

NTS Labs, LLC Test Report for EMI Emissions Testing of the ExpressVote®XL

Prepared For

Pro V&V, Inc | 6705 Odyssey Drive, Suite C | Huntsville, AL 35806

Performed By

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A handwritten signature in cursive script that reads "Jessica Bedard".

Jessica Bedard
Preparer

A handwritten signature in cursive script that reads "Eugene DeVito".

Eugene DeVito
Program Manager

This report and the information contained herein represent the results of testing of only those articles/products identified in this document and selected by the client. The tests were performed to specifications and/or procedures approved by the client. NTS Labs, LLC makes no representations expressed or implied that such testing fully demonstrates efficiency, performance, reliability, or any other characteristic of the articles being tested, or similar products. This report should not be relied upon as an endorsement or certification by NTS Labs, LLC of the equipment tested, nor does it present any statement whatsoever as to the merchantability or fitness of the test article or similar products for a particular purpose. This document shall not be reproduced except in full without written approval from NTS Labs, LLC.

Revision History

Rev.	Description	Issue Date
0	Initial Release	09/07/2023
1	<ul style="list-style-type: none">• Corrected unit name and address on cover page• Revised test specification VVSG throughout• Added/corrected EUT part and serial numbers in Tables 3.0-1 and 5.0-1• Removed reference to Class A throughout• Corrected OH Radiated Emissions test date in Table 5.0-1• Removed unnecessary/duplicate photos and data from Sections 5.1 and 5.3	10/10/2023

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1.0 Introduction

This document presents the test procedures used and the results obtained during the performance of an Electromagnetic Interference (EMI) test program. The test program was conducted to assess the ability of the specified Equipment Under Test (EUT) to successfully satisfy the requirements listed in Section 2.0.

2.0 References

The following references listed below form a part of this document to the extent specified herein.

- Test Specification: FCC Part 15 Class B
- Pro V&V, Inc Purchase Order(s) 2023-010, dated 04/24/2023
- NTS Labs, LLC (NTS) Quote(s) OP0638254, dated 04/19/2023
- ISO/IEC 17025:2017(E) *General Requirements for the Competence of Testing and Calibration Laboratories*, dated 11/1/2017

3.0 Product Selection and Description

Pro V&V, Inc selected and provided the following test sample(s) to be used as the Equipment Under Test:

Table 3.0-1: Product Identification - Equipment Under Test (EUT)

Item	Qty.	Name/Description	Part Number	Serial Number
1	1	ExpressVote@XL	ExpressVoteXL	XL0119040262
2	1	ExpressVote@XL	ExpressVoteXL	XL0122080503
3	1	Universal Voting Control	UVC	UVC08180917
4	1	Universal Voting Control	UVC	UVC09211413

3.1 Security Classification

Non-classified

4.0 General Test Requirements

4.1 Test Equipment

The instrumentation used in the performance of these tests is periodically calibrated and standardized within manufacturer's rated accuracies and are traceable to the National Institute of Standards and Technology. The calibration procedures and practices are in accordance with ISO 17025:2017. Certification of calibration is on file subject to inspection by authorized personnel.

4.2 Measurement Uncertainties

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below were calculated using the approach described in CISPR 16-4-2:2003 using a coverage factor of k=2, which gives a level of confidence of approximately 95%. The levels were found to be below levels of CISPR and therefore no adjustment of the data for measurement uncertainty is required.

Table 4.2-1: Measurement Uncertainties

Measurement Type	Measurement Units	Frequency Range	Expanded Uncertainty
Conducted Emissions	dBuA	150kHz to 30MHz	+/- 3.75 dB
Radiated Emissions	dBuV/m	30MHz to 1GHz	+/- 6.32 dB
		1GHz to 6GHz	+/- 9.59 dB
		6GHz to 18GHz	+/- 7.58 dB
		18GHz to 40GHz	+/- 6.08 dB



5.0 Test Descriptions and Results

Table 5.0-1: Summary of Test Information & Results

Section	Test	Specification	Test Facility	Test Date	Part #	Serial #	Test Result
5.1	Radiated Emissions	FCC Part 15 Class B	Longmont	08/09/2023	ExpressVoteXL	XL0119040262	Passed
					UVC	UVC08180917	
5.2	Conducted Emissions	FCC Part 15 Class B	Longmont	08/10/2023	ExpressVoteXL	XL0119040262	Passed
					UVC	UVC08180917	
5.3	Radiated Emissions - OH Lower & Upper Levels	FCC Part 15 Class B	Longmont	08/22/2023	ExpressVoteXL	XL0122080503	Passed
					UVC	UVC09211413	

The decision rule for Test Results was based on the Test Specification used for testing.



5.1 Radiated Emissions

5.1.1 Test Procedure

FCC Part 15, Class B

5.1.2 Test Result

Passed

5.1.3 Test Datasheets

National Technical Systems				
Radiated Emissions, FCC Part 15, Class B				
Standard Referenced: FCC Part 15, Class B		Date: 8/9/2023		
Temperature: 24°C	Humidity: 38%	Pressure: 838 mb		
Input Voltage: 120Vac/60Hz		Pretest & Linearity Check: Pass		
Configuration of Unit: Shoe-shine Mode		Sweep Time Check: Ok		
Test Engineer / Technician: T. Wittig				
Date	Time	Log Entries	Initials	Result
8/9/2023	1030	Setup and performed RE pre-test verification prior to testing	TW	Complete
		Performed ambient scans on V-H poles	TW	Ok
	1055	Begin Radiated Emissions, 30 MHz - 1 GHz.FCC Part 15. Class B. (4.1.2.9)	TW	---
	1300	Completed RE testing	TW	Pass

“Type” refers to the type of measurement performed. The type of measurement made is based on the requirements of the particular standard:

- PK = Peak Measurement: RBW is 120kHz, VBW is 3 MHz
- QP = Quasi-Peak Measurement: RBW is 120kHz, VBW is 3 MHz, and QP Detection is ENABLED
- AV = Video Average Measurement: RBW is 1 MHz, VBW is 10 Hz

The “field strength” (FS) emissions level is attained by adding the received amplitude measured (RA), Antenna factor (AF), and cable factor (CF) minus the amplifier gain (AG). $FS = RA + AF + CF - AG$. Final measurements are made with the Azimuth, Polarity, Height, and EUT Cables positioned for maximum radiation. If applicable, cables positions are noted in the test log.
(Sample Calculation: $49.6 \text{ dBuV} + 11.4 \text{ dB/m} - 28.8 \text{ dB (CF/AG)} = 32.2 \text{ dBuV/m}$. Important Note: This is a sample calculation only for the purpose of demonstration, and does not reflect data in this report.)

The “Azm/Pol/Hgt” indicates the turn-table azimuth, the antenna polarity, and the antenna height where the maximum emissions level was measured.

The “Margin” is with reference to the emissions limit. A positive number indicates that the emission measurement is below the limit. A negative number indicates that the emission measurement exceeds the limit.

The PRESCAN is a peak measurement and is performed with the RBW set to 120 kHz, VBW set to 3 MHz (30 MHz to 1 GHz), and the RBW set to 1 MHz, VBW set to 3MHz (> 1 GHz)

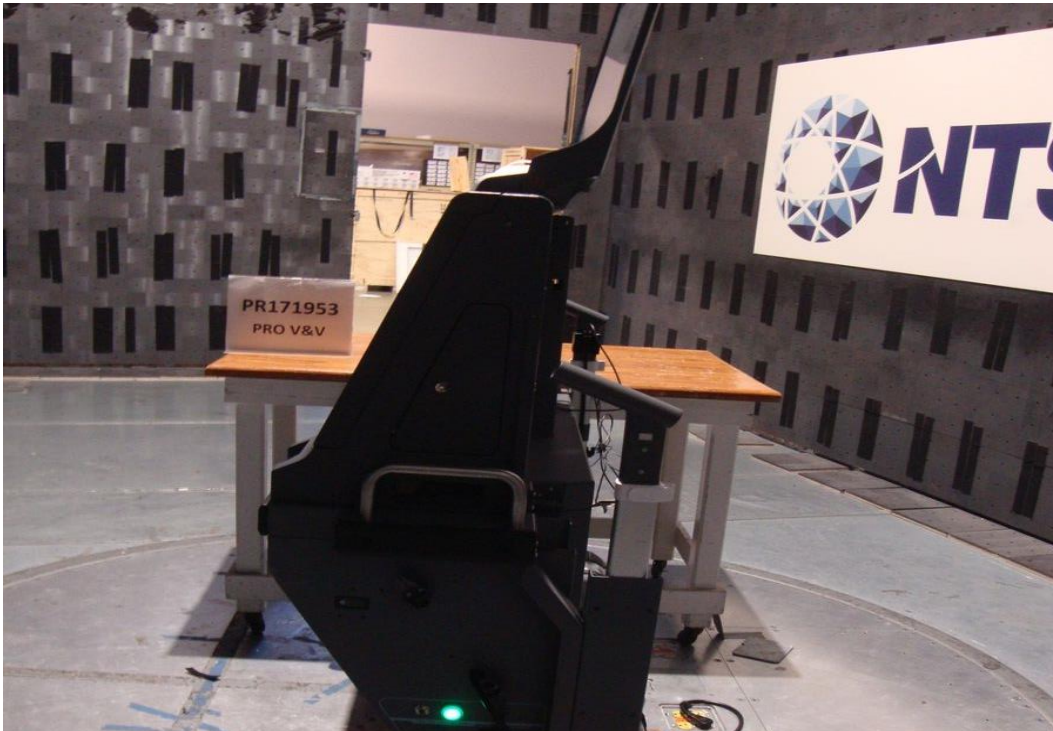
The Antenna setup for >1GHz should match the setup that was used to meet SVSWR requirements. Refer to the SVSWR report stored in the calibration records for the chamber being used.

5.1.4 Test Photographs

Radiated Emissions Test Setup – XL0119040262 Front Side



Radiated Emissions Test Setup – XL0119040262 Left Side



Radiated Emissions Test Setup – XL0119040262 Right Side



Radiated Emissions Test Setup – XL0119040262 Back Side

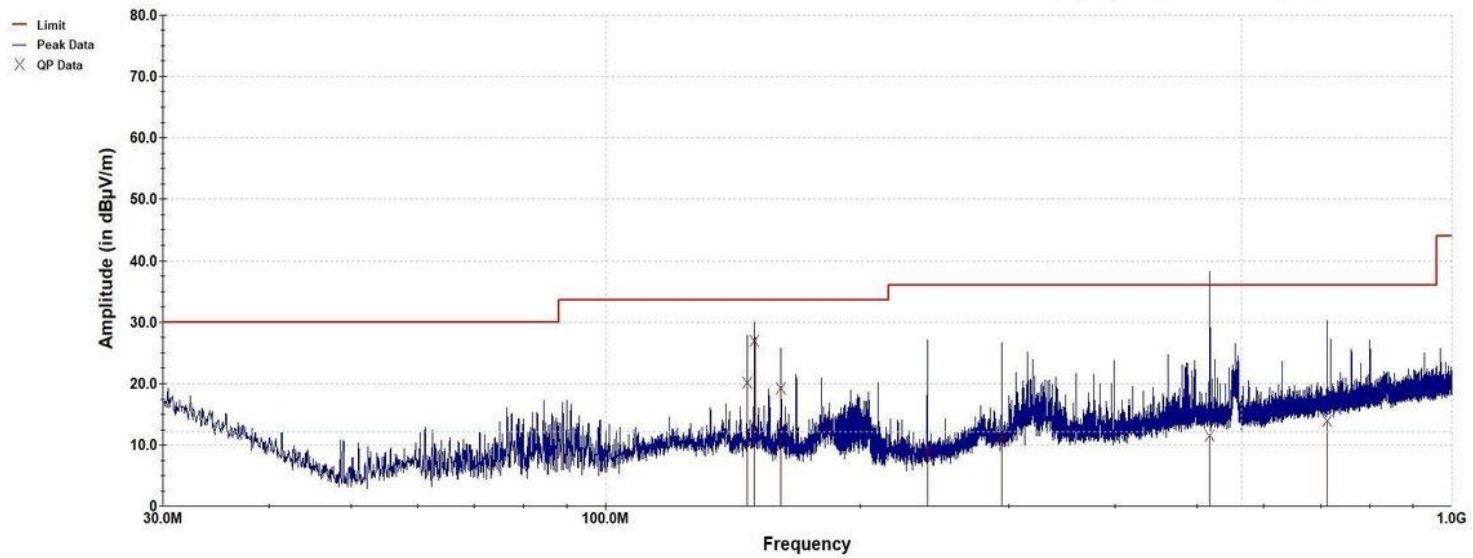


5.1.5 Test Data

Standard Limit:
FCC Class B
120Vac/60Hz

Radiated Emissions
Peak and Quasi-peak Measurements
Graph Horizontal Data

EUT - ExpressVoteXL
Serial # - XL0119040262
Mode of Operation - Shoe-shine Mode



Operator: T. Wittig

Customer: PRO V&V

Last Data Update 12:00:24 PM, Wednesday, August 09, 2023

PR#: PR171953

Radiated Emissions Graph Horizontal Data, XL0119040262



Radiated Emissions
Table: Horizontal Quasi-Peaks below 1 GHz

Operator: T. Wittig

EUT: ExpressVoteXL
PR#: PR171953
Customer: PRO V&V

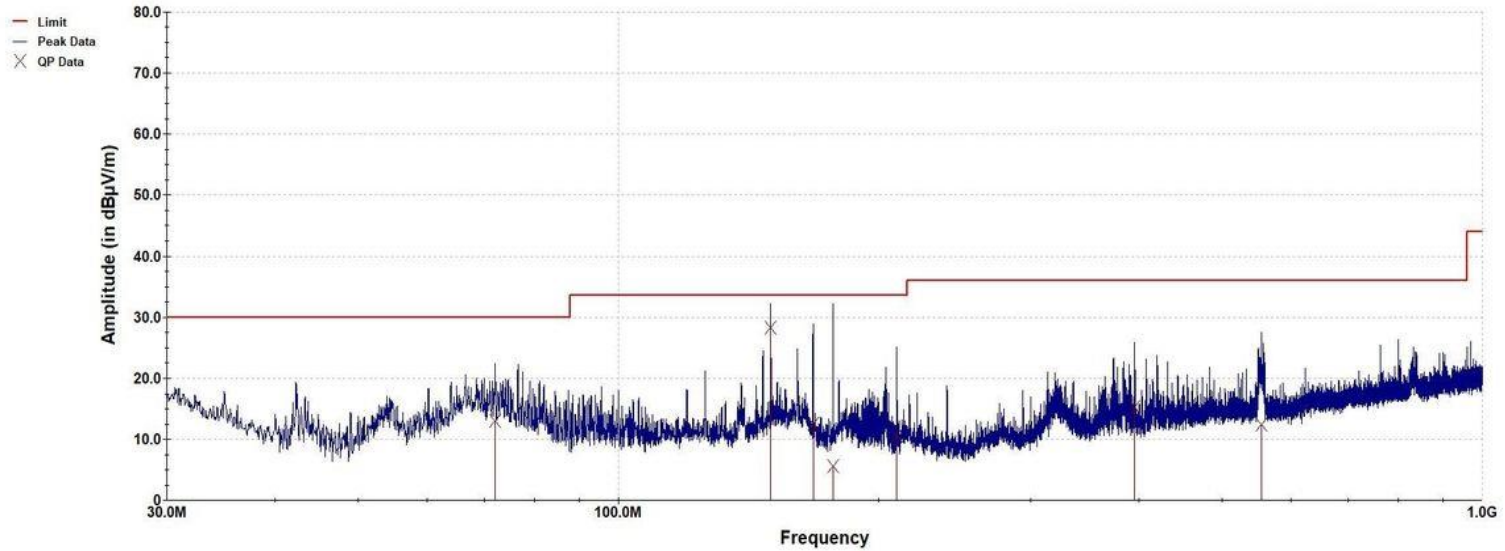
Frequency (MHz)	QP (in dBuV)	Delta QP to Limit (in dBuV)	Height (in cm)	Azimuth (in Degrees)
146.990 MHz	20.111	-13.409	281	273
150.010 MHz	26.945	-6.575	347	73
161.210 MHz	19.214	-14.306	124	89
239.990 MHz	9.388	-26.632	309	145
294.010 MHz	11.555	-24.465	108	160
517.910 MHz	11.456	-24.564	322	76
712.130 MHz	13.964	-22.056	353	103
Standard Limit:				
FCC Class B				
120Vac/60Hz				

Radiated Emissions Horizontal Quasi-Peak Data Table, XL0119040262

Standard Limit:
FCC Class B
120Vac/60Hz

Radiated Emissions
Peak and Quasi-peak Measurements
Graph Vertical Data

EUT - ExpressVoteXL
Serial # - XL0119040262
Mode of Operation - Shoe-shine Mode



Operator: T. Wittig

Last Data Update 12:27:03 PM, Wednesday, August 09, 2023

Customer: PRO V&V

PR#: PR171953

Radiated Emissions Graph Vertical Data, XL0119040262



Radiated Emissions

Table: Vertical Quasi-Peaks below 1 GHz

Operator: T. Wittig

EUT: ExpressVoteXL
PR#: PR171953
Customer: PRO V&V

Frequency (MHz)	QP (in dBuV)	Delta QP to Limit (in dBuV)	Height (in cm)	Azimuth (in Degrees)
71.990 MHz	13.021	-16.979	167	182
149.950 MHz	28.281	-5.239	115	323
167.990 MHz	12.527	-20.993	287	276
177.210 MHz	5.550	-27.970	240	27
209.890 MHz	10.638	-22.882	108	308
396.110 MHz	15.348	-20.672	296	130
554.670 MHz	12.484	-23.536	364	222
Standard Limit:				
FCC Class B				
120Vac/60Hz				

Radiated Emissions Vertical Quasi-Peak Data Table, XL0119040262



5.1.6 Test Equipment List

Table 5.1-1: Radiated Emissions Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059623	Chamber (EMI, Semi-Anechoic)	Rayproof	SR2	NCR	NCR
WC059745	Power Supply (AC)	California Instruments	MX15-1	NCR	NCR
WC059822	Receiver	Keysight Technologies	N9038A	09/21/2022	09/21/2023
WC070276	Antenna (Biconical)	Sunol Sciences	JB1	09/21/2021	09/21/2023
WC076938	Cable (Test)	N/A	RF Coax Cable	09/16/2022	09/16/2023
WC076941	Cable (Test)	Teledyne-taber	Teledyne RF Coax Cable	09/15/2022	09/15/2023
WC078465	Amplifier (Pre/RF/Low Noise)	Pasternack Enterprises	PE15A1013	09/06/2022	09/06/2023
WC078470	Software	ETS-Lindgren	C47213	NCR	NCR
WC078488	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	02/15/2023	02/15/2024
WC059431	Controller (System)	Sunol Sciences	SC110V	NCR	NCR
WC059550	Amplifier (Pre/RF/Low Noise)	Ciao Wireless	1-18 GHZ	06/01/2023	06/01/2024
WC059551	Amplifier (Pre/RF/Low Noise)	Pasternack Enterprises	EMCI-LNA-30-1000M	07/05/2023	07/05/2024
WC059584	Antenna (Active Monopole)	ETS-Lindgren	3301B	04/14/2022	04/14/2024
WC059692	Meter (Digital Multimeter)	Fluke	83-3	09/12/2022	09/12/2023
WC059739	Antenna (Biconilog)	Sunol Sciences	JB1	05/18/2021	05/11/2024
WC059742	Antenna (Double Ridge Guide)	EMCO	3115	09/22/2021	02/03/2024
WC076859	Receiver	Rohde & Schwarz	ESW44	01/25/2023	01/25/2024
WC076870	Cable (Test)	Pasternack Enterprises	RF Coaxial Cable (20 meters)	07/05/2023	07/05/2024
WC076925	Cable (Test)	Teledyne-taber	3 M RF Coax Cable	06/01/2023	06/01/2024
WC078490	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	02/15/2023	02/15/2024

Calibration Abbreviations

CAL: Calibration

NCR: No Calibration Required



5.2 Conducted Emissions

5.2.1 Test Procedure

FCC Part 15, Class B

5.2.2 Test Result

Passed

5.2.3 Test Datasheets

National Technical Systems				
Conducted Emissions, FCC Part 15, Class B				
Standard Referenced: FCC Part 15, Class B			Date: 8/10/2023	
Temperature: 24°C		Humidity: 38%		Pressure: 836 mb
Input Voltage: 120Vac/60Hz			LISN Bonding: 1.8 milliohms	
Configuration of Unit: Shoe-shine Mode			Sweep Time Check: Yes	
Test Engineer: T. Wittig				
Date	Time	Log Entries	Initials	Result
8/10/2023	0800	Performed CE pre-test verification and ambient scans on L1 and Neutral prior to testing	TW	Complete
		Setup EUT 10 meter ground plane	TW	Complete
	0830	Begin Conducted Emissions, 150 kHz - 30 MHz. FCC Part 15. Class B (4.1.2.9)	TW	---
		Completed CE testing	TW	Pass

“Type” refers to the type of measurement performed. The type of measurement made is based on the requirements of the particular standard:

PK = Peak Measurement: RBW is 9 kHz, VBW is 3 MHz

QP = Quasi-Peak Measurement: RBW is 9 kHz, VBW is 3 MHz, and QP Detection is ENABLED

AV = Video Average Measurement: RBW is 9 kHz, VBW is 10 Hz

The “CE Level” is attained by adding the conducted amplitude measured (CA), Attenuation Cal factor (ACF), cable factor (CF) plus the LISN Cal Factor (LCF). CE Level = CA + ACF + CF + LCF . If applicable, cables positions are noted in the test log. (Sample Calculation: -7.5 dBuV + 20.2 dB + 1.5 dB + 23.8 dB= 38 dBuV. **Important Note:** This is a sample calculation only for the purpose of demonstration, and does not reflect data in this report.)

The “TestPoint” indicates which AC or DC input power line or which I/O cable the measurement was made on.

The “Margin” is with reference to the emissions limit. A positive number indicates that the emission measurement is below the limit. A negative number indicates that the emission measurement exceeds the limit.

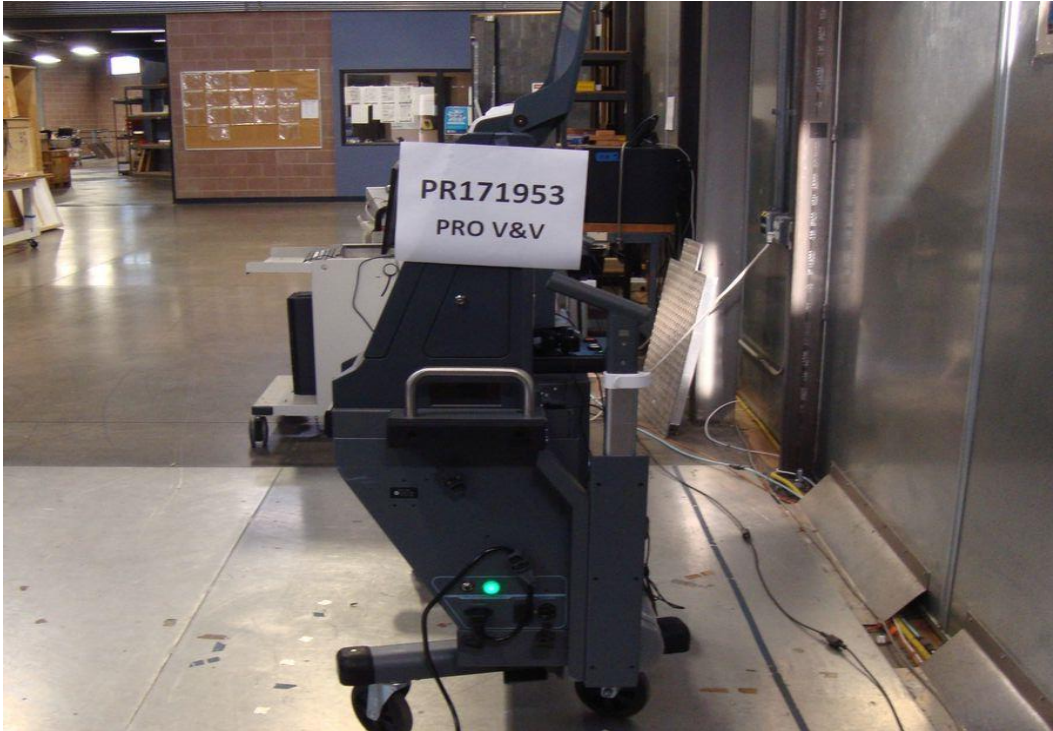
5.2.4 Test Photographs



Conducted Emissions Test Setup Photo - Front



Conducted Emissions Test Setup Photo - Left

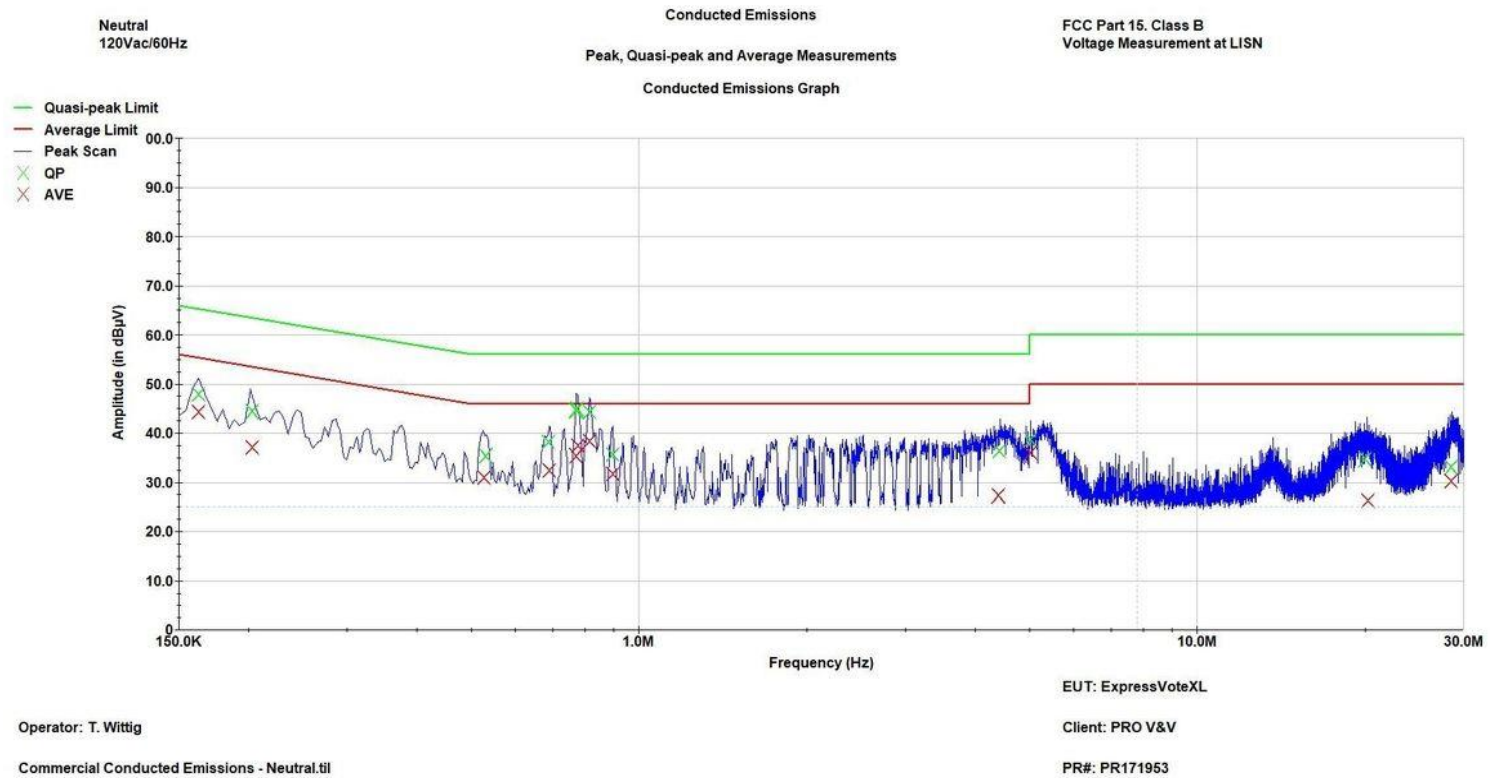


Conducted Emissions Test Setup Photo - Right



Conducted Emissions Test Setup Photo - Back

5.2.5 Test Data



Conducted Emissions Graph Neutral



Conducted Emissions
Quasi-Peak Data Table

Operator: T. Wittig
09:34:36 AM, Thursday, August 10, 2023

EUT: ExpressVoteXL
PR#: PR171953
Client: PRO V&V

Frequency (MHz)	Amplitude (in dB μ V)	Quasi-peak Limit (in dB μ V)	Delta to Quasi-peak Limit (in dB)
162.69 KHz	47.95	65.64	-17.69
203.12 KHz	44.53	64.48	-19.95
530.51 KHz	35.34	56.00	-20.66
688.69 KHz	38.14	56.00	-17.86
772.48 KHz	44.76	56.00	-11.24
773.85 KHz	45.08	56.00	-10.92
816.03 KHz	44.32	56.00	-11.68
896.29 KHz	35.66	56.00	-20.34
4.42 MHz	36.35	56.00	-19.65
5.03 MHz	38.72	60.00	-21.28
19.99 MHz	34.72	60.00	-25.28
28.46 MHz	33.21	60.00	-26.79
Neutral			
120Vac/60Hz			

Conducted Emissions Quasi-Peak Data Table Neutral



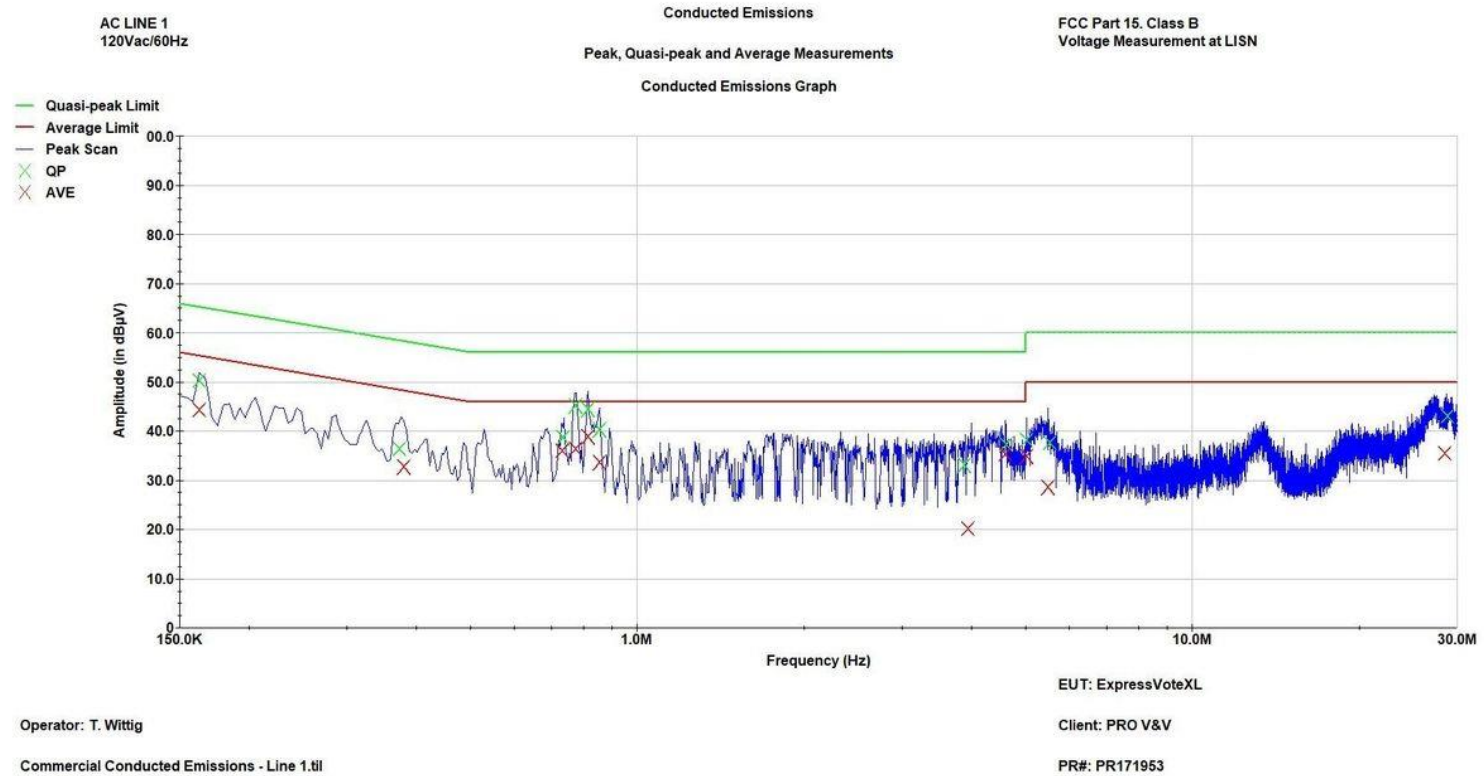
Conducted Emissions
Average Data Table

Operator: T. Wittig
09:38:30 AM, Thursday, August 10, 2023

EUT: ExpressVoteXL
PR#: PR171953
Client: PRO V&V

Frequency (MHz)	Amplitude (in dB μ V)	Average Limit (in dB μ V)	Delta to Average Limit (in dB)
162.69 KHz	44.27	55.64	-11.37
203.12 KHz	37.17	54.48	-17.31
527.49 KHz	30.88	46.00	-15.12
690.96 KHz	32.38	46.00	-13.62
771.59 KHz	35.27	46.00	-10.73
776.02 KHz	37.47	46.00	-8.53
816.04 KHz	38.32	46.00	-7.68
896.30 KHz	31.74	46.00	-14.26
4.40 MHz	27.46	46.00	-18.54
5.03 MHz	36.05	50.00	-13.95
20.17 MHz	26.25	50.00	-23.75
28.48 MHz	30.21	50.00	-19.79
Neutral			
120Vac/60Hz			

Conducted Emissions Average Data Table Neutral



Conducted Emissions Graph Line 1



Conducted Emissions
Quasi-Peak Data Table

Operator: T. Wittig
09:16:59 AM, Thursday, August 10, 2023

EUT: ExpressVoteXL
PR#: PR171953
Client: PRO V&V

Frequency (MHz)	Amplitude (in dB μ V)	Quasi-peak Limit (in dB μ V)	Delta to Quasi-peak Limit (in dB)
162.69 KHz	50.30	65.64	-15.34
372.25 KHz	36.36	59.65	-23.29
735.53 KHz	38.77	56.00	-17.23
775.21 KHz	45.18	56.00	-10.82
816.03 KHz	44.51	56.00	-11.49
856.31 KHz	40.29	56.00	-15.71
3.89 MHz	33.10	56.00	-22.90
4.61 MHz	37.35	56.00	-18.65
5.03 MHz	38.23	60.00	-21.77
5.53 MHz	37.67	60.00	-22.33
28.83 MHz	42.99	60.00	-17.01
AC LINE 1			
120Vac/60Hz			

Conducted Emissions Quasi-Peak Data Table Line 1



Conducted Emissions
Average Data Table

Operator: T. Wittig
09:20:28 AM, Thursday, August 10, 2023

EUT: ExpressVoteXL
PR#: PR171953
Client: PRO V&V

Frequency (MHz)	Amplitude (in dB μ V)	Average Limit (in dB μ V)	Delta to Average Limit (in dB)
162.69 KHz	44.24	55.64	-11.40
379.77 KHz	32.73	49.44	-16.70
733.28 KHz	36.01	46.00	-9.99
775.21 KHz	36.28	46.00	-9.72
816.04 KHz	38.83	46.00	-7.17
854.06 KHz	33.61	46.00	-12.39
3.94 MHz	20.12	46.00	-25.88
4.61 MHz	35.36	46.00	-10.64
5.02 MHz	34.92	50.00	-15.08
5.50 MHz	28.57	50.00	-21.43
28.52 MHz	35.55	50.00	-14.45
AC LINE 1			
120Vac/60Hz			

Conducted Emissions Average Data Table Line 1

5.2.6 Test Equipment List

Table 5.2-1: Conducted Emissions Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059623	Chamber (EMI, Semi-Anechoic)	Rayproof	SR2	NCR	NCR
WC059439	Meter (Digital Multimeter)	Fluke	85	08/15/2022	08/15/2023
WC059589	Meter (Milliohm)	Hewlett Packard	4328A	11/08/2022	04/10/2024
WC059729	Power Supply (AC)	Pacific Power Source	TMX 140	NCR	NCR
WC059822	Receiver	Keysight Technologies	N9038A	09/21/2022	09/21/2023
WC076848	Network (LISN)	Solar Electronics	8012-50-R-25-BNC	02/15/2023	02/15/2024
WC078470	Software	ETS-Lindgren	C47213	NCR	NCR
WC078471	Cable (Test)	N/A	BNC Coaxial Cable	NCR	NCR
WC078490	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	02/15/2023	02/15/2024

Calibration Abbreviations

CAL: Calibration

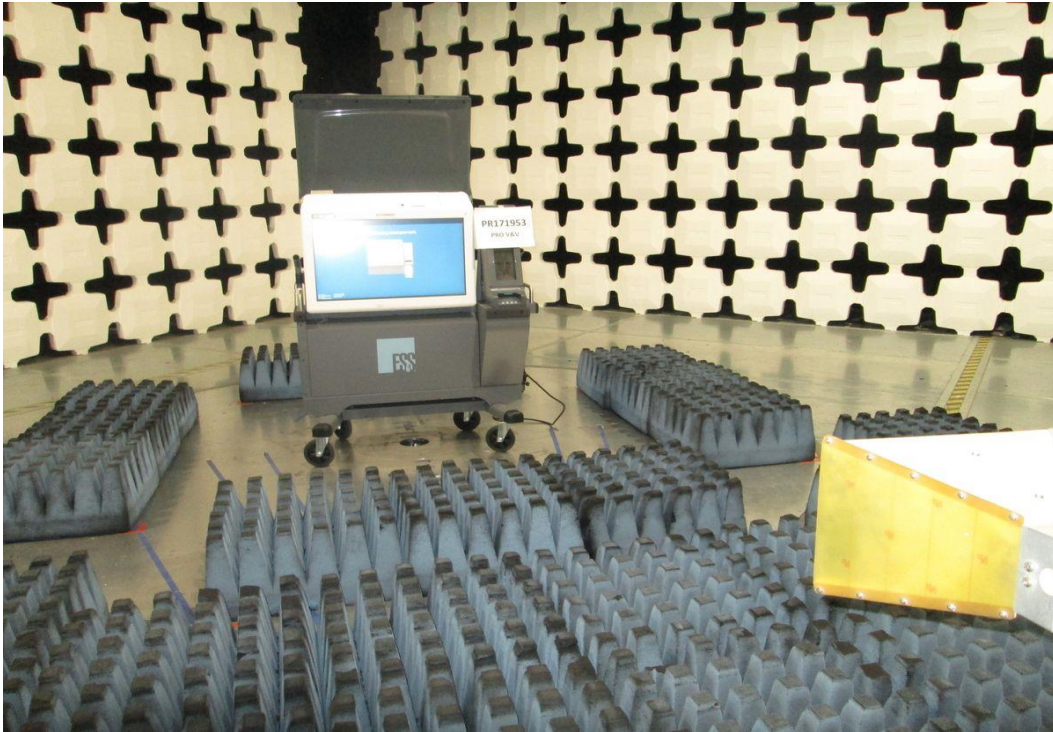
NCR: No Calibration Required

5.3 Radiated Emissions - OH Lower & Upper Levels

5.3.1 Test Procedure

FCC Part 15, Class B

5.3.2 Test Photographs

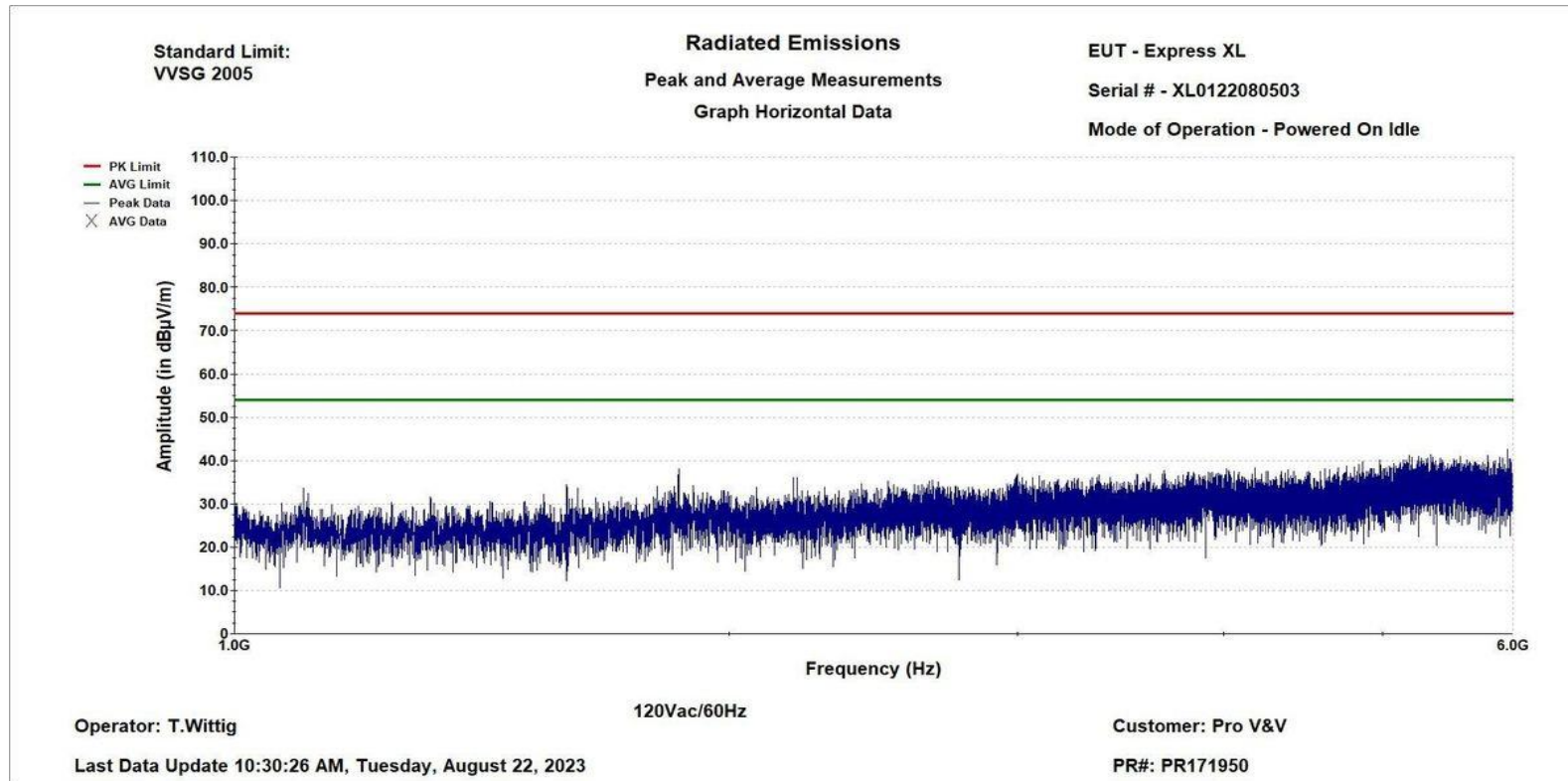


Radiated Emissions - OH Lower & Upper Levels Test Setup – XL0122080503, 1-6 GHz



Radiated Emissions - OH Lower & Upper Levels Test Setup – XL0122080503, 10 kHz-30 MHz

5.3.3 Test Data

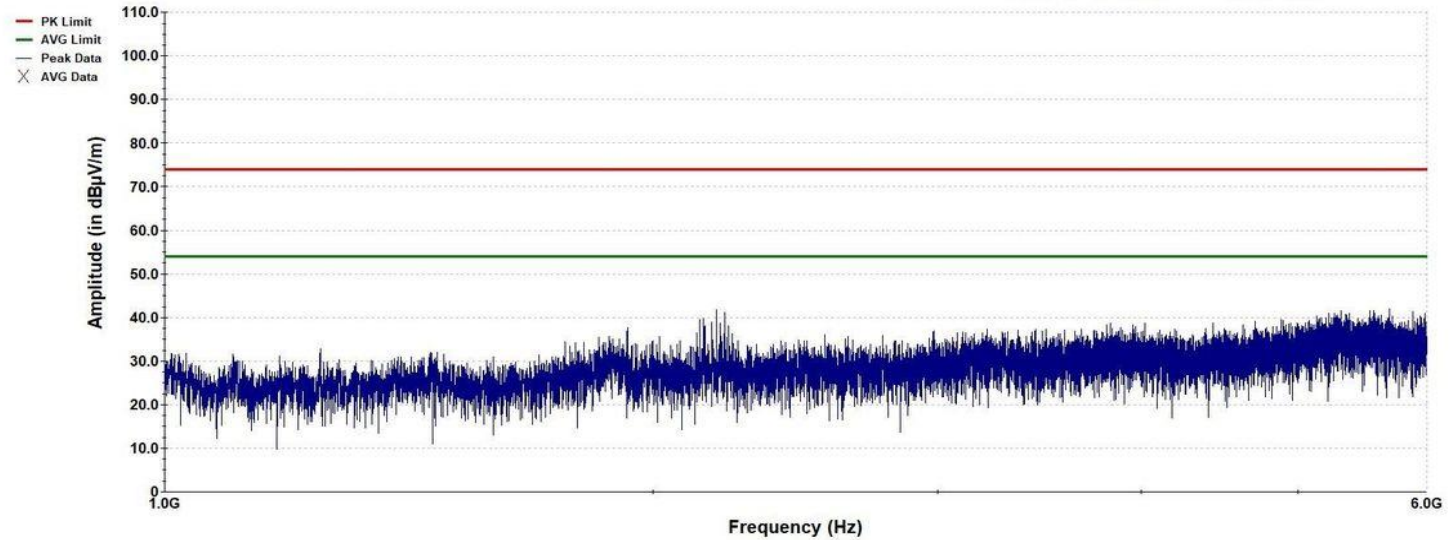


Radiated Emissions - OH Lower & Upper Levels Graph Horizontal 1GHz-6GHz, XL0122080503

Standard Limit:
VMSG 2005

Radiated Emissions
Peak and Average Measurements
Graph Vertical Data

EUT - Express XL
Serial # - XL0122080503
Mode of Operation - Powered On Idle



Operator: T.Wittig

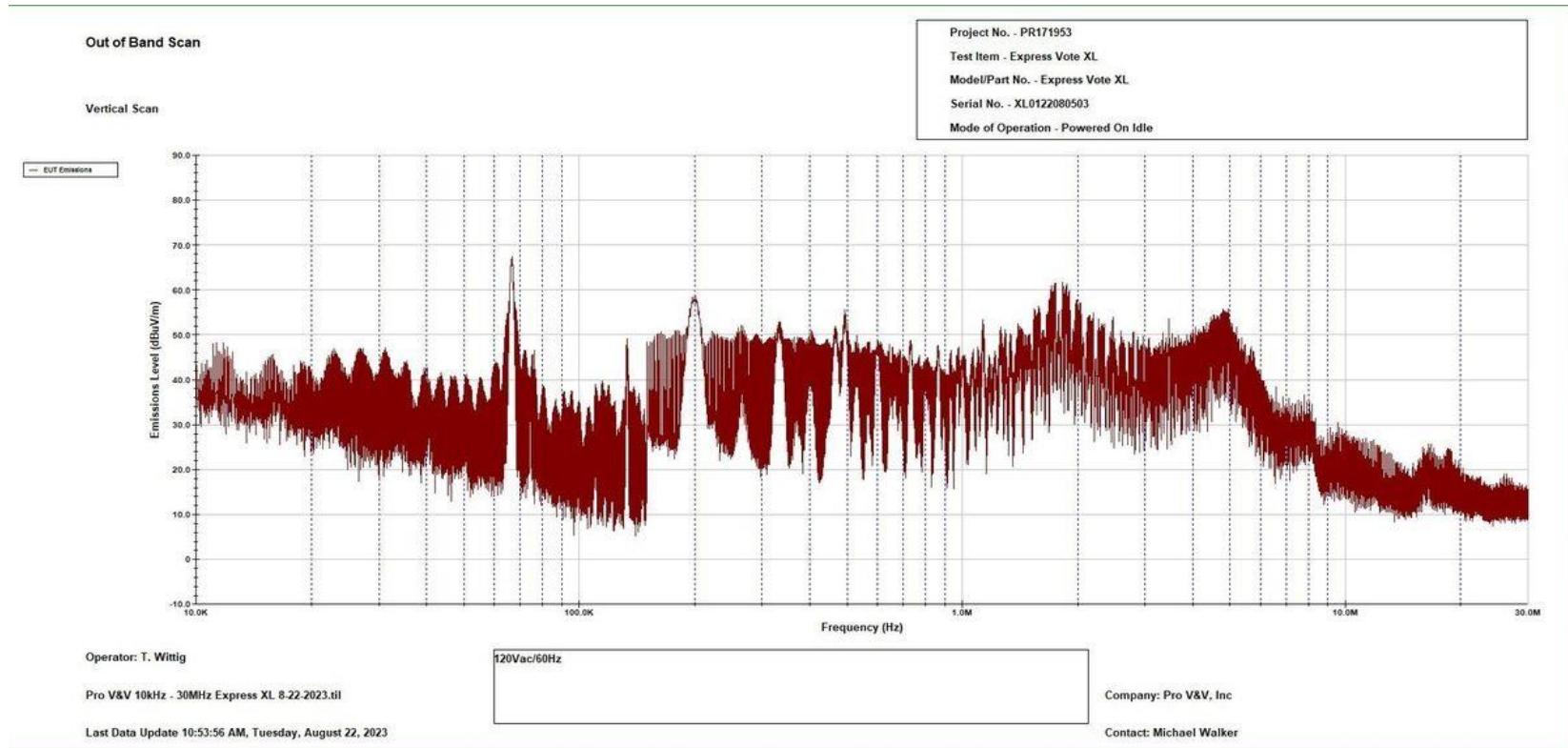
120Vac/60Hz

Customer: Pro V&V

Last Data Update 10:30:45 AM, Tuesday, August 22, 2023

PR#: PR171950

Radiated Emissions - OH Lower & Upper Levels Graph Vertical 1GHz-6GHz, XL0122080503



Radiated Emissions - OH Lower & Upper Levels Graph 10kHz-30MHz, XL0122080503



5.3.4 Test Equipment List

Table 5.3-1: Radiated Emissions - OH Lower & Upper Levels Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059623	Chamber (EMI, Semi-Anechoic)	Rayproof	SR2	NCR	NCR
WC059745	Power Supply (AC)	California Instruments	MX15-1	NCR	NCR
WC059822	Receiver	Keysight Technologies	N9038A	09/21/2022	09/21/2023
WC070276	Antenna (Biconical)	Sunol Sciences	JB1	09/21/2021	09/21/2023
WC076938	Cable (Test)	N/A	RF Coax Cable	09/16/2022	09/16/2023
WC076941	Cable (Test)	Teledyne-taber	Teledyne RF Coax Cable	09/15/2022	09/15/2023
WC078465	Amplifier (Pre/RF/Low Noise)	Pasternack Enterprises	PE15A1013	09/06/2022	09/06/2023
WC078470	Software	ETS-Lindgren	C47213	NCR	NCR
WC078488	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	02/15/2023	02/15/2024
WC059431	Controller (System)	Sunol Sciences	SC110V	NCR	NCR
WC059550	Amplifier (Pre/RF/Low Noise)	Ciao Wireless	1-18 GHZ	06/01/2023	06/01/2024
WC059551	Amplifier (Pre/RF/Low Noise)	Pasternack Enterprises	EMCI-LNA-30-1000M	07/05/2023	07/05/2024
WC059584	Antenna (Active Monopole)	ETS-Lindgren	3301B	04/14/2022	04/14/2024
WC059692	Meter (Digital Multimeter)	Fluke	83-3	09/12/2022	09/12/2023
WC059739	Antenna (Biconilog)	Sunol Sciences	JB1	05/18/2021	05/11/2024
WC059742	Antenna (Double Ridge Guide)	EMCO	3115	09/22/2021	02/03/2024
WC076859	Receiver	Rohde & Schwarz	ESW44	01/25/2023	01/25/2024
WC076870	Cable (Test)	Pasternack Enterprises	RF Coaxial Cable (20 meters)	07/05/2023	07/05/2024
WC076925	Cable (Test)	Teledyne-taber	3 M RF Coax Cable	06/01/2023	06/01/2024
WC078490	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	02/15/2023	02/15/2024

Calibration Abbreviations

CAL: Calibration

NCR: No Calibration Required



End of Test Report