

NTS Labs, LLC Test Report for Electromagnetic Interference (EMI) Testing of the HP Printer

Prepared For

Pro V&V, Inc | 1736 Vista View Drive | Longmont, CO 80504

Performed By

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A handwritten signature in black ink, appearing to read "Andrew Garcia".

Andrew Garcia
Preparer

A handwritten signature in black ink, appearing to read "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	10/28/2022

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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) 2022-016 dated 09/23/2022 and 2022-017 dated 10/06/2022
- NTS Labs, LLC (NTS) Quote(s) OP0626276 dated 09/21/2022
- 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	HP Printer	4001dn	VNB0306793
2	1	HP Printer	M404dn	PHDBC16712

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, 30 MHz - 1 GHz	FCC Part 15 Class B	Longmont	10/17/2022	4001dn	VNB0306793	Passed
5.2	Radiated Emissions, 30 MHz - 1 GHz	FCC Part 15 Class B	Longmont	10/18/2022	M404dn	PHDBC16712	Passed
5.3	Conducted Emissions, 150 kHz - 30 MHz	FCC Part 15 Class B	Longmont	10/18/2022	M404dn	PHDBC16712	Passed
5.4	Conducted Emissions, 150 kHz - 30 MHz	FCC Part 15 Class B	Longmont	10/21/2022	4001dn	VNB0306793	Passed

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



5.1 Radiated Emissions, 30 MHz - 1 GHz

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: <u>FCC Part 15, Class B</u>		Date: <u>10/17/2022</u>		
Temperature: <u>18°C</u> Humidity: <u>27%</u>		Pressure: <u>831 mb</u>		
Input Voltage: <u>120Vac/60Hz</u>		Pretest & Linearity Check: <u>Pass</u>		
Configuration of Unit: <u>Normal Operation</u>		Sweep Time Check: <u>OK</u>		
Test Engineer / Technician: <u>T. Wittig</u>				
Date	Time	Log Entries	Initials	Result
10/17/22	0800	Performed RE pre-test verification	TW/WK	---
	0815	Performed ambient scans	TW/WK	---
	0945	Setup for Radiated Emissions, 30 MHz - 1 GHz FCC Part 15. Class B. 120 VAC / 60 Hz (4.1.2.9)	TW/WK	---
	1200	Continuing Radiated Emissions, 30 MHz - 1 GHz FCC Part 15. Class B. 120 VAC / 60 Hz Trouble shooting Vertical QP.	TW/WK	---
	1330	Continuing Radiated Emissions, 30 MHz - 1 GHz FCC Part 15. Class B. 120 VAC / 60 Hz Trouble shooting Vertical QP Removed non test equipment from chamber.	TW/WK	---
	1400	Continuing Radiated Emissions, 30 MHz - 1 GHz FCC Part 15. Class B. 120 VAC / 60 Hz. Printer EUT in chamber only.	TW/WK	Pass
	1600	RE testing complete	TW/WK	Pass



National Technical Systems	
Radiated Emissions, FCC Part 15, Class B	
Standard Referenced: FCC Part 15, Class B	Date: 10/17/2022
Temperature: 18°C Humidity: 27%	Pressure: 831 mb
Input Voltage: 120Vac/60Hz	Pretest & Linearity Check: Pass
Configuration of Unit: Normal Operation	Sweep Time Check: OK
Test Engineer / Technician: T. Wittig	

“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.)

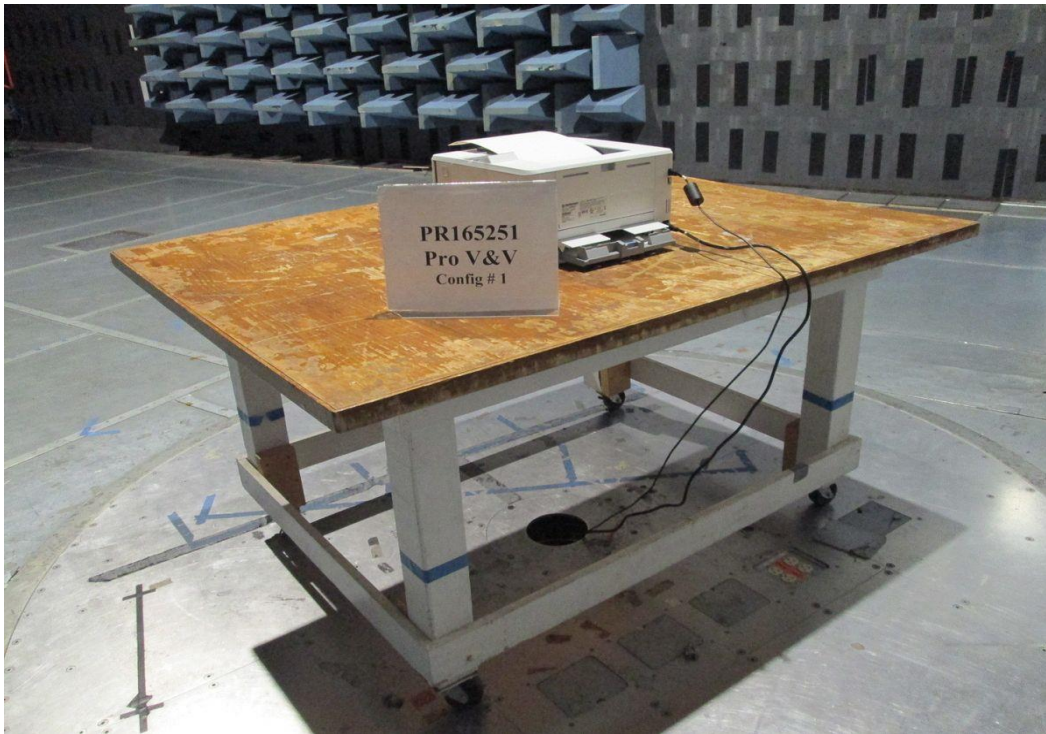
The “Azm/Pol/Hgt” indicates the turn-table azimuth, the antenna polarity, and the antenna height where the maximum emissions level was measured.

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



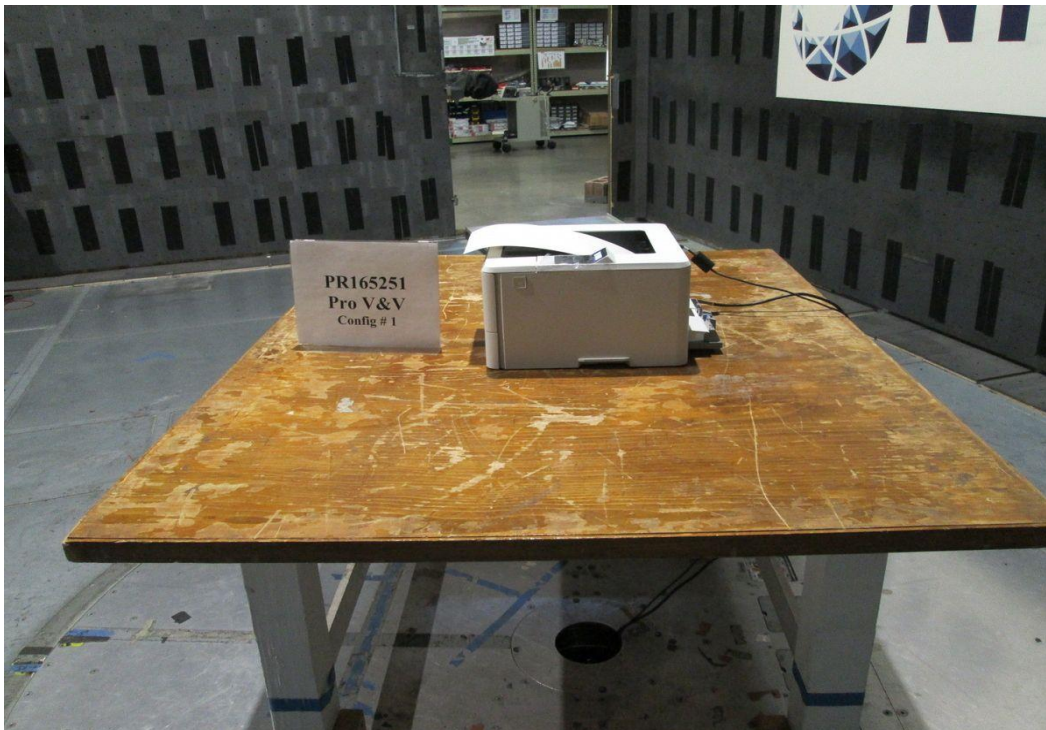
RE Config 1 Back Side



RE Config 1 Front Side



RE Config 1 Left Side



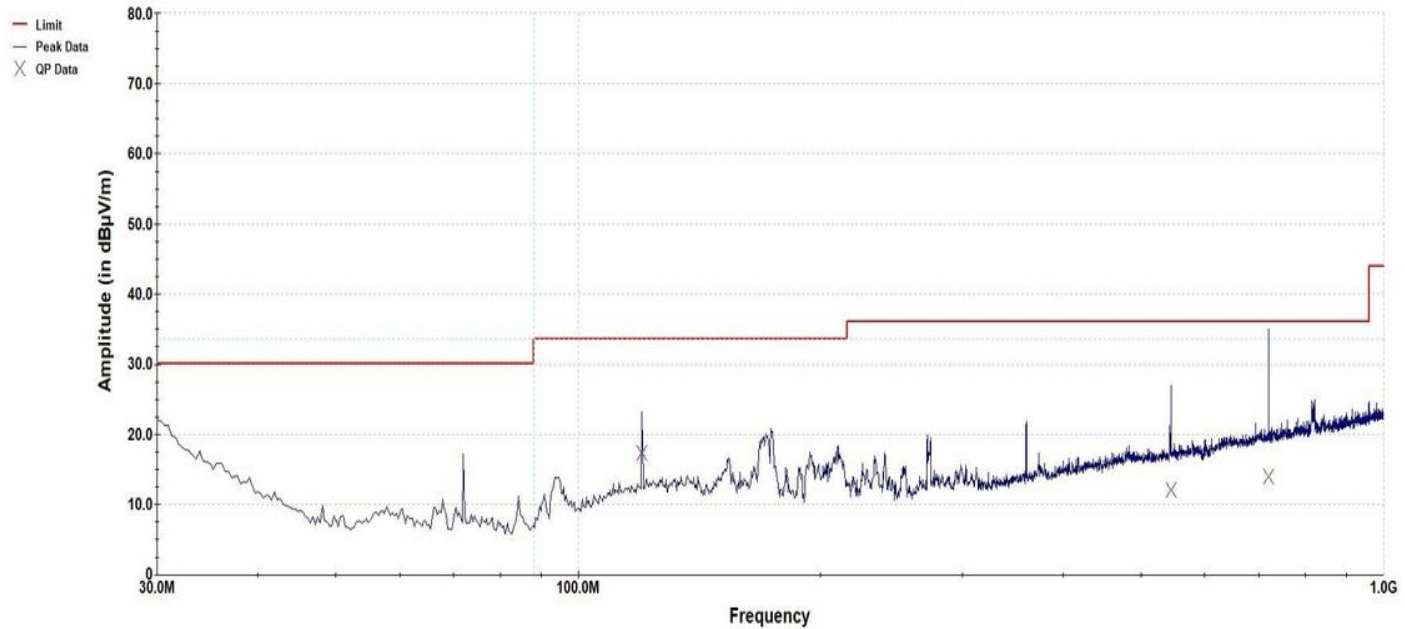
RE Config 1 Right Side

5.1.6 Test Data

FCC Class B
120Vac/60Hz
Configuration #1

Radiated Emissions
Peak and Quasi-peak Measurements
Graph Horizontal Data

EUT - Laser Pro 4001dn
Serial # - VNB0306793
Mode of Operation - Printing mode every 15 seconds



Operator: T. Wittig

Last Data Update 03:21:53 PM, Monday, October 17, 2022

Customer: Pro V&V

PR#: PR165251

Graph Horizontal Data

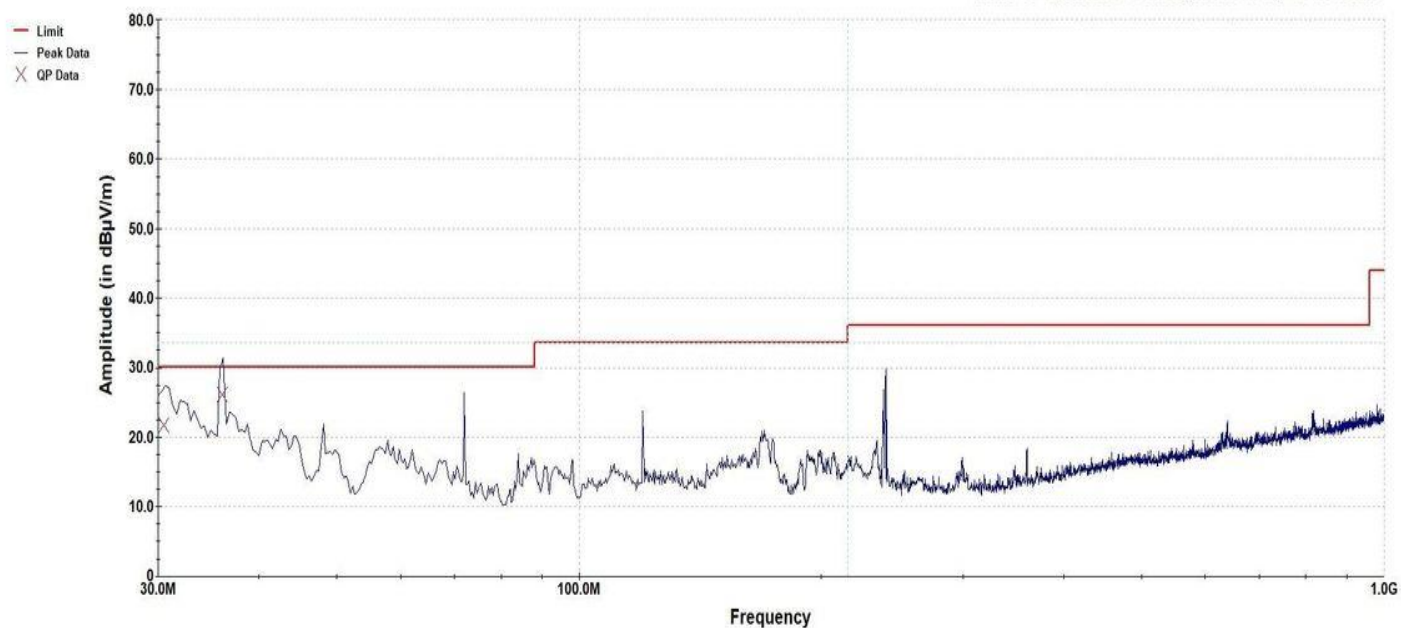
FCC Class B
120Vac/60Hz
Configuration #1

Radiated Emissions
Peak and Quasi-peak Measurements
Graph Vertical Data

EUT - Laser Pro 4001dn

Serial # - VNB0306793

Mode of Operation - Printing mode every 15 seconds



Operator: T. Wittig

Last Data Update 02:36:50 PM, Monday, October 17, 2022

Customer: Pro V&V

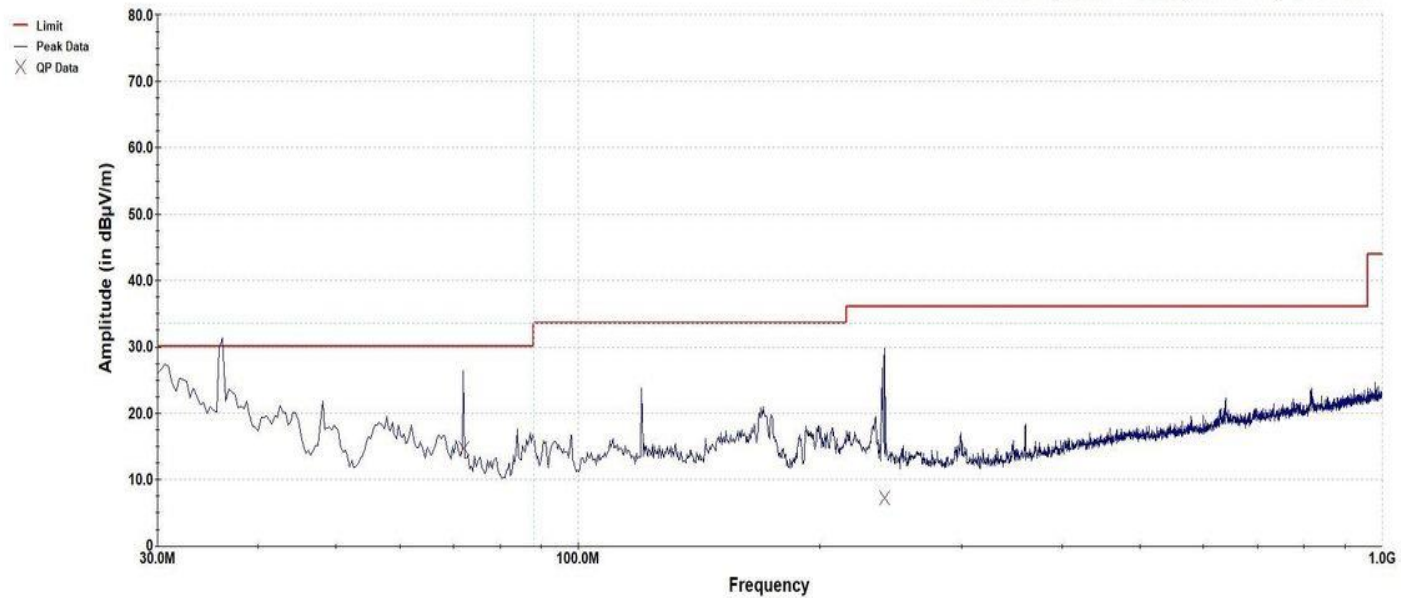
PR#: PR165251

Graph Vertical Data First Partial Scan

FCC Class B
120Vac/60Hz
Configuration #1

Radiated Emissions
Peak and Quasi-peak Measurements
Graph Vertical Data

EUT - Laser Pro 4001dn
Serial # - VNB0306793
Mode of Operation - Printing mode every 15 seconds



Operator: T. Wittig

Last Data Update 02:43:30 PM, Monday, October 17, 2022

Customer: Pro V&V

PR#: PR165251

Graph Vertical Data Second Partial Scan



Operator: T. Wittig

Radiated Emissions
Table: Horizontal Quasi-Peaks below 1 GHz

Frequency (MHz)	QP (in dBuV)	Delta QP to Limit (in dBuV)	Height (in cm)	Azimuth (in Degrees)
119.992 MHz	17.359	-16.161	264	112
544.958 MHz	12.078	-23.942	149	286
719.872 MHz	14.011	-22.009	100	360
FCC Class B				
120Vac/60Hz				
Configuration #1				

Table Horizontal Quasi-Peaks below 1 GHz



Radiated Emissions
Table: Vertical Quasi-Peaks below 1 GHz

Operator: T. Wittig

Frequency (MHz)	QP (in dBuV)	Delta QP to Limit (in dBuV)	Height (in cm)	Azimuth (in Degrees)
30.498 MHz	21.702	-8.298	100	0
35.998 MHz	26.096	-3.904	100	323
FCC Class B				
120Vac/60Hz				
Configuration #1				

Table Vertical Quasi-Peaks below 1 GHz First Partial Scan

Radiated Emissions
Table: Vertical Quasi-Peaks below 1 GHz

Operator: T. Wittig

Frequency (MHz)	QP (in dBuV)	Delta QP to Limit (in dBuV)	Height (in cm)	Azimuth (in Degrees)
72.036 MHz	14.723	-15.277	161	96
240.663 MHz	7.258	-28.762	150	150
FCC Class B				
120Vac/60Hz				
Configuration #1				

Table Vertical Quasi-Peaks below 1 GHz Second Partial Scan



5.1.7 Test Equipment List

Table 5.1-1: Radiated Emissions, 30 MHz - 1 GHz Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059736	Chamber (EMI, Semi-Anechoic)	CIR Enterprises	CH 1	04/03/2022	04/03/2024
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	06/14/2021	01/19/2023

Calibration Abbreviations

CAL: Calibration

NCR: No Calibration Required



5.2 Radiated Emissions, 30 MHz - 1 GHz

5.2.1 Test Procedure

FCC Part 15 Class B

5.2.2 Test Result

Passed

5.2.3 Test Datasheets

National Technical Systems				
Radiated Emissions, FCC Part 15, Class B				
Standard Referenced:		FCC Part 15, Class B	Date: 10/18/2022	
Temperature:		24°C	Humidity: 20%	Pressure: 834mb
Input Voltage: 120Vac, 60Hz			Pretest & Linearity Check: Pass	
Configuration of Unit:		Normal Operation	Sweep Time Check: Ok	
Test Engineer / Technician: W Koenig				
Date	Time	Log Entries	Initials	Result
10/18/22	0800	Setup for Radiated Emissions	WK	---
	0830	Radiated Emissions, 30 MHz - 1 GHz FCC Part 15. Class B. 120 VAC / 60 Hz (4.1.2.9)	WK	Pass
		Testing Complete	WK	Pass



National Technical Systems	
Radiated Emissions, FCC Part 15, Class B	
Standard Referenced: <u>FCC Part 15, Class B</u>	Date: <u>10/18/2022</u>
Temperature: <u>24°C</u> Humidity: <u>20%</u>	Pressure: <u>834mb</u>
Input Voltage: <u>120Vac, 60Hz</u>	Pretest & Linearity Check: <u>Pass</u>
Configuration of Unit: <u>Normal Operation</u>	Sweep Time Check: <u>Ok</u>
Test Engineer / Technician: <u>W Koenig</u>	

“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.

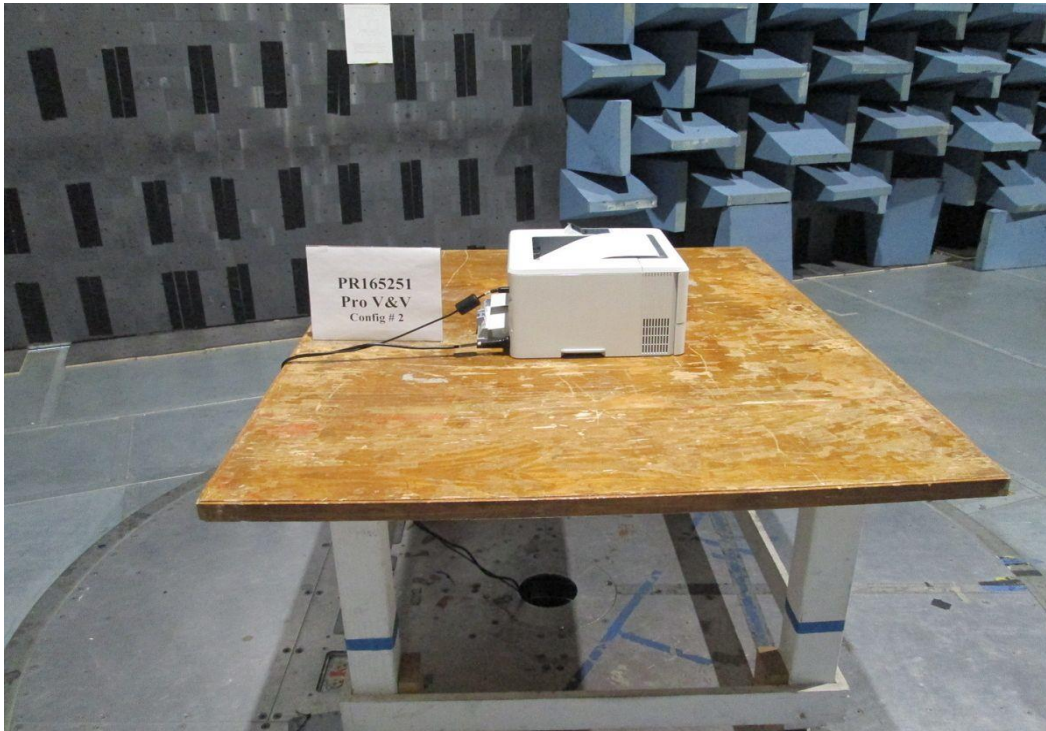
5.2.4 Test Photographs



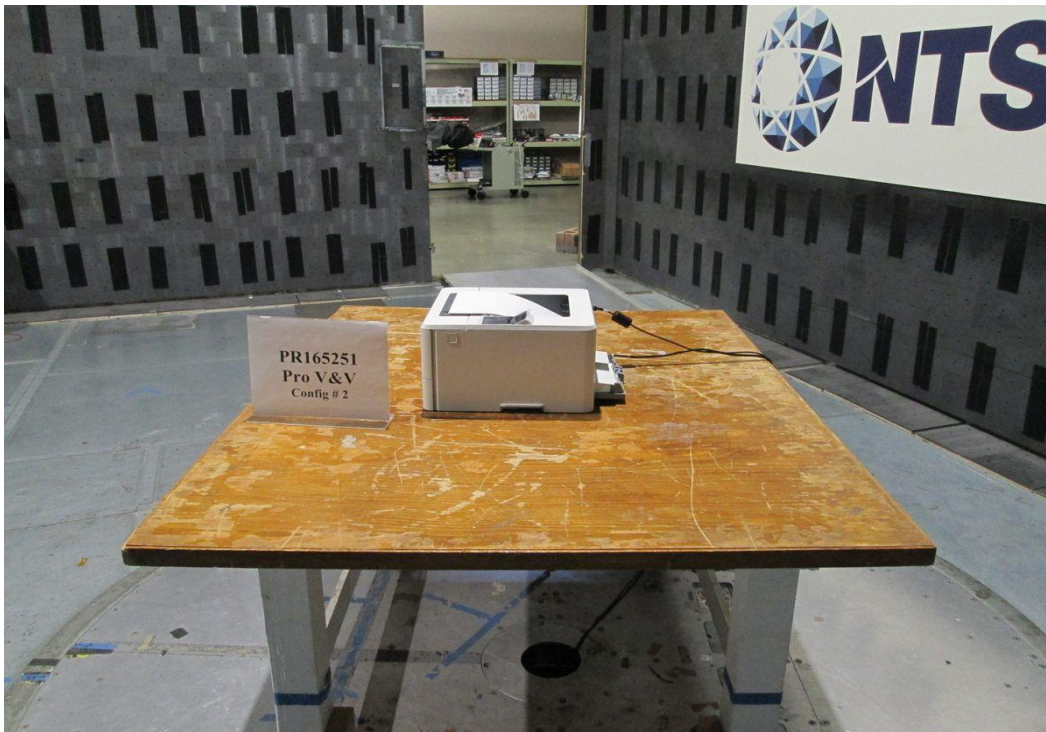
RE Config 2 Back Side



RE Config 2 Front Side



RE Config 2 Left Side



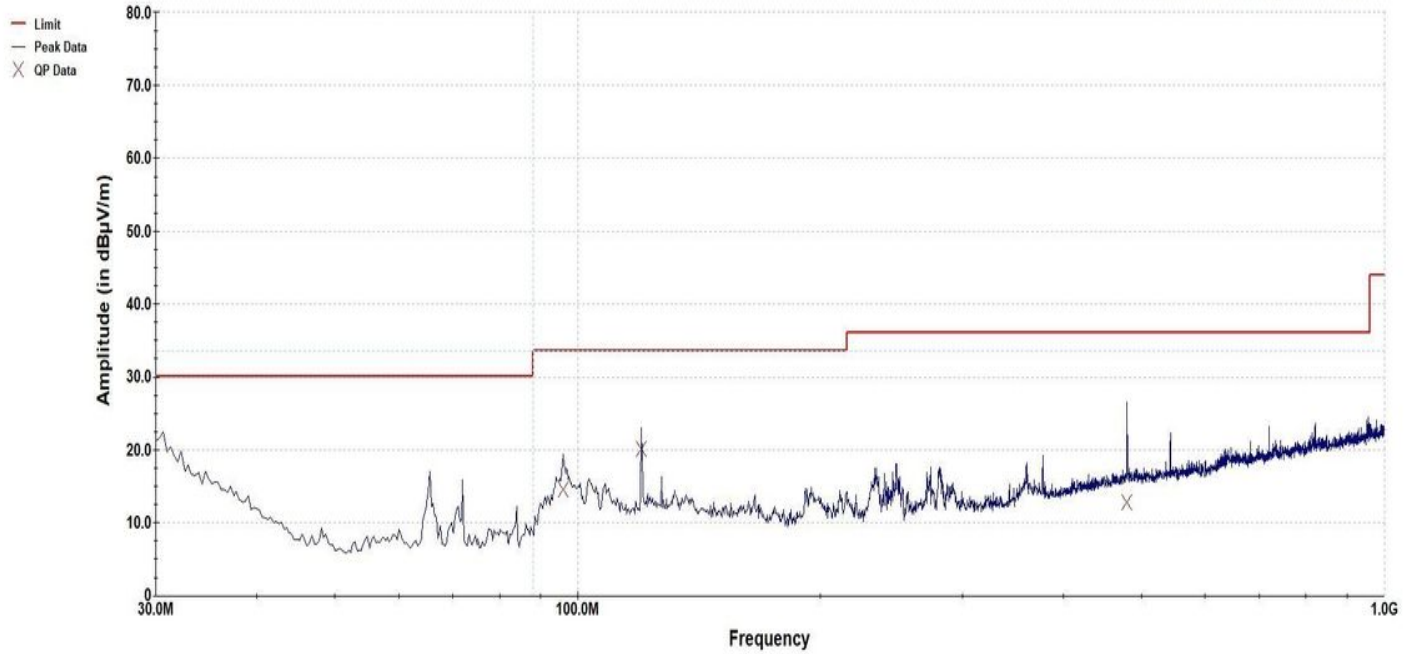
RE Config 2 Right Side

5.2.6 Test Data

FCC Class B
120Vac/60Hz
Configuration #2

Radiated Emissions
Peak and Quasi-peak Measurements
Graph Horizontal Data

EUT - Laser Pro M404dn
Serial # - PHDBC16712
Mode of Operation - Printing mode every 15 seconds



Operator: T. Wittig

Customer: Pro V&V

Last Data Update 09:26:42 AM, Tuesday, October 18, 2022

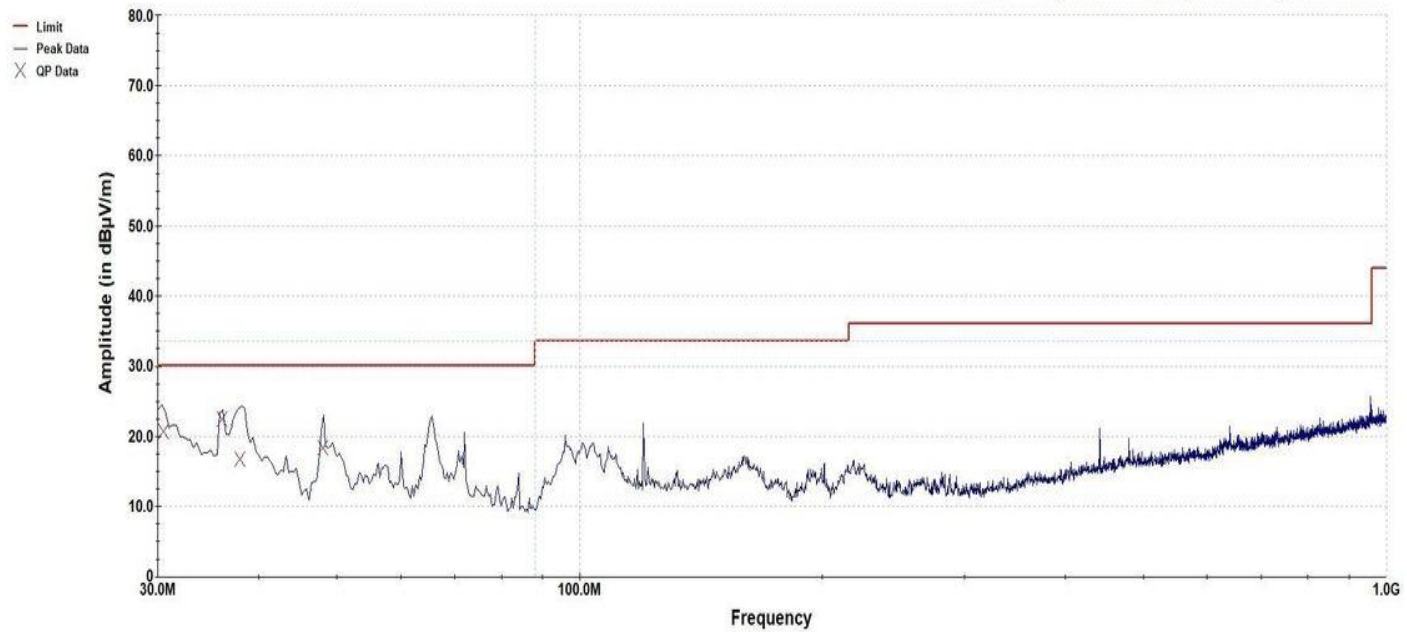
PR#: PR165251

Graph Horizontal Data

FCC Class B
120Vac/60Hz
Configuration #2

Radiated Emissions
Peak and Quasi-peak Measurements
Graph Vertical Data

EUT - Laser Pro M404dn
Serial # - PHDBC16712
Mode of Operation - Printing mode every 15 seconds



Operator: T. Wittig

Customer: Pro V&V

Last Data Update 09:42:23 AM, Tuesday, October 18, 2022

PR#: PR165251

Graph Vertical Data

Radiated Emissions
Table: Horizontal Quasi-Peaks below 1 GHz

Operator: T. Wittig

Frequency (MHz)	QP (in dBuV)	Delta QP to Limit (in dBuV)	Height (in cm)	Azimuth (in Degrees)
95.859 MHz	14.486	-19.034	400	299
119.995 MHz	20.132	-13.388	270	360
479.978 MHz	12.779	-23.241	159	165
FCC Class B				
120Vac/60Hz				
Configuration #2				

Table Horizontal Quasi-Peaks below 1 GHz

Radiated Emissions
Table: Vertical Quasi-Peaks below 1 GHz

Operator: T. Wittig

Frequency (MHz)	QP (in dBuV)	Delta QP to Limit (in dBuV)	Height (in cm)	Azimuth (in Degrees)
30.460 MHz	20.650	-9.350	100	0
36.002 MHz	22.469	-7.531	100	20
37.950 MHz	16.669	-13.331	100	39
48.002 MHz	18.384	-11.616	100	0
FCC Class B				
120Vac/60Hz				
Configuration #2				

Table Vertical Quasi-Peaks below 1 GHz



5.2.7 Test Equipment List

Table 5.2-1: Radiated Emissions, 30 MHz - 1 GHz Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059736	Chamber (EMI, Semi-Anechoic)	CIR Enterprises	CH 1	04/03/2022	04/03/2024
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	06/14/2021	01/19/2023

Calibration Abbreviations

CAL: Calibration

NCR: No Calibration Required



5.3 Conducted Emissions, 150 kHz - 30 MHz

5.3.1 Test Procedure

FCC Part 15 Class B

5.3.2 Test Result

Passed

5.3.3 Test Datasheets

National Technical Systems				
Conducted Emissions, FCC Part 15, Class B				
Standard Referenced: FCC Part 15, Class B		Date: 10/18/2022		
Temperature: 25 C	Humidity: 20%%	Pressure: 842mb		
Input Voltage: 120Vac/60Hz		LISN Bonding: 1.5 mOhms		
Configuration of Unit: Normal Operation		Sweep Time Check: Yes		
Test Engineer: W Koenig				
Date	Time	Log Entries	Initials	Result
10/18/22	1230	Setup for Conducted Emissions	WK	---
	1330	Conducted Emissions, 150 kHz - 30 MHz. FCC Part 15. Class B. 120 VAC / 60 Hz. Line 1	WK	Pass
	1430	Conducted Emissions, 150 kHz - 30 MHz. FCC Part 15. Class B. 120 VAC / 60 Hz. Neutral	WK	Pass
	1500	Testing Complete	WK	Pass



National Technical Systems	
Conducted Emissions, FCC Part 15, Class B	
Standard Referenced: FCC Part 15, Class B	Date: 10/18/2022
Temperature: 25 C Humidity: 20%%	Pressure: 842mb
Input Voltage: 120Vac/60Hz	LISN Bonding: 1.5 mOhms
Configuration of Unit: Normal Operation	Sweep Time Check: Yes
Test Engineer: W Koenig	

“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.

5.3.4 Test Photographs



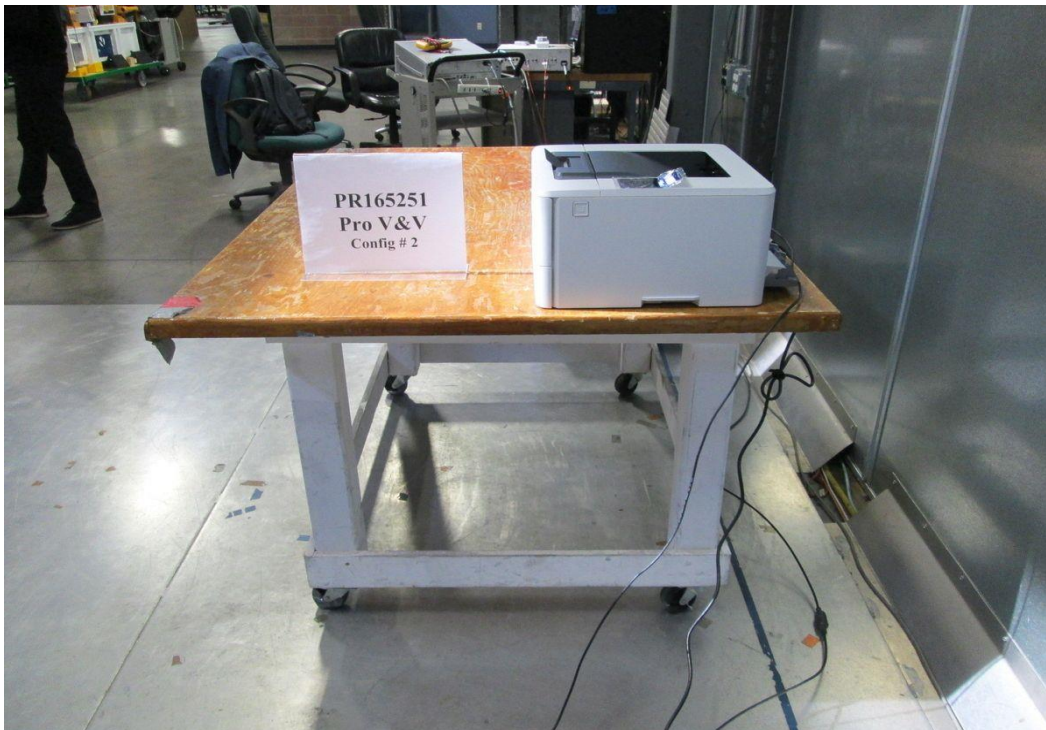
CE Config 2 Back Side



CE Config 2 Front Side

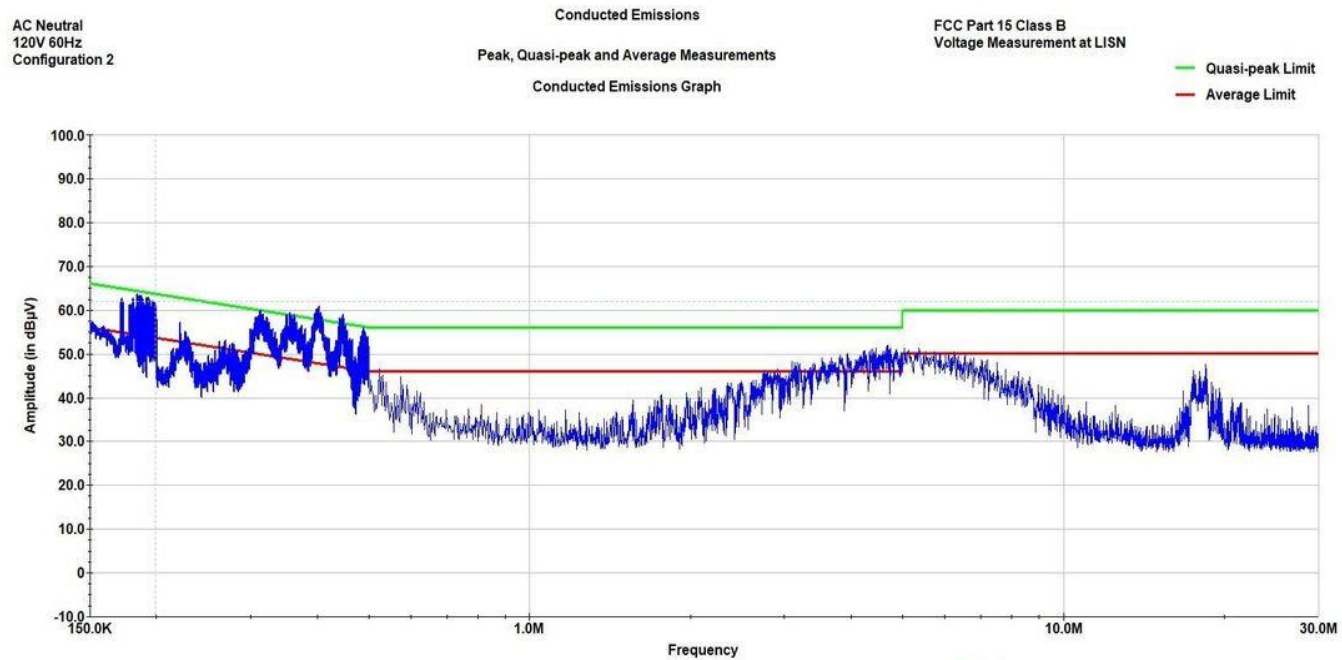


CE Config 2 Left Side



CE Config 2 Right Side

5.3.6 Test Data



Operator: W Koenig

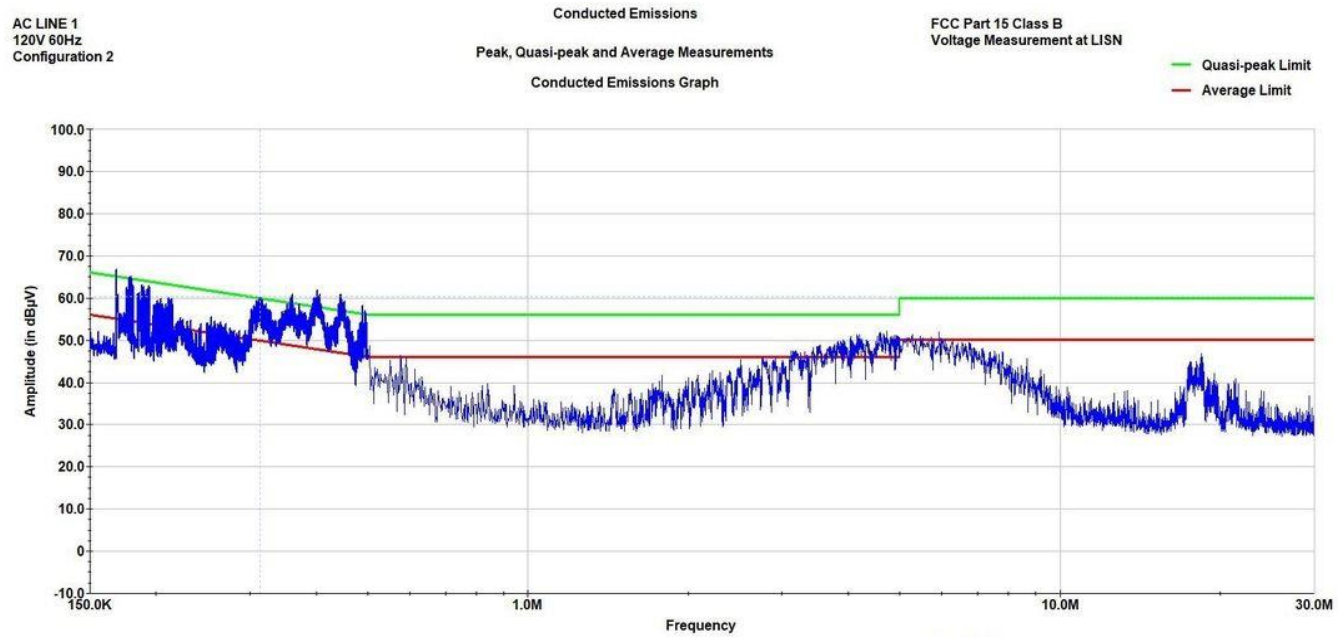
Conducted Emissions FCC - Class B - PR165152 Configuration 2_Neutral.ttl

EUT: M404dn

Client: Pro V&V

PR#: 165251

Conducted Emissions Graph Neutral



Operator: W Koenig

Conducted Emissions FCC - Class B - PR165152 Configuration 2 _ Line 1.ttl

EUT: M404dn

Client: Pro V&V

PR#: 165251

Conducted Emissions Graph Line 1



Conducted Emissions
Average Data Table

Operator: W Koenig
02:55:31 PM, Tuesday, October 18, 2022

Frequency (MHz)	Amplitude (in dBµV)	Average Limit (in dBµV)	Delta to Average Limit (in dB)
400.12 KHz	38.11	48.85	-10.75
447.90 KHz	32.58	47.49	-14.91
3.80 MHz	28.04	46.00	-17.96
4.64 MHz	31.98	46.00	-14.02
4.73 MHz	30.21	46.00	-15.79
AC Neutral			
120V 60Hz			
Configuration 2			

Table Average Data Neutral

Conducted Emissions
 Average Data Table

 Operator: W Koenig
 02:08:11 PM, Tuesday, October 18, 2022

Frequency (MHz)	Amplitude (in dBµV)	Average Limit (in dBµV)	Delta to Average Limit (in dB)
161.25 KHz	33.58	55.68	-22.10
354.51 KHz	36.30	50.16	-13.86
403.65 KHz	38.54	48.75	-10.21
444.10 KHz	32.53	47.60	-15.07
4.23 MHz	31.47	46.00	-14.53
4.64 MHz	31.98	46.00	-14.02
AC LINE 1			
120V 60Hz			
Configuration 2			

Table Average Data Line 1

Conducted Emissions
 Quasi-Peak Data Table

 Operator: W Koenig
 02:51:25 PM, Tuesday, October 18, 2022

Frequency (MHz)	Amplitude (in dB μ V)	Quasi-peak Limit (in dB μ V)	Delta to Quasi-peak Limit (in dB)
401.25 KHz	54.42	58.82	-4.40
445.30 KHz	51.90	57.56	-5.66
3.93 MHz	40.97	56.00	-15.03
4.60 MHz	43.25	56.00	-12.75
4.83 MHz	43.68	56.00	-12.32
AC Neutral			
120V 60Hz			
Configuration 2			

Table Quasi-Peak Data Neutral

Conducted Emissions
 Quasi-Peak Data Table

 Operator: W Koenig
 01:58:23 PM, Tuesday, October 18, 2022

Frequency (MHz)	Amplitude (in dB μ V)	Quasi-peak Limit (in dB μ V)	Delta to Quasi-peak Limit (in dB)
160.32 KHz	40.91	65.71	-24.80
358.26 KHz	51.72	60.05	-8.33
402.16 KHz	53.69	58.80	-5.11
444.55 KHz	50.49	57.58	-7.09
3.94 MHz	44.76	56.00	-11.24
4.84 MHz	44.99	56.00	-11.01
AC LINE 1			
120V 60Hz			
Configuration 2			

Table Quasi-Peak Data Line 1



5.3.7 Test Equipment List

Table 5.3-1: Conducted Emissions, 150 kHz - 30 MHz Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059736	Chamber (EMI, Semi-Anechoic)	CIR Enterprises	CH 1	04/03/2022	04/03/2024
WC059439	Meter (Digital Multimeter)	Fluke	85	08/15/2022	08/15/2023
WC059822	Receiver	Keysight Technologies	N9038A	09/21/2022	09/21/2023
WC076847	Network (LISN)	Solar Electronics	8012-50-R-25-BNC	11/04/2021	11/04/2022
WC078470	Software	ETS-Lindgren	C47213	NCR	NCR
WC078488	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	06/14/2021	01/19/2023

Calibration Abbreviations

CAL: Calibration

NCR: No Calibration Required



5.4 Conducted Emissions, 150 kHz - 30 MHz

5.4.1 Test Procedure

FCC Part 15 Class B

5.4.2 Test Result

Passed

5.4.3 Test Datasheets

National Technical Systems				
Conducted Emissions, FCC Part 15, Class B				
Standard Referenced: FCC Part 15, Class B			Date: 10/21/2022	
Temperature: 20°C	Humidity: 19%		Pressure: 842 mb	
Input Voltage: 120Vac/60Hz			LISN Bonding: 1.8 mΩ	
Configuration of Unit: Normal Operation			Sweep Time Check: Yes	
Test Engineer: Mike Tidquist				
Date	Time	Log Entries	Initials	Result
10/21/22	1400-1530	Conducted Emissions, 150 kHz - 30 MHz. FCC Part 15. Class B. 120 VAC / 60 Hz (4.1.2.9)	MT	Pass

National Technical Systems				
Conducted Emissions, FCC Part 15, Class B				
Standard Referenced: FCC Part 15, Class B			Date: 10/21/2022	
Temperature: 20°C	Humidity: 19%		Pressure: 842 mb	
Input Voltage: 120Vac/60Hz			LISN Bonding: 1.8 mΩ	
Configuration of Unit: Normal Operation			Sweep Time Check: Yes	
Test Engineer: Mike Tidquist				

“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.

5.4.4 Test Photographs



CE 004



CE Back

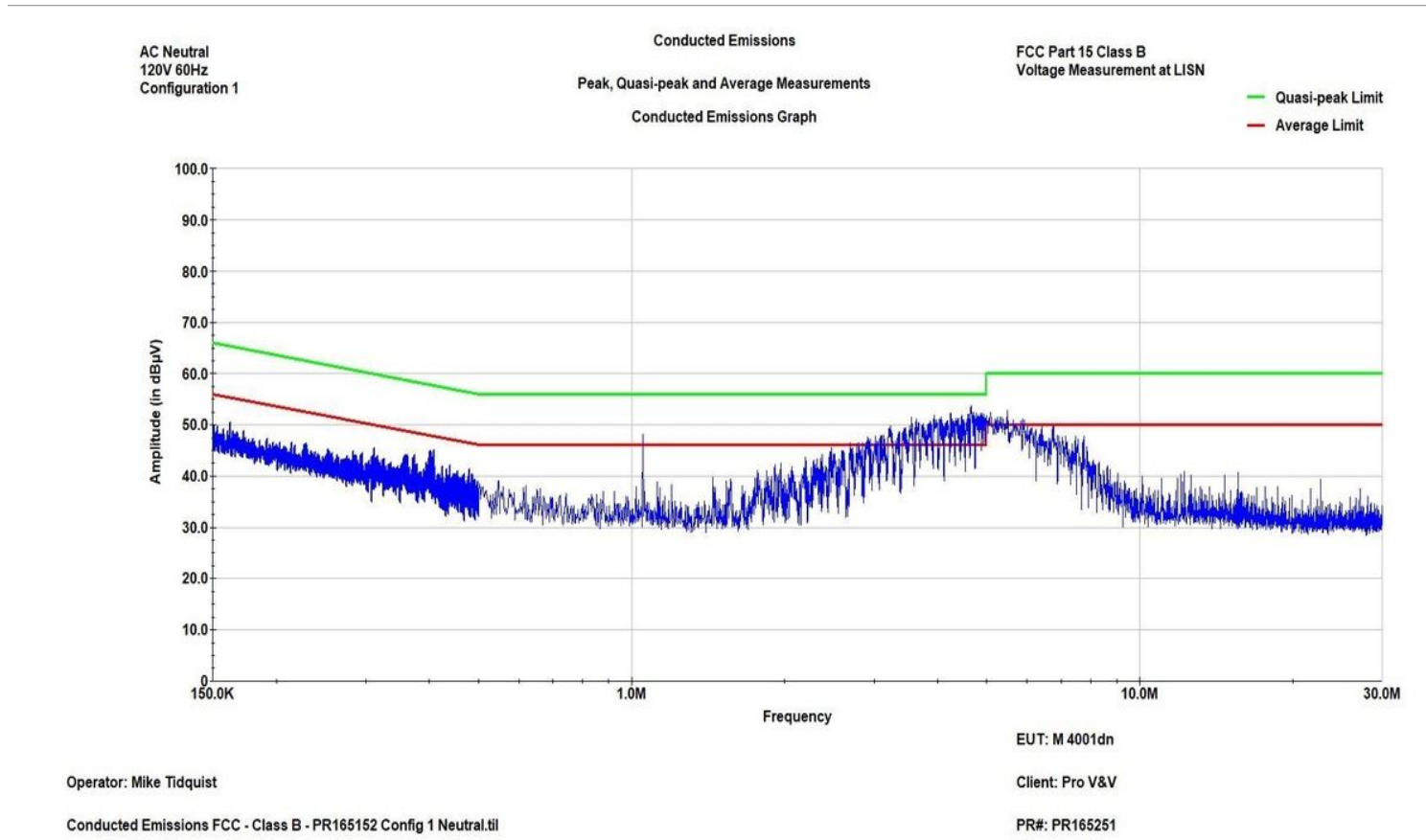


CE Front

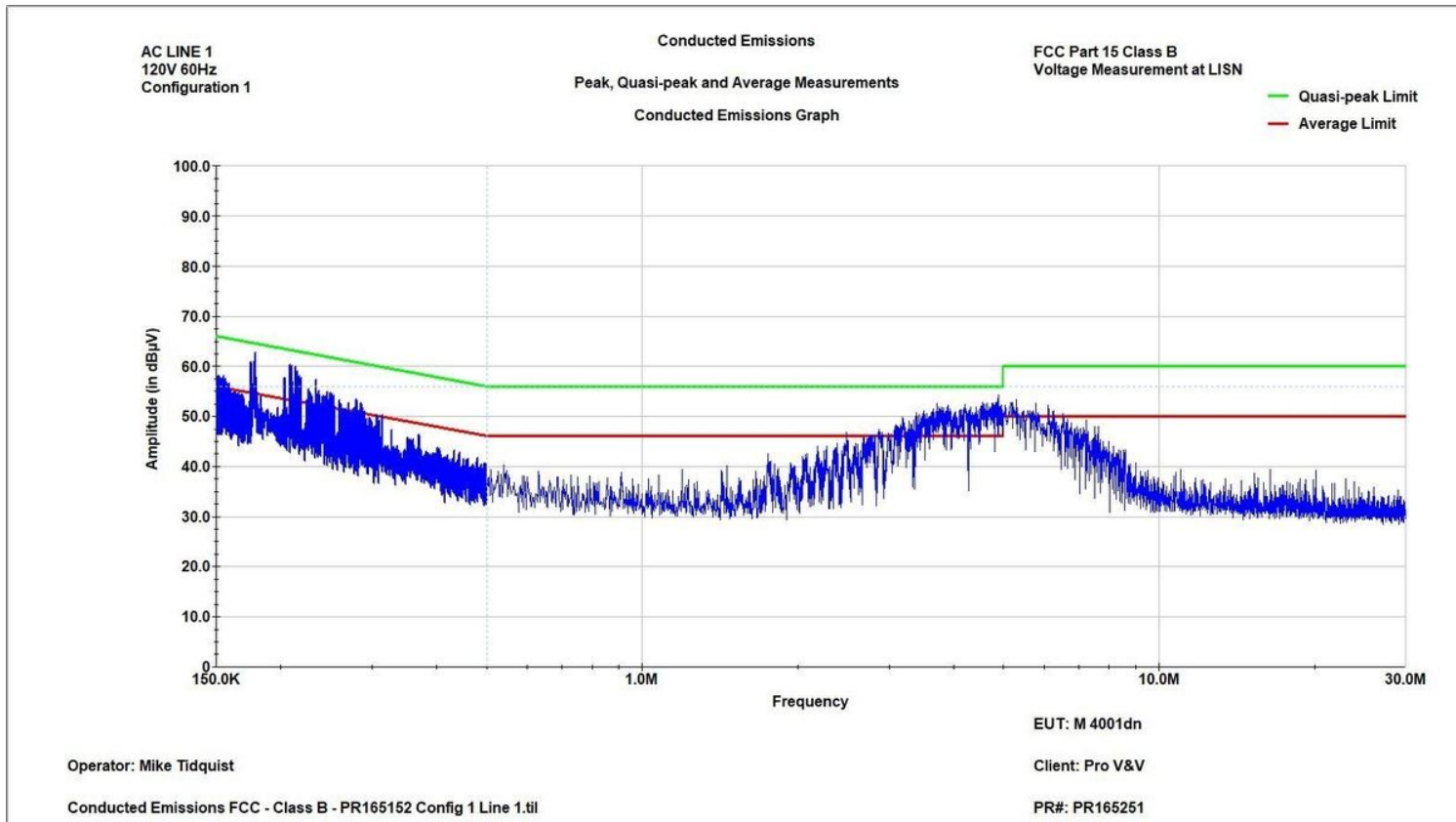


CE Right

5.4.6 Test Data



Conducted Emissions Graph Neutral



Coducted Emissions Graph Line 1



Conducted Emissions
Average Data Table

Operator: Mike Tidquist
02:58:12 PM, Friday, October 21, 2022

EUT: M 4001dn
PR#: PR165251
Client: Pro V&V

Frequency (MHz)	Amplitude (in dBµV)	Average Limit (in dBµV)	Delta to Average Limit (in dB)
159.59 KHz	30.75	55.73	-24.97
295.68 KHz	22.16	51.84	-29.68
399.82 KHz	24.14	48.86	-24.72
1.09 MHz	14.03	46.00	-31.97
2.99 MHz	28.18	46.00	-17.82
3.33 MHz	29.00	46.00	-17.00
3.69 MHz	32.71	46.00	-13.29
3.86 MHz	33.38	46.00	-12.62
4.15 MHz	32.54	46.00	-13.46
4.84 MHz	34.94	46.00	-11.06
4.86 MHz	35.32	46.00	-10.68
5.23 MHz	34.25	50.00	-15.75
5.45 MHz	34.54	50.00	-15.46
5.76 MHz	33.28	50.00	-16.72
AC Neutral			
120V 60Hz			
Configuration 1			

Average Data Table Neutral



Conducted Emissions
Average Data Table

Operator: Mike Tidquist
02:26:12 PM, Friday, October 21, 2022

EUT: M 4001dn
PR#: PR165251
Client: Pro V&V

Frequency (MHz)	Amplitude (in dBμV)	Average Limit (in dBμV)	Delta to Average Limit (in dB)
152.40 KHz	33.93	55.93	-22.00
153.86 KHz	34.47	55.89	-21.42
177.05 KHz	31.56	55.23	-23.66
183.80 KHz	30.90	55.03	-24.13
200.05 KHz	29.72	54.57	-24.85
217.94 KHz	28.98	54.06	-25.08
231.30 KHz	28.29	53.68	-25.38
269.89 KHz	26.93	52.57	-25.65
3.39 MHz	31.69	46.00	-14.31
3.82 MHz	33.44	46.00	-12.56
4.13 MHz	34.00	46.00	-12.00
4.64 MHz	34.15	46.00	-11.85
5.22 MHz	34.16	50.00	-15.84
5.28 MHz	34.64	50.00	-15.36
AC LINE 1			
120V 60Hz			
Configuration 1			

Average Data Table Line 1



Conducted Emissions
Quasi-Peak Data Table

Operator: Mike Tidquist
02:47:48 PM, Friday, October 21, 2022

EUT: M 4001dn
PR#: PR165251
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)
154.30 KHz	55.79	65.88	-10.08
312.83 KHz	35.78	61.35	-25.57
402.16 KHz	35.37	58.80	-23.42
1.02 MHz	26.58	56.00	-29.42
3.07 MHz	44.50	56.00	-11.50
3.36 MHz	46.44	56.00	-9.56
3.67 MHz	44.97	56.00	-11.03
3.85 MHz	47.63	56.00	-8.37
4.20 MHz	47.47	56.00	-8.53
4.82 MHz	49.10	56.00	-6.90
4.87 MHz	48.41	56.00	-7.59
5.01 MHz	47.70	60.00	-12.30
5.44 MHz	48.58	60.00	-11.42
5.67 MHz	46.70	60.00	-13.30
AC Neutral			
120V 60Hz			
Configuration 1			

Quasi-Peak Data Table Neutral



Conducted Emissions
Quasi-Peak Data Table

Operator: Mike Tidquist
02:15:50 PM, Friday, October 21, 2022

EUT: M 4001dn
PR#: PR165251
Client: Pro V&V

Frequency (MHz)	Amplitude (in dBµV)	Quasi-peak Limit (in dBµV)	Delta to Quasi-peak Limit (in dB)
151.75 KHz	42.83	65.95	-23.12
155.30 KHz	42.10	65.85	-23.74
167.10 KHz	39.54	65.51	-25.97
169.62 KHz	55.29	65.44	-10.15
199.57 KHz	48.62	64.58	-15.96
202.72 KHz	36.49	64.49	-28.00
226.16 KHz	37.71	63.82	-26.11
276.71 KHz	33.78	62.38	-28.60
3.48 MHz	45.86	56.00	-10.14
3.87 MHz	47.52	56.00	-8.48
4.38 MHz	47.27	56.00	-8.73
5.01 MHz	48.31	60.00	-11.69
5.03 MHz	47.80	60.00	-12.20
5.45 MHz	47.42	60.00	-12.58
AC LINE 1			
120V 60Hz			
Configuration 1			

Quasi-Peak Data Table Line 1

5.4.7 Test Equipment List

Table 5.4-1: Conducted Emissions, 150 kHz - 30 MHz Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC059736	Chamber (EMI, Semi-Anechoic)	CIR Enterprises	CH 1	04/03/2022	04/03/2024
WC059439	Meter (Digital Multimeter)	Fluke	85	08/15/2022	08/15/2023
WC059729	Power Supply (AC)	Pacific Power Source	TMX 140	NCR	NCR
WC059822	Receiver	Keysight Technologies	N9038A	09/21/2022	09/21/2023
WC076847	Network (LISN)	Solar Electronics	8012-50-R-25-BNC	11/04/2021	11/04/2022
WC078486	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	06/22/2022	06/22/2023
WC078542	Meter (Milliohm)	Extech Instruments	380460	09/01/2022	09/01/2023

Calibration Abbreviations

CAL: Calibration

NCR: No Calibration Required



End of Test Report