Appendix for 15.247

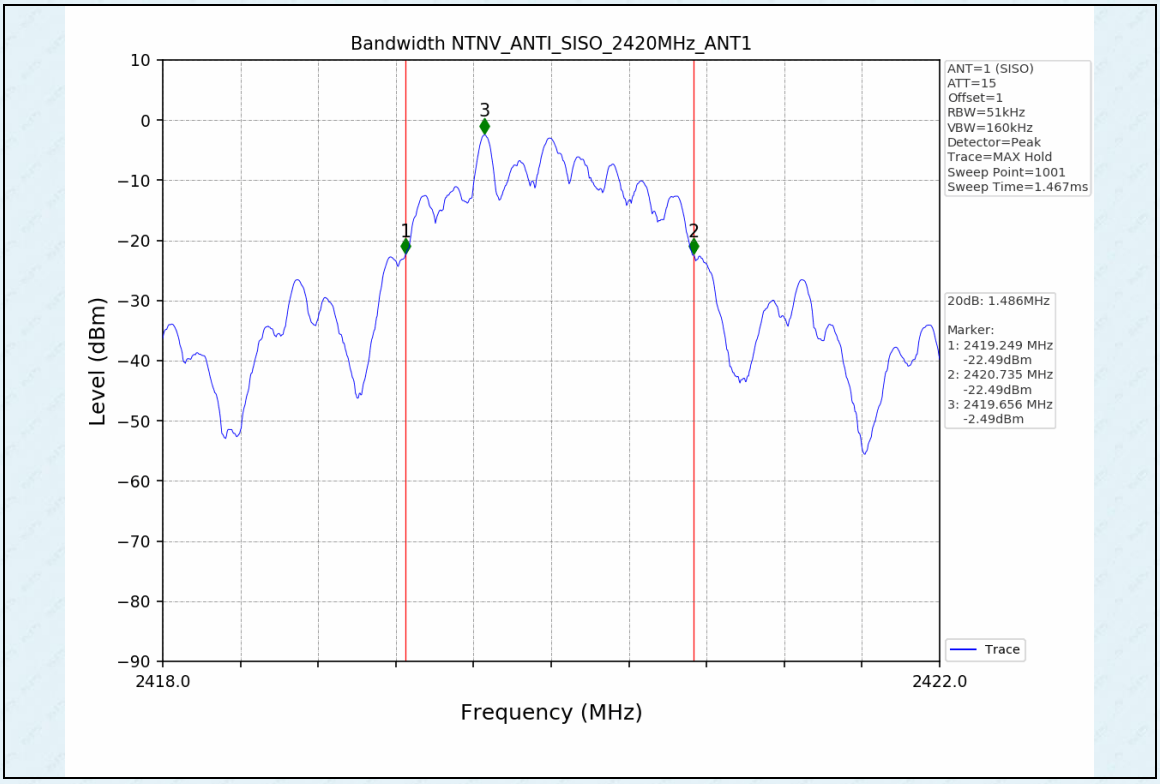
1. Bandwidth

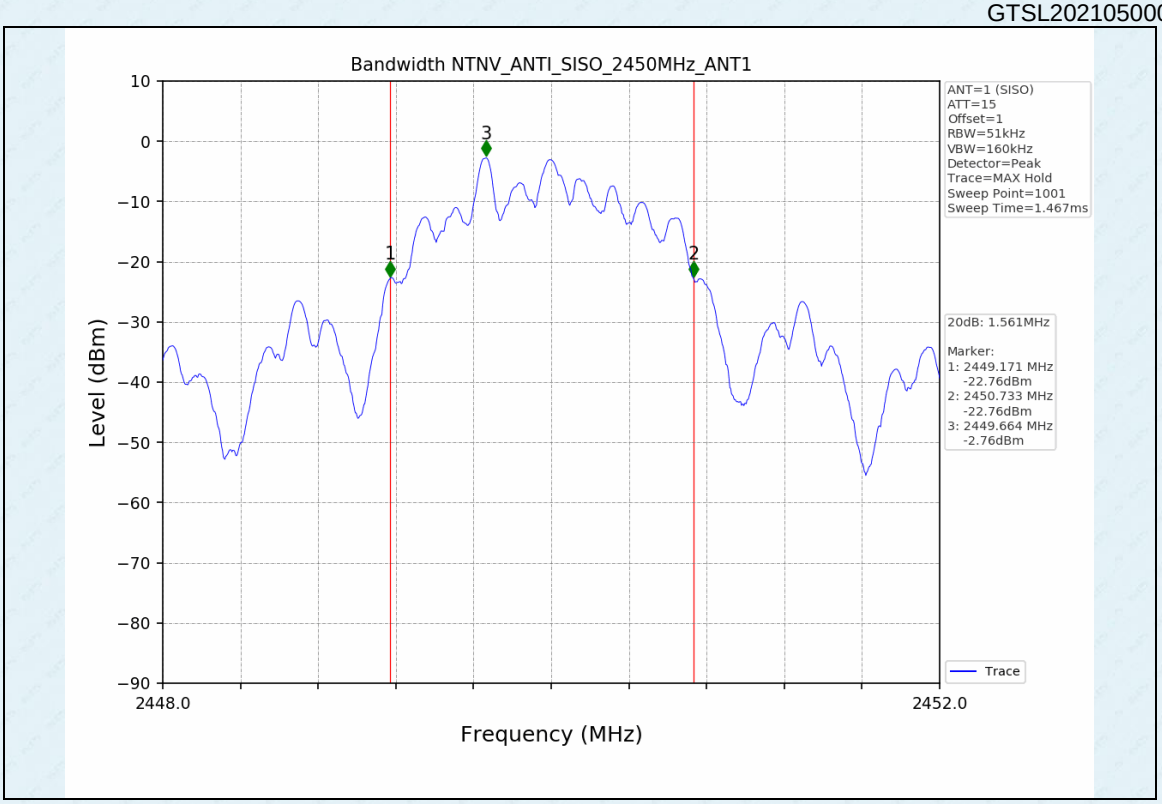
1.1 Test Result

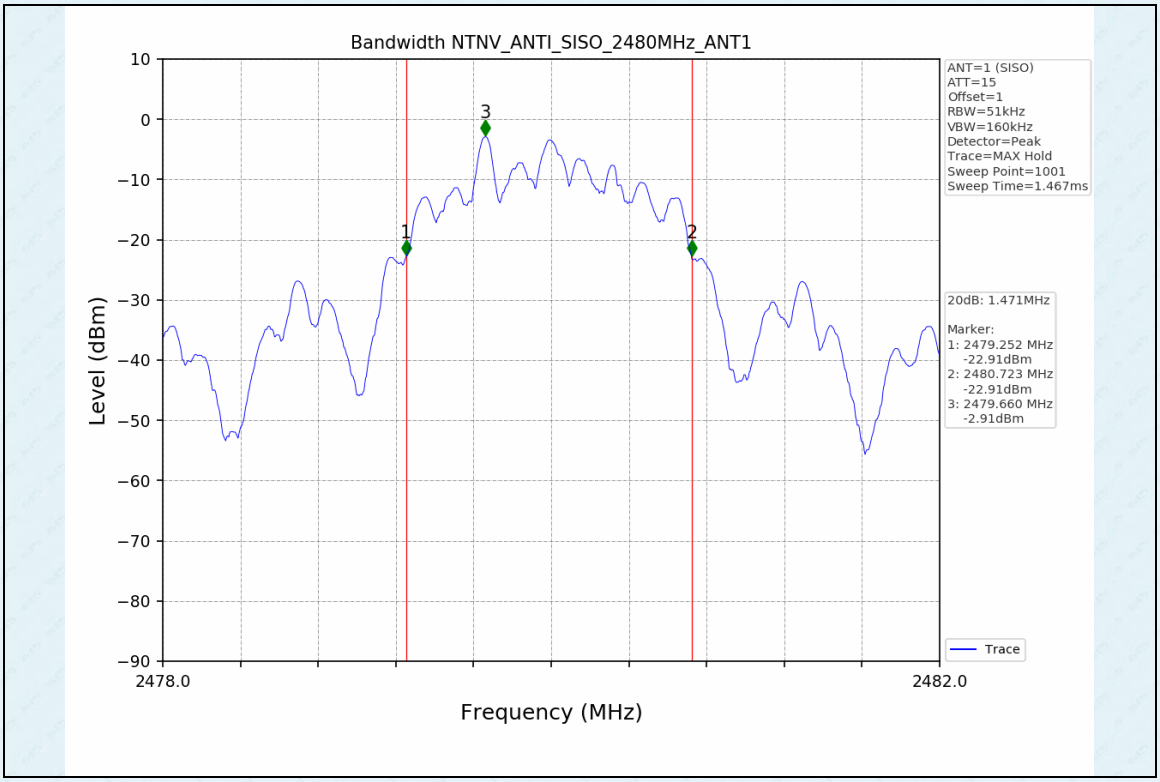
Test Mode	Frequency (MHz)	TX Type	20dB Bandwidth Test Result (MHz)	Verdict
ANTI	2420	SISO	1.486	PASS
	2450	SISO	1.561	PASS
	2480	SISO	1.471	PASS
ANT2	2420	SISO	1.554	PASS
	2450	SISO	1.455	PASS
	2480	SISO	1.478	PASS

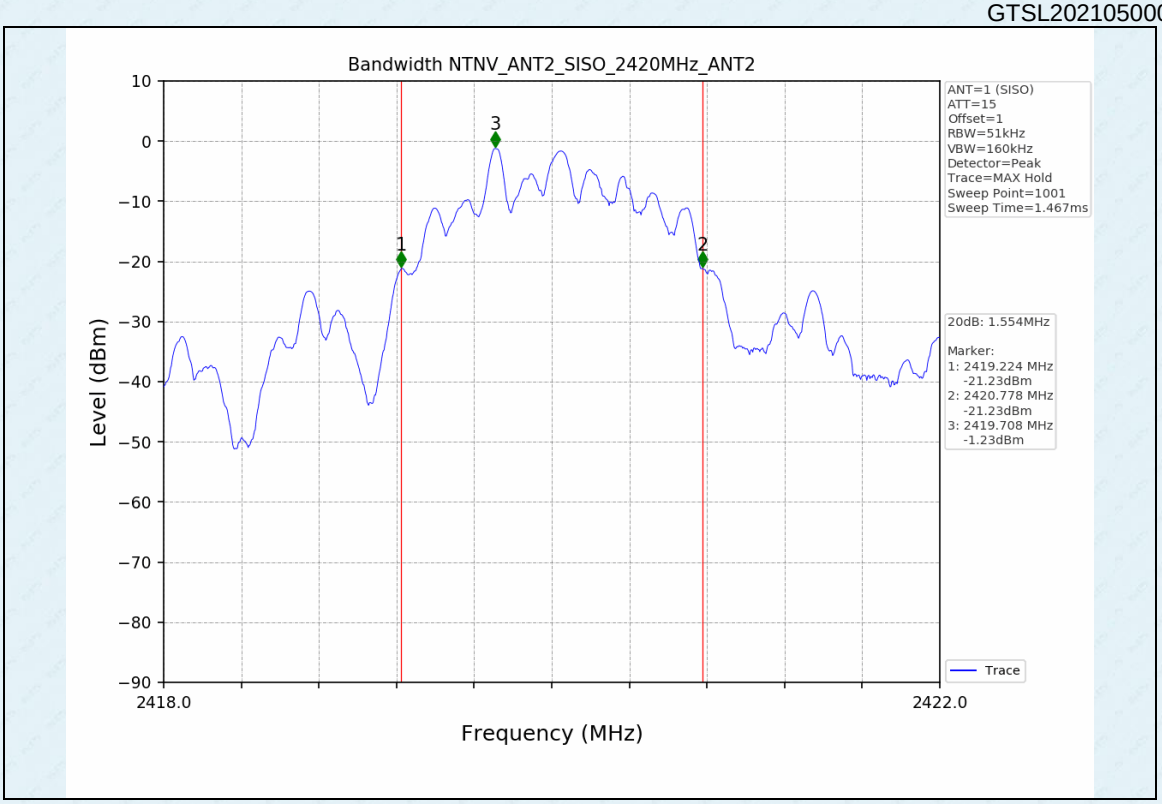
Test Mode	Frequency (MHz)	TX Type	99% Occupied Bandwidth Test Result (MHz)	
ANTI	2420	SISO	1.483	Only for Report Use
	2450	SISO	1.485	Only for Report Use
	2480	SISO	1.488	Only for Report Use
ANT2	2420	SISO	1.495	Only for Report Use
	2450	SISO	1.486	Only for Report Use
	2480	SISO	1.483	Only for Report Use

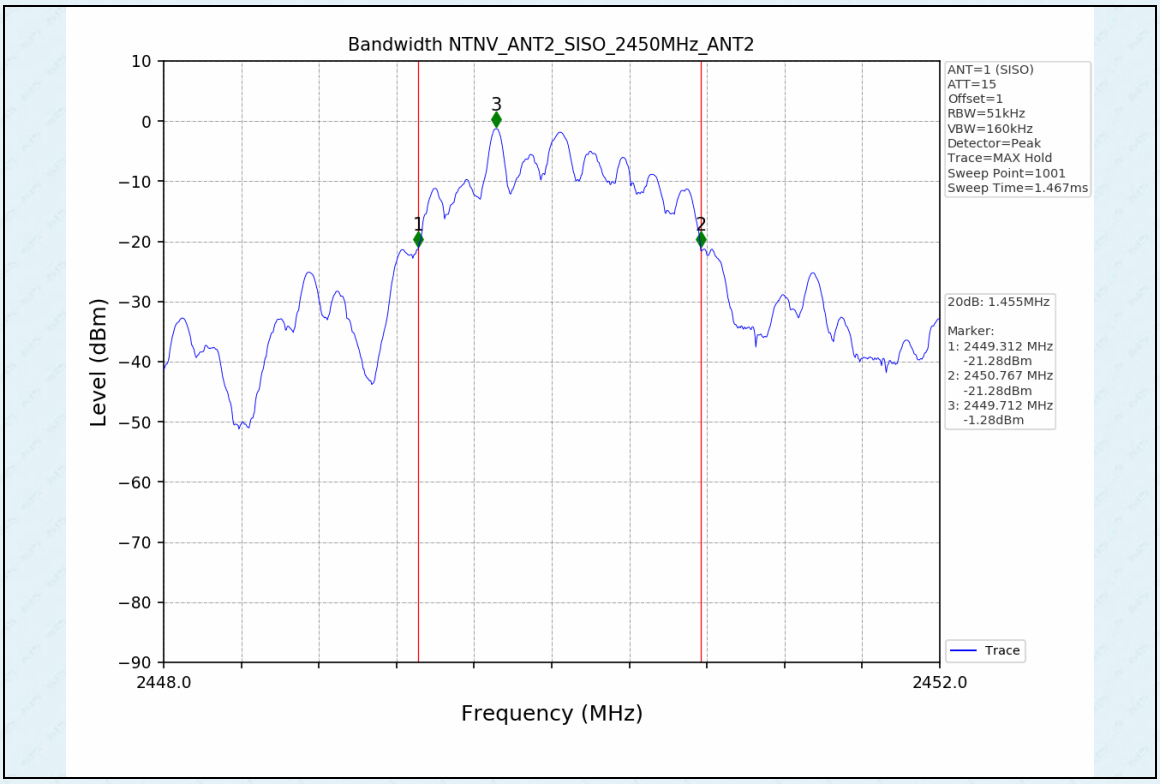
1.2 Test Graph - 20dB Bandwidth

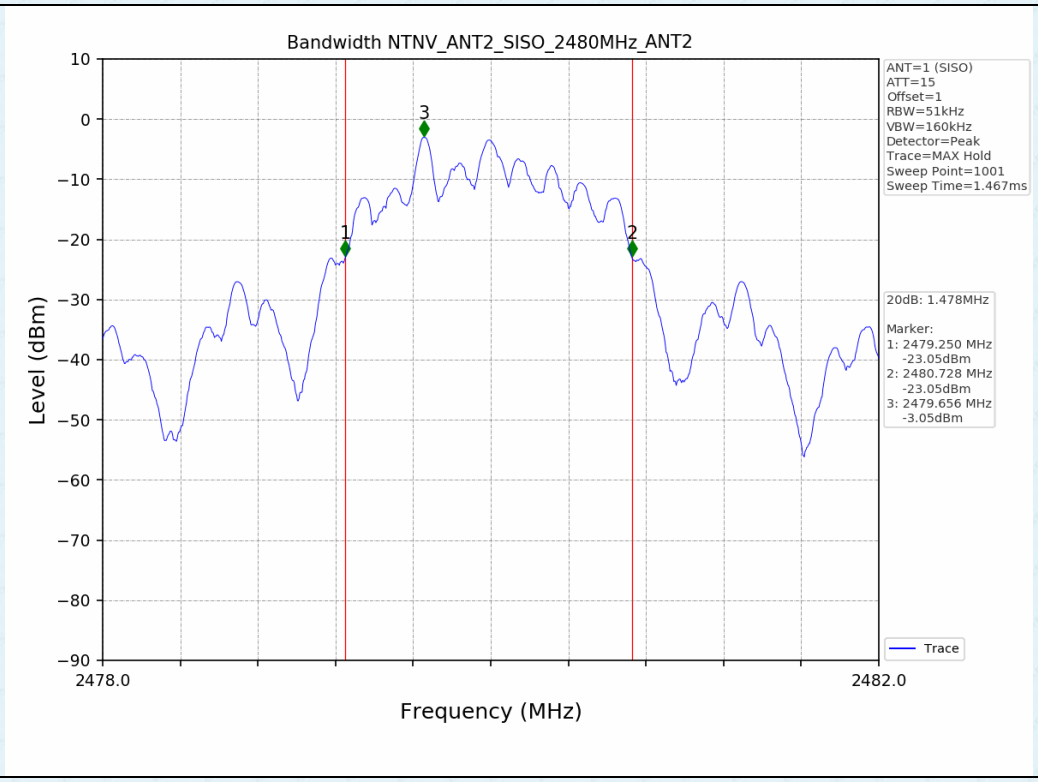



Bandwidth NTNV_ANTI_SISO_2450MHz_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=51kHz
VBW=160kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1.467ms
20dB: 1.561MHz
Marker:
1: 2449.171 MHz
-22.76dBm
2: 2450.733 MHz
-22.76dBm
3: 2449.664 MHz
-2.76dBm
Trace
Level (dBm)
Frequency (MHz)
2448.0
2452.0

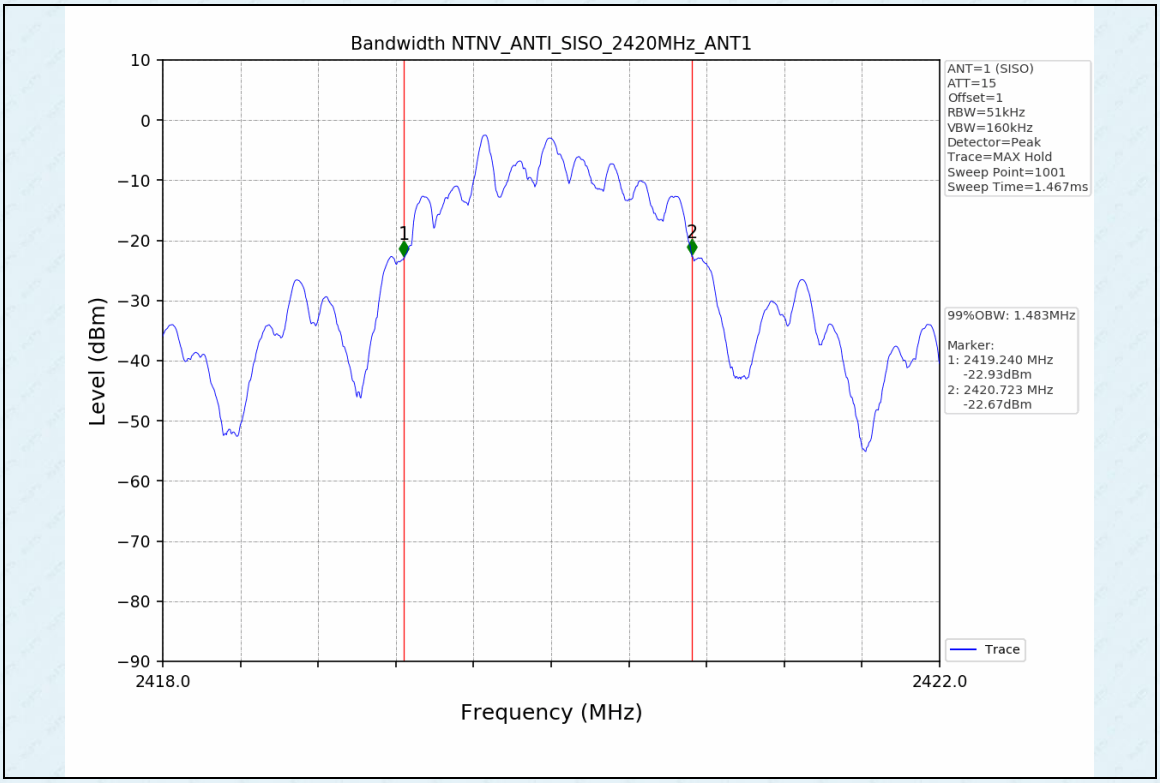

Bandwidth NTNV_ANTI_SISO_2480MHz_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=51kHz
VBW=160kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1.467ms
20dB: 1.471MHz
Marker:
1: 2479.252 MHz
-22.91dBm
2: 2480.723 MHz
-22.91dBm
3: 2479.660 MHz
-2.91dBm
Trace
Level (dBm)
Frequency (MHz)
2478.0
2482.0

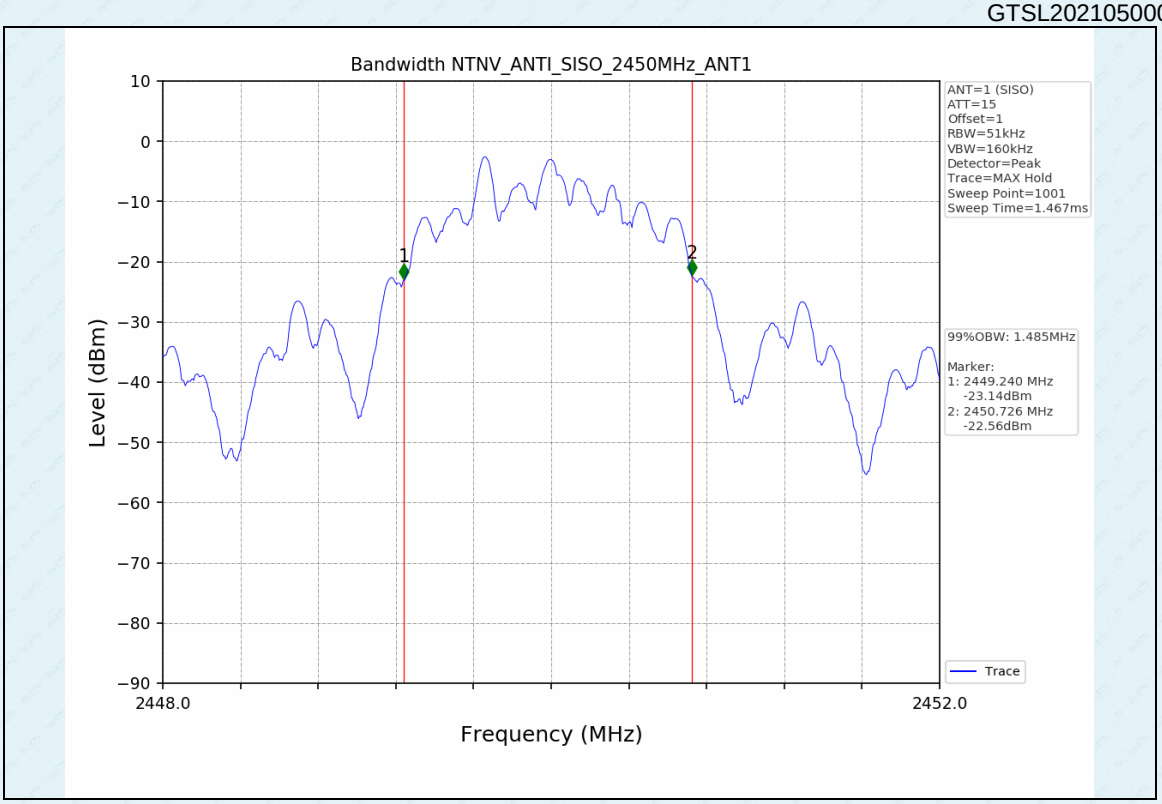

Bandwidth NTNV_ANT2_SISO_2420MHz_ANT2
ANT=1 (SISO)
ATT=15
Offset=1
RBW=51kHz
VBW=160kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1.467ms
20dB: 1.554MHz
Marker:
1: 2419.224 MHz
-21.23dBm
2: 2420.778 MHz
-21.23dBm
3: 2419.708 MHz
-1.23dBm
Trace
Level (dBm)
Frequency (MHz)
2418.0
2422.0

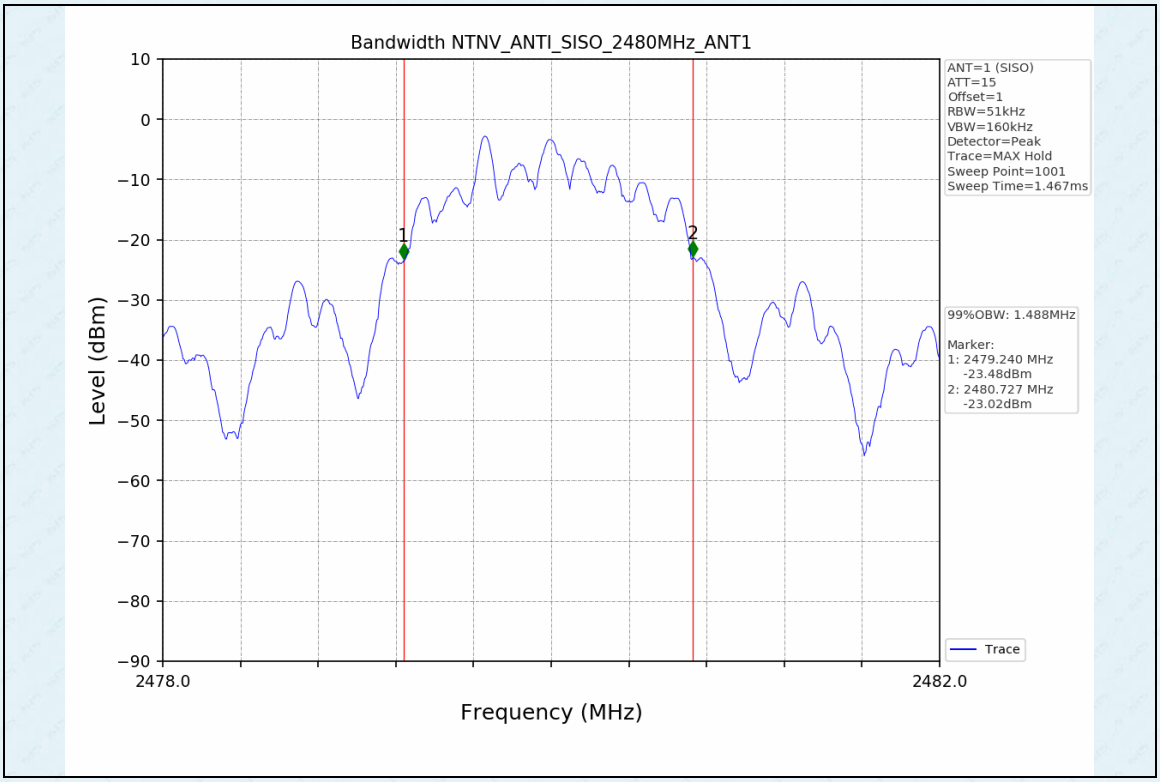

Bandwidth NTNV_ANT2_SISO_2450MHz_ANT2
ANT=1 (SISO)
ATT=15
Offset=1
RBW=51kHz
VBW=160kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1.467ms
20dB: 1.455MHz
Marker:
1: 2449.312 MHz
-21.28dBm
2: 2450.767 MHz
-21.28dBm
3: 2449.712 MHz
-1.28dBm
Trace
Level (dBm)
Frequency (MHz)
2448.0
2452.0

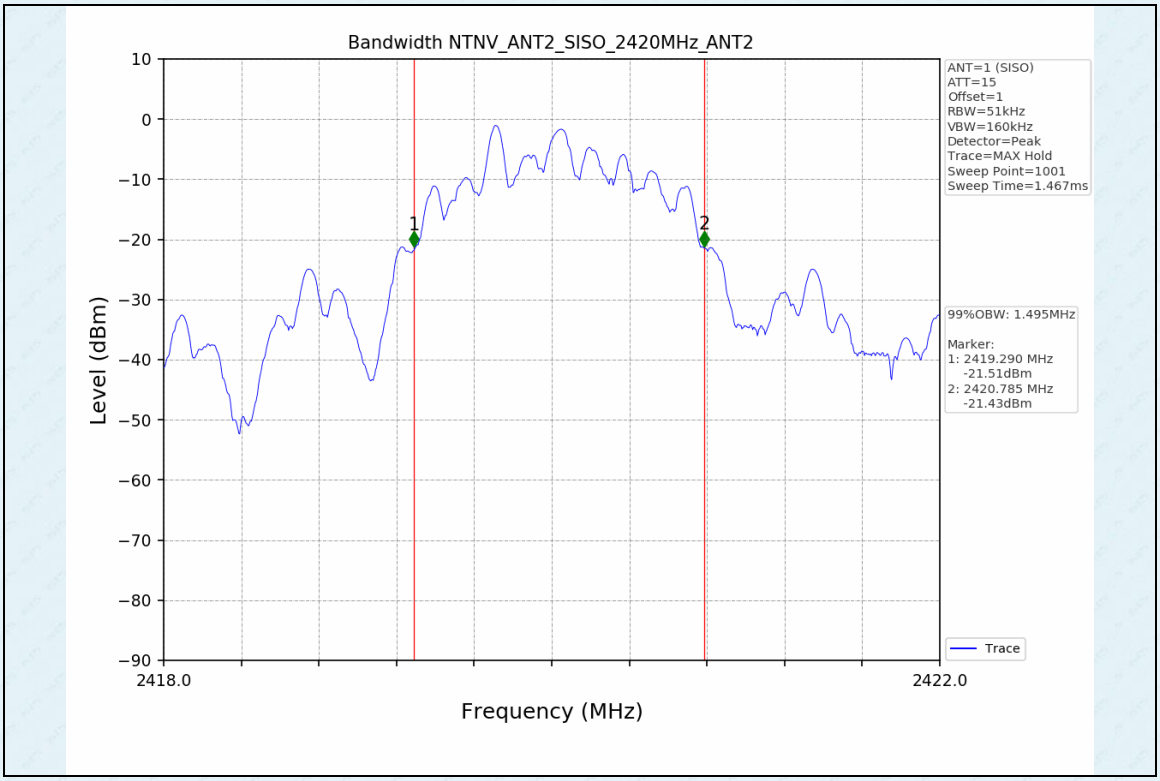

Bandwidth NTNV_ANT2_SISO_2480MHz_ANT2
ANT=1 (SISO)
ATT=15
Offset=1
RBW=51kHz
VBW=160kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1.467ms
20dB: 1.478MHz
Marker:
1: 2479.250 MHz
-23.05dBm
2: 2480.728 MHz
-23.05dBm
3: 2479.656 MHz
-3.05dBm
Trace
Level (dBm)
Frequency (MHz)
2478.0
2482.0
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
1
2
3

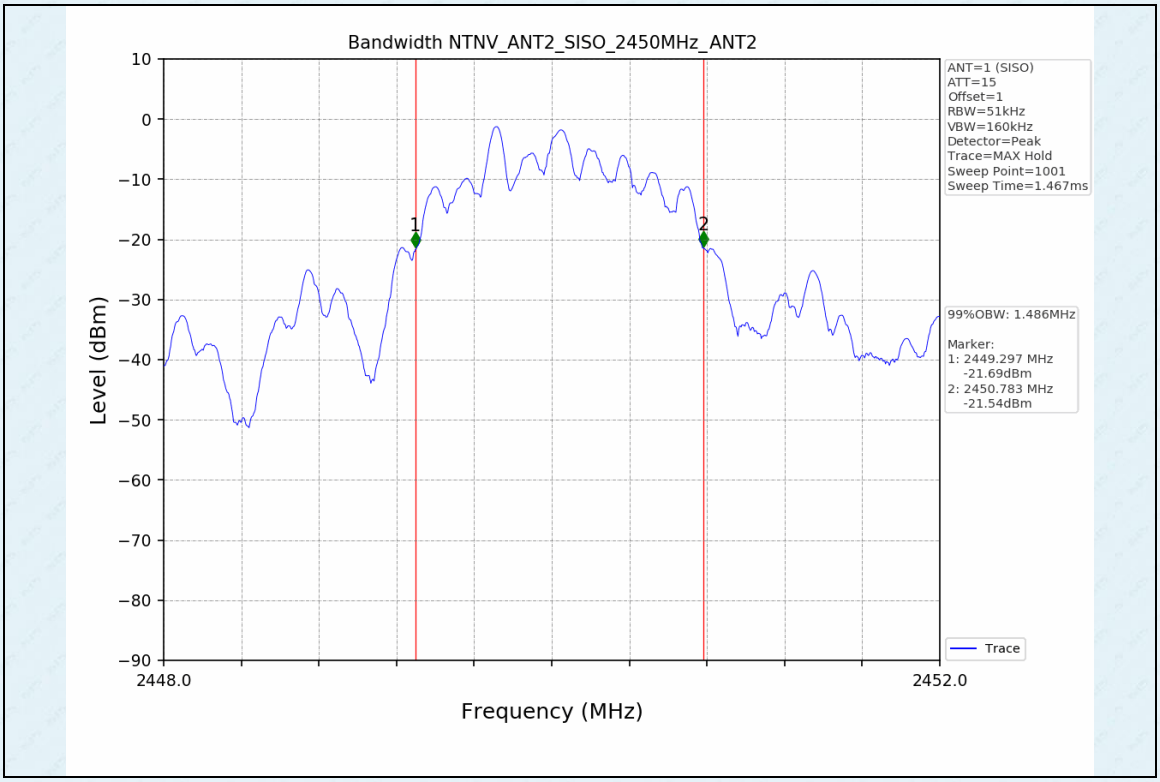
1.3 Test Graph - 99% Occupied Bandwidth

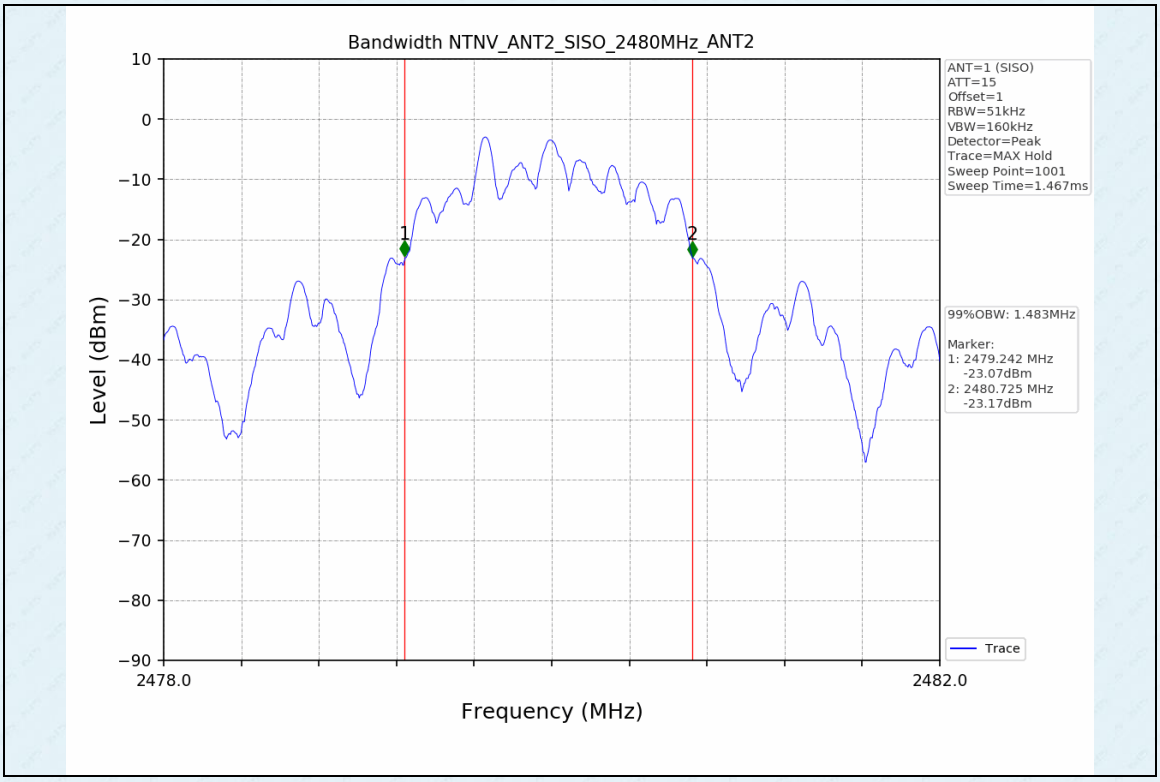



Bandwidth NTNV_ANTI_SISO_2450MHz_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=51kHz
VBW=160kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1.467ms
99%OBW: 1.485MHz
Marker:
1: 2449.240 MHz
-23.14dBm
2: 2450.726 MHz
-22.56dBm
Trace
Level (dBm)
Frequency (MHz)
2448.0
2452.0


Bandwidth NTNV_ANTI_SISO_2480MHz_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=51kHz
VBW=160kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1.467ms
99%OBW: 1.488MHz
Marker:
1: 2479.240 MHz
-23.48dBm
2: 2480.727 MHz
-23.02dBm
Trace
Level (dBm)
Frequency (MHz)
2478.0
2482.0


Bandwidth NTNV_ANT2_SISO_2420MHz_ANT2
ANT=1 (SISO)
ATT=15
Offset=1
RBW=51kHz
VBW=160kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1.467ms
99%OBW: 1.495MHz
Marker:
1: 2419.290 MHz
-21.51dBm
2: 2420.785 MHz
-21.43dBm
Trace
Level (dBm)
Frequency (MHz)
2418.0
2422.0


Bandwidth NTNV_ANT2_SISO_2450MHz_ANT2
ANT=1 (SISO)
ATT=15
Offset=1
RBW=51kHz
VBW=160kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1.467ms
99%OBW: 1.486MHz
Marker:
1: 2449.297 MHz
-21.69dBm
2: 2450.783 MHz
-21.54dBm
Trace
Level (dBm)
Frequency (MHz)
2448.0
2452.0



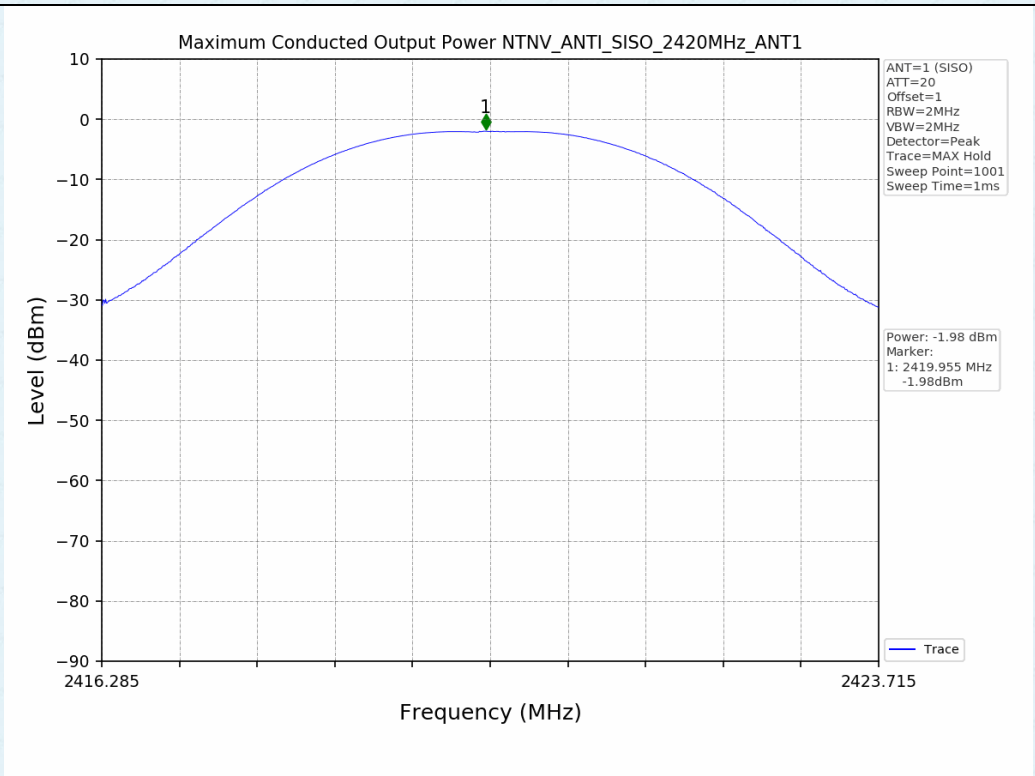
2. Maximum Conducted Output Power

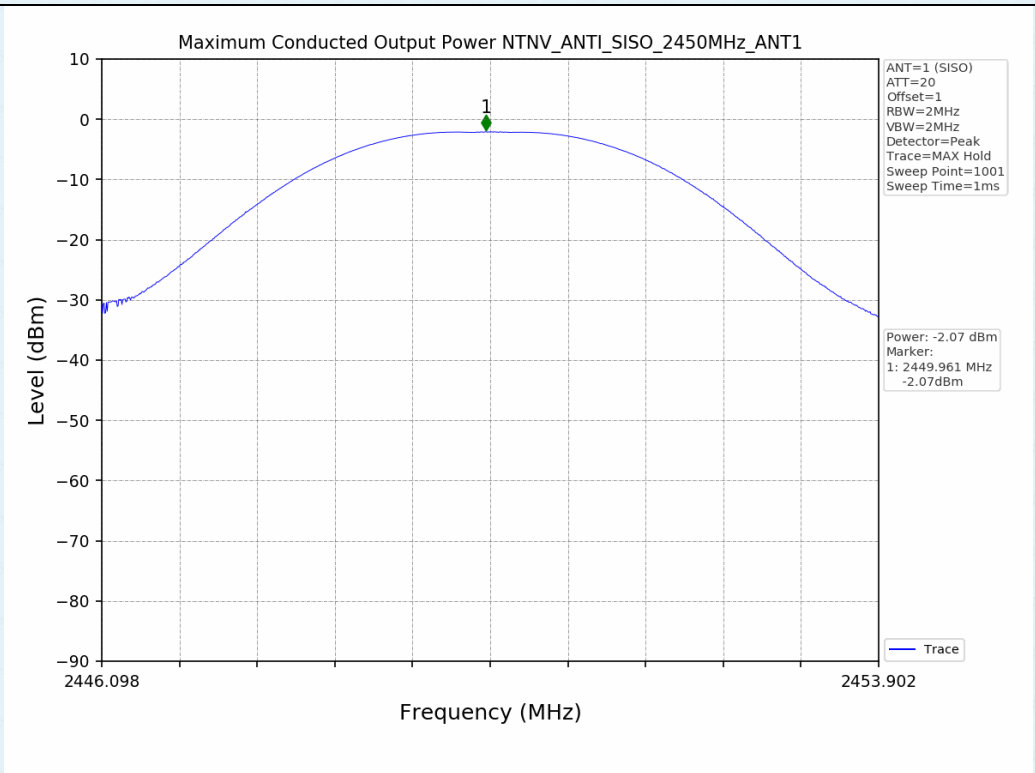
2.1 Test Result

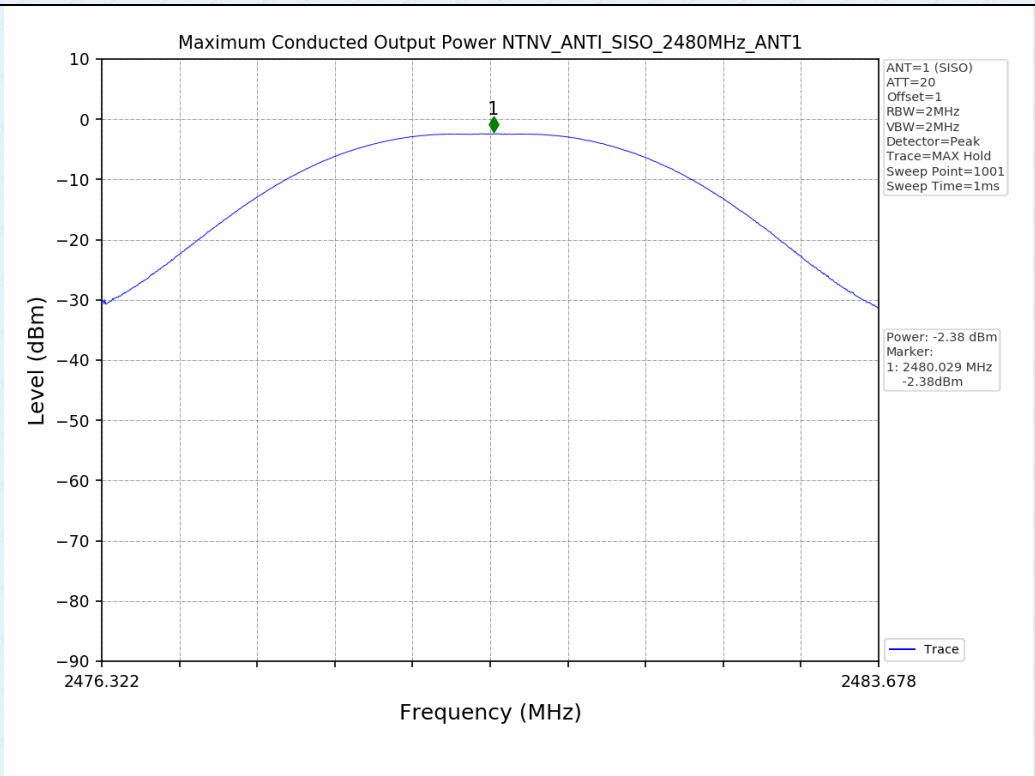
Test Mode	Frequency (MHz)	Tx Type	Measured Peak Output Power (dBm)	Limits (dBm)	Verdict
			Ant 1		
ANTI	2420	SISO	-1.98	20.97	PASS
	2450	SISO	-2.07	20.97	PASS
	2480	SISO	-2.38	20.97	PASS

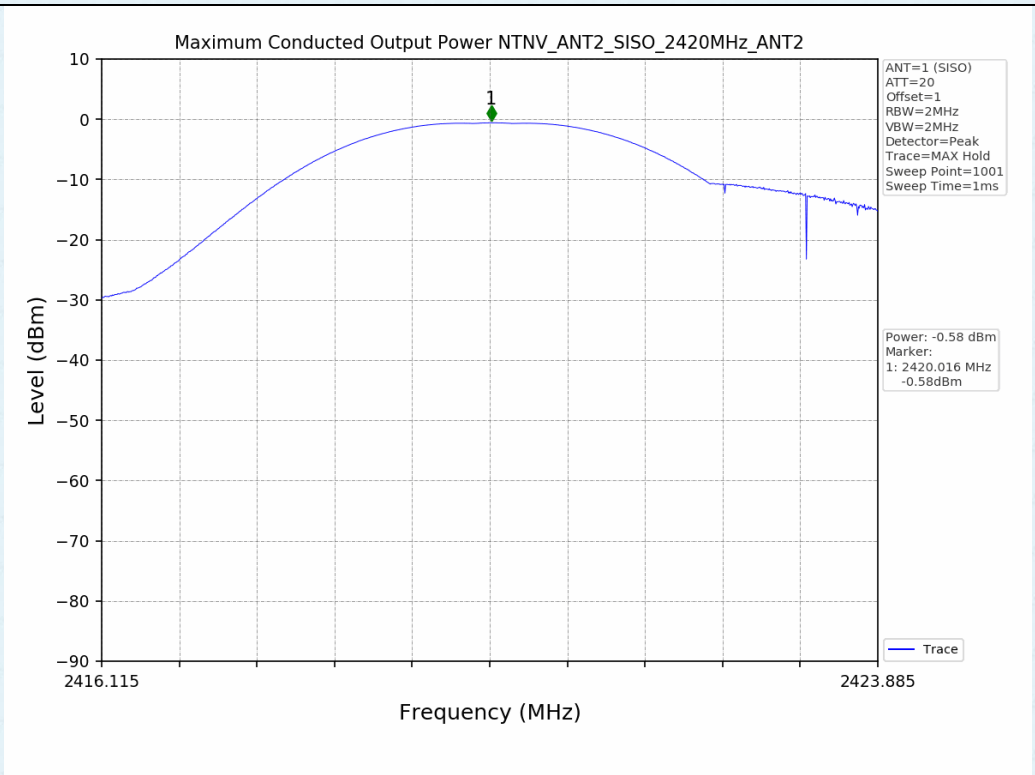
Test Mode	Frequency (MHz)	Tx Type	Measured Peak Output Power (dBm)	Limits (dBm)	Verdict
			Ant 1		
ANT2	2420	SISO	-0.58	20.97	PASS
	2450	SISO	-0.75	20.97	PASS
	2480	SISO	-0.97	20.97	PASS

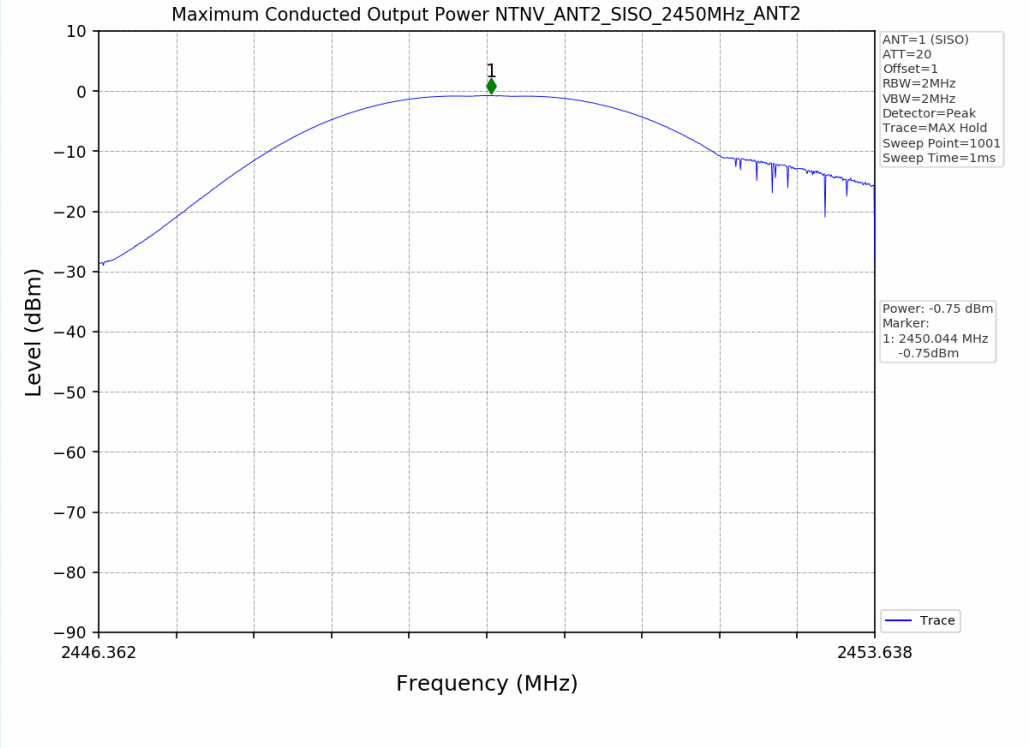
2.2 Test Graph

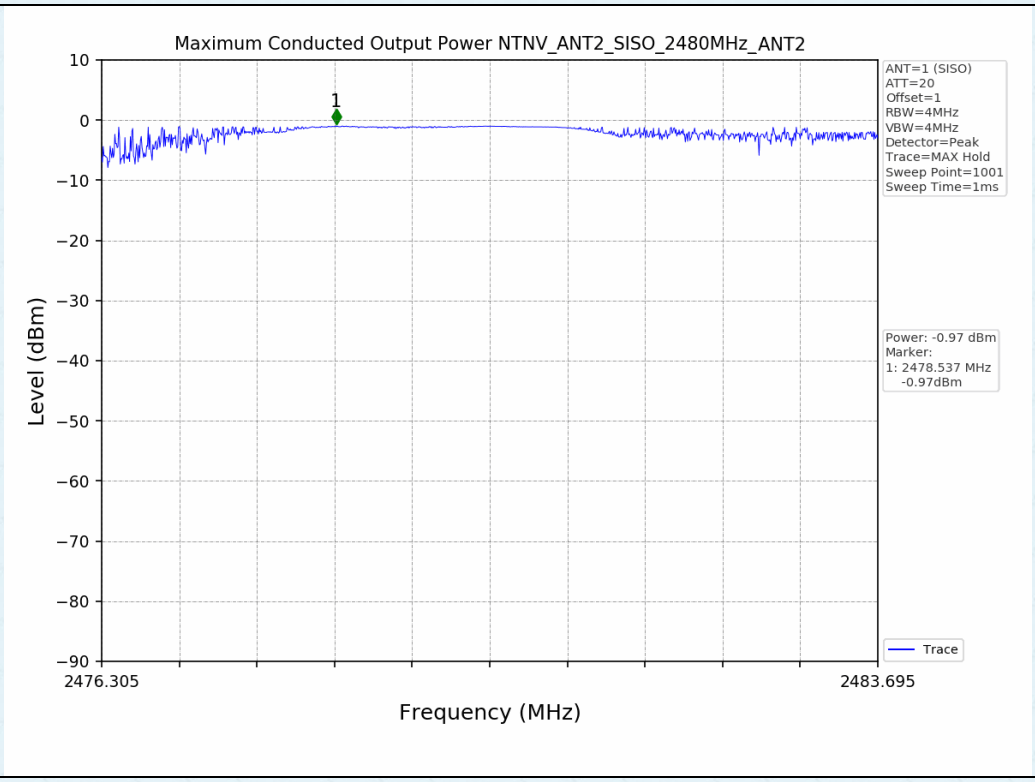

Maximum Conducted Output Power NTNV_ANTI_SISO_2420MHz_ANT1
ANT=1 (SISO)
ATT=20
Offset=1
RBW=2MHz
VBW=2MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Power: -1.98 dBm
Marker:
1: 2419.955 MHz
-1.98dBm
Trace
Level (dBm)
Frequency (MHz)
2416.285
2423.715


Maximum Conducted Output Power NTNV_ANTI_SISO_2450MHz_ANT1
ANT=1 (SISO)
ATT=20
Offset=1
RBW=2MHz
VBW=2MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Power: -2.07 dBm
Marker:
1: 2449.961 MHz
-2.07dBm
Trace
Level (dBm)
Frequency (MHz)
2446.098
2453.902


Maximum Conducted Output Power NTNV_ANTI_SISO_2480MHz_ANT1
ANT=1 (SISO)
ATT=20
Offset=1
RBW=2MHz
VBW=2MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Power: -2.38 dBm
Marker:
1: 2480.029 MHz
-2.38dBm
Trace
Level (dBm)
Frequency (MHz)
2476.322
2483.678


Maximum Conducted Output Power NTNV_ANT2_SISO_2420MHz_ANT2
ANT=1 (SISO)
ATT=20
Offset=1
RBW=2MHz
VBW=2MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Power: -0.58 dBm
Marker:
1: 2420.016 MHz
-0.58dBm
Trace
Level (dBm)
Frequency (MHz)
2416.115
2423.885


Maximum Conducted Output Power NTNV_ANT2_SISO_2450MHz_ANT2
ANT=1 (SISO)
ATT=20
Offset=1
RBW=2MHz
VBW=2MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Power: -0.75 dBm
Marker:
1: 2450.044 MHz
-0.75dBm
Trace
Level (dBm)
Frequency (MHz)
2446.362
2453.638

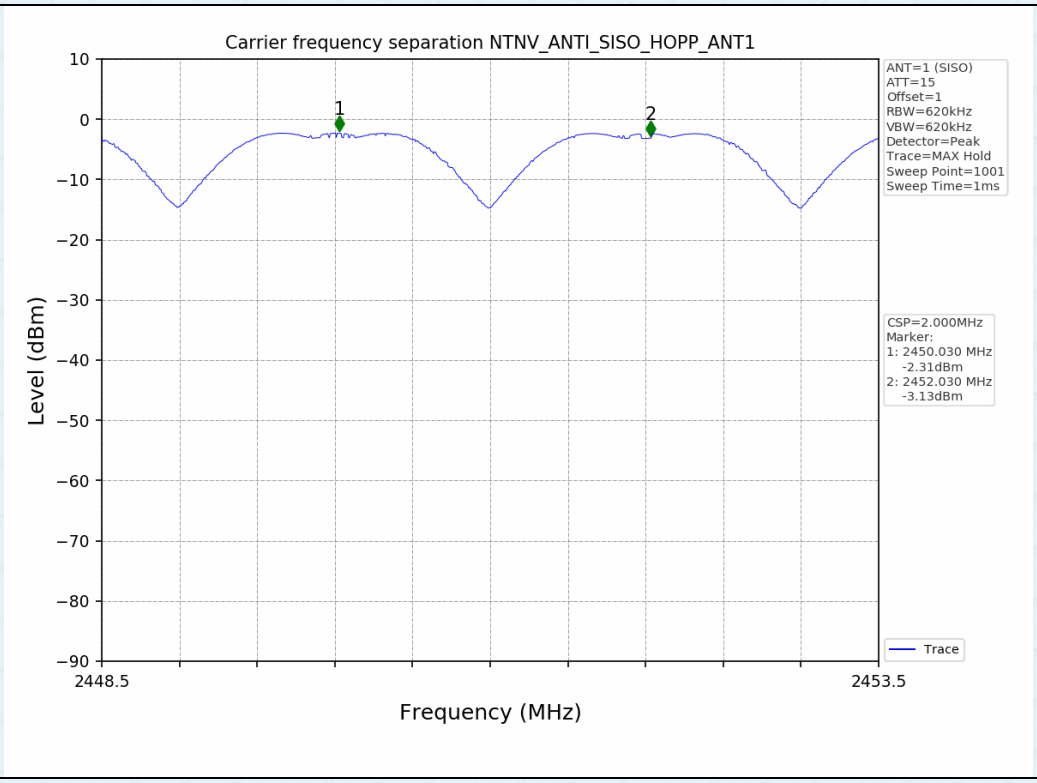

Maximum Conducted Output Power NTNV_ANT2_SISO_2480MHz_ANT2
ANT=1 (SISO)
ATT=20
Offset=1
RBW=4MHz
VBW=4MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Power: -0.97 dBm
Marker:
1: 2478.537 MHz
-0.97dBm
Trace
Level (dBm)
Frequency (MHz)
2476.305
2483.695

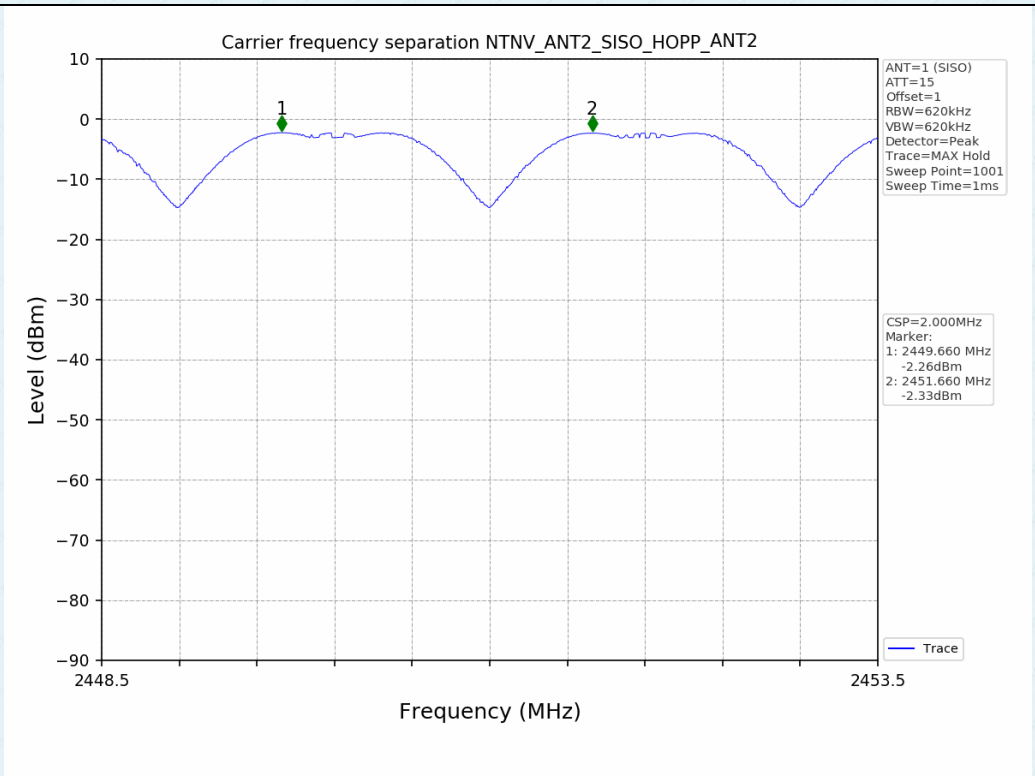
3. Carrier frequency separation

3.1 Test Result

Test Mode	TX Type	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limits (MHz)	Verdict
ANTI	SISO	2.000	1.561	≥1.561	PASS
ANT2	SISO	2.000	1.554	≥1.554	PASS

3.2 Test Graph



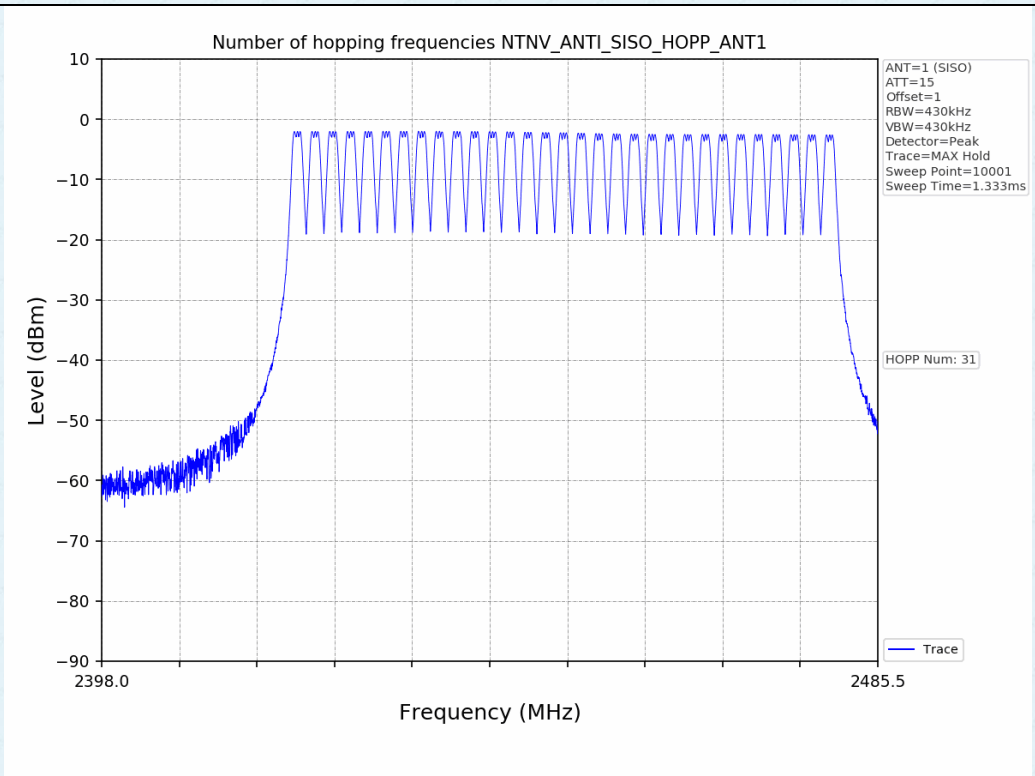


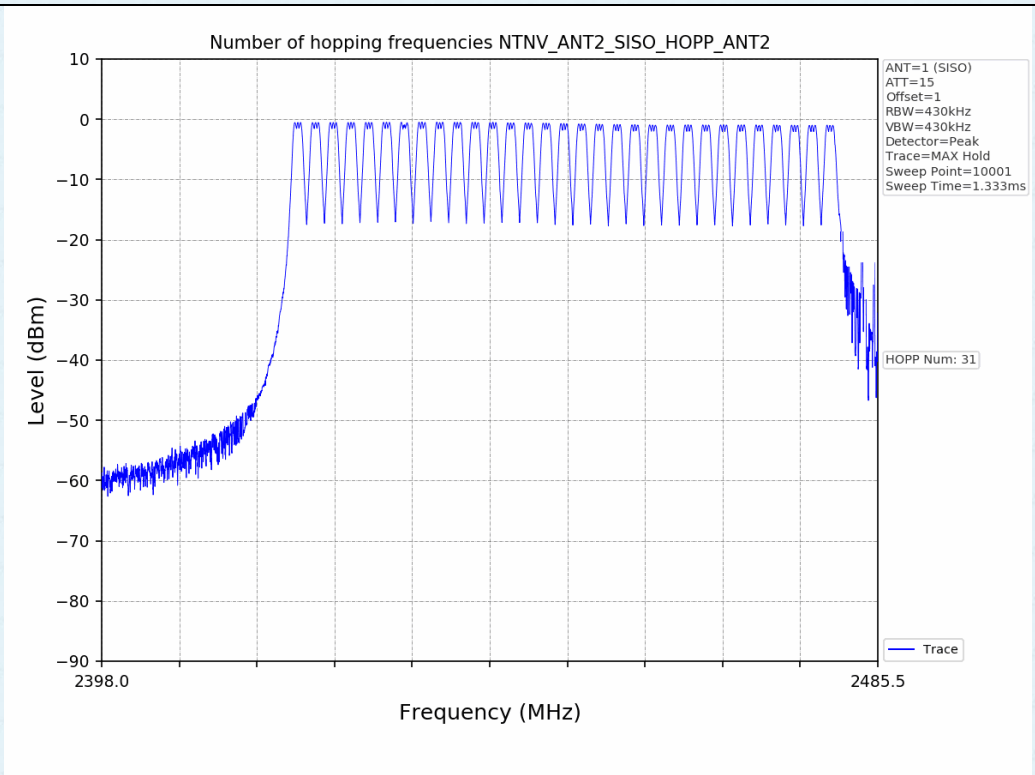
4. Number of hopping frequencies

4.1 Test Result

Test Mode	TX Type	Num of Hopping Frequencies	Limits	Verdict
ANTI	SISO	31	≥15	PASS
ANT2	SISO	31	≥15	PASS

4.2 Test Graph


Number of hopping frequencies NTNV_ANTI_SISO_HOPP_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=430kHz
VBW=430kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=10001
Sweep Time=1.333ms
HOPP Num: 31
Trace
Level (dBm)
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
2398.0
2485.5
Frequency (MHz)

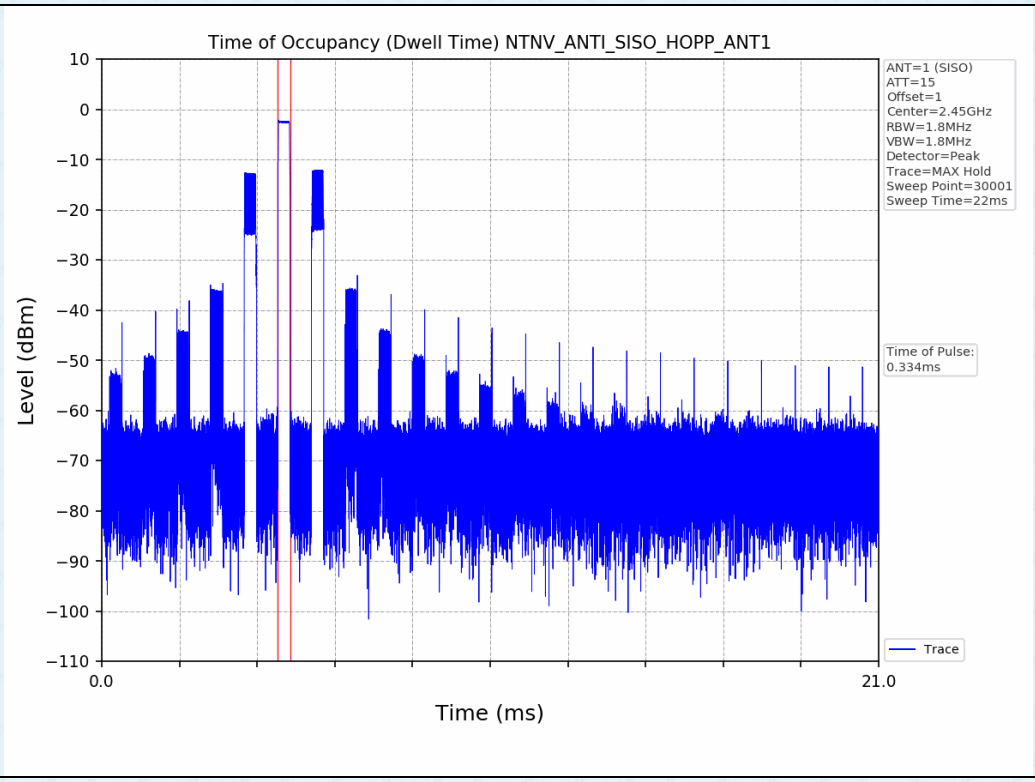

Number of hopping frequencies NTNV_ANT2_SISO_HOPP_ANT2
ANT=1 (SISO)
ATT=15
Offset=1
RBW=430kHz
VBW=430kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=10001
Sweep Time=1.333ms
HOPP Num: 31
Trace
Level (dBm)
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
2398.0
2485.5
Frequency (MHz)

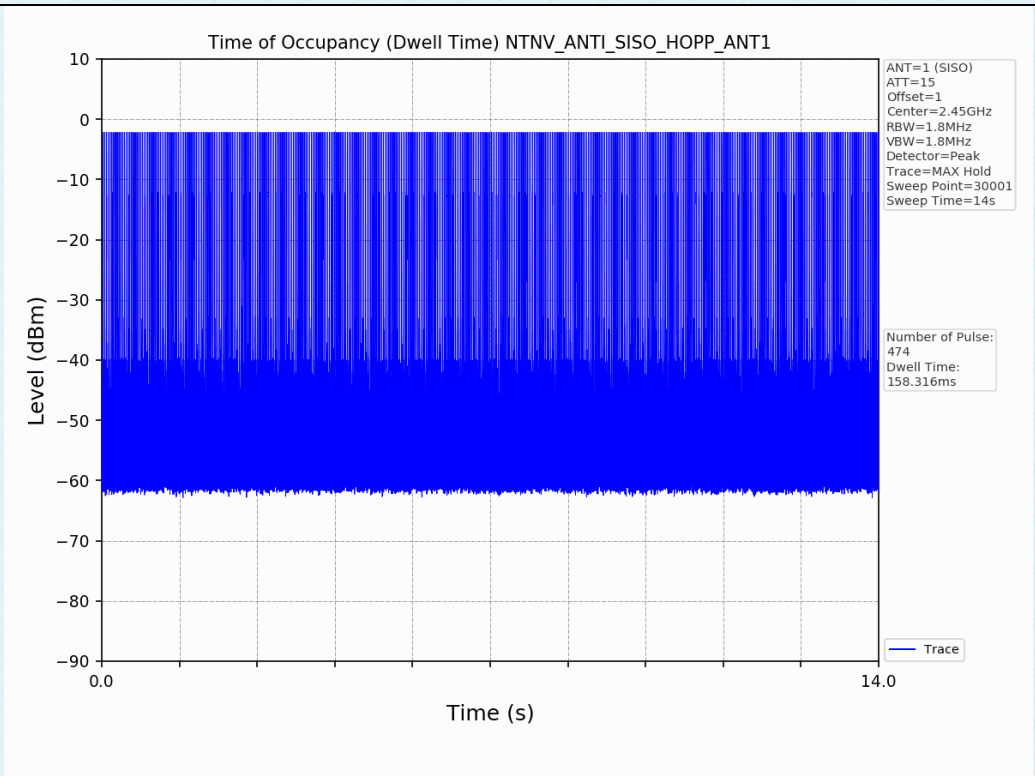
5. Time of Occupancy (Dwell Time)

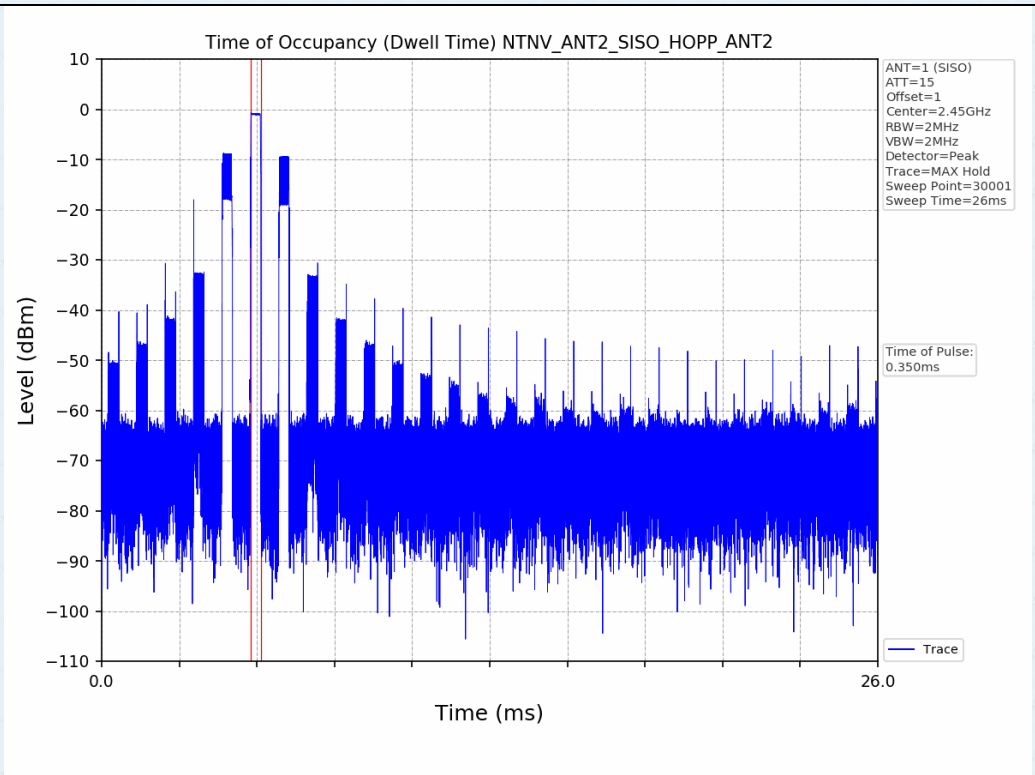
5.1 Test Result

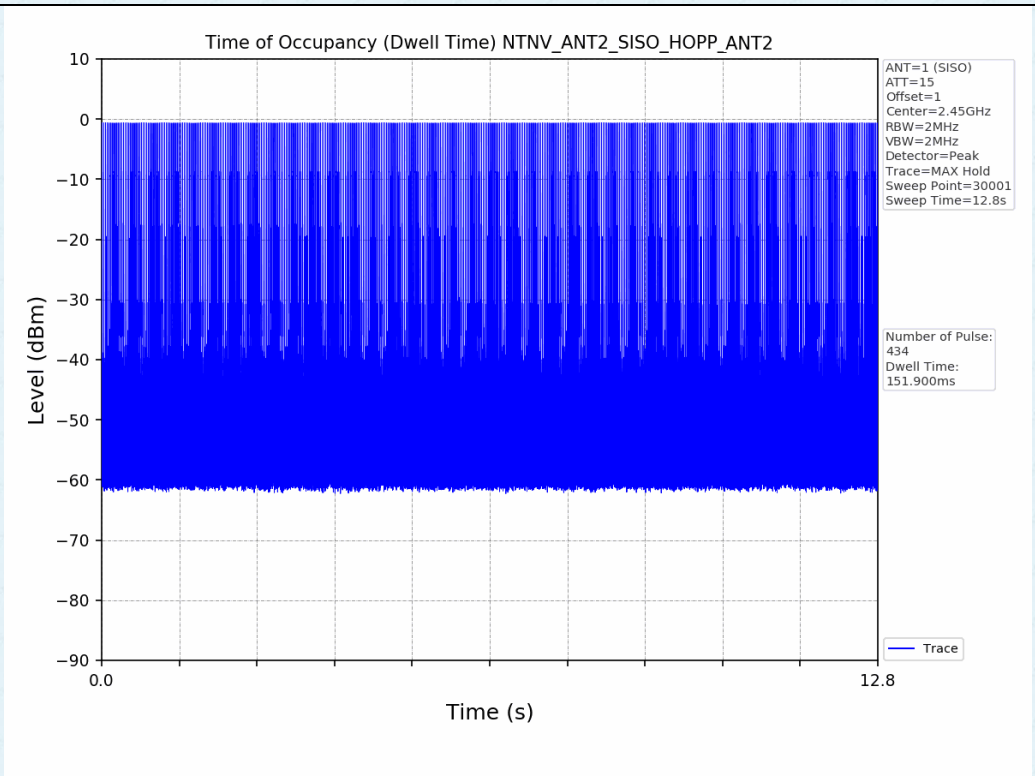
Test Mode	Packet Type	TX Type	Duration of Single Pulse (ms)	Obeservation Period (s)	Num of Pulse in Observation Period	Dwell Time (ms)	Limits (ms)	Verdict
ANTI	NoPT	SISO	0.334	14	474	158.316	≤400	PASS
ANT2	NoPT	SISO	0.350	14	434	151.900	≤400	PASS

5.2 Test Graph




Time of Occupancy (Dwell Time) NTNV_ANTI_SISO_HOPP_ANT1
Level (dBm)
Time (s)
0.0
14.0
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
ANT=1 (SISO)
ATT=15
Offset=1
Center=2.45GHz
RBW=1.8MHz
VBW=1.8MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=30001
Sweep Time=14s
Number of Pulse:
474
Dwell Time:
158.316ms
Trace


Time of Occupancy (Dwell Time) NTNV_ANT2_SISO_HOPP_ANT2
Level (dBm)
Time (ms)
0.0
26.0
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
ANT=1 (SISO)
ATT=15
Offset=1
Center=2.45GHz
RBW=2MHz
VBW=2MHz
Detector=Peak
Trace=MAX Hold
Sweep Point=30001
Sweep Time=26ms
Time of Pulse:
0.350ms
Trace



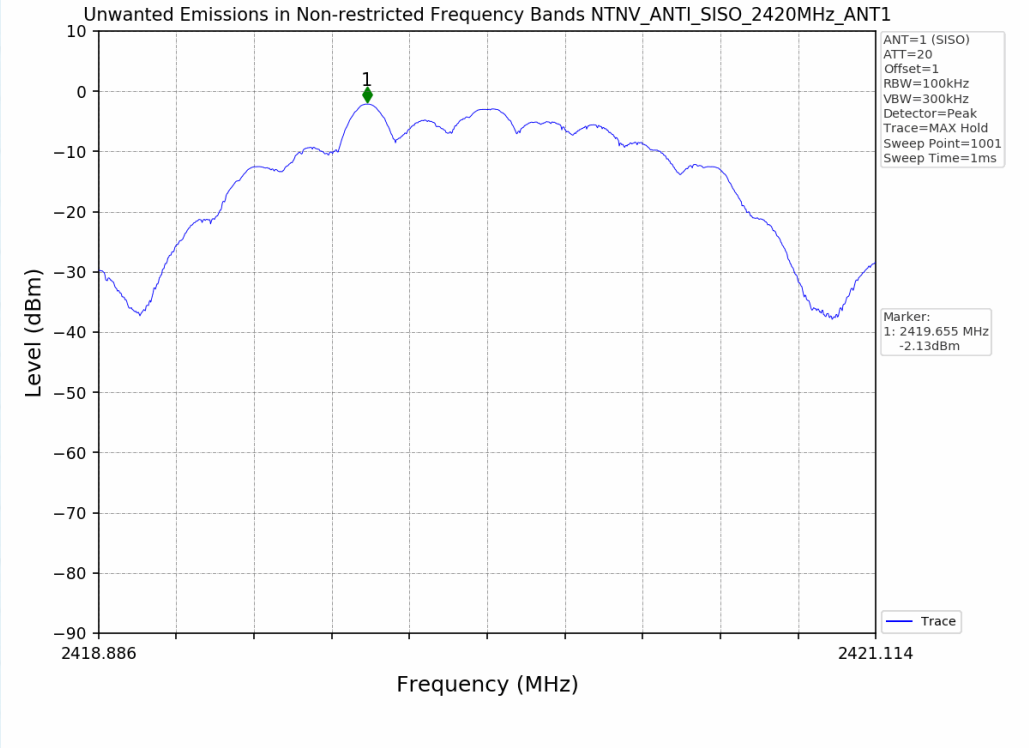
6. Unwanted Emissions in Non-restricted Frequency Bands

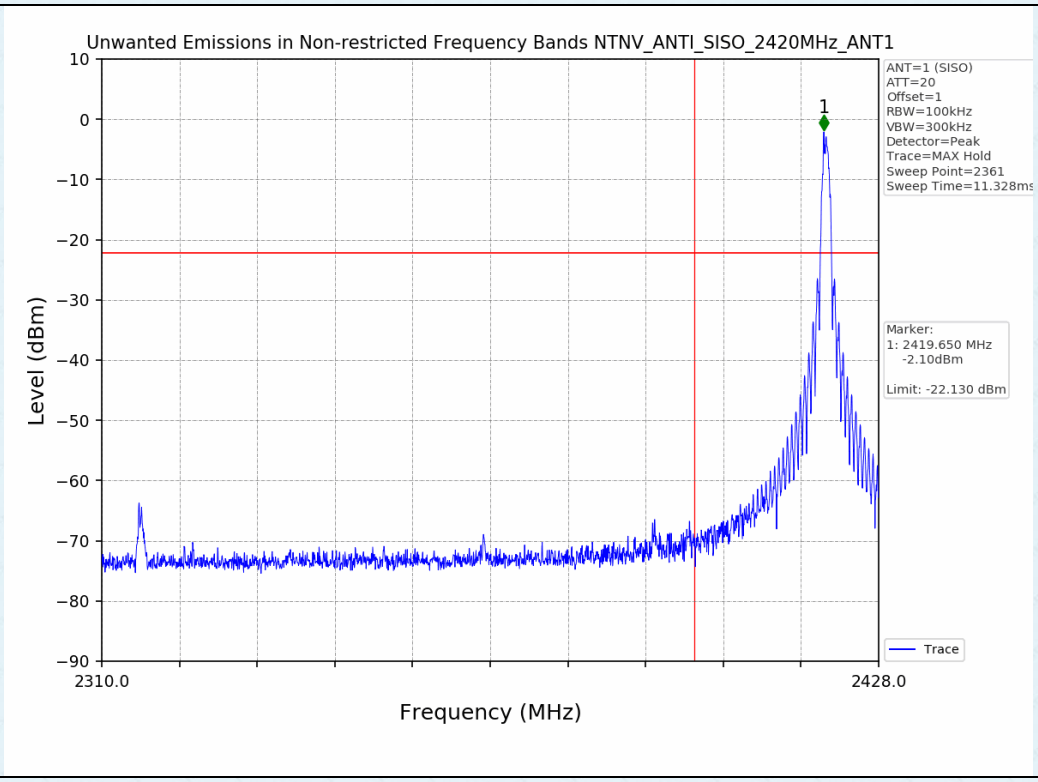
6.1 Test Result

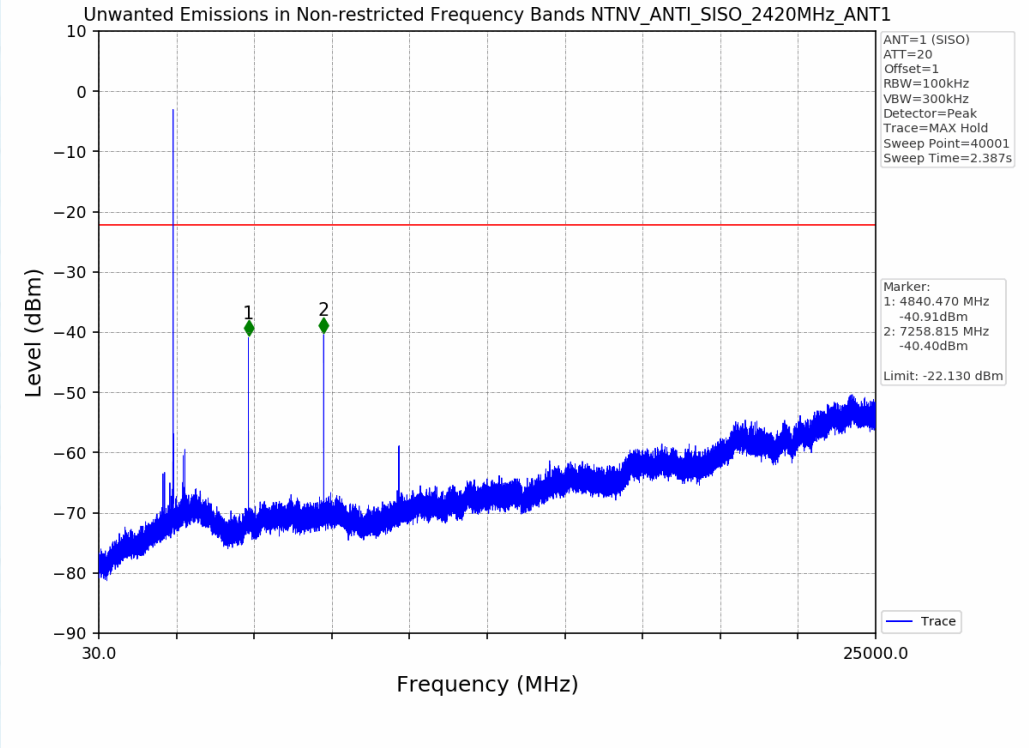
Test Mode	Frequency (MHz)	TX Type	Spurious Conducted Emission (dBm)	Limits (dBm)	Verdict
ANTI	2420	SISO	Refer to test graph	-22.13	PASS
	2450	SISO	Refer to test graph	-22.13	PASS
	2480	SISO	Refer to test graph	-22.13	PASS
	Hopping	SISO	Refer to test graph	-22.13	PASS

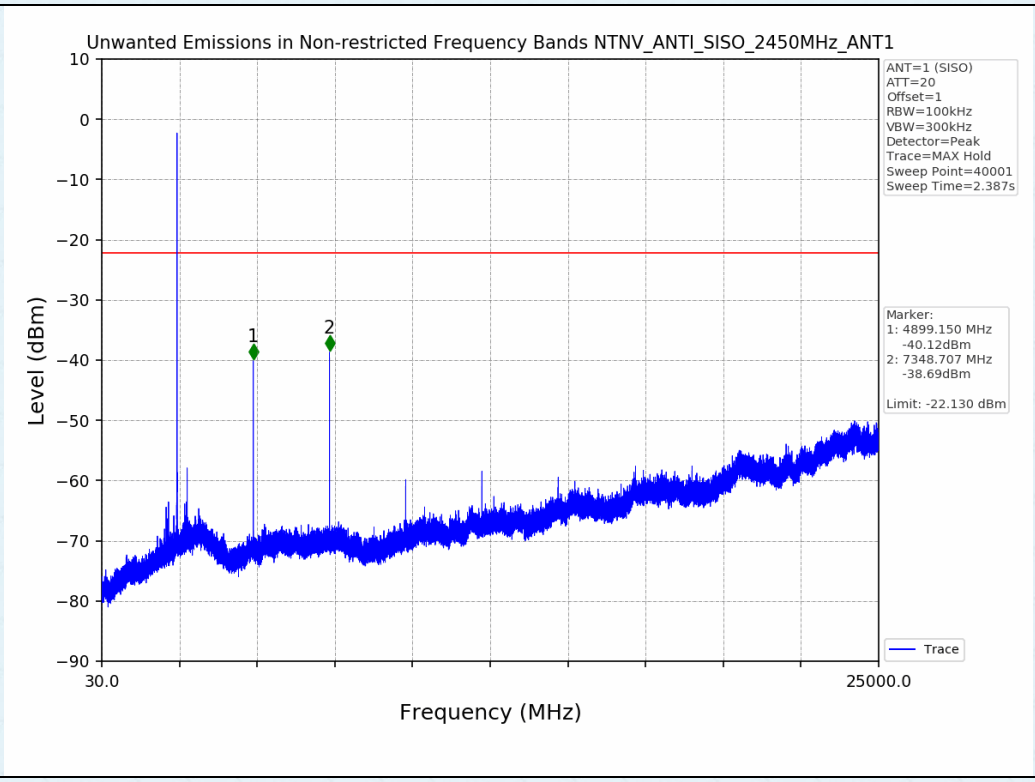
Test Mode	Frequency (MHz)	TX Type	Spurious Conducted Emission (dBm)	Limits (dBm)	Verdict
ANT2	2420	SISO	Refer to test graph	-20.76	PASS
	2450	SISO	Refer to test graph	-20.76	PASS
	2480	SISO	Refer to test graph	-20.76	PASS
	Hopping	SISO	Refer to test graph	-20.76	PASS

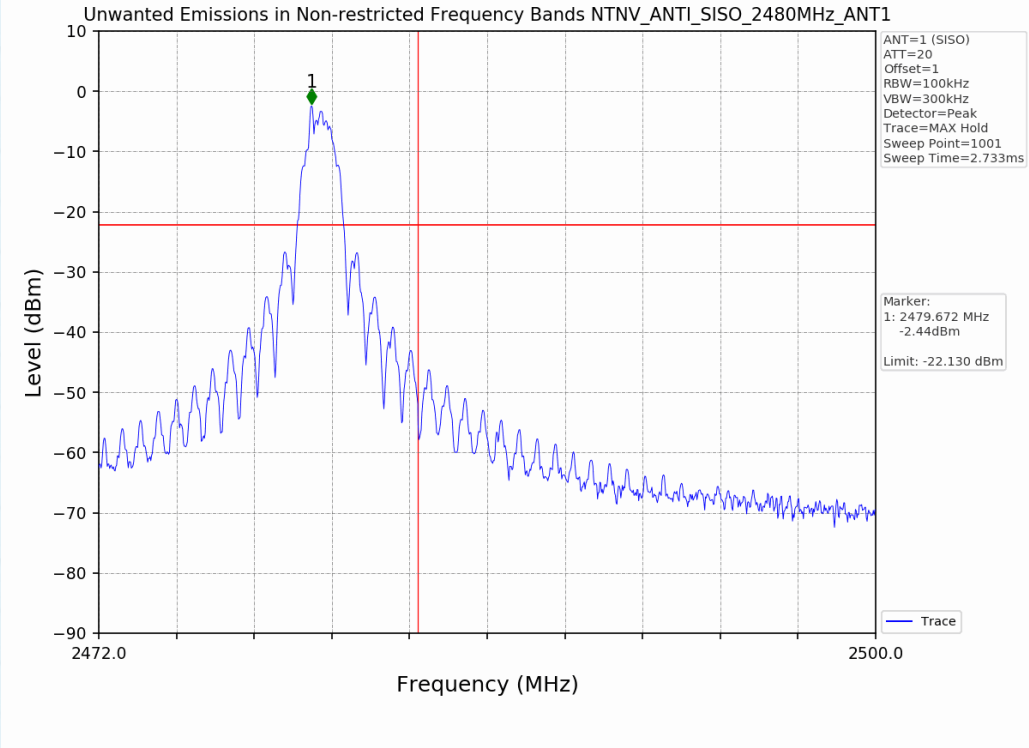
6.2 Test Graph

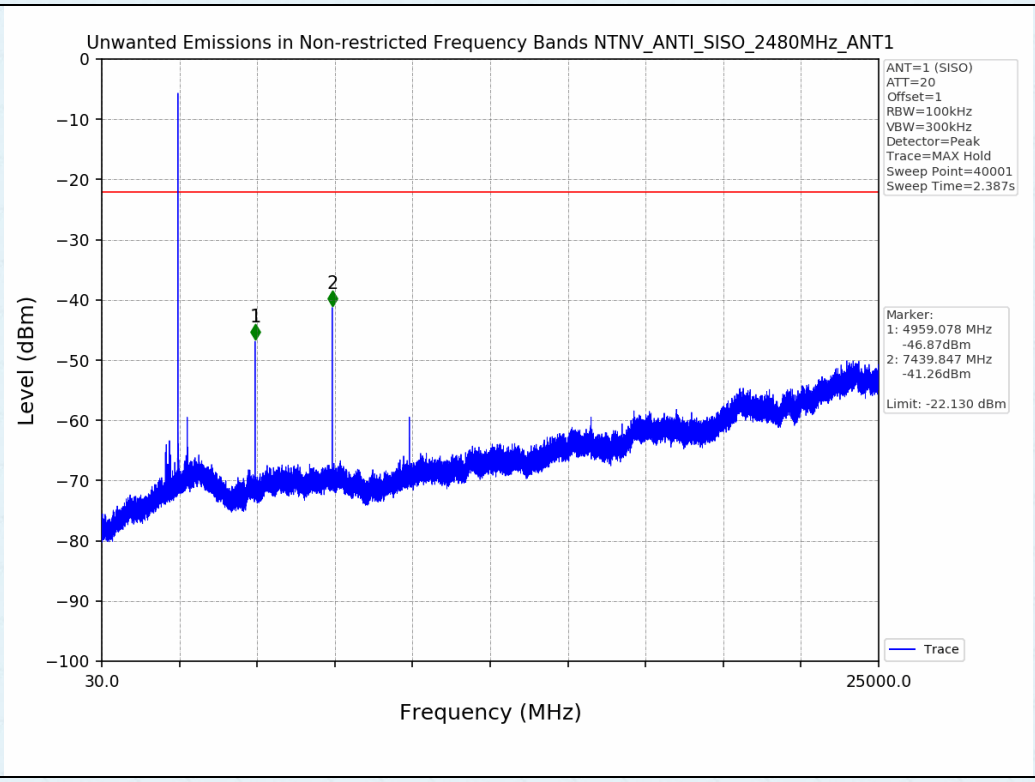

Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANTI_SISO_2420MHz_ANT1
ANT=1 (SISO)
ATT=20
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Marker:
1: 2419.655 MHz
-2.13dBm
Trace
Level (dBm)
Frequency (MHz)
2418.886
2421.114

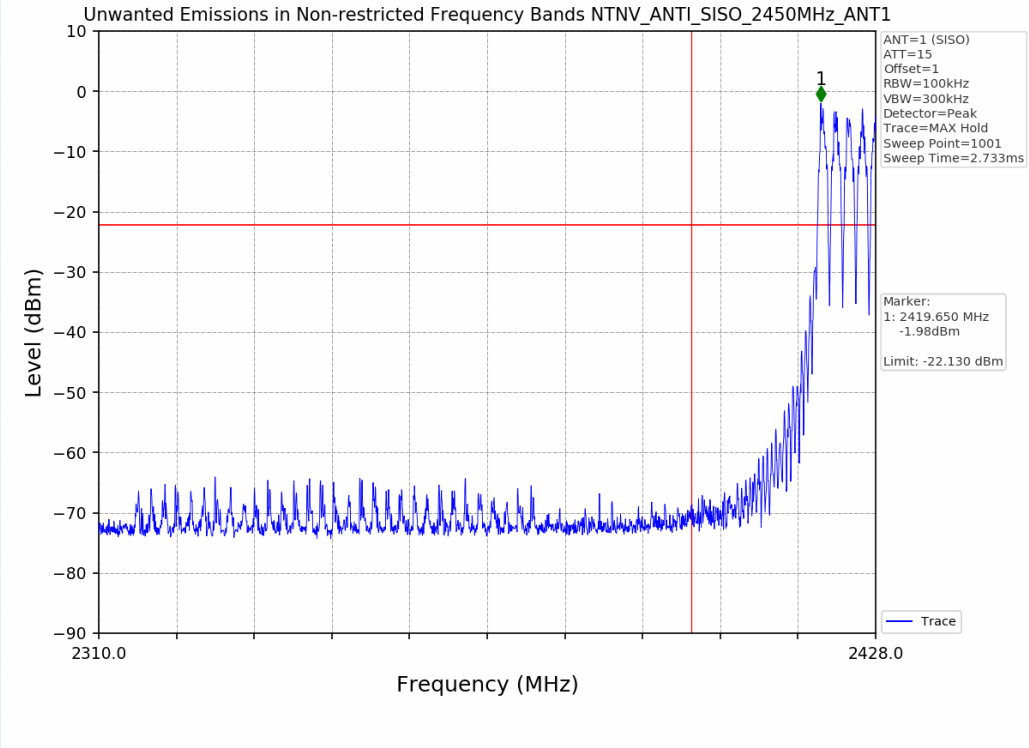

Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANTI_SISO_2420MHz_ANT1
ANT=1 (SISO)
ATT=20
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=2361
Sweep Time=11.328ms
Marker:
1: 2419.650 MHz
-2.10dBm
Limit: -22.130 dBm
Trace
Level (dBm)
Frequency (MHz)
2310.0
2428.0

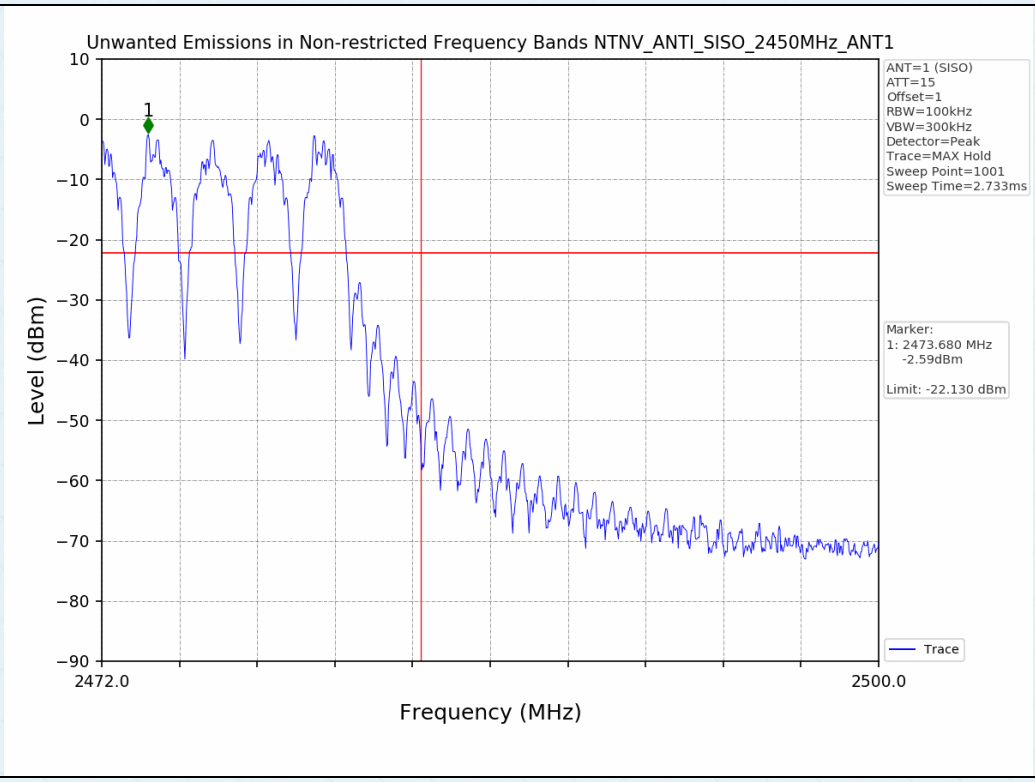

Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANTI_SISO_2420MHz_ANT1
ANT=1 (SISO)
ATT=20
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=40001
Sweep Time=2.387s
Marker:
1: 4840.470 MHz
-40.91dBm
2: 7258.815 MHz
-40.40dBm
Limit: -22.130 dBm
Trace
Level (dBm)
Frequency (MHz)
30.0
25000.0

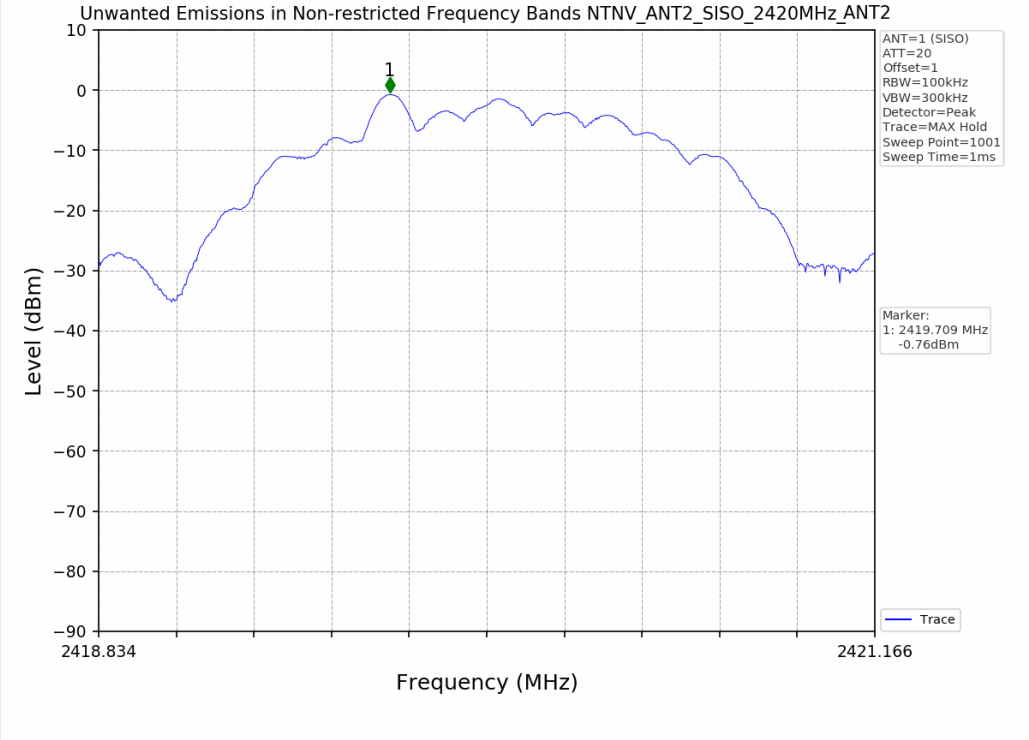

Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANTI_SISO_2450MHz_ANT1
ANT=1 (SISO)
ATT=20
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=40001
Sweep Time=2.387s
Marker:
1: 4899.150 MHz
-40.12dBm
2: 7348.707 MHz
-38.69dBm
Limit: -22.130 dBm
Trace
Level (dBm)
Frequency (MHz)
30.0
25000.0

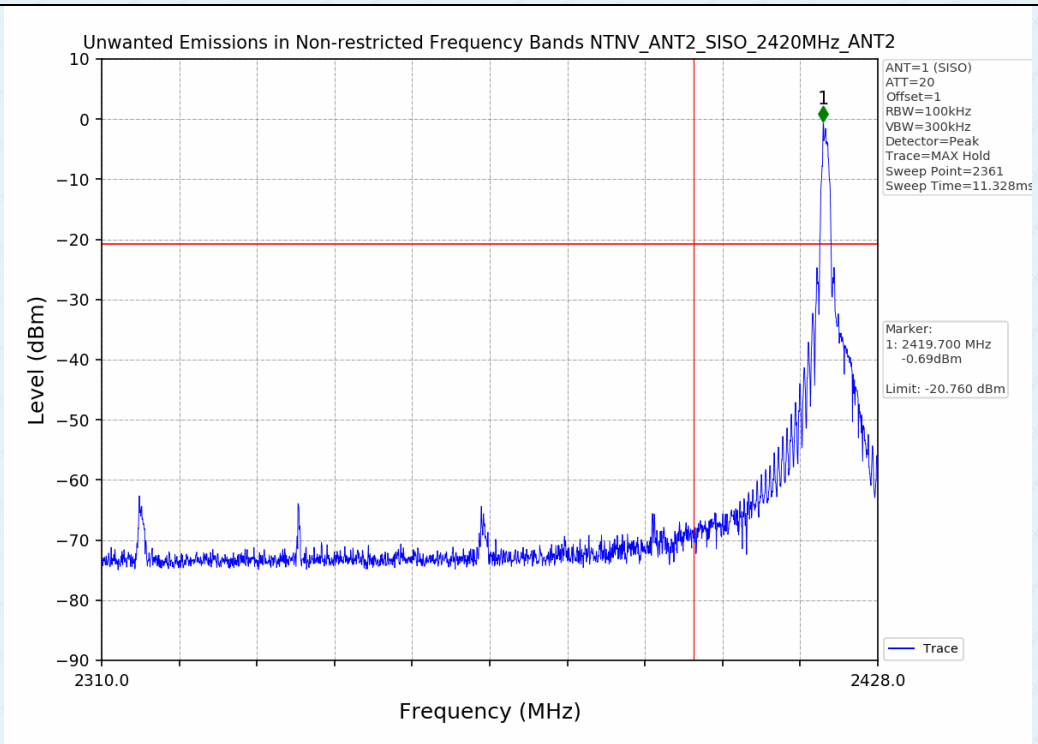

Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANTI_SISO_2480MHz_ANT1
ANT=1 (SISO)
ATT=20
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.733ms
Marker:
1: 2479.672 MHz
-2.44dBm
Limit: -22.130 dBm
Trace
Level (dBm)
Frequency (MHz)
2472.0
2500.0

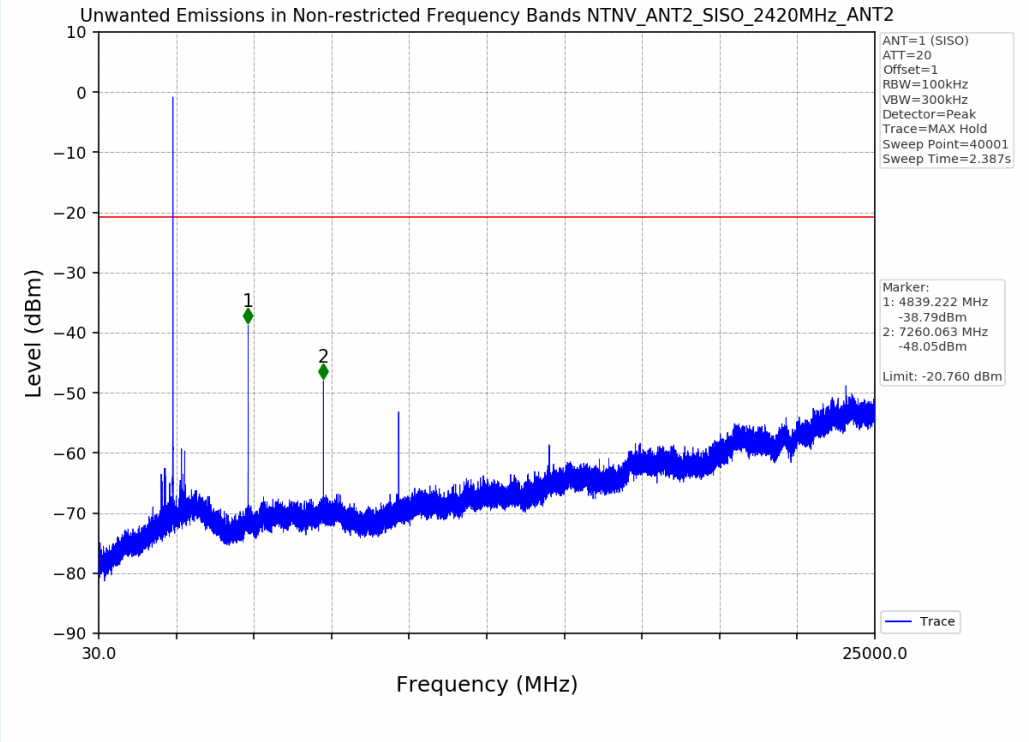

Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANTI_SISO_2480MHz_ANT1
ANT=1 (SISO)
ATT=20
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=40001
Sweep Time=2.387s
Marker:
1: 4959.078 MHz
-46.87dBm
2: 7439.847 MHz
-41.26dBm
Limit: -22.130 dBm
Trace
Level (dBm)
Frequency (MHz)
30.0
25000.0

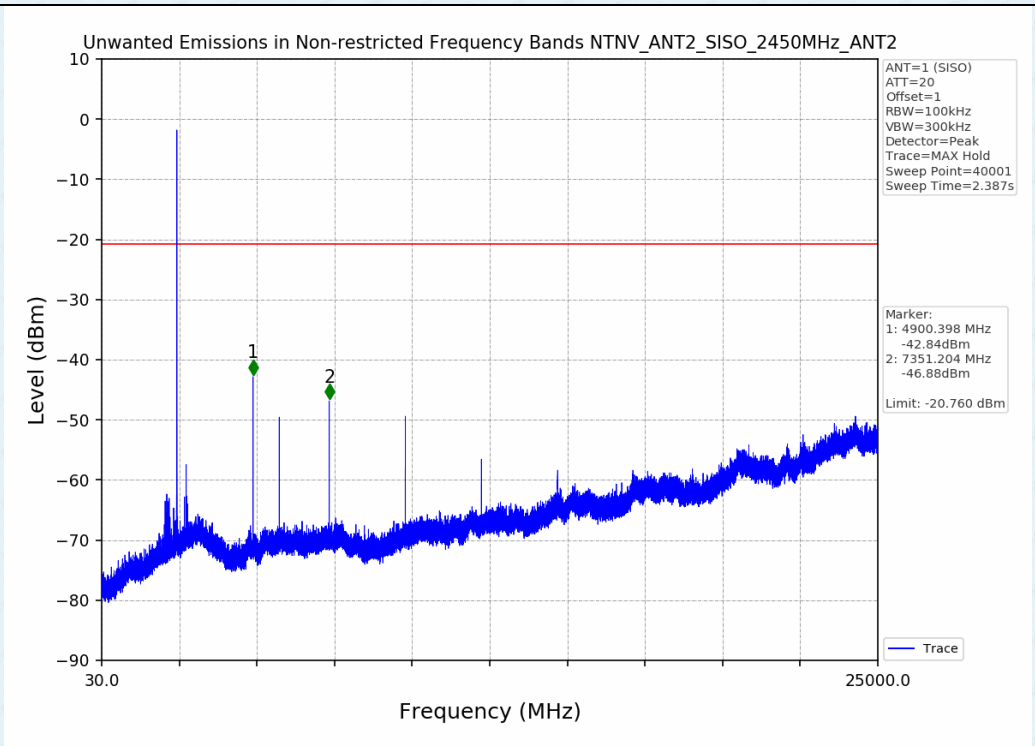

Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANTI_SISO_2450MHz_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.733ms
Marker:
1: 2419.650 MHz
-1.98dBm
Limit: -22.130 dBm
Trace
Level (dBm)
Frequency (MHz)
2310.0
2428.0

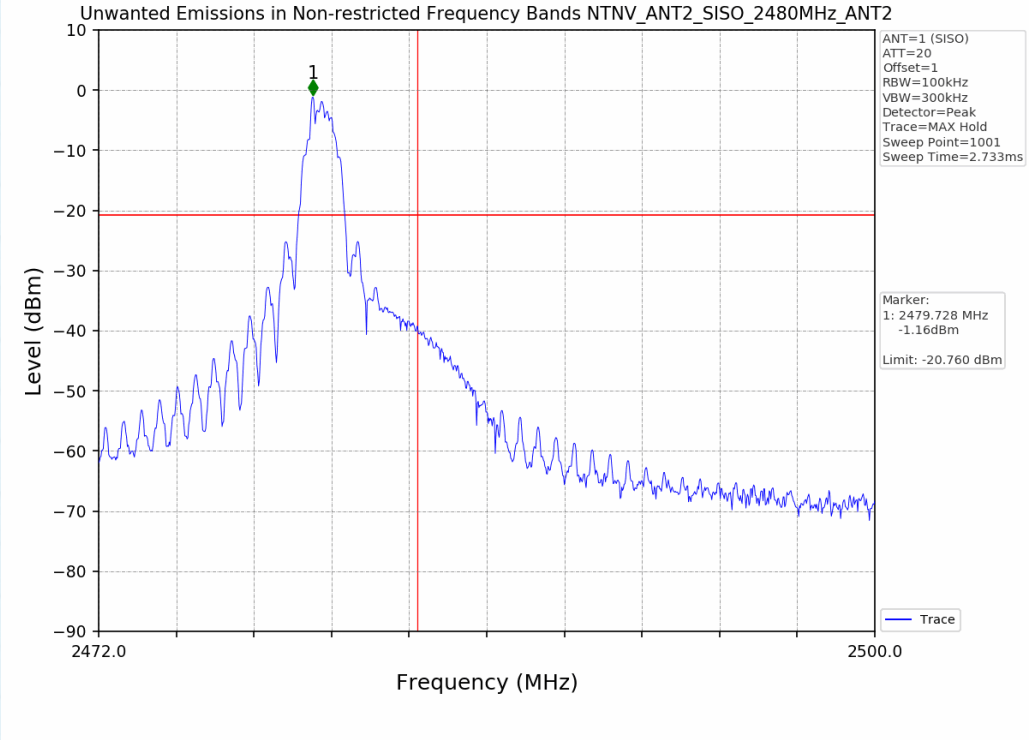

Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANTI_SISO_2450MHz_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.733ms
Marker:
1: 2473.680 MHz
-2.59dBm
Limit: -22.130 dBm
Trace
Level (dBm)
Frequency (MHz)
2472.0
2500.0

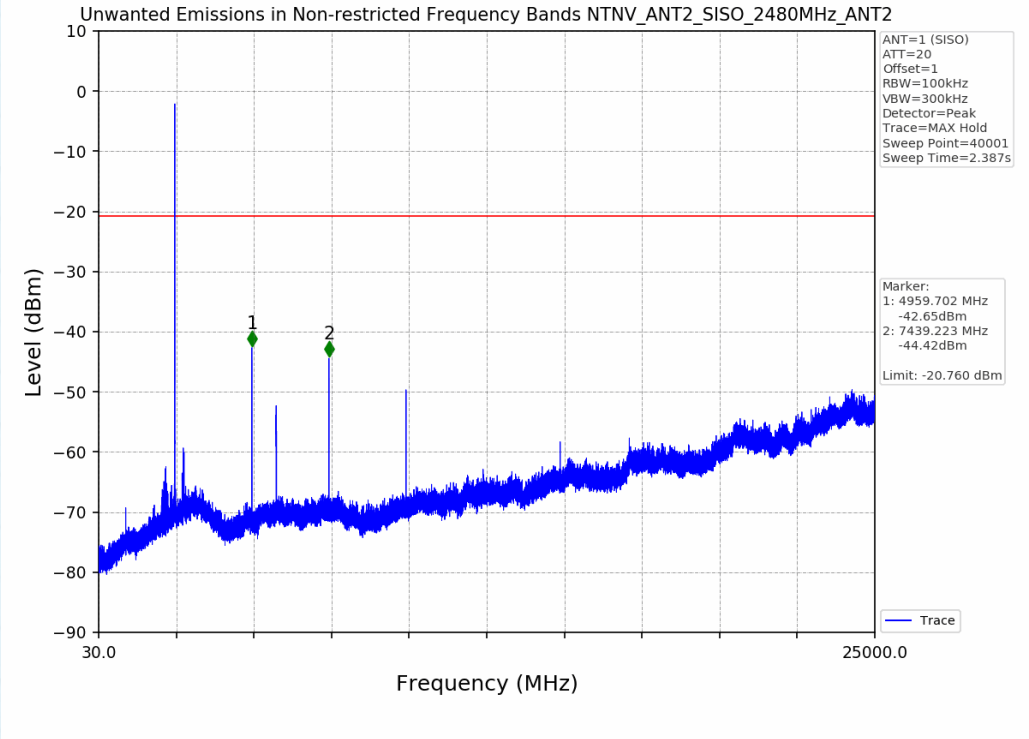

Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANT2_SISO_2420MHz_ANT2
ANT=1 (SISO)
ATT=20
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=1ms
Marker:
1: 2419.709 MHz
-0.76dBm
Trace
Level (dBm)
Frequency (MHz)
2418.834
2421.166

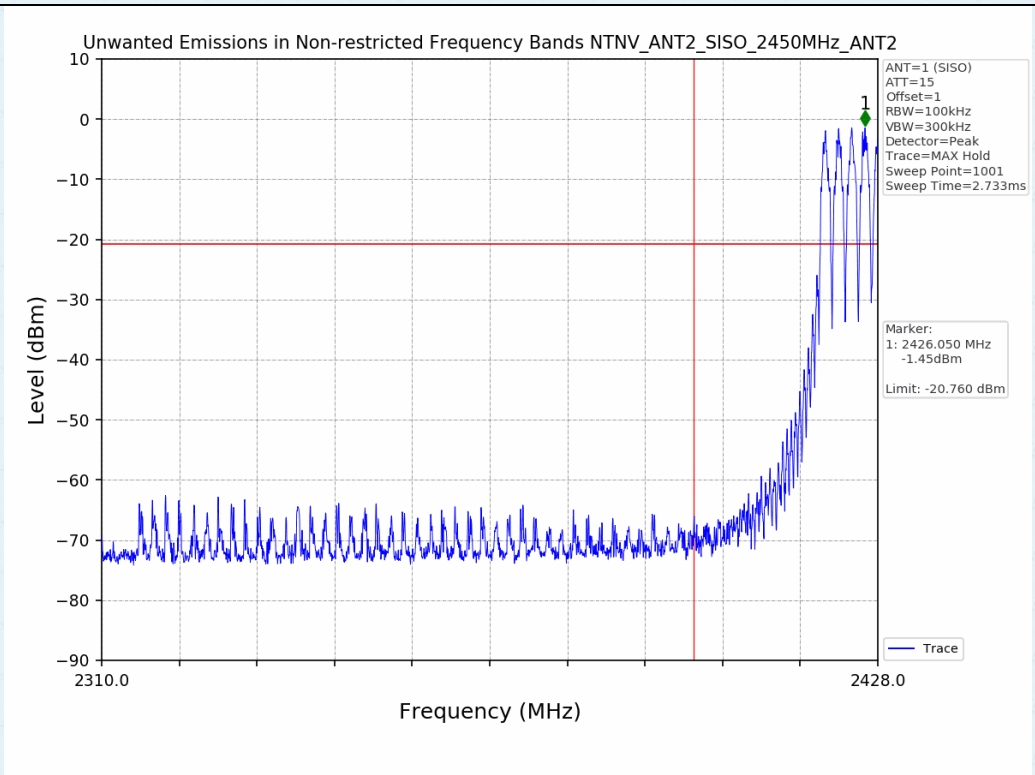

Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANT2_SISO_2420MHz_ANT2
ANT=1 (SISO)
ATT=20
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=2361
Sweep Time=11.328ms
Marker:
1: 2419.700 MHz
-0.69dBm
Limit: -20.760 dBm
Trace
Level (dBm)
Frequency (MHz)
2310.0
2428.0

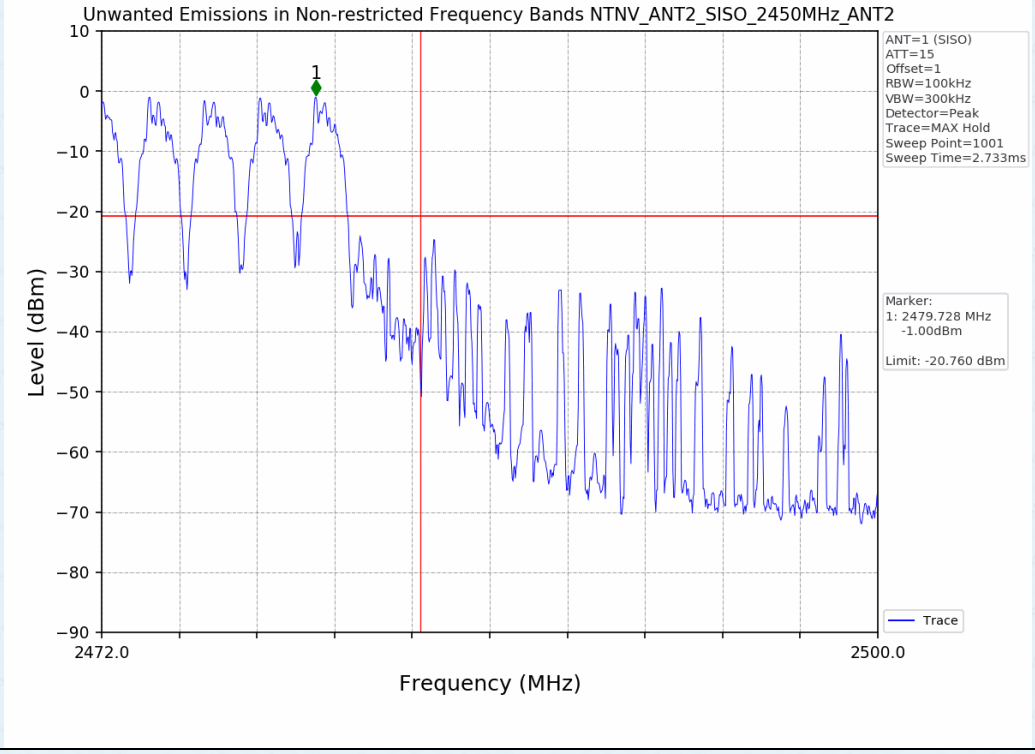

Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANT2_SISO_2420MHz_ANT2
ANT=1 (SISO)
ATT=20
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=40001
Sweep Time=2.387s
Marker:
1: 4839.222 MHz
-38.79dBm
2: 7260.063 MHz
-48.05dBm
Limit: -20.760 dBm
Trace
Level (dBm)
Frequency (MHz)
30.0
25000.0
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
1
2


Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANT2_SISO_2450MHz_ANT2
ANT=1 (SISO)
ATT=20
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=40001
Sweep Time=2.387s
Marker:
1: 4900.398 MHz
-42.84dBm
2: 7351.204 MHz
-46.88dBm
Limit: -20.760 dBm
Trace
Level (dBm)
Frequency (MHz)
30.0
25000.0
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
1
2


Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANT2_SISO_2480MHz_ANT2
ANT=1 (SISO)
ATT=20
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.733ms
Marker:
1: 2479.728 MHz
-1.16dBm
Limit: -20.760 dBm
Trace
Level (dBm)
Frequency (MHz)
2472.0
2500.0
1


Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANT2_SISO_2480MHz_ANT2
ANT=1 (SISO)
ATT=20
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=40001
Sweep Time=2.387s
Marker:
1: 4959.702 MHz
-42.65dBm
2: 7439.223 MHz
-44.42dBm
Limit: -20.760 dBm
Trace
Level (dBm)
Frequency (MHz)
30.0
25000.0
1
2


Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANT2_SISO_2450MHz_ANT2
ANT=1 (SISO)
ATT=15
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.733ms
Marker:
1: 2426.050 MHz
-1.45dBm
Limit: -20.760 dBm
Trace
Level (dBm)
Frequency (MHz)
2310.0
2428.0


Unwanted Emissions in Non-restricted Frequency Bands NTNV_ANT2_SISO_2450MHz_ANT2
ANT=1 (SISO)
ATT=15
Offset=1
RBW=100kHz
VBW=300kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=2.733ms
Marker:
1: 2479.728 MHz
-1.00dBm
Limit: -20.760 dBm
Trace
Level (dBm)
Frequency (MHz)
2472.0
2500.0

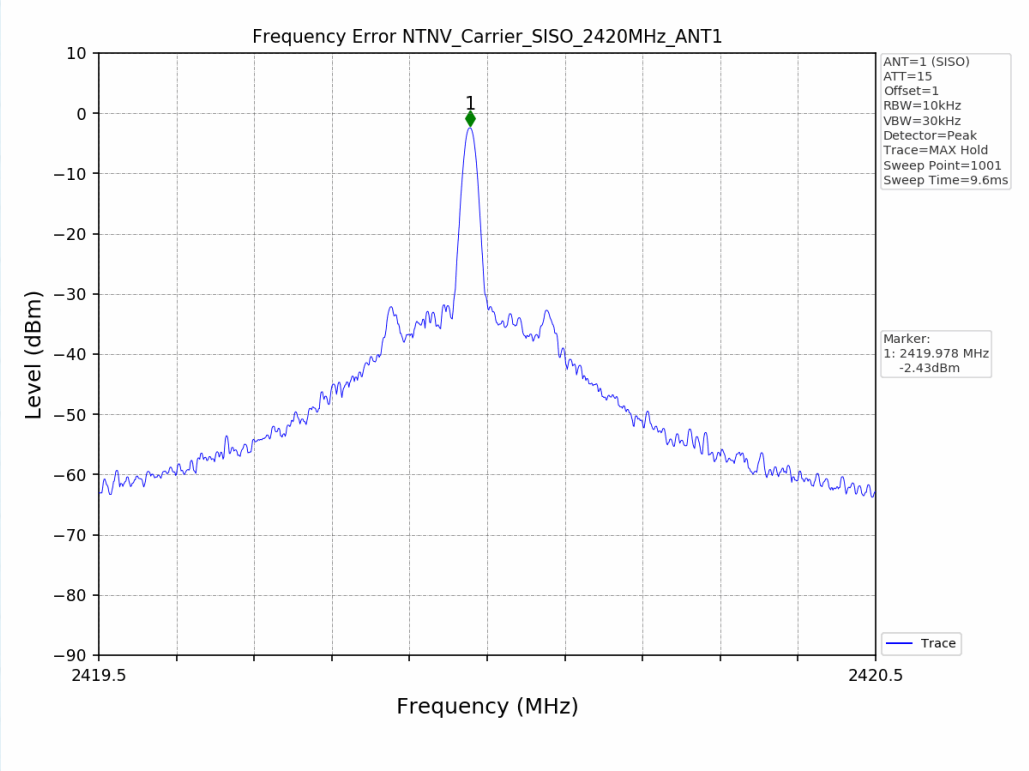
7. Frequency Error

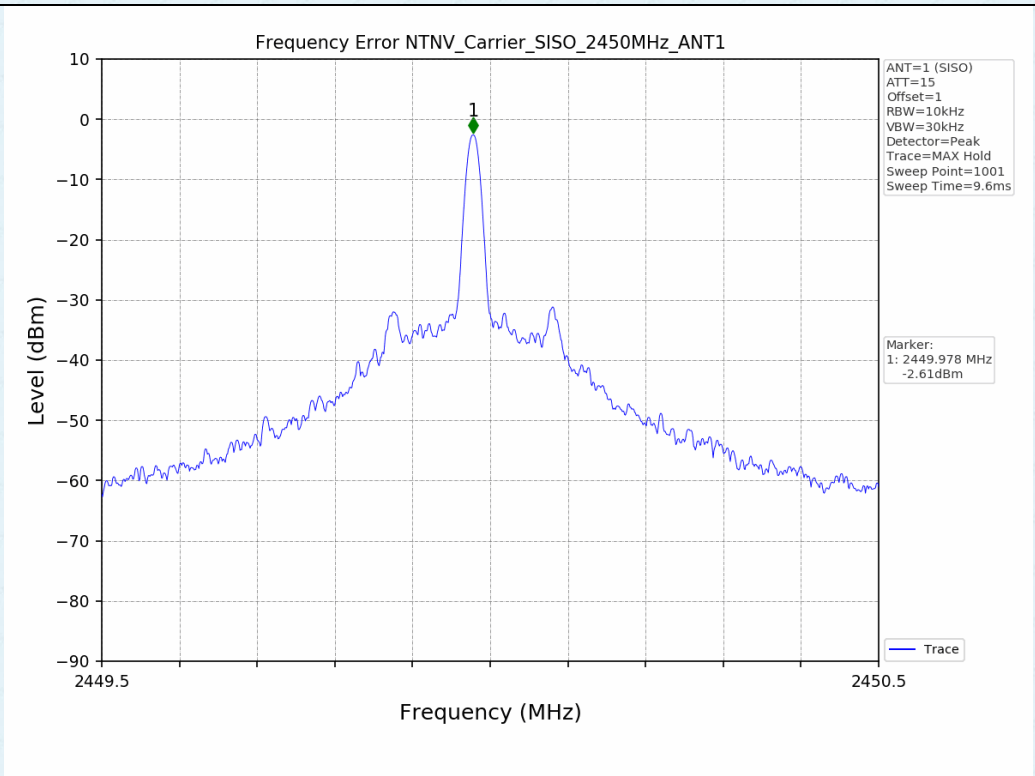
7.1 Test Result

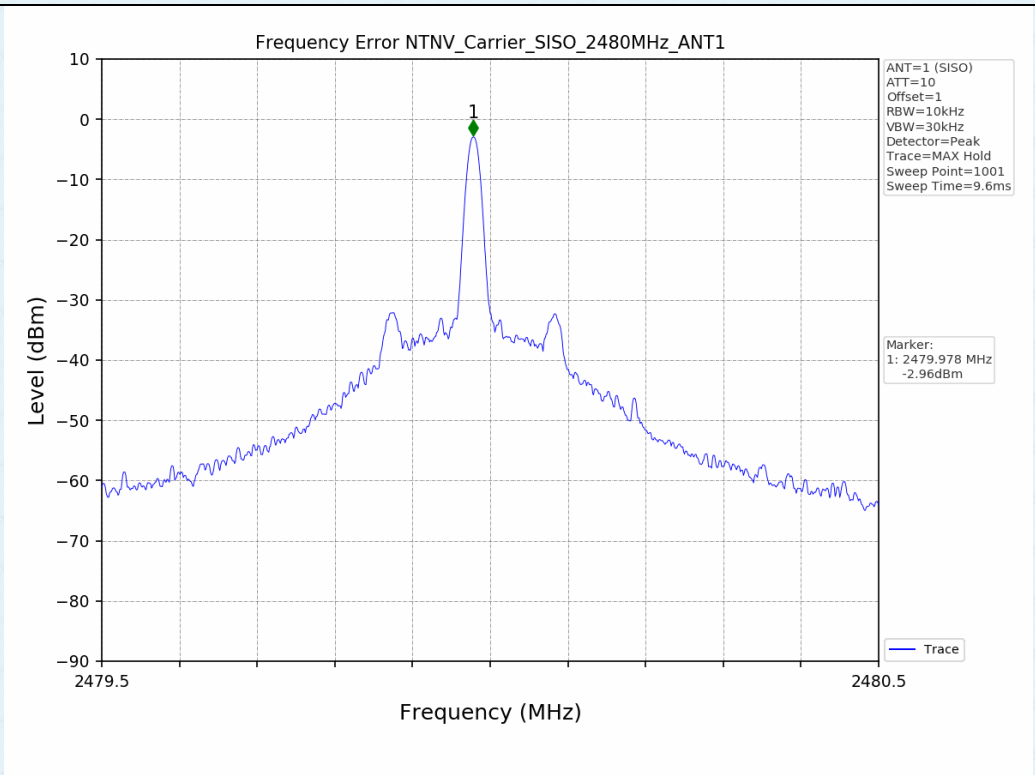
Test Mode	Frequency (MHz)	TX Type	ANT	Measured Frequency (MHz)		Verdict
				Test Result	Limit	
Carrier	2420	SISO	1	2419.98	2400-2483.5	PASS
	2450	SISO	1	2449.98	2400-2483.5	PASS
	2480	SISO	1	2479.98	2400-2483.5	PASS

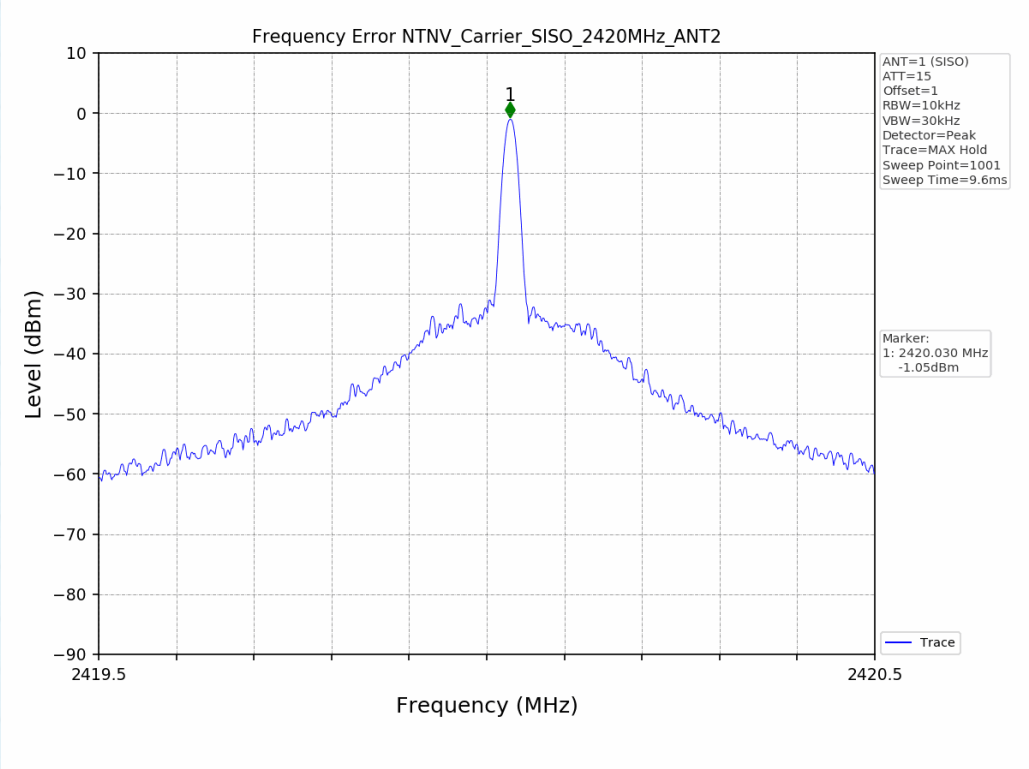
Test Mode	Frequency (MHz)	TX Type	ANT	Measured Frequency (MHz)		Verdict
				Test Result	Limit	
Carrier	2420	SISO	2	2420.03	2400-2483.5	PASS
	2450	SISO	2	2450.03	2400-2483.5	PASS
	2480	SISO	2	2480.03	2400-2483.5	PASS

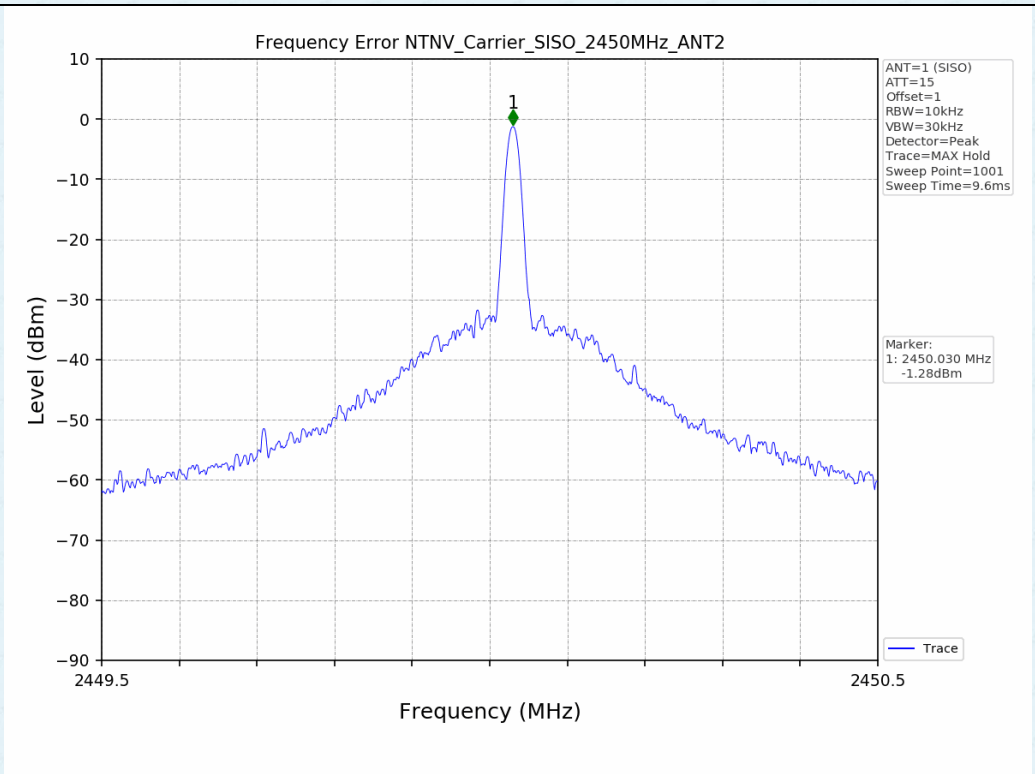
7.2 Test Graph

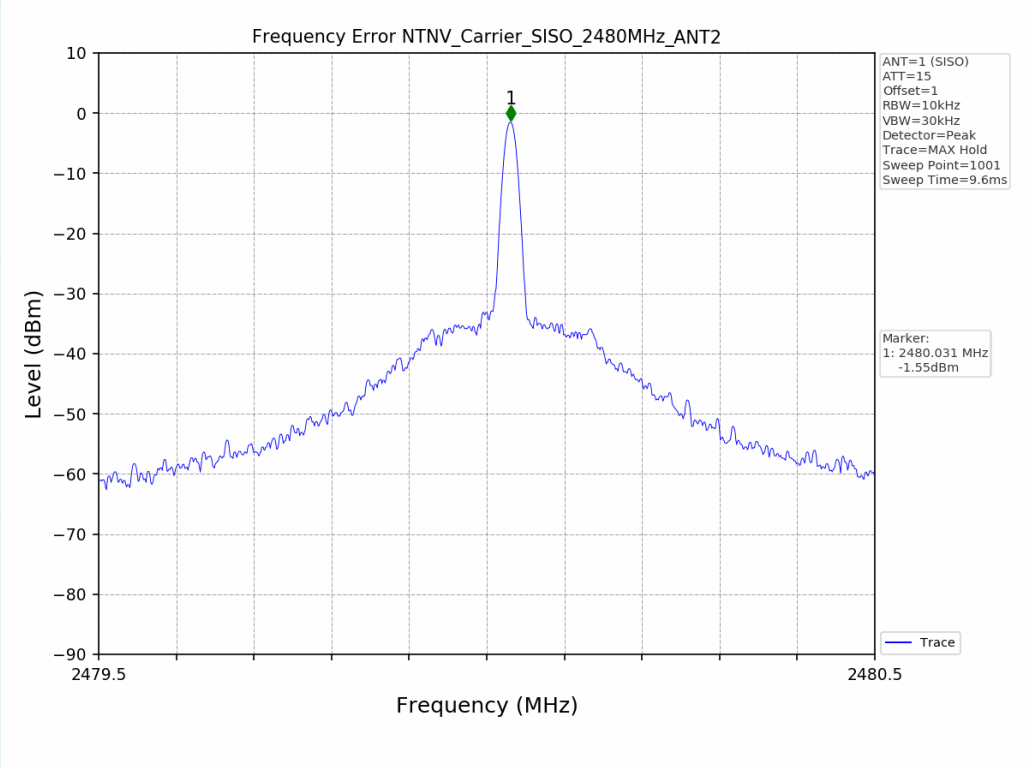



Frequency Error NTNV_Carrier_SISO_2450MHz_ANT1
ANT=1 (SISO)
ATT=15
Offset=1
RBW=10kHz
VBW=30kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=9.6ms
Marker:
1: 2449.978 MHz
-2.61dBm
Trace
Level (dBm)
Frequency (MHz)
2449.5
2450.5


Frequency Error NTNV_Carrier_SISO_2480MHz_ANT1
ANT=1 (SISO)
ATT=10
Offset=1
RBW=10kHz
VBW=30kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=9.6ms
Marker:
1: 2479.978 MHz
-2.96dBm
Trace
Level (dBm)
Frequency (MHz)
2479.5
2480.5


Frequency Error NTNV_Carrier_SISO_2420MHz_ANT2
ANT=1 (SISO)
ATT=15
Offset=1
RBW=10kHz
VBW=30kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=9.6ms
Marker:
1: 2420.030 MHz
-1.05dBm
Trace
Level (dBm)
Frequency (MHz)
2419.5
2420.5


Frequency Error NTNV_Carrier_SISO_2450MHz_ANT2
ANT=1 (SISO)
ATT=15
Offset=1
RBW=10kHz
VBW=30kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=9.6ms
Marker:
1: 2450.030 MHz
-1.28dBm
Trace
Level (dBm)
Frequency (MHz)
2449.5
2450.5


Frequency Error NTNV_Carrier_SISO_2480MHz_ANT2
ANT=1 (SISO)
ATT=15
Offset=1
RBW=10kHz
VBW=30kHz
Detector=Peak
Trace=MAX Hold
Sweep Point=1001
Sweep Time=9.6ms
Marker:
1: 2480.031 MHz
-1.55dBm
Trace
Level (dBm)
Frequency (MHz)
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
2479.5
2480.5
1