



Appendix A

RF Test Data for 2.4G BT (Conducted Measurement)

Product Name: Smart water bottle

Test Model: SPORT5

Environmental Conditions

Temperature:	23.5° C
Relative Humidity:	52.2%
ATM Pressure:	100.0 kPa
Test Engineer:	Ling Zhu
Supervised by:	Li Huan



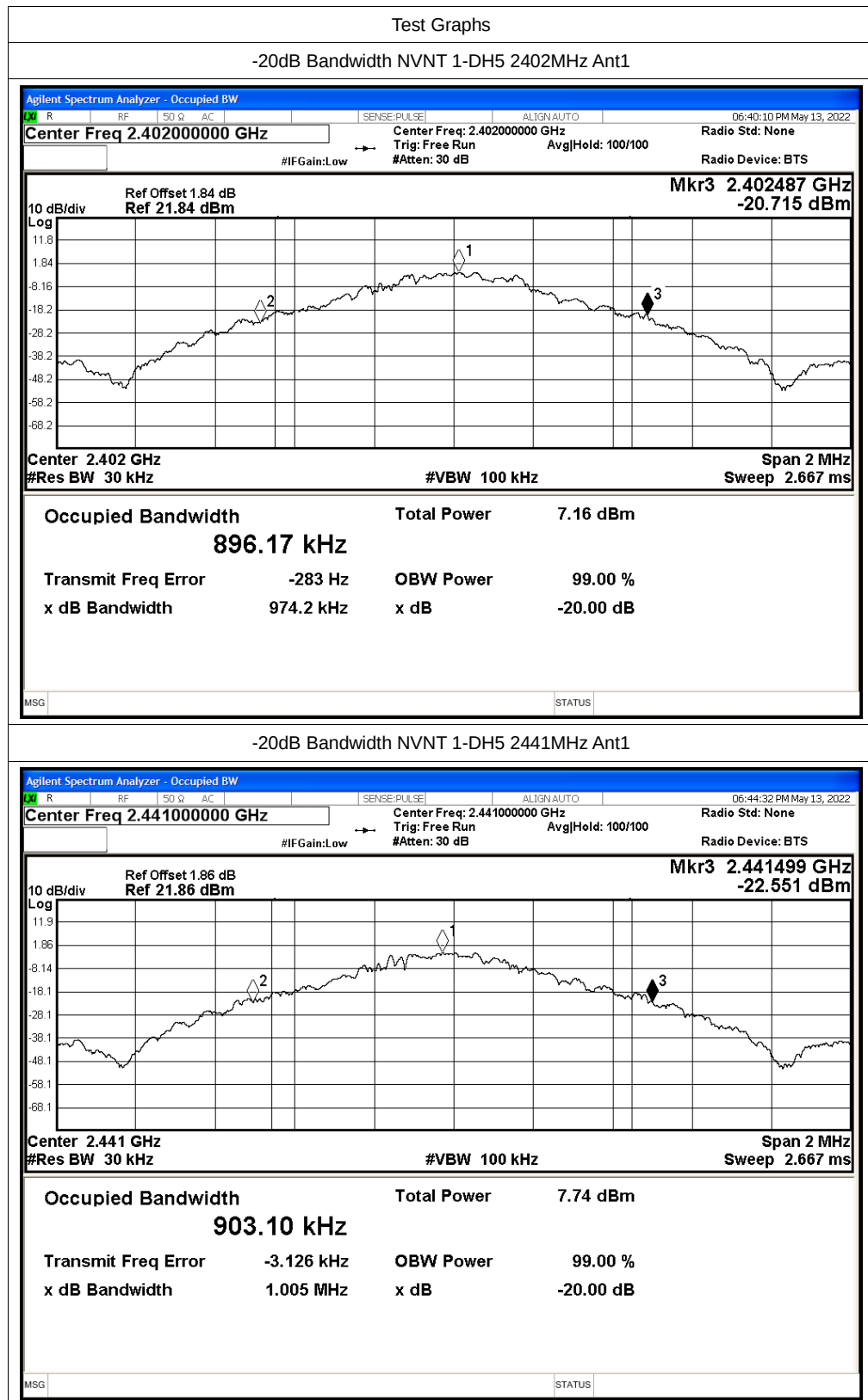
A.1 20dB Emission Bandwidth

Test Result

TestMode	Antenna	Channel	20db EBW[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.974	---	---
		2441	1.005	---	---
		2480	0.962	---	---
2DH5	Ant1	2402	1.281	---	---
		2441	1.307	---	---
		2480	1.307	---	---
3DH5	Ant1	2402	1.301	---	---
		2441	1.299	---	---
		2480	1.299	---	---

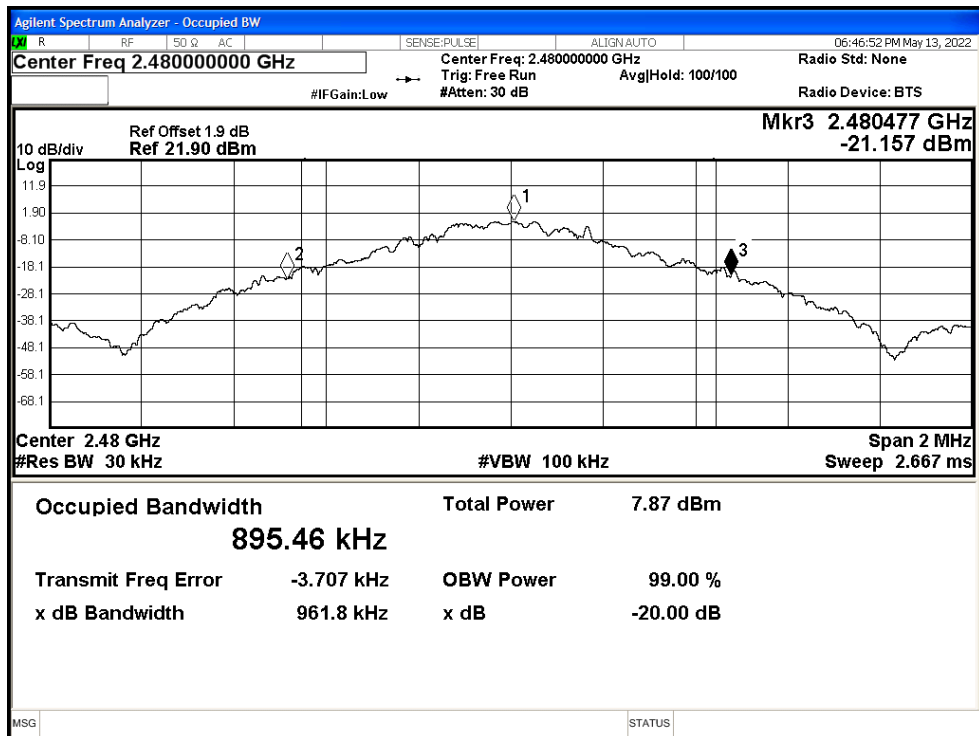


Test Graphs

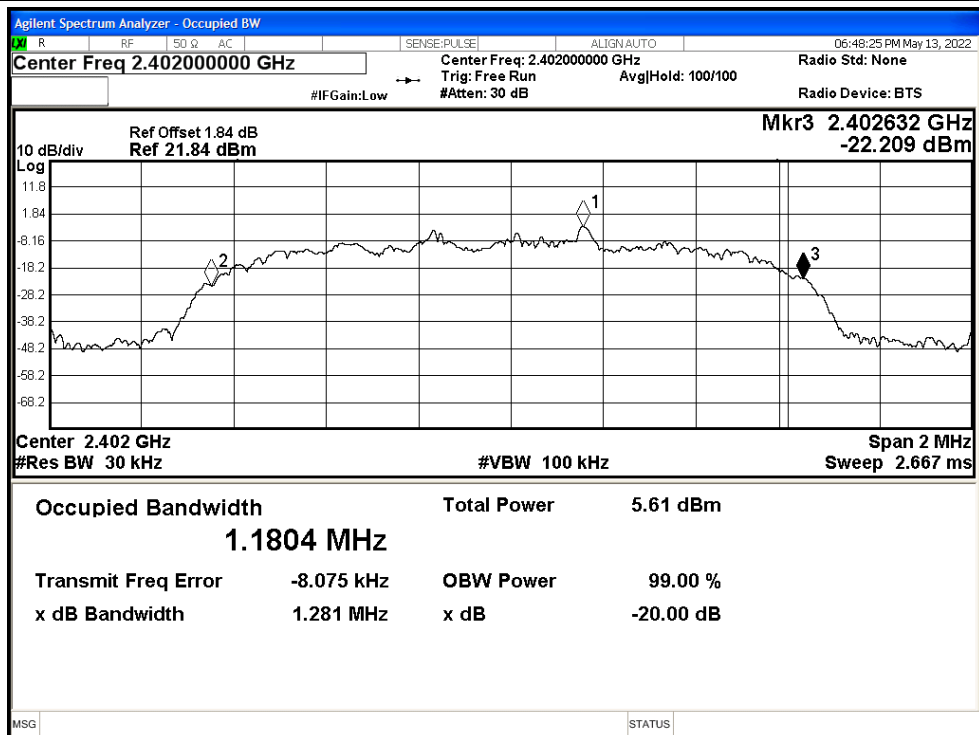




-20dB Bandwidth NVNT 1-DH5 2480MHz Ant1

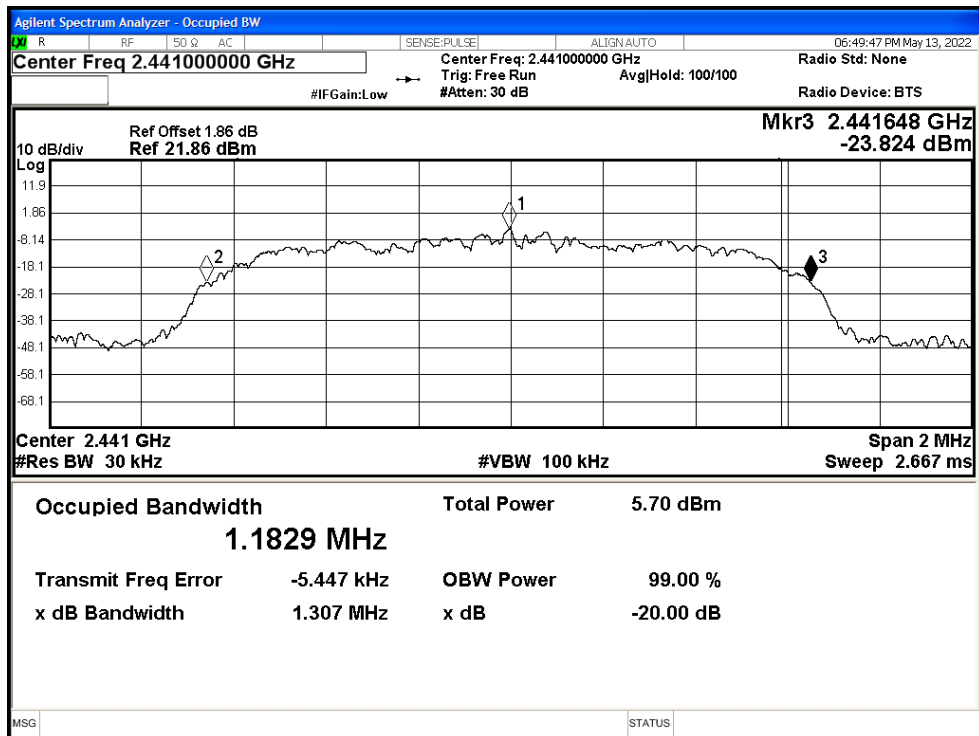


-20dB Bandwidth NVNT 2-DH5 2402MHz Ant1

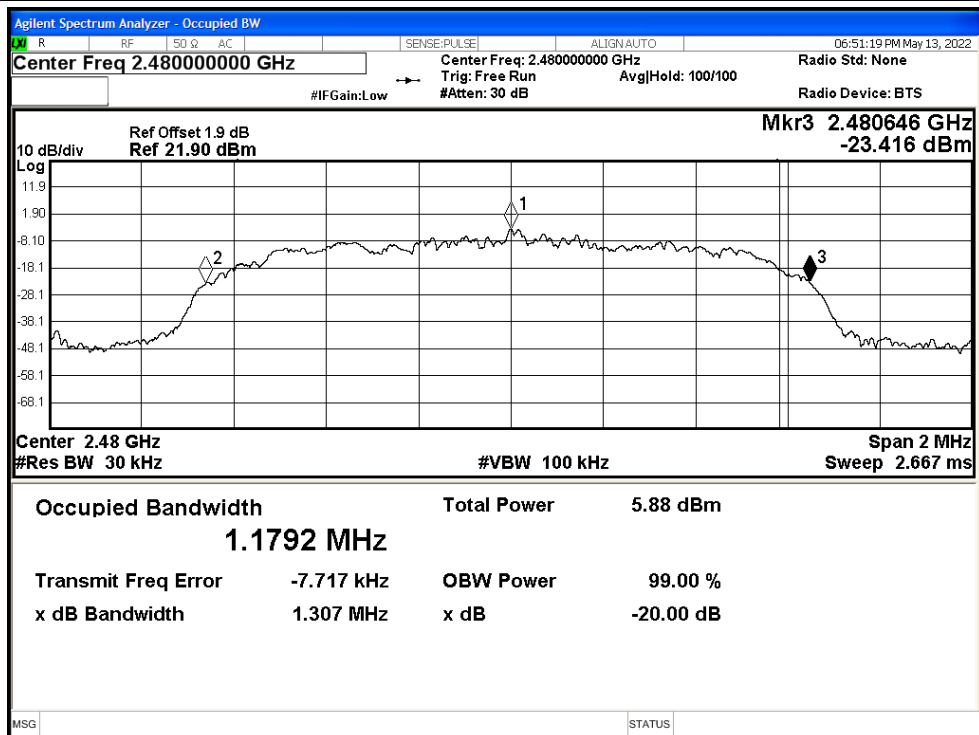




-20dB Bandwidth NVNT 2-DH5 2441MHz Ant1

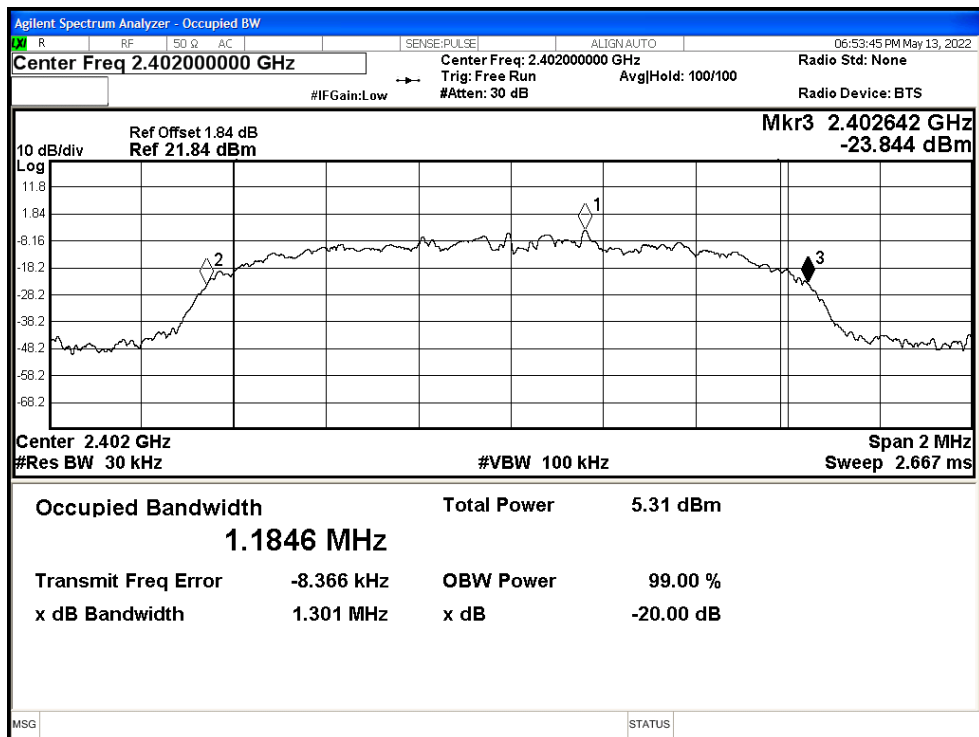


-20dB Bandwidth NVNT 2-DH5 2480MHz Ant1

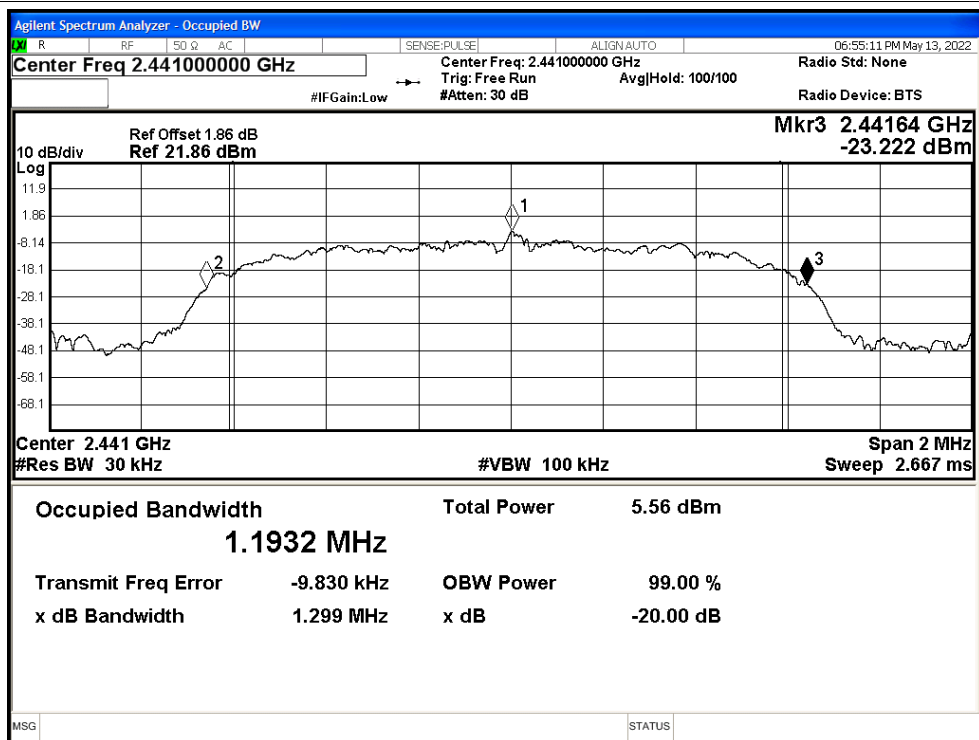


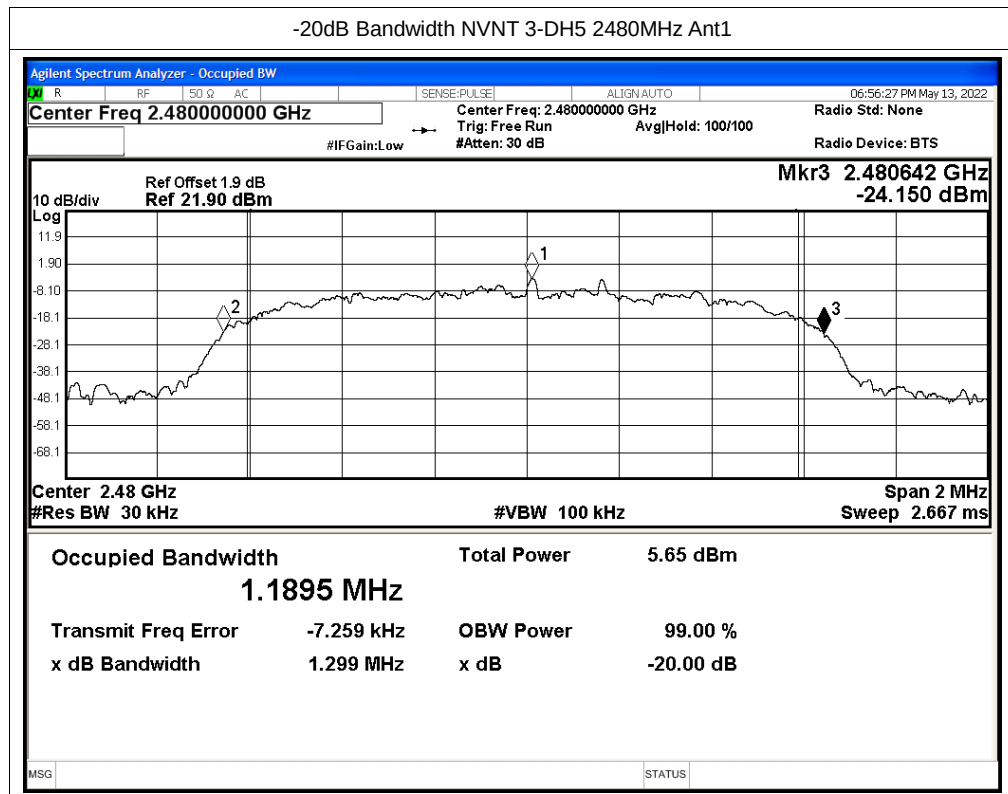


-20dB Bandwidth NVNT 3-DH5 2402MHz Ant1



-20dB Bandwidth NVNT 3-DH5 2441MHz Ant1







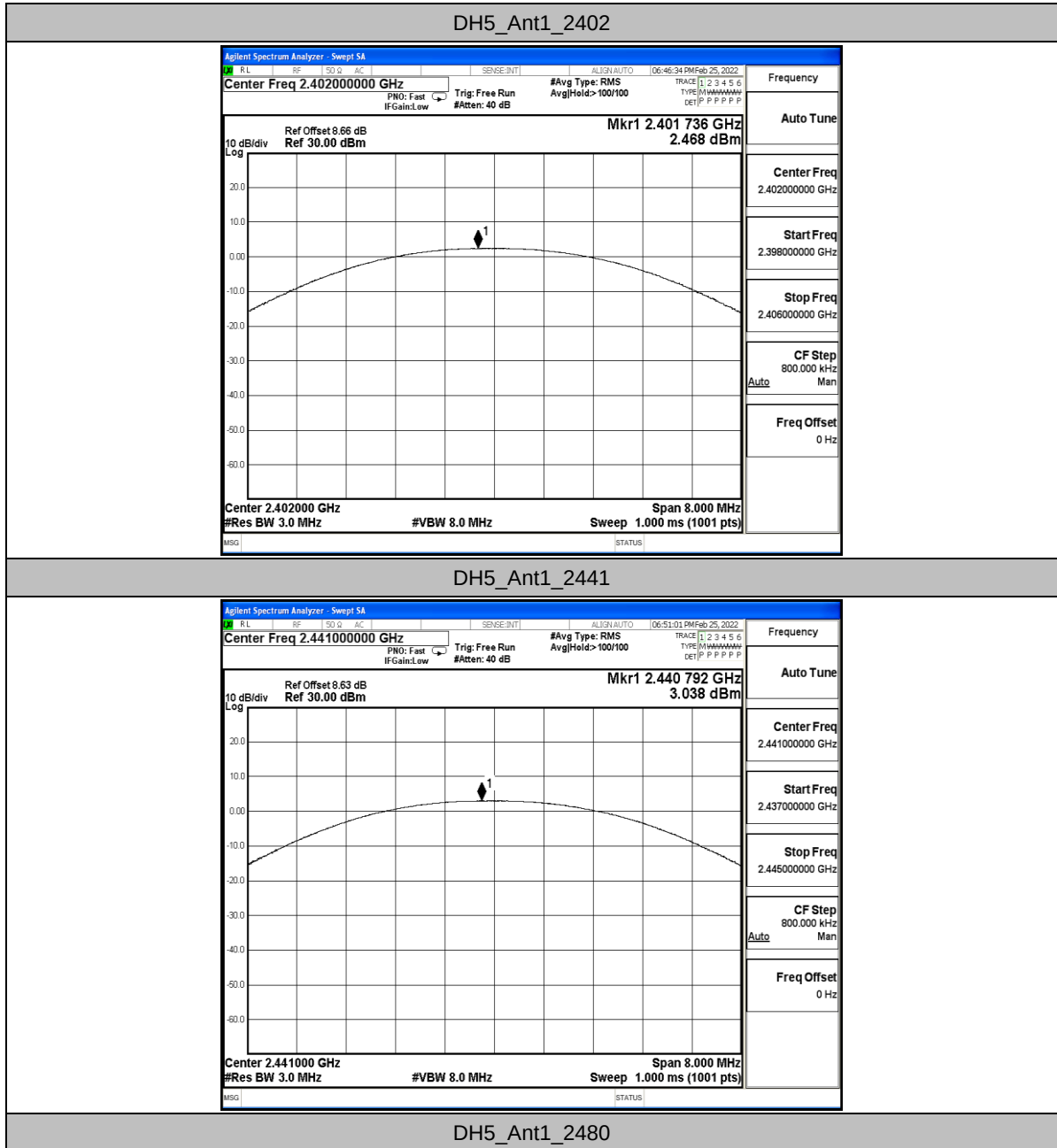
A.2 Maximum conducted output power

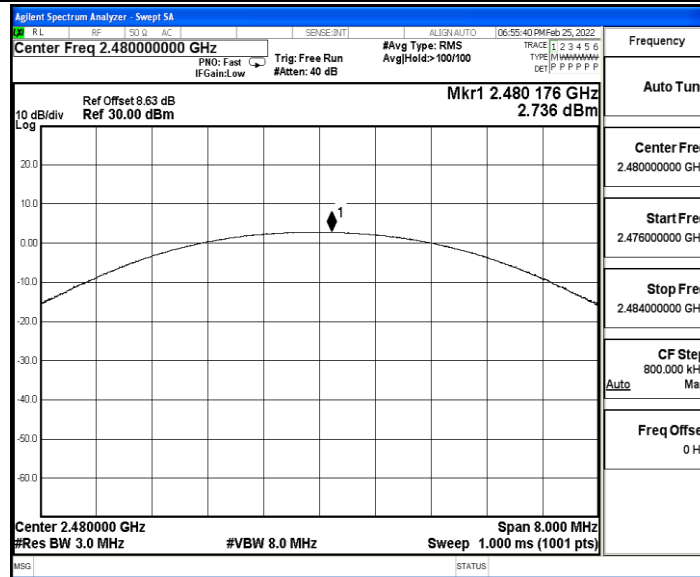
Test Result

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH5	Ant1	2402	2.47	≤20.97	PASS
		2441	3.04	≤20.97	PASS
		2480	2.74	≤20.97	PASS
2DH5	Ant1	2402	2.19	≤20.97	PASS
		2441	2.89	≤20.97	PASS
		2480	2.47	≤20.97	PASS
3DH5	Ant1	2402	2.3	≤20.97	PASS
		2441	2.9	≤20.97	PASS
		2480	2.54	≤20.97	PASS

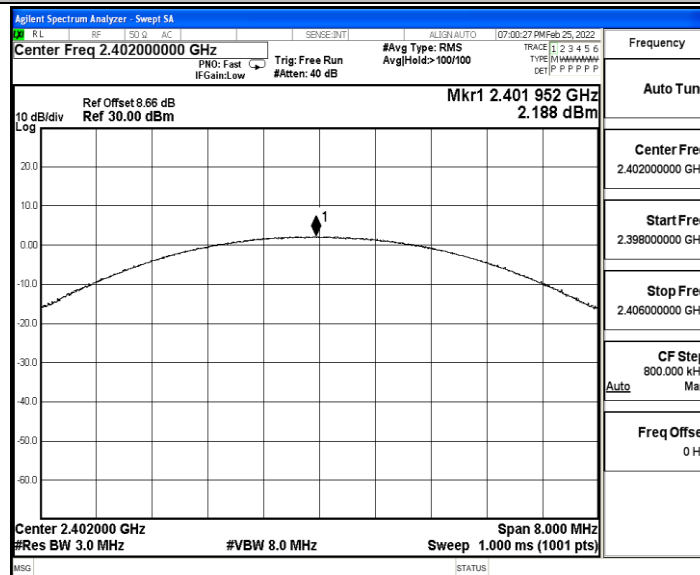


Test Graphs

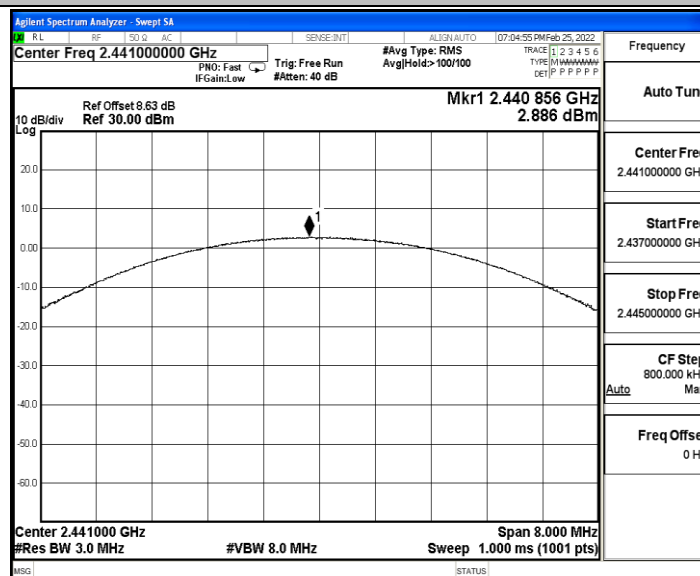




2DH5_Ant1_2402

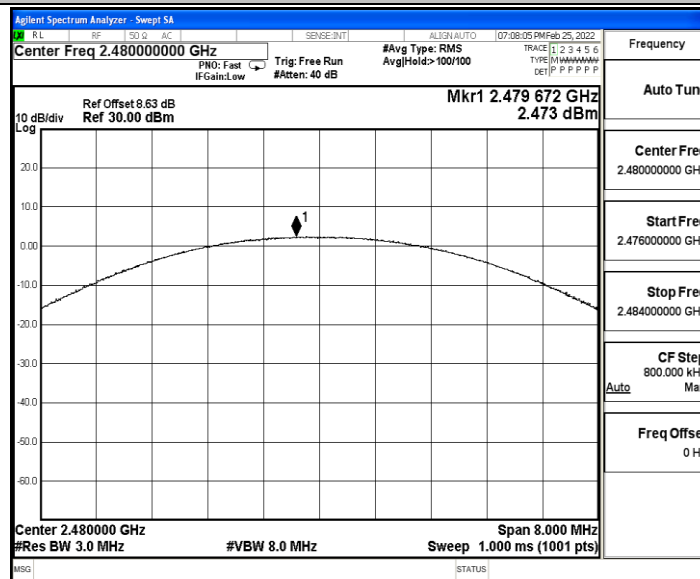


2DH5_Ant1_2441

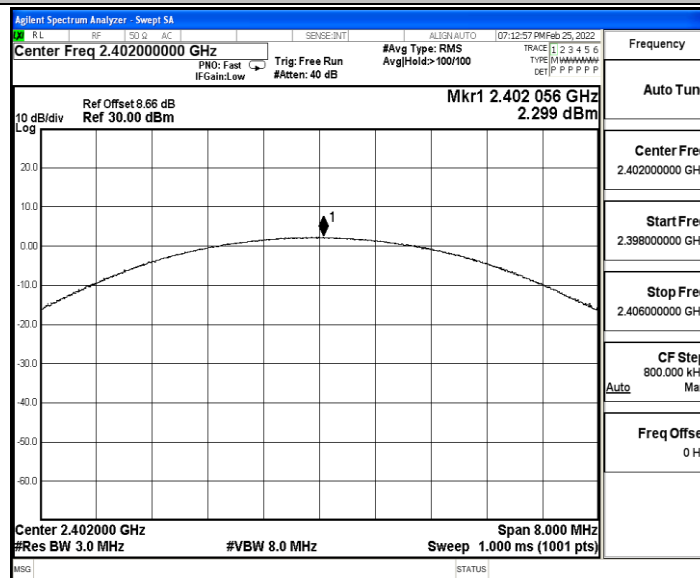




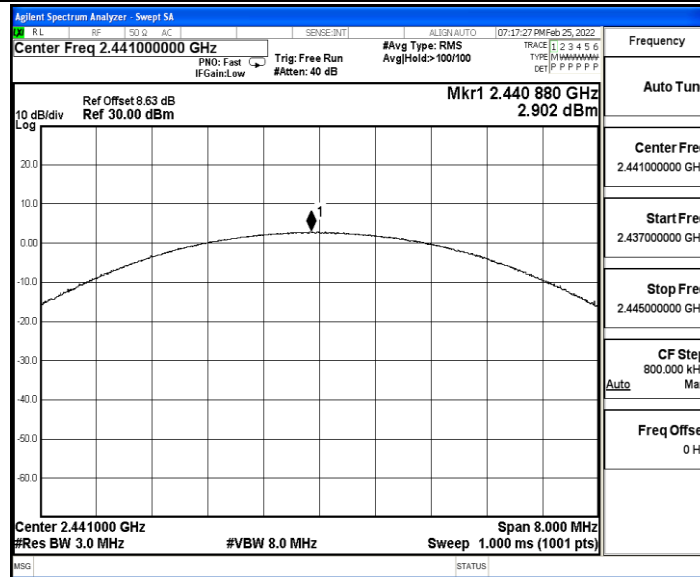
2DH5_Ant1_2480



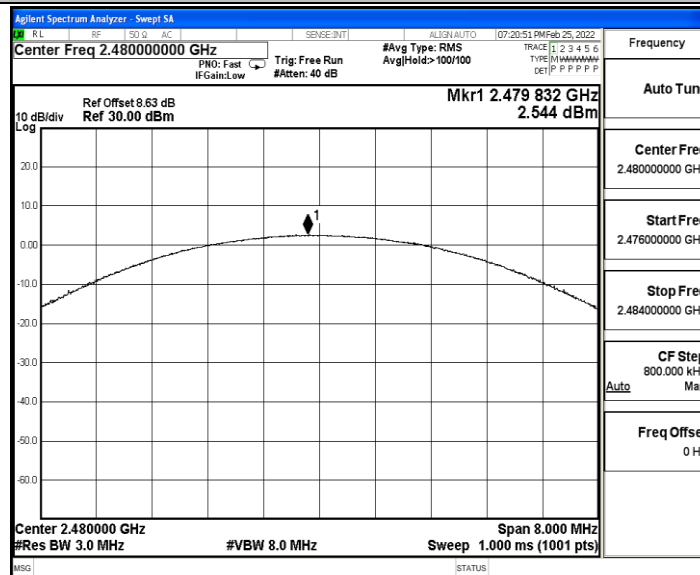
3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480





A.3 Carrier frequency separation

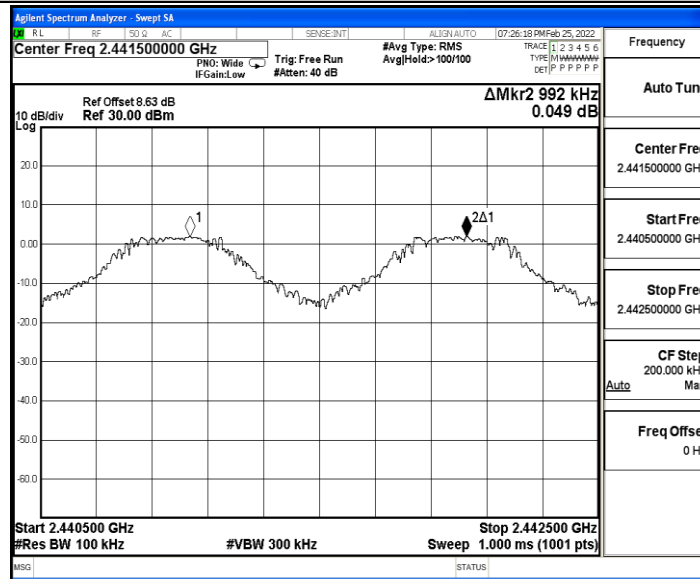
Test Result

TestMode	Antenna	Channel	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Hop	0.992	≥ 0.686	PASS
2DH5	Ant1	Hop	0.986	≥ 0.862	PASS
3DH5	Ant1	Hop	1.306	≥ 0.874	PASS

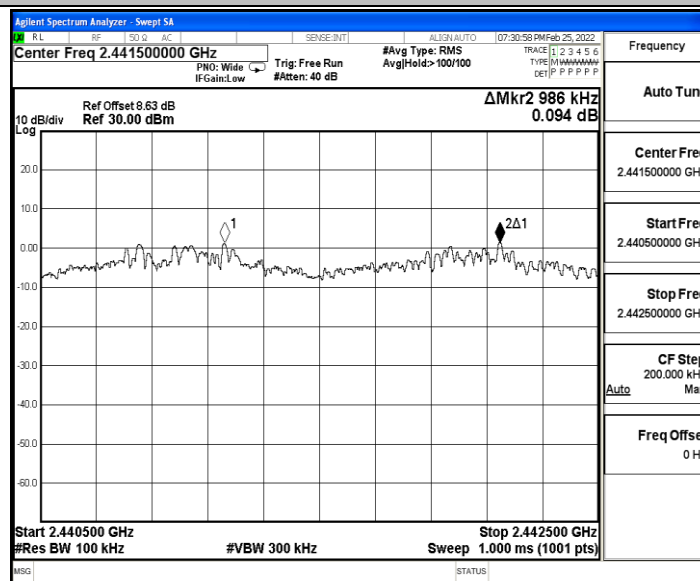


Test Graphs

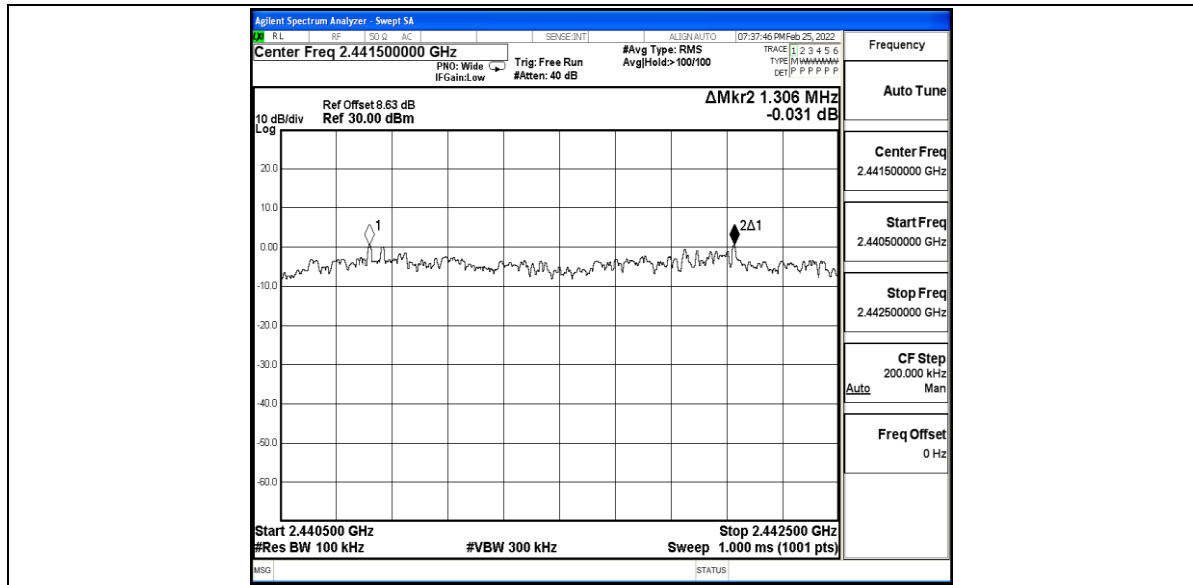
DH5_Ant1_Hop



2DH5_Ant1_Hop



3DH5_Ant1_Hop





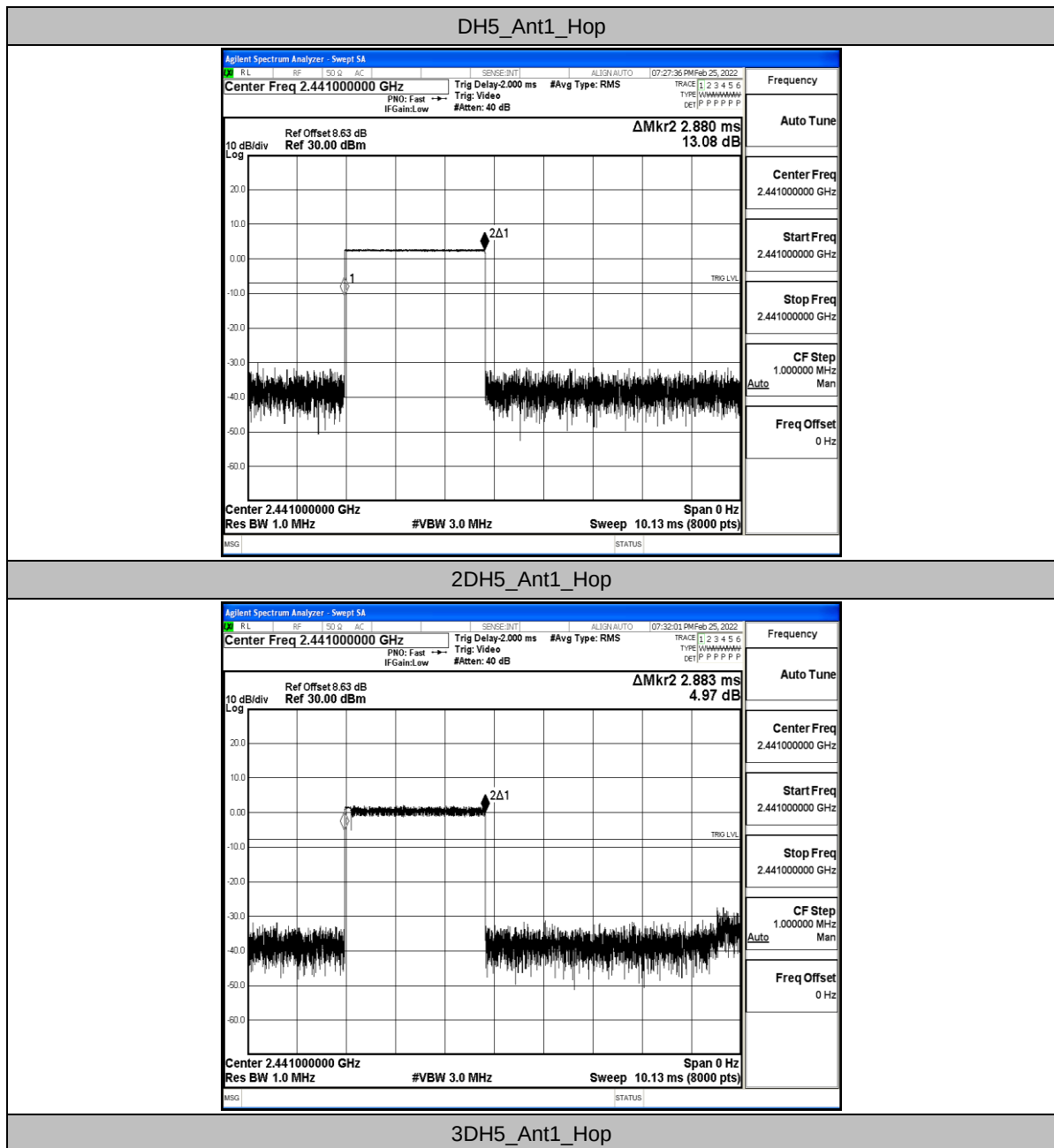
A.4 Time of occupancy

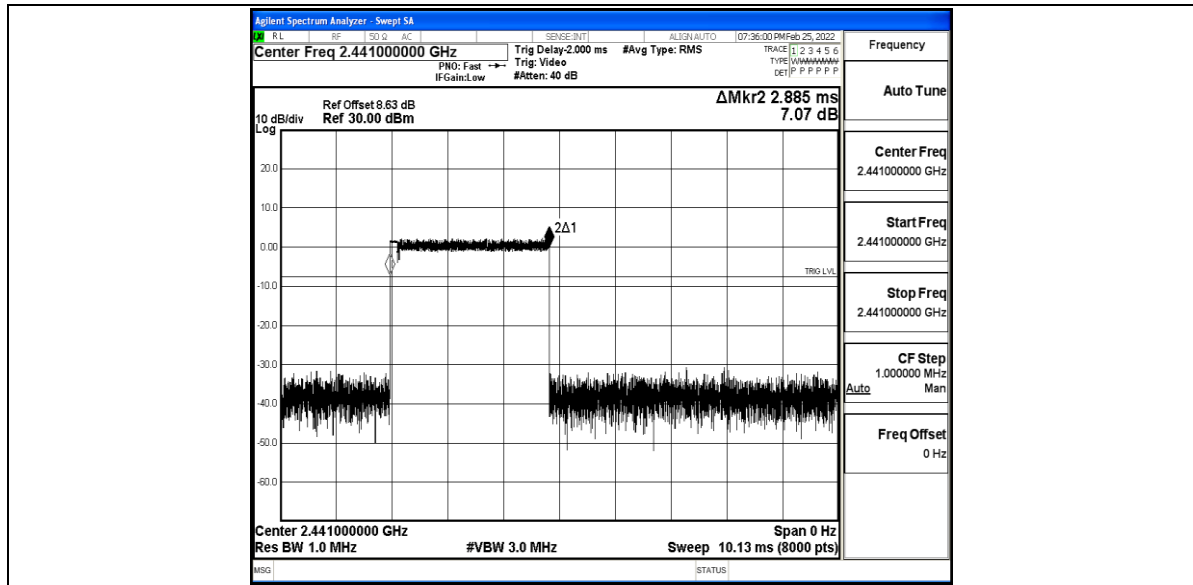
Test Result

TestMode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH5	Ant1	Hop	2.88	106.67	0.307	≤0.4	PASS
2DH5	Ant1	Hop	2.88	106.67	0.308	≤0.4	PASS
3DH5	Ant1	Hop	2.89	106.67	0.308	≤0.4	PASS



Test Graphs







A.5 Number of hopping channels

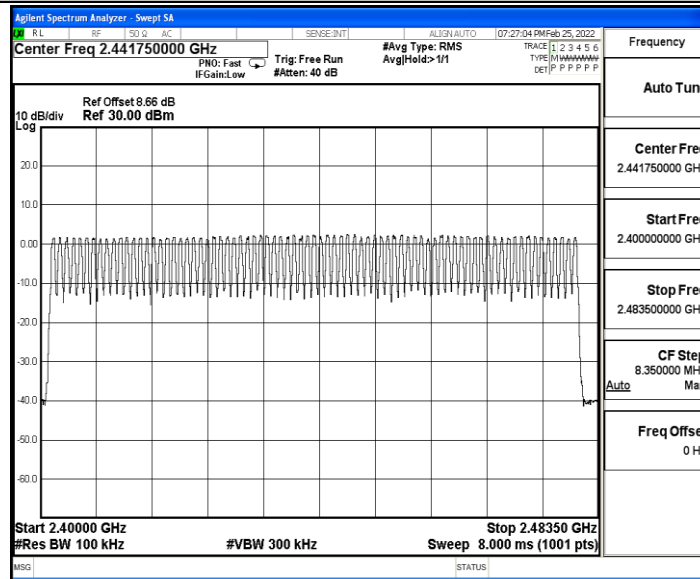
Test Result

TestMode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Hop	79	≥15	PASS
2DH5	Ant1	Hop	79	≥15	PASS
3DH5	Ant1	Hop	79	≥15	PASS

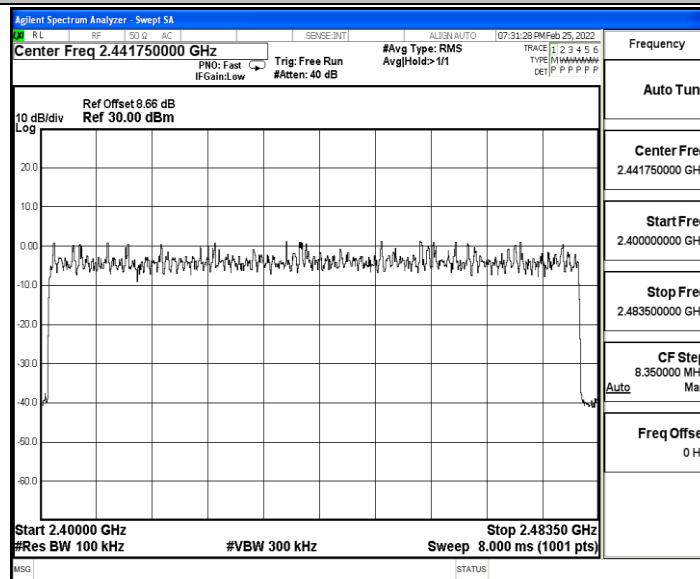


Test Graphs

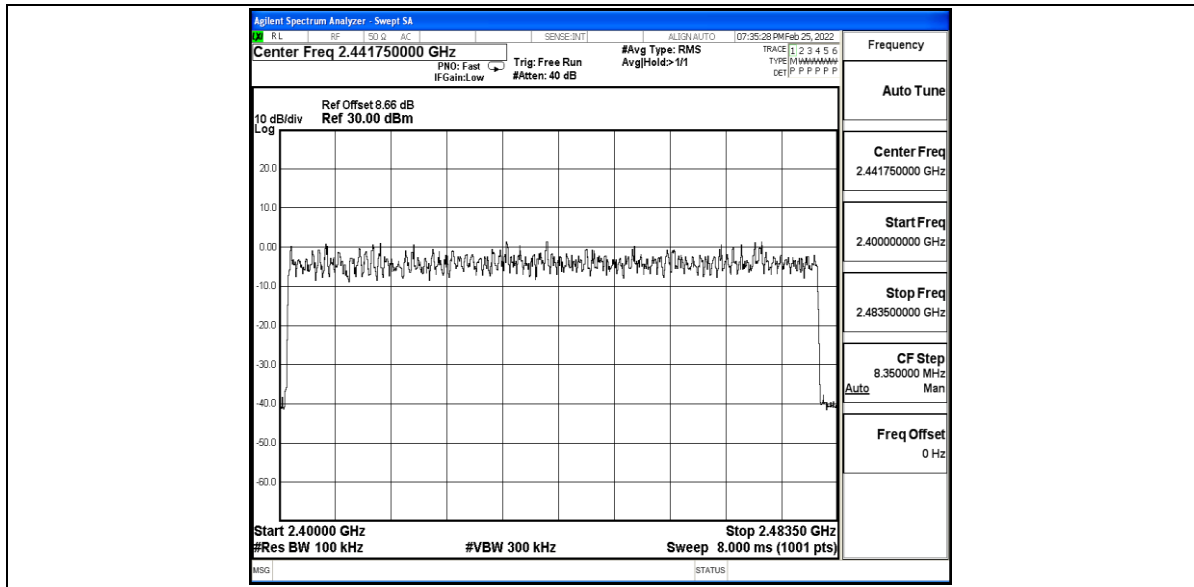
DH5_Ant1_Hop



2DH5_Ant1_Hop



3DH5_Ant1_Hop

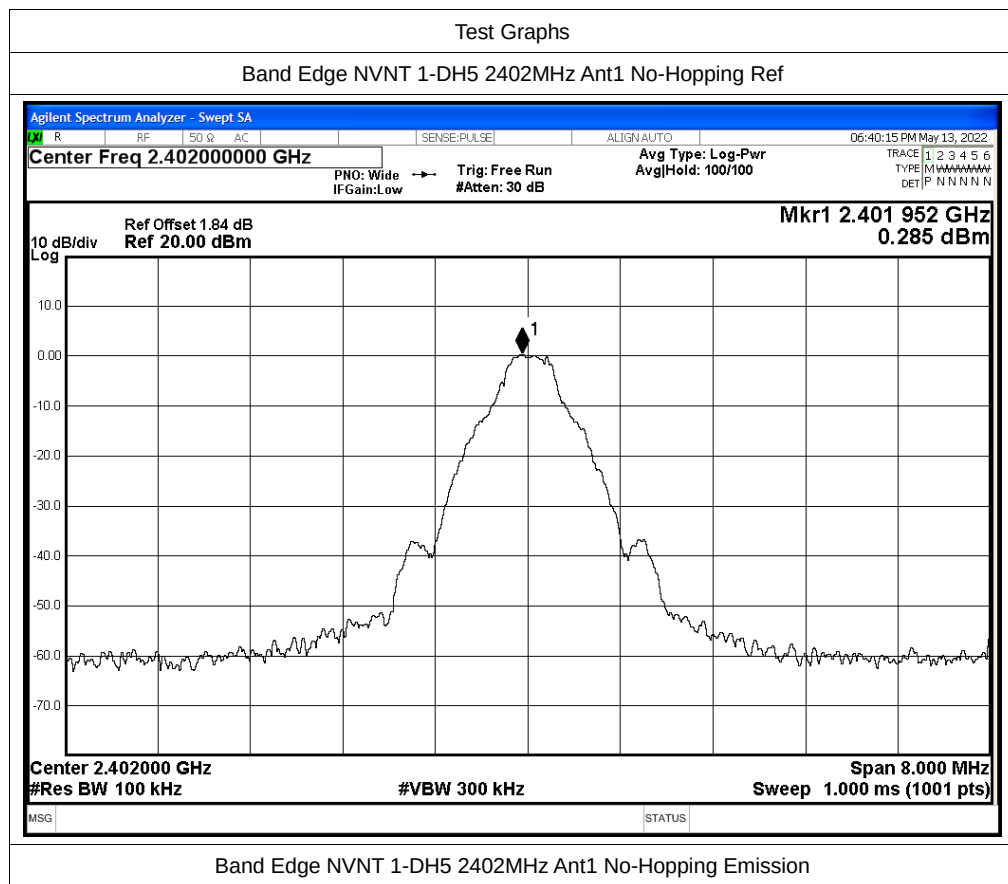


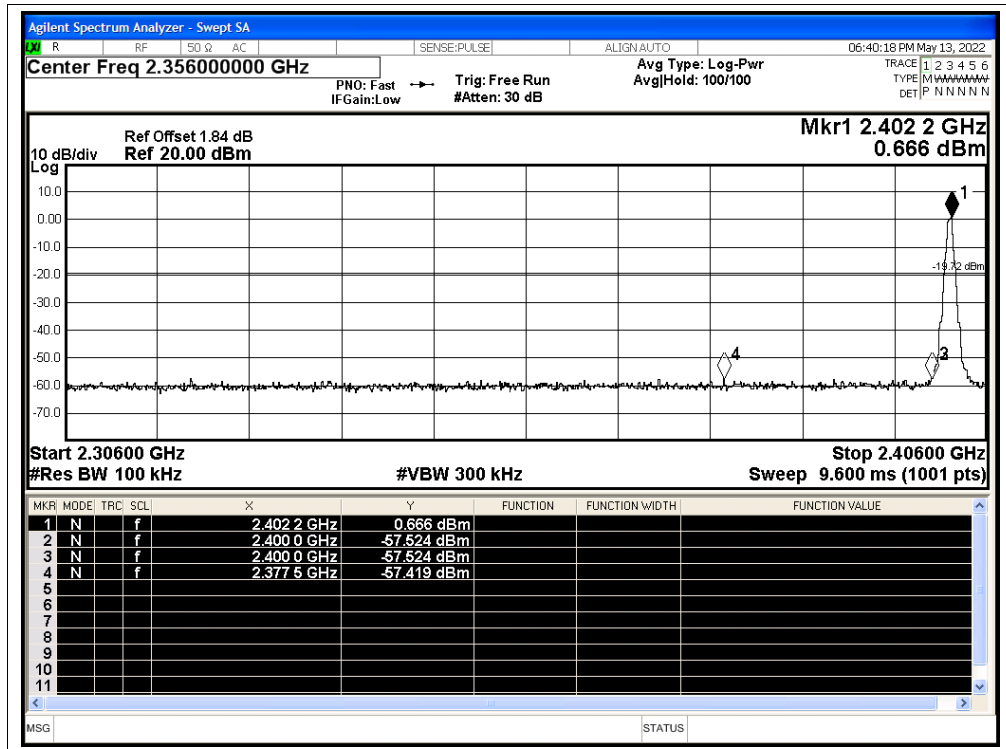


A.6 Band edge measurements

Test Result

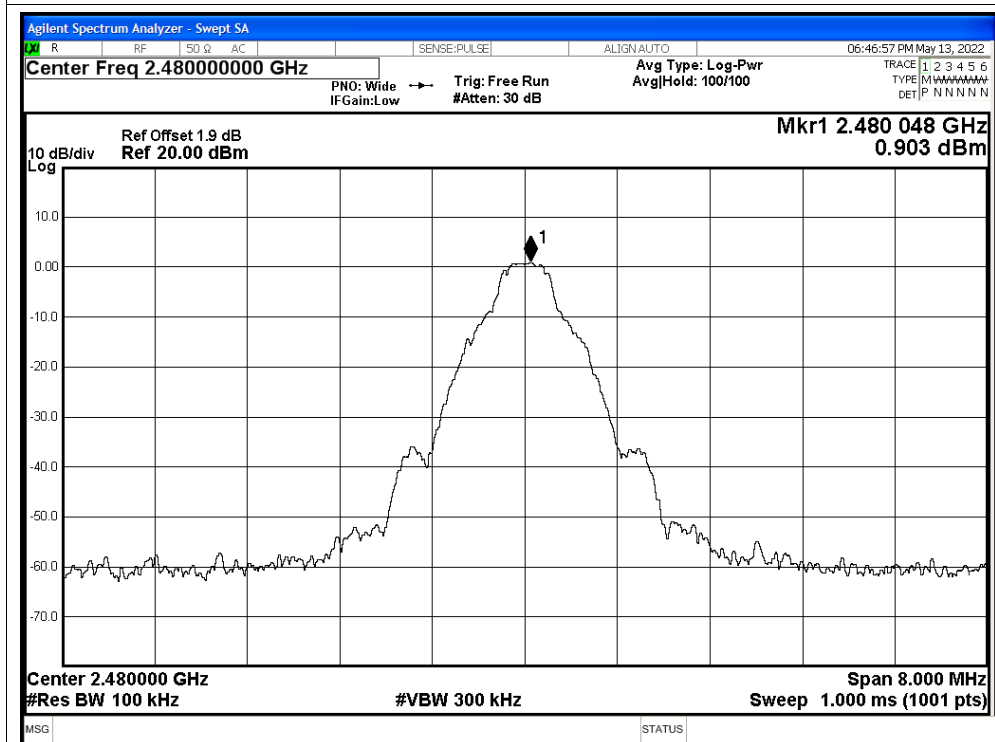
Condition	Mode	Frequency (MHz)	Antenna	Hopping Mode	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	1-DH5	2402	Ant1	No-Hopping	-57.7	-20	Pass
NVNT	1-DH5	2480	Ant1	No-Hopping	-58.01	-20	Pass
NVNT	2-DH5	2402	Ant1	No-Hopping	-55.67	-20	Pass
NVNT	2-DH5	2480	Ant1	No-Hopping	-52.75	-20	Pass
NVNT	3-DH5	2402	Ant1	No-Hopping	-54.54	-20	Pass
NVNT	3-DH5	2480	Ant1	No-Hopping	-54.73	-20	Pass



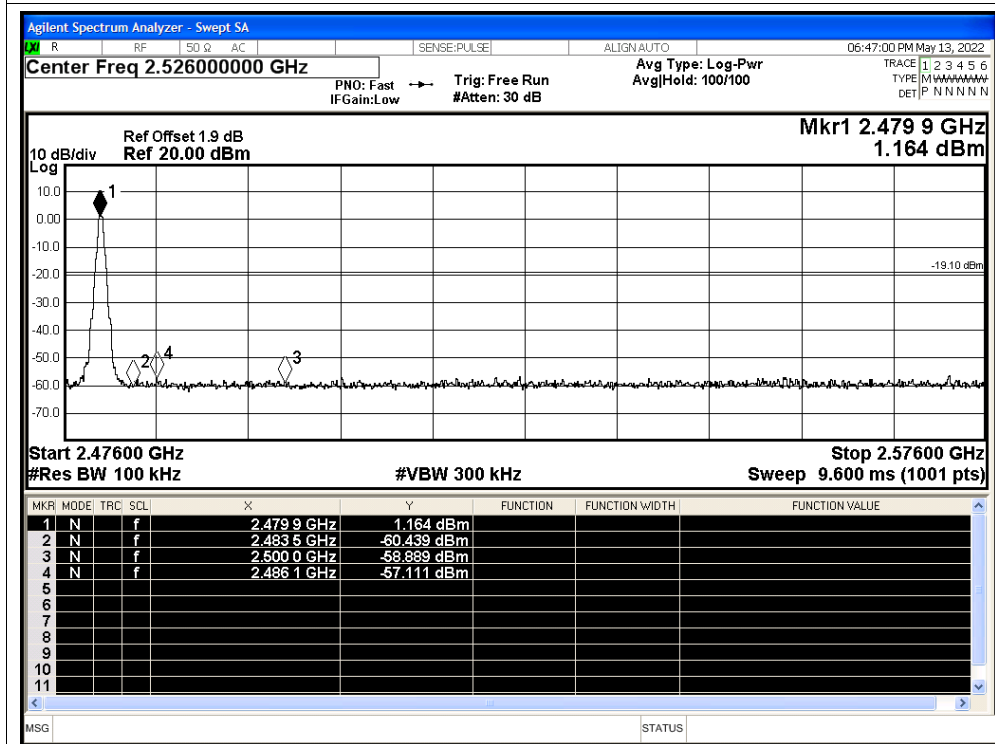




Band Edge NVNT 1-DH5 2480MHz Ant1 No-Hopping Ref

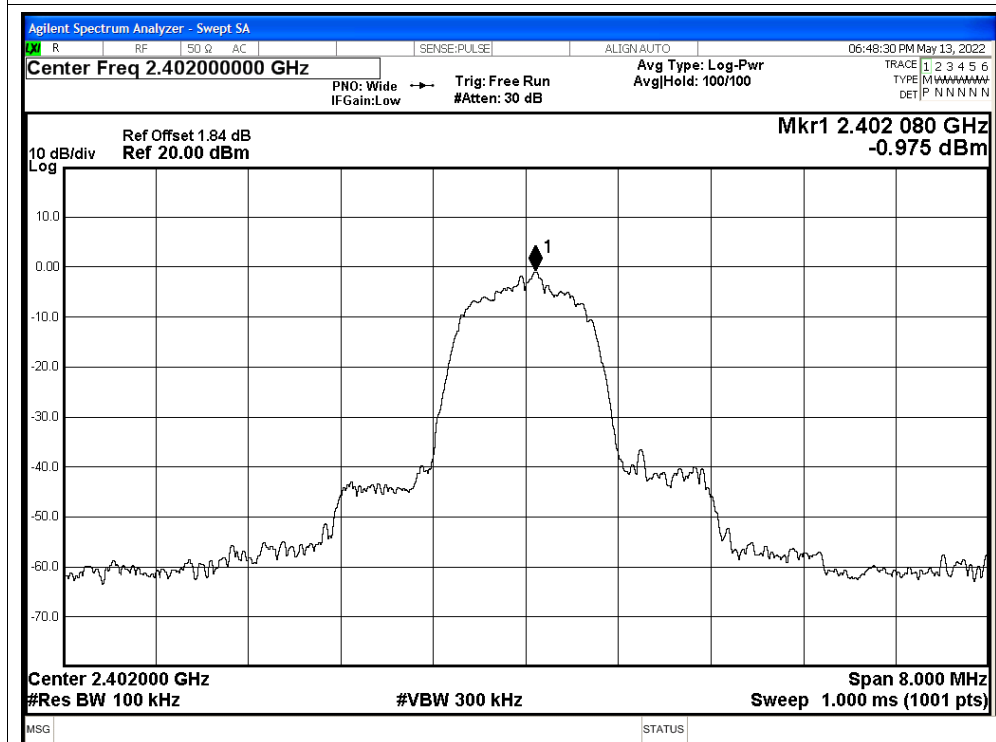


Band Edge NVNT 1-DH5 2480MHz Ant1 No-Hopping Emission

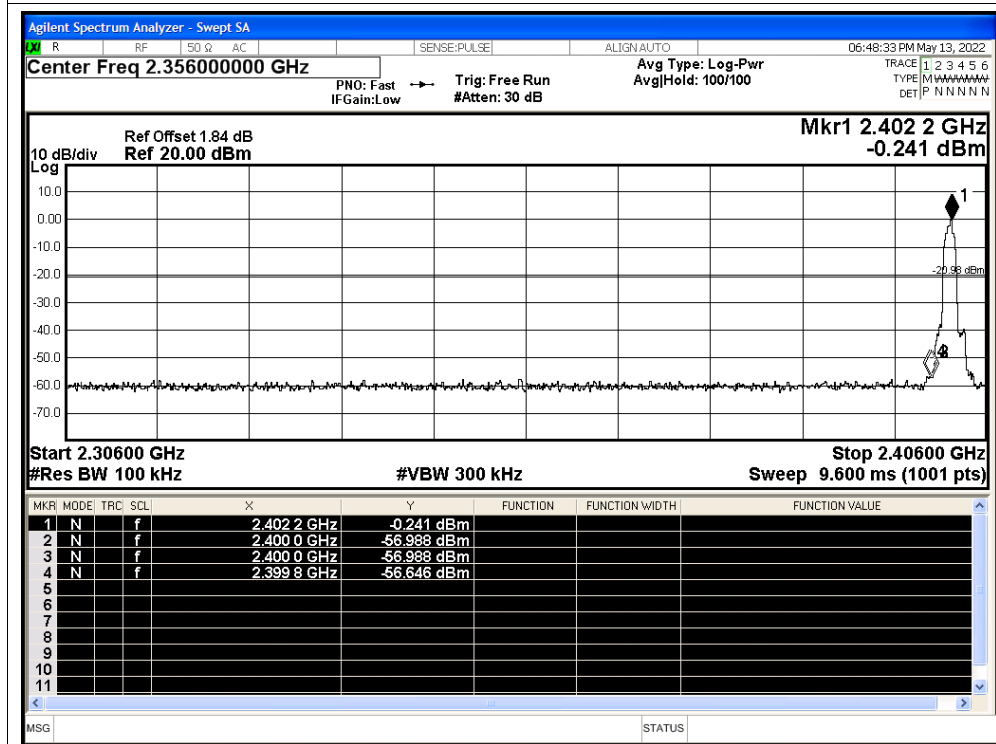




Band Edge NVNT 2-DH5 2402MHz Ant1 No-Hopping Ref

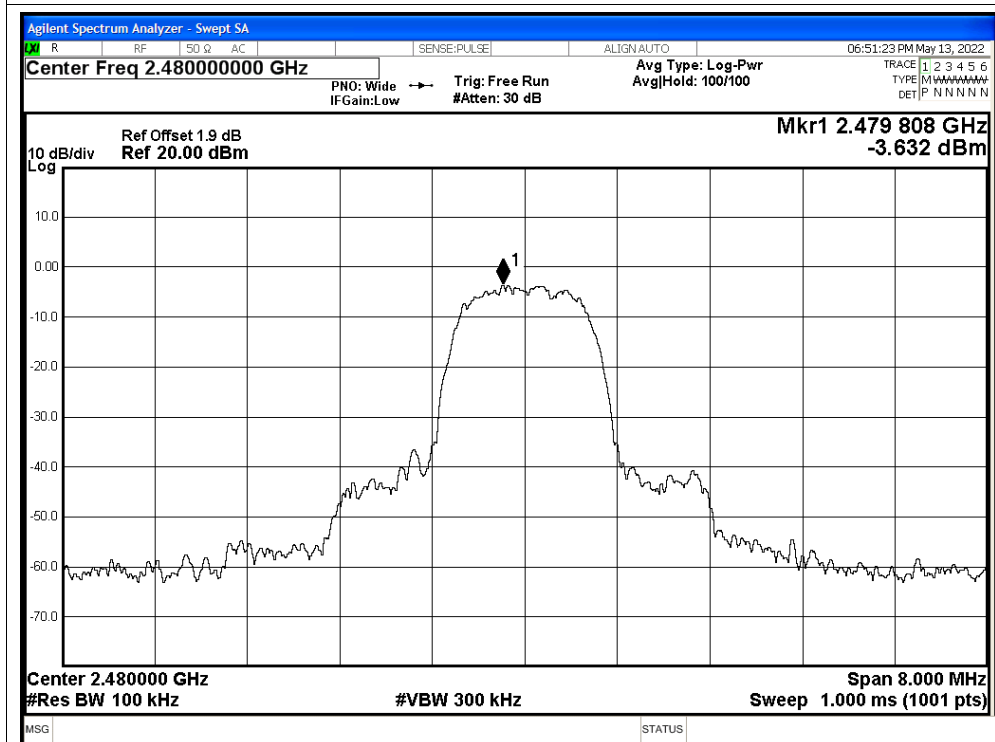


Band Edge NVNT 2-DH5 2402MHz Ant1 No-Hopping Emission

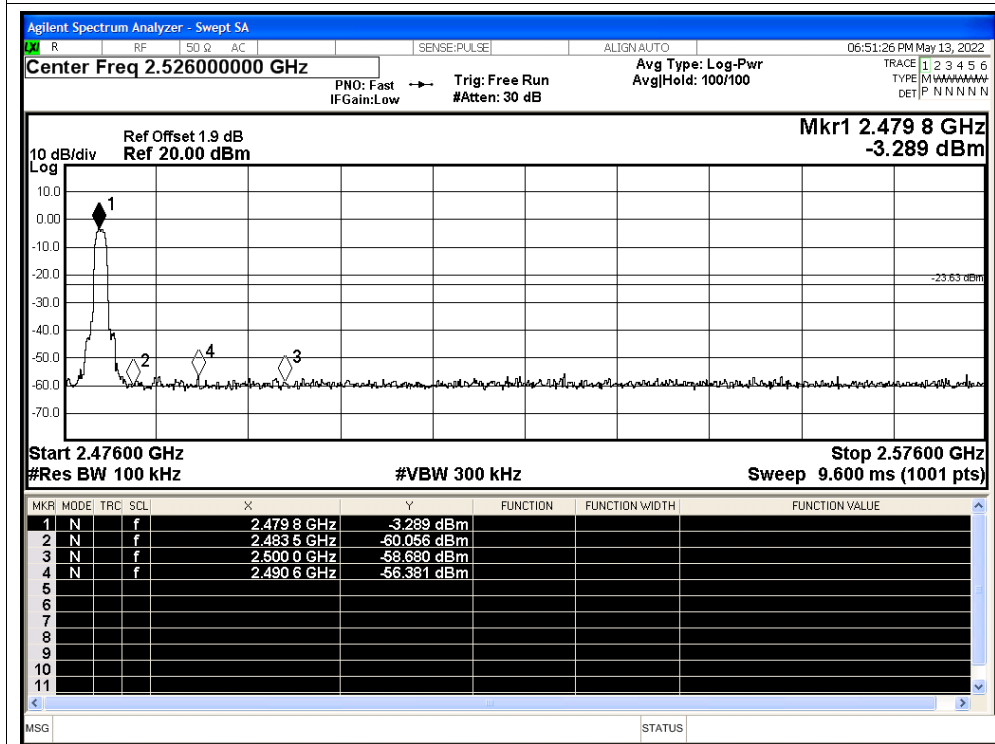




Band Edge NVNT 2-DH5 2480MHz Ant1 No-Hopping Ref

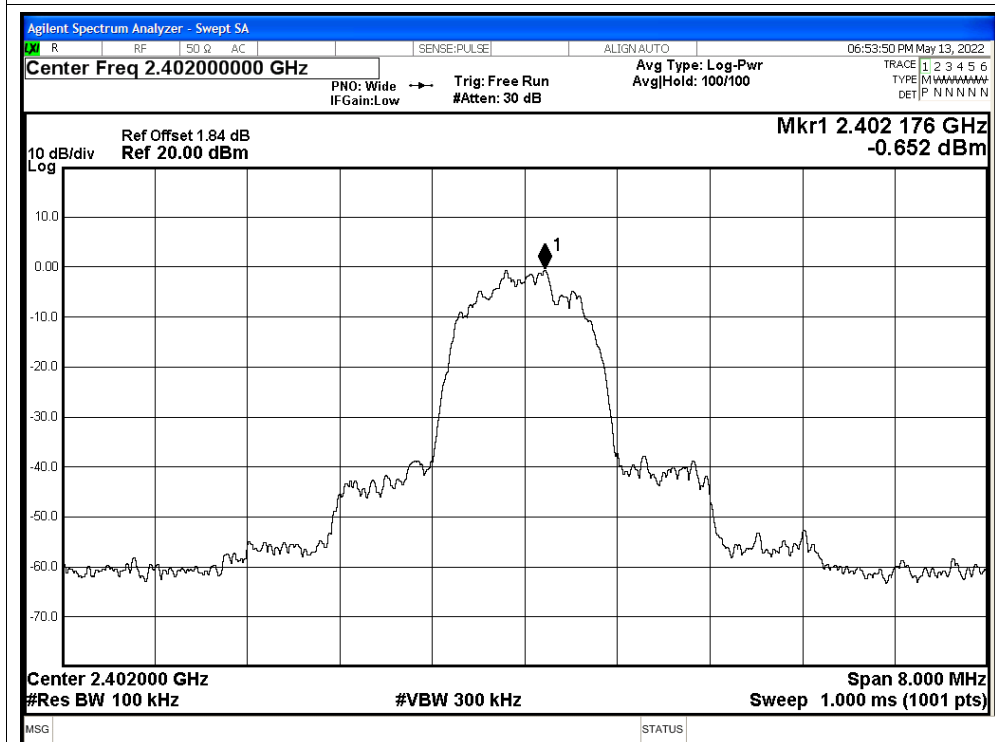


Band Edge NVNT 2-DH5 2480MHz Ant1 No-Hopping Emission

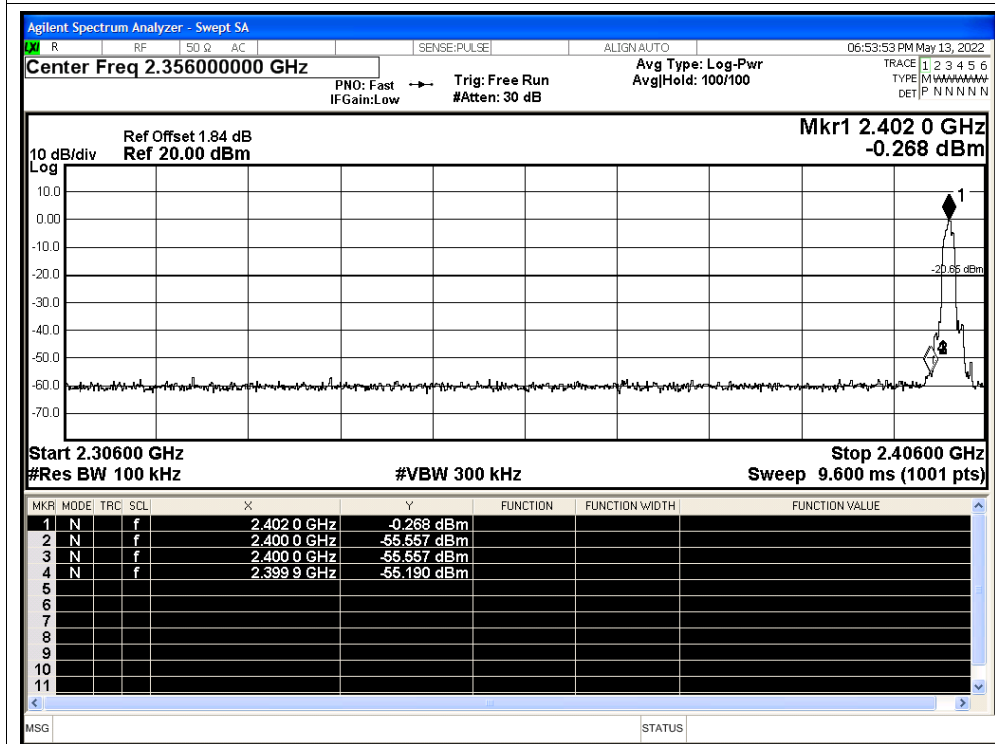




Band Edge NVNT 3-DH5 2402MHz Ant1 No-Hopping Ref

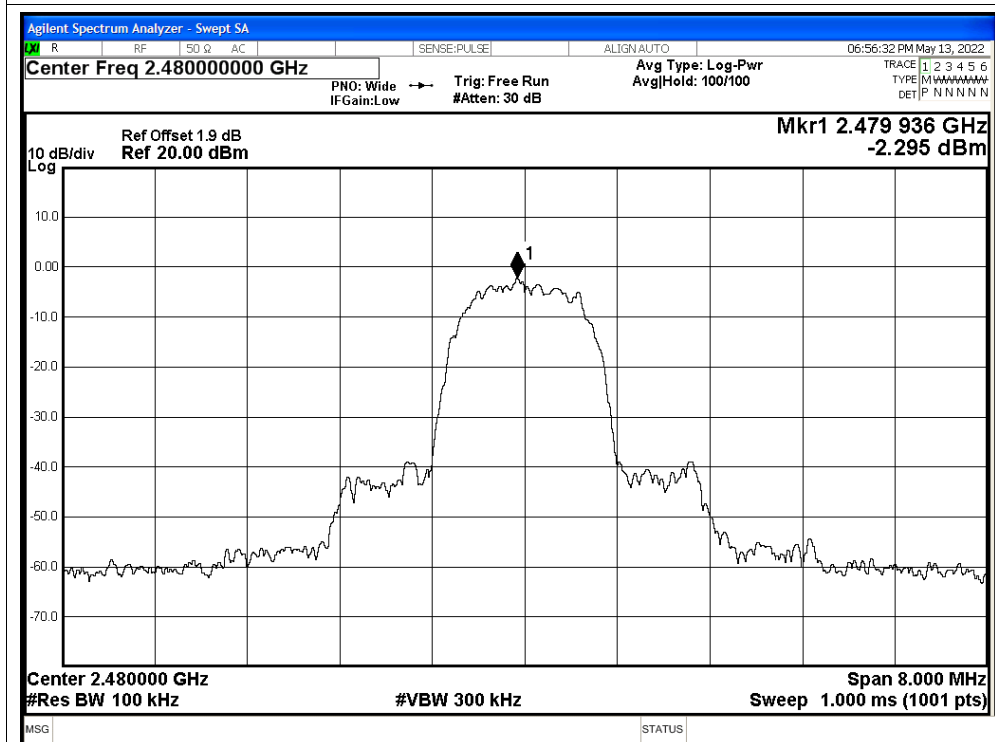


Band Edge NVNT 3-DH5 2402MHz Ant1 No-Hopping Emission

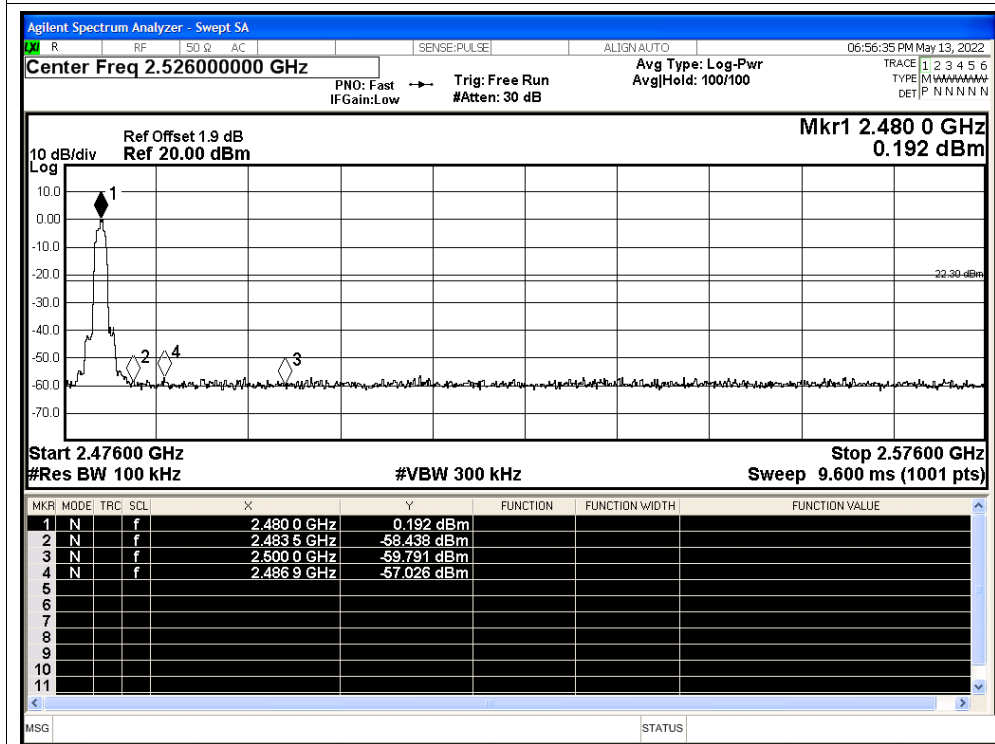




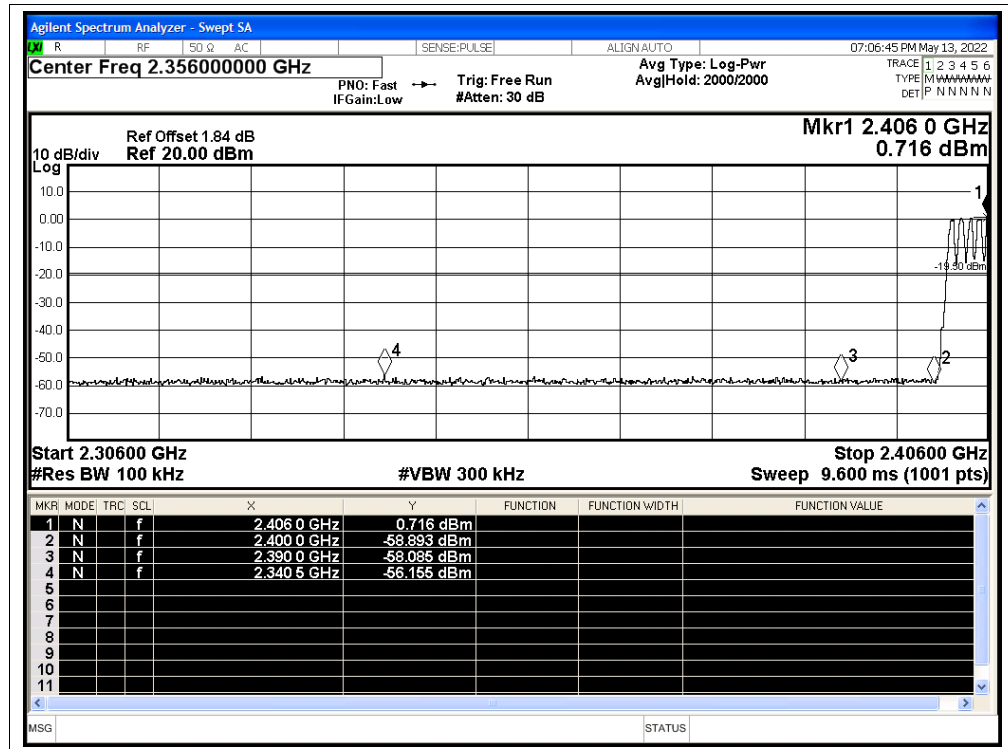
Band Edge NVNT 3-DH5 2480MHz Ant1 No-Hopping Ref



Band Edge NVNT 3-DH5 2480MHz Ant1 No-Hopping Emission

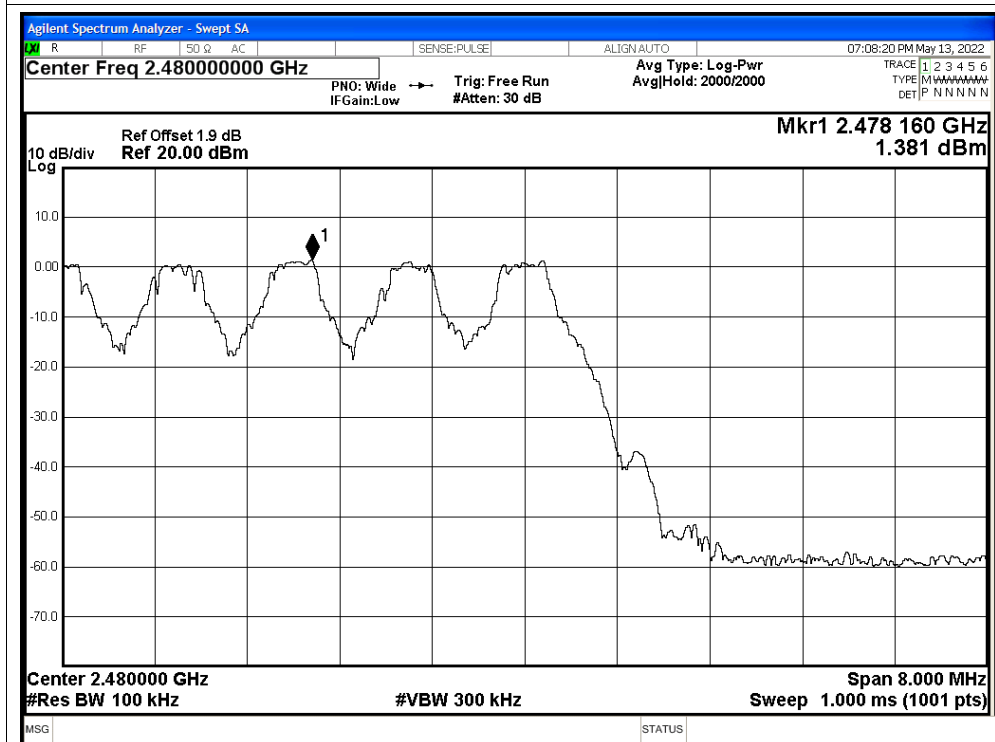




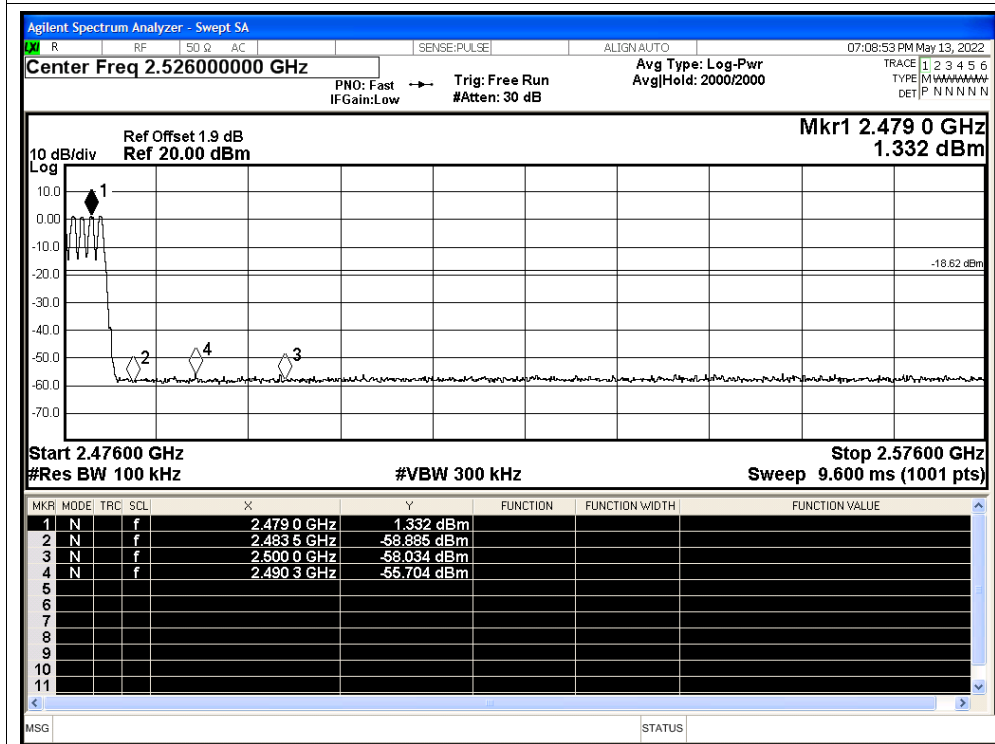




Band Edge(Hopping) NVNT 1-DH5 2480MHz Ant1 Hopping Ref

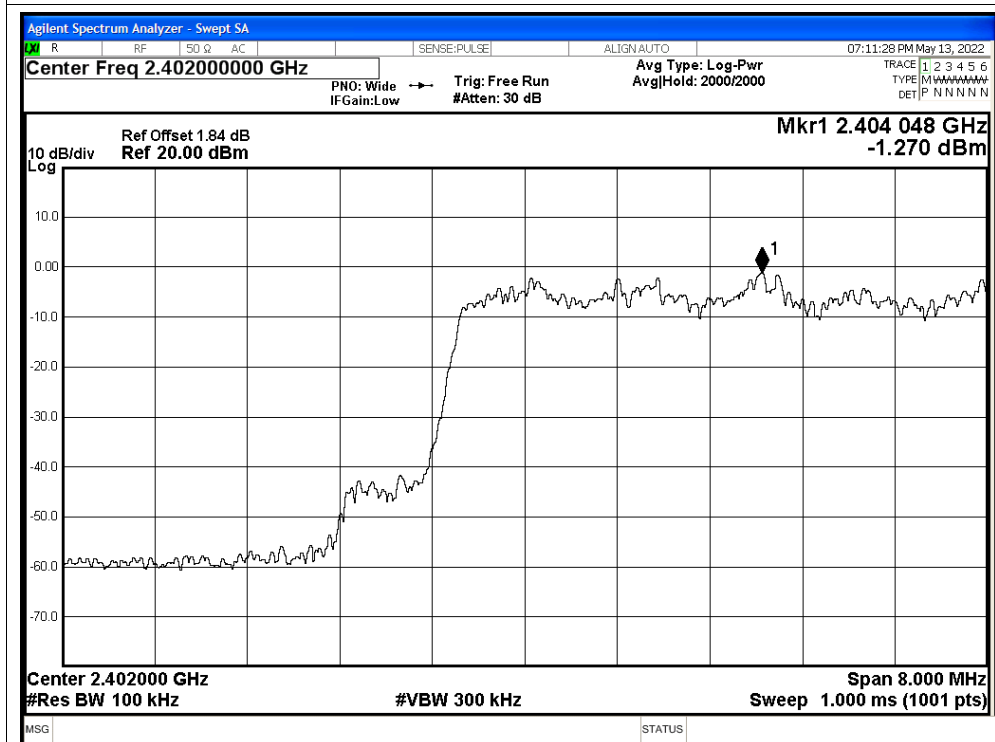


Band Edge(Hopping) NVNT 1-DH5 2480MHz Ant1 Hopping Emission

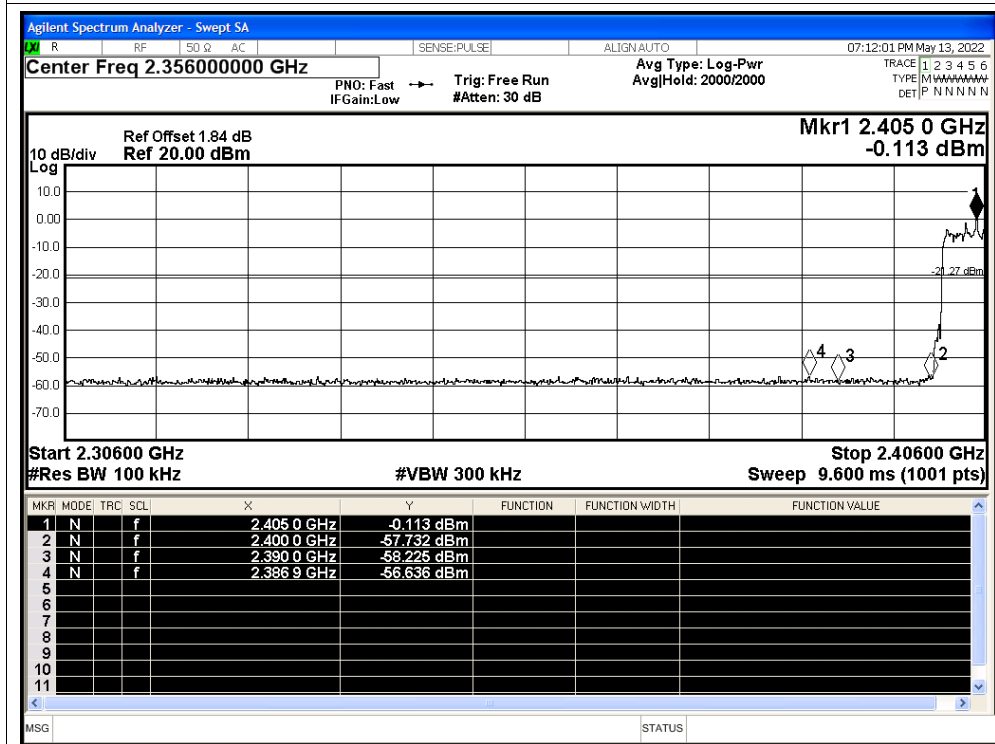




Band Edge(Hopping) NVNT 2-DH5 2402MHz Ant1 Hopping Ref

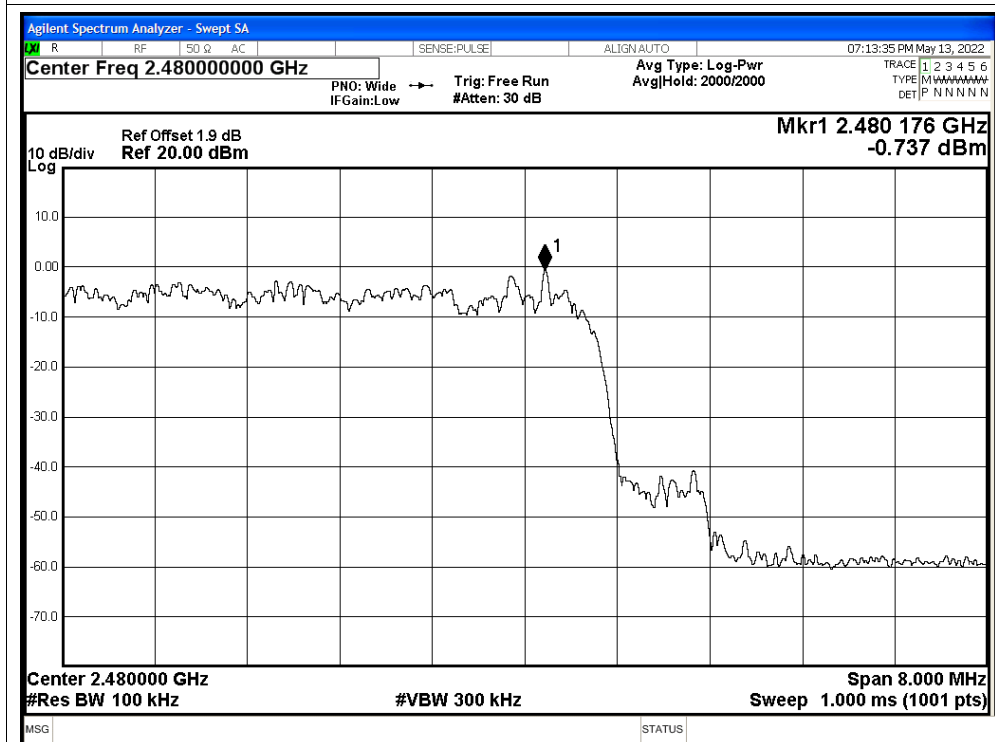


Band Edge(Hopping) NVNT 2-DH5 2402MHz Ant1 Hopping Emission

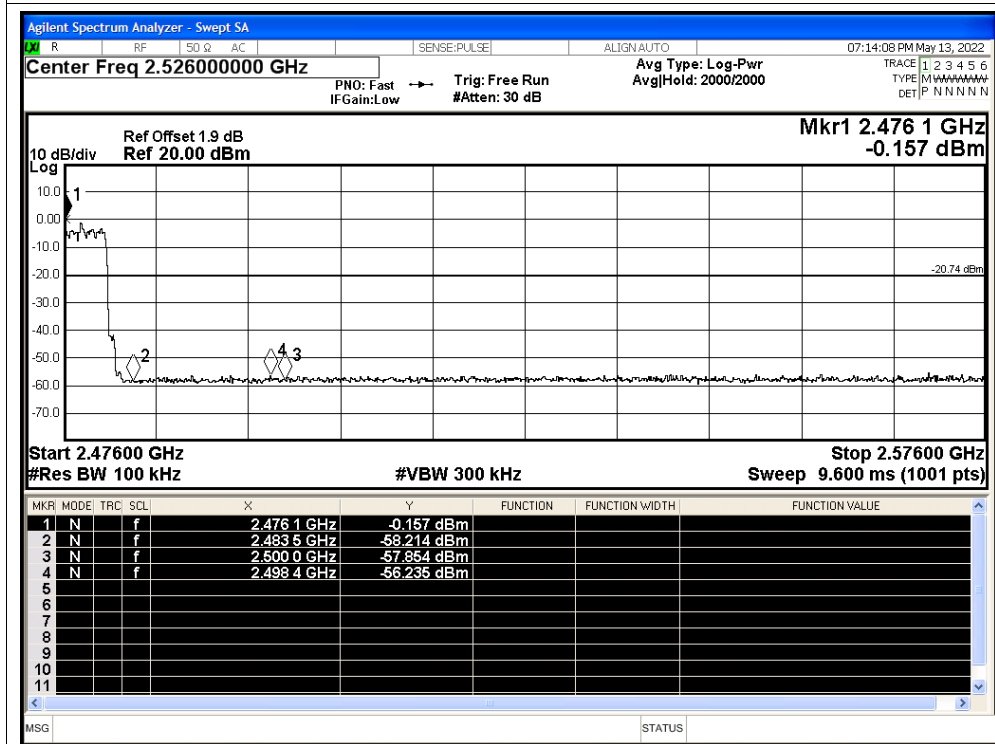




Band Edge(Hopping) NVNT 2-DH5 2480MHz Ant1 Hopping Ref



Band Edge(Hopping) NVNT 2-DH5 2480MHz Ant1 Hopping Emission

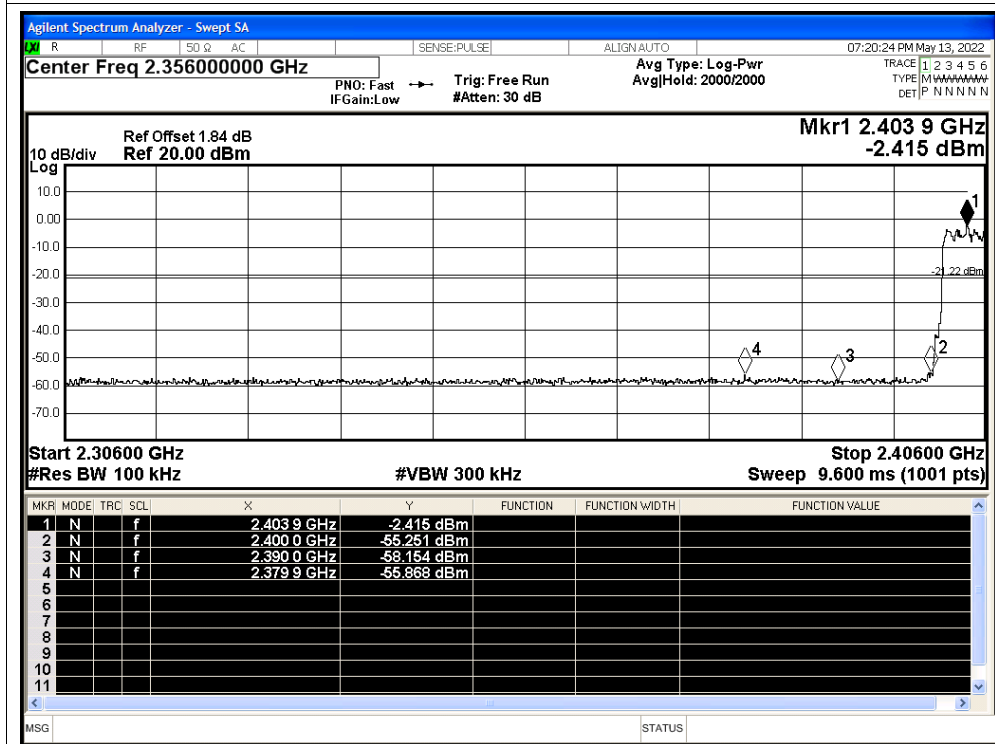




Band Edge(Hopping) NVNT 3-DH5 2402MHz Ant1 Hopping Ref

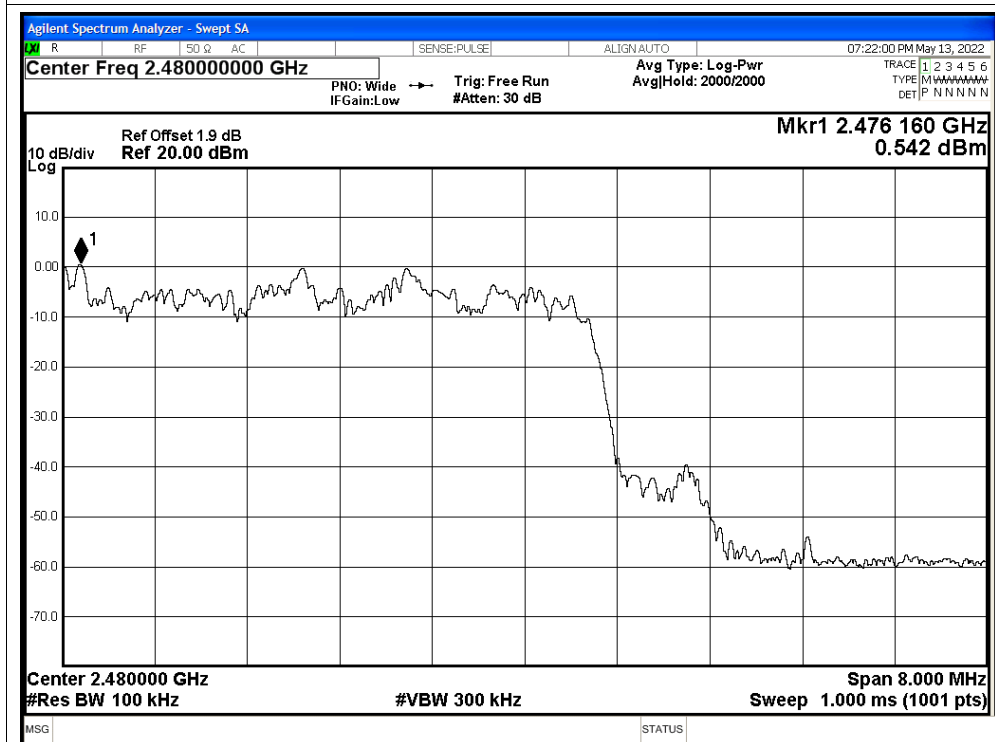


Band Edge(Hopping) NVNT 3-DH5 2402MHz Ant1 Hopping Emission

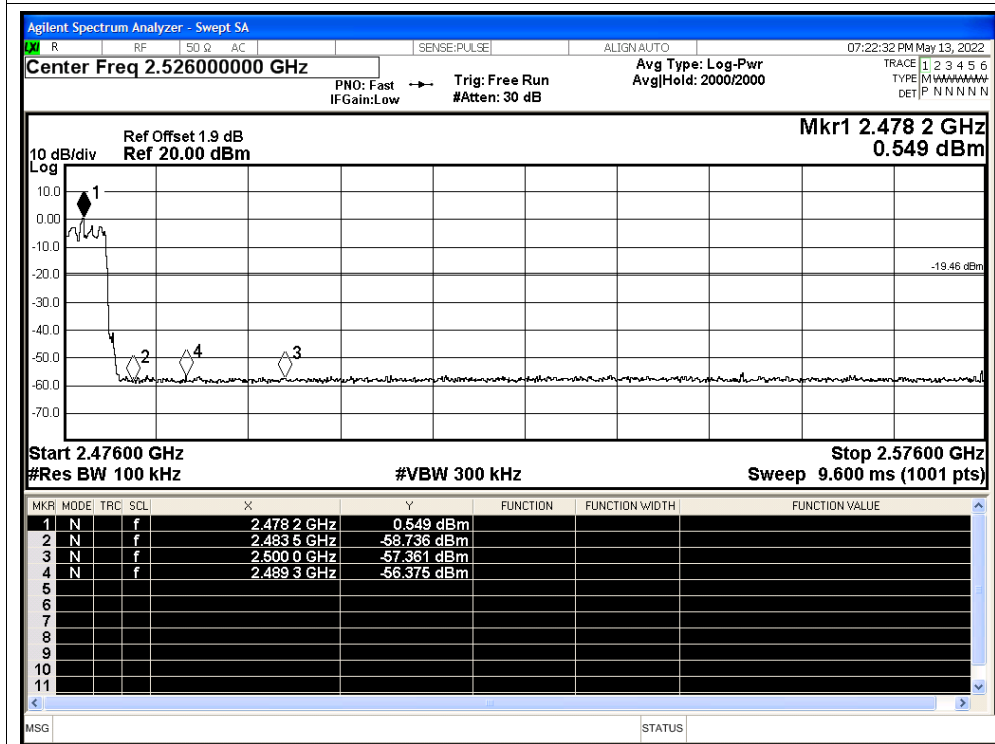




Band Edge(Hopping) NVNT 3-DH5 2480MHz Ant1 Hopping Ref



Band Edge(Hopping) NVNT 3-DH5 2480MHz Ant1 Hopping Emission





A.7 Conducted Spurious Emission

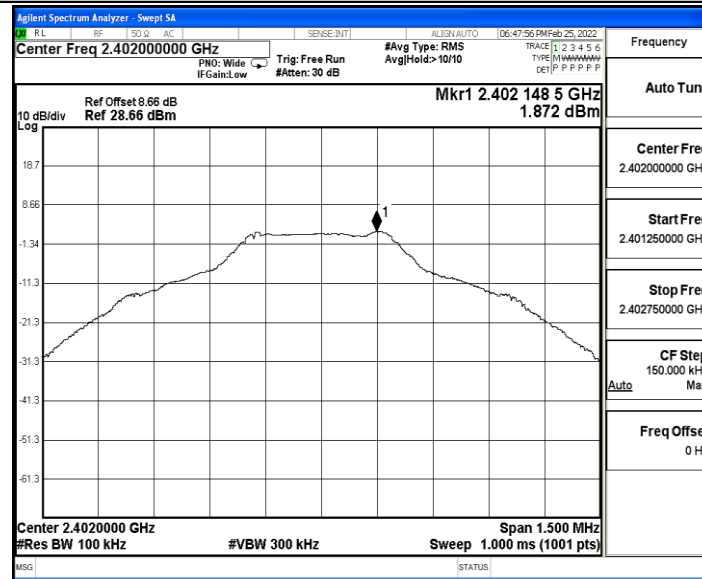
Test Result

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	Reference	1.87	1.87	---	PASS
			30~1000	1.87	-60.25	≤ -18.13	PASS
			1000~26500	1.87	-46.36	≤ -18.13	PASS
		2441	Reference	2.32	2.32	---	PASS
			30~1000	2.32	-60.51	≤ -17.68	PASS
			1000~26500	2.32	-46.22	≤ -17.68	PASS
		2480	Reference	2.14	2.14	---	PASS
			30~1000	2.14	-60.9	≤ -17.86	PASS
			1000~26500	2.14	-45.96	≤ -17.86	PASS
2DH5	Ant1	2402	Reference	0.74	0.74	---	PASS
			30~1000	0.74	-60.55	≤ -19.26	PASS
			1000~26500	0.74	-46.56	≤ -19.26	PASS
		2441	Reference	1.42	1.42	---	PASS
			30~1000	1.42	-60.88	≤ -18.58	PASS
			1000~26500	1.42	-43.6	≤ -18.58	PASS
		2480	Reference	0.97	0.97	---	PASS
			30~1000	0.97	-60.96	≤ -19.03	PASS
			1000~26500	0.97	-46.82	≤ -19.03	PASS
3DH5	Ant1	2402	Reference	0.64	0.64	---	PASS
			30~1000	0.64	-60.59	≤ -19.36	PASS
			1000~26500	0.64	-45.85	≤ -19.36	PASS
		2441	Reference	1.44	1.44	---	PASS
			30~1000	1.44	-60.8	≤ -18.56	PASS
			1000~26500	1.44	-46.05	≤ -18.56	PASS
		2480	Reference	1.13	1.13	---	PASS
			30~1000	1.13	-60.44	≤ -18.87	PASS
			1000~26500	1.13	-46.38	≤ -18.87	PASS

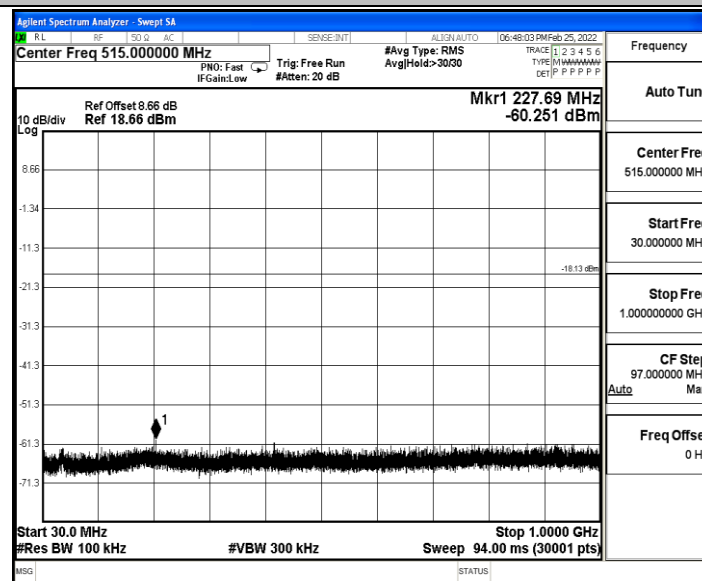


Test Graphs

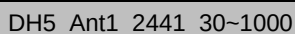
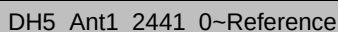
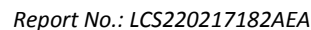
DH5_Ant1_2402_0~Reference



DH5_Ant1_2402_30~1000

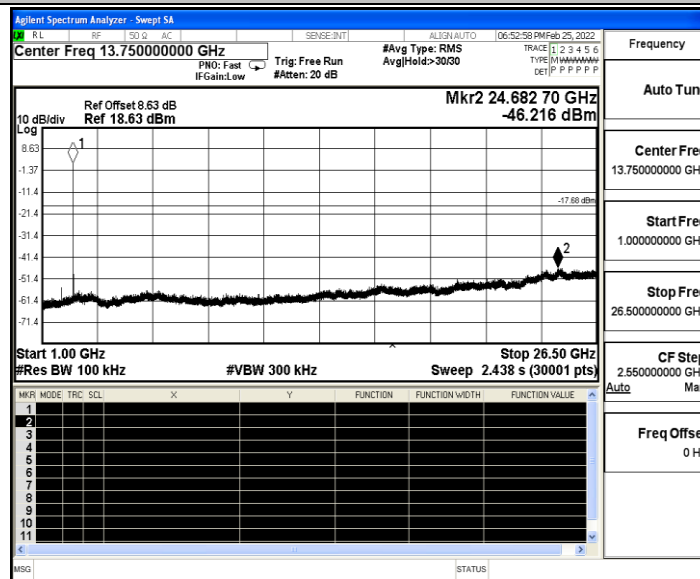


DH5_Ant1_2402_1000~26500

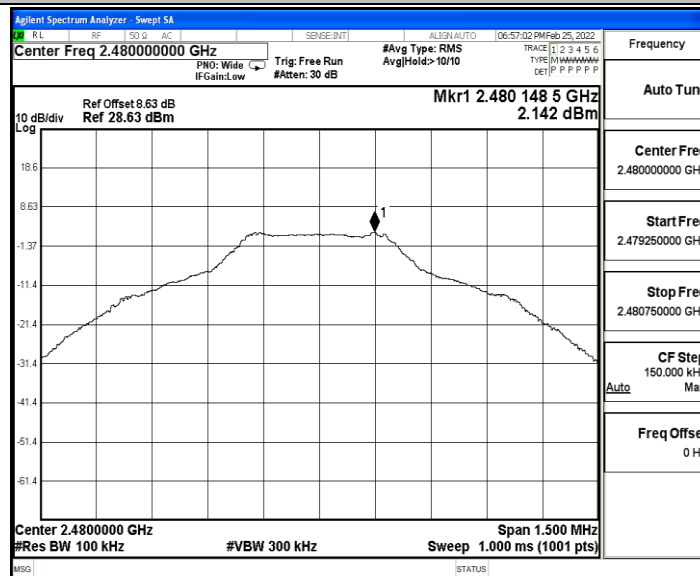




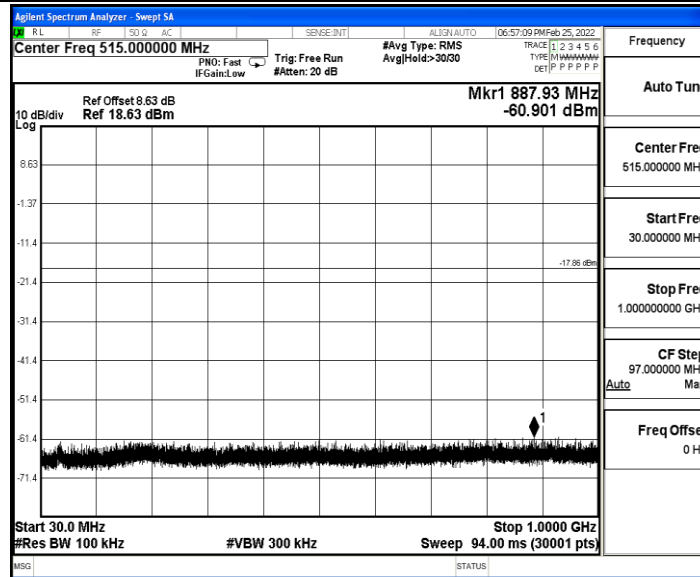
DH5_Ant1_2441_1000~26500



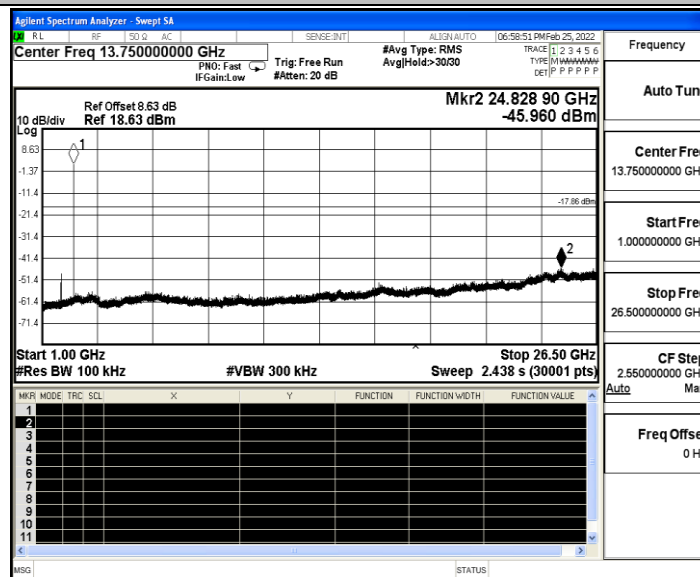
DH5_Ant1_2480_0~Reference



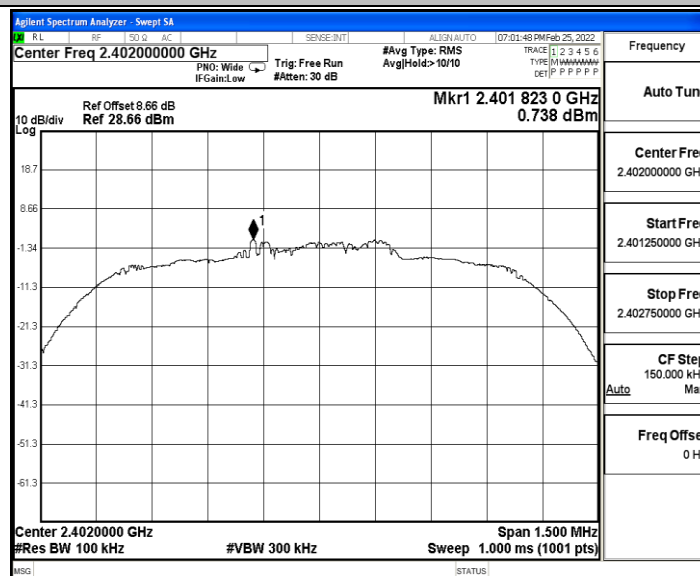
DH5_Ant1_2480_30~1000



DH5_Ant1_2480_1000~26500

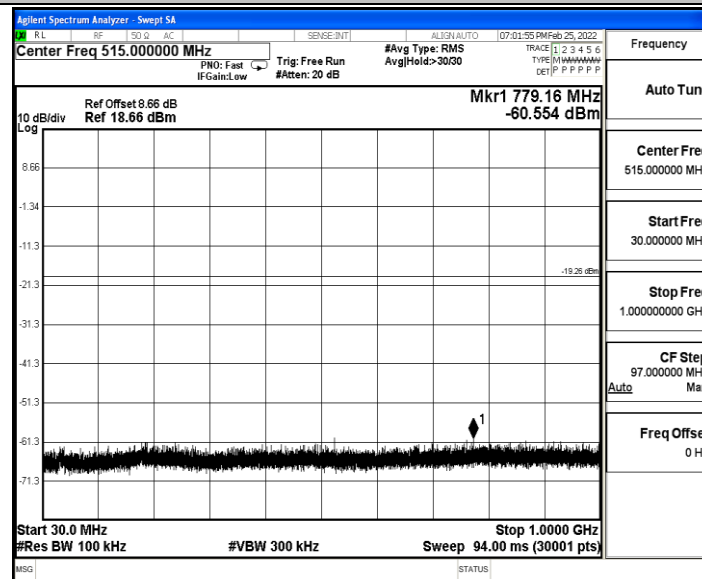


2DH5_Ant1_2402_0~Reference

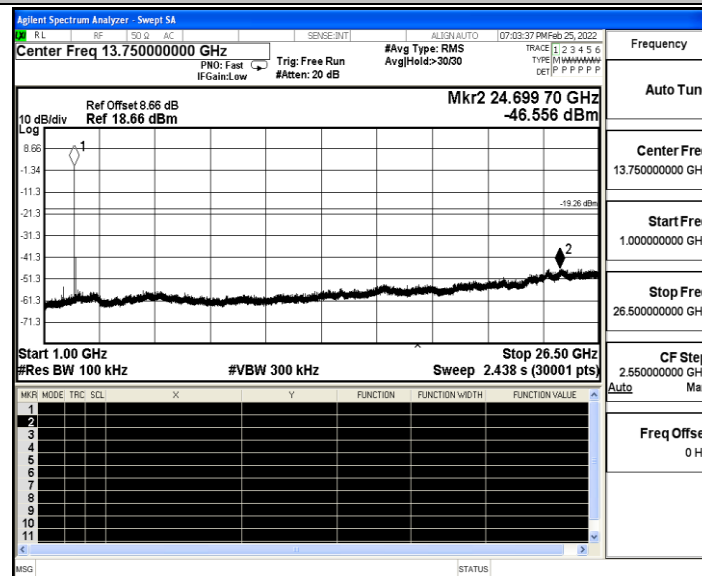




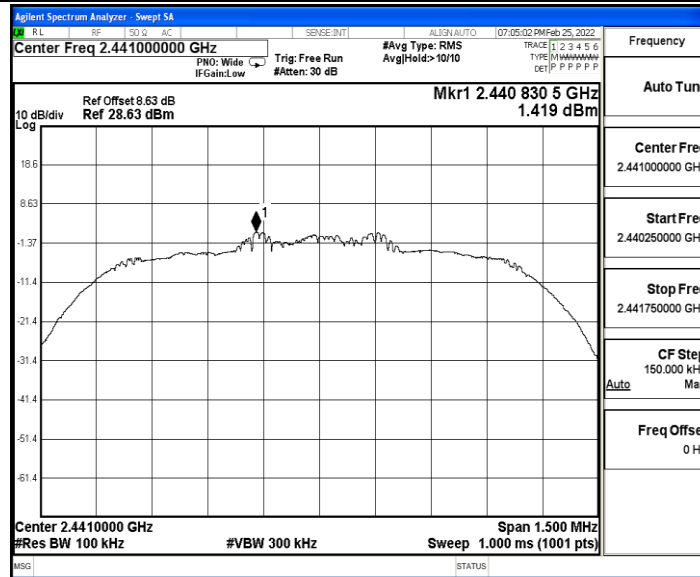
2DH5_Ant1_2402_30~1000



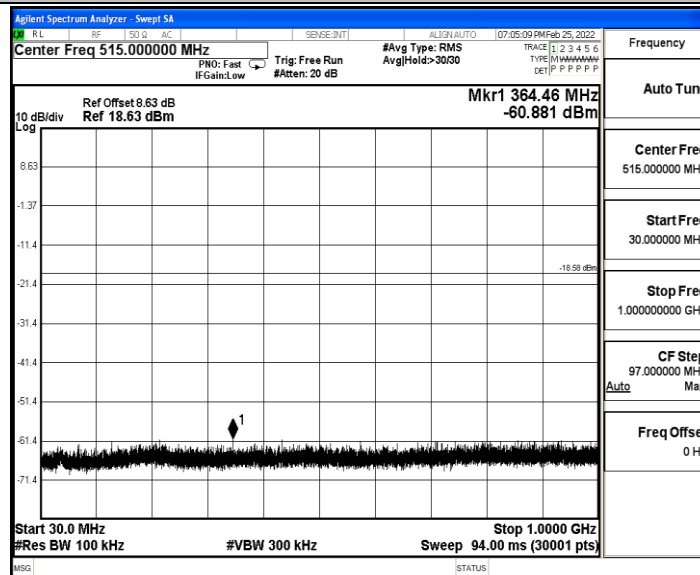
2DH5_Ant1_2402_1000~26500



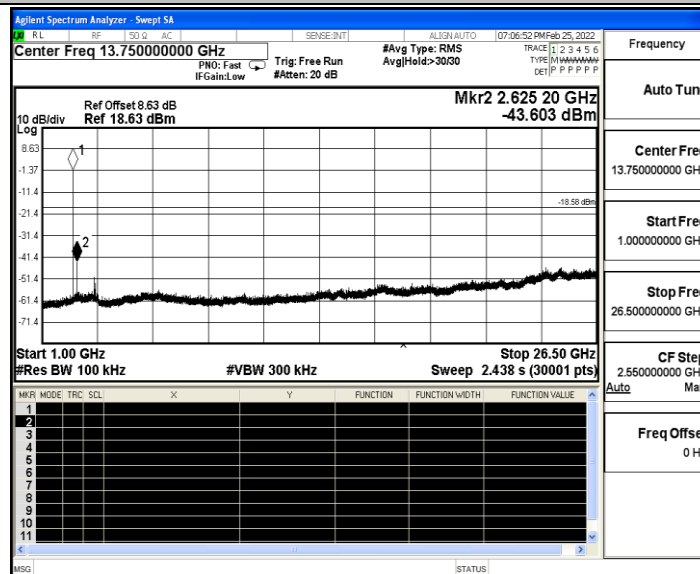
2DH5_Ant1_2441_0~Reference



2DH5_Ant1_2441_30~1000

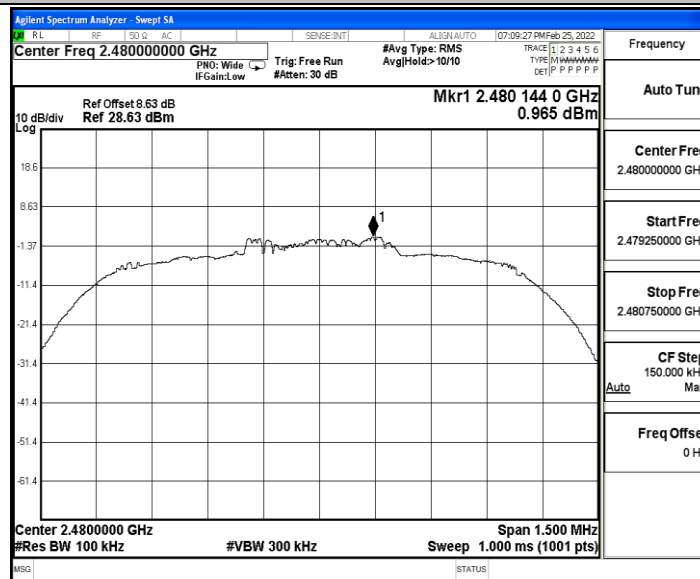


2DH5_Ant1_2441_1000~26500

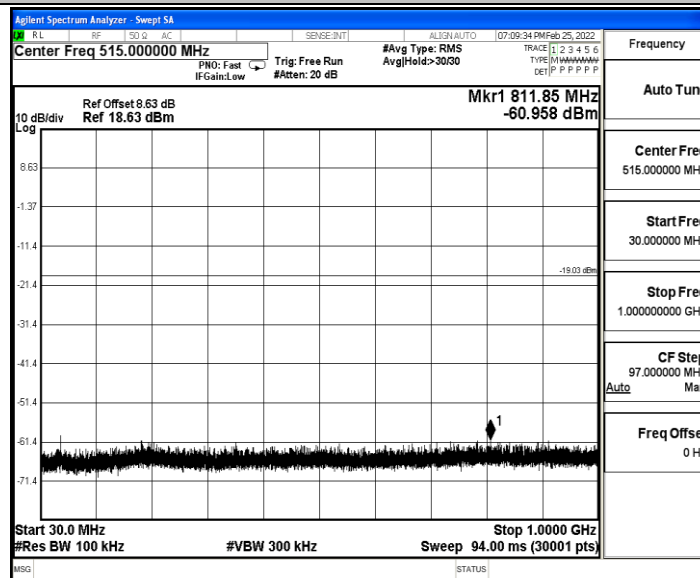




2DH5_Ant1_2480_0~Reference



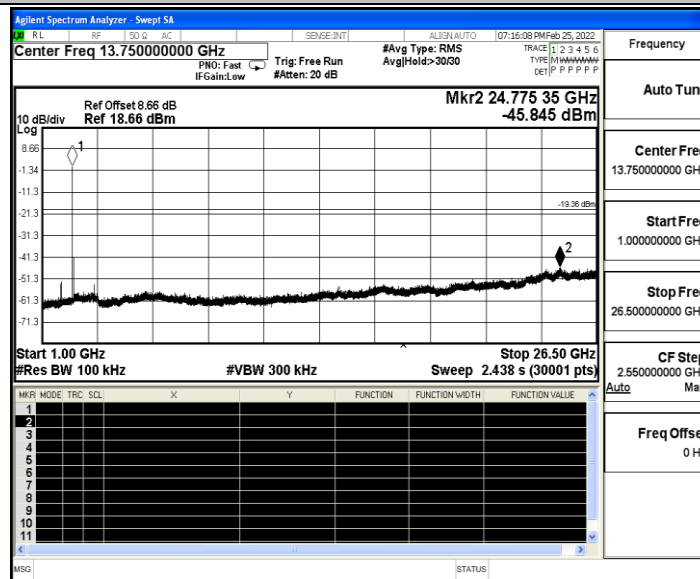
2DH5_Ant1_2480_30~1000



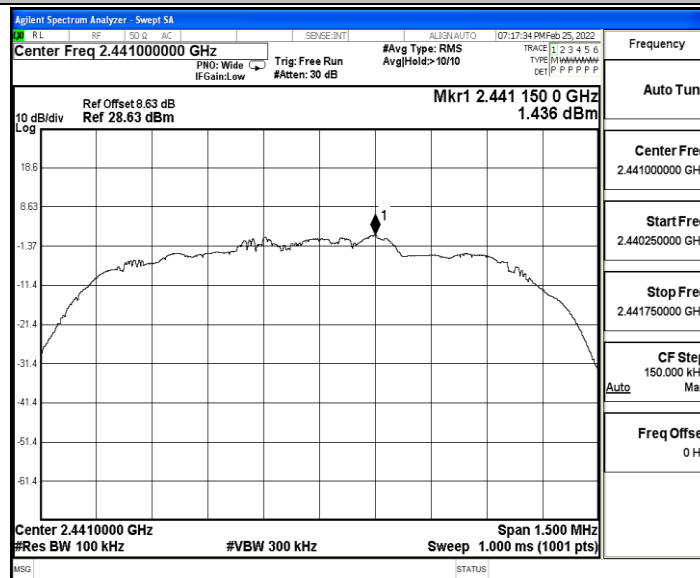
2DH5_Ant1_2480_1000~26500



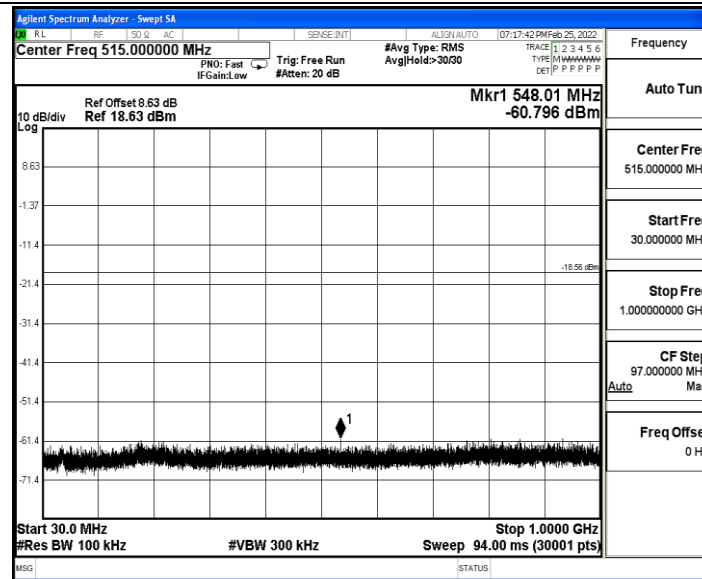
3DH5_Ant1_2402_1000~26500



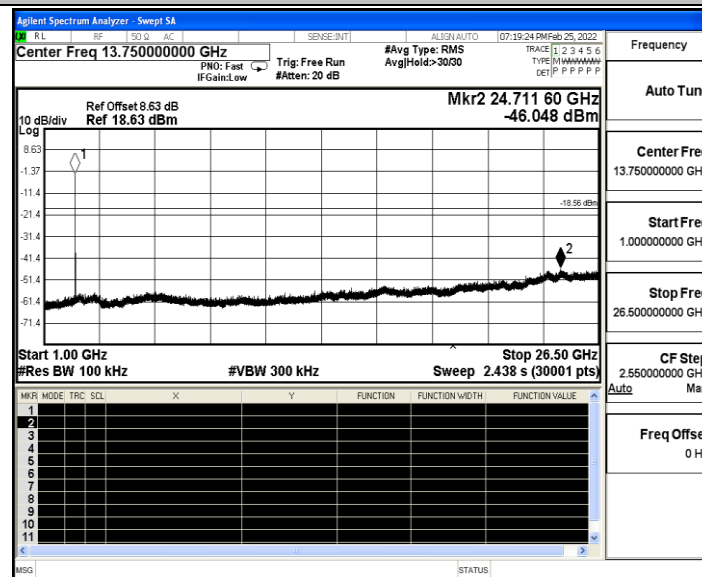
3DH5_Ant1_2441_0~Reference



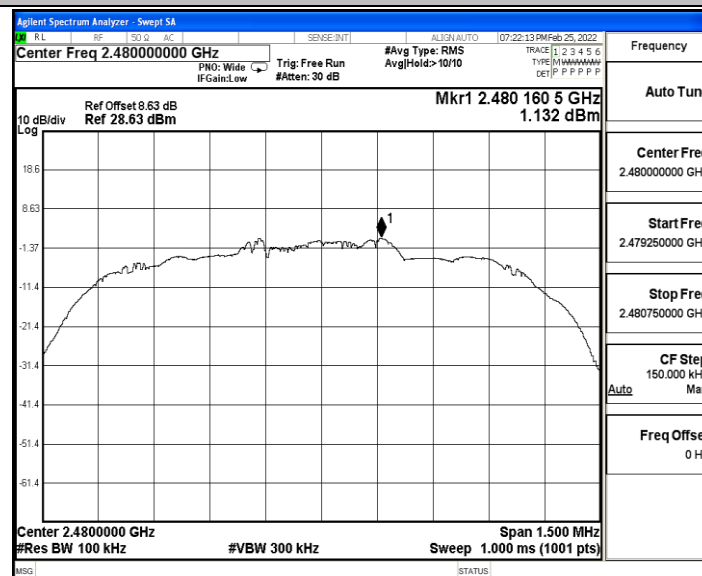
3DH5_Ant1_2441_30~1000



3DH5_Ant1_2441_1000~26500

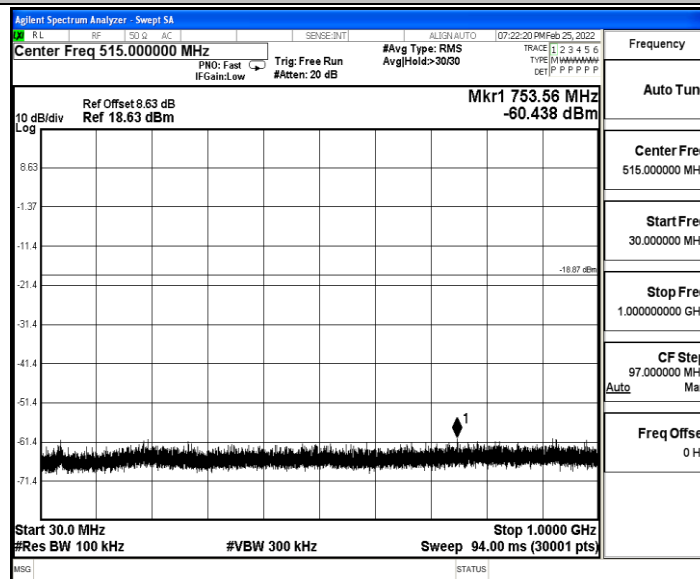


3DH5_Ant1_2480_0~Reference

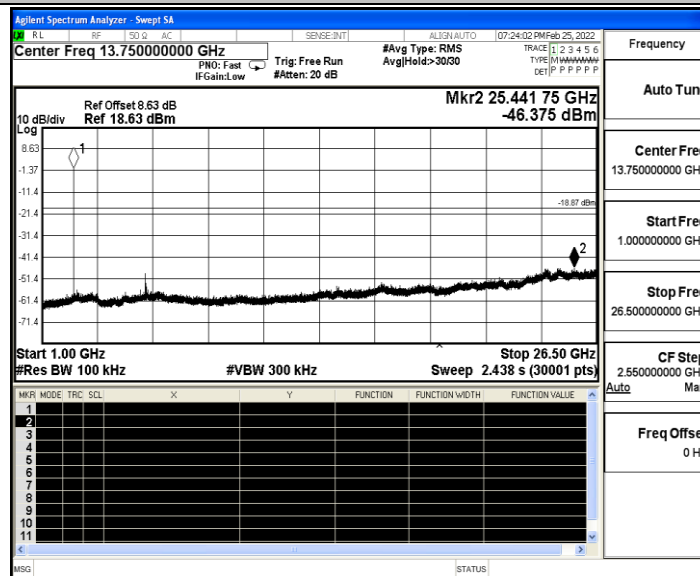




3DH5_Ant1_2480_30~1000



3DH5_Ant1_2480_1000~26500





A.8 Emissions in Restricted Bands

Test Result

Condition	Mode	Frequency (MHz)	Hopping Mode	Spur Freq (MHz)	Power (dBm)	Gain (dBi)	E (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
NVNT	1-DH5	2402	No-Hopping	2310	-49.62	2	47.64	Peak	74	Pass
NVNT	1-DH5	2402	No-Hopping	2310	-60.69	2	36.57	Average	54	Pass
NVNT	1-DH5	2402	No-Hopping	2382.096	-47.64	2	49.62	Peak	74	Pass
NVNT	1-DH5	2402	No-Hopping	2378.928	-60.13	2	37.13	Average	54	Pass
NVNT	1-DH5	2402	No-Hopping	2390	-52.26	2	45	Peak	74	Pass
NVNT	1-DH5	2402	No-Hopping	2390	-60.32	2	36.94	Average	54	Pass
NVNT	1-DH5	2480	No-Hopping	2483.5	-49.46	2	47.8	Peak	74	Pass
NVNT	1-DH5	2480	No-Hopping	2483.5	-60.02	2	37.24	Average	54	Pass
NVNT	1-DH5	2480	No-Hopping	2498.536	-47.13	2	50.13	Peak	74	Pass
NVNT	1-DH5	2480	No-Hopping	2484.28	-59.67	2	37.59	Average	54	Pass
NVNT	1-DH5	2480	No-Hopping	2500	-51.63	2	45.63	Peak	74	Pass
NVNT	1-DH5	2480	No-Hopping	2500	-60.15	2	37.11	Average	54	Pass
NVNT	2-DH5	2402	No-Hopping	2310	-50.02	2	47.24	Peak	74	Pass
NVNT	2-DH5	2402	No-Hopping	2310	-60.8	2	36.46	Average	54	Pass
NVNT	2-DH5	2402	No-Hopping	2388.432	-47.75	2	49.51	Peak	74	Pass
NVNT	2-DH5	2402	No-Hopping	2386.992	-60.19	2	37.07	Average	54	Pass
NVNT	2-DH5	2402	No-Hopping	2390	-50.9	2	46.36	Peak	74	Pass
NVNT	2-DH5	2402	No-Hopping	2390	-60.28	2	36.98	Average	54	Pass
NVNT	2-DH5	2480	No-Hopping	2483.5	-50.74	2	46.52	Peak	74	Pass
NVNT	2-DH5	2480	No-Hopping	2483.5	-59.8	2	37.46	Average	54	Pass
NVNT	2-DH5	2480	No-Hopping	2484.232	-47.8	2	49.46	Peak	74	Pass
NVNT	2-DH5	2480	No-Hopping	2483.632	-59.58	2	37.68	Average	54	Pass
NVNT	2-DH5	2480	No-Hopping	2500	-51.66	2	45.6	Peak	74	Pass
NVNT	2-DH5	2480	No-Hopping	2500	-60.01	2	37.25	Average	54	Pass
NVNT	3-DH5	2402	No-Hopping	2310	-48.68	2	48.58	Peak	74	Pass
NVNT	3-DH5	2402	No-Hopping	2310	-60.61	2	36.65	Average	54	Pass
NVNT	3-DH5	2402	No-Hopping	2361.648	-47.44	2	49.82	Peak	74	Pass
NVNT	3-DH5	2402	No-Hopping	2388.24	-60.1	2	37.16	Average	54	Pass
NVNT	3-DH5	2402	No-Hopping	2390	-50.71	2	46.55	Peak	74	Pass
NVNT	3-DH5	2402	No-Hopping	2390	-60.41	2	36.85	Average	54	Pass
NVNT	3-DH5	2480	No-Hopping	2483.5	-50.84	2	46.42	Peak	74	Pass
NVNT	3-DH5	2480	No-Hopping	2483.5	-59.57	2	37.69	Average	54	Pass
NVNT	3-DH5	2480	No-Hopping	2484.64	-46.84	2	50.42	Peak	74	Pass
NVNT	3-DH5	2480	No-Hopping	2483.512	-59.57	2	37.69	Average	54	Pass
NVNT	3-DH5	2480	No-Hopping	2500	-49.96	2	47.3	Peak	74	Pass
NVNT	3-DH5	2480	No-Hopping	2500	-60.01	2	37.25	Average	54	Pass

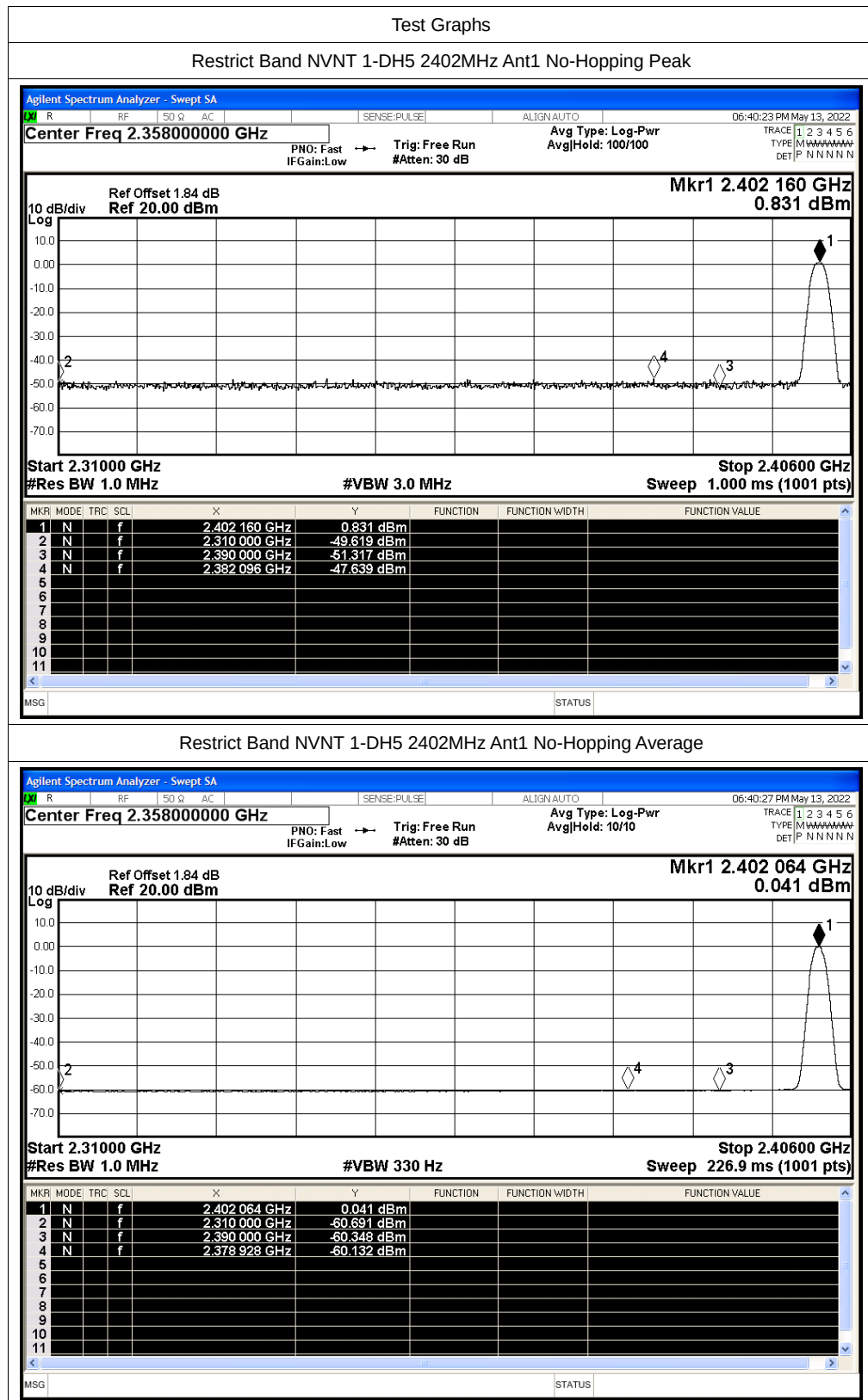


Note:

1. The Antenna Gain is compensated in the graph.
2. The limit in dBm for average detector is conversion from 54dBuV/m, according to 15.209(a). The limit in dBm for peak detector is 20dB above the limit of average detector in dBm.

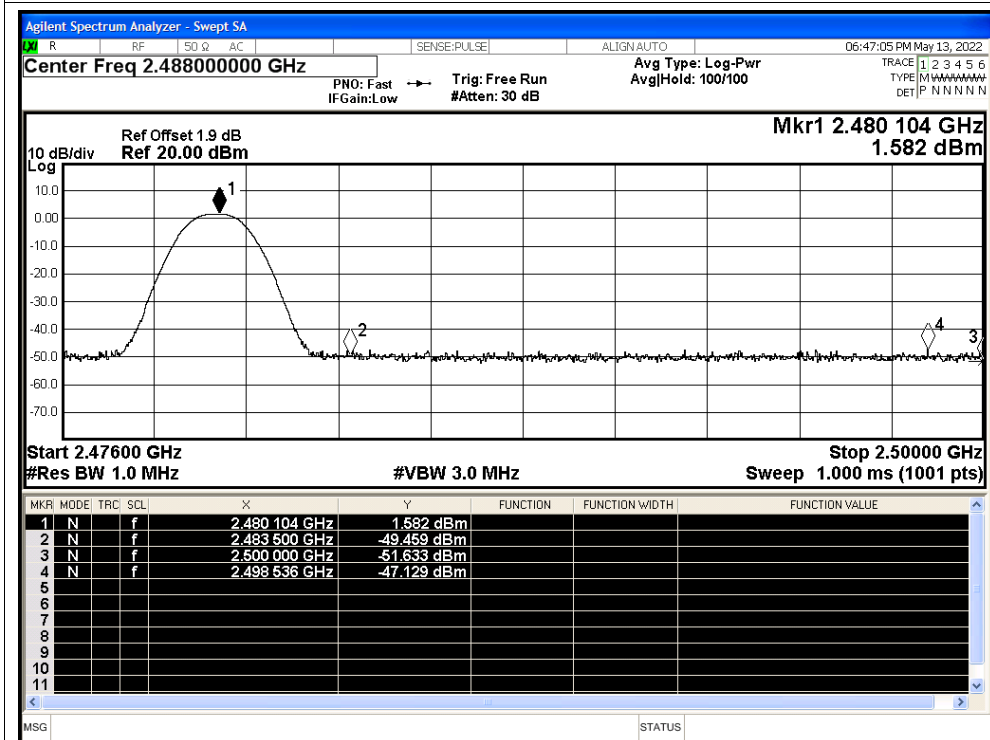


Test Graphs

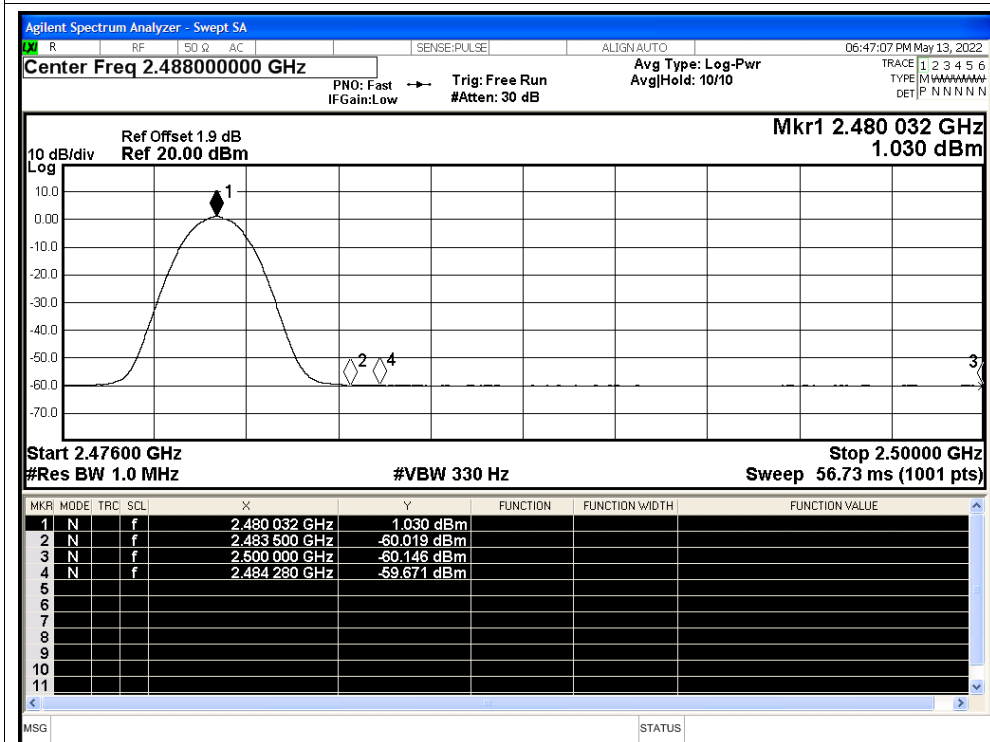




Restrict Band NVNT 1-DH5 2480MHz Ant1 No-Hopping Peak

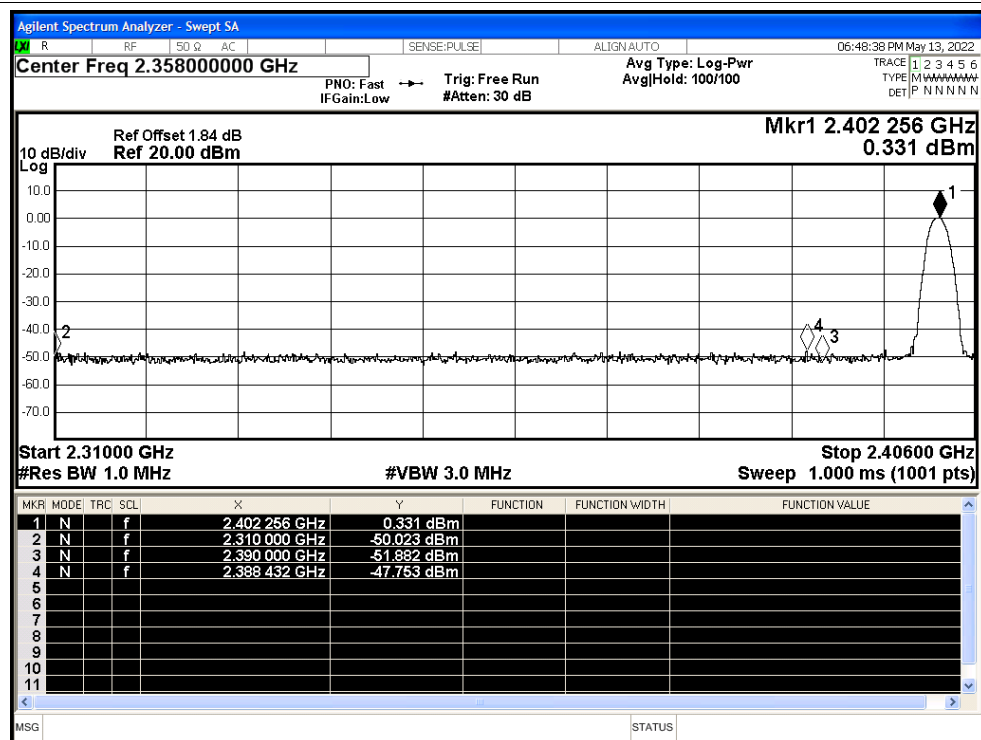


Restrict Band NVNT 1-DH5 2480MHz Ant1 No-Hopping Average

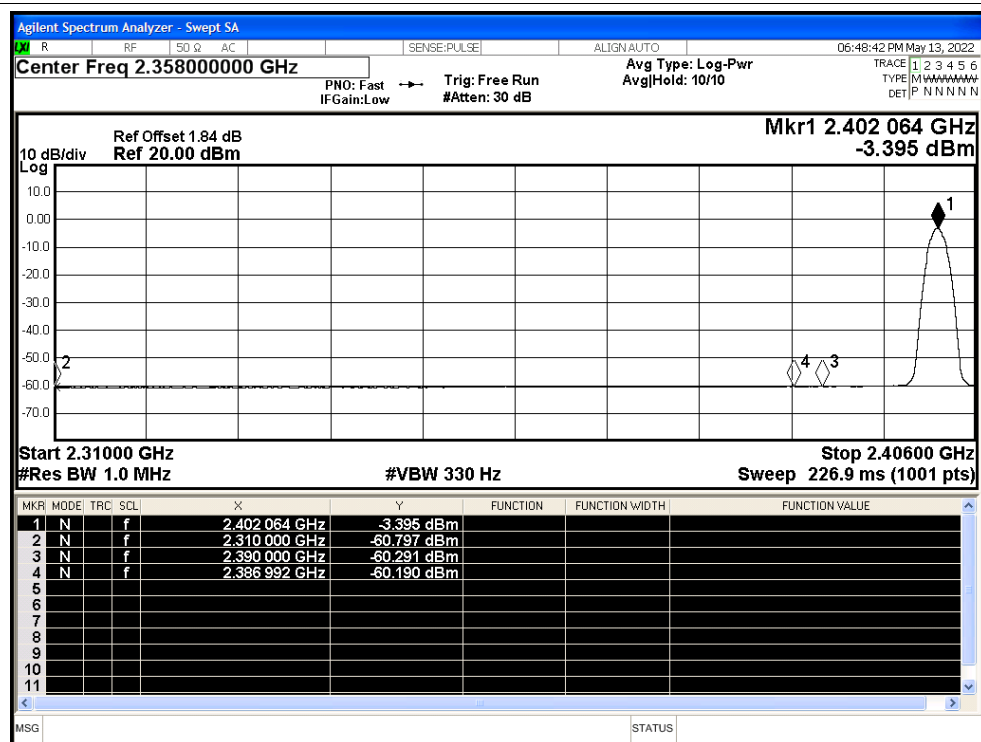




Restrict Band NVNT 2-DH5 2402MHz Ant1 No-Hopping Peak

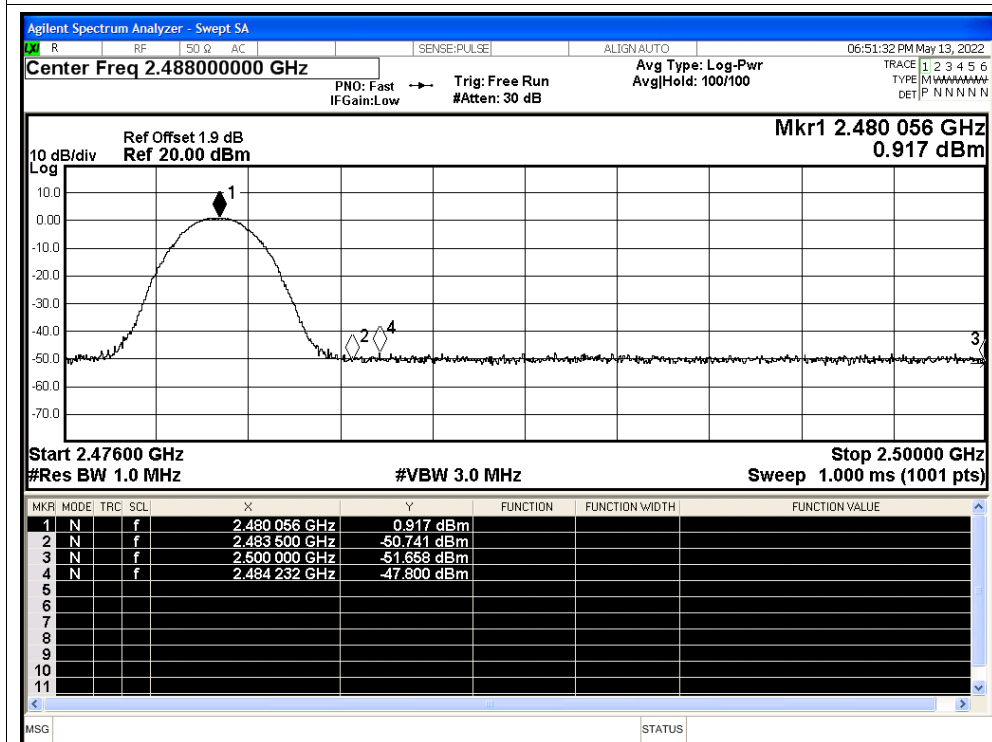


Restrict Band NVNT 2-DH5 2402MHz Ant1 No-Hopping Average

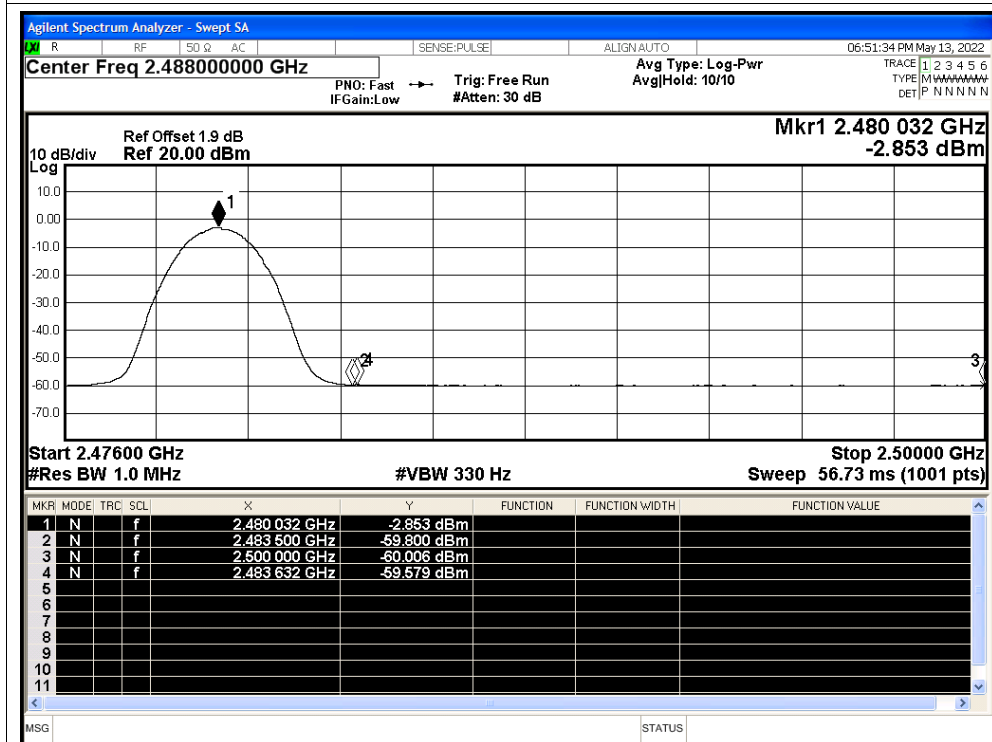




Restrict Band NVNT 2-DH5 2480MHz Ant1 No-Hopping Peak

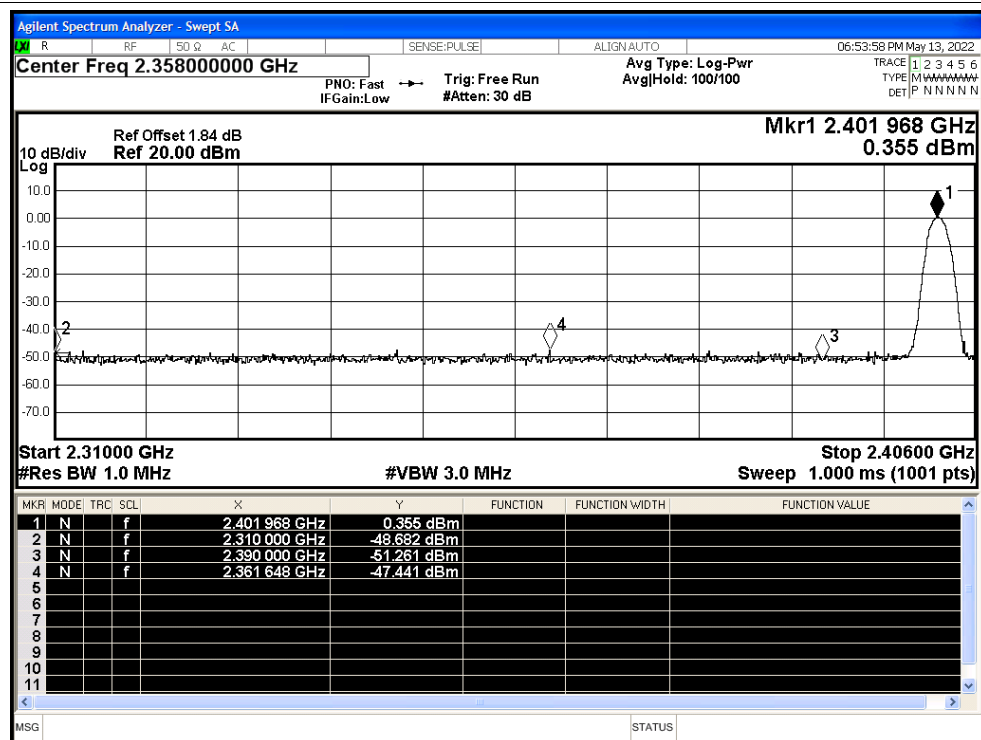


Restrict Band NVNT 2-DH5 2480MHz Ant1 No-Hopping Average

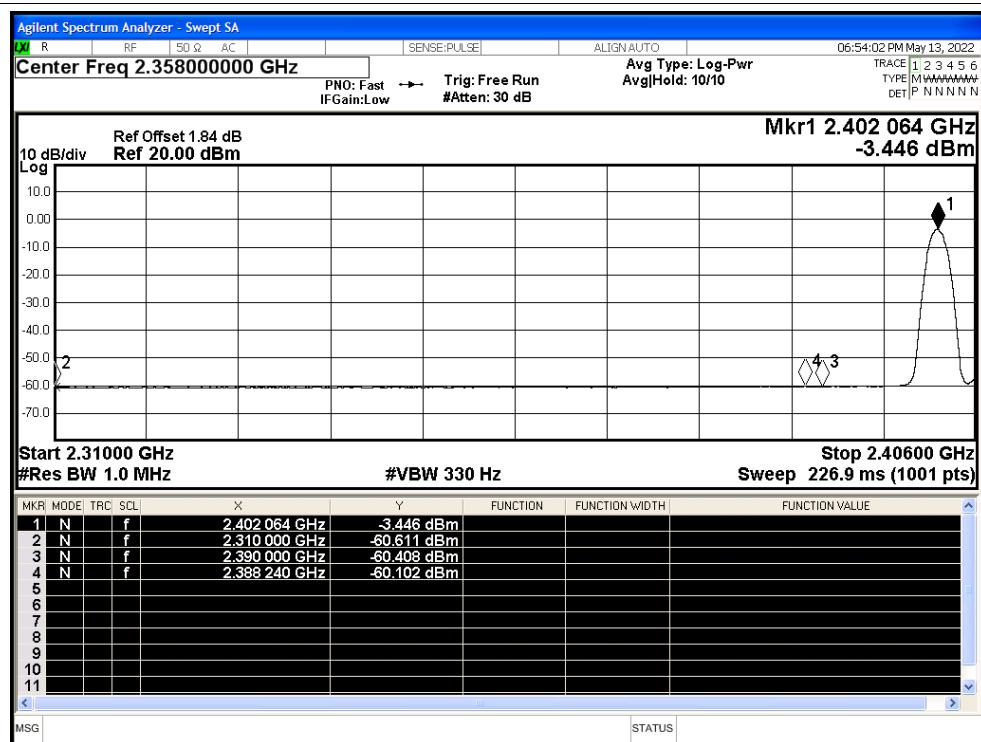




Restrict Band NVNT 3-DH5 2402MHz Ant1 No-Hopping Peak

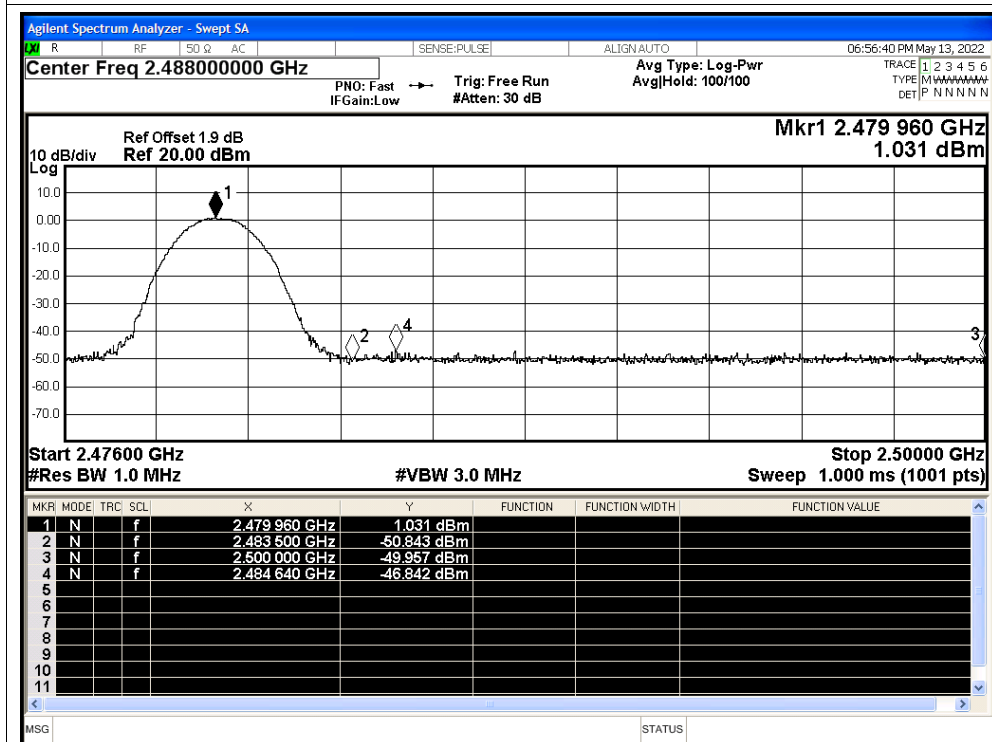


Restrict Band NVNT 3-DH5 2402MHz Ant1 No-Hopping Average





Restrict Band NVNT 3-DH5 2480MHz Ant1 No-Hopping Peak



Restrict Band NVNT 3-DH5 2480MHz Ant1 No-Hopping Average

