FCC Certification Report

L3Harris Technologies
221 Jefferson Ridge Parkway
Lynchburg, VA 24501

Model: XL-90D

FCC ID: OWDTR-0167-E

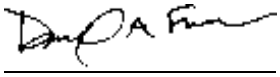
November 2, 2022

Standards Referenced for this Report	
Part 2: 2021	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 24: 2021	Personal Communications Services
ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

Report Prepared By: Daniel Baltzell

Document Number: 2022085PCB

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from the standards referenced above.

Signature:  Date: November 2, 2022

Typed/Printed Name: Desmond A. Fraser Position: President

FCC Equipment Class: PCB

FCC Rule Part	Frequency Range (MHz)	Conducted Output Power (W)	Frequency Tolerance (ppm)	Emission Designator	Transmit Mode
24D	901 – 902	3.0	0.2	8K40F1D/E	C4FM Data/Voice
24D	940 – 941	2.7	0.2	8K40F1D/E	
24D	901 – 902	3.0	0.2	8K10DXW	H-CPM (TDMA) Data/Voice
24D	940 – 941	2.7	0.2	8K10DXW	

Table of Contents

Table of Figures

Table of Tables

Table of Plots

Table of Appendixes

Table of Photographs

1 Test Result Summary

Test	FCC Reference	Result
RF Power Output	2.1046(a), 24.132(a), 24.132(b)	Complies
Spurious Emissions at Antenna Terminals	2.1051, 24.133	Complies
Field Strength of Spurious Radiation	2.1053(a), 24.133	Complies
Occupied Bandwidth/Emission Masks	2.1049(c)(1), 24.131, 24.133(a)(1),(2)	Complies
Frequency Stability vs. Temperature and Voltage	2.1055, 24.135	Complies

2 General Information

The following Certification Report is prepared on behalf of L3Harris Technologies in accordance with the Federal Communications Commission. The Equipment Under Test (EUT) was the XL-90D; FCC ID: OWDTR-0167-E.

All measurements contained in this application were conducted in accordance with the applicable sections of FCC Rules and Regulations CFR 47 Parts 2 and 24. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

2.1 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170.

2.2 Related Submittal(s)/Grant(s)

This is an original certification application for L3Harris Technologies Model XL-90D, FCC ID: OWDTR-0167-E.

2.3 Grant Notes

TBD

2.4 Tested System Details

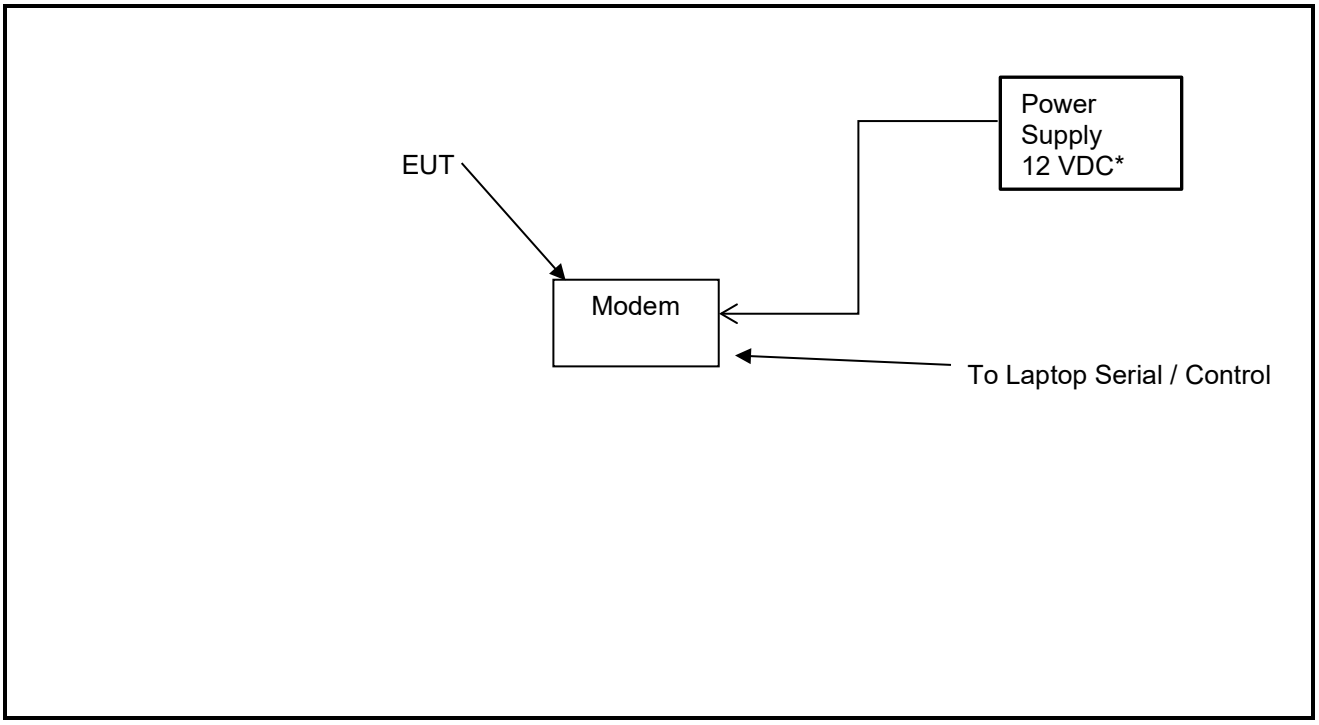
The test sample was received on August 16, 2022. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

The device was programmed for multiple modes of operation and modulation types.

Table 2-1: Equipment Under Test (EUT)

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Modem	L3Harris Technologies	XL-90D	A40333E1C001	OWDTR-0167-E	24115

2.5 Configuration of Tested System



** EUT power input range is 9 to 57 VDC. 12 VDC was used for all testing except frequency stability vs temperature.*

Figure 2-1: Configuration of Tested System

3 FCC Part 2.1033(C)(8): Voltages and Currents through the Final Amplifying Stage

22 VDC / 0.53 A

9 VDC / 1.349

4 FCC Part 2.1046(a): RF Power Output: Conducted; Part 24.132(a)/(b): Power and antenna height limits;

4.1 Test Procedure

ANSI C63.26, section 5.2

The EUT was connected to a coaxial attenuator having a 50 Ω load impedance. Manufacturer's rated power: 3.0 W.

4.2 Test Data

Table 4-1: RF Conducted Output Power – Measured

Frequency (MHz)	Rated Power (dBm)	Rated Power (W)	High Power (dBm)	High Power (W)	Low Power (dBm)	Low Power (W)
901.9750	35.1	3.2	34.8	3.0	27.1	0.5
940.9750	34.3	2.7	34.4	2.7	27.1	0.5

Notes: Data presented is for analog mode. All other modes were investigated and found to have equivalent power within measurement tolerances.

Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±0.8 dB

Results: Pass

Table 4-2: Test Equipment Used For Testing RF Power Output – Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901773	Rohde & Schwarz	FSW50	Spectrum Analyzer	1166.1660.50	02/02/2025
901724	API Weinschel, Inc.	48-40-34	40 dB 100W Attenuator	CJ8921	09/20/2022

Test Personnel:

Daniel Baltzell		August 23, 2022
EMC Test Engineer	Signature	Date of Test

5 FCC Part 2.1051: Spurious Emissions at Antenna Terminals; Part 24.133: Emission Limits

5.1 Test Procedure

ANSI C63.26, Section 5.7

The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer.

Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence.

5.2 Test Data

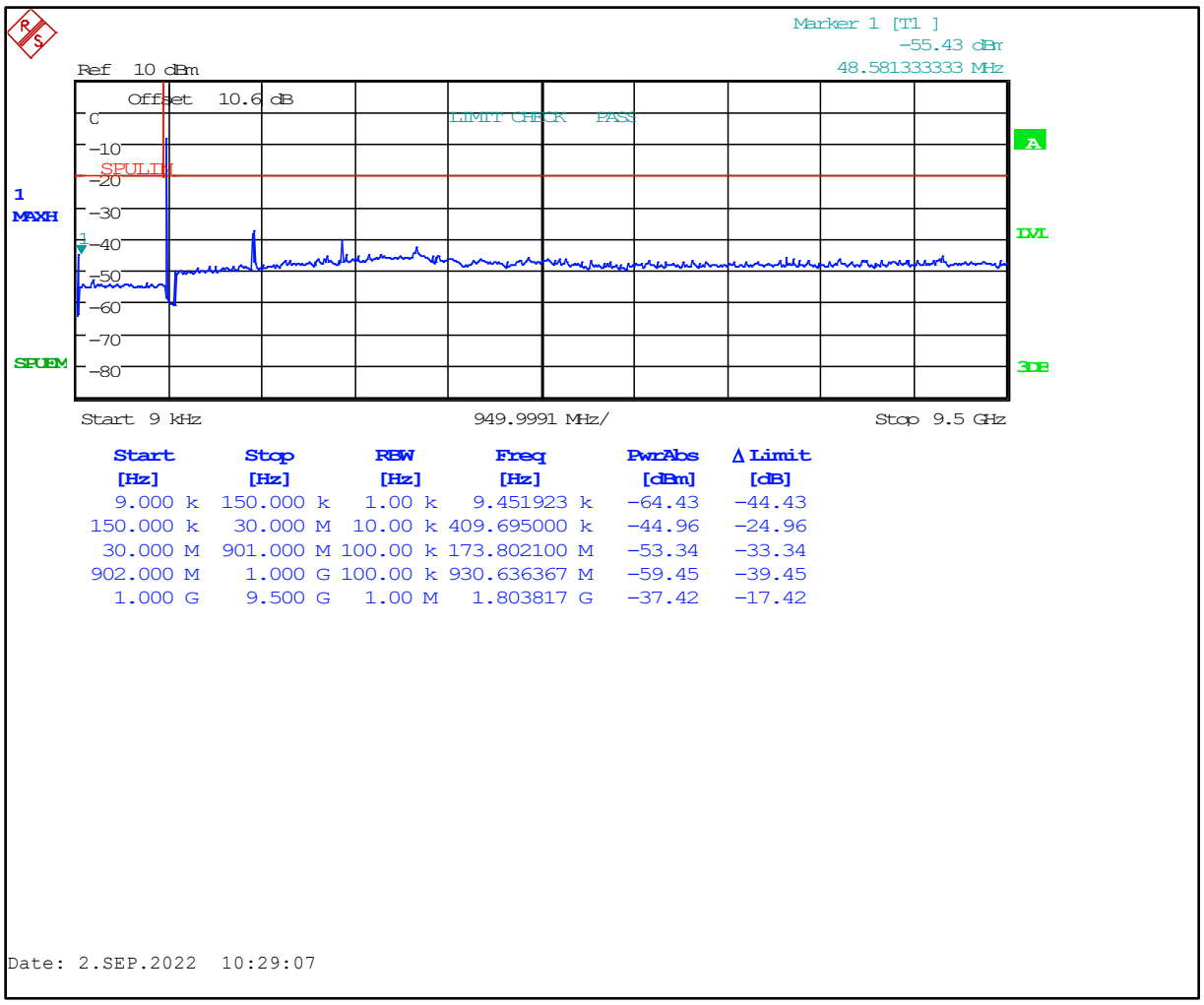
Frequency range of measurement per Part 2.1057: 9 kHz to 10 x Fc

Limits: (43+10LOG P(W)) for wideband and 50 + 10 LOG P(W)) for narrowband

The following channels (in MHz) were investigated: 901.9750 and 940.9750.

Both high and low power settings were checked; high power was found to be worst case and is presented. Data is only presented for frequencies above 20 dB below the limit. All modes were investigated and no other emissions were found within 20 dB below the limit.

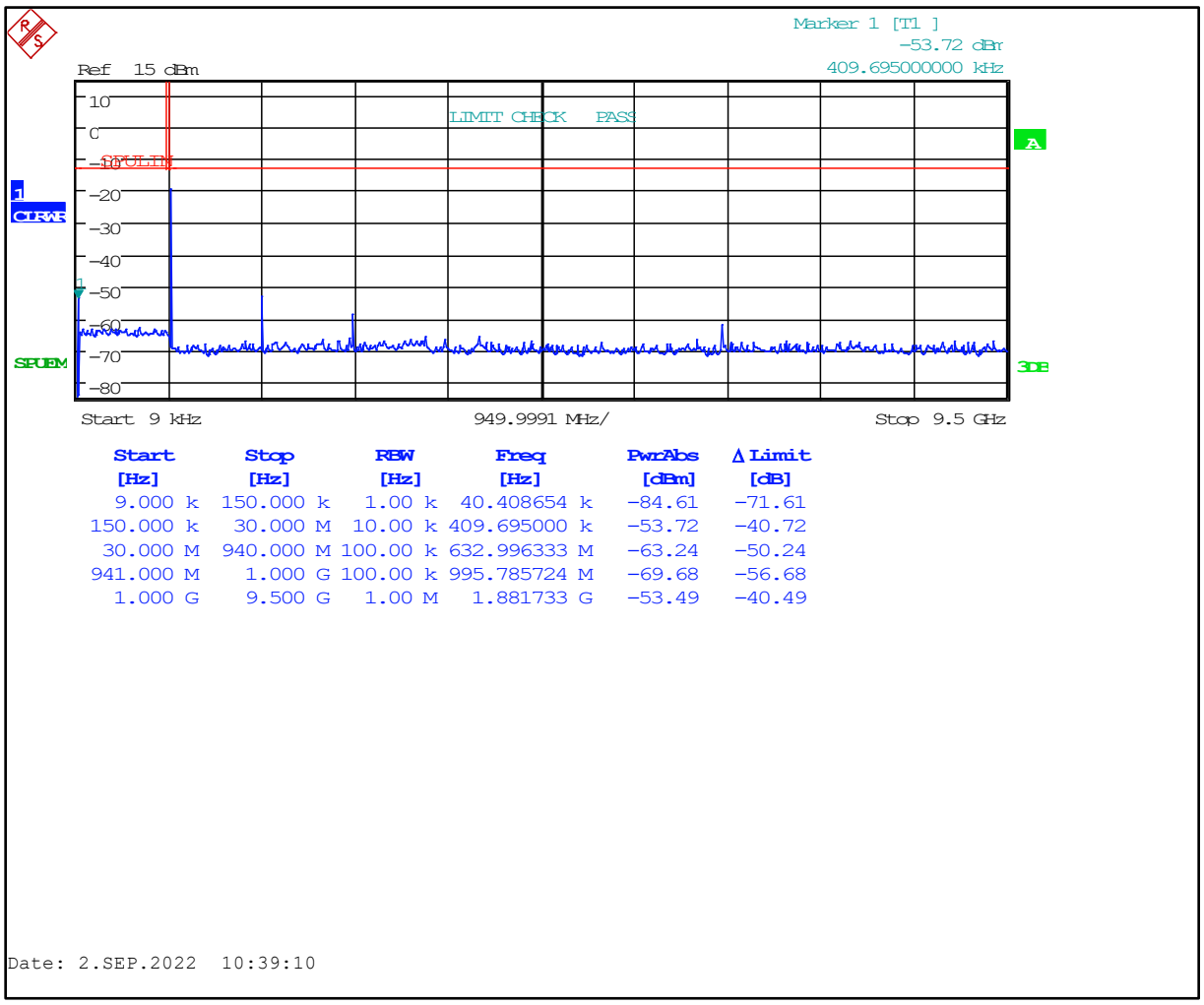
Plot 5-1: Conducted Spurious Emissions – 901.9750 MHz



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	Δ Limit [dB]
9.000 k	150.000 k	1.00 k	9.451923 k	-64.43	-44.43
150.000 k	30.000 M	10.00 k	409.695000 k	-44.96	-24.96
30.000 M	901.000 M	100.00 k	173.802100 M	-53.34	-33.34
902.000 M	1.000 G	100.00 k	930.636367 M	-59.45	-39.45
1.000 G	9.500 G	1.00 M	1.803817 G	-37.42	-17.42

Date: 2.SEP.2022 10:29:07

Plot 5-2: Conducted Spurious Emissions – 940.9750 MHz



Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±0.8 dB

Results: Pass

Table 5-1: Test Equipment Used For Testing Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	12/01/2024
901337	Narda Microline	766-10	10 dB 20W Attenuator	6242	02/21/2023
901132	Par Electronics	806-902 (25W)	UHF Notch Filter	N/A	10/15/2022

Test Personnel:

Daniel Baltzell		September 2, 2022
EMC Test Engineer	Signature	Date of Test

6 FCC Part 2.1053(a): Field Strength of Spurious Emissions; Part 24.133: Emission Limits

6.1 Test Procedure

ANSI C63.26 section 5.5

The device uses digital modulation modulated to its maximum extent using a pseudo-random data sequence.

The spurious emissions levels were measured, and the device under test was replaced by a substitution antenna connected to a signal generator. This signal generator level was then corrected by subtracting the cable loss from the substitution antenna to the signal generator, and the gain of the antenna (dBi) was added to achieve the EIRP level, then converted from the corrected signal generator level (dBm) to dBc and compared to the limit.

6.2 Test Data

Table 6-1: Field Strength of Spurious Radiation – 901.9750 MHz

Conducted Power 34.8 dBm; 3 W; Limit = 43+10 Log P=47.8 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
1803.9500	35.8	-32.3	0.9	6.7	61.3	-13.5
2705.9250	46.7	-31.0	1.2	7.7	59.3	-11.5
3607.9000	38.7	-37.1	1.4	7.6	65.7	-17.9
4509.8750	11.4	-59.2	1.6	8.8	86.8	-39.0
5411.8500	8.4	-61.3	1.8	8.5	89.4	-41.6
6313.8250	21.4	-47.6	1.9	9.3	75.0	-27.2
7215.8000	15.0	-53.0	2.1	9.1	80.8	-33.0
8117.7750	-3.4	-70.3	2.1	9.2	98.0	-50.2
9019.7500	3.2	-59.2	2.2	9.0	87.2	-39.4

Table 6-2: Field Strength of Spurious Radiation – 940.9750 MHz

Conducted Power 34.4 dBm; 2.7 W; Limit = 43+10 Log P=47.3 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
1881.9500	40.1	-26.2	1.0	6.3	55.3	-8.0
2822.9250	41.6	-35.8	1.2	7.9	63.7	-16.4
3763.9000	7.8	-67.1	1.5	7.0	96.0	-48.7
4704.8750	8.1	-62.7	1.7	9.0	89.9	-42.6
5645.8500	15.0	-54.7	1.8	8.8	82.2	-34.9
6586.8250	16.2	-52.8	2.0	9.7	79.6	-32.3
7527.8000	1.1	-65.9	2.1	9.0	93.5	-46.2
8468.7750	-10.5	-73.3	2.2	9.4	100.6	-53.3
9409.7500	-6.6	-68.7	2.3	9.4	96.1	-48.8

Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±4.6 dB

Results: Pass

Table 6-3: Test Equipment Used For Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter antenna mast, polarizing	OATS1	N/A
901729	Insulated Wire Inc.	KPS-1503-3150-KPR	SMK RF Cables 20’	NA	12/06/2022
901132	Par Electronics	806-902 (25W)	UHF Notch Filter	N/A	10/15/2022
901727	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	09/21/2022
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	N/A
900791	Chase	CBL6111B	Bilog Antenna (30–2000 MHz)	N/A	10/04/2022
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	08/05/2024
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	08/05/2024
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	08/05/2024
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	12/01/2024
901582	Rohde & Schwarz	1167.0000.02	Signal Generator	101903	05/23/2024

Test Personnel:

Daniel Baltzell		September 1, 2018
Test Engineer	Signature	Date of Tests

7 FCC Part 2.1049(c)(1): Occupied Bandwidth; Part 24.131, Part 24.133(a)(1),(2): Authorized Bandwidth;

Occupied Bandwidth - Compliance with the Emission Masks

7.1 Test Procedure

ANSI C63.26-2015, section 5.4

Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence.

Part 24.131 Authorized Bandwidth

The authorized bandwidth of narrowband PCS channels will be 10 kHz for 12.5 kHz channels and 45 kHz for 50 kHz channels. For aggregated adjacent channels, a maximum authorized bandwidth of 5 kHz less than the total aggregated channel width is permitted.

Part 24.133 Emission Limits

(1) For transmitters authorized a bandwidth greater than 10 kHz:

(i) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of up to and including 40 kHz: at least 116 Log10 ((fd + 10)/6.1) decibels or 50 plus 10 Log10 (P) decibels or 70 decibels, whichever is the lesser attenuation;

(ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 40 kHz: at least 43 + 10 Log10 (P) decibels or 80 decibels, whichever is the lesser attenuation.

(2) For transmitters authorized a bandwidth of 10 kHz:

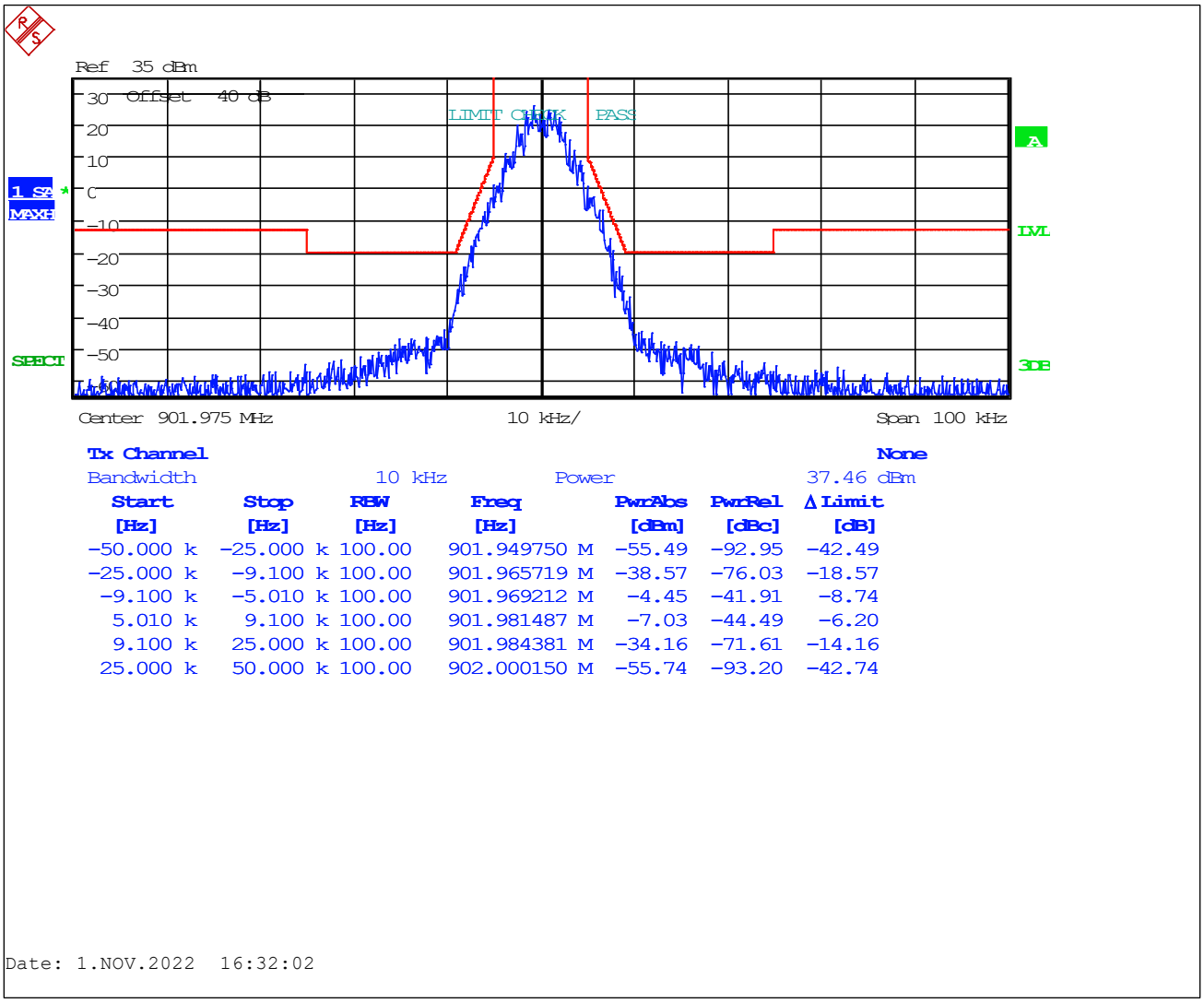
(i) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of up to and including 20 kHz: at least 116 × Log10 ((fd + 5)/3.05) decibels or 50 + 10 × Log10 (P) decibels or 70 decibels, whichever is the lesser attenuation;

(ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 20 kHz: at least 43 + 10 Log 10 (P) decibels or 80 decibels, whichever is the lesser attenuation.

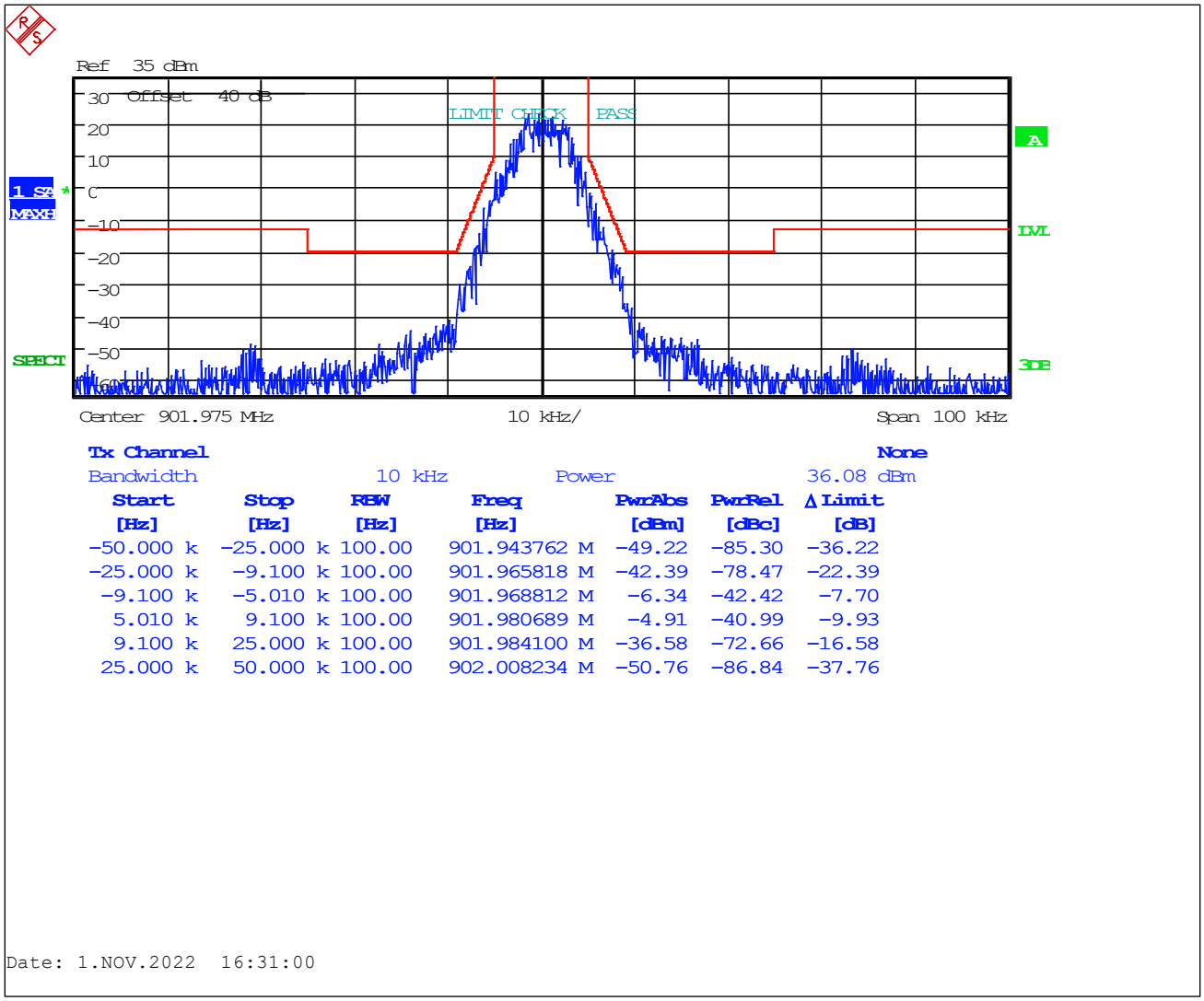
(d) The following minimum spectrum analyzer resolution bandwidth settings will be used: 300 Hz when showing compliance with paragraphs (a)(1)(i) and (a)(2)(i) of this section; and 30 kHz when showing compliance with paragraphs (a)(1)(ii) and (a)(2)(ii) of this section.

7.2 Test Data

Plot 7-1: Occupied Bandwidth – 901.9750 MHz; C4FM; Mask 24.133(2)



Plot 7-2: Occupied Bandwidth – 901.9750 MHz; H-CPM (TDMA); Mask 24.133(2)



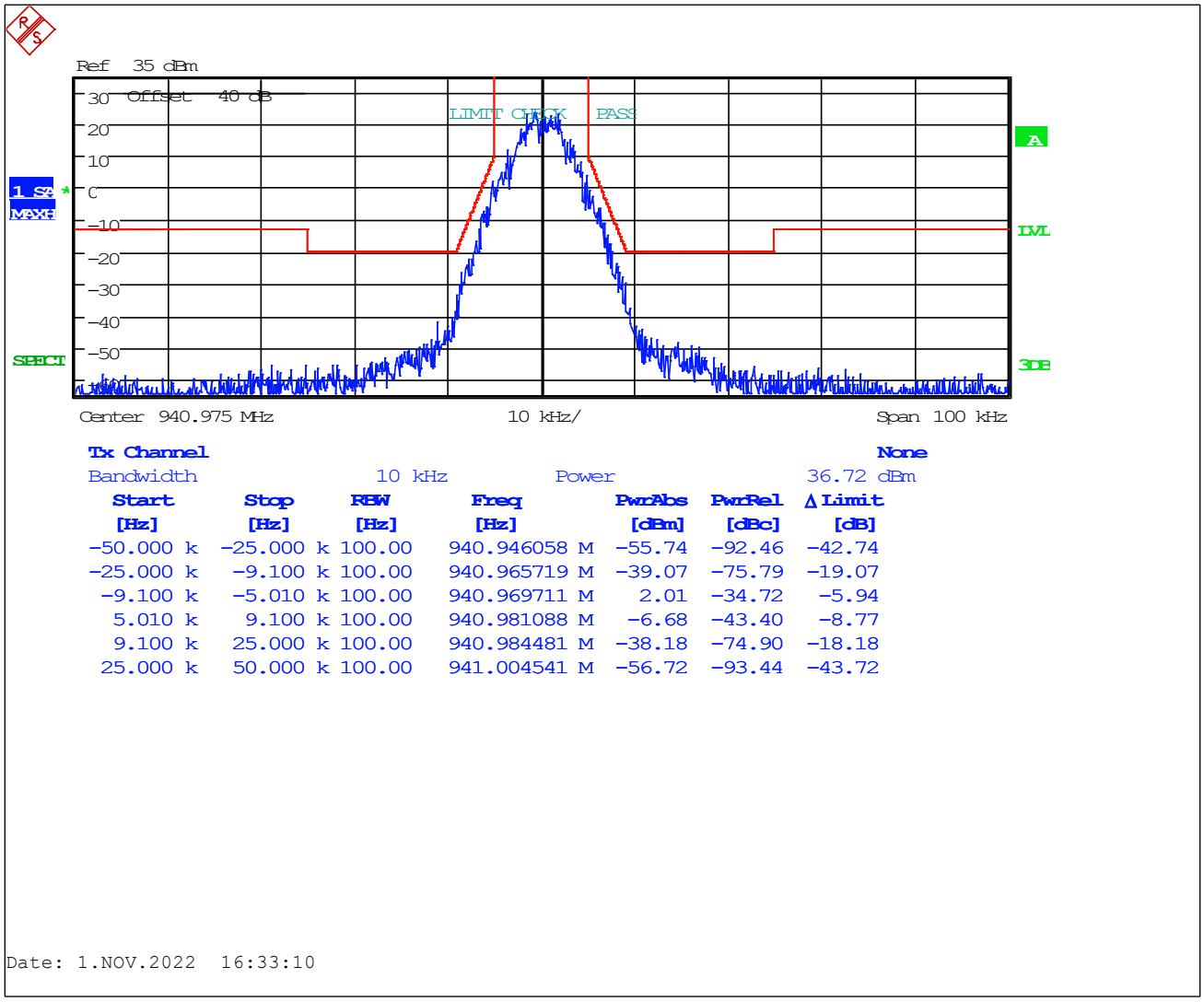
Tx Channel **None**

Bandwidth 10 kHz Power 36.08 dBm

Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	PwrRel [dBc]	Δ Limit [dB]
-50.000 k	-25.000 k	100.00	901.943762 M	-49.22	-85.30	-36.22
-25.000 k	-9.100 k	100.00	901.965818 M	-42.39	-78.47	-22.39
-9.100 k	-5.010 k	100.00	901.968812 M	-6.34	-42.42	-7.70
5.010 k	9.100 k	100.00	901.980689 M	-4.91	-40.99	-9.93
9.100 k	25.000 k	100.00	901.984100 M	-36.58	-72.66	-16.58
25.000 k	50.000 k	100.00	902.008234 M	-50.76	-86.84	-37.76

Date: 1.NOV.2022 16:31:00

Plot 7-3: Occupied Bandwidth – 940.9750 MHz; C4FM; Mask 24.133(2)



Tx Channel **None**

Bandwidth 10 kHz Power 36.72 dBm

Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	PwrRel [dBc]	Δ Limit [dB]
-50.000 k	-25.000 k	100.00	940.946058 M	-55.74	-92.46	-42.74
-25.000 k	-9.100 k	100.00	940.965719 M	-39.07	-75.79	-19.07
-9.100 k	-5.010 k	100.00	940.969711 M	2.01	-34.72	-5.94
5.010 k	9.100 k	100.00	940.981088 M	-6.68	-43.40	-8.77
9.100 k	25.000 k	100.00	940.984481 M	-38.18	-74.90	-18.18
25.000 k	50.000 k	100.00	941.004541 M	-56.72	-93.44	-43.72

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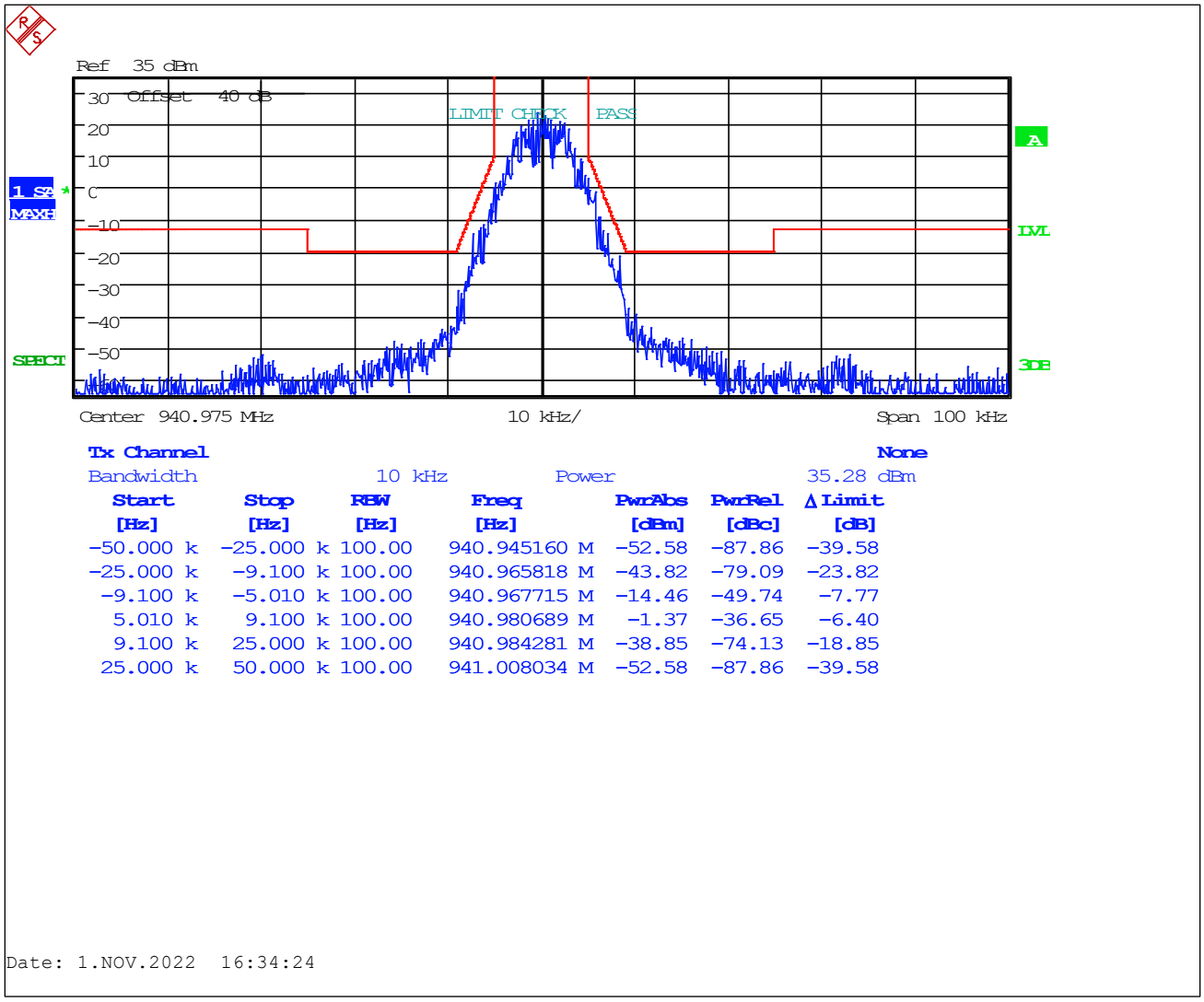
Plot 7-4: Occupied Bandwidth – 940.9750 MHz; H-CPM (TDMA); Mask 24.133(2)



Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±0.5 Hz

Results: Pass

Table 7-1: Test Equipment Used For Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	12/01/2024
901337	Narda Microline	766-10	Attenuator (DC-4GHz, 10 dB, 20W)	6242	02/21/2023

Test Personnel:

Daniel Baltzell		November 1, 2022
EMC Test Engineer	Signature	Date of Test

8 FCC Part 2.1055: Frequency Stability; Part 24.135: Frequency Stability

8.1 Test Procedure

ANSI C63.26, section 5.6

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -30°C to +60°C.

Note: Though the frequency tested below is not within the Part 24 frequency allocations, it is representative of the frequency stability for the entire 900 MHz band.

The temperature was initially set to -30°C and a 1-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A ½-hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied +/-15% nominal input voltage.

Part 24.135: Frequency Stability

(a) The frequency stability of the transmitter shall be maintained within ±0.0001 percent (±1 ppm) of the center frequency over a temperature variation of -30° Celsius to +60° Celsius at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20° Celsius.
(b) For battery operated equipment, the equipment tests shall be performed using a new battery without any further requirement to vary supply voltage.
(c) It is acceptable for a transmitter to meet this frequency stability requirement over a narrower temperature range provided the transmitter ceases to function before it exceeds these frequency stability limits.

8.2 Test Data

Table 8-1: Temperature Frequency Stability – 937.5 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	937.500188	0.20
-20	937.500188	0.20
-10	937.500157	0.17
0	937.500157	0.17
10	937.500031	0.03
20 (reference)	937.500000	0.00
30	937.499812	-0.20
40	937.499906	-0.10
50	937.499906	-0.10
60	937.499843	-0.17

Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±0.5 Hz

Results: Pass

Table 8-2: Test Equipment Used For Testing Temperature Frequency Stability

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901626	Amprobe	34XR-A	Multimeter	13041390A	10/18/2023
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	200106	12/01/2024
901337	Narda Microline	766-10	10 dB 20W Attenuator	6242	02/21/2023
901014	Kikusui	PCR4000L	Power Supply	DB001921	Not Required
900946	Tenney Engineering	TH65	Temperature Chamber with Humidity	11380	06/23/2025

Test Personnel:

Daniel Baltzell		August 22, 2022
EMC Test Engineer	Signature	Date of Test

8.2.1 Frequency Stability/Voltage Variation

Table 8-3: Frequency Stability/Voltage Variation – 937.5 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
7.65	937.500000	0.00
9.0	937.500000	0.00
28.05	937.500000	0.00
33.0 (reference)	937.500000	0.00
37.95	937.500000	0.00
57.0	937.500000	0.00
65.55	937.500000	0.00

Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±0.5 Hz

Results: Pass

Table 8-4: Test Equipment Used For Testing Frequency Stability/Voltage Variation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901626	Amprobe	34XR-A	Multimeter	13041390A	10/18/2023
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	200106	12/01/2024
901337	Narda Microline	766-10	10 dB 20W Attenuator	6242	02/21/2023
901014	Kikusui	PCR4000L	Power Supply	DB001921	Not Required
900946	Tenney Engineering	TH65	Temperature Chamber with Humidity	11380	06/23/2025

Test Personnel:

Daniel Baltzell		August 22, 2022
EMC Test Engineer	Signature	Date of Test

9 FCC Part 2.202: Necessary Bandwidth and Emission Bandwidth

C4FM Data/Voice (P25 Phase 1)
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 1800
Bn = [9600/$\log_2$(4) + 2 (1800) (1)] = 8.400 kHz
Emission designator: 8K40F1D, 8K40F1E

H-CPM (TDMA) Data/Voice (P25 Phase 2)
Calculation:
Data rate in bps (R) =12000
Peak deviation of carrier (D) = 1050
Bn = [12000/$\log_2$(4) + 2 (1050) (1)] = 8.1 kHz
Emission designator: 8K10DXW

10 Conclusion

The data in this measurement report shows that the L3Harris Technoloogies XL-90D, FCC ID: OWDTR-0167-E, complies with the applicable requirements of Parts 2 and 24 of the FCC Rules.