



# RF TEST REPORT

Product Name: Laser Engraver

Model Name: SF-A9 enclose, SF-A9, SF-A9 enclose 20W, SF-A9 20W

FCC ID: 2BF27-SF-A9

Issued For : Shenzhen Sculpfun Technology Co., Ltd.

Room 201, Building B, Jinzhicai Factory, No. 1, Guihua  
Industrial Zone, Guanlan Street, Longhua District, Shenzhen  
City, Guangdong China

Issued By : Shenzhen LGT Test Service Co., Ltd.

Room 205, Building 13, Zone B, Zhenxiong Industrial Park,  
No.177, Renmin West Road, Jinsha, Kengzi Street, Pingshan  
District, Shenzhen, Guangdong, China

Report Number: LGT24D045RF04

Sample Received Date: Apr. 10, 2024

Date of Test: Apr. 10, 2024 – May 11, 2024

Date of Issue: May 11, 2024

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# TEST REPORT CERTIFICATION

**Applicant:** Shenzhen Sculpfun Technology Co., Ltd.  
**Address:** Room 201, Building B, Jinzhicai Factory, No. 1, Guihua Industrial Zone, Guanlan Street, Longhua District, Shenzhen City, Guangdong China

**Manufacturer:** Shenzhen Sculpfun Technology Co., Ltd.  
**Address:** Room 201, Building B, Jinzhicai Factory, No. 1, Guihua Industrial Zone, Guanlan Street, Longhua District, Shenzhen City, Guangdong China

**Product Name:** Laser Engraver  
**Trademark:** SCULPFUN  
**Model Name:** SF-A9 enclose, SF-A9, SF-A9 enclose 20W, SF-A9 20W  
**Sample Status:** Normal

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC Part 15.247, Subpart C ANSI C63.10-2013 KDB558074 D01 15.247 Meas Guidance v05r02	PASS

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**Revision History**

Rev.	Issue Date	Revisions
00	May 11, 2024	Initial Issue



## 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:  
KDB 558074 D01 15.247 Meas Guidance v05r02.

<b>FCC Part 15.247, Subpart C</b>			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	PASS	--
15.247 (a)(2)	6dB Bandwidth	PASS	--
15.247 (b)(3)	Output Power	PASS	--
15.209	Radiated Spurious Emission	PASS	--
15.247 (d)	Conducted Spurious & Band Edge Emission	PASS	--
15.247 (e)	Power Spectral Density	PASS	--
15.205	Restricted Band Edge Emission	PASS	--
Part 15.247(d)/ Part 15.209(a)	Band Edge Emission	PASS	--
15.203	Antenna Requirement	PASS	--

### NOTE:

- (1) 'N/A' denotes test is not applicable in this Test Report.
- (2) All tests are according to ANSI C63.10-2013.



## 1.1 TEST FACTORY

Company Name:	Shenzhen LGT Test Service Co., Ltd.
Address:	Room 205, Building 13, Zone B, Zhenxiong Industrial Park, No.177, Renmin West Road, Jinsha, Kengzi Street, Pingshan District, Shenzhen, Guangdong, China
Accreditation Certificate	A2LA Certificate No.: 6727.01
	FCC Registration No.: 746540
	CAB ID: CN0136

## 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately **95** %.

No.	Item	Uncertainty
1	RF Output Power, Conducted	$\pm 0.71$ dB
2	Power Spectral Density, Conducted	$\pm 1.57$ dB
3	Unwanted Emission, Conducted	$\pm 0.63$ dB
4	Conducted emission	$\pm 2.80$ dB
5	All Emissions, Radiated (0.009-30MHz)	$\pm 2.16$ dB
6	All Emissions, Radiated (30MHz-1GHz)	$\pm 4.40$ dB
7	All Emissions, Radiated (1GHz-18GHz)	$\pm 5.49$ dB

Note: The measurement uncertainty is not included in the test result.



## 2. GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF THE EUT

Product Name:	Laser Engraver	
Trademark:	SCULPFUN	
Model Name:	SF-A9 enclose	
Series Model:	SF-A9, SF-A9 enclose 20W, SF-A9 20W	
Model Difference:	Only the model is different.	
Product Description:	Operation Frequency:	802.11b/g/n(20MHz): 2412~2462MHz
	Modulation Type:	802.11b(DSSS):CCK,DQPSK,DBPSK 802.11g(OFDM):BPSK,QPSK,16-QAM,64-QAM 802.11n(OFDM):BPSK,QPSK,16-QAM,64-QAM
	Number of Channel:	802.11b/g/n: 11CH
	Antenna Designation:	Dipole
	Antenna Gain(dBi):	4.81
	Channel List:	Please refer to the Note 3.
Adapter:	Input: 100-240V, 50/60Hz, 5.0A Output: 24.0V-10.0A 240.0Wmax	
Hardware Version:	N/A	
Software Version:	N/A	
Connecting I/O Port(s):	Please refer to the Note 1.	

**Note:**

1. For a more detailed features description, please refer to the manufacturer's specifications or the User Manual.
2. The antenna information refers to the manufacturer provide report, applicable only to the tested sample identified in the report. Due to the incorrect antenna information, a series of problems such as the accuracy of the test results will be borne by the customer.





3.

Operation Frequency of channel	
802.11b/g/n(20MHz)	
Channel	Frequency
01	2412
02	2417
03	2422
04	2427
05	2432
06	2437
07	2442
08	2447
09	2452
10	2457
11	2462

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Carrier Frequency Channel

2.4GHz Test Frequency:

For 802.11b/g/n(HT20)	
Channel	Freq.(MHz)
01	2412
06	2437
11	2462



## 2.2 DESCRIPTION OF THE TEST MODES

Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Worst Mode	Description	Data Rate
Mode 1	TX IEEE 802.11b CH1	1 Mbps
Mode 2	TX IEEE 802.11b CH6	1 Mbps
Mode 3	TX IEEE 802.11 b CH11	1 Mbps
Mode 4	TX IEEE 802.11g CH1	6 Mbps
Mode 5	TX IEEE 802.11g CH6	6 Mbps
Mode 6	TX IEEE 802.11g CH11	6 Mbps
Mode 7	TX IEEE 802.11n HT20 CH1	MCS 0
Mode 8	TX IEEE 802.11n HT20 CH6	MCS 0
Mode 9	TX IEEE 802.11n HT20 CH11	MCS 0

Note:

(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

### AC Conducted Emission

Test Case	
AC Conducted Emission	Mode 10: Keeping TX + WLAN Link

## 2.3 TEST SOFTWARE AND POWER LEVEL

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

Test software Version	Test program: 2.4G WIFI	
EspRFTTestTool_v2.8	Mode Or Modulation type	Power setting
	b	15
	g	25
	n20	30



## 2.4 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

### Accessories Equipment

Description	Manufacturer	Model	S/N	Rating
Adapter	ShenZhen Teng Da Xing Electron Co.,Ltd	TDX90-1207000C14	N/A	Input: 100-240V ~ 50/60Hz 2A Output: 12V, 5A
USB-A to USB-C Cable	N/A	N/A	N/A	1.5m, shielded, without ferrite core

### Auxiliary Equipment

Description	Manufacturer	Model	S/N	Rating
Laptop	Lenovo	T470s	N/A	N/A

Note:

- (1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.



## 2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

<b>Conducted Emission</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Cal. Date</b>	<b>Cal. Until</b>
EMI Test Receiver	R&S	ESU8	100372	2024.03.09	2025.03.08
LISN	COM-POWER	LI-115	02032	2024.03.09	2025.03.08
LISN	SCHWARZBECK	NNLK 8122	00160	2024.03.09	2025.03.08
Transient Limiter	CYBERTEK	EM5010A	E2250100049	2024.03.09	2025.03.08
Temperature & Humidity	KTJ	TA218B	N.A	2024.03.09	2025.03.08
Testing Software	EMC-I_V1.4.0.3_SKET				

<b>Radiated Test equipment</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Cal. Date</b>	<b>Cal. Until</b>
EMI Test Receiver	R&S	ESU8	100372	2024.03.09	2025.03.08
Active loop Antenna	ETS	6502	00049544	2023.10.13	2025.10.12
Spectrum Analyzer	Keysight	N9010B	MY60242508	2023.08.14	2024.08.13
Bilog Antenna(30M-1G)	SCHWARZBECK	VULB 9168	2705	2022.12.12	2025.12.11
Horn Antenna(1-18G)	SCHWARZBECK	3115	10SL0060	2022.06.02	2025.06.01
Horn Antenna(18-40G)	A-INFO	LB-180400-KF	J211060273	2022.06.08	2025.06.07
Pre-amplifier(30M-1G)	EMtrace	RP01A	02019	2024.03.09	2025.03.08
Pre-amplifier(1-26.5G)	Agilent	8449B	3008A4722	2024.03.09	2025.03.08
Pre-amplifier(18-40G)	com-mw	LNPA_18-40-01	18050003	2024.03.09	2025.03.08
Wireless Communications Test Set	R&S	CMW 500	137737	2024.03.09	2025.03.08
Temperature & Humidity	JINGCHUANG	BT-3	N.A	2024.03.11	2025.03.10
Testing Software	EMC-I_V1.4.0.3_SKET				

<b>RF Conducted Test equipment</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Cal. Date</b>	<b>Cal. Until</b>
Signal Analyzer	Keysight	N9010B	MY60242508	2023.08.14	2024.08.13
Signal Analyzer	Keysight	N9020A	MY50530994	2024.03.09	2025.03.08
RF Automatic Test system	MW	MW100-RFCB	MW220322LG-033	2024.03.09	2025.03.08
MXG Vector Signal Generator	Keysight	N5182B	MY59100717	2024.03.09	2025.03.08
Temperature & Humidity test chamber	AISRY	LX-1000L	171200018	2024.03.09	2025.03.08
Attenuator	eastsheep	90db	N.A	2024.03.09	2025.03.08
Temperature & Humidity	JINGCHUANG	BT-3	N.A	2024.03.11	2025.03.10
Digital multimeter	MASTECH	MS8261	MBGBC83053	2024.03.09	2025.03.08
Testing Software	MTS8310_V2.0.0.0_MW				



### 3. EMC EMISSION TEST

#### 3.1 CONDUCTED EMISSION MEASUREMENT

##### 3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

FREQUENCY (MHz)	Conducted Emission limit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of “ \* ” marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

The following table is the setting of the receiver

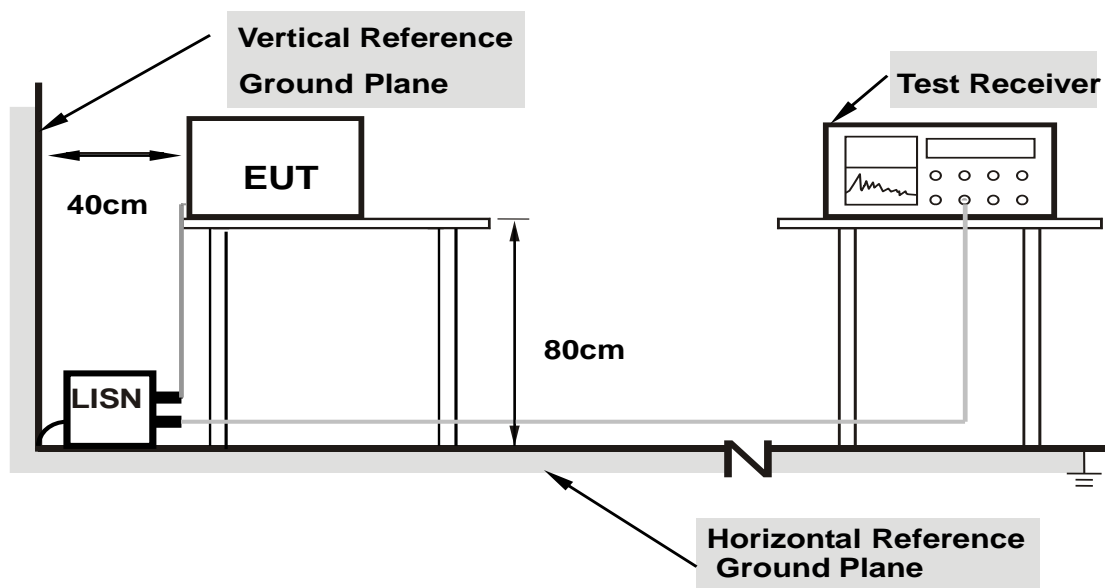
Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz



### 3.1.2 TEST PROCEDURE

- a. The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN is at least 80 cm from the nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

### 3.1.3 TEST SETUP



- Note: 1. Support units were connected to second LISN.**
- 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support units.**

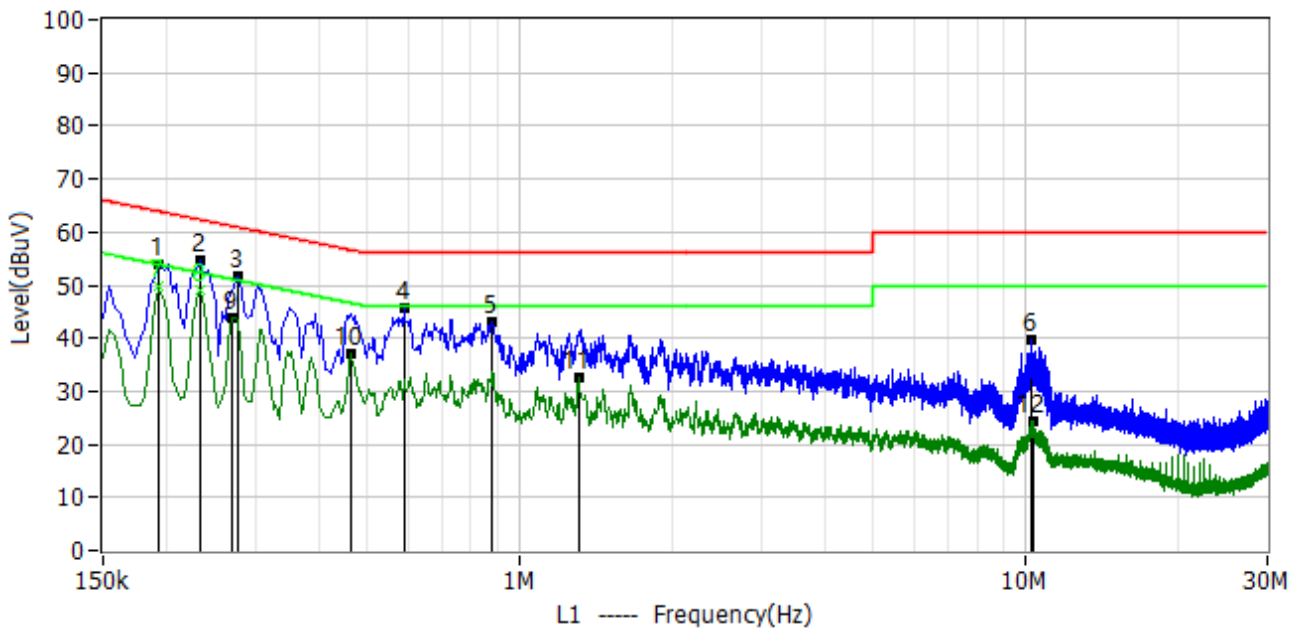
### 3.1.4 EUT OPERATING CONDITIONS

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.



### 3.1.5 TEST RESULT

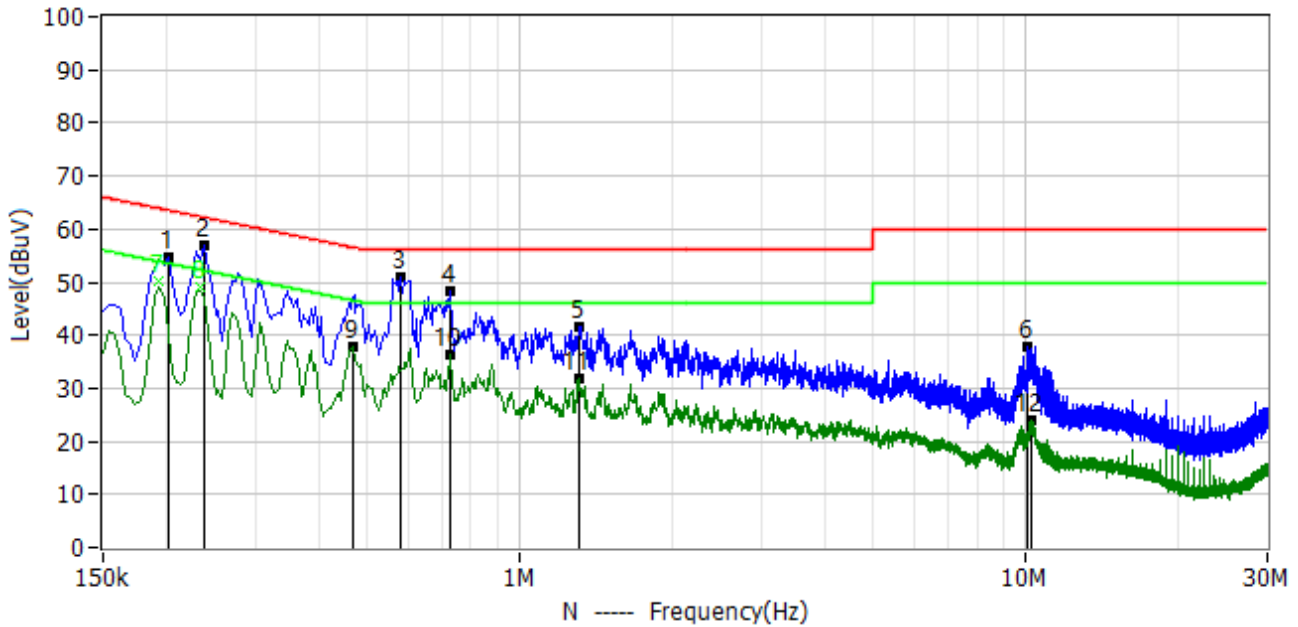
Project: LGT24D045	Test Engineer: LiuH
EUT: Laser Engraver	Temperature: 26°C
M/N: SF-A9 enclose	Humidity: 69%RH
Test Voltage: AC 120V/60Hz	Test Data: 2024-04-22
Test Mode: TX 802.11b 2412	
Note:	



No.	Frequency MHz	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Margin dB	Detector	Polar
1*	0.194	43.42	10.49	53.91	63.86	-9.95	QP	L1
2*	0.234	44.07	10.49	54.56	62.31	-7.75	QP	L1
3*	0.278	41.15	10.49	51.64	60.88	-9.24	QP	L1
4*	0.590	35.16	10.50	45.66	56.00	-10.34	QP	L1
5*	0.882	32.71	10.51	43.22	56.00	-12.78	QP	L1
6*	10.290	28.82	10.96	39.78	60.00	-20.22	QP	L1
7	0.194	39.33	10.50	49.83	53.86	-4.04	AV	L1
8	0.234	38.38	10.50	48.88	52.31	-3.43	AV	L1
9*	0.270	33.29	10.49	43.78	51.12	-7.34	AV	L1
10*	0.462	26.68	10.50	37.18	46.66	-9.48	AV	L1
11*	1.310	21.95	10.58	32.53	46.00	-13.47	AV	L1
12*	10.298	13.48	10.96	24.44	50.00	-25.56	AV	L1



Project: LGT24D045	Test Engineer: LiuH
EUT: Laser Engraver	Temperature: 26°C
M/N: SF-A9 enclose	Humidity: 69%RH
Test Voltage: AC 120V/60Hz	Test Data: 2024-04-22
Test Mode: TX 802.11b 2412	
Note:	



No.	Frequency MHz	Reading dBuV	Factor dB	Level dBuV	Limit dBuV	Margin dB	Detector	Polar
1*	0.202	44.04	10.49	54.53	63.53	-9.00	QP	N
2*	0.238	46.27	10.49	56.76	62.17	-5.40	QP	N
3*	0.582	40.57	10.50	51.07	56.00	-4.93	QP	N
4*	0.726	37.91	10.51	48.42	56.00	-7.58	QP	N
5*	1.310	31.04	10.58	41.62	56.00	-14.38	QP	N
6*	10.054	26.88	10.98	37.86	60.00	-22.14	QP	N
7	0.194	39.62	10.50	50.12	53.86	-3.75	AV	N
8	0.234	38.47	10.50	48.97	52.31	-3.33	AV	N
9*	0.466	27.42	10.50	37.92	46.58	-8.67	AV	N
10*	0.726	25.71	10.51	36.22	46.00	-9.78	AV	N
11*	1.306	21.09	10.58	31.67	46.00	-14.33	AV	N
12*	10.214	13.15	10.98	24.13	50.00	-25.87	AV	N





### 3.2 RADIATED EMISSION MEASUREMENT

#### 3.2.1 RADIATED EMISSION LIMITS

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (1000MHz-25GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

#### LIMITS OF RESTRICTED FREQUENCY BANDS

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			



For Radiated Emission

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP/AV
Start Frequency	9 KHz/150KHz(Peak/QP/AV)
Stop Frequency	150KHz/30MHz(Peak/QP/AV)
RB / VB (emission in restricted band)	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz); 200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP
Start Frequency	30 MHz(Peak/QP)
Stop Frequency	1000 MHz (Peak/QP)
RB / VB (emission in restricted band)	120 KHz / 300 KHz

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier harmonic(Peak/AV)
RB / VB (emission in restricted band)	1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG)

For Restricted band

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2310 to 2430 MHz Upper Band Edge: 2445 to 2500 MHz
RB / VB	1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG)

Receiver Parameter	Setting
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP



### 3.2.2 TEST PROCEDURE

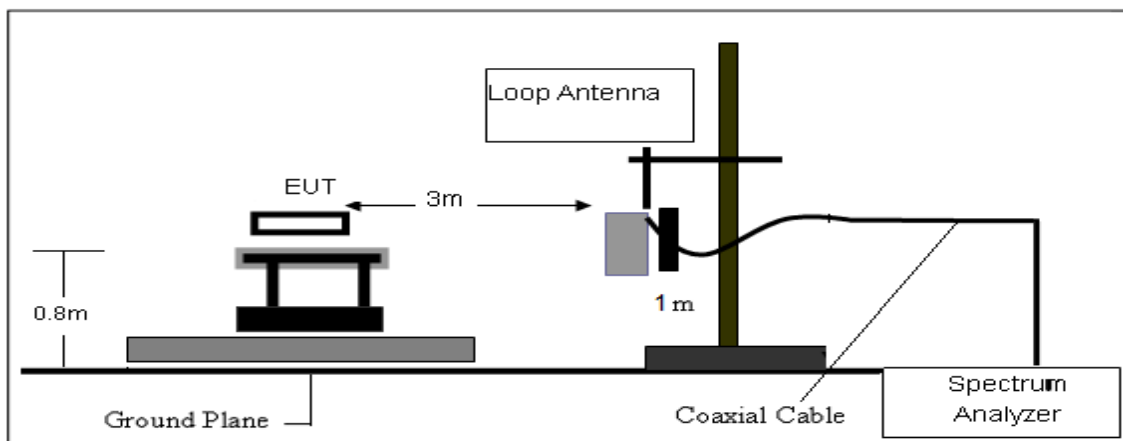
- a. The measuring distance at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
- b. The EUT was placed on the top of a rotating table 0.8 m (above 1GHz is 1.5 m) above the ground at a 3 m anechoic chamber test site. The table was rotated 360 degree to determine the position of the highest radiation.
- c. The height of the equipment shall be 0.8 m (above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarization of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and QuasiPeak detector mode will be re-measured.
- e. If the Peak Mode measured value is compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and no additional QP Mode measurement was performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

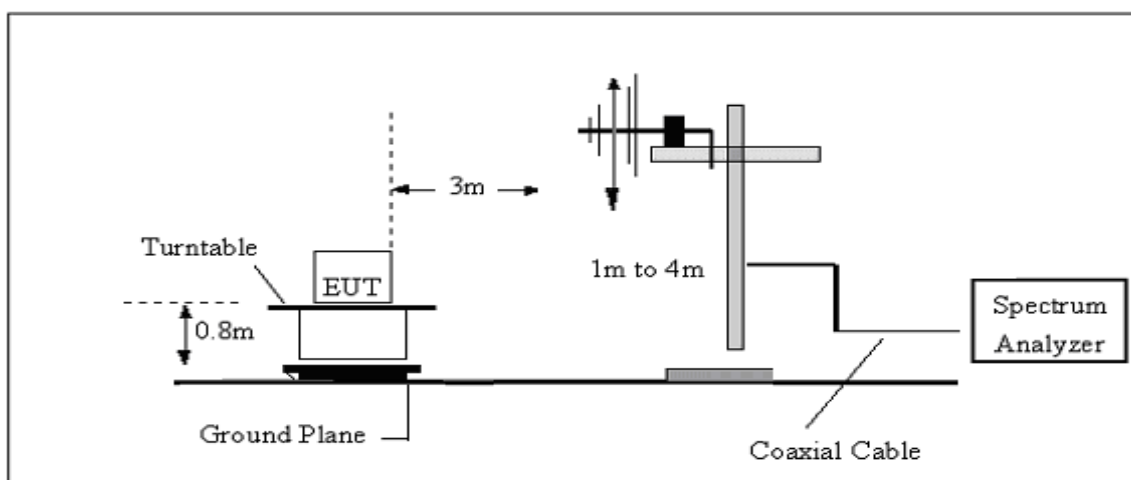
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

### 3.2.3 TEST SETUP

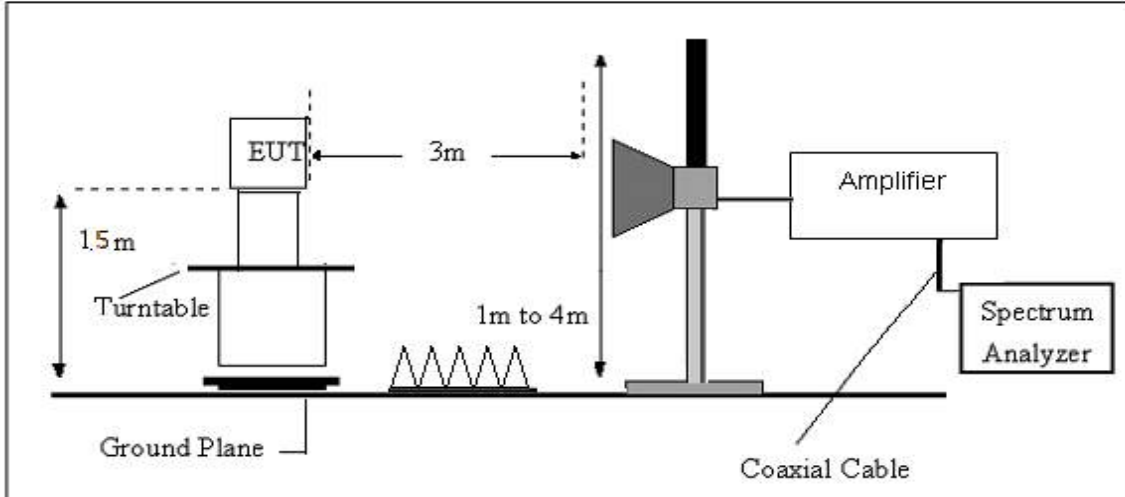
#### (A) Radiated Emission Test-Up Frequency Below 30MHz



#### (B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.2.4 EUT OPERATING CONDITIONS

Please refer to section 3.1.4 of this report.

3.2.5 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

Frequency (MHz)	FS (dB $\mu$ V/m)	RA (dB $\mu$ V/m)	AF (dB)	CL (dB)	AG (dB)	Factor (dB)
300	40	58.1	12.2	1.6	31.9	-18.1

$$\text{Factor} = \text{AF} + \text{CL} - \text{AG}$$



### 3.2.6 TEST RESULT

#### Results of Radiated Emissions (9 KHz~30MHz)

No.	Frequency	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Remark
1*	-	-	-	-	-	-	-	See Note

**Note:**

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.

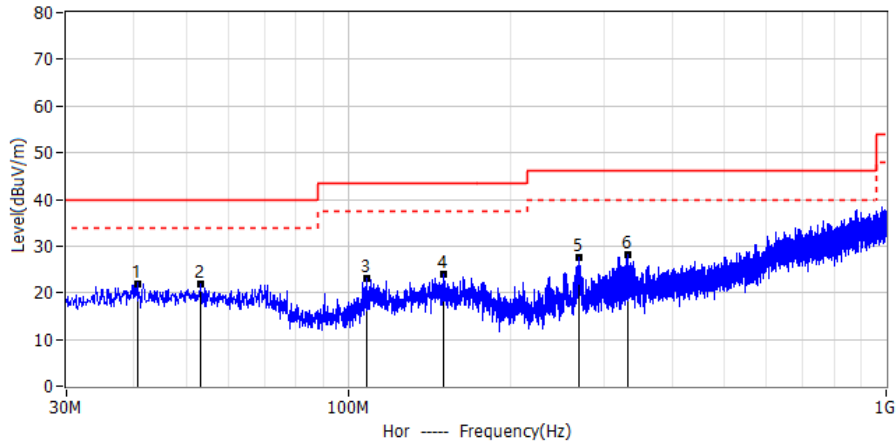
Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

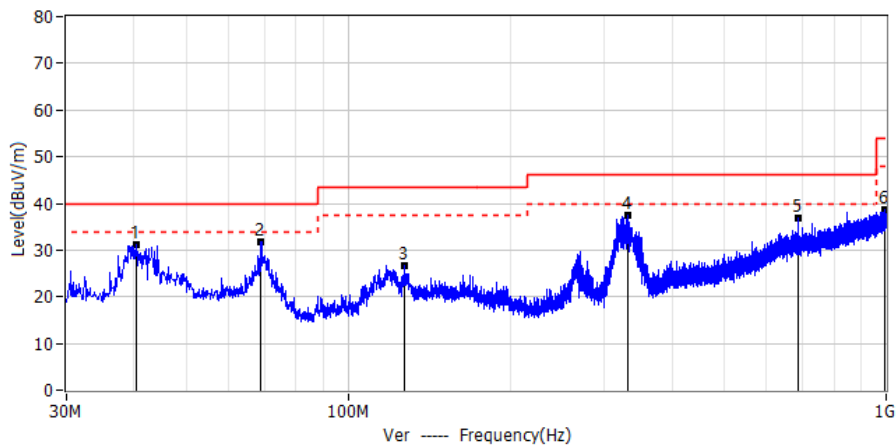


## Results of Radiated Emissions (30MHz~1000MHz)

Project: LGT24D045	Test Engineer: Xiangdong Ma
EUT: Laser Engraver	Temperature: 24.8°C
M/N: SF-A9 enclose	Humidity: 65%RH
Test Voltage: AC 120V/60Hz	Test Data: 2024-04-23
Test Mode: TX 802.11b 2412	
Note:	



No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	40.670	2.66	19.36	22.02	40.00	-17.98	QP	Hor
2*	53.280	2.86	19.12	21.98	40.00	-18.02	QP	Hor
3*	108.570	6.58	16.61	23.19	43.50	-20.31	QP	Hor
4*	150.523	3.93	19.98	23.91	43.50	-19.59	QP	Hor
5*	268.984	8.32	19.14	27.46	46.00	-18.54	QP	Hor
6*	331.670	7.29	20.83	28.12	46.00	-17.88	QP	Hor

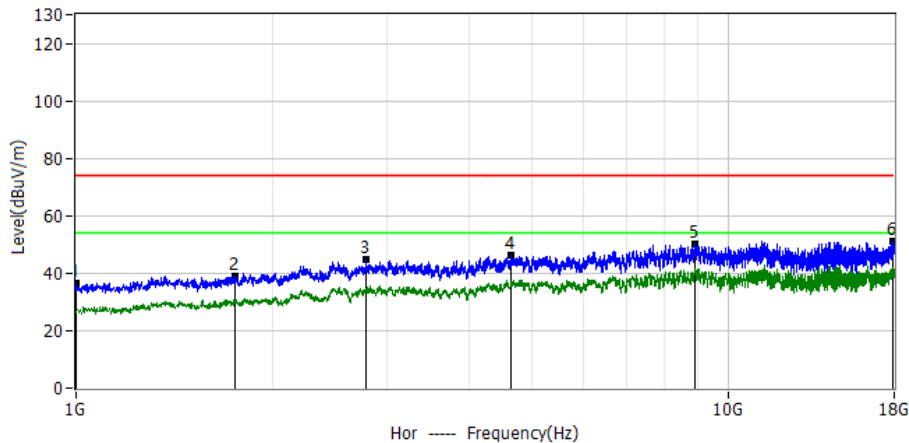


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	40.428	11.85	19.37	31.22	40.00	-8.78	QP	Ver
2*	68.800	13.82	18.09	31.91	40.00	-8.09	QP	Ver
3*	127.364	8.27	18.27	26.54	43.50	-16.96	QP	Ver
4*	330.943	16.60	20.82	37.42	46.00	-8.58	QP	Ver
5*	687.539	7.05	29.69	36.74	46.00	-9.26	QP	Ver
6*	995.514	3.97	34.55	38.52	54.00	-15.48	QP	Ver

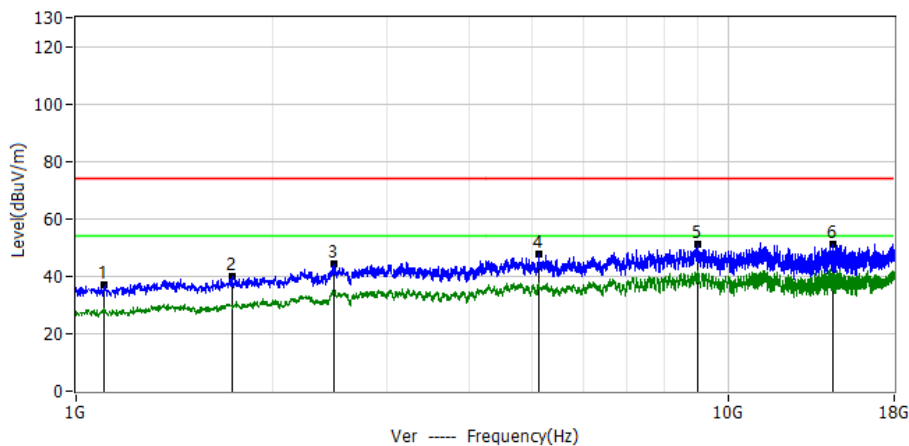


## Results of Radiated Emissions (Above 1000MHz)

Project: LGT24D045	Test Engineer: Xiangdong Ma
EUT: Laser Engraver	Temperature: 24.8°C
M/N: SF-A9 enclose	Humidity: 65%RH
Test Voltage: AC 120V/60Hz	Test Data: 2024-04-23
Test Mode: 802.11b 2412	
Note: Worst Case	



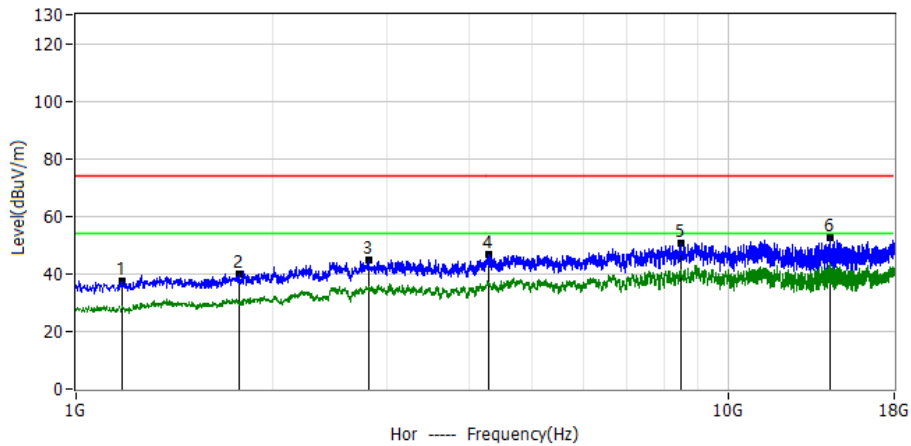
No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1002.1000	61.38	-24.73	36.65	74.00	-37.35	PK	Hor
2*	1750.1000	57.92	-18.89	39.03	74.00	-34.97	PK	Hor
3*	2785.0000	54.58	-9.86	44.72	74.00	-29.28	PK	Hor
4*	4642.2000	52.87	-6.65	46.22	74.00	-27.78	PK	Hor
5*	8915.6000	54.13	-3.82	50.31	74.00	-23.69	PK	Hor
6*	17949.0000	49.26	2.00	51.26	74.00	-22.74	PK	Hor



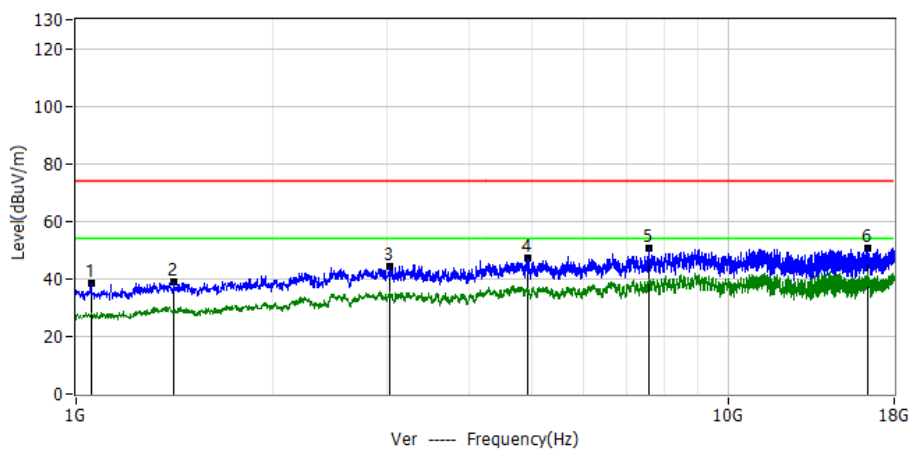
No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1106.2000	60.95	-23.83	37.12	74.00	-36.88	PK	Ver
2*	1739.5000	58.75	-18.99	39.76	74.00	-34.24	PK	Ver
3*	2487.5000	55.61	-11.43	44.18	74.00	-29.82	PK	Ver
4*	5126.7000	55.32	-7.43	47.89	74.00	-26.11	PK	Ver
5*	8994.2000	54.87	-3.68	51.19	74.00	-22.81	PK	Ver
6*	14489.5000	50.69	0.67	51.36	74.00	-22.64	PK	Ver



Project: LGT24D045	Test Engineer: Xiangdong Ma
EUT: Laser Engraver	Temperature: 24.8°C
M/N: SF-A9 enclose	Humidity: 65%RH
Test Voltage: AC 120V/60Hz	Test Data: 2024-04-23
Test Mode: 802.11b 2437	
Note: Worst Case	



No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1176.4000	60.90	-23.21	37.69	74.00	-36.31	PK	Hor
2*	1775.6000	58.75	-18.65	40.10	74.00	-33.90	PK	Hor
3*	2814.7000	54.54	-9.71	44.83	74.00	-29.17	PK	Hor
4*	4300.1000	54.28	-7.31	46.97	74.00	-27.03	PK	Hor
5*	8458.7000	55.33	-4.66	50.67	74.00	-23.33	PK	Hor
6*	14376.9000	52.04	0.72	52.76	74.00	-21.24	PK	Hor

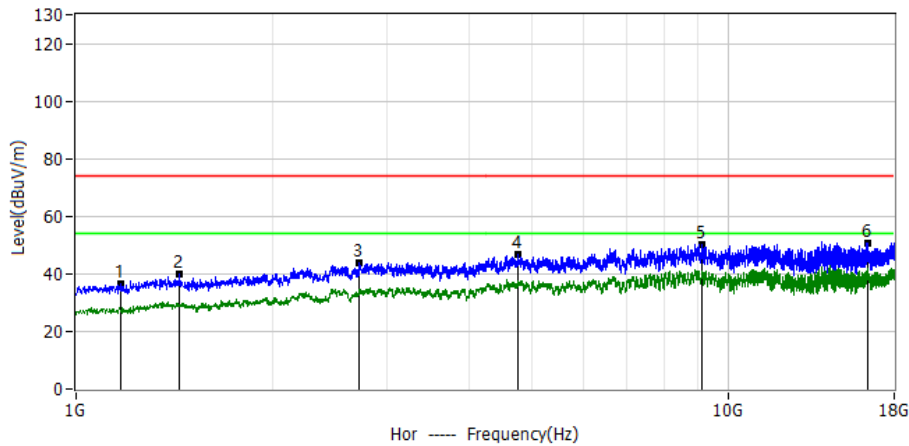


No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1053.1000	62.93	-24.29	38.64	74.00	-35.36	PK	Ver
2*	1412.2000	60.37	-21.40	38.97	74.00	-35.03	PK	Ver
3*	3027.2000	52.88	-8.78	44.10	74.00	-29.90	PK	Ver
4*	4918.5000	54.25	-6.92	47.33	74.00	-26.67	PK	Ver
5*	7576.9000	56.09	-5.66	50.43	74.00	-23.57	PK	Ver
6*	16374.4000	49.85	0.75	50.60	74.00	-23.40	PK	Ver

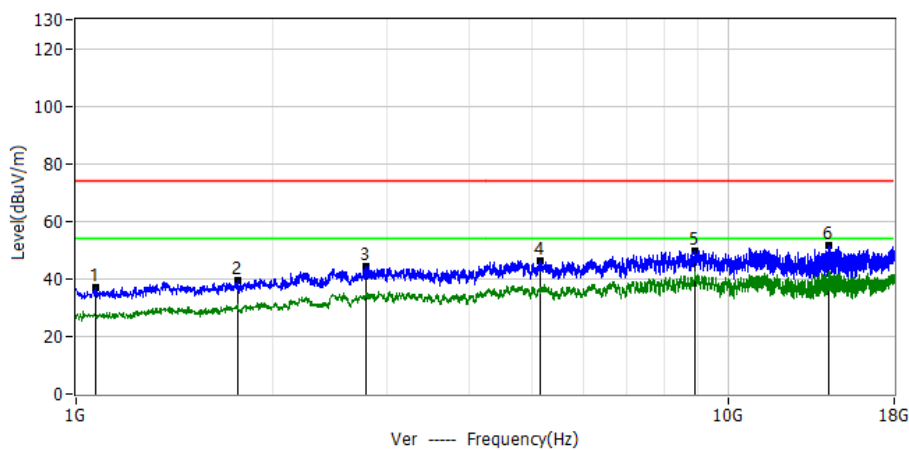




Project: LGT24D045	Test Engineer: Xiangdong Ma
EUT: Laser Engraver	Temperature: 24.8°C
M/N: SF-A9 enclose	Humidity: 65%RH
Test Voltage: AC 120V/60Hz	Test Data: 2024-04-23
Test Mode: 802.11b 2462	
Note: Worst Case	



No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1167.9000	59.98	-23.29	36.69	74.00	-37.31	PK	Hor
2*	1442.0000	61.07	-21.25	39.82	74.00	-34.18	PK	Hor
3*	2721.2000	53.90	-10.18	43.72	74.00	-30.28	PK	Hor
4*	4769.7000	53.30	-6.77	46.53	74.00	-27.47	PK	Hor
5*	9123.9000	54.00	-3.73	50.27	74.00	-23.73	PK	Hor
6*	16389.2000	50.01	0.77	50.78	74.00	-23.22	PK	Hor



No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	1072.2000	61.24	-24.12	37.12	74.00	-36.88	PK	Ver
2*	1769.2000	58.35	-18.71	39.64	74.00	-34.36	PK	Ver
3*	2791.4000	54.35	-9.83	44.52	74.00	-29.48	PK	Ver
4*	5160.7000	54.02	-7.55	46.47	74.00	-27.53	PK	Ver
5*	8919.9000	53.67	-3.82	49.85	74.00	-24.15	PK	Ver
6*	14255.7000	50.78	0.77	51.55	74.00	-22.45	PK	Ver

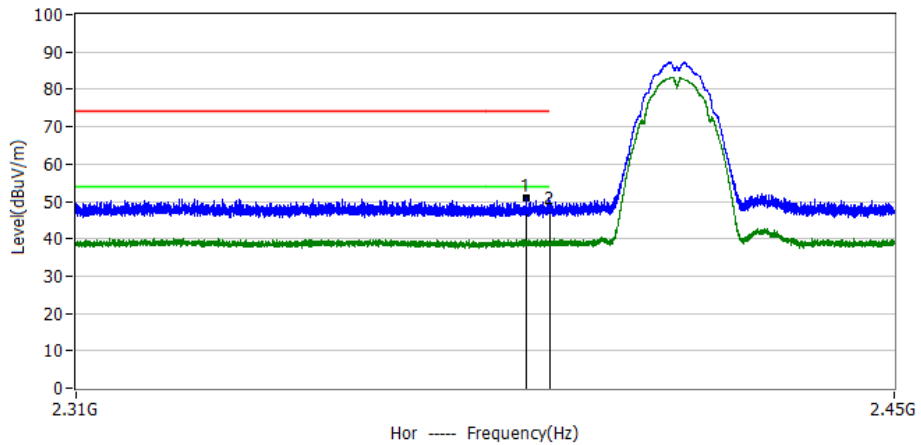
**Remark:**

In frequency ranges 18~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.

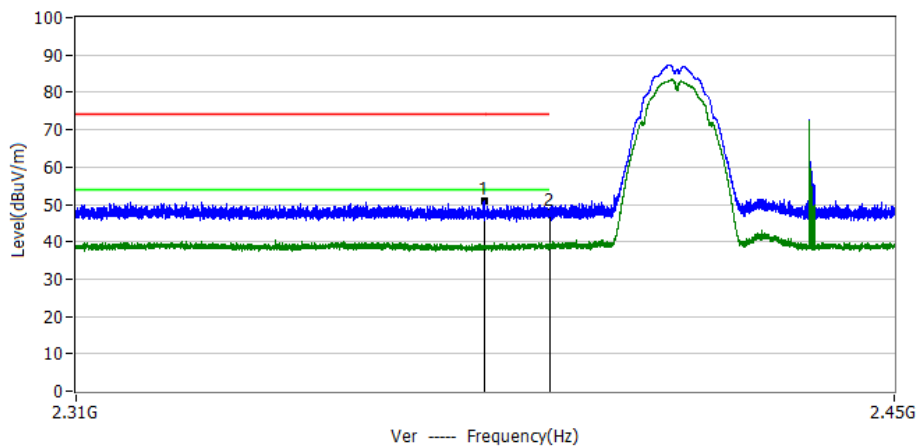


### 3.2.7 TEST RESULTS(Band edge Requirements)

Project: LGT24D045	Test Engineer: Xiangdong Ma
EUT: Laser Engraver	Temperature: 24.8°C
M/N: SF-A9 enclose	Humidity: 65%RH
Test Voltage: AC 120V/60Hz	Test Data: 2024-04-23
Test Mode: 802.11b 2412	
Note:	



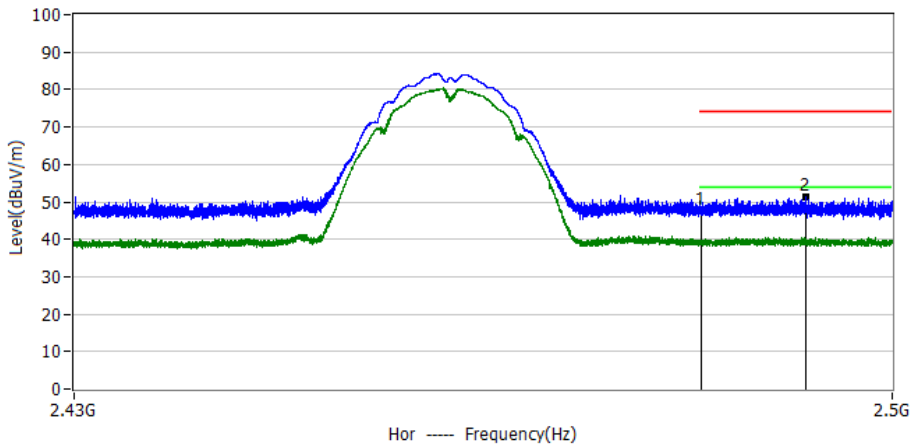
No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2386.0000	16.84	33.96	50.80	74.00	-23.20	PK	Hor
2*	2390.0000	13.65	33.95	47.60	74.00	-26.40	PK	Hor



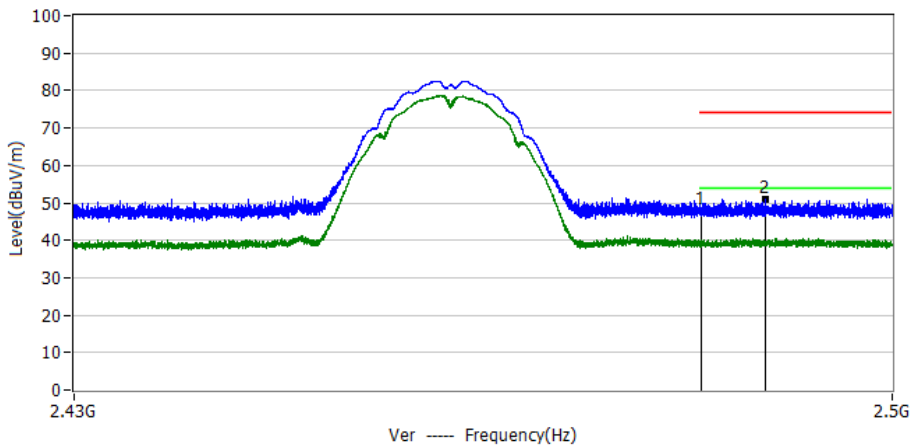
No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2378.9000	17.00	33.98	50.98	74.00	-23.02	PK	Ver
2*	2390.0000	14.05	33.95	48.00	74.00	-26.00	PK	Ver



Project: LGT24D045	Test Engineer: Xiangdong Ma
EUT: Laser Engraver	Temperature: 24.8°C
M/N: SF-A9 enclose	Humidity: 65%RH
Test Voltage: AC 120V/60Hz	Test Data: 2024-04-23
Test Mode: 802.11b 2462	
Note:	



No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2483.5000	13.47	34.13	47.60	74.00	-26.40	PK	Hor
2*	2492.5000	17.05	34.15	51.20	74.00	-22.80	PK	Hor



No.	Frequency MHz	Reading dBuV	Factor dB/m	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Polar
1*	2483.5000	13.87	34.13	48.00	74.00	-26.00	PK	Ver
2*	2489.0000	16.80	34.14	50.94	74.00	-23.06	PK	Ver



## 4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

### 4.1 LIMIT

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 4.2 TEST PROCEDURE

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

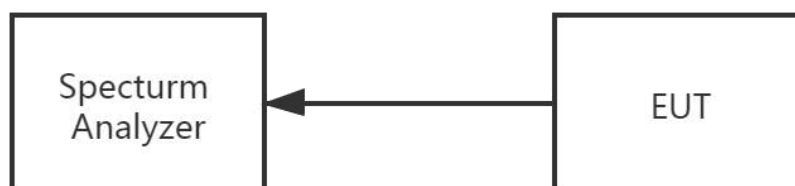
For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2300 to 2432 MHz Upper Band Edge: 2442 to 2500 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

### 4.3 DEVIATION FROM STANDARD

No deviation.

### 4.4 TEST SETUP



The EUT is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

### 4.5 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

### 4.6 TEST RESULTS

For the measurement records, refer to the appendix I.



## 5. POWER SPECTRAL DENSITY TEST

### 5.1 LIMIT

FCC Part15.247 , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(e)	Power Spectral Density	$\leq 8$ dBm (RBW $\geq 3$ KHz)	2400-2483.5	PASS

### 5.2 TEST PROCEDURE

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the  $100 \text{ kHz} \geq \text{RBW} \geq 3 \text{ kHz}$ .
4. Set the  $\text{VBW} \geq 3 \times \text{RBW}$ .
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### 5.3 DEVIATION FROM STANDARD

No deviation.

### 5.4 TEST SETUP



### 5.5 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

### 5.6 TEST RESULTS

For the measurement records, refer to the appendix I.



## 6. BANDWIDTH TEST

### 6.1 LIMIT

FCC Part15.247,Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	$\geq 500\text{KHz}$ (6dB bandwidth)	2400-2483.5	PASS

### 6.2 TEST PROCEDURE

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW $\geq$ 3RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be  $\geq 6$  dB.

### 6.3 DEVIATION FROM STANDARD

No deviation.

### 6.4 TEST SETUP



### 6.5 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

### 6.6 TEST RESULTS

For the measurement records, refer to the appendix I.



## 7. PEAK OUTPUT POWER TEST

### 7.1 LIMIT

FCC Part15.247,Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Output Power	1 watt or 30dBm	2400-2483.5	PASS

### 7.2 TEST PROCEDURE

One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

RBW  $\geq$  DTS bandwidth

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

- Set the RBW  $\geq$  DTS bandwidth.
- Set VBW  $\geq$  [3  $\times$  RBW].
- Set span  $\geq$  [3  $\times$  RBW].
- Sweep time = auto couple.
- Detector = peak.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use peak marker function to determine the peak amplitude level.

Integrated band power method:

The following procedure can be used when the maximum available RBW of the instrument is less than the

DTS bandwidth:

- Set the RBW = 1 MHz.
- Set the VBW  $\geq$  [3  $\times$  RBW].
- Set the span  $\geq$  [1.5  $\times$  DTS bandwidth].
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select the peak detector). If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS channel bandwidth.

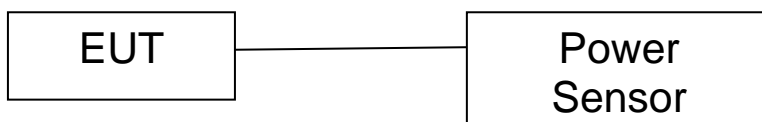
PKPM1 Peak power meter method:

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.

### 7.3 DEVIATION FROM STANDARD

No deviation.

### 7.4 TEST SETUP



### 7.5 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

### 7.6 TEST RESULTS

For the measurement records, refer to the appendix I.



## 8. ANTENNA REQUIREMENT

### 8.1 STANDARD REQUIREMENT

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.

### 8.2 EUT ANTENNA

The EUT antenna is Dipole Antenna. It comply with the standard requirement.





## APPENDIX I - TEST RESULTS

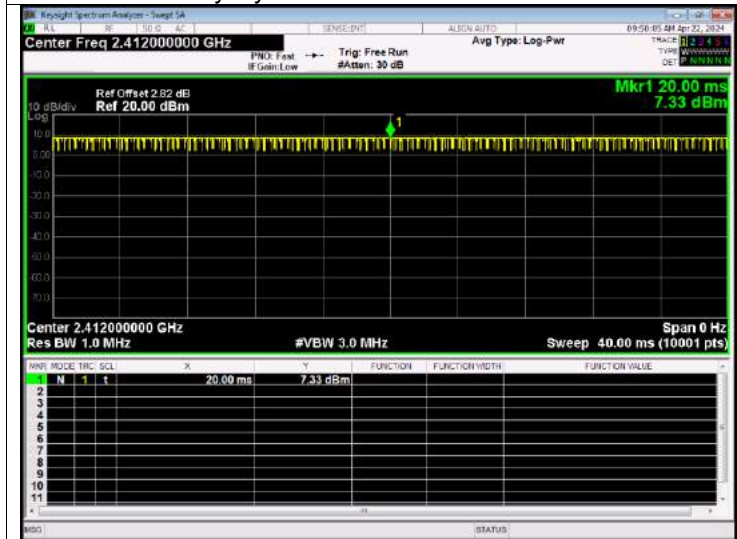
### Duty Cycle

Condition	Mode	Frequency (MHz)	Antenna	Duty Cycle (%)	Correction Factor (dB)	1/T (kHz)
NVNT	b	2412	Ant1	100	0	0.01
NVNT	b	2437	Ant1	100	0	0.01
NVNT	b	2462	Ant1	100	0	0.01
NVNT	g	2412	Ant1	100	0	0.01
NVNT	g	2437	Ant1	100	0	0.01
NVNT	g	2462	Ant1	100	0	0.01
NVNT	n20	2412	Ant1	100	0	0.01
NVNT	n20	2437	Ant1	100	0	0.01
NVNT	n20	2462	Ant1	100	0	0.01

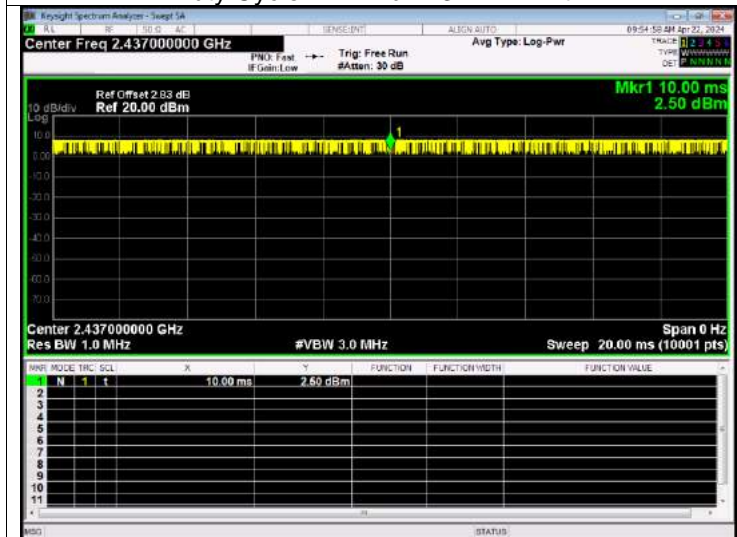


### Test Graphs

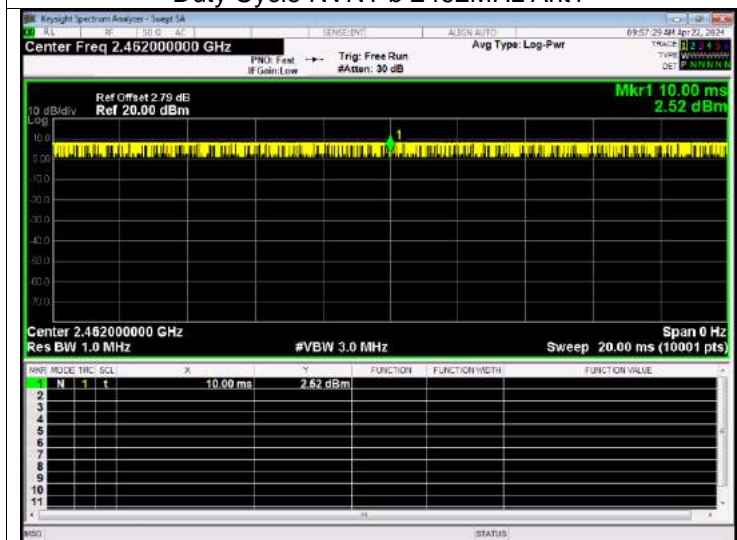
#### Duty Cycle NVNT b 2412MHz Ant1

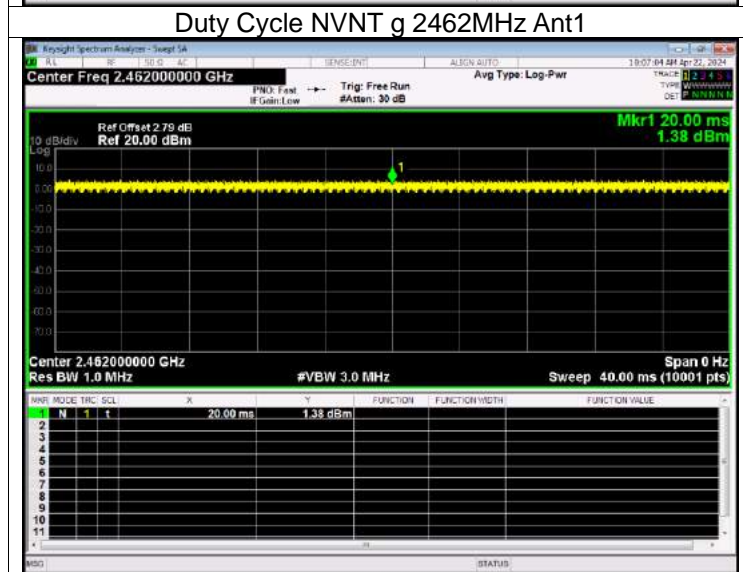
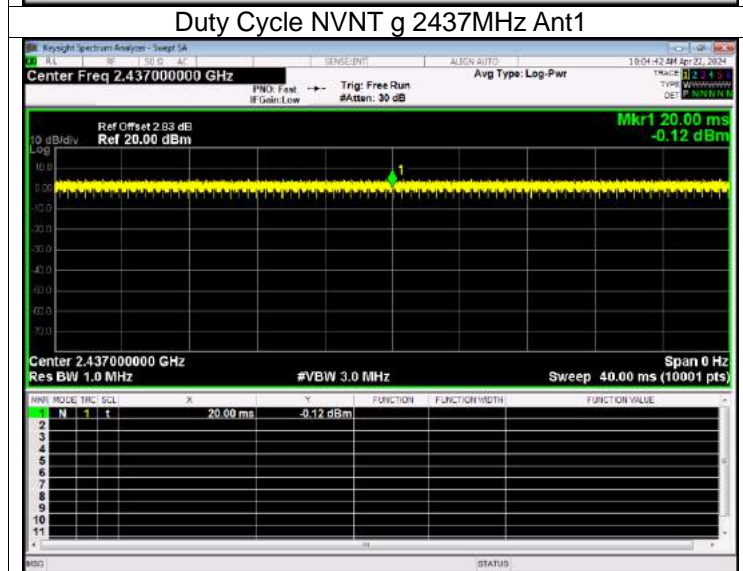
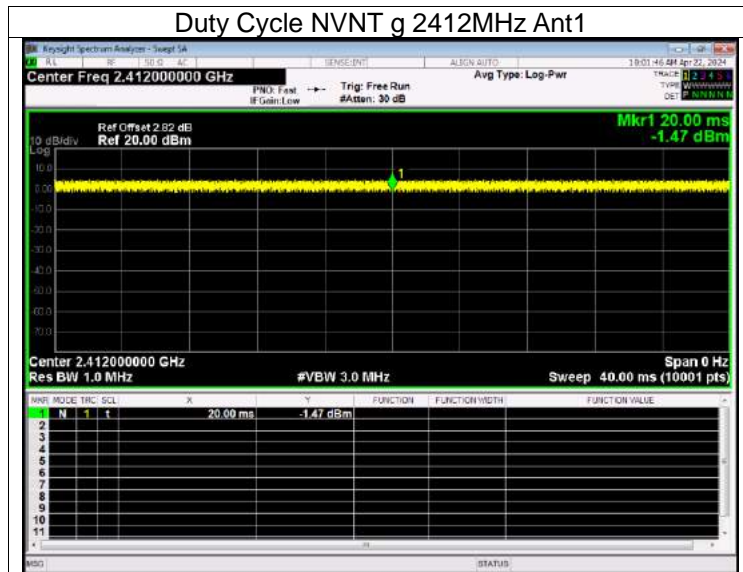


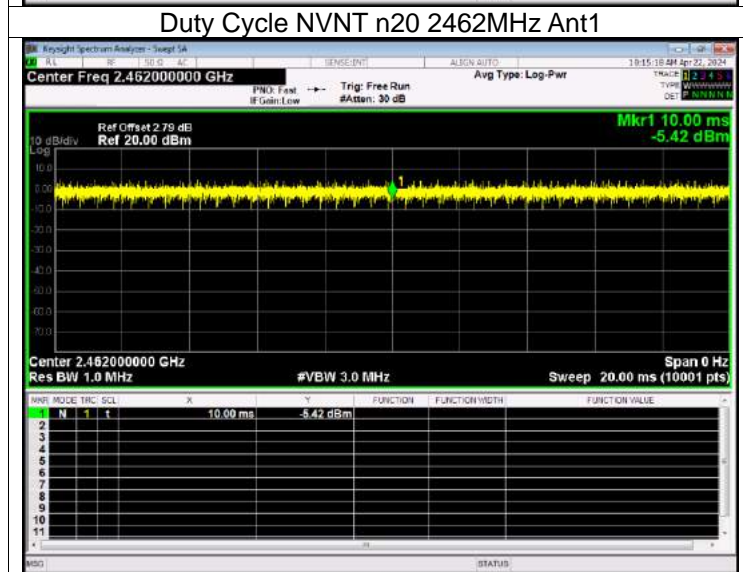
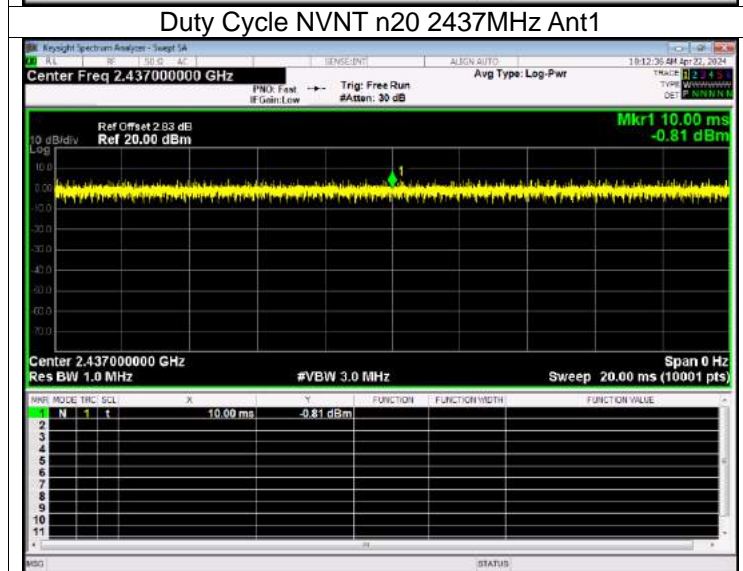
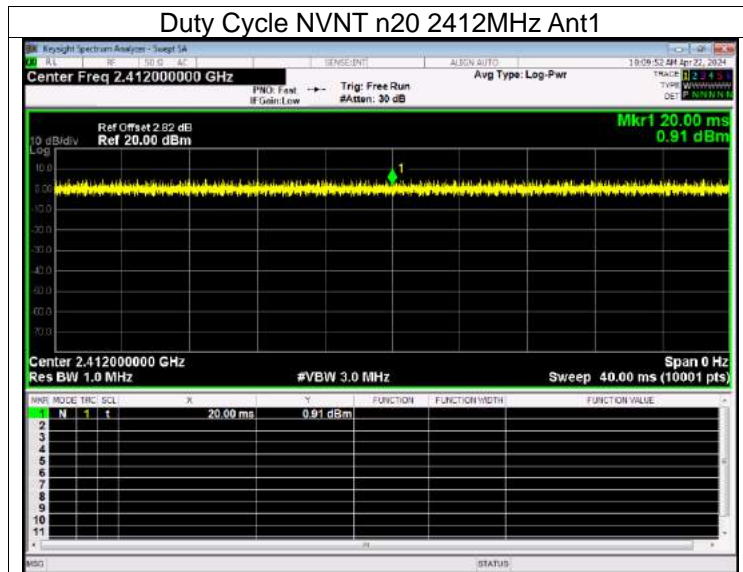
#### Duty Cycle NVNT b 2437MHz Ant1



#### Duty Cycle NVNT b 2462MHz Ant1









### Maximum Peak Conducted Output Power

Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	b	2412	Ant1	15.03	30	Pass
NVNT	b	2437	Ant1	14.49	30	Pass
NVNT	b	2462	Ant1	14.45	30	Pass
NVNT	g	2412	Ant1	14.52	30	Pass
NVNT	g	2437	Ant1	14.05	30	Pass
NVNT	g	2462	Ant1	14.06	30	Pass
NVNT	n20	2412	Ant1	13.2	30	Pass
NVNT	n20	2437	Ant1	12.83	30	Pass
NVNT	n20	2462	Ant1	12.72	30	Pass



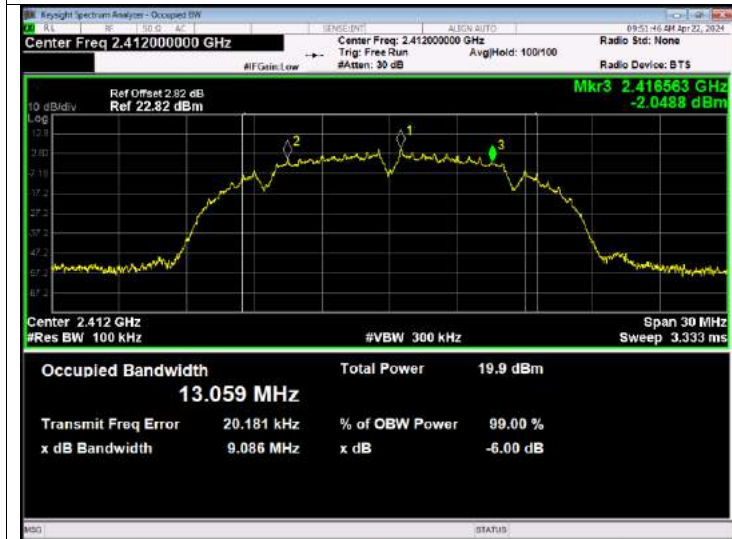
-6dB Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	b	2412	Ant1	9.086	0.5	Pass
NVNT	b	2437	Ant1	8.592	0.5	Pass
NVNT	b	2462	Ant1	9.085	0.5	Pass
NVNT	g	2412	Ant1	16.414	0.5	Pass
NVNT	g	2437	Ant1	16.42	0.5	Pass
NVNT	g	2462	Ant1	16.499	0.5	Pass
NVNT	n20	2412	Ant1	17.315	0.5	Pass
NVNT	n20	2437	Ant1	17.551	0.5	Pass
NVNT	n20	2462	Ant1	17.321	0.5	Pass



### Test Graphs

#### -6dB Bandwidth NVNT b 2412MHz Ant1



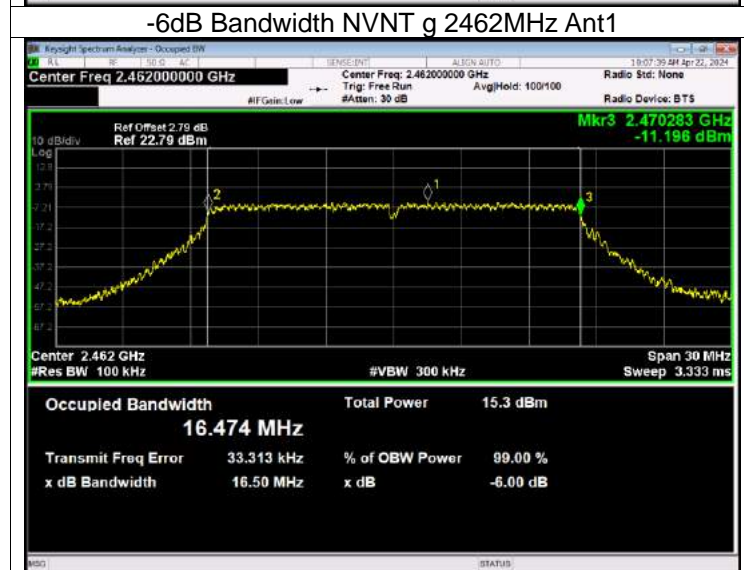
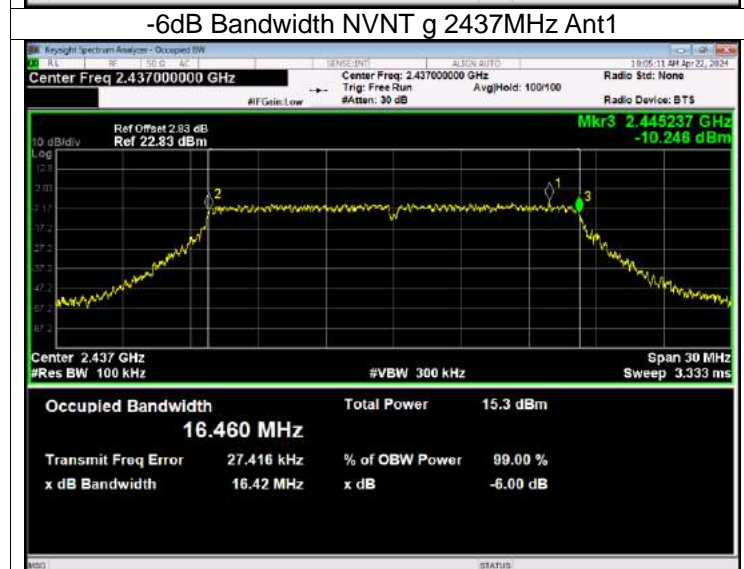
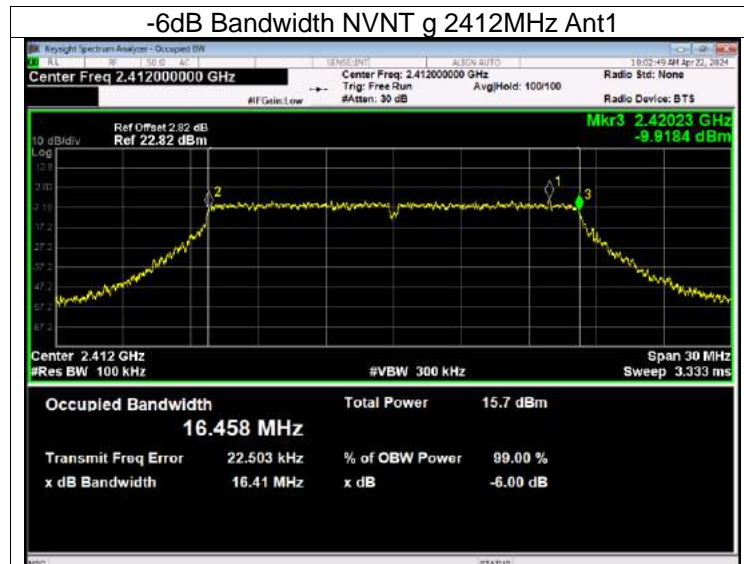
#### -6dB Bandwidth NVNT b 2437MHz Ant1



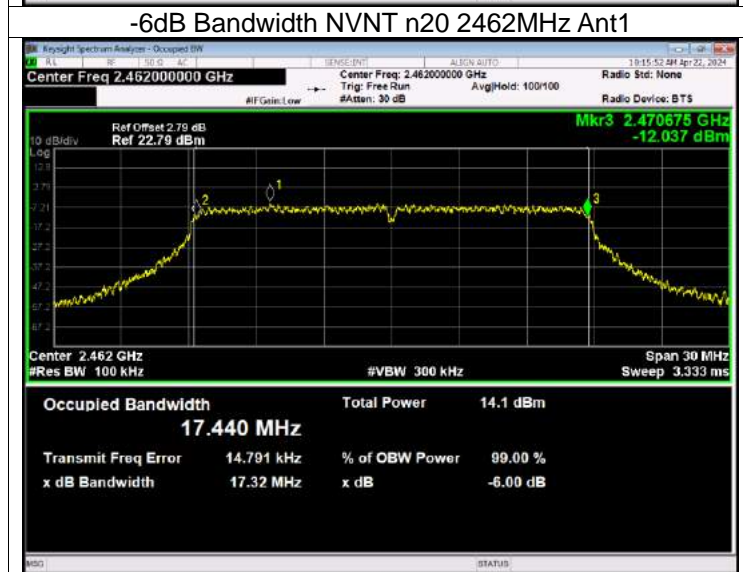
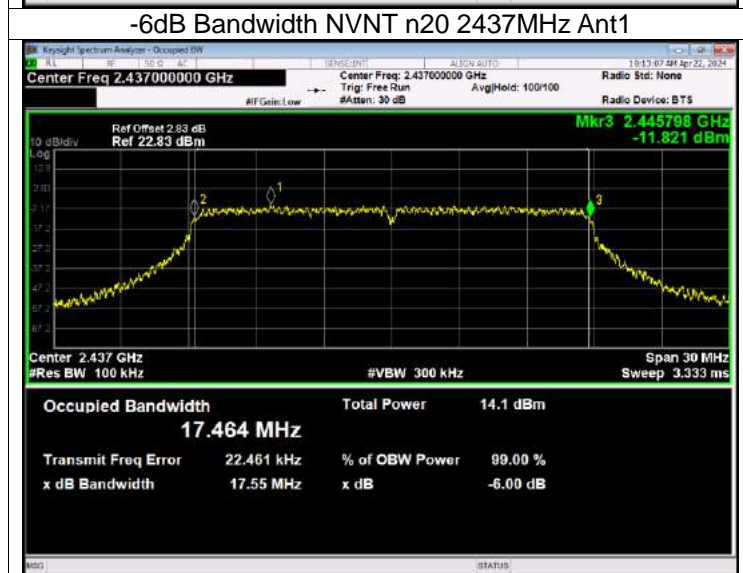
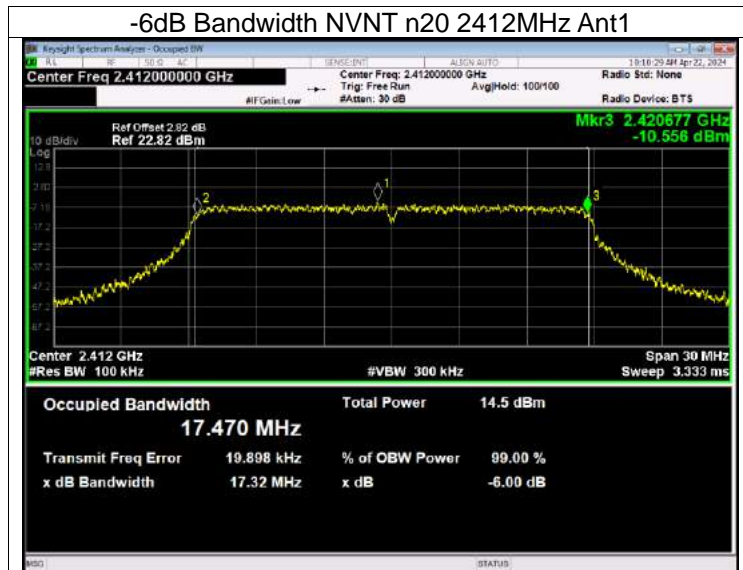
#### -6dB Bandwidth NVNT b 2462MHz Ant1













## Occupied Channel Bandwidth

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	b	2412	Ant1	13.064
NVNT	b	2437	Ant1	13.037
NVNT	b	2462	Ant1	13.035
NVNT	g	2412	Ant1	16.48
NVNT	g	2437	Ant1	16.484
NVNT	g	2462	Ant1	16.476
NVNT	n20	2412	Ant1	17.454
NVNT	n20	2437	Ant1	17.428
NVNT	n20	2462	Ant1	17.417



### Test Graphs

#### OBW NVNT b 2412MHz Ant1

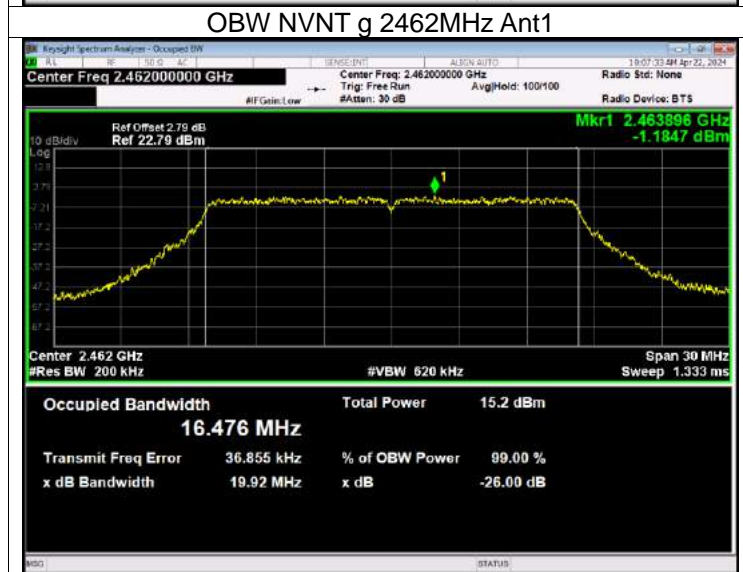
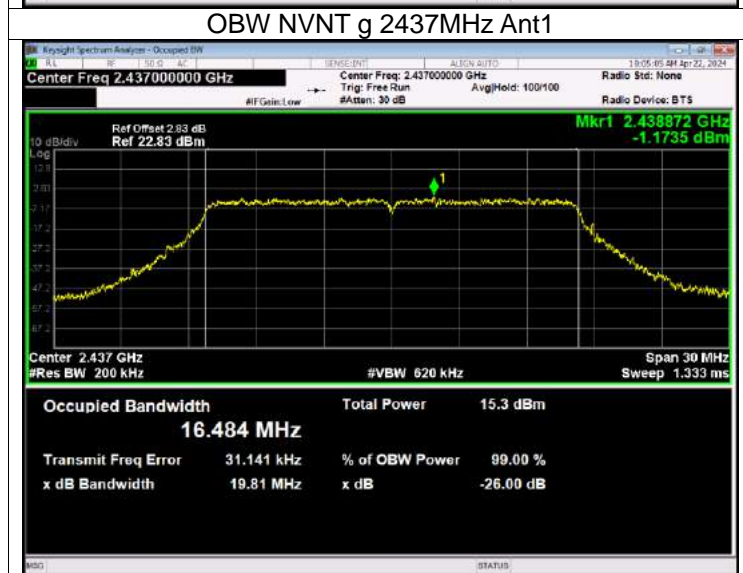
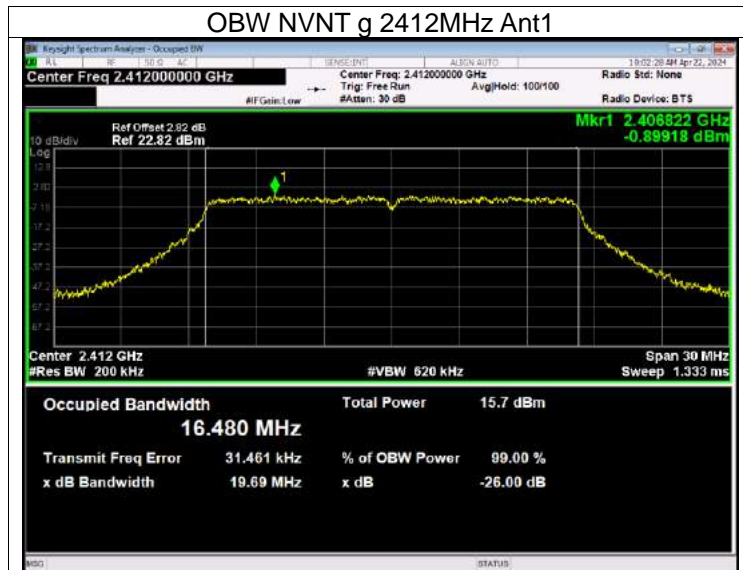


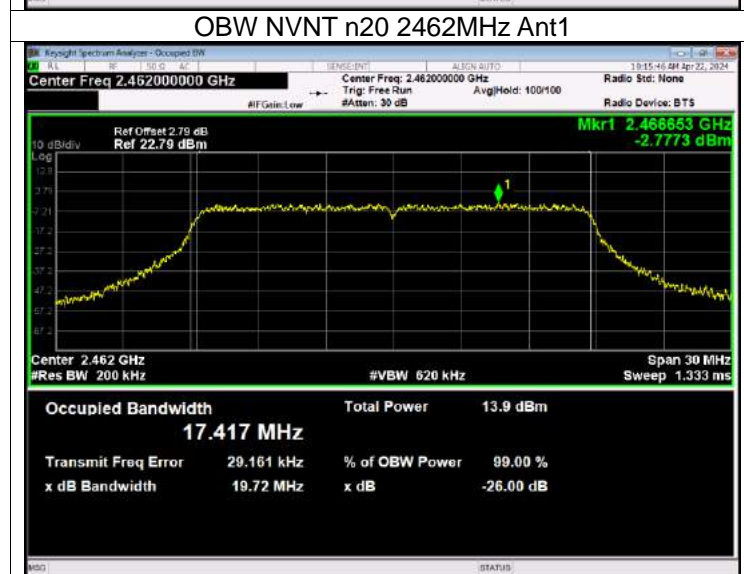
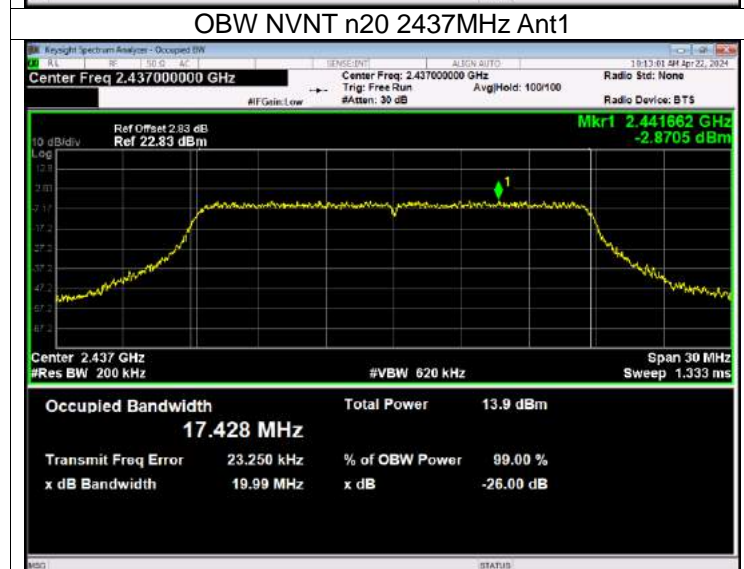
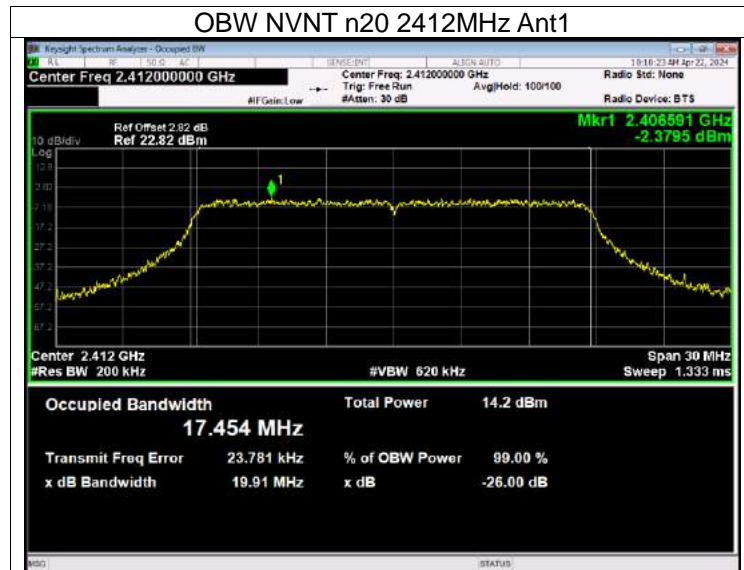
#### OBW NVNT b 2437MHz Ant1



#### OBW NVNT b 2462MHz Ant1





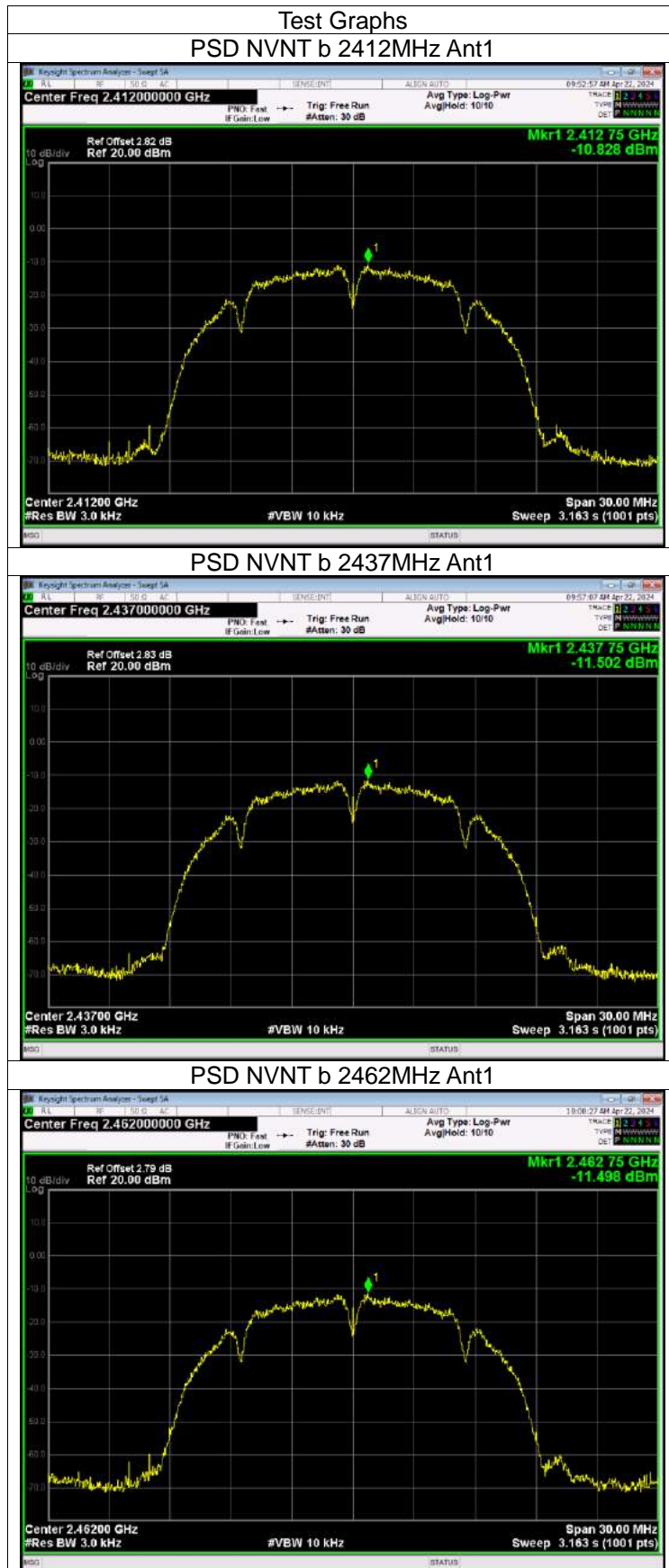


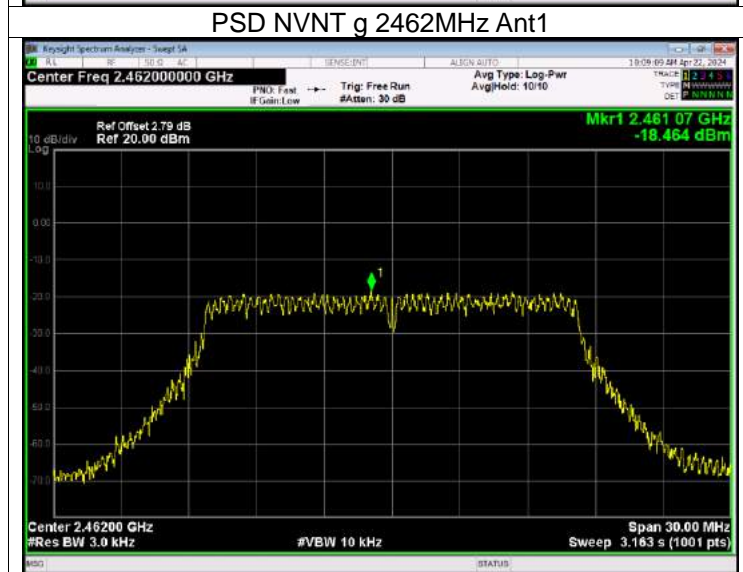
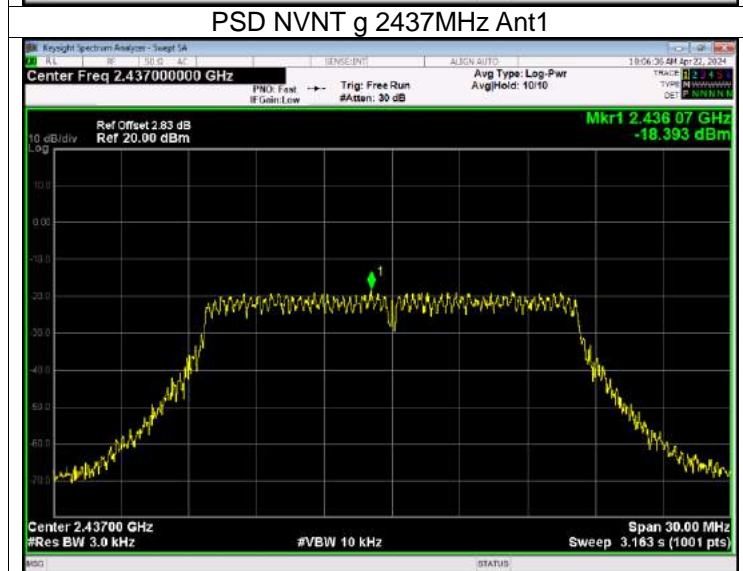
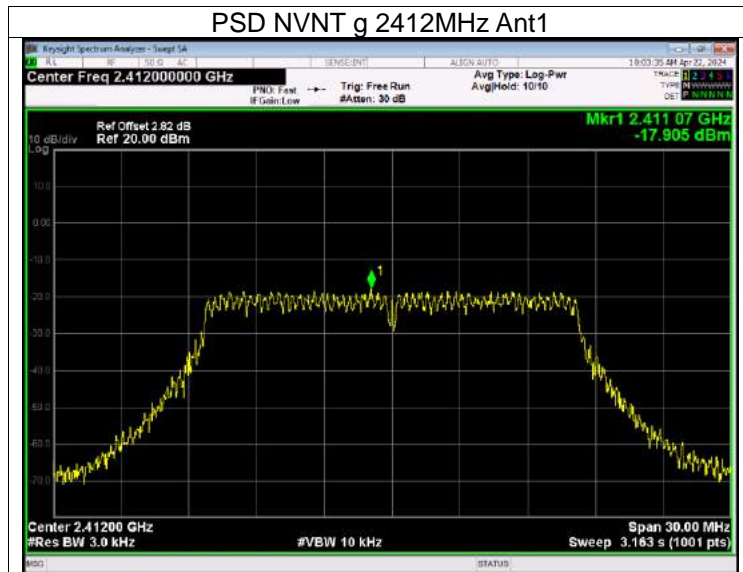


### Maximum Power Spectral Density Level

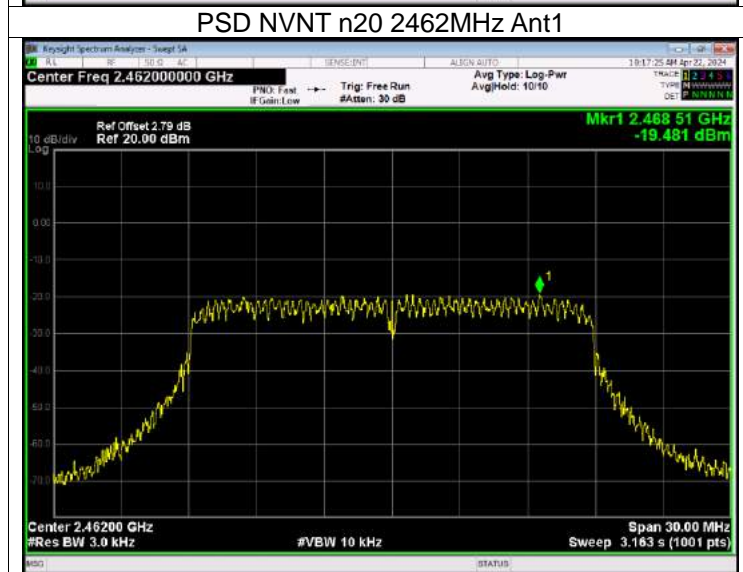
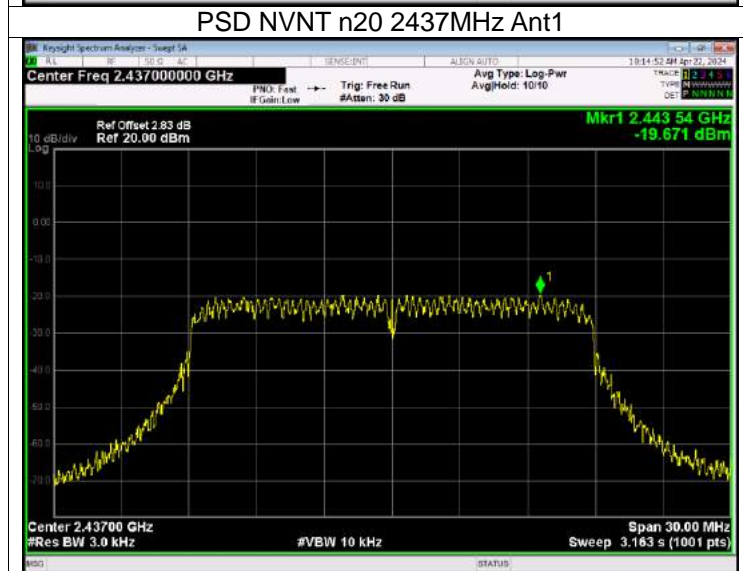
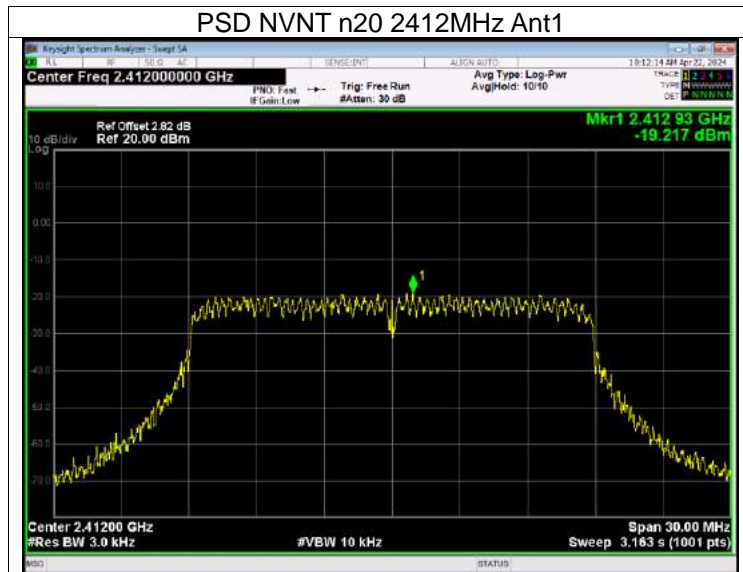
Condition	Mode	Frequency (MHz)	Antenna	Conducted PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
NVNT	b	2412	Ant1	-10.83	8	Pass
NVNT	b	2437	Ant1	-11.5	8	Pass
NVNT	b	2462	Ant1	-11.5	8	Pass
NVNT	g	2412	Ant1	-17.91	8	Pass
NVNT	g	2437	Ant1	-18.39	8	Pass
NVNT	g	2462	Ant1	-18.46	8	Pass
NVNT	n20	2412	Ant1	-19.22	8	Pass
NVNT	n20	2437	Ant1	-19.67	8	Pass
NVNT	n20	2462	Ant1	-19.48	8	Pass







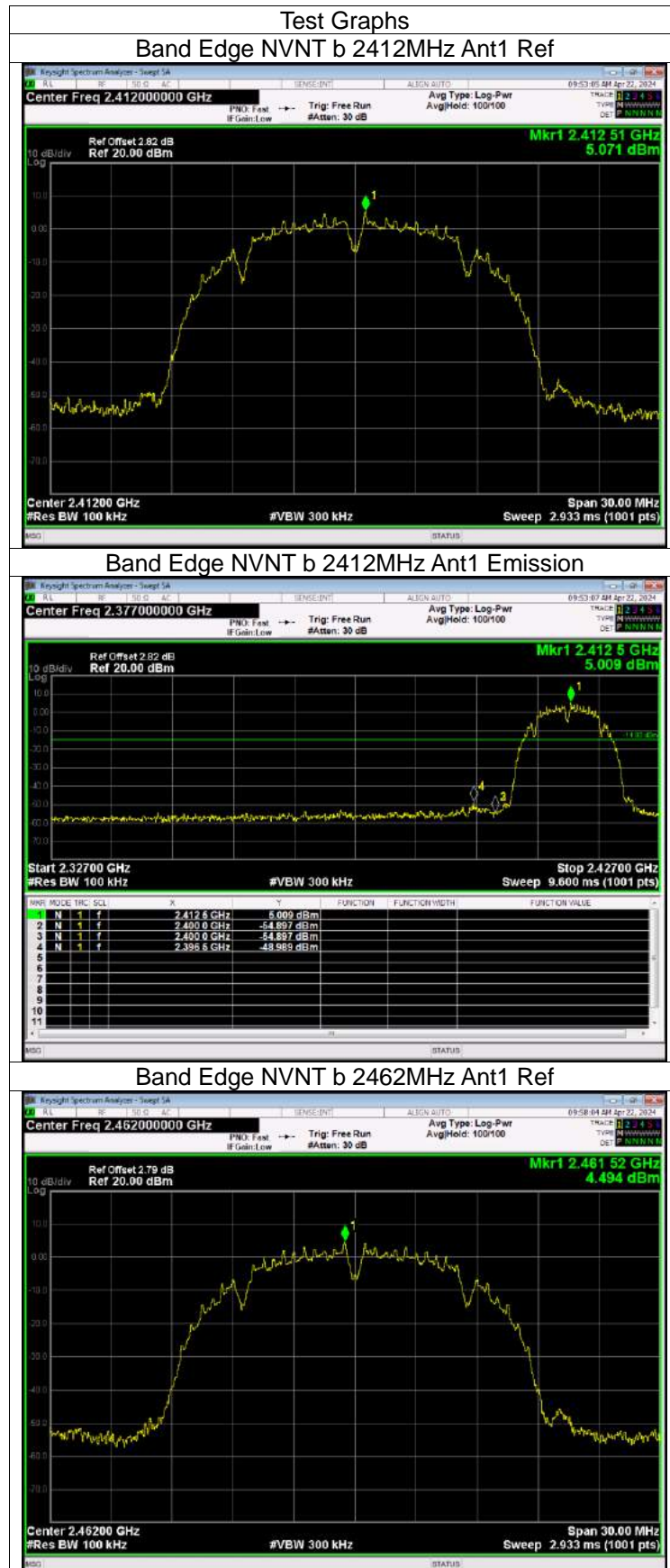


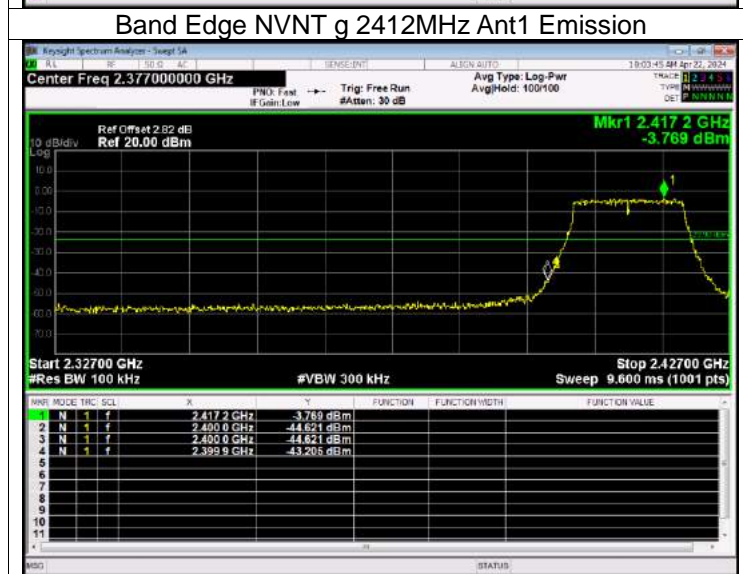
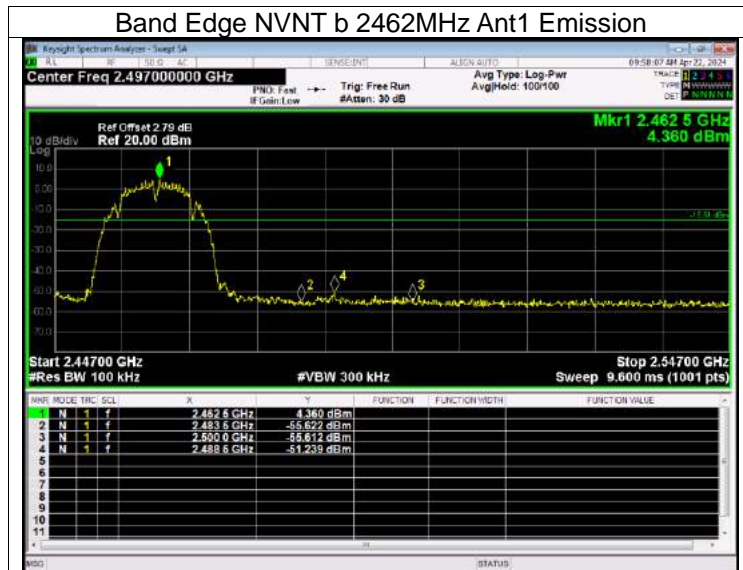


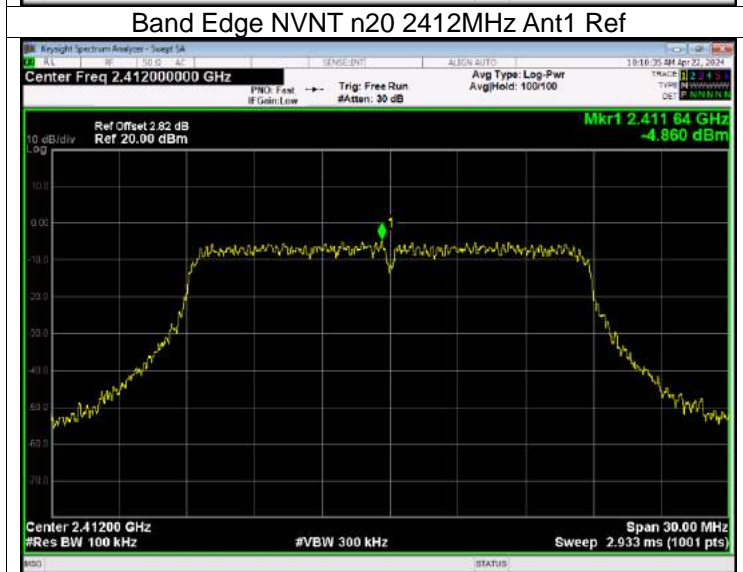
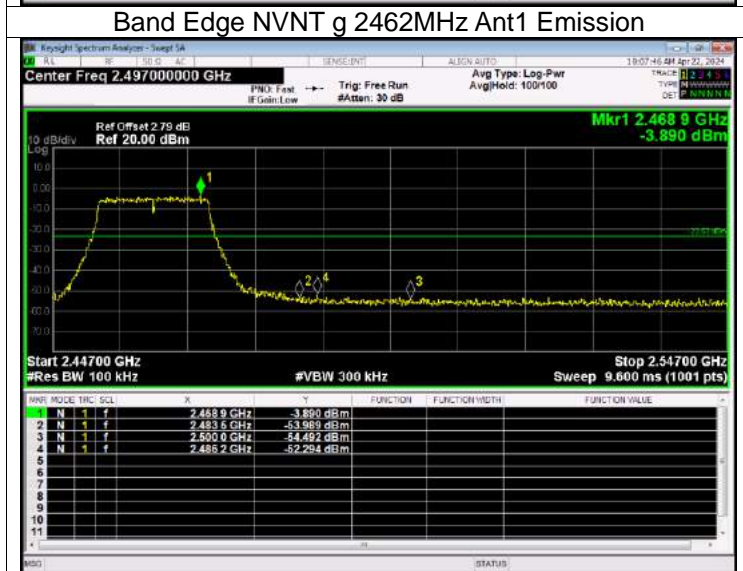
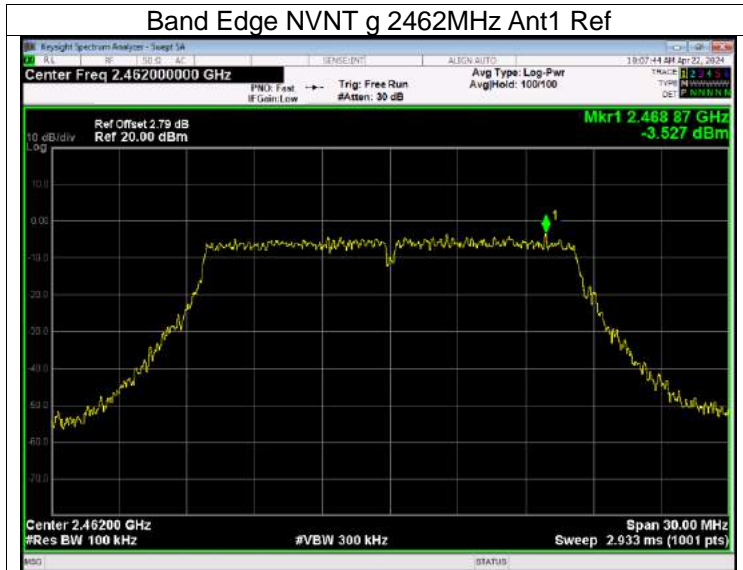


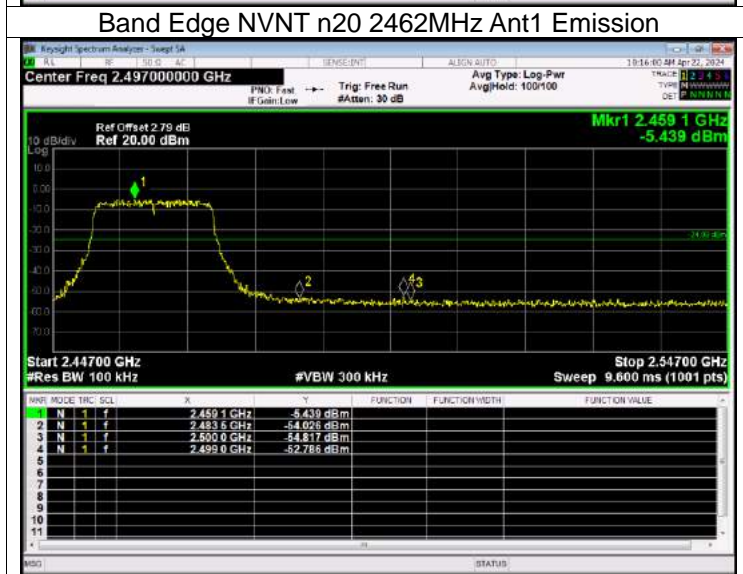
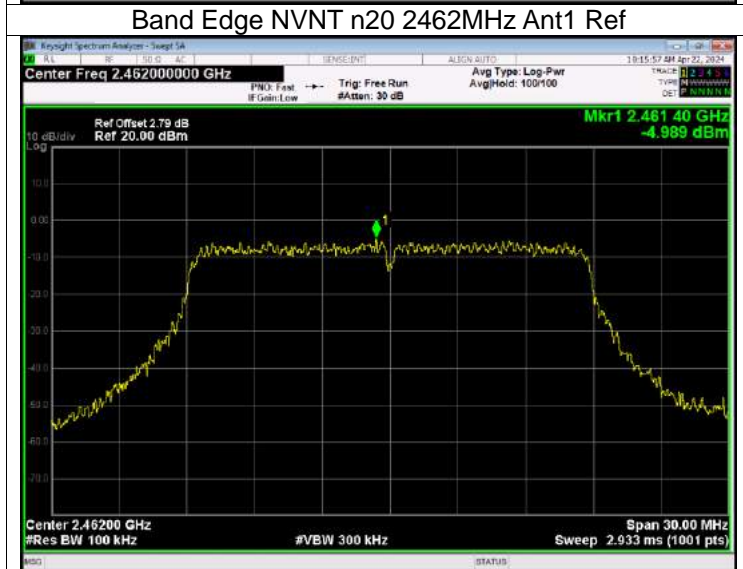
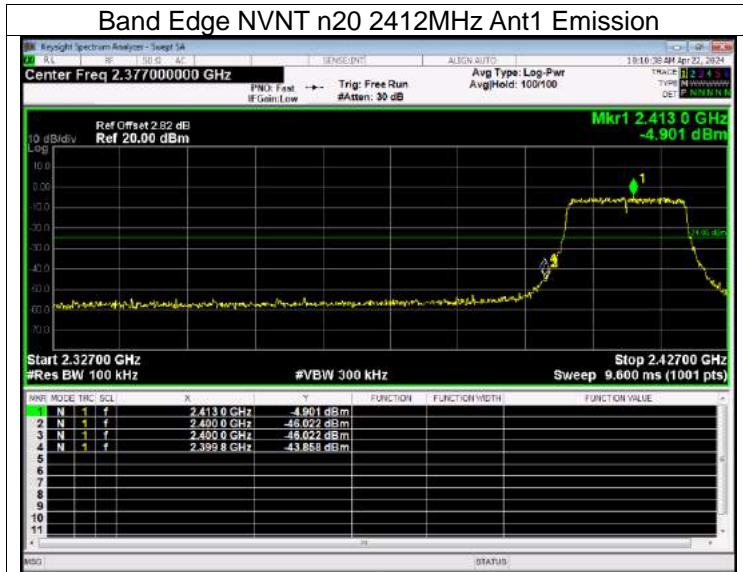
## Band Edge

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	b	2412	Ant1	-54.05	-20	Pass
NVNT	b	2462	Ant1	-55.72	-20	Pass
NVNT	g	2412	Ant1	-39.3	-20	Pass
NVNT	g	2462	Ant1	-48.76	-20	Pass
NVNT	n20	2412	Ant1	-38.99	-20	Pass
NVNT	n20	2462	Ant1	-47.79	-20	Pass







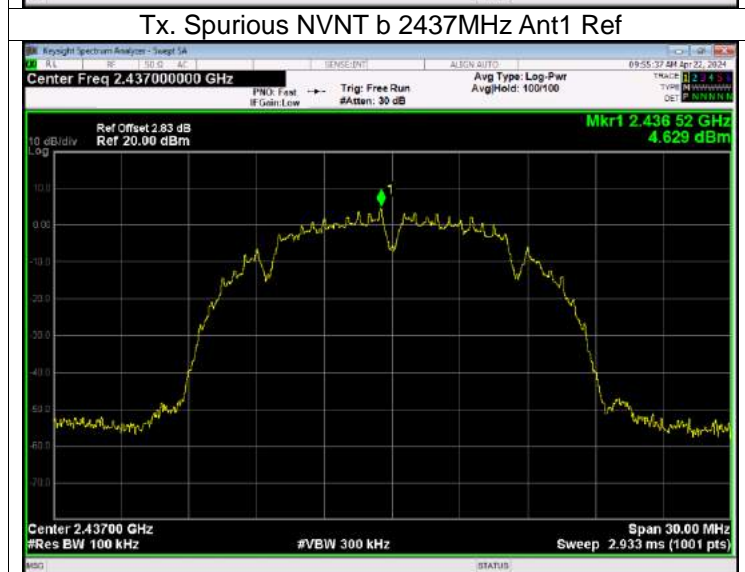
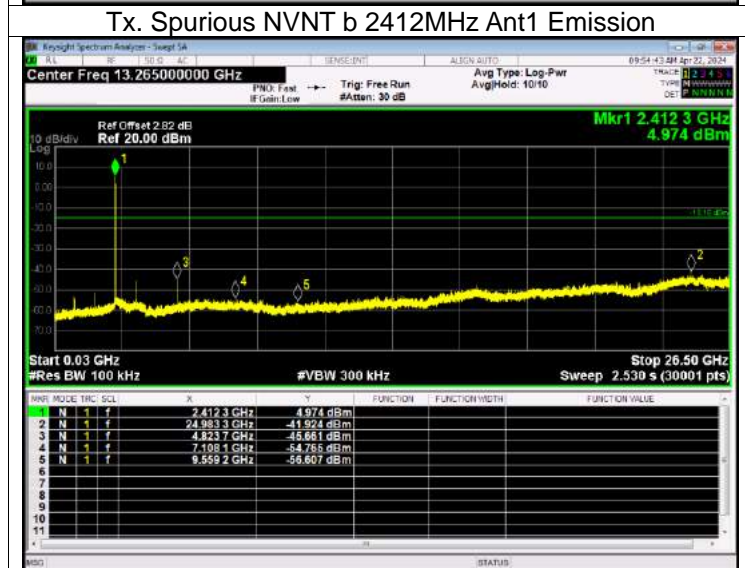
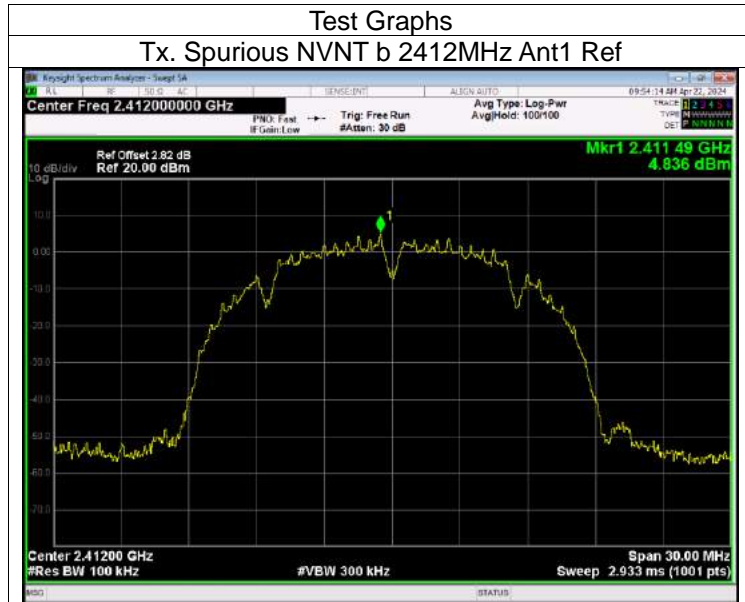




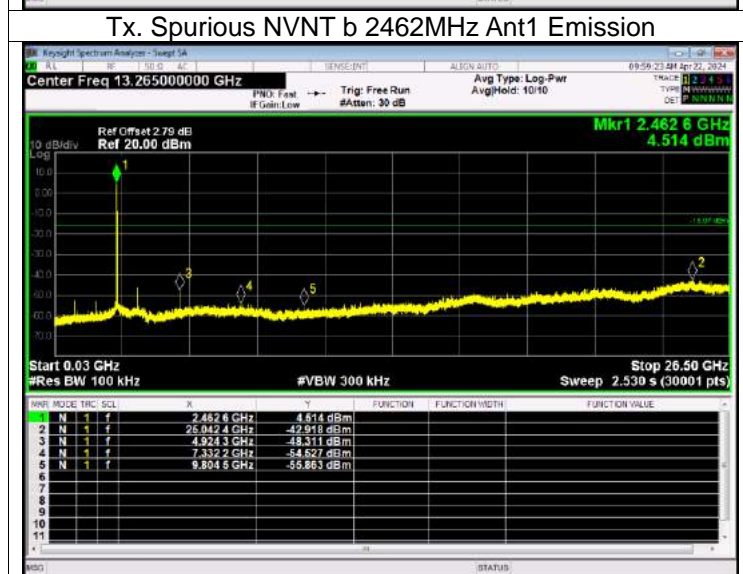
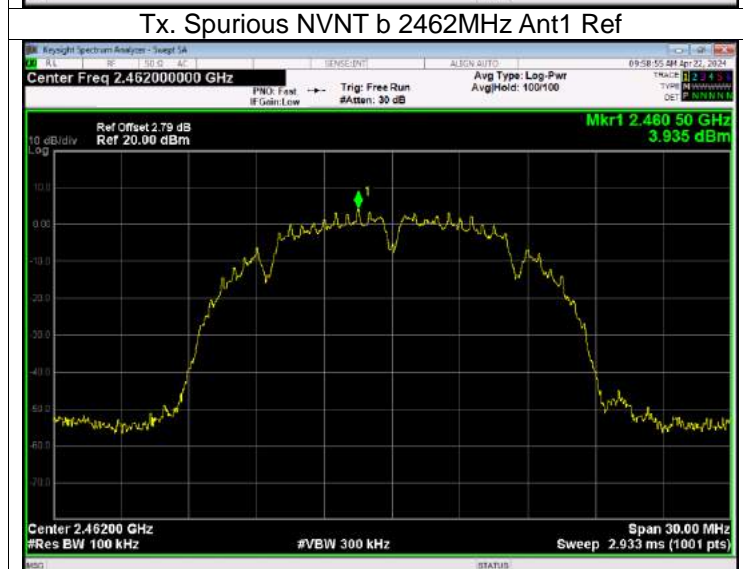
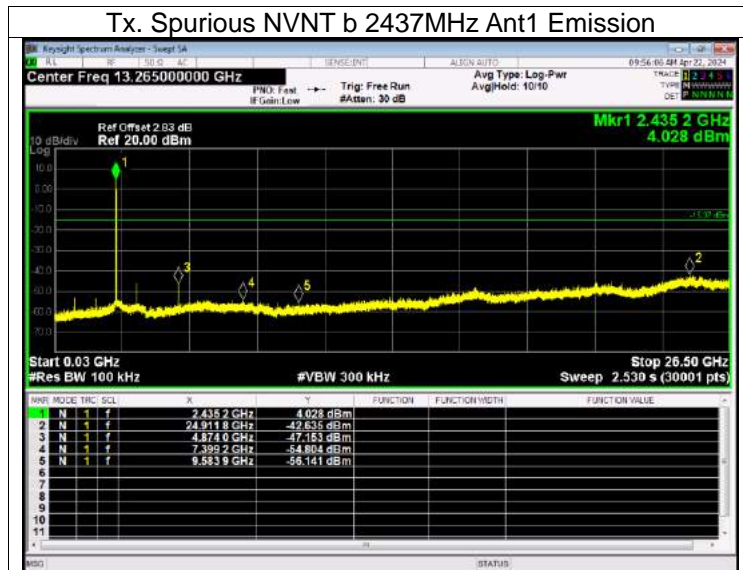
### Conducted RF Spurious Emission

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	b	2412	Ant1	-46.76	-20	Pass
NVNT	b	2437	Ant1	-47.26	-20	Pass
NVNT	b	2462	Ant1	-46.85	-20	Pass
NVNT	g	2412	Ant1	-38.66	-20	Pass
NVNT	g	2437	Ant1	-38.69	-20	Pass
NVNT	g	2462	Ant1	-39	-20	Pass
NVNT	n20	2412	Ant1	-37.5	-20	Pass
NVNT	n20	2437	Ant1	-36.64	-20	Pass
NVNT	n20	2462	Ant1	-36.4	-20	Pass



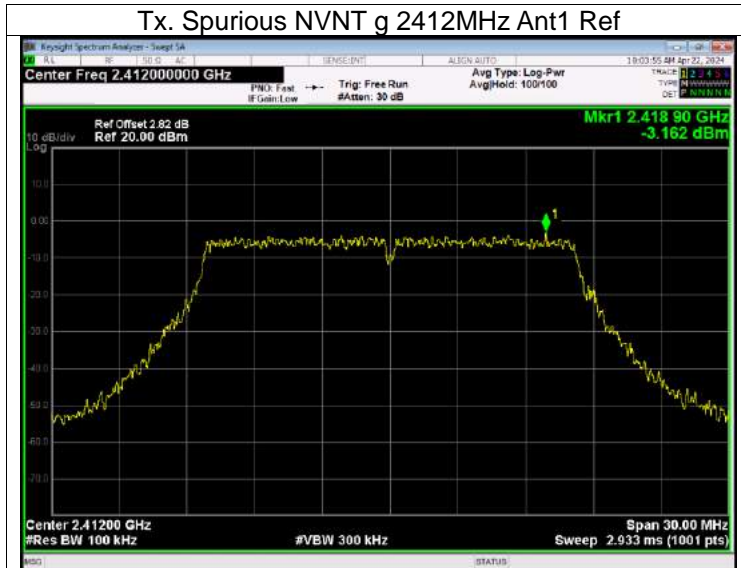




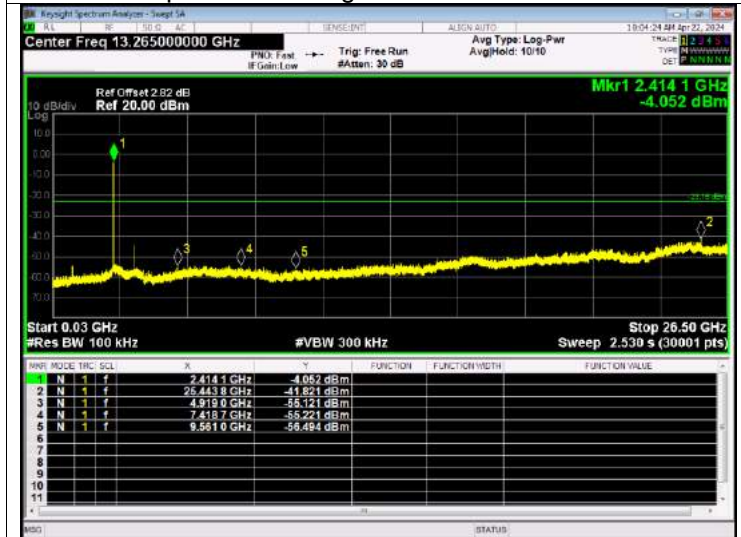




### Tx. Spurious NVNT g 2412MHz Ant1 Ref

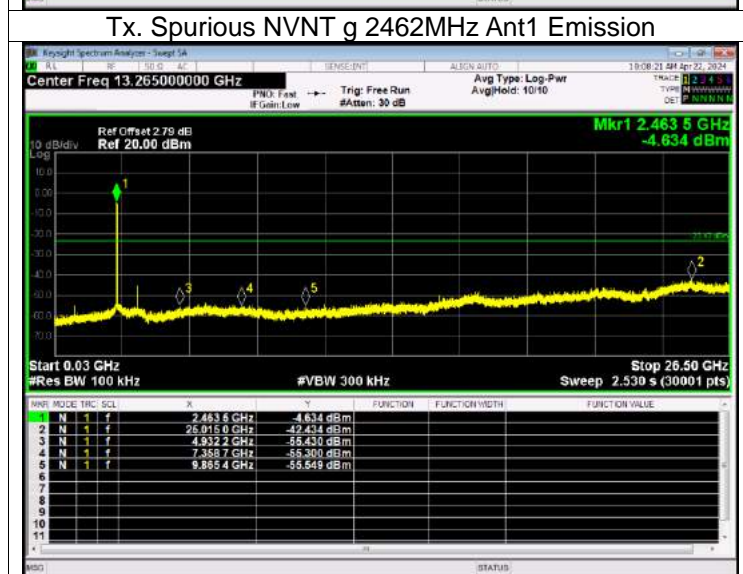
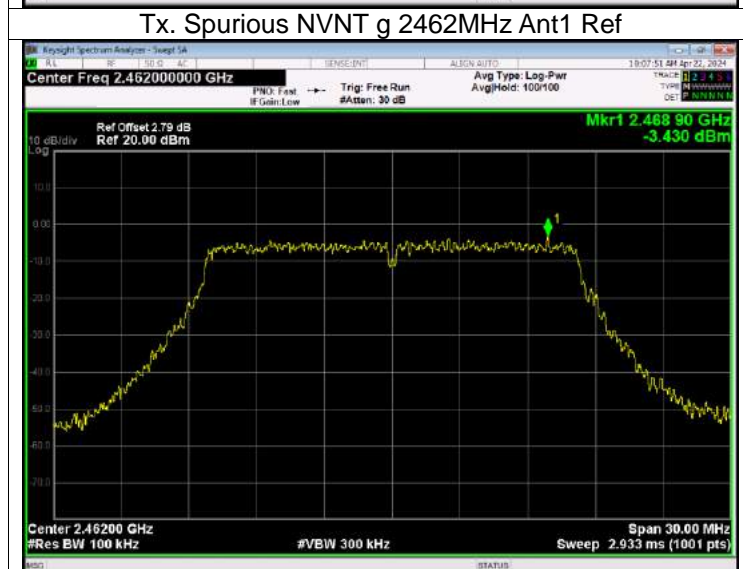
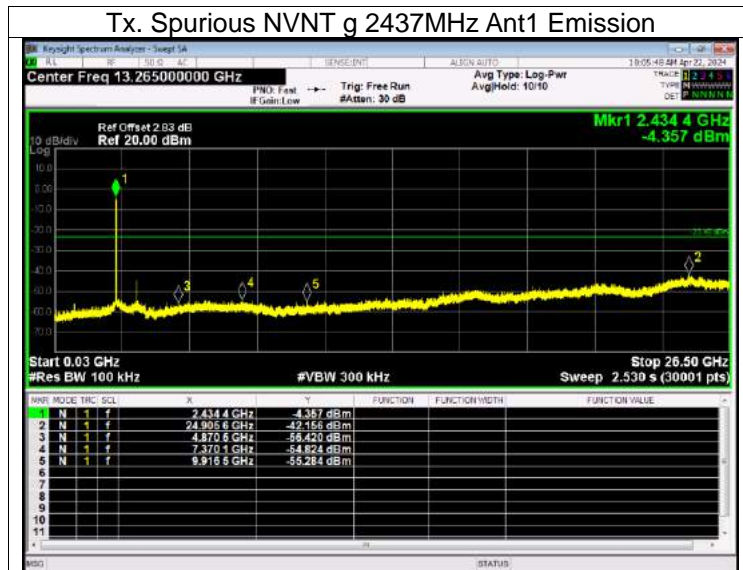


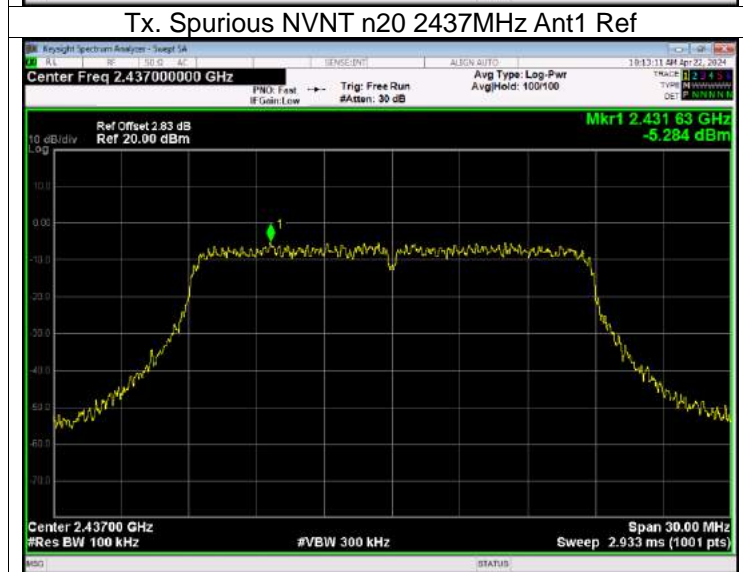
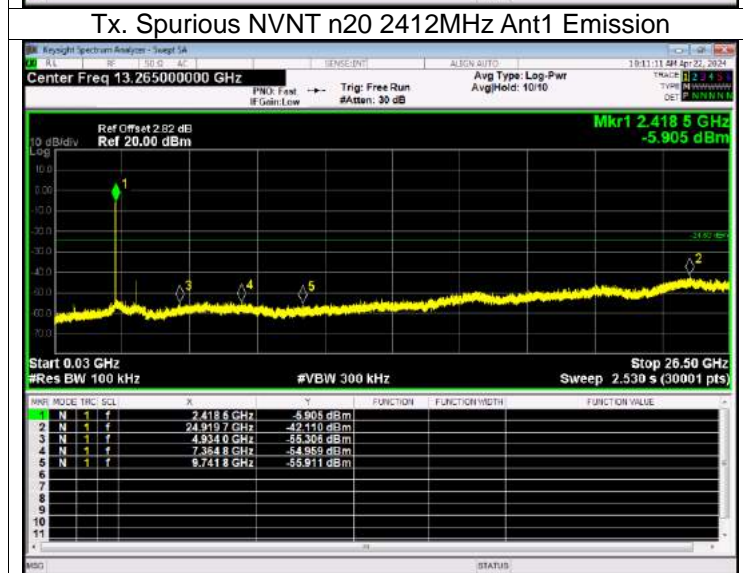
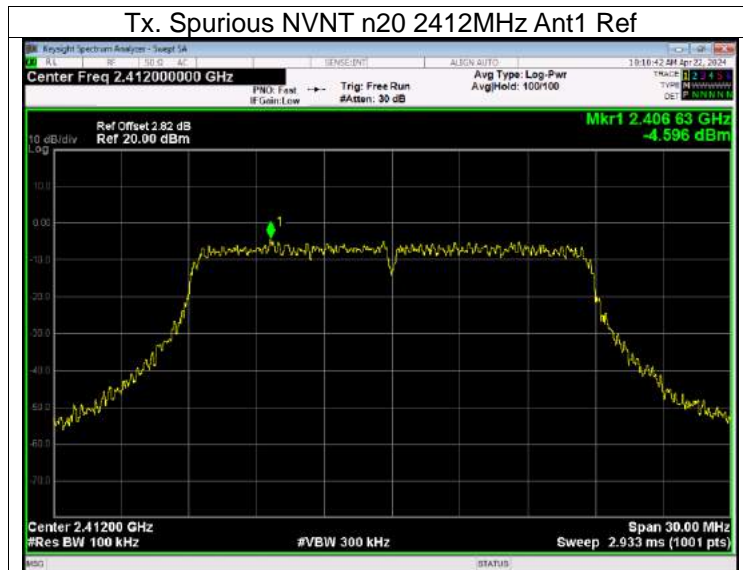
### Tx. Spurious NVNT g 2412MHz Ant1 Emission

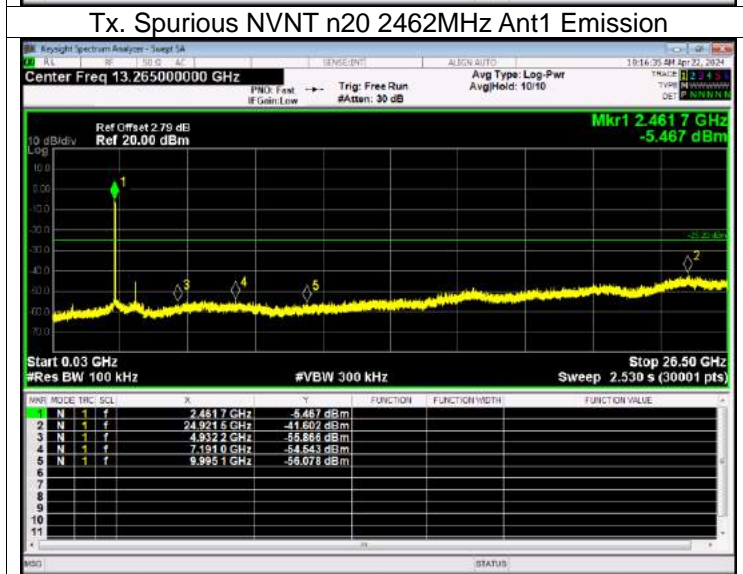
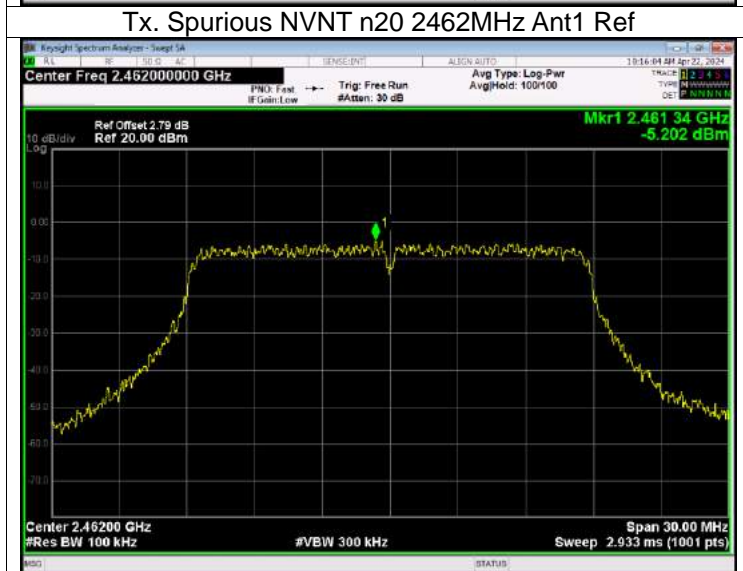
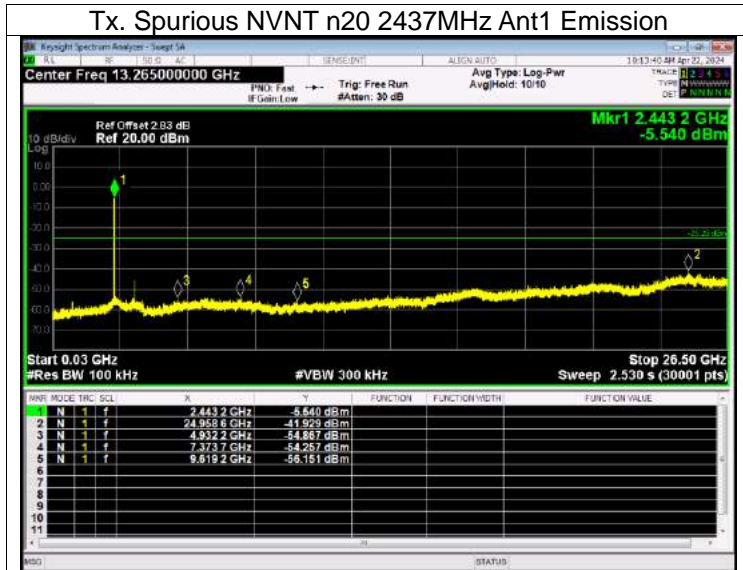


### Tx. Spurious NVNT g 2437MHz Ant1 Ref









\*\*\*\*\*END OF THE REPORT\*\*\*\*\*