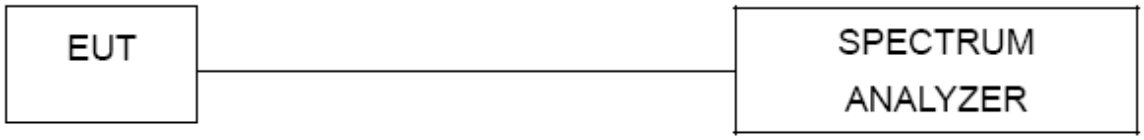
11. Out Of Band Emissions

11.1 Block Diagram Of Test Setup



11.2 Limit

According to FCC §15.407(b)
Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:
(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(2) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

11.3 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

11.4 EUT Operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data

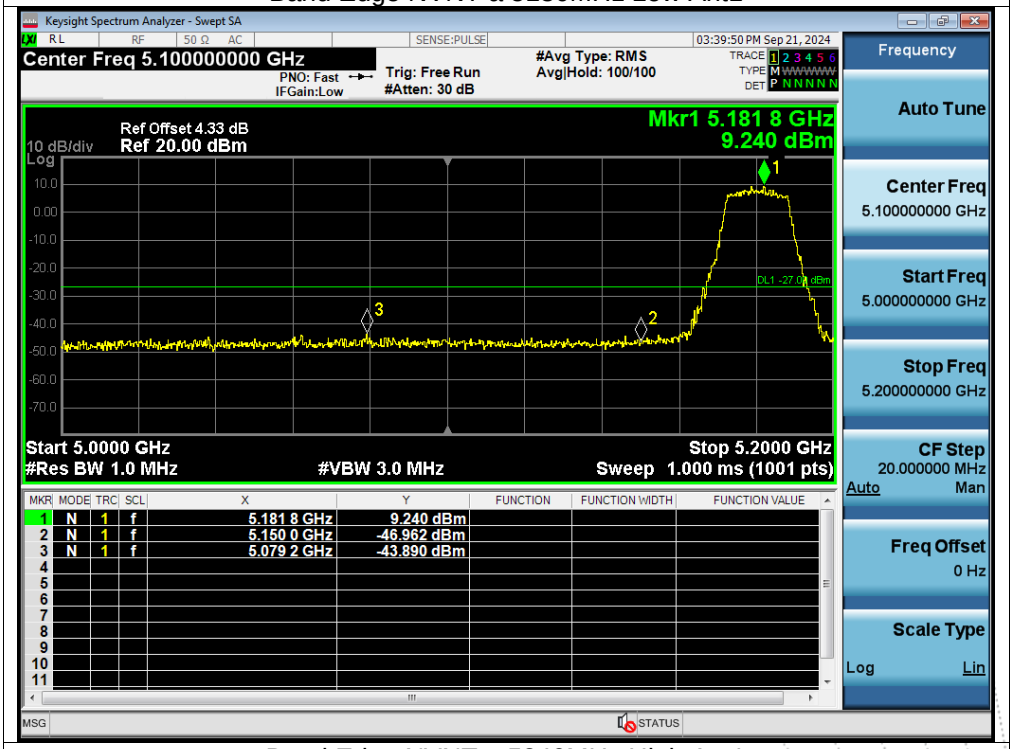
11.5 Test Result

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101kPa	Test Voltage:	AC120/60Hz

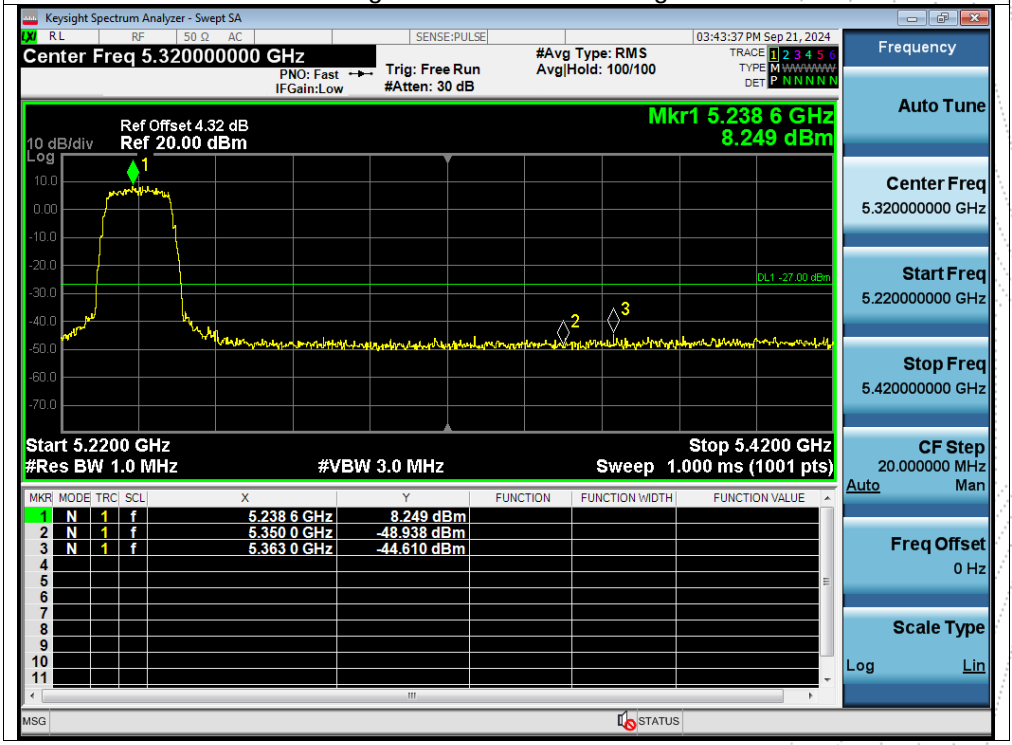
Note: A(B) Represent the value of antenna A and B, The worst data is Antenna A, only shown Antenna A.
Plot. Antenna A: 5180-5240MHz

Test Graphs

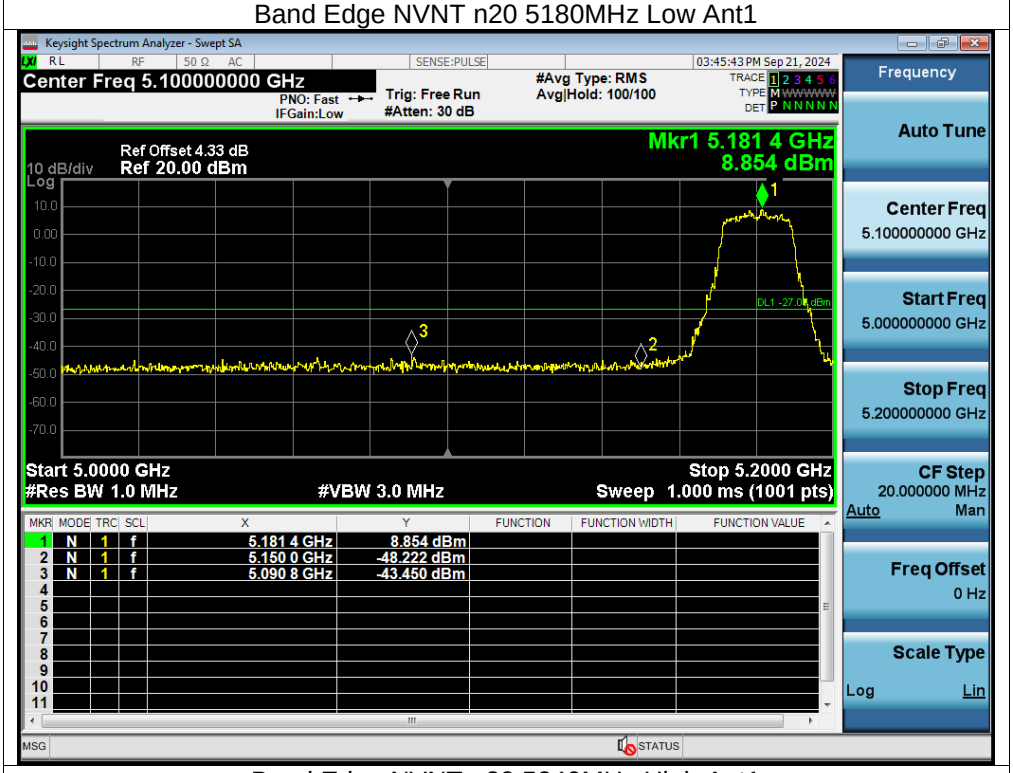
Band Edge NVNT a 5180MHz Low Ant1



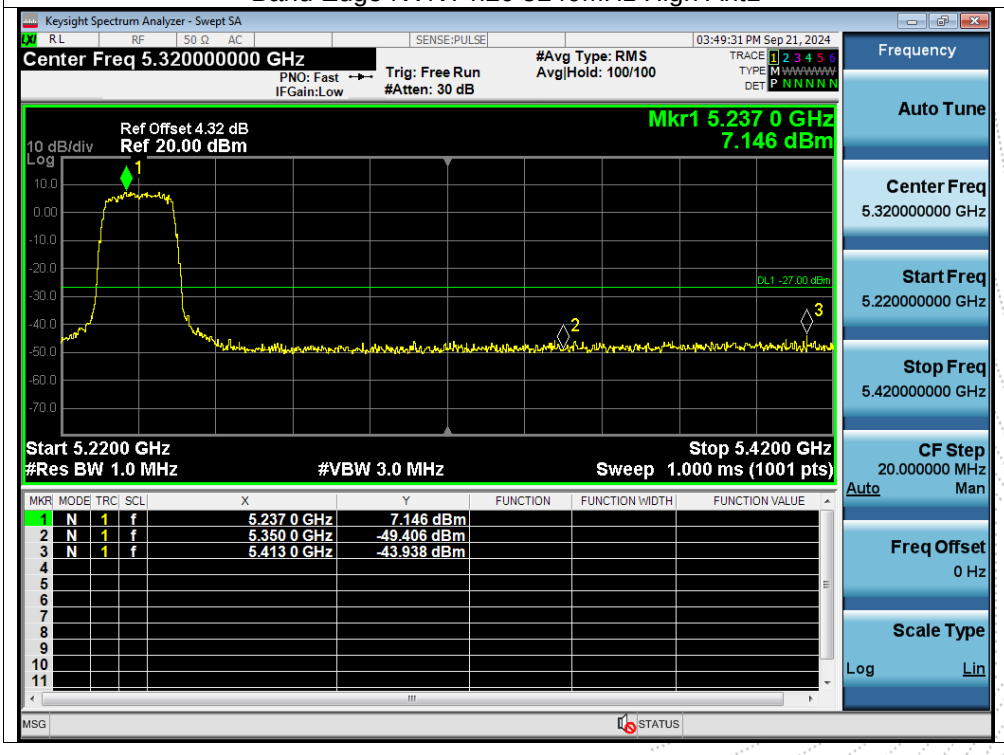
Band Edge NVNT a 5240MHz High Ant1



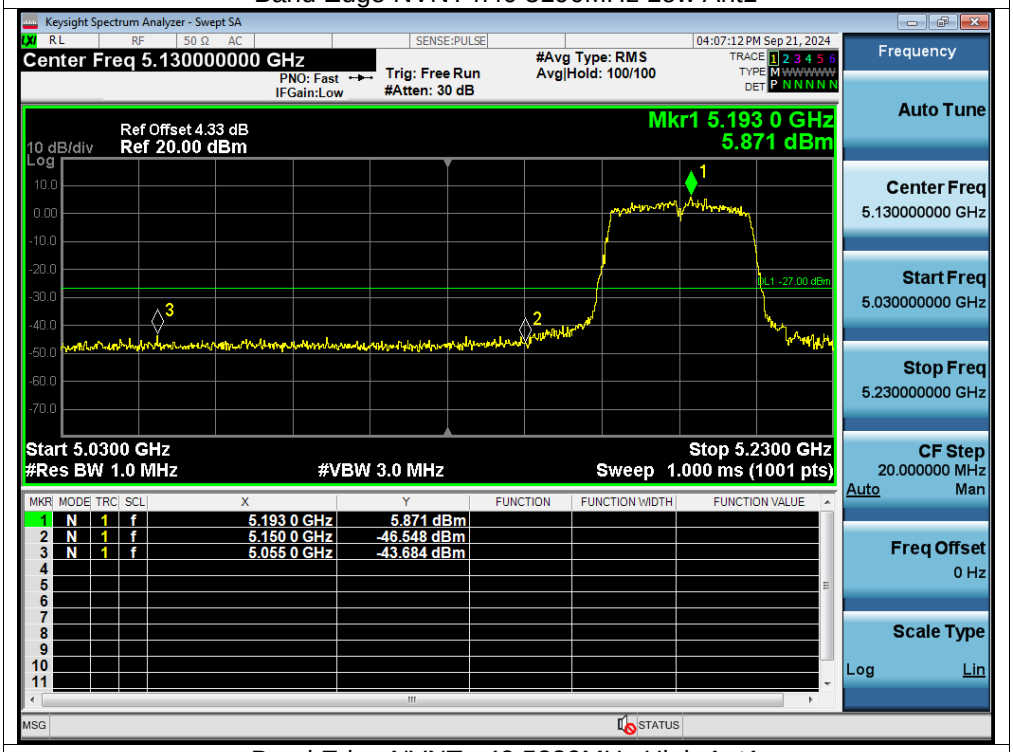
Band Edge NVNT n20 5180MHz Low Ant1



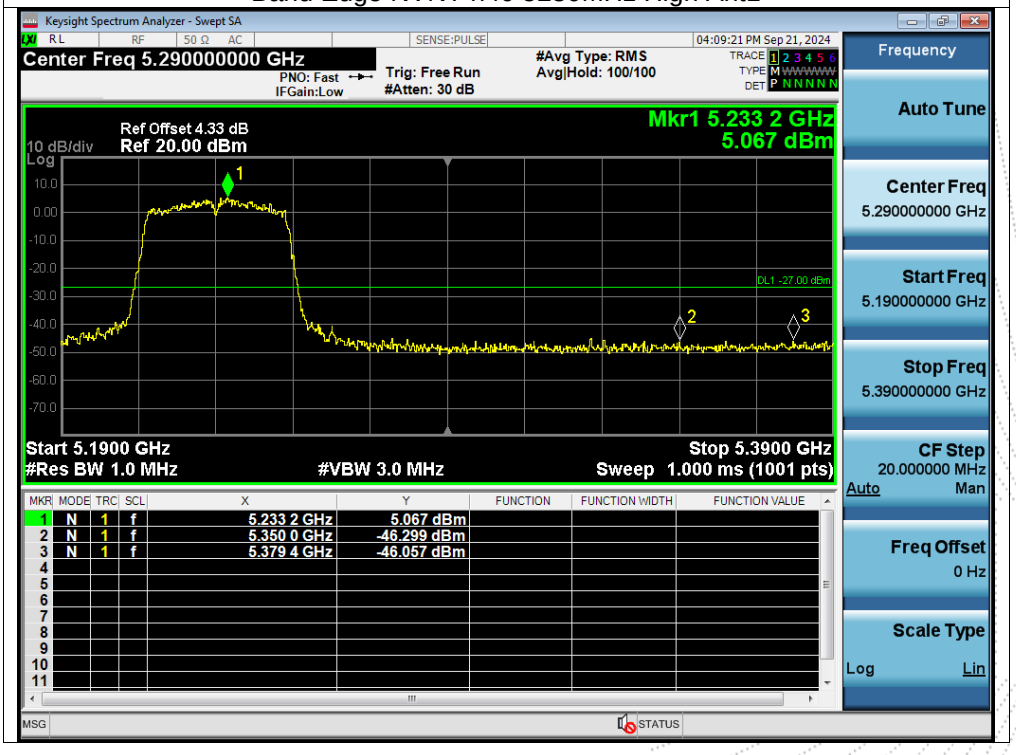
Band Edge NVNT n20 5240MHz High Ant1



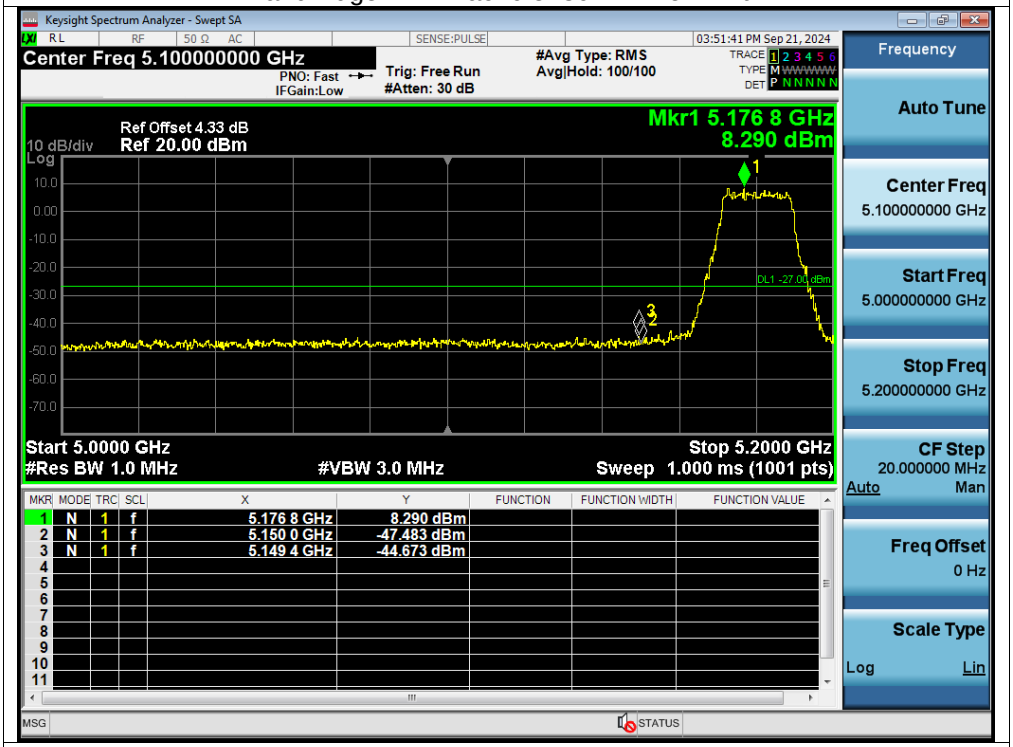
Band Edge NVNT n40 5190MHz Low Ant1



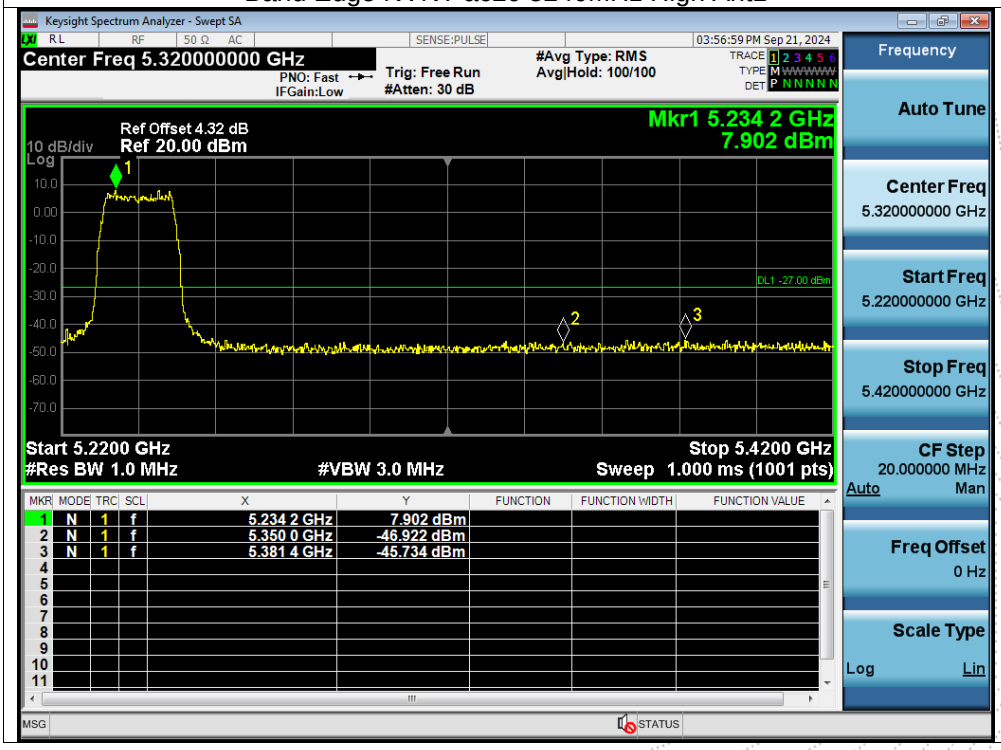
Band Edge NVNT n40 5230MHz High Ant1



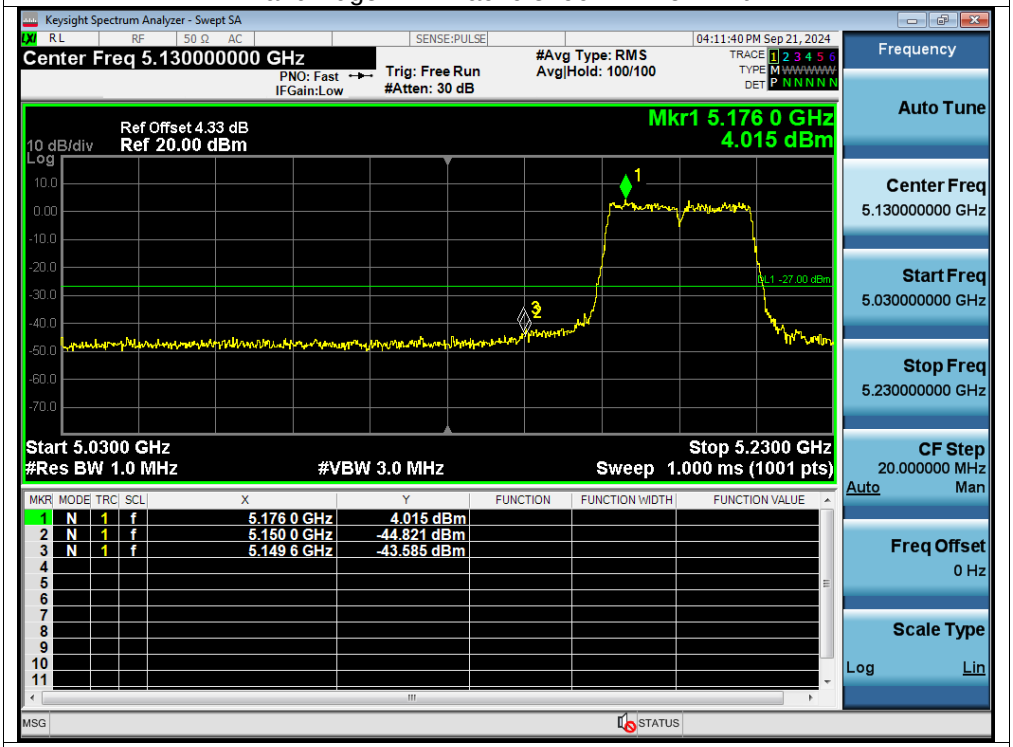
Band Edge NVNT ac20 5180MHz Low Ant1



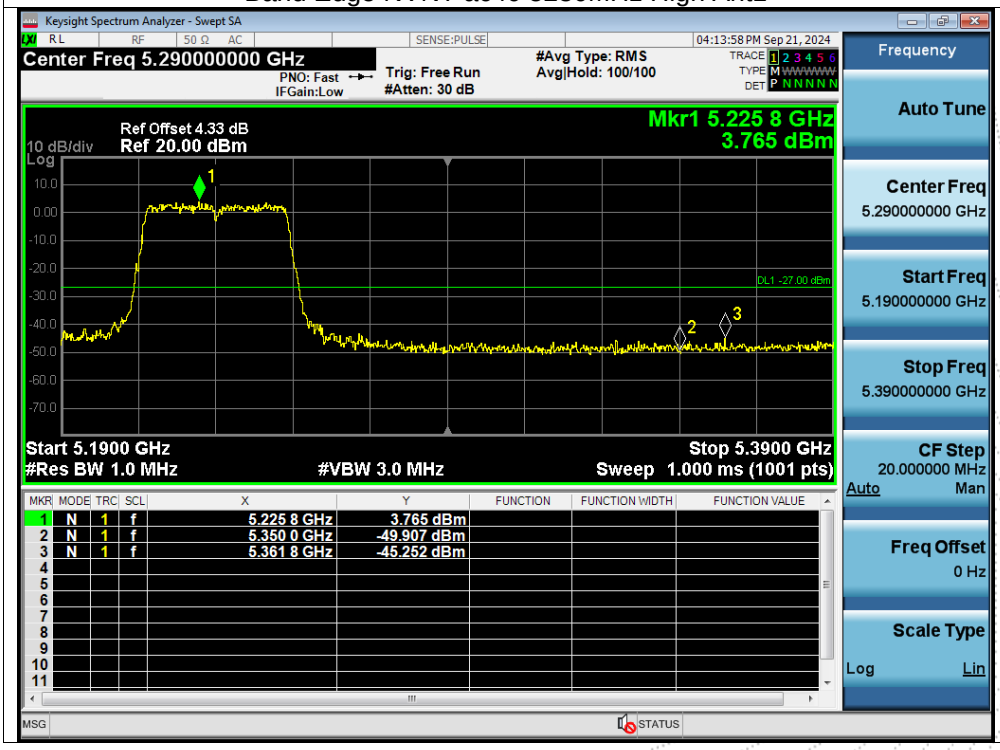
Band Edge NVNT ac20 5240MHz High Ant1



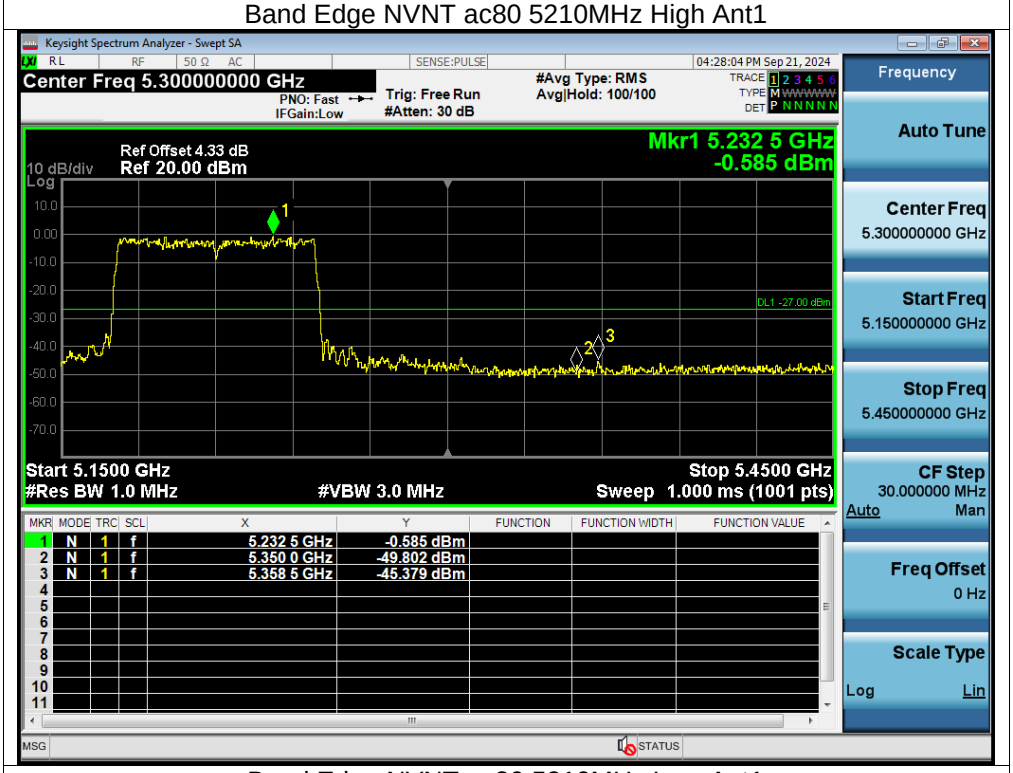
Band Edge NVNT ac40 5190MHz Low Ant1



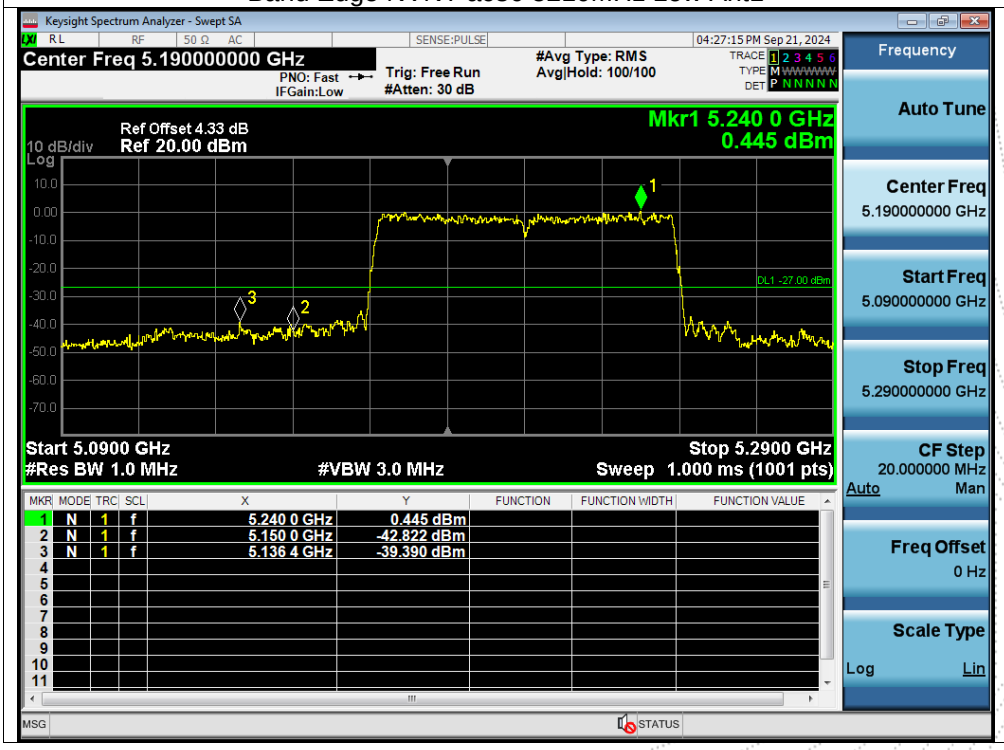
Band Edge NVNT ac40 5230MHz High Ant1



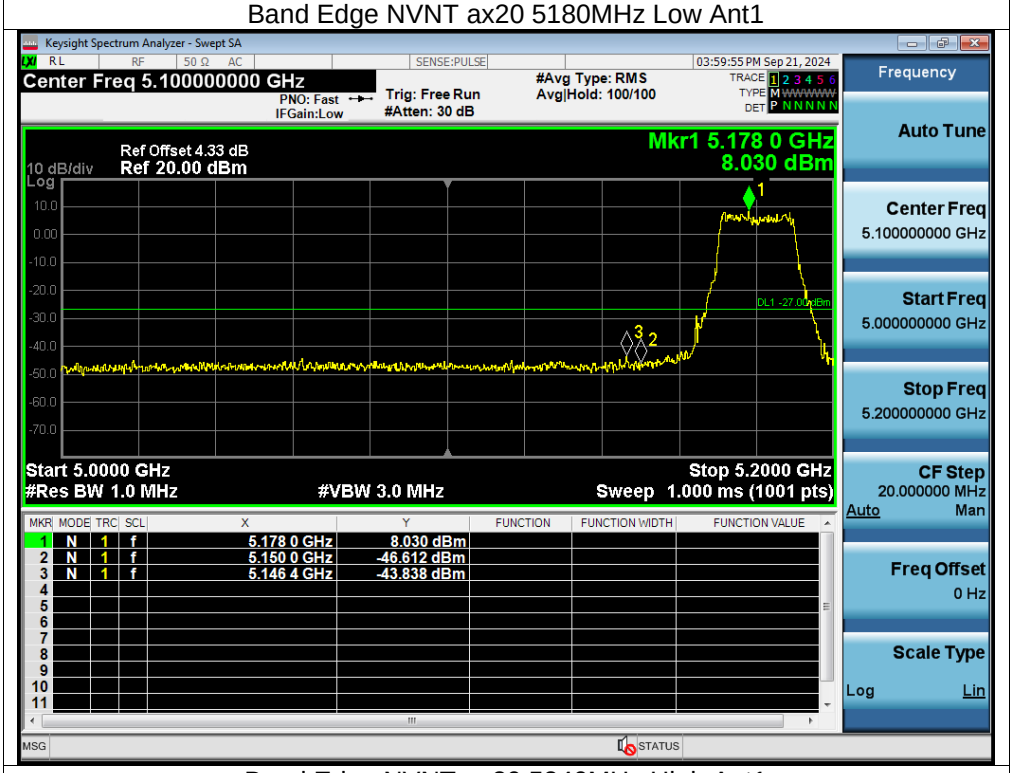
Band Edge NVNT ac80 5210MHz High Ant1



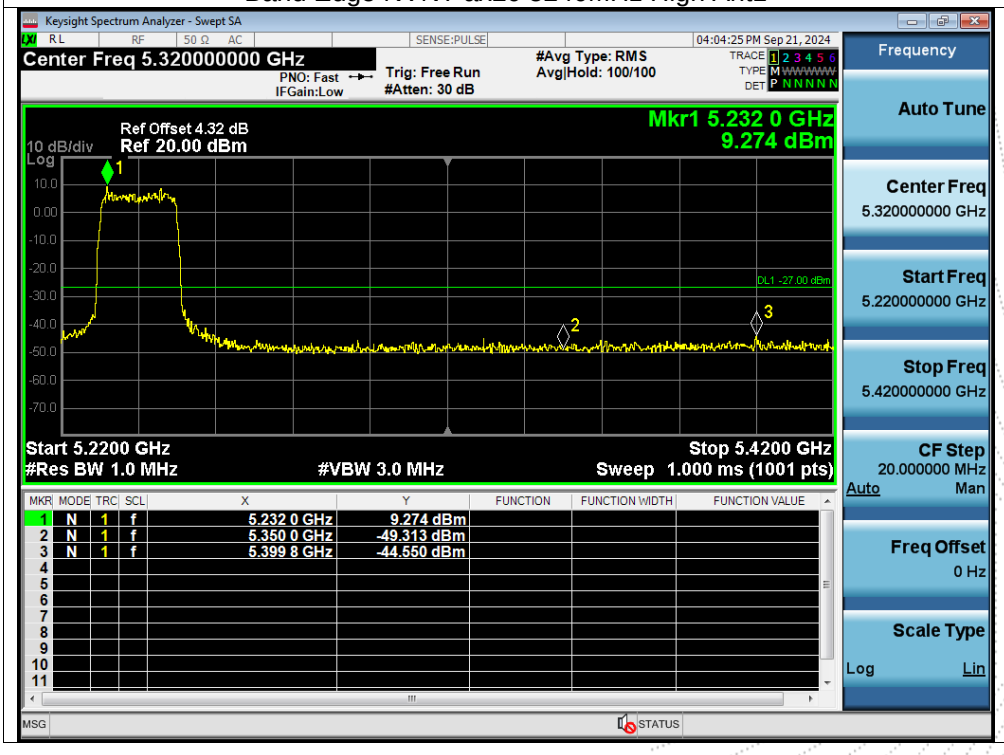
Band Edge NVNT ac80 5210MHz Low Ant1



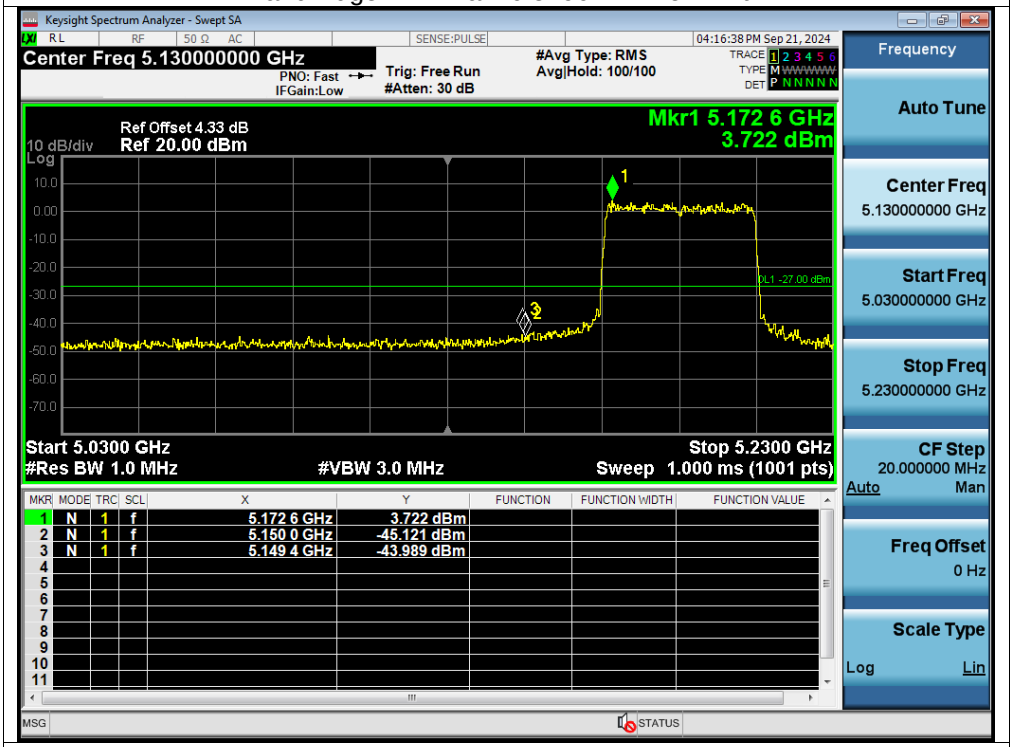
Band Edge NVNT ax20 5180MHz Low Ant1



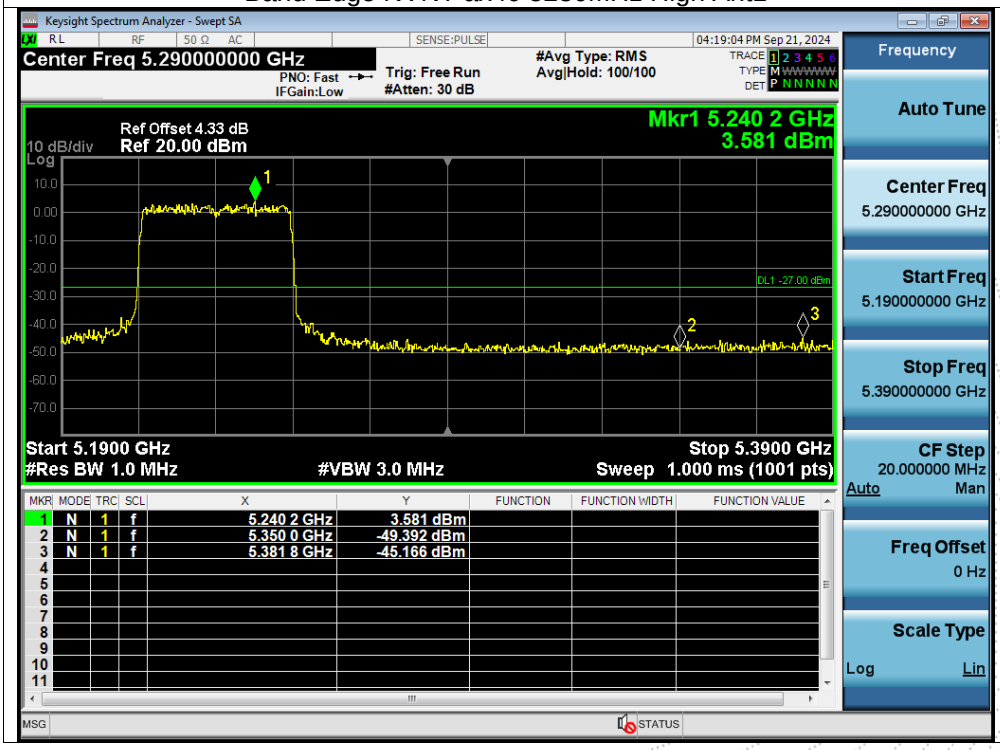
Band Edge NVNT ax20 5240MHz High Ant1



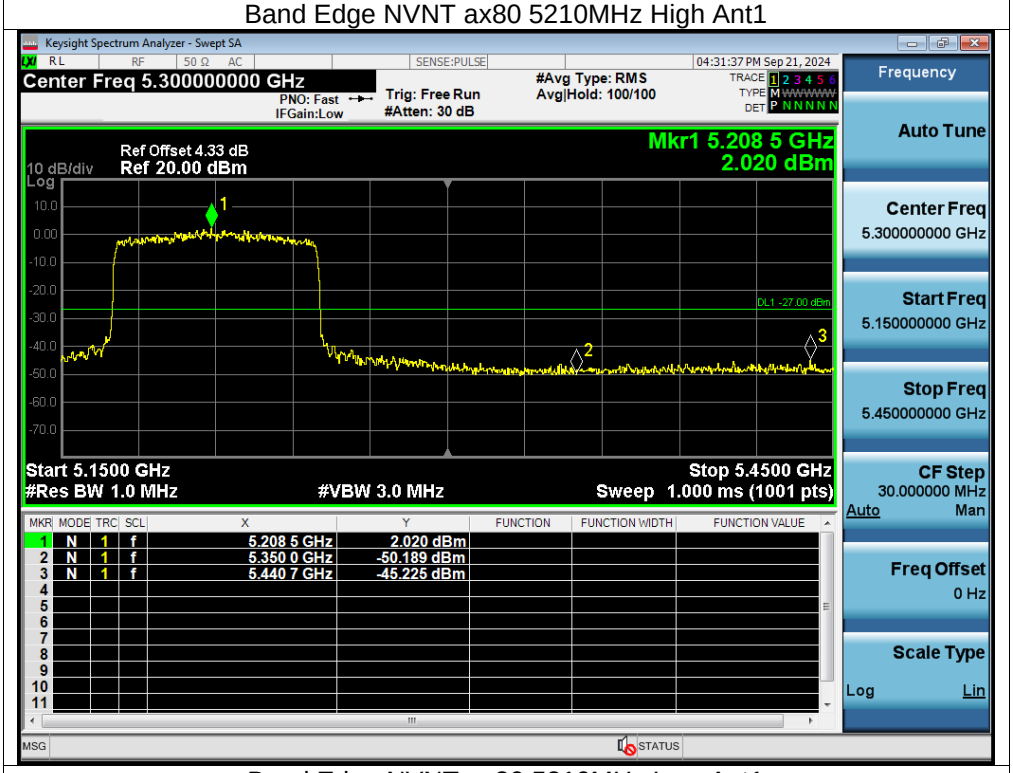
Band Edge NVNT ax40 5190MHz Low Ant1



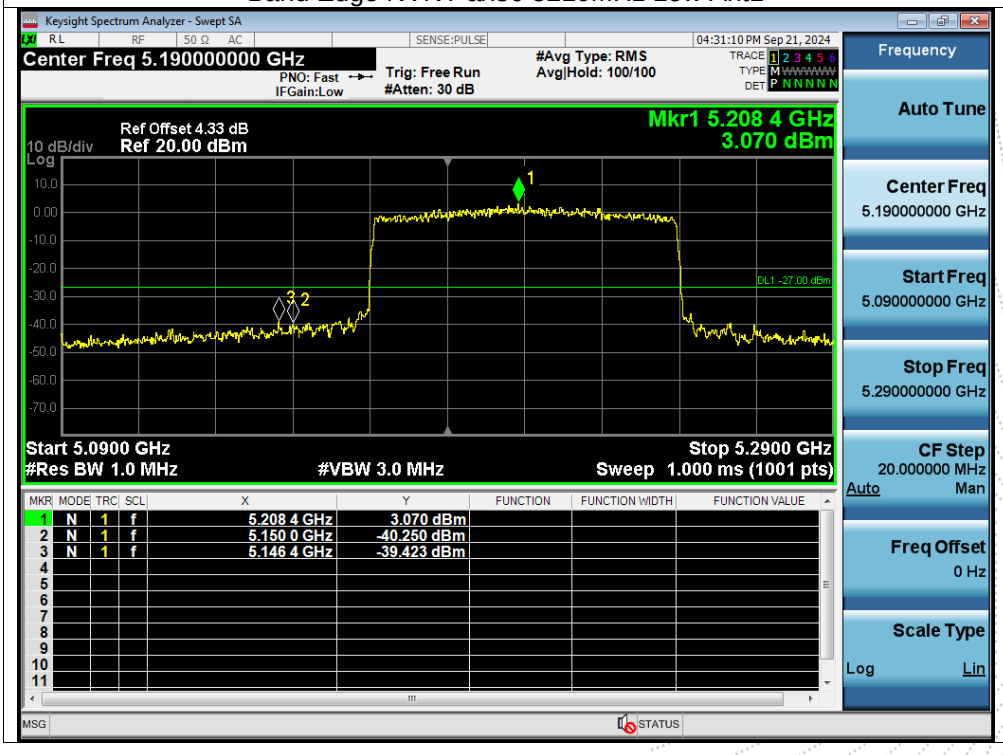
Band Edge NVNT ax40 5230MHz High Ant1



Band Edge NVNT ax80 5210MHz High Ant1



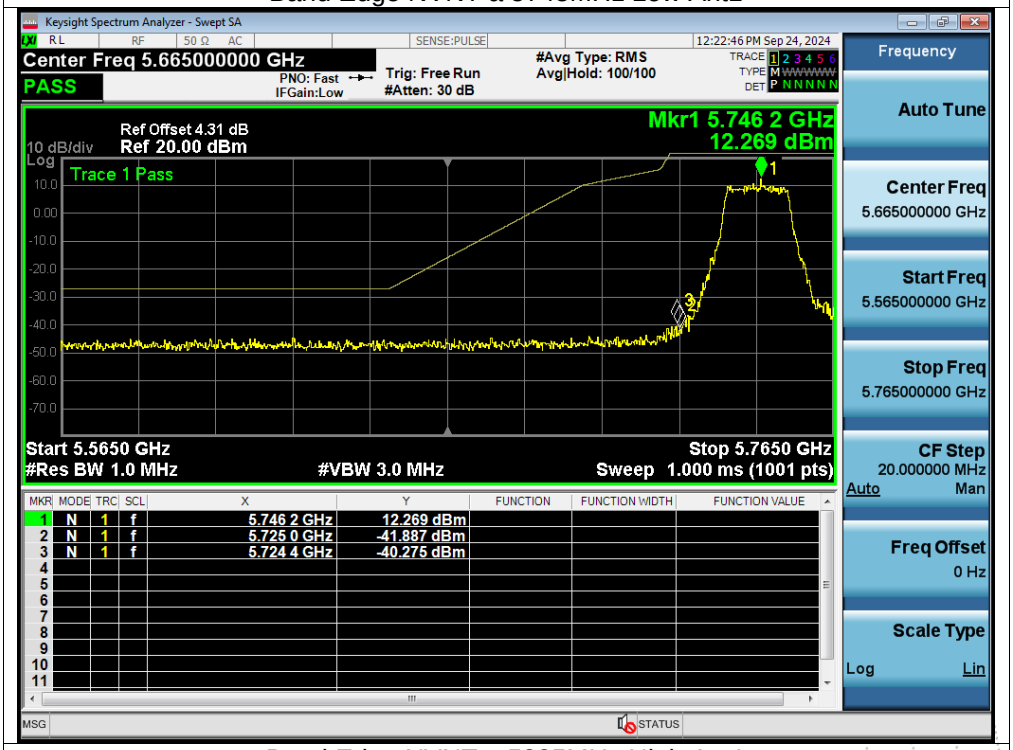
Band Edge NVNT ax80 5210MHz Low Ant1



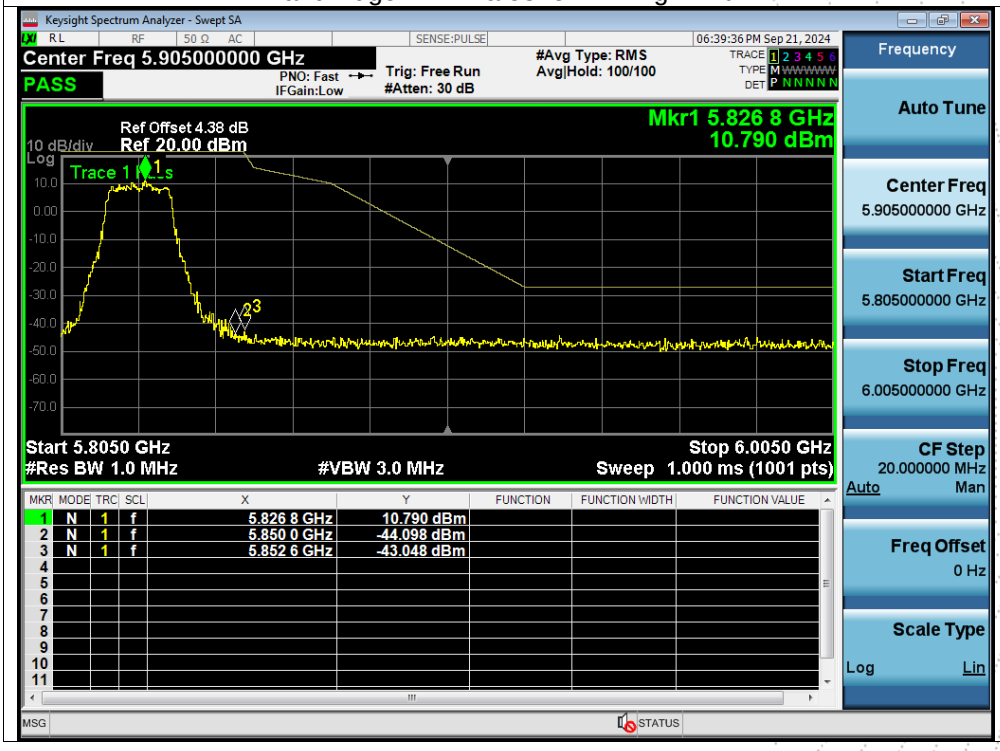
Note: A(B) Represent the value of antenna A and B, The worst data is Antenna A, only shown Antenna A.
Antenna A: 5745-5825MHz

Test Graphs

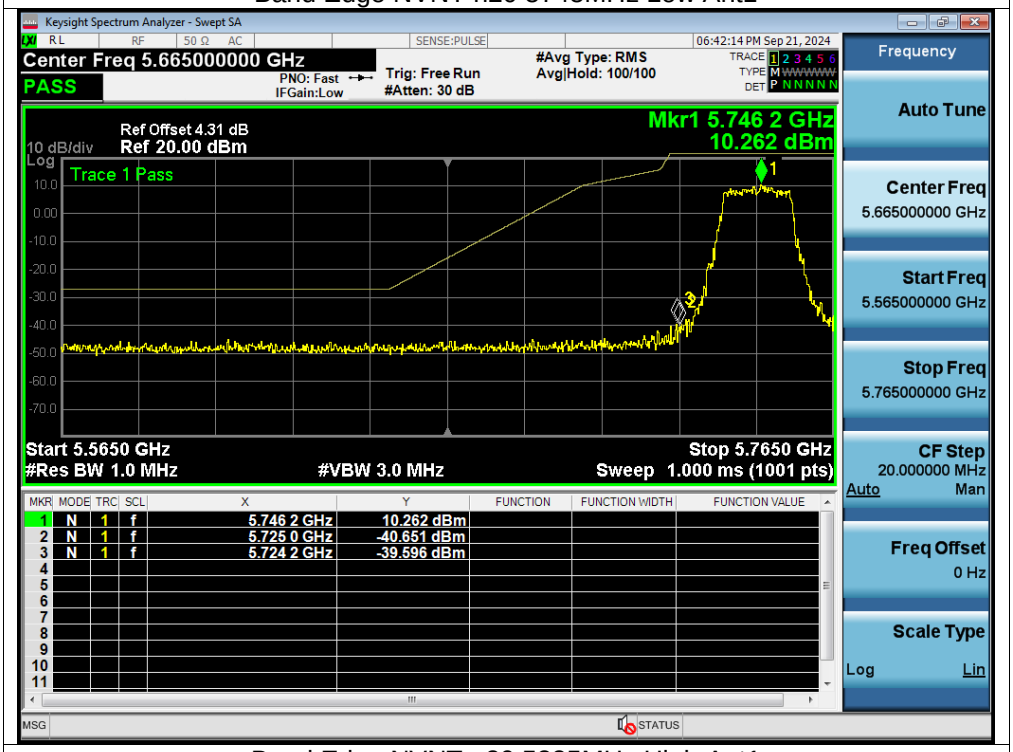
Band Edge NVNT a 5745MHz Low Ant1



Band Edge NVNT a 5825MHz High Ant1

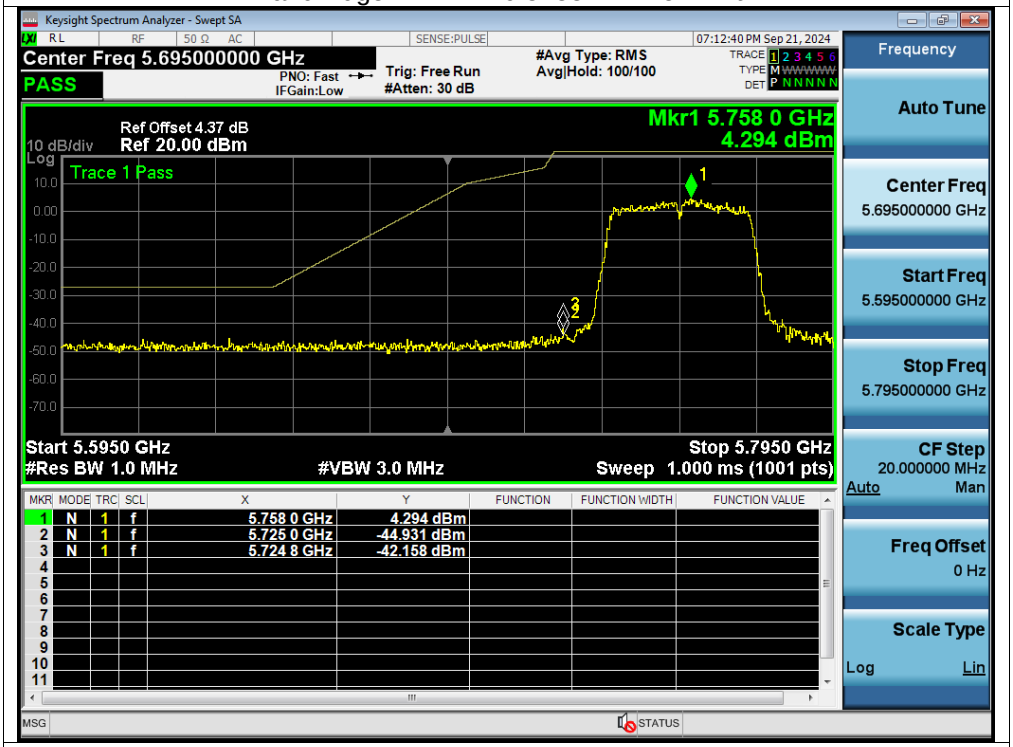


Band Edge NVNT n20 5745MHz Low Ant1

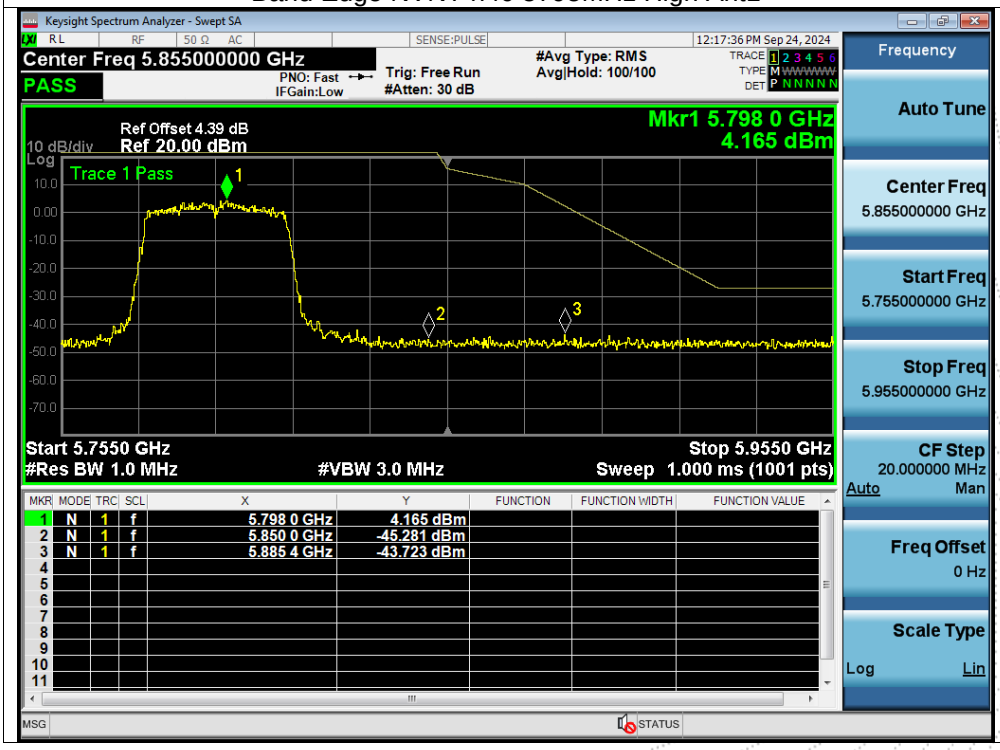


Band Edge NVNT n20 5825MHz High Ant1

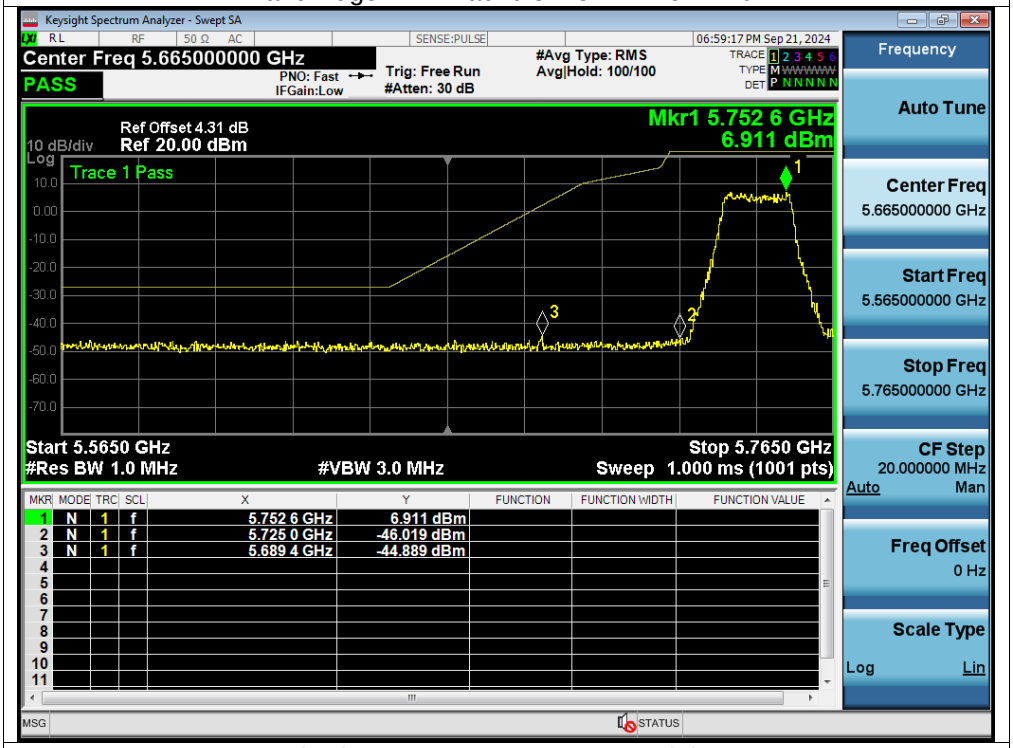
Band Edge NVNT n40 5755MHz Low Ant1



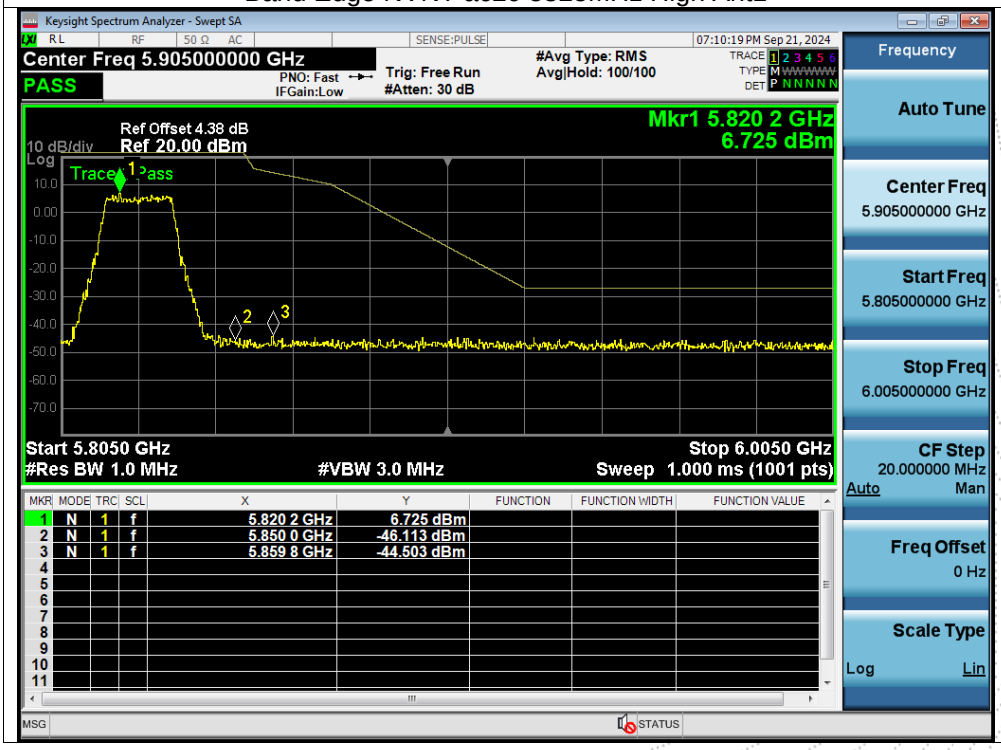
Band Edge NVNT n40 5795MHz High Ant1



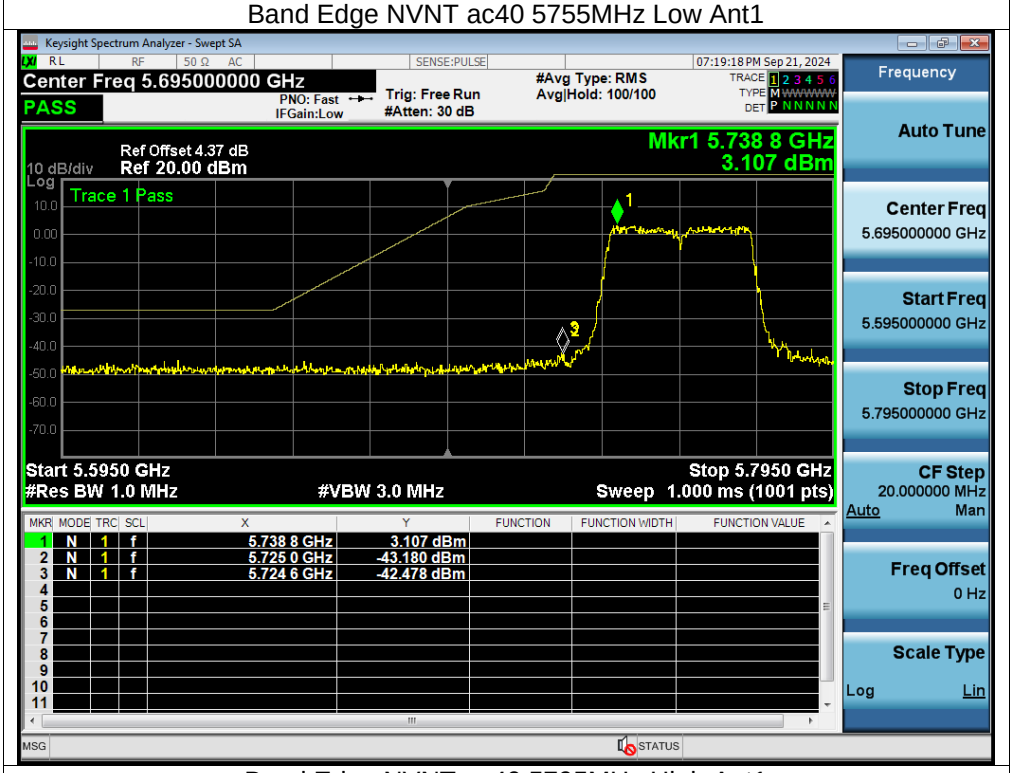
Band Edge NVNT ac20 5745MHz Low Ant1



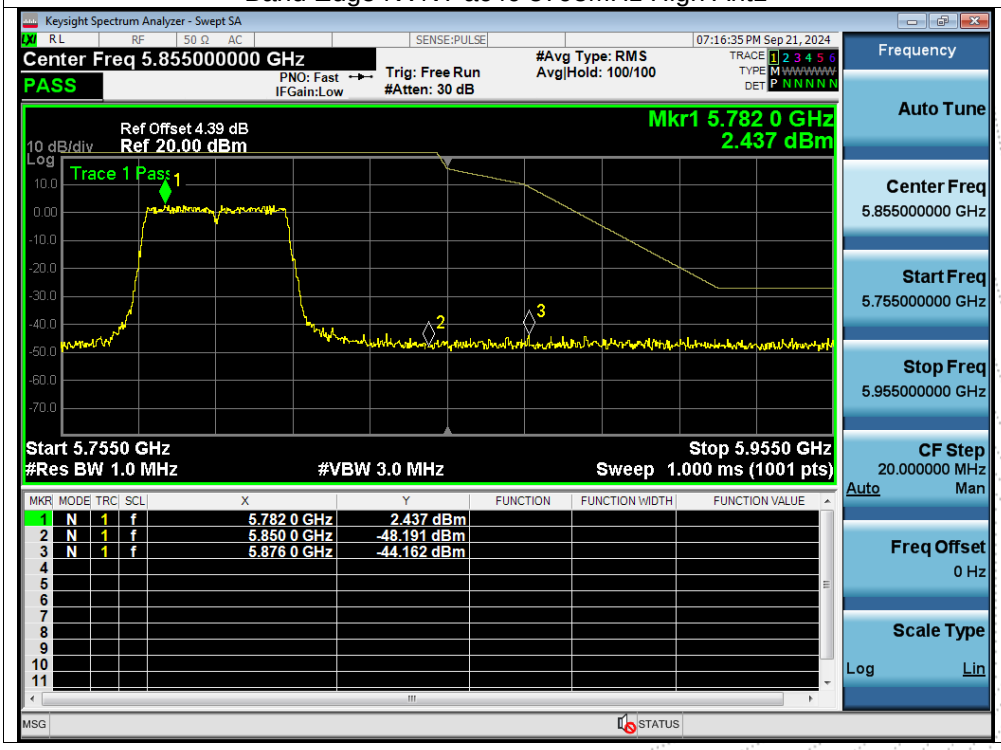
Band Edge NVNT ac20 5825MHz High Ant1



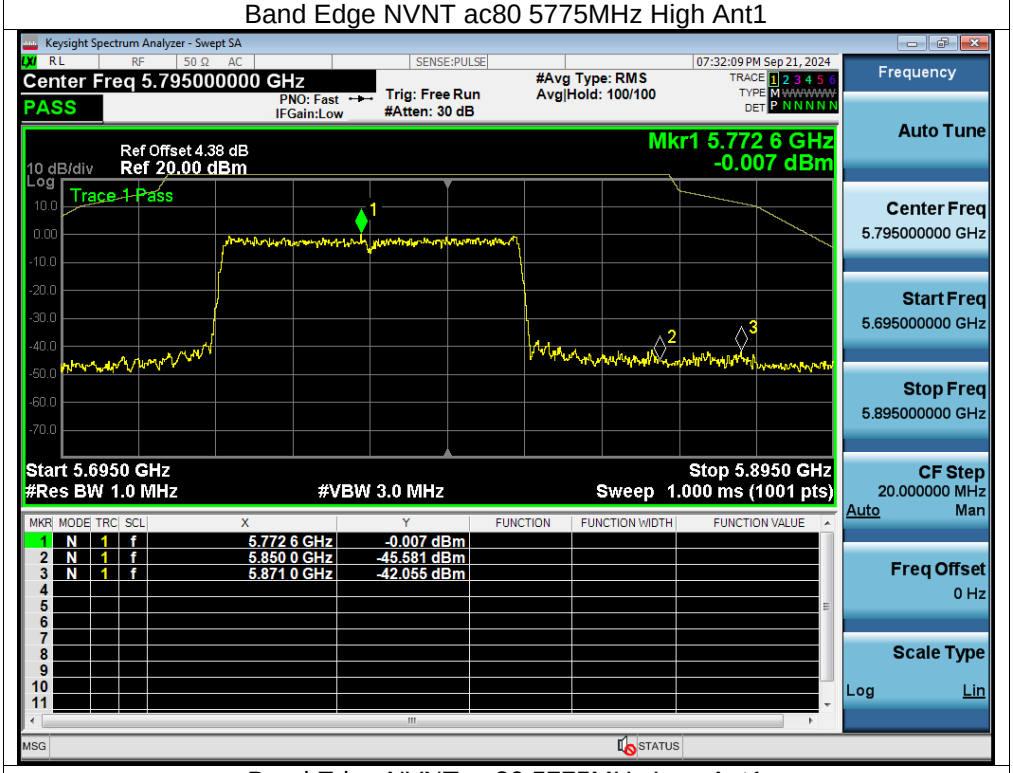
Band Edge NVNT ac40 5755MHz Low Ant1



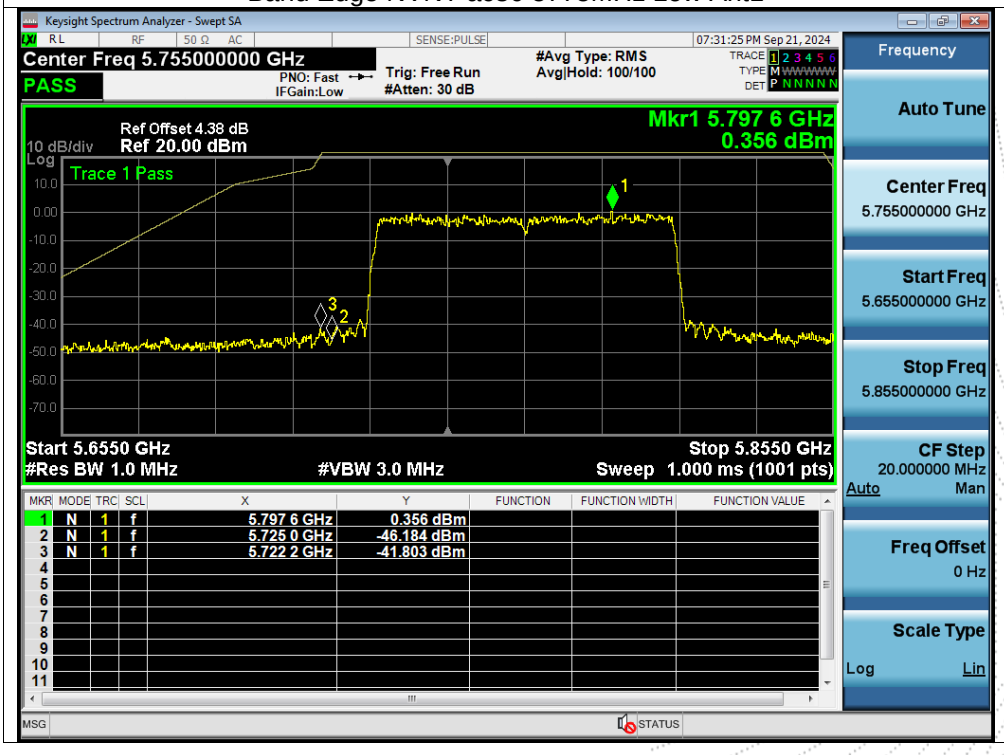
Band Edge NVNT ac40 5795MHz High Ant1



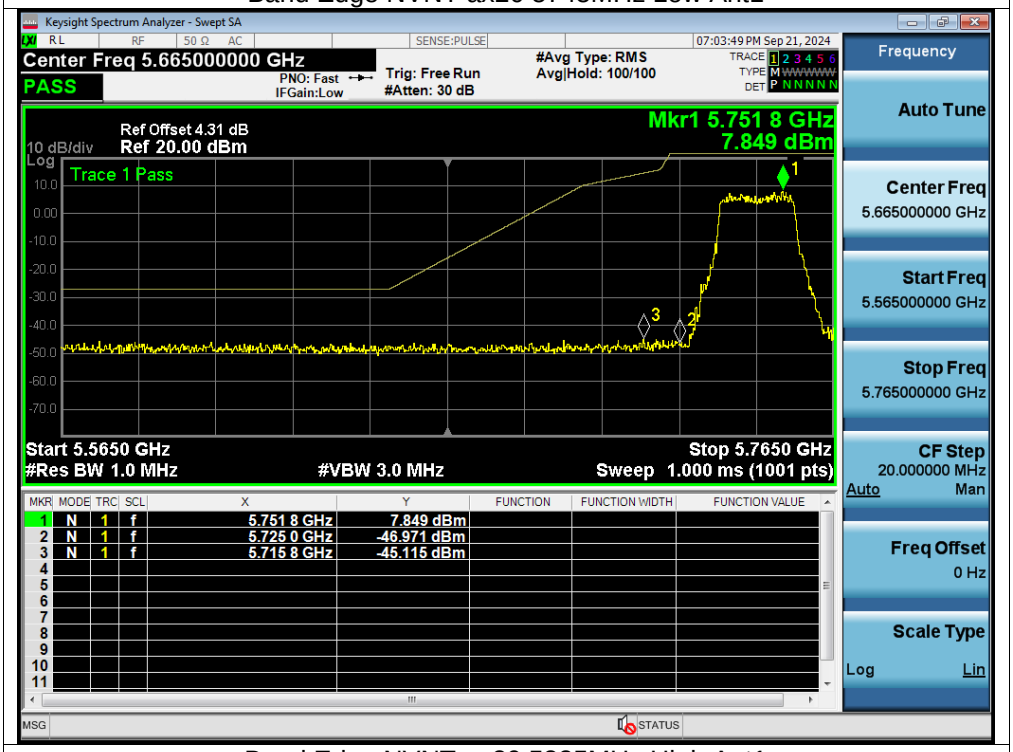
Band Edge NVNT ac80 5775MHz High Ant1



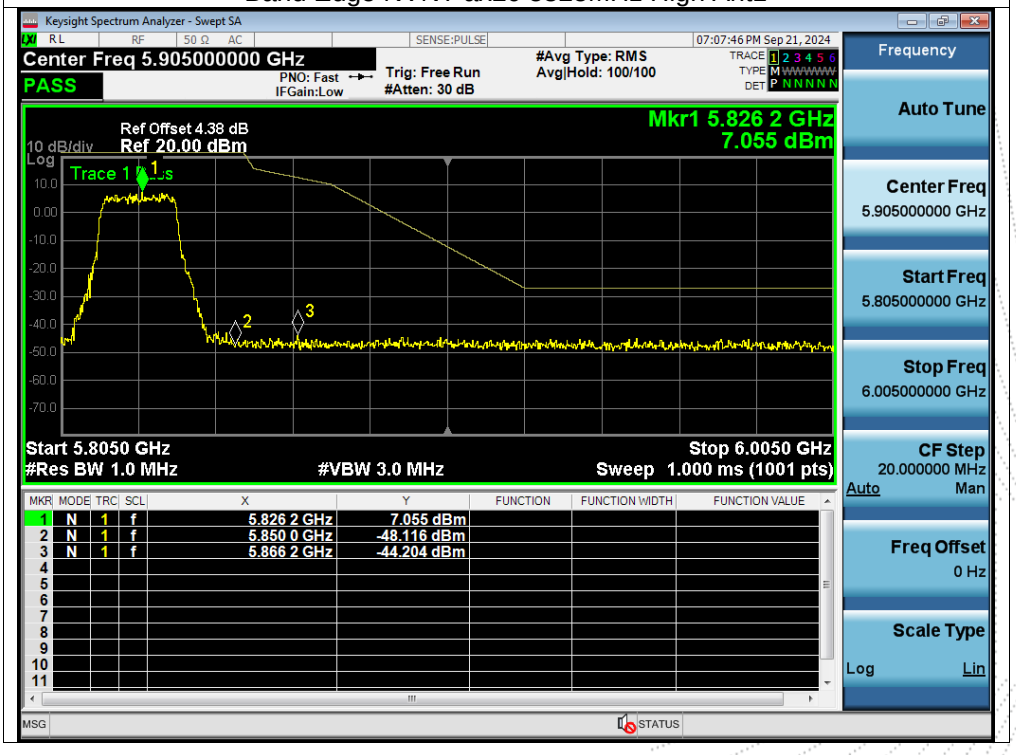
Band Edge NVNT ac80 5775MHz Low Ant1



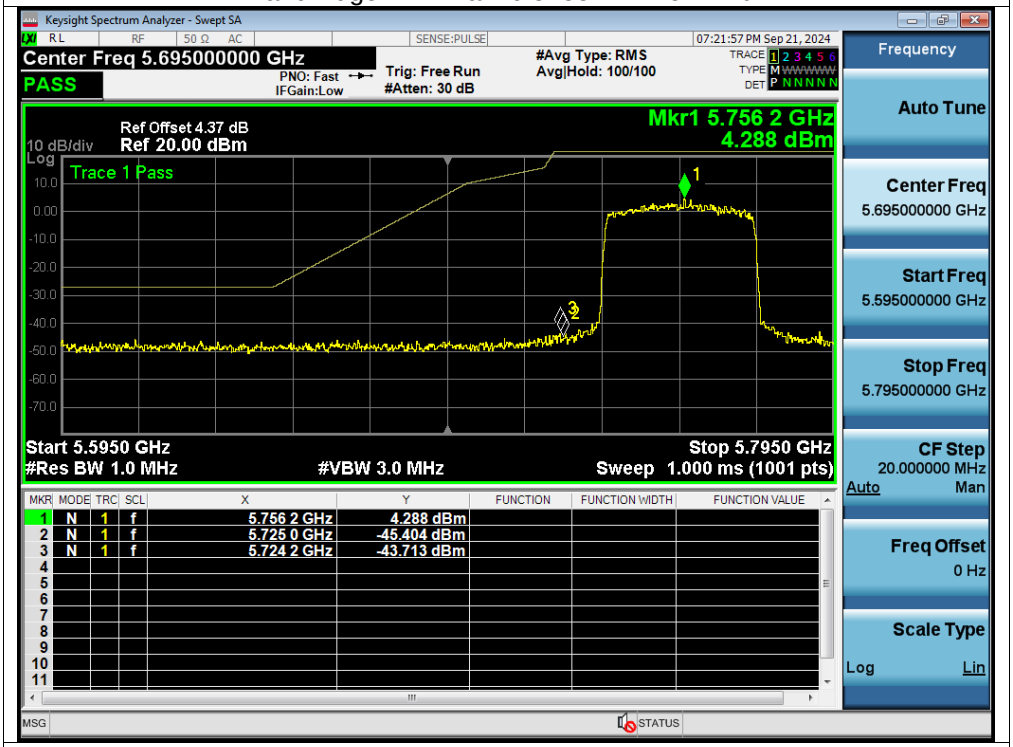
Band Edge NVNT ax20 5745MHz Low Ant1



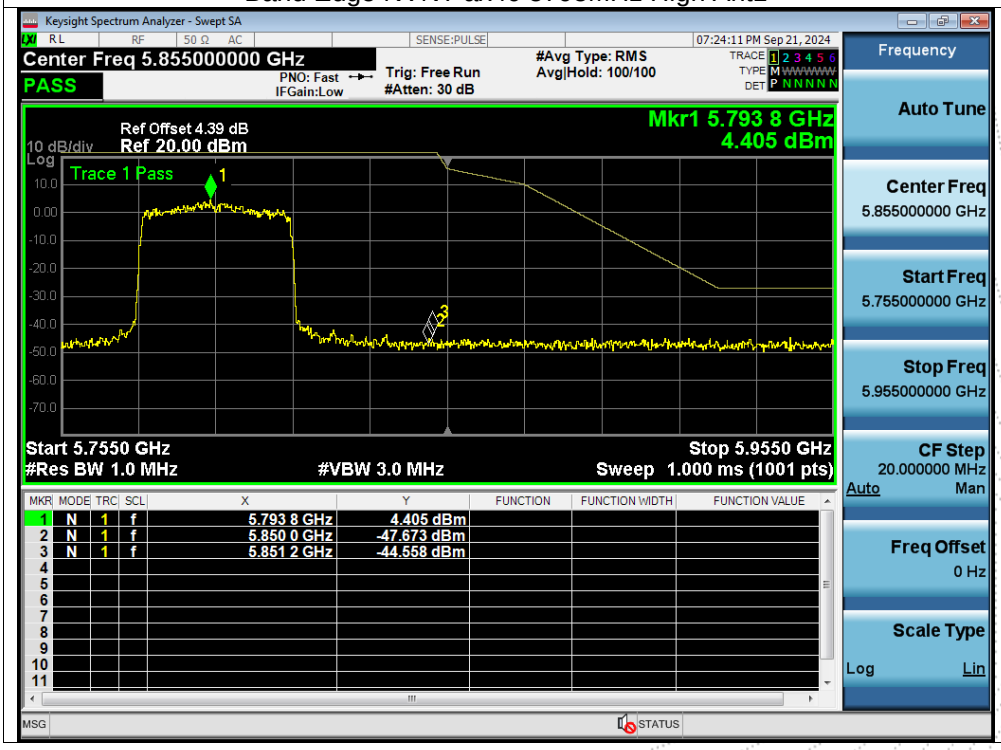
Band Edge NVNT ax20 5825MHz High Ant1



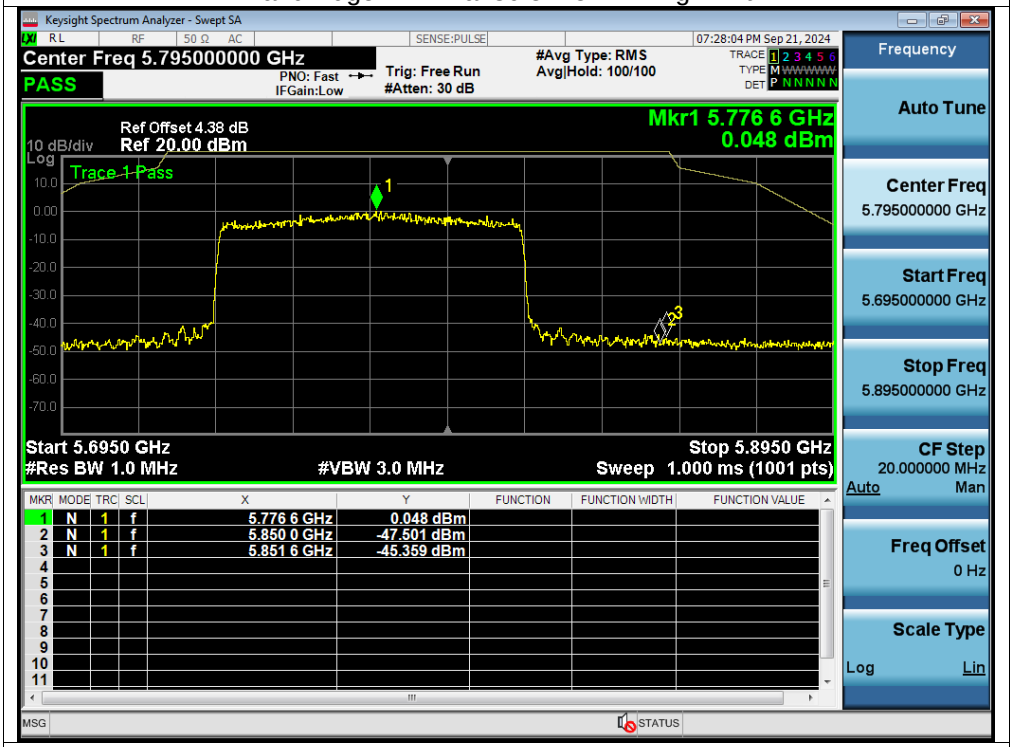
Band Edge NVNT ax40 5755MHz Low Ant1



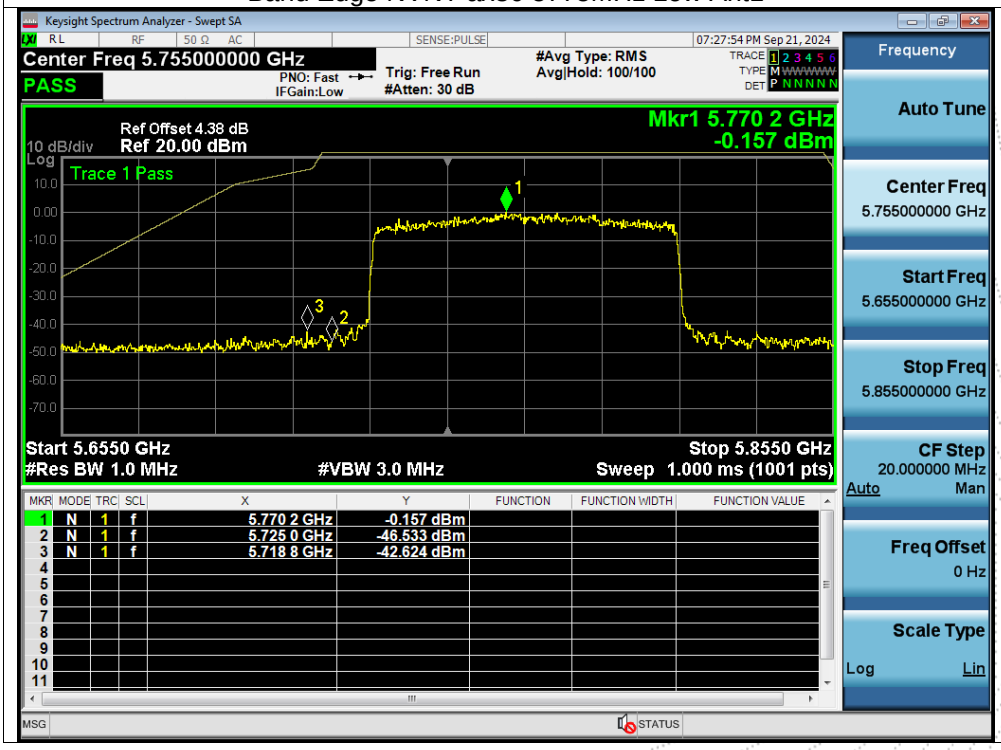
Band Edge NVNT ax40 5795MHz High Ant1



Band Edge NVNT ax80 5775MHz High Ant1

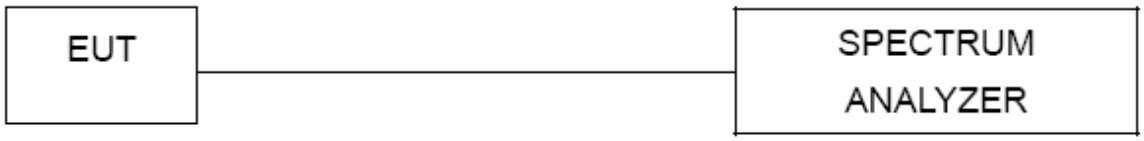


Band Edge NVNT ax80 5775MHz Low Ant1



12. Spurious RF Conducted Emissions

12.1 Block Diagram Of Test Setup



12.2 Limit

Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:
(1)For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(2)For transmitters operating in the 5.725-5.85 GHz band(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge..

12.3 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

12.4 Test Result

Remark: The measurement frequency range is from 9KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

About:26.5GHz-40GHz, The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Note: A(B) Represent the value of antenna A and B, The worst data is AntennaA, only shown Antenna A .
Plot. Antenna A: 5180-5240MHz

Test Graphs

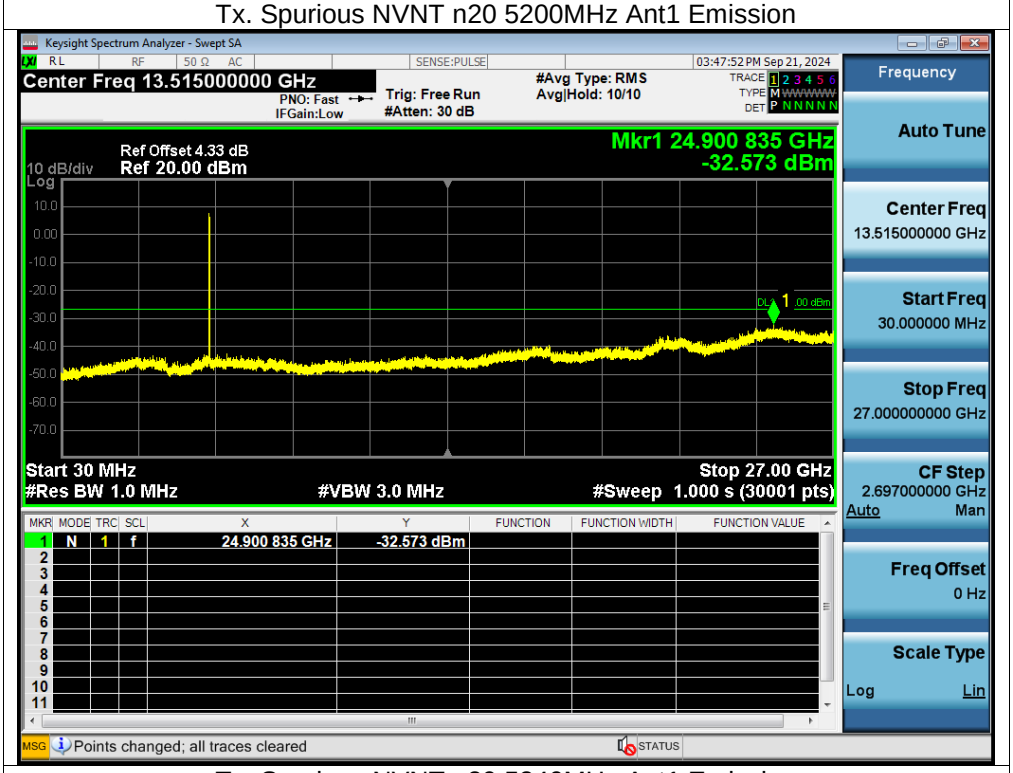
Tx. Spurious NVNT a 5180MHz Ant1 Emission

Tx. Spurious NVNT a 5200MHz Ant1 Emission

Tx. Spurious NVNT a 5240MHz Ant1 Emission

Tx. Spurious NVNT n20 5180MHz Ant1 Emission

Tx. Spurious NVNT n20 5200MHz Ant1 Emission



Tx. Spurious NVNT n20 5240MHz Ant1 Emission

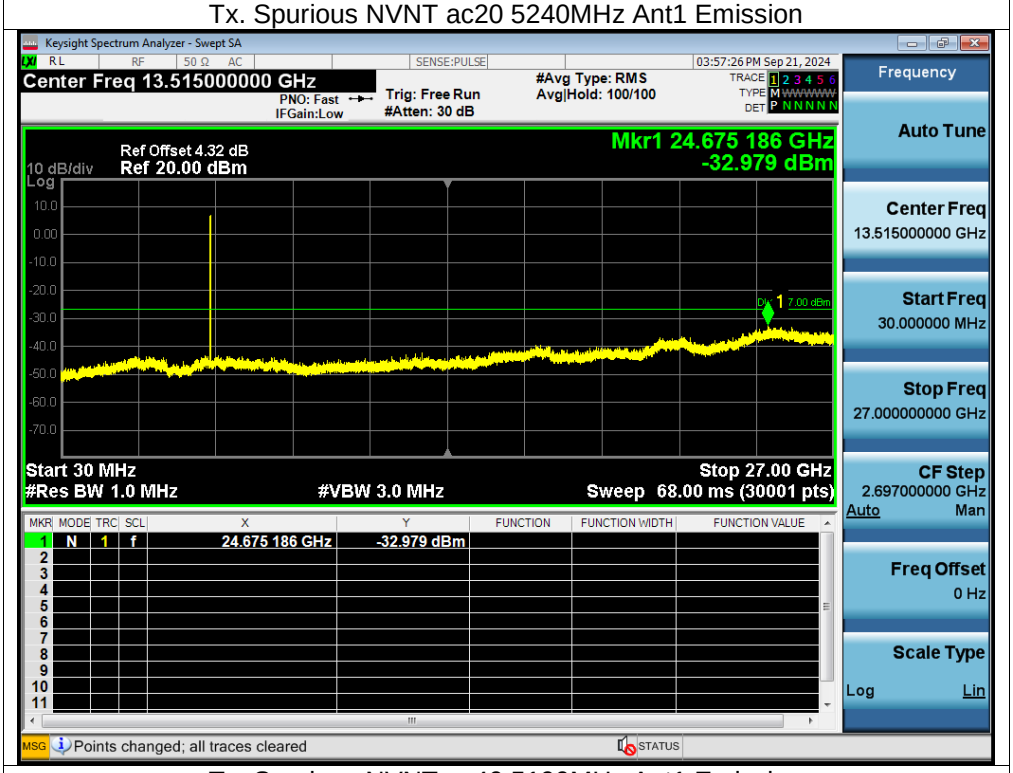
Tx. Spurious NVNT n40 5190MHz Ant1 Emission

Tx. Spurious NVNT n40 5230MHz Ant1 Emission

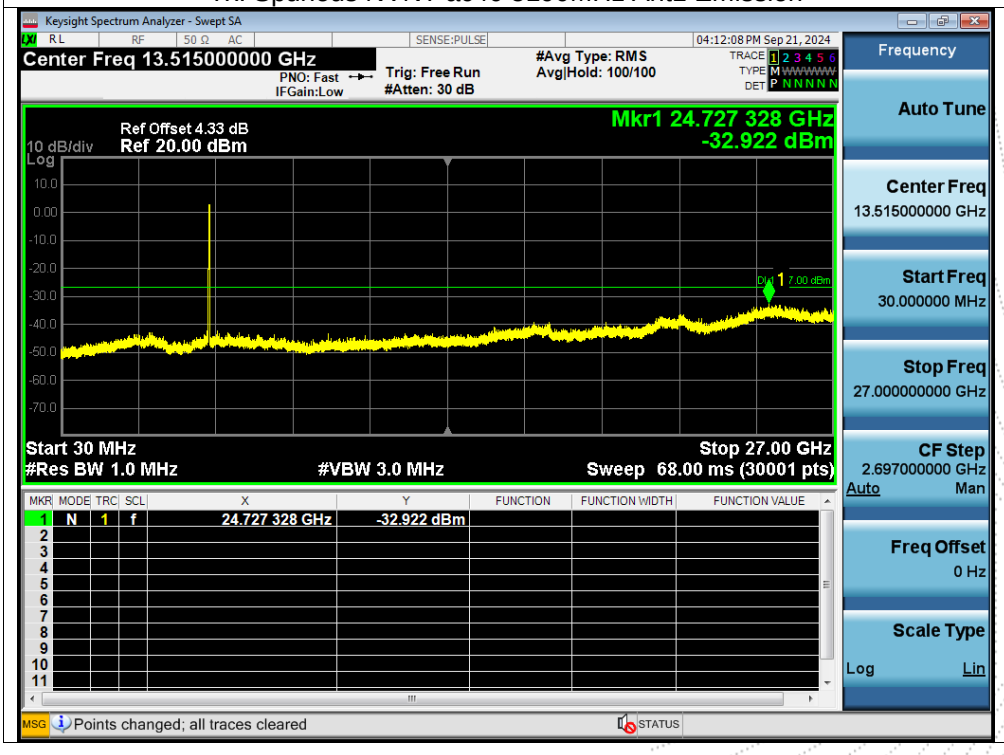
Tx. Spurious NVNT ac20 5180MHz Ant1 Emission

Tx. Spurious NVNT ac20 5200MHz Ant1 Emission

Tx. Spurious NVNT ac20 5240MHz Ant1 Emission

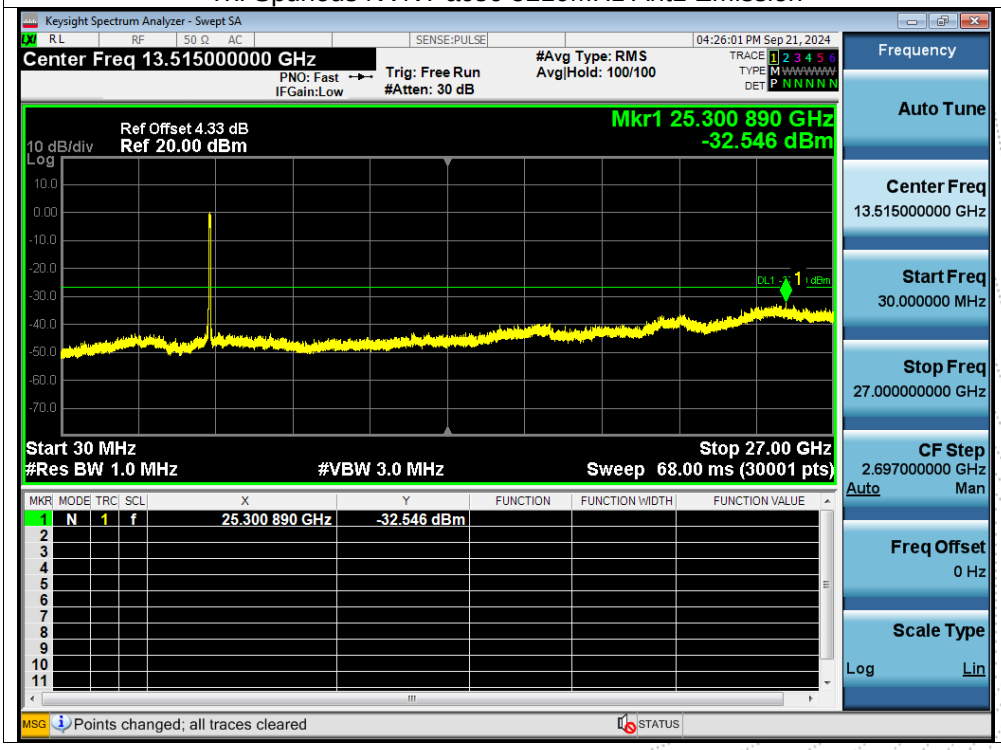


Tx. Spurious NVNT ac40 5190MHz Ant1 Emission



Tx. Spurious NVNT ac40 5230MHz Ant1 Emission

Tx. Spurious NVNT ac80 5210MHz Ant1 Emission



Tx. Spurious NVNT ax20 5180MHz Ant1 Emission

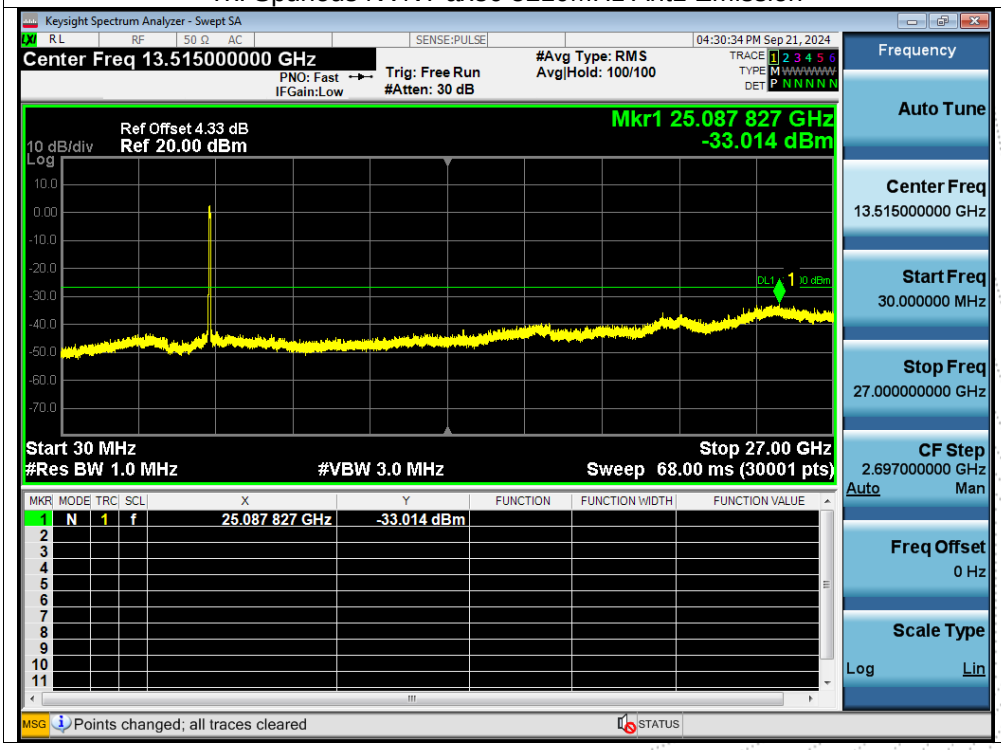
Tx. Spurious NVNT ax20 5200MHz Ant1 Emission

Tx. Spurious NVNT ax20 5240MHz Ant1 Emission

Tx. Spurious NVNT ax40 5190MHz Ant1 Emission

Tx. Spurious NVNT ax40 5230MHz Ant1 Emission

Tx. Spurious NVNT ax80 5210MHz Ant1 Emission

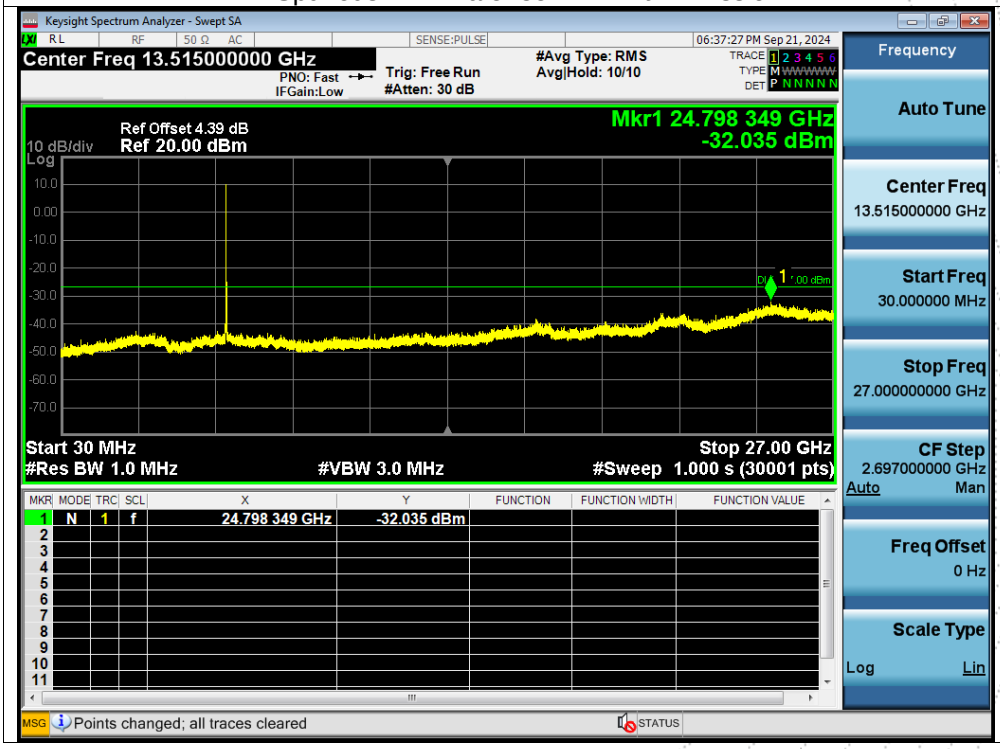


Note: A(B) Represent the value of antenna A and B, The worst data is Antenna A, only shown Antenna A.
Antenna A: 5745-58250MHz

Test Graphs

Tx. Spurious NVNT a 5745MHz Ant1 Emission

Tx. Spurious NVNT a 5785MHz Ant1 Emission



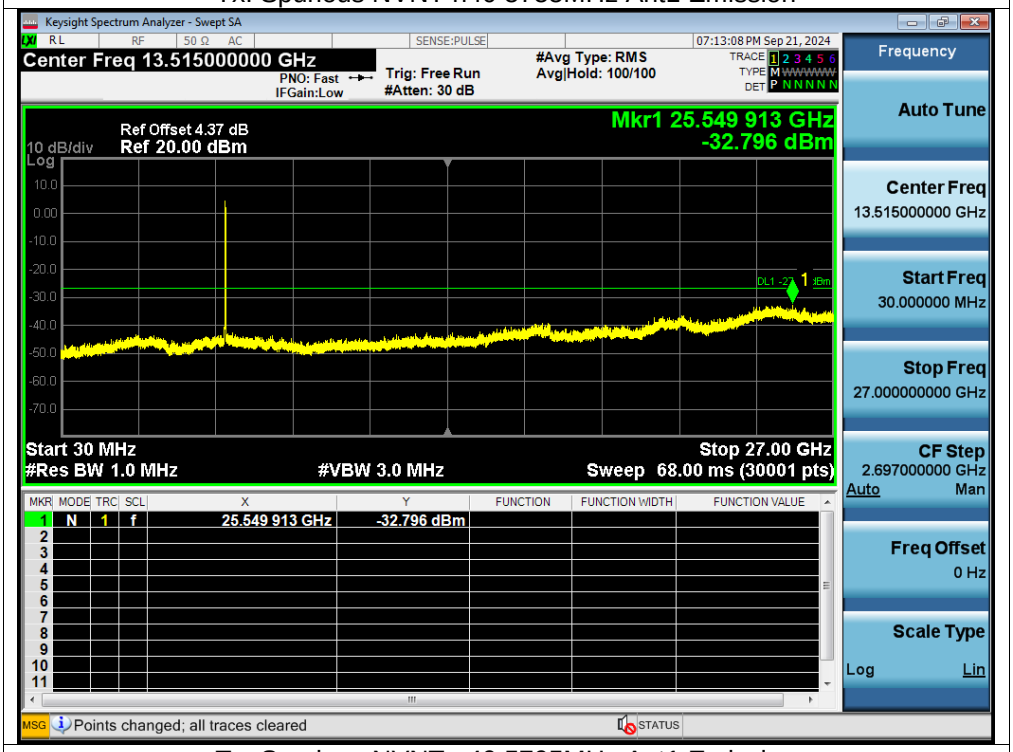
Tx. Spurious NVNT a 5825MHz Ant1 Emission

Tx. Spurious NVNT n20 5745MHz Ant1 Emission

Tx. Spurious NVNT n20 5785MHz Ant1 Emission

Tx. Spurious NVNT n20 5825MHz Ant1 Emission

Tx. Spurious NVNT n40 5755MHz Ant1 Emission

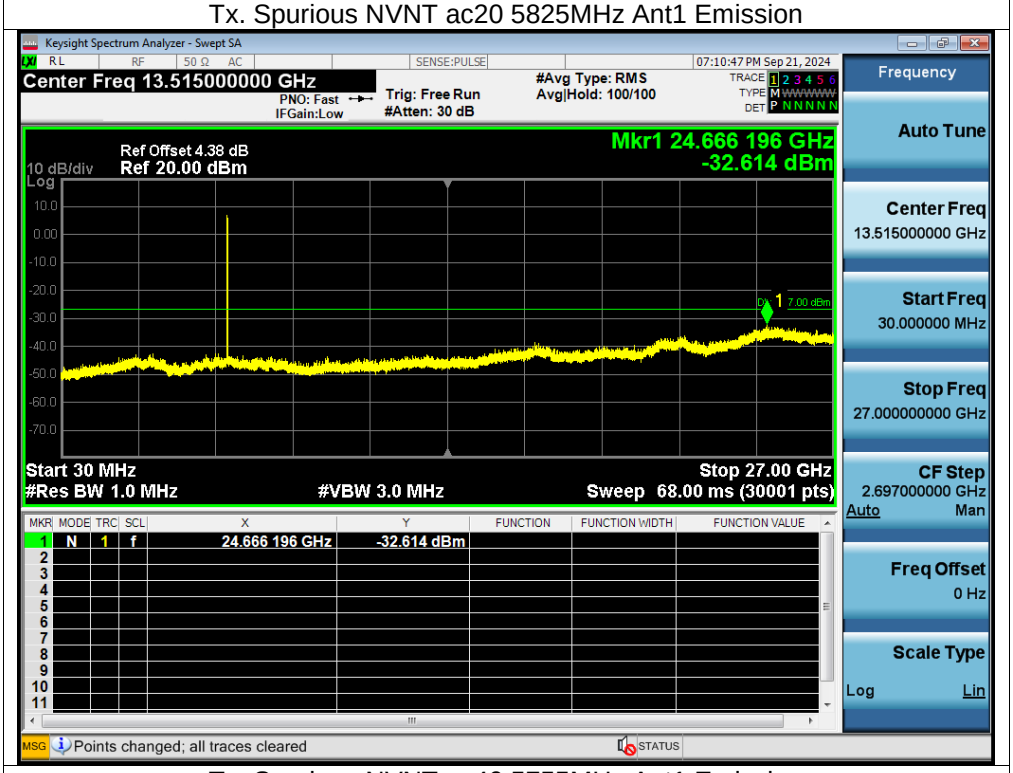


Tx. Spurious NVNT n40 5795MHz Ant1 Emission

Tx. Spurious NVNT ac20 5745MHz Ant1 Emission

Tx. Spurious NVNT ac20 5785MHz Ant1 Emission

Tx. Spurious NVNT ac20 5825MHz Ant1 Emission



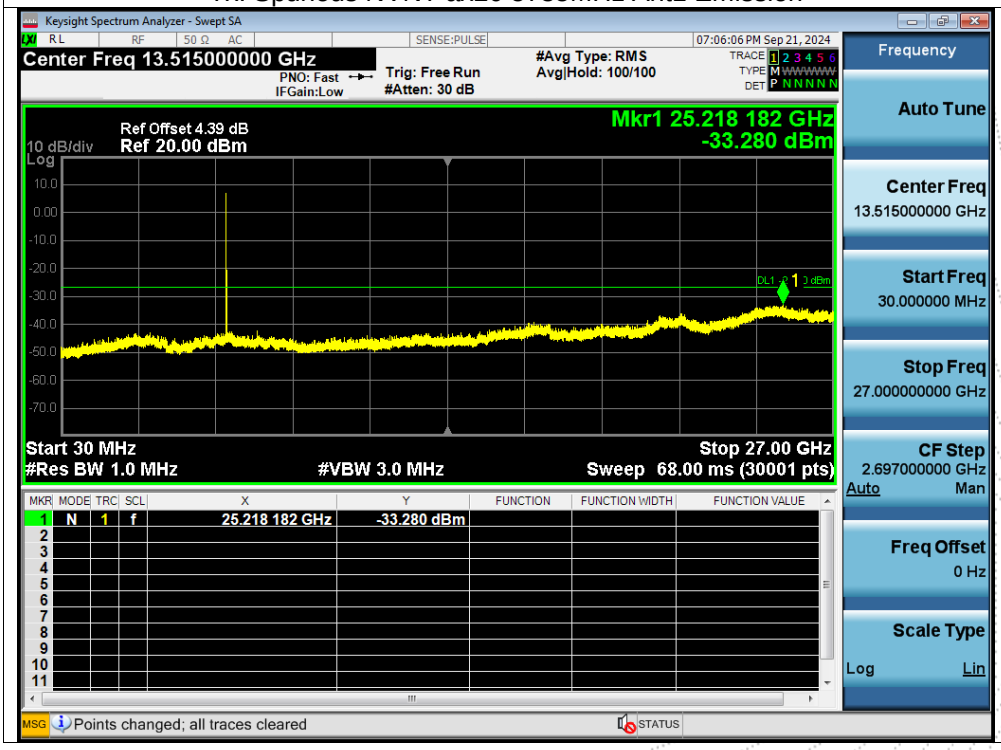
Tx. Spurious NVNT ac40 5755MHz Ant1 Emission

Tx. Spurious NVNT ac40 5795MHz Ant1 Emission

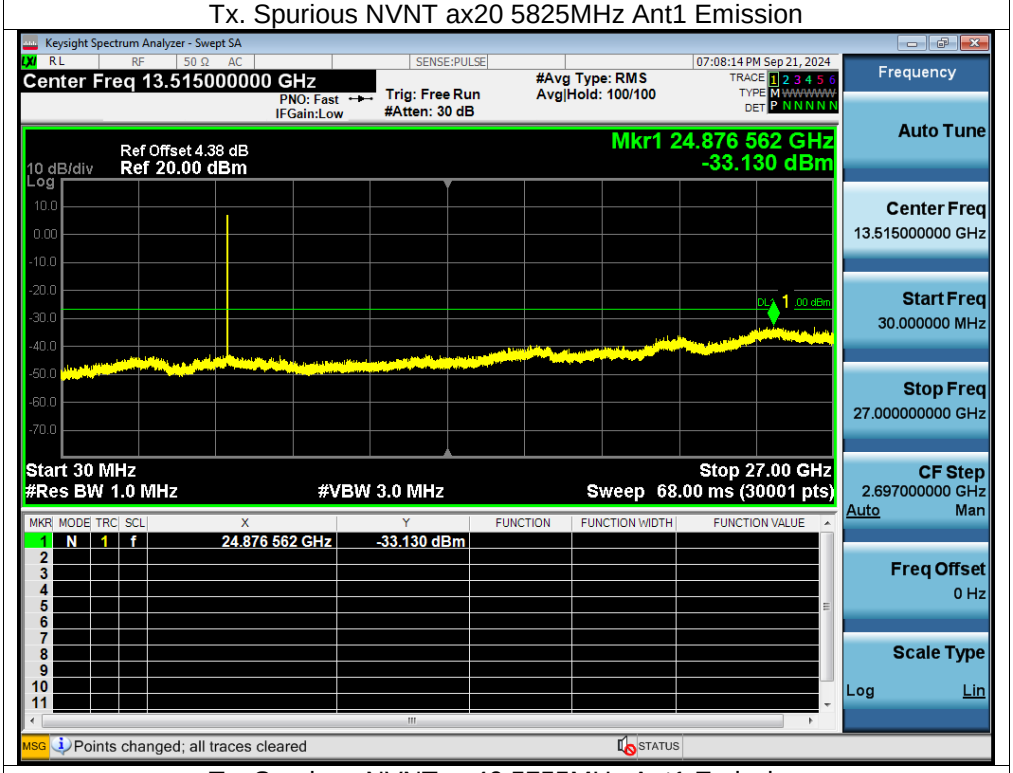
Tx. Spurious NVNT ac80 5775MHz Ant1 Emission

Tx. Spurious NVNT ax20 5745MHz Ant1 Emission

Tx. Spurious NVNT ax20 5785MHz Ant1 Emission

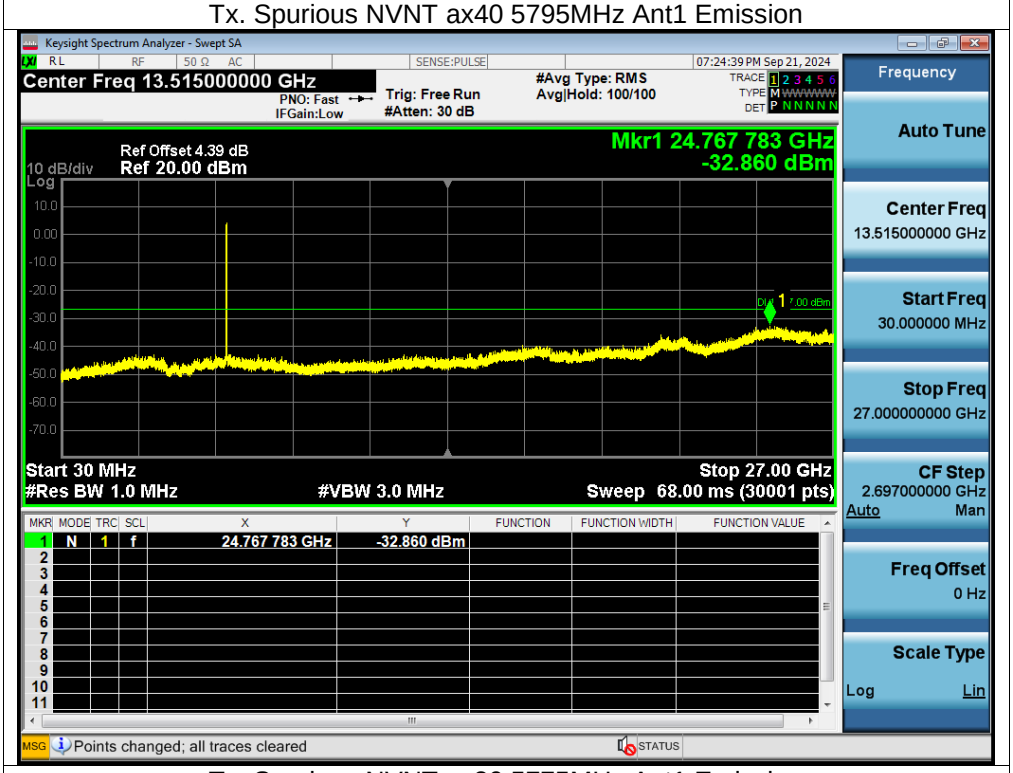


Tx. Spurious NVNT ax20 5825MHz Ant1 Emission

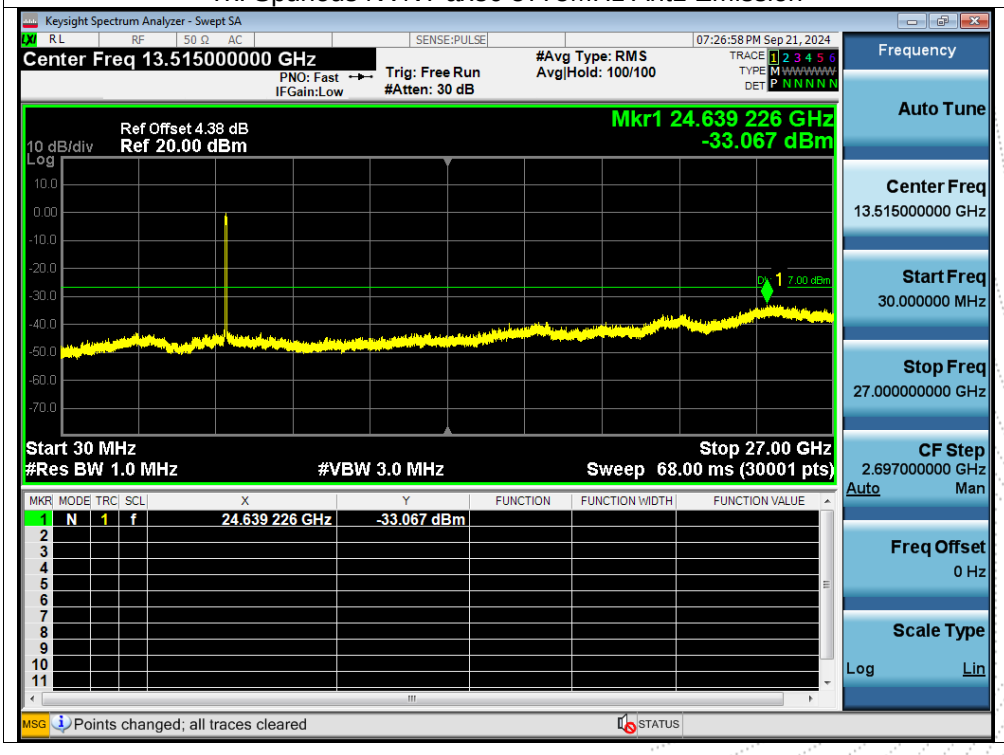


Tx. Spurious NVNT ax40 5755MHz Ant1 Emission

Tx. Spurious NVNT ax40 5795MHz Ant1 Emission

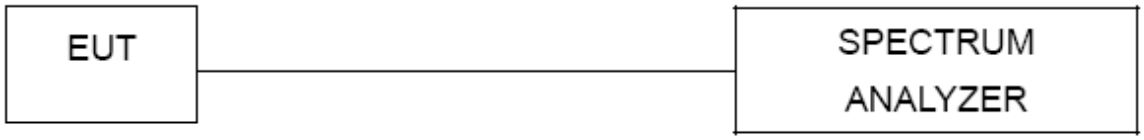


Tx. Spurious NVNT ax80 5775MHz Ant1 Emission



13. Frequency Stability Measurement

13.1 Block Diagram Of Test Setup



13.2 Limit

Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.
The transmitter center frequency tolerance shall be ± 20 ppm maximum for the 5 GHz band (IEEE 802.11n specification)..

13.3 Test Procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of modulation signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and maxhold settings.
5. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 106 ppm and he limit is less than ±20ppm (IEEE 802.11nspecification).
6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
7. Extreme temperature is -20°C~70°C.

13.4 Test Result

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage:	AC120/60Hz
Test Mode:	TX (5.1G) Mode Frequency U-NII-1 (5180-5240MHz)		

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.00	5180.0116	5180	0.0116	2.2485
		V max (V)	13.80	5180.0182	5180	0.0182	3.5152
		V min (V)	10.20	5180.0198	5180	0.0198	3.8157
Limits				5150-5250 MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	-20	5180.0048	5180	0.0048	0.9304
		T (°C)	-10	5180.0051	5180	0.0051	0.9926
		T (°C)	0	5180.0075	5180	0.0075	1.4459
		T (°C)	10	5180.0006	5180	0.0006	0.1119
		T (°C)	20	5180.0082	5180	0.0082	1.5827
		T (°C)	30	5180.0093	5180	0.0093	1.8043
		T (°C)	40	5180.0094	5180	0.0094	1.8199
		T (°C)	50	5180.0108	5180	0.0108	2.0760
		T (°C)	60	5180.0082	5180	0.0082	1.5863
		T (°C)	70	5180.0106	5180	0.0106	2.0535
Limits				5150-5250 MHz			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.00	5200.0108	5200	0.0108	2.0801
		V max (V)	13.80	5200.0022	5200	0.0022	0.4284
		V min (V)	10.20	5200.0018	5200	0.0018	0.3530
Limits				5150-5250 MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	-20	5200.01104	5200	0.01104	2.1231
		T (°C)	-10	5200.00663	5200	0.00663	1.2746
		T (°C)	0	5200.01228	5200	0.01228	2.3616
		T (°C)	10	5200.00680	5200	0.00680	1.3084
		T (°C)	20	5200.00989	5200	0.00989	1.9012
		T (°C)	30	5200.00827	5200	0.00827	1.5900
		T (°C)	40	5200.01324	5200	0.01324	2.5463
		T (°C)	50	5200.00860	5200	0.00860	1.6536
		T (°C)	60	5200.00240	5200	0.00240	0.4607
		T (°C)	70	5200.00798	5200	0.00798	1.5347
Limits				5150-5250 MHz			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency:5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.00	5240.0128	5240	0.0128	2.4360
		V max (V)	13.80	5240.0089	5240	0.0089	1.6917
		V min (V)	10.20	5240.0048	5240	0.0048	0.9199
Limits				5150-5250 MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency:5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	-20	5240.0127	5240	0.0127	2.4330
		T (°C)	-10	5240.0122	5240	0.0122	2.3317
		T (°C)	0	5240.0080	5240	0.0080	1.5318
		T (°C)	10	5240.0047	5240	0.0047	0.8921
		T (°C)	20	5240.0022	5240	0.0022	0.4112
		T (°C)	30	5240.0123	5240	0.0123	2.3414
		T (°C)	40	5240.0101	5240	0.0101	1.9186
		T (°C)	50	5240.0021	5240	0.0021	0.3979
		T (°C)	60	5240.0057	5240	0.0057	1.0865
		T (°C)	70	5240.0057	5240	0.0057	1.0796
Limits				5150-5250 MHz			
Result				Complies			

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Test Voltage:	AC120/60HZ
Test Mode:	TX (5.8G) Mode Frequency U-NII-3 (5745-5825MHz)		

Voltage vs. Frequency Stabilit

TEST CONDITIONS				Reference Frequency: 5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.00	5745.00384	5745	0.00384	0.6688
		V max (V)	13.80	5745.00873	5745	0.00873	1.5197
		V min (V)	10.20	5745.00542	5745	0.00542	0.9428
Limits				5725-5850 MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	-20	5745.00113	5745	0.00113	0.1966
		T (°C)	-10	5745.01096	5745	0.01096	1.9072
		T (°C)	0	5745.00564	5745	0.00564	0.9822
		T (°C)	10	5745.00054	5745	0.00054	0.0935
		T (°C)	20	5745.00796	5745	0.00796	1.3856
		T (°C)	30	5745.01005	5745	0.01005	1.7488
		T (°C)	40	5745.00136	5745	0.00136	0.2374
		T (°C)	50	5745.01182	5745	0.01182	2.0573
		T (°C)	60	5745.00888	5745	0.00888	1.5465
		T (°C)	70	5745.00381	5745	0.00381	0.6633
Limits				5725-5850 MHz			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency:5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.00	5785.01071	5785	0.01071	1.8517
		V max (V)	13.80	5785.00755	5785	0.00755	1.3049
		V min (V)	10.20	5785.00673	5785	0.00673	1.1637
Limits				5725-5850 MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency:5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	-20	5785.00301	5785	0.00301	0.5199
		T (°C)	-10	5785.00580	5785	0.00580	1.0026
		T (°C)	0	5785.00626	5785	0.00626	1.0824
		T (°C)	10	5785.00926	5785	0.00926	1.6009
		T (°C)	20	5785.00829	5785	0.00829	1.4333
		T (°C)	30	5785.00515	5785	0.00515	0.8897
		T (°C)	40	5785.01299	5785	0.01299	2.2449
		T (°C)	50	5785.00092	5785	0.00092	0.1596
		T (°C)	60	5785.01316	5785	0.01316	2.2755
		T (°C)	70	5785.00773	5785	0.00773	1.3354
Limits				5725-5850 MHz			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency:5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.00	5825.00360	5825	0.00360	0.6180
		V max (V)	13.80	5825.00502	5825	0.00502	0.8624
		V min (V)	10.20	5825.00718	5825	0.00718	1.2324
Limits				5725-5850 MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency:5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	-20	5825.00863	5825	0.00863	1.4813
		T (°C)	-10	5825.01153	5825	0.01153	1.9796
		T (°C)	0	5825.01261	5825	0.01261	2.1650
		T (°C)	10	5825.00550	5825	0.00550	0.9443
		T (°C)	20	5825.00213	5825	0.00213	0.3655
		T (°C)	30	5825.00120	5825	0.00120	0.2056
		T (°C)	40	5825.00079	5825	0.00079	0.1361
		T (°C)	50	5825.00758	5825	0.00758	1.3006
		T (°C)	60	5825.00399	5825	0.00399	0.6852
		T (°C)	70	5825.00025	5825	0.00025	0.0435
Limits				5725-5850 MHz			
Result				Complies			

14. Duty Cycle Of Test Signal

14.1 Standard Requirement

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle. All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

14.2 Formula

Duty Cycle = Ton / (Ton+Toff)

14.3 Test Procedure

1.Set span = Zero
2. RBW = 8MHz
3. VBW = 8MHz,
4. Detector = Peak

14.4 Test Result

Condition	Mode	Frequency (MHz)	Antenna	Duty Cycle (%)	Correction Factor (dB)	1/T (kHz)
NVNT	a	5180	AntA	100	0	0
NVNT	a	5200	AntA	100	0	0
NVNT	a	5240	AntA	100	0	0
NVNT	n20	5180	AntA	100	0	0
NVNT	n20	5200	AntA	100	0	0
NVNT	n20	5240	AntA	100	0	0
NVNT	n40	5190	AntA	100	0	0
NVNT	n40	5230	AntA	100	0	0
NVNT	ac20	5180	AntA	100	0	0
NVNT	ac20	5200	AntA	100	0	0
NVNT	ac20	5240	AntA	100	0	0
NVNT	ac40	5190	AntA	100	0	0
NVNT	ac40	5230	AntA	100	0	0
NVNT	ac80	5210	AntA	100	0	0
NVNT	ax20	5180	AntA	100	0	0
NVNT	ax20	5200	AntA	100	0	0
NVNT	ax20	5240	AntA	100	0	0
NVNT	ax40	5190	AntA	100	0	0
NVNT	ax40	5230	AntA	100	0	0
NVNT	ax80	5210	AntA	100	0	0

15. Antenna Requirement

15.1 Limit

15.203 requirement:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217,§15.219, or §15.221. Further, this requirement does not apply to intentionalradiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

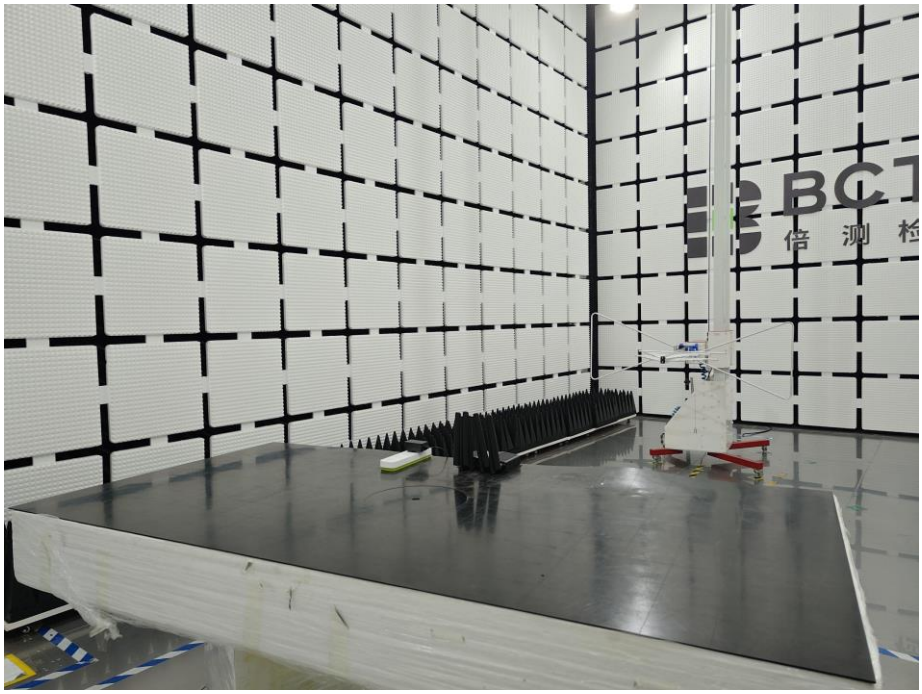
15.2 Test Result

The EUT antenna is external antenna, not using a standard antenna jack or electrical connector for antenna replacement, fulfill the requirement of this section.

16. EUT Test Setup Photographs

Conducted emissions

Radiated Measurement Photos



STATEMENT

1. The equipment lists are traceable to the national reference standards.

2. The test report can not be partially copied unless prior written approval is issued from our lab.

3. The test report is invalid without the "special seal for inspection and testing".

4. The test report is invalid without the signature of the approver.

5. The test process and test result is only related to the Unit Under Test.

6. Sample information is provided by the client and the laboratory is not responsible for its authenticity.

7. The quality system of our laboratory is in accordance with ISO/IEC17025.

8. If there is any objection to this test report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

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※※※※※ **END** ※※※※※