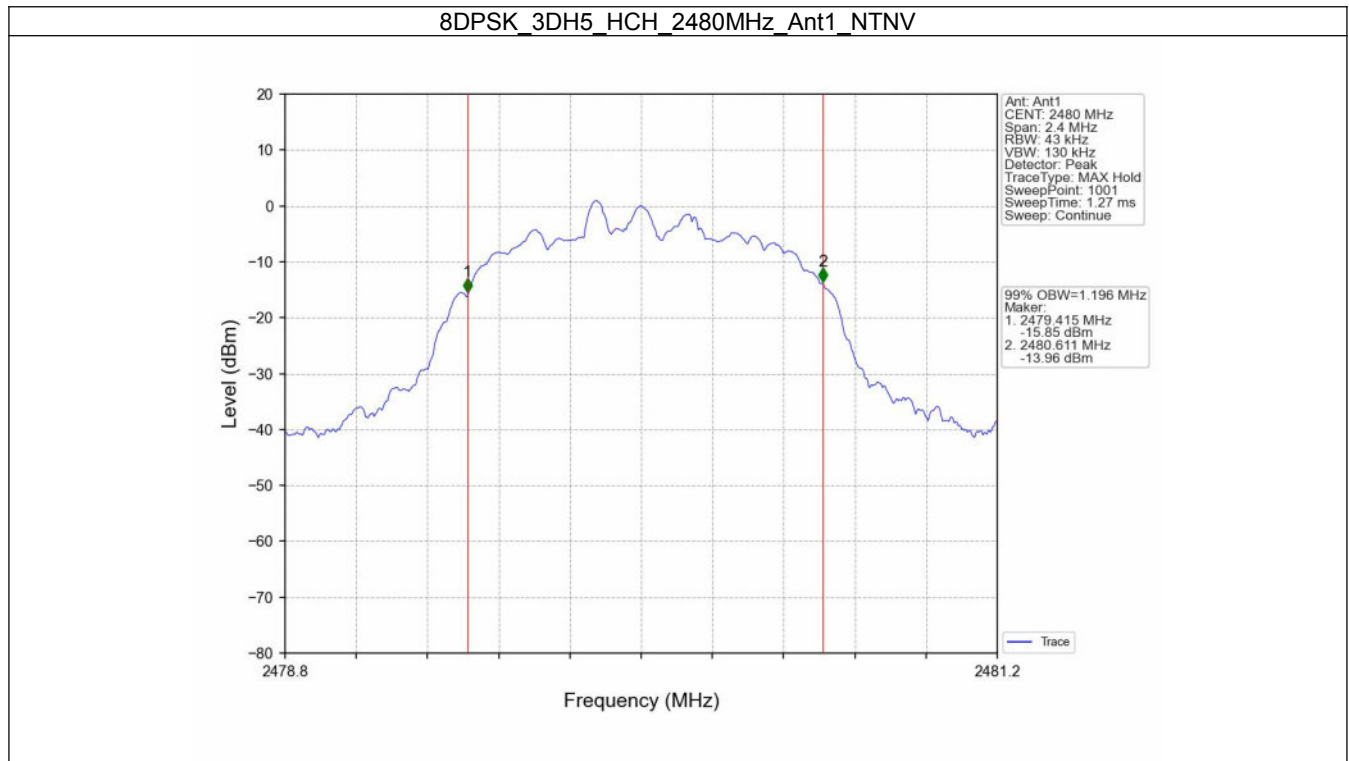
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV

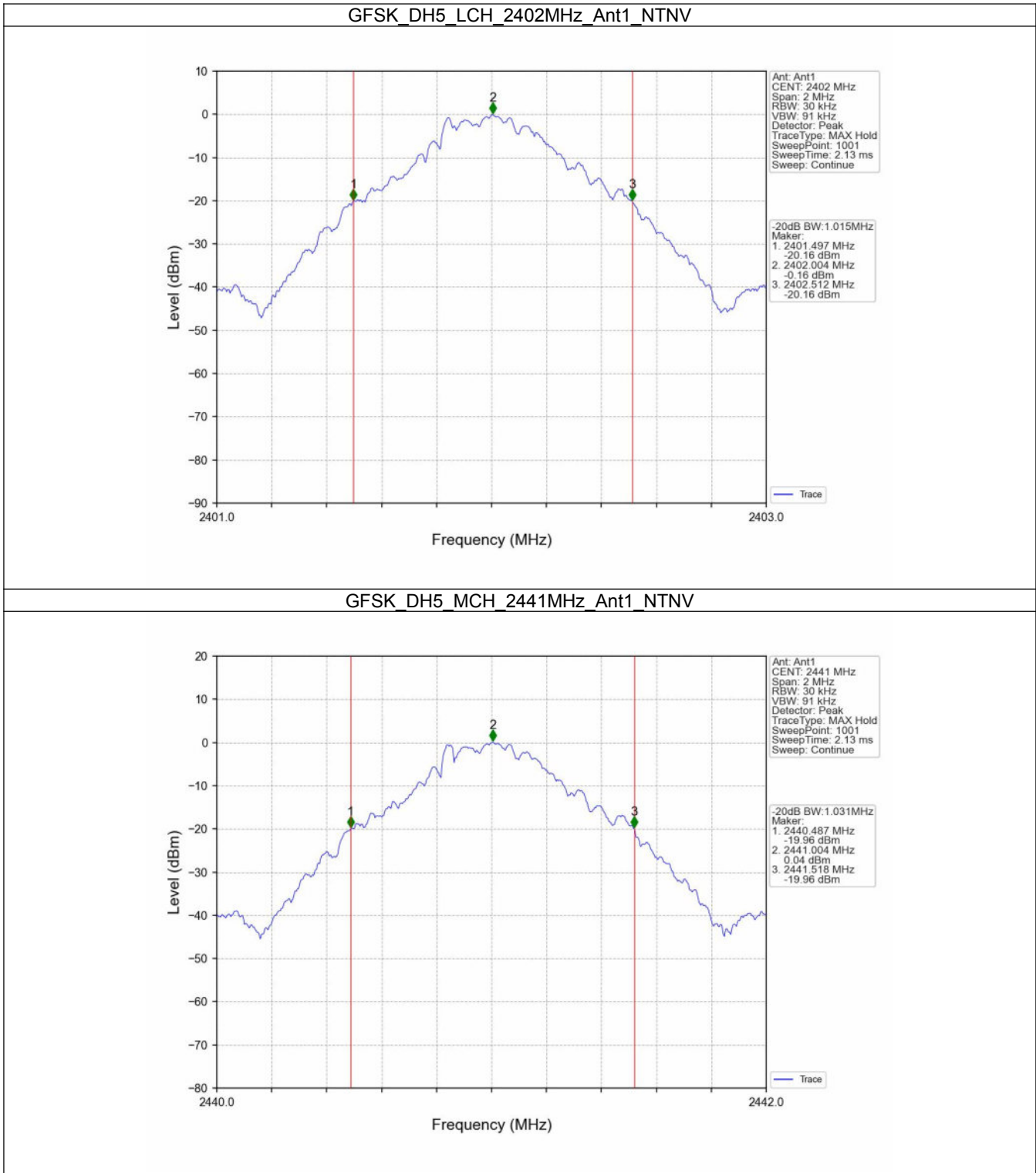


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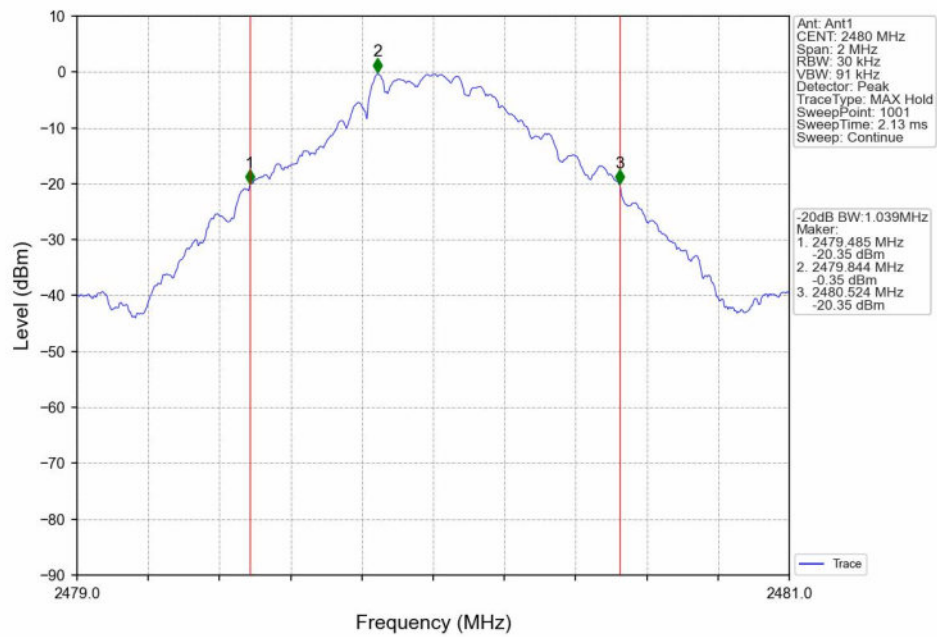
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1.2.2 20dB BW

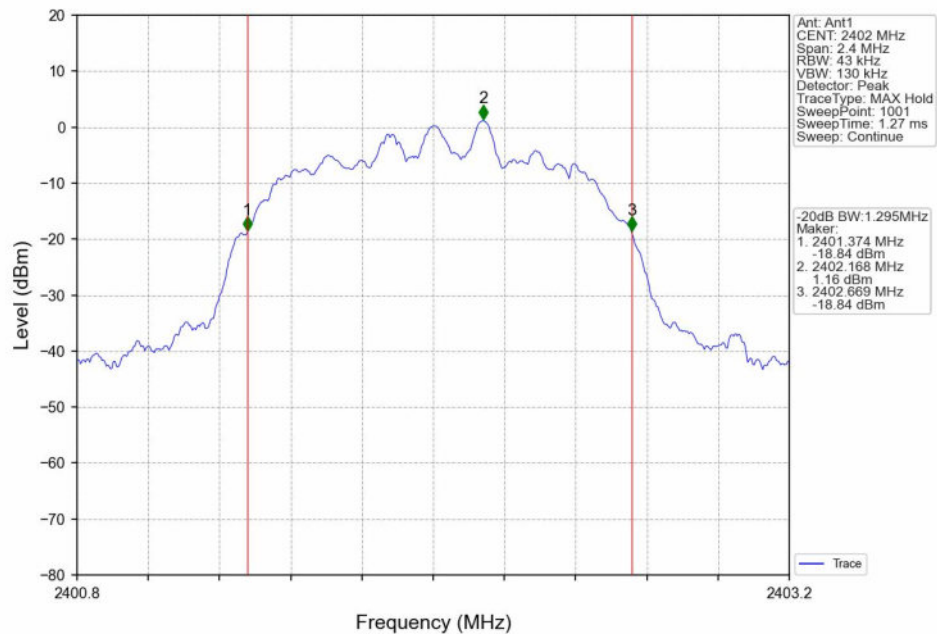


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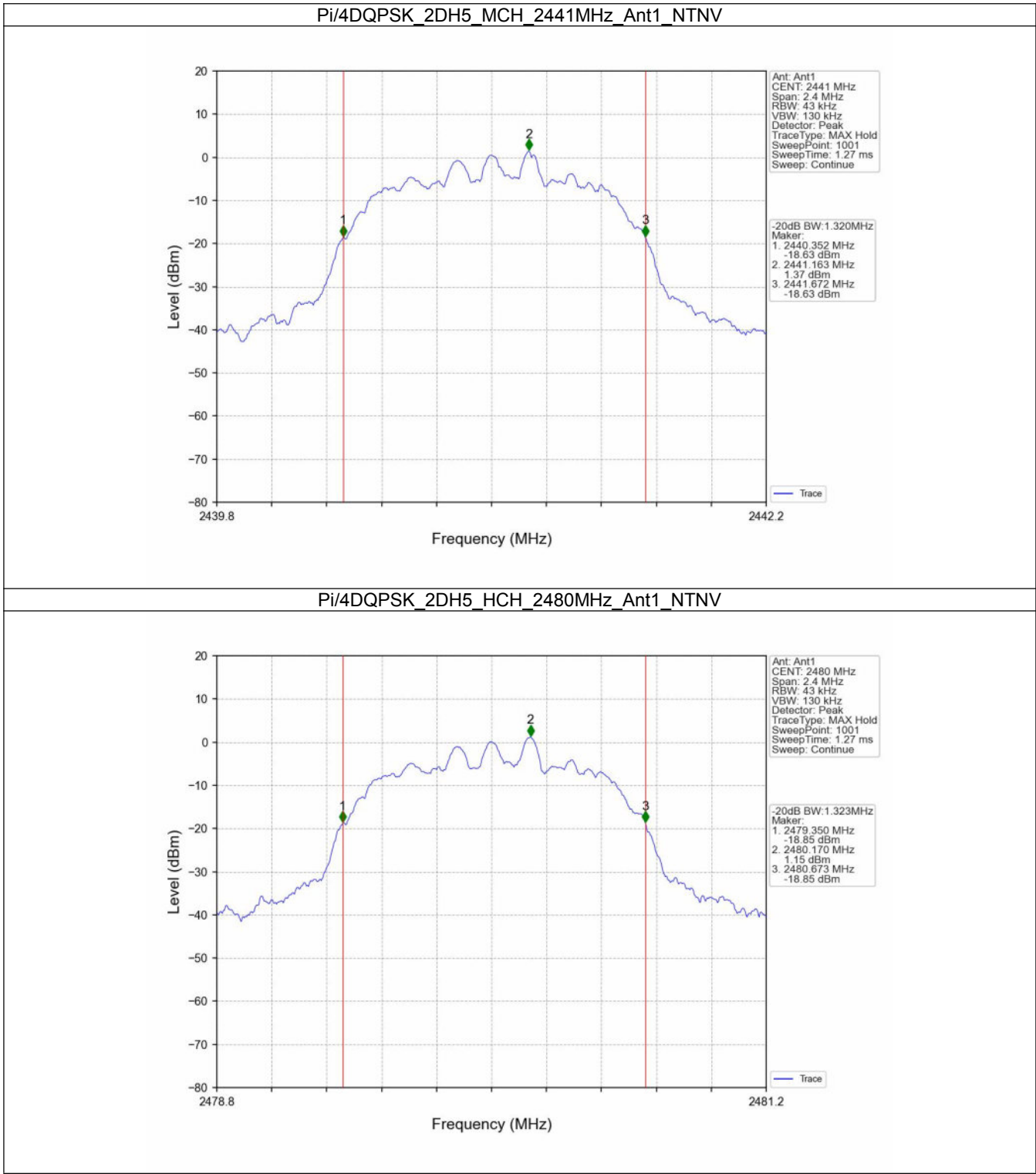
GFSK_DH5_HCH_2480MHz_Ant1_NTNV



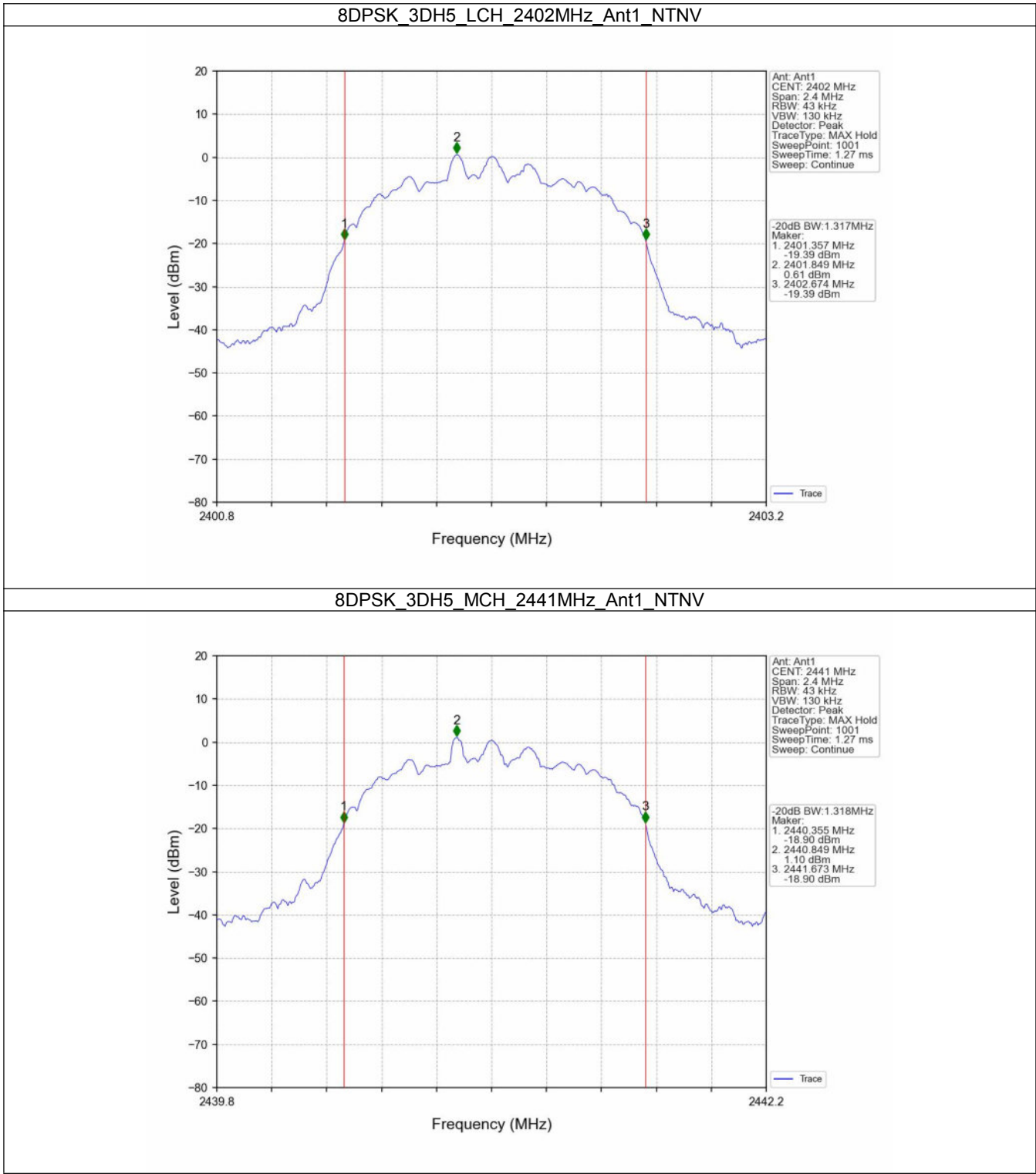
Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV



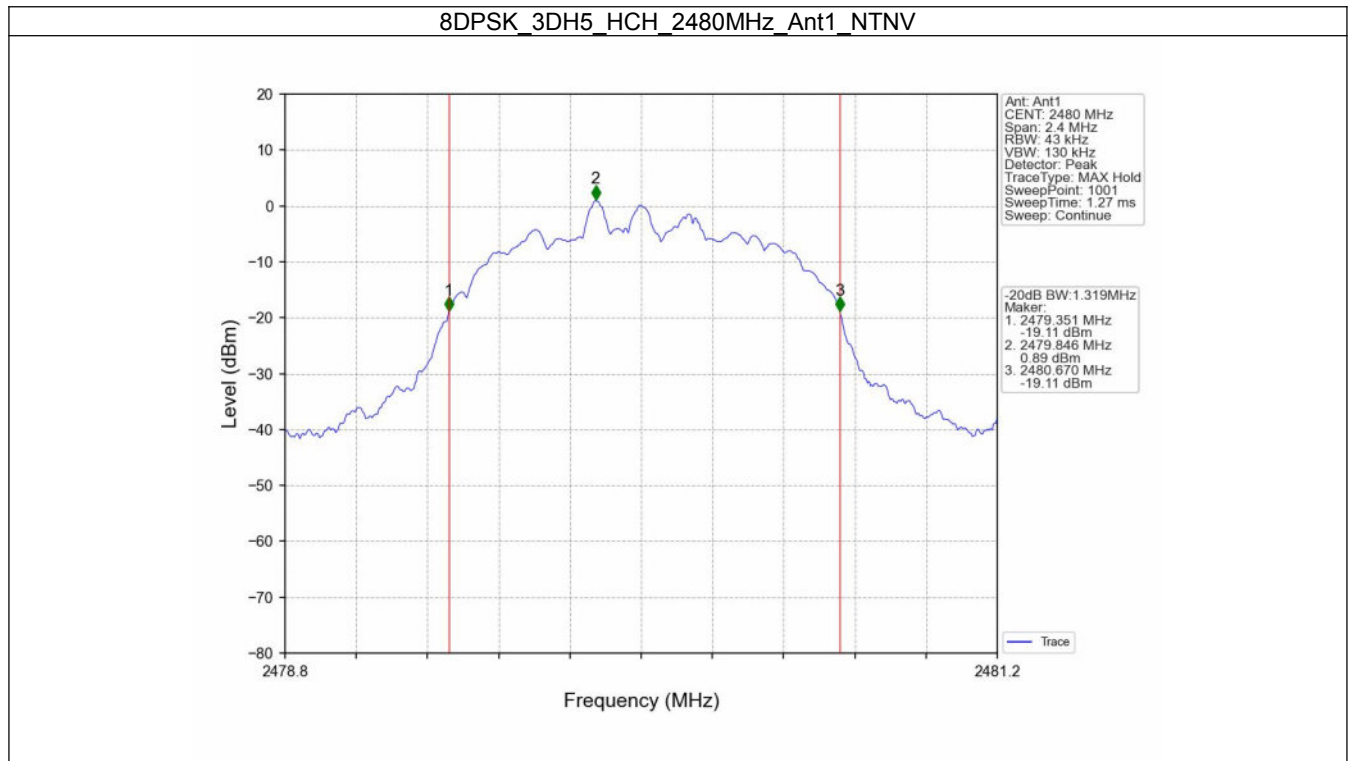
FCC ID: 2BHFP-RUMBLE



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2. Maximum Conducted Output Power

2.1 Test Result

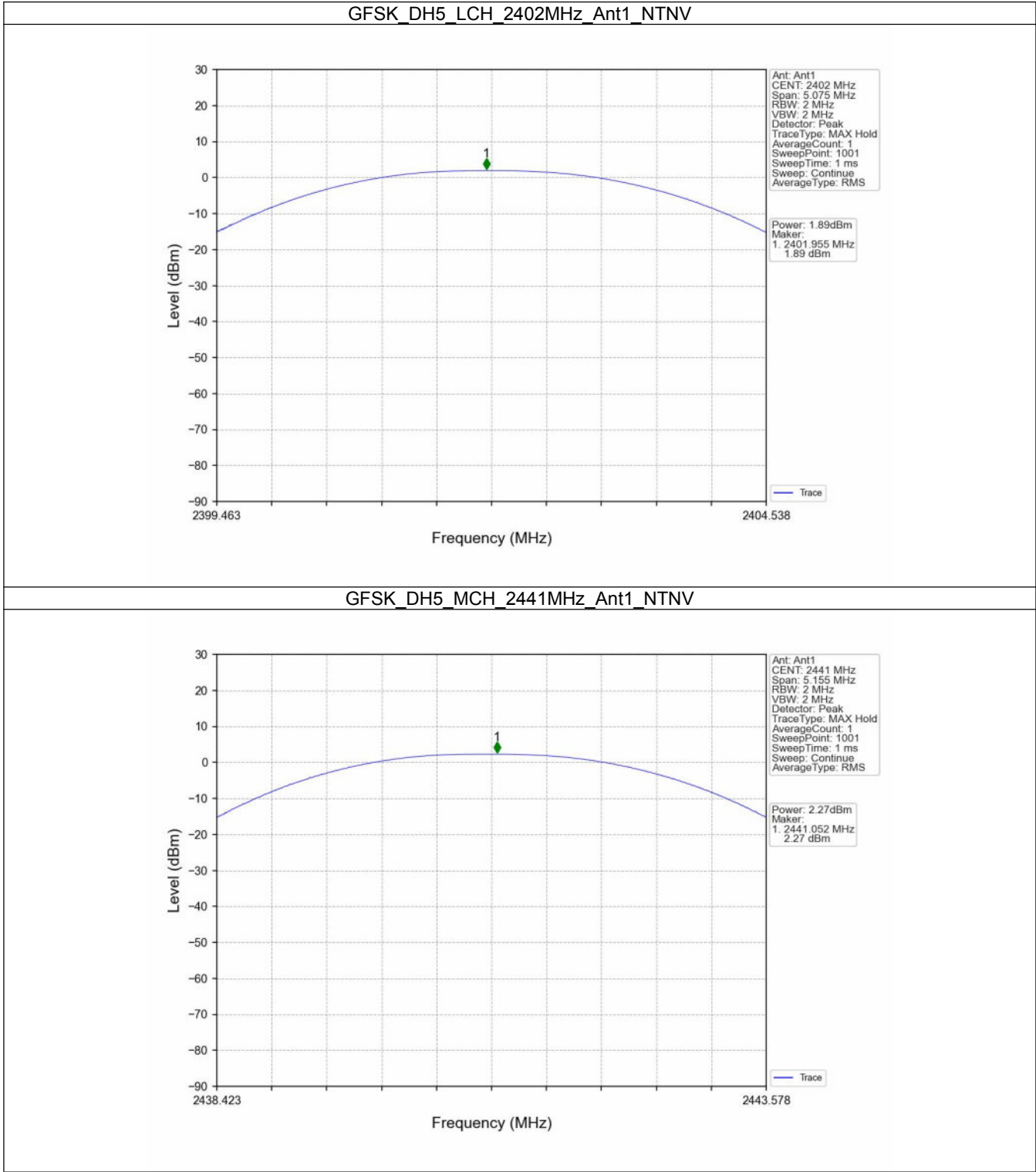
2.1.1 Power

Mode	TX Type	Frequency (MHz)	Packet Type	Maximum Peak Conducted Output Power (dBm)		Verdict
				ANT1	Limit	
GFSK	SISO	2402	DH5	1.89	<=20.97	Pass
		2441	DH5	2.27	<=20.97	Pass
		2480	DH5	2.05	<=20.97	Pass
Pi/4DQPSK	SISO	2402	2DH5	2.73	<=20.97	Pass
		2441	2DH5	3.11	<=20.97	Pass
		2480	2DH5	2.83	<=20.97	Pass
8DPSK	SISO	2402	3DH5	3.07	<=20.97	Pass
		2441	3DH5	3.50	<=20.97	Pass
		2480	3DH5	3.27	<=20.97	Pass
Note1: Antenna Gain: Ant1: 1.08dBi;						

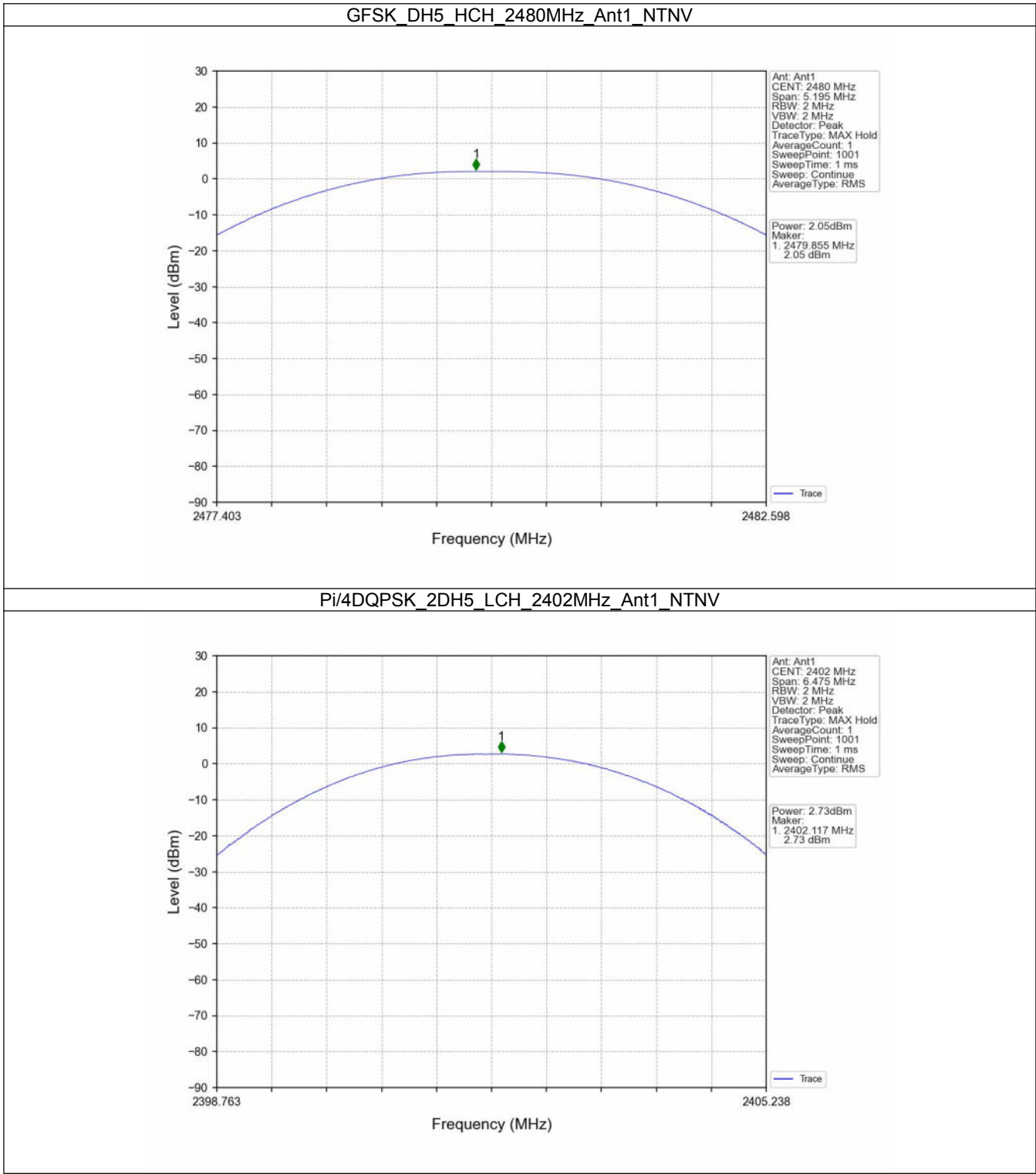
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2.2 Test Graph

2.2.1 Power

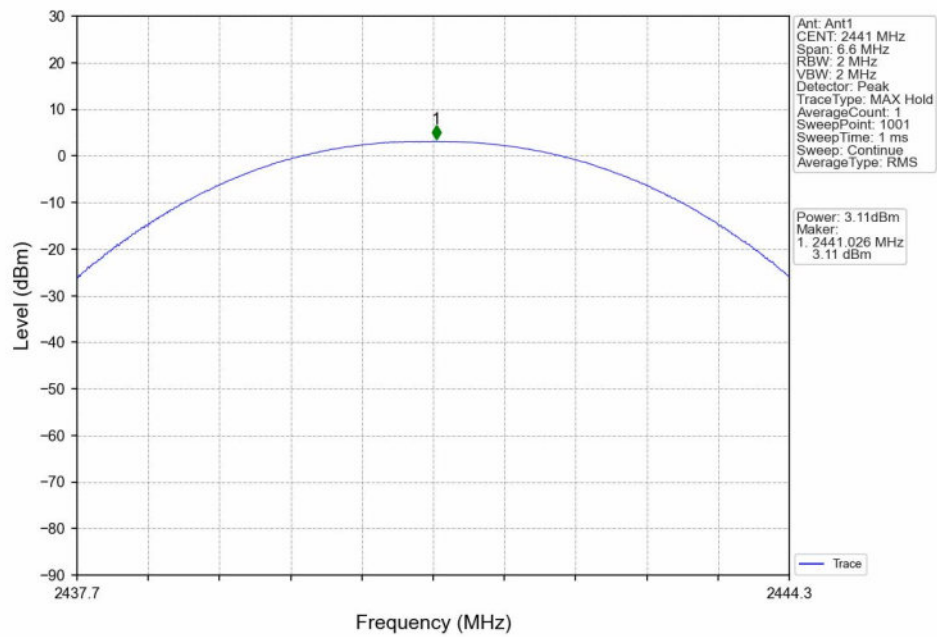


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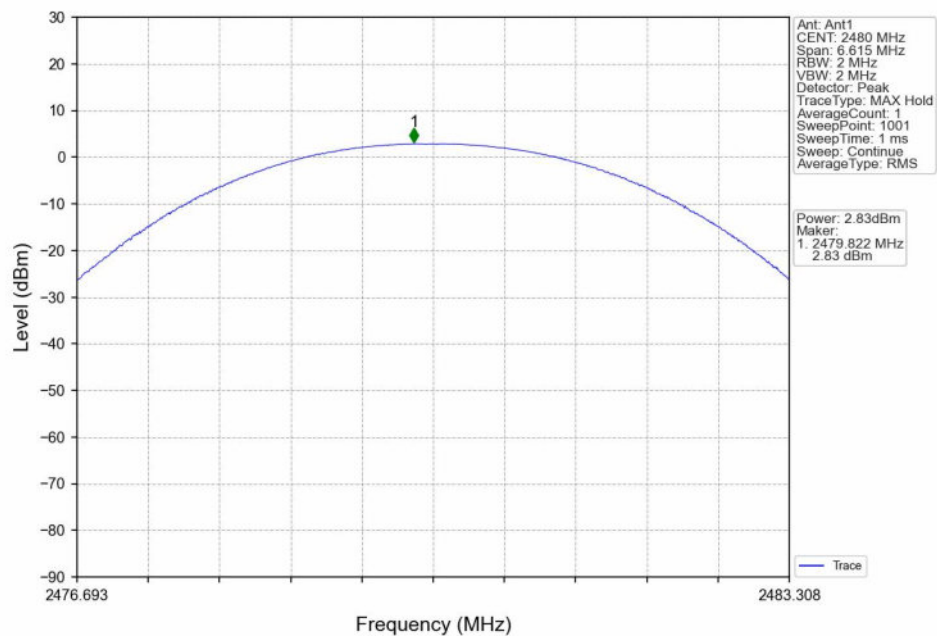


FCC ID: 2BHFP-RUMBLE

Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV

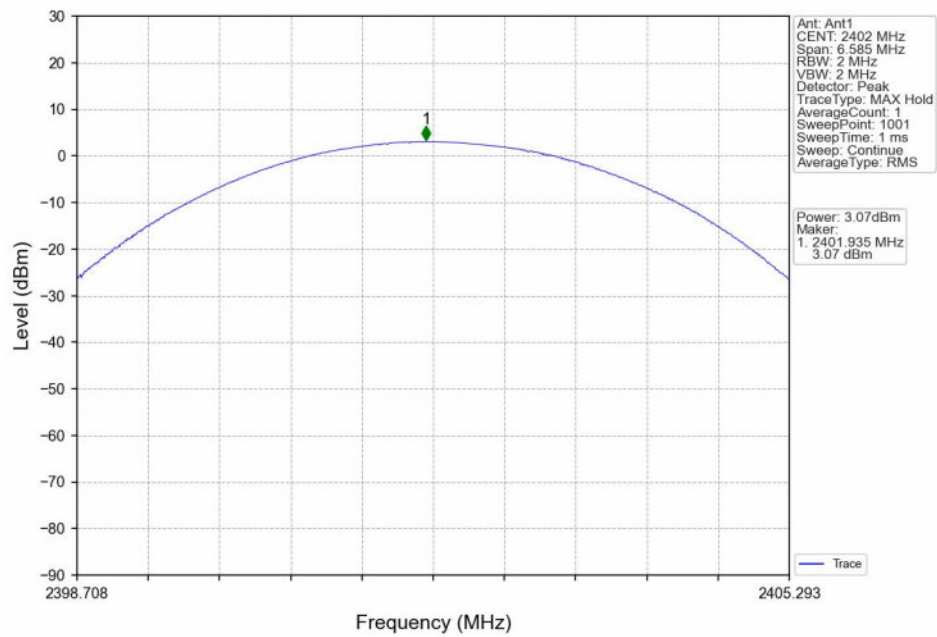


Pi/4DQPSK_2DH5_HCH_2480MHz_Ant1_NTNV

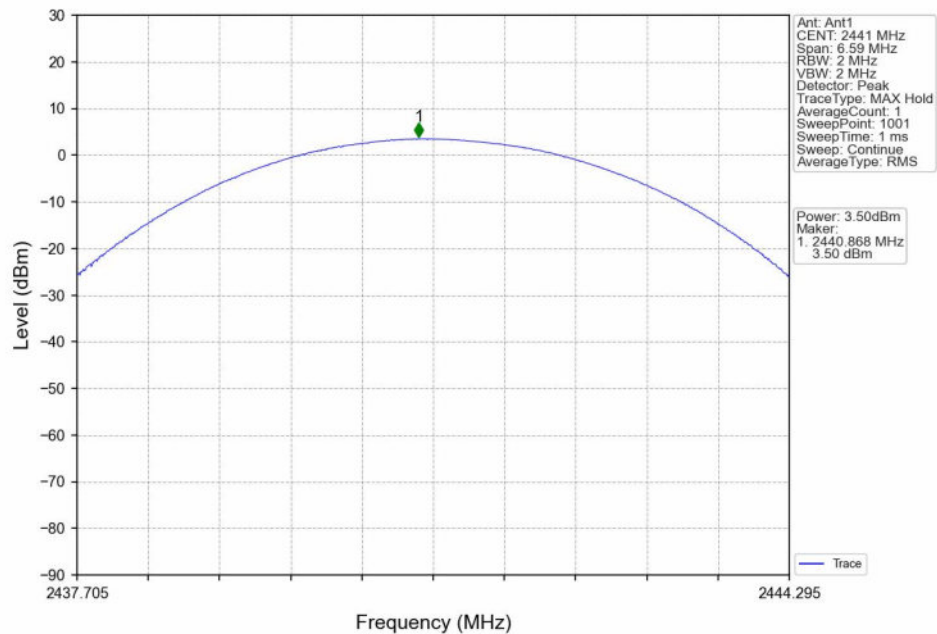


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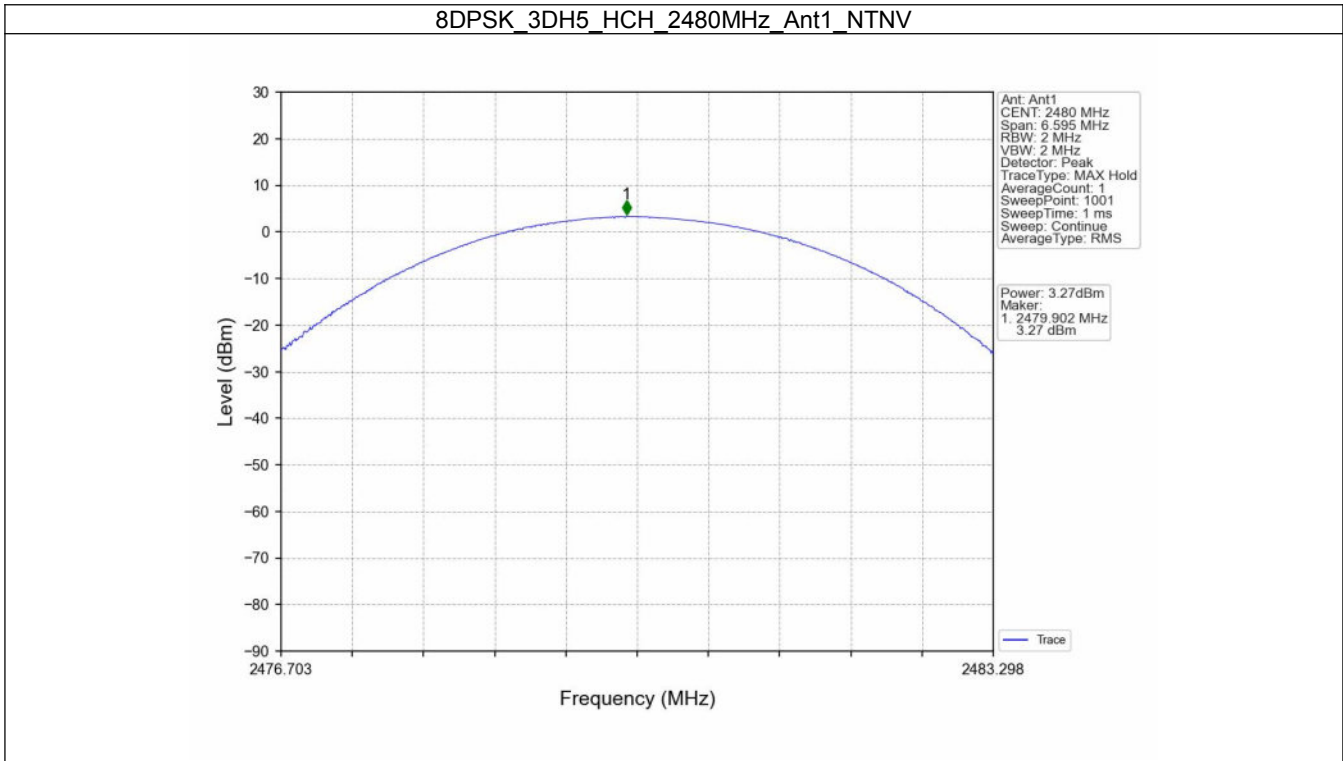
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV



FCC ID: 2BHFP-RUMBLE



FCC ID: 2BHFP-RUMBLE

3. Carrier Frequency Separation

3.1 Test Result

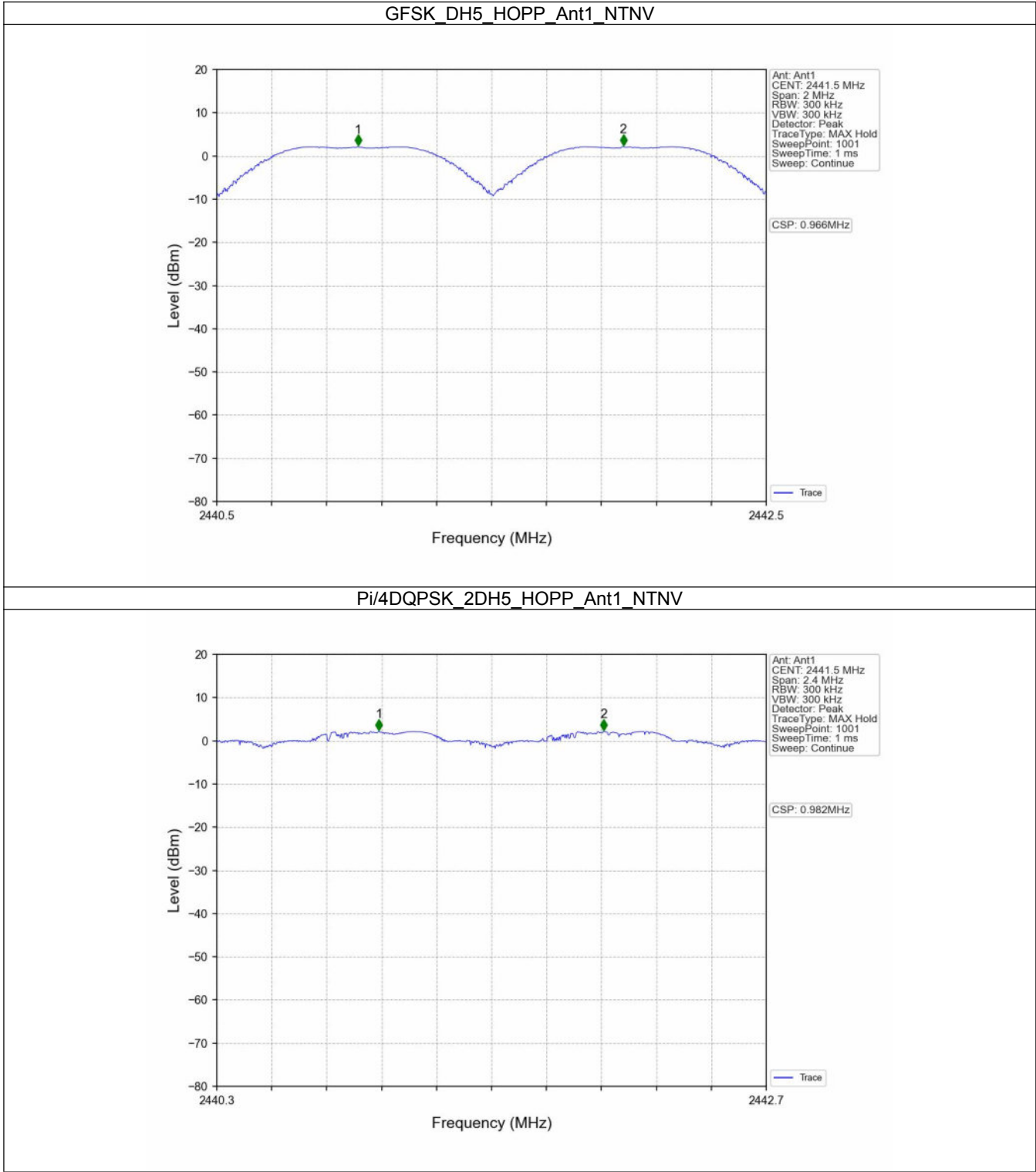
3.1.1 Ant1

Ant1							
Mode	TX Type	Frequency (MHz)	Packet Type	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict
GFSK	SISO	HOPP	DH5	0.966	1.039	≥ 0.693	Pass
Pi/4DQPSK	SISO	HOPP	2DH5	0.982	1.323	≥ 0.882	Pass
8DPSK	SISO	HOPP	3DH5	1.006	1.319	≥ 0.879	Pass

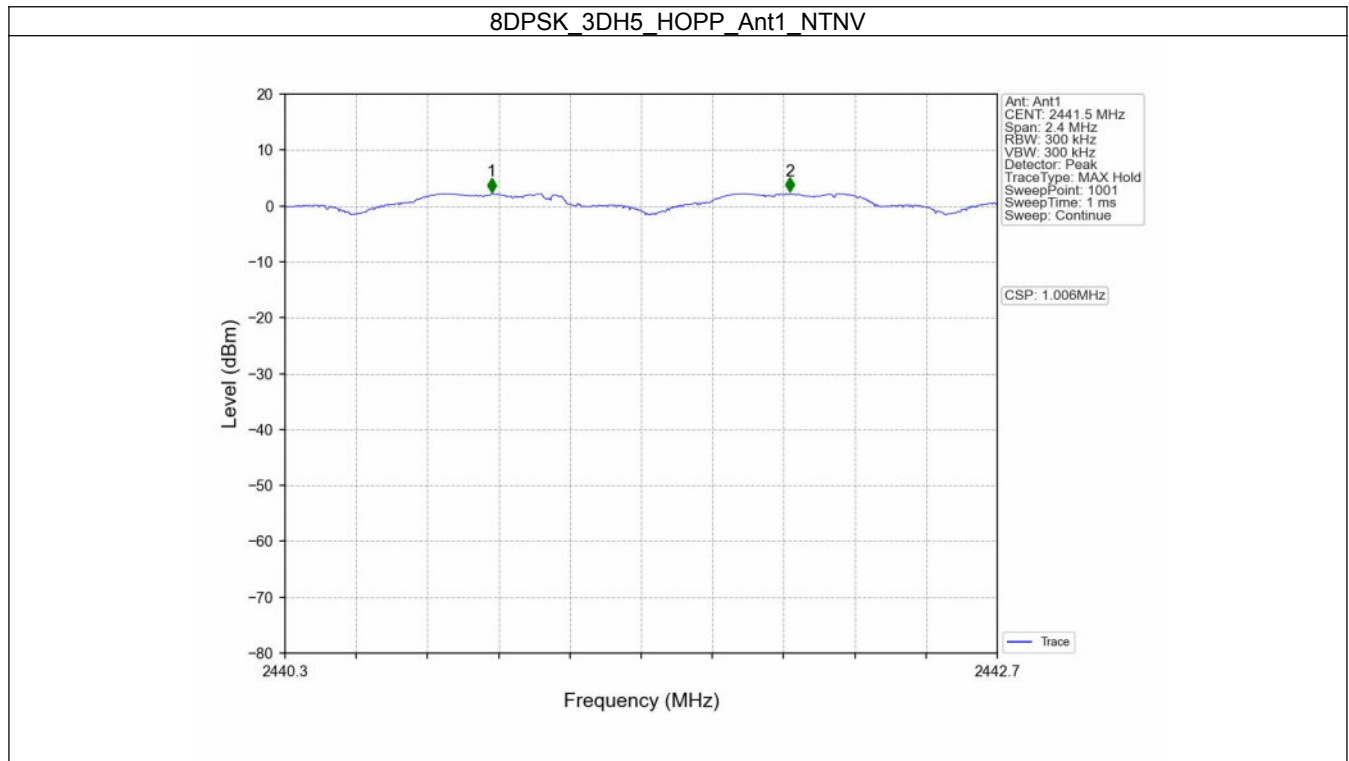
FCC ID: 2BHFP-RUMBLE

3.2 Test Graph

3.2.1 Ant1



FCC ID: 2BHFP-RUMBLE



FCC ID: 2BHFP-RUMBLE

4. Number of Hopping Frequencies

4.1 Test Result

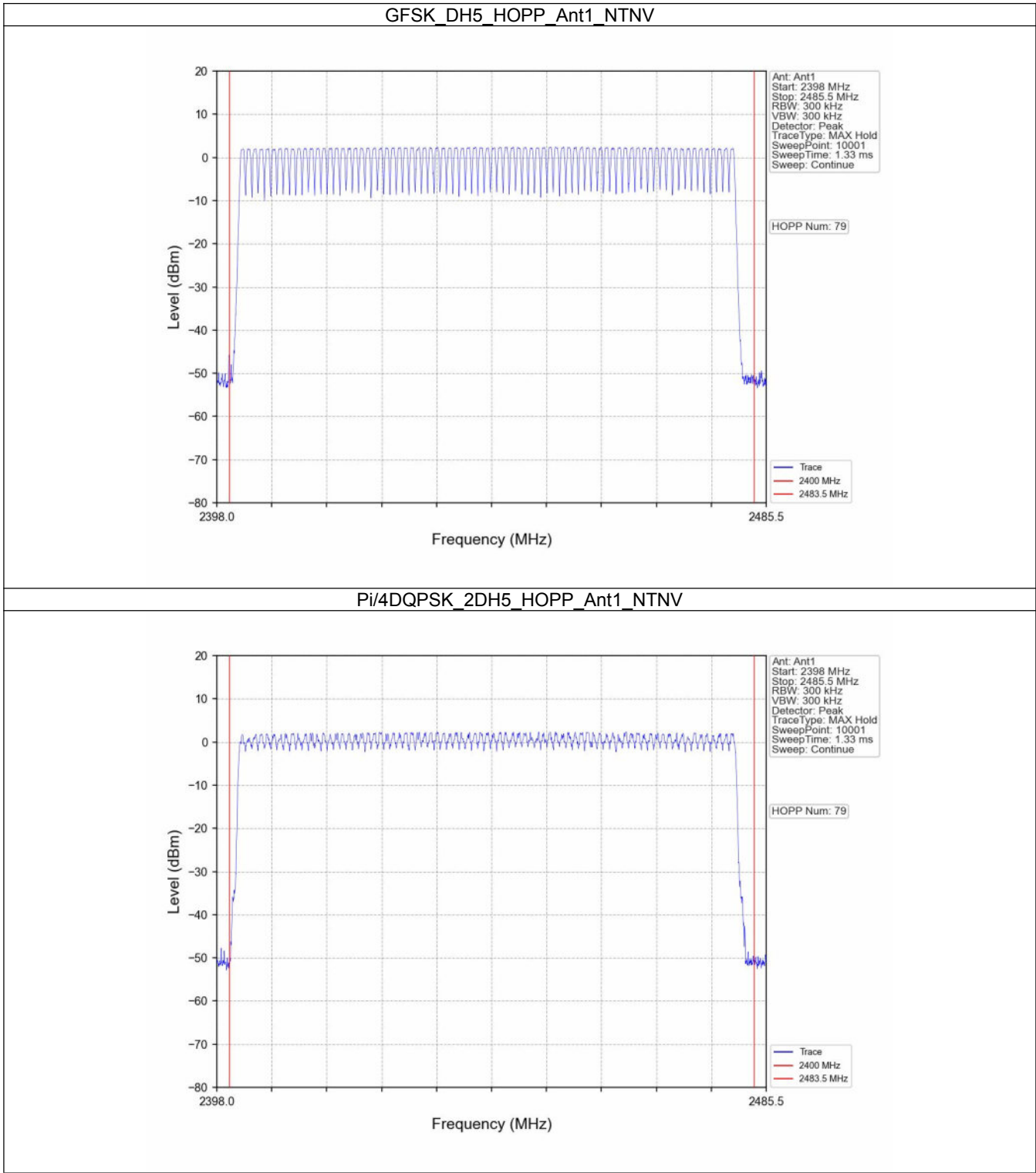
4.1.1 HoppNum

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

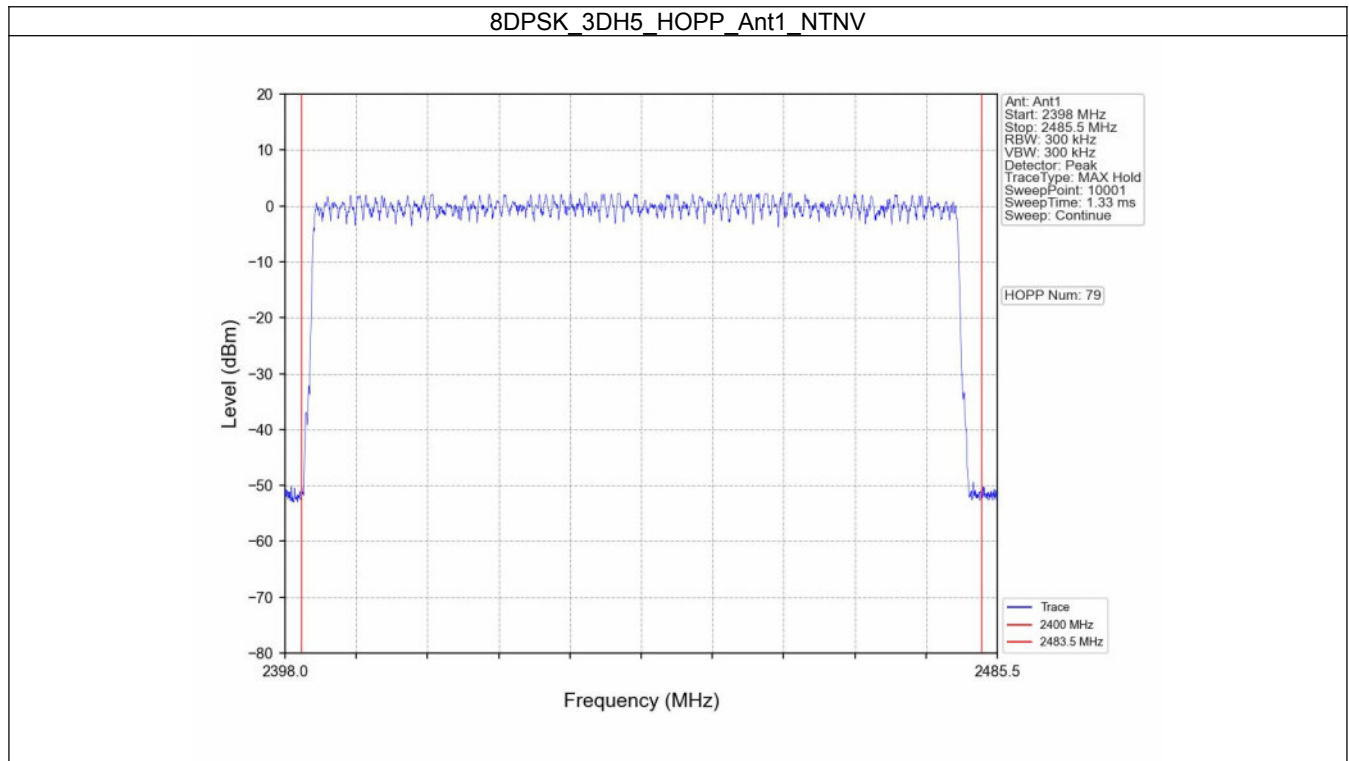
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4.2 Test Graph

4.2.1 HoppNum



FCC ID: 2BHFP-RUMBLE



FCC ID: 2BHFP-RUMBLE

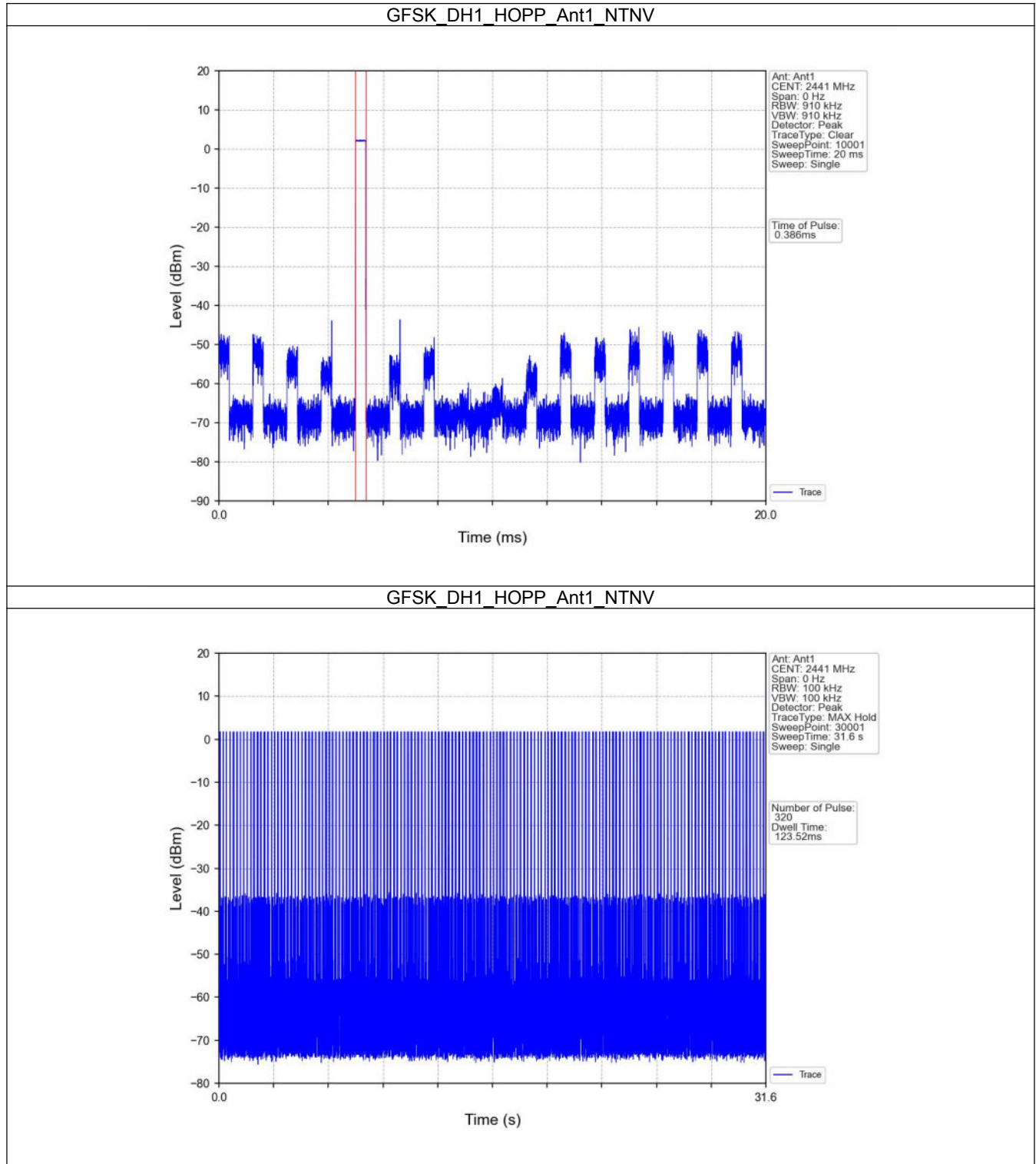
5. Time of Occupancy (Dwell Time)**5.1 Test Result****5.1.1 Ant1**

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	0.386	31.600	320	123.520	<=400	Pass
			DH3	1.636	31.600	170	278.120	<=400	Pass
			DH5	2.890	31.600	96	277.440	<=400	Pass
Pi/4DQPSK	SISO	HOPP	2DH1	0.394	31.600	319	125.686	<=400	Pass
			2DH3	1.642	31.600	165	270.930	<=400	Pass
			2DH5	2.890	31.600	96	277.440	<=400	Pass
8DPSK	SISO	HOPP	3DH1	0.392	31.600	320	125.440	<=400	Pass
			3DH3	1.640	31.600	156	255.840	<=400	Pass
			3DH5	2.898	31.600	116	336.168	<=400	Pass

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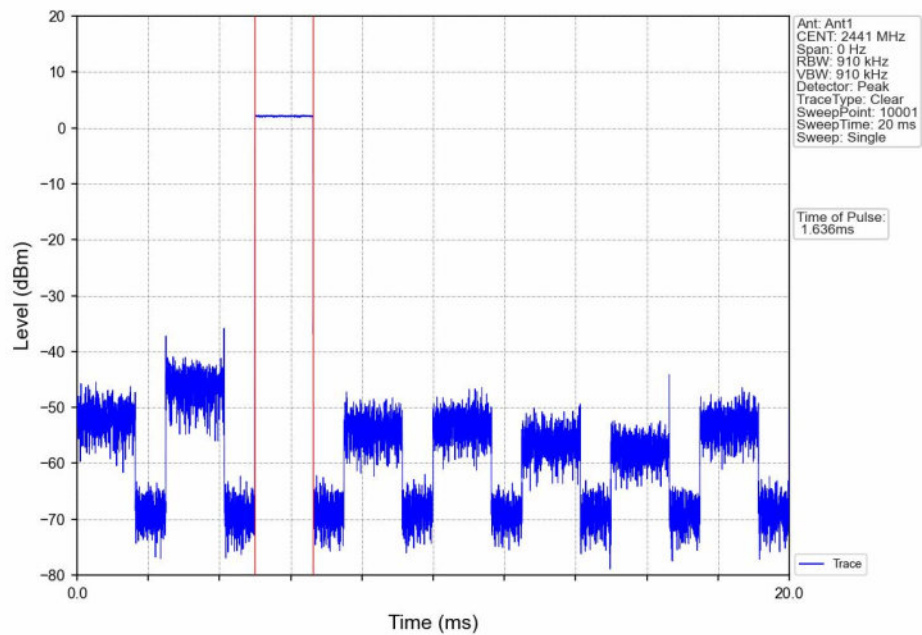
5.2 Test Graph

5.2.1 Ant1

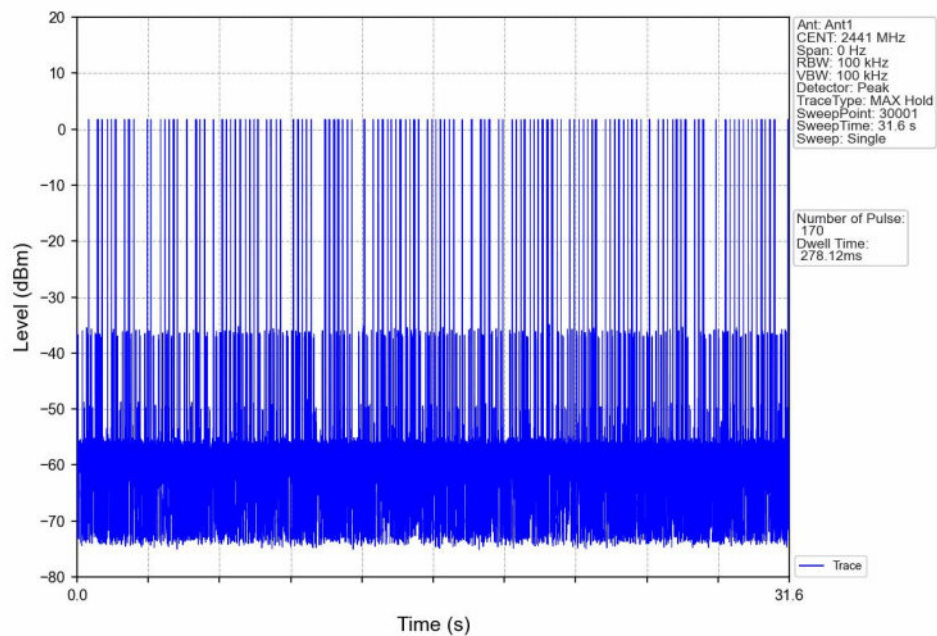


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GFSK_DH3_HOPP_Ant1_NTNV

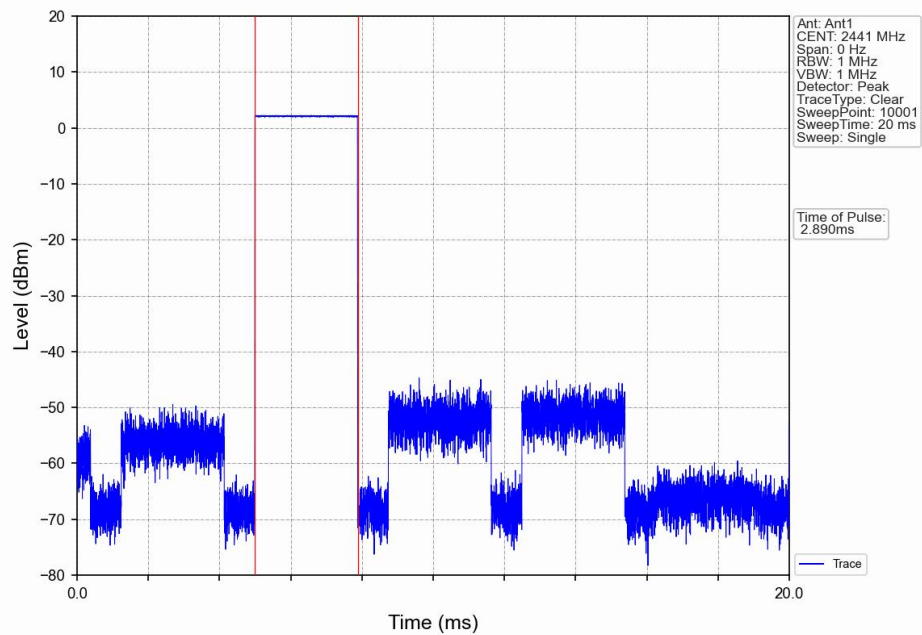


GFSK_DH3_HOPP_Ant1_NTNV

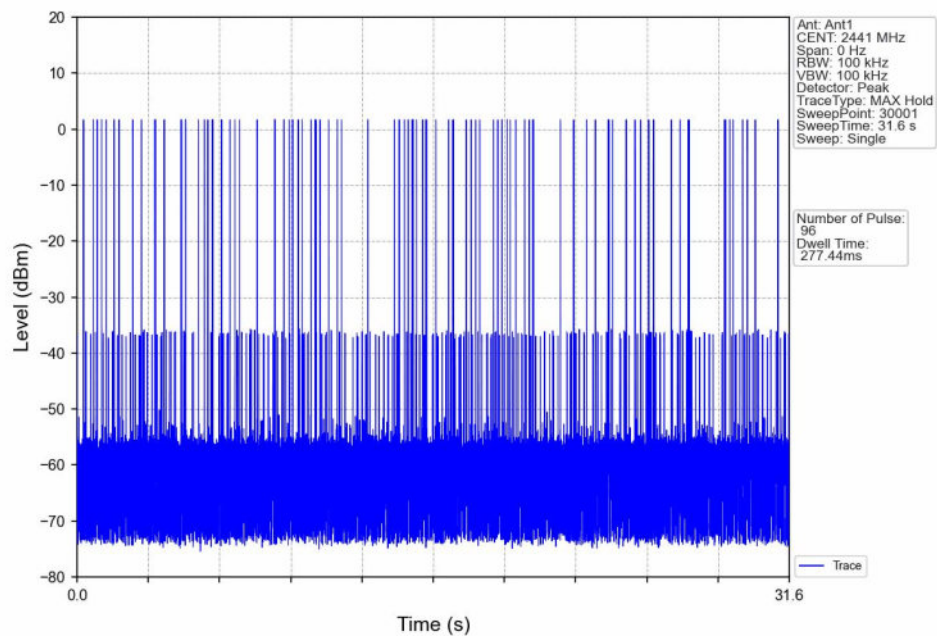


FCC ID: 2BHFP-RUMBLE

GFSK_DH5_HOPP_Ant1_NTNV

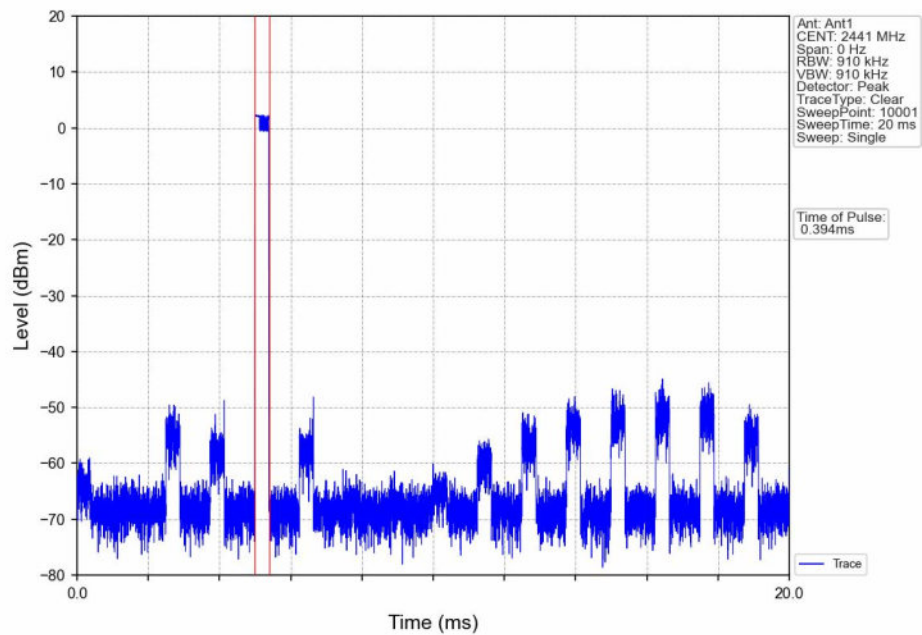


GFSK_DH5_HOPP_Ant1_NTNV

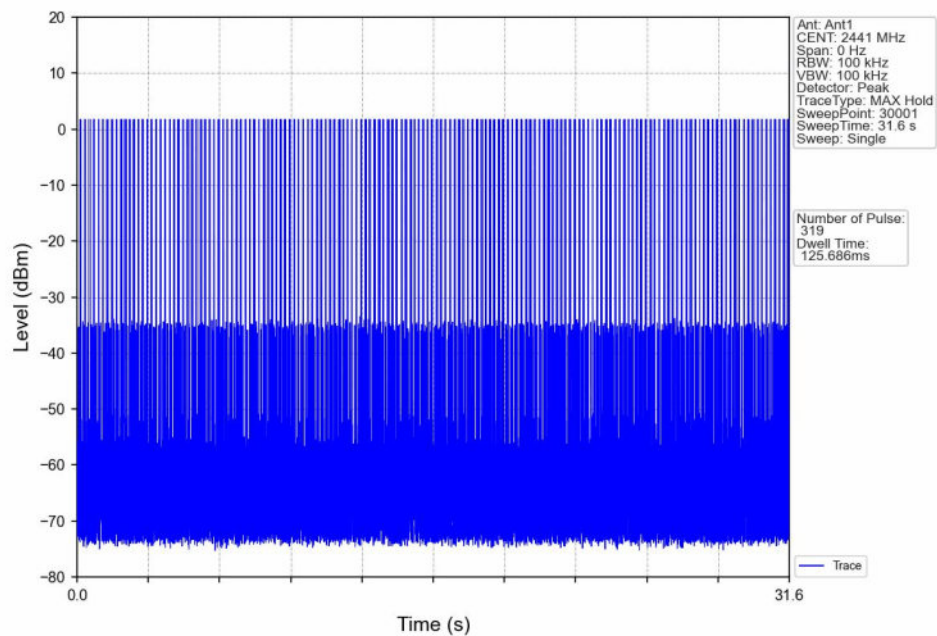


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Pi/4DQPSK_2DH1_HOPP_Ant1_NTNV

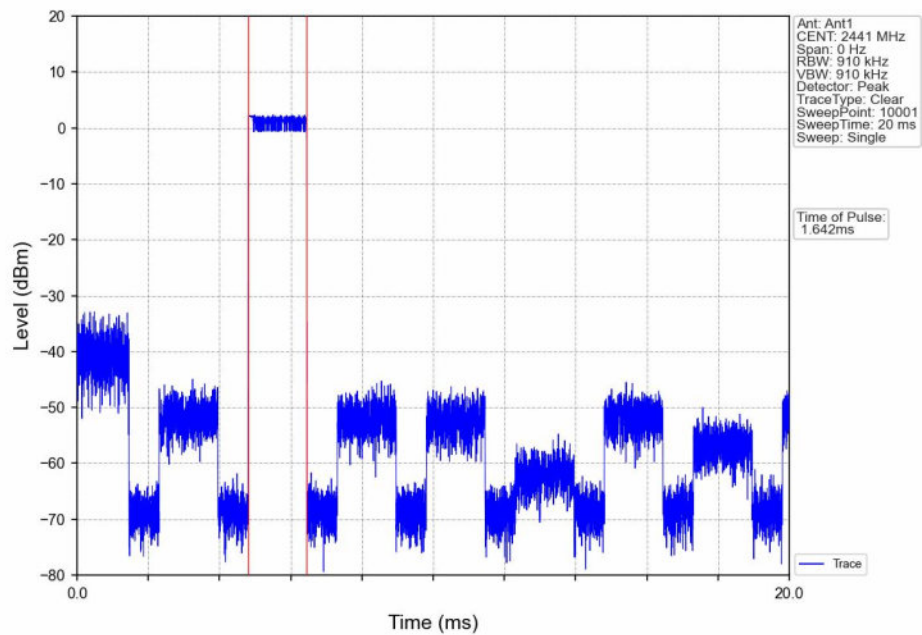


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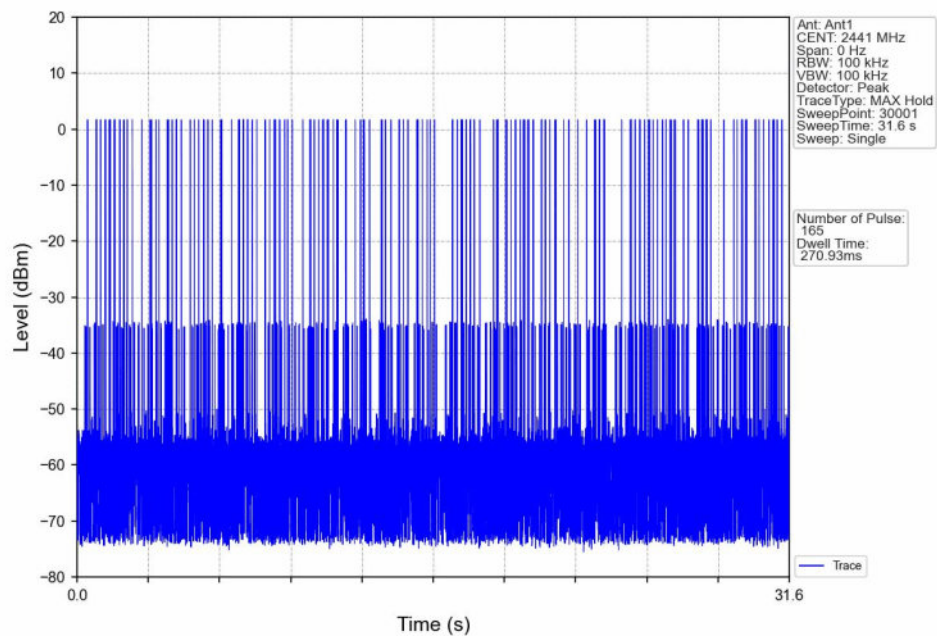


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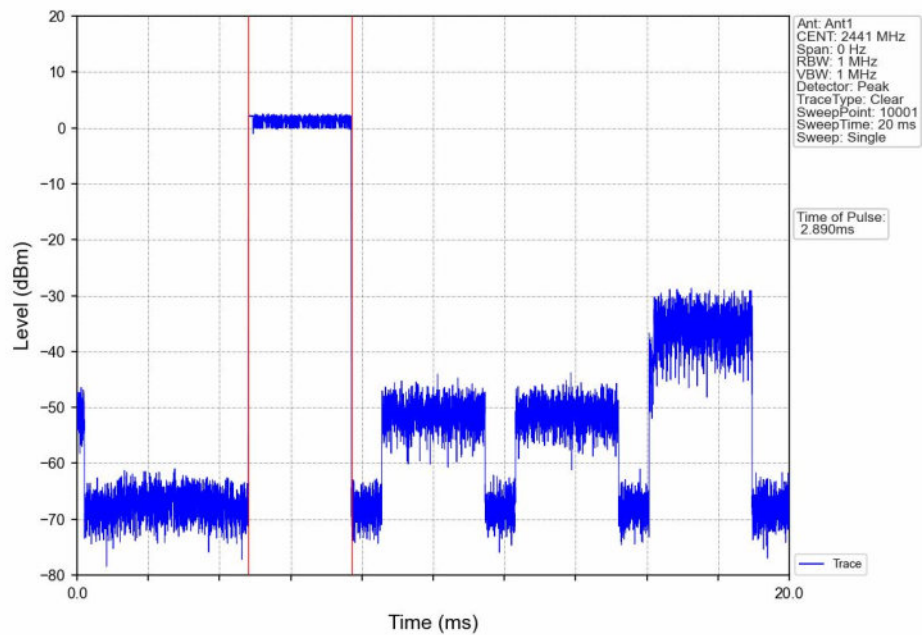


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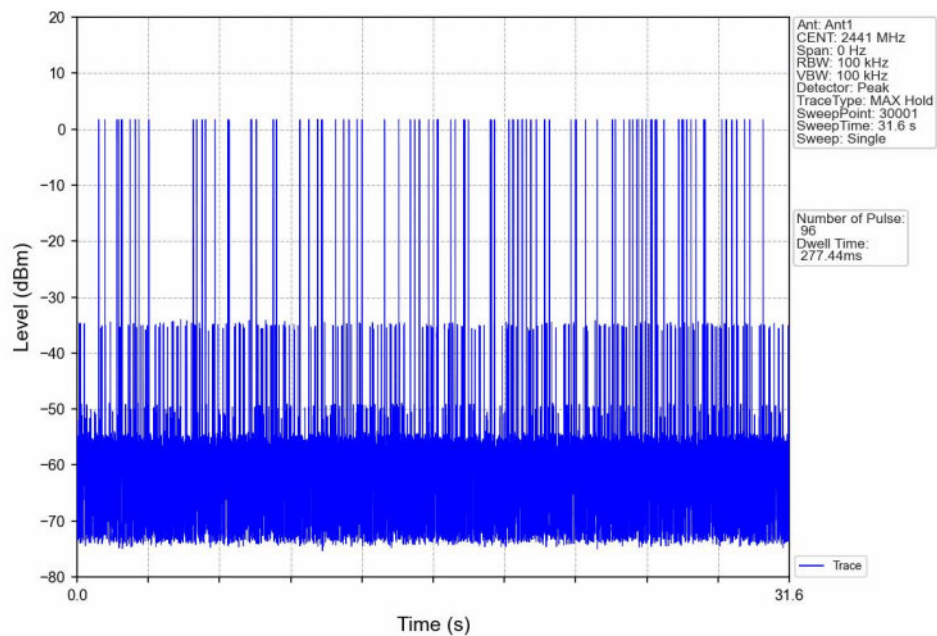


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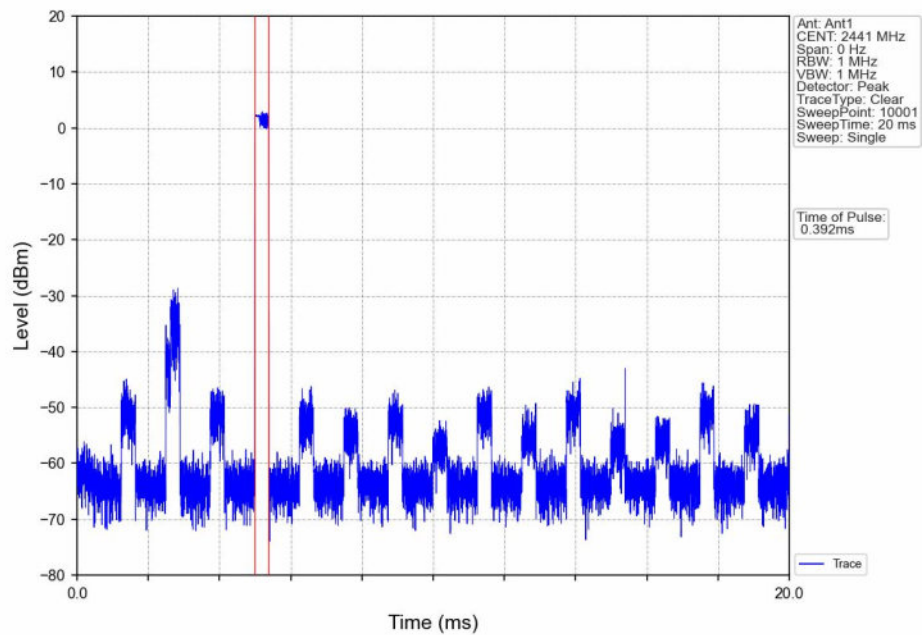


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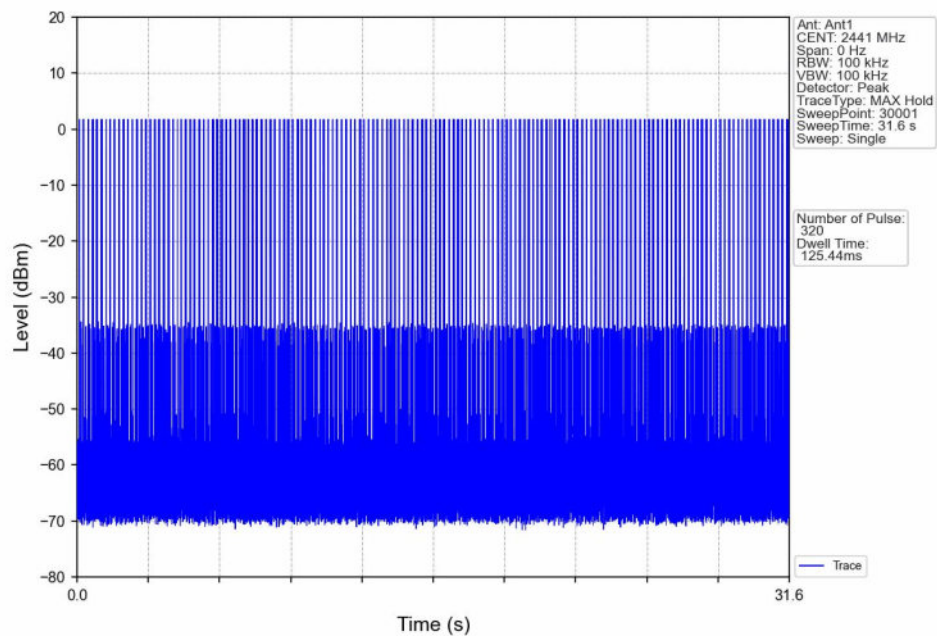


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8DPSK_3DH1_HOPP_Ant1_NTNV

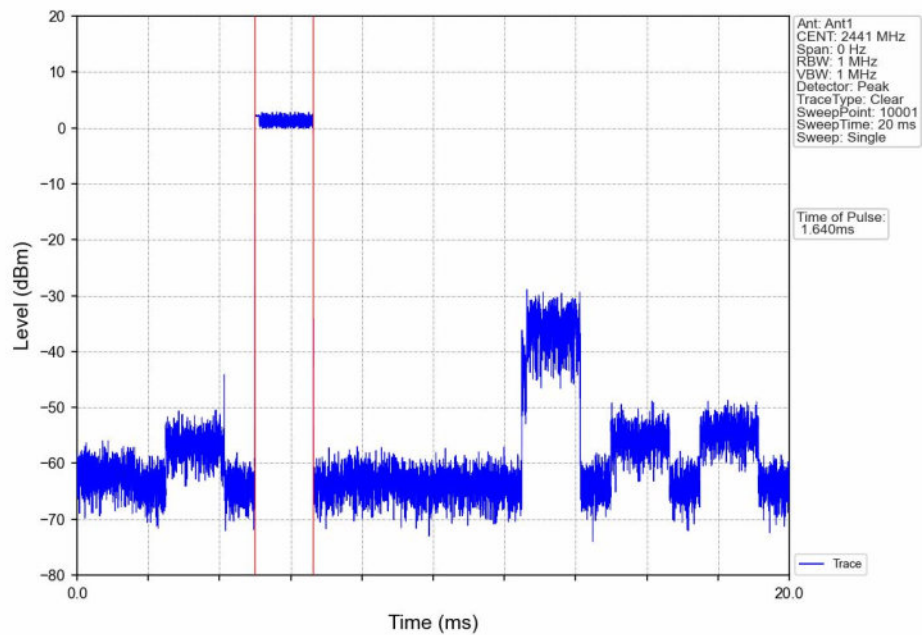


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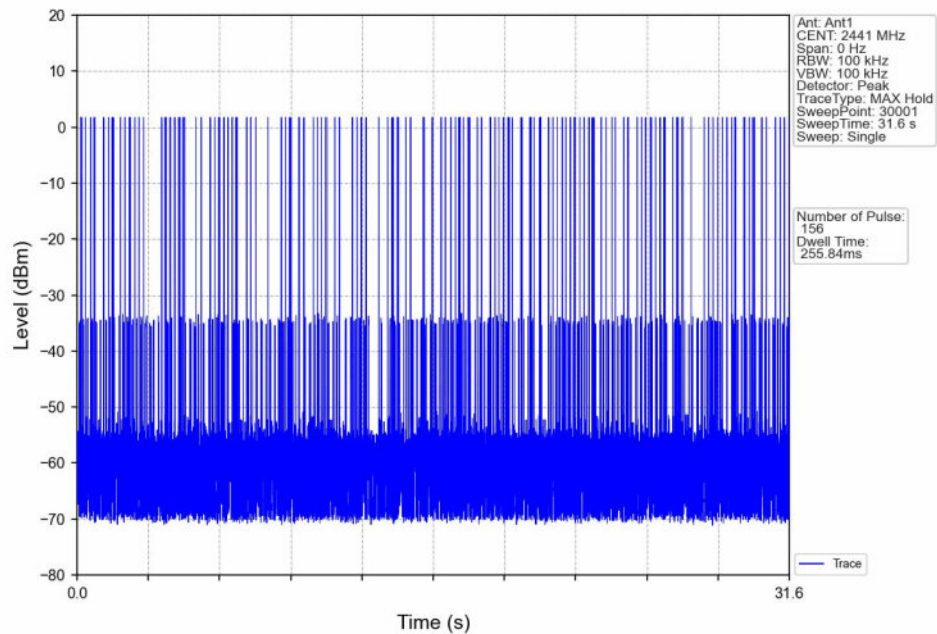


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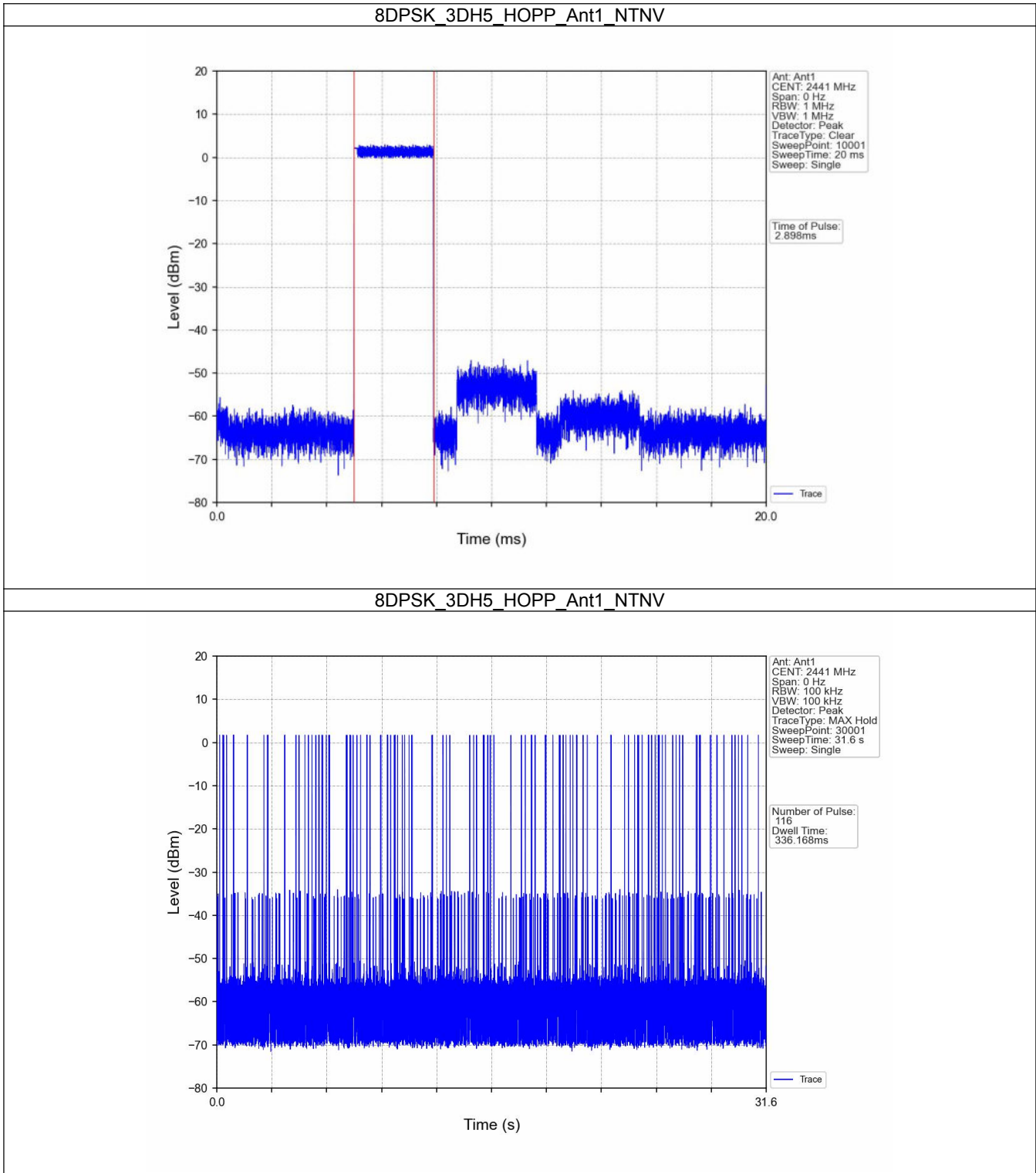
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8DPSK_3DH3_HOPP_Ant1_NTNV



FCC ID: 2BHFP-RUMBLE



FCC ID: 2BHFP-RUMBLE

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	1.72
		2441	DH5	1	2.08
		2480	DH5	1	1.65
Pi/4DQPSK	SISO	2402	2DH5	1	1.72
		2441	2DH5	1	2.13
		2480	2DH5	1	1.82
8DPSK	SISO	2402	3DH5	1	1.70
		2441	3DH5	1	2.15
		2480	3DH5	1	1.88

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

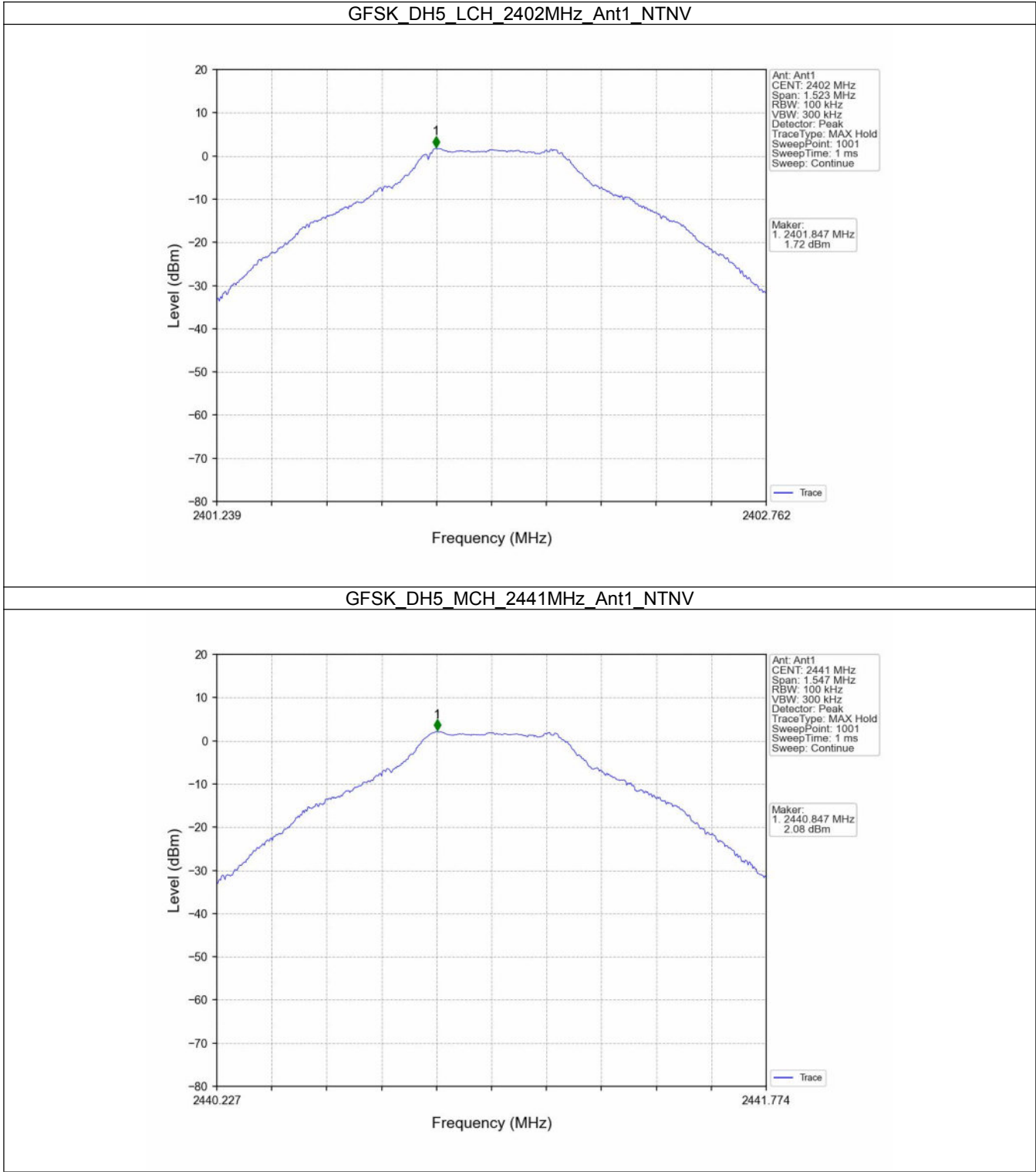
Mode	TX Type	Frequency (MHz)	Packet Type	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
GFSK	SISO	2402	DH5	1	2.08	-17.92	Pass
		2441	DH5	1	2.08	-17.92	Pass
		2480	DH5	1	2.08	-17.92	Pass
		HOPP	DH5	1	2.08	-17.92	Pass
					2.08	-17.92	Pass
Pi/4DQPSK	SISO	2402	2DH5	1	2.13	-17.87	Pass
		2441	2DH5	1	2.13	-17.87	Pass
		2480	2DH5	1	2.13	-17.87	Pass
		HOPP	2DH5	1	2.13	-17.87	Pass
					2.13	-17.87	Pass
8DPSK	SISO	2402	3DH5	1	2.15	-17.85	Pass
		2441	3DH5	1	2.15	-17.85	Pass
		2480	3DH5	1	2.15	-17.85	Pass
		HOPP	3DH5	1	2.15	-17.85	Pass
					2.15	-17.85	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.

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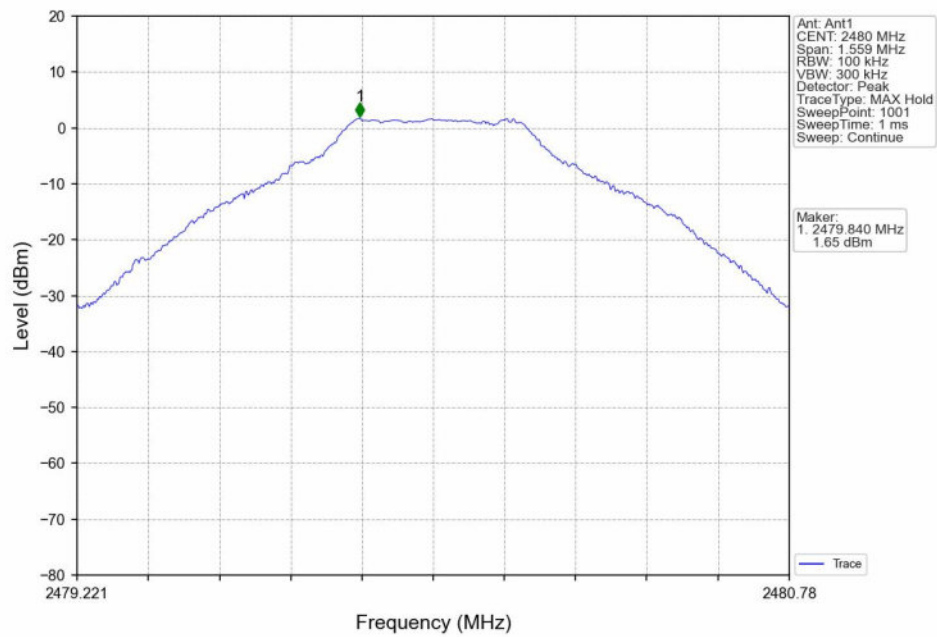
6.2 Test Graph

6.2.1 Ref

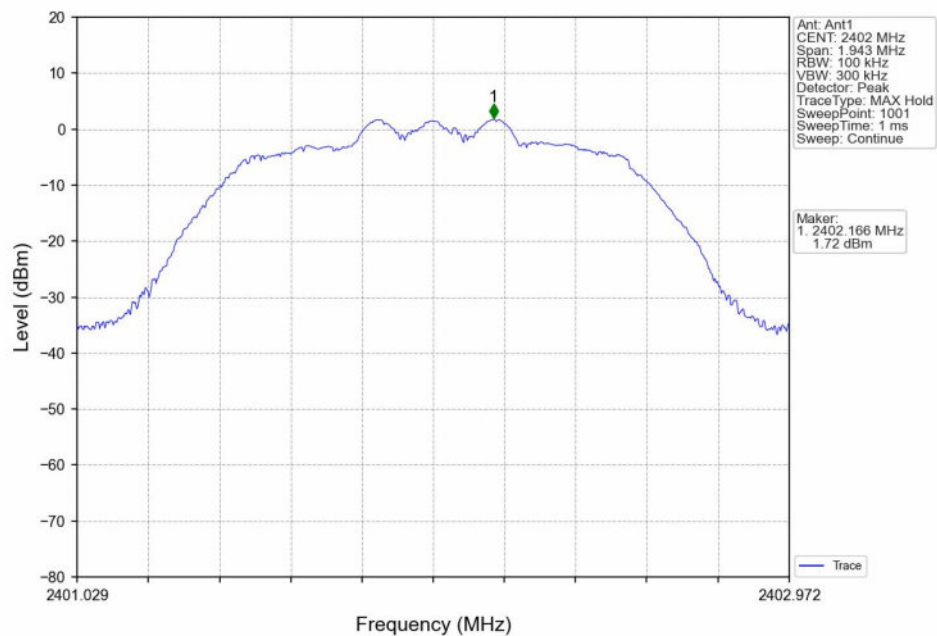


FCC ID: 2BHFP-RUMBLE

GFSK_DH5_HCH_2480MHz_Ant1_NTNV

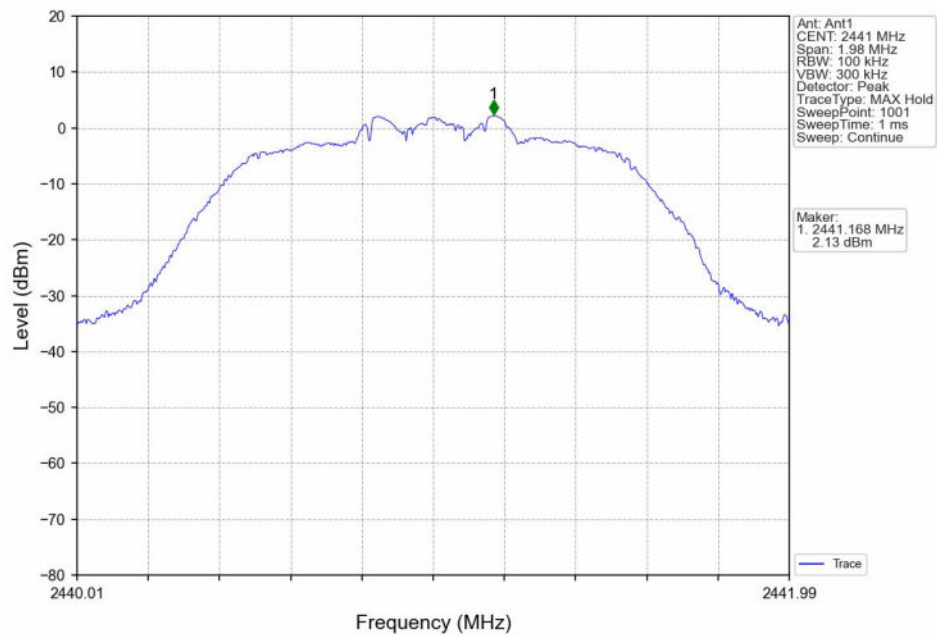


Pi/4DQPSK_2DH5_LCH_2402MHz_Ant1_NTNV

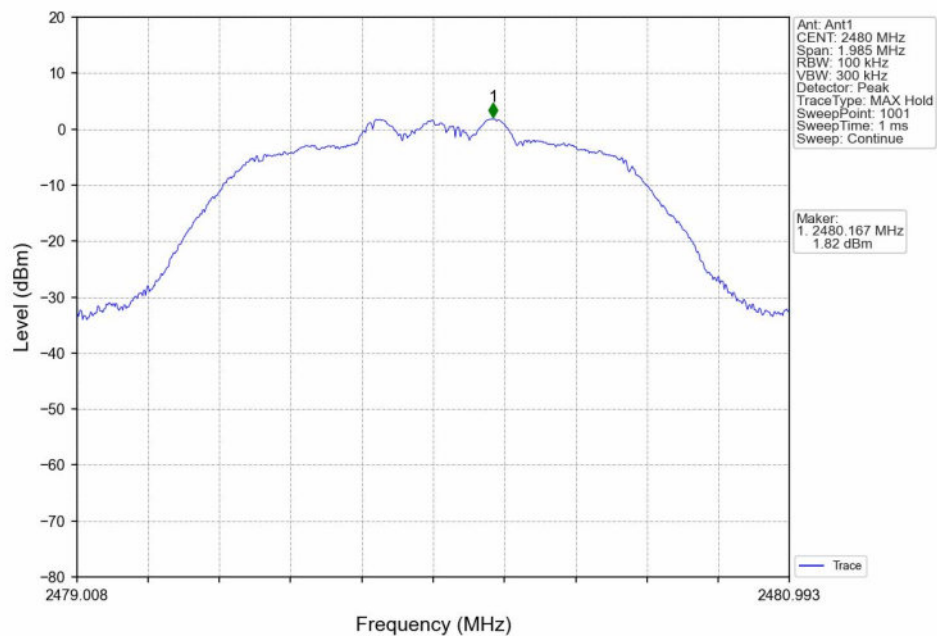


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Pi/4DQPSK_2DH5_MCH_2441MHz_Ant1_NTNV

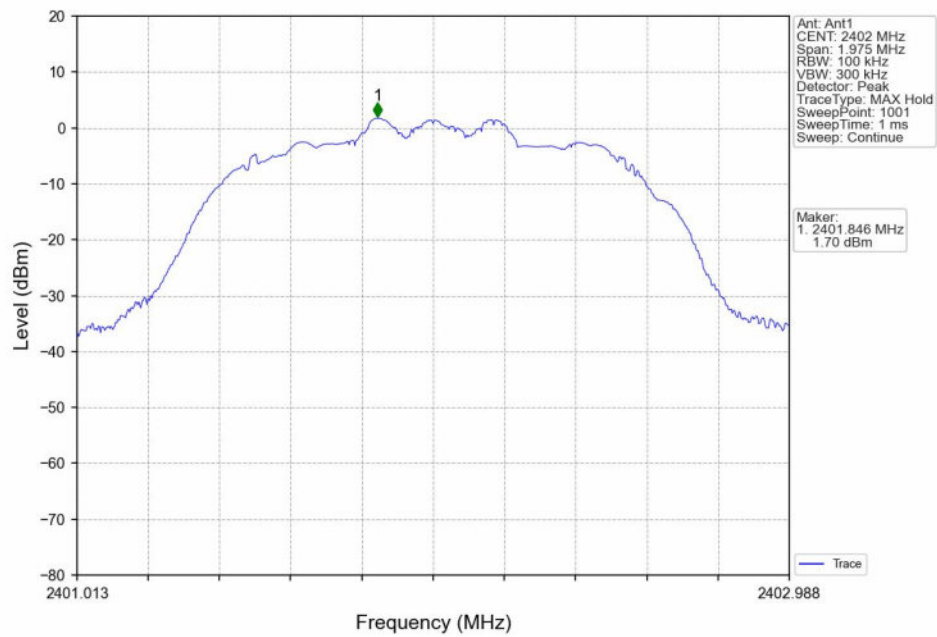


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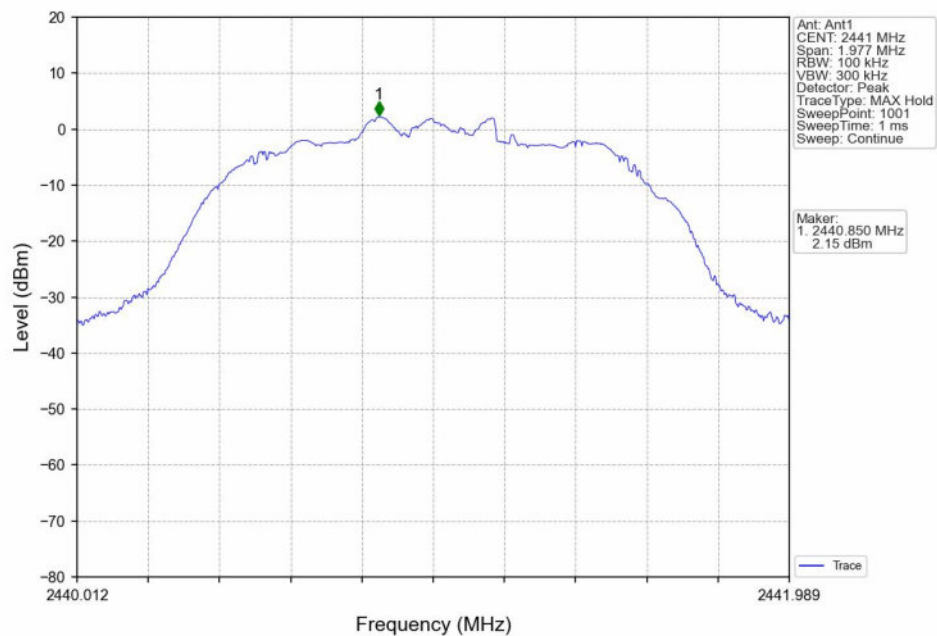


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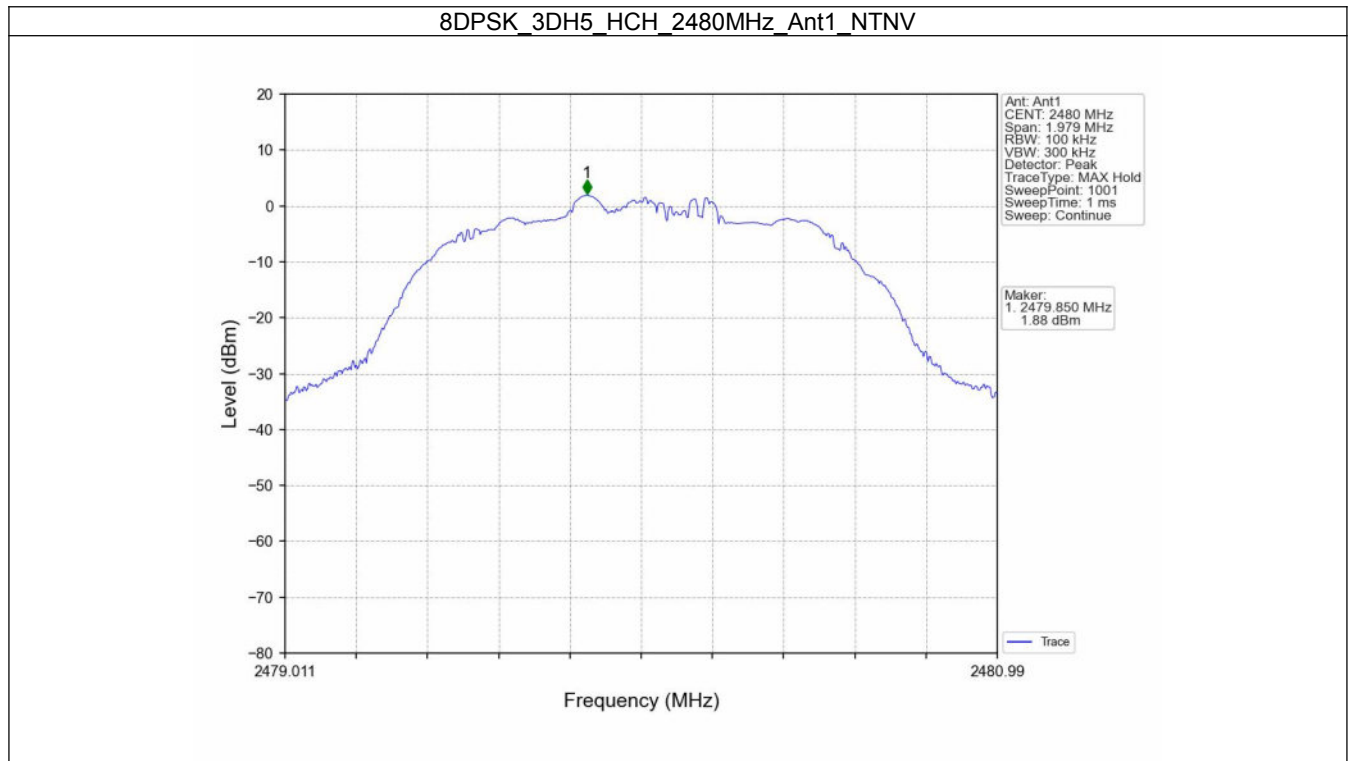
8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV



8DPSK_3DH5_MCH_2441MHz_Ant1_NTNV

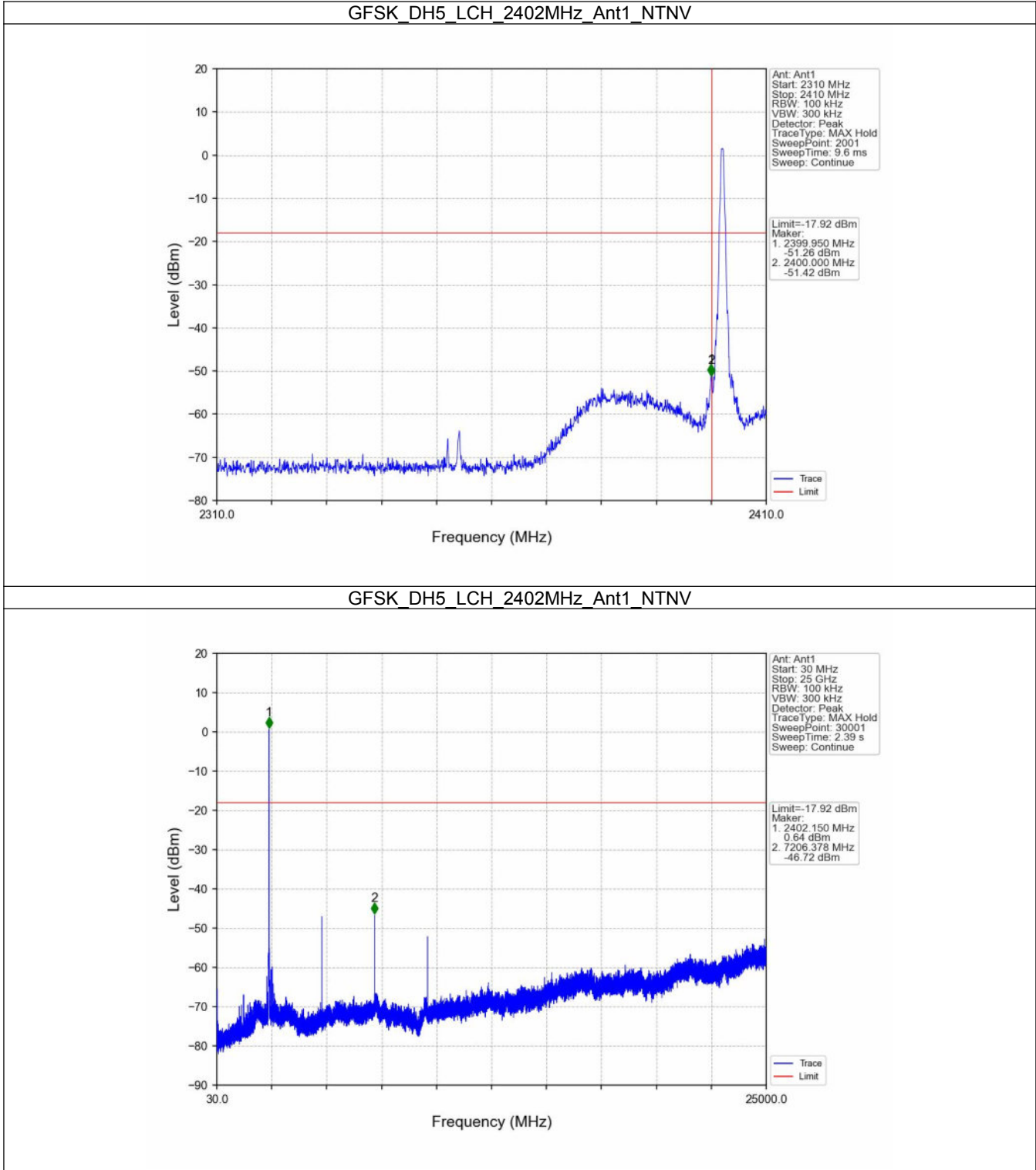


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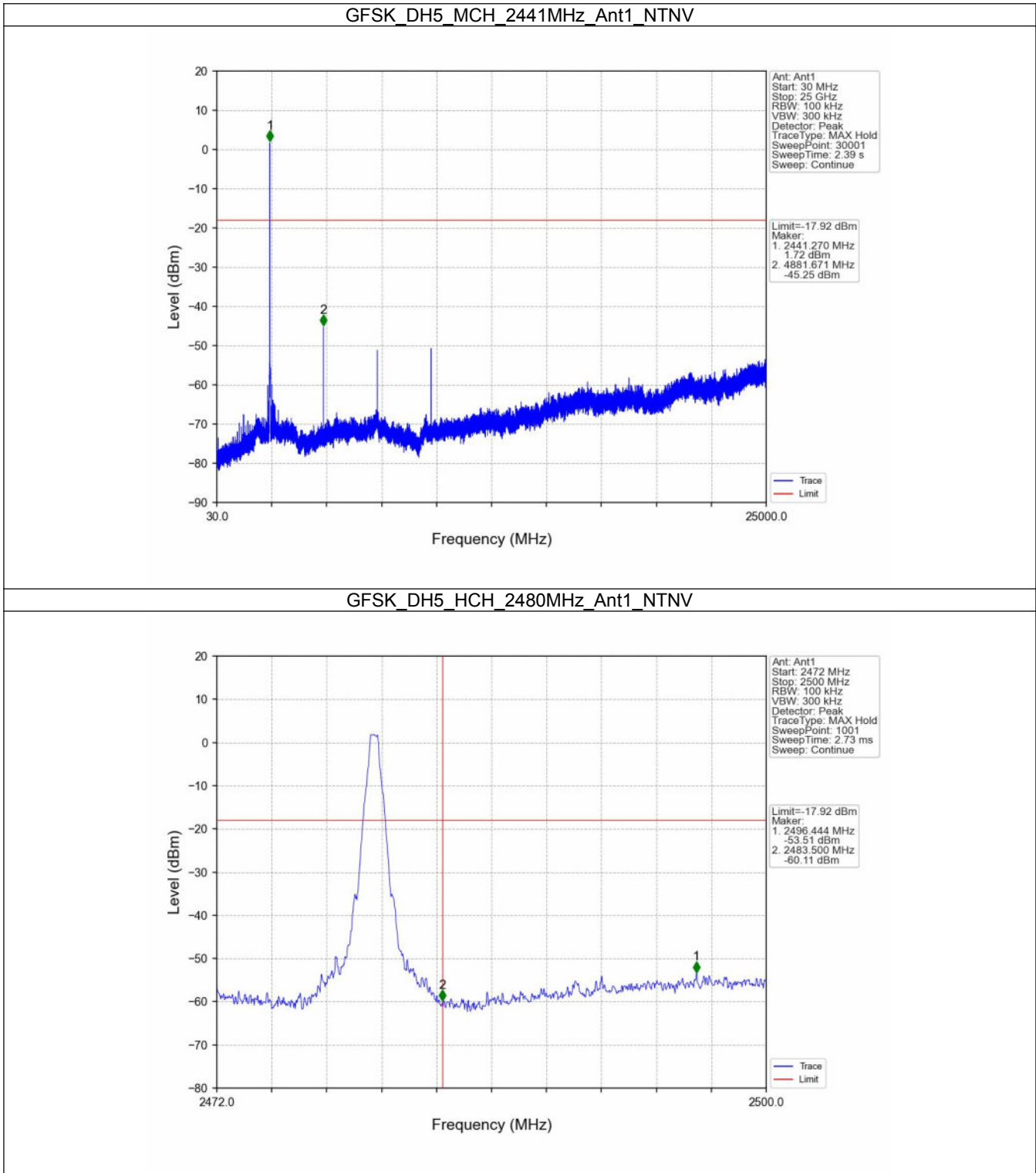


FCC ID: 2BHFP-RUMBLE

6.2.2 CSE

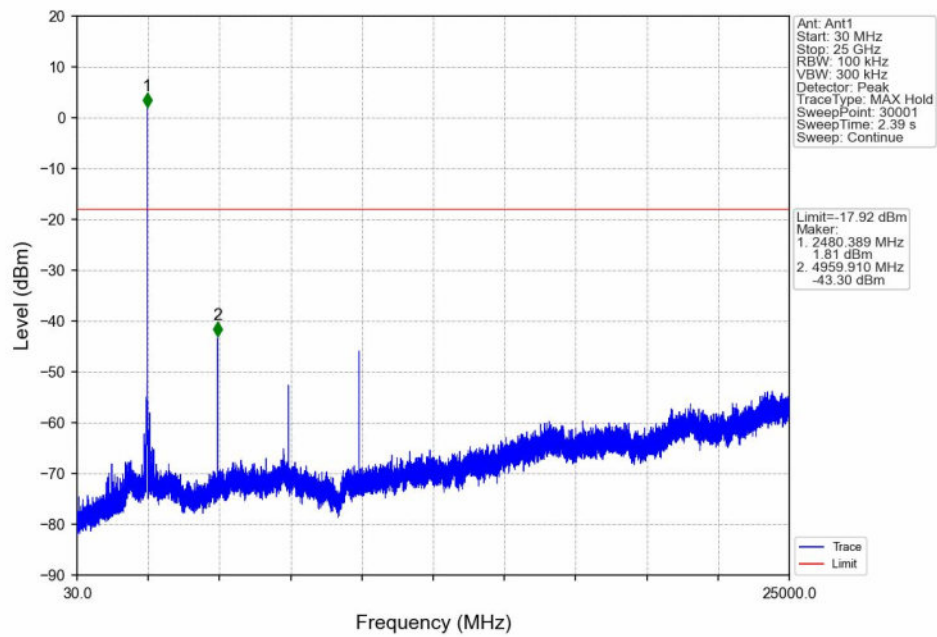


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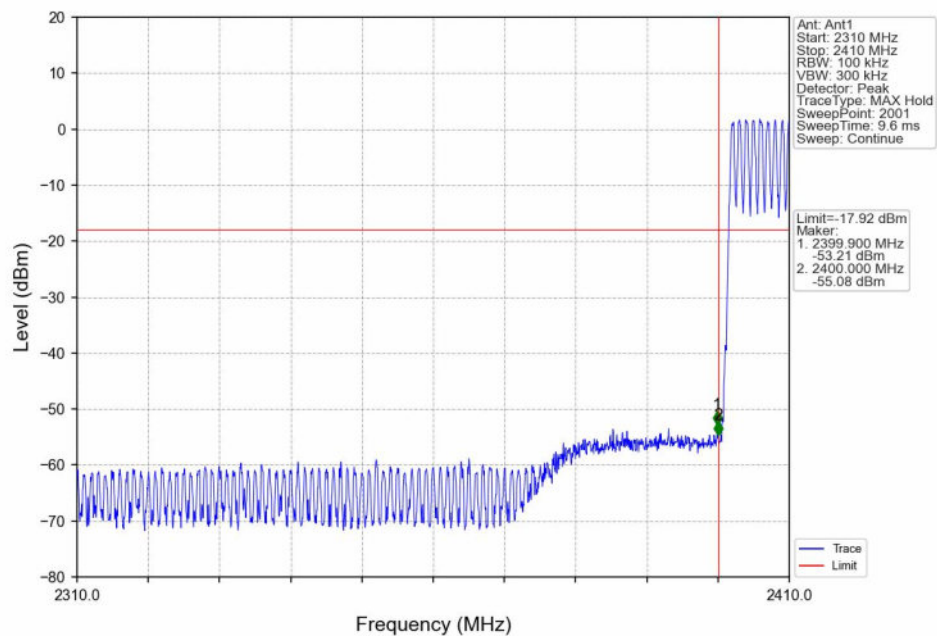


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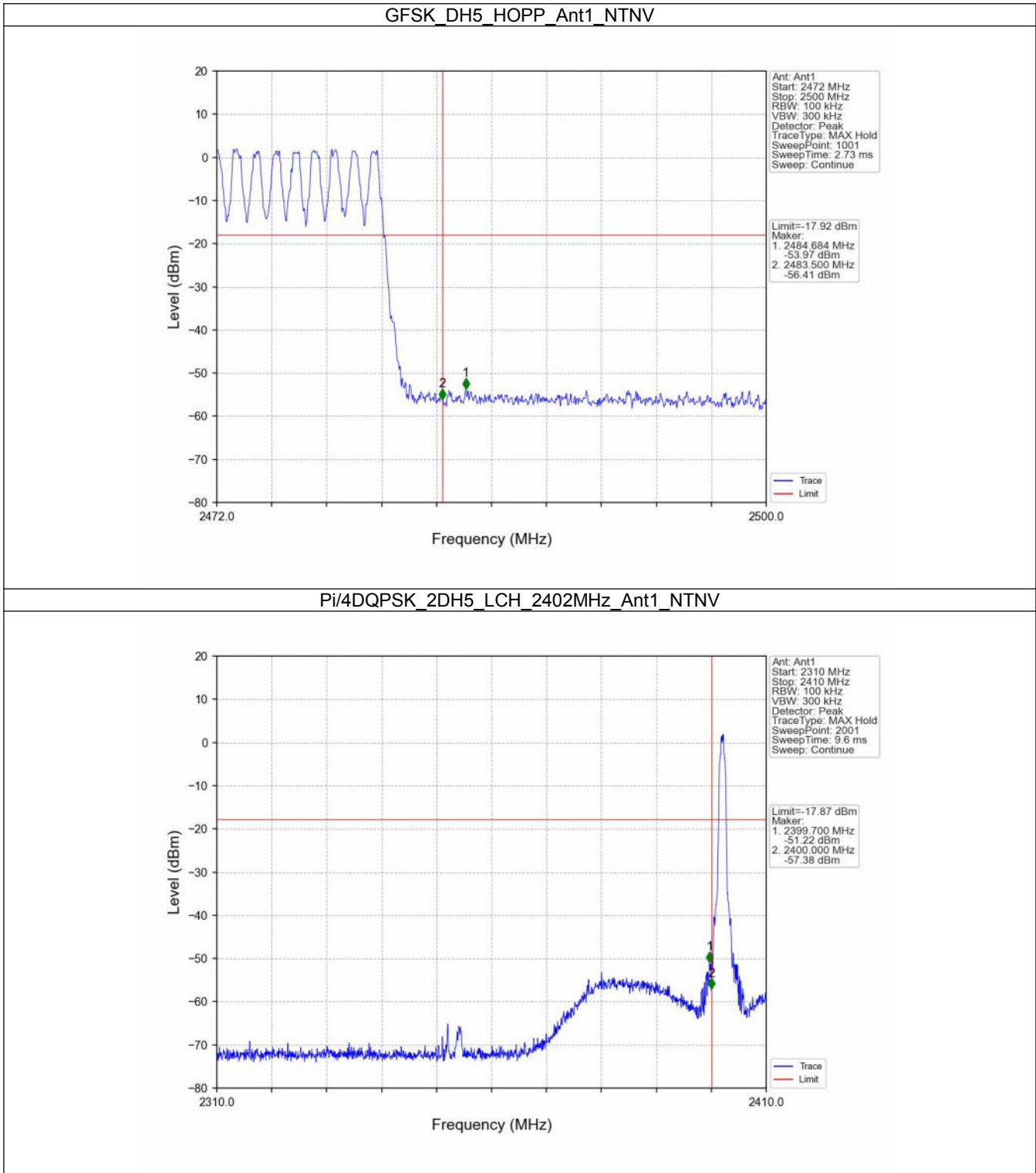
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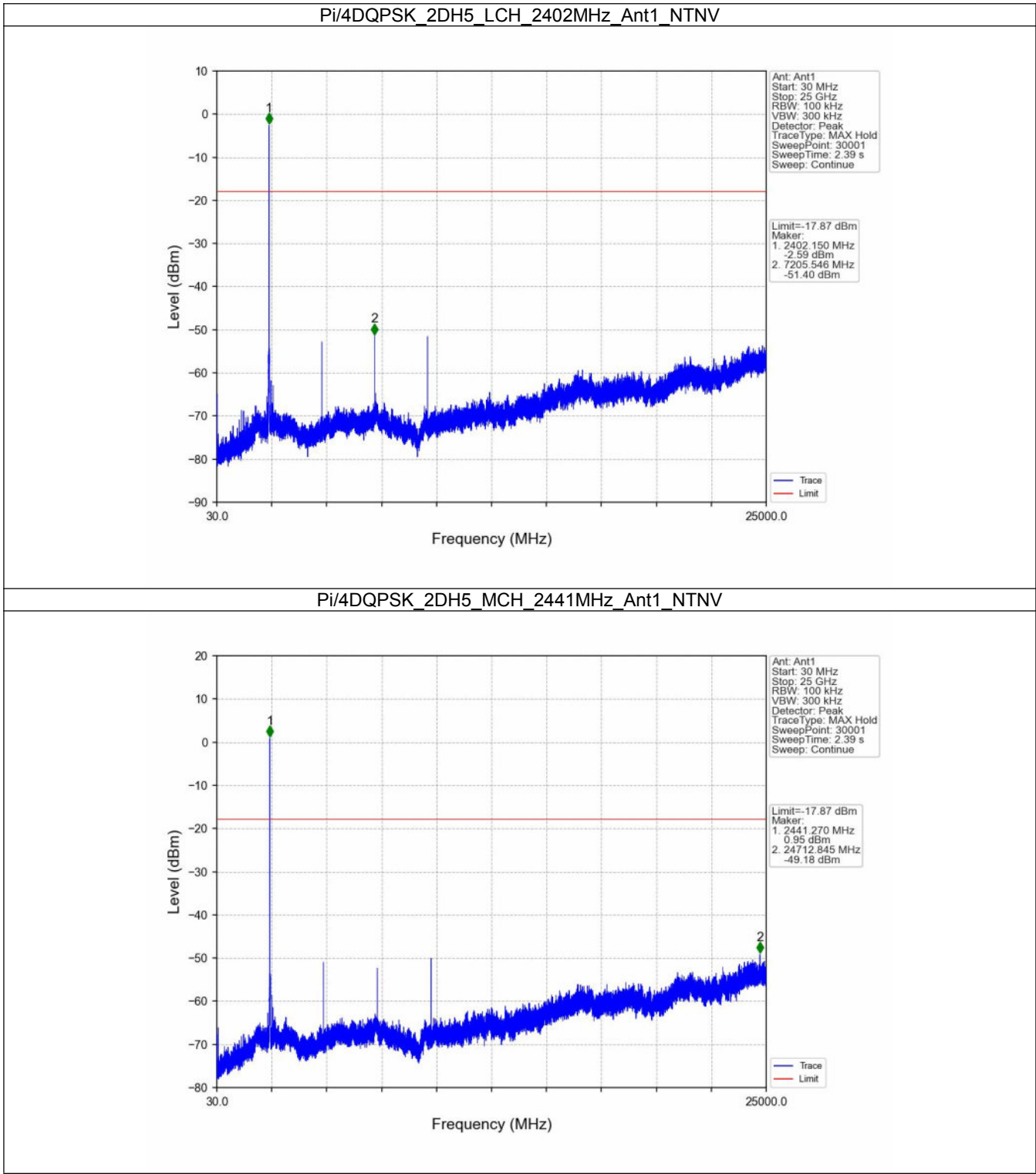
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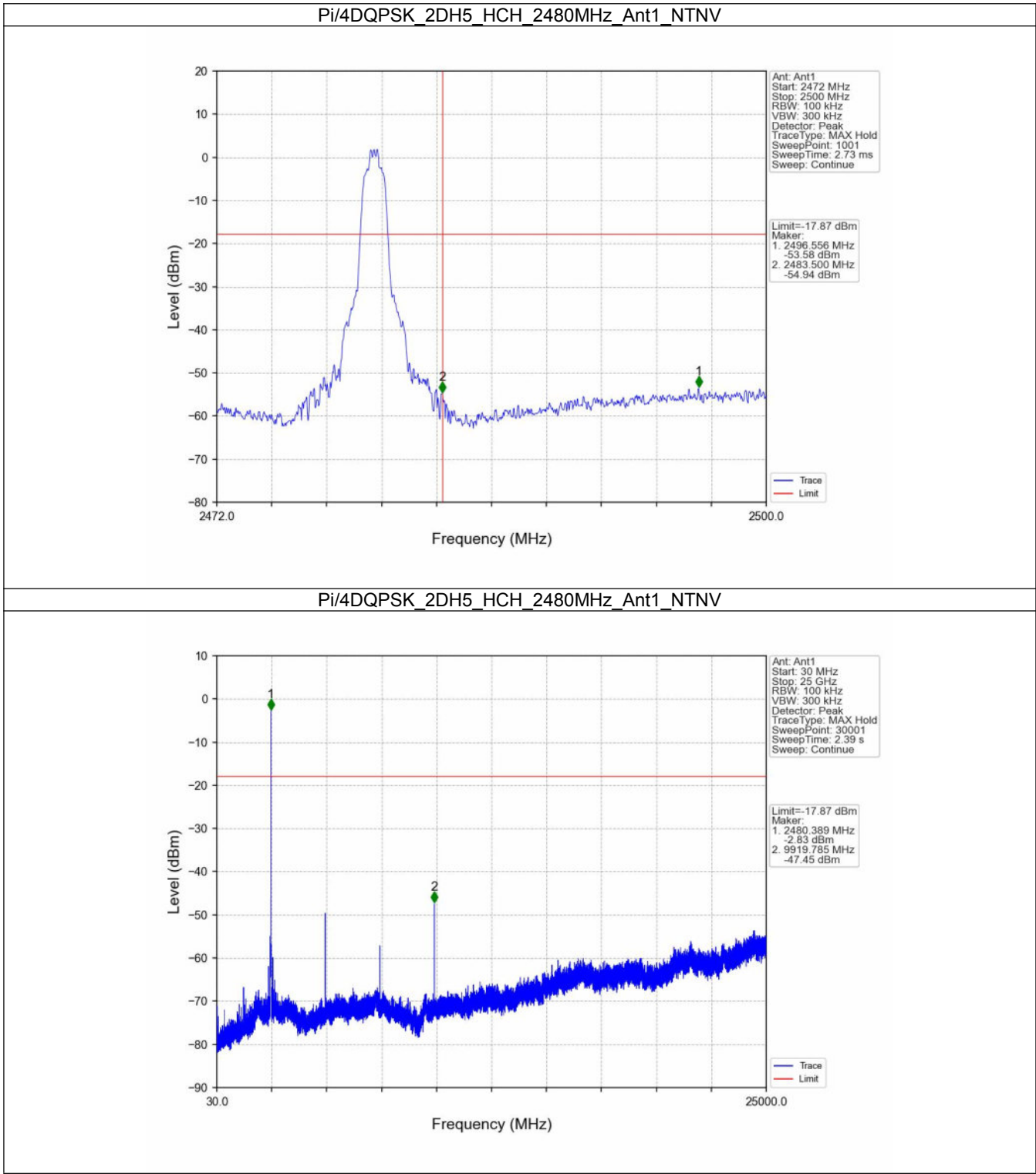
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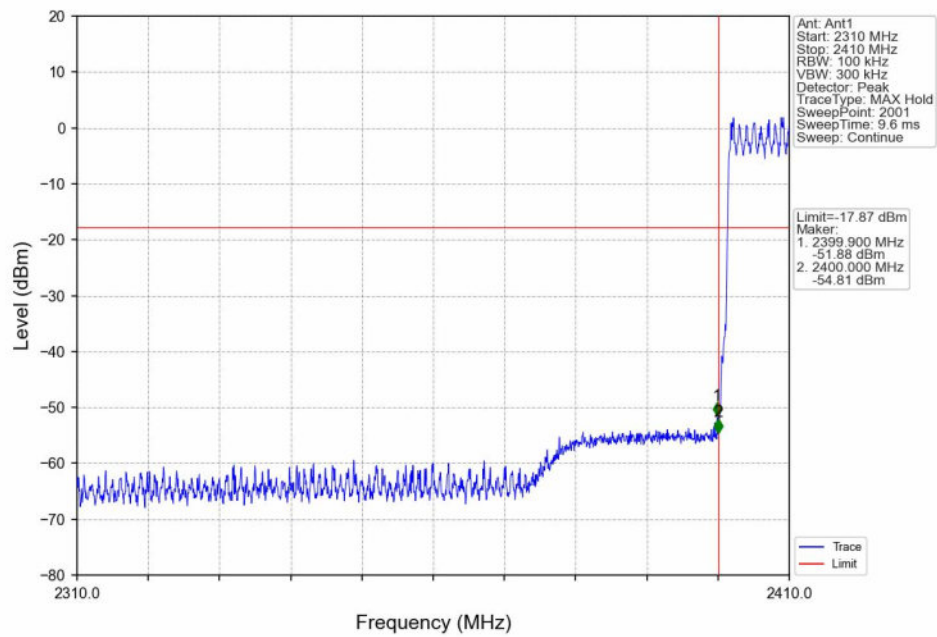


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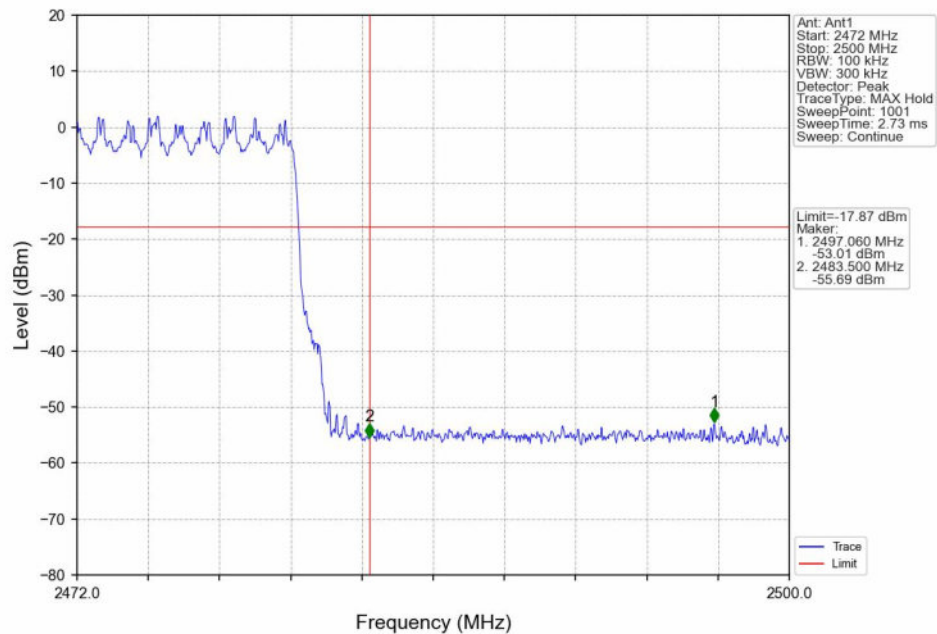


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Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV

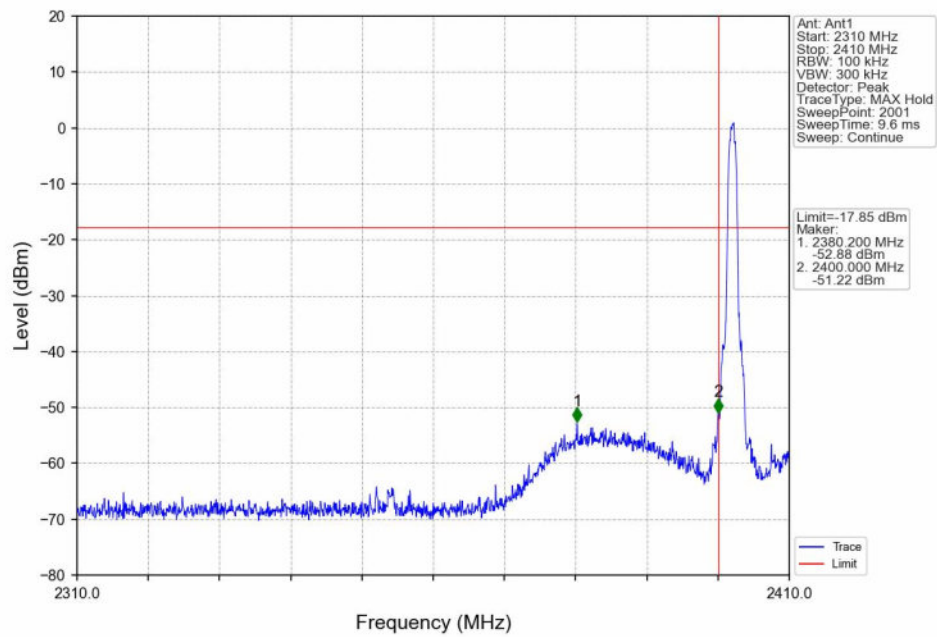


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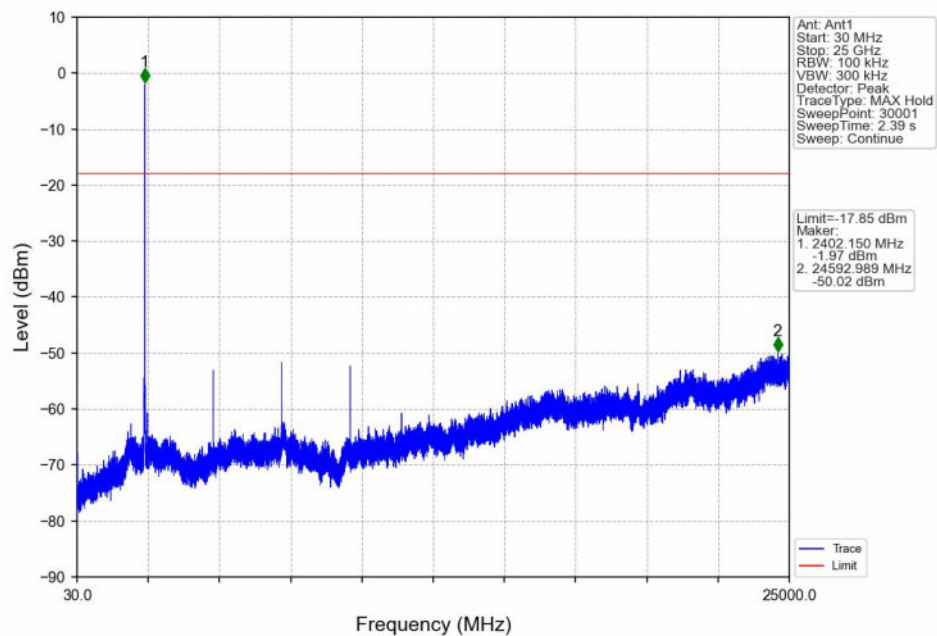


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8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV

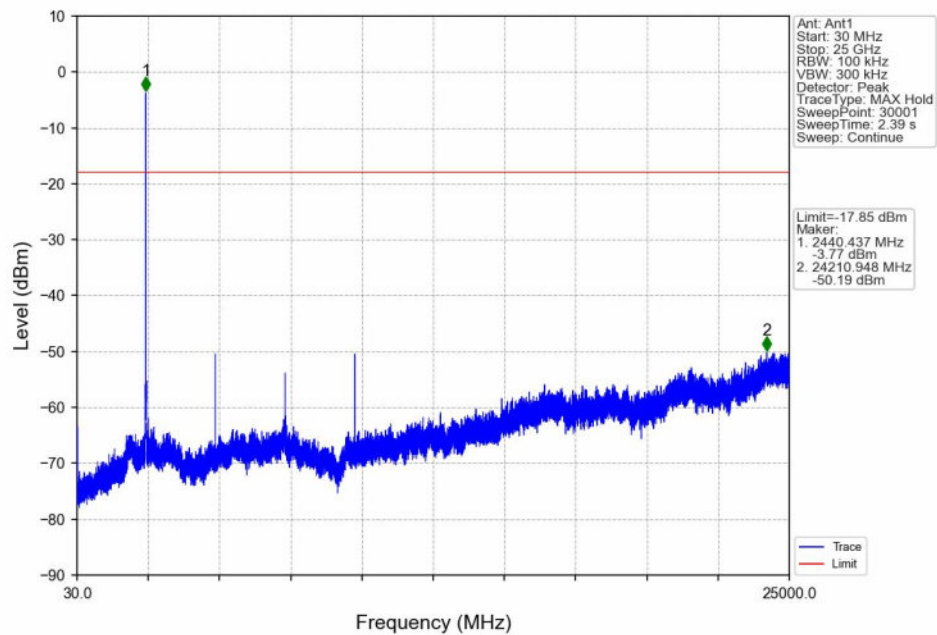


8DPSK_3DH5_LCH_2402MHz_Ant1_NTNV

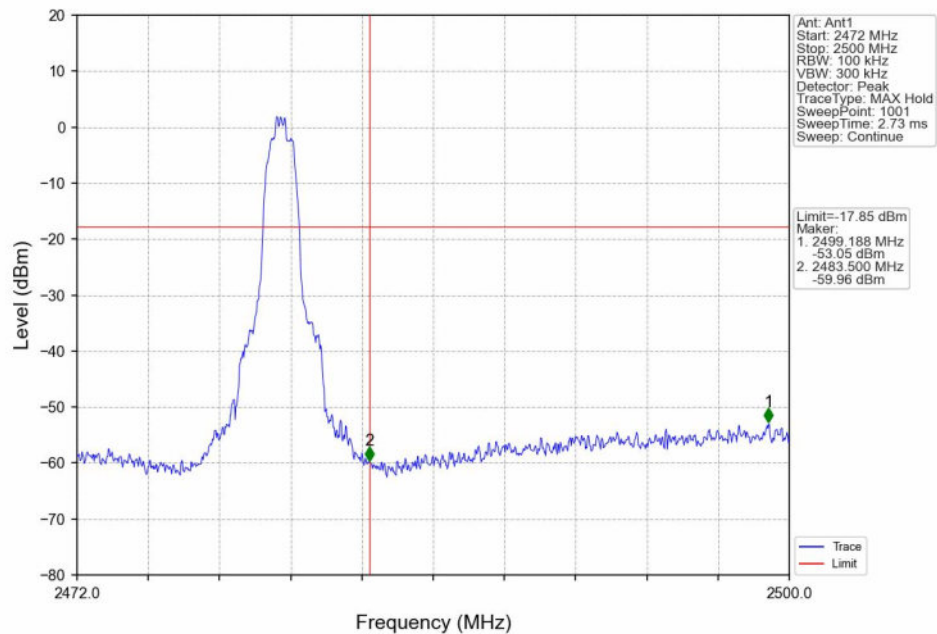


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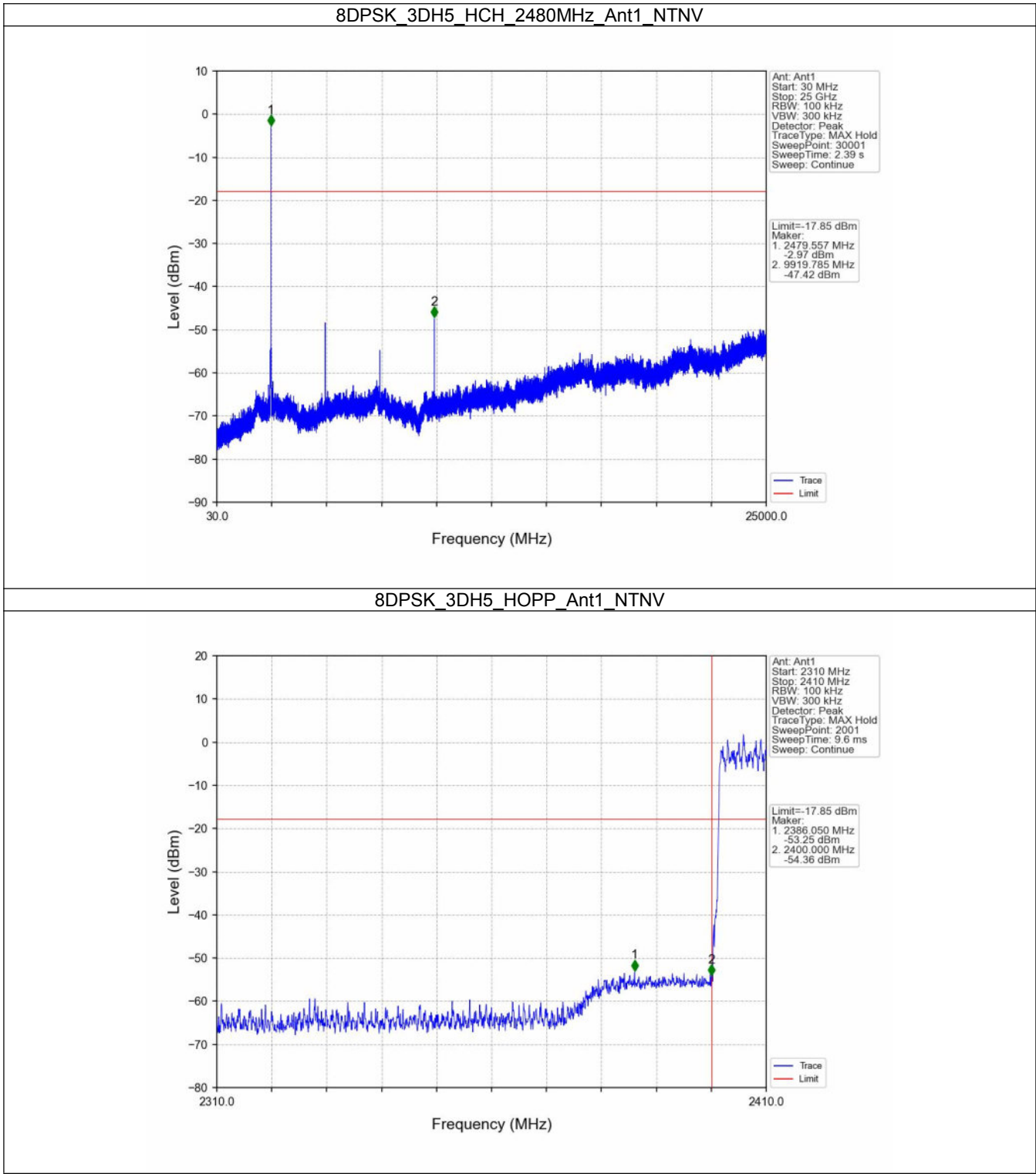
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8DPSK_3DH5_HCH_2480MHz_Ant1_NTNV



FCC ID: 2BHFP-RUMBLE



FCC ID: 2BHFP-RUMBLE

