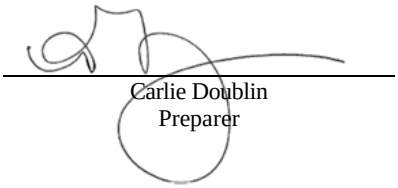
National Technical Systems Test Report for Electromagnetic Interference (EMI) Testing of the Thermal Config #1 and #2

Prepared For
Pro V&V, Inc | 6705 Obyssey Drive NW, Suite C | Huntsville, AL 35806

Performed By
National Technical Systems | 1736 Vista View Drive | Longmont, CO 80504-5242 | 303-776-7249 | www.nts.com



Carlie Doublin
Preparer

John Hill
Program Manager

Revision History

Rev.	Description	Issue Date
0	Initial Release	08/04/2022
1	Page 8, Dell Laptop P/N and S/N information added to test log.	09/01/2022

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List of Tables

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
- Pro V&V, Inc Purchase Order(s) 2022-012, dated 06/29/2022
- National Technical Systems (NTS) Quote(s) OP0620236, dated 06/27/2022
- 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	Thermal Config #1	ClearMark Thermal	4610001001
2	1	Thermal Config #2	ClearMark Thermal	4610001002

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 Unit	Frequency Range
Conducted Emissions	dBuV or dBuA	150 kHz – 30 MHz
Radiated Electric Field	dBuV/m	30-1,000 MHz
		1,000-6,000 MHz

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	Longmont	07/21/2022 - 07/25/2022	74272722 74271221	4610001001 4610001002	NOD #1
5.2	Conducted Emissions	FCC Part 15	Longmont	07/25/2022	74272722 74271221	4610001001 4610001002	Complies

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

5.1.2 Test Result

The Thermal Config #1 and #2 initially did not meet the specification requirements for Radiated Emissions (see NOD #1), ferrite was added to the DC power cable and the test item met the specification requirements for Radiated Emissions.

5.1.3 Test Datasheets

National Technical Systems

Radiated Emissions, FCC Part 15, Class A

Standard Referenced:	FCC Part 15, Class A	Date:	7/20/2022
Temperature:	26°C	Humidity: 45%	Pressure: 841 mb
Input Voltage:	120Vac, 60Hz	Pretest & Linearity Check:	Pass
Configuration of Unit:	Printing/scanning mode (Thermal Config. #1)	Sweep Time Check:	Yes
Test Engineer / Technician:	Mike Tidquist T. Wittig		

Date	Time	Log Entries	Initials	Result
7/20/22	1330-1530	Radiated Emissions, 30 MHz - 1 GHz. FCC Part 15. Class A. 120 VAC / 60 Hz (ClearMark Thermal Config. 1) AIO: 4610001001 Scanner: 4630001001 Printer: 4620001001 Power Supply: Y1823NKF012046 ATI: ATI-6	MT	Fail
7/20/22	1530-1600	Added Ferrite to AC Cable will re-Quasi Peak failing Frequencies will rerun 30MHz - 1Ghz scan tomorrow	MT	Complete
7/21/22	0800	Resumed RE testing in 10 meter #1	TW	---
		EUT failed at 96 MHz, client added ferrites to comply to RE testing	TW	---
		Modifications: added Wurth ferrites to the AC power supply: PN: 74272722, 74271221. Added ferrite to the DC power cable on power supply, PN: 74271221	TW	---
	1000	Re-ran pre-scan, 30 to 1000 MHz	TW	Pass

National Technical Systems

Radiated Emissions, FCC Part 15, Class B

Standard Referenced:	FCC Part 15, Class B	Date:	7/20/2022
Temperature:	27˚C	Humidity: 38%	Pressure: 839 mb
Input Voltage:	120Vac, 60Hz	Pretest & Linearity Check:	Pass
Configuration of Unit:	Printing/scanning mode (Laser Config. #1	Sweep Time Check:	Yes
Test Engineer / Technician:	T. Wittig, M. Tidquist		

Date	Time	Log Entries	Initials	Result
7/21/22	0800	Resumed Radiated Emissions, 30 MHz - 1 GHz, FCC Part 15. Class B. 120 VAC / 60 Hz (4.1.2.9)	TW	---
		Client has a total of four ferrites to be compliant	TW	---
		AC Power Supply: 742-727-22, 742-712-21 DC Power Cable on PS: 742-712-21 AC Cable on UPS: 431-177-081	TW	---
	1230	Due to trouble shooting, was unable to complete testing	TW	---
7/25/22		Complete all RE testing	MT	Pass

National Technical Systems

Radiated Emissions, FCC Part 15, Class A

Standard Referenced:	FCC Part 15, Class A	Date:	8/3/2022
Temperature:	22°C Humidity: 62%	Pressure:	839 mb
Input Voltage:	120Vac, 60Hz	Pretest & Linearity Check:	Pass
Configuration of Unit:	Normal Operation	Sweep Time Check:	Yes
Test Engineer / Technician:	Mike Tidquist		

Date	Time	Log Entries	Initials	Result
8/3/22	0800-1100	OHIO SPECIFIC RE TESTING FOR LOWER AND UPPER LEVELS TO 6GB Radiated Emissions Testing. 120-140 KHz, 2-90Mhz, and 300MHz - 6GHz. (ClearMark Laser Config #1 and ClearMark Thermal Config. 1) Test per Per Client Dell Laptop – P/N LATITUDE 5531 S/N 341BNL3 Dell Laptop - P/N LATITUDE5521 S/N JP3WSG3	MT	Pass

National Technical Systems			
Radiated Emissions, FCC Part 15, Class A			
Standard Referenced:	FCC Part 15, Class A	Date:	7/20/2022
Temperature:	26°C Humidity: 45%	Pressure:	841 mb
Input Voltage:	120Vac, 60Hz	Pretest & Linearity Check:	Pass
Configuration of Unit:	Printing/scanning mode (Thermal Config. #1)	Sweep Time Check:	Yes
Test Engineer / Technician:	Mike Tidquist 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 dBuV + 11.4 dB/m – 28.8 dB (CF/AG) = 32.2 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 storred in the calibration records for the chamber being used.

National Technical Systems			
Radiated Emissions, FCC Part 15, Class B			
Standard Referenced:	FCC Part 15, Class B	Date:	7/20/2022
Temperature:	27°C Humidity: 38%	Pressure:	839 mb
Input Voltage:	120Vac, 60Hz	Pretest & Linearity Check:	Pass
Configuration of Unit:	Printing/scanning mode (Laser Config. #1	Sweep Time Check:	Yes
Test Engineer / Technician:	T. Wittig, M. 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 120kHz, VBW is 3 MHz
QP = Quasi-Peak Measurement: RBW is 120kHz, VBW is 3 MHz, and QP Detection is ENABLED
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The "Azm/Pol/Hgt" indicates the turn-table azimuth, the antenna polarity, and the antenna height where the maximum emissions level was measured.

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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 storred in the calibration records for the chamber being used.

National Technical Systems			
Radiated Emissions, FCC Part 15, Class A			
Standard Referenced:	FCC Part 15, Class A	Date:	8/3/2022
Temperature:	22°C Humidity: 62%	Pressure:	839 mb
Input Voltage:	120Vac, 60Hz	Pretest & Linearity Check:	Pass
Configuration of Unit:	Normal Operation	Sweep Time Check:	Yes
Test Engineer / Technician:	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 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 dBuV + 11.4 dB/m – 28.8 dB (CF/AG) = 32.2 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 storred in the calibration records for the chamber being used.

5.1.4 Notice of Deviation (NOD)

NOTICE OF DEVIATION

Client:	Pro V&V, Inc	Job #:	PR162132	NOD #:	1
P. O. #:	2022-012	Date of Deviation:	7/20/2022	CAR #:	N/A
Notification Made To: (Client Contact)	Client	Notification Made By:	Mike Tidquist		
If notification was not made, provide justification:	N/A				
Date:	7/20/2022	Via:	Verbal		
Test:	Radiated Emissions	Test Item:	ClearMark Thermal Config. 1		
Specification:	FCC Part 15	Model or P/N:	N/A		
Revision/Date:		Serial Number:	Multiple S/N's		

REQUIREMENTS: *(Reference paragraph or section of specification)*

Radiated Emissions per: FCC Part 15 Class B

DESCRIPTION OF DEVIATION

EUT Failed @ 30.36 MHz and 31.56 MHz

DISPOSITIONS/COMMENTS/RECOMMENDATIONS:

Client Added Ferrite to AC Input line, will rerun scan at a later date

Client Disposition Authorization	7/21/22 Date	Kerry Martin NTS Quality Representative	7/21/22 Date
J. Hill NTS Project Manager	7/21/22 Date	N/A Government QAR (if applicable)	N/A Date

NOTE: IT IS THE CLIENT'S RESPONSIBILITY TO ANALYZE AND DISPOSITION DEVIATIONS ON CLIENT TEST PROGRAMS.

FOR NTS QA USE: *Tracking Code:* 5 *Risk Level:* Low

Tracking Codes:

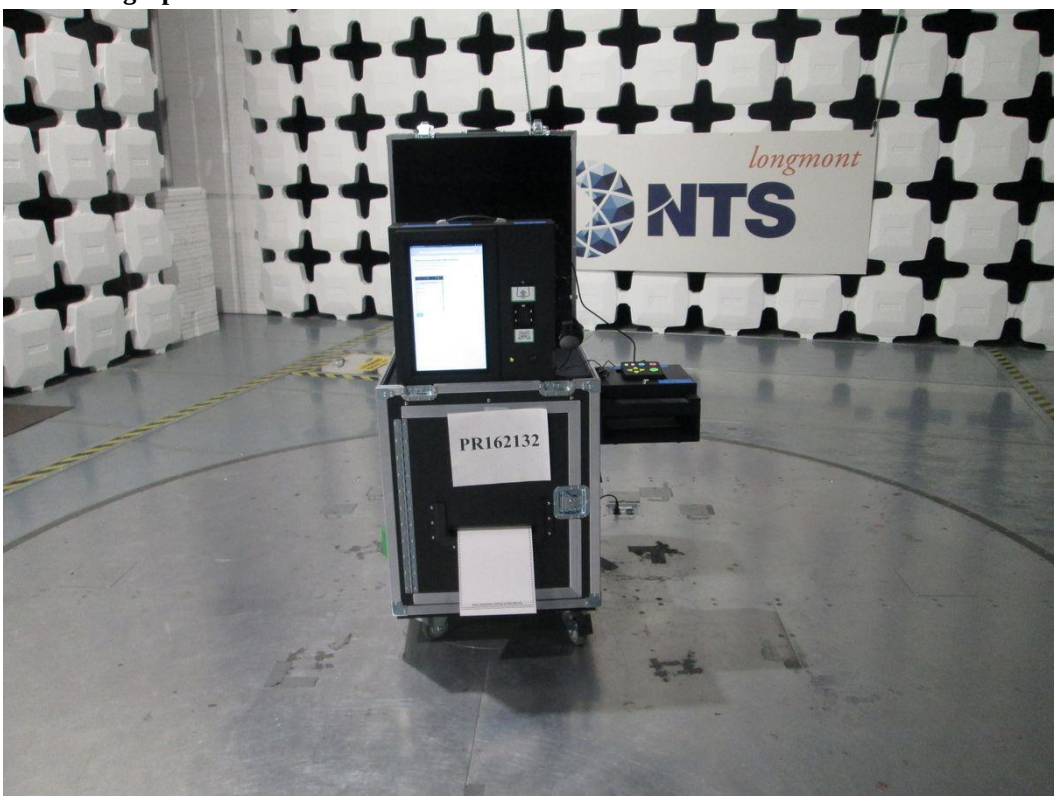
1. Employee Error - Training	2. Employee Error - Process	3. Test Equipment Problem	4. Equipment Limitations	5. Customer Item Problem	6. Other

Risk Levels:

Low	Medium	High

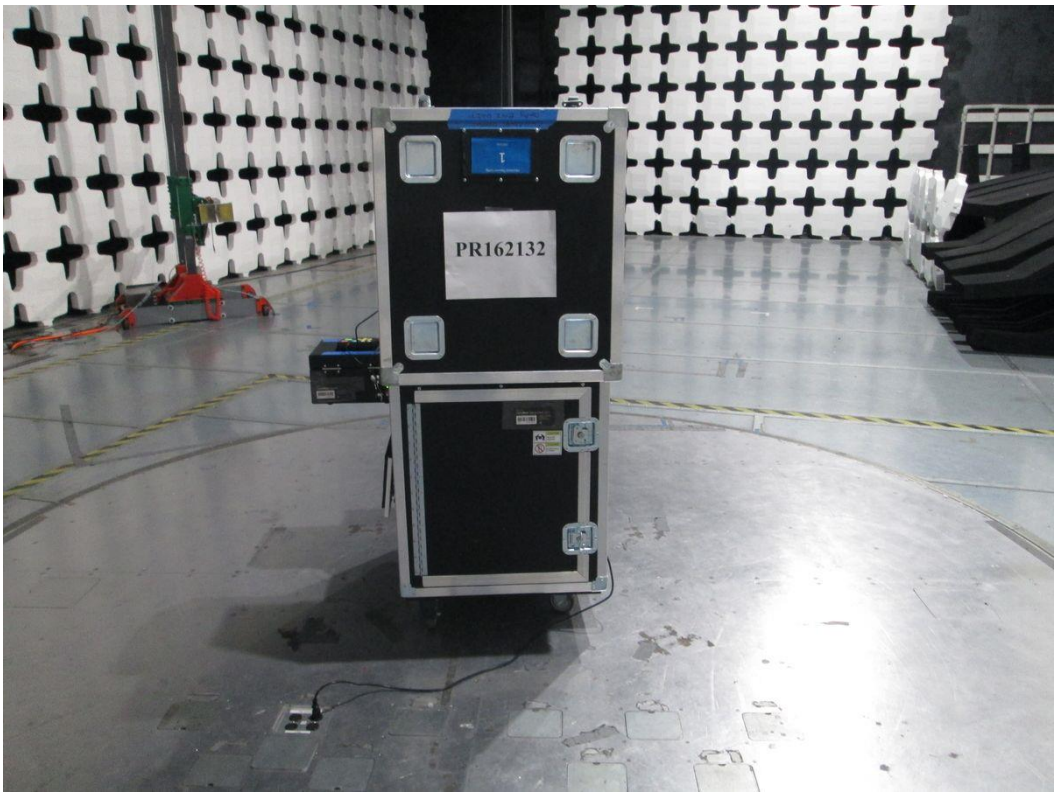
COR 16.0, REV. 7

5.1.5 Test Photographs



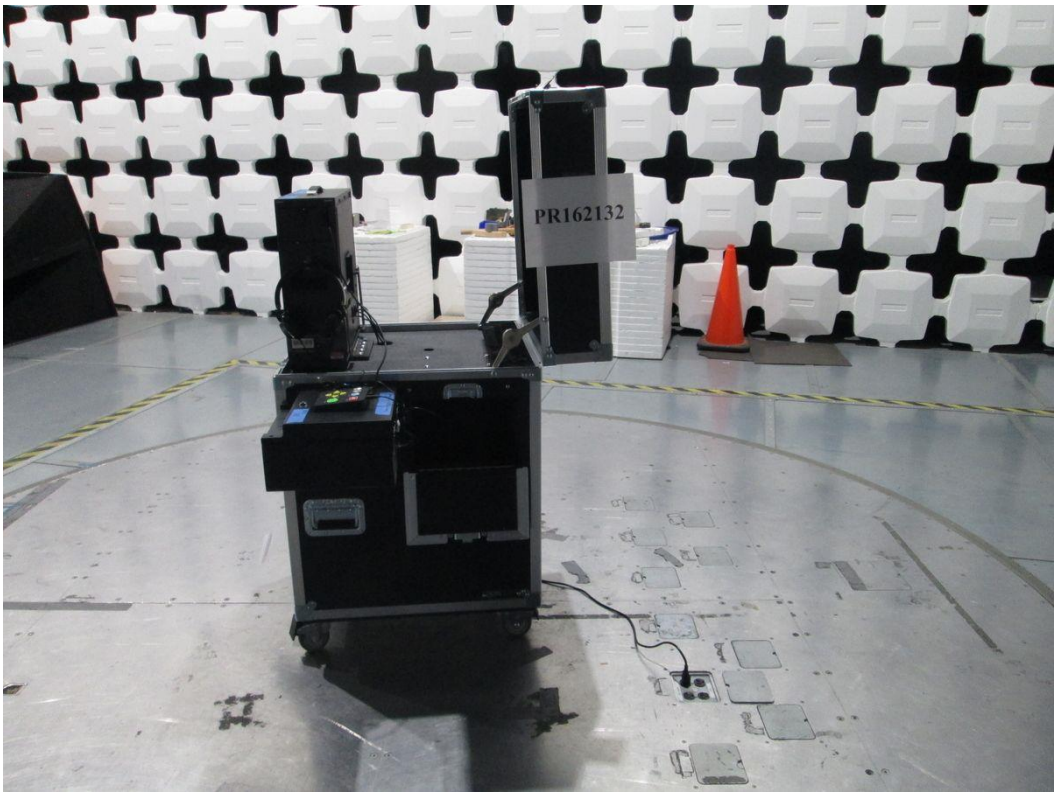
RE 30-1GHz CM Thermal 1 - Front

RE Setup Photo - Front Side 10 Meter



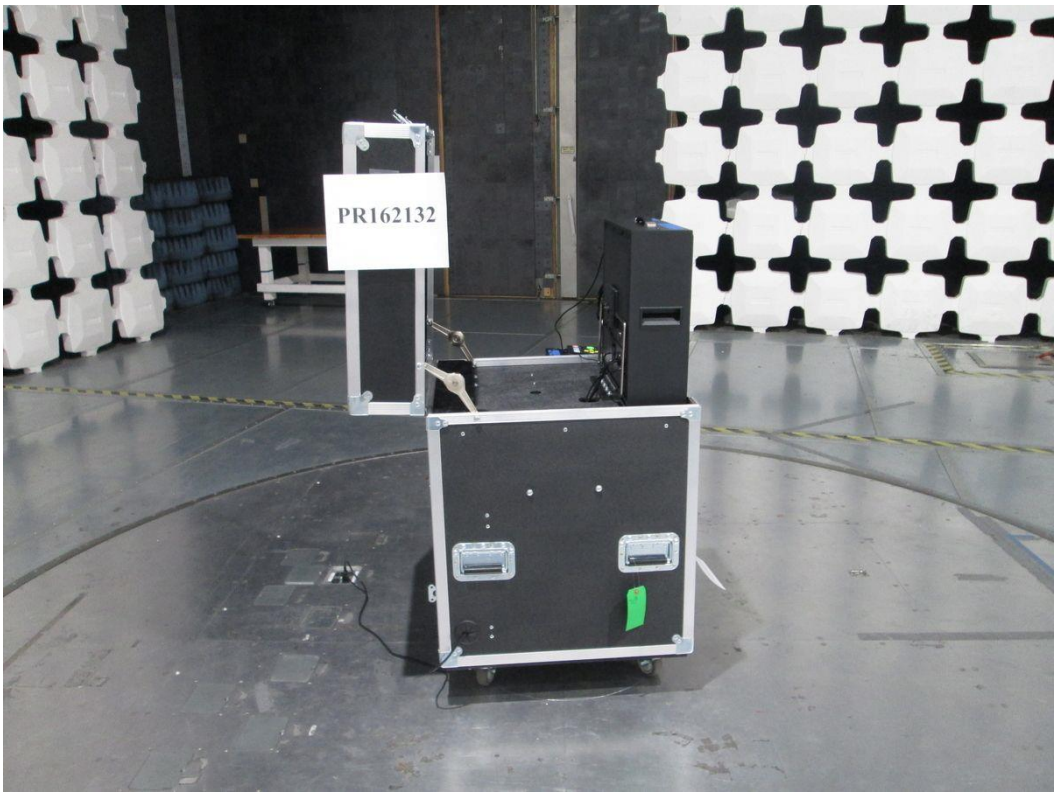
RE 30-1GHz CM Thermal 1 - Back

RE Setup Photo - Back Side 10 Meter

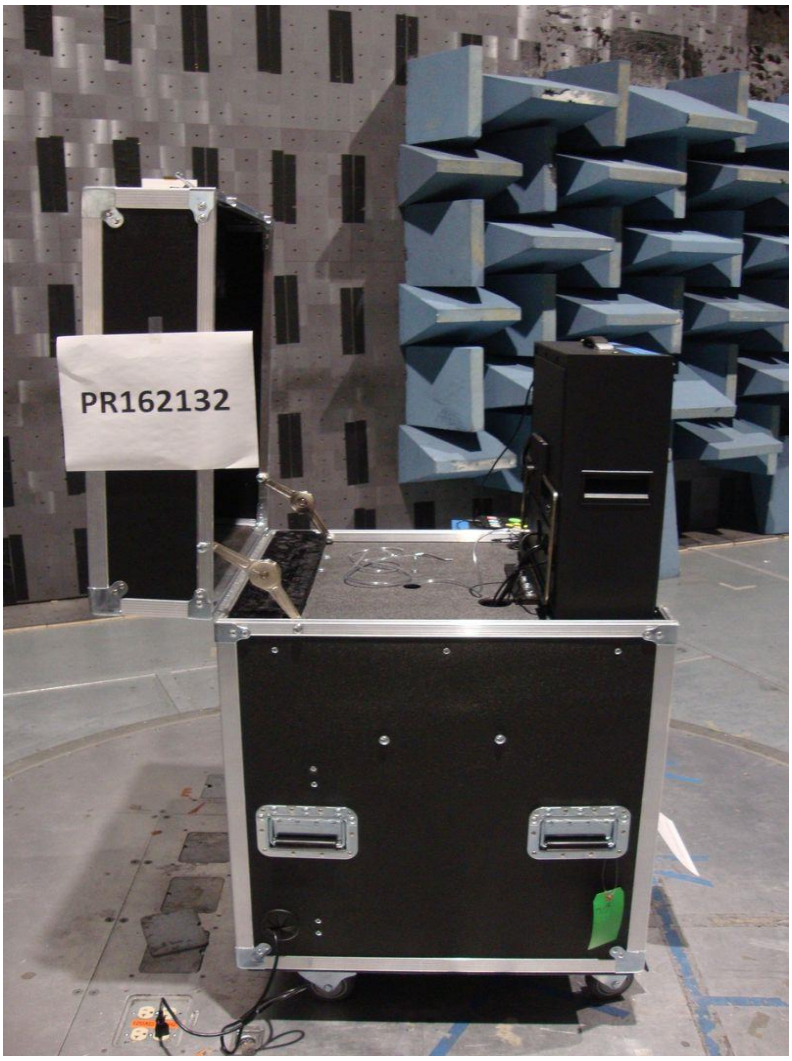


RE 30-1GHz CM Thermal 1 - Right

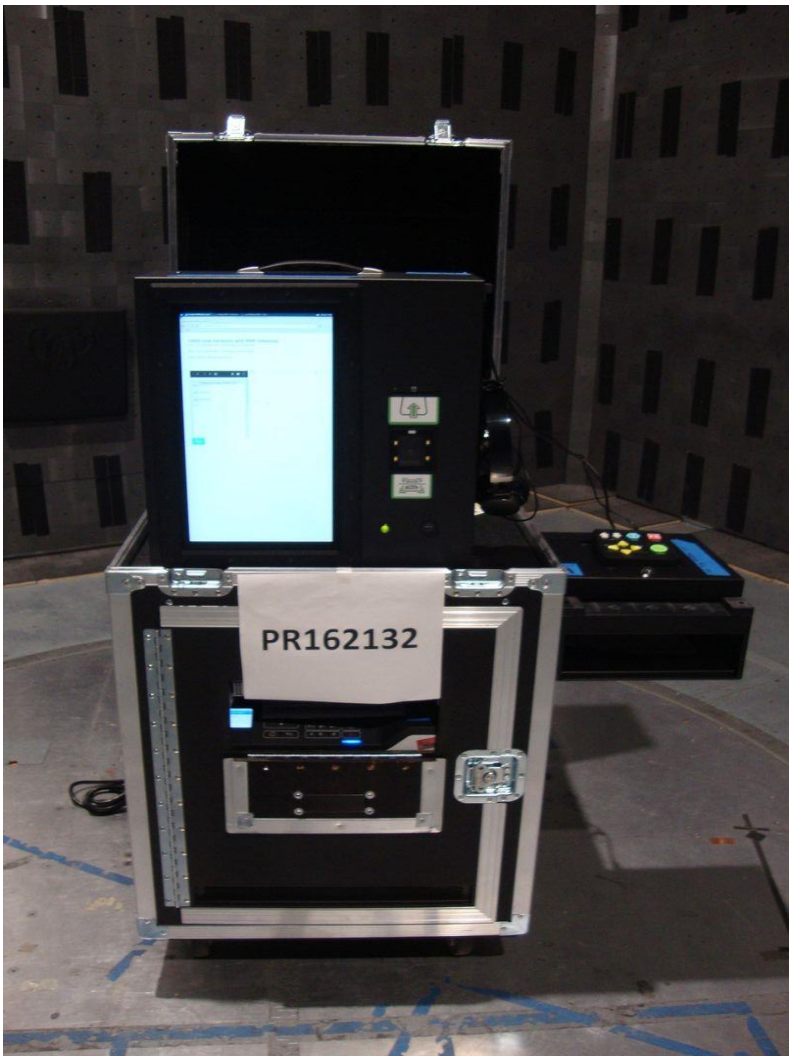
RE Setup Photo - Right Side 10 Meter



RE 30-1GHz CM Thermal 1 - Left

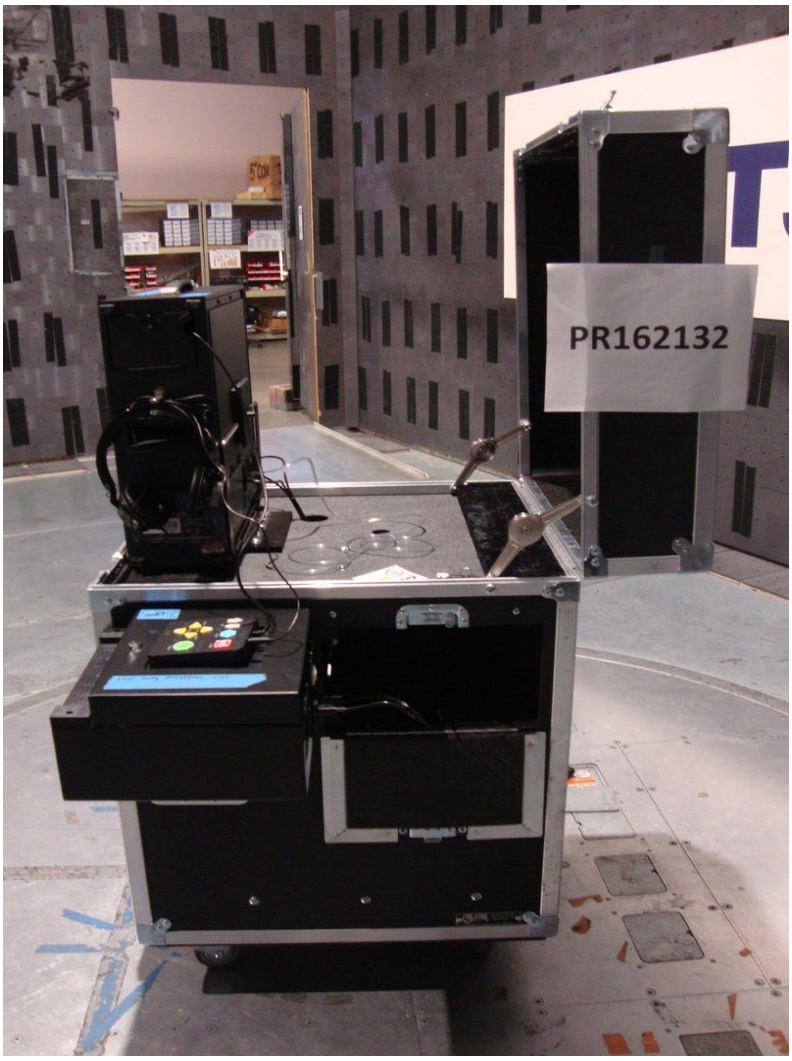


RE Setup Photo - Left Side 10 Meter



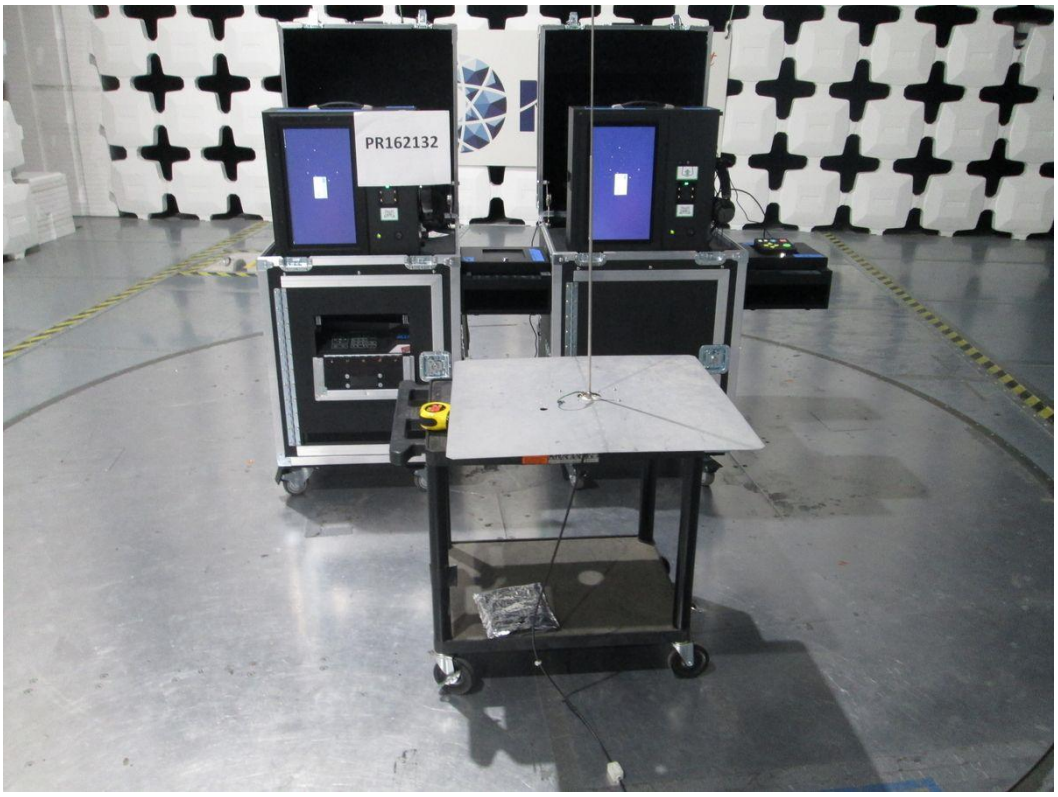
RE - Front

RE - Back

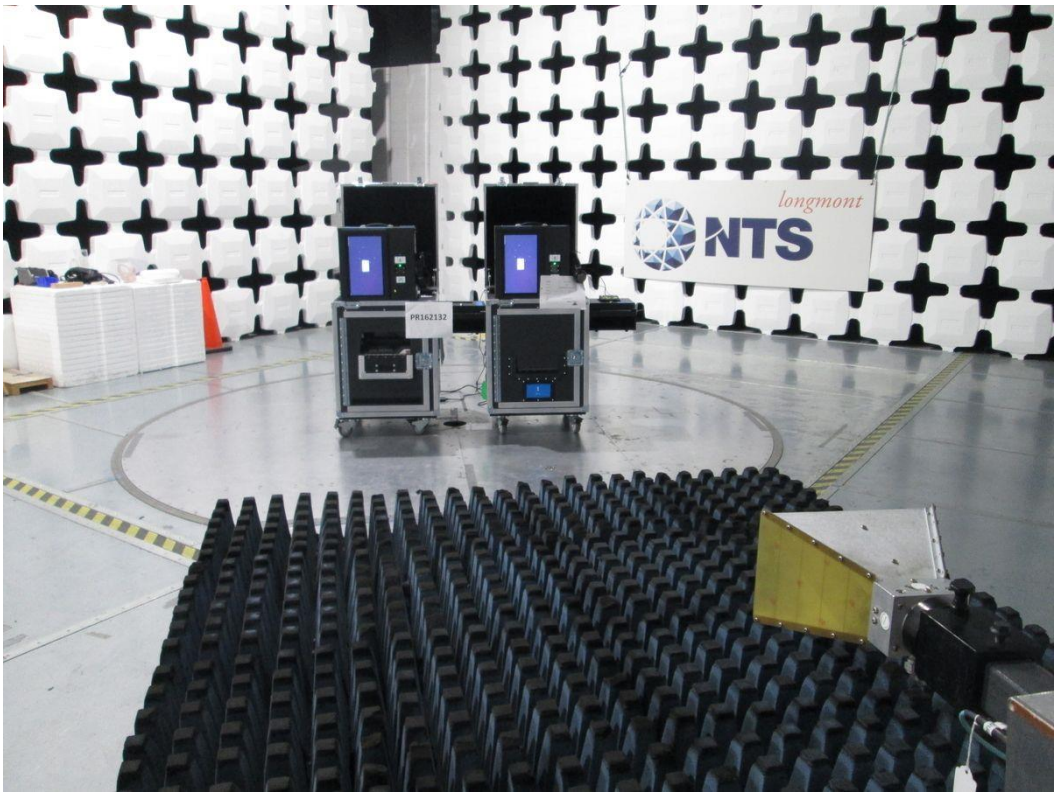


RE - Right

RE - Left

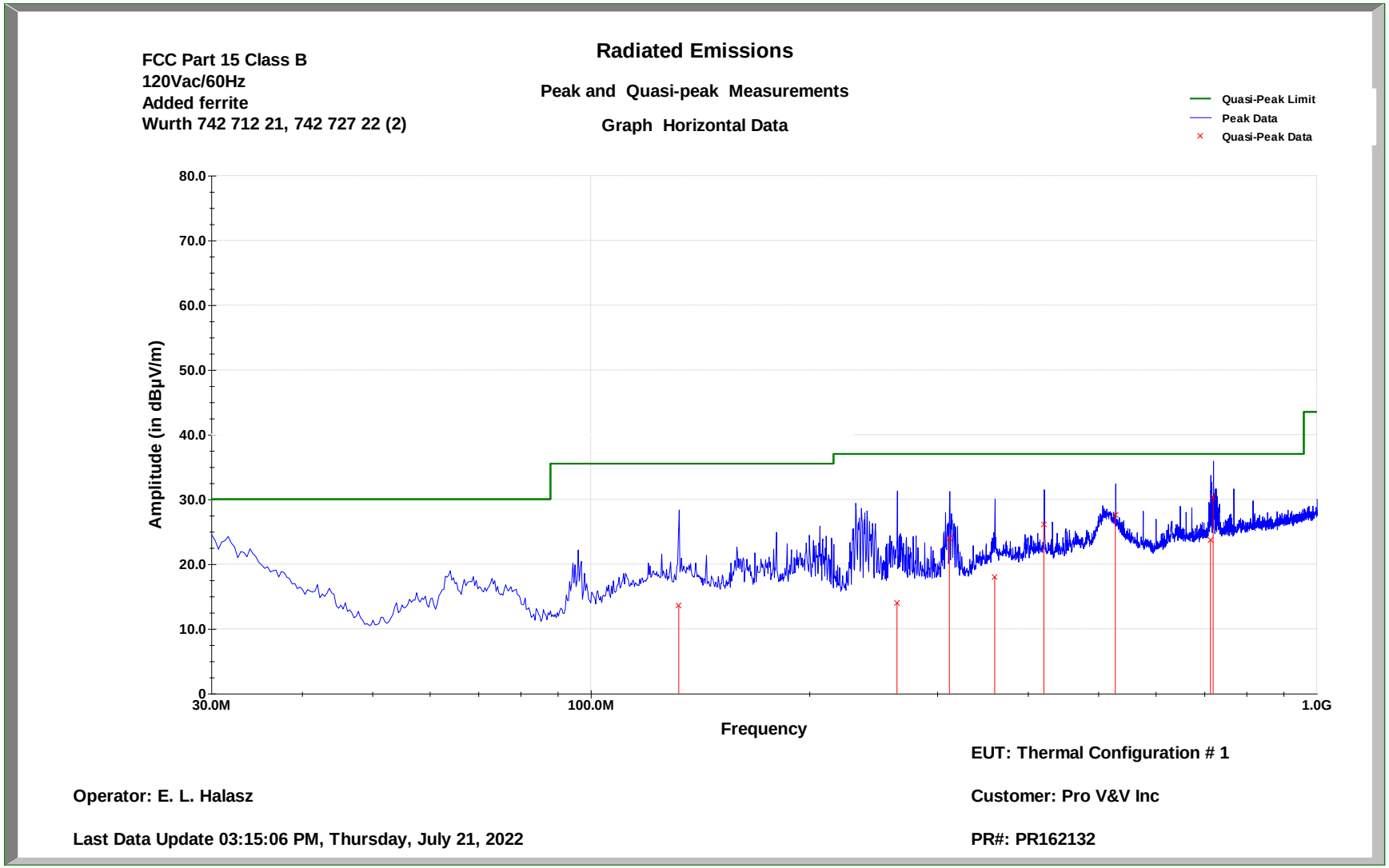


Ohio RE 10kHz - 30MHz - Front



Ohio RE 1Ghz - 6GHz – Front

5.1.6 Test Data



Radiated Emissions
Quasi-peak Measurements
Table: Horizontal Quasi-peaks below 1 GHz
Operator: E. L. Halasz Thermal Config
PR#: PR162132
Customer: Pro V&V Inc

Frequency	Amplitude	Quasi-peak Limit	Delta to Limit	EUT Azimuth	Antenna Height
MHz	in dBµV/m	in dBµV/m	in dB	in degrees	in cm
132.173	13.5	35.5	-22	328	100
264.093	14	37	-23	314	234
311.946	24	37	-13	227	329
360.123	18	37	-19	264	267
420.91	26.2	37	-10.8	30	123
527.933	27.6	37	-9.4	145	263
713.85	23.7	37	-13.3	181	381
719.993	30.4	37	-6.6	310	392

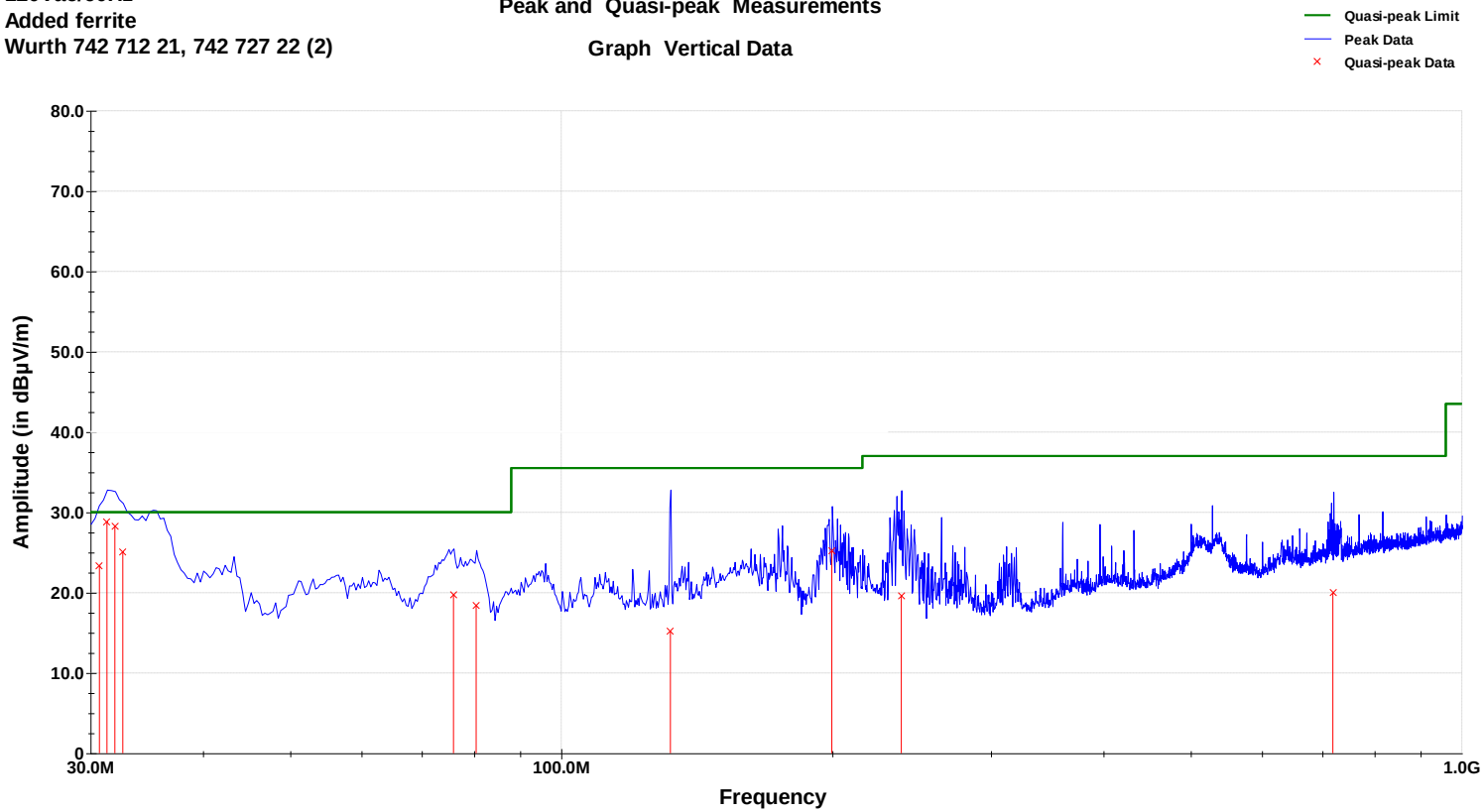
FCC Part 15 Class B
120Vac/60Hz
Thermal CONFIG

FCC Part 15 Class B
120Vac/60Hz
Added ferrite
Wurth 742 712 21, 742 727 22 (2)

Radiated Emissions

Peak and Quasi-peak Measurements

Graph Vertical Data



EUT: Thermal Configuration # 1

Operator: E. L. Halasz

Customer: Pro V&V Inc

Last Data Update 03:48:00 PM, Thursday, July 21, 2022

PR#: PR162132

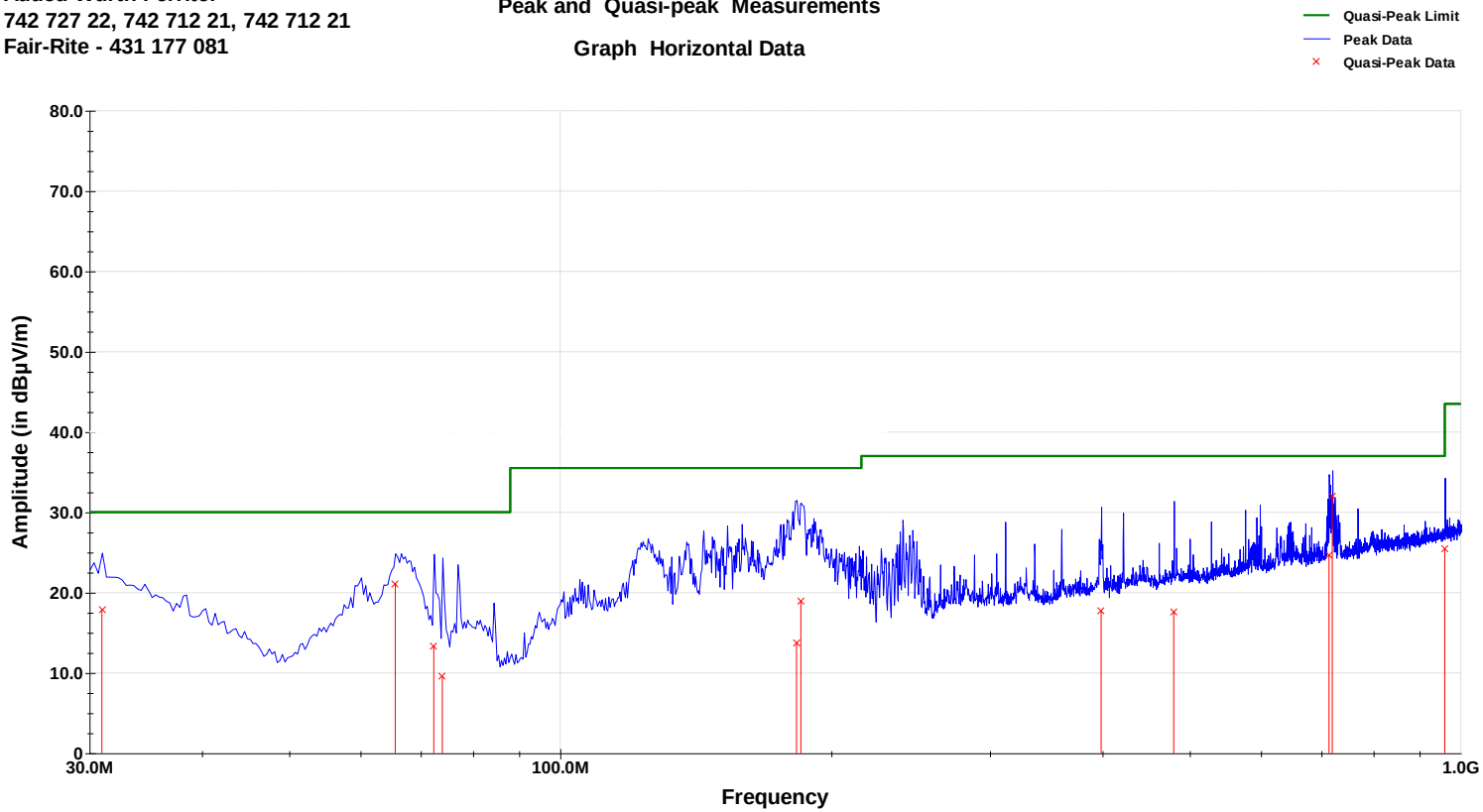
Radiated Emissions					
Quasi-peak Measurements					
Table: Vertical Quasi-peaks below 1 GHz					
Operator: E. L. Halasz Thermal Config					
PR#: PR162132					
Customer: Pro V&V Inc					
Frequency	Amplitude	Quasi-peak Limit	Delta to Limit	EUT Azimuth	Antenna Height
MHz	in dBµV/m	in dBµV/m	in dB	in degrees	in cm
30.698	23.3	30	-6.7	182	400
31.293	28.8	30	-1.2	207	120
31.94	28.3	30	-1.7	28	120
32.588	25.1	30	-4.9	0	190
75.913	19.8	30	-10.2	0	292
80.44	18.4	30	-11.6	0	224
132.173	15.2	35.5	-20.3	0	103
199.75	25.2	35.5	-10.3	0	102
238.55	19.6	37	-17.4	229	102
719.296	19.9	37	-17.1	110	101
FCC Part 15 Class B					
120Vac/60Hz					
Thermal CONFIG					

120Vac/60Hz
Added Wurth Ferrite:
742 727 22, 742 712 21, 742 712 21
Fair-Rite - 431 177 081

Radiated Emissions

Peak and Quasi-peak Measurements

Graph Horizontal Data



EUT: ClearMark Laser Configuration #1

Operator: T. Wittig

Customer: Pro V&V Inc

Last Data Update 09:19:56 AM, Monday, July 25, 2022

PR#: PR162132

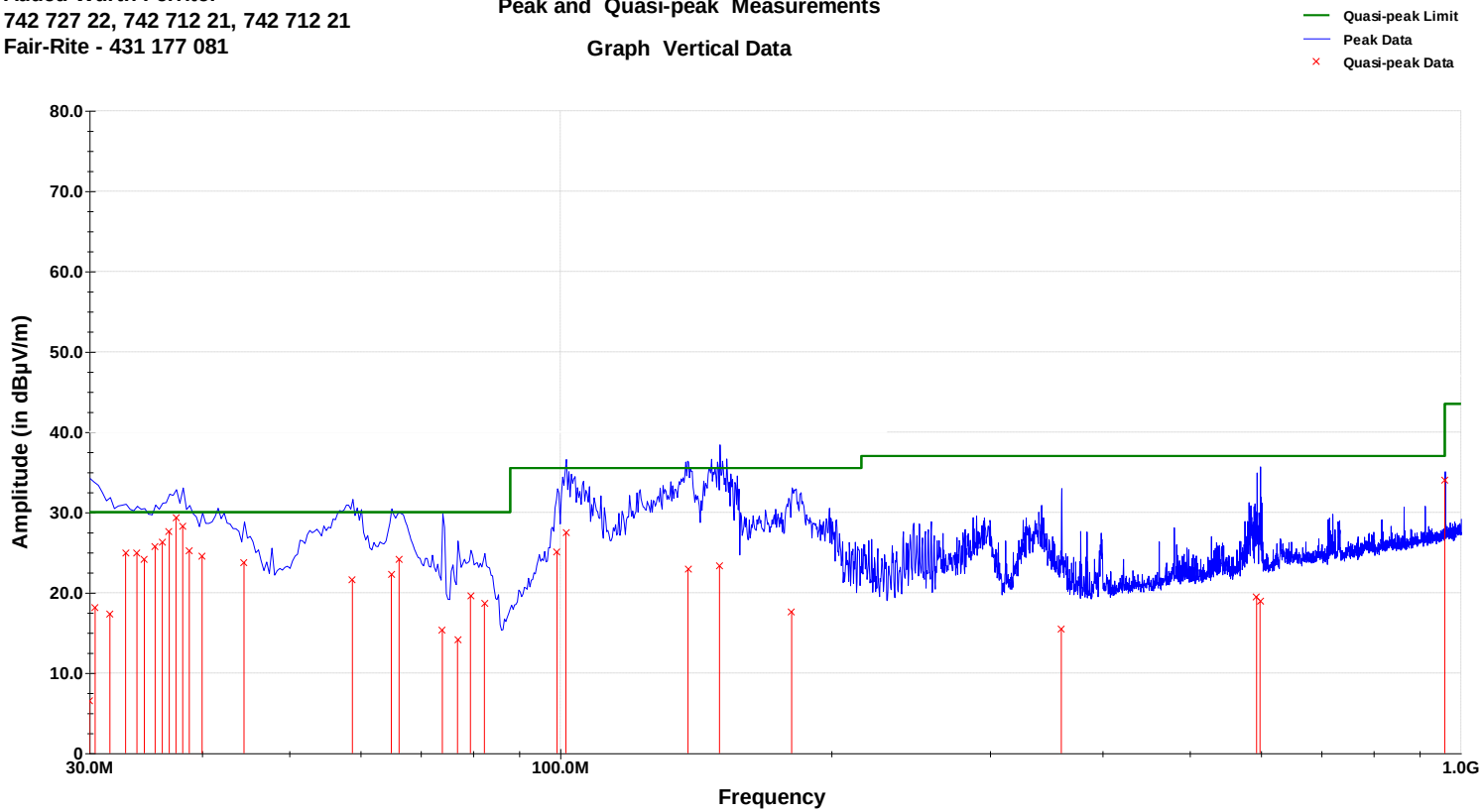
	Radiated Emissions								
	Quasi-peak Measurements								
	Table: Horizontal Quasi-peaks below 1 GHz								
Operator: T. WittigEUT: ClearMark Laser Configuration									
PR#: PR162132									
Customer: Pro V&V Inc									
Frequency	Amplitude	Quasi-peak Limit	Delta to Limit	EUT Azimuth	Antenna Height				
MHz	in dBµV/m	in dBµV/m	in dB	in degrees	in cm				
30.97	17.8	30	-12.2	176	382				
65.57	21.1	30	-8.9	102	389				
72.36	13.4	30	-16.6	75	400				
73.97	9.5	30	-20.5	153	400				
182.94	13.7	35.5	-21.8	0	345				
185	18.9	35.5	-16.6	34	400				
398.6	17.7	37	-19.3	0	291				
480.08	17.6	37	-19.4	126	223				
713.85	24.7	37	-12.3	75	113				
720	32	37	-5	52	100				
959.91	25.4	37	-11.6	226	99				
120Vac/60Hz									
Added Wurth Ferrite:									
742 727 22	742 712 21	742 712 21							

120Vac/60Hz
Added Wurth Ferrite:
742 727 22, 742 712 21, 742 712 21
Fair-Rite - 431 177 081

Radiated Emissions

Peak and Quasi-peak Measurements

Graph Vertical Data



EUT: ClearMark Laser Configuration #1

Operator: T. Wittig

Customer: Pro V&V Inc

Last Data Update 10:53:51 AM, Monday, July 25, 2022

PR#: PR162132

Operator: T. WittigEUT: ClearMark Laser Configuration
PR#: PR162132
Customer: Pro V&V Inc

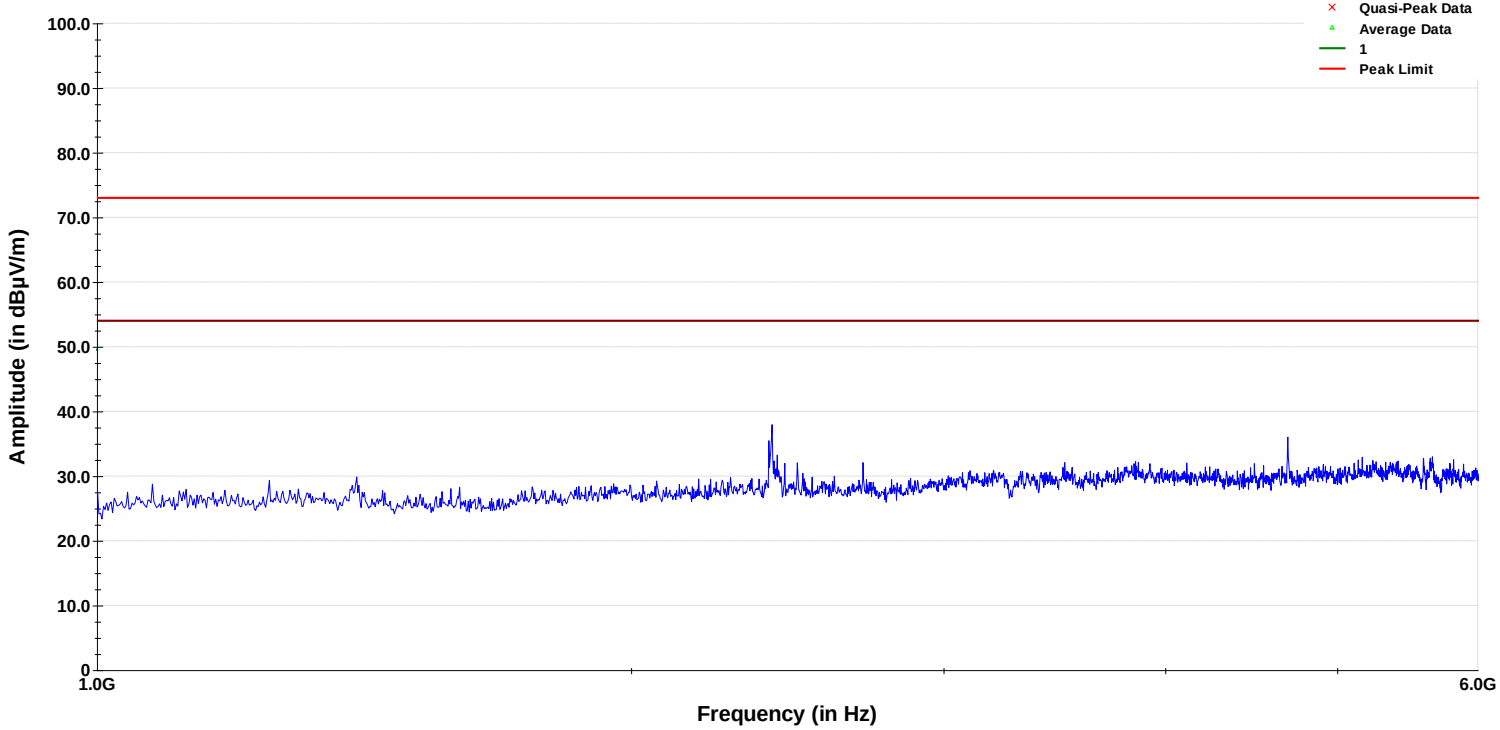
Frequency	Amplitude	Quasi-peak Limit	Delta to Limit	EUT Azimuth	Antenna Height
MHz	in dBµV/m	in dBµV/m	in dB	in degrees	in cm
30	6.5	30	-23.5	120	100
30.446	18.2	30	-11.8	311	100
31.616	17.4	30	-12.6	360	154
32.91	24.9	30	-5.1	75	121
33.88	24.9	30	-5.1	106	121
34.526	24.1	30	-5.9	224	100
35.496	25.7	30	-4.3	119	100
36.143	26.2	30	-3.8	105	100
36.79	27.6	30	-2.4	139	100
37.436	29.3	30	-0.7	139	100
38.083	28.2	30	-1.8	317	100
38.73	25.3	30	-4.7	300	100
40.023	24.5	30	-5.5	291	100
44.55	23.8	30	-6.2	300	100
58.776	21.6	30	-8.4	193	314
64.92	22.3	30	-7.7	75	375
66.213	24.1	30	-5.9	75	374
73.973	15.3	30	-14.7	75	324
76.883	14.1	30	-15.9	255	324
79.47	19.6	30	-10.4	333	124
82.38	18.6	30	-11.4	0	175
99.19	25.1	35.5	-10.4	0	100
101.46	27.5	35.5	-8	337	100
138.64	22.9	35.5	-12.6	157	275
150.28	23.3	35.5	-12.2	165	123
180.67	17.6	35.5	-17.9	114	100
360.12	15.5	37	-21.5	65	100
593.25	19.5	37	-17.5	112	100
598.42	18.9	37	-18.1	99	100
960	34.1	37	-2.9	29	234

FCC Class B
120Vac/60Hz
Thermal Config. 1 and Laser Config. 1

Radiated Emissions

Peak and Average Data

Graph: Horizontal Data



EUT: Thermal Config. 1, Laser Config 1

Operator: Mike Tidquist

Customer: Pro V&V

Last Data Update 10:11:37 AM, Wednesday, August 03, 2022

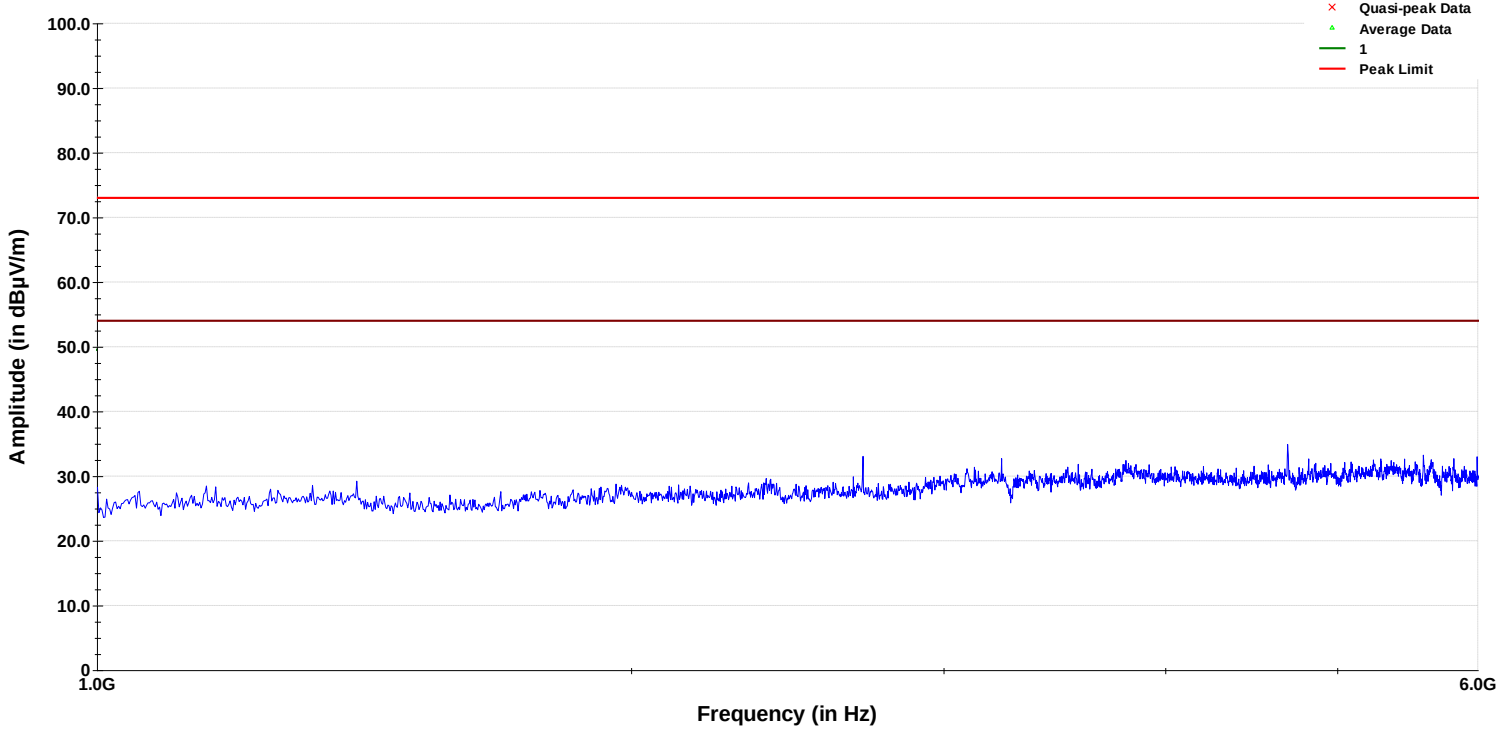
PR#: PR162132

FCC Class B
120Vac/60Hz
Thermal Config. 1 and Laser Config. 1

Radiated Emissions

Peak, and Average Data

Graph: Vertical Data



EUT: Thermal Config. 1, Laser Config 1

Operator: Mike Tidquist

Customer: Pro V&V

Last Data Update 10:12:01 AM, Wednesday, August 03, 2022

PR#: PR162132

5.1.7 Test Equipment List

Table 5.1-1: Radiated Emissions 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
WC059431	Controller (System)	Sunol Sciences	SC110V	NCR	NCR
WC059439	Meter (Digital Multimeter)	Fluke	85	07/30/2021	07/30/2022
WC059551	Amplifier (Pre/RF/Low Noise)	Pasternack Enterprises	EMCI-LNA-30-1000M	12/06/2021	12/06/2022
WC059739	Antenna (Biconilog)	Sunol Sciences	JB1	05/18/2021	05/18/2023
WC076859	Receiver	Rohde & Schwarz	ESW44	02/15/2022	02/15/2023
WC078470	Software	ETS-Lindgren	C47213	NCR	NCR
WC078486	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	06/22/2022	06/22/2023

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

5.2 Conducted Emissions

5.2.1 Test Procedure

FCC Part 15

5.2.2 Test Result

The Thermal Config #1 and #2 met the specification requirements for Conducted Emissions.

5.2.3 Test Datasheets

National Technical Systems

Conducted Emissions, FCC Part 15, VVSG Class B

Standard Referenced:	FCC Part 15, VVSG Class B	Date:	7/25/2022
Temperature:		Humidity:	
Input Voltage:	120Vac/60Hz	Pressure:	839 mb
Configuration of Unit:	Normal Operation	LISN Bonding:	2.0 mΩ
Test Engineer:	Mike Tidquist	Sweep Time Check:	Yes

Date	Time	Log Entries	Initials	Result
7/25/22	1100-1200	Conducted Emissions, 150 kHz - 30 MHz. FCC Part 15. Class B. 120 VAC / 60 Hz (4.1.2.9) (ClearMark Laser Config 1) Swapping out UPS Same Model PWLKU2P00020	MT	
7/25/22	1400-1500	Conducted Emissions, 150 kHz - 30 MHz. FCC Part 15. Class B. 120 VAC / 60 Hz (4.1.2.9) (ClearMark Laser Config 1) Swapped out UPS Same Model PWLKU2P00020	MT	Pass

National Technical Systems			
Conducted Emissions, FCC Part 15, VVSG Class B			
Standard Referenced:	FCC Part 15, VVSG Class B	Date:	7/25/2022
Temperature:	0 Humidity: 0%	Pressure:	839 mb
Input Voltage:	120Vac/60Hz	LISN Bonding:	2.0 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.

5.2.4 Test Photographs

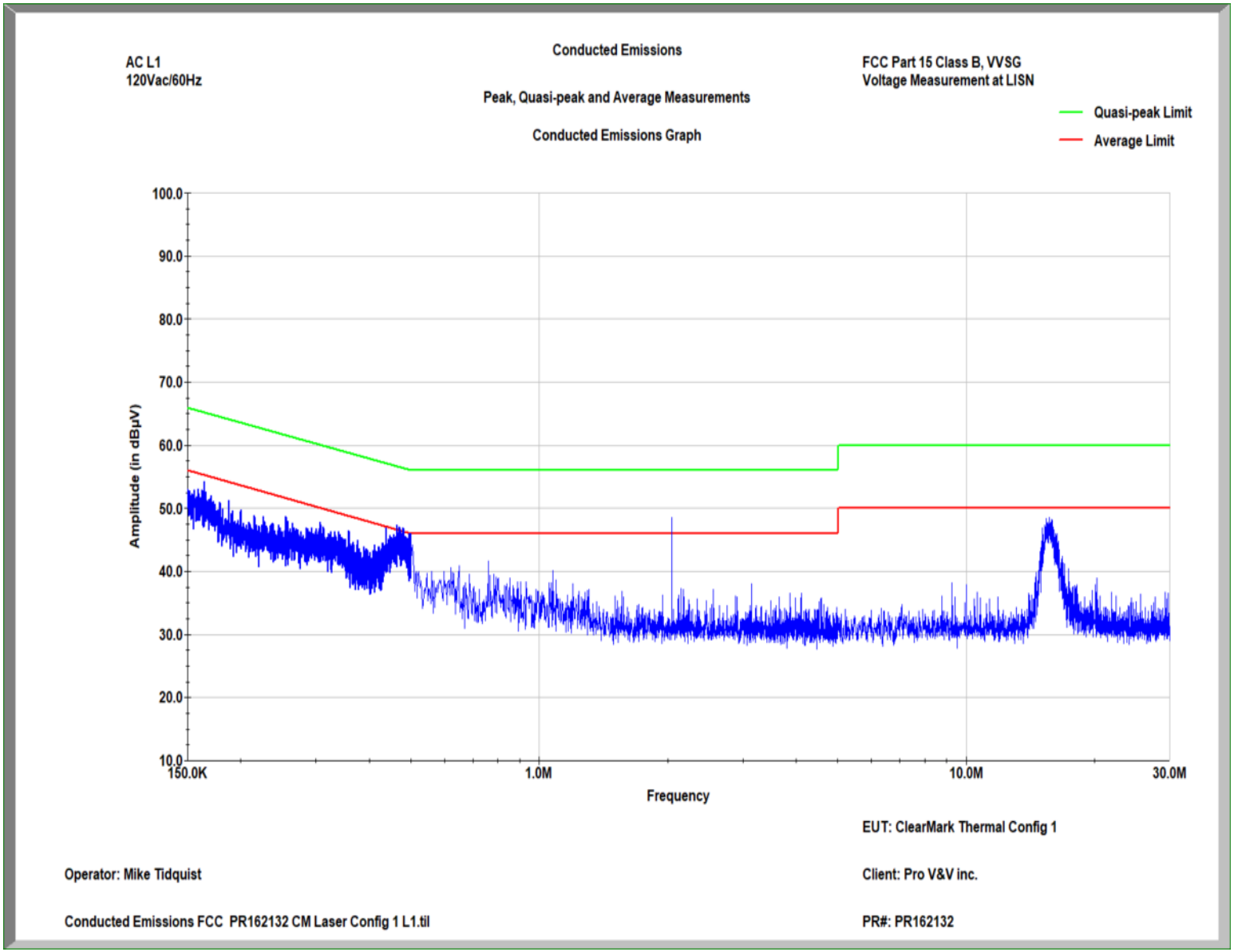
CE CM Laser Config. 1 - Front

CE CM Laser Config. 1 - Back

CE CM Laser Config. 1 - Right

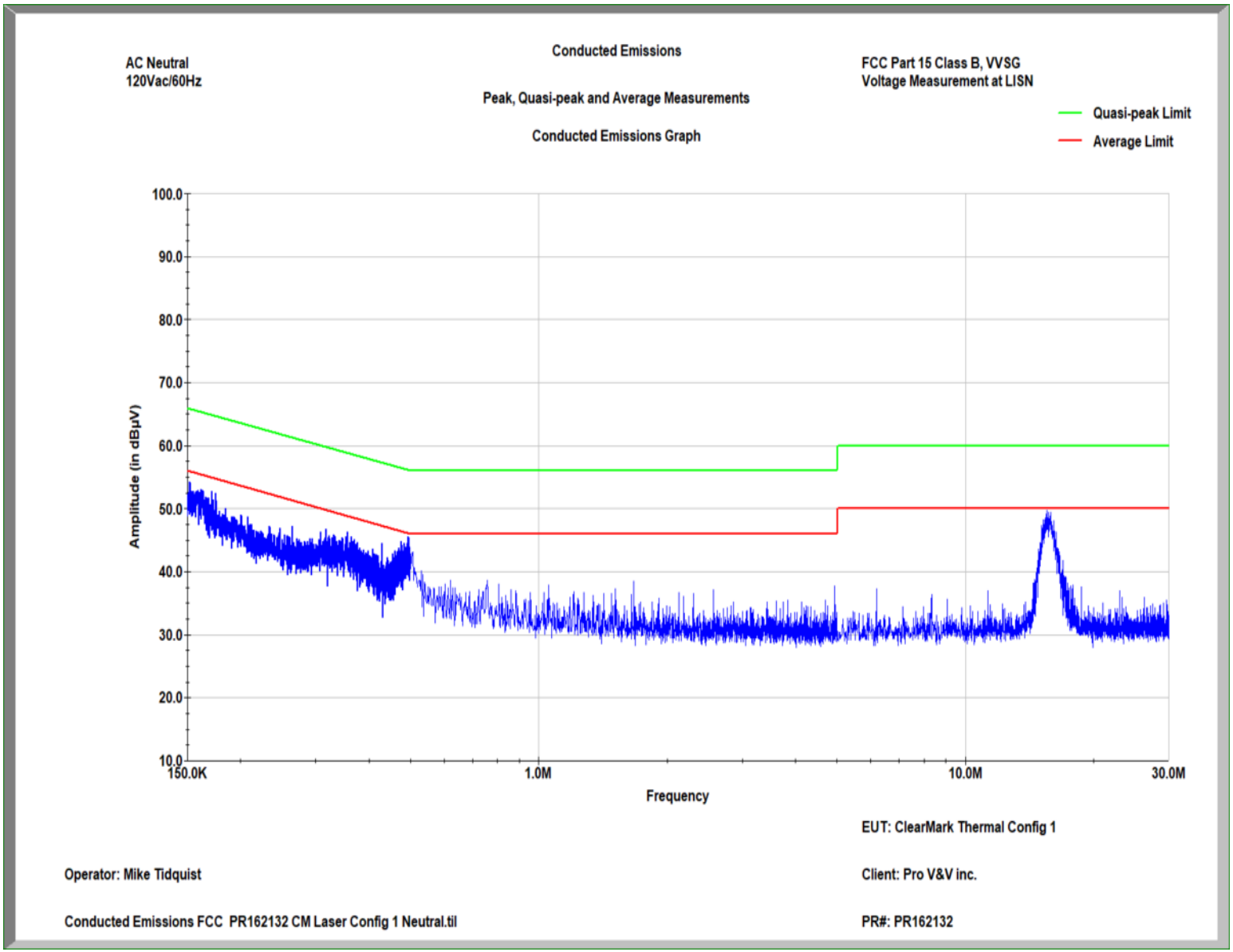
CE CM Laser Config. 1 - Left

5.2.5 Test Data



	Conducted Emissions					
	Average Measurements					
	Average Data Table					
Operator: Mike TidquistEUT: ClearMark Thermal Config 1						
PR#: PR162132						
2:19:10 PM	Monday	July 25	2022Client: Pro V&V inc.			
Frequency	Amplitude	Quasi-peak Limit	Delta to Quasi-peak Limit	Average Limit	Delta to Average Limit	
MHz	in dBµV	in dBµV	in dB	in dBµV	in dB	
0.16	37.59	65.81	-28.22	55.81	-18.22	
0.16	36.93	65.63	-28.7	55.63	-18.7	
0.31	30.95	61.39	-30.44	51.39	-20.44	
0.44	28.76	57.8	-29.04	47.8	-19.04	
0.47	28.32	56.82	-28.51	46.82	-18.51	
0.48	30.39	56.67	-26.28	46.67	-16.28	
2.06	14.79	56	-41.21	46	-31.21	
15.43	36.84	60	-23.16	50	-13.16	
AC L1						
120Vac/60Hz						

Conducted Emissions						
Quasi-peak Data						
Quasi-peak Data Table						
Operator: Mike TidquistEUT: ClearMark Thermal Config 1						
PR#: PR162132						
2:12:23 PM	Monday	July 25	2022Client: Pro V&V inc.			
Frequency	Amplitude	Quasi-peak Limit	Delta to Quasi-peak Limit	Average Limit	Delta to Average Limit	
MHz	in dBµV	in dBµV	in dB	in dBµV	in dB	
0.16	47.95	65.7	-17.76	55.7	-7.76	
0.16	47.4	65.64	-18.24	55.64	-8.24	
0.29	39	61.91	-22.91	51.91	-12.91	
0.46	39.7	57.23	-17.53	47.23	-7.53	
0.46	40.01	57.02	-17.01	47.02	-7.01	
0.48	40.42	56.52	-16.1	46.52	-6.1	
2.14	23.55	56	-32.45	46	-22.45	
15.64	44.25	60	-15.75	50	-5.75	
AC L1						
120Vac/60Hz						


AC Neutral
120Vac/60Hz
Conducted Emissions
Peak, Quasi-peak and Average Measurements
Conducted Emissions Graph
FCC Part 15 Class B, VVSG
Voltage Measurement at LISN
Quasi-peak Limit
Average Limit
Amplitude (in dBµV)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
150.0K
1.0M
10.0M
30.0M
Frequency
EUT: ClearMark Thermal Config 1
Operator: Mike Tidquist
Client: Pro V&V inc.
Conducted Emissions FCC PR162132 CM Laser Config 1 Neutral.til
PR#: PR162132

	Conducted Emissions					
	Average Measurements					
	Average Data Table					
Operator: Mike TidquistEUT: ClearMark Thermal Config 1						
PR#: PR162132						
2:44:00 PM	Monday	July 25	2022Client: Pro V&V inc.			
Frequency	Amplitude	Quasi-peak Limit	Delta to Quasi-peak Limit	Average Limit	Delta to Average Limit	
MHz	in dBµV	in dBµV	in dB	in dBµV	in dB	
0.15	33.83	65.99	-32.16	55.99	-22.16	
0.15	36.75	65.9	-29.16	55.9	-19.16	
0.16	37.56	65.64	-28.08	55.64	-18.08	
0.17	36.07	65.51	-29.44	55.51	-19.44	
0.31	30.13	61.32	-31.19	51.32	-21.19	
0.34	29.33	60.5	-31.17	50.5	-21.17	
0.49	28.9	56.36	-27.46	46.36	-17.46	
15.61	38.01	60	-21.99	50	-11.99	
AC Neutral						
120Vac/60Hz						

Conducted Emissions						
Quasi-peak Data						
Quasi-peak Data Table						
Operator: Mike TidquistEUT: ClearMark Thermal Config 1						
PR#: PR162132						
2:36:58 PM	Monday	July 25	2022Client: Pro V&V inc.			
Frequency	Amplitude	Quasi-peak Limit	Delta to Quasi-peak Limit	Average Limit	Delta to Average Limit	
MHz	in dBµV	in dBµV	in dB	in dBµV	in dB	
0.16	48.85	65.79	-16.94	55.79	-6.94	
0.16	48.07	65.64	-17.57	55.64	-7.57	
0.16	47.86	65.61	-17.76	55.61	-7.76	
0.17	47.3	65.54	-18.24	55.54	-8.24	
0.31	37.96	61.39	-23.43	51.39	-13.43	
0.35	37.98	60.25	-22.27	50.25	-12.27	
0.48	38.34	56.47	-18.13	46.47	-8.13	
15.63	45.18	60	-14.82	50	-4.82	
AC Neutral						
120Vac/60Hz						

5.2.6 Test Equipment List

Table 5.2-1: Conducted Emissions 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	07/30/2021	07/30/2022
WC059589	Meter (Milliohm)	Hewlett Packard	4328A	09/15/2021	09/15/2022
WC059729	Power Supply (AC)	Pacific Power Source	TMX 140	NCR	NCR
WC059822	Receiver	Keysight Technologies	N9038A	10/08/2021	10/08/2022
WC076847	Network (LISN)	Solar Electronics	8012-50-R-25-BNC	11/04/2021	11/04/2022
WC078470	Software	ETS-Lindgren	C47213	NCR	NCR
WC078486	Meter (Hydrometer)	Extech Instruments	Datalogger 42270	06/22/2022	06/22/2023

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

End of Test Report