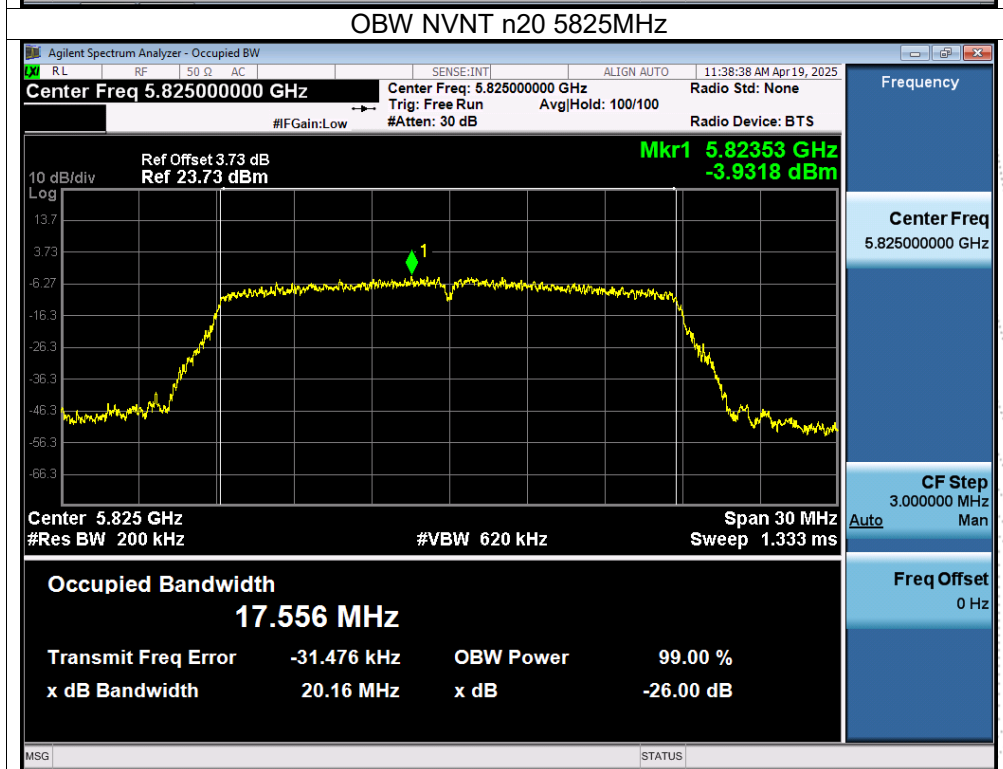
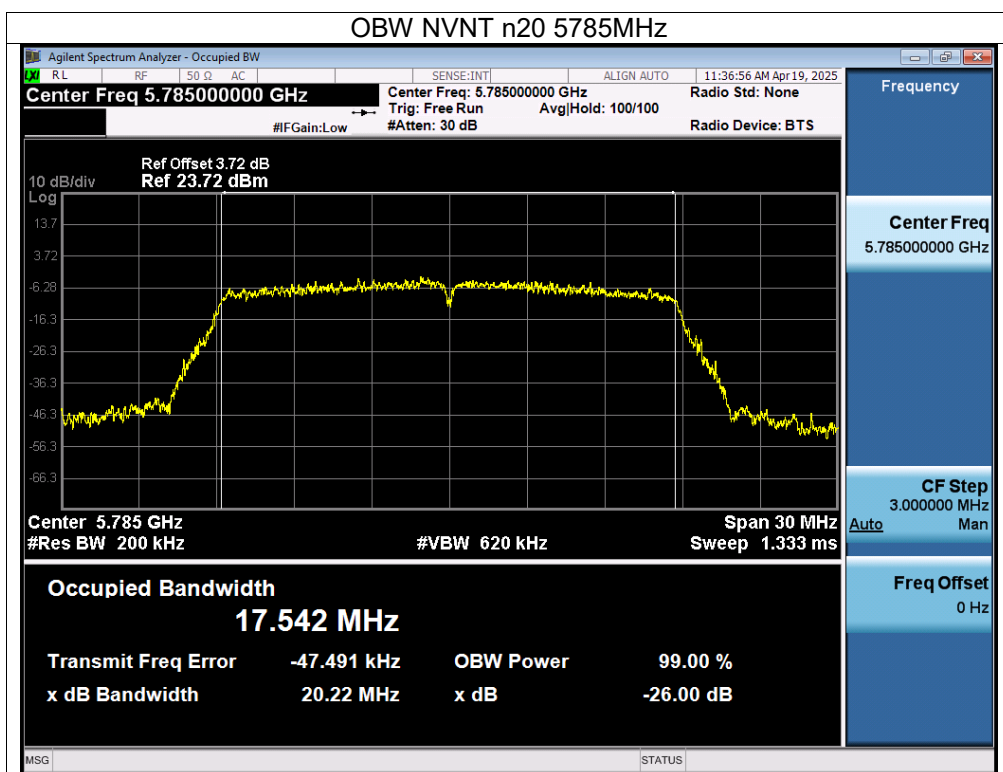
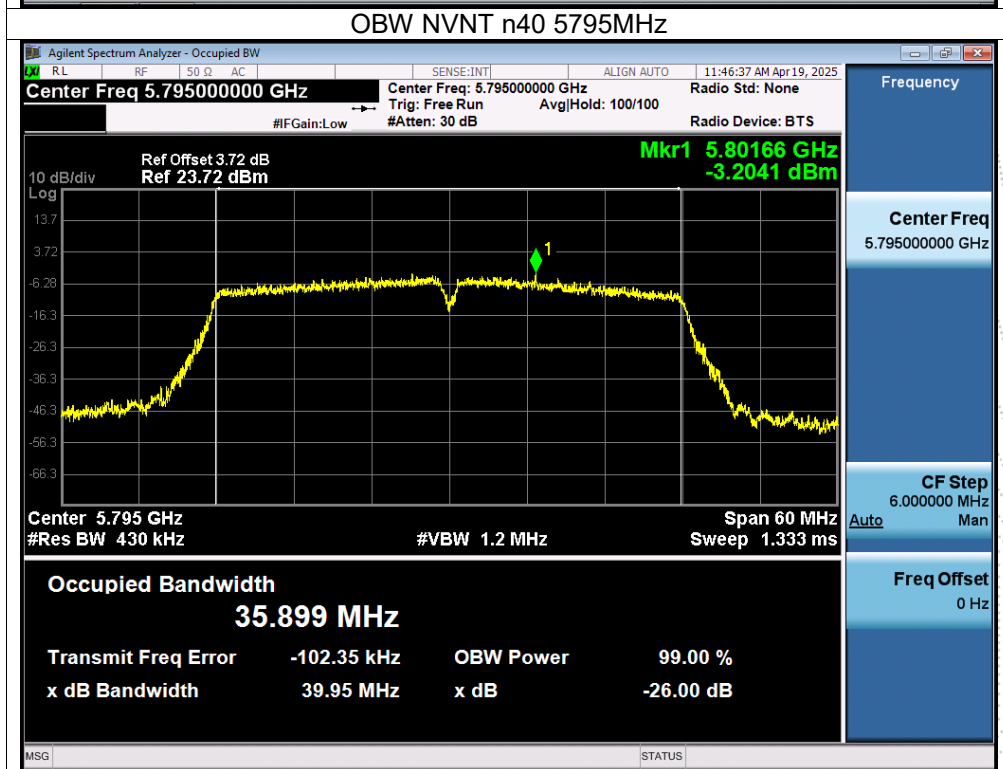
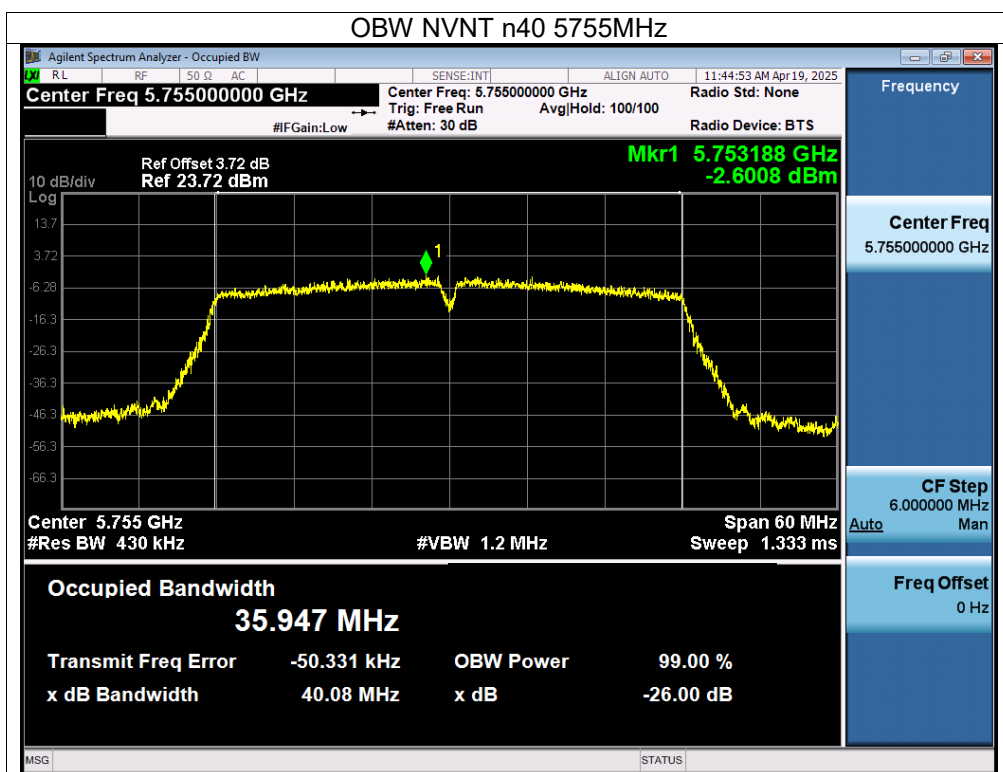
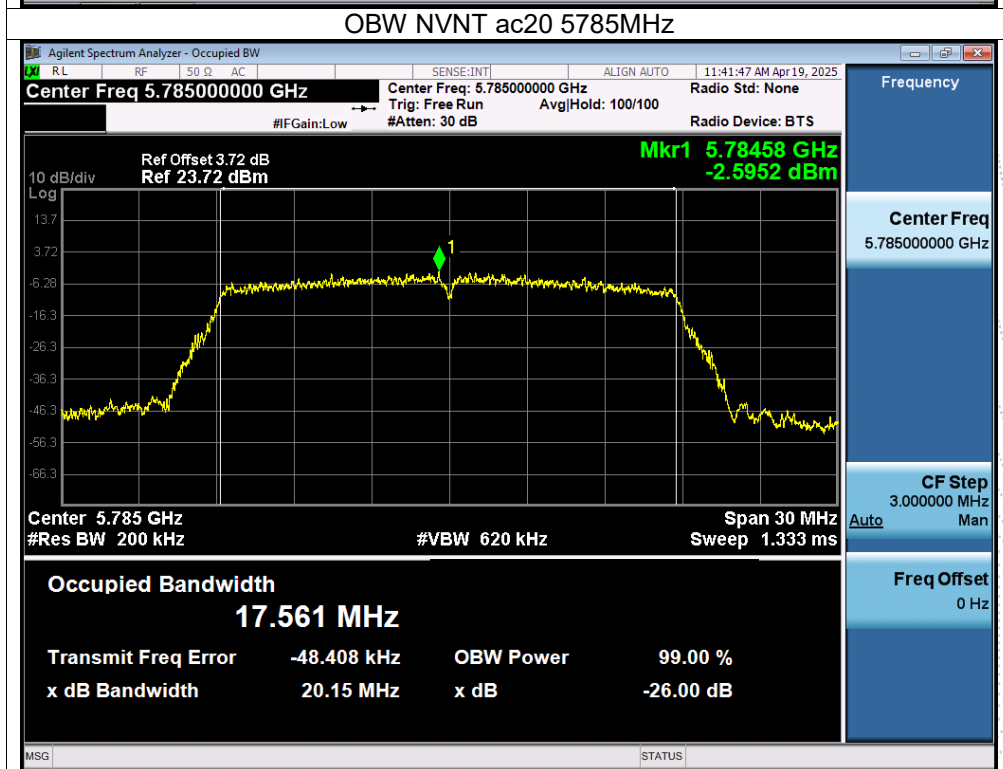
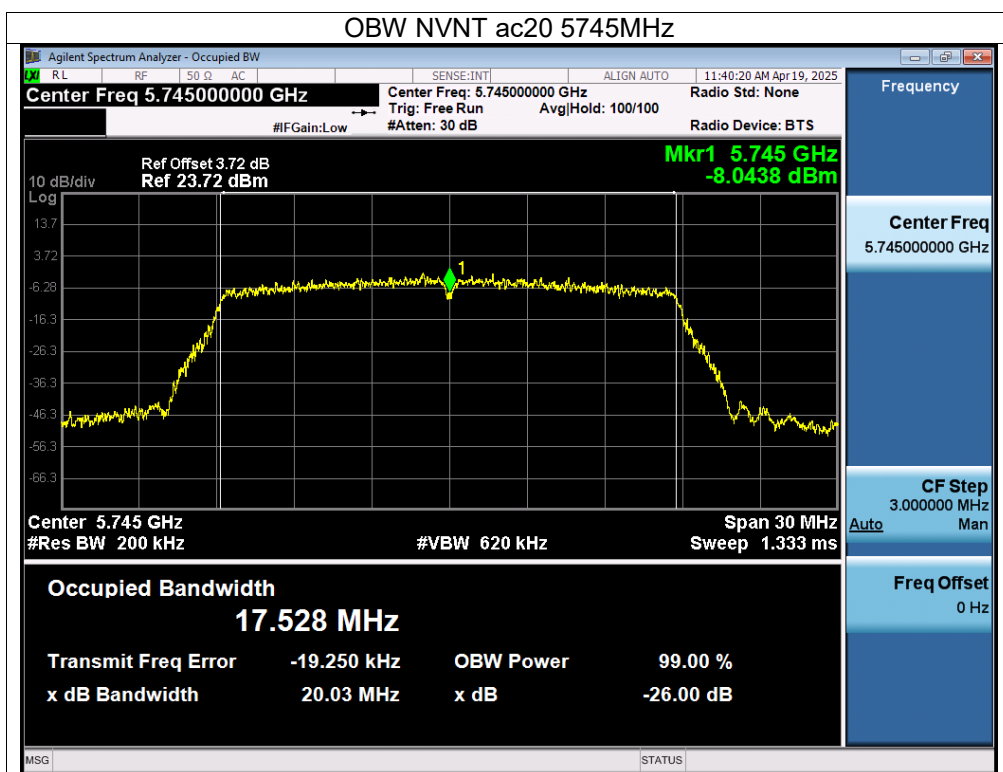
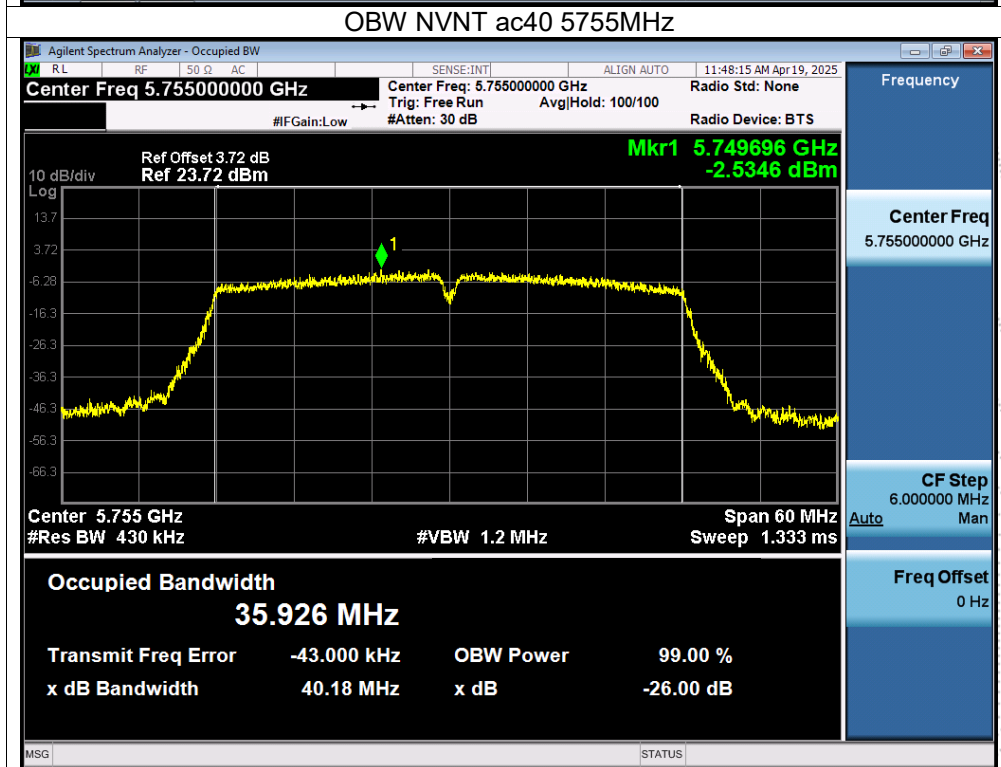
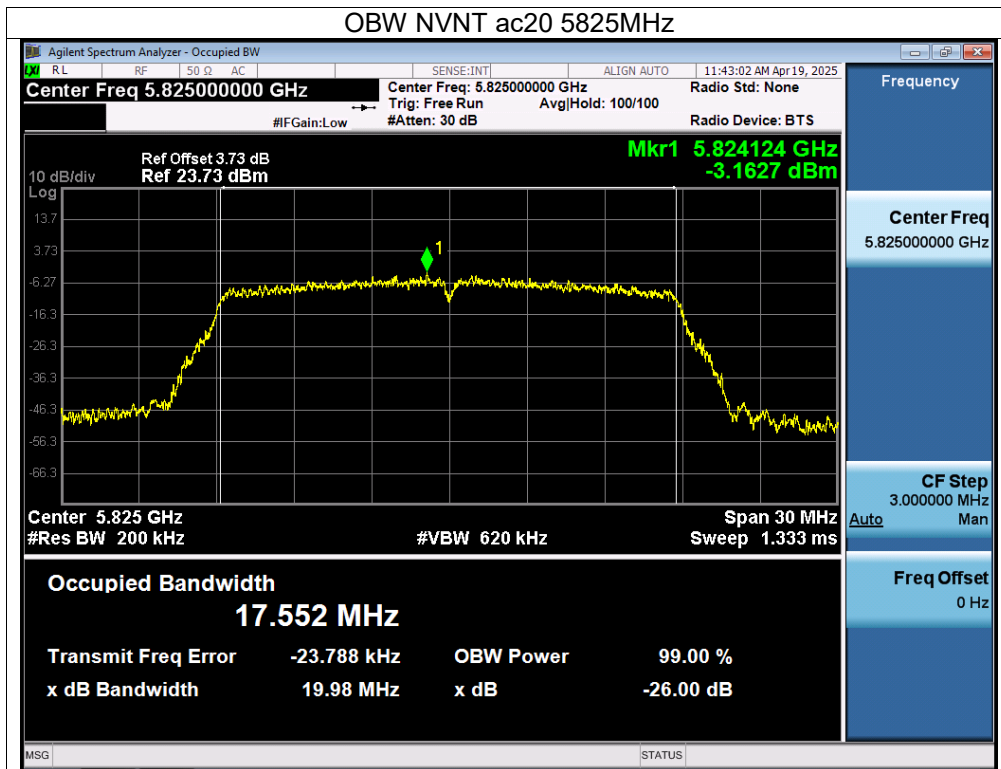
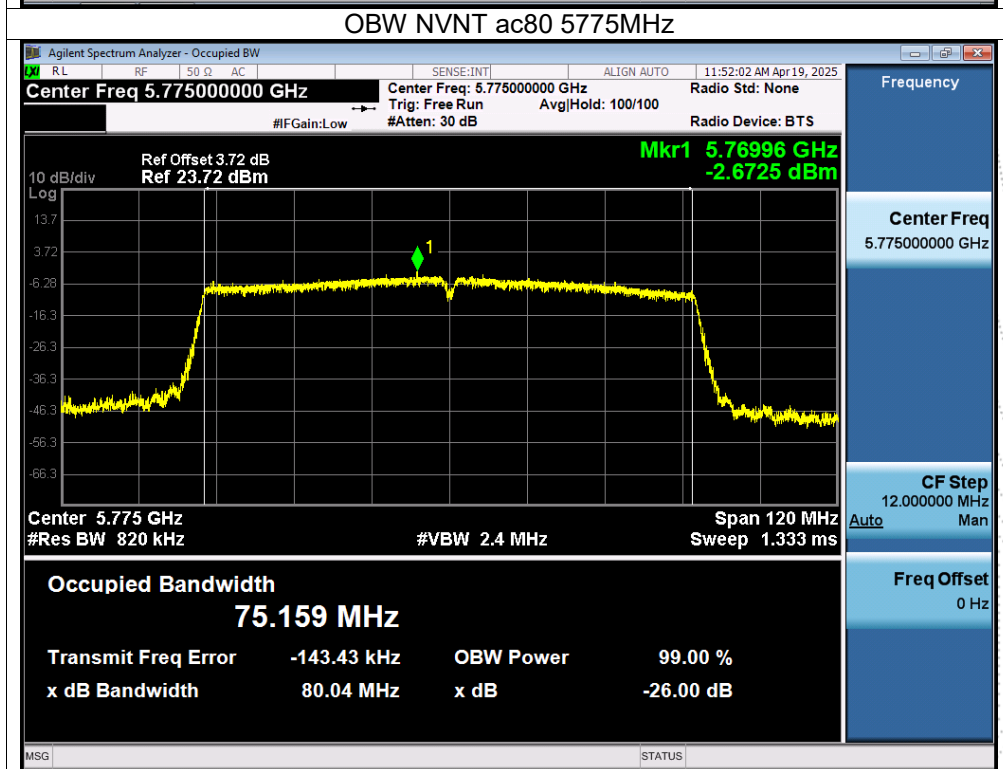
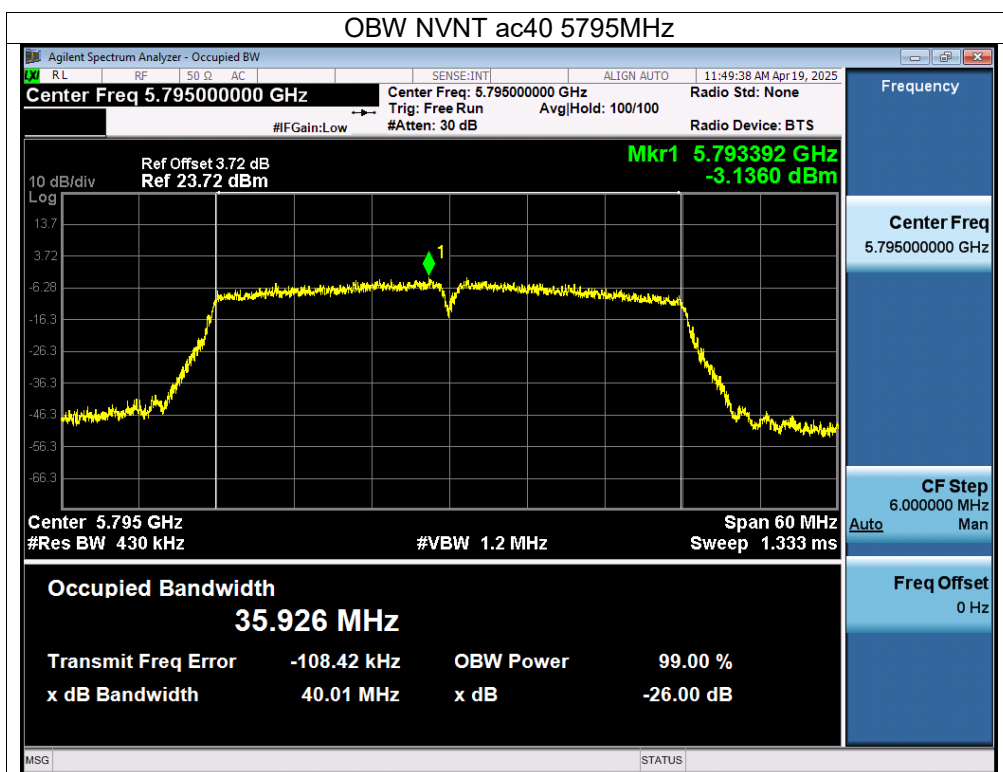












10. Maximum Conducted Output Power

10.1 Block Diagram Of Test Setup



10.2 Limit

According to FCC §15.407

The maximum conducted output power should not exceed:

Frequency Band(MHz)	Limit
5150~5250	250mW
5725~5850	1W

10.3 Test Procedure

Maximum conducted output power may be measured using a spectrum analyzer/EMI receiver or an RF power meter.

1. Device Configuration

If possible, configure or modify the operation of the EUT so that it transmits continuously at its maximum power control level (see section II.B.).

- The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (to no lower than 98 percent) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.
- If continuous transmission (or at least 98 percent duty cycle) cannot be achieved due to hardware limitations (e.g., overheating), the EUT shall be operated at its maximum power control level with the transmit duration as long as possible and the duty cycle as high as possible.

2. Measurement using a Spectrum Analyzer or EMI Receiver (SA)

Measurement of maximum conducted output power using a spectrum analyzer requires integrating the spectrum across a frequency span that encompasses, at a minimum, either the EBW or the 99-percent occupied bandwidth of the signal.¹ However, the EBW must be used to determine bandwidth dependent limits on maximum conducted output power in accordance with § 15.407(a).

a) The test method shall be selected as follows: (i) Method SA-1 or SA-1 Alternative (averaging with the EUT transmitting at full power throughout each sweep) shall be applied if either of the following conditions can be satisfied:

- The EUT transmits continuously (or with a duty cycle ≥ 98 percent).
- Sweep triggering or gating can be implemented in a way that the device transmits at the maximum power control level throughout the duration of each of the instrument sweeps to be averaged. This condition can generally be achieved by triggering the instrument's sweep if the duration of the sweep (with the analyzer configured as in Method SA-1, below) is equal to or shorter than the duration T of each transmission from the EUT and if those transmissions exhibit full power throughout their durations.

(ii) Method SA-2 or SA-2 Alternative (averaging across on and off times of the EUT transmissions, followed by duty cycle correction) shall be applied if the conditions of (i) cannot be achieved and the transmissions exhibit a constant duty cycle during the measurement duration. Duty cycle will be considered to be constant if variations are less than ± 2 percent.

(iii) Method SA-3 (RMS detection with max hold) or SA-3 Alternative (reduced VBW with max hold) shall be applied if the conditions of (i) and (ii) cannot be achieved.

b) Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep): (i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(ii) Set RBW = 1 MHz.

(iii) Set VBW ≥ 3 MHz.

(iv) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is $\leq$ RBW/2, so that narrowband signals are not lost between frequency bins.)

(v) Sweep time = auto.

(vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

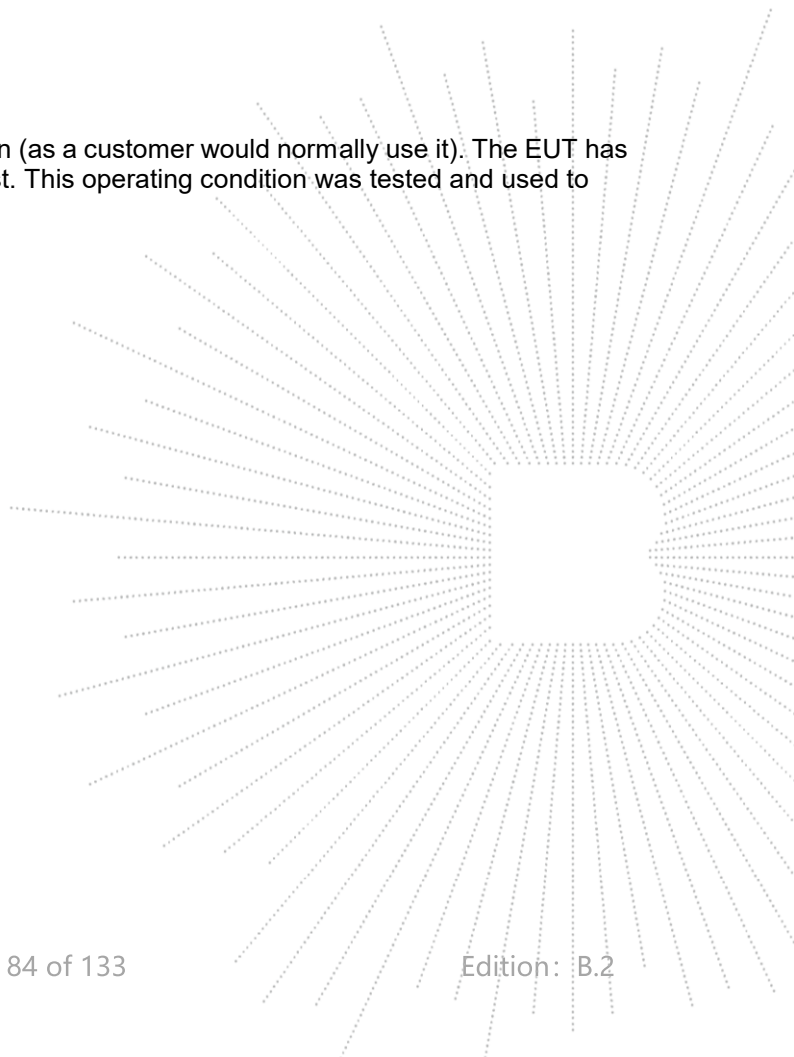
(vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".

(viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode.

(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum

10.4 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.



10.5 Test Result

Temperature:	26 °C	Relative Humidity:	54%
Pressure:	101kPa	Test Voltage :	DC 3.87V
Test Mode :	TX (5.1G) Mode Frequency U-NII-1 (5180-5240MHz) & TX (5.8G) Mode Frequency U-NII-3 (5745-5825MHz)		

Condition	Mode	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	a	5180	13.16	24	Pass
NVNT	a	5200	13.04	24	Pass
NVNT	a	5240	11.81	24	Pass
NVNT	n20	5180	12.19	24	Pass
NVNT	n20	5200	11.68	24	Pass
NVNT	n20	5240	10.29	24	Pass
NVNT	n40	5190	10.75	24	Pass
NVNT	n40	5230	9.19	24	Pass
NVNT	ac20	5180	12.16	24	Pass
NVNT	ac20	5200	11.8	24	Pass
NVNT	ac20	5240	10.49	24	Pass
NVNT	ac40	5190	10.74	24	Pass
NVNT	ac40	5230	9.37	24	Pass
NVNT	ac80	5210	8.67	24	Pass

Condition	Mode	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	a	5745	12.04	30	Pass
NVNT	a	5785	11.31	30	Pass
NVNT	a	5825	10.35	30	Pass
NVNT	n20	5745	10.9	30	Pass
NVNT	n20	5785	10	30	Pass
NVNT	n20	5825	9.24	30	Pass
NVNT	n40	5755	9.97	30	Pass
NVNT	n40	5795	8.96	30	Pass
NVNT	ac20	5745	10.92	30	Pass
NVNT	ac20	5785	10.36	30	Pass
NVNT	ac20	5825	9.29	30	Pass
NVNT	ac40	5755	10.04	30	Pass
NVNT	ac40	5795	8.99	30	Pass
NVNT	ac80	5775	9.23	30	Pass

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.

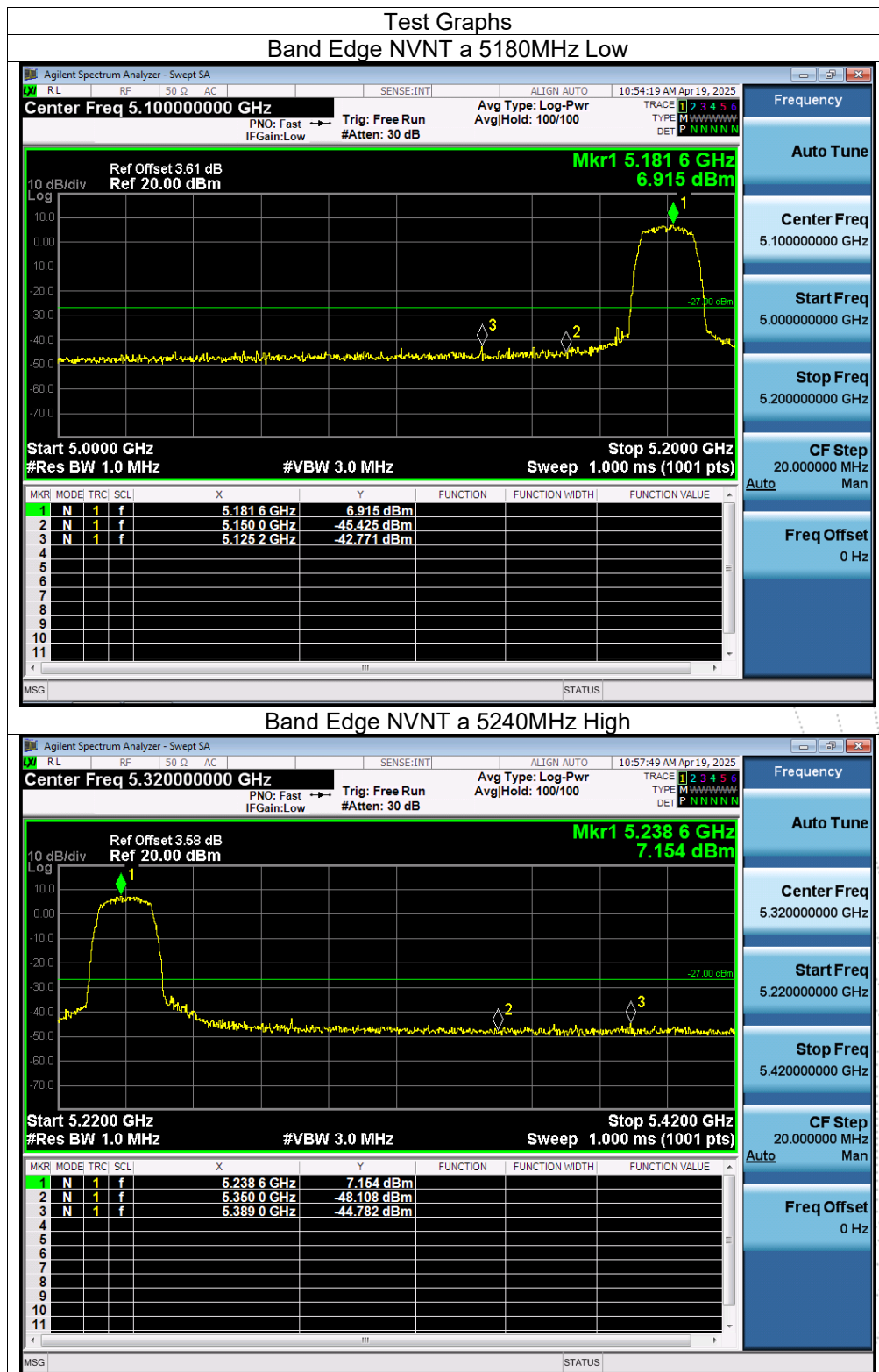
11.3 Test Procedure

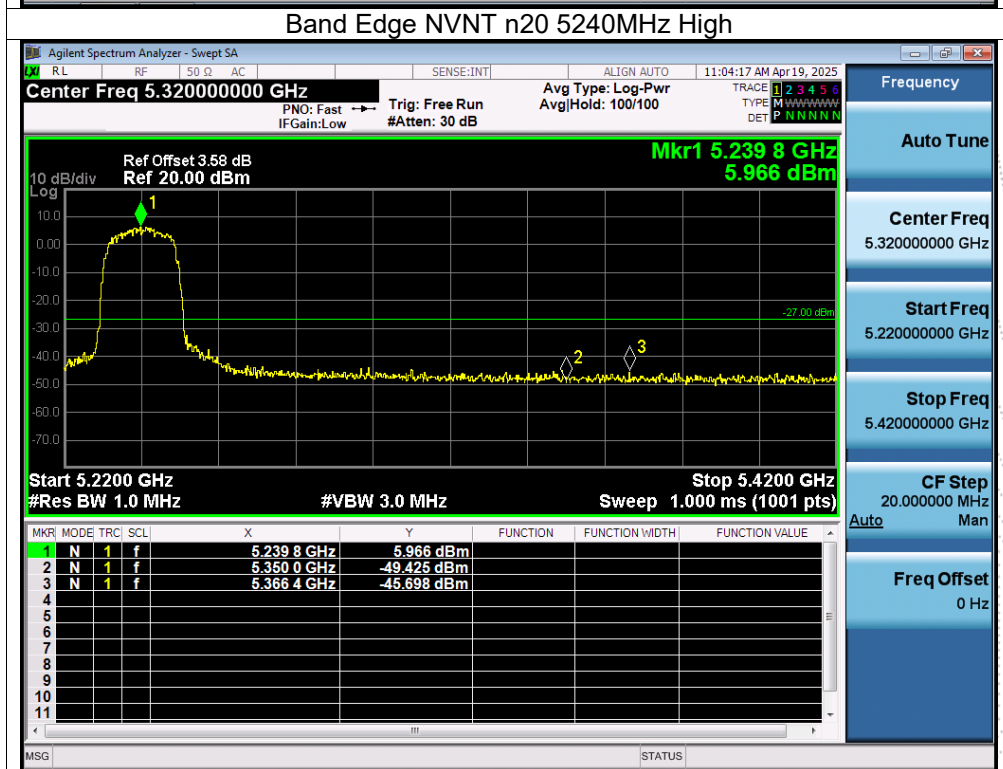
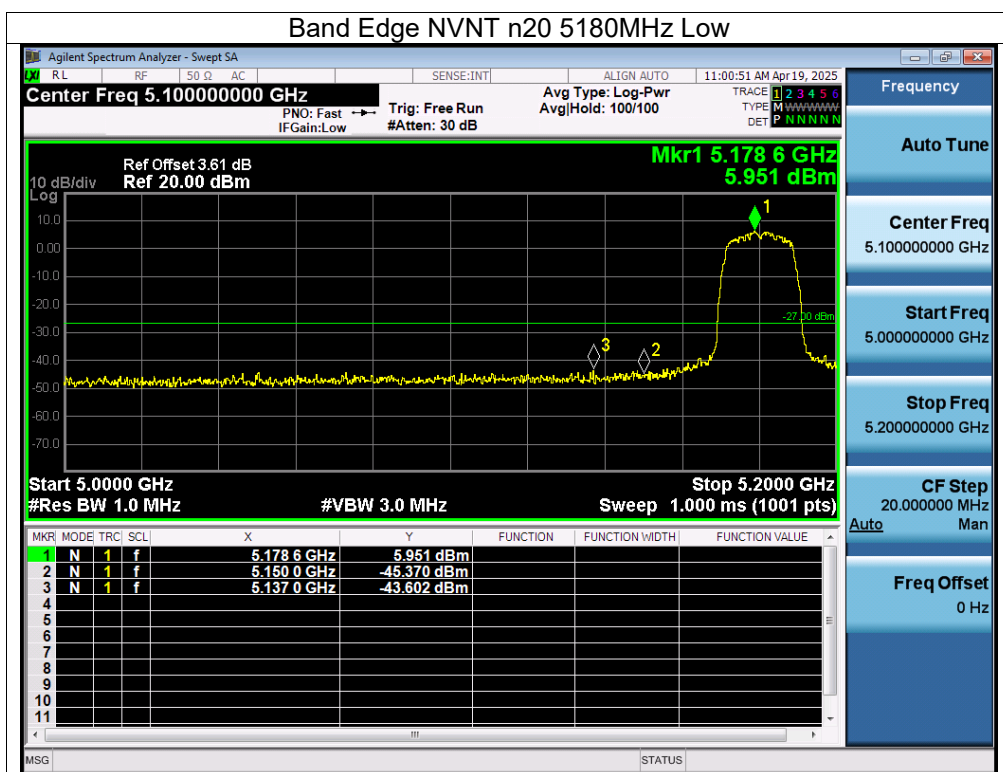
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then 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.

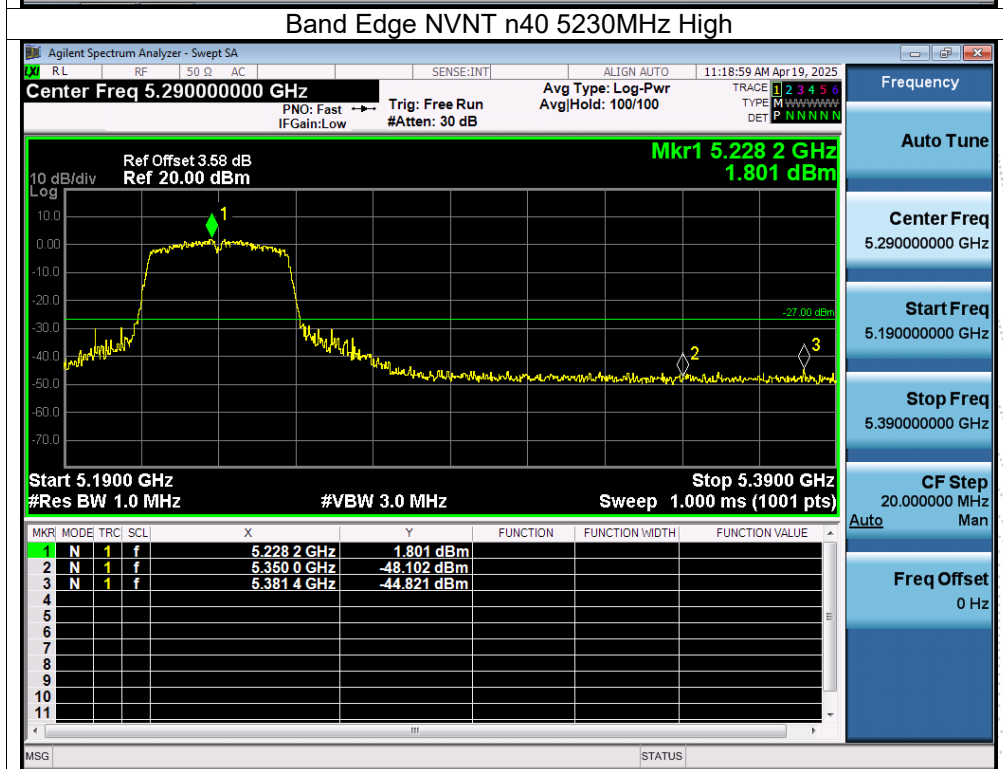
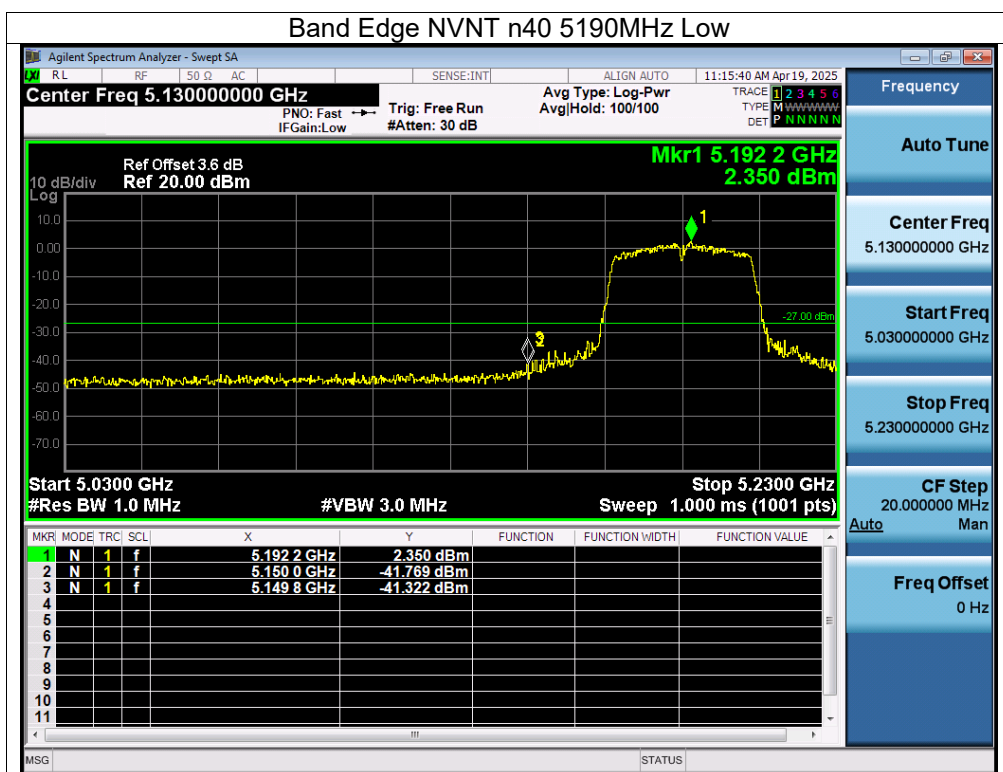
11.4 EUT Operating Conditions

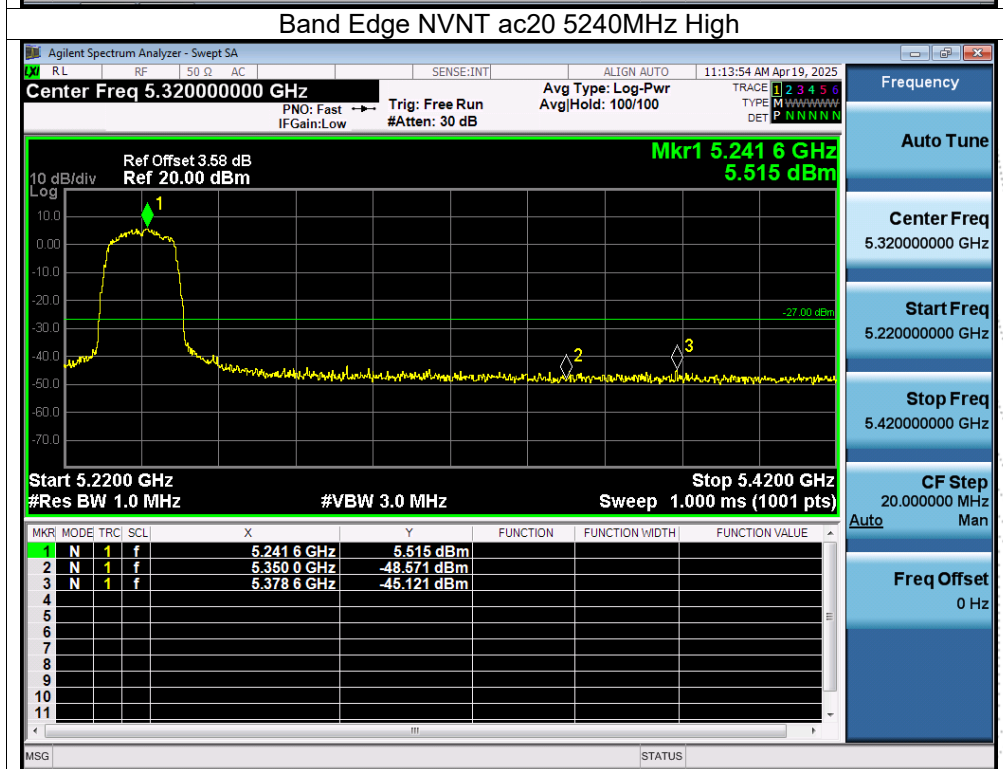
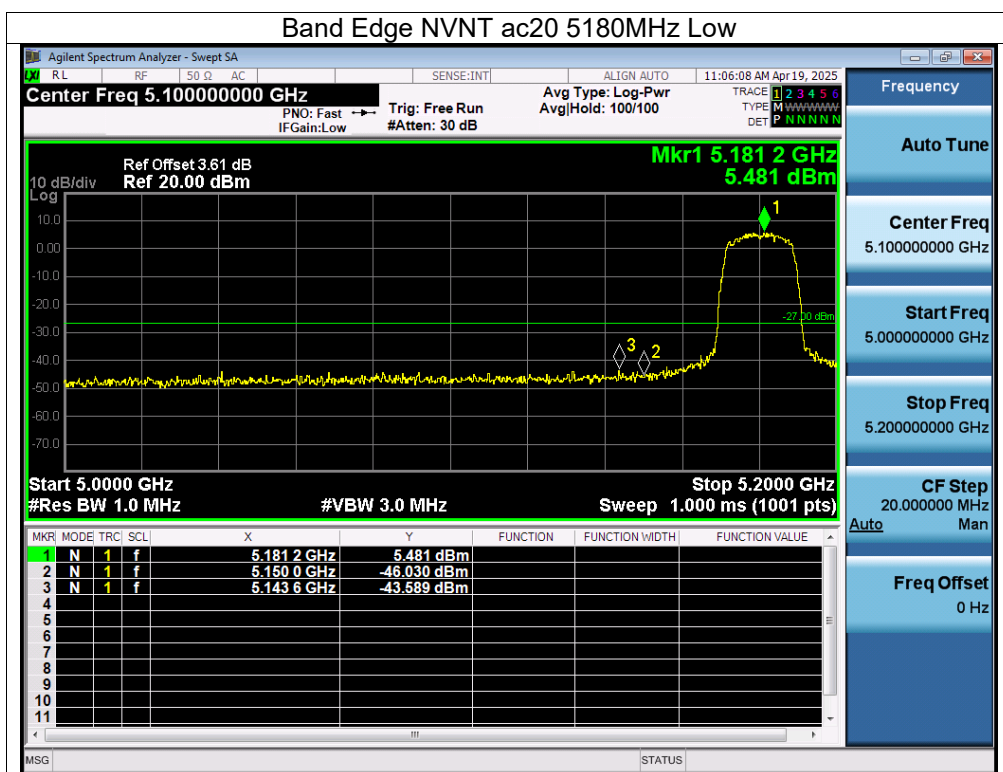
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data

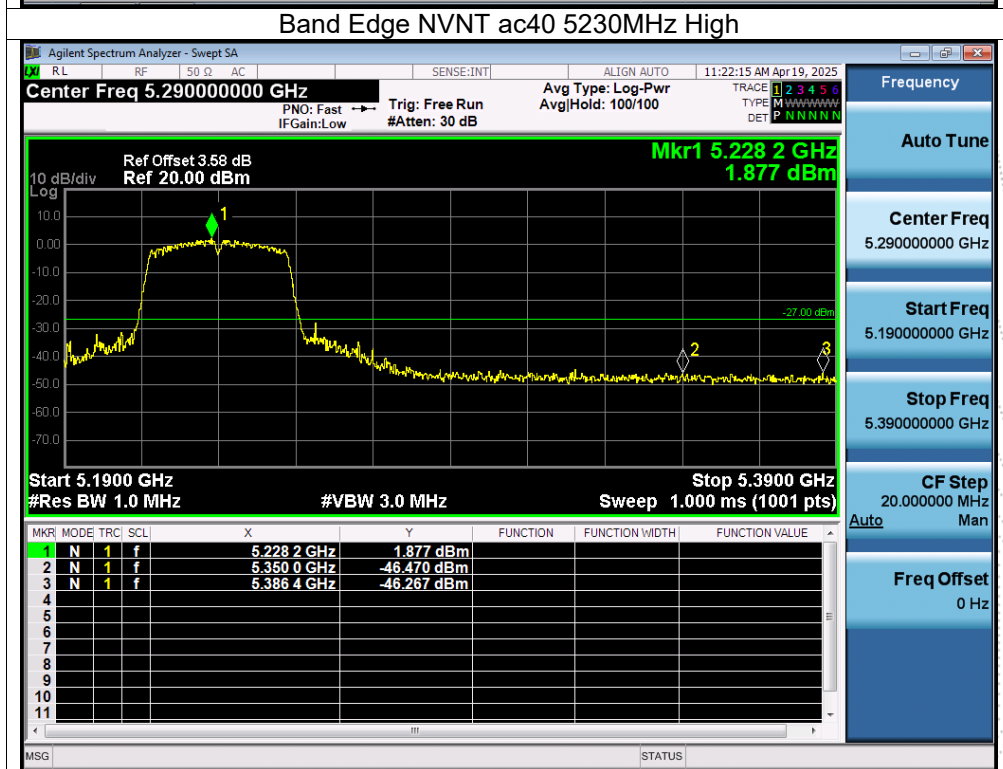
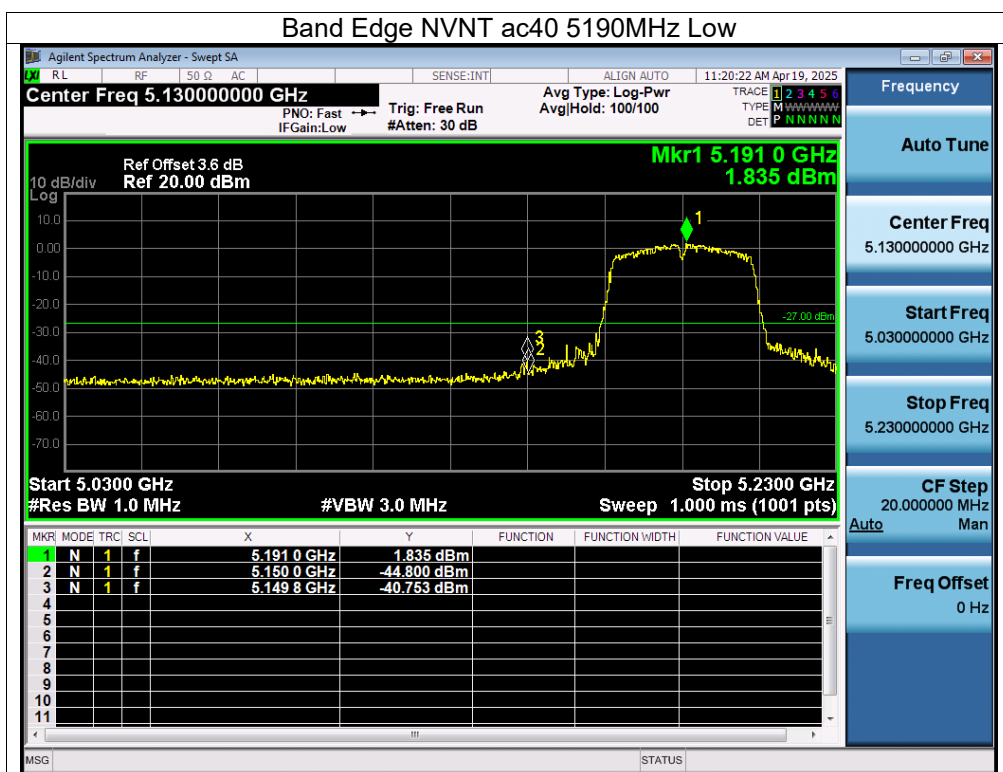
11.5 Test Result

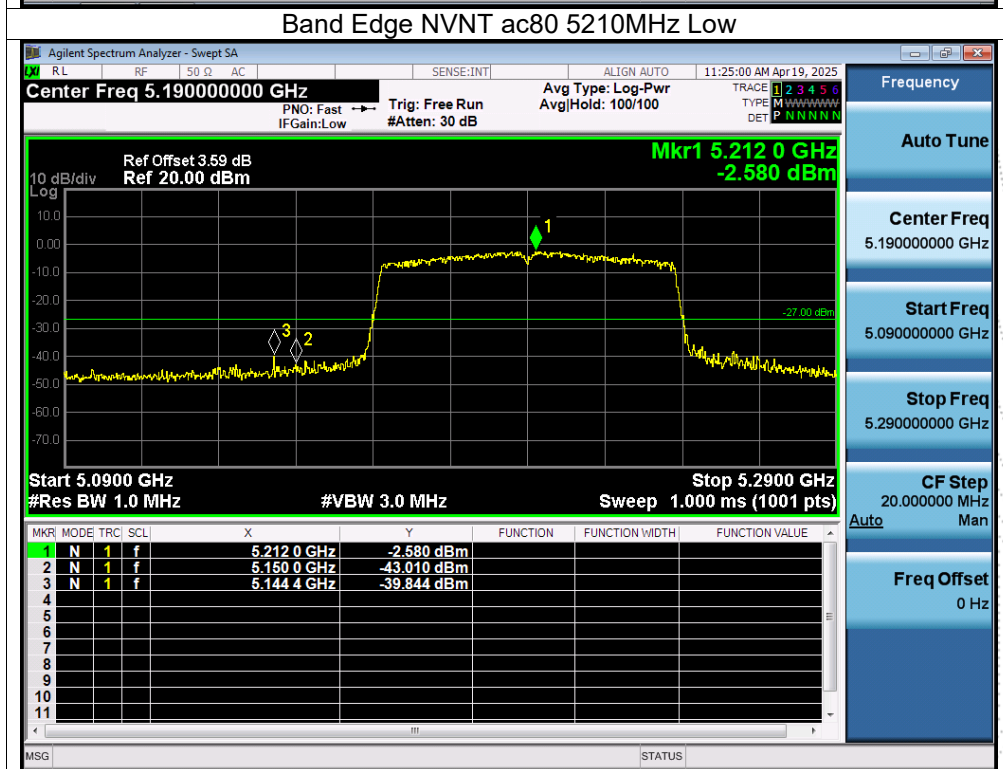
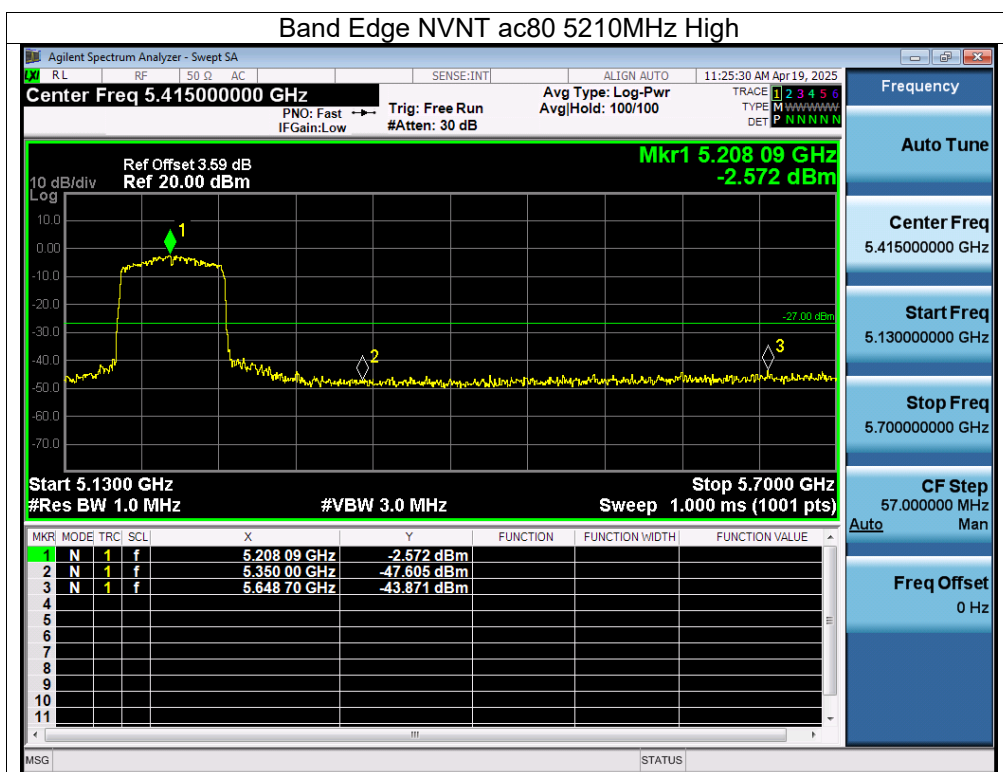






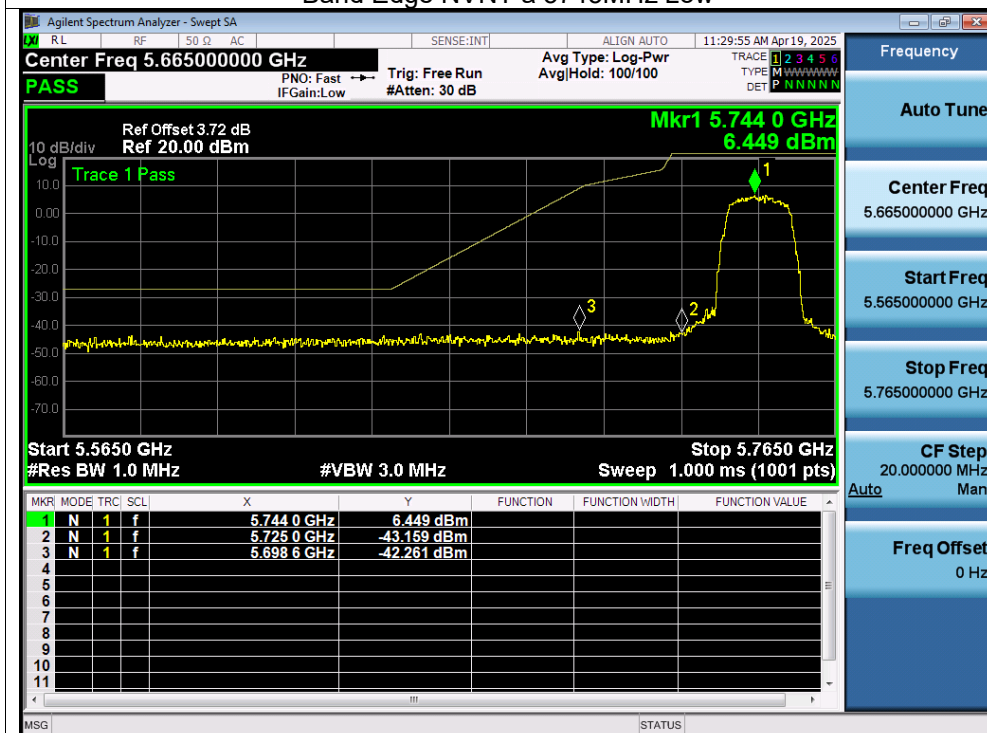




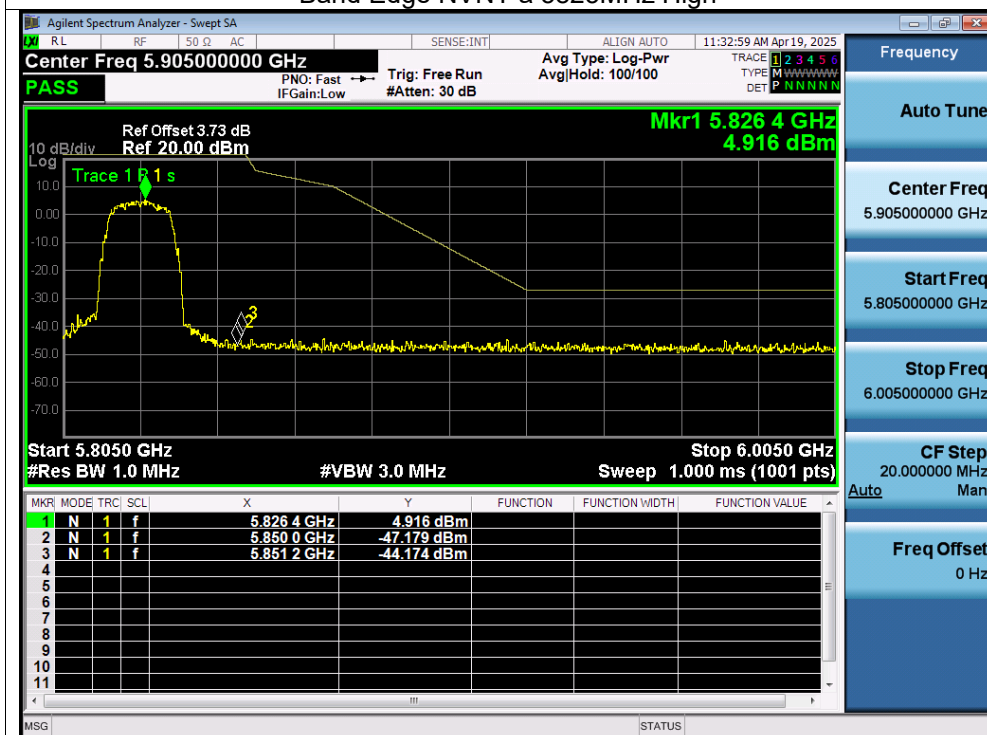


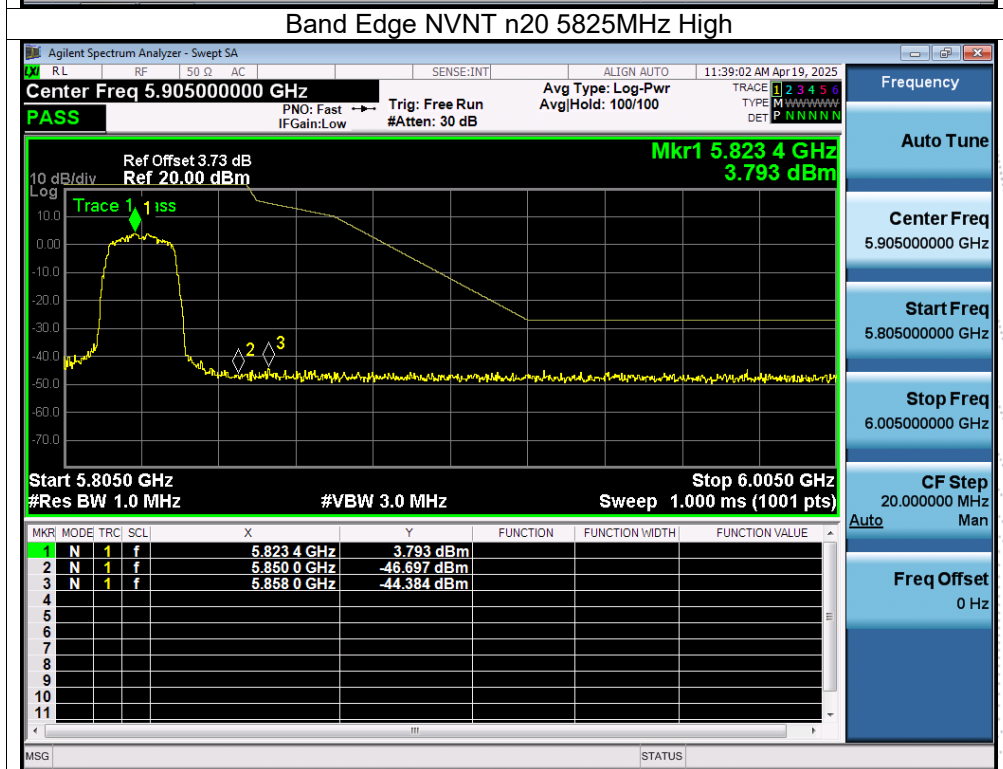
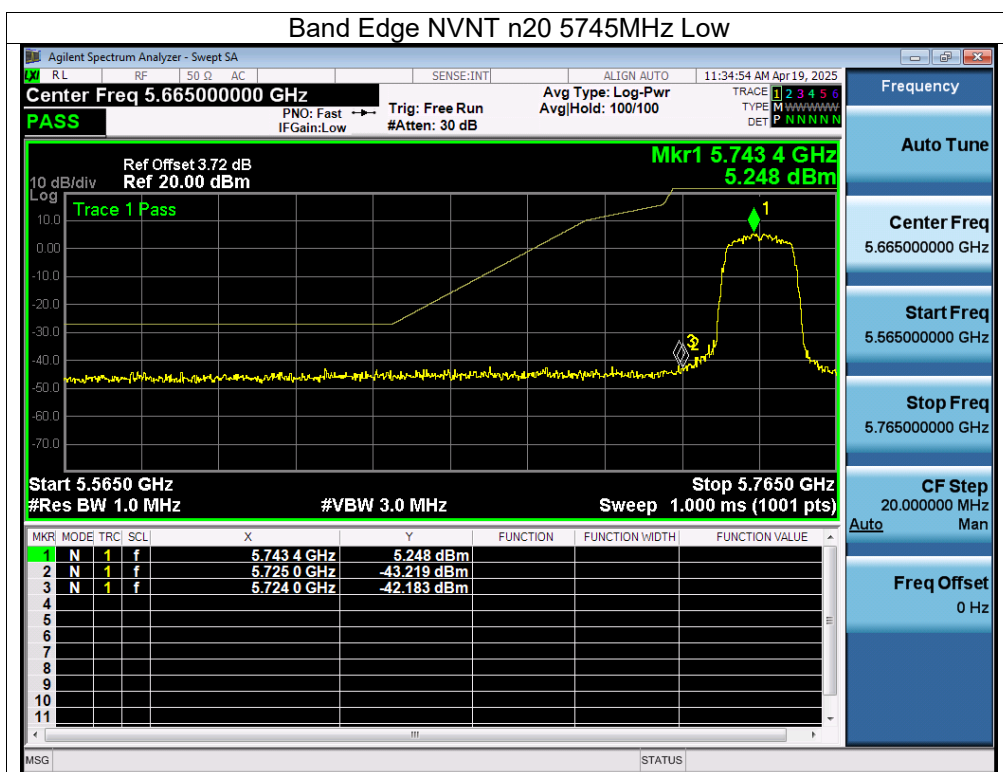
Test Graphs

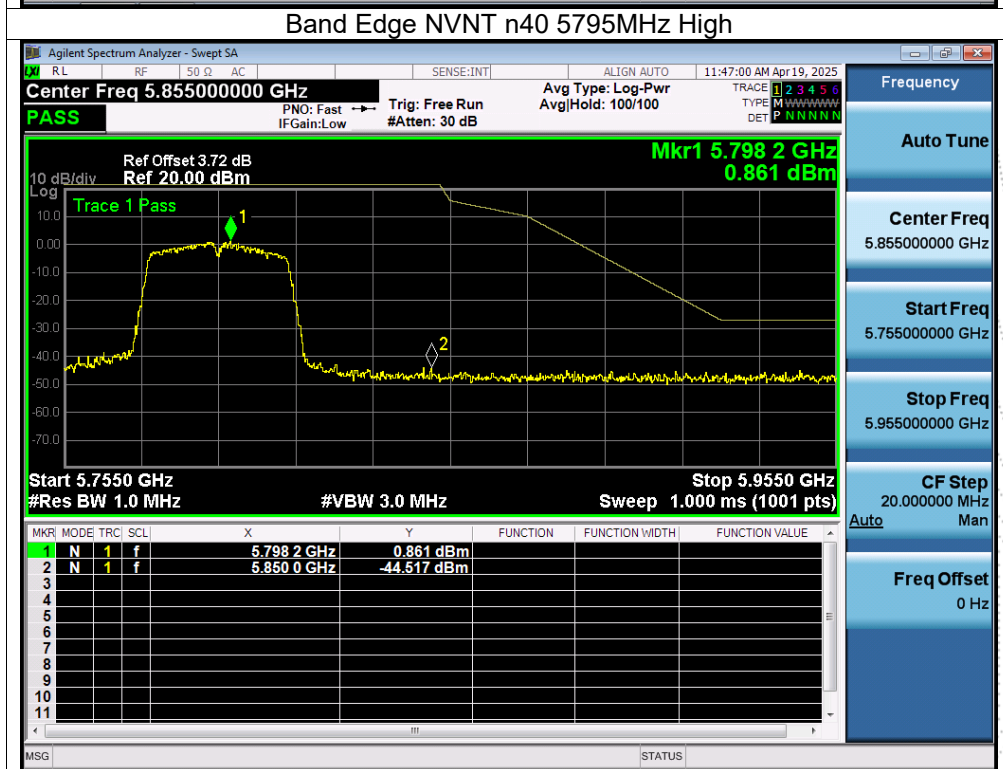
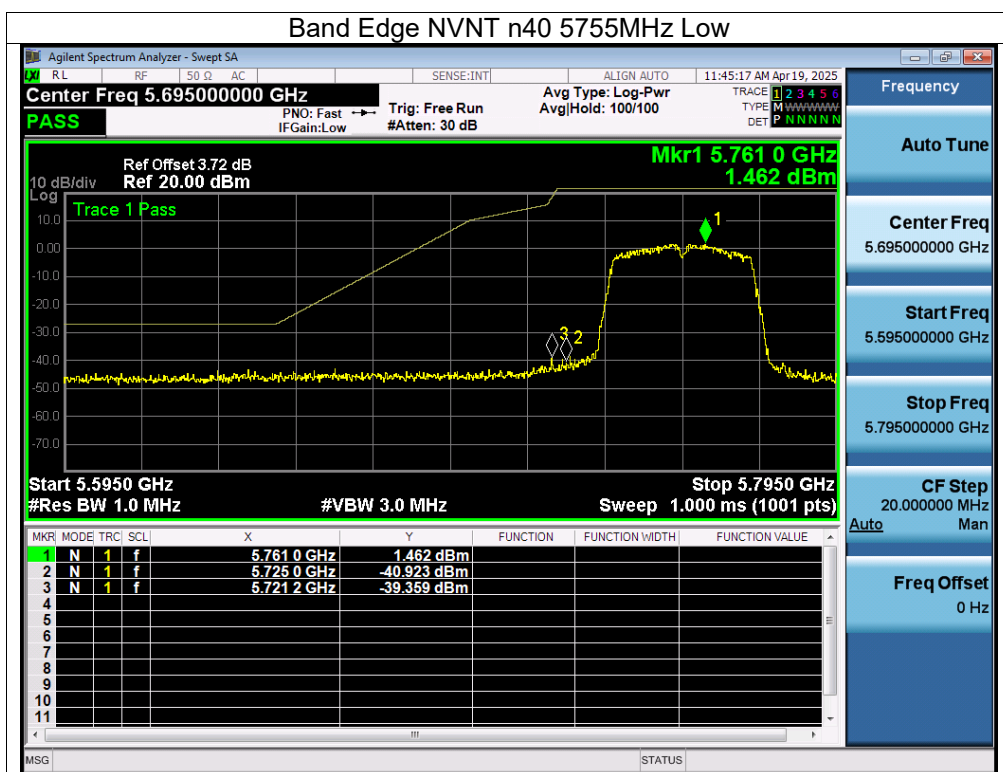
Band Edge NVNT a 5745MHz Low

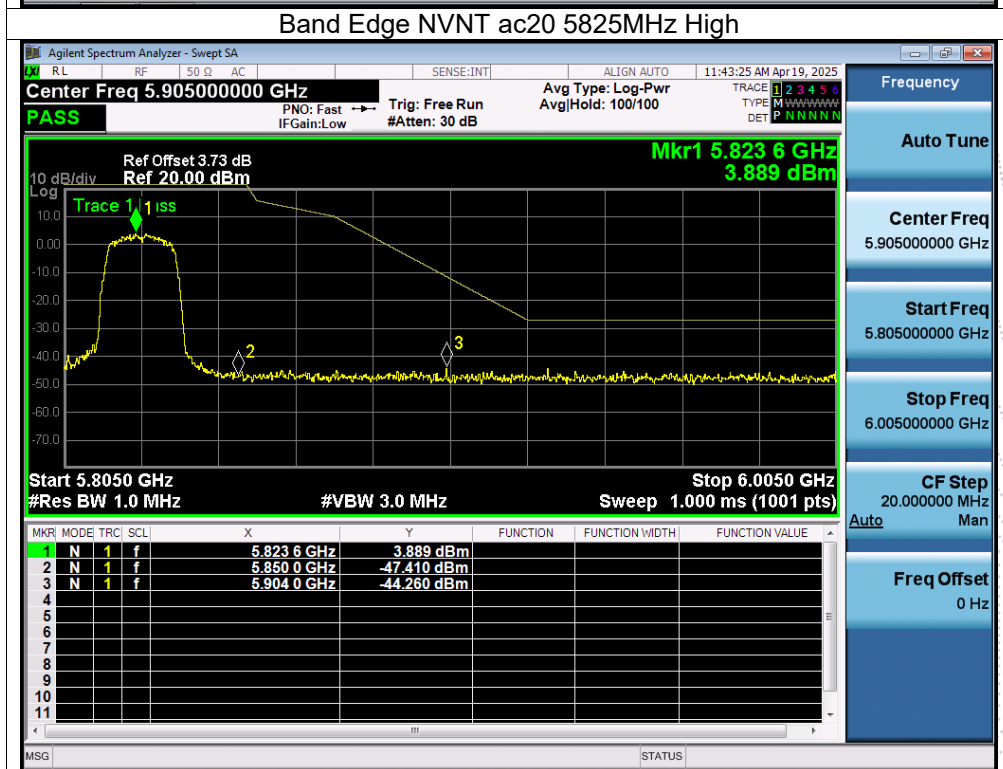
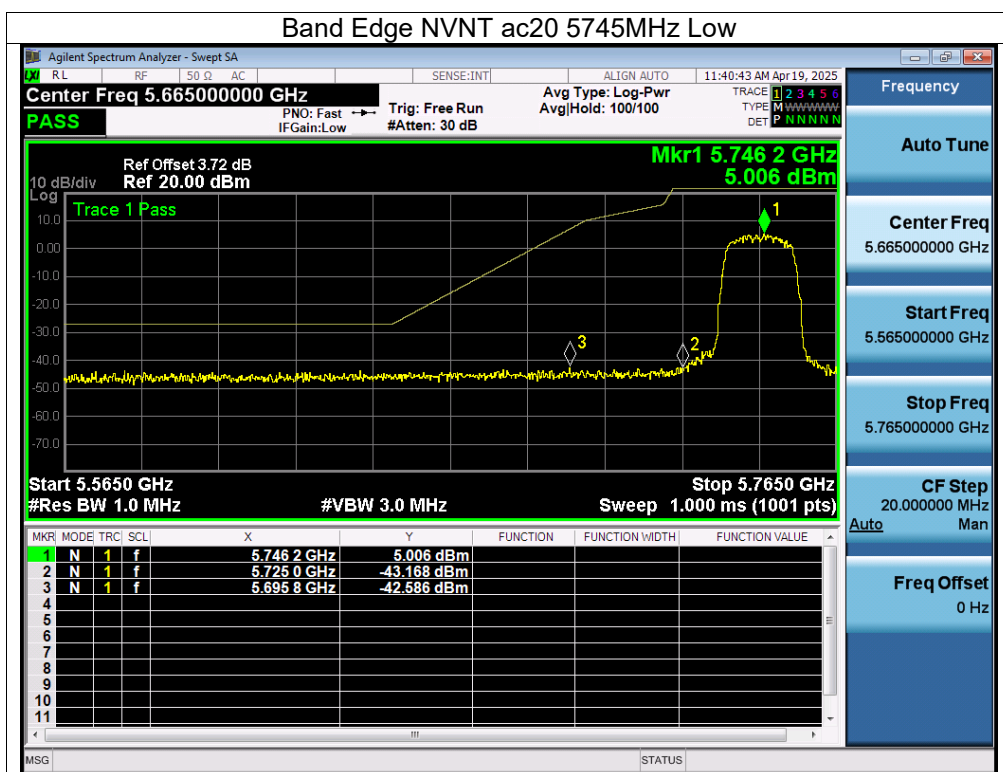


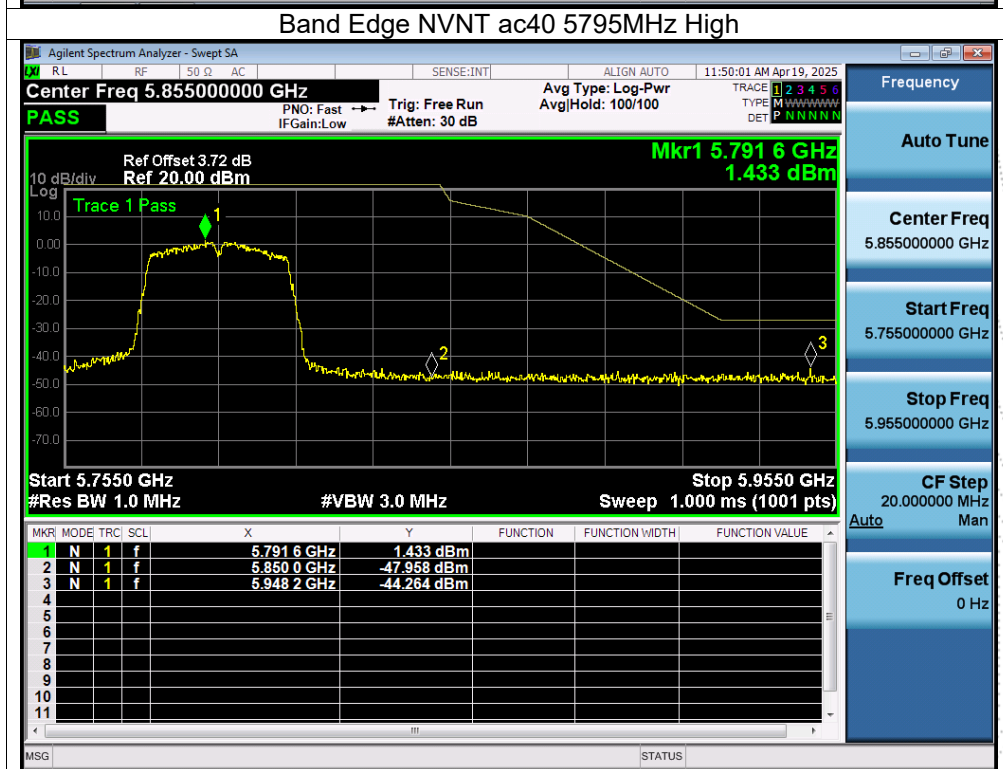
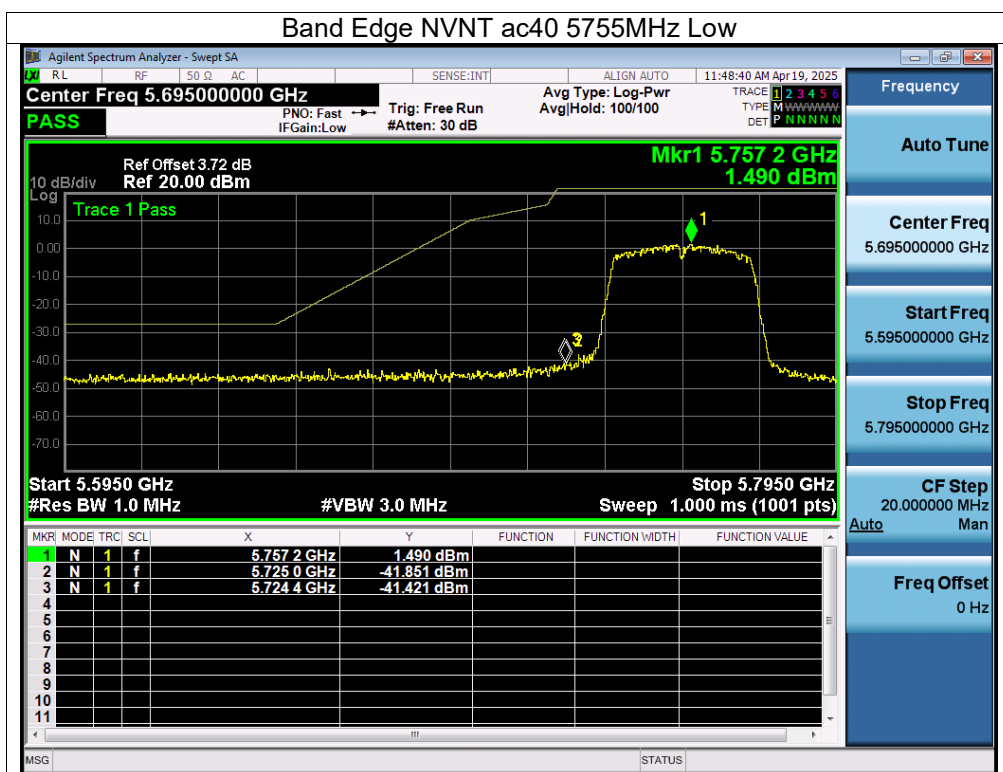
Band Edge NVNT a 5825MHz High

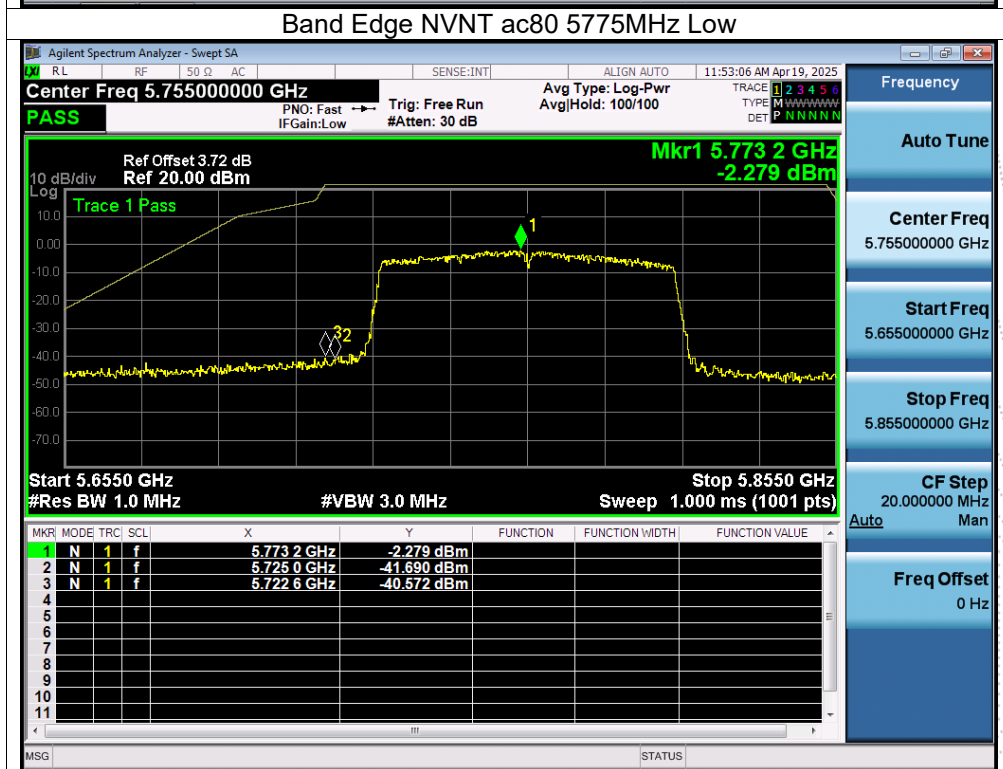
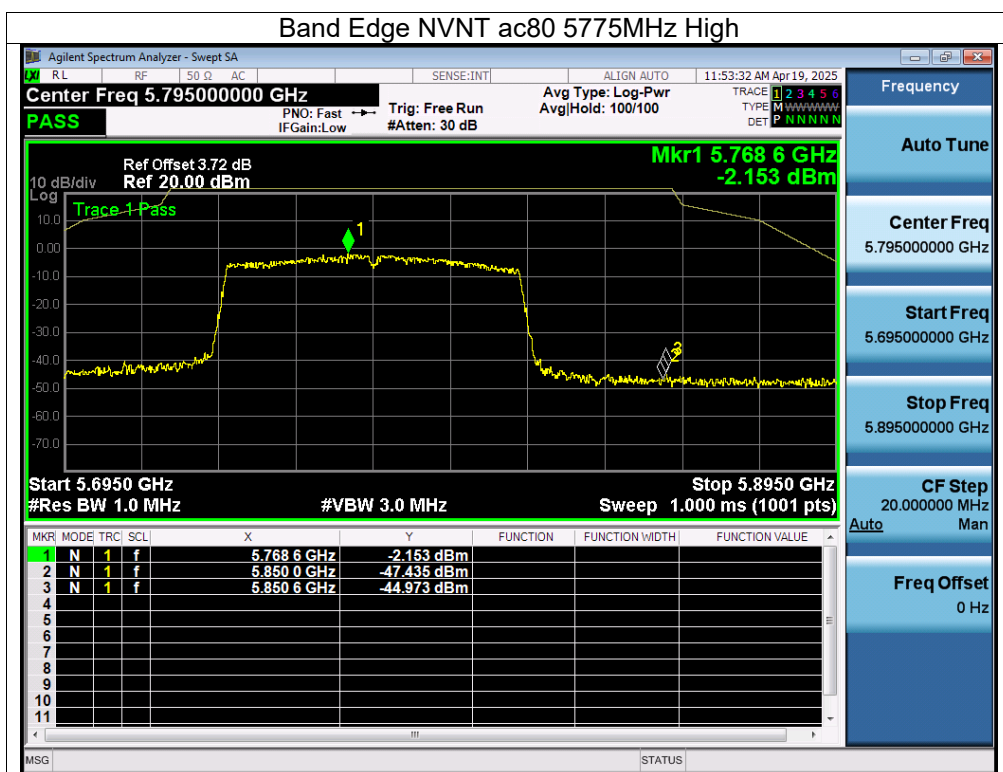












12. Spurious RF Conducted Emissions

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.

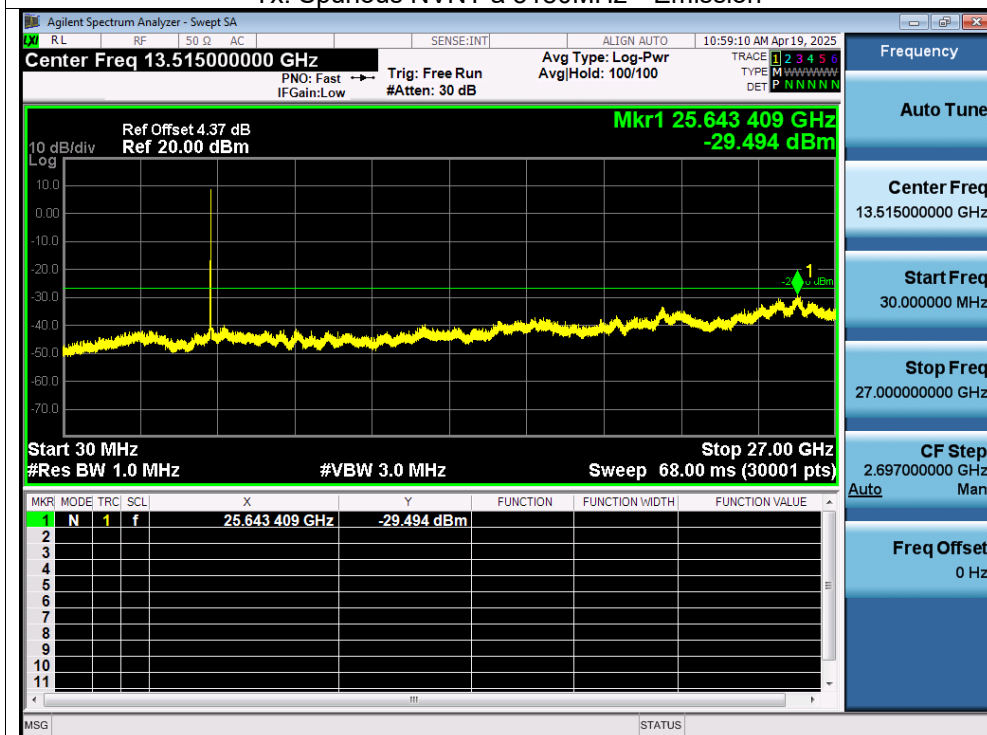
12.4 Test Result

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 band edge measurement data.

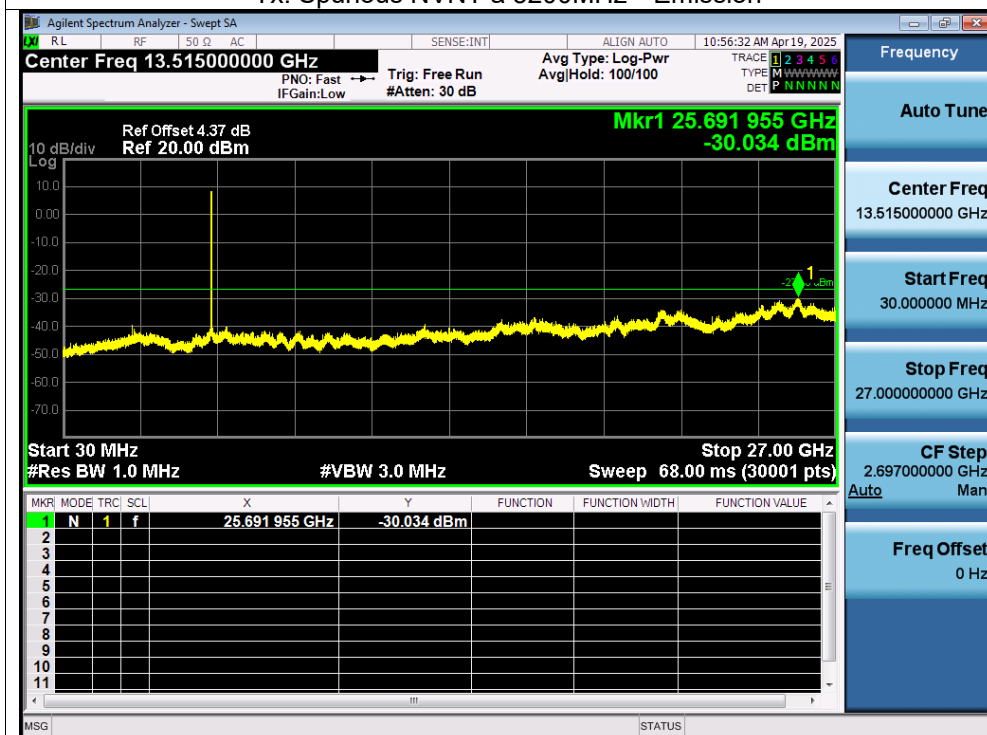
About: 26.5GHz-40GHz, The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

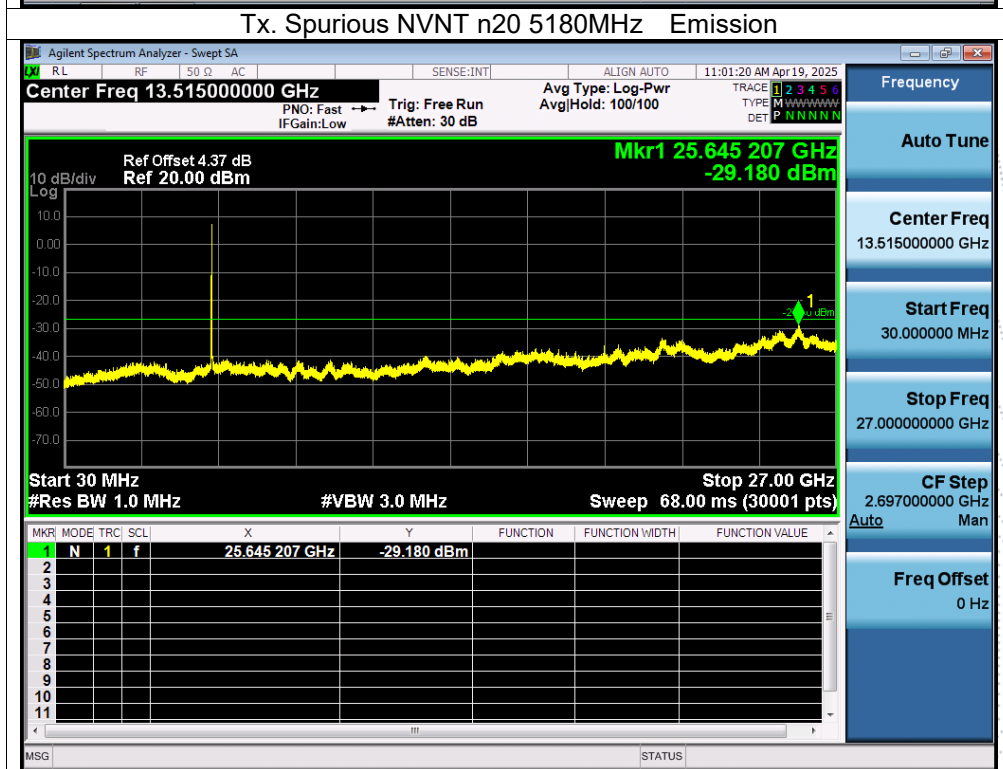
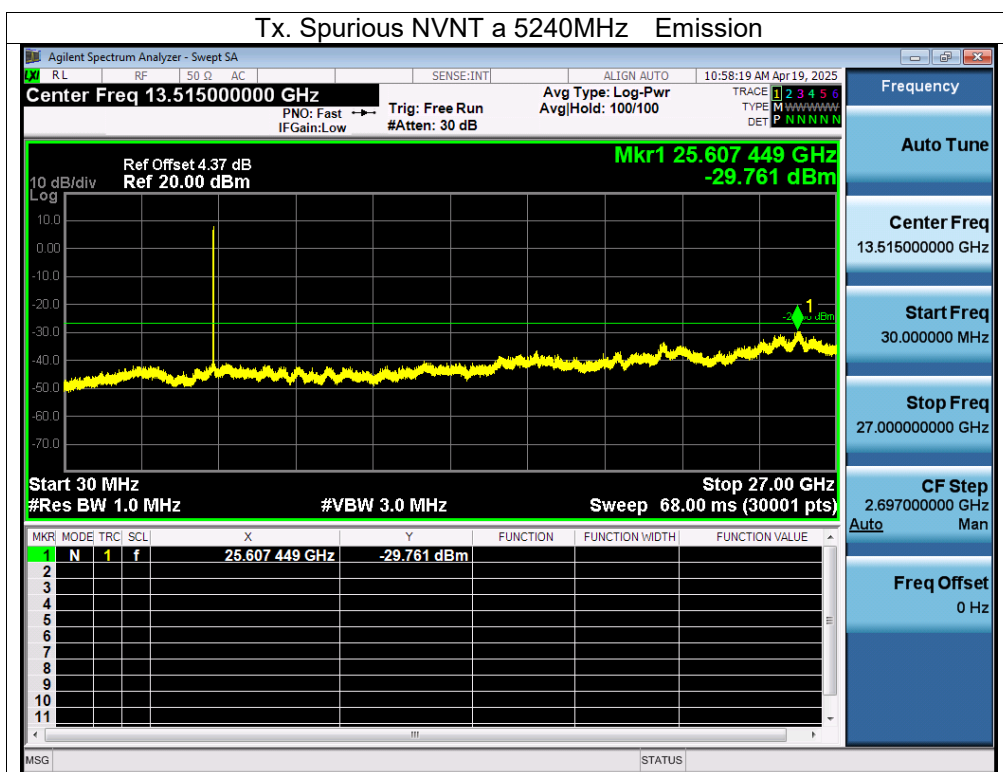
Test Graphs

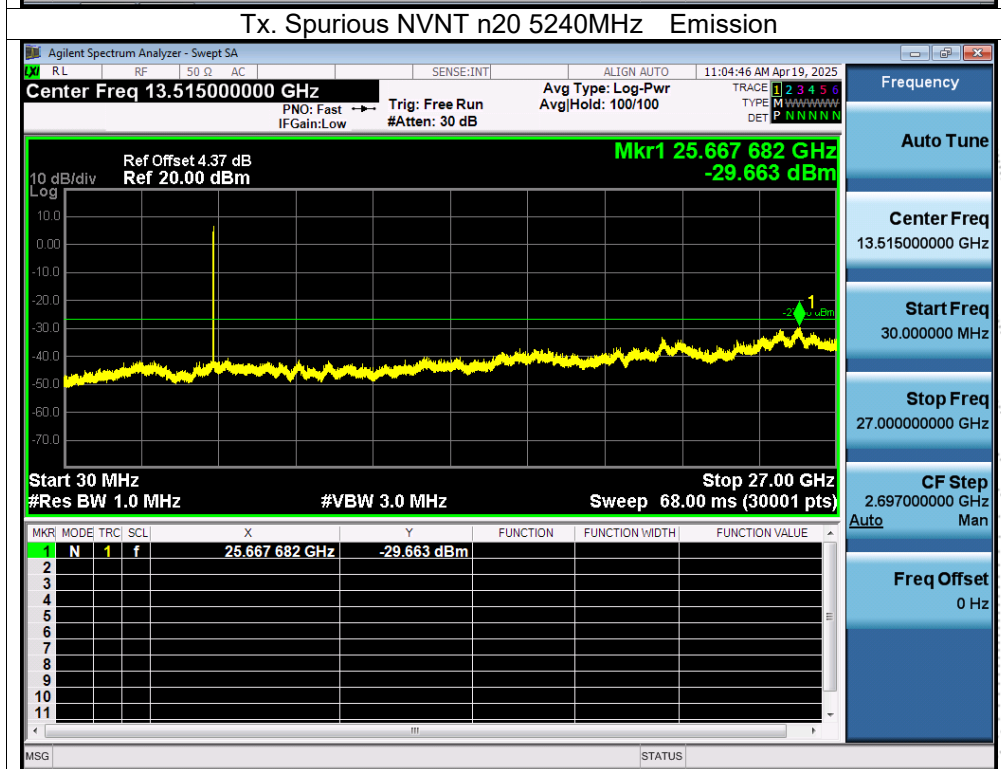
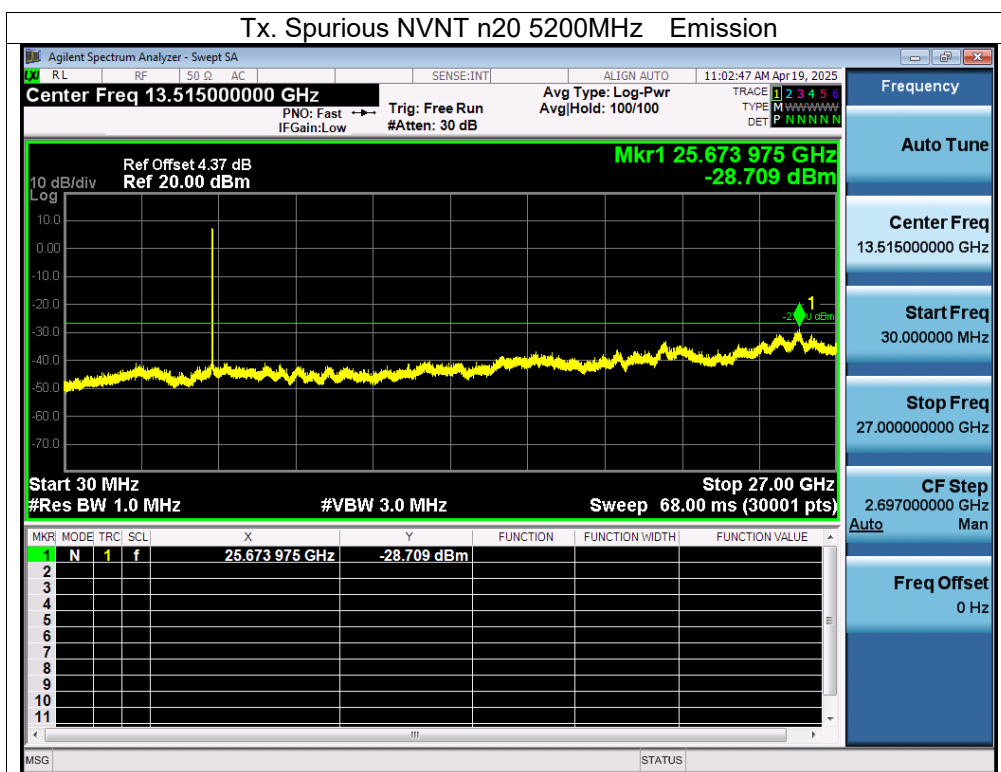
Tx. Spurious NVNT a 5180MHz Emission

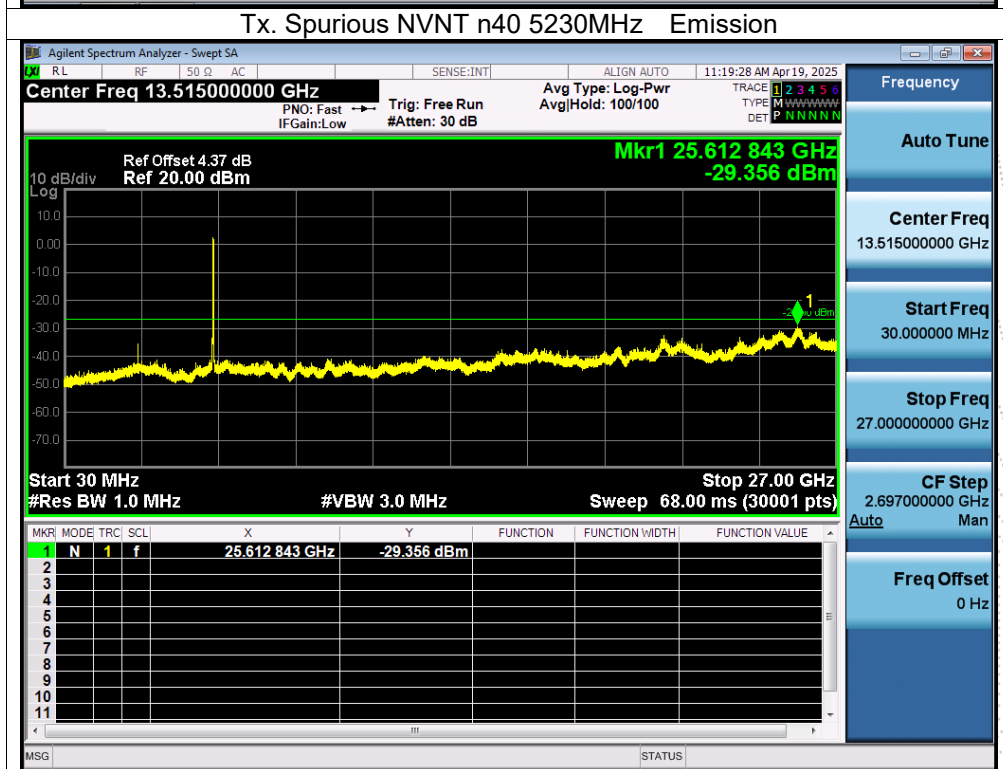
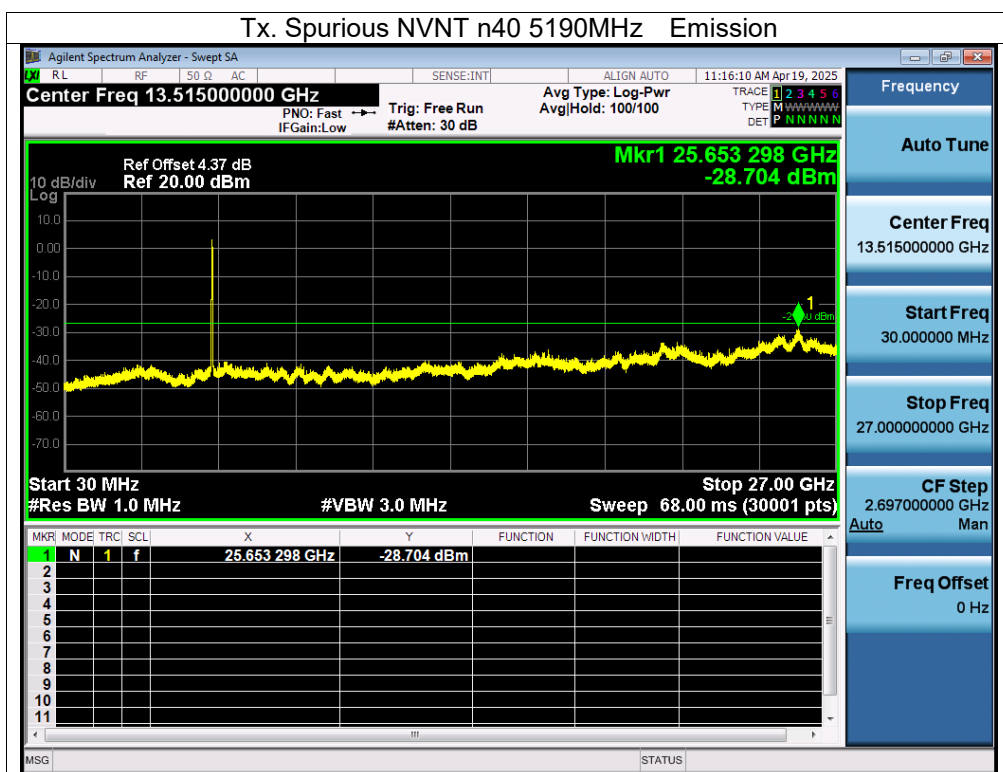


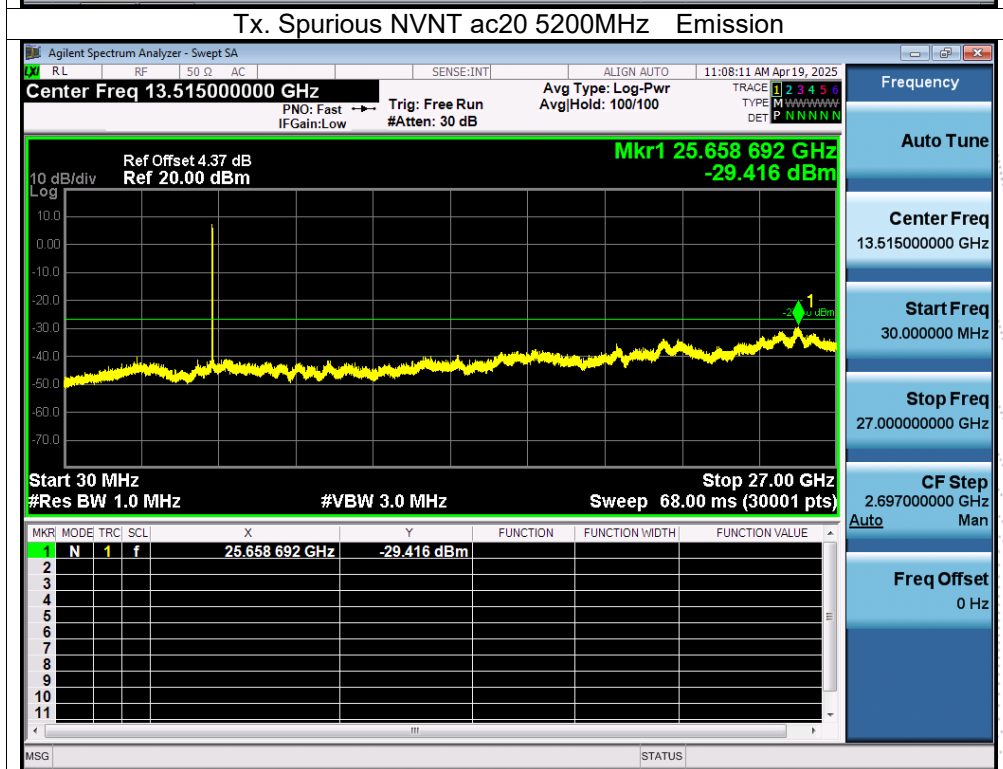
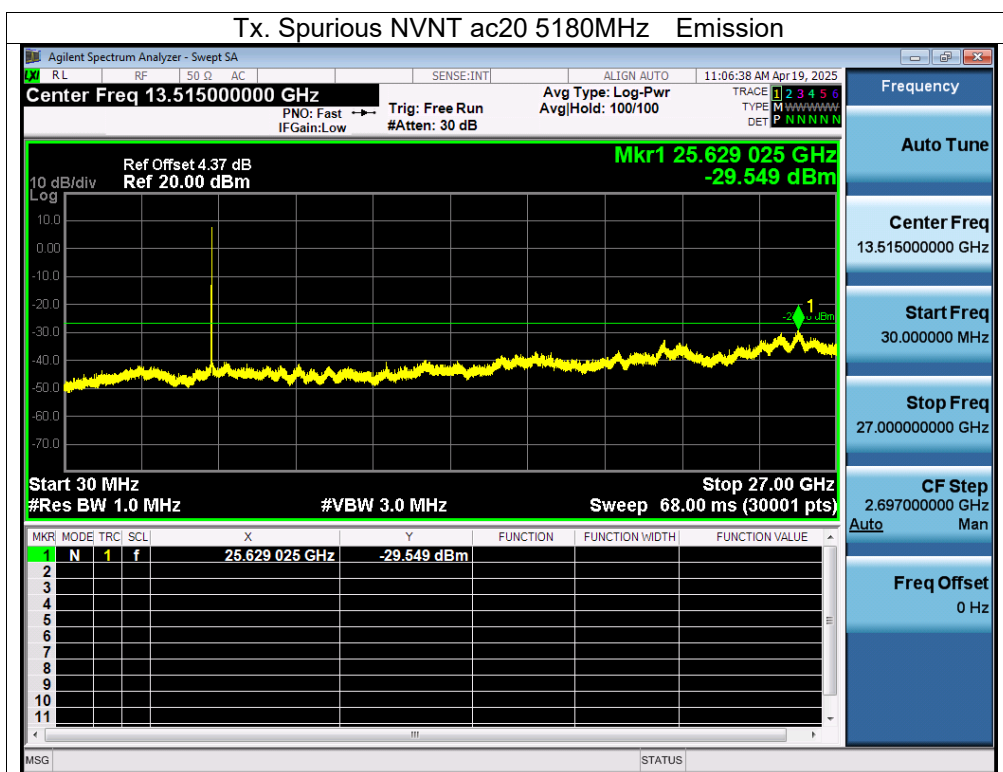
Tx. Spurious NVNT a 5200MHz Emission

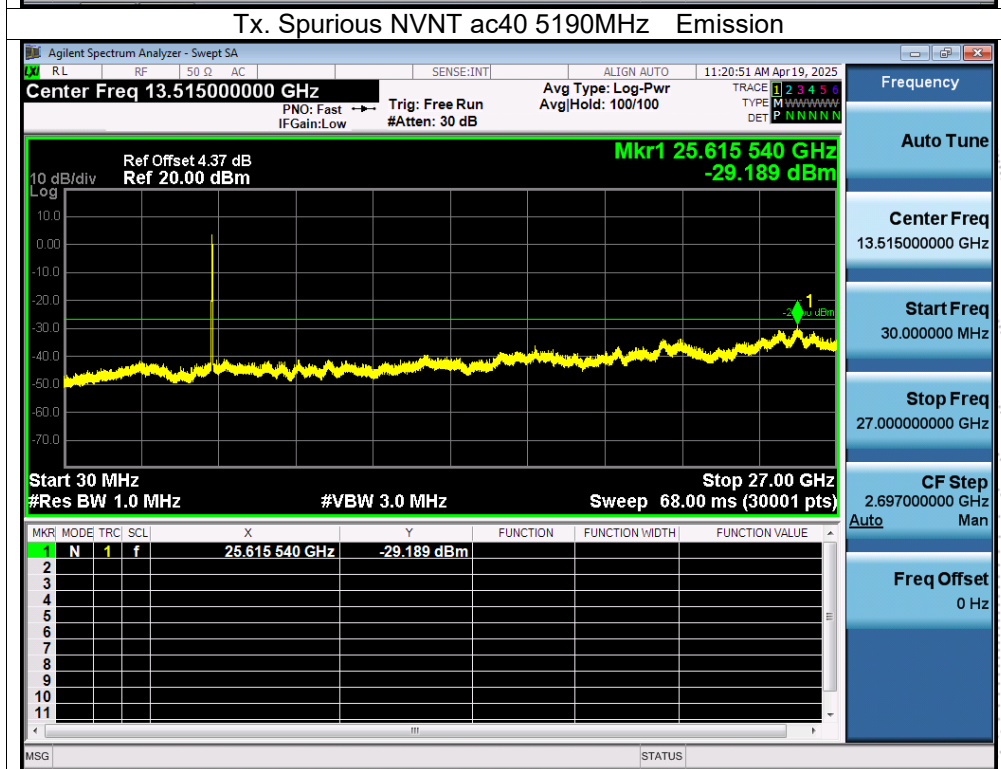
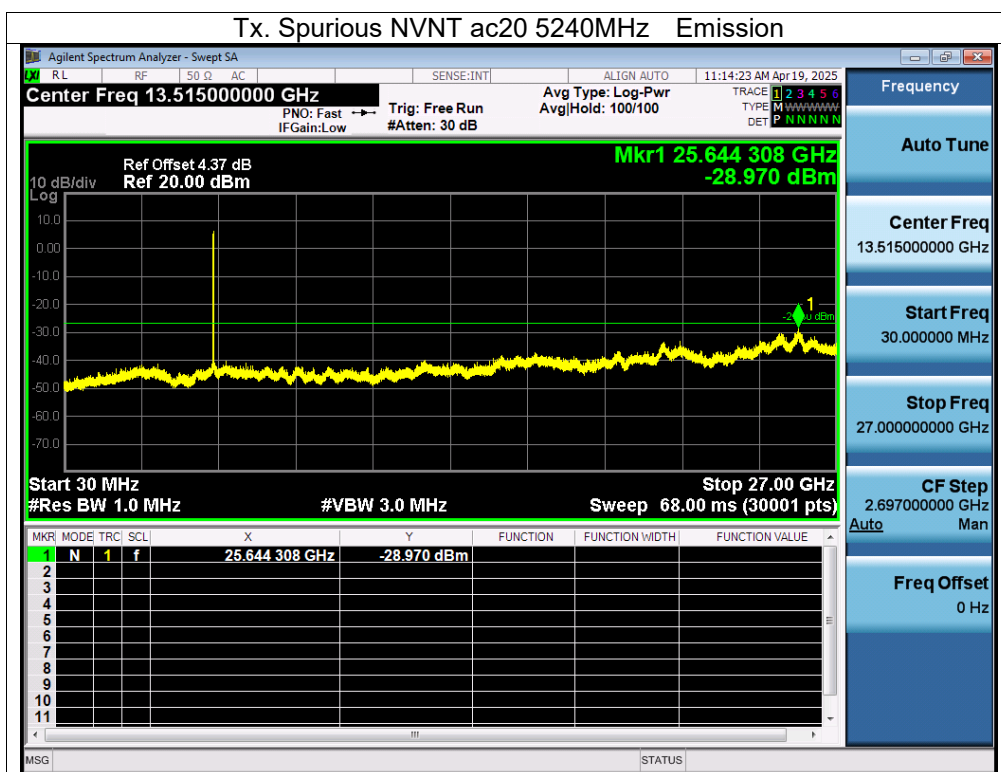


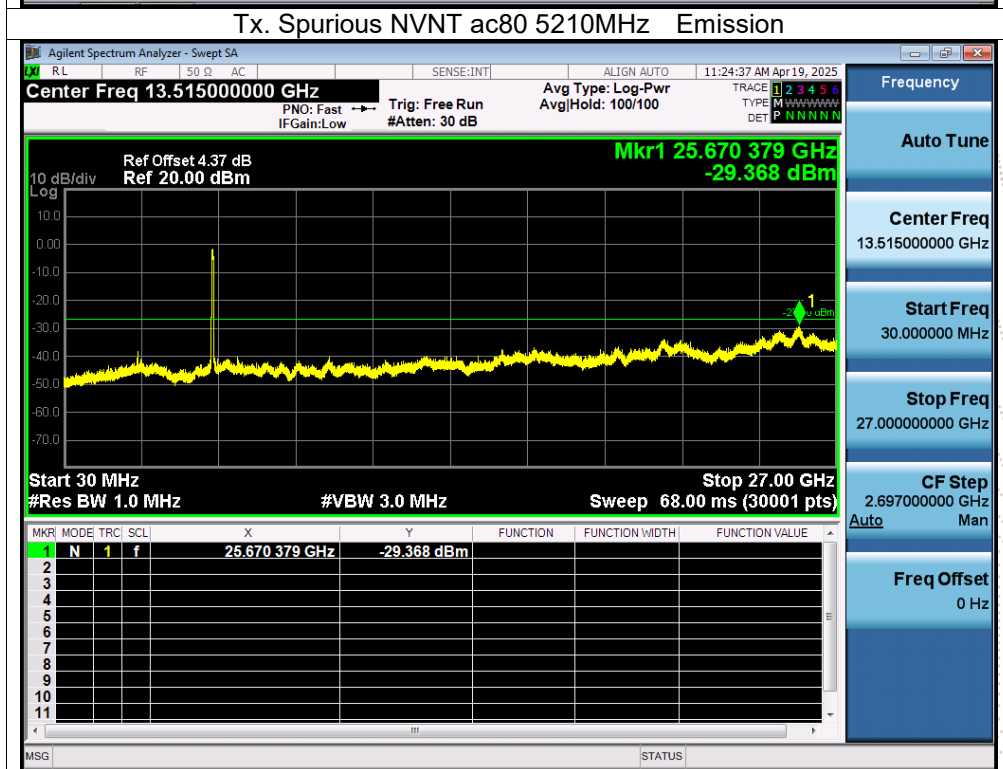
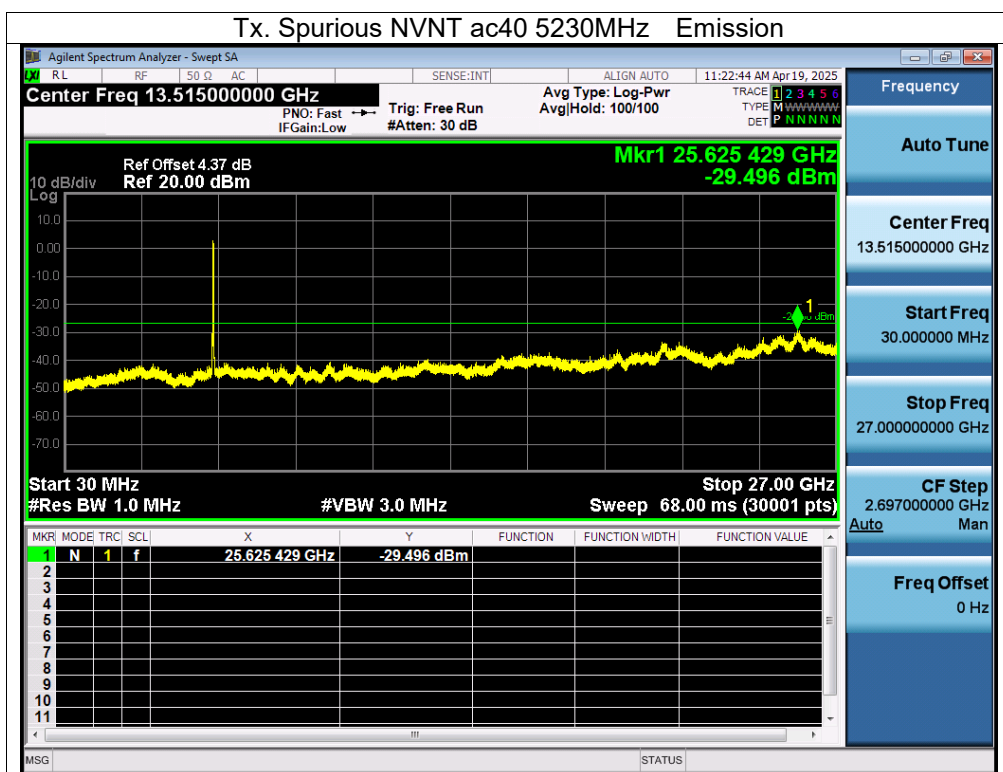






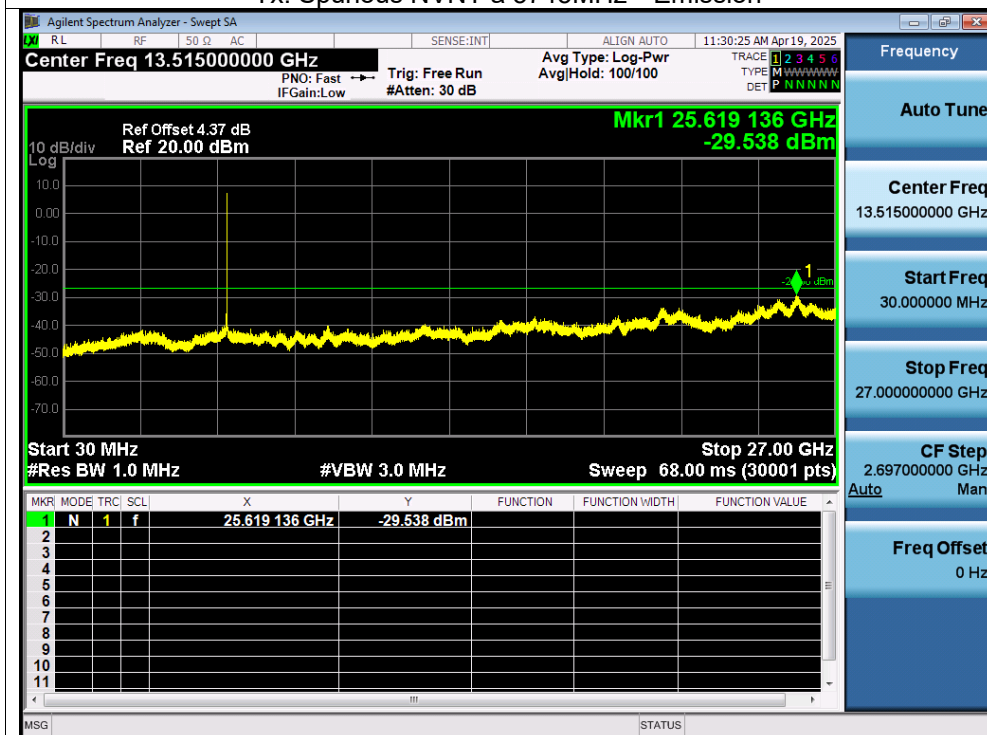




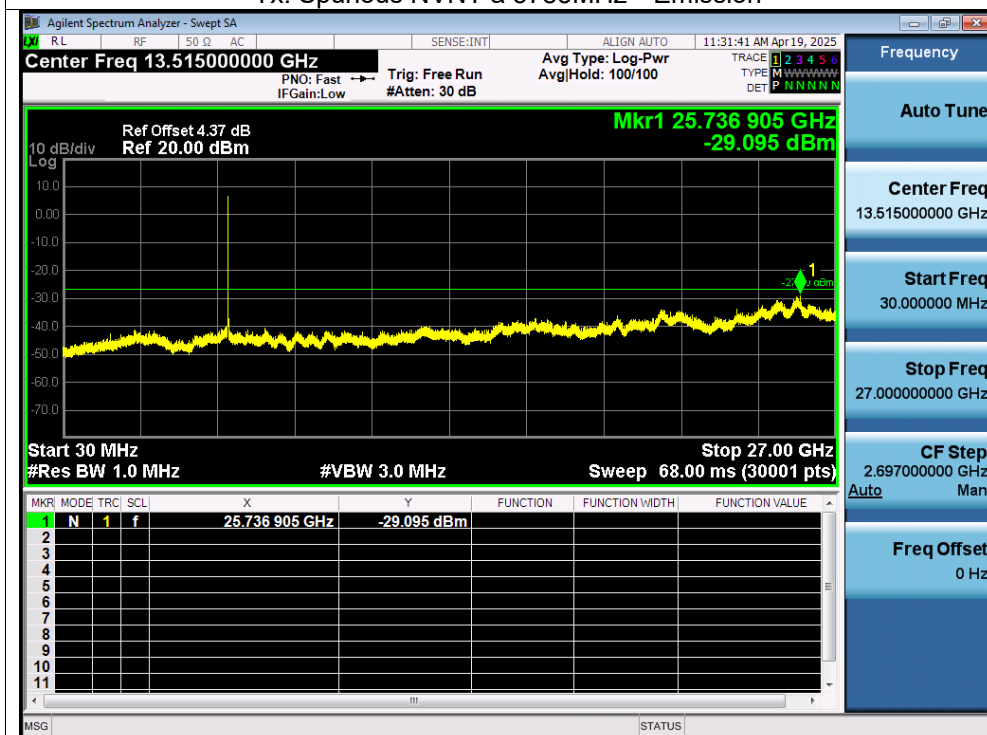


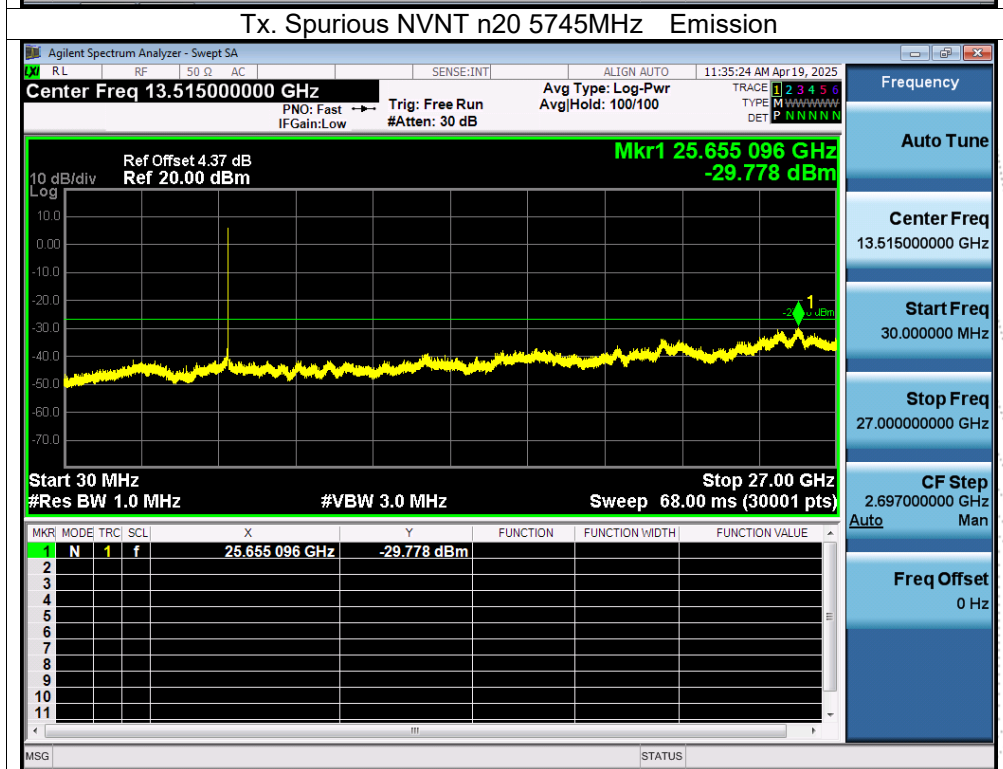
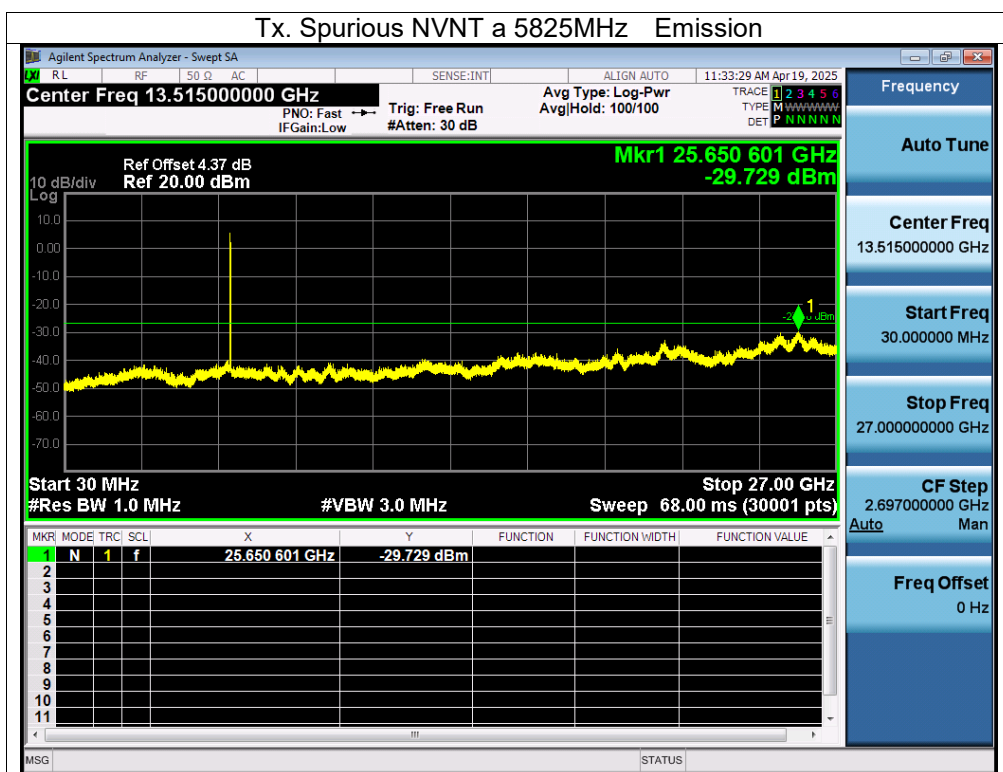
Test Graphs

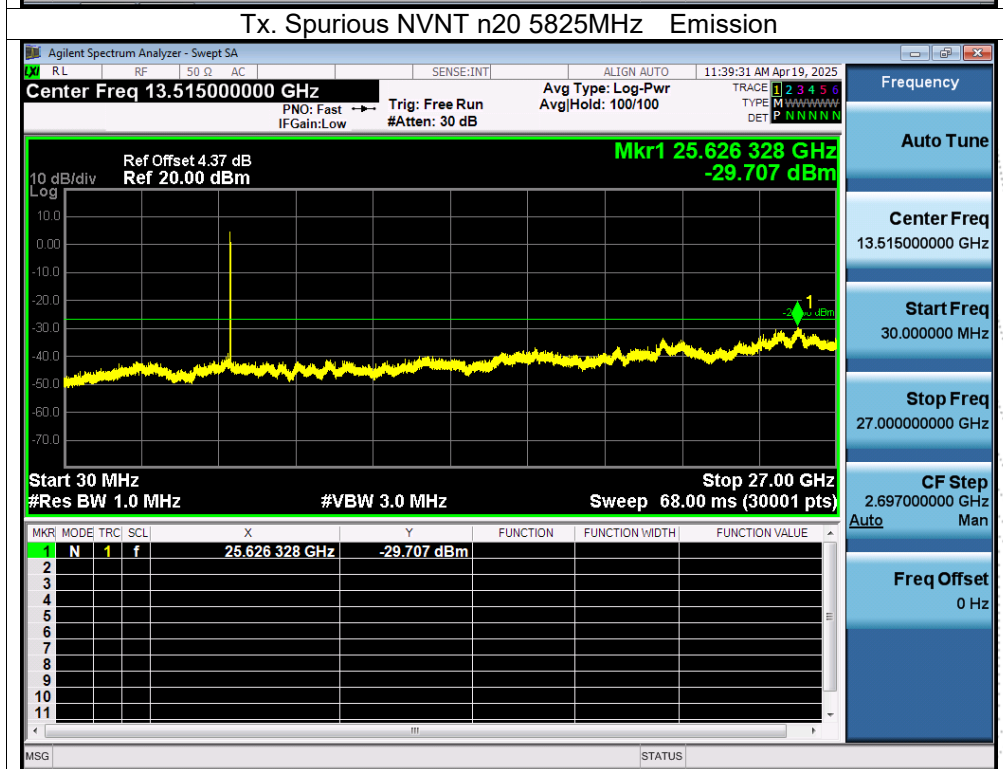
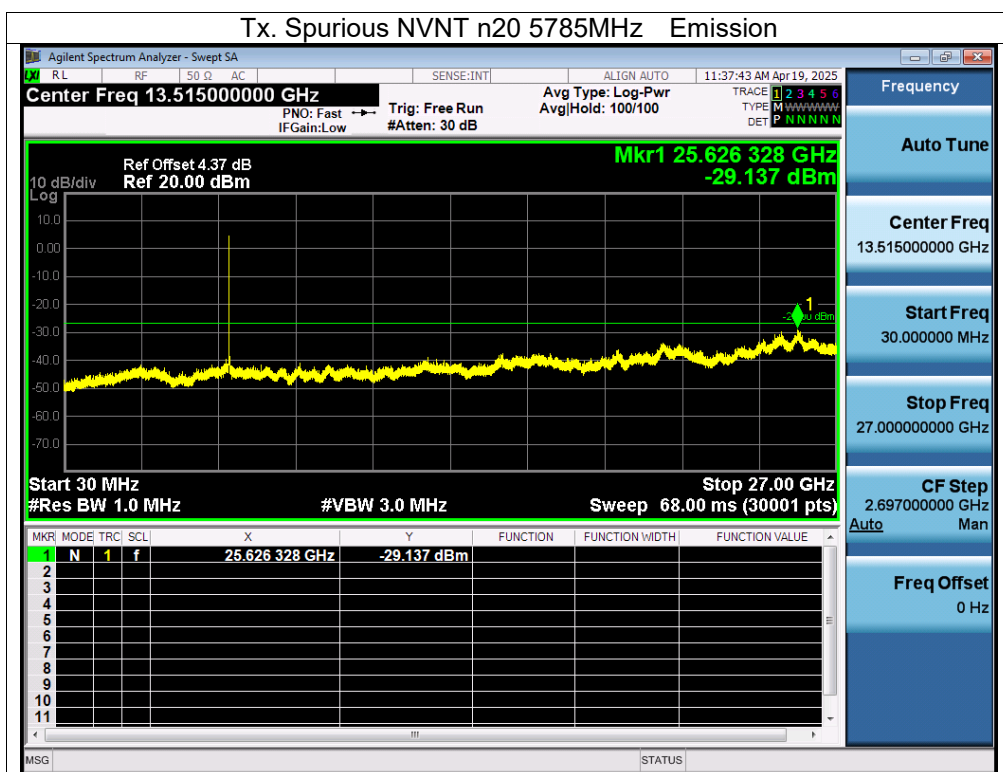
Tx. Spurious NVNT a 5745MHz Emission

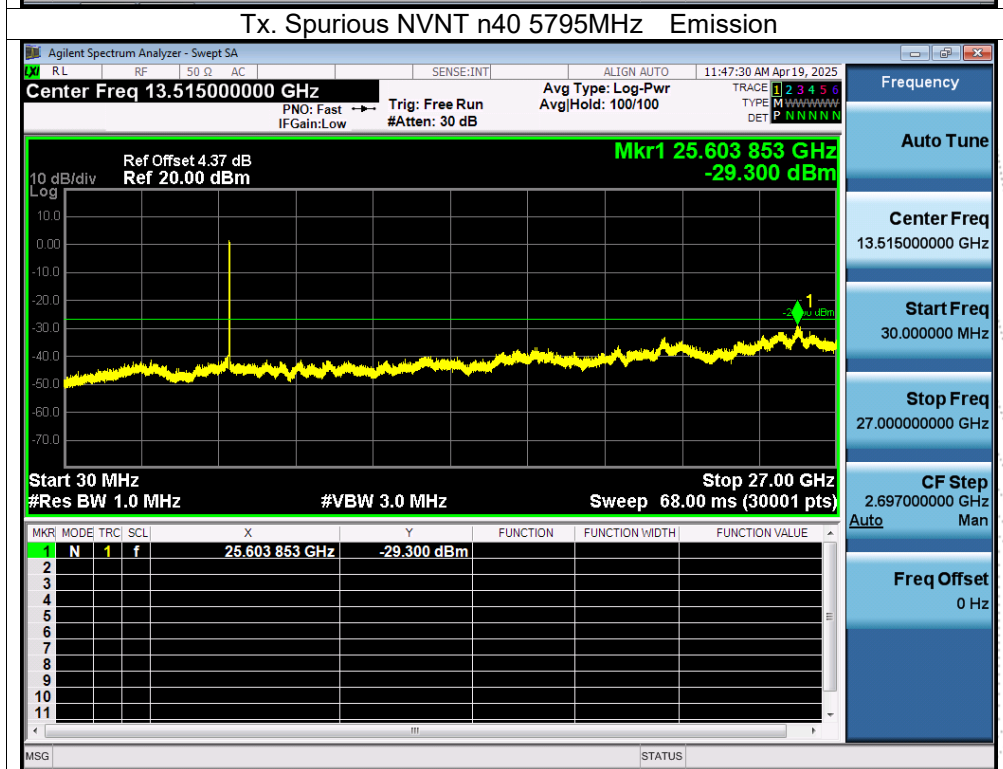
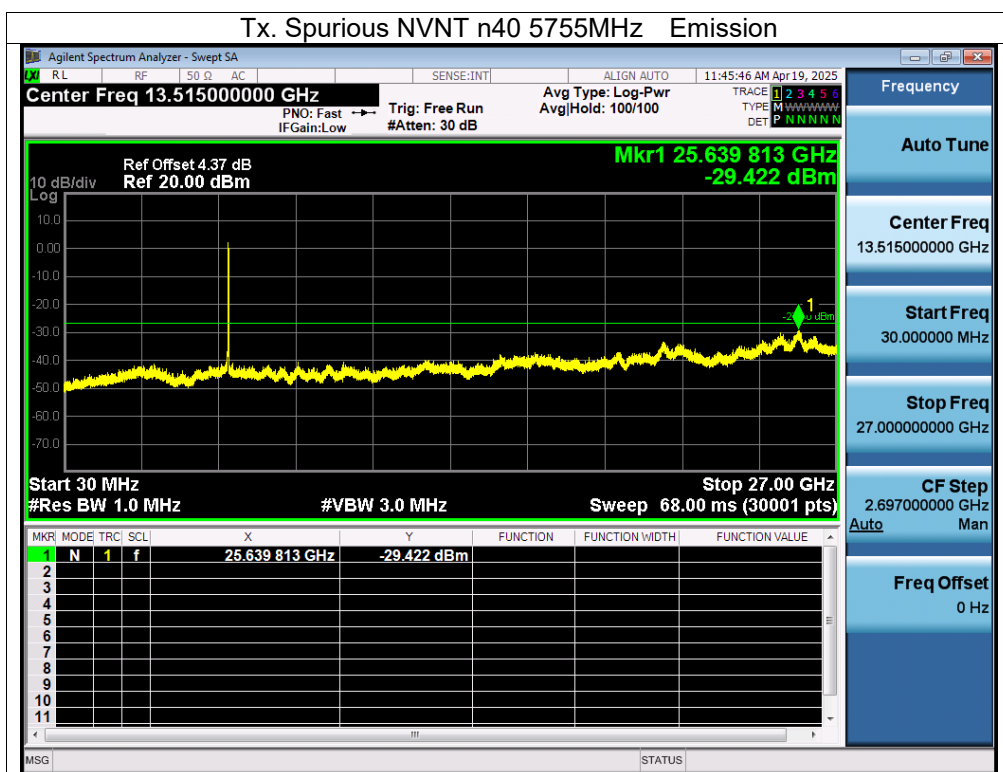


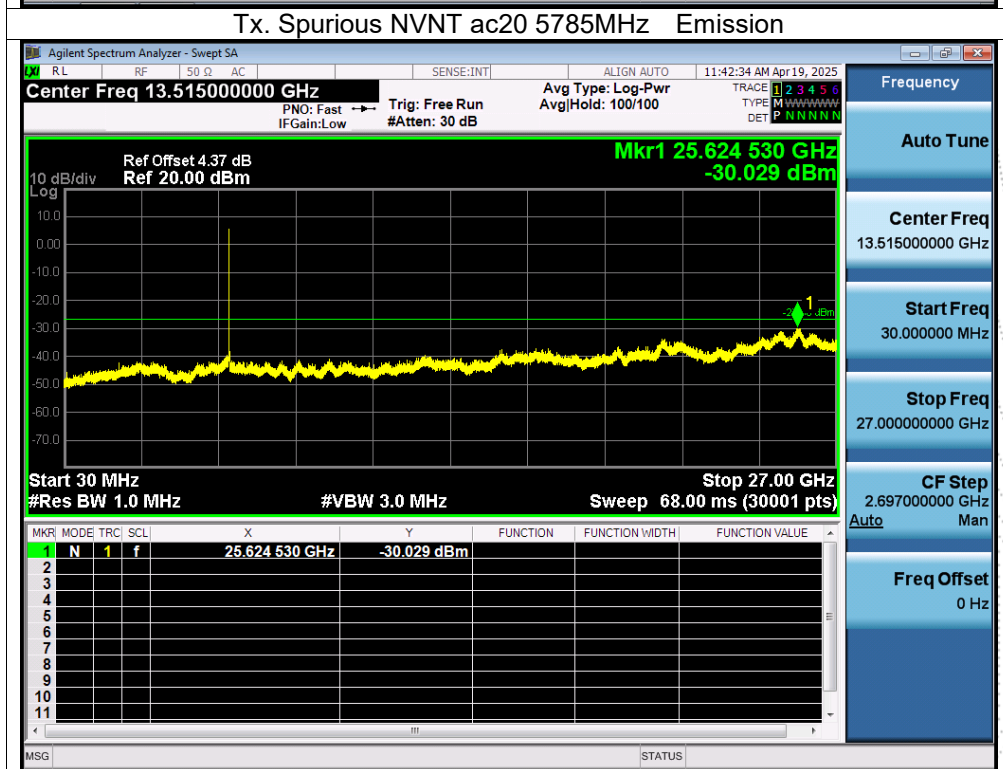
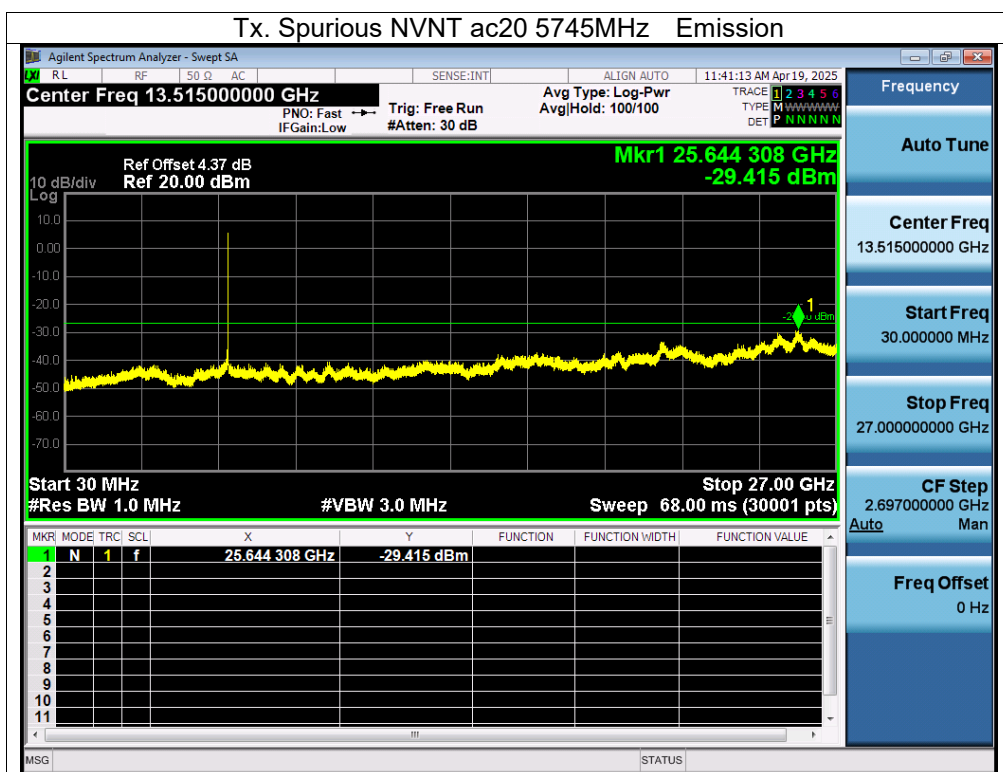
Tx. Spurious NVNT a 5785MHz Emission

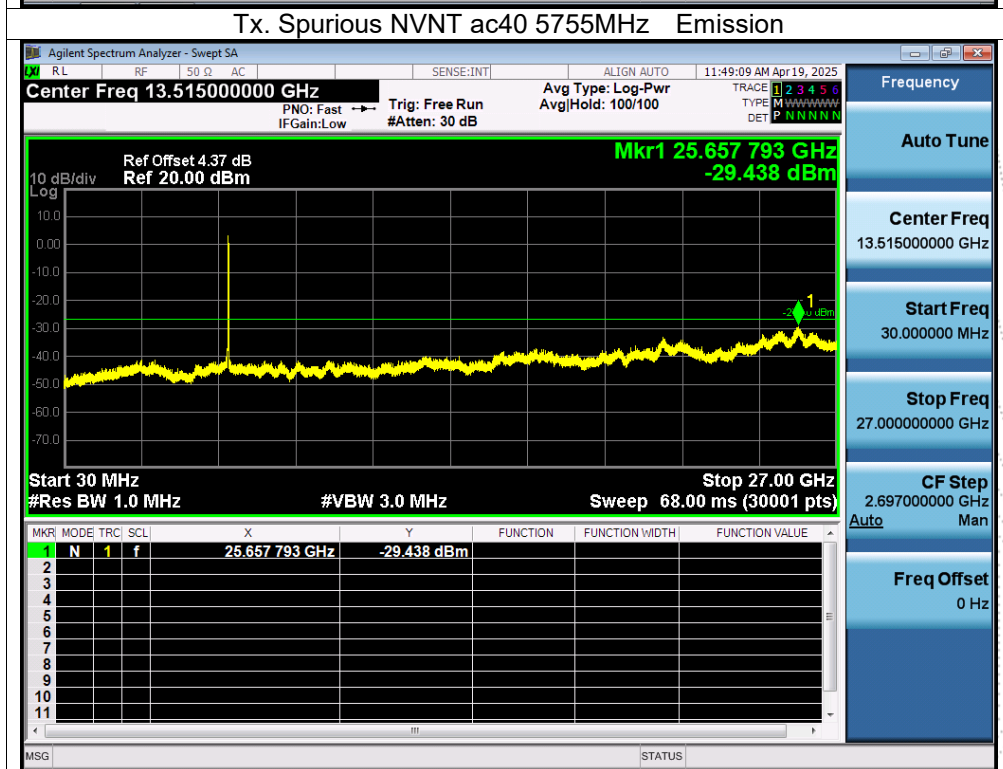
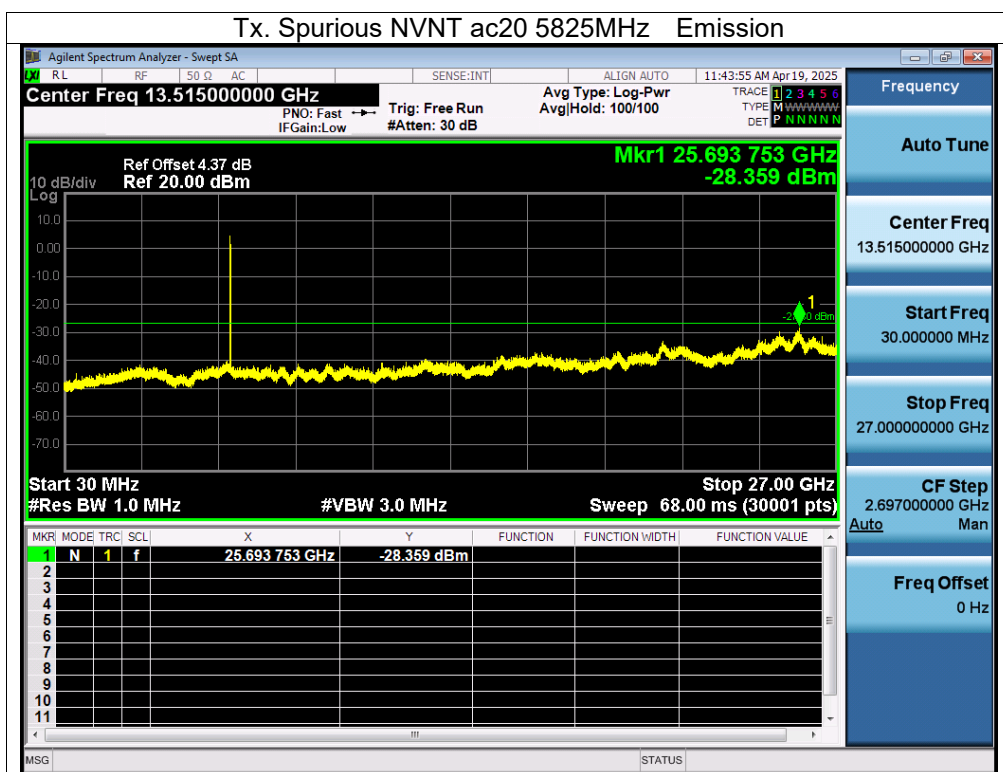


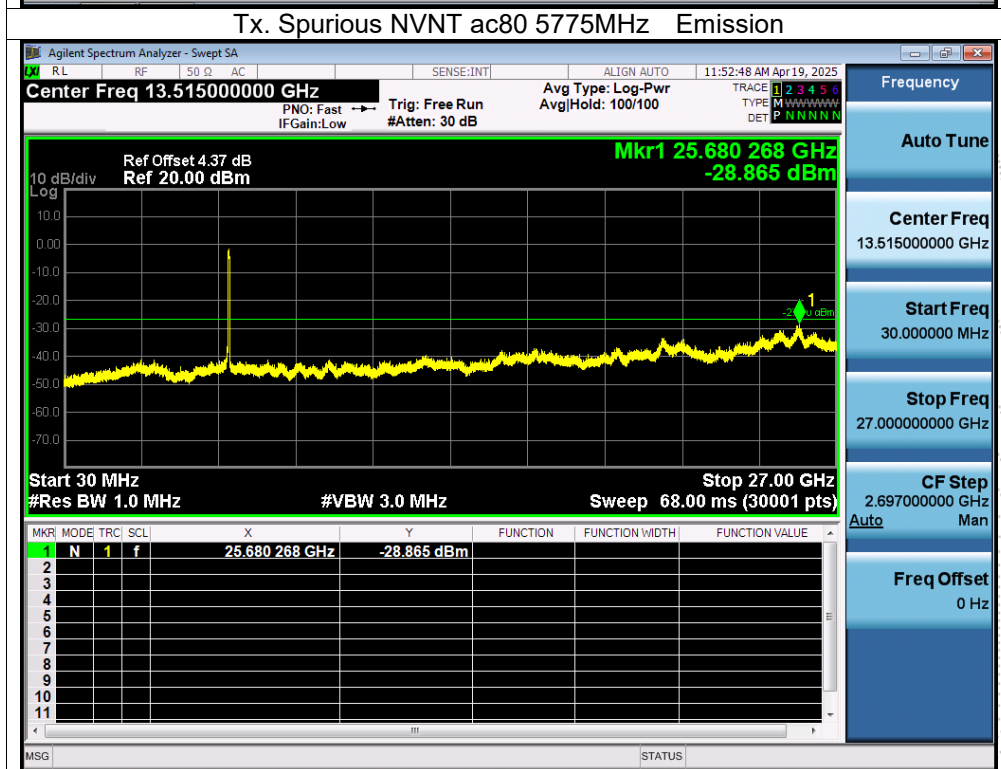
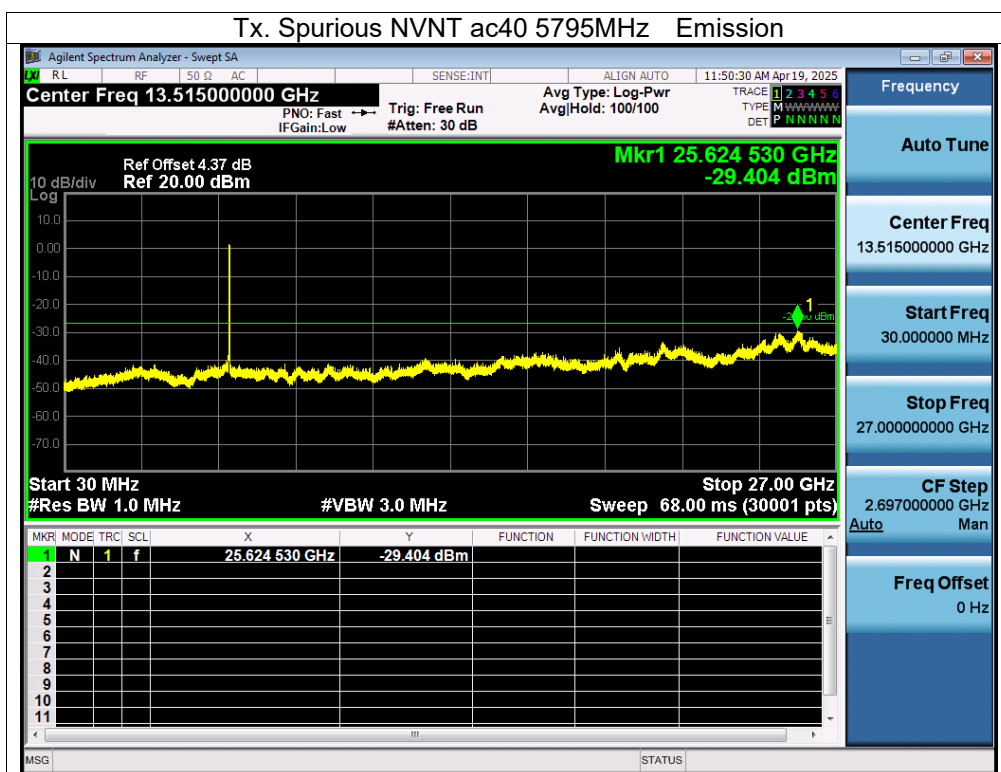












13. Frequency Stability Measurement

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. f_c is declaring of channel frequency. Then the frequency error formula is $(f_c - f)/f_c \times 10^6$ ppm and he limit is less than ± 20 ppm (IEEE 802.11n specification).
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 $-20^{\circ}\text{C} \sim 70^{\circ}\text{C}$.

13.4 Test Result

Temperature:	26 °C	Relative Humidity:	54%
Pressure:	101kPa	Test Voltage:	DC 3.87V
Test Mode:	TX 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)	3.87	5180.0018	5180	0.0018	0.3475
		V max (V)	4.45	5180.0135	5180	0.0135	2.6062
		V min (V)	3.29	5180.0097	5180	0.0097	1.8726
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)	3.87	T (°C)	-20	5180.0071	5180	0.0071	1.3707
		T (°C)	-10	5180.0112	5180	0.0112	2.1622
		T (°C)	0	5180.0127	5180	0.0127	2.4517
		T (°C)	10	5180.0135	5180	0.0135	2.6062
		T (°C)	20	5180.0048	5180	0.0048	0.9266
		T (°C)	30	5180.0097	5180	0.0097	1.8726
		T (°C)	40	5180.0035	5180	0.0035	0.6757
		T (°C)	50	5180.0008	5180	0.0008	0.1544
		T (°C)	60	5180.0118	5180	0.0118	2.2780
		T (°C)	70	5180.0017	5180	0.0017	0.3282
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)	3.87	5200.0103	5200	0.0103	1.9808
		V max (V)	4.45	5200.0059	5200	0.0059	1.1346
		V min (V)	3.29	5200.0013	5200	0.0013	0.2500
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)	3.87	T (°C)	-20	5200.01320	5200	0.01320	2.5385
		T (°C)	-10	5200.00580	5200	0.00580	1.1154
		T (°C)	0	5200.00330	5200	0.00330	0.6346
		T (°C)	10	5200.00070	5200	0.00070	0.1346
		T (°C)	20	5200.00540	5200	0.00540	1.0385
		T (°C)	30	5200.00260	5200	0.00260	0.5000
		T (°C)	40	5200.00310	5200	0.00310	0.5962
		T (°C)	50	5200.01010	5200	0.01010	1.9423
		T (°C)	60	5200.00410	5200	0.00410	0.7885
		T (°C)	70	5200.00920	5200	0.00920	1.7692
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)	3.87	5240.0062	5240	0.0062	1.1832
		V max (V)	4.45	5240.0023	5240	0.0023	0.4389
		V min (V)	3.29	5240.0083	5240	0.0083	1.5840
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)	3.87	T (°C)	-20	5240.0108	5240	0.0108	2.0611
		T (°C)	-10	5240.0027	5240	0.0027	0.5153
		T (°C)	0	5240.0017	5240	0.0017	0.3244
		T (°C)	10	5240.0113	5240	0.0113	2.1565
		T (°C)	20	5240.0006	5240	0.0006	0.1145
		T (°C)	30	5240.0112	5240	0.0112	2.1374
		T (°C)	40	5240.0132	5240	0.0132	2.5191
		T (°C)	50	5240.0063	5240	0.0063	1.2023
		T (°C)	60	5240.0040	5240	0.0040	0.7634
		T (°C)	70	5240.0015	5240	0.0015	0.2863
Limits				5150-5250 MHz			
Result				Complies			

Temperature:	26 °C	Relative Humidity:	54%
Pressure:	101kPa	Test Voltage:	DC 3.87V
Test Mode:	TX Frequency(5745-5825MHz)		

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	3.87	5745.00630	5745	0.00630	1.0966
		V max (V)	4.45	5745.00570	5745	0.00570	0.9922
		V min (V)	3.29	5745.00320	5745	0.00320	0.5570
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)	3.87	T (°C)	-20	5745.00280	5745	0.00280	0.4874
		T (°C)	-10	5745.00900	5745	0.00900	1.5666
		T (°C)	0	5745.01260	5745	0.01260	2.1932
		T (°C)	10	5745.00700	5745	0.00700	1.2185
		T (°C)	20	5745.00820	5745	0.00820	1.4273
		T (°C)	30	5745.00730	5745	0.00730	1.2707
		T (°C)	40	5745.00410	5745	0.00410	0.7137
		T (°C)	50	5745.00980	5745	0.00980	1.7058
		T (°C)	60	5745.01190	5745	0.01190	2.0714
		T (°C)	70	5745.01170	5745	0.01170	2.0366
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)	3.87	5785.00230	5785	0.00230	0.3976
		V max (V)	4.45	5785.01190	5785	0.01190	2.0570
		V min (V)	3.29	5785.00110	5785	0.00110	0.1901
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)	3.87	T (°C)	-20	5785.00280	5785	0.00280	0.4840
		T (°C)	-10	5785.00220	5785	0.00220	0.3803
		T (°C)	0	5785.00330	5785	0.00330	0.5704
		T (°C)	10	5785.00270	5785	0.00270	0.4667
		T (°C)	20	5785.01060	5785	0.01060	1.8323
		T (°C)	30	5785.00350	5785	0.00350	0.6050
		T (°C)	40	5785.00450	5785	0.00450	0.7779
		T (°C)	50	5785.01020	5785	0.01020	1.7632
		T (°C)	60	5785.00140	5785	0.00140	0.2420
		T (°C)	70	5785.01250	5785	0.01250	2.1608
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)	3.87	5825.00990	5825	0.00990	1.6996
		V max (V)	4.45	5825.00770	5825	0.00770	1.3219
		V min (V)	3.29	5825.01120	5825	0.01120	1.9227
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)	3.87	T (°C)	-20	5825.01200	5825	0.01200	2.0601
		T (°C)	-10	5825.00130	5825	0.00130	0.2232
		T (°C)	0	5825.00390	5825	0.00390	0.6695
		T (°C)	10	5825.00230	5825	0.00230	0.3948
		T (°C)	20	5825.00230	5825	0.00230	0.3948
		T (°C)	30	5825.01200	5825	0.01200	2.0601
		T (°C)	40	5825.00240	5825	0.00240	0.4120
		T (°C)	50	5825.00130	5825	0.00130	0.2232
		T (°C)	60	5825.01340	5825	0.01340	2.3004
		T (°C)	70	5825.00780	5825	0.00780	1.3391
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 = $T_{on} / (T_{on} + T_{off})$

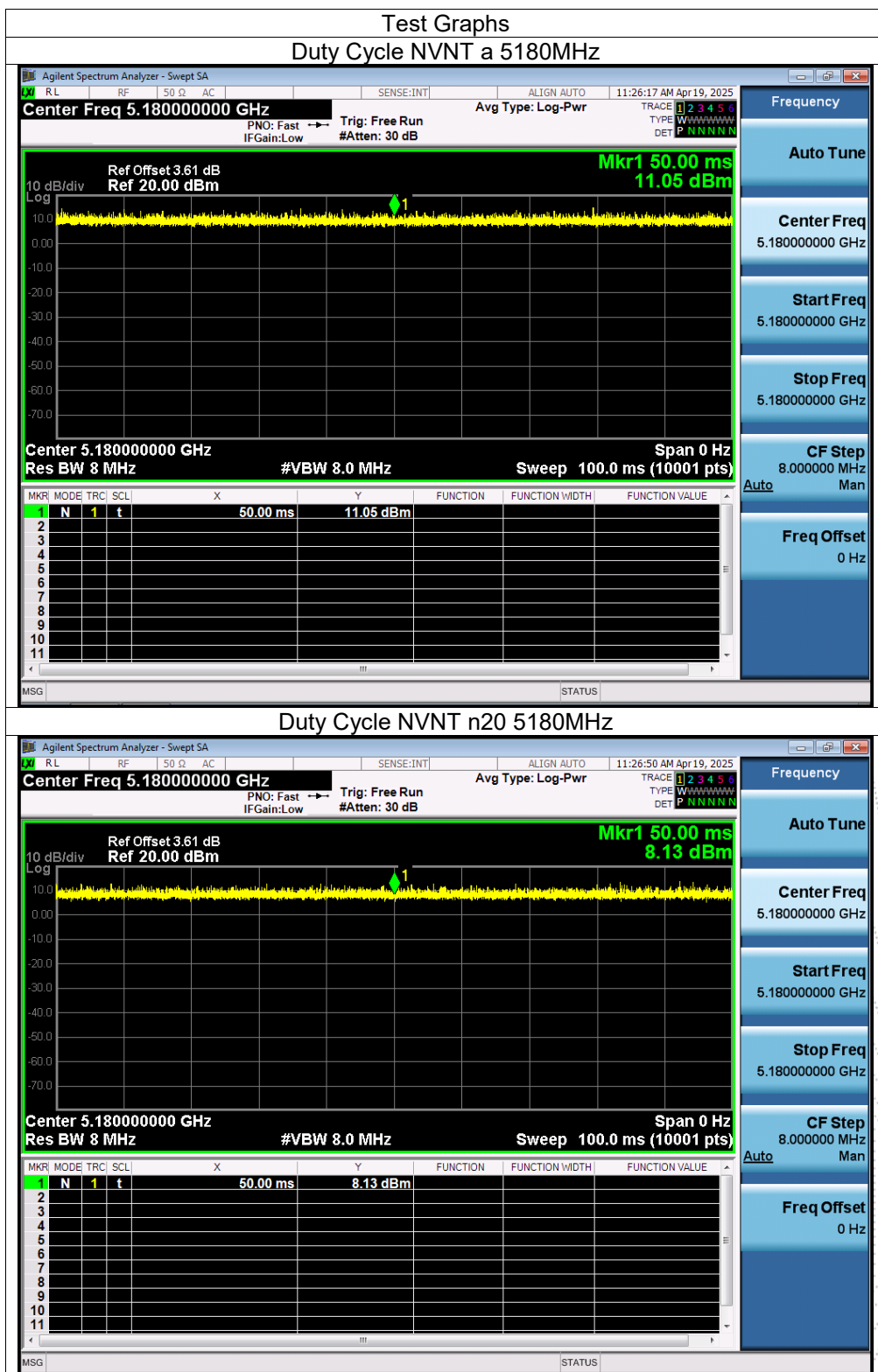
14.3 Test Procedure

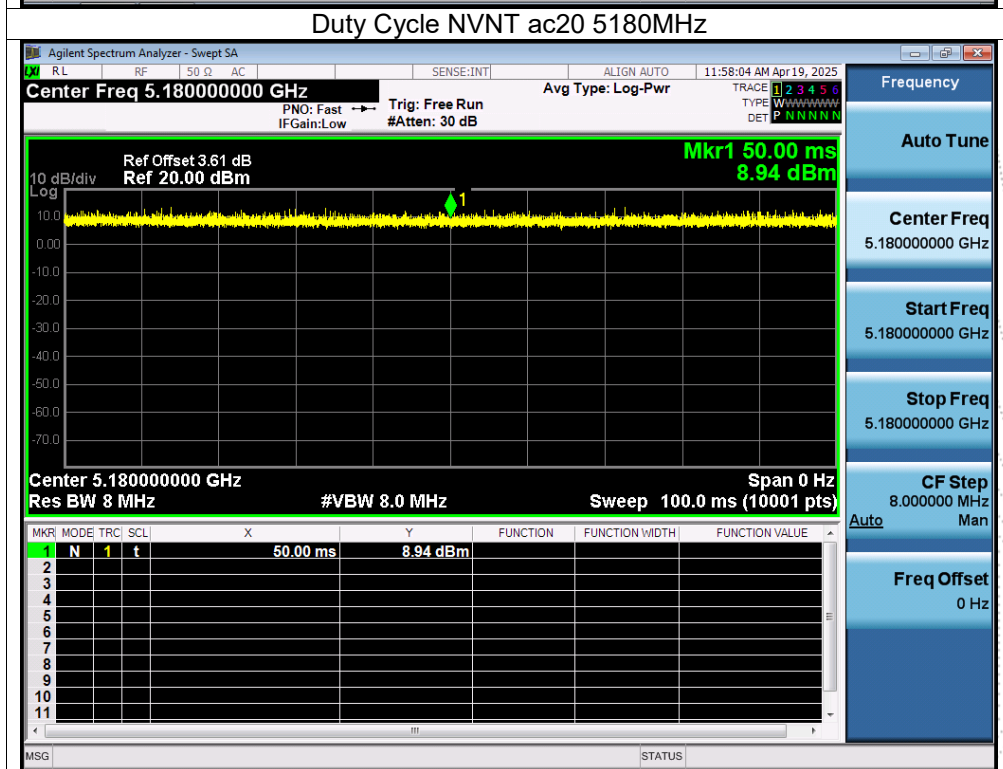
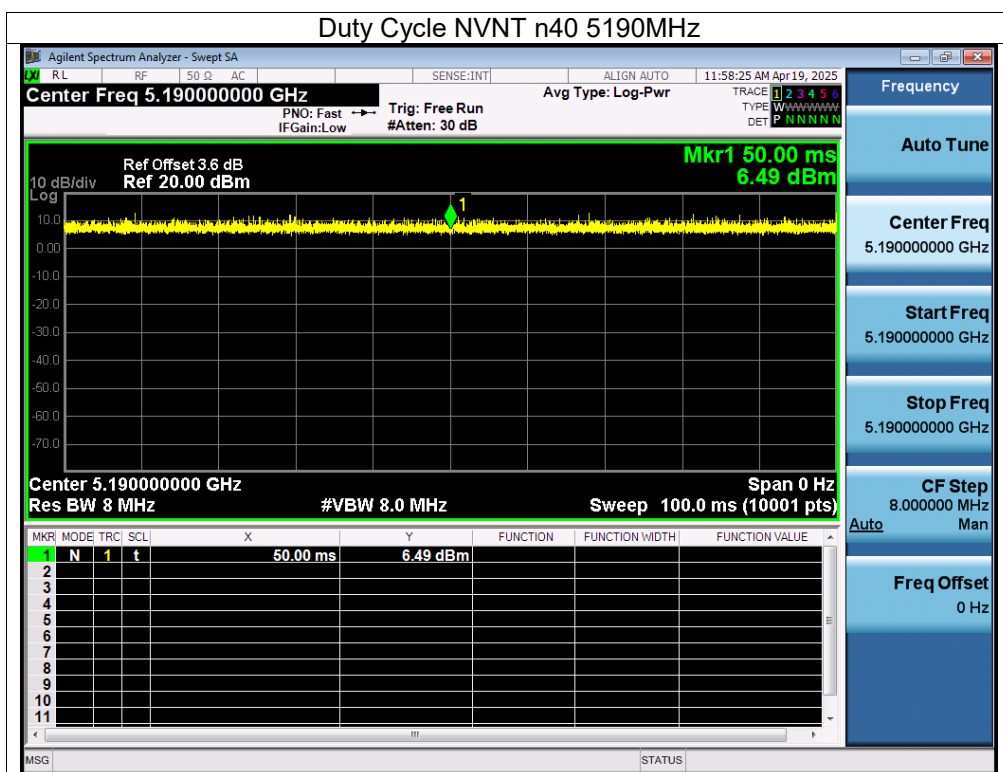
1. Set span = Zero
2. RBW = 8MHz
3. VBW = 8MHz,
4. Detector = Peak

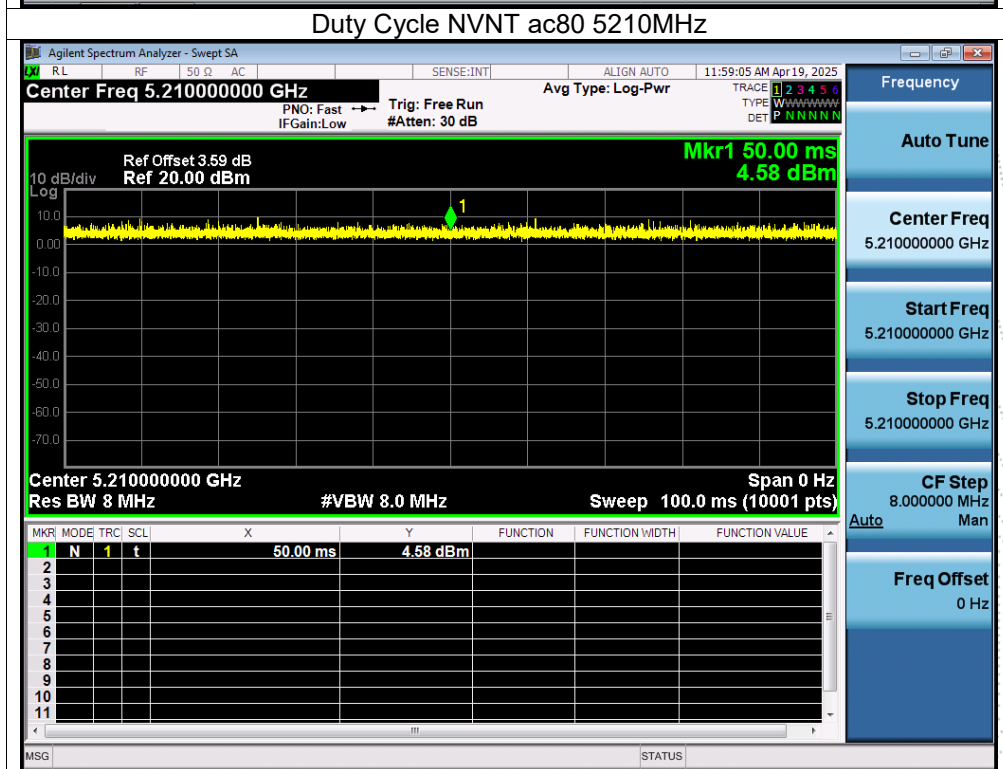
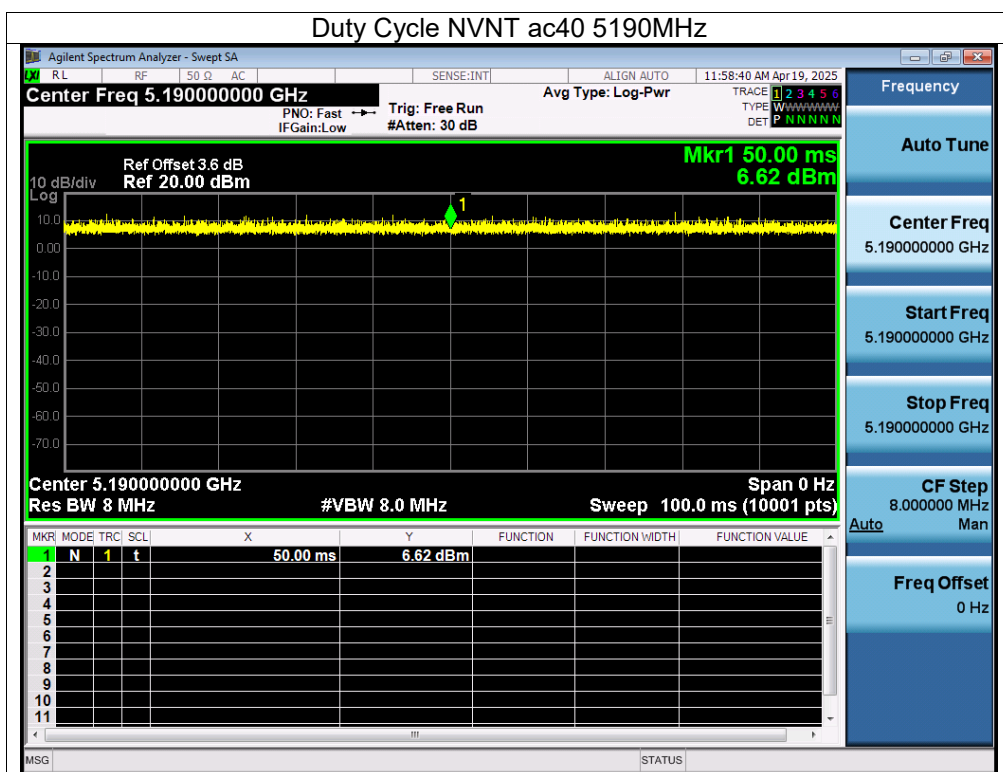
14.4 Test Result

5.1G

Condition	Mode	Frequency (MHz)	Duty Cycle (%)	Correction Factor (dB)
NVNT	a	5180	100	0
NVNT	n20	5180	100	0
NVNT	n40	5190	100	0
NVNT	ac20	5180	100	0
NVNT	ac40	5190	100	0
NVNT	ac80	5210	100	0

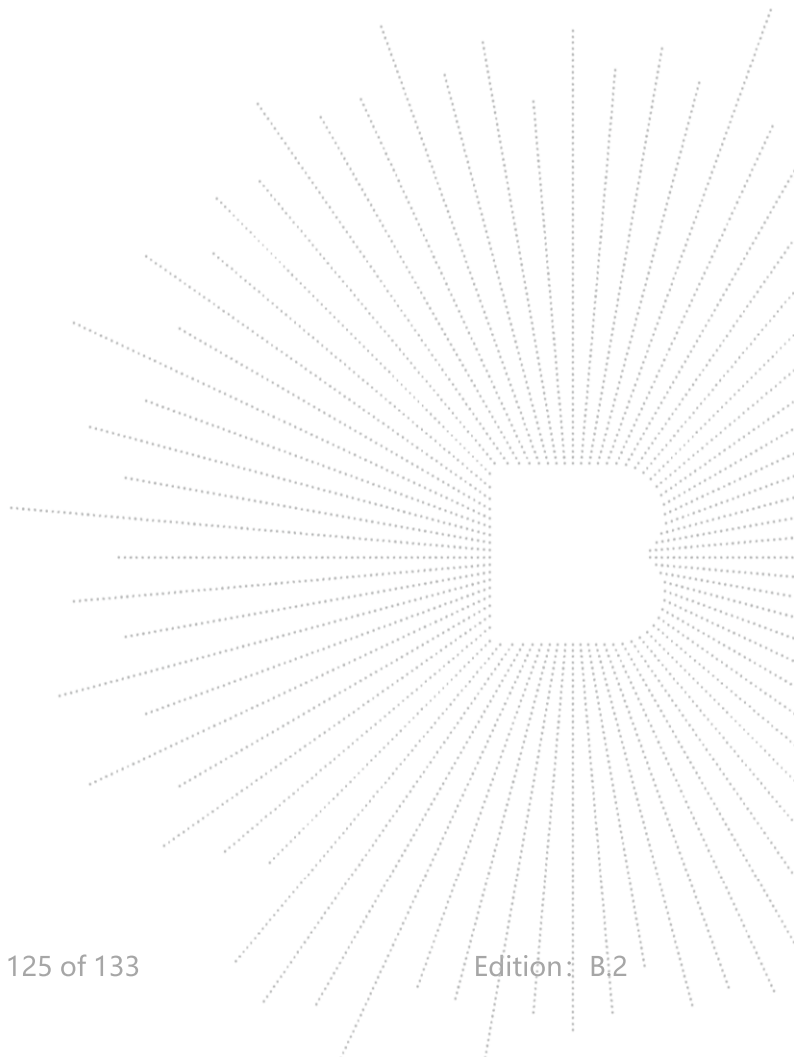


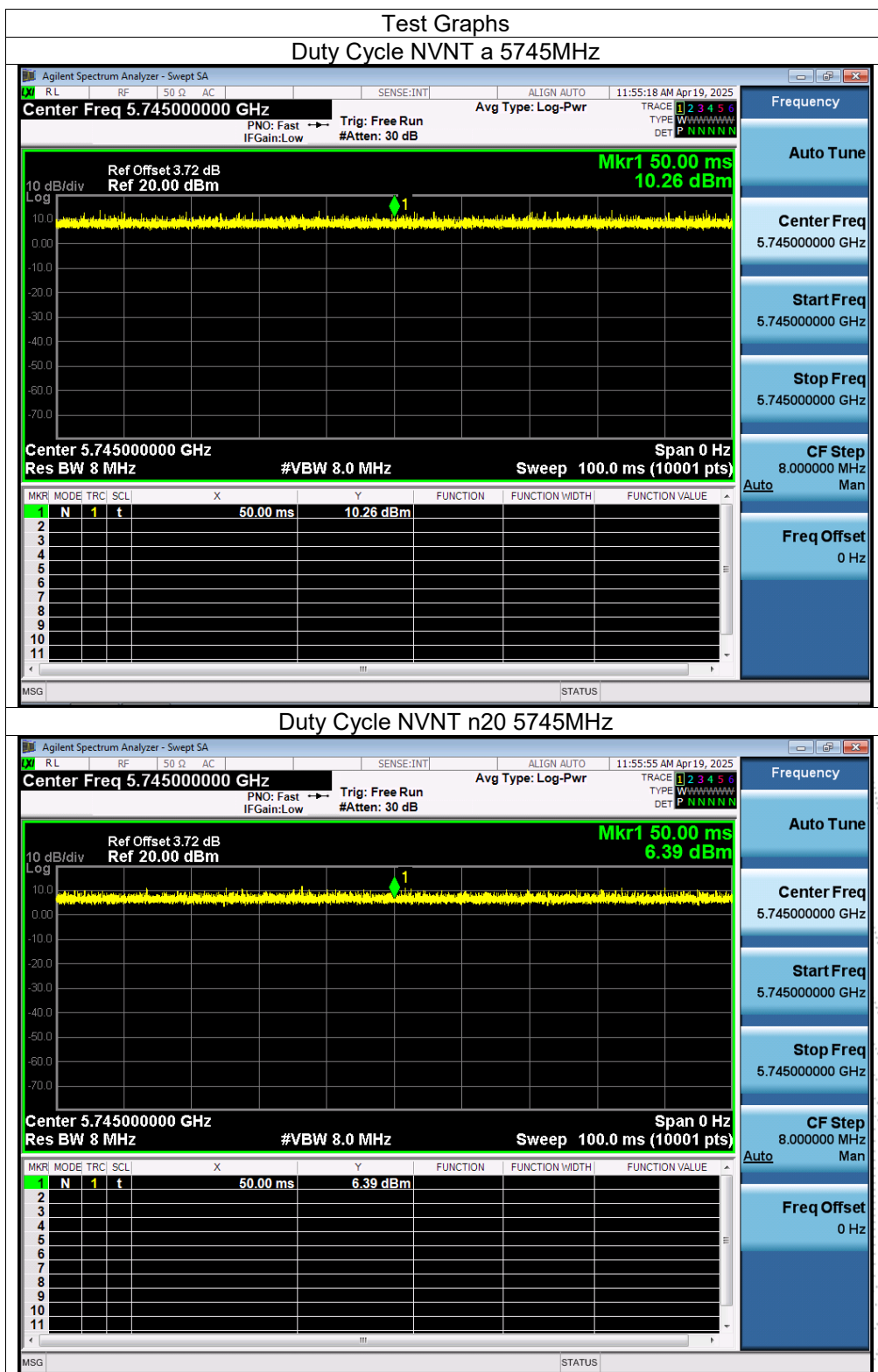


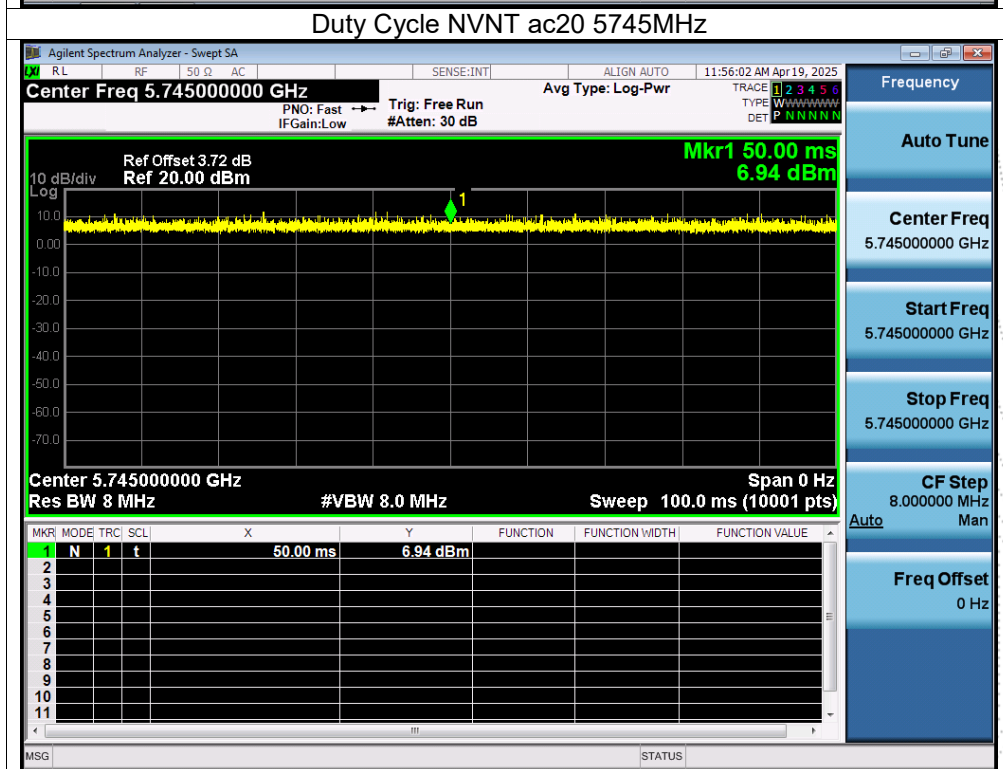
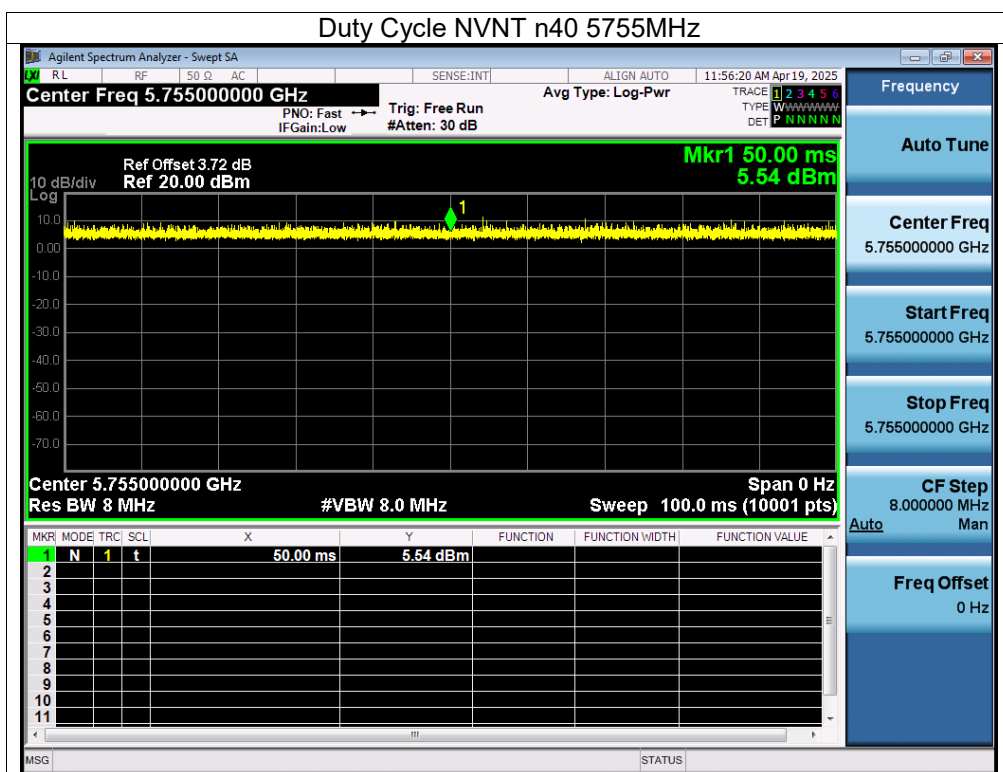


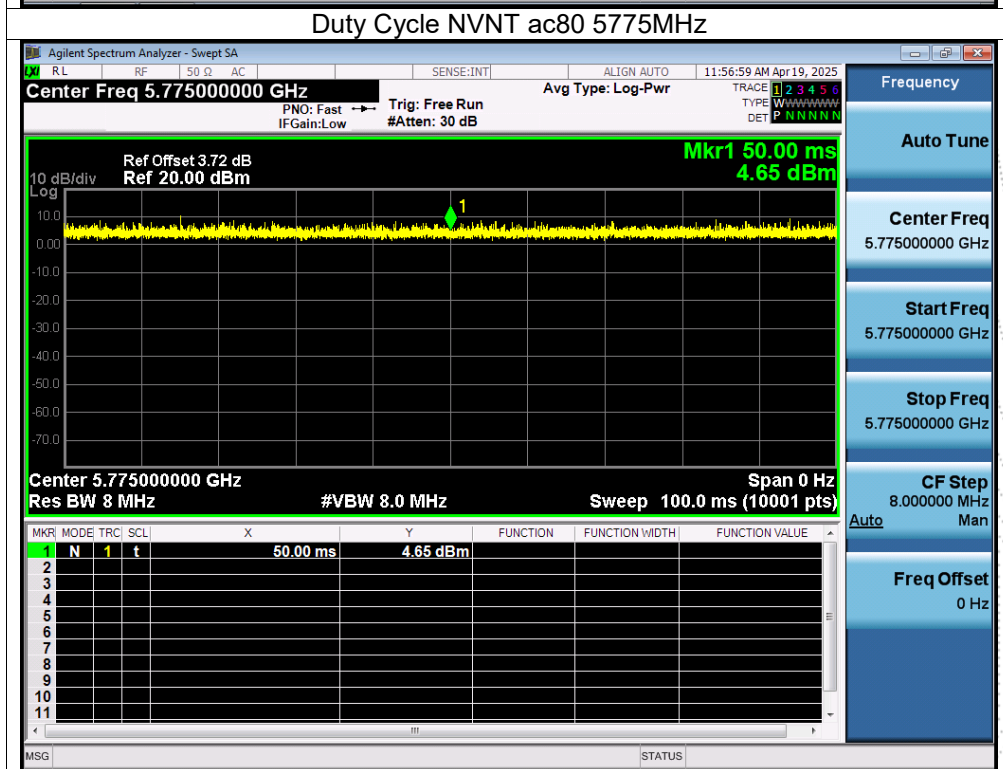
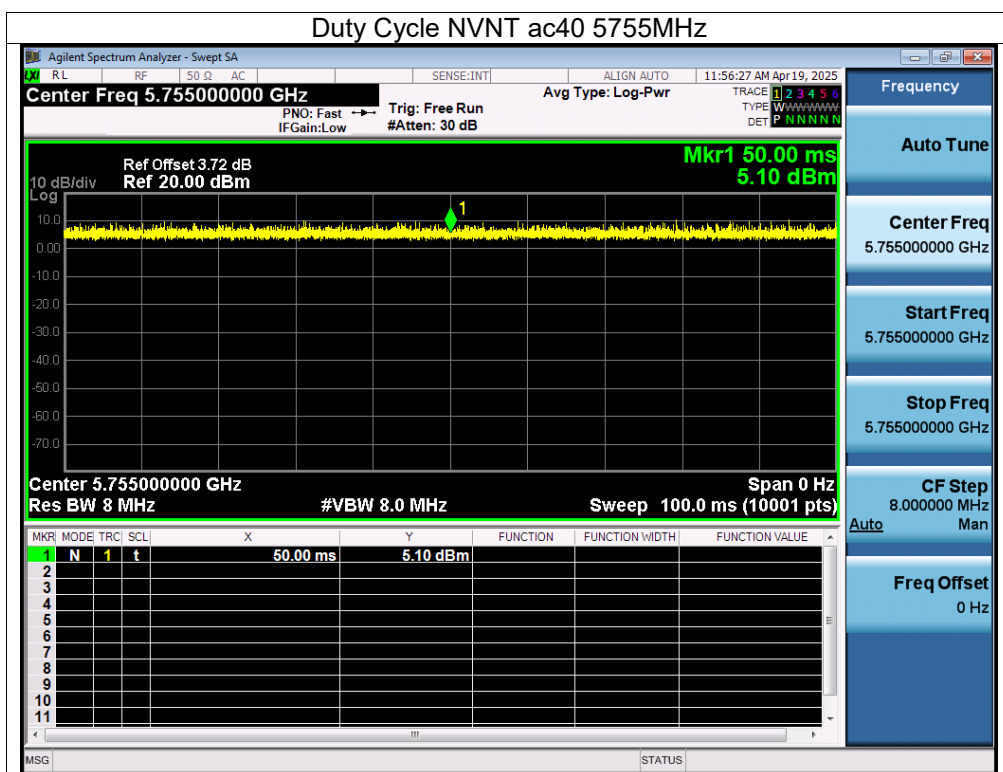
5.8G

Condition	Mode	Frequency (MHz)	Duty Cycle (%)	Correction Factor (dB)
NVNT	a	5745	100	0
NVNT	n20	5745	100	0
NVNT	n40	5755	100	0
NVNT	ac20	5745	100	0
NVNT	ac40	5755	100	0
NVNT	ac80	5775	100	0









15. Antenna Requirement

15.1 Limit

15.203 requirement: For intentional device, according to 15.203: 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.

15.2 Test Result

The EUT antenna is Internal antenna (antenna gain: 0.22 dBi). It comply with the standard requirement.

