NTS Labs, LLC Test Report for Shielding Effectiveness Testing of the Cabinet

Prepared For
Schroff, Inc. | 170 Commerce Dr. | Warwick, RI 02886

Prepared By
NTS Labs, LLC | 7800 Highway 20 West | Huntsville, AL 35806 | 256-837-4411 | www.ntslabs.com

Joshua V. Bailey	Lance Wallace	Edward Rea
Digitally signed by Joshua V. Bailey Date: 2023.04.10 11:37:44 -05'00'	Digitally signed by Lance Wallace Date: 2023.04.10 15:20:23 -05'00'	Digitally signed by Edward Rea Date: 2023.04.13 06:00:12 -05'00'
Technical Writer	EMI Project Engineer	Quality Management Representative

Revision History

Rev.	Description	Issue Date
0	Initial release	04/10/2023

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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: NTS Test Procedure TP-PR168728-00
- Schroff, Inc. Purchase Order(s) 709876OS
- NTS Labs, LLC Quote(s) OP0625811
- ISO/IEC 17025:2017(E) *General Requirements for the Competence of Testing and Calibration Laboratories,* dated 11/1/2017
- ISO-9001:2015, *Quality Management Systems Requirements*

3.0 Product Selection and Description

Schroff, 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	Cabinet	10630049	177363-002

3.0.1 Received EUT Photographs

3.1 Security Classification

Non-classified

3.2 Source Inspection

NTS Labs, LLC QA

4.0 General Test Requirement

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 Standard Test Conditions

The EUT was configured using the method as described in NTS Test Procedure TP-PR168728-00.

1. The EUT physical layout was performed by NTS Labs, LLC personnel.

2. The EUT installation and operation were verified prior to start of testing by the customer's technical representative.

3. The customer's technical representative authorization was acquired prior to test commencement.

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	Shielding Effectiveness	NTS-TP-PR168728-00	Huntsville	03/28/2023 - 03/30/2023	10630049	177363-002	Not Applicable

5.1 Shielding Effectiveness

5.1.1 Test Procedure

The EUT was tested to NTS Test Procedure TP-PR168728-00.

5.1.2 Test Result

Test Result: The EUT was subjected to Shielding Effectiveness testing per TP-PR168728-00. Final determination is left to customer.

5.1.3 Test Datasheet

NTS WE ENGINEER SUCCESS
HUNTSVILLE OPERATIONS

DATA SHEET

NTS Project No.: PR168728-00

Start Date: 3/27/23

Customer:	Schroff	Temperature:	NR	Humidity:	NR
EUT:	Cabinet	Measurement Point:	See below		
Model No.:	10630049	Interference Signal:	200 V/m Field		
Serial No.:	1773363-002	Frequency Range:	2MHz to 18GHz (Discrete Points)		

Test Title: Shielding Effectiveness- Per TP-PR168728-02

Discrete Frequencies Tested	Meets Limit		Maximum Field Applied	Field Strength Measured	Shielding Effectiveness (dB)
	Yes	No	( ) dB ( ) V ( ) kV (X) V/m ( ) Vrms ( ) dBµA ( ) dBµV ( ) dBµV/m ( ) dBpT		
2 MHz	X		200	3.57	35.35
10 MHz	X		200	1.28	43.92
20 MHz	X		200	1.38	43.29
30 MHz	X		200	0.699	49.43
50 MHz	X		200	1.48	43.00
100 MHz	X		200	0.75	48.57
150 MHz	X		200	0.31	56.29
200 MHz	X		200	0.95	46.44
400 MHz	X		200	3.42	35.34
600 MHz	X		200	4.26	33.34
700 MHz	X		200	5.66	33.48
800 MHz	X		200	4.37	33.25
900 MHz	X		200	16.54	21.65
1 GHz	X		200	0.88	47.24

Notice of Deviation: None

Witness None

Tested By: M. Tillery Technician Date: 3/27/2023

Approved: Jacob Martel Project Engineer Date: 3/31/23

NTSH-1432, Rev. OCT '15

NTS WE ENGINEER SUCCESS
HUNTSVILLE OPERATIONS

DATA SHEET

NTS Project No.: PR168728-00

Start Date: 3/27/23

Customer:	Schroff	**Temperature:**	NR	**Humidity:**	NR
EUT:	Cabinet	**Measurement Point:**	See below		
Model No.:	10630049	**Interference Signal:**	200 V/m Field		
Serial No.:	1773363-002	**Frequency Range:**	2MHz to 18GHz (Discrete Points)		

Test Title: Shielding Effectiveness- Per TP-PR168728-02

Discrete Frequencies Tested	Meets Limit		Maximum Field Applied	Field Strength Measured	Shielding Effectiveness (dB)
	Yes	No	( ) dB ( ) V ( ) kV (X) V/m ( ) Vrms ( ) dBµA ( ) dBµV ( ) dBµV/m ( ) dBpT		
1 GHz	X		200	0.88	47.24
1.5 GHz	X		200	3.89	34.25
2 GHz	X		200	2.48	38.14
2.5 GHz	X		200	0.91	46.84
3 GHz	X		200	3.79	34.4
3.5 GHz	X		200	1.03	45.76
4 GHz	X		200	0.84	47.86
4.5 GHz	X		200	2.46	38.39
5 GHz	X		200	3.00	36.52
5.5 GHz	X		200	2.11	39.69
6 GHz	X		200	1.48	42.77
6.5 GHz	X		200	1.55	42.27
7 GHz	X		200	1.96	40.29
7.5 GHz	X		200	1.39	43.27
8 GHz	X		200	1.18	44.73
9 GHz	X		200	1.53	42.36
10 GHz	X		200	1.08	45.32
11 GHz	X		200	1.99	40.08
12 GHz	X		200	2.67	37.7

Notice of Deviation: None

Witness None

Tested By: M. Tillery **Date:** 3/27/2023
Technician

Approved: Jacob Martel **Date:** 3/31/23
Project Engineer

NTS WE ENGINEER SUCCESS
HUNTSVILLE OPERATIONS

DATA SHEET

NTS Project No.: PR168728-00

Start Date: 3/27/23

Customer:	Schroff	**Temperature:**	NR	**Humidity:**	NR
EUT:	Cabinet	**Measurement Point:**	See below		
Model No.:	10630049	**Interference Signal:**	200 V/m Field		
Serial No.:	1773363-002	**Frequency Range:**	2MHz to 18GHz (Discrete Points)		

Test Title: Shielding Effectiveness- Per TP-PR168728-02

Discrete Frequencies Tested	Meets Limit		Maximum Field Applied	Field Strength Measured	Shielding Effectiveness (dB)
	Yes	No	( ) dB ( ) V ( ) kV (X) V/m ( ) Vrms ( ) dBµA ( ) dBµV ( ) dBµV/m ( ) dBpT		
13 GHz	X		200	2.98	36.55
14 GHz	X		200	2.86	37.1
15 GHz	X		200	2.96	36.81
16 GHz	X		200	2.5	38.12
17 GHz	X		200	3.49	35.4
18 GHz	X		200	4.79	32.46

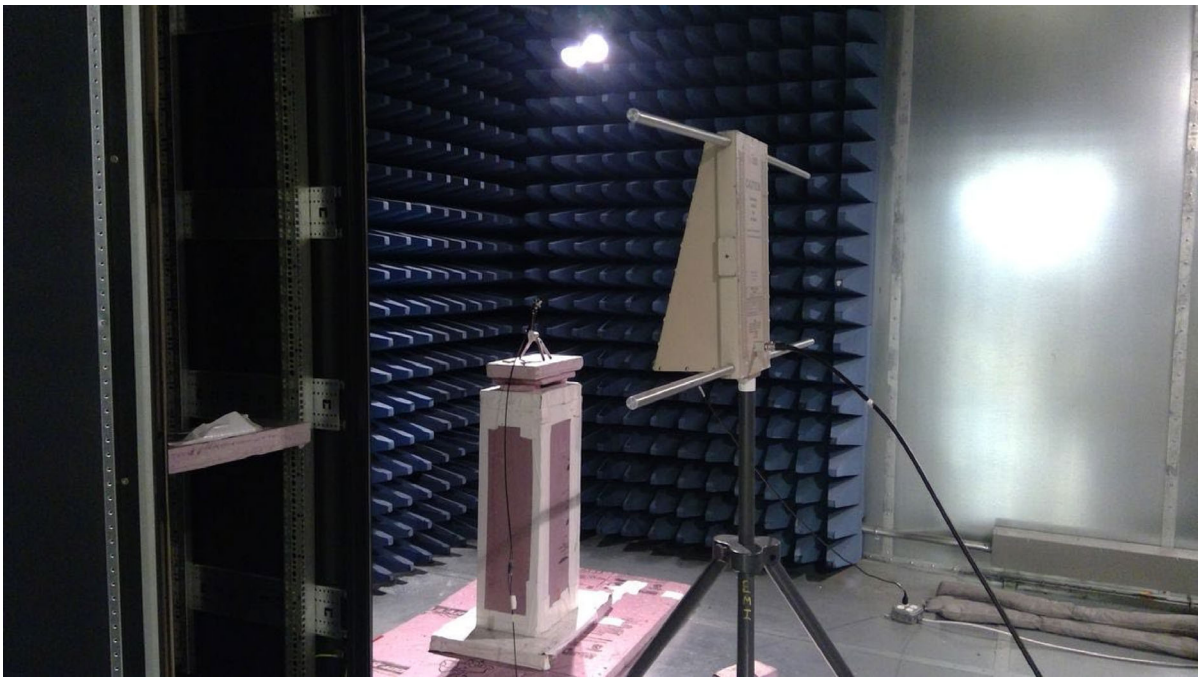
Notice of Deviation: None

Witness None

Tested By: M. Tillery **Date:** 3/27/2023
Technician

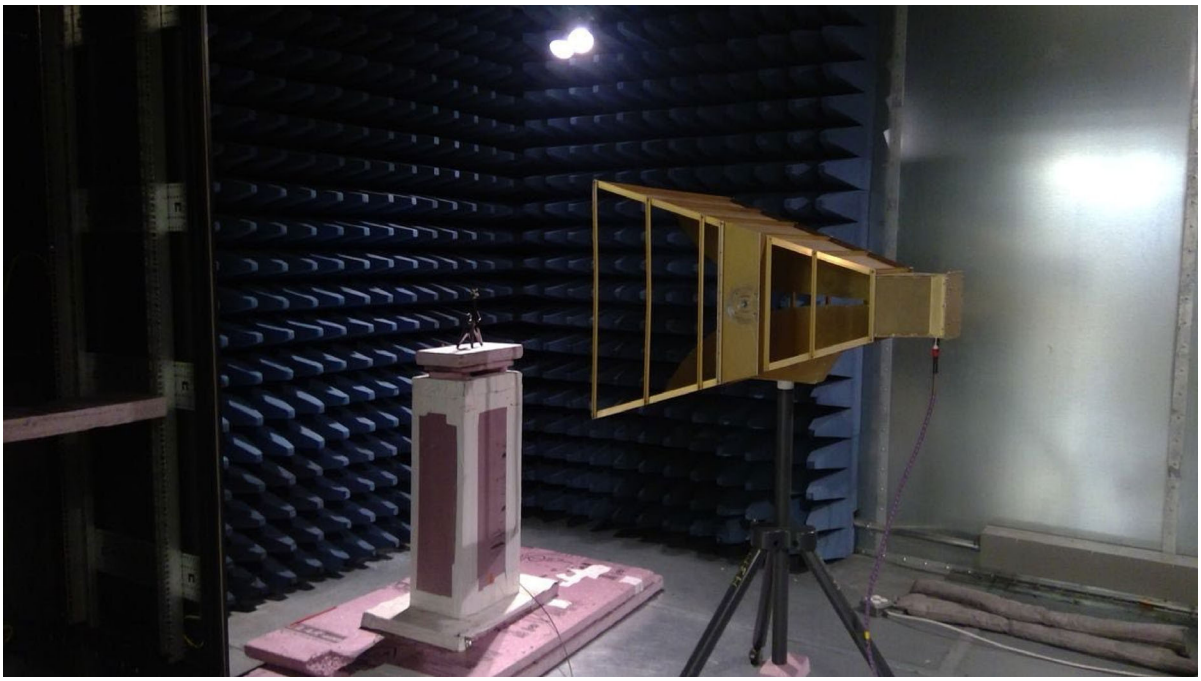
Approved: Jacob Martel **Date:** 3/31/23
Project Engineer

5.1.4 Test Photographs

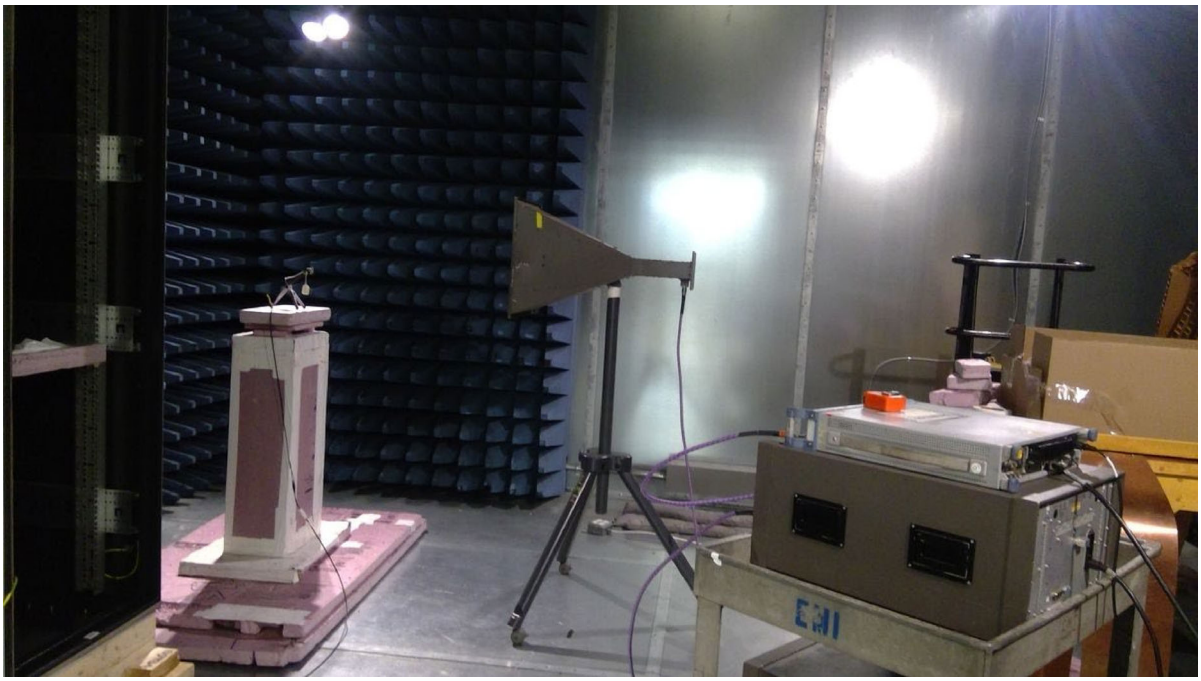


Calibration 2-30 Mhz

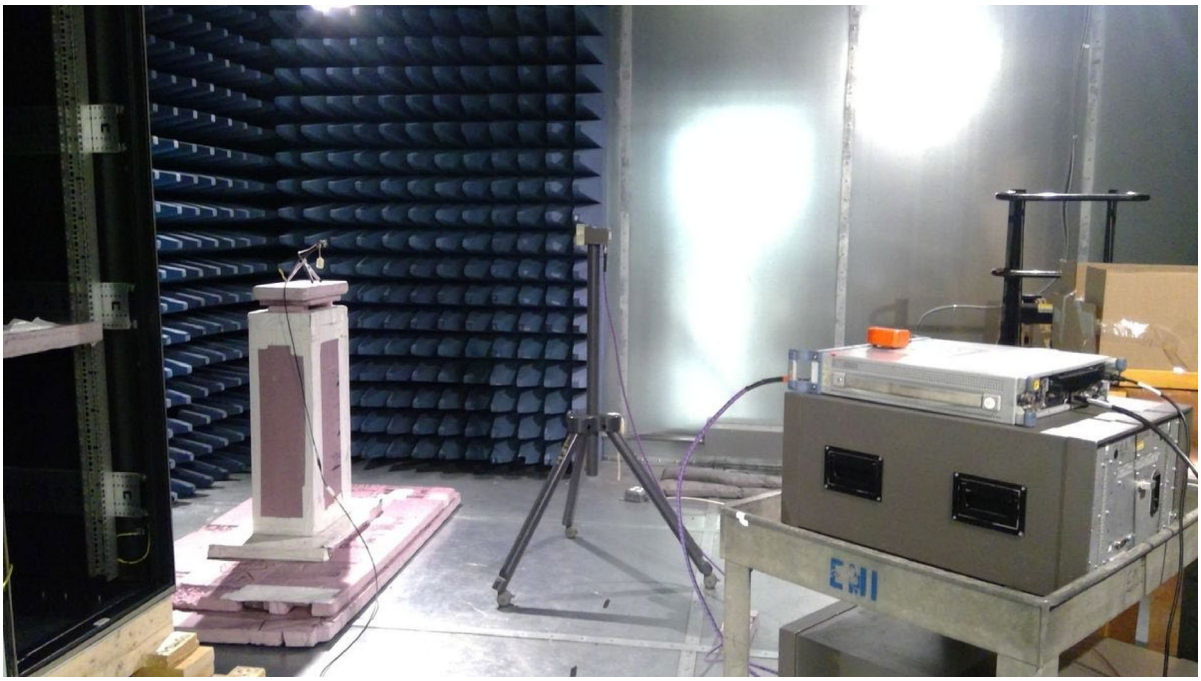
Calibration 30-200 Mhz



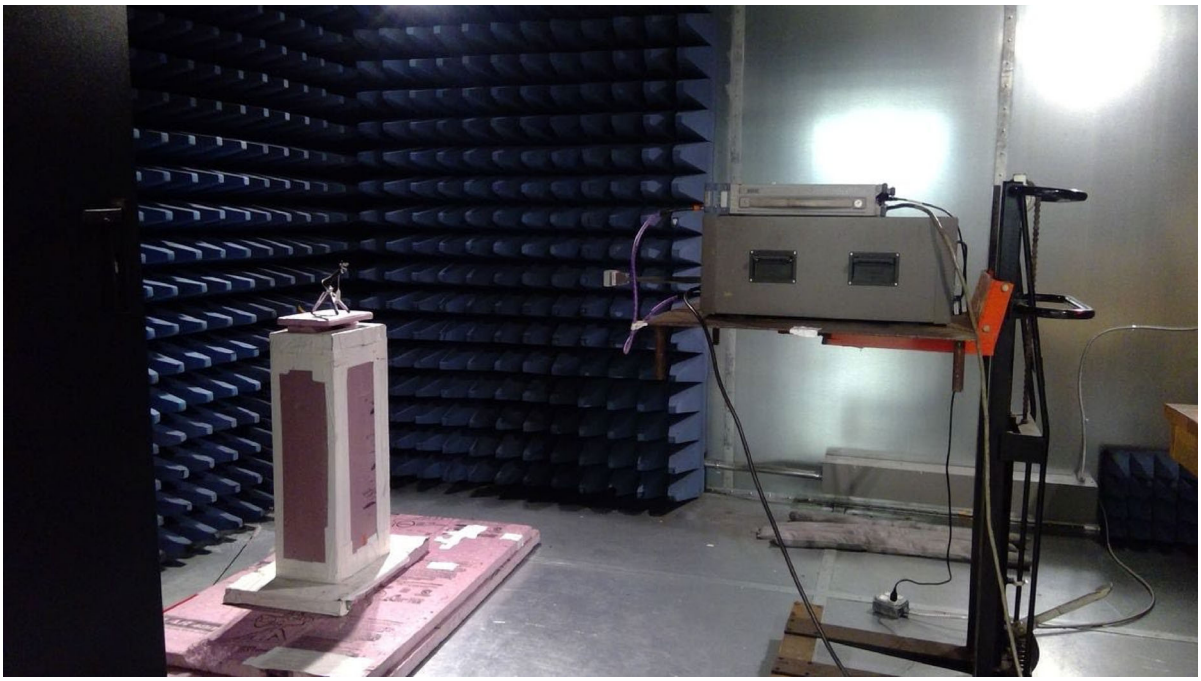
Calibration 200 MHz-1 GHz



Calibration 1- 4 GHz

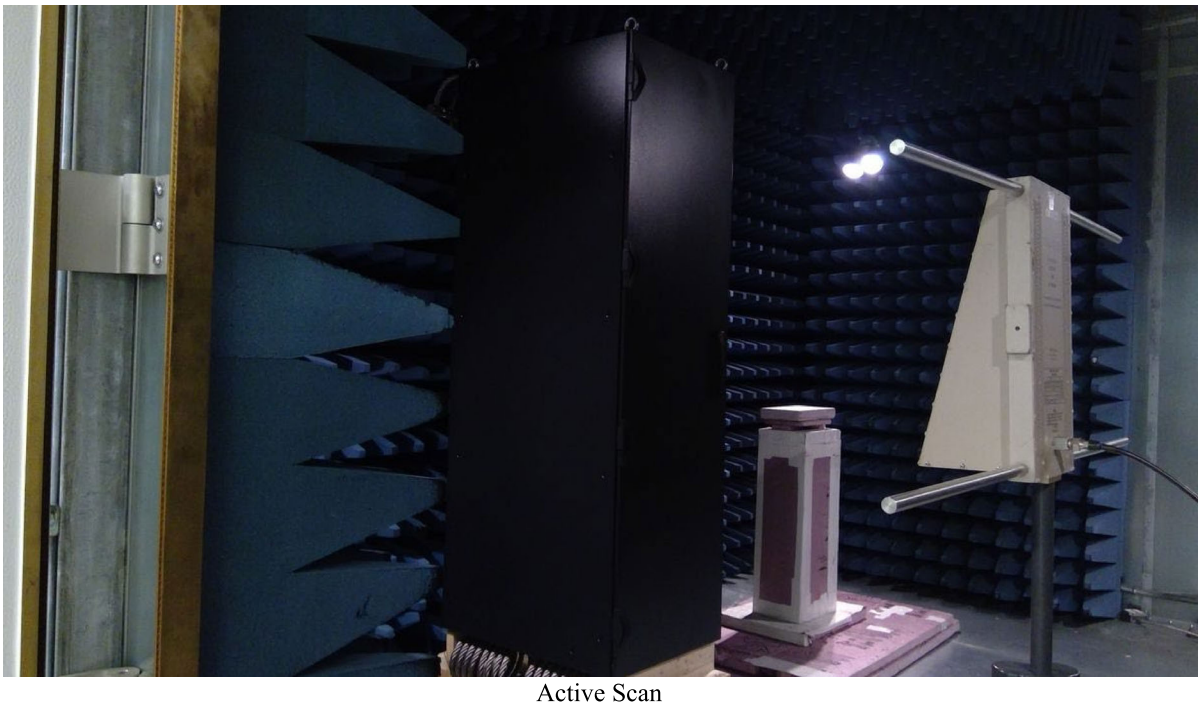


Calibration 4-8 GHz

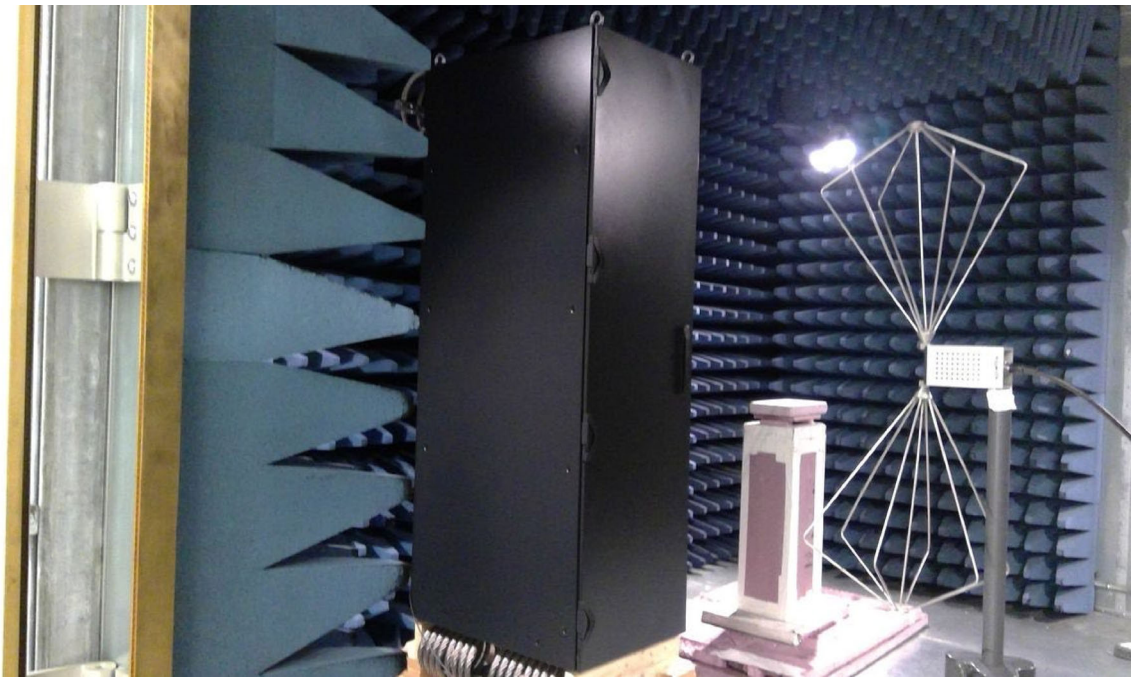


Calibration 8-18 GHz

Active
Probe Location

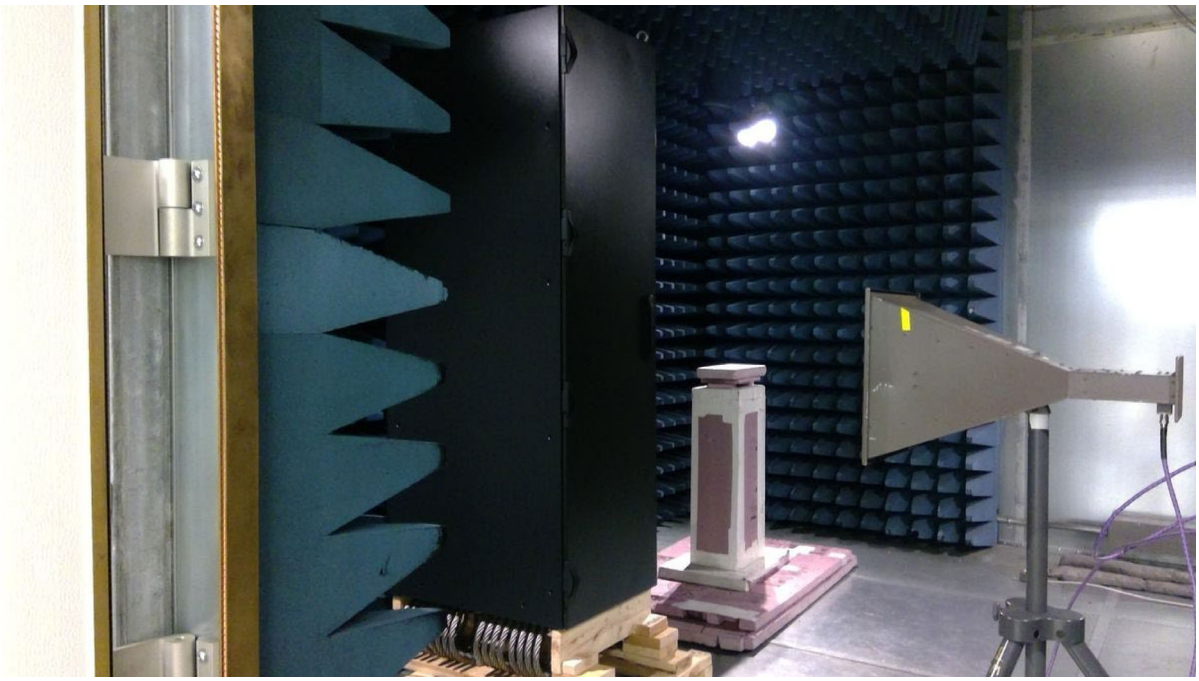


Active Scan
2-30 MHz

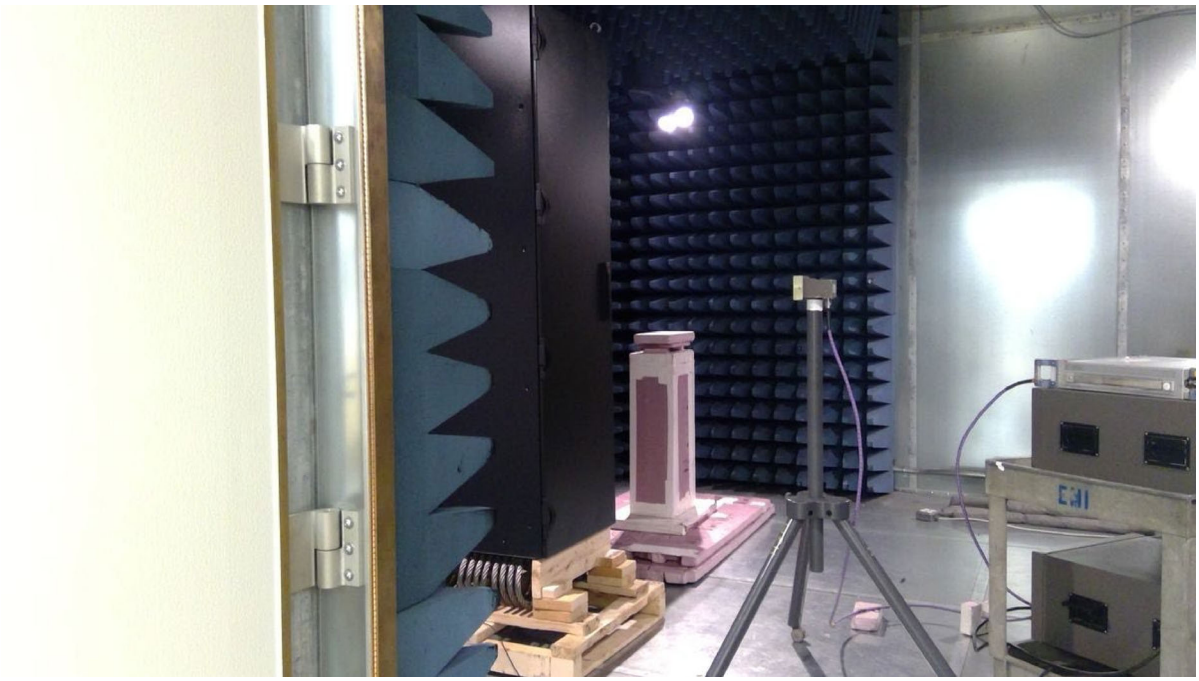


Active Scan
30-200 MHz

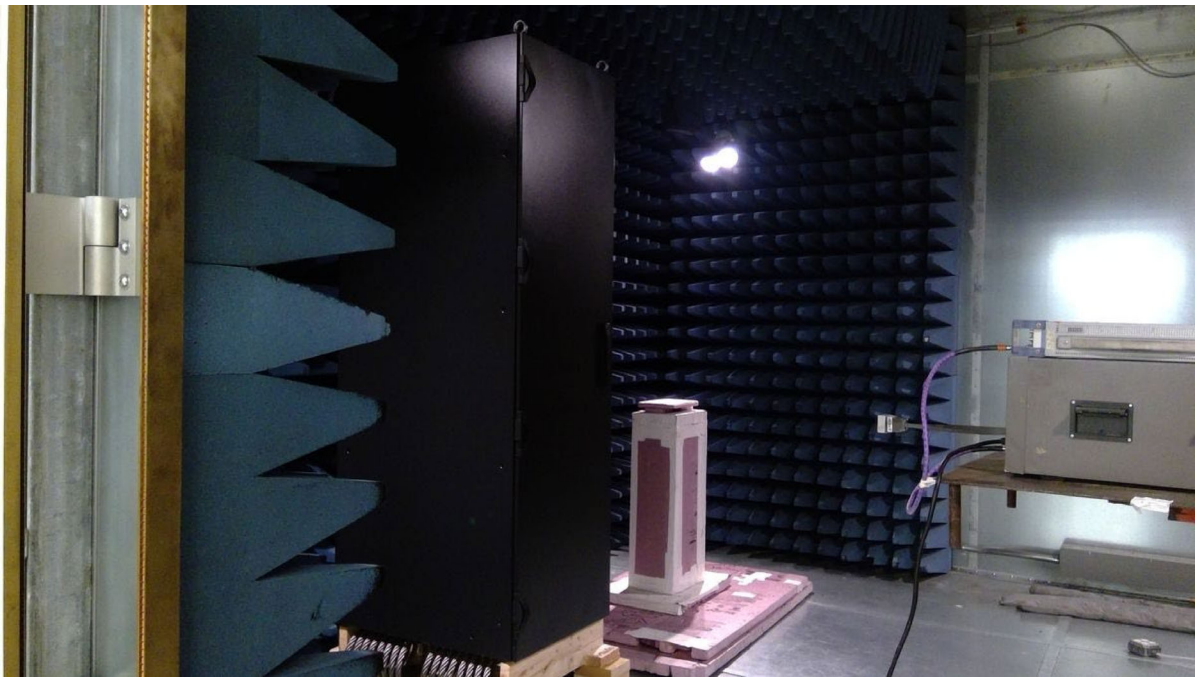
Active Scan
200 MHz-1 GHz



Active Scan
1-4 GHz

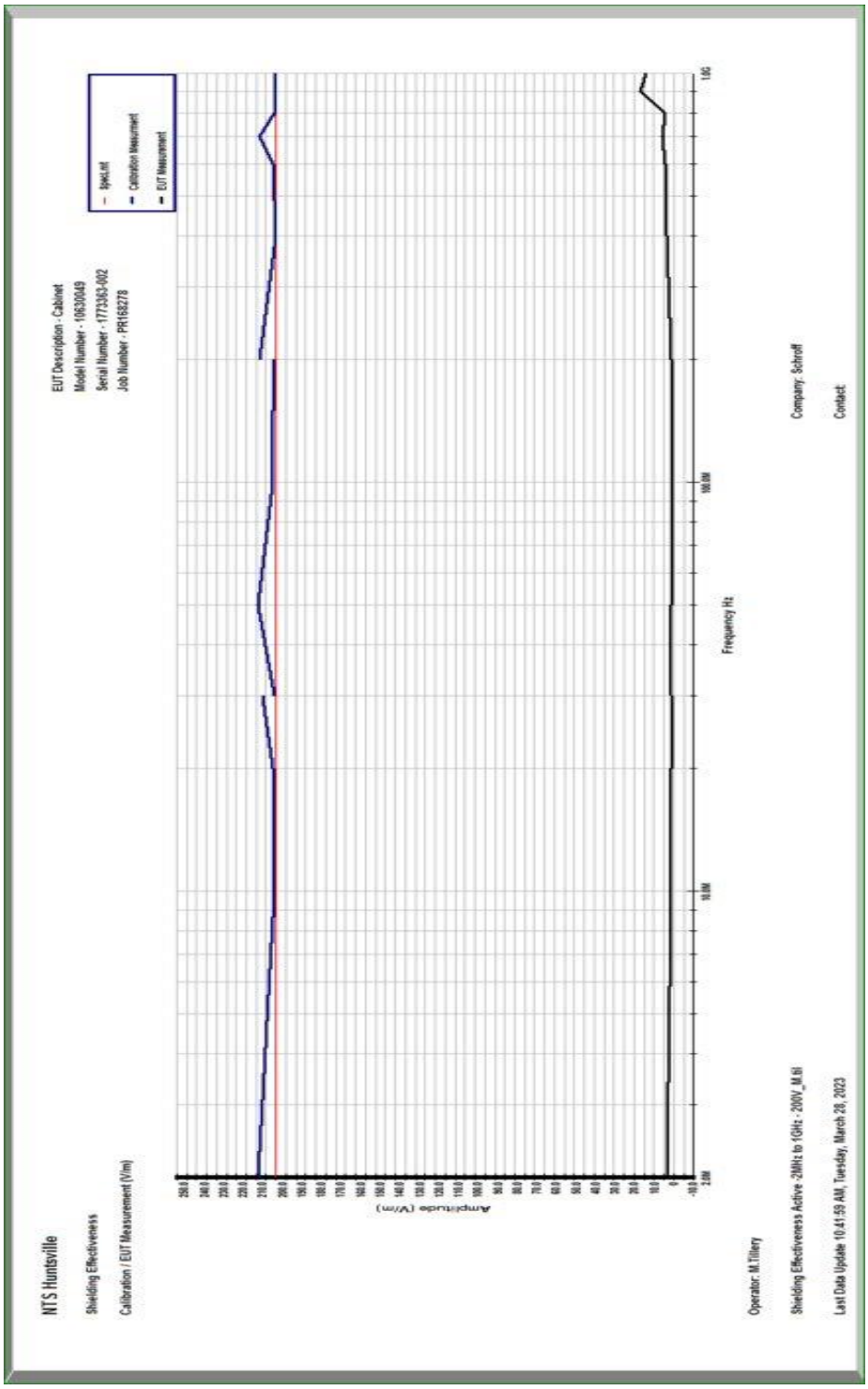


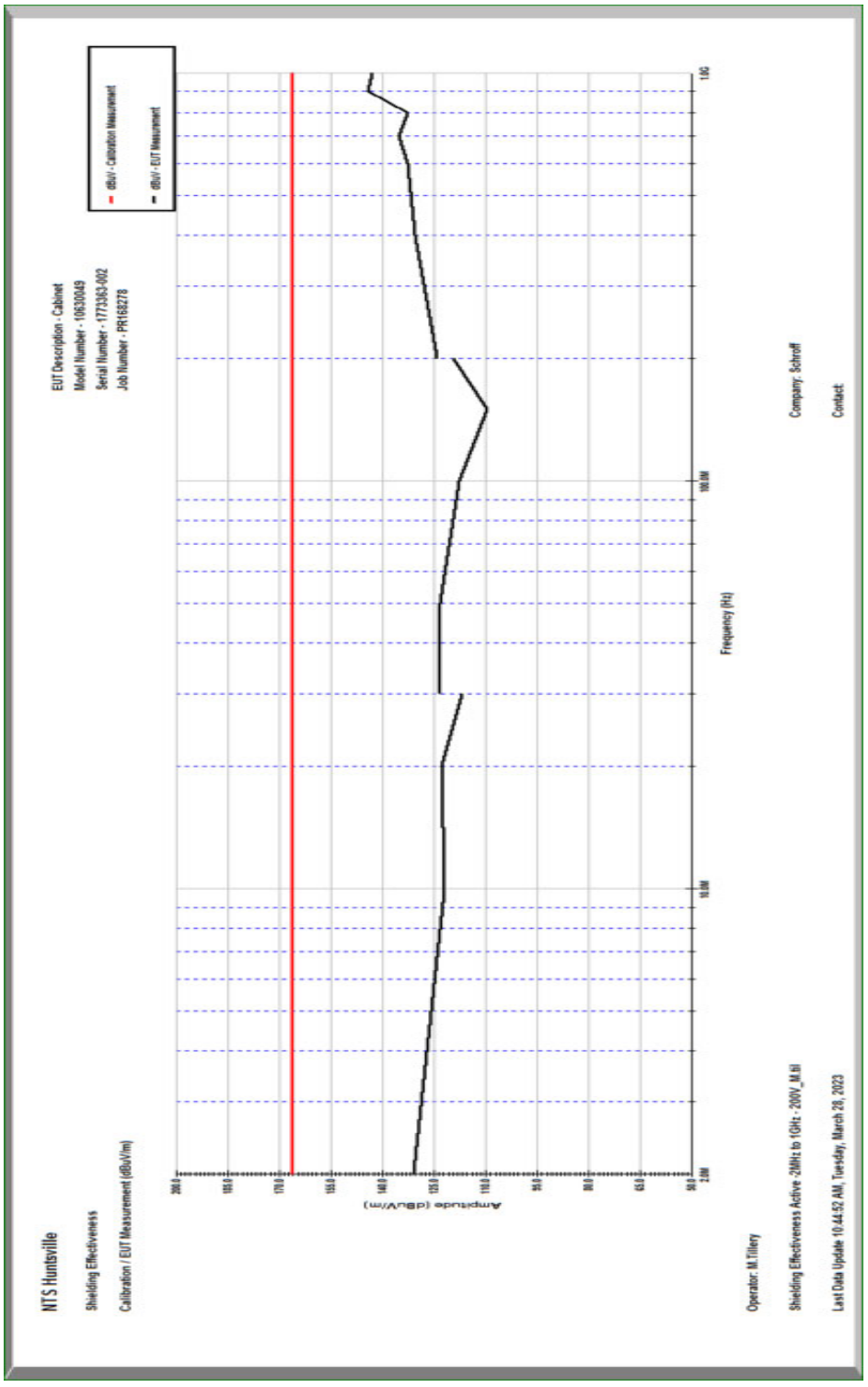
Active Scan
4-8 GHz



Active Scan
8-18 GHz

5.1.5 Test Waveforms




NTS Huntsville
Shielding Effectiveness
Calibration / EUT Measurement (dBuV/m)
EUT Description - Cabinet
Model Number - 10630049
Serial Number - 1773363-002
Job Number - PR168278
dBuV - Calibration Measurement
dBuV - EUT Measurement
Amplitude (dBuV/m)
Frequency (Hz)
Company: Schroff
Contact:
Operator: M.Tillery
Shielding Effectiveness Active 2MHz to 1GHz - 200V_M.til
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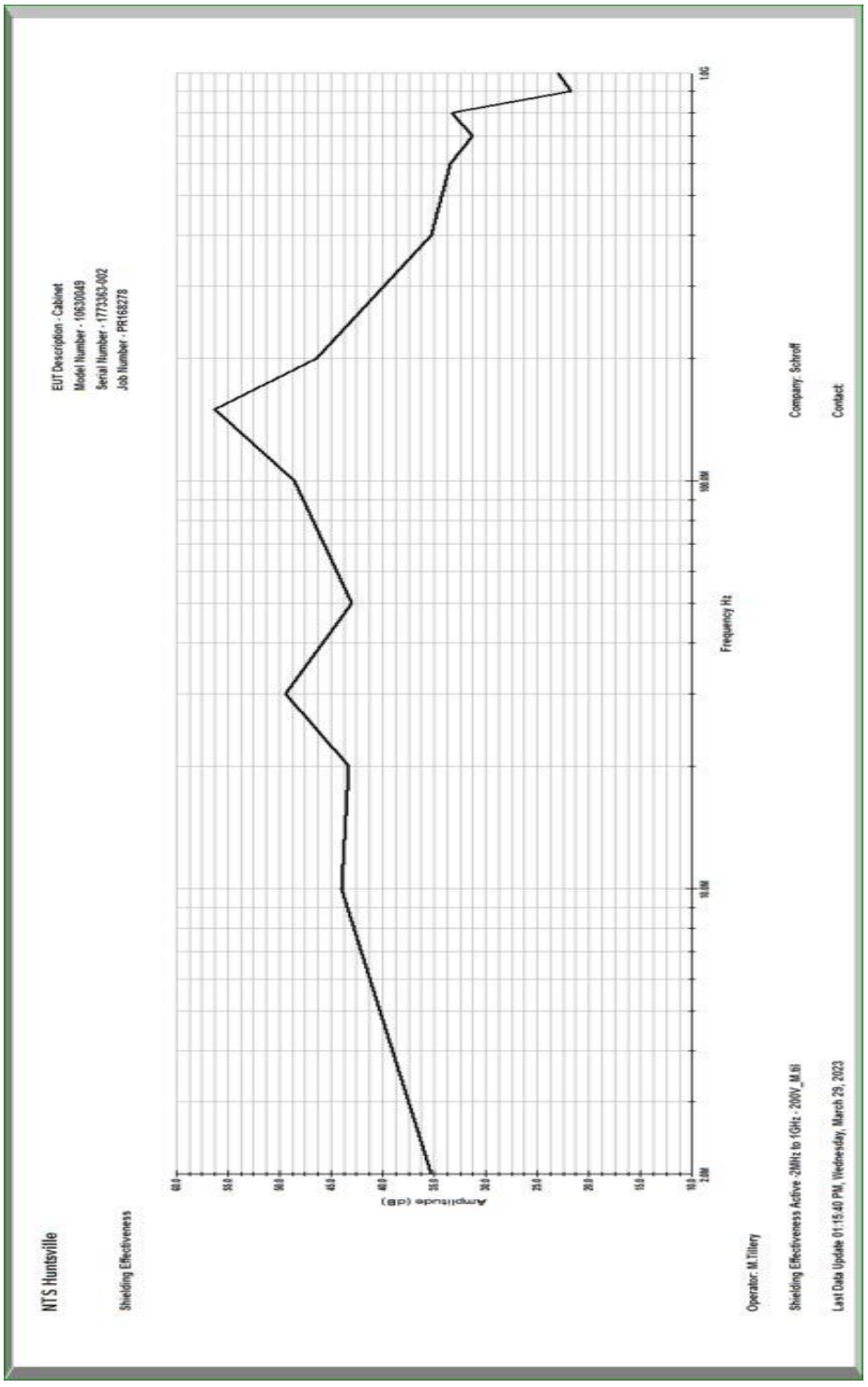
NTS Huntsville
Shielding Effectiveness
EUT Description - Cabinet
Model Number - 10630049
Serial Number - 1773363-002
Job Number - PR168278
Company: Schroff
Contact:
Amplitude (dB)
Frequency Hz
Operator: M.Tillery
Shielding Effectiveness Active 2MHz to 1GHz - 200V_M.til
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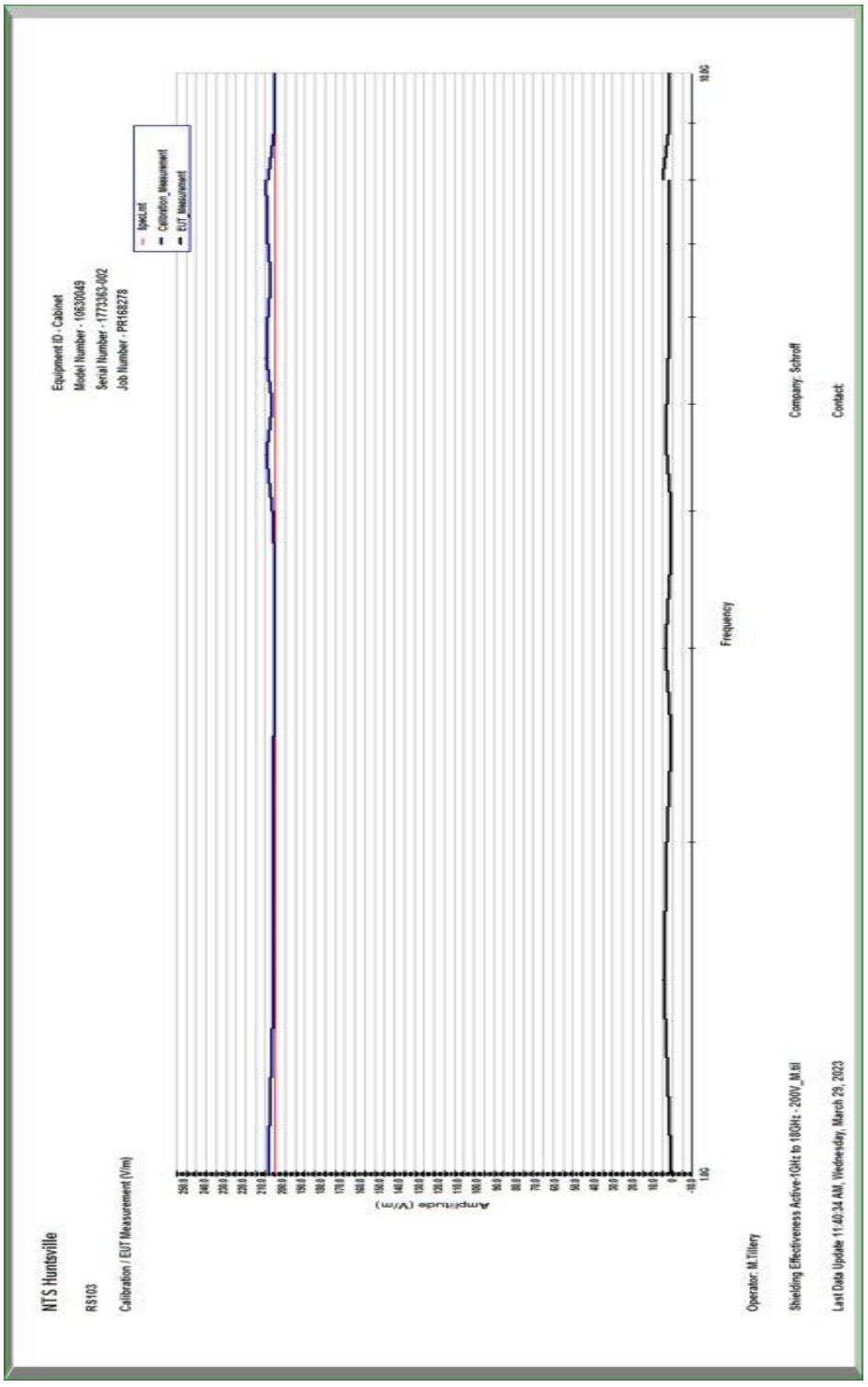
NTS Huntsville
R5103
Calibration / EUT Measurement (V/m)
Equipment ID - Cabinet
Model Number - 10630049
Serial Number - 1773363-002
Job Number - PR168278
SpecLimit
Calibration_Measurement
EUT_Measurement
Amplitude (V/m)
Frequency
Operator: M.Tillery
Company: Schroff
Contact:
Shielding Effectiveness Active-1GHz to 18GHz - 200V_M.tst
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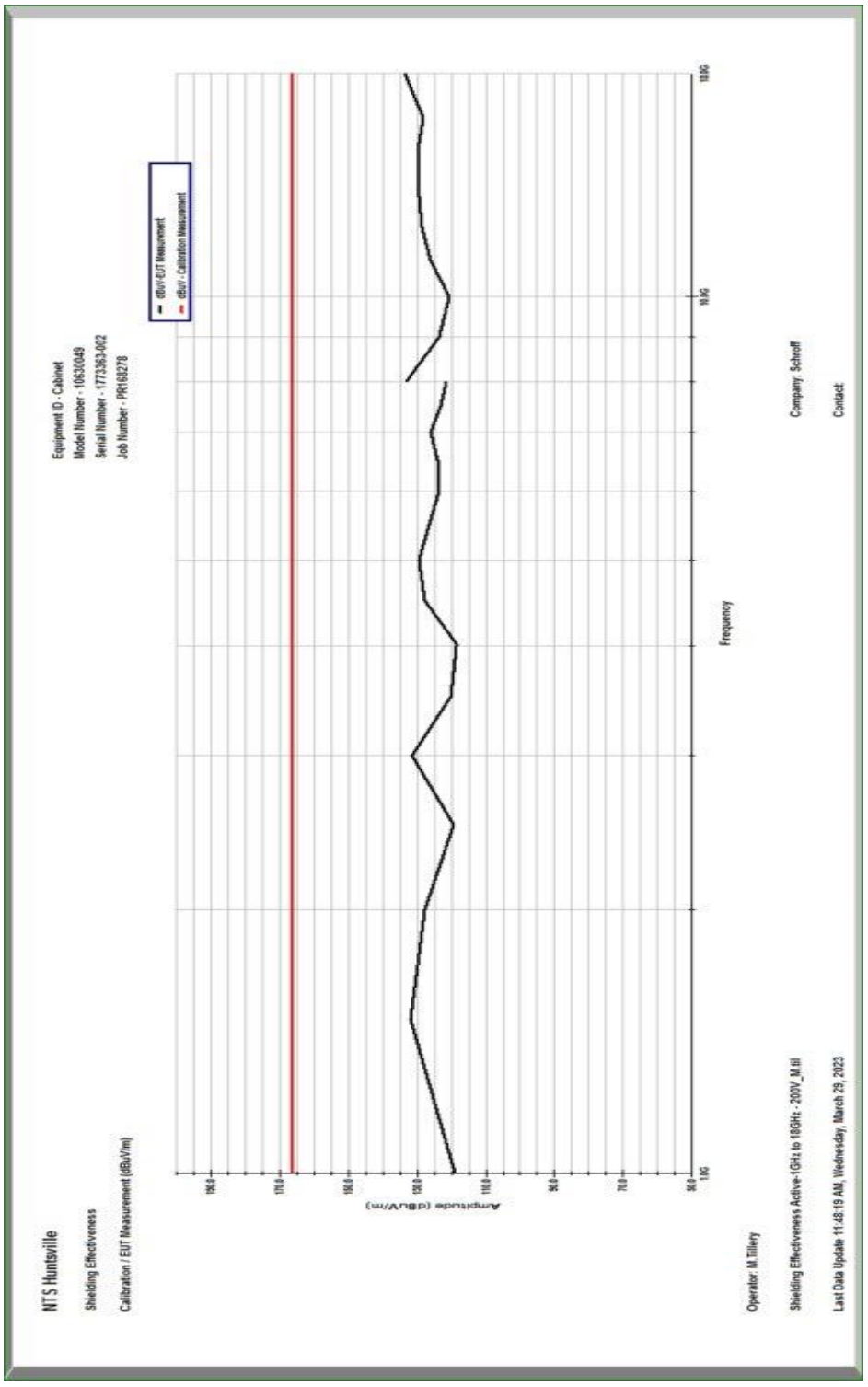
NTS Huntsville
Shielding Effectiveness
Calibration / EUT Measurement (dBuV/m)
Equipment ID - Cabinet
Model Number - 10630049
Serial Number - 1773363-002
Job Number - PR168278
dBuV EUT Measurement
dBuV Calibration Measurement
Amplitude (dBuV/m)
Frequency
Operator: M.Tillery
Company: Schroff
Contact:
Shielding Effectiveness Active 1GHz to 18GHz - 200V_M.til
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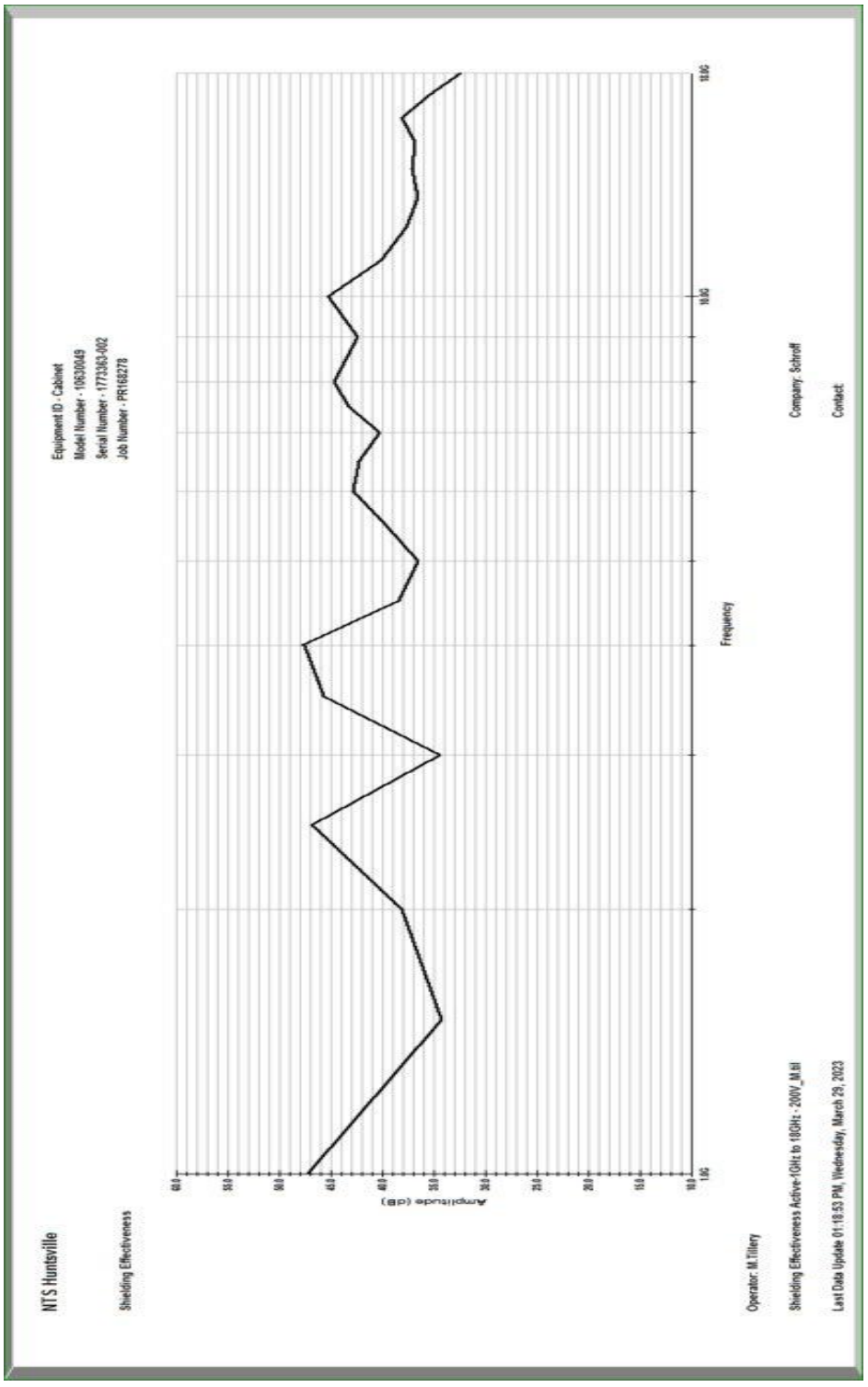
NTS Huntsville
Shielding Effectiveness
Equipment ID - Cabinet
Model Number - 10030049
Serial Number - 1773363-002
Job Number - PR168278
Company: Schroff
Contact:
Amplitude (dB)
Frequency
Operator: M.Tillery
Shielding Effectiveness Active-1GHz to 18GHz - 200V_M.tst
Last Data Update 01:18:53 PM, Wednesday, March 29, 2023

5.1.6 Test Equipment List

Table 5.1-1: Shielding Effectiveness Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC042494	Chamber (EMI, Semi-Anechoic)	ETS-Lindgren	CH 1 (S201 8X8)	NCR	NCR
WC042117	Antenna (Double Ridge Guide)	A. H. Systems	SAS-570	NCR	NCR
WC042234	Probe (Isotropic Field)	Narda	EP-604	04/05/2022	04/05/2023
WC042501	Antenna (Dipole)	EMCO	3109	NCR	NCR
WC042508	Amplifier (Pre/RF/Low Noise)	Amplifier Research	2500A225	NCR	NCR
WC042512	Amplifier (Pre/RF/Low Noise)	Amplifier Research	200T4G8	NCR	NCR
WC042516	Amplifier (Microwave)	Amplifier Research	250T8G18M3	NCR	NCR
WC042522	Generator (Signal)	Rohde & Schwarz	SMR40	04/22/2022	04/22/2023
WC042529	Generator (E-Field)	Amplifier Research	AT3000	NCR	NCR
WC042594	Antenna (Horn/Waveguide)	Amplifier Research	AT4004	NCR	NCR
WC043177	Generator (Signal)	Rohde & Schwarz	SMC100A	01/31/2023	01/31/2024
WC043234	Amplifier (Conditioning)	Amplifier Research	125S1G4	NCR	NCR
WC060039	Antenna (Horn/Waveguide)	Amplifier Research	AT4003	NCR	NCR
WC060108	Sensor (Power)	Amplifier Research	AT4002A	NCR	NCR
WC069385	Antenna (Horn/Waveguide)	Amplifier Research	AT4004	NCR	NCR

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

End of Test Report