

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.).

a) 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.

b) 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. 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 \geq 3 MHz.

(iv) Number of points in sweep \geq 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.

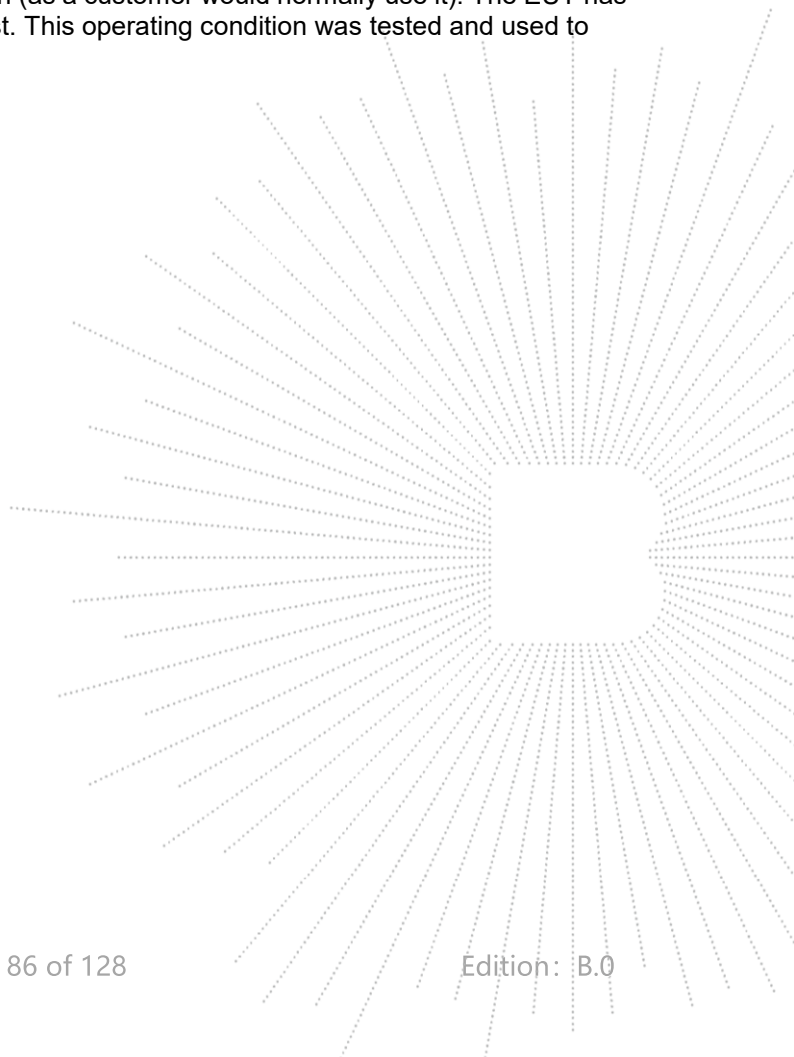
(vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle \geq 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

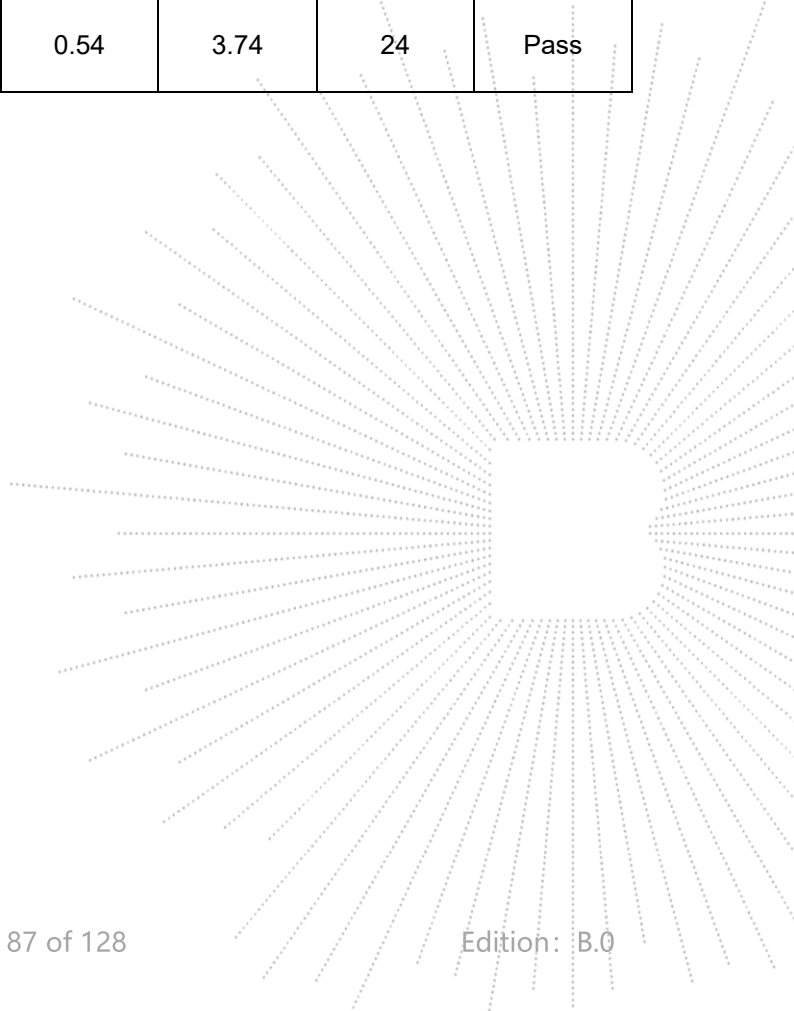
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



10.5 Test Result

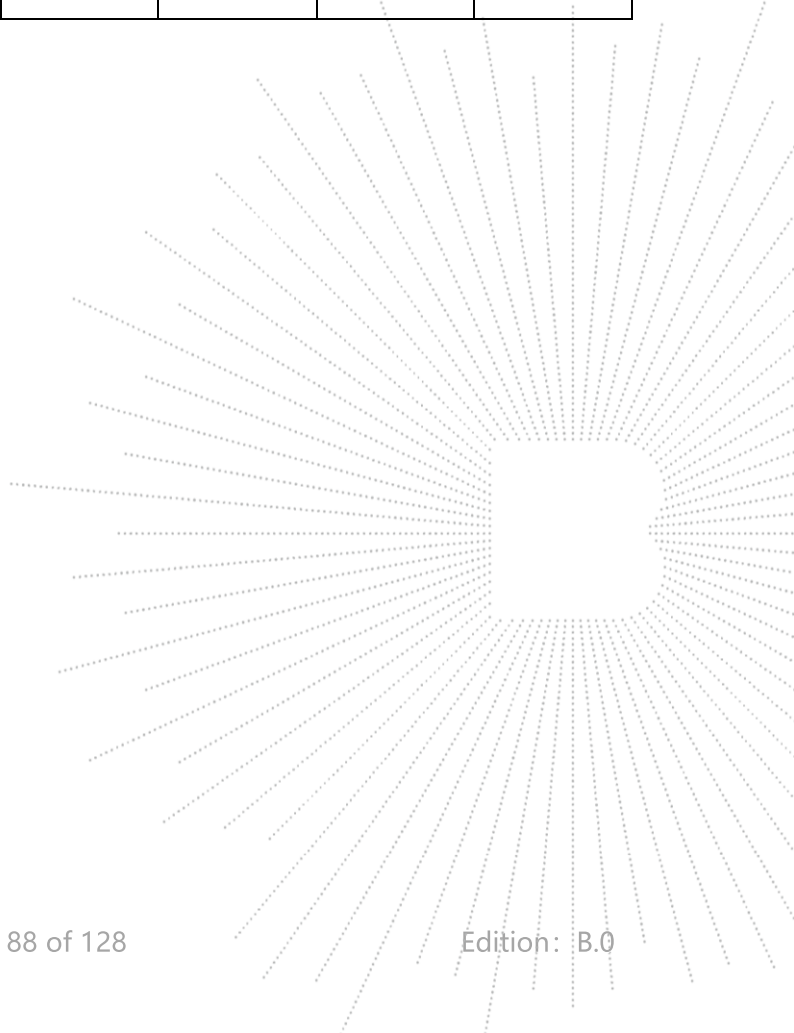
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	101kPa	Test Voltage :	DC 12V
Test Mode :	TX (5G) Mode Frequency U-NII-1 (5180-5240MHz)		

Test Mode	Test Channel	Frequency (MHz)	Maximum output power. Antenna port (AV)			Limit dBm	Result
			ANT A(dBm)	ANT B(dBm)	Total(dBm)		
TX 802.11a Mode	CH36	5180	3.6	3.11	/	24	Pass
	CH40	5200	3.58	2.64	/	24	Pass
	CH48	5240	3.82	2.6	/	24	Pass
TX 802.11 n20M Mode	CH36	5180	2.73	1.98	5.38	24	Pass
	CH40	5200	2.56	1.7	5.16	24	Pass
	CH48	5240	2.85	1.48	5.23	24	Pass
TX 802.11 n40M Mode	CH38	5190	2.69	1.93	5.34	24	Pass
	CH46	5230	2.84	1.66	5.30	24	Pass
TX 802.11 AC20M Mode	CH36	5180	2.75	2.02	5.41	24	Pass
	CH40	5200	2.59	2.16	5.39	24	Pass
	CH48	5240	2.88	1.45	5.23	24	Pass
TX 802.11 AC40M Mode	CH38	5190	2.65	1.93	5.32	24	Pass
	CH46	5230	2.8	1.64	5.27	24	Pass
TX 802.11 AC80M Mode	CH42	5210	0.91	0.54	3.74	24	Pass



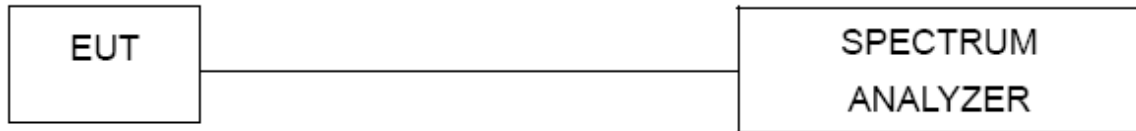
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	101kPa	Test Voltage :	DC 12V
Test Mode :	TX (5G) Mode Frequency U-NII-3 (5745-5825MHz)		

Test Mode	Test Channel	Frequency (MHz)	Maximum output power. Antenna port (AV)			Limit dBm	Result
			ANT A(dBm)	ANT B(dBm)	Total(dBm)		
TX 802.11a Mode	CH 149	5745	2.63	3.87	/	30	Pass
	CH 157	5785	1.89	3.29	/	30	Pass
	CH 165	5825	0.31	2.1	/	30	Pass
TX 802.11 n20M Mode	CH 149	5745	1.71	2.4	5.08	30	Pass
	CH 157	5785	0.78	1.28	4.05	30	Pass
	CH 165	5825	-0.65	-0.07	2.66	30	Pass
TX 802.11 n40M Mode	CH 151	5755	1.72	1.56	4.65	30	Pass
	CH 159	5795	0.31	0.77	3.56	30	Pass
TX 802.11 AC20M Mode	CH 151	5755	1.77	2.33	5.07	30	Pass
	CH 159	5795	0.6	1.25	3.95	30	Pass
	CH 151	5755	-0.68	0.1	2.74	30	Pass
TX 802.11 AC40M Mode	CH 151	5755	1.28	1.89	4.61	30	Pass
	CH 159	5795	0.36	0.83	3.61	30	Pass
TX 802.11 AC80M Mode	CH 155	5775	-0.26	0.82	3.32	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.

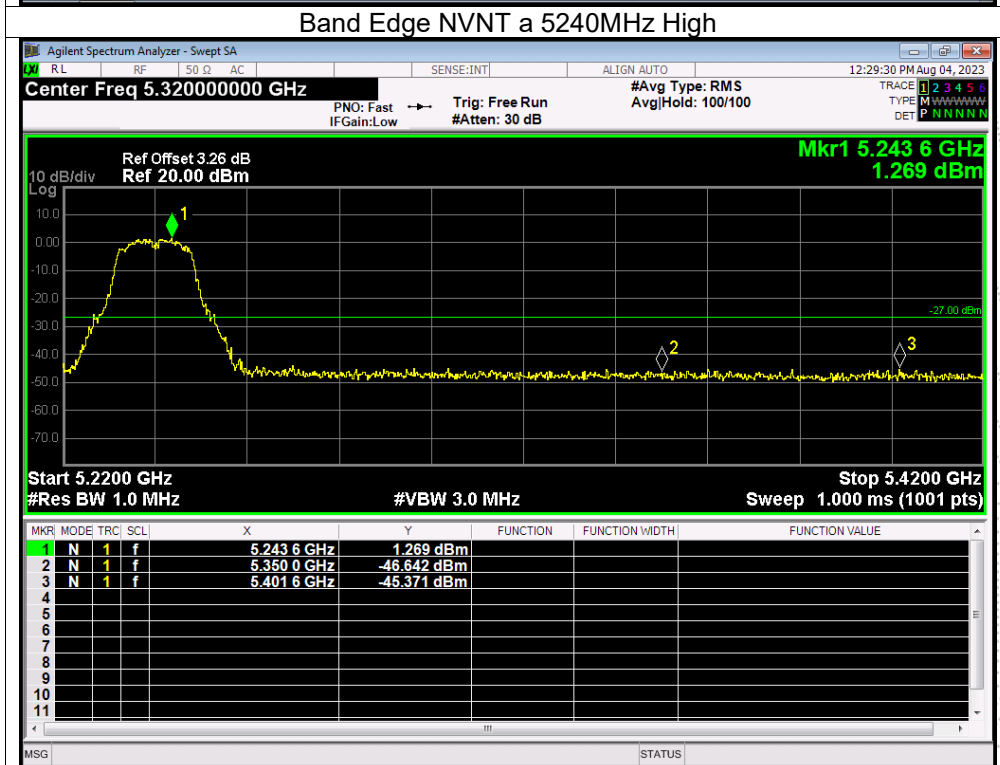
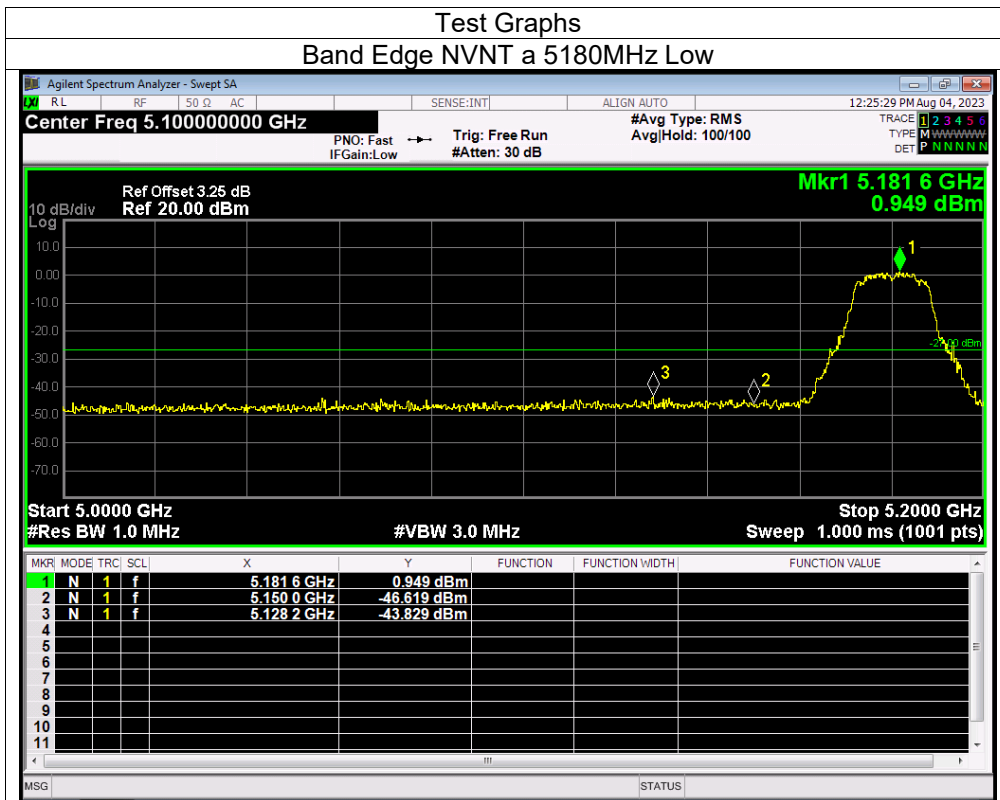
11.4 EUT Operating Conditions

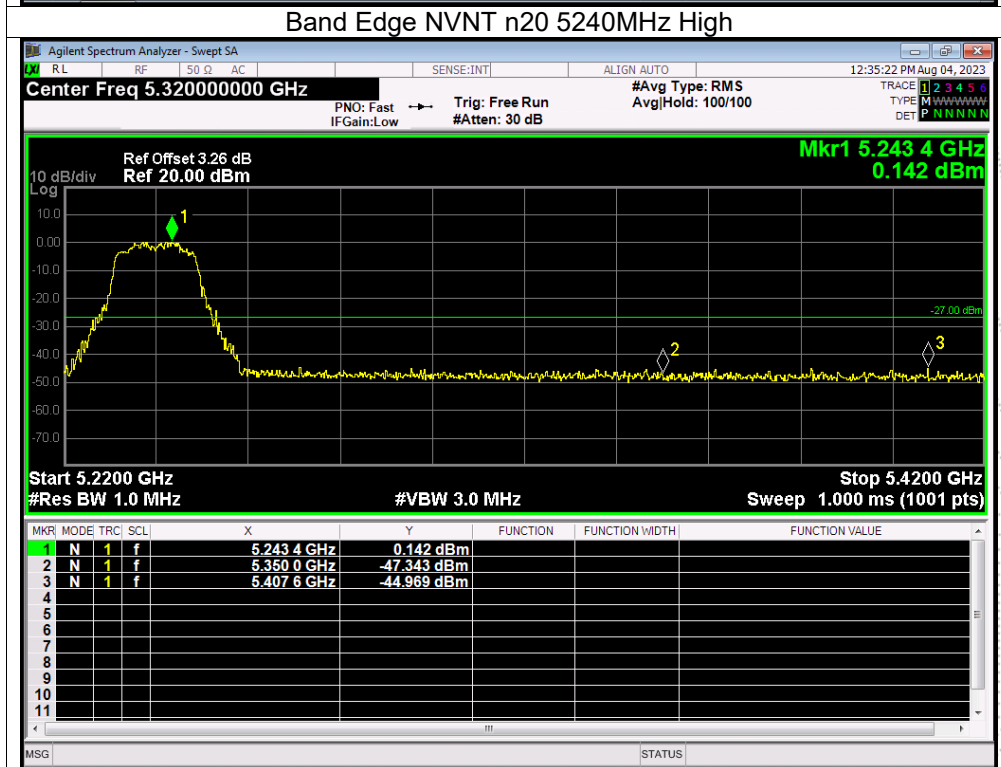
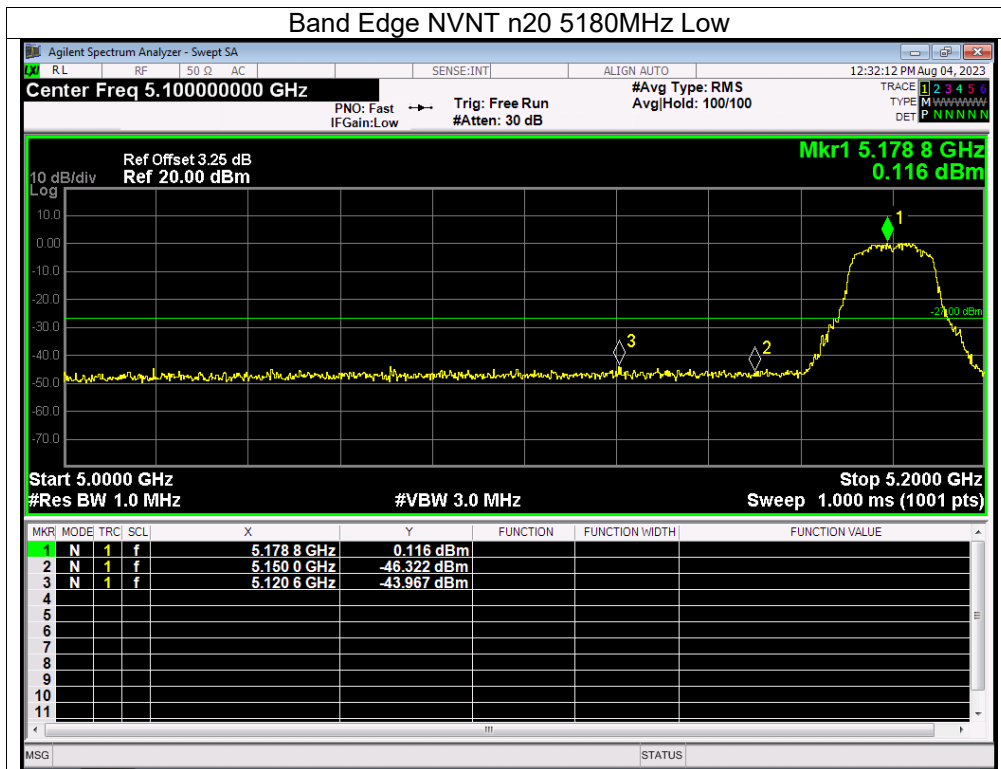
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data

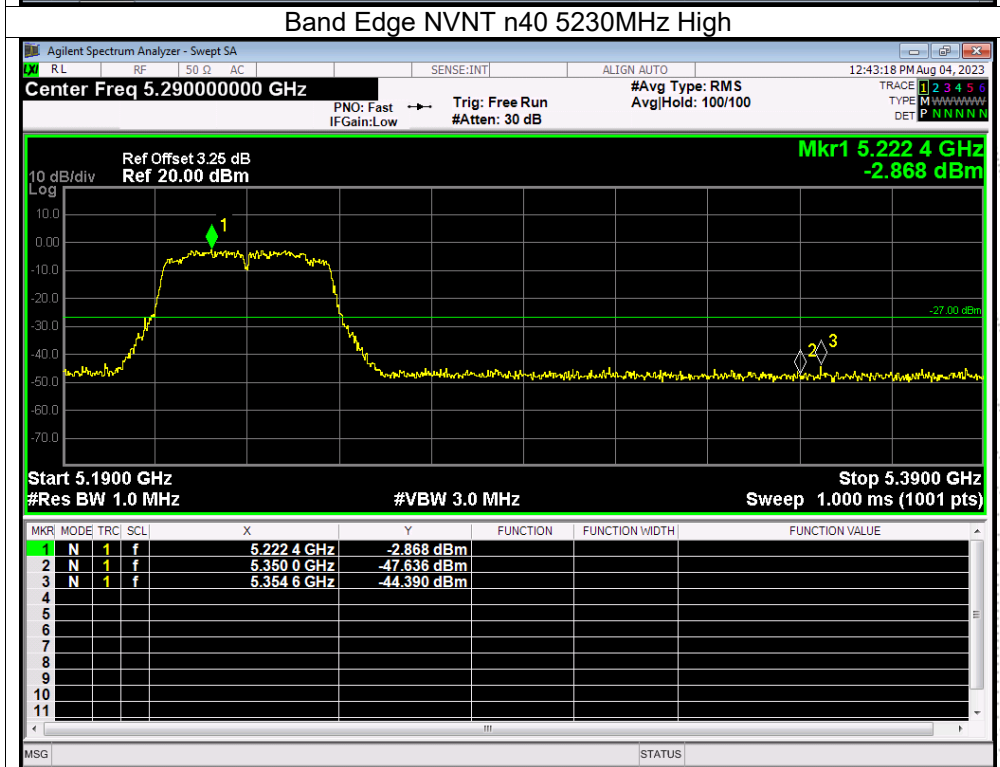
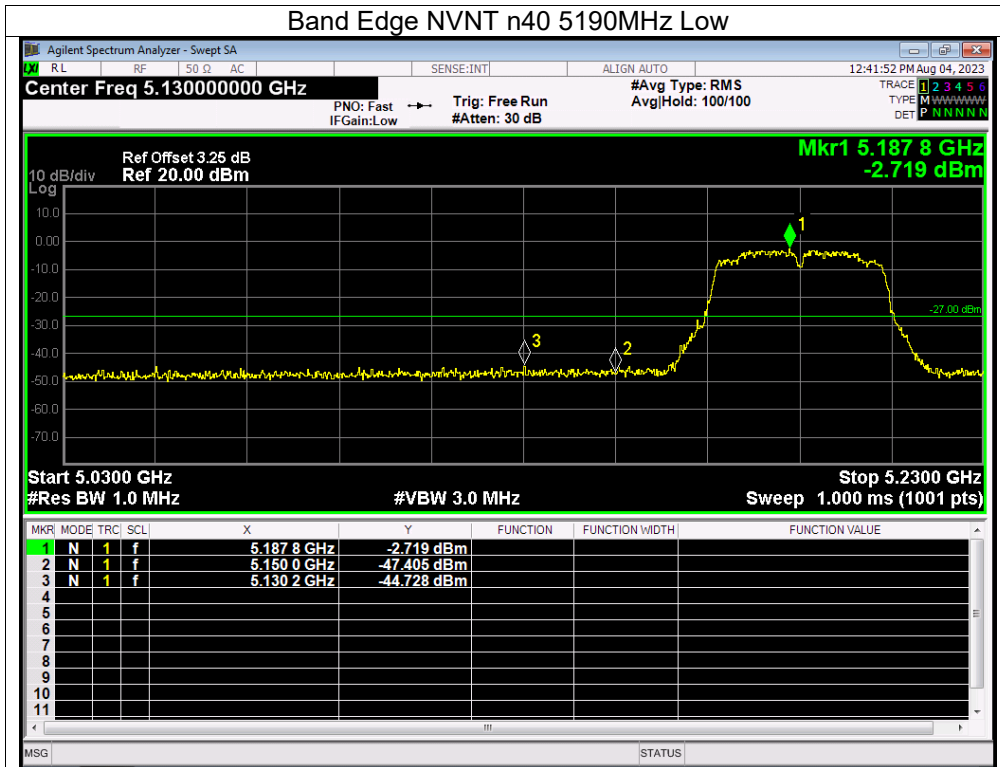
11.5 Test Result

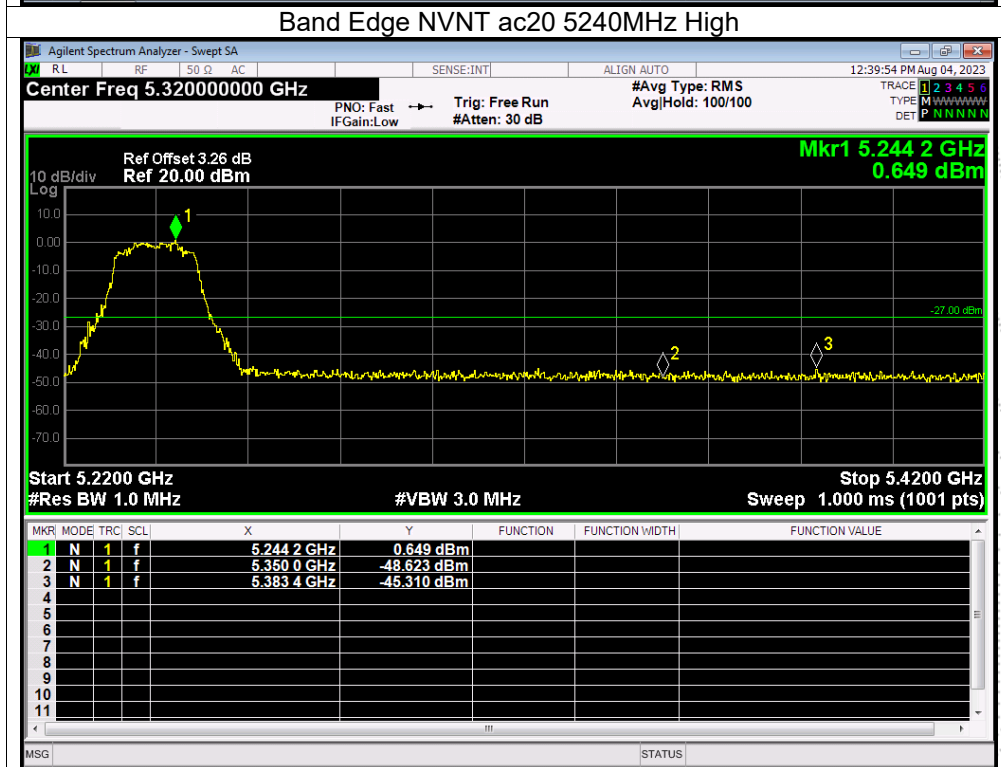
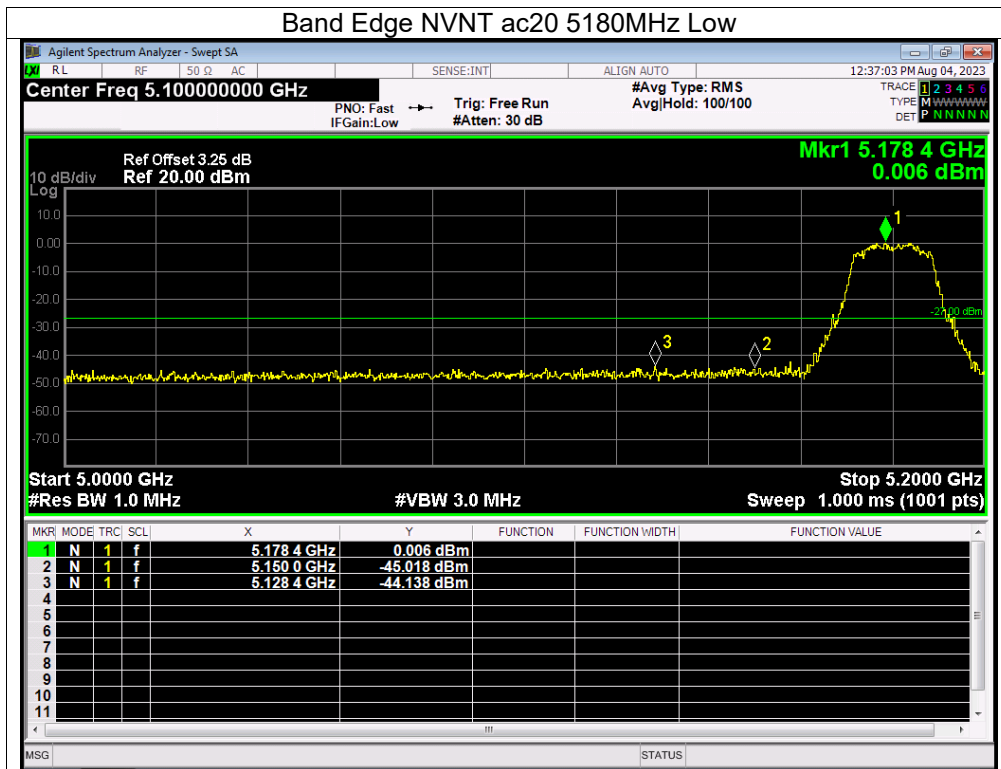
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	101kPa	Test Voltage :	DC 12V

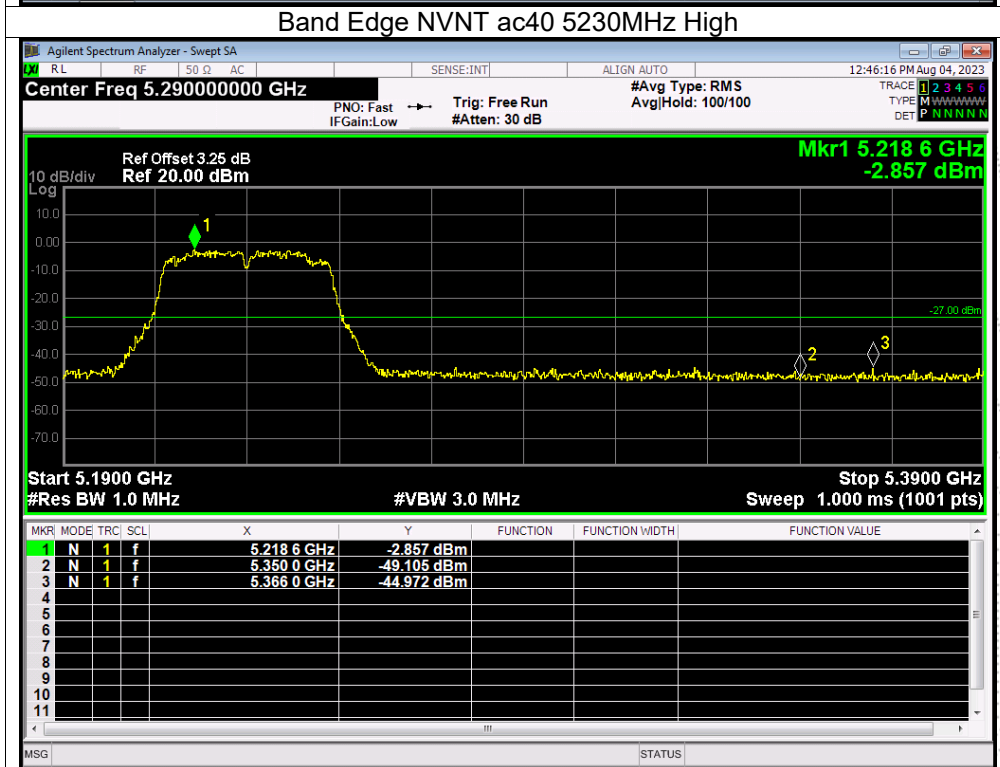
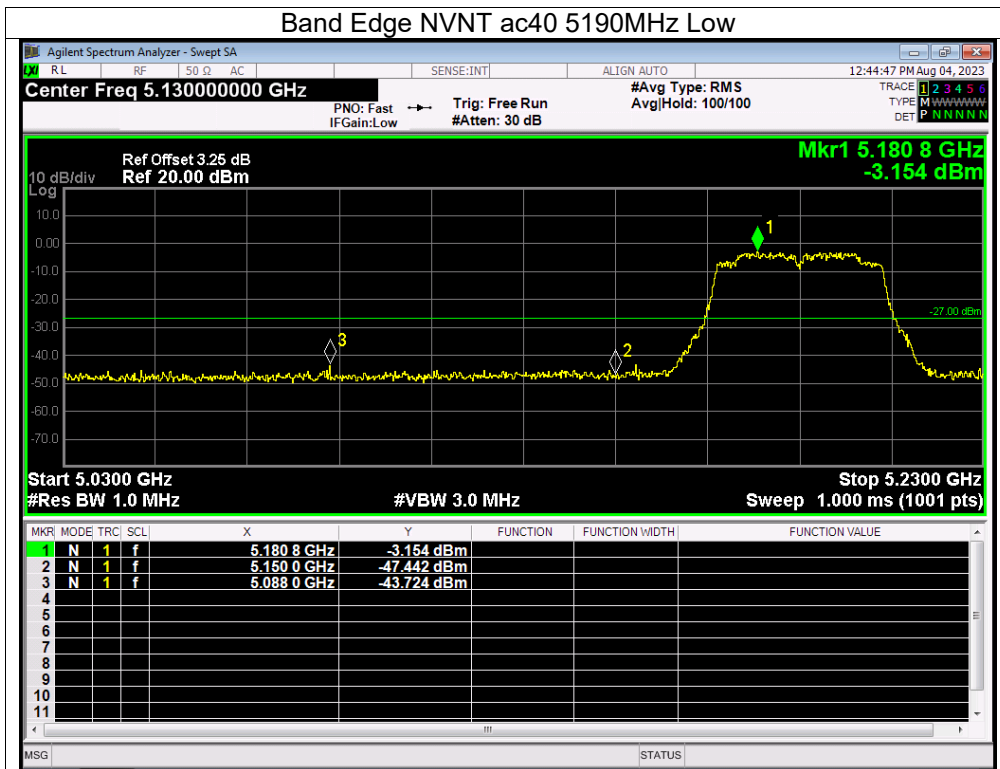
Note: A(B) Represent the value of antenna A and B, The worst data is Antenna A, only shown Antenna A.
Plot. Antenna B: 5180-5240MHz

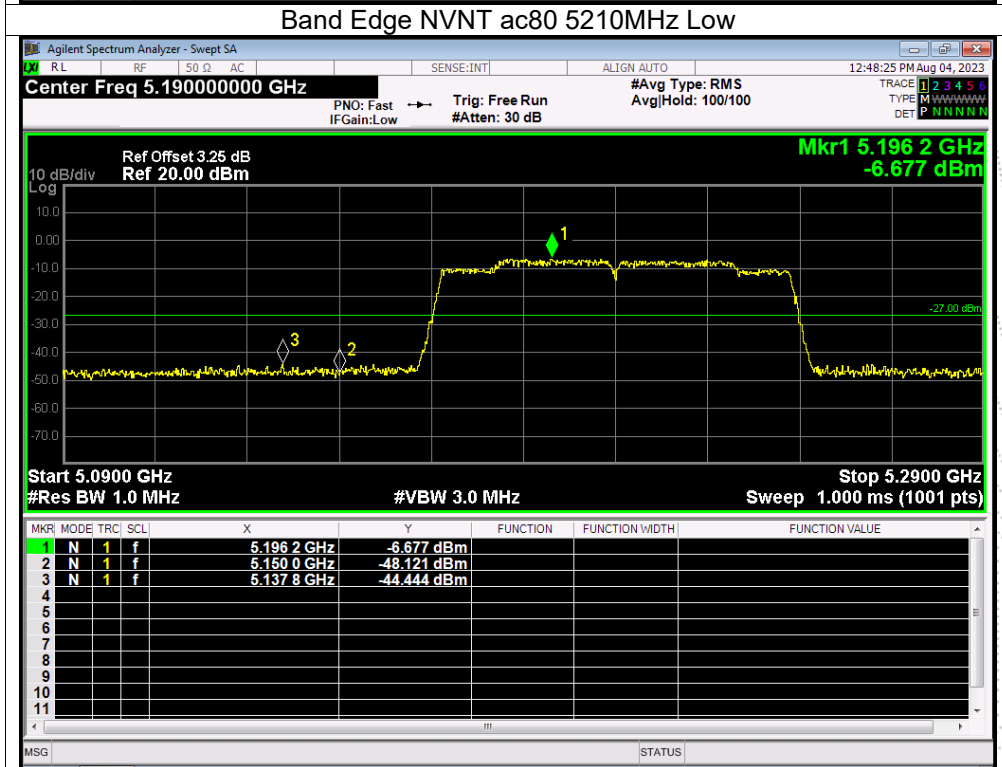
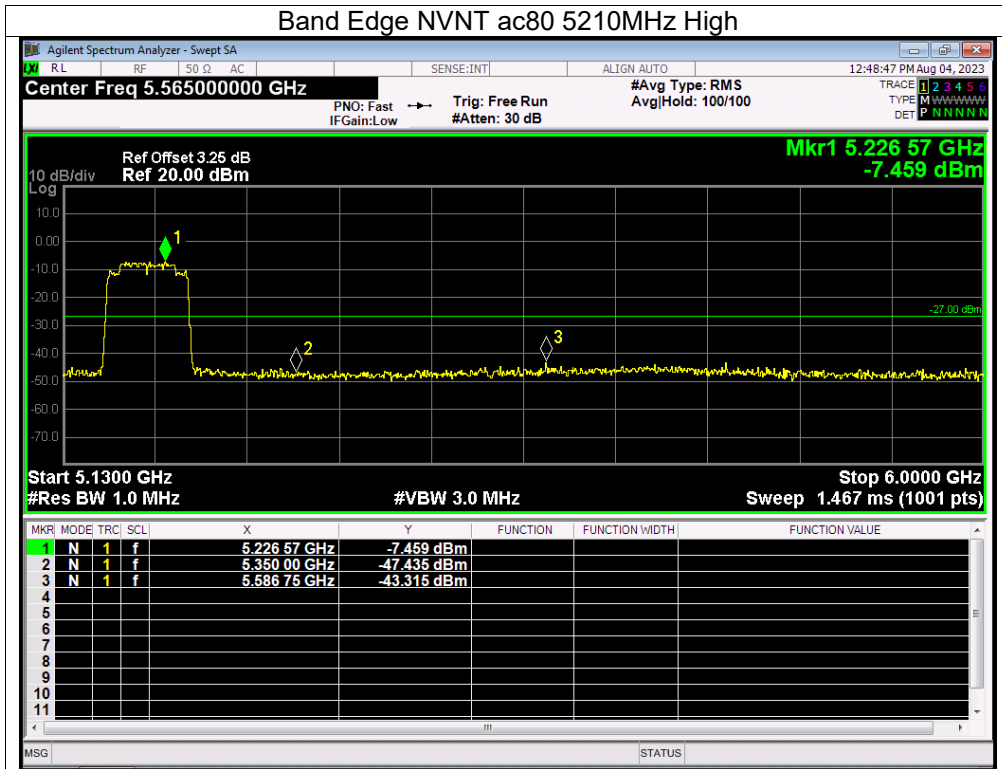




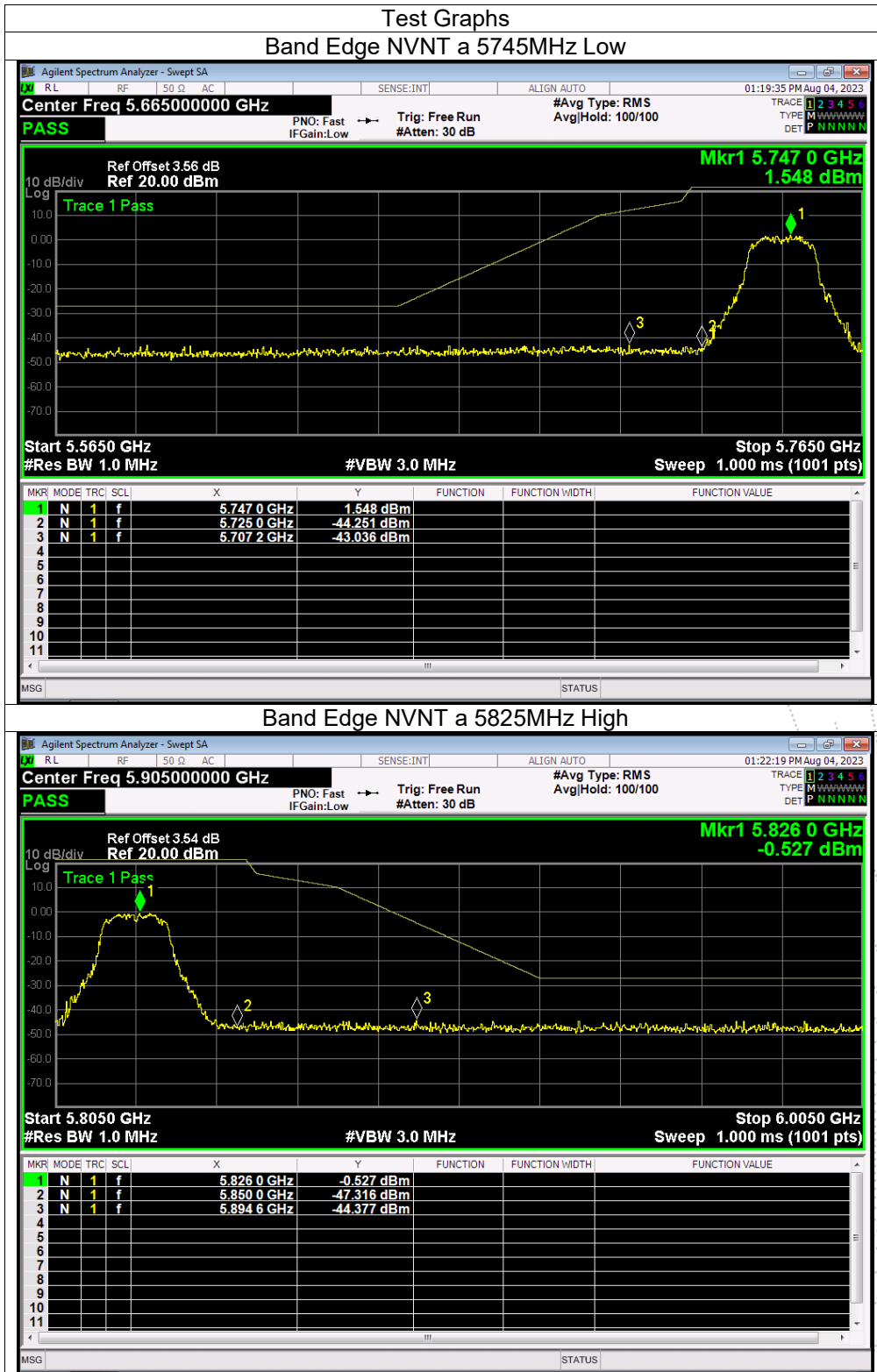


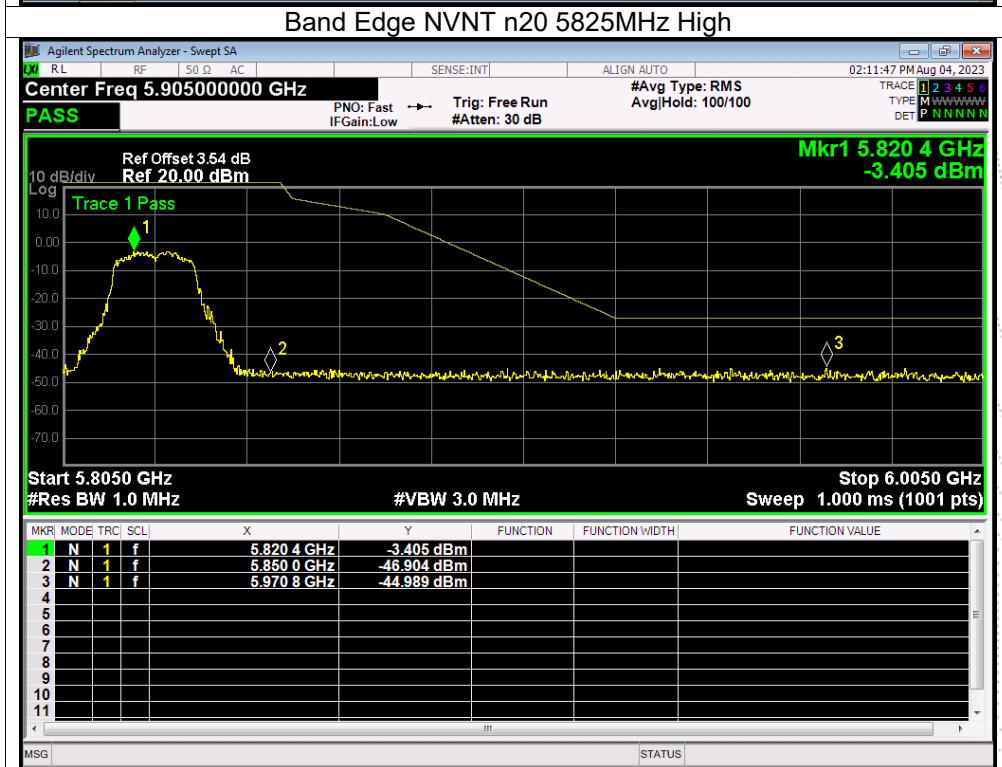
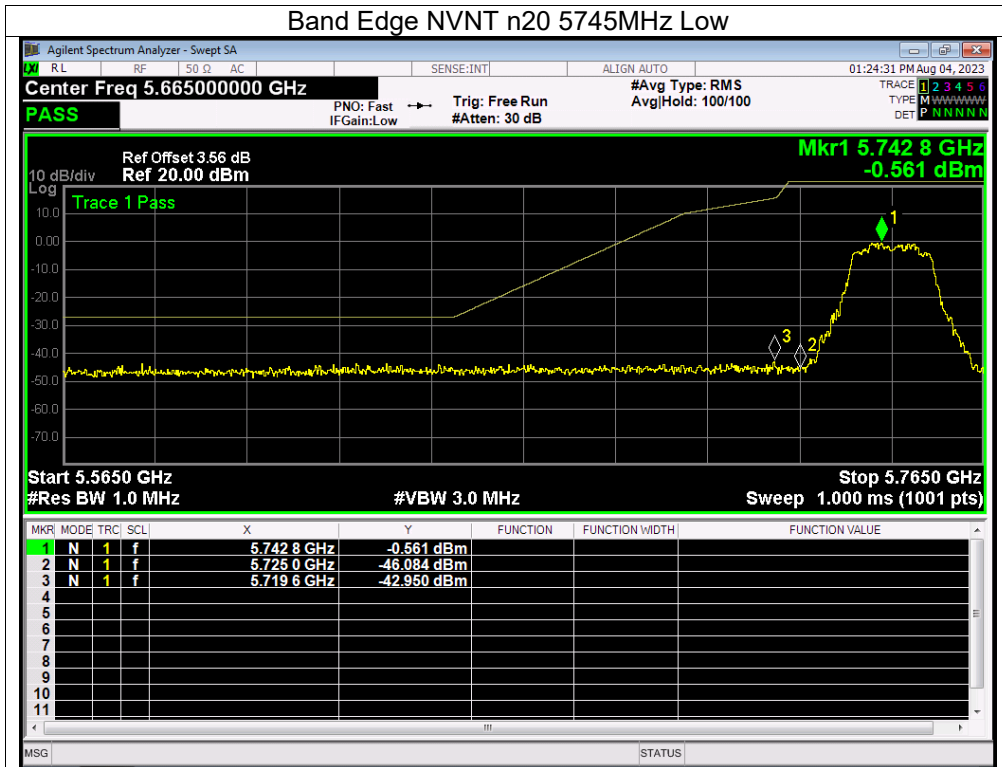


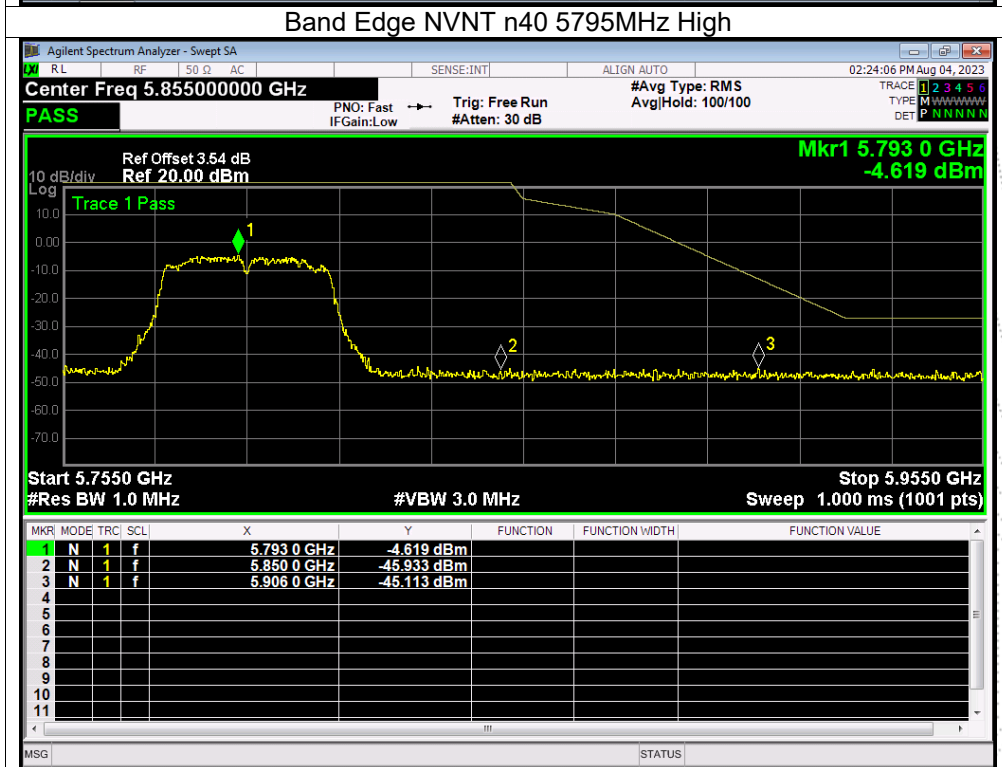
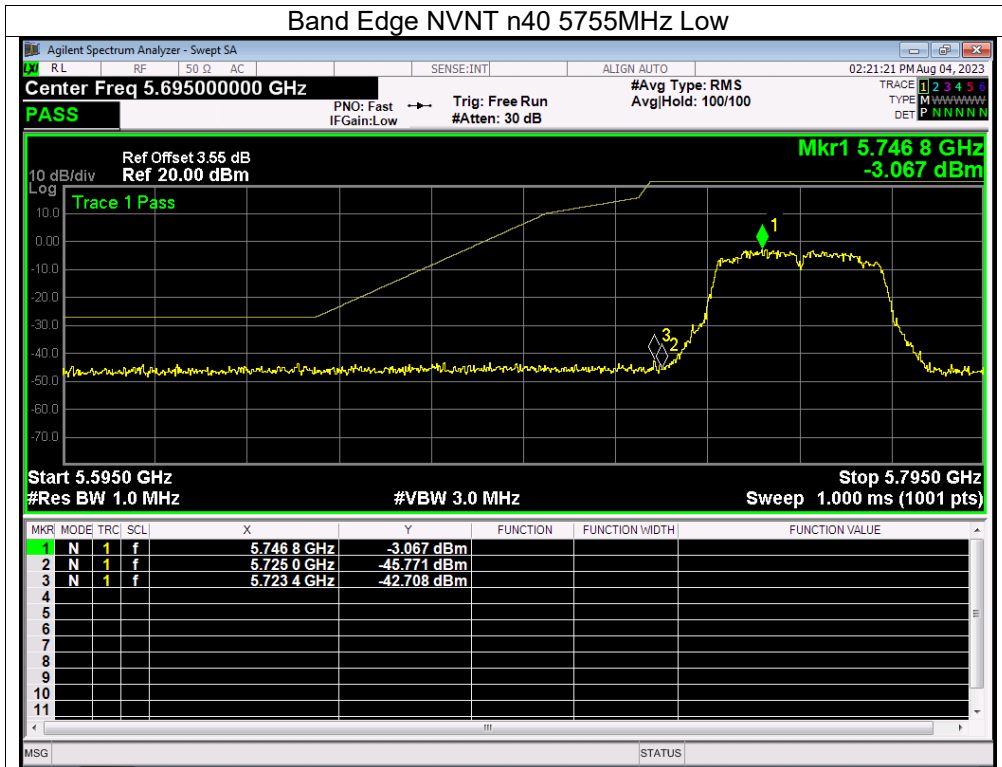


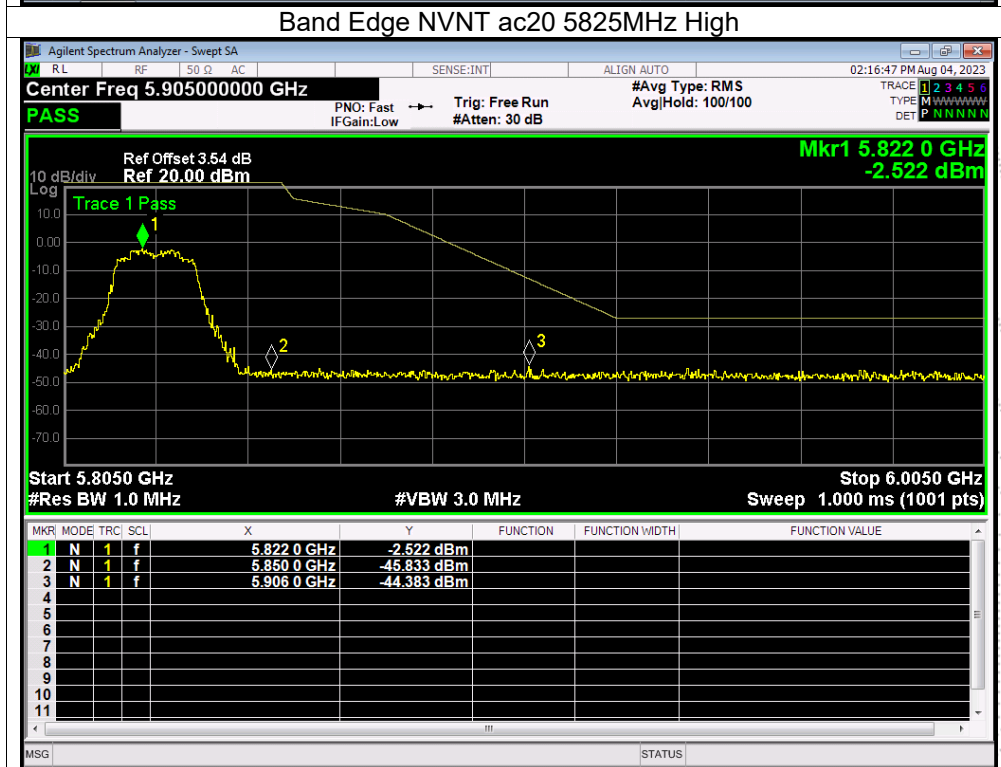
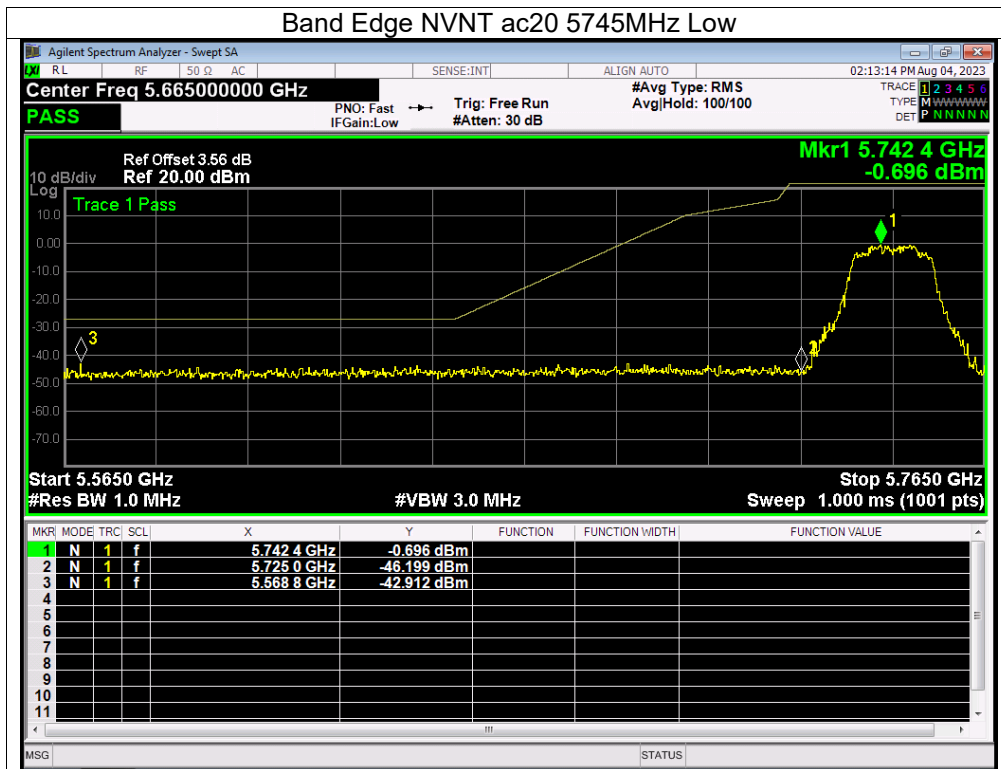


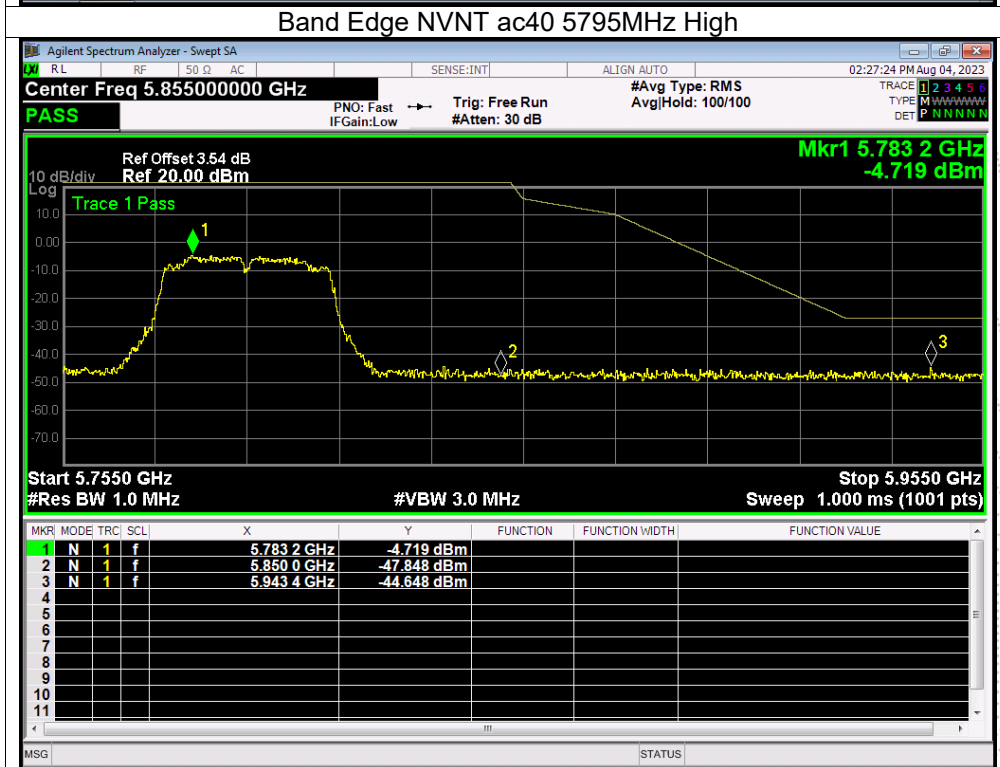
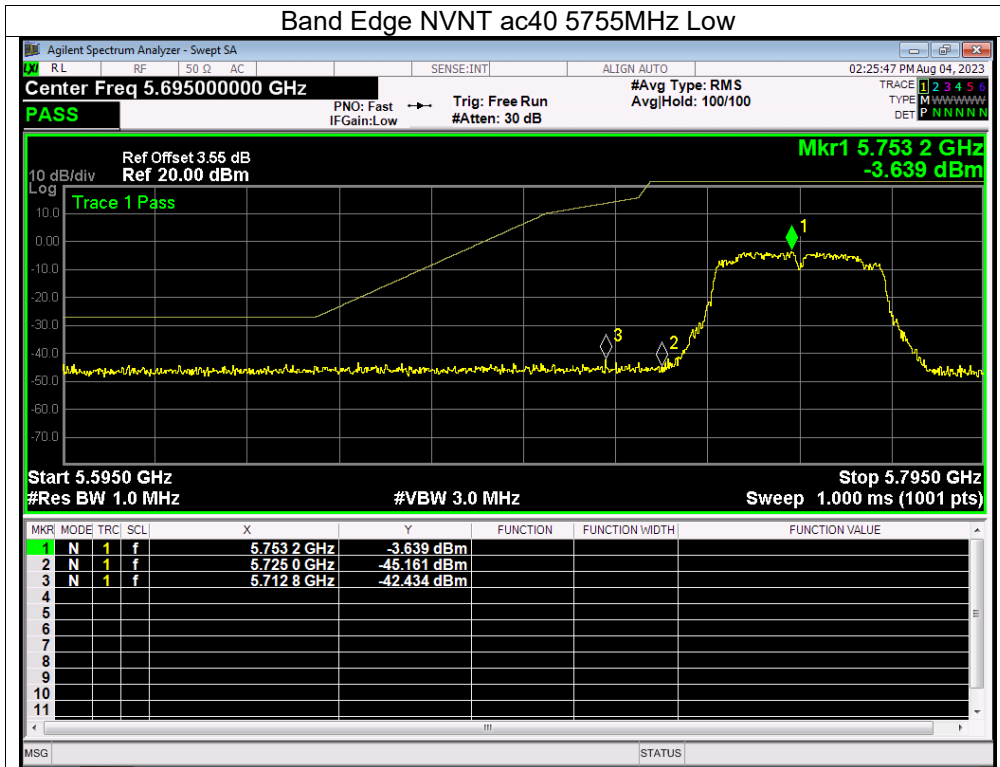
Note: A(B) Represent the value of antenna A and B. The worst data is Antenna B, only shown Antenna B.
 Antenna B: 5745-58250MHz

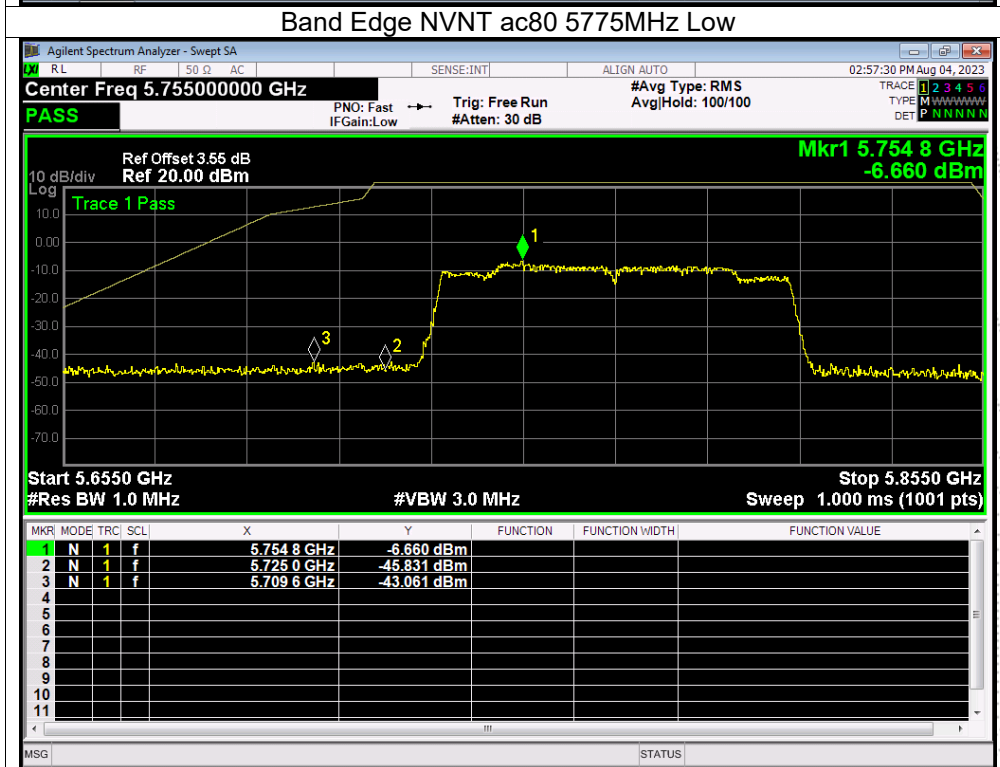
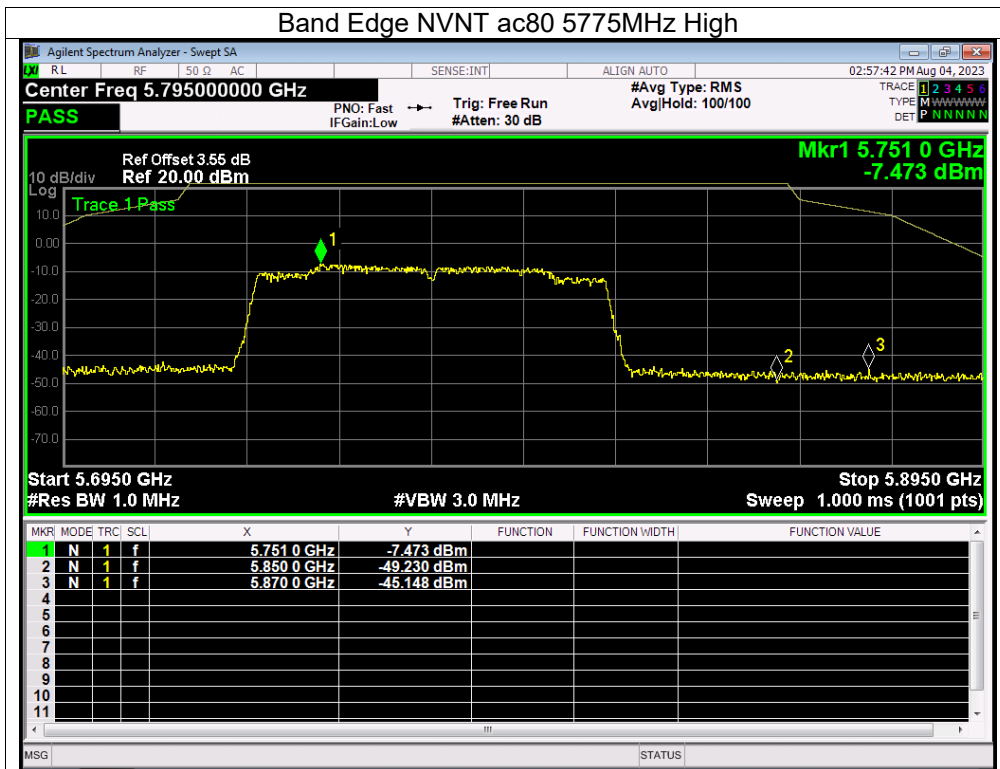






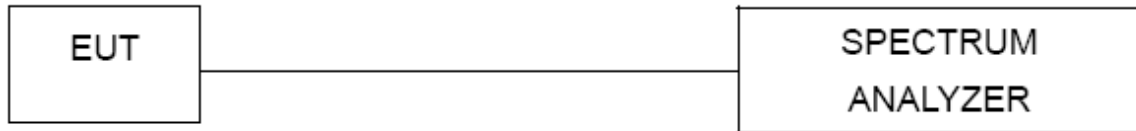






12. Spurious RF Conducted Emissions

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

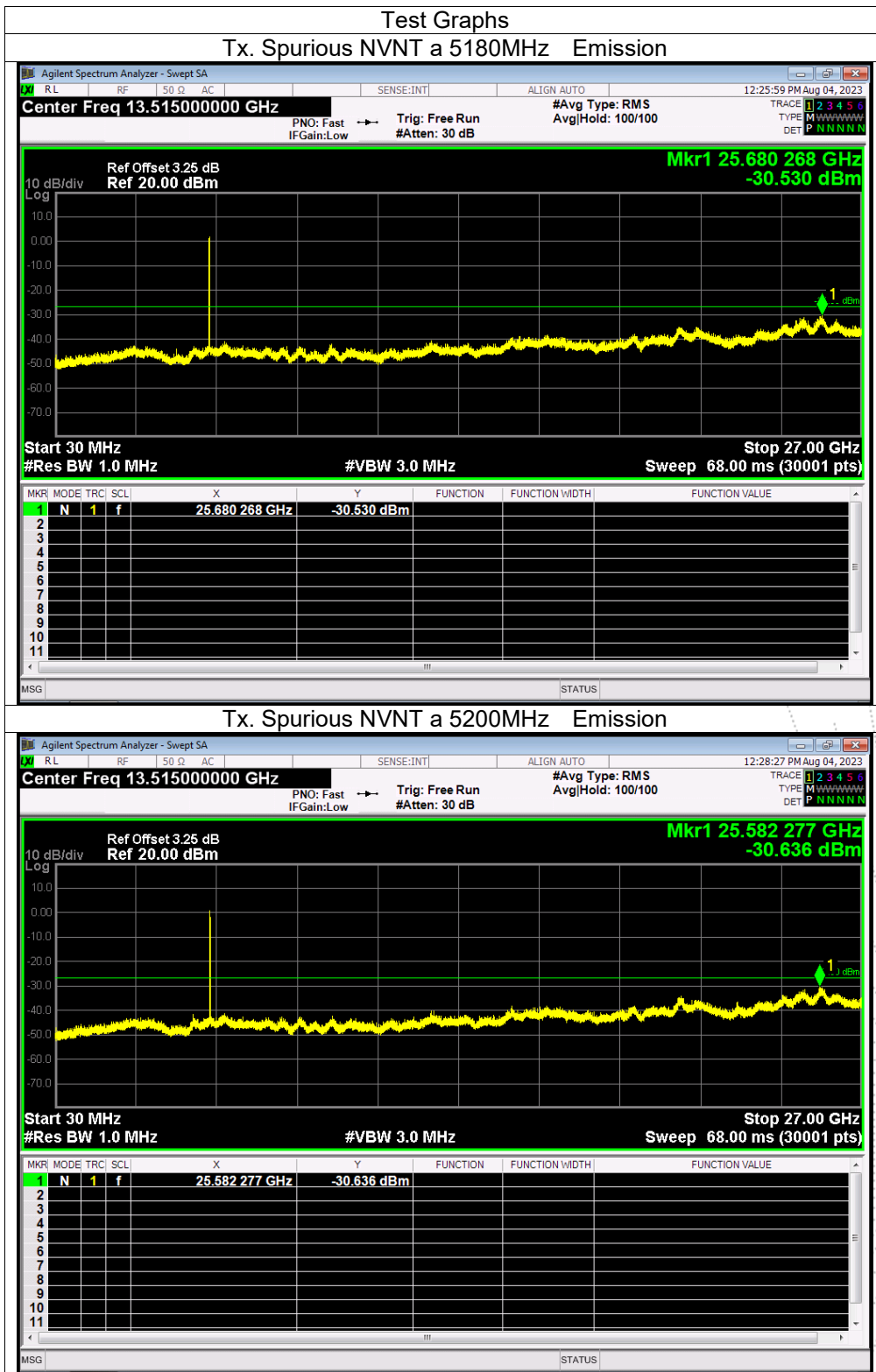
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then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

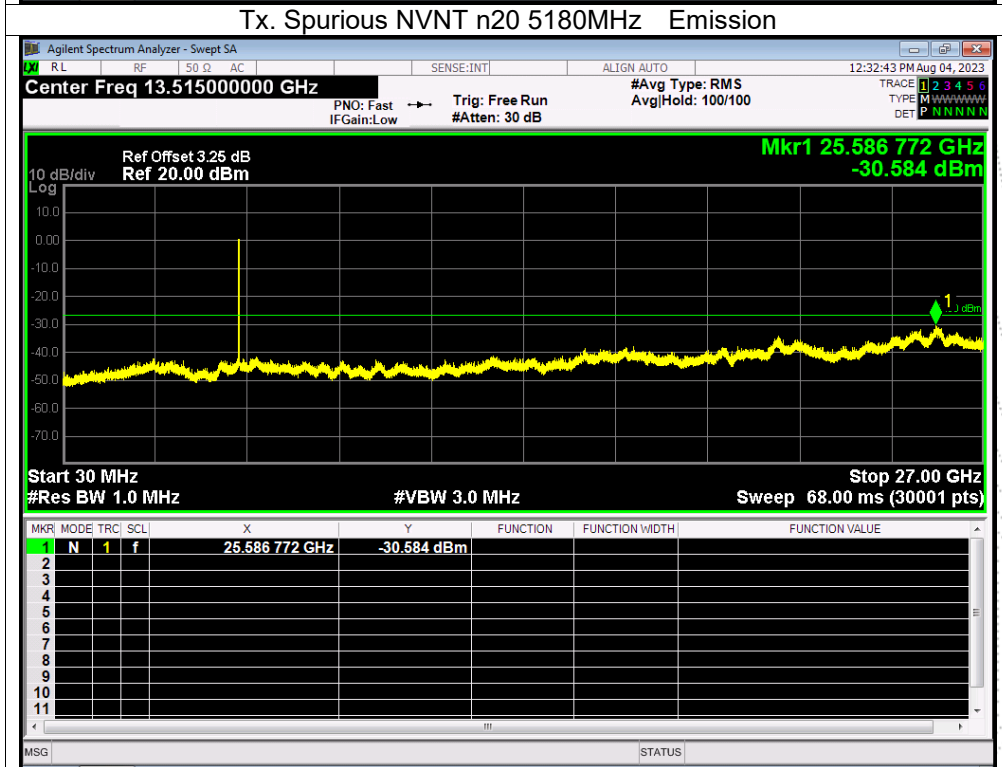
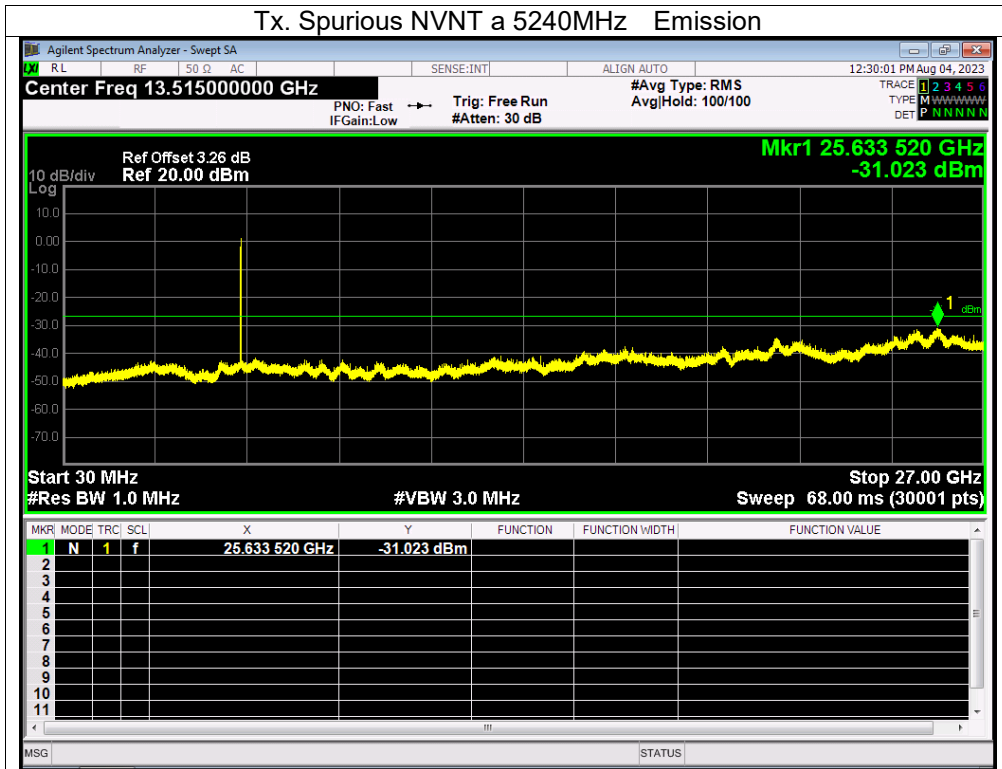
12.4 Test Result

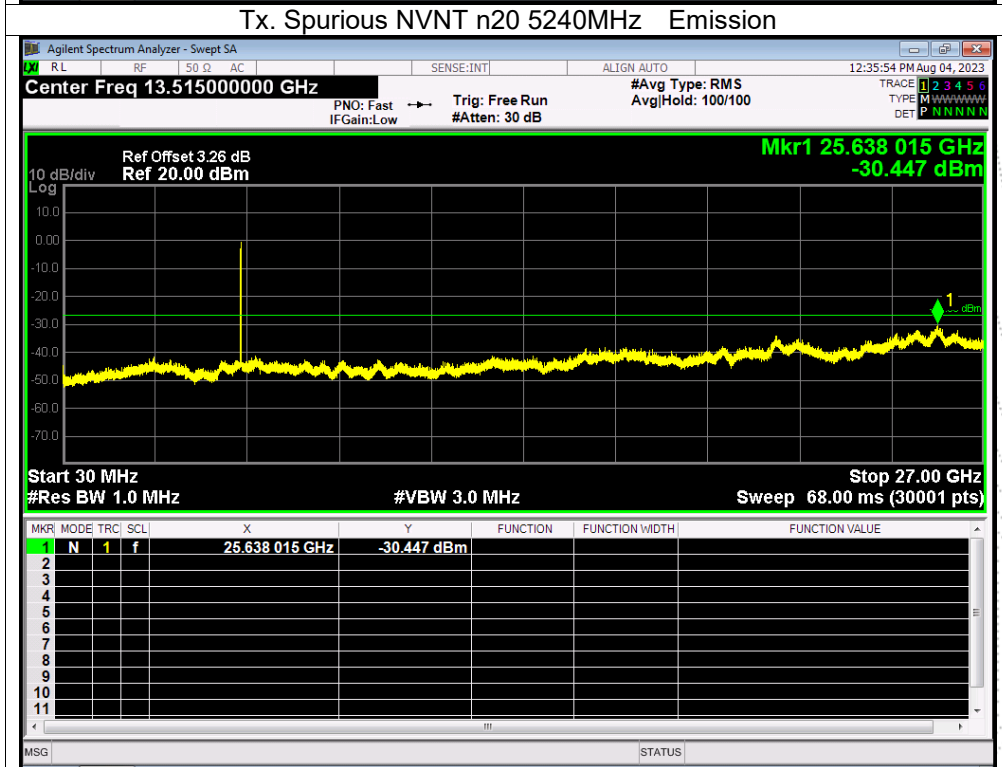
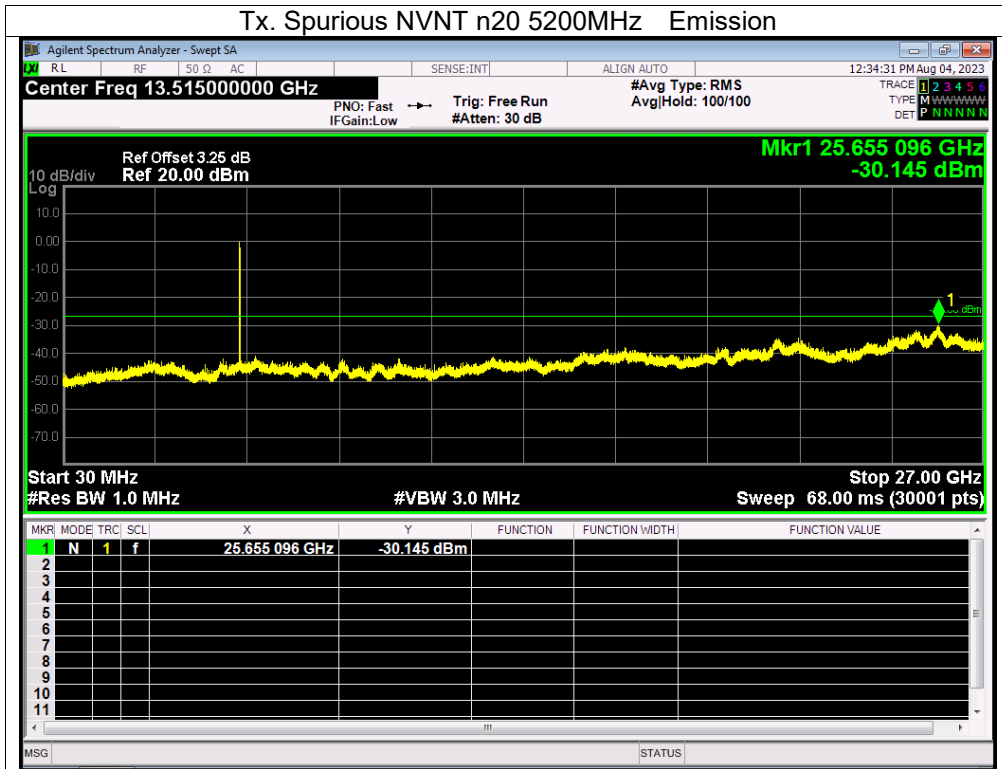
Remark: The measurement frequency range is from 9KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and band edge measurement data.

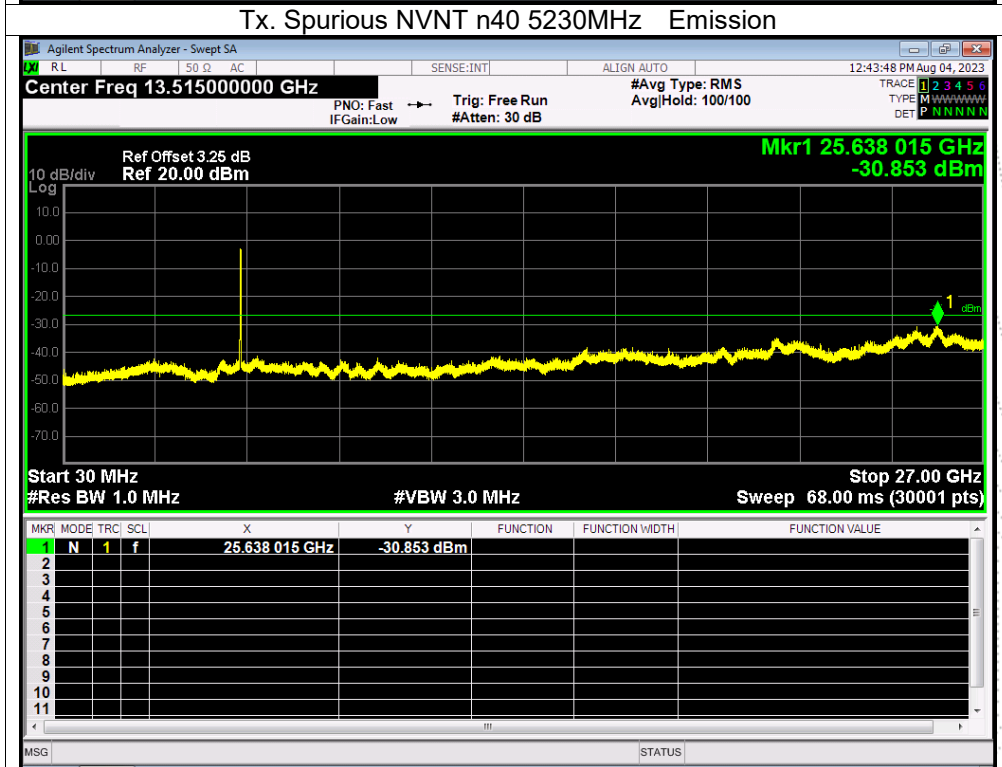
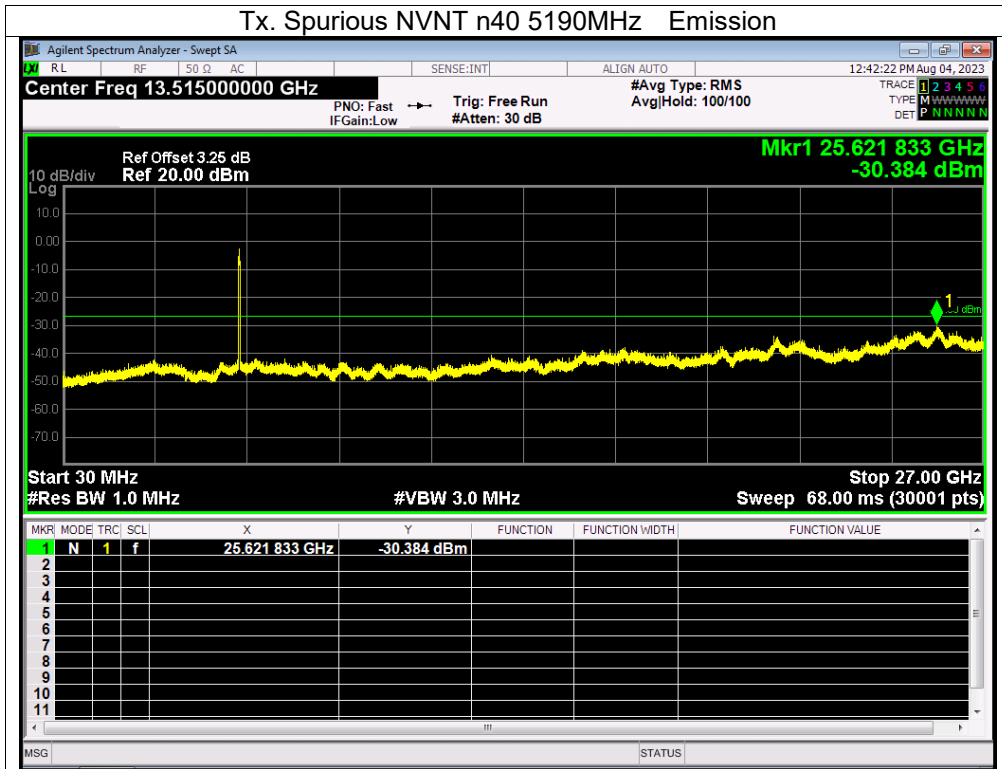
About: 26.5GHz-40GHz, The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

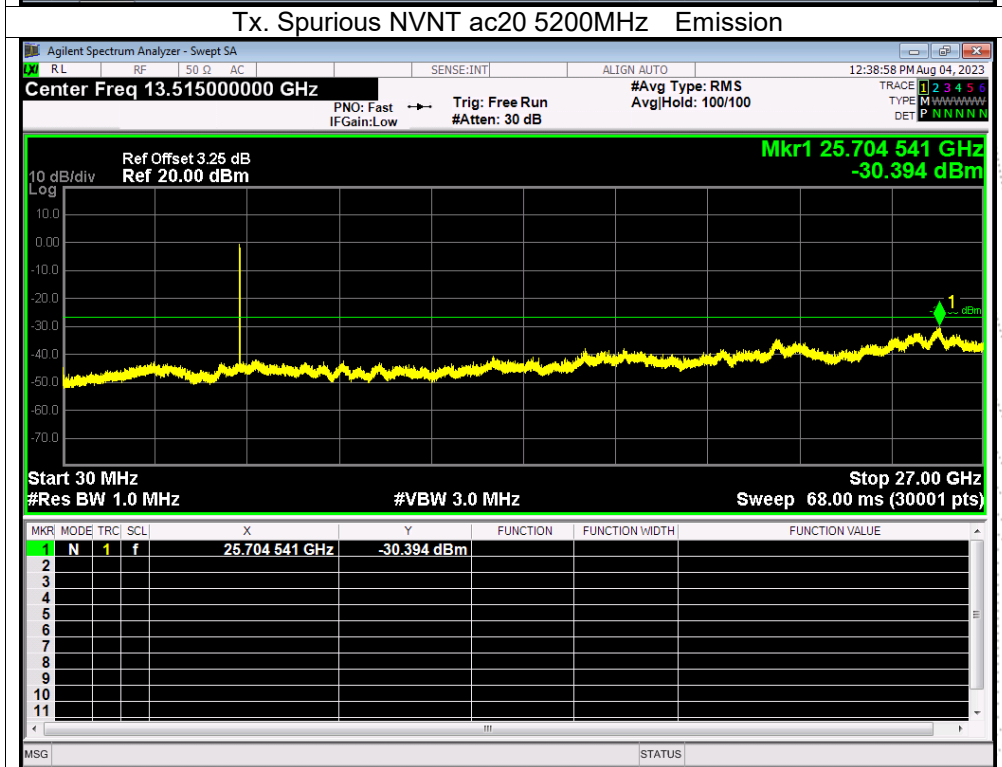
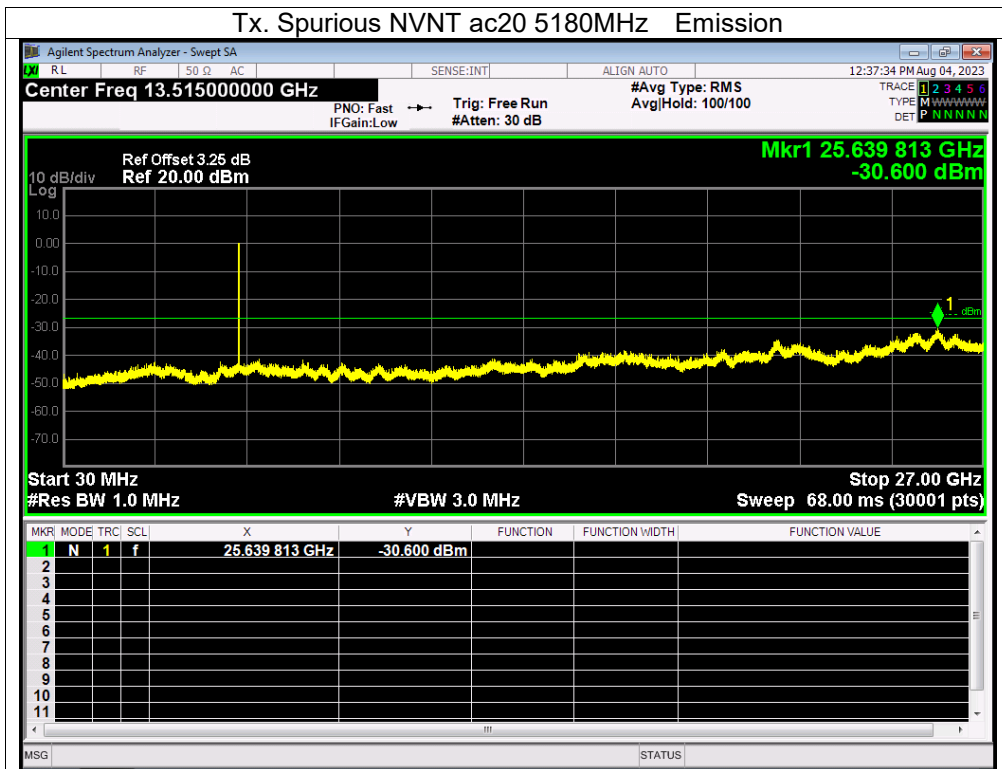
Note: A(B) Represent the value of antenna A and B, The worst data is Antenna A, only shown Antenna A.
 Plot. Antenna B: 5180-5240MHz

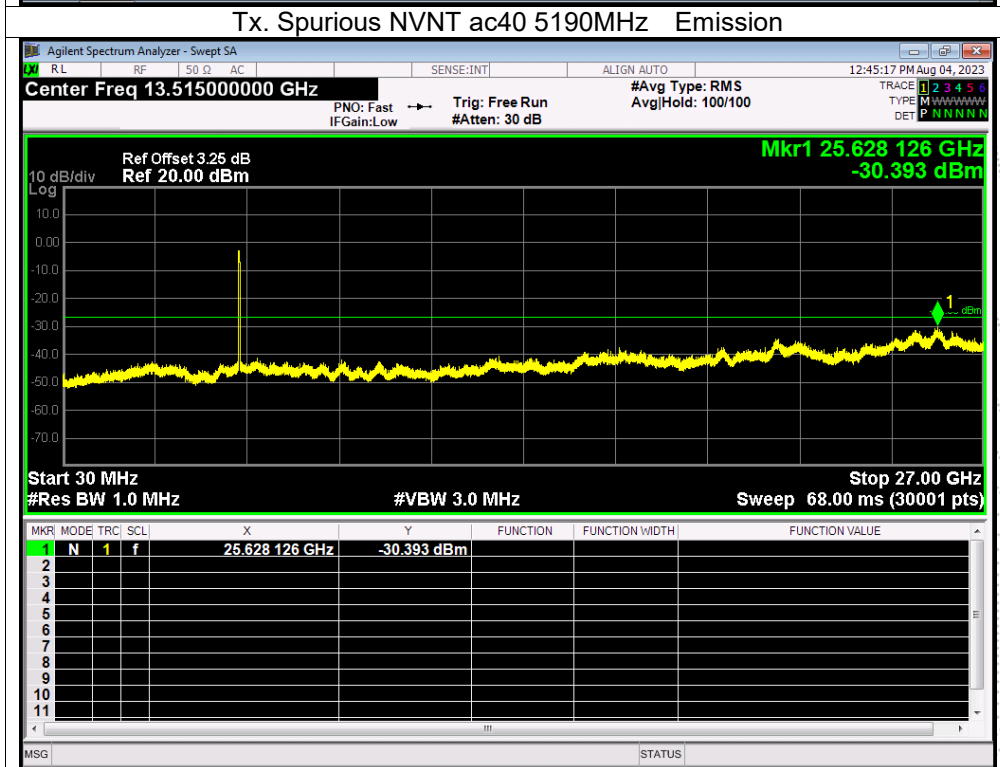
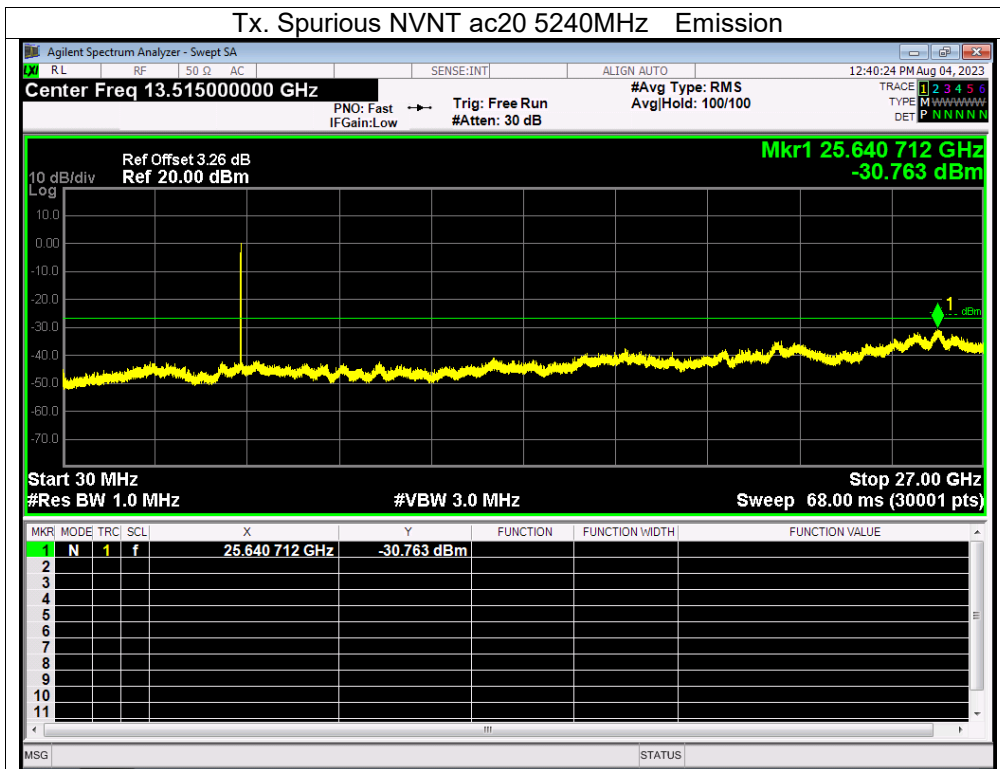


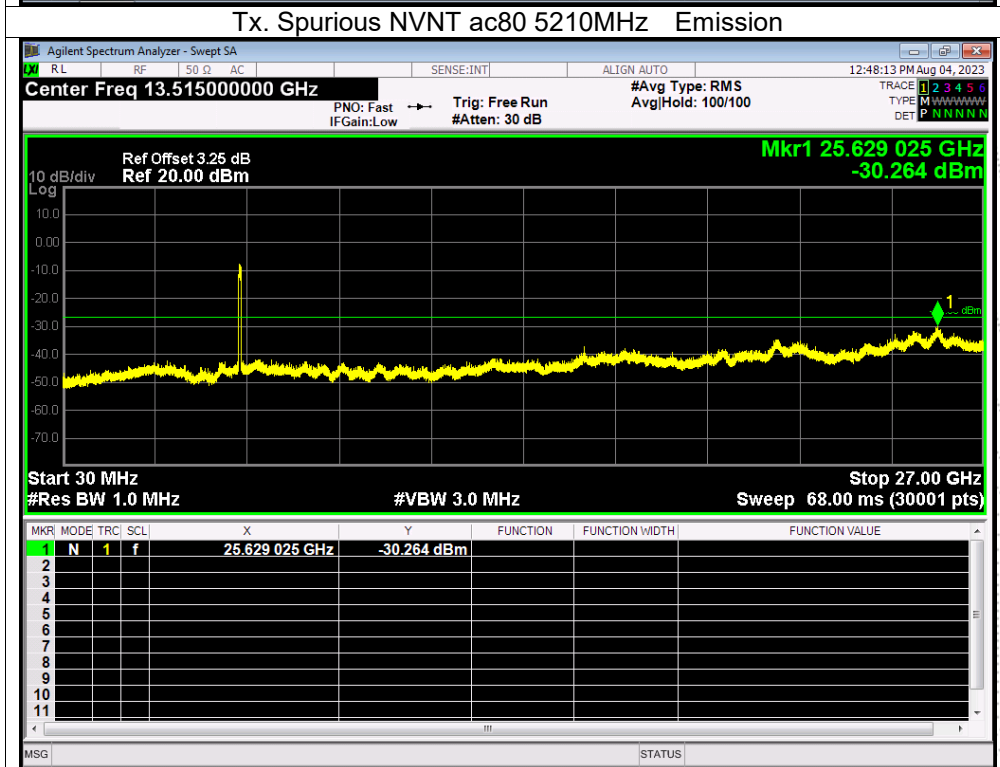
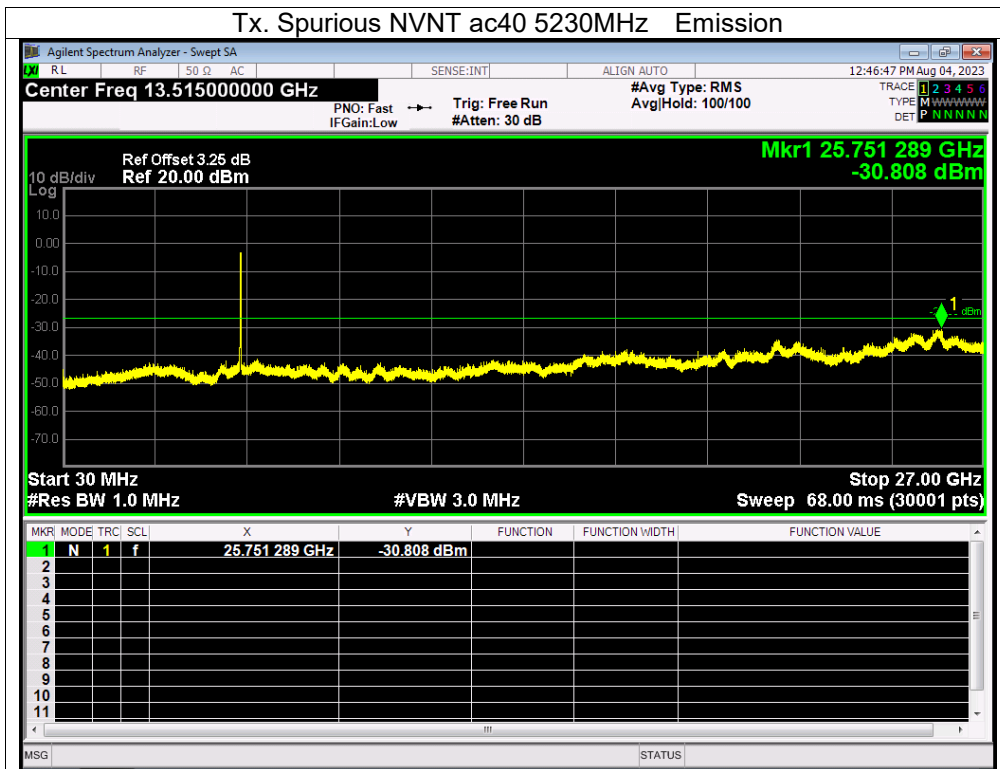




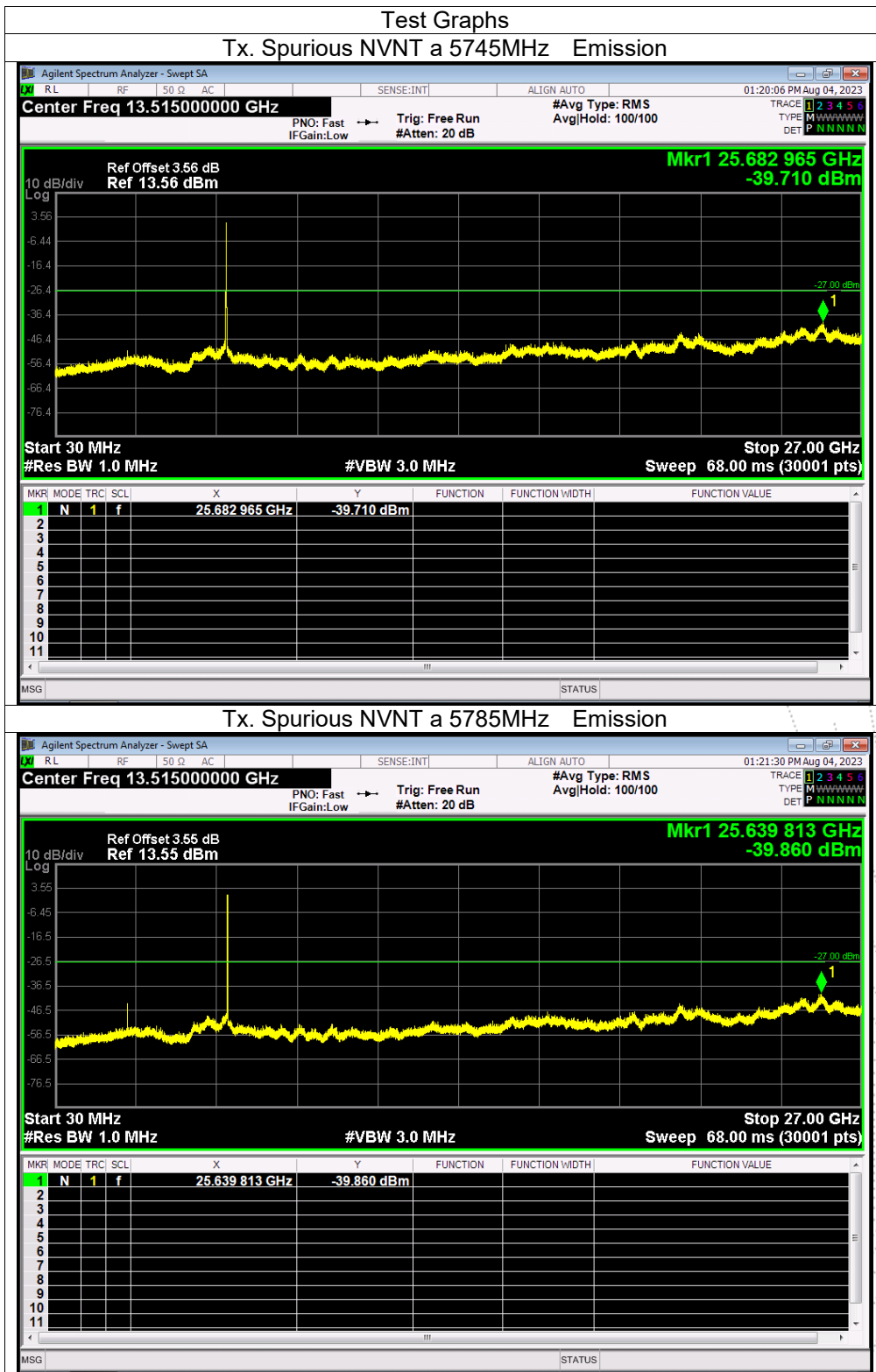


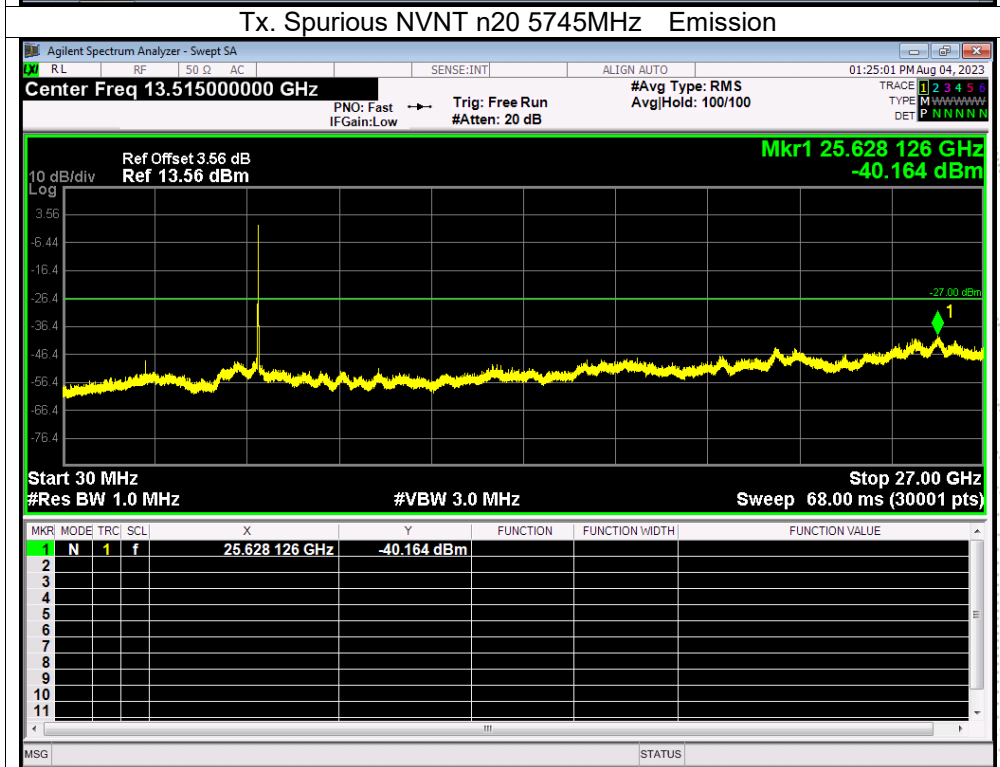
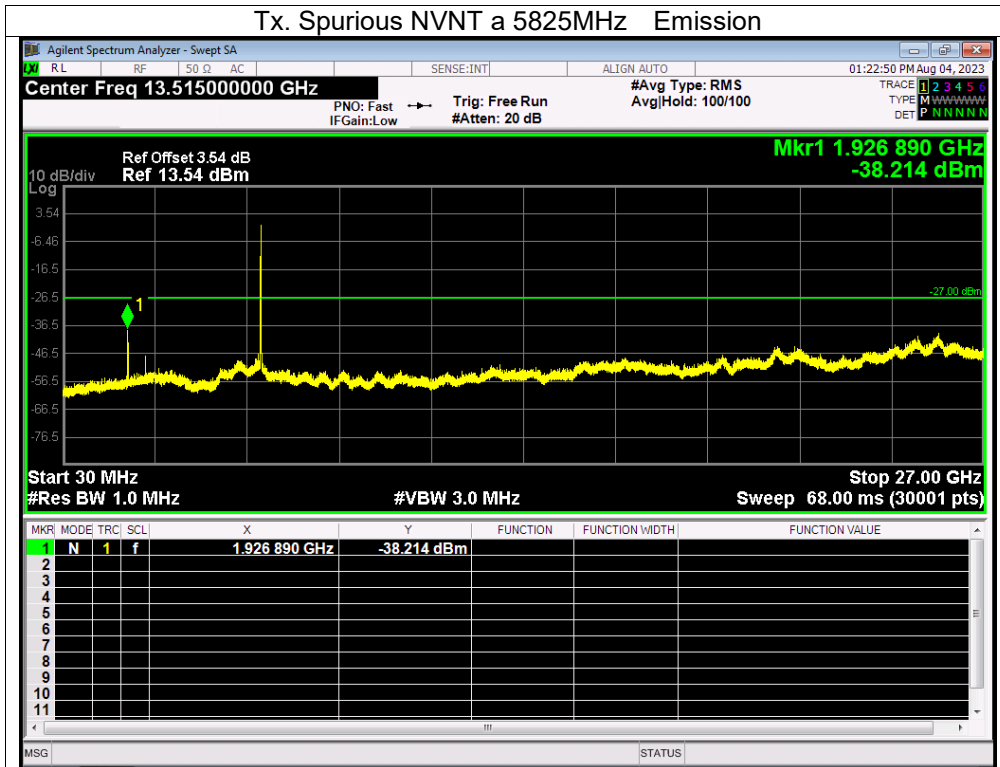


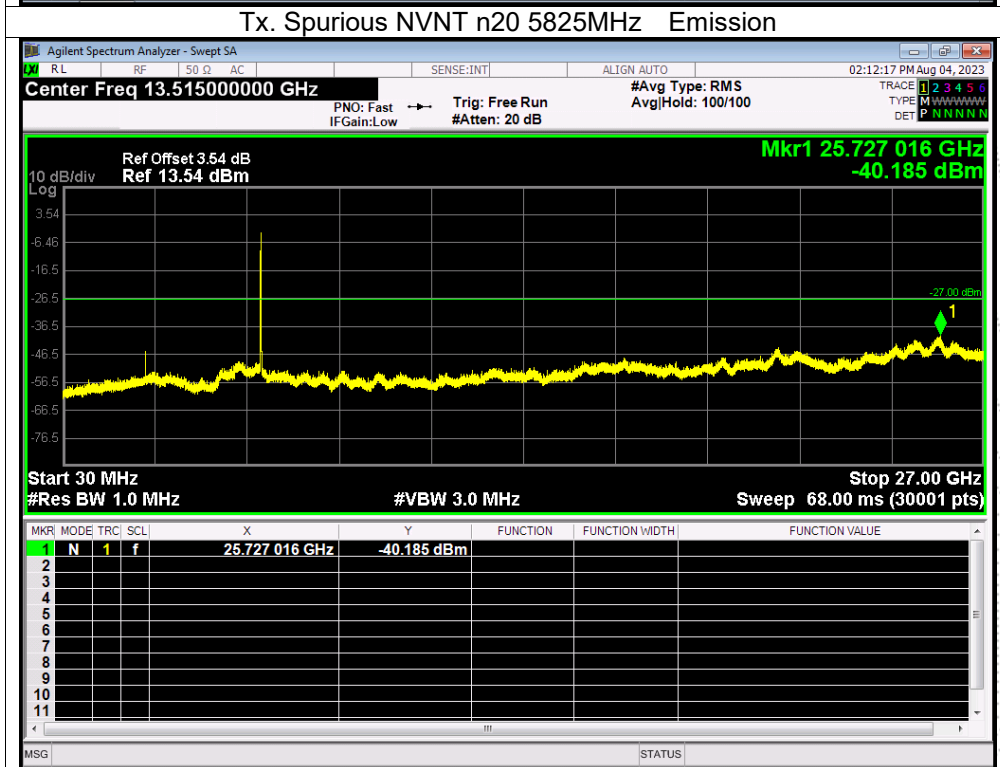
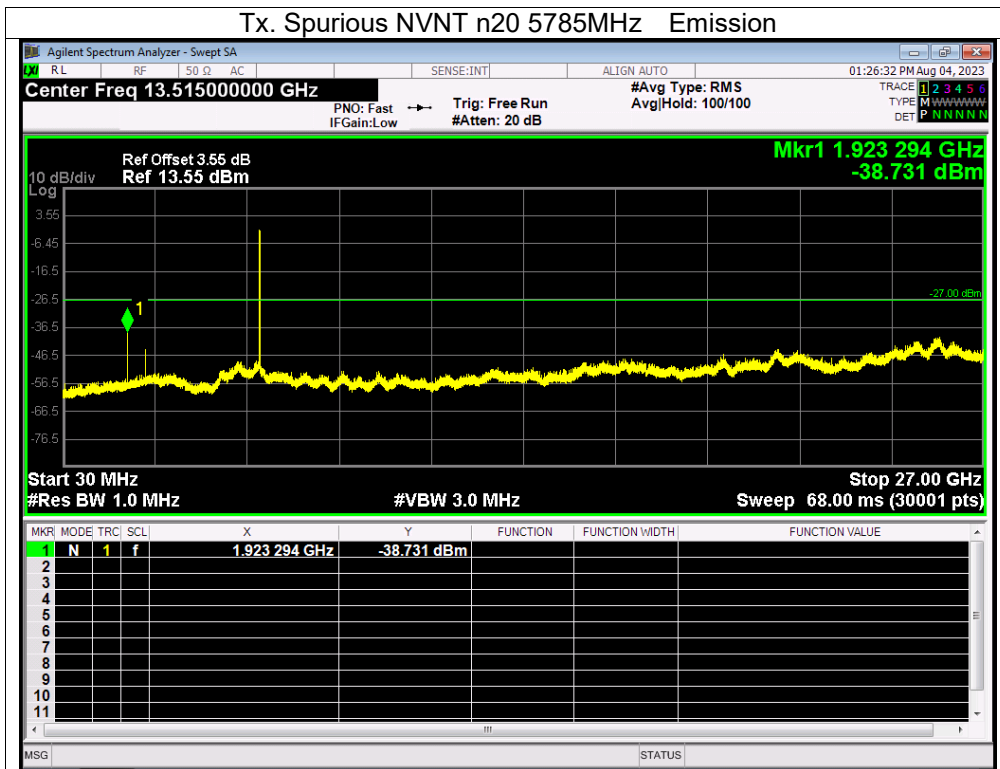


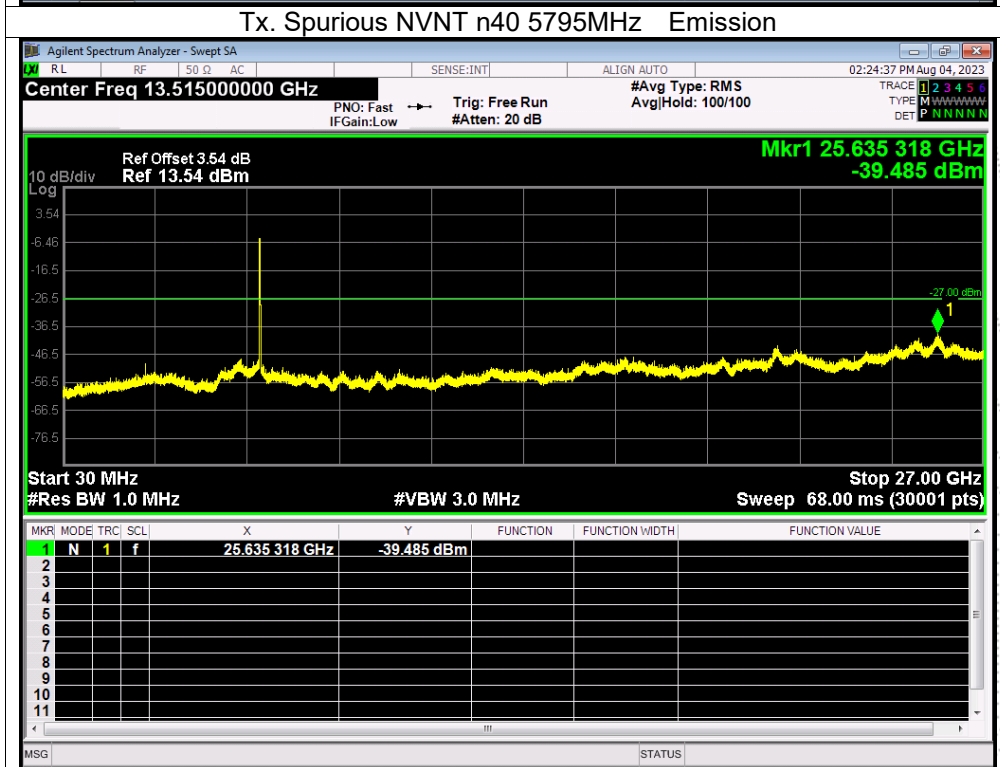
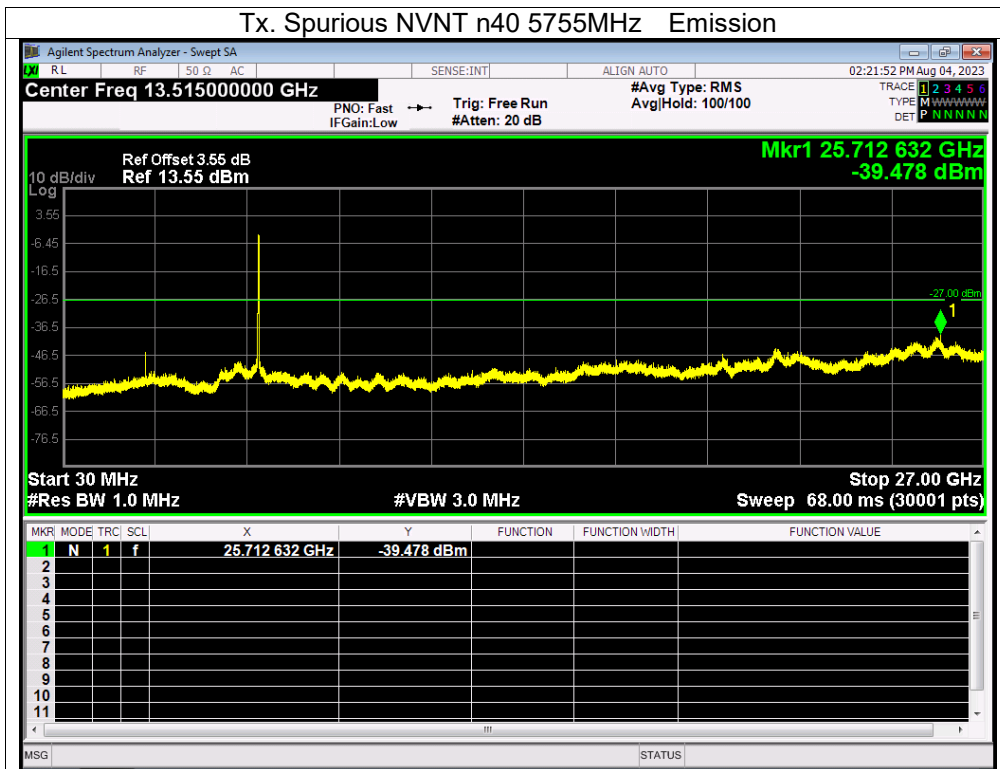


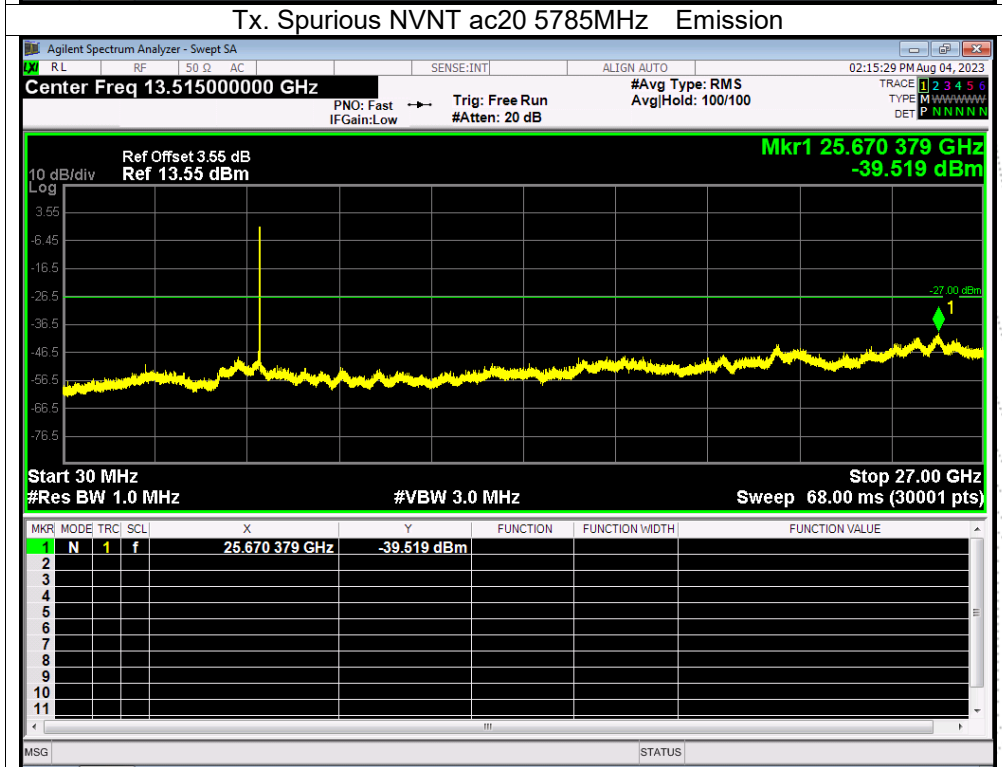
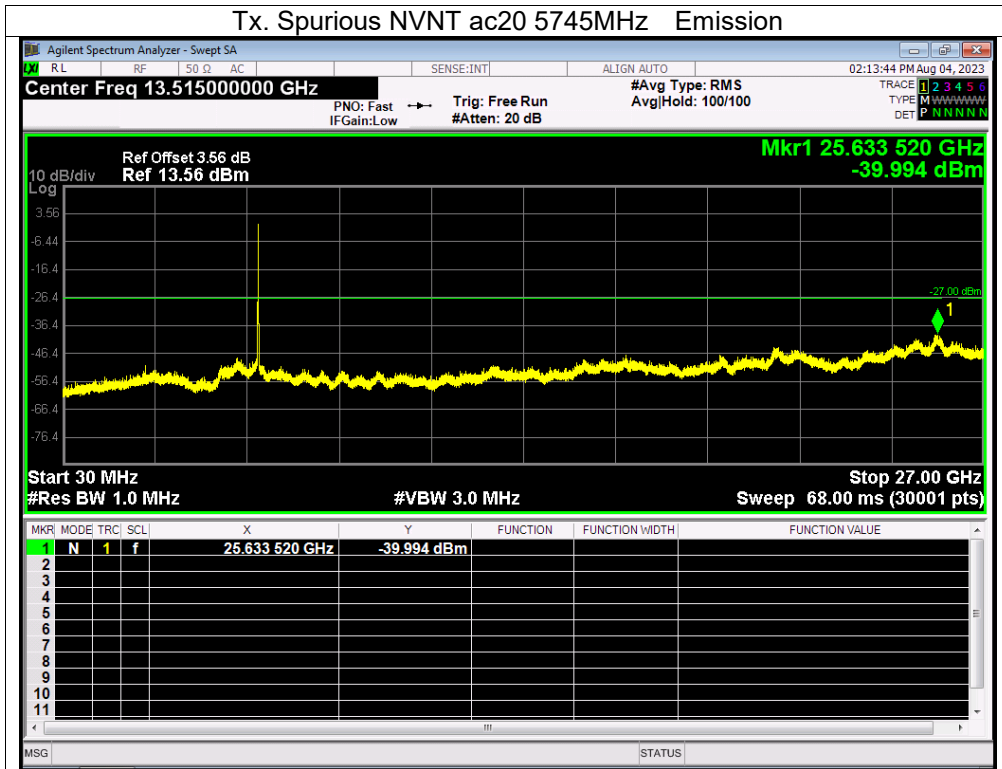
Note: A(B) Represent the value of antenna A and B, The worst data is Antenna B, only shown Antenna B.
 Antenna B: 5745-58250MHz

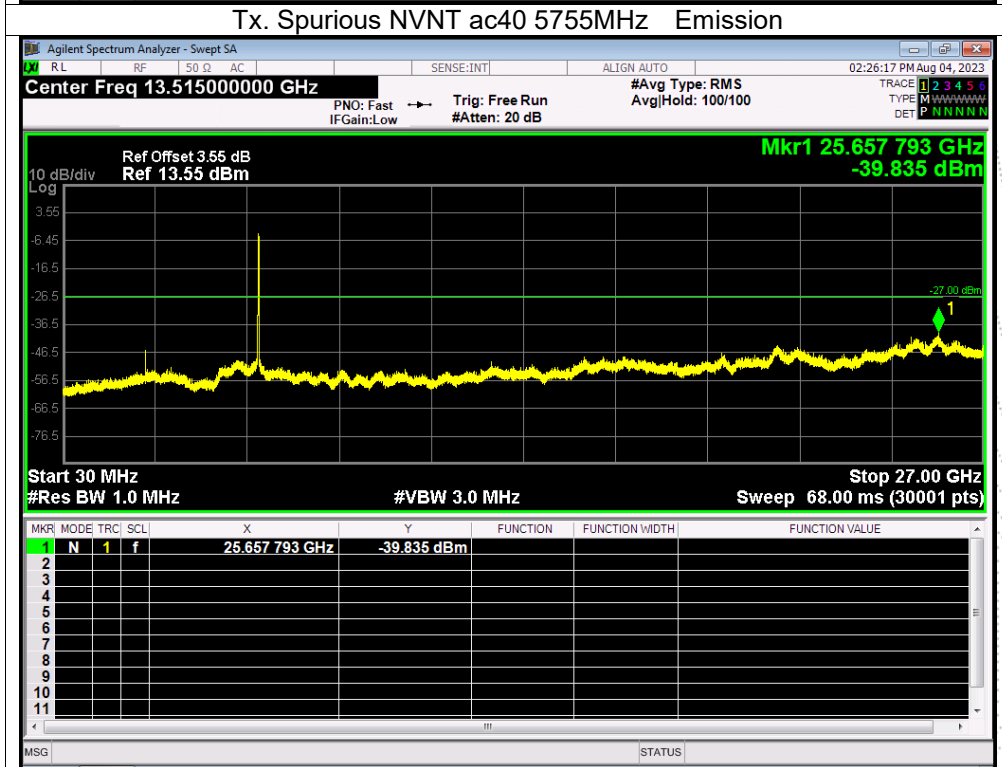
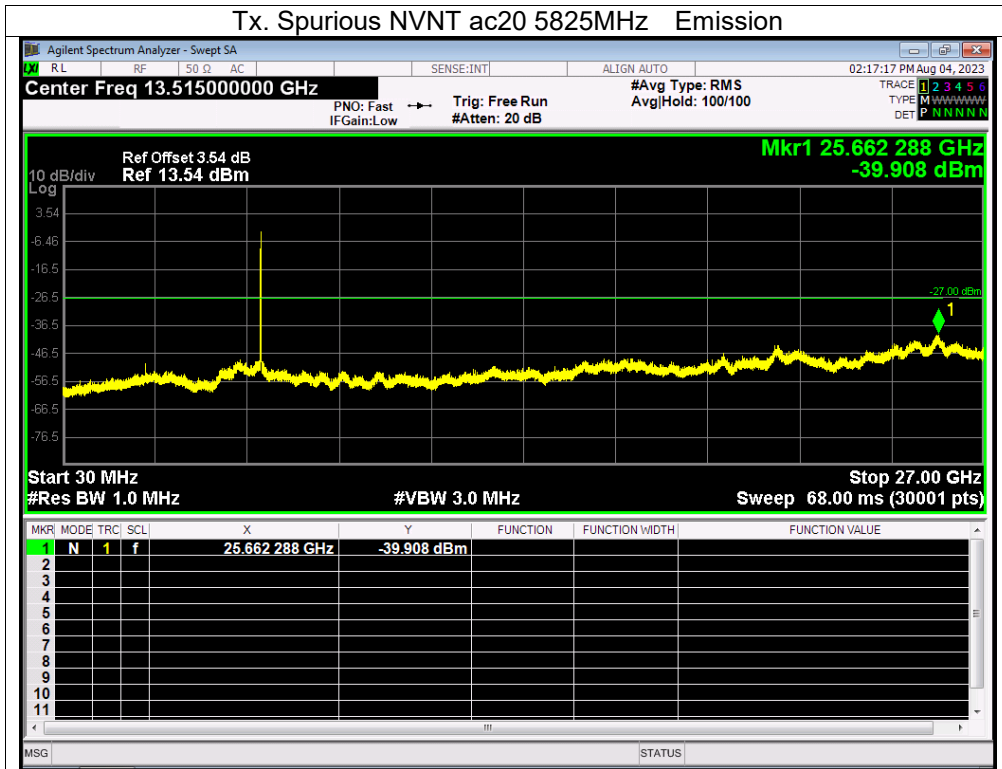


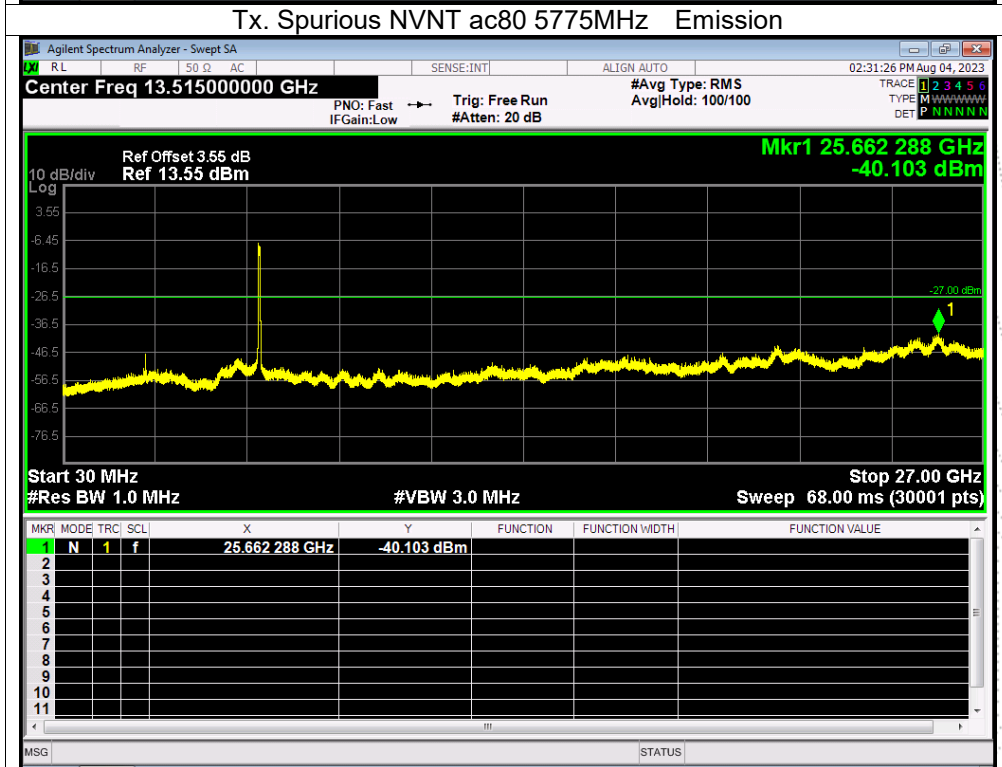
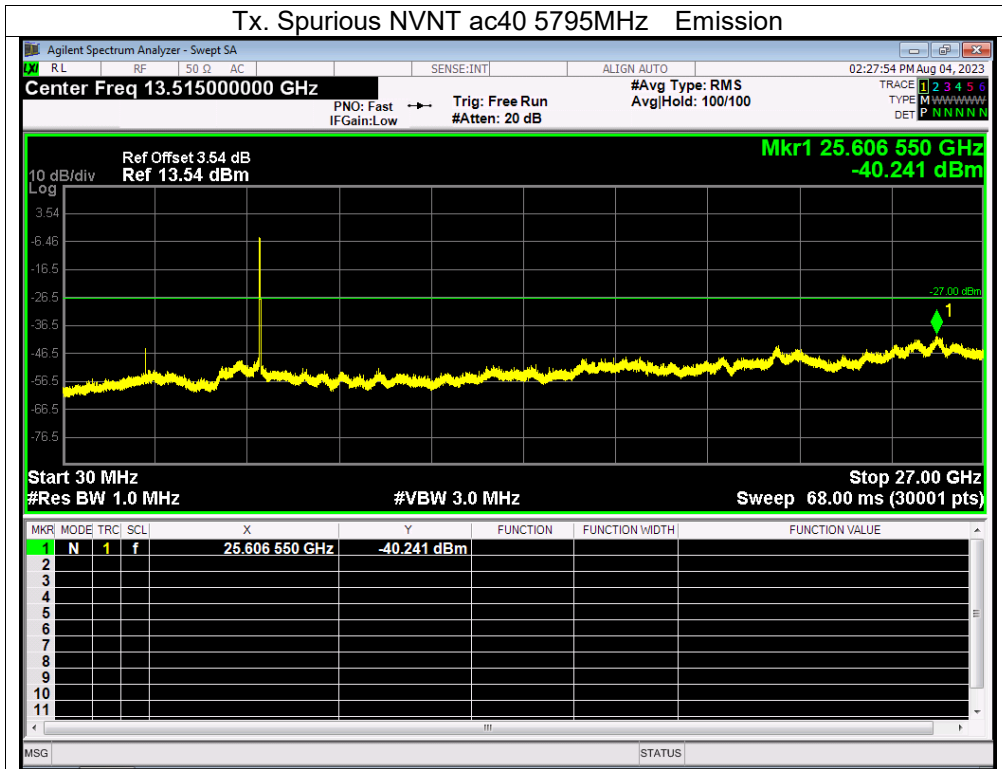






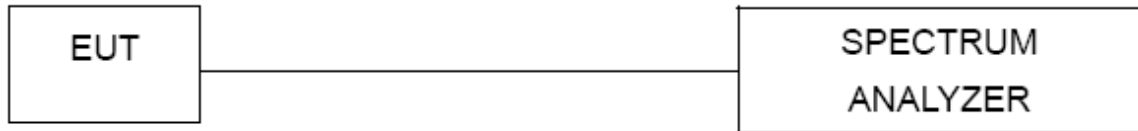






13. Frequency Stability Measurement

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 12V
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)	12.00	5180.0064	5180	0.0064	1.2436
		V max (V)	13.80	5180.0157	5180	0.0157	3.0307
		V min (V)	10.20	5180.0037	5180	0.0037	0.7199
Limits				5150-5250 MHz			
Result				Complies			

Temperature vs. Frequency Stability

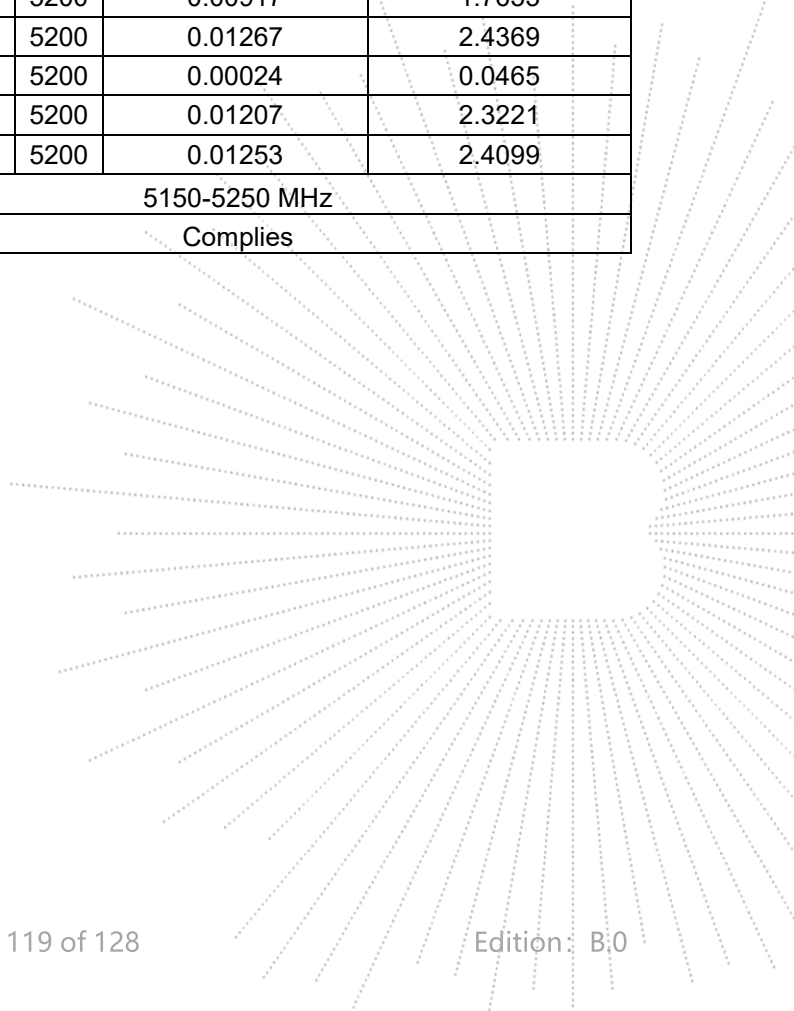
TEST CONDITIONS				Reference Frequency: 5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	12	T (°C)	-20	5180.0109	5180	0.0109	2.1135
		T (°C)	-10	5180.0097	5180	0.0097	1.8752
		T (°C)	0	5180.0115	5180	0.0115	2.2232
		T (°C)	10	5180.0072	5180	0.0072	1.3866
		T (°C)	20	5180.0066	5180	0.0066	1.2765
		T (°C)	30	5180.0039	5180	0.0039	0.7544
		T (°C)	40	5180.0117	5180	0.0117	2.2544
		T (°C)	50	5180.0058	5180	0.0058	1.1200
		T (°C)	60	5180.0074	5180	0.0074	1.4289
		T (°C)	70	5180.0019	5180	0.0019	0.3575
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	5200.0071	5200	0.0071	1.3658
		V max (V)	13.80	5200.0042	5200	0.0042	0.8120
		V min (V)	10.20	5200.0046	5200	0.0046	0.8793
Limits				5725-5850 MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	12	T (°C)	-20	5200.01294	5200	0.01294	2.4886
		T (°C)	-10	5200.00203	5200	0.00203	0.3913
		T (°C)	0	5200.00157	5200	0.00157	0.3029
		T (°C)	10	5200.00705	5200	0.00705	1.3557
		T (°C)	20	5200.00043	5200	0.00043	0.0818
		T (°C)	30	5200.00917	5200	0.00917	1.7633
		T (°C)	40	5200.01267	5200	0.01267	2.4369
		T (°C)	50	5200.00024	5200	0.00024	0.0465
		T (°C)	60	5200.01207	5200	0.01207	2.3221
		T (°C)	70	5200.01253	5200	0.01253	2.4099
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	5240.0040	5240	0.0040	0.7544
		V max (V)	13.80	5240.0074	5240	0.0074	1.4186
		V min (V)	10.20	5240.0100	5240	0.0100	1.9064
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)	12	T (°C)	-20	5240.0026	5240	0.0026	0.4904
		T (°C)	-10	5240.0129	5240	0.0129	2.4557
		T (°C)	0	5240.0025	5240	0.0025	0.4791
		T (°C)	10	5240.0071	5240	0.0071	1.3614
		T (°C)	20	5240.0042	5240	0.0042	0.8063
		T (°C)	30	5240.0014	5240	0.0014	0.2691
		T (°C)	40	5240.0063	5240	0.0063	1.2077
		T (°C)	50	5240.0080	5240	0.0080	1.5352
		T (°C)	60	5240.0067	5240	0.0067	1.2819
		T (°C)	70	5240.0091	5240	0.0091	1.7314
Limits				5150-5250 MHz			
Result				Complies			

Temperature :	26 °C	Relative Humidity :	54%
Pressure :	101kPa	Test Voltage :	DC 12V
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)	12.00	5745.00862	5745	0.00862	1.5011
		V max (V)	13.80	5745.00044	5745	0.00044	0.0769
		V min (V)	10.20	5745.01098	5745	0.01098	1.9107
Limits				5725-5850 MHz			
Result				Complies			

Temperature vs. Frequency Stability

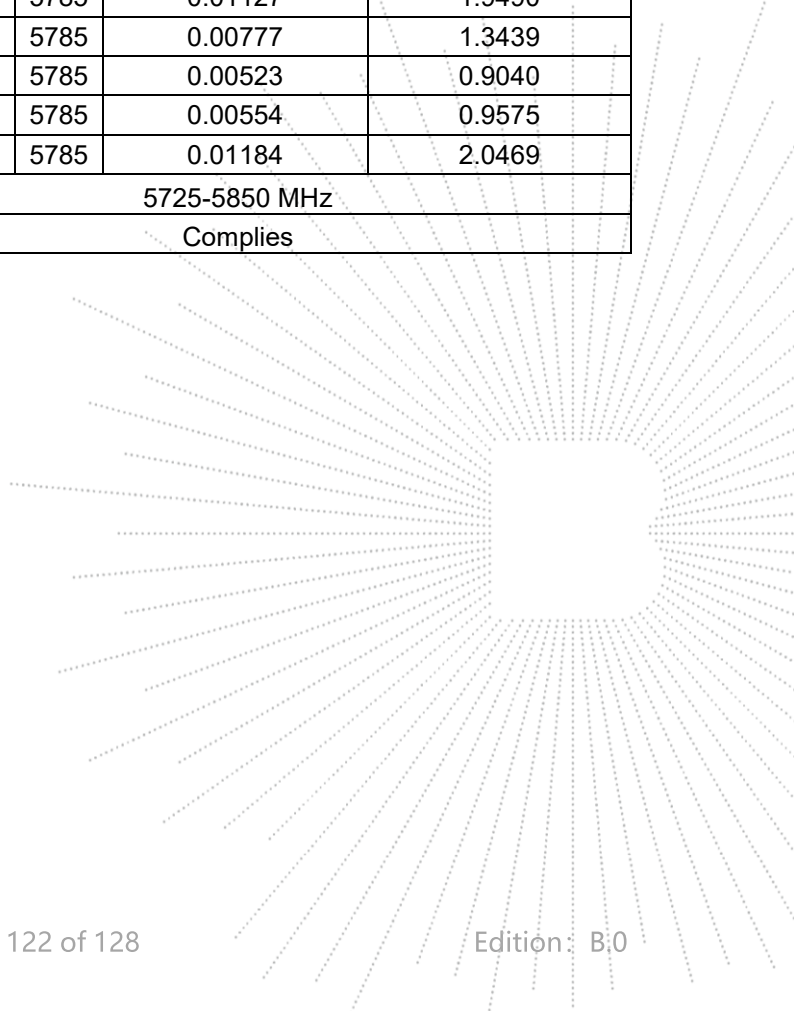
TEST CONDITIONS				Reference Frequency: 5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	12	T (°C)	-20	5745.01054	5745	0.01054	1.8343
		T (°C)	-10	5745.00082	5745	0.00082	0.1434
		T (°C)	0	5745.01188	5745	0.01188	2.0681
		T (°C)	10	5745.00687	5745	0.00687	1.1961
		T (°C)	20	5745.00136	5745	0.00136	0.2368
		T (°C)	30	5745.00129	5745	0.00129	0.2238
		T (°C)	40	5745.00215	5745	0.00215	0.3737
		T (°C)	50	5745.00058	5745	0.00058	0.1010
		T (°C)	60	5745.00446	5745	0.00446	0.7761
		T (°C)	70	5745.00044	5745	0.00044	0.0762
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	5785.00863	5785	0.00863	1.4918
		V max (V)	13.80	5785.00197	5785	0.00197	0.3397
		V min (V)	10.20	5785.00596	5785	0.00596	1.0305
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)	12	T (°C)	-20	5785.00762	5785	0.00762	1.3170
		T (°C)	-10	5785.00363	5785	0.00363	0.6280
		T (°C)	0	5785.00118	5785	0.00118	0.2046
		T (°C)	10	5785.00984	5785	0.00984	1.7002
		T (°C)	20	5785.01084	5785	0.01084	1.8744
		T (°C)	30	5785.01127	5785	0.01127	1.9490
		T (°C)	40	5785.00777	5785	0.00777	1.3439
		T (°C)	50	5785.00523	5785	0.00523	0.9040
		T (°C)	60	5785.00554	5785	0.00554	0.9575
		T (°C)	70	5785.01184	5785	0.01184	2.0469
Limits				5725-5850 MHz			
Result				Complies			

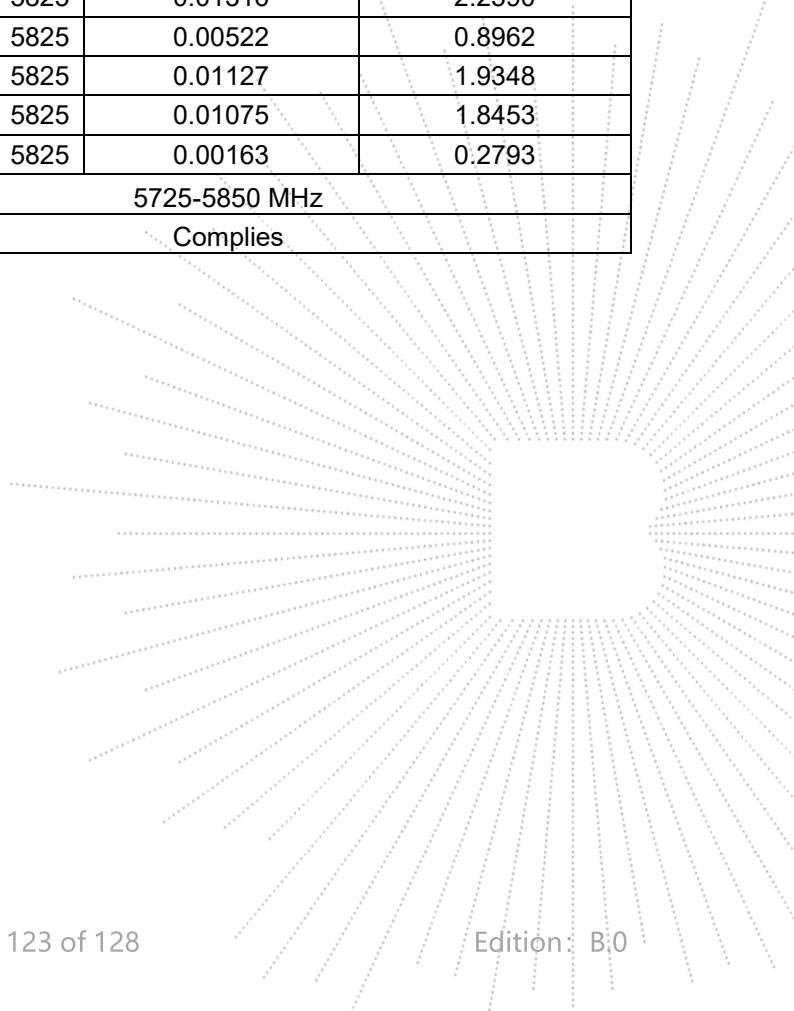


Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency: 5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	12.00	5825.00013	5825	0.00013	0.0220
		V max (V)	13.80	5825.01292	5825	0.01292	2.2173
		V min (V)	10.20	5825.00771	5825	0.00771	1.3237
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)	12	T (°C)	-20	5825.00674	5825	0.00674	1.1571
		T (°C)	-10	5825.01238	5825	0.01238	2.1255
		T (°C)	0	5825.00819	5825	0.00819	1.4054
		T (°C)	10	5825.00969	5825	0.00969	1.6628
		T (°C)	20	5825.00769	5825	0.00769	1.3199
		T (°C)	30	5825.01316	5825	0.01316	2.2590
		T (°C)	40	5825.00522	5825	0.00522	0.8962
		T (°C)	50	5825.01127	5825	0.01127	1.9348
		T (°C)	60	5825.01075	5825	0.01075	1.8453
		T (°C)	70	5825.00163	5825	0.00163	0.2793
Limits				5725-5850 MHz			
Result				Complies			



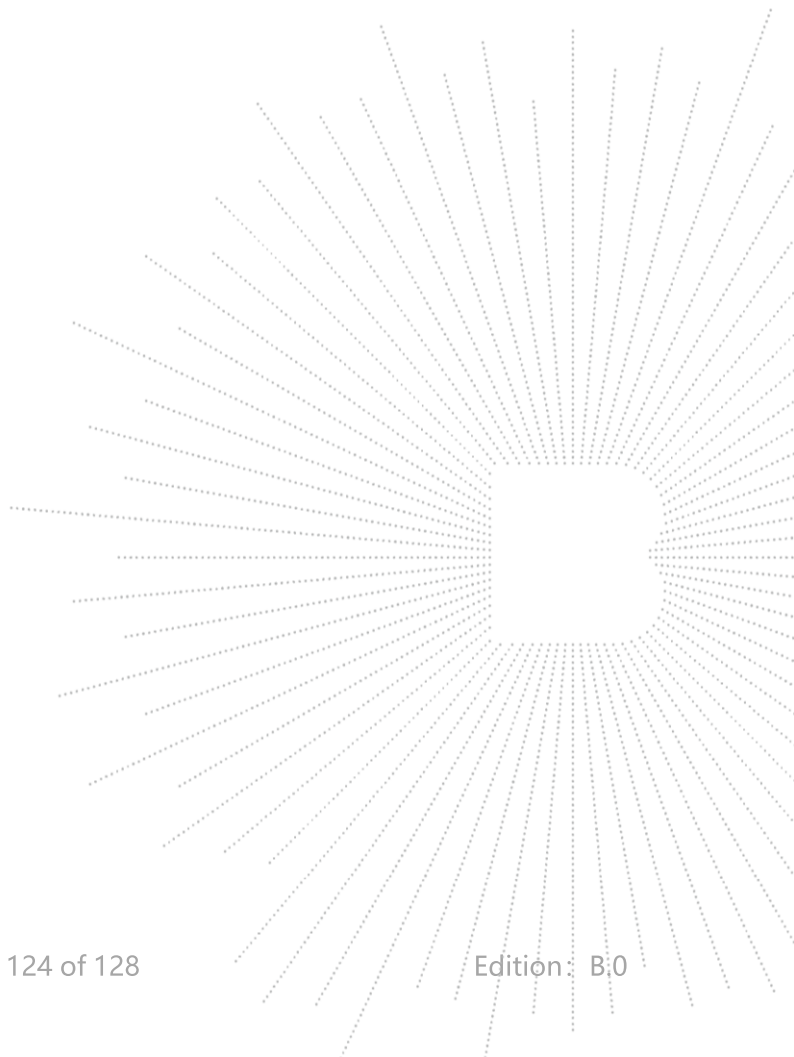
14. Antenna Requirement

14.1 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.

14.2 Test Result

The EUT antenna is Internal antenna (antenna gain (A): 2.67dBi; antenna gain (B) : 2.67dBi). It comply with the standard requirement.

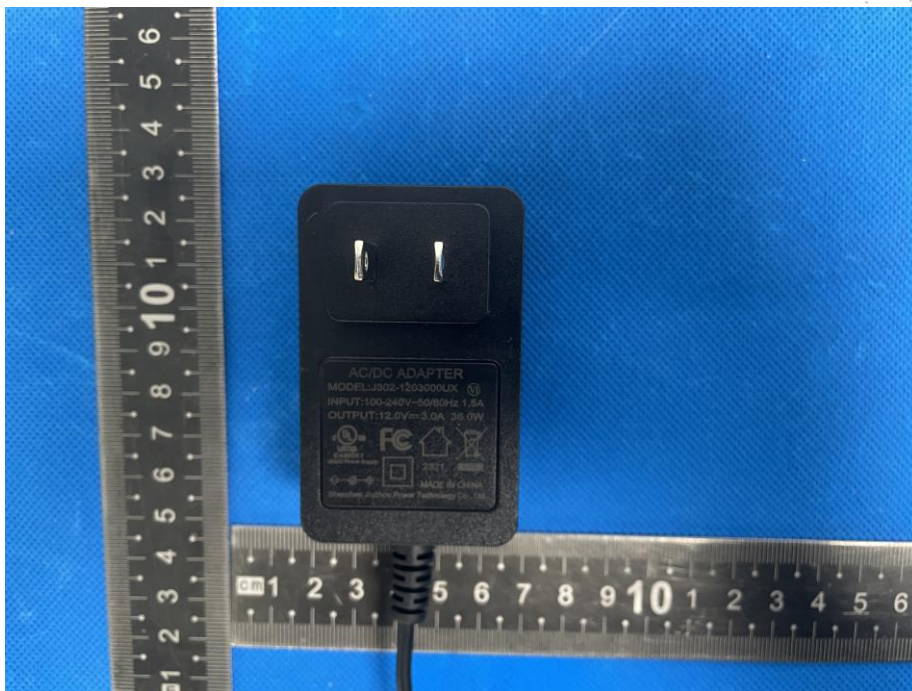


15. EUT Photographs

EUT Photo 1



EUT Photo 2



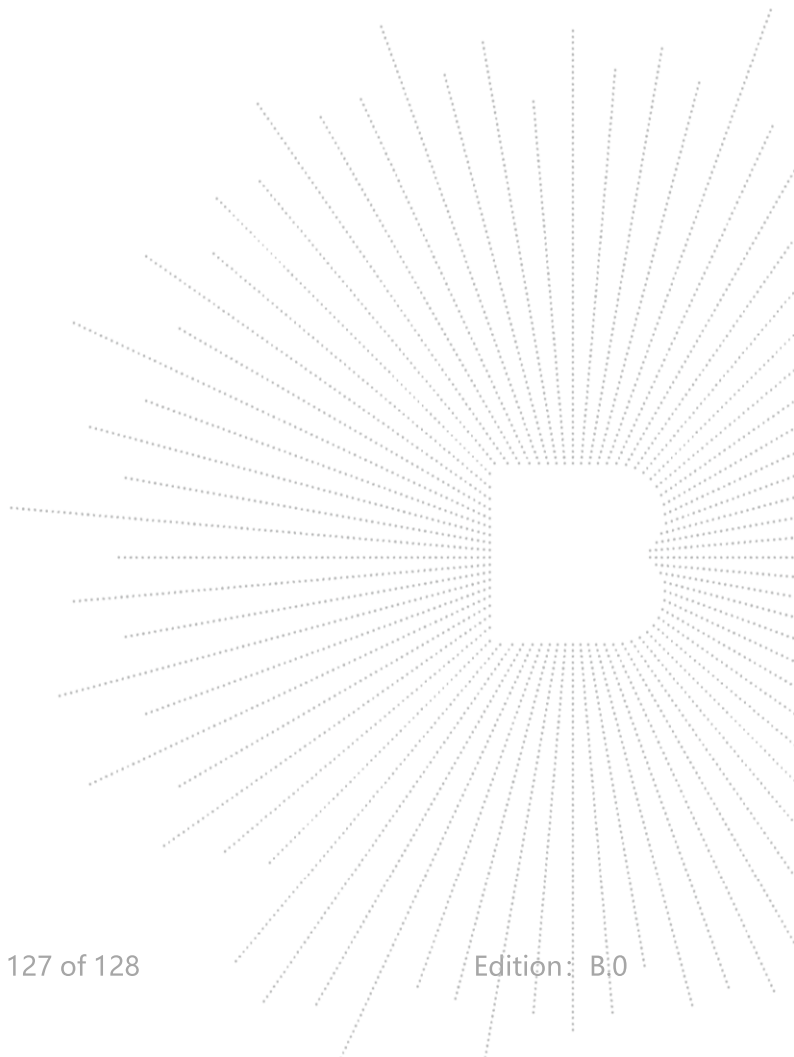
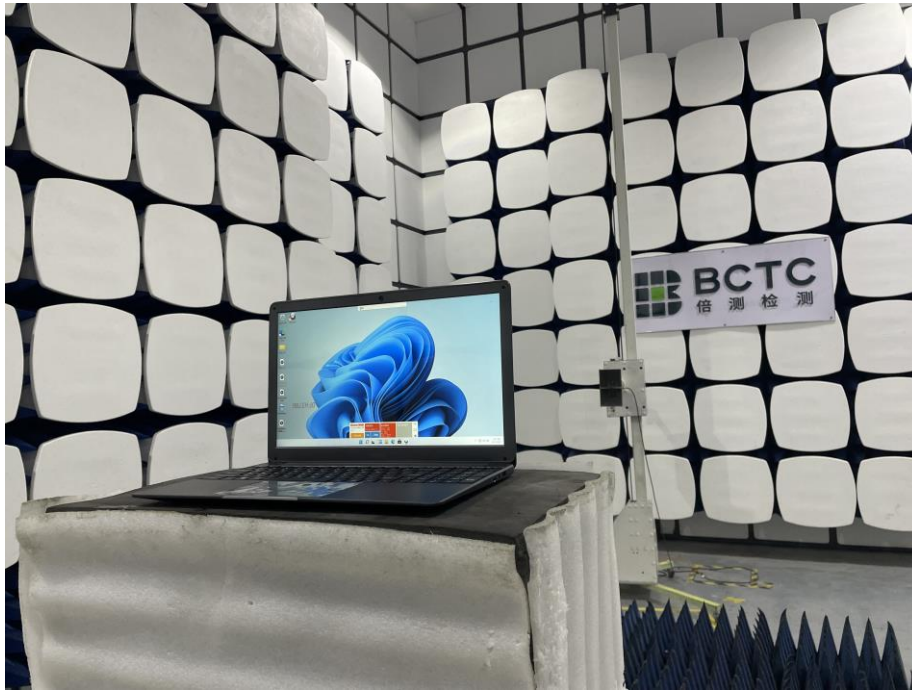
16. EUT Test Setup Photographs

Conducted Measurement Photo



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 *****

