

**FCC/ISED - TEST REPORT**Report Number : **709502405028-00B** Date of Issue: September 18, 2024Model : FreeScan UE Pro2Product Type : Laser 3D ScannerApplicant : SHINING 3D Tech Co., Ltd.Address : No.1398 Xiangbin Rd., Wenyan St.,Xiaoshan
District,Hangzhou,ChinaManufacturer : SHINING 3D Tech Co., Ltd.Address : No.1398 Xiangbin Rd., Wenyan St.,Xiaoshan
District,Hangzhou,ChinaTest Result : **n Positive** **o Negative**Total pages including
Appendices : 129

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1 Table of Contents

1	Table of Contents.....	2
2	Report Modification Record.....	3
3	Details about the Test Laboratory	3
4	Description of the Equipment under Test.....	4
5	Summary of Test Standards	6
6	Summary of Test Results	7
7	General Remarks.....	8
8	Test Setups	9
9	Systems test configuration	12
10	Technical Requirement	13
10.1	Conducted Emission	13
10.2	Conducted peak output power & EIRP	18
10.3	6dB bandwidth and 99% Occupied Bandwidth	45
10.4	Power spectral density	62
10.5	Spurious RF conducted emissions.....	72
10.6	Band edge	97
10.7	Spurious radiated emissions for transmitter	114
11	Test Equipment List.....	126
12	System Measurement Uncertainty	127
13	Photographs of Test Set-ups	128
14	Photographs of EUT	129



2 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
709502405028-00B	First Issue	09/18/2024

3 Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
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FCC Registration No.: 820234

FCC Designation Number: CN1183

ISED CAB identifier CN0101

IC Registration No.: 31668

4 Description of the Equipment under Test

Product: Laser 3D Scanner

PMN / HVIN / Model no.: FreeScan UE Pro2

FCC ID: 2AMG4-FSUEP2

IC: 24652-FSUEP2

Options and accessories: NA

Rating: DC24V 3.75A for Laser 3D Scanner
Input AC 100-240V~, 50/60Hz, Output DC 24V for adapter

RF Transmission Frequency: For 2.4GHz Wi-Fi:802.11b/g/n-HT20/ax(HE20):2412~2462 MHz (Full RU)
For 5GHz Wi-Fi:5180~5240 MHz (U-NII-1)
5745~5825 MHz (U-NII-3)

No. of Operated Channel: 2.4GHz WIFI:
11 for 802.11b/802.11g/802.11(H20)/ax(HE20)

Ch	Fre(MHz)	Ch	Fre(MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

5180~5240 MHz (U-NII-1):
4 channels for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax(HE20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	44	5220
40	5200	48	5240

2 channels are for 802.11n (HT40), 802.11ac (VHT40), 802.11ax(HE40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
38	5190	46	5230

1 channel is provided for 802.11ac (VHT80) and 802.11ax(HE80):

Channel	Frequency (MHz)
42	5210

5745~5825 MHz (U-NII-3): Channel 149 – 165

5 channels for 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax(HE20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	161	5805
153	5765	165	5825
157	5785		



2 channels for 802.11n (HT40), 802.11ac (VHT40), 802.11ax(HE40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
151	5755	159	5795

1 channel is provided for 802.11ac (VHT80) and 802.11ax(HE80):

Channel	Frequency (MHz)
155	5755

Modulation: Direct Sequence Spread Spectrum (DSSS) for 802.11b
Orthogonal Frequency Division Multiplexing (OFDM) for
802.11a/g/n/ac; Orthogonal Frequency Division Multiple Access
(OFDMA) for 802.11ax

Hardware Version: 1.0

Software Version: 2.1.0.4

Data speed: 2.4G Wi-Fi
SISO:11b 1-11Mbps, 11g 6-54Mbps
MIMO:11n HT20 13~144.4Mbps, 11ax HE20 17.2 ~ 286.8Mbps

5G Wi-Fi
SISO: 11a 6 ~ 54Mbps,
11n HT20 6.5 ~ 72.2Mbps, 11n HT 40 13.5 ~ 150Mbps,
11ac VHT20 6.5 ~ 86.7Mbps, 11ac VHT40 13.5 ~ 200Mbps,
11ac VHT80 29.3 ~ 433.3Mbps
11ax HE20 8.6 ~ 143.4Mbps,
11ax HE40 17.2 ~ 286.8Mbps,
11ax HE80 36 ~ 600.5Mbps

MIMO: 11n HT20 13 ~ 144.4Mbps, 11n HT 40 27 ~ 300Mbps,
11ac VHT20 13 ~ 173.3Mbps, 11ac VHT40 27 ~ 400Mbps,
11ac VHT80 58.5 ~ 866.7Mbps
11ax HE20 17.2 ~ 286.8Mbps,
11ax HE40 34.4 ~ 573.5Mbps,
11ac HE80 72.1 ~ 1201Mbps

Antenna Type: PCB Antenna 1 and PCB Antenna 2

Antenna Gain: Antenna 1: 2.17dBi, Antenna 2: 2.17dBi

Directional Gain: $GAN + 10 \log(N_{Ant}) \text{ dBi} = 2.17 + 3.01 = 5.18 \text{ dBi}$

Description of the EUT: The Equipment Under Test (EUT) is a Laser 3D Scanner with 2.4GHz and 5GHz Wi-Fi. This report is only 2.4GHz Wi-Fi included.

Test sample no.: SHA-828049-1(RF Radiated);
SHA-828049-1(RF conducted)

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment, antenna gain or any information supplied.



5 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2023 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 5 April 2018 + Amendment 1 March 2019 + Amendment 2 February 2021	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 3 August 2023	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE- LAN) Devices

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 Measurement Guidance and ANSI C63.10-2020.



6 Summary of Test Results

Technical Requirements							
FCC Part 15 Subpart C & RSS-247 Issue 3/RSS-Gen Issue 5							
Test Condition			Pages	Test Site	Test Result		
					Pass	Fail	N/A
§15.207	RSS-GEN 8.8	Conducted emission AC power port	13~17	Site 1	☒	☐	☐
§15.247 (b) (3)	RSS-247 5.4(d)	Conducted peak output power & e.i.r.p	18~44	Site 1	☒	☐	☐
§15.247(a)(1)	RSS-247 5.1(a) & RSS-Gen 6.7	20dB bandwidth and 99% Occupied Bandwidth	---	---	☐	☐	☒
§15.247(a)(1)	RSS-247 5.1(b)	Carrier frequency separation	---	---	☐	☐	☒
§15.247(a)(1)(iii)	RSS-247 5.1(d)	Number of hopping frequencies	---	---	☐	☐	☒
§15.247(a)(1)(iii)	RSS-247 5.1(d)	Dwell Time - Average Time of Occupancy	---	---	☐	☐	☒
§15.247(a)(2)	RSS-247 5.2(a) & RSS-Gen 6.7	6dB bandwidth and 99% Occupied Bandwidth	45~61	Site 1	☒	☐	☐
§15.247(e)	RSS-247 5.2(b)	Power spectral density	62~71	Site 1	☒	☐	☐
§15.247(e)	RSS-247 5.5	Spurious RF conducted emissions	72~96	Site 1	☒	☐	☐
§15.247(d)	RSS-247 5.5	Band edge	97~113	Site 1	☒	☐	☐
§15.247(d) & §15.209 & §15.205	RSS-247 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	114~125	Site 1	☒	☐	☐
§15.203	RSS-Gen 6.8	Antenna requirement	See note 1		☒	☐	☐

Remark 1: N/A – Not Applicable.

Note 1: The EUT uses two PCB antenna, which gain is Antenna1: 2.17 dBi, Antenna2: 2.17 dBi.

In accordance to §15.203 and RSS-Gen 6.8, It is considered sufficiently to comply with the provisions of this section.



7 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2AMG4-FSUEP2, IC: 24652-FSUEP2 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules and RSS-247, RSS-GEN.

SUMMARY:

All tests according to the regulations cited on page 5 were

n - Performed

o - **Not** Performed

The Equipment under Test

n - **Fulfills** the general approval requirements.

o - **Does not** fulfill the general approval requirements.

Sample Received Date: July 1, 2024

Testing Start Date: July 2, 2024

Testing End Date: September 12, 2024

-TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:

Prepared by:

Tested by:



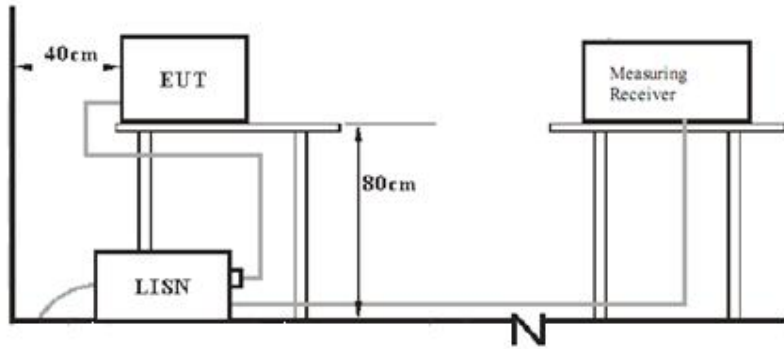
Hui TONG
Review Engineer

Jiayi XU
Project Engineer

Chengjie GUO
Test Engineer

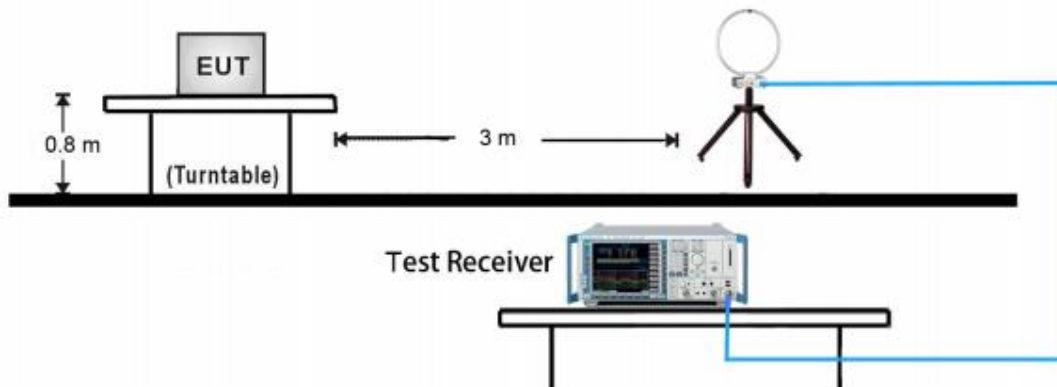
8 Test Setups

7.1 AC Power Line Conducted Emission test setups

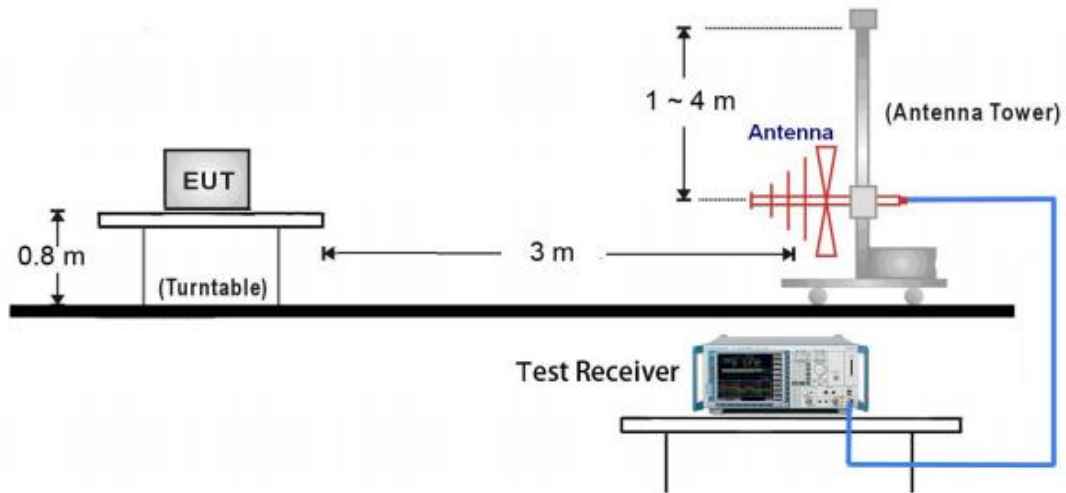


7.2 Radiated test setups

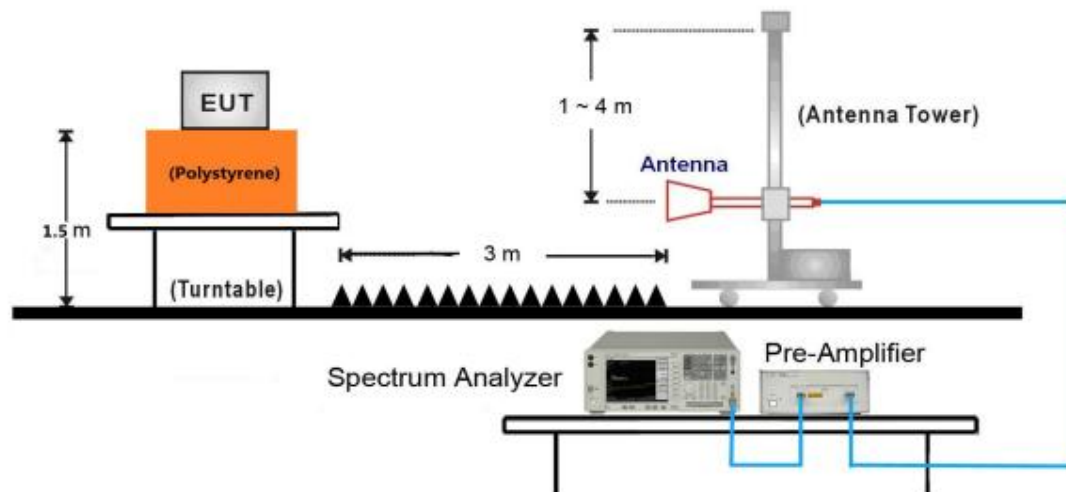
9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:

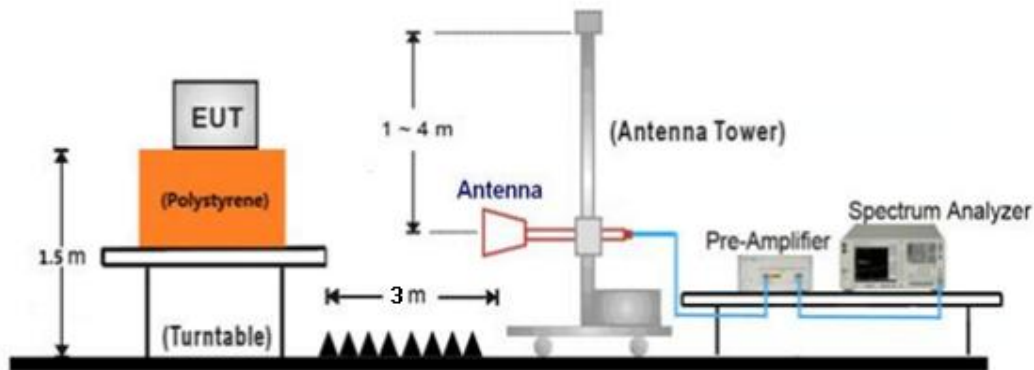


1GHz ~ 18GHz Test Setup:



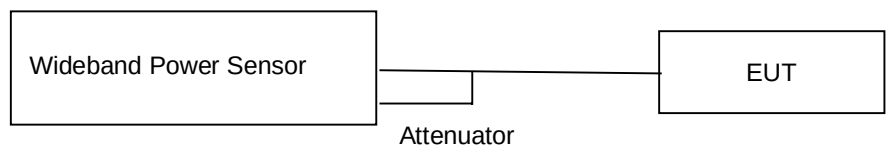


18GHz ~ 40GHz Test Setup:



7.3 Conducted RF test setups

For Conducted peak output power



For other test items



9 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Laptop	MSI	Crosshair 15 R6E B12UEZ	---

Test software: adb command, which used to control the EUT in continues transmitting mode.

The system was configured to channel 1(2412MHz), 6(2437MHz), and 11(2462MHz) for the test.

Test Mode Applicability and Tested Channel Detail for nominal bandwidths

Mode	Tested Channel	Data Rate (Mbps)	Modulation	Index Value (Power level setting)	Test Mode
802.11b	1	1	CCK	14	SISO
	6	1	CCK	14	SISO
	11	1	CCK	14	SISO
802.11g	1	6	OFDM	14	SISO
	6	6	OFDM	14	SISO
	11	6	OFDM	14	SISO
802.11n HT20	1	MCS0	OFDM	14	SISO, MIMO
	6	MCS0	OFDM	14	SISO, MIMO
	11	MCS0	OFDM	14	SISO, MIMO
802.11ax HE20 (Full RU)	1	MCS0	OFDMA	13	SISO, MIMO
	6	MCS0	OFDMA	13	SISO, MIMO
	11	MCS0	OFDMA	13	SISO, MIMO

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

10 Technical Requirement

10.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

According to §15.207 & RSS-GEN 8.8, conducted emissions limit as below:

Frequency MHz	QP Limit dB μ V	AV Limit dB μ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

Conducted Emission

150k-30MHz Conducted Emission Test

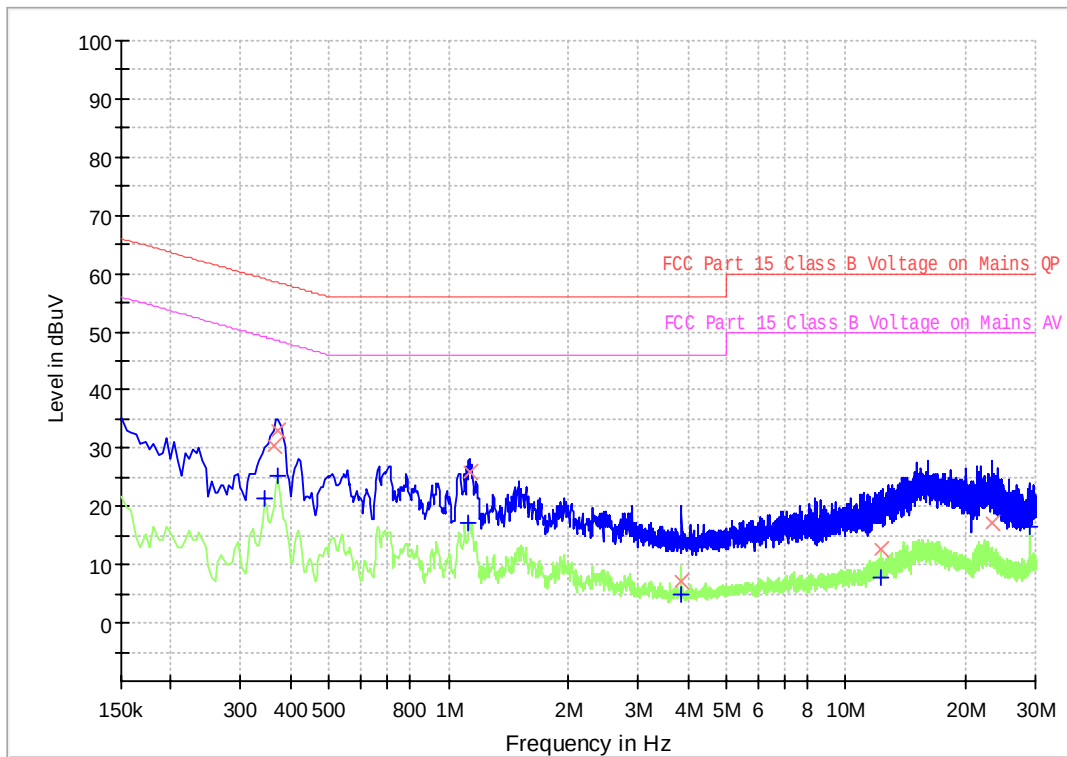
EUT Information

EUT Name:	Laser 3D Scanner
Model	FreeScan UE Pro2
Client:	Shining 3D Tech Co.,Ltd
Op Cond	TX at 802.11 ax20 MIMO_2412MHz, AC 120V,60Hz.
Operator:	Chengjie GUO
Standard	FCC part 15.207(a)
Sample No.:	SHA-828049-2

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup:	Voltage with 2-Line-LISN
Receiver:	[ESR 3]
Level Unit:	dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamplifier
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.02 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB





Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.343500	---	21.39	49.12	27.73	1000.0	9.000	L1	19.5
0.361500	30.30	---	58.69	28.39	1000.0	9.000	L1	19.5
0.370500	---	25.28	48.49	23.21	1000.0	9.000	L1	19.5
0.370500	33.19	---	58.49	25.30	1000.0	9.000	L1	19.5
1.122000	---	17.31	46.00	28.69	1000.0	9.000	L1	19.5
1.126500	25.78	---	56.00	30.22	1000.0	9.000	L1	19.5
3.862500	7.19	---	56.00	48.81	1000.0	9.000	L1	19.6
3.862500	---	4.89	46.00	41.11	1000.0	9.000	L1	19.6
12.250500	12.72	---	60.00	47.28	1000.0	9.000	L1	19.9
12.286500	---	7.75	50.00	42.25	1000.0	9.000	L1	19.9
23.320500	17.32	---	60.00	42.68	1000.0	9.000	L1	20.8
28.977000	---	16.38	50.00	33.62	1000.0	9.000	L1	21.2

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
 Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator



150k-30MHz Conducted Emission Test

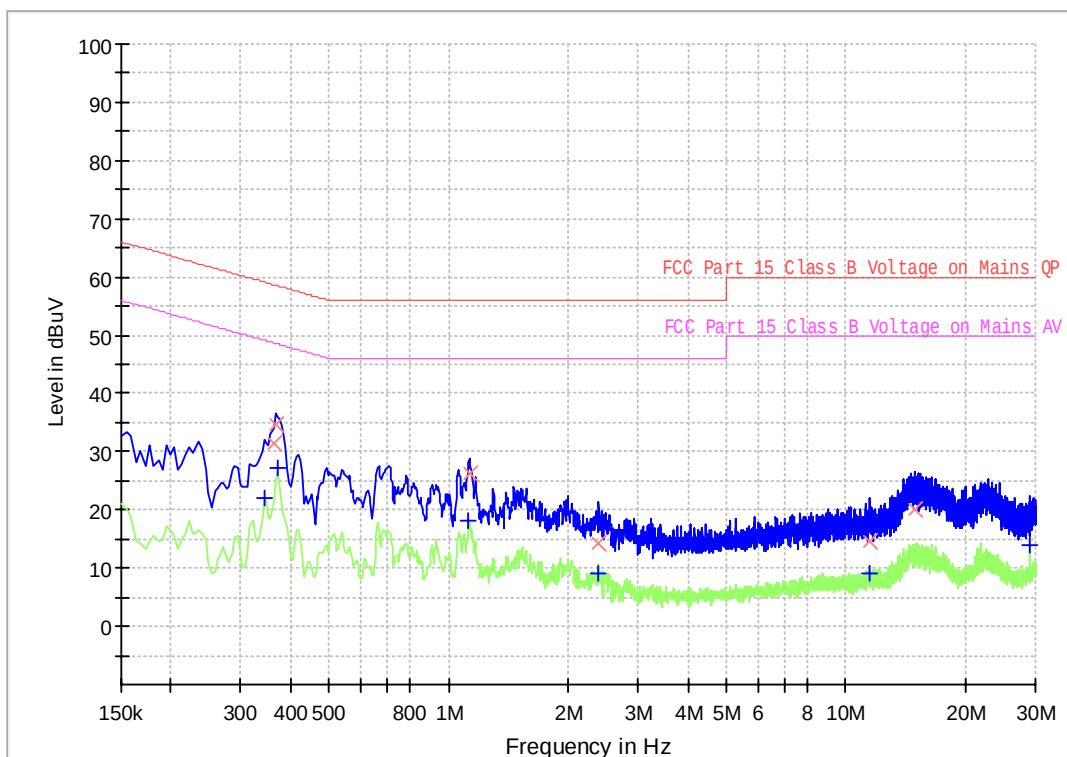
EUT Information

EUT Name: Laser 3D Scanner
 Model: FreeScan UE Pro2
 Client: Shining 3D Tech Co.,Ltd
 Op Cond: TX at 802.11 ax20 MIMO_2412MHz, AC 120V,60Hz.
 Operator: Chengjie GUO
 Standard: FCC part 15.207(a)
 Sample No.: SHA-828049-2

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup: Voltage with 2-Line-LISN
 Receiver: [ESR 3]
 Level Unit: dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.02 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB





Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.343500	---	22.12	49.12	27.00	1000.0	9.000	N	19.5
0.361500	31.38	---	58.69	27.31	1000.0	9.000	N	19.5
0.366000	34.79	---	58.59	23.80	1000.0	9.000	N	19.5
0.370500	---	27.07	48.49	21.42	1000.0	9.000	N	19.5
1.122000	---	18.30	46.00	27.70	1000.0	9.000	N	19.5
1.126500	26.30	---	56.00	29.70	1000.0	9.000	N	19.5
2.391000	14.11	---	56.00	41.89	1000.0	9.000	N	19.5
2.391000	---	9.14	46.00	36.86	1000.0	9.000	N	19.5
11.485500	14.74	---	60.00	45.26	1000.0	9.000	N	19.8
11.485500	---	9.14	50.00	40.86	1000.0	9.000	N	19.8
14.878500	19.97	---	60.00	40.03	1000.0	9.000	N	19.9
28.990500	---	13.81	50.00	36.19	1000.0	9.000	N	20.7

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

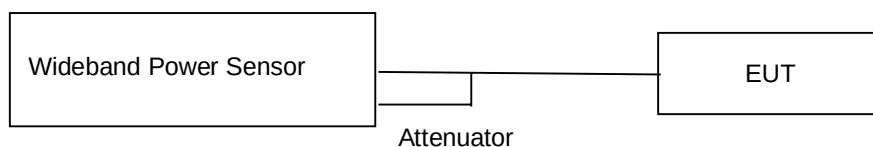
10.2 Conducted peak output power & EIRP

Test Method (1)

1. Measure the duty cycle D of the transmitter output signal.
2. Set span to at least 1.5 times the OBW.
3. Set RBW = 1% to 5% of the OBW, not to exceed 1 MHz.
4. Set VBW $\geq [3 \times \text{RBW}]$.
5. Number of points in sweep $\geq [2 \times \text{span} / \text{RBW}]$. (This gives bin-to-bin spacing $\leq \text{RBW} / 2$, so that narrowband signals are not lost between frequency bins.)
6. Sweep time = auto.
7. Detector = RMS (i.e., power averaging), if available. Otherwise, use the sample detector mode.
8. Do not use sweep triggering. Allow the sweep to “free run.”
9. Trace average at least 100 traces in power averaging (rms) mode; however, the number of traces to be averaged shall be increased above 100 as needed such that the average accurately represents the true average over the ON and OFF periods of the transmitter.
10. Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
11. Add $[10 \log (1 / D)]$, where D is the duty cycle, to the measured power to compute the average power during the actual transmission times (because the measurement represents an average over both the ON and OFF times of the transmission).

Test Method (2)

- 1) The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
- 2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
- 3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
- 4) Measure the peak power of the transmitter. This measurement is a peak over both the ON and OFF periods of the transmitter.



Wideband Power Sensor conducted test setup

Limits

According to §15.247 (b) (3) & RSS-247 5.4(d), conducted peak (average) output power limit as below:

	Frequency Range	Limit	Limit
	MHz	W	dBm
Conducted peak output power	2400-2483.5	≤ 1	≤ 30
e.i.r.p.	2400-2483.5	≤ 4	≤ 36



Test result (average power) as below table

802.11B (SISO)

Frequency MHz	Antenna 1			Antenna 2			Sum Power(average)	Limit	Result
	Conducted Power	Duty Factor	Total Power	Conducted Power	Duty Factor	Total Power			
	dBm	dB	dBm	dBm	dB	dBm			
2412MHz	12.51	0.46	12.97	11.67	0.45	12.12	--	≤30	Pass
2437MHz	12.75	0.46	13.21	11.58	0.46	12.04	--	≤30	Pass
2462MHz	12.65	0.46	13.11	11.41	0.46	11.87	--	≤30	Pass

802.11G (SISO)

Frequency MHz	Antenna 1			Antenna 2			Sum Power(average)	Limit	Result
	Conducted Power	Duty Factor	Total Power	Conducted Power	Duty Factor	Total Power			
	dBm	dB	dBm	dBm	dB	dBm			
2412MHz	11.36	1.91	13.27	10.28	1.95	12.23	--	≤30	Pass
2437MHz	10.53	1.91	12.44	10.08	1.95	12.03	--	≤30	Pass
2462MHz	10.29	1.92	12.21	9.89	1.91	11.8	--	≤30	Pass

802.11N20 (SISO)

Frequency MHz	Antenna 1			Antenna 2			Sum Power(average)	Limit	Result
	Conducted Power	Duty Factor	Total Power	Conducted Power	Duty Factor	Total Power			
	dBm	dB	dBm	dBm	dB	dBm			
2412MHz	10.64	2.01	12.65	10.14	2.01	12.15	--	≤30	Pass
2437MHz	10.39	2.07	12.46	10.09	2.01	12.10	--	≤30	Pass
2462MHz	10.35	2.01	12.36	9.55	2.07	11.62	--	≤30	Pass

802.11N20 (MIMO)

Frequency MHz	Antenna 1			Antenna 2			Sum Power(average)	Limit	Result
	Conducted Power	Duty Factor	Total Power	Conducted Power	Duty Factor	Total Power			
	dBm	dB	dBm	dBm	dB	dBm			
2412MHz	12.61	0	12.61	12.58	0	12.58	15.61	≤30	Pass
2437MHz	13.43	0	13.43	13.12	0	13.12	16.29	≤30	Pass
2462MHz	13.90	0	13.90	13.49	0	13.49	16.71	≤30	Pass

802.11ax(HE20) (SISO)

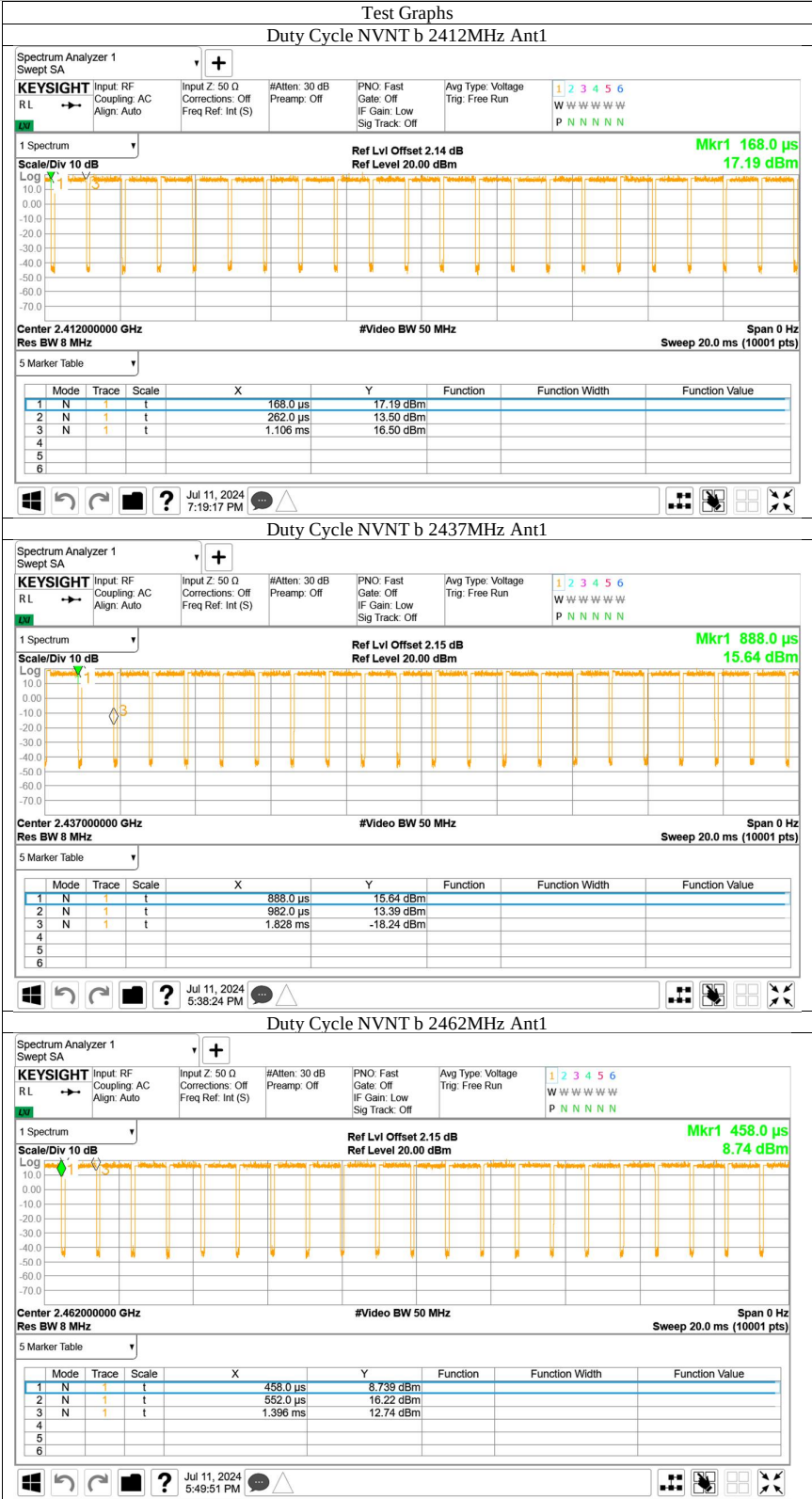
Frequency MHz	Antenna 1			Antenna 2			Sum Power(average)	Limit	Result
	Conducted Power	Duty Factor	Total Power	Conducted Power	Duty Factor	Total Power			
	dBm	dB	dBm	dBm	dB	dBm			
2412MHz	11.05	2.33	13.38	10.25	2.33	12.58	--	≤30	Pass
2437MHz	10.65	2.33	12.98	10.38	2.33	12.71	--	≤30	Pass
2462MHz	10.8	2.33	13.13	10.11	2.33	12.44	--	≤30	Pass

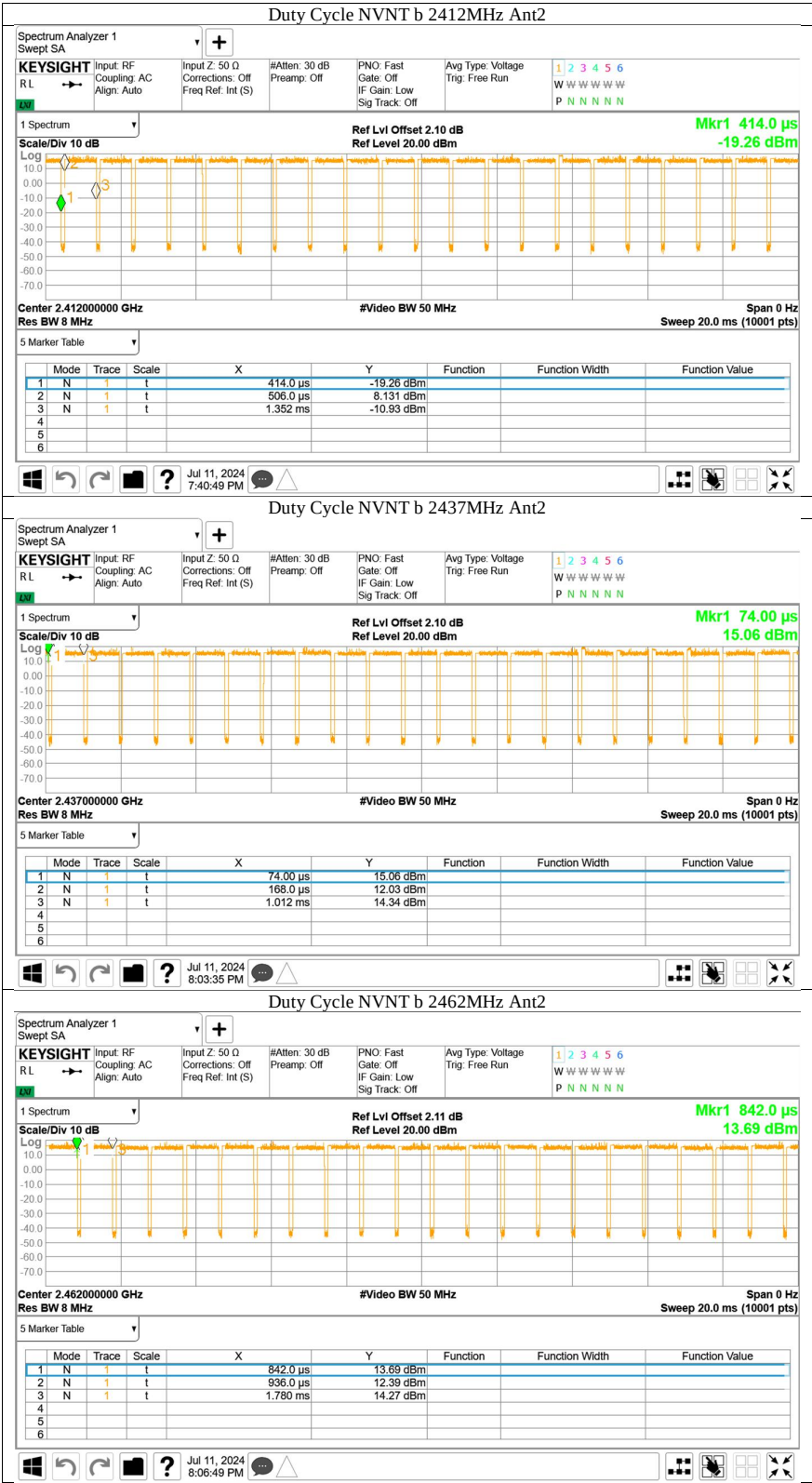
802.11ax(HE20) (MIMO)

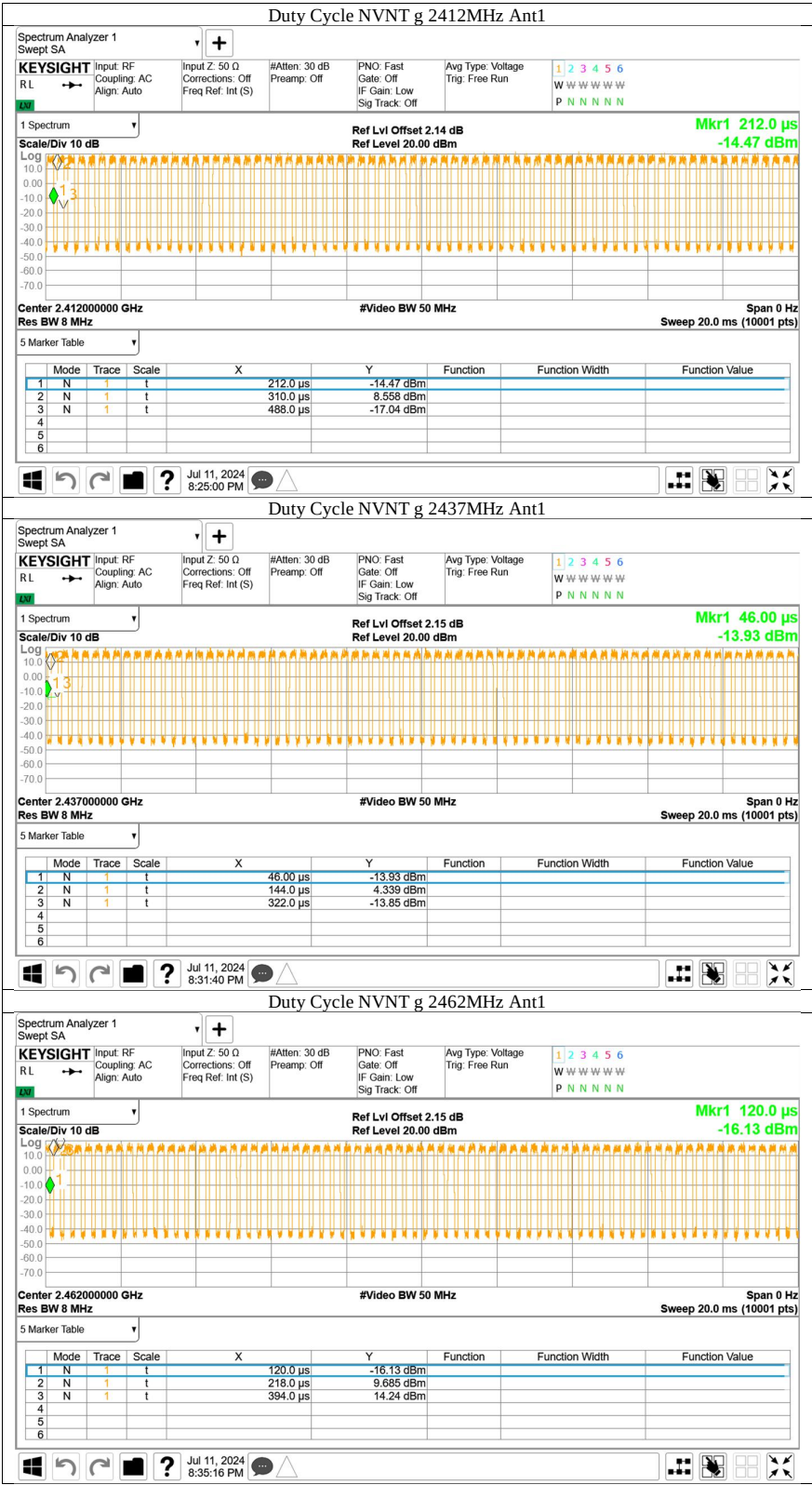
Frequency MHz	Antenna 1			Antenna 2			Sum Power(average)	Limit	Result
	Conducted Power	Duty Factor	Total Power	Conducted Power	Duty Factor	Total Power			
	dBm	dB	dBm	dBm	dB	dBm			
2412MHz	13.19	0.48	13.67	12.21	0.48	12.69	16.22	≤30	Pass
2437MHz	13	0.49	13.49	12.49	0.49	12.98	16.25	≤30	Pass
2462MHz	12.83	0.48	13.31	12.54	0.48	13.02	16.18	≤30	Pass

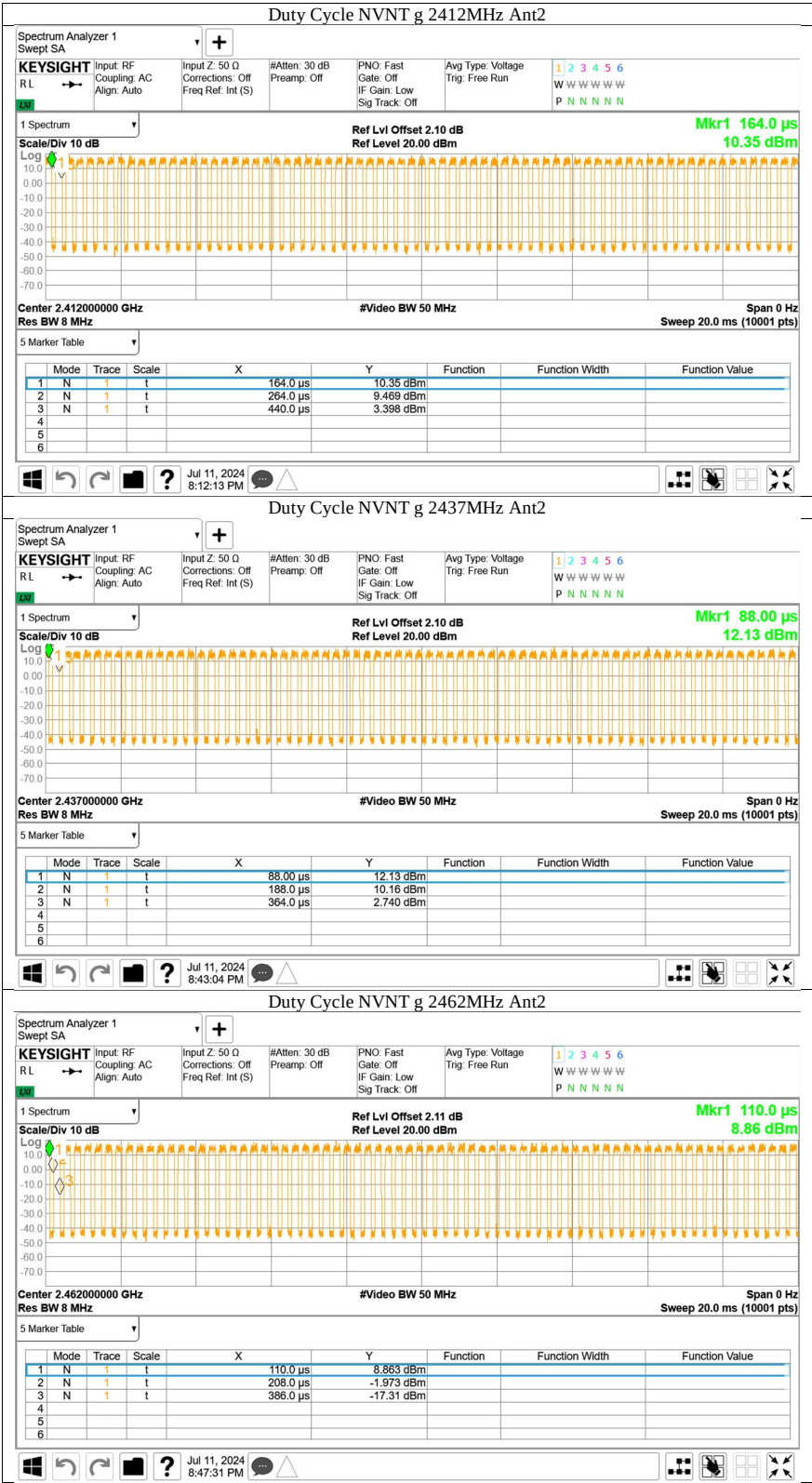


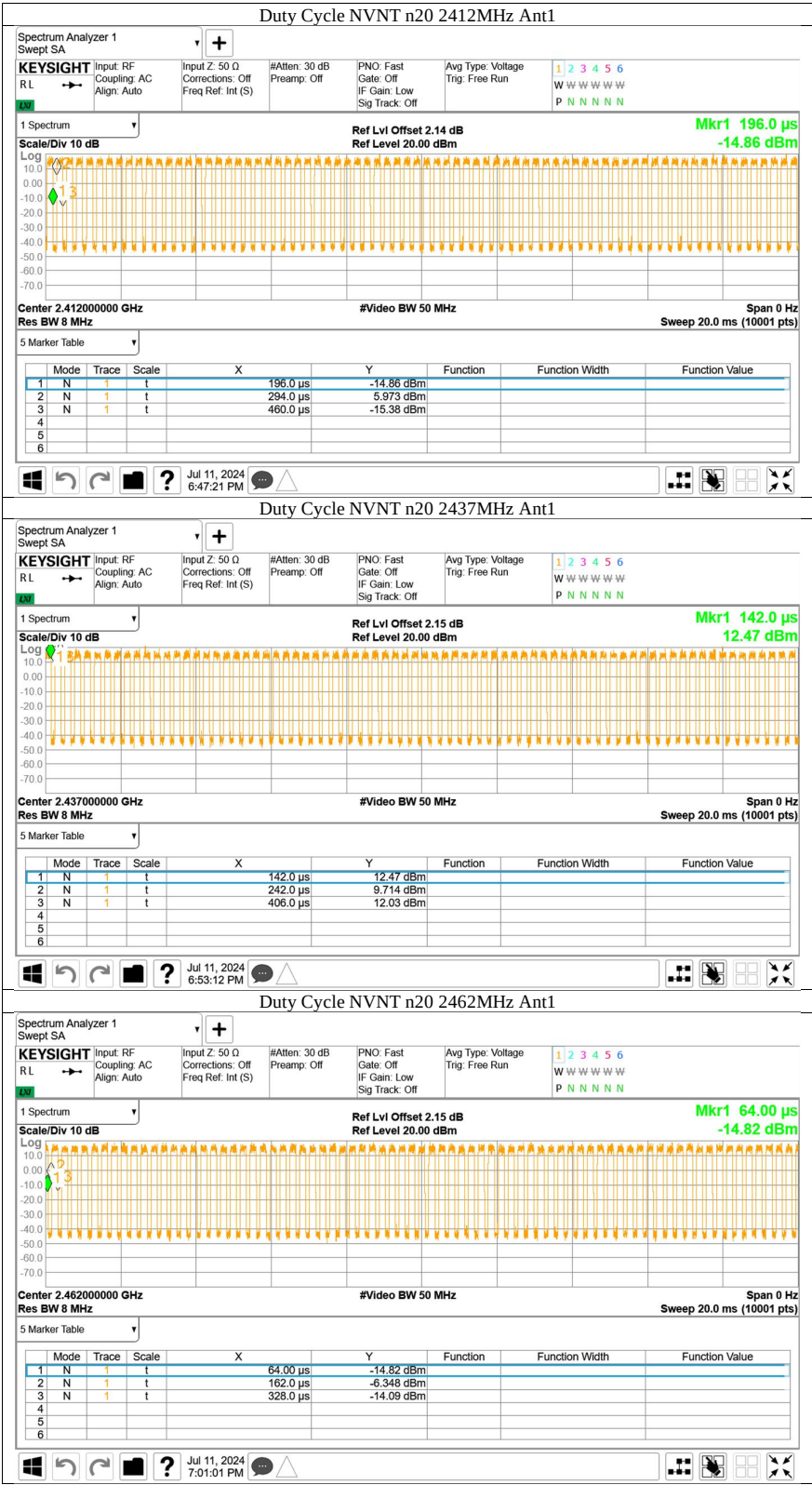
Duty Cycle

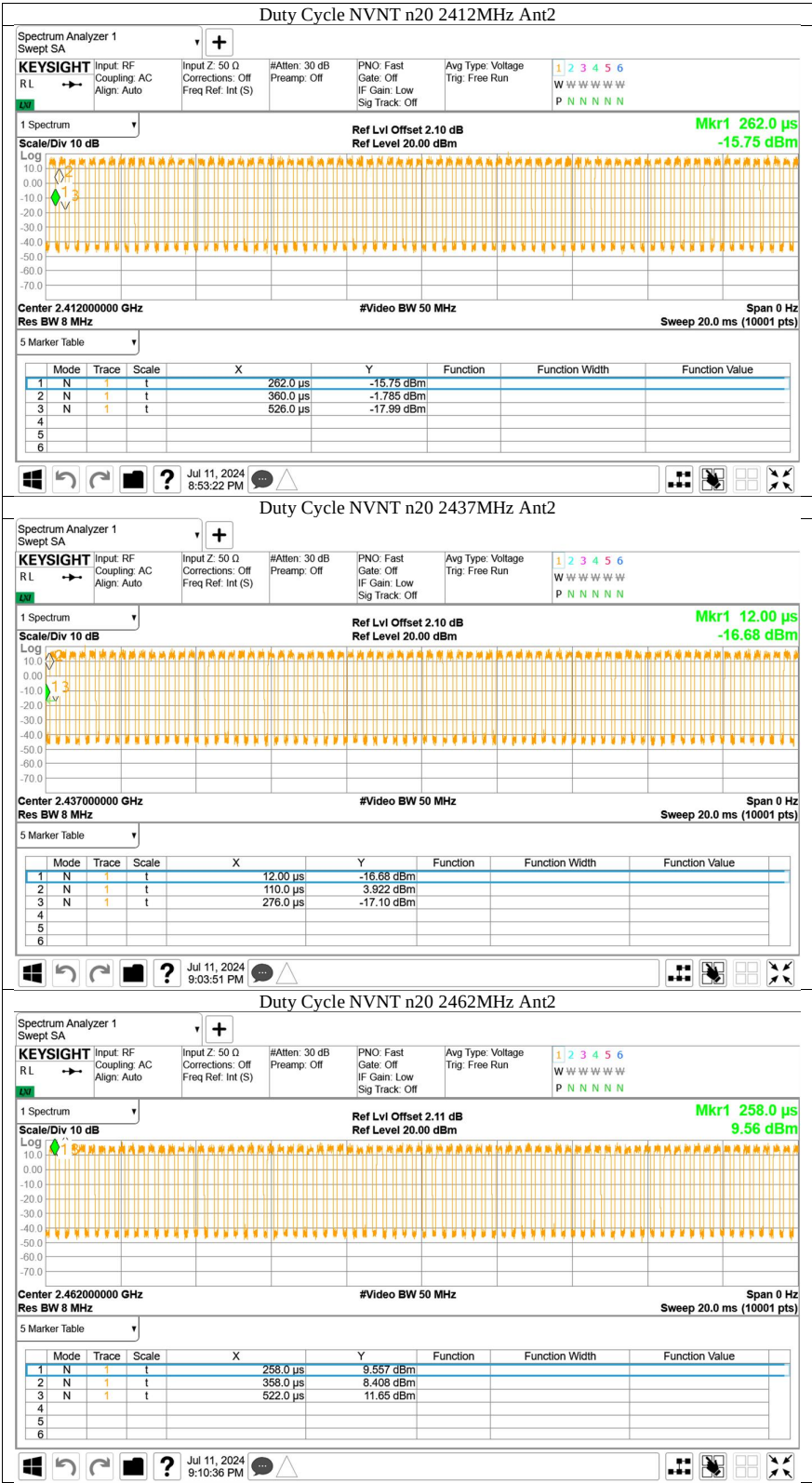


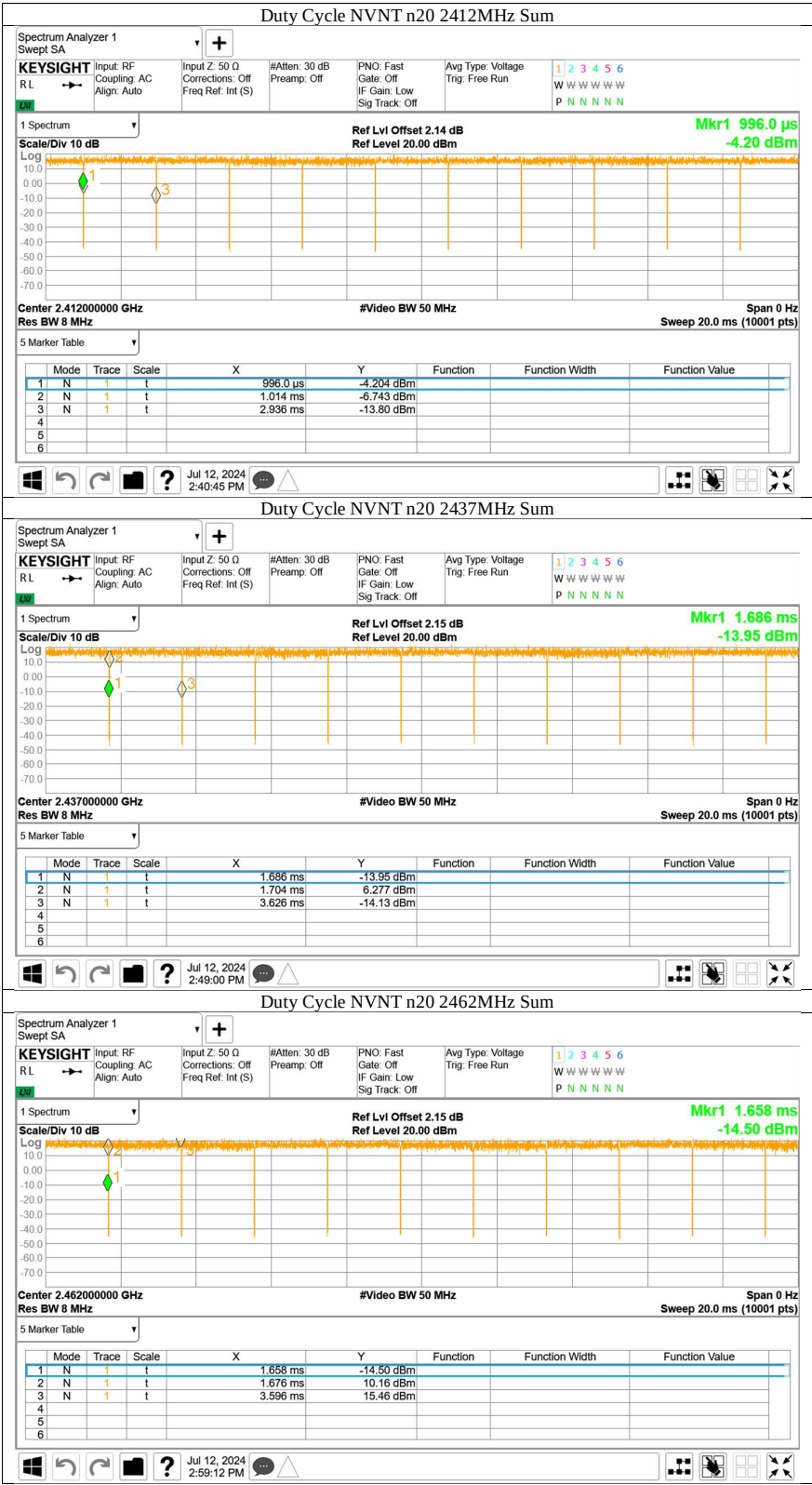


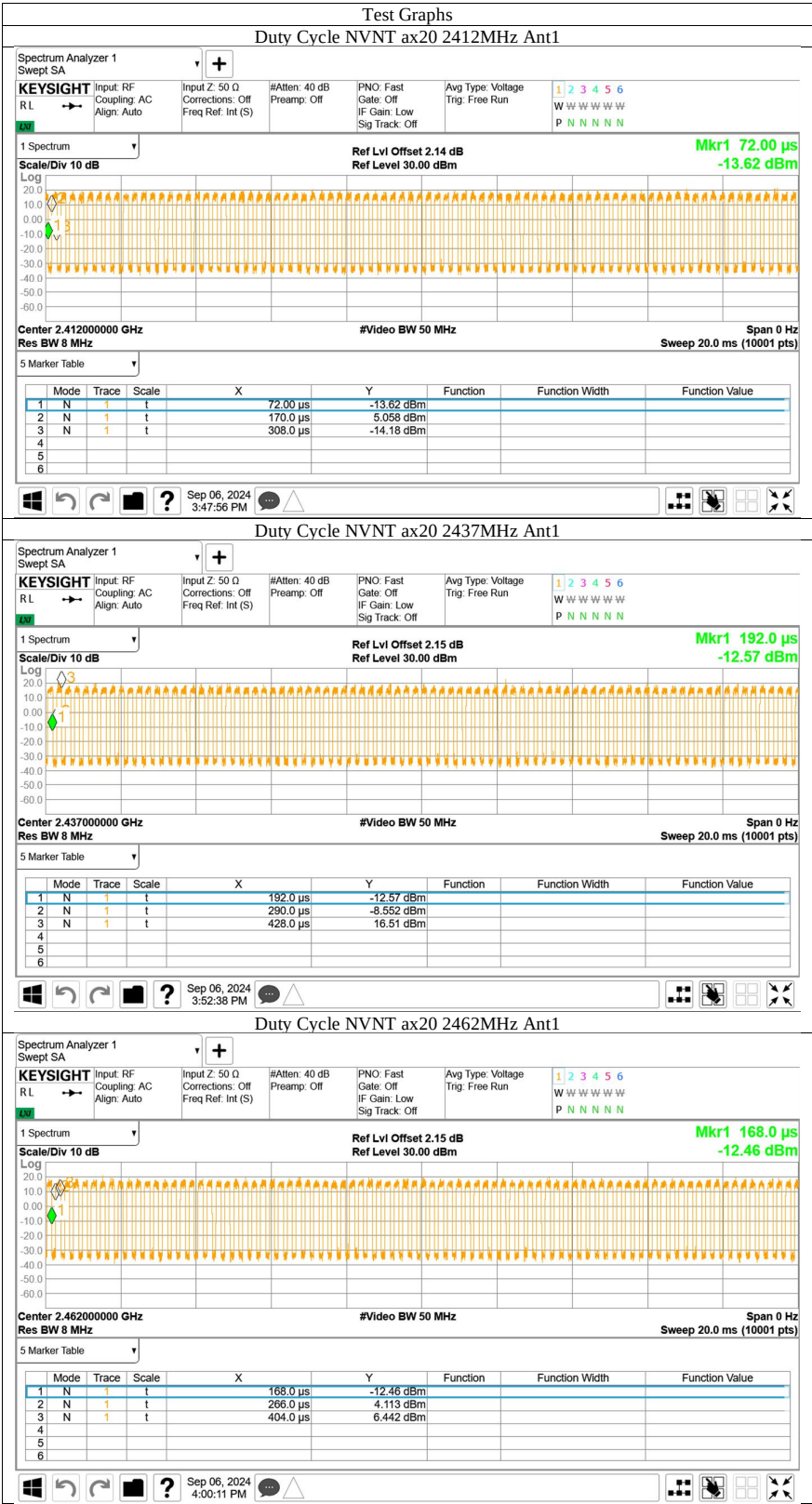


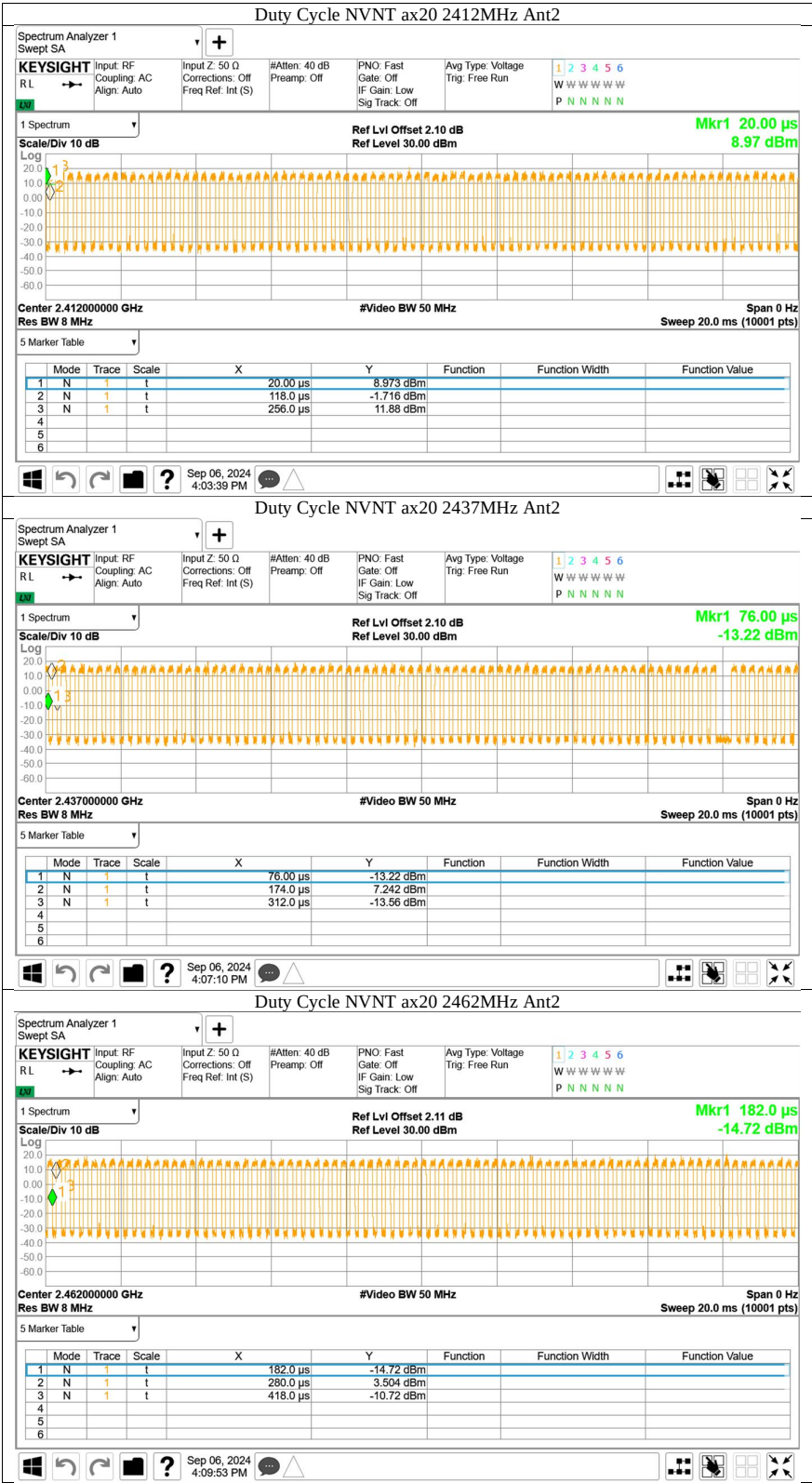


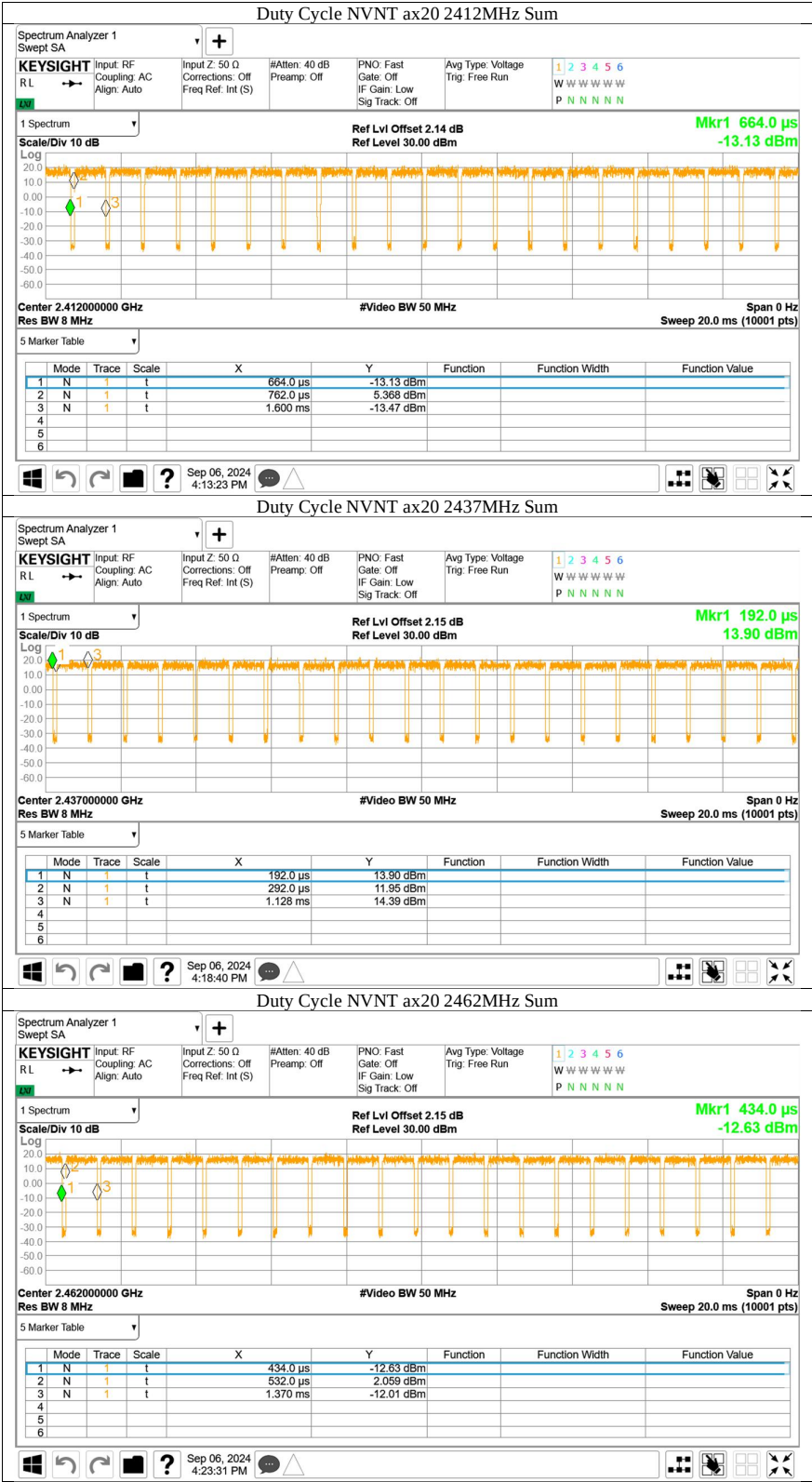














Conducted Power

