Appendix for 15.247

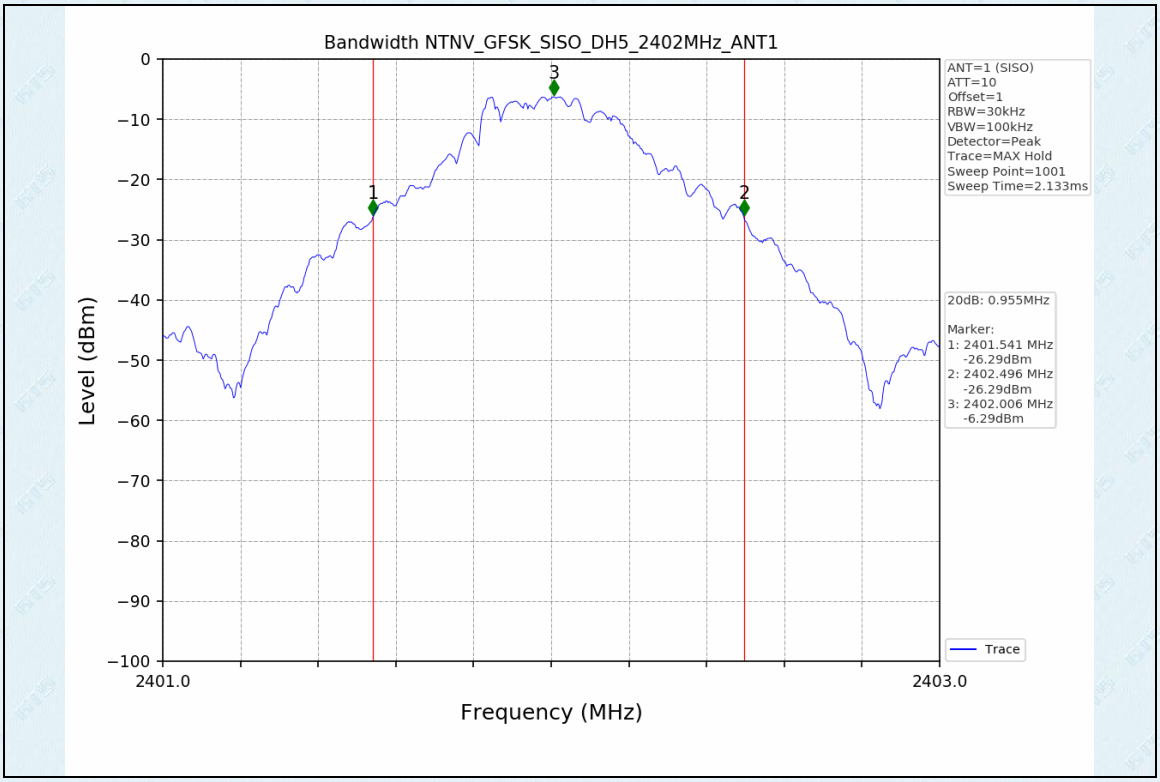
1. Bandwidth

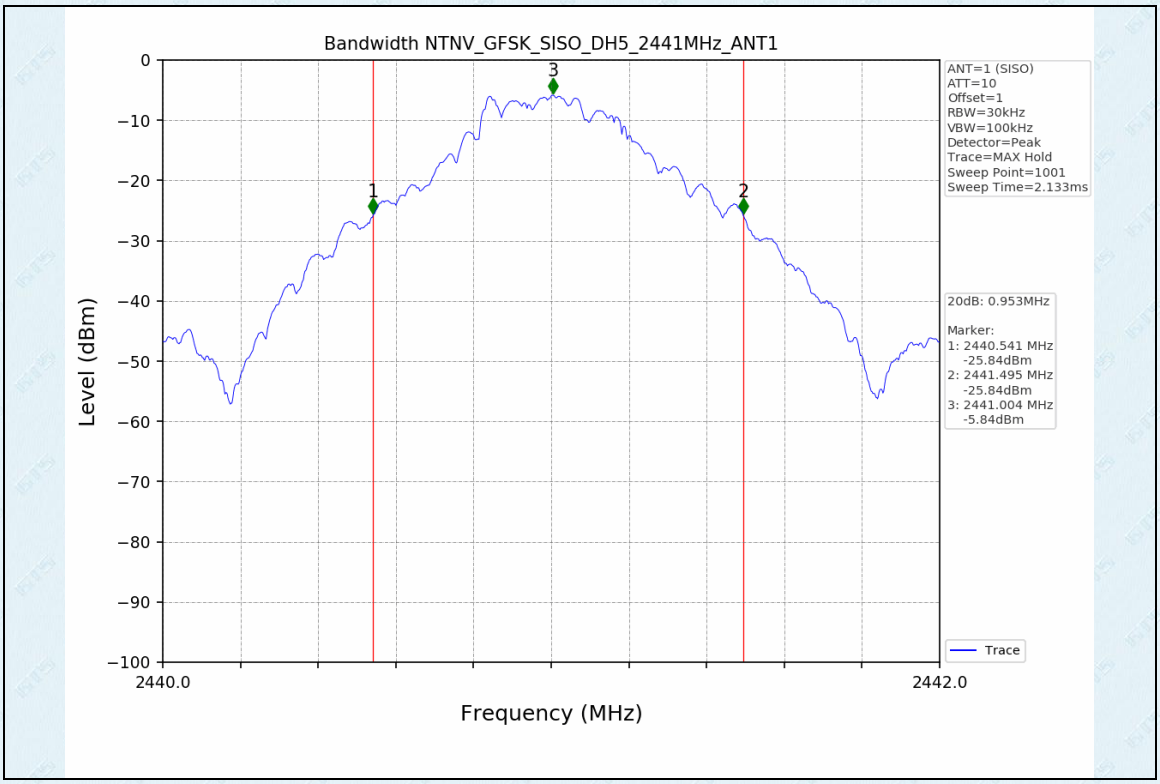
1.1 Test Result

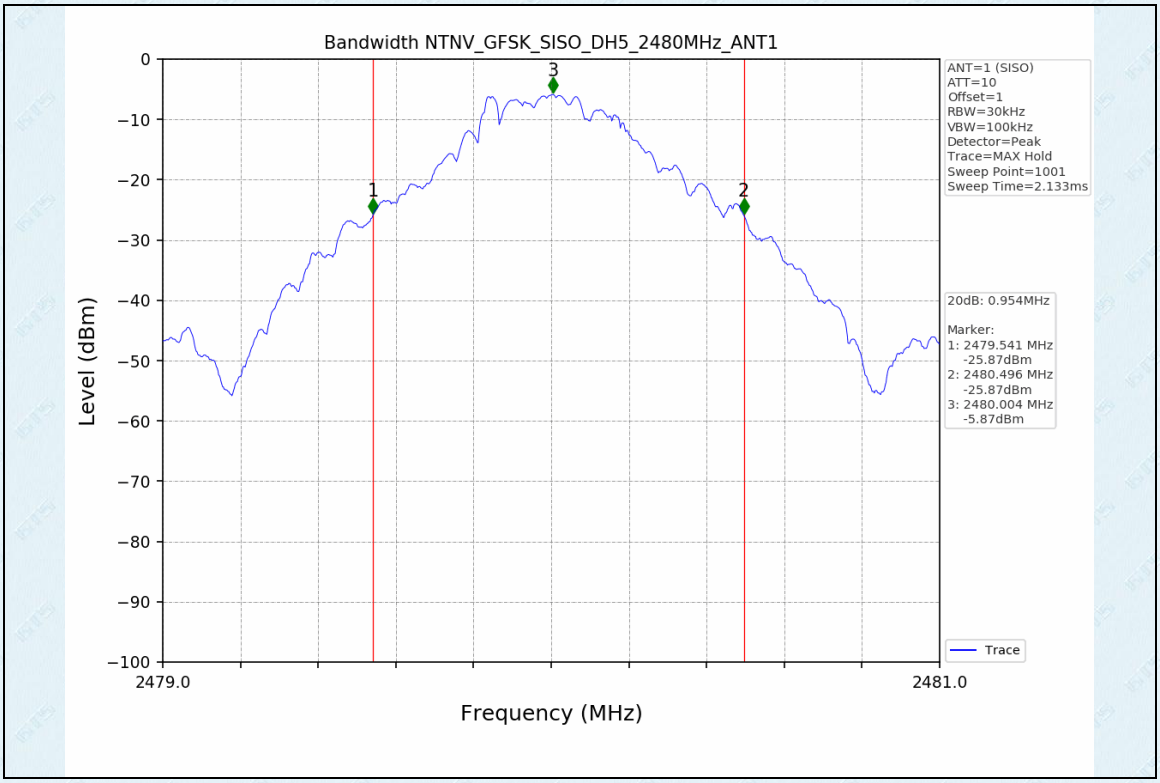
Test Mode	Frequency (MHz)	TX Type	ANT No.	20dB Bandwidth Test Result (MHz)	Verdict
GFSK	2402	SISO	1	0.955	PASS
	2441	SISO	1	0.953	PASS
	2480	SISO	1	0.954	PASS
π/4-DQPSK	2402	SISO	1	1.281	PASS
	2441	SISO	1	1.281	PASS
	2480	SISO	1	1.281	PASS

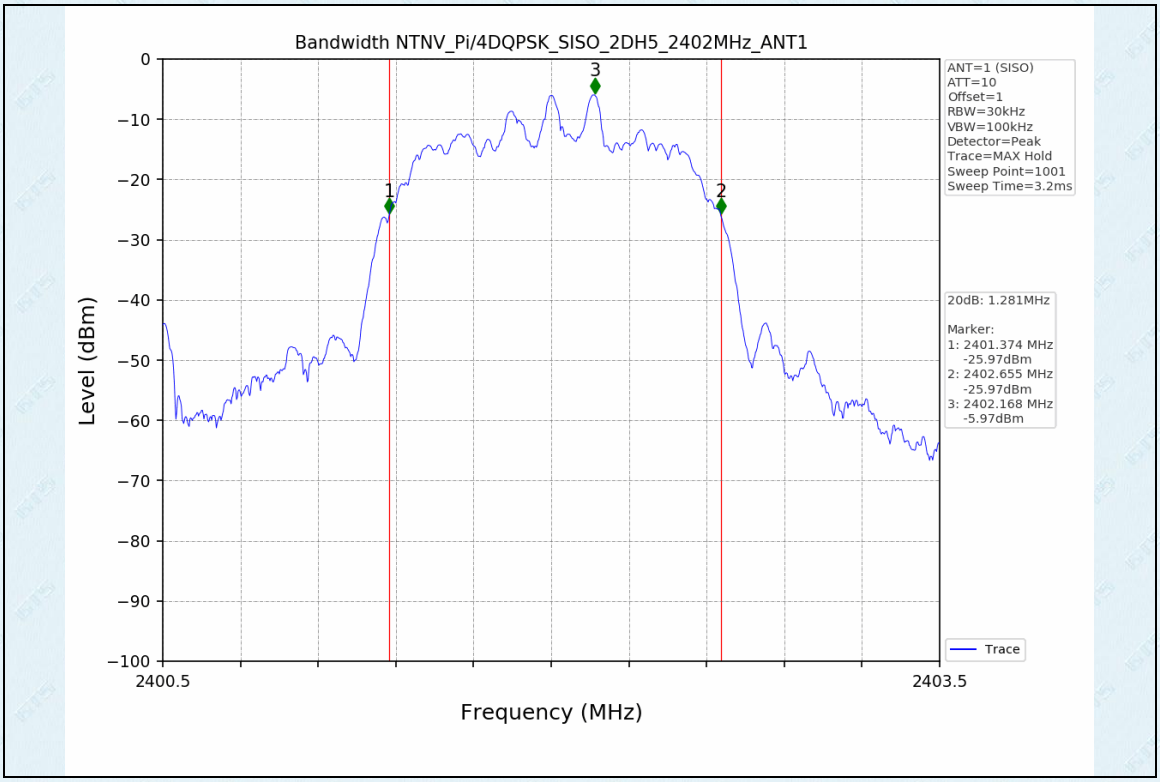
Test Mode	Frequency (MHz)	TX Type	ANT No.	99% Occupied Bandwidth Test Result (MHz)	
GFSK	2402	SISO	1	0.852	Only for Report Use
	2441	SISO	1	0.848	Only for Report Use
	2480	SISO	1	0.848	Only for Report Use
π/4-DQPSK	2402	SISO	1	1.170	Only for Report Use
	2441	SISO	1	1.174	Only for Report Use
	2480	SISO	1	1.173	Only for Report Use

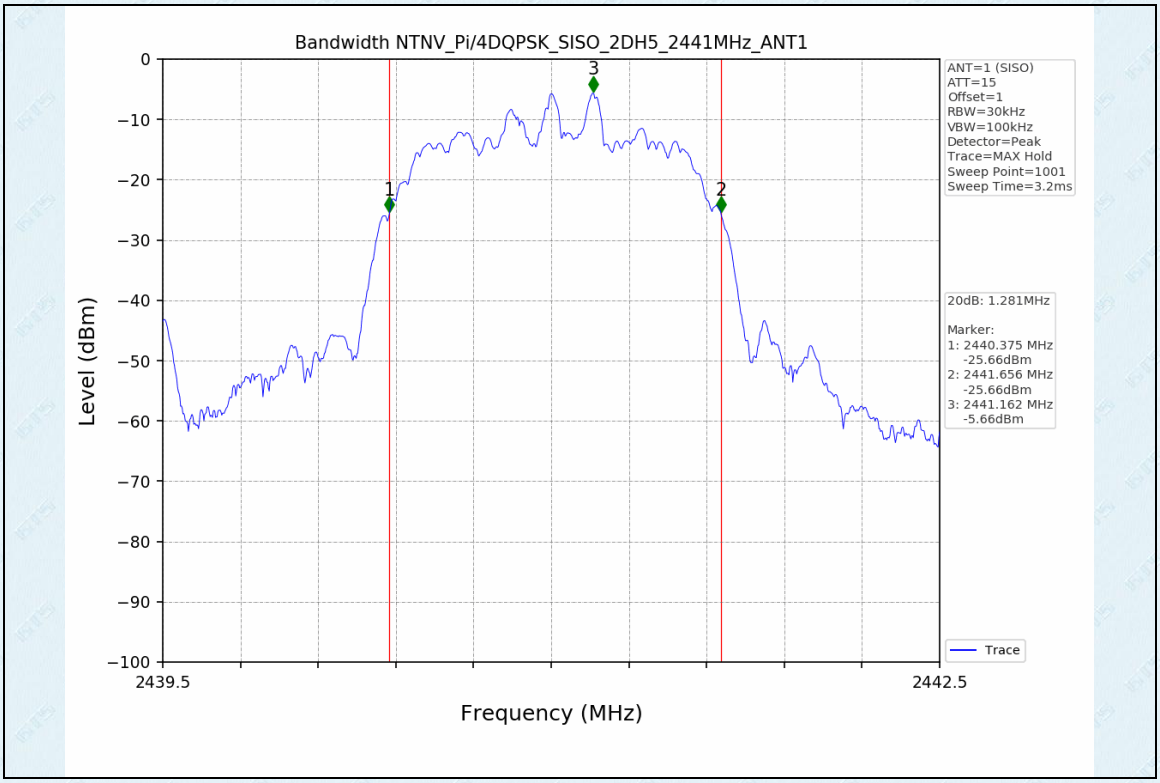
1.2 Test Graph - 20dB Bandwidth

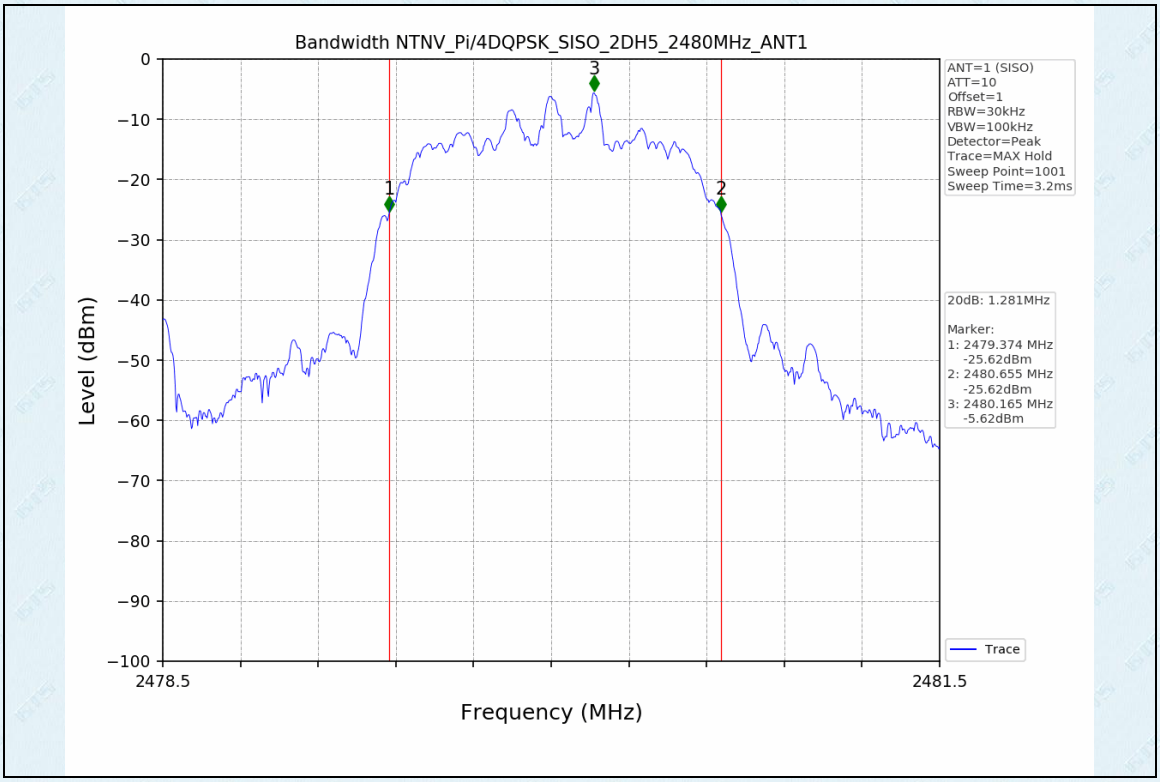




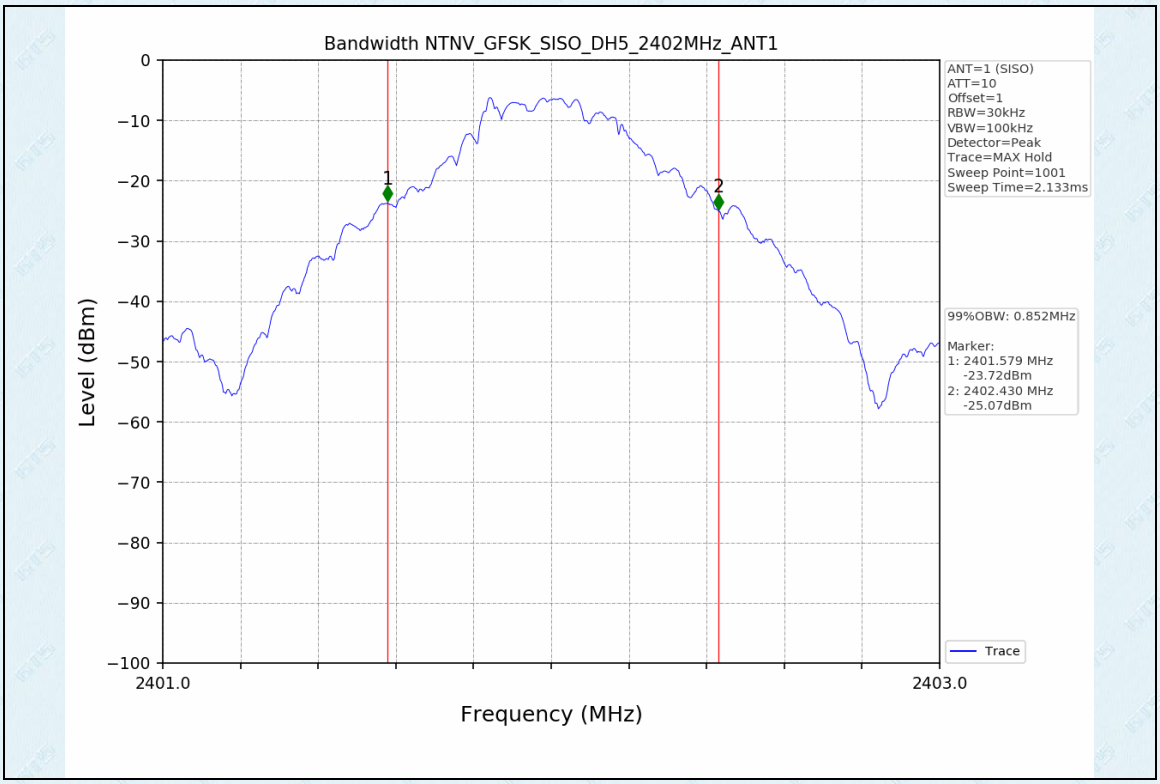

Bandwidth NTNV_GFSK_SISO_DH5_2480MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=30kHz
VBW=100kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.133ms
20dB: 0.954MHz
Marker:
1: 2479.541 MHz
-25.87dBm
2: 2480.496 MHz
-25.87dBm
3: 2480.004 MHz
-5.87dBm
Trace
Level (dBm)
Frequency (MHz)
2479.0
2481.0

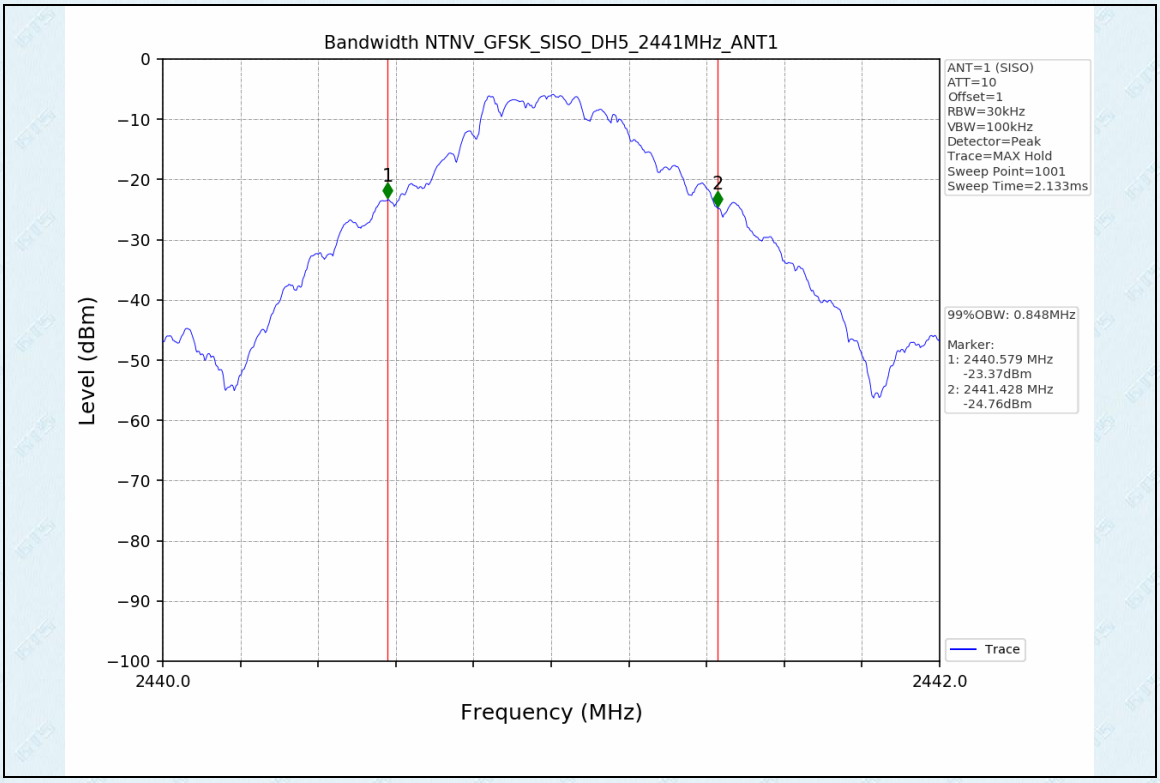

Bandwidth NTNV_Pi/4DQPSK_SISO_2DH5_2402MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=30kHz
VBW=100kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=3.2ms
20dB: 1.281MHz
Marker:
1: 2401.374 MHz
-25.97dBm
2: 2402.655 MHz
-25.97dBm
3: 2402.168 MHz
-5.97dBm
Trace
Level (dBm)
Frequency (MHz)
2400.5
2403.5

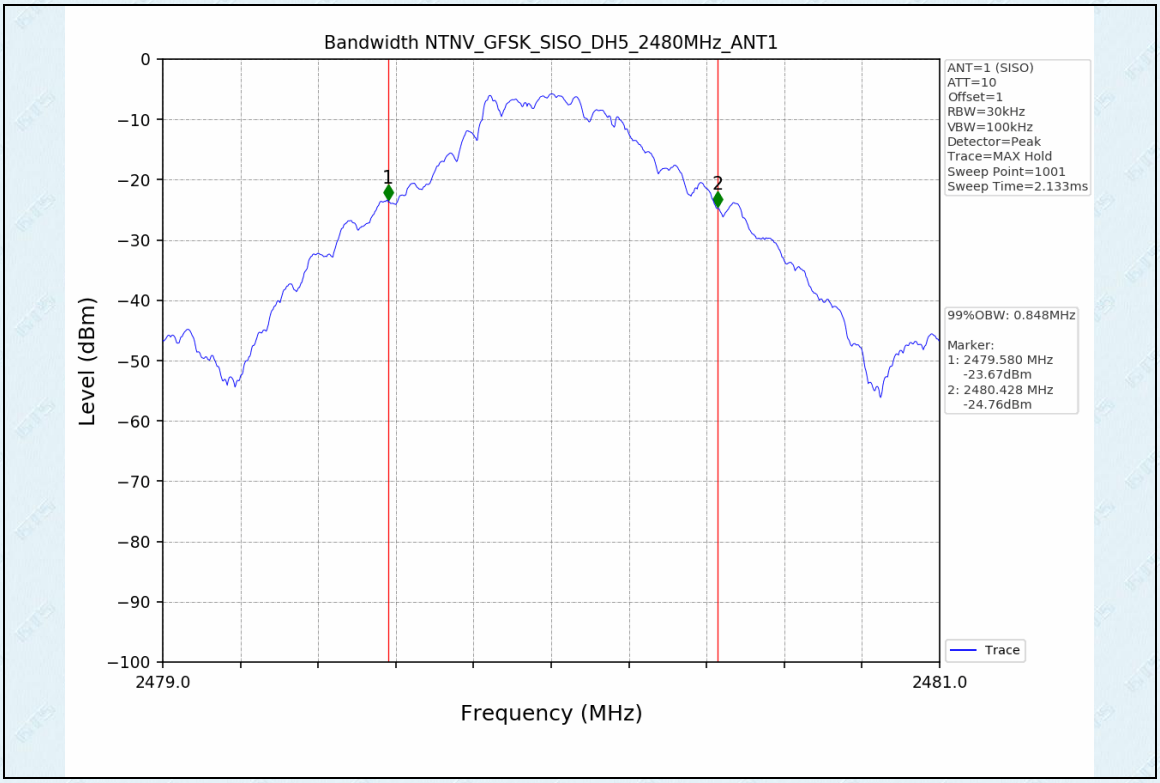

Bandwidth NTNV_Pi/4DQPSK_SISO_2DH5_2441MHz_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=30kHz
VBW=100kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=3.2ms
20dB: 1.281MHz
Marker:
1: 2440.375 MHz
-25.66dBm
2: 2441.656 MHz
-25.66dBm
3: 2441.162 MHz
-5.66dBm
Trace
Level (dBm)
Frequency (MHz)
2439.5
2442.5

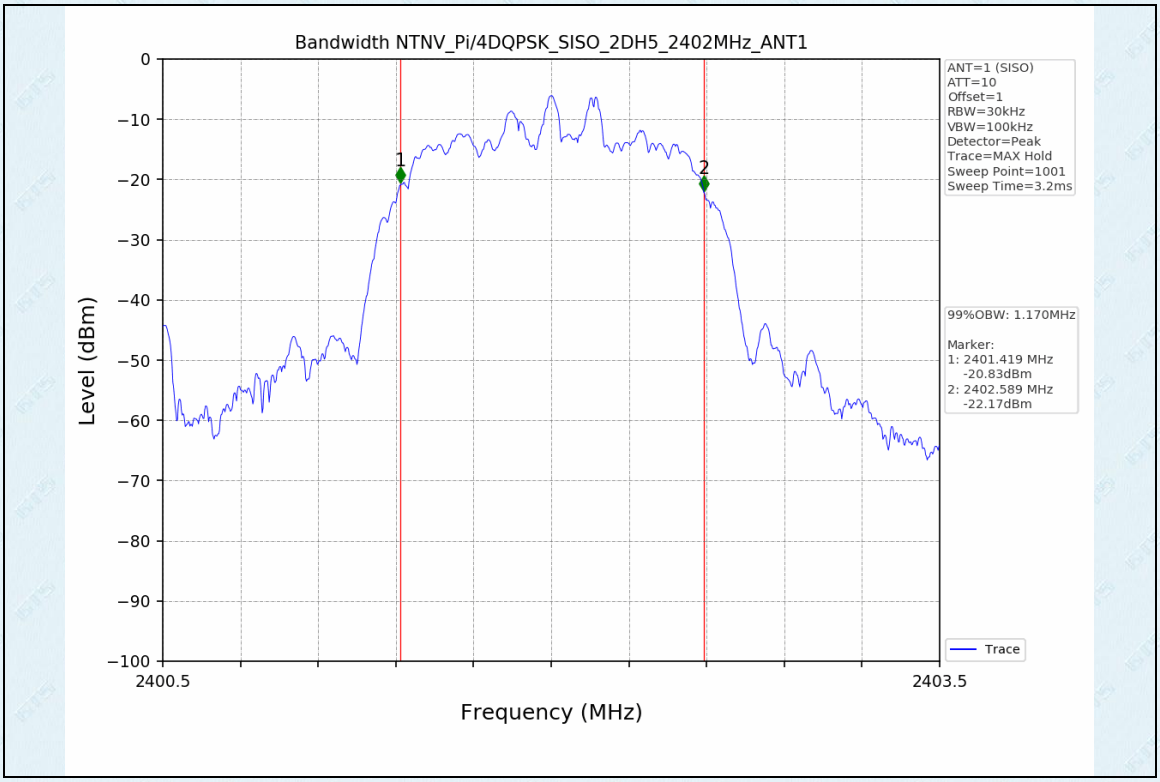

Bandwidth NTNV_Pi/4DQPSK_SISO_2DH5_2480MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=30kHz
VBW=100kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=3.2ms
20dB: 1.281MHz
Marker:
1: 2479.374 MHz
-25.62dBm
2: 2480.655 MHz
-25.62dBm
3: 2480.165 MHz
-5.62dBm
Trace
Level (dBm)
Frequency (MHz)
2478.5
2481.5

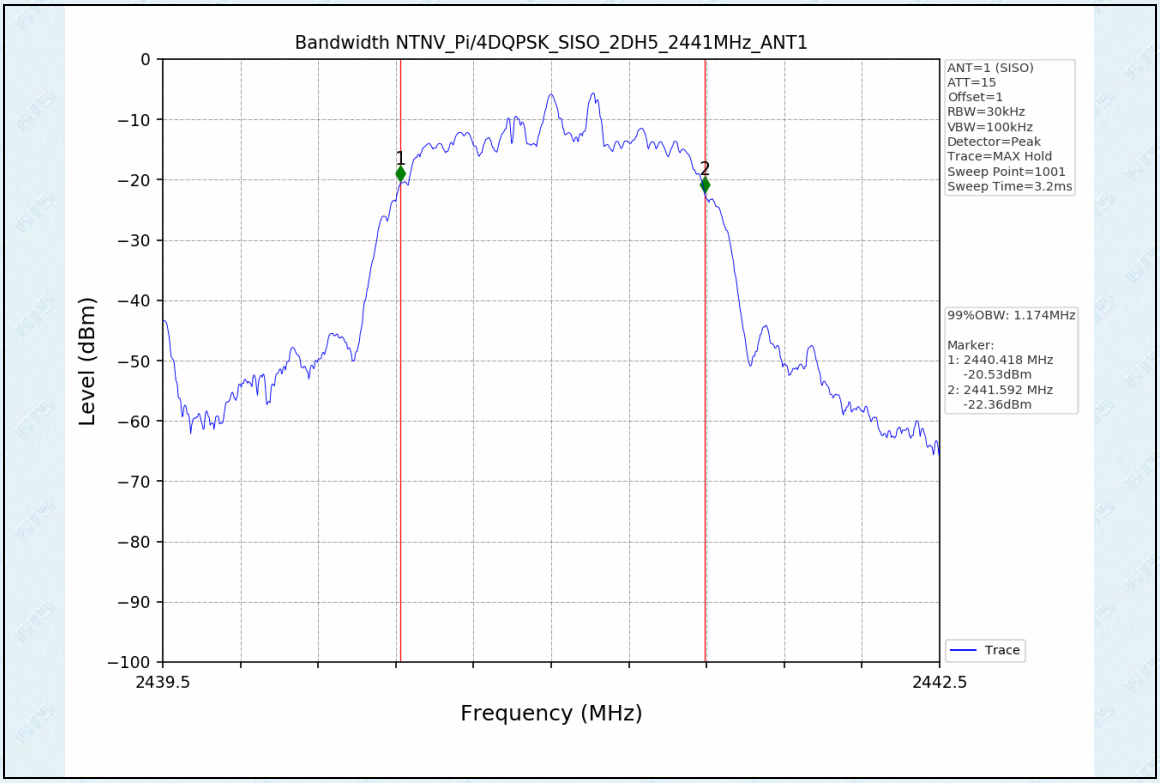
1.3 Test Graph - 99% Occupied Bandwidth

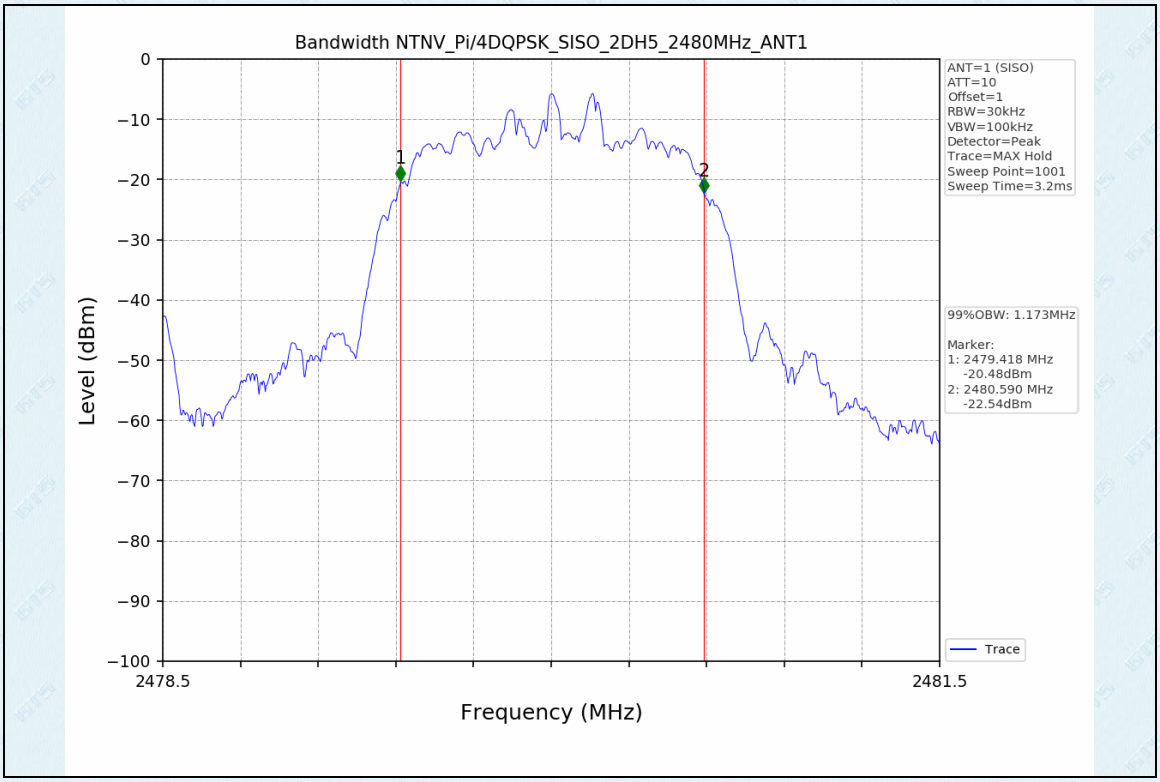





Bandwidth NTNV_GFSK_SISO_DH5_2480MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=30kHz
VBW=100kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.133ms
99%OBW: 0.848MHz
Marker:
1: 2479.580 MHz
-23.67dBm
2: 2480.428 MHz
-24.76dBm
Trace
Level (dBm)
Frequency (MHz)
2479.0
2481.0


Bandwidth NTNV_Pi/4DQPSK_SISO_2DH5_2402MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=30kHz
VBW=100kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=3.2ms
99%OBW: 1.170MHz
Marker:
1: 2401.419 MHz
-20.83dBm
2: 2402.589 MHz
-22.17dBm
Trace
Level (dBm)
Frequency (MHz)
2400.5
2403.5


Bandwidth NTNV_Pi/4DQPSK_SISO_2DH5_2441MHz_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=30kHz
VBW=100kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=3.2ms
99%OBW: 1.174MHz
Marker:
1: 2440.418 MHz
-20.53dBm
2: 2441.592 MHz
-22.36dBm
Trace
Level (dBm)
Frequency (MHz)
2439.5
2442.5

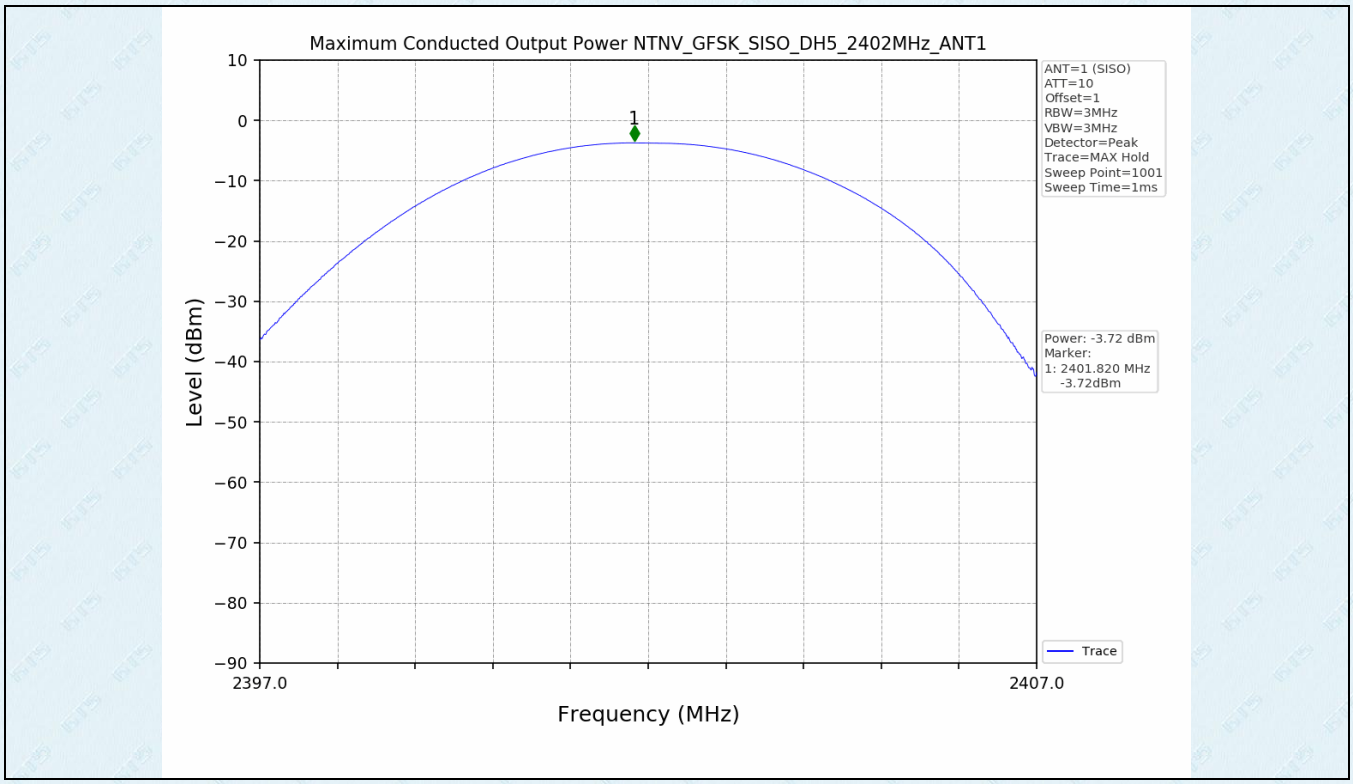

Bandwidth NTNV_Pi/4DQPSK_SISO_2DH5_2480MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=30kHz
VBW=100kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=3.2ms
99%OBW: 1.173MHz
Marker:
1: 2479.418 MHz
-20.48dBm
2: 2480.590 MHz
-22.54dBm
Trace
Level (dBm)
Frequency (MHz)
2478.5
2481.5

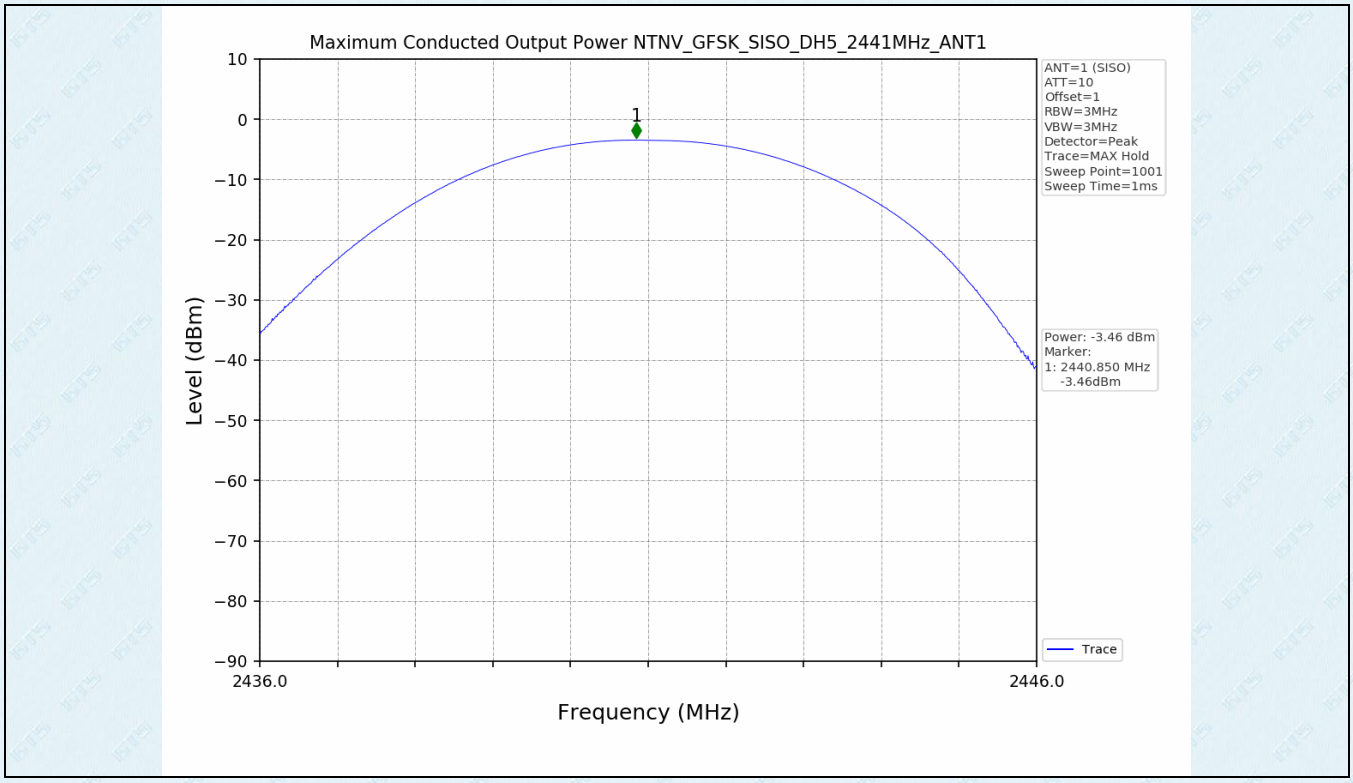
2. Maximum Conducted Output Power

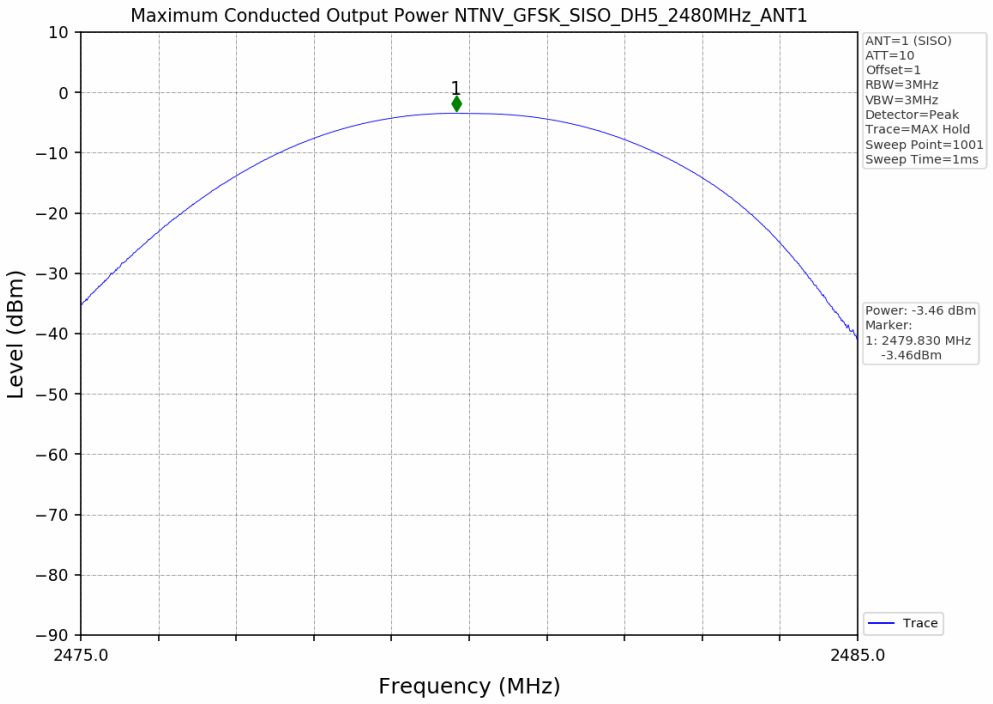
2.1 Test Result

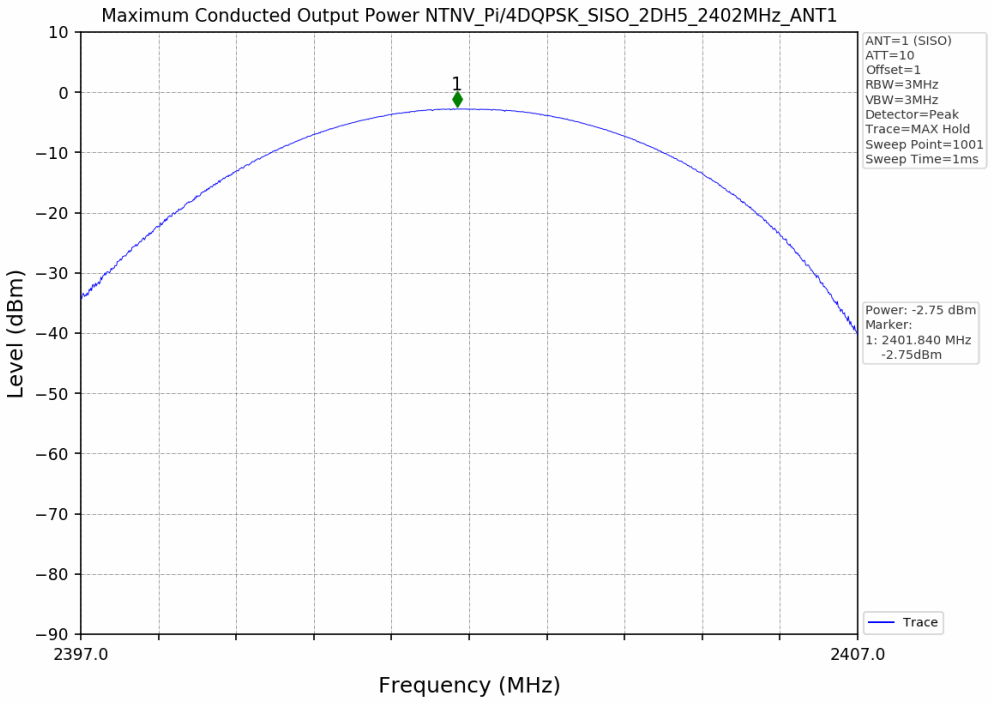
Test Mode	Frequency (MHz)	Tx Type	Measured Peak Output Power (dBm)	Limits (dBm)	Verdict
			Ant 1		
GFSK	2402	SISO	-3.72	30	PASS
	2441	SISO	-3.46	30	PASS
	2480	SISO	-3.46	30	PASS
π/4-DQPSK	2402	SISO	-2.75	20.97	PASS
	2441	SISO	-2.47	20.97	PASS
	2480	SISO	-2.51	20.97	PASS

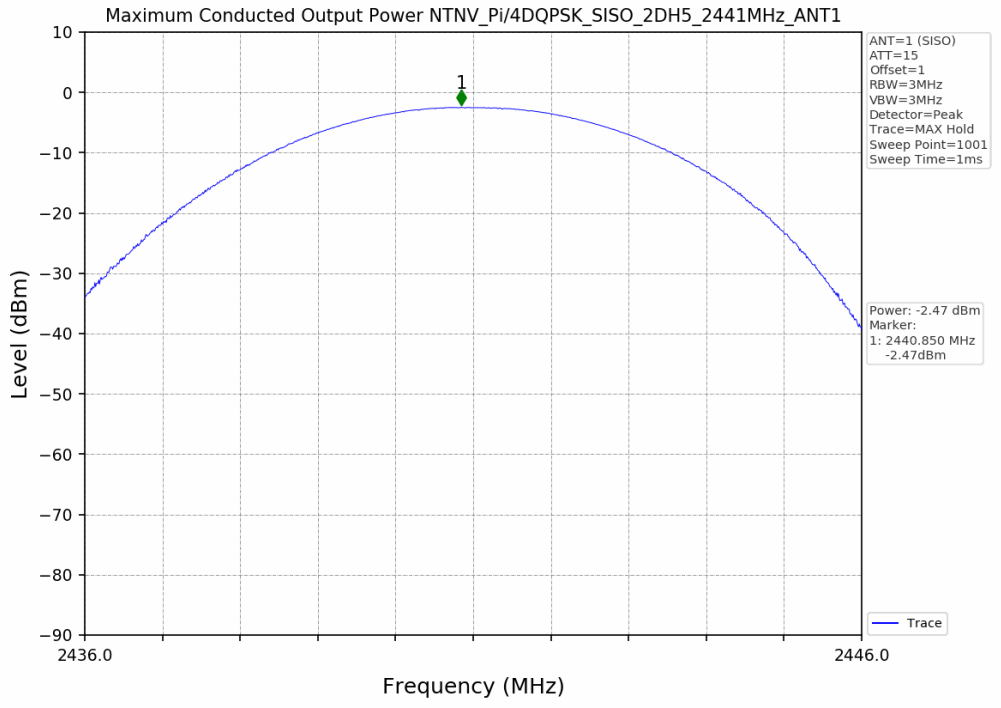
2.2 Test Graph

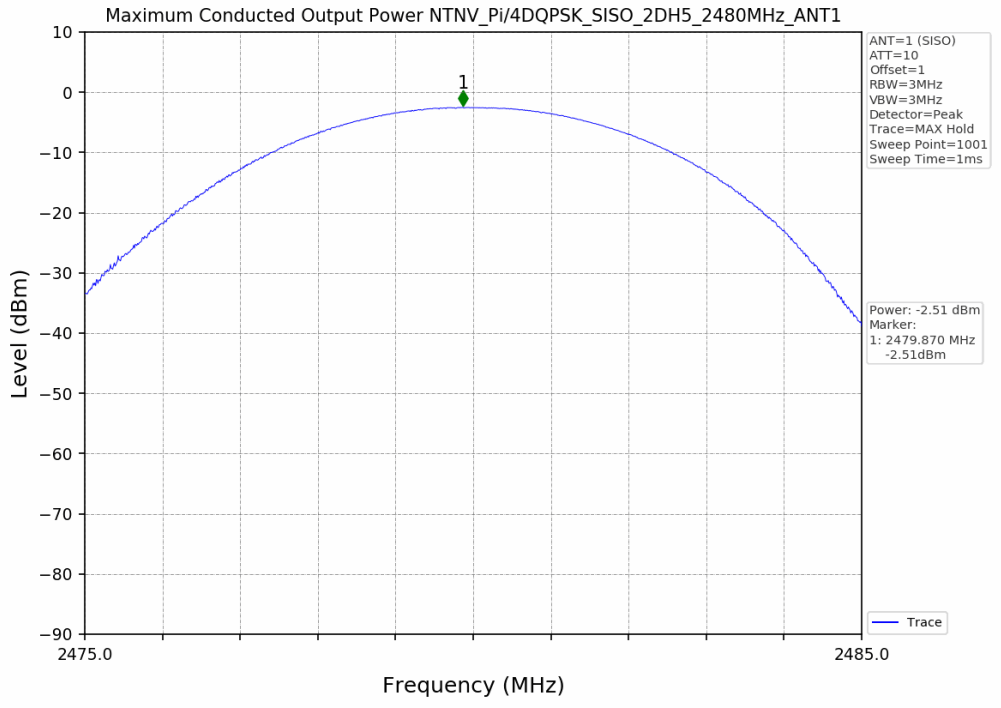





Maximum Conducted Output Power NTNV_GFSK_SISO_DH5_2480MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=3MHz
VBW=3MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Power: -3.46 dBm
Marker:
1: 2479.830 MHz
-3.46dBm
Trace
Level (dBm)
Frequency (MHz)
2475.0
2485.0


Maximum Conducted Output Power NTNV_Pi/4DQPSK_SISO_2DH5_2402MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=3MHz
VBW=3MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Power: -2.75 dBm
Marker:
1: 2401.840 MHz
-2.75dBm
Trace
Level (dBm)
Frequency (MHz)
2397.0
2407.0


Maximum Conducted Output Power NTNV_Pi/4DQPSK_SISO_2DH5_2441MHz_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=3MHz
VBW=3MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Power: -2.47 dBm
Marker:
1: 2440.850 MHz
-2.47dBm
Trace
Level (dBm)
Frequency (MHz)
2436.0
2446.0

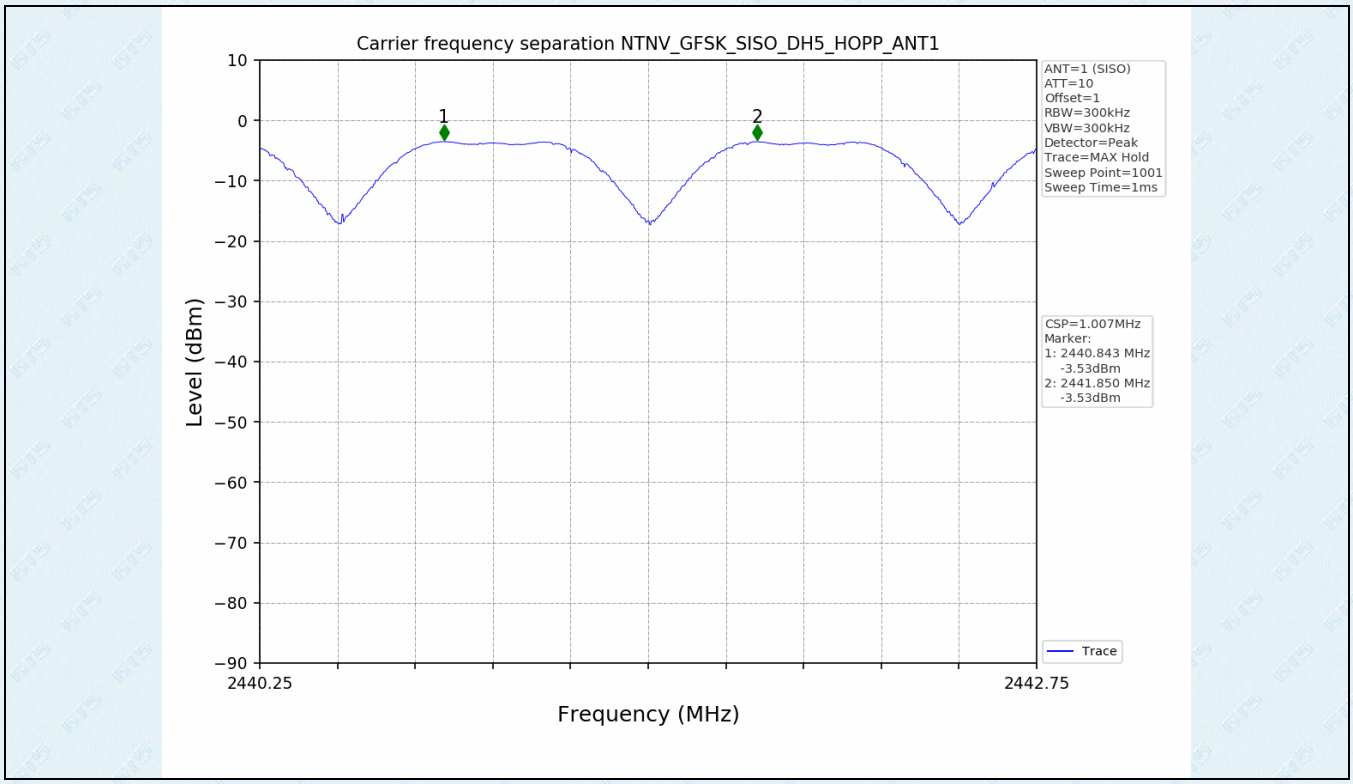

Maximum Conducted Output Power NTNV_Pi/4DQPSK_SISO_2DH5_2480MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=3MHz
VBW=3MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Power: -2.51 dBm
Marker:
1: 2479.870 MHz
-2.51dBm
Trace
Level (dBm)
Frequency (MHz)
2475.0
2485.0

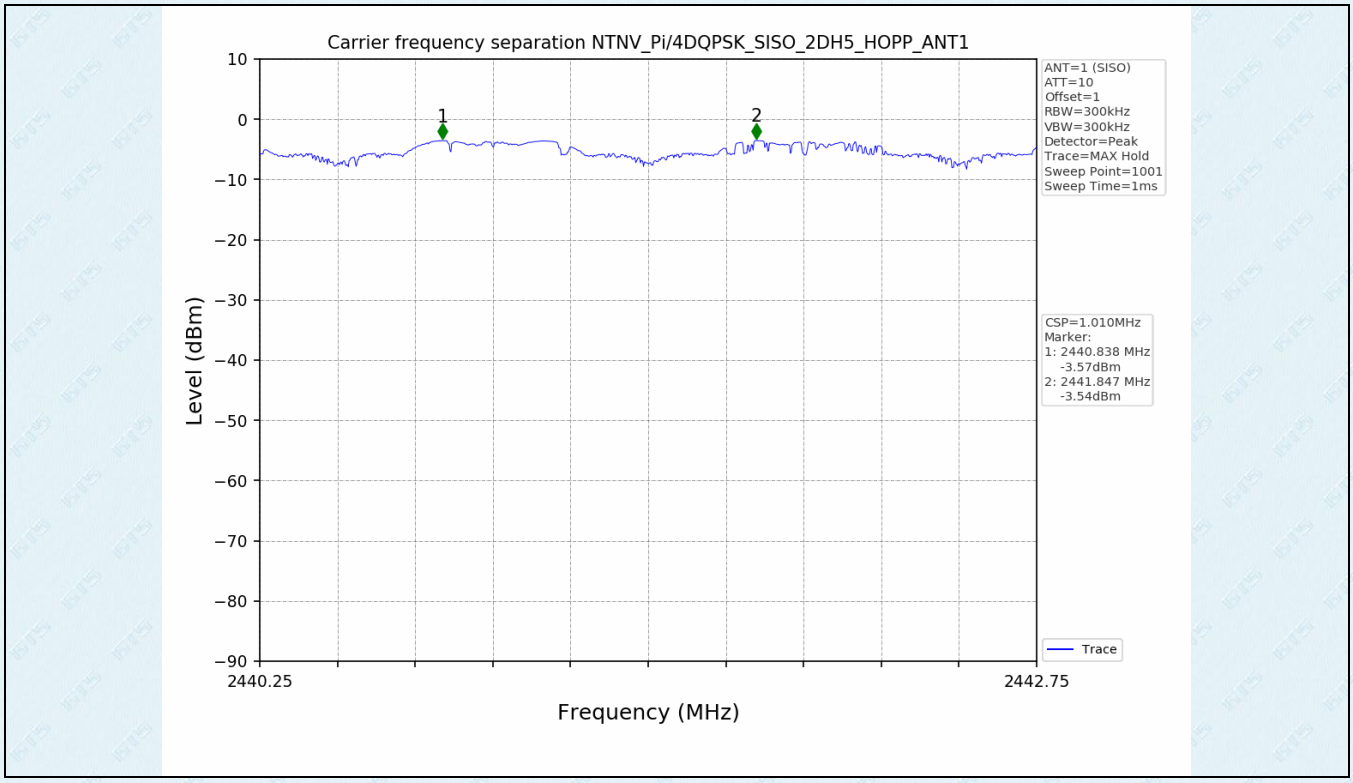
3. Carrier frequency separation

3.1 Test Result

Test Mode	TX Type	ANT No.	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limits (MHz)	Verdict
GFSK	SISO	1	1.007	1.000	≥1.000	PASS
π/4-DQPSK	SISO	1	1.010	1.200	≥0.800	PASS

3.2 Test Graph



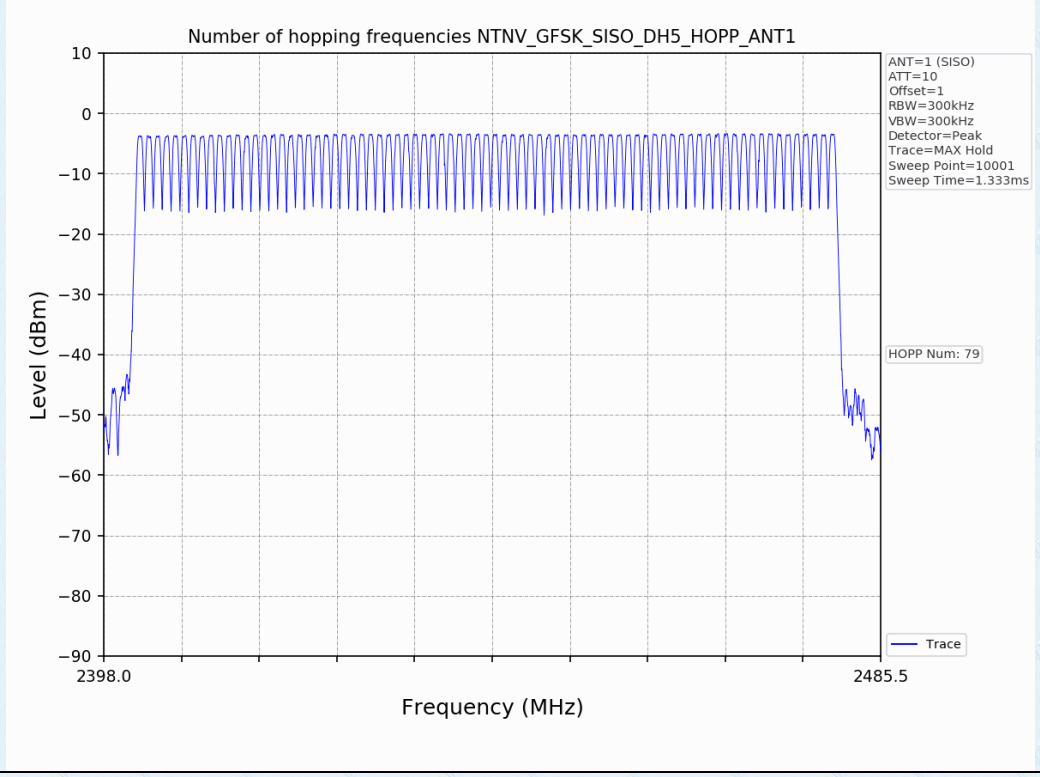


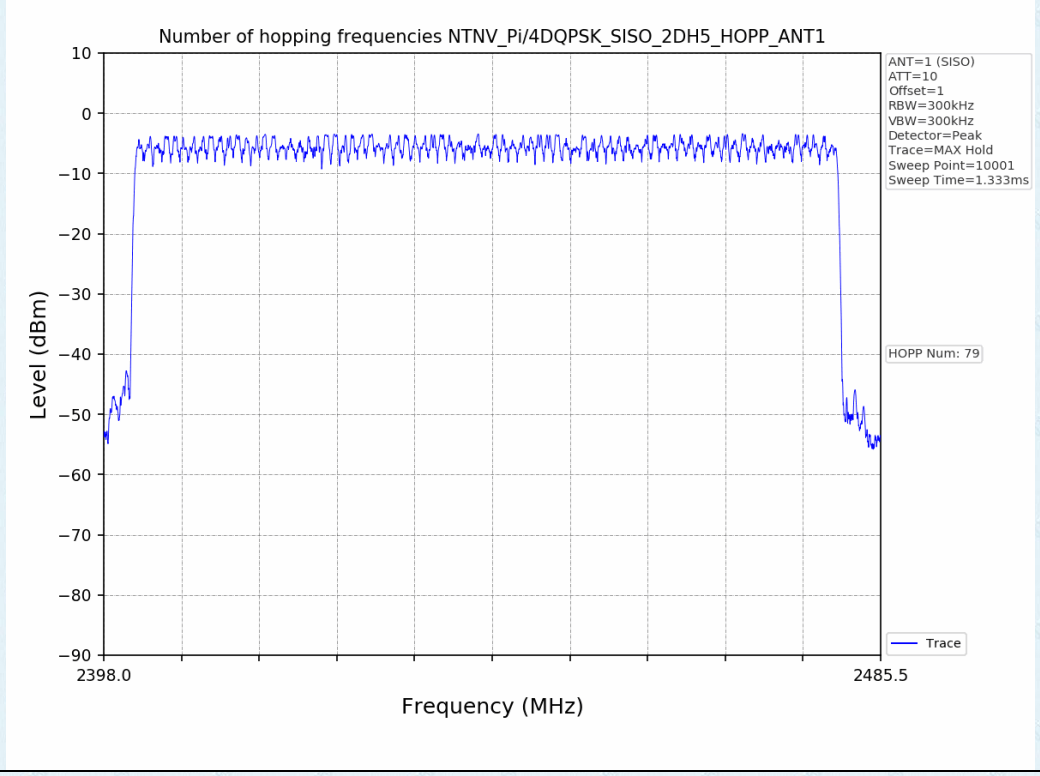
4. Number of hopping frequencies

4.1 Test Result

Test Mode	TX Type	ANT No.	Num of Hopping Frequencies	Limits	Verdict
GFSK	SISO	1	79	≥15	PASS
π/4-DQPSK	SISO	1	79	≥15	PASS

4.2 Test Graph



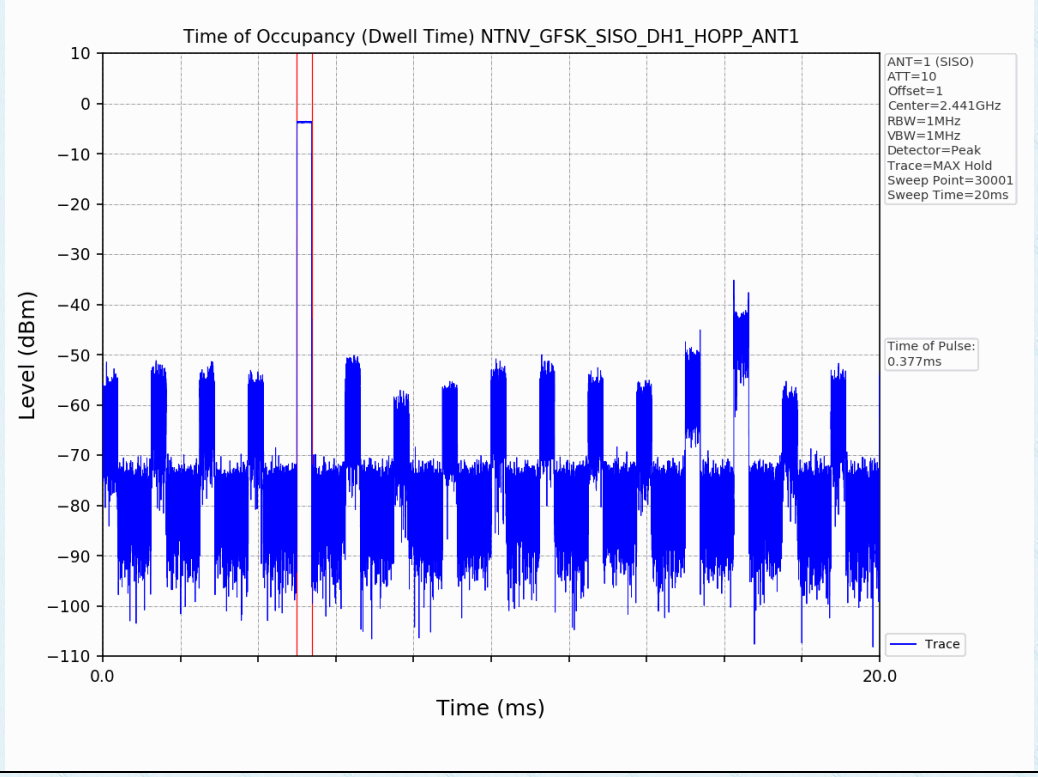


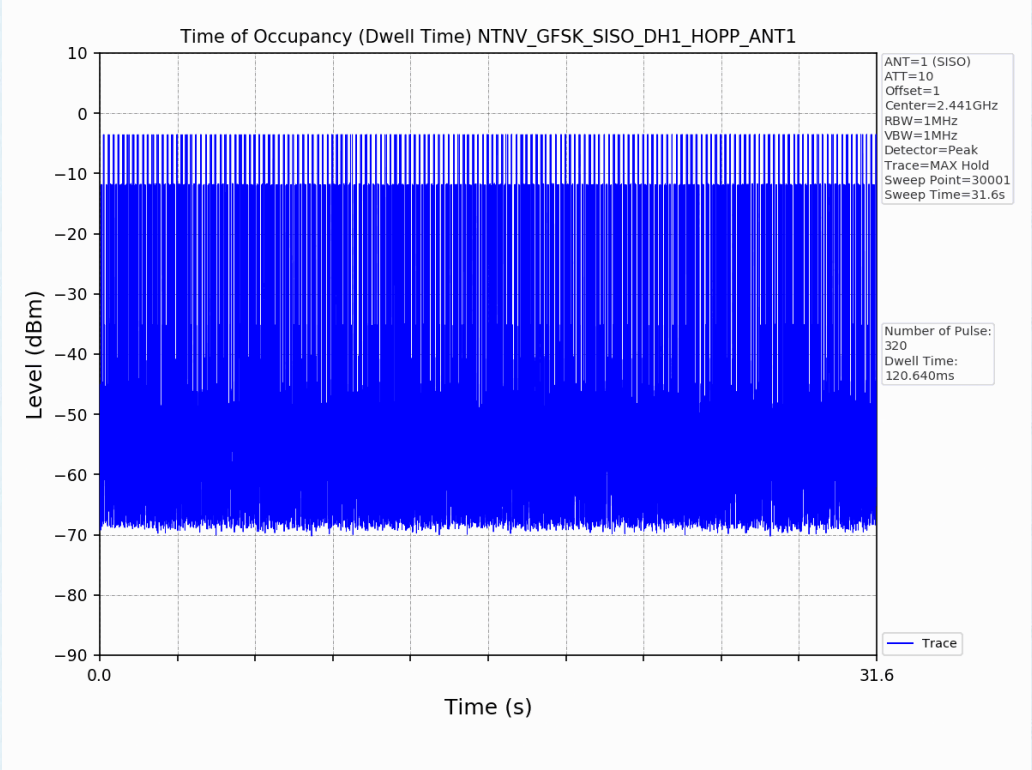
5. Time of Occupancy (Dwell Time)

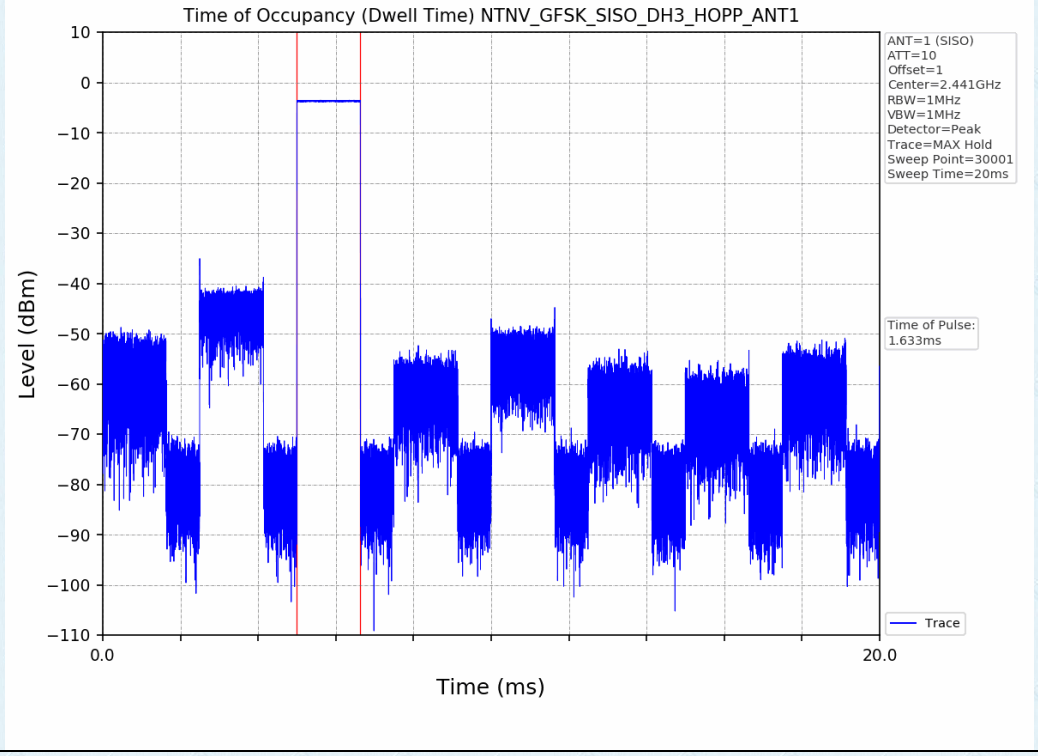
5.1 Test Result

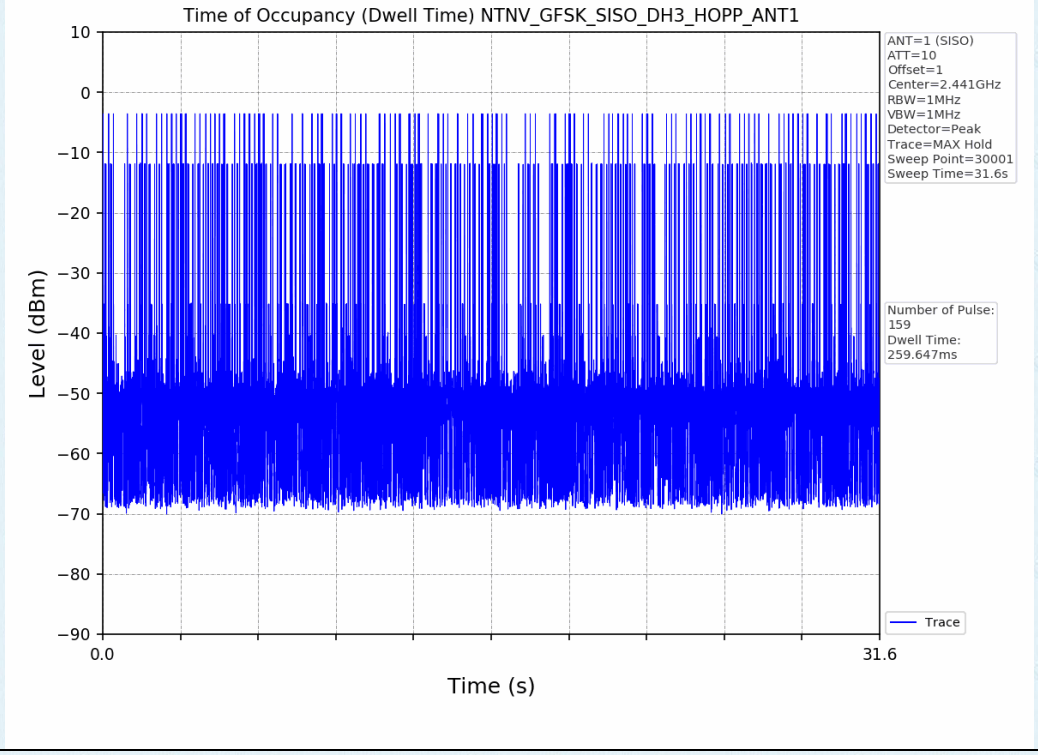
Test Mode	Packet Type	TX Type	ANT No.	Duration of Single Pulse (ms)	Obeservation Period (s)	Num of Pulse in Observation Period	Dwell Time (ms)	Limits (ms)	Verdict
GFSK	DH1	SISO	1	0.377	31.6	320	120.640	≤400	PASS
	DH3	SISO	1	1.633	31.6	159	259.647	≤400	PASS
	DH5	SISO	1	2.881	31.6	108	311.148	≤400	PASS
π/4-DQPSK	2DH1	SISO	1	0.387	31.6	317	122.679	≤400	PASS
	2DH3	SISO	1	1.639	31.6	155	254.045	≤400	PASS
	2DH5	SISO	1	2.887	31.6	104	300.248	≤400	PASS

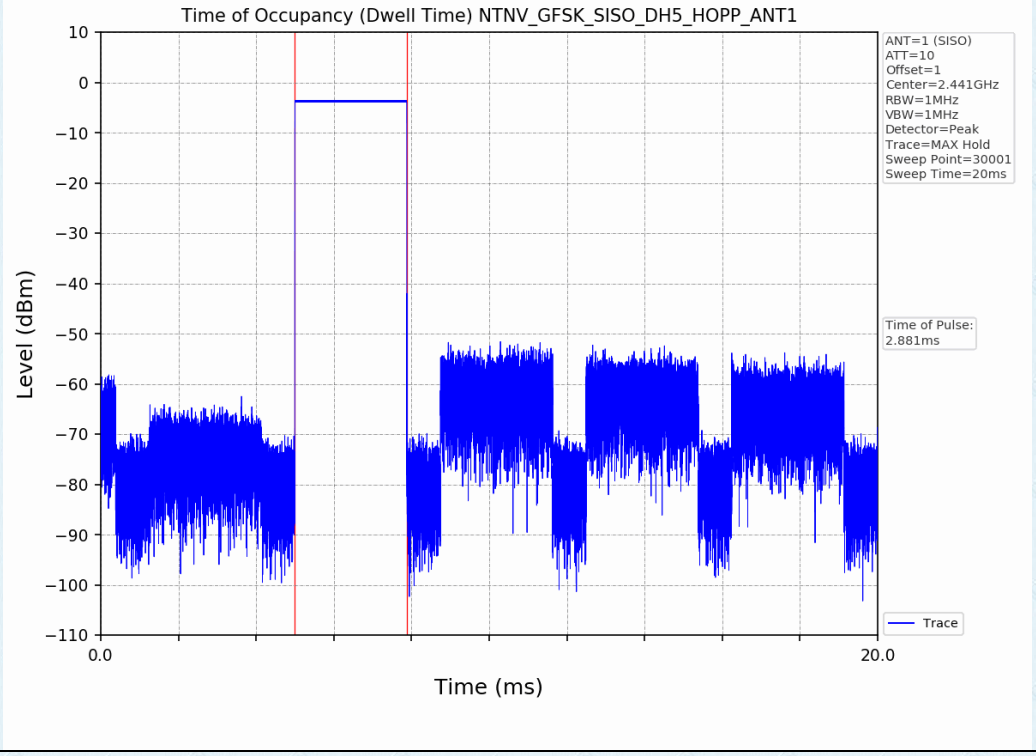
5.2 Test Graph

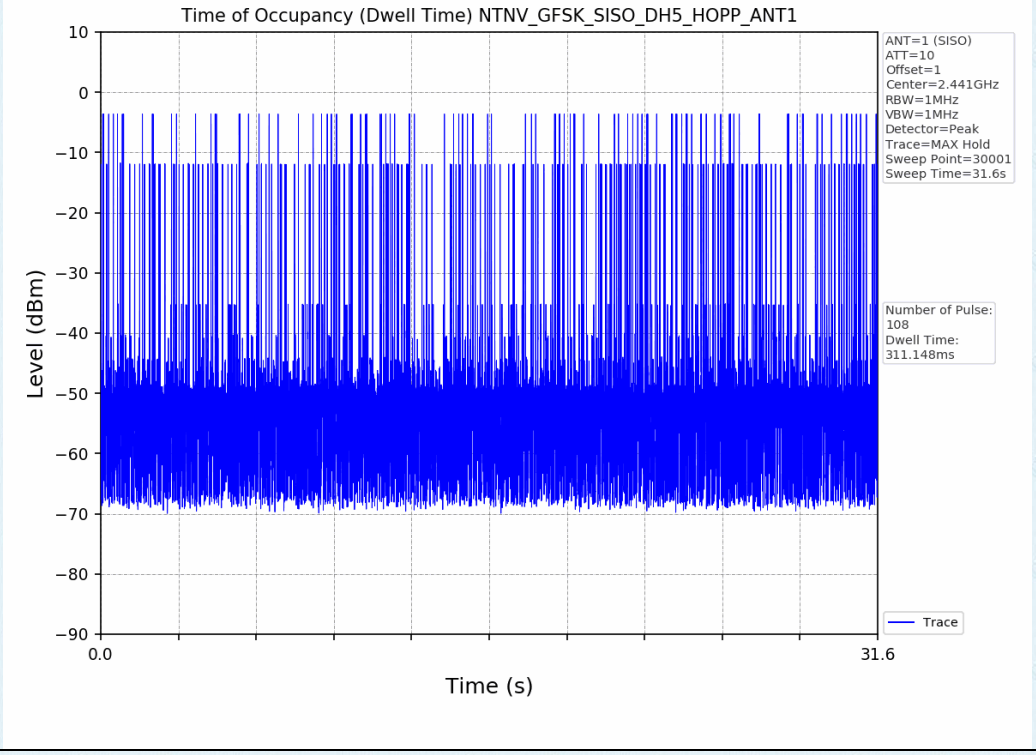


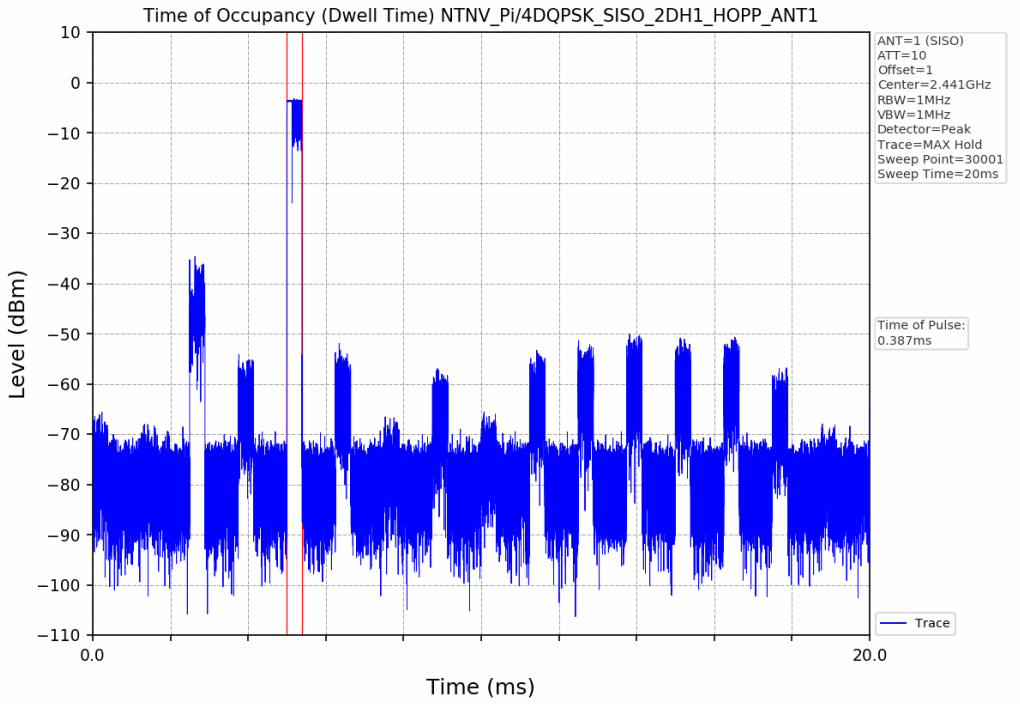


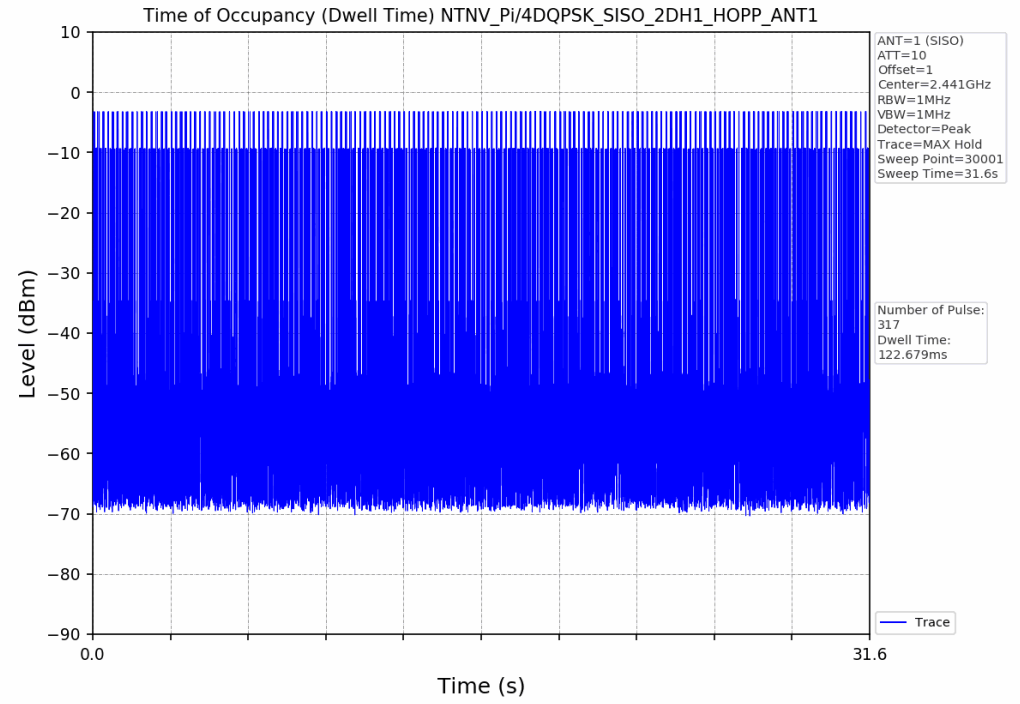

Time of Occupancy (Dwell Time) NTNV_GFSK_SISO_DH3_HOPP_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
Center=2.441GHz
RBW=1MHz
VBW=1MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=30001
Sweep Time=20ms
Time of Pulse:
1.633ms
Trace
Level (dBm)
Time (ms)
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
0.0
20.0

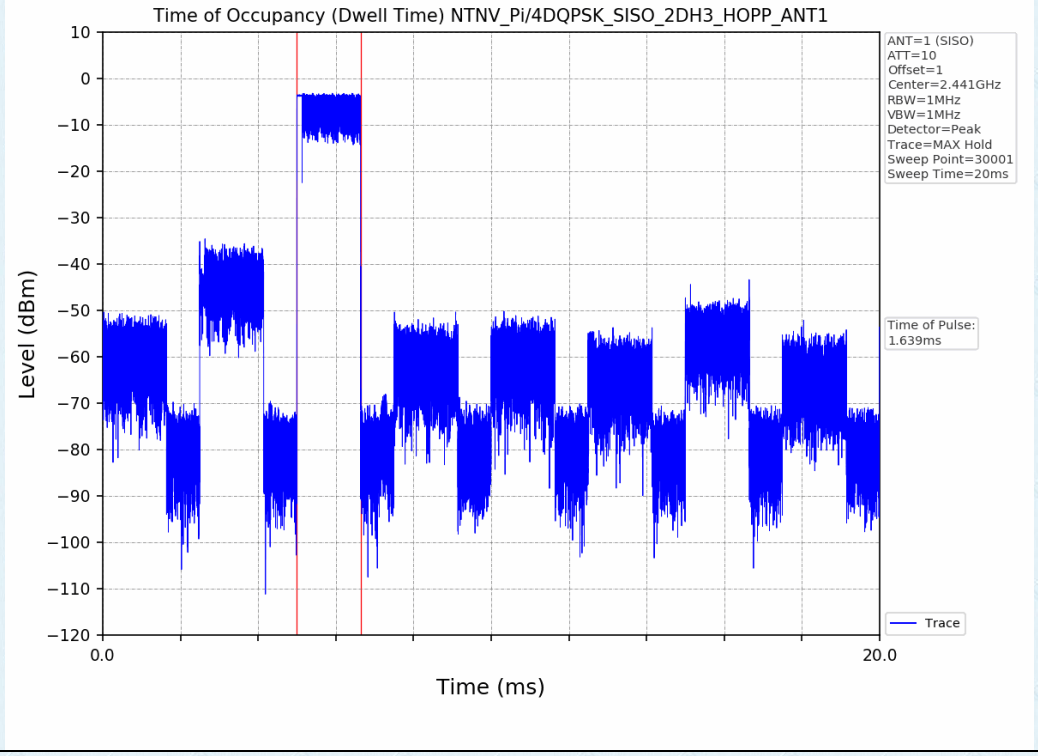

Time of Occupancy (Dwell Time) NTNV_GFSK_SISO_DH3_HOPP_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
Center=2.441GHz
RBW=1MHz
VBW=1MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=30001
Sweep Time=31.6s
Number of Pulse:
159
Dwell Time:
259.647ms
Trace
Level (dBm)
Time (s)
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
0.0
31.6

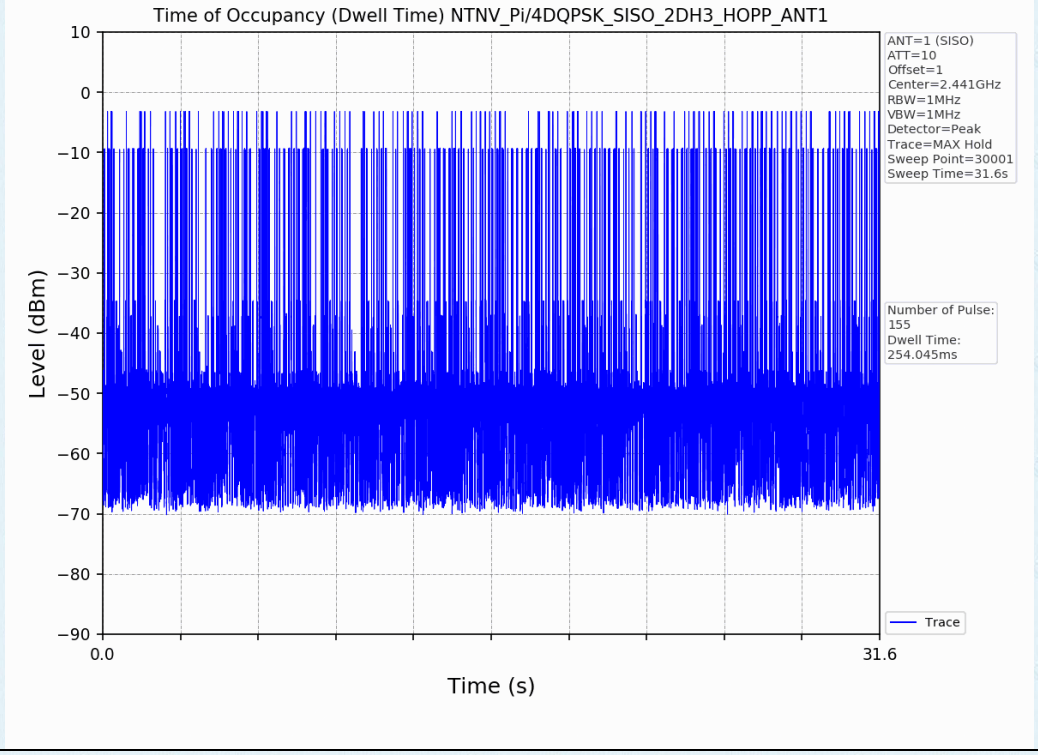

Time of Occupancy (Dwell Time) NTNV_GFSK_SISO_DH5_HOPP_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
Center=2.441GHz
RBW=1MHz
VBW=1MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=30001
Sweep Time=20ms
Time of Pulse:
2.881ms
Trace
Level (dBm)
Time (ms)
0.0
20.0

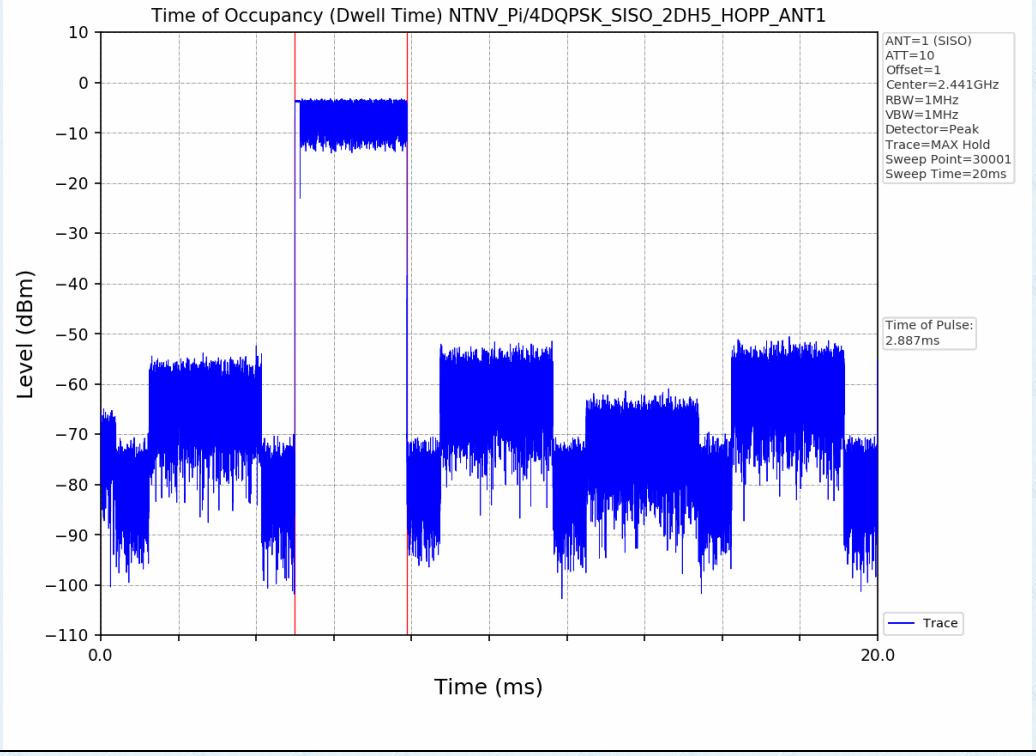

Time of Occupancy (Dwell Time) NTNV_GFSK_SISO_DH5_HOPP_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
Center=2.441GHz
RBW=1MHz
VBW=1MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=30001
Sweep Time=31.6s
Number of Pulse:
108
Dwell Time:
311.148ms
Trace
Level (dBm)
Time (s)
0.0
31.6

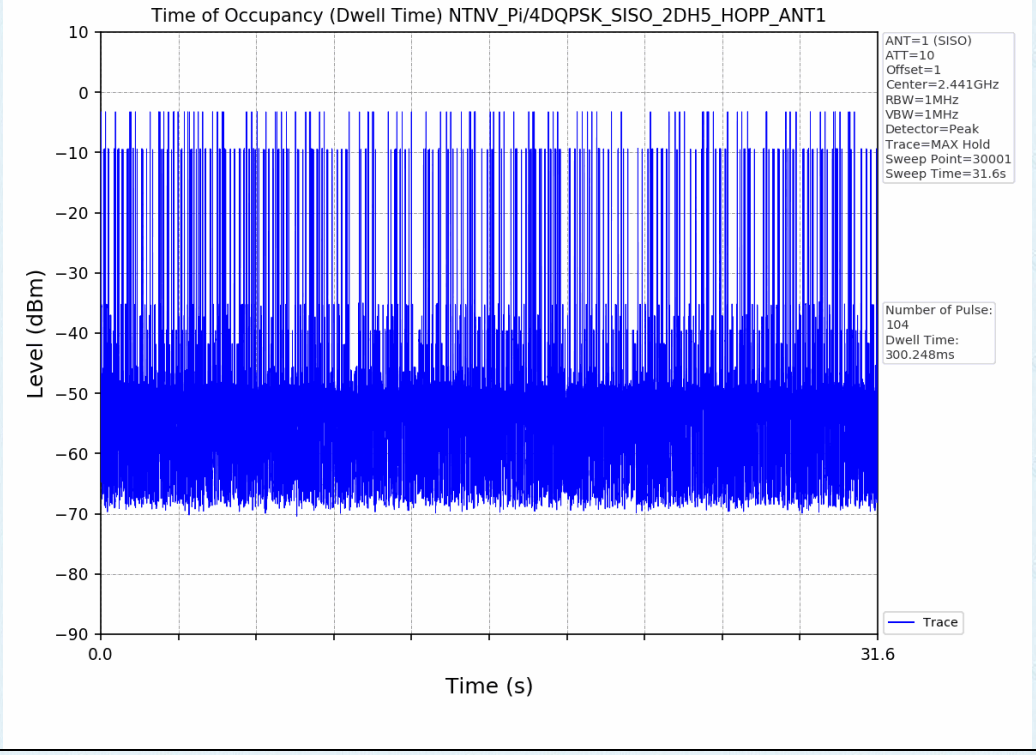

Time of Occupancy (Dwell Time) NTNV_Pi/4DQPSK_SISO_2DH1_HOPP_ANT1
Level (dBm)
Time (ms)
0.0
20.0
ANT=1 (SISO)
ATT=10
Offset=1
Center=2.441GHz
RBW=1MHz
VBW=1MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=30001
Sweep Time=20ms
Time of Pulse:
0.387ms
Trace


Time of Occupancy (Dwell Time) NTNV_Pi/4DQPSK_SISO_2DH1_HOPP_ANT1
Level (dBm)
Time (s)
0.0
31.6
ANT=1 (SISO)
ATT=10
Offset=1
Center=2.441GHz
RBW=1MHz
VBW=1MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=30001
Sweep Time=31.6s
Number of Pulse:
317
Dwell Time:
122.679ms
Trace


Time of Occupancy (Dwell Time) NTNV_Pi/4DQPSK_SISO_2DH3_HOPP_ANT1
Level (dBm)
Time (ms)
0.0
20.0
ANT=1 (SISO)
ATT=10
Offset=1
Center=2.441GHz
RBW=1MHz
VBW=1MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=30001
Sweep Time=20ms
Time of Pulse:
1.639ms
Trace


Time of Occupancy (Dwell Time) NTNV_Pi/4DQPSK_SISO_2DH3_HOPP_ANT1
Level (dBm)
Time (s)
0.0
31.6
ANT=1 (SISO)
ATT=10
Offset=1
Center=2.441GHz
RBW=1MHz
VBW=1MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=30001
Sweep Time=31.6s
Number of Pulse:
155
Dwell Time:
254.045ms
Trace


Time of Occupancy (Dwell Time) NTNV_Pi/4DQPSK_SISO_2DH5_HOPP_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
Center=2.441GHz
RBW=1MHz
VBW=1MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=30001
Sweep Time=20ms
Time of Pulse:
2.887ms
Trace
Level (dBm)
Time (ms)
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
0.0
20.0

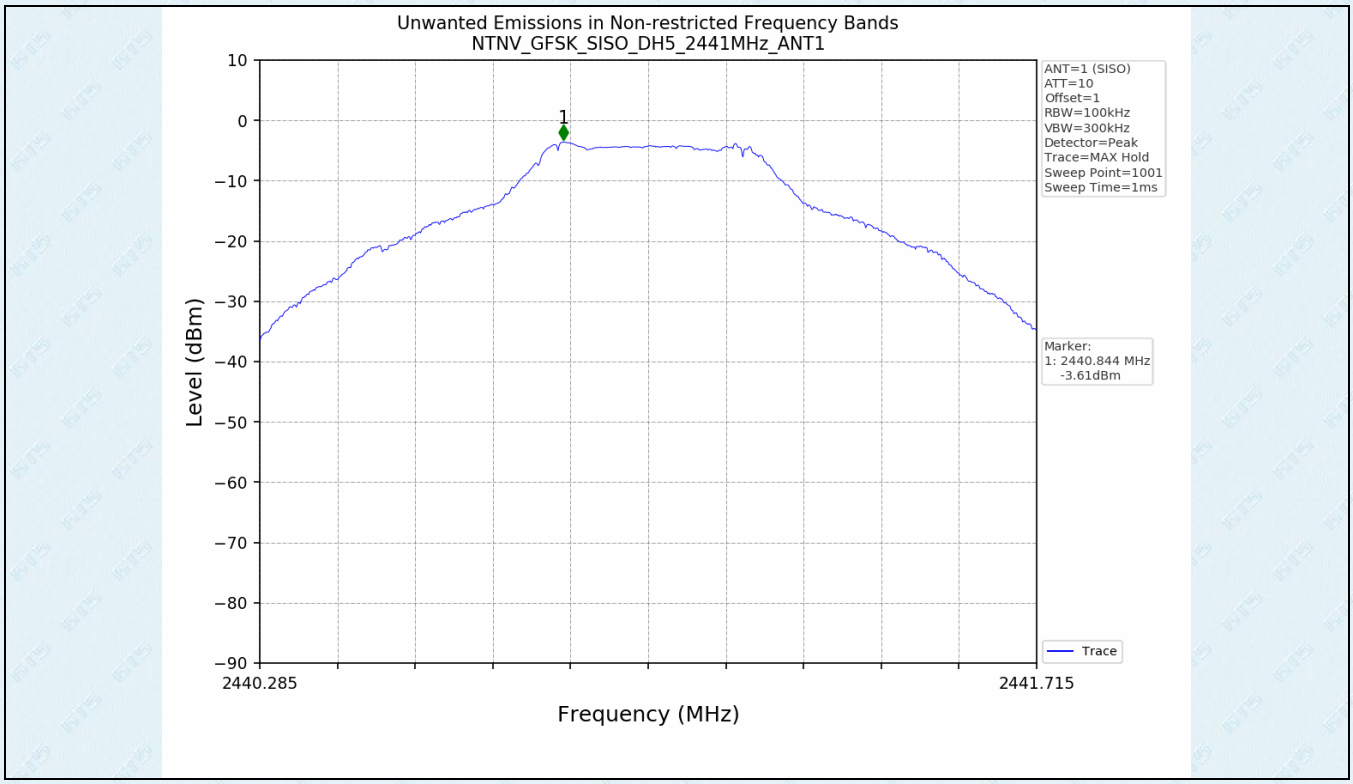

Time of Occupancy (Dwell Time) NTNV_Pi/4DQPSK_SISO_2DH5_HOPP_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
Center=2.441GHz
RBW=1MHz
VBW=1MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=30001
Sweep Time=31.6s
Number of Pulse:
104
Dwell Time:
300.248ms
Trace
Level (dBm)
Time (s)
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
0.0
31.6

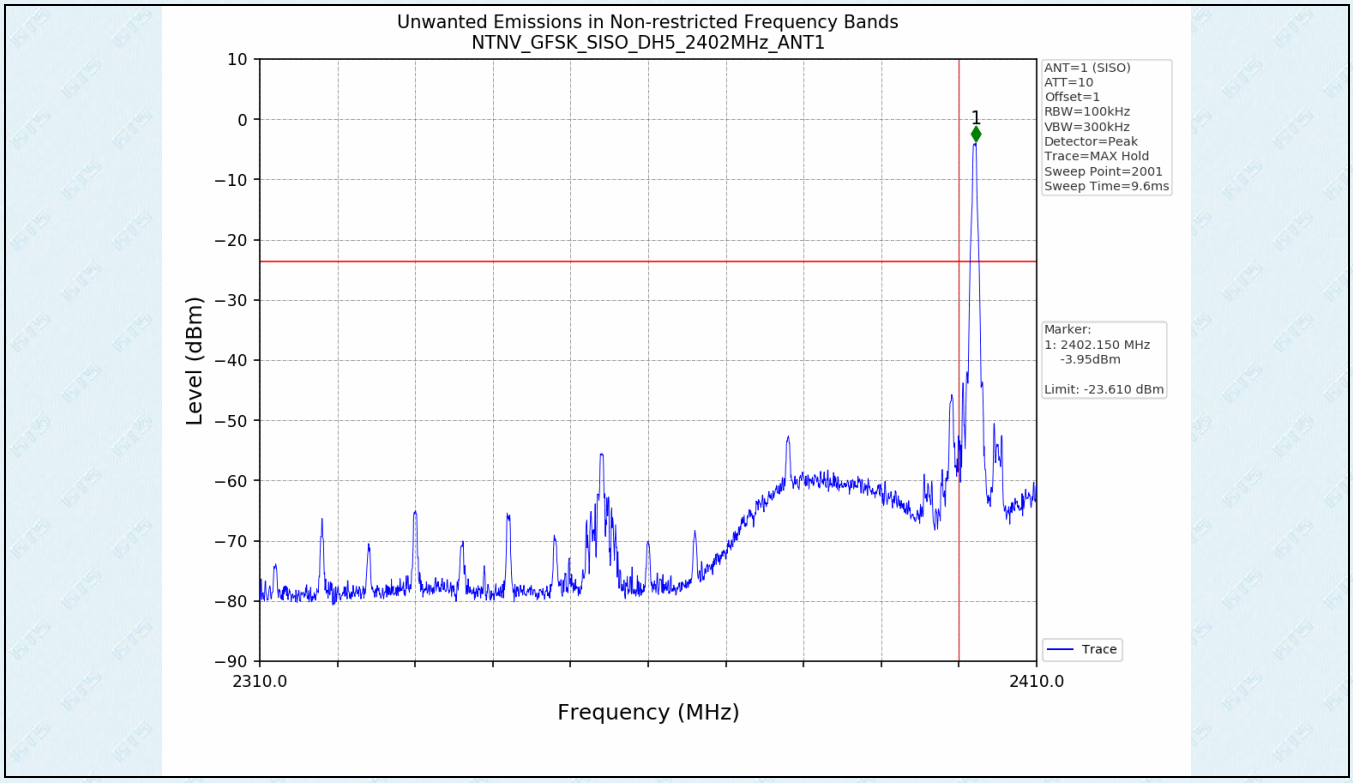
6. Unwanted Emissions in Non-restricted Frequency Bands

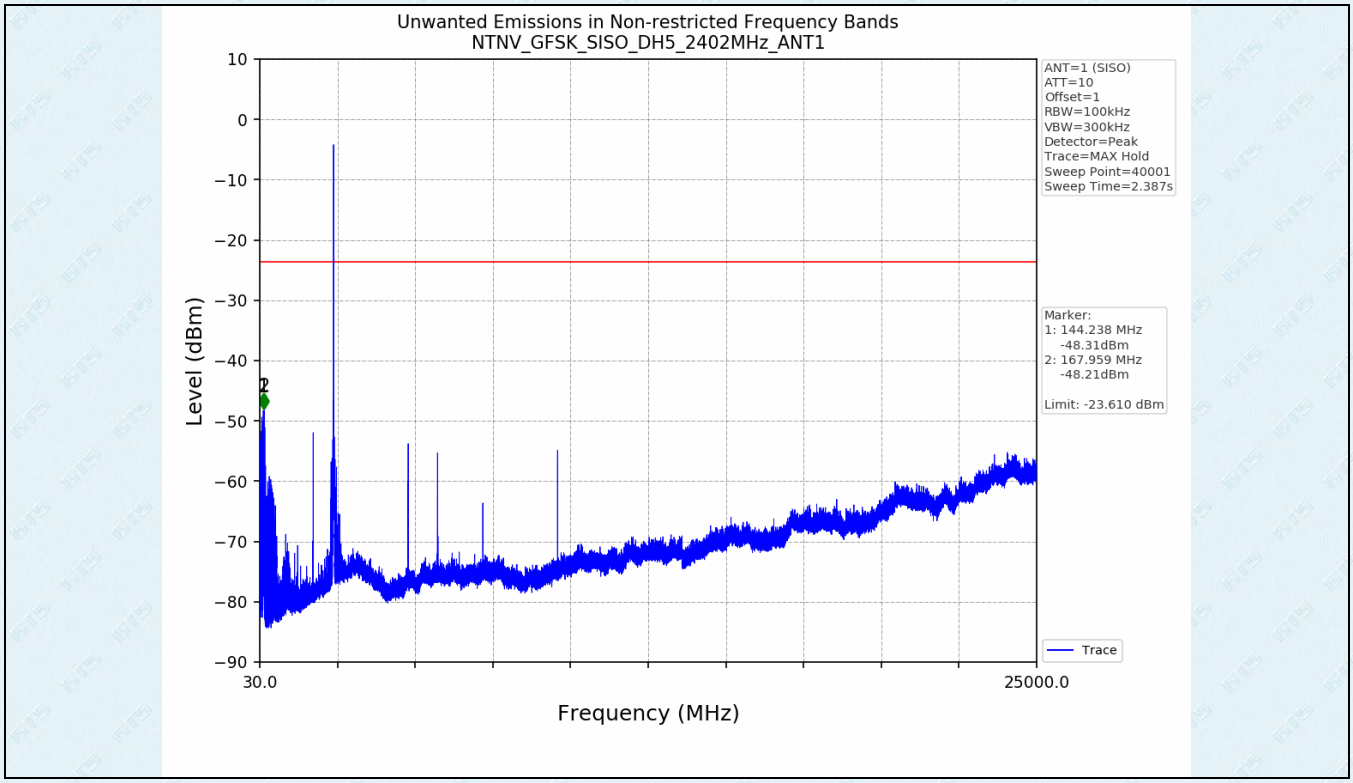
6.1 Test Result

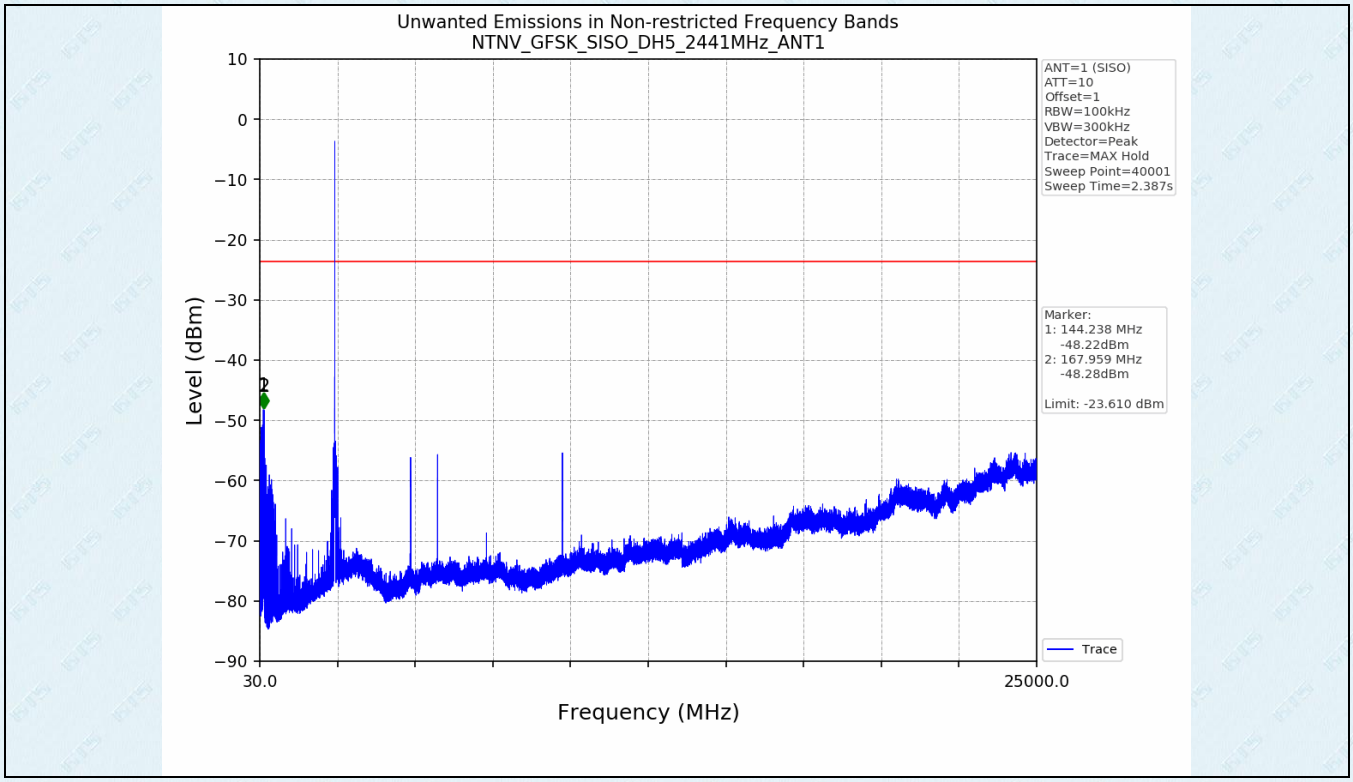
Test Mode	Frequency (MHz)	TX Type	ANT No.	Spurious Conducted Emission (dBm)	Limits (dBm)	Verdict
GFSK	2402	SISO	1	Refer to test graph	-23.61	PASS
	2441	SISO	1	Refer to test graph	-23.61	PASS
	2480	SISO	1	Refer to test graph	-23.61	PASS
	Hopping	SISO	1	Refer to test graph	-23.61	PASS
π/4-DQPSK	2402	SISO	1	Refer to test graph	-23.62	PASS
	2441	SISO	1	Refer to test graph	-23.62	PASS
	2480	SISO	1	Refer to test graph	-23.62	PASS
	Hopping	SISO	1	Refer to test graph	-23.62	PASS

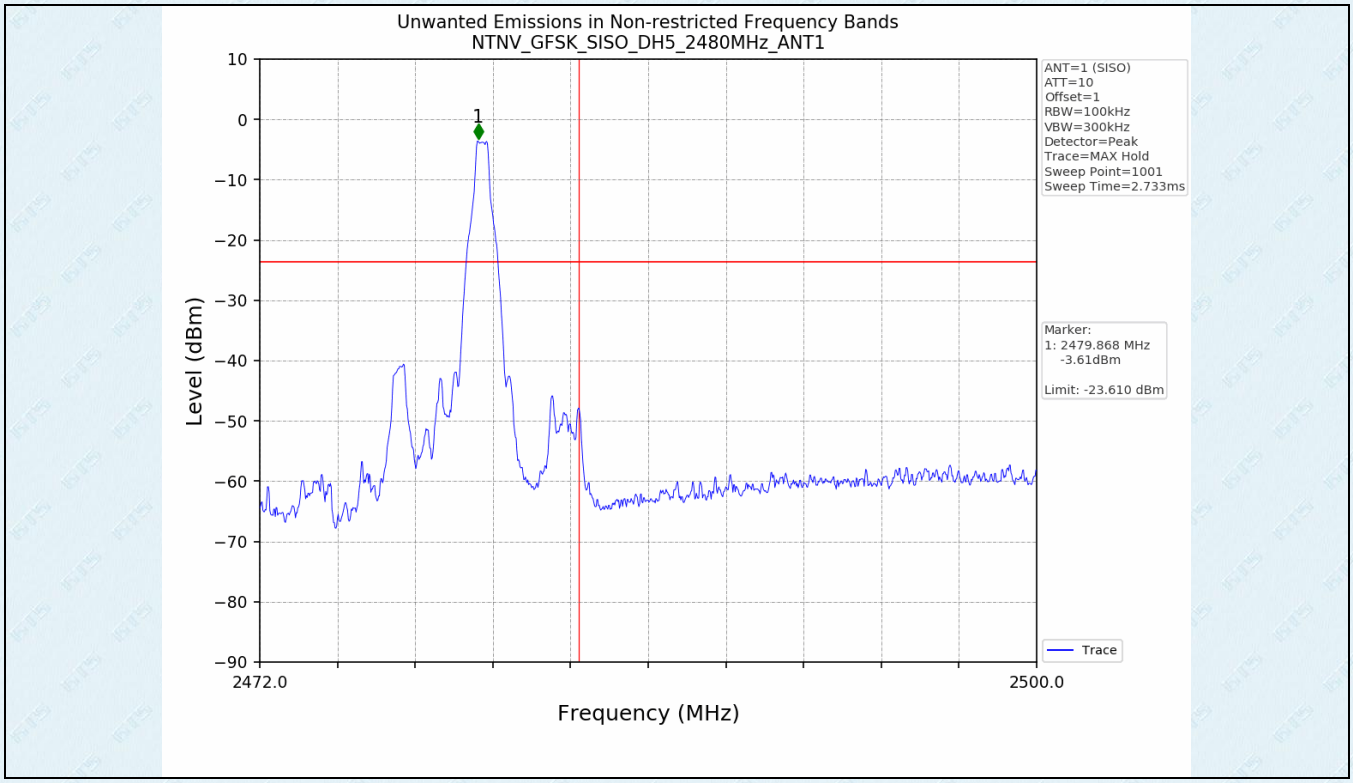
6.2 Test Graph

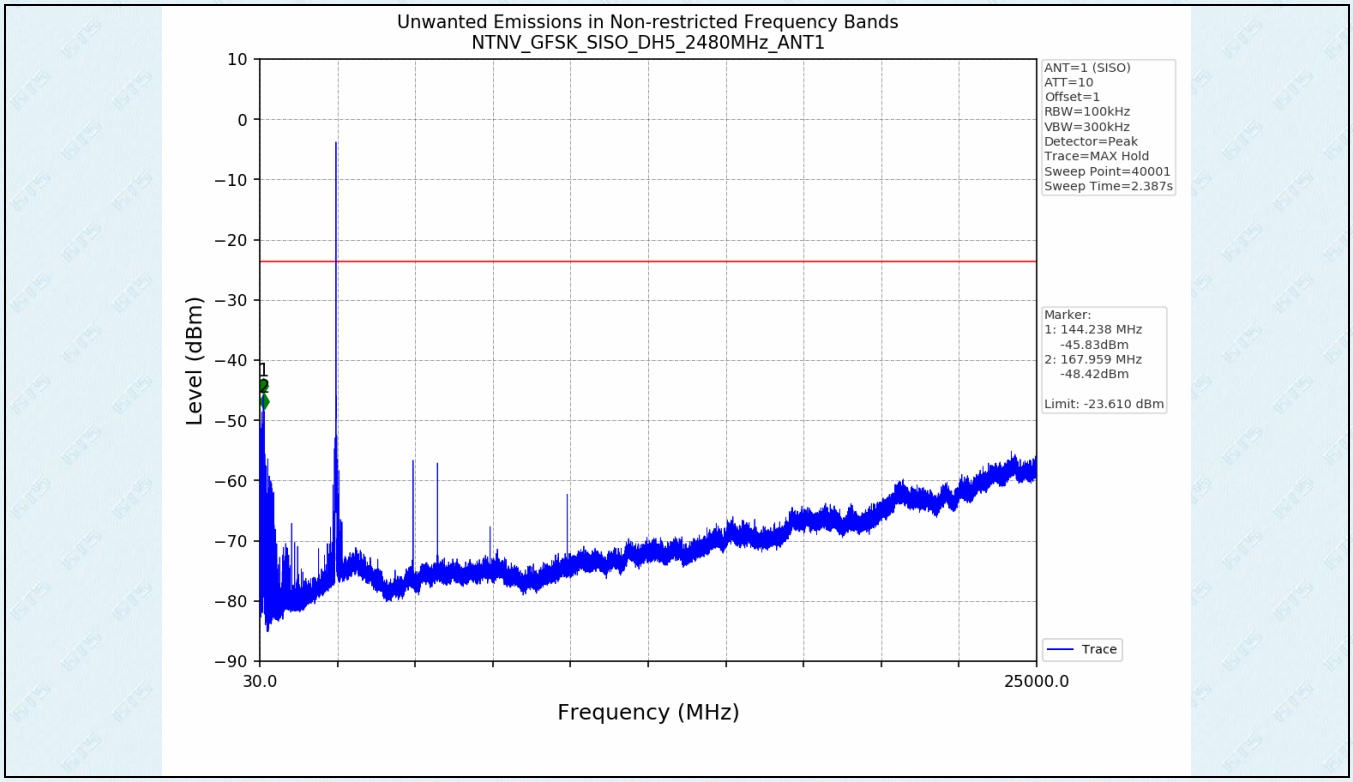


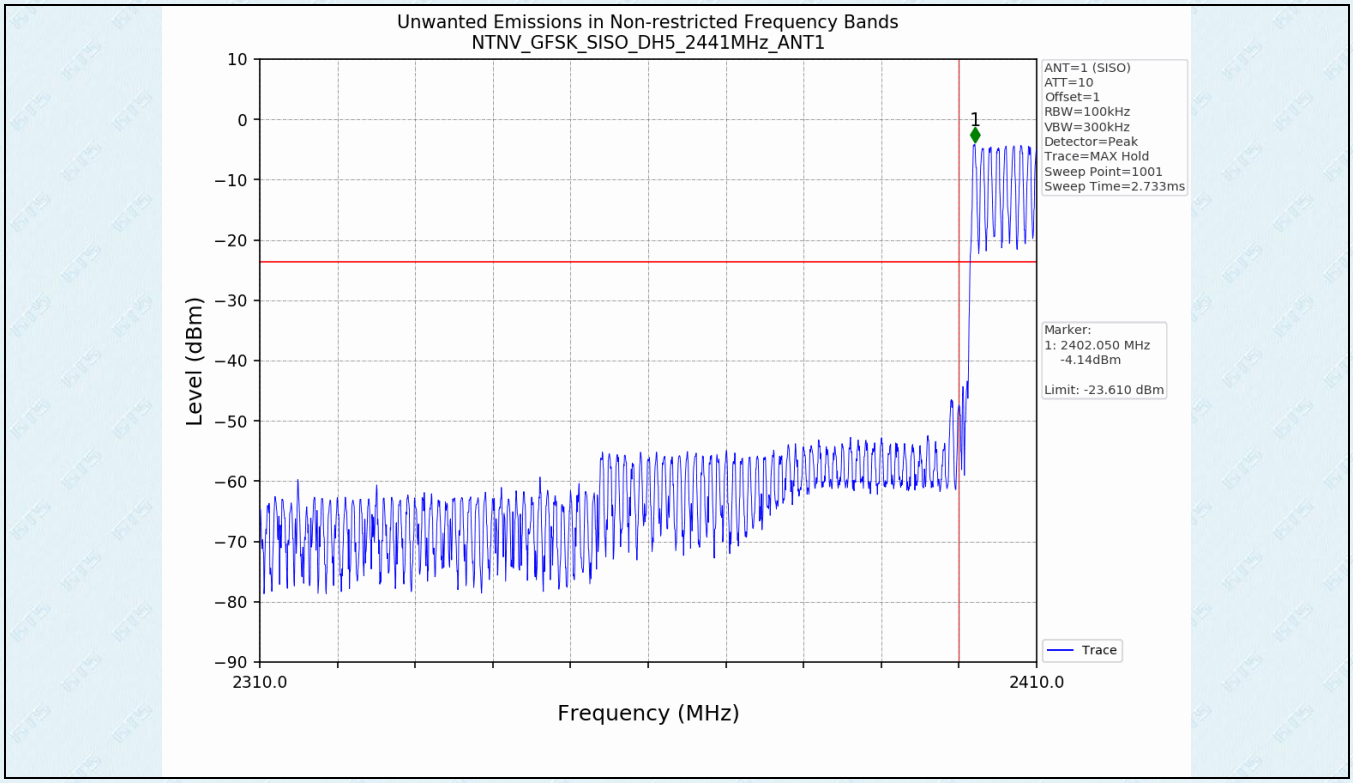


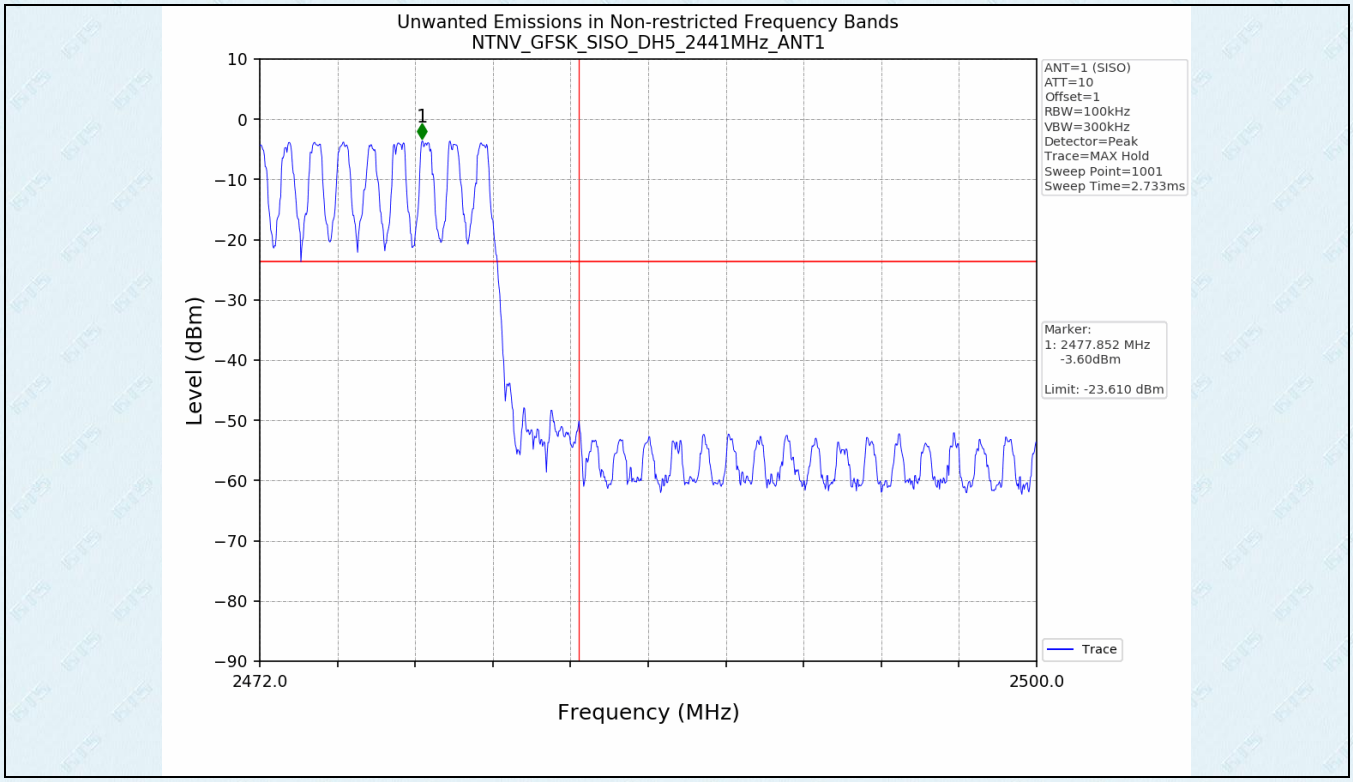

Unwanted Emissions in Non-restricted Frequency Bands
NTNV_GFSK_SISO_DH5_2402MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=40001
Sweep Time=2.387s
Marker:
1: 144.238 MHz
-48.31dBm
2: 167.959 MHz
-48.21dBm
Limit: -23.610 dBm
Trace
Level (dBm)
Frequency (MHz)
30.0
25000.0

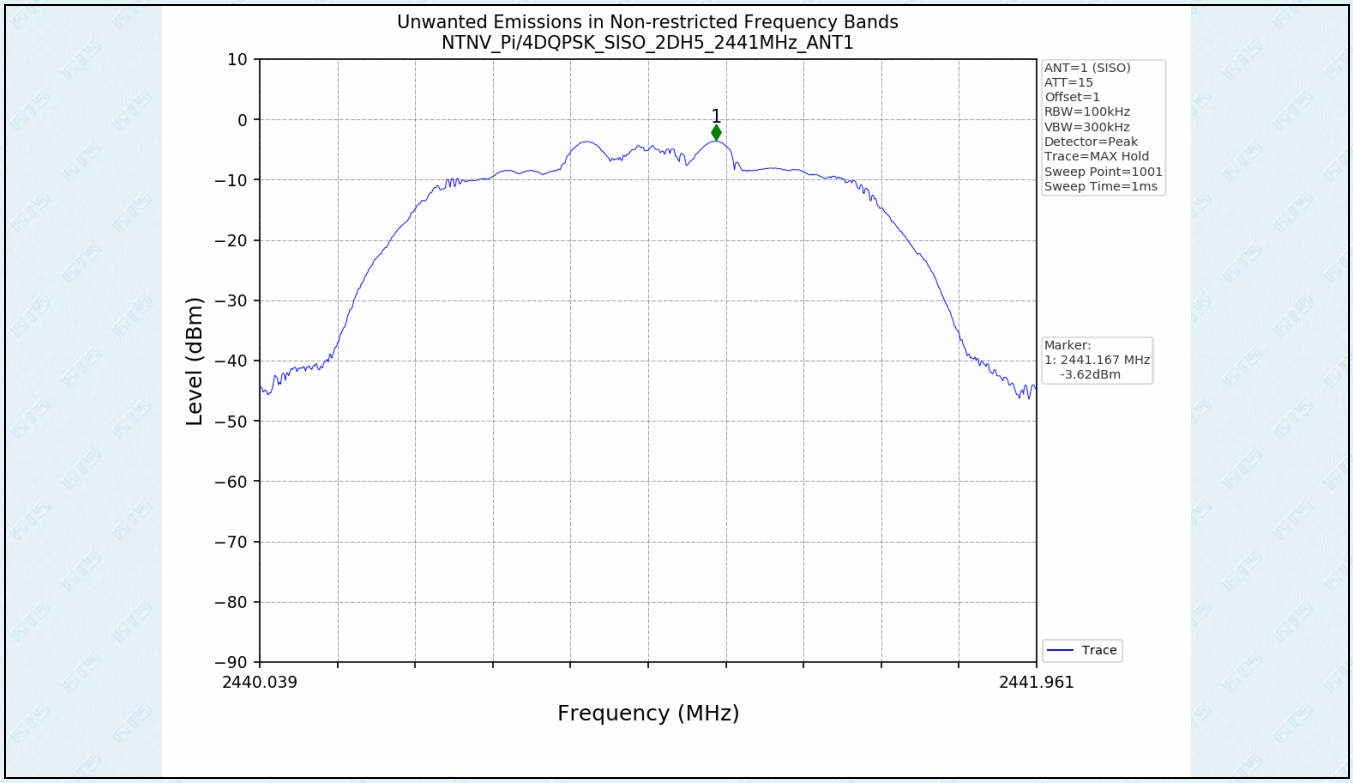

Unwanted Emissions in Non-restricted Frequency Bands
NTNV_GFSK_SISO_DH5_2441MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=40001
Sweep Time=2.387s
Marker:
1: 144.238 MHz
-48.22dBm
2: 167.959 MHz
-48.28dBm
Limit: -23.610 dBm
Trace
Level (dBm)
Frequency (MHz)
30.0
25000.0

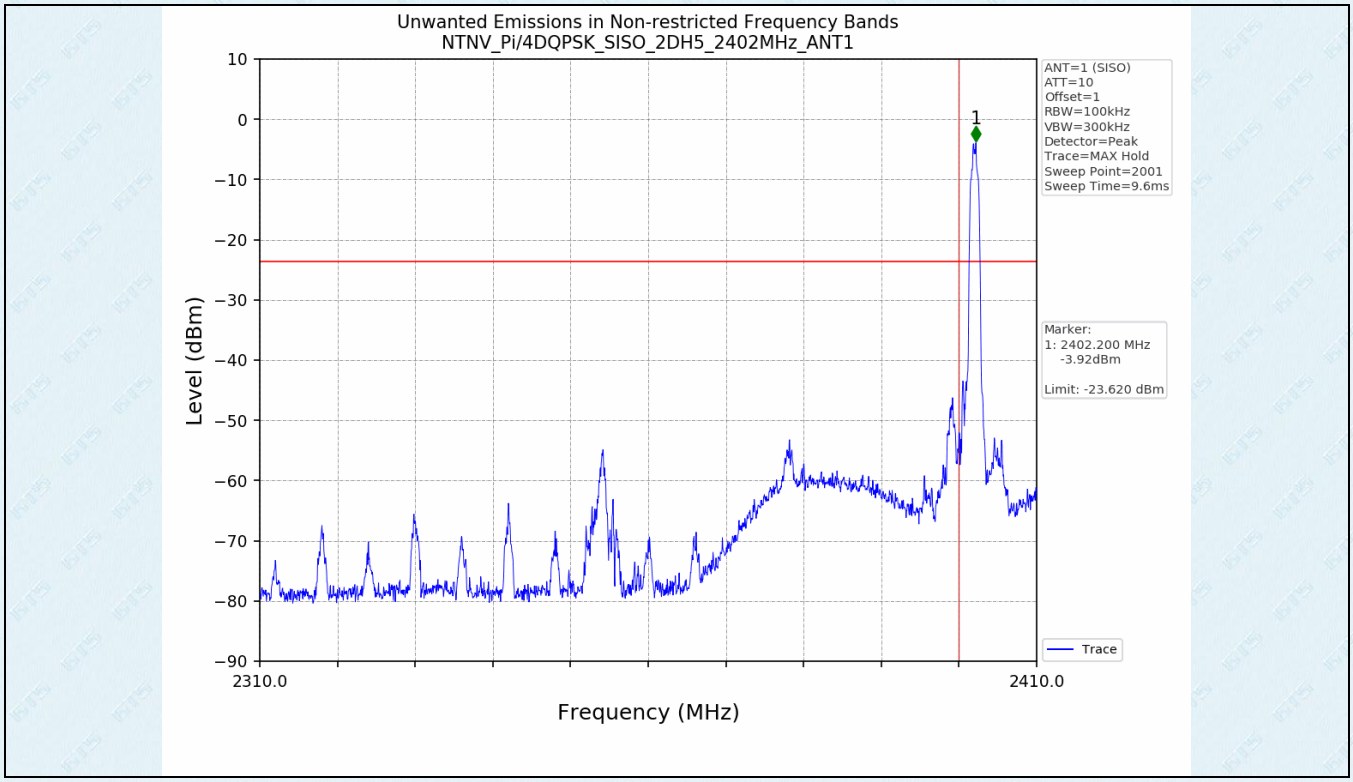

Unwanted Emissions in Non-restricted Frequency Bands
NTNV_GFSK_SISO_DH5_2480MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.733ms
Marker:
1: 2479.868 MHz
-3.61dBm
Limit: -23.610 dBm
Trace
Level (dBm)
Frequency (MHz)
2472.0
2500.0

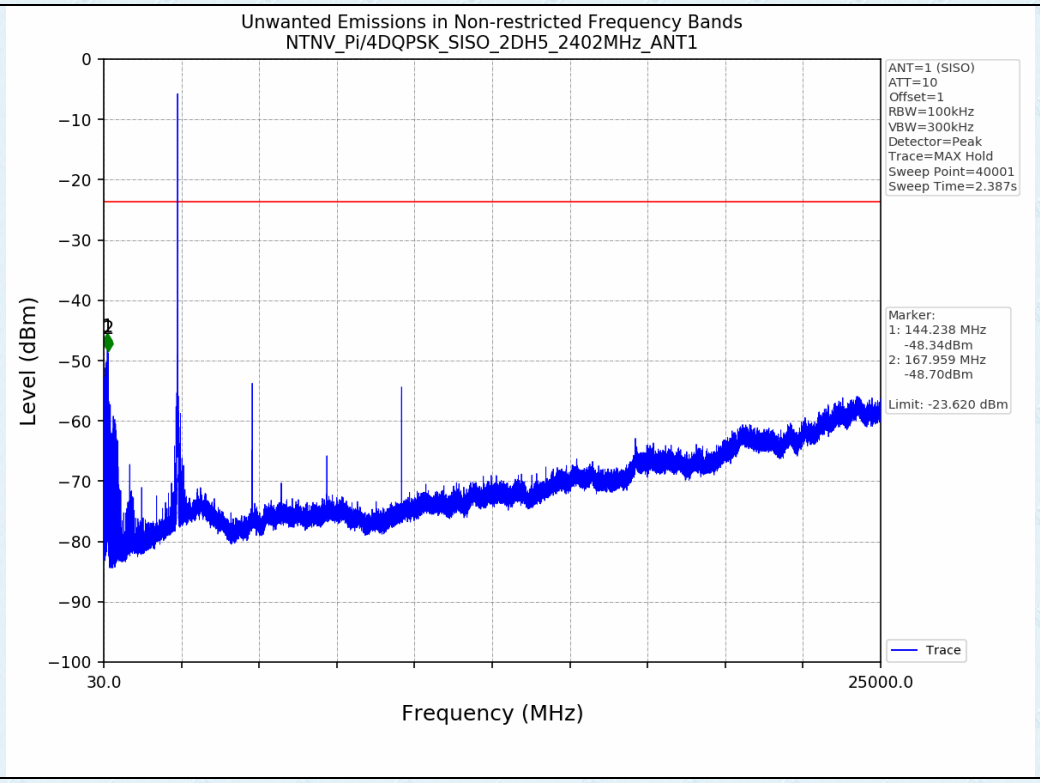

Unwanted Emissions in Non-restricted Frequency Bands
NTNV_GFSK_SISO_DH5_2480MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=40001
Sweep Time=2.387s
Marker:
1: 144.238 MHz
-45.83dBm
2: 167.959 MHz
-48.42dBm
Limit: -23.610 dBm
Trace
Level (dBm)
Frequency (MHz)
30.0
25000.0

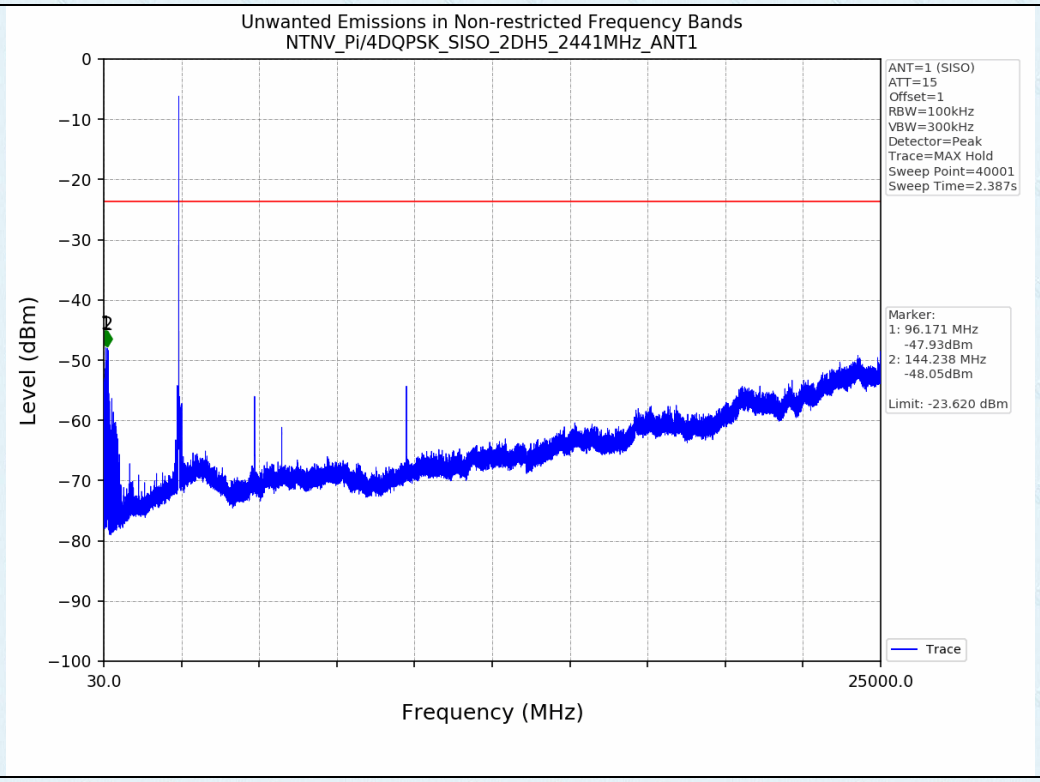

Unwanted Emissions in Non-restricted Frequency Bands
NTNV_GFSK_SISO_DH5_2441MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.733ms
Marker:
1: 2402.050 MHz
-4.14dBm
Limit: -23.610 dBm
Trace
Level (dBm)
Frequency (MHz)
2310.0
2410.0

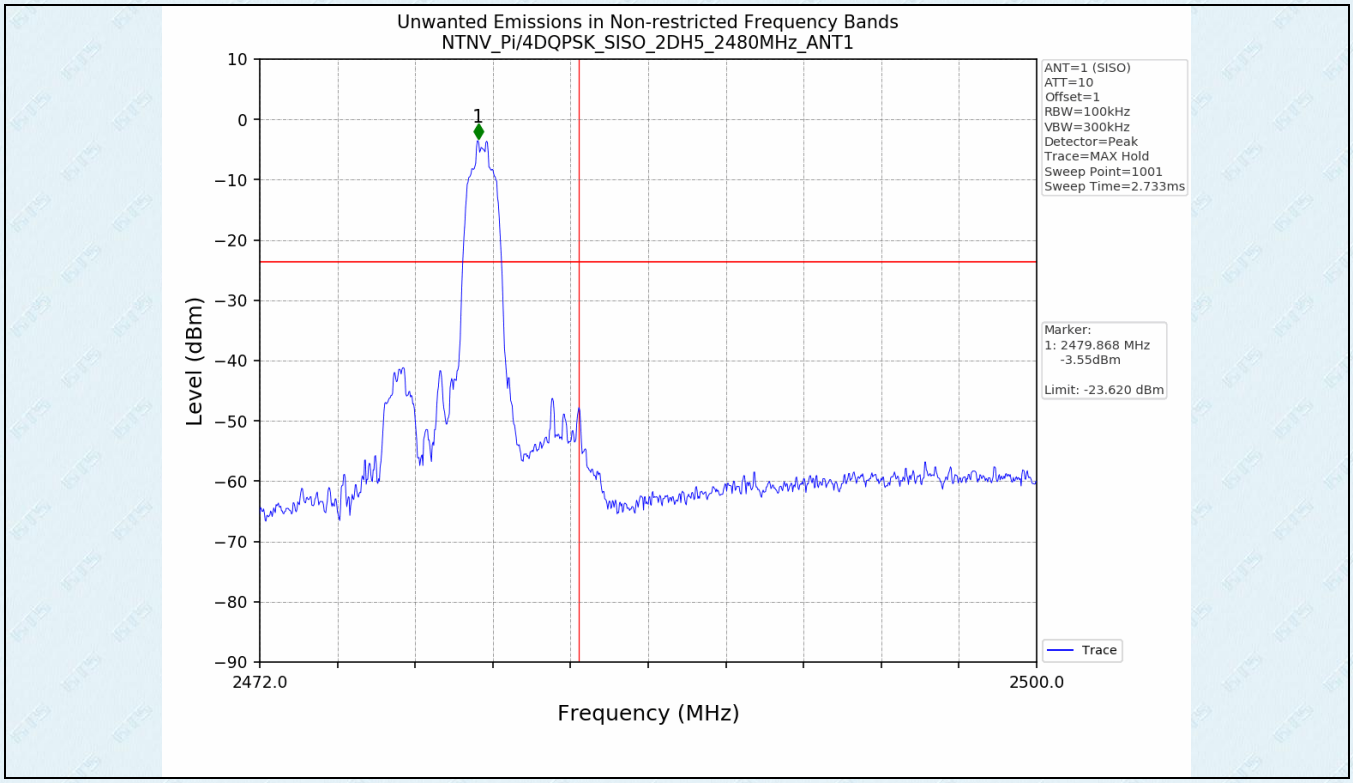

Unwanted Emissions in Non-restricted Frequency Bands
NTNV_GFSK_SISO_DH5_2441MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.733ms
Marker:
1: 2477.852 MHz
-3.60dBm
Limit: -23.610 dBm
Trace
Level (dBm)
Frequency (MHz)
2472.0
2500.0

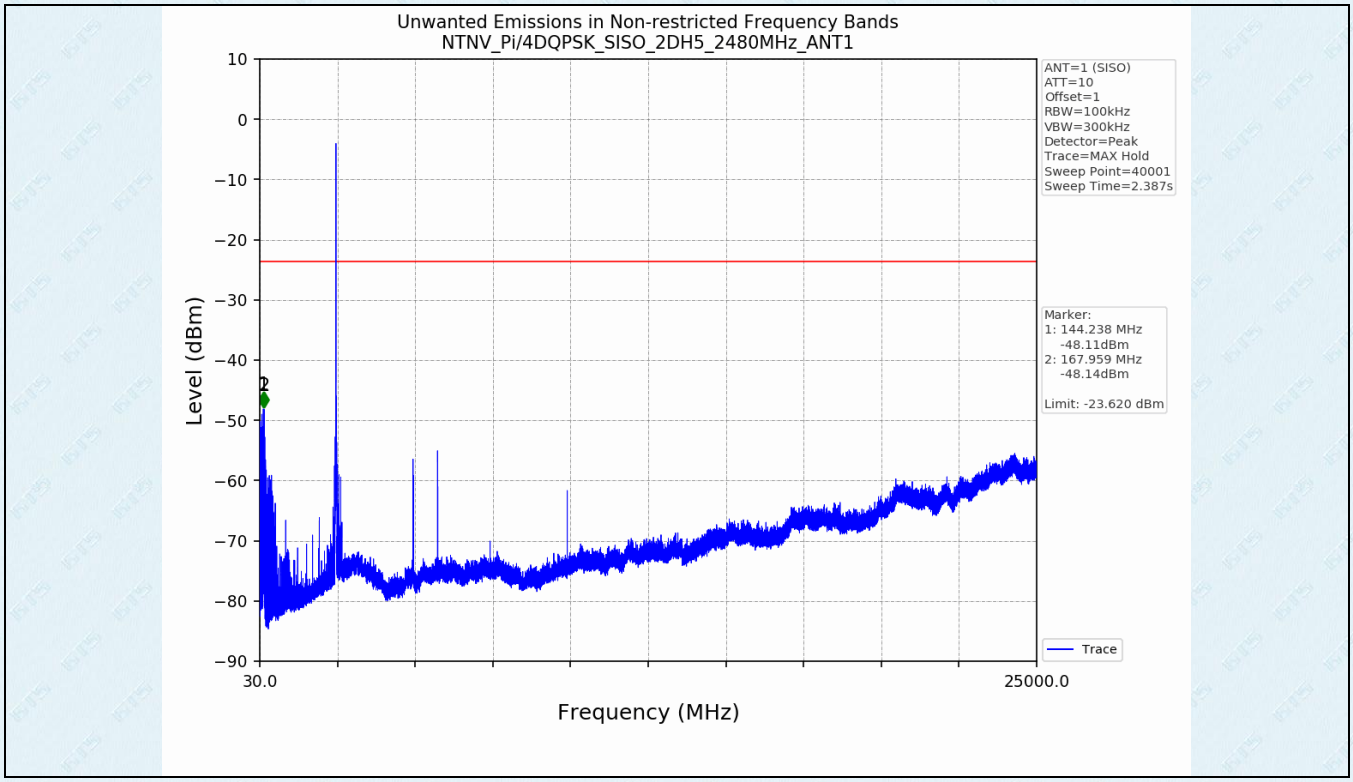

Unwanted Emissions in Non-restricted Frequency Bands
NTNV_Pi/4DQPSK_SISO_2DH5_2441MHz_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Marker:
1: 2441.167 MHz
-3.62dBm
Trace
Level (dBm)
Frequency (MHz)
2440.039
2441.961

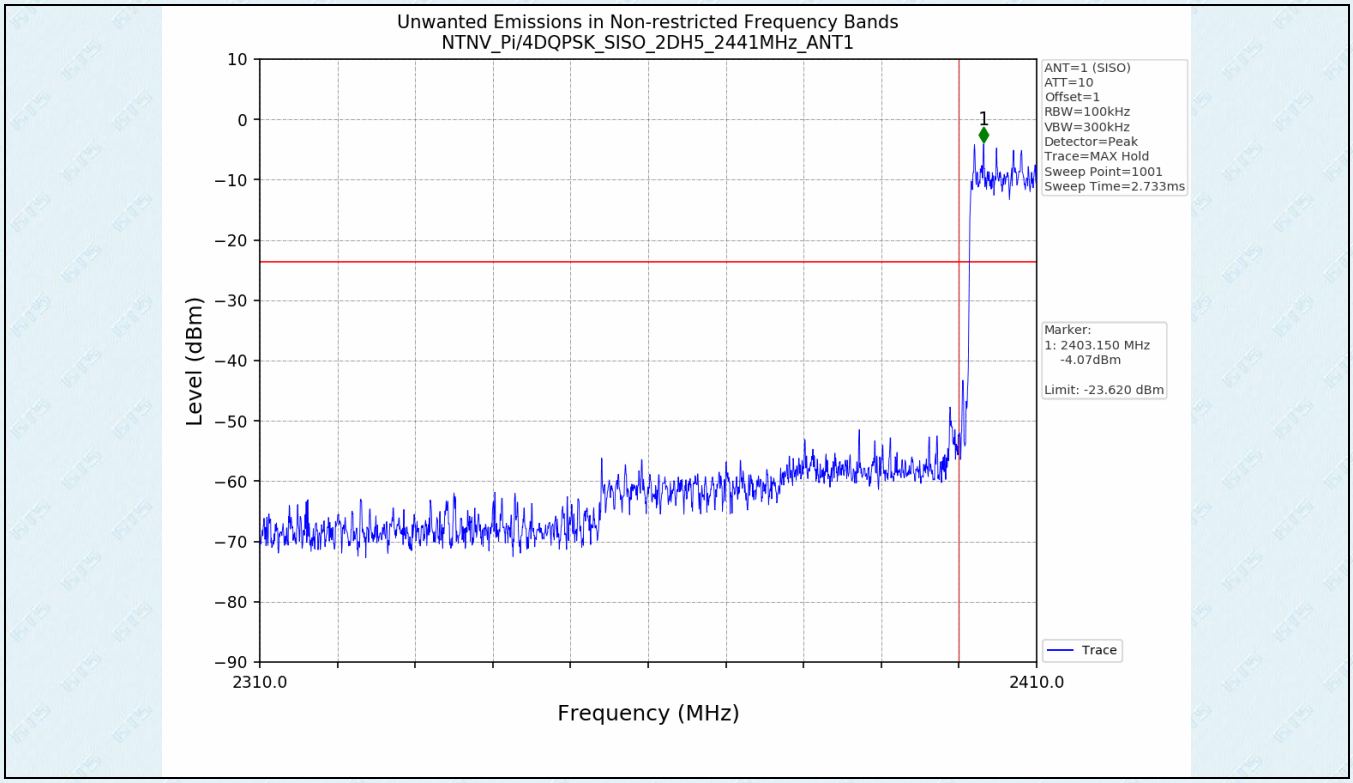

Unwanted Emissions in Non-restricted Frequency Bands
NTNV_Pi/4DQPSK_SISO_2DH5_2402MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=2001
Sweep Time=9.6ms
Marker:
1: 2402.200 MHz
-3.92dBm
Limit: -23.620 dBm
Trace
Level (dBm)
Frequency (MHz)
2310.0
2410.0

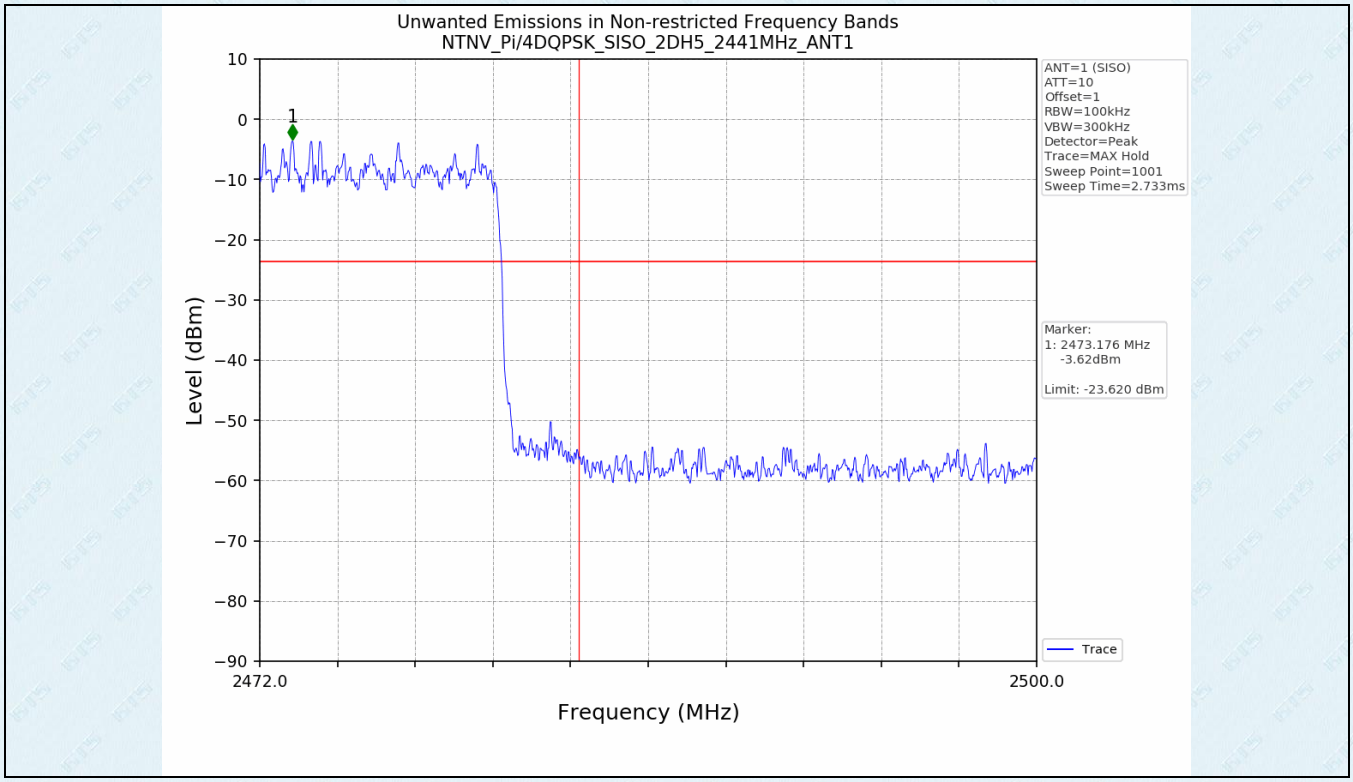

Unwanted Emissions in Non-restricted Frequency Bands
NTNV_Pi/4DQPSK_SISO_2DH5_2402MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=40001
Sweep Time=2.387s
Marker:
1: 144.238 MHz
-48.34dBm
2: 167.959 MHz
-48.70dBm
Limit: -23.620 dBm
Trace
Level (dBm)
Frequency (MHz)
30.0
25000.0


Unwanted Emissions in Non-restricted Frequency Bands
NTNV_Pi/4DQPSK_SISO_2DH5_2441MHz_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=40001
Sweep Time=2.387s
Marker:
1: 96.171 MHz
-47.93dBm
2: 144.238 MHz
-48.05dBm
Limit: -23.620 dBm
Trace
Level (dBm)
Frequency (MHz)
30.0
25000.0


Unwanted Emissions in Non-restricted Frequency Bands
NTNV_Pi/4DQPSK_SISO_2DH5_2480MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.733ms
Marker:
1: 2479.868 MHz
-3.55dBm
Limit: -23.620 dBm
Trace
Level (dBm)
Frequency (MHz)
2472.0
2500.0


Unwanted Emissions in Non-restricted Frequency Bands
NTNV_Pi/4DQPSK_SISO_2DH5_2480MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=40001
Sweep Time=2.387s
Marker:
1: 144.238 MHz
-48.11dBm
2: 167.959 MHz
-48.14dBm
Limit: -23.620 dBm
Trace
Level (dBm)
Frequency (MHz)
30.0
25000.0


Unwanted Emissions in Non-restricted Frequency Bands
NTNV_Pi/4DQPSK_SISO_2DH5_2441MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.733ms
Marker:
1: 2403.150 MHz
-4.07dBm
Limit: -23.620 dBm
Trace
Level (dBm)
Frequency (MHz)
2310.0
2410.0


Unwanted Emissions in Non-restricted Frequency Bands
NTNV_Pi/4DQPSK_SISO_2DH5_2441MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.733ms
Marker:
1: 2473.176 MHz
-3.62dBm
Limit: -23.620 dBm
Trace
Level (dBm)
Frequency (MHz)
2472.0
2500.0

------End------