



Advanced Testing Services, Inc.

14959 –TR MIL-STD-188-125-1 APP A FT OTS ISTS REV 05

TEST REPORT

TEST #1

FACTORY TESTING

**MIL-STD-188-125-1 APPENDIX A
RF SHIELDING EFFECTIVENESS TESTING**

OF

**OMNI THREAT STRUCTURES (OTS)
INTEGRATED SHIELDED TEST STRUCTURE (ISTS)**

Date of Document: Rev 05
February 3, 2020

Prepared For:
OMNI-THREAT STRUCTURES
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1.0 INTRODUCTION

1.1 Test Objectives

MIL-STD-188-125-1 Appendix A Acceptance testing was performed on one six-sided shielded structure known as Omni Threat Structures (OTS) Integrated Shielded Test Structure (ISTS) and will be referred to in this report as ISTS. Successful factory testing will validate its ability to provide attenuation levels compliant with MIL-STD-188-125-1 Appendix A Acceptance testing. This is considered Factory testing and is meant to identify assembly, manufacturing, and design issues that may prevent the unit under test from meeting the attenuation specifications outlined in this test report.

1.2 Applicable Documents

The following documents are applicable to this test report to the extent specified.

MIL-HDBK-423	(15 May 1993 High-Altitude Electromagnetic Pulse (Hemp) Protection for Fixed and Transportable Ground – Based C4I Facilities –Volume 1 – Fixed Facilities)
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MIL-STD-188-125-1	High-Altitude Electromagnetic Pulse (HEMP) Protection for Ground-Based C ⁴ I Facilities Performing Critical, Time Urgent Missions, 17/July/1998.
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1.3 ATSI Company Credentials

Advanced Testing Services, Inc. (ATSI) is an independent testing organization specializing in EMI, EMC, HEMP, RF Shielding Effectiveness, and Acoustic testing. ATSI has been the quality control, testing and certifying agency on many shielding projects such as the National Test Facility at Falcon AFB in Colorado, a 350,000 square foot RF shielded building and the LC-40 Launch Complex in Cape Canaveral Florida, which is a 21 story RF shielded complex used to house the TITAN IV missile prior to launch.

ATSI personnel have been performing EMI, and EMC measurements for IEC 801.3 chamber verification, MIL-STD-188-125-1, MIL-STD-461 EMC testing, MIL-STD-285, NSA 65-6, and NSA 73-2A RF Shielding Effectiveness testing since 1984, and have performed acoustic measurements of SCIF Facilities and other secure type enclosures in the continental US and overseas.

Additional Company Qualifications and References are shown in appendix B of this report.



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1.4 Test Personnel

Testing was performed by two ATSI employees to execute the required testing specified by MIL-STD-188-125-1 Appendix A. The test team personnel names and titles are as follows:

Cardenas Jr, Antonio – Senior Test Engineer

Kenneth Baker – Test Technician

1.5 Executive Summary

MIL-STD-188-125-1 Appendix A acceptance testing was performed on one RF shielded enclosure known as OTS ISTS. This testing took place at Omni-Threat Structures located in Lakeland, Florida. Testing took place on December 4, 2019. with no deviations of MIL-STD-188-125-1 Appendix A. The OTS ISTS under test successfully satisfied all pass/fail criteria specified in section 3.8 of this test report. Data plots for the shielding effectiveness (SE) measurements taken can be found in Appendix A of this test report.

2.0 OTS ISTS DESCRIPTION

The OTS ISTS consists of a 10 inch thick cube of OTS proprietary, licensed conductive concrete mix with two embedded shielding grids. The approximate dimensions of the OTS ISTS are 8' x 8' x 10'. One RF door and four WBC Pipe Penetrations were installed as part of the RF shield barrier. Typical Drawing is shown in figure 2-1.

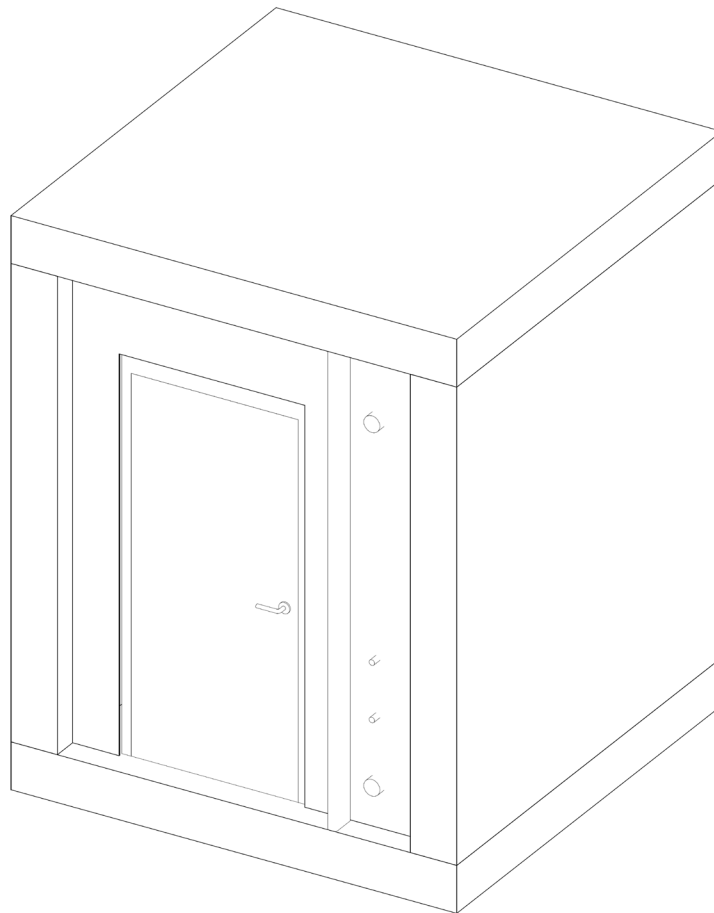


Figure 2-1 OTS ISTS Typical Drawing

3.0 RF SHIELDING EFFECTIVENESS MEASUREMENT PROCEDURES FOR MIL-STD-188-125-1, APPENDIX A, ACCEPTANCE TESTING

3.1 General Test Setup

Testing is conducted in accordance with MIL-STD-188-125-1 Appendix A test procedures. In general, the shielding effectiveness measurements are a stepped frequency measurement technique, where the transmitting system is placed outside the HEMP shield barrier, and the receiver is placed inside the barrier at the same location and specified distances. A controller steps the transmitting and receiving system through a series of frequencies from 10 KHz through 20 MHz Magnetic field and 20 MHz through 1000 MHz for the resonant/plane wave. The resulting signal level in dBm at each frequency is then measured and recorded. A previously measured level in dBm at the same frequencies with no shield barrier in place is used as the reference level. The algebraic difference from the reference level to the measured level produces the Shielding Effectiveness in dB for that specific location at all frequencies measured. Shielding Effectiveness is displayed in a graphic format with a comparison to the required attenuation. The measurement system is an automated data collection system using a Network Analyzer with EG&G RF over fiber as part of the transmit and receive system. All test data is recorded into specific files and used for creating the resultant graphs and test results.

Table 3-1 MIL-STD-188-125-1 Test Equipment

Equipment	Manufacturer	Model Number	Serial Number	Frequency Range	Calibration Due Date
Network Analyzer	Keysight Technologies	E5061B	MY49101556	5Hz - 3GHz	03/04/20
RF Over Fiber	EG&G	ODR-15H	015	10KHz-1GHz	N/A
RF Over Fiber	EG&G	ODT-15	09003	10KHz-1GHz	N/A
Power Amplifier	Amplifier Research	25W1000A	24525	1MHz-1000MHz	N/A
Power Amplifier	Amplifier Research	75A250	305466	10KHz-250MHz	N/A
Switch Modules	ATSI	SW05	001	DC-18GHz	N/A
Loop Antenna	ETS-Lindgren	6512	00094557	10KHz-30MHz	N/A
Loop Antenna	ETS-Lindgren	6512	00094555	10KHz-30MHz	N/A
Biconical Dipole Antenna	Raven Engineering	94455-1	96022401	20MHz-200MHz	N/A
Log Periodic Antenna	Electro Metrics	LPA-30	2417	200MHz-1GHz	N/A
Omni Directional Antenna	Electro Metrics	6842-1	101	20MHz-18GHz	N/A
Computer	HP	ZBook			N/A
Coax Cables		RG223			

3.2 Calibration Procedure

Calibration for all test frequencies, and both polarizations is performed using the equipment configuration in Figure 3-1 Calibration Measurement Equipment Configuration. The transmitting and receiving antennas are on the same plane, and the distance between antennas is 3.05 meters. The instrumentation is stepped through the test frequencies, and the received signal strength for

each test frequency and antenna polarization is recorded as the calibration signal level for that configuration. Frequency stepping is interrupted as necessary to perform antenna and equipment changes. Table 3-1 MIL-STD-188-125-1 Test Equipment, shows the test equipment that was used for conducting the shielding effectiveness measurements.

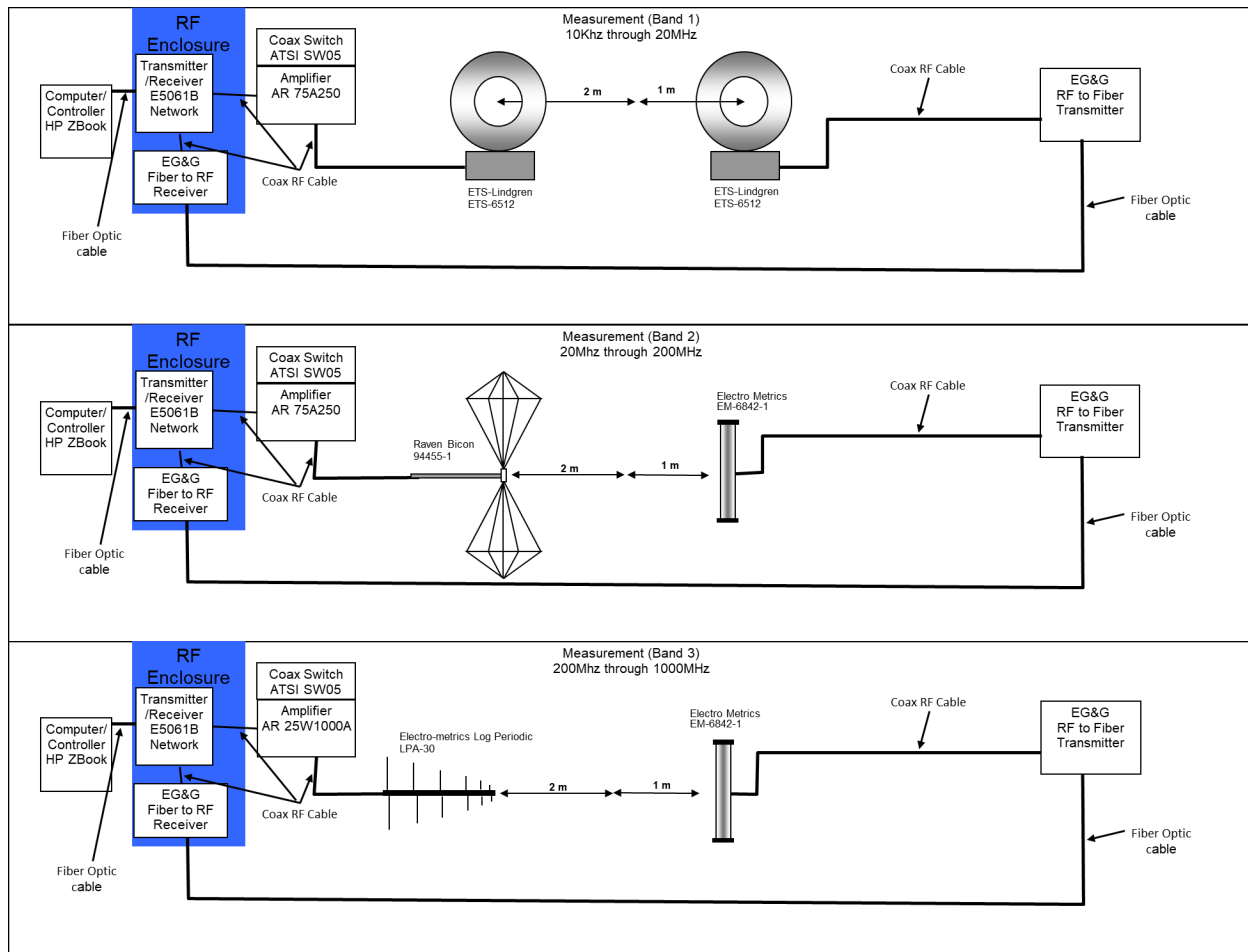


Figure 3-1 Calibration Measurement Equipment Configuration

3.3 Measurement Procedure

Shielding effectiveness measurements for the OTS ISTS at each test frequency and required antenna polarization is performed using the configuration, as shown in Figure 3-3 SE Measurement Equipment Configuration. The transmit antenna is placed outside the shielded enclosure centered on the test point with a separation distance between the antenna and shield surface of 2 meters. The receive antenna is placed inside the shielded enclosure centered on the test point with a separation distance between the antenna and shield surface of 0.746 meters. Both antennas are co-polarized to either horizontal or vertical, and the measurement sequence is started. Identical equipment, antennas, cables, and equipment settings (except attenuation) is used in the calibration and SE measurements.

The system completes two separate measurement sequences. The first sequence steps through the test frequencies with the transmitting signal powered off and the received signal strength for each test frequency is recorded as the Measurement Range (MR) signal level for that test point and configuration. The second sequence steps through the test frequencies with the transmitting signal on and the received signal strength for each test frequency is recorded as the Shielding Effectiveness (SE) signal level for that test point and configuration.

Frequency stepping was interrupted as necessary to perform antenna and equipment changes.

The minimum dynamic range requirement is 20dB greater than the attenuation requirements set forth by MIL-STD-188-125-1 and is shown in Figure 3-2 Minimum HEMP Shielding Effectiveness Requirements.

The antenna polarizations are as follows:

- a. For the walls, the loop antennas are in the same plane, with the loop parallel to the ground in the horizontal polarization and perpendicular to the ground in the vertical polarization. For the ceiling, the loop antennas are in the same plane, with the vertical recognized as front to back and Horizontal as left to right.
- b. For the walls, the Log Periodic, Bi-conical, or Club antennas elements are parallel with the ground in the horizontal polarization and perpendicular to the ground in the vertical polarization. For the ceiling, the antennas are in the same plane, with the vertical recognized as front to back and horizontal recognized as left to right.
- c. The planes of all the antennas are perpendicular to the surface of the shield for each test position.

When making the pass/fail determination, below-specification shielding effectiveness values can be disregarded if it can be demonstrated that the reading is due to an ambient noise source that cannot practically be eliminated.

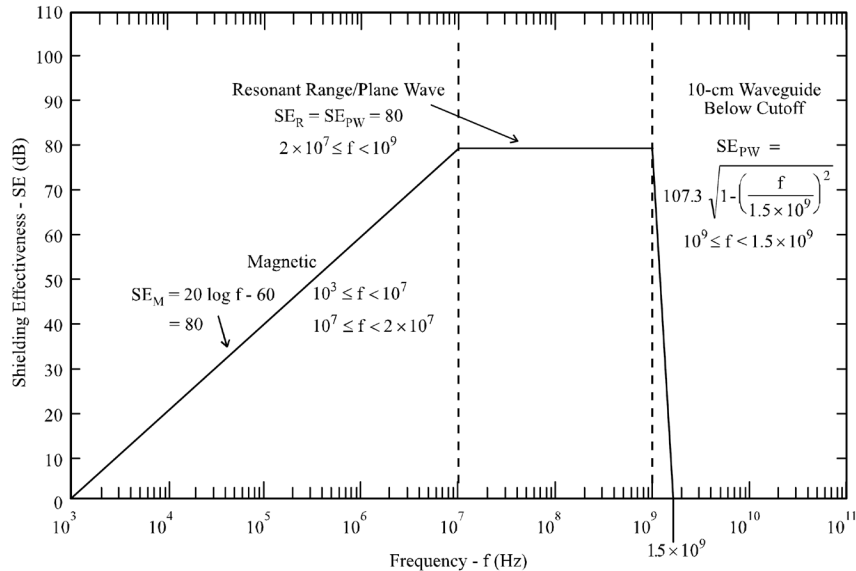


FIGURE A-5. Minimum HEMP shielding effectiveness requirements.

Figure 3-2 Minimum HEMP Shielding Effectiveness Requirements

3.4 Test Instrumentation Set-up

The instrumentation equipment listed in Table 3-1 MIL-STD-188-125-1 Test Equipment is configured as shown in the block diagram in Figure 3-3 SE Measurement Equipment Configuration. This instrumentation configuration is used to conduct the RF shielding effectiveness measurements for the MIL-STD-188-125-1 Appendix A testing. The switching of antennas and cable connections for the different frequency ranges and fields measured is done manually.

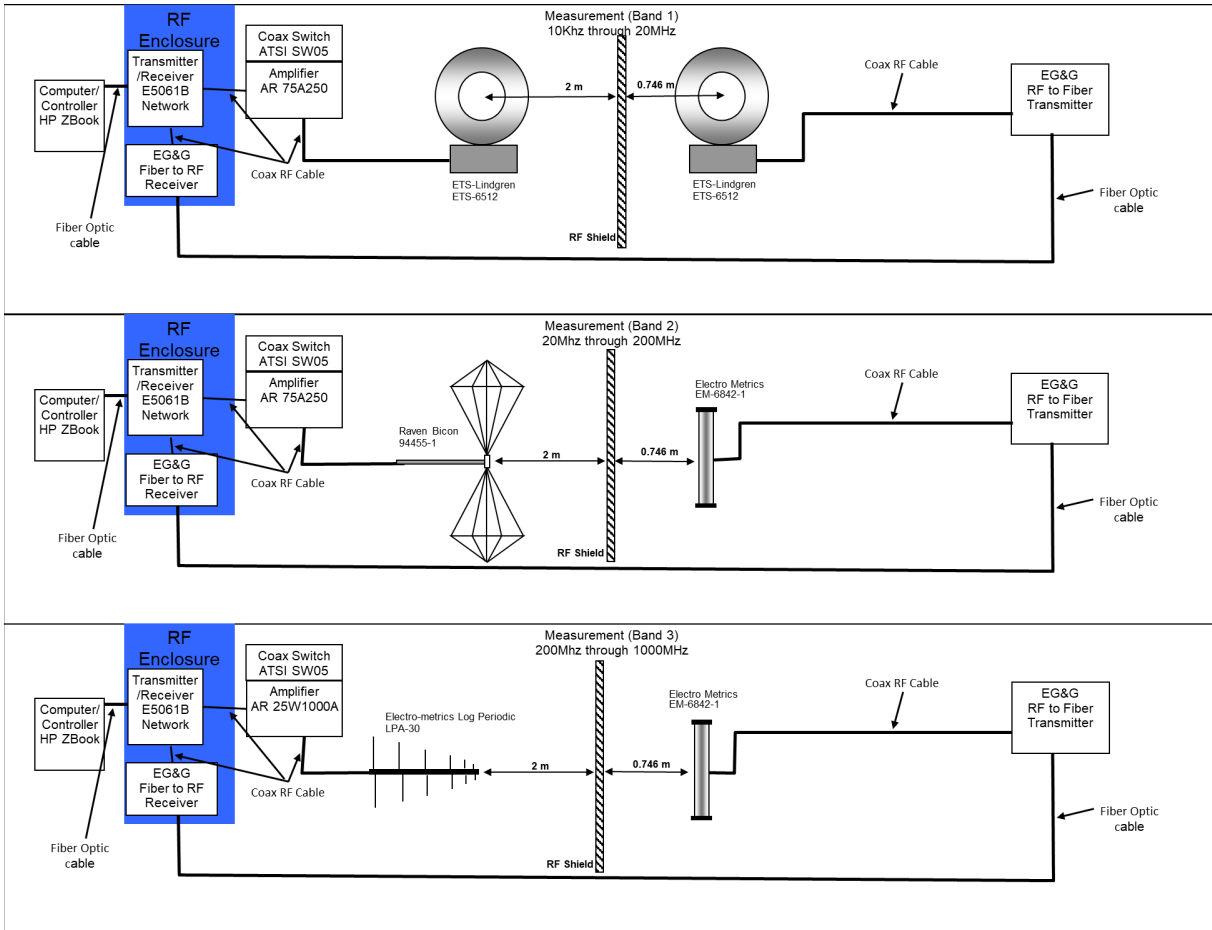


Figure 3-3 SE Measurement Equipment Configuration

3.5 Test Point Locations

Test point locations were determined using a 10' x 10' grid. Using the 10' x 10' grid, the established test points for the OTS ISTS included 5 test point locations. These included one test point for each of the four sides of the OTS ISTS and one test point for the top of the OTS ISTS. Figure 3-4 shows the test point location numbered 1-5.

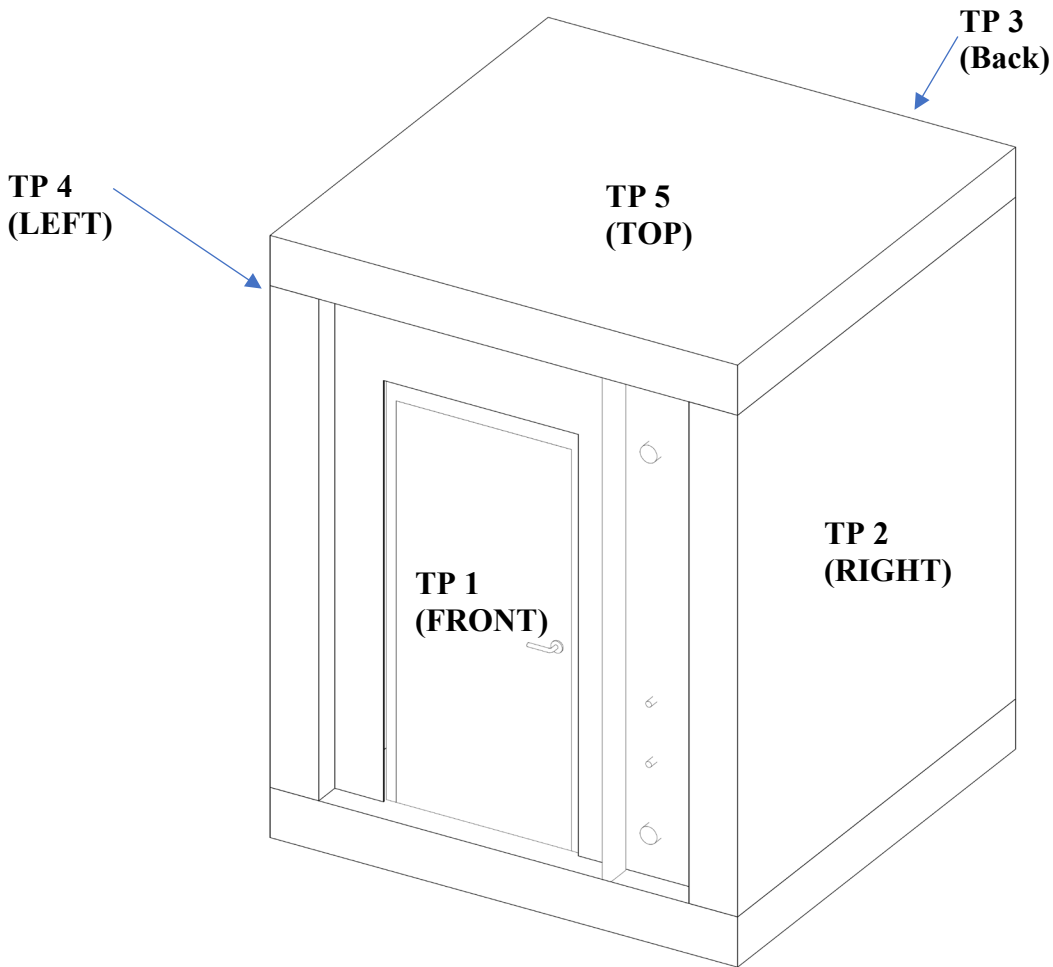


Figure 3-4 OTS ISTS Test Point locations

3.6 Test Frequencies

The test frequencies are spaced approximately logarithmically within each decade, with minimum sampling density as follows:

- | | |
|--------------------|------------------------|
| • 10 KHz – 100 KHz | : 22 Test Frequencies |
| • 100 KHz – 1 MHz | : 21 Test Frequencies |
| • 1 MHz – 10 MHz | : 40 Test Frequencies |
| • 10 MHz – 100 MHz | : 152 Test Frequencies |
| • 100 MHz – 1 GHz | : 151 Test Frequencies |



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Table 3-2 Appendix A Test Frequencies shows the test frequencies that were used for MIL-STD-188-125-1 Appendix A testing.

Table 3-2 Appendix A Test Frequencies

10KHz-100KHz (Hz)									
10000	11225.98542	12451.97085	13894.95494	15598.45617	17301.95739	19306.97729	21673.98456	24040.99184	26826.95795
30309.95104	33792.94412	37275.9372	41595.62163	46695.18421	51794.74679	57796.92884	64882.74807	71968.5673	80308.57221
90154.28611	100000								
100KHz-1MHz (Hz)									
112259.8542	124519.7085	138949.5494	155984.5617	173019.5739	193069.7729	216739.8456	240409.9184	268269.5795	303099.5104
337929.4412	372759.372	415956.2163	466951.8421	517947.4679	577969.2884	648827.4807	719685.673	803085.7221	901542.8611
1000000									
1MHz-10MHz (Hz)									
1064838.558	1129677.117	1194515.675	1259354.234	1324192.792	1400688.179	1491506.781	1582325.383	1673143.986	1763962.588
1854781.19	1961927.374	2089135.917	2216344.459	2343553.002	2470761.545	2597970.087	2748048.481	2926227.983	3104407.485
3282586.986	3460766.488	3638945.99	3849159.022	4098732.944	4348306.866	4597880.788	4847454.71	5097028.632	5391471.54
5741046.783	6090622.025	6440197.267	6789772.509	7139347.752	7551770.453	8041416.363	8531062.272	9020708.181	9510354.091
10MHz-100MHz (Hz)									
10000000	10179733.57	10359467.14	10539200.71	10718934.28	10898667.85	11078401.42	11258135	11437868.57	11617602.14
11797335.71	11977069.28	12156802.85	12336536.42	12516269.99	12696003.56	12875737.13	13055470.7	13235204.27	13414937.84
13594671.42	13774404.99	13986059.27	14235427.47	14484795.67	14734163.87	14983532.07	15232900.27	15482268.47	15731636.67
15981004.87	16230373.07	16479741.27	16729109.47	16978477.67	17227845.87	17477214.07	17726582.27	17975950.47	18225318.67
18474686.87	18724055.07	18973423.27	19264964.45	19611220.53	19957476.62	20303732.7	20649988.79	20996244.87	21342500.96
21688757.05	22035013.13	22381269.22	22727525.3	23073781.39	23420037.47	23766293.56	24112549.64	24458805.73	24805061.81
25151317.9	25497573.98	25843830.07	26190086.15	26536342.24	26944093.45	27428369.27	27912645.08	28396920.89	28881196.71
29365472.52	29849748.33	30334024.14	30818299.96	31302575.77	31786851.58	32271127.4	32755403.21	33239679.02	33723954.83
34208230.65	34692506.46	35176782.27	35661058.08	36145333.9	36629609.71	37113885.52	37684168.79	38361479.82	39038790.84
39716101.86	40393412.88	41070723.9	41748034.92	42425345.95	43102656.97	43779967.99	44457279.01	45134590.03	45811901.06
46489212.08	47166523.1	47843834.12	48521145.14	49198456.16	49875767.19	50553078.21	51230389.23	51907700.25	52705301.81
53645025.15	54584748.48	55524471.82	56464195.15	57403918.49	58343641.82	59283365.16	60223088.5	61162811.83	62102535.17
63042258.5	63981981.84	64921705.17	65861428.51	66801151.84	67740875.18	68680598.51	69620321.85	70560045.18	71499768.52
72598417.21	73903254.49	75208091.76	76512929.04	77817766.31	79122603.59	80427440.86	81732278.14	83037115.42	84341952.69
85646789.97	86951627.24	88256464.52	89561301.79	90866139.07	92170976.35	93475813.62	94780650.9	96085488.17	97390325.45
98695162.72	100000000								
100MHz-1000MHz (Hz)									
101797335.70	103594671.40	105392007.10	107189342.80	108986678.50	110784014.20	112581350.00	114378685.70	116176021.40	117973357.10
119770692.80	121568028.50	123365364.20	125162699.90	126960035.60	128757371.30	130554707.00	132352042.70	134149378.40	135946714.20
137744049.90	139860592.70	142354274.70	144847956.70	147341638.70	149835320.70	152329002.70	154822684.70	157316366.70	159810048.70
162303730.70	164797412.70	167291094.70	169784776.70	172278458.70	174772140.70	177265822.70	179759504.70	182253186.70	184746868.70
187240550.70	189734232.70	192649644.50	196112205.30	199574766.2	203037327	206499887.9	209962448.7	213425009.6	216887570.5
220350131.3	223812692.2	227275253	230737813.9	234200374.7	237662935.6	241125496.4	244588057.3	248050618.1	251513179
254975739.8	258438300.7	261900861.5	265363422.4	269440934.5	274283692.7	279126450.8	283969208.9	288811967.1	293654725.2
298497483.3	303340241.4	308182999.6	313025757.7	317868515.8	322711274	327554032.1	332396790.2	337239548.3	342082306.5
346925064.6	351767822.7	356610580.8	361453339	366296097.1	371138855.2	376841687.9	383614798.2	390387908.4	397161018.6
403934128.8	410707239	417480349.2	424253459.5	431026569.7	437799679.9	444572790.1	451345900.3	458119010.6	464892120.8
471665231	478438341.2	485211451.4	491984561.6	498757671.9	505530782.1	512303892.3	519077002.5	527053018.1	536450251.5
545847484.8	555244718.2	564641951.5	574039184.9	583436418.2	592833651.6	602230885	611628118.3	621025351.7	630422585
639819818.4	649217051.7	658614285.1	668011518.4	677408751.8	686805985.1	696203218.5	705600451.8	714997685.2	725984172.1
739032544.9	752080917.6	765129290.4	778177663.1	791226035.9	804274408.6	817322781.4	830371154.2	843419526.9	856467899.7
869516272.4	882564645.2	895613017.9	908661390.7	921709763.5	934758136.2	947806509	960854881.7	973903254.5	986951627.2
1000000000									

These are the frequencies that were used by ATSI's program for the MIL-STD-188-125-1, Appendix A, RF Shielding Effectiveness testing. There is a total of 386 frequencies.

3.7 Data Management

Data is produced at the time of testing. After each measurement is complete, a binary file is created with a date, time, and unique identifier. This data is considered Raw Data and is permanently stored on the computer hard drive.

When SE and MR measurements are taken, the resulting data is immediately processed with the calibration data. The resulting attenuation data is then displayed on the computer screen in graph form. The test engineer can view the resulting data and determine the validity of the test at that time. Once the test is determined valid, the resulting data is plotted in an excel file template. The

resulting data is processed and compared to the pass/fail criteria outlined in MIL-STD-188-128-1 Appendix A Paragraph A.5.5.

3.8 Pass/Fail Criteria

The shielding effectiveness pass/fail criteria are shown as a function of frequency in Figure 3-2 Minimum HEMP Shielding Effectiveness Requirements. The facility HEMP shield and aperture POE protective treatments shall be considered satisfactory when both of the following criteria are met:

- a. No sequence of measurements occurs at three consecutive frequencies with the measured shielding effectiveness below the minimum requirements curve (Figure 3-2).
- b. No more than 10 percent of the measurements in any decade (10 kHz – 100 kHz, 100 kHz – 1 MHz, 1 MHz – 10 MHz, 10 MHz – 100 MHz, and 100 MHz – 1 GHz) are below the minimum requirements.

3.9 Data Presentation

Each graph contains information regarding the test location, date of test, facility, and contains the following plots:

1. Measurement Range Plot (MR)
2. Shielding Effectiveness Plot (SE)
3. Specification or Limit Plot (Spec)

Data plots of the test measurements are shown in appendix A of this test report.

4.0 Safety

All necessary precautions were taken when operating RF antennas, amplifiers, signal generators, and any associated equipment, including the use of Personal Protective Equipment (PPE) at the discretion of the testing team.

5.0 Security

The test data collected on the PC is unclassified. ATSI will adhere to all security requirements for this project.

6.0 Summary of Test Results and Conclusions

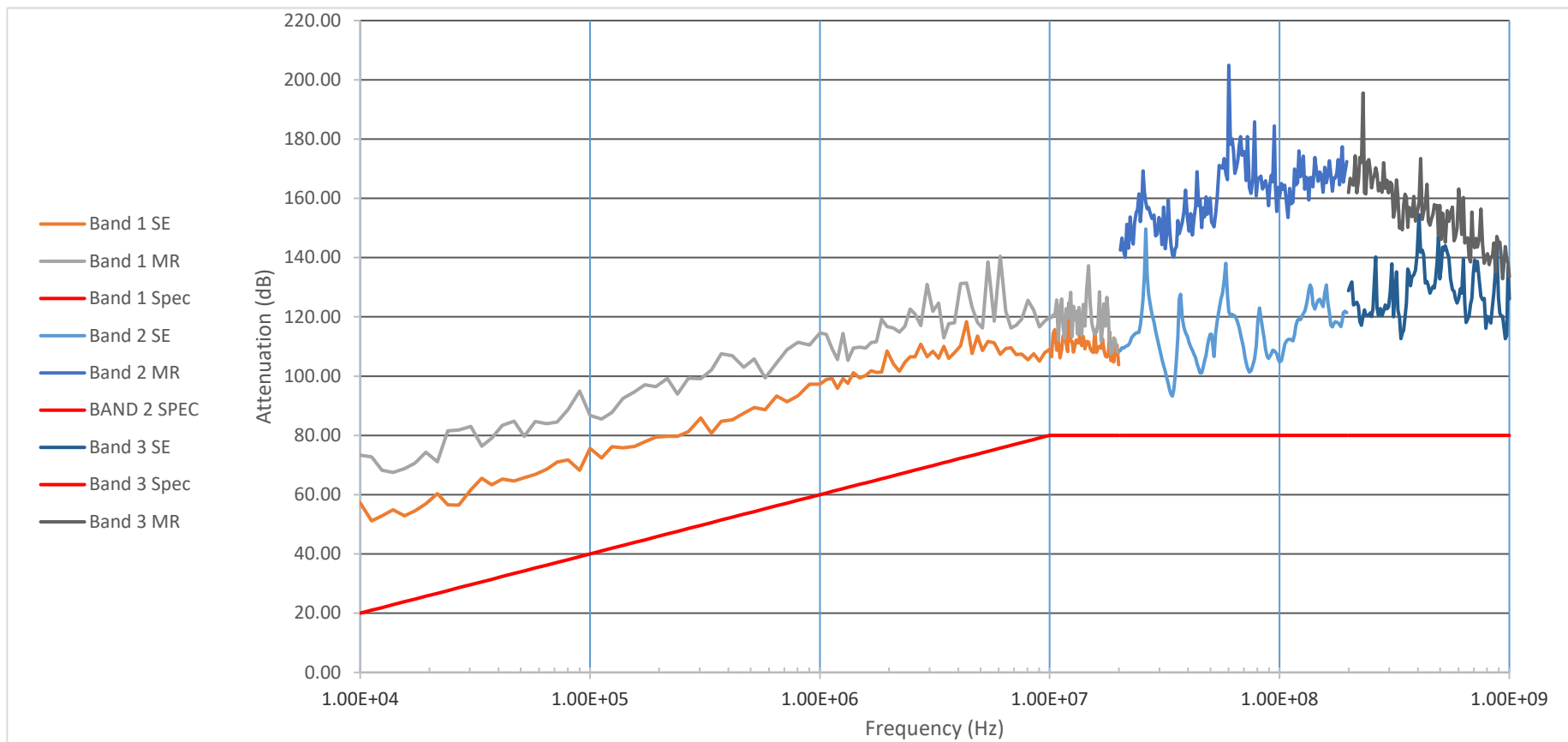
This OTS ISTS was tested to the specifications called out by MIL-STD-188-125-1 Appendix A. All data from the measurements taken has been processed and is displayed in graph format in Appendix A of this test report. Final test results indicate that the OTS ISTS under test has satisfied all pass/fail criteria specified in section A.5.5 of MIL-STD-188-125-1 Appendix A.



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APPENDIX A
MIL-STD-188-125-1 APPENDIX A
DATA PLOTS

Shielding Effectiveness Measurement-OTS Integrated Shielded Test Structure-Test Point 1 HOR

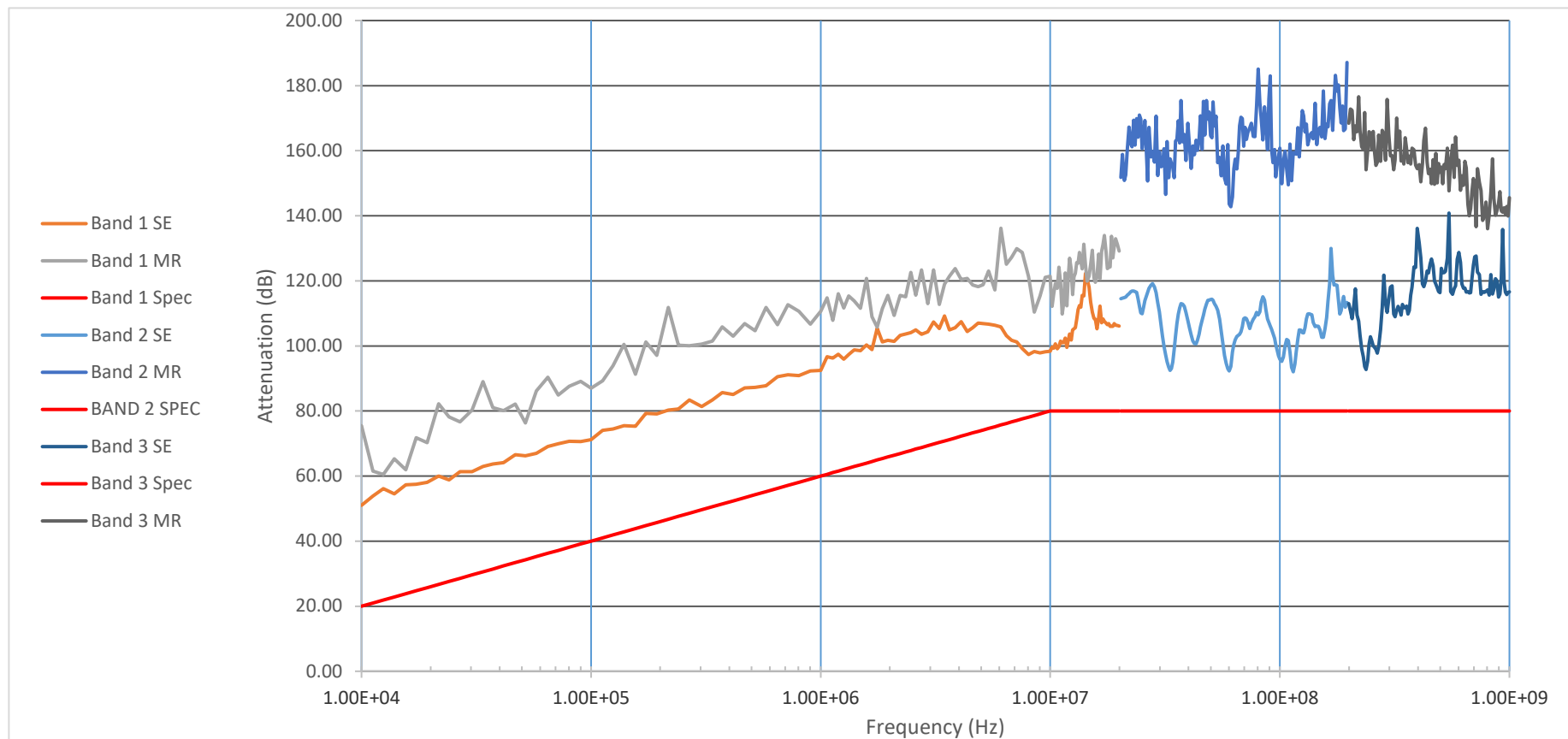


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3852 Hawkins St NE
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Shielding Effectiveness Measurement-OTS Integrated Shielded Test Structure-Test Point 1 VER



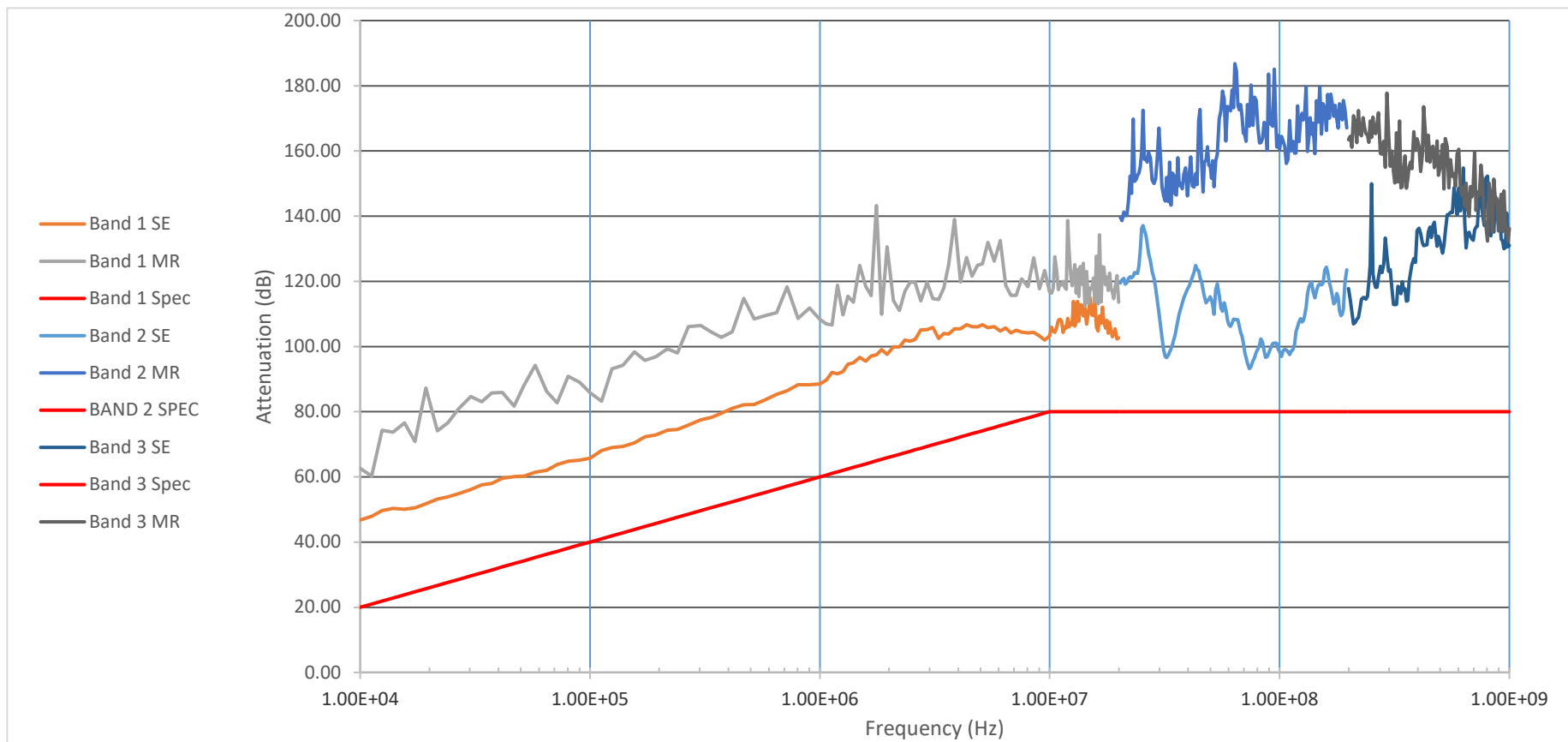
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Shielding Effectiveness Measurement-OTS Integrated Shielded Test Structure-Test Point 2 HOR



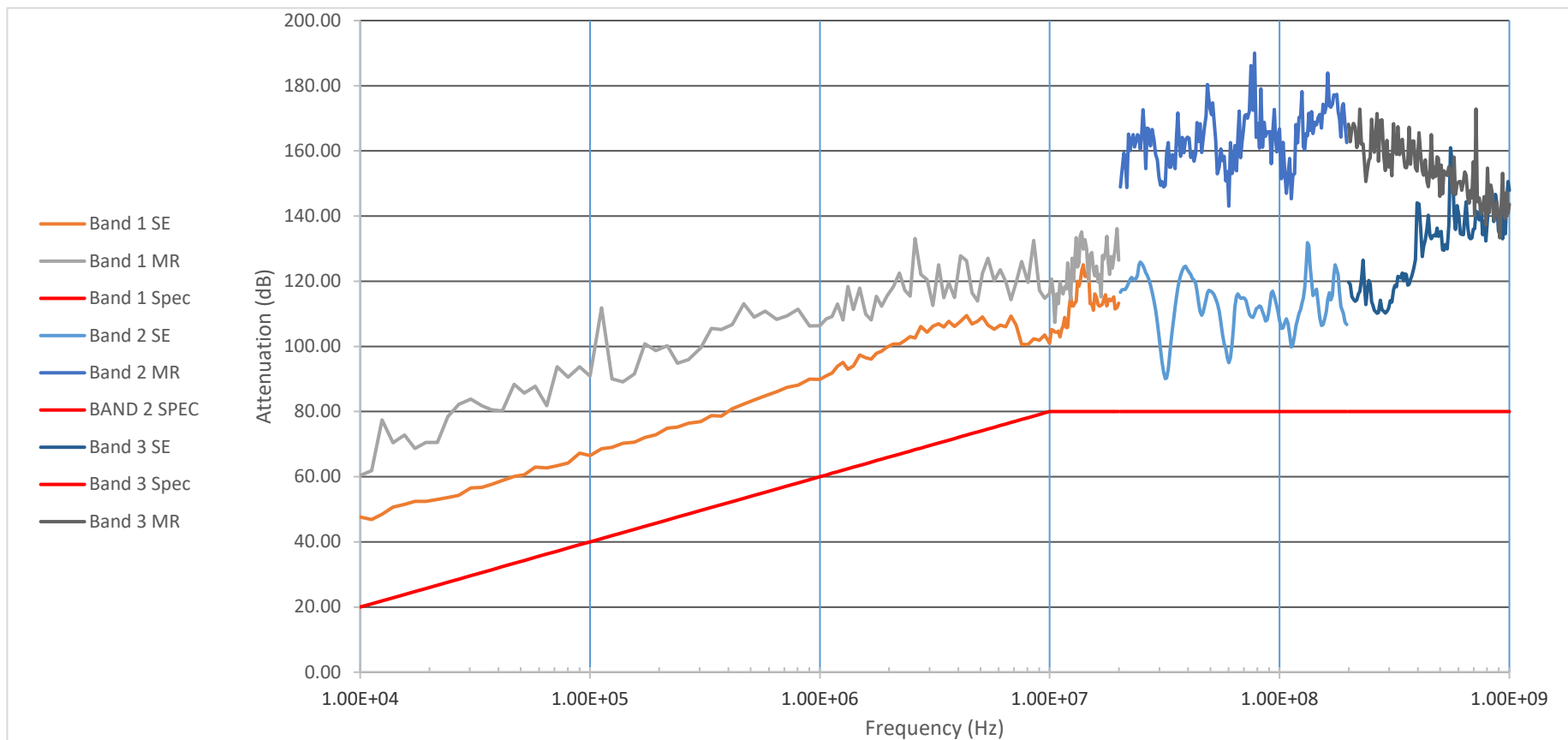
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Shielding Effectiveness Measurement-OTS Integrated Shielded Test Structure-Test Point 2 VER

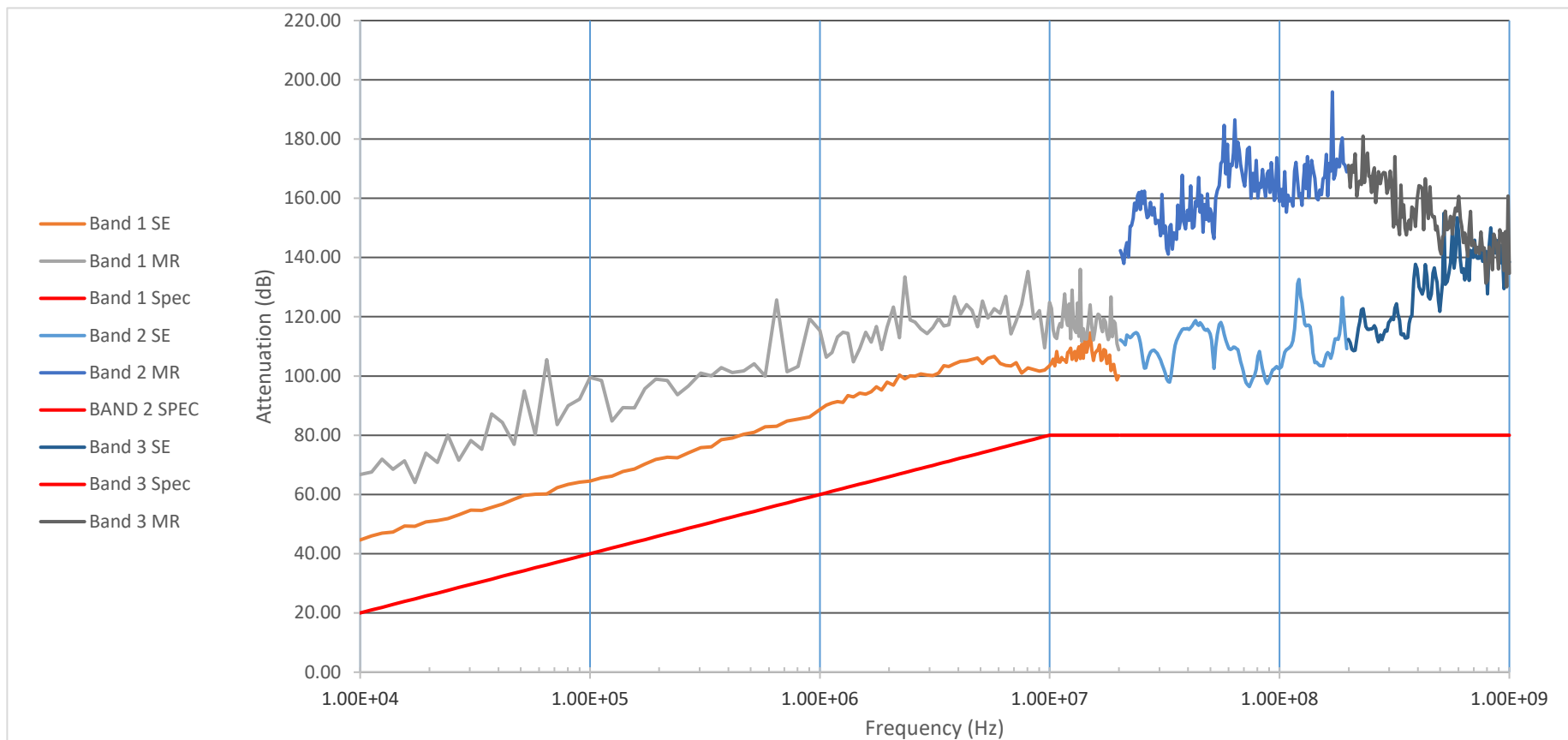


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3852 Hawkins St NE
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Shielding Effectiveness Measurement-OTS Integrated Shielded Test Structure-Test Point 3 HOR



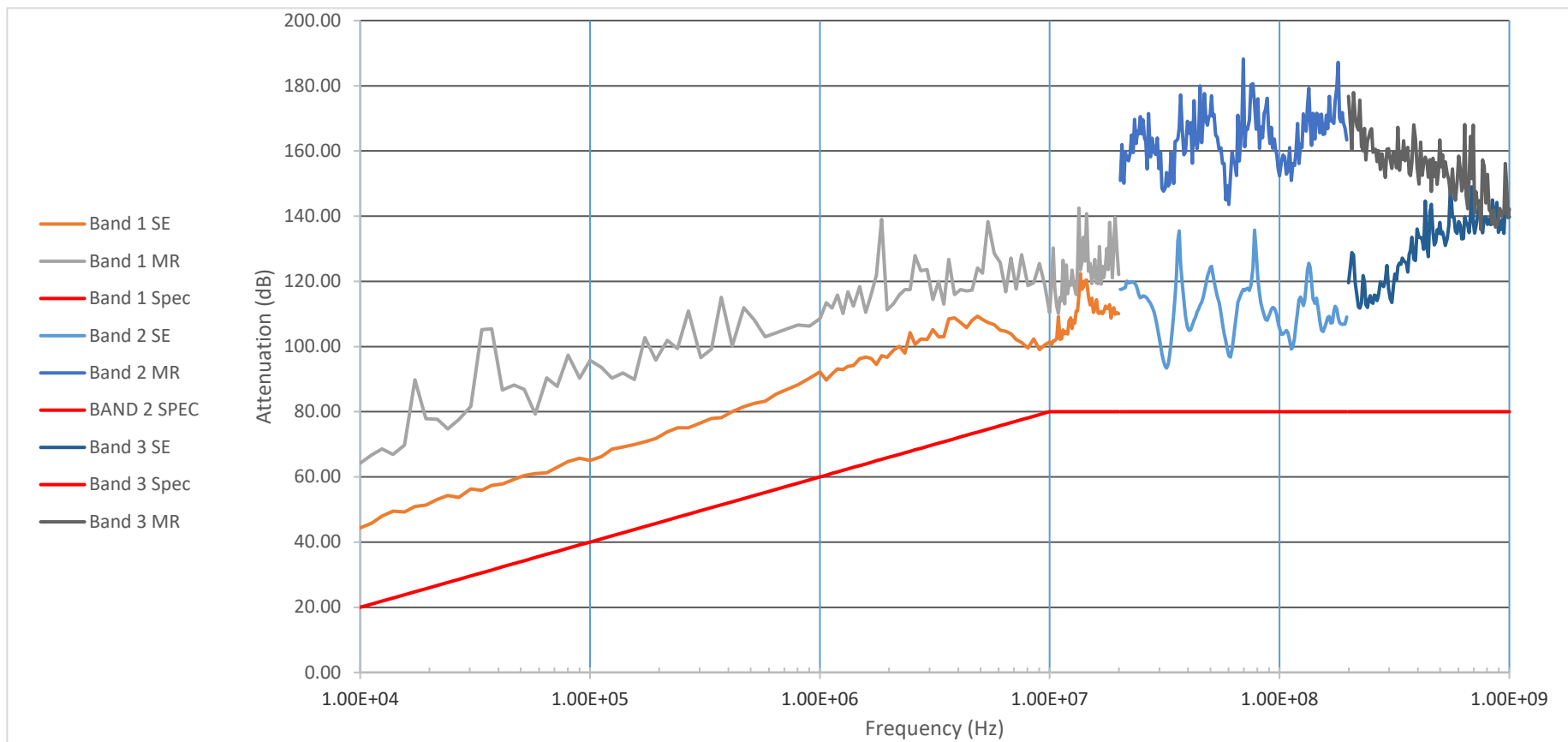
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145901



Shielding Effectiveness Measurement-OTS Electromagnetic Shielded Test Cube-Test Point 3 VER

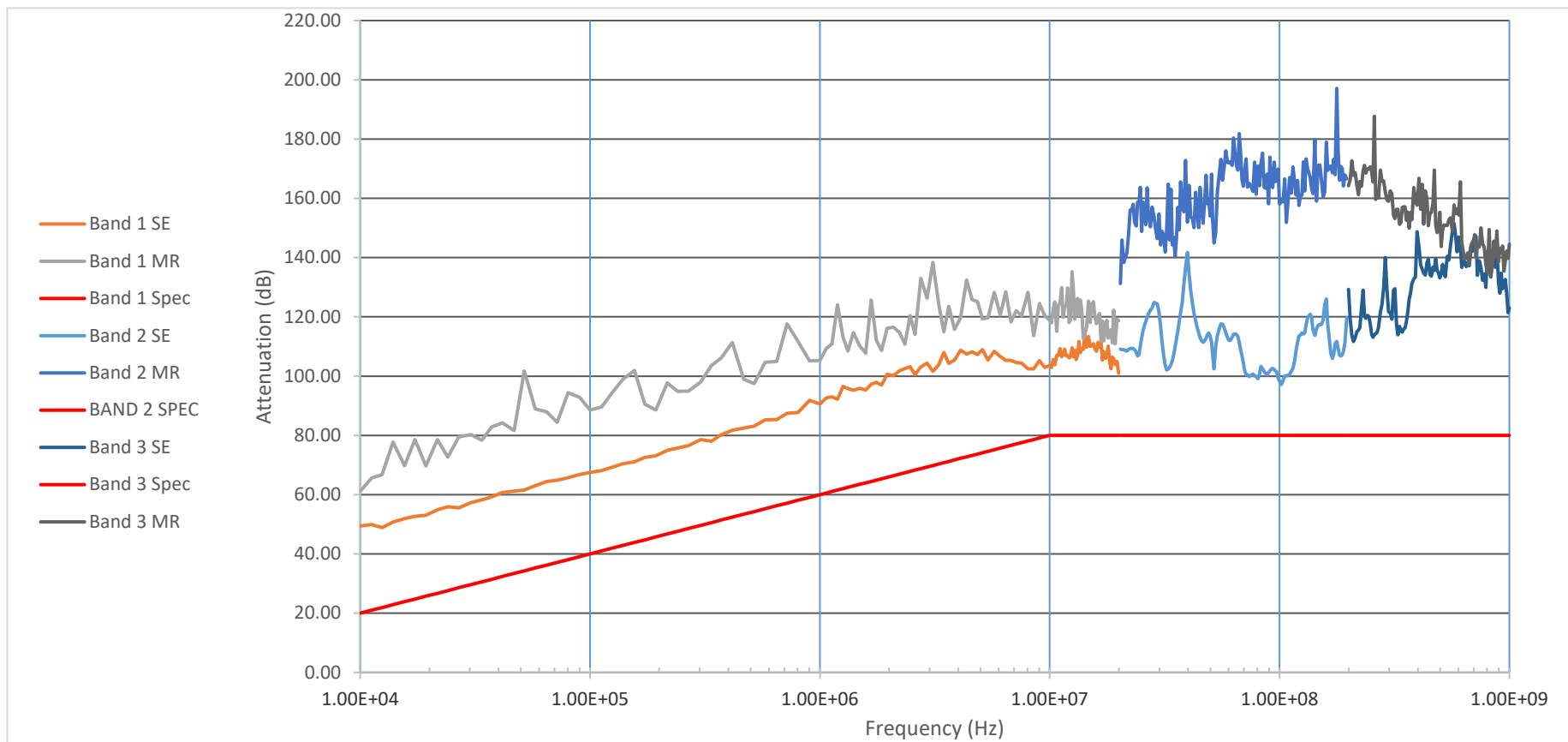


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Shielding Effectiveness Measurement-OTS Integrated Shielded Test Structure-Test Point 4 HOR



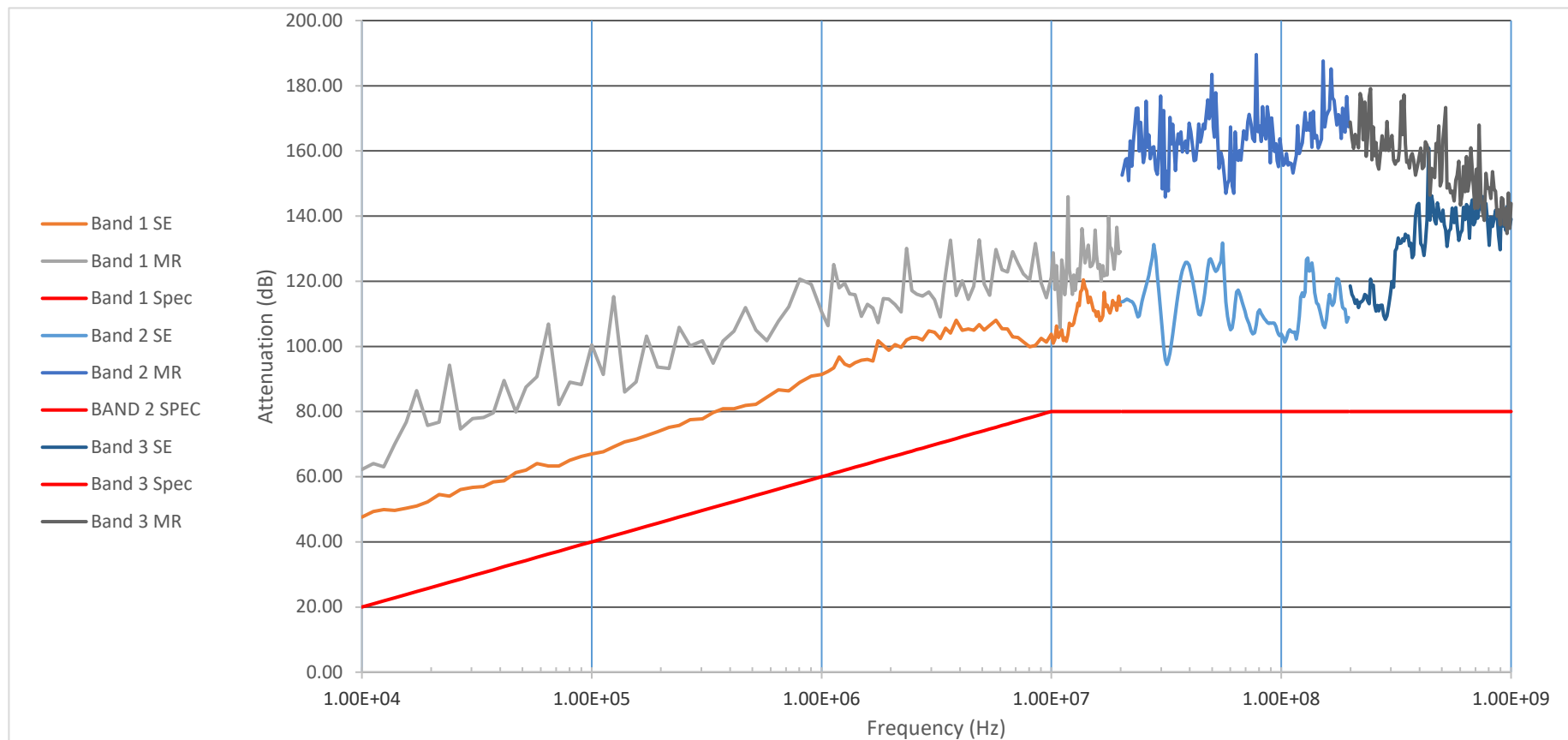
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Shielding Effectiveness Measurement-OTS Integrated Shielded Test Structure-Test Point 4 VER

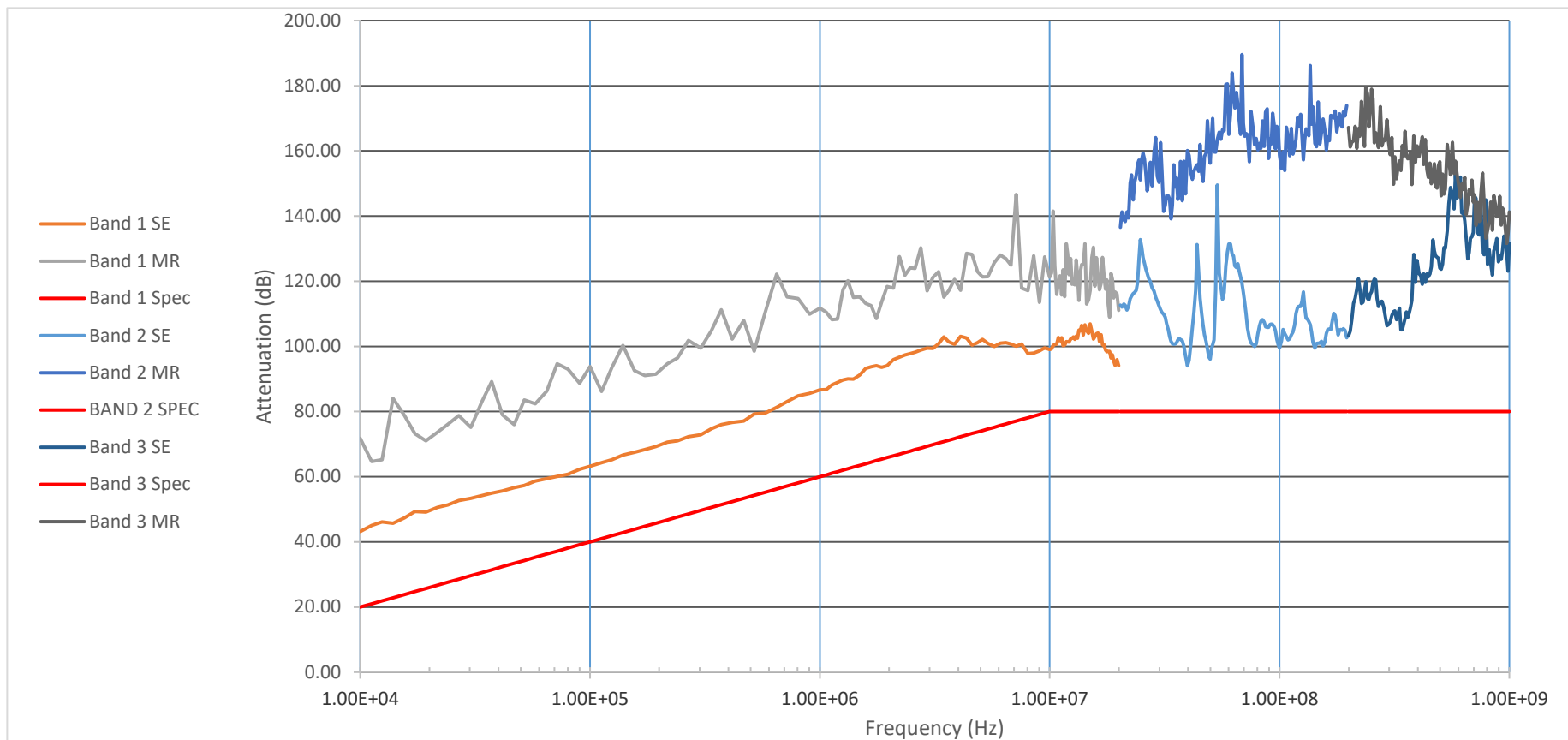


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Shielding Effectiveness Measurement-OTS Integrated Shielded Test Structure-Test Point 5 HOR



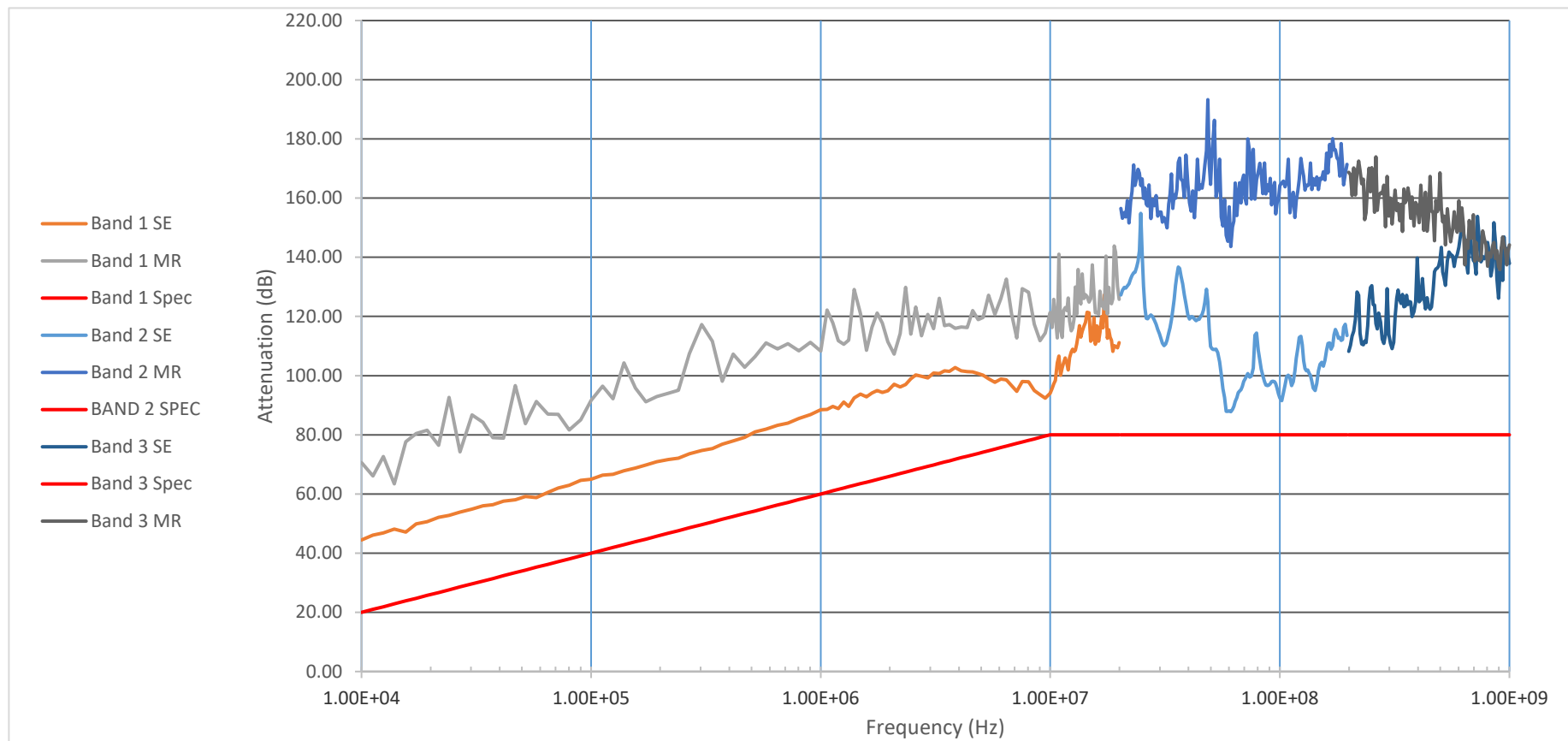
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Shielding Effectiveness Measurement-OTS Integrated Shielded Test Structure-Test Point 5 VER



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APPENDIX B
ADVANCED TESTING SERVICES INC.
QUALIFICATIONS AND REFERENCES



Advanced Testing Services, Inc.

COMPANY QUALIFICATIONS AND REFERENCES

Advanced Testing Services, Inc

RF SHIELDED CHAMBERS AND TEST FACILITIES

Over the years, our people have gained significant insight into the proper methods of testing and have set new standards for performance testing of RF Shielded test facilities and anechoic test chambers. ATSI has worked on numerous shielding projects worldwide and can test any facility regardless of size or location. We have tested countless enclosures constructed of demountable panel systems such as those manufactured by Universal Shielding Corporation and Ray-proof Shielding Systems, and many large welded steel facilities. Although these systems are designed to meet the most stringent attenuation requirements specified by the US Government, there are always some minor problems, which can only be identified during the testing process. We are consistent in finding these problems and offering the correct solutions for the customer. Other inexperienced testing companies and personnel may not have the necessary expertise to identify such problems.

HIGH ALTITUDE ELECTROMAGNETIC PULSE (HEMP) TESTING

ATSI staff members have provided RF shielding effectiveness testing for HEMP facilities since 1993. The RF Shielding effectiveness radiated testing and SELDS testing associated with large steel RF shielded HEMP facilities encourages innovative methods for testing these large facilities. ATSI's innovative staff has always been able to come up with unique solutions to difficult testing problems on these extremely large HEMP and EMI facilities. ATSI has been the quality control and certifying test agency on HEMP/EMI projects nationwide, including Hawaii and Alaska, and Overseas. ATSI developed state of the art data collection programs using National Instruments instrumentation, and LabView data collection and equipment control software. ATSI developed these control and data collection programs to conduct HEMP RF shielding effectiveness testing, HEMP PCI testing, and HEMP CWI testing in accordance with MIL-STD-188-125-1, Appendix A, B, and C, which allows ATSI to conduct this testing efficiently and provide accurate data collection and presentation. ATSI has worked with Defense Threat Reduction Agency (DTRA), Army Corp of Engineers, Department of Defense, State Department, US Navy, and other US government organizations providing HEMP Shield and Pulse Current Injection (PCI) testing for RF shielded facilities used for HEMP, EMI/EMC, and Security, protection.

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MRI FACILITIES

In addition to testing large government-owned facilities, ATSI also provides RF testing services to the Magnetic Resonance Imaging (MRI) industry. We have tested MRI facilities all across the nation and stand ready to respond within 24 hrs to any location in the continental United States. ATSI also provides troubleshooting services for clients experiencing a problem with their MRI images. Most times, the RF shield is suspect of leaking RF and causing imaging artifacts to the MRI. ATSI can determine if the shield is the cause of the problem or if other RF/EM interference may be the culprit.

EMI and EMC

ATSI has performed various EMI and EMC tests from MIL-STD-461 field testing the V-22 Osprey Flight Simulator, a 35 million dollar unit, to conducting EM Interference studies on mobile and stationary MRI units. We have also provided troubleshooting efforts to EMC test chambers that are experiencing outside interference. We have located and corrected these problems for both commercial and government clients. ATSI has also conducted numerous certifications of test chambers for ANSI C63.4 Site Attenuation and IEC 61000-4-3 Field Uniformity Measurements. The chambers ranged from pre-compliance chambers, FCC and Canadian listed chambers, to anechoic chambers used for government test facilities. These chambers ranged in size from small 12'L x 20'W x 12'H high control rooms and test chambers to the extraordinary EMC test facility for testing military aircraft, which is 180'L x 180'W x 80'H.

SENSITIVE COMPARTMENTED INFORMATION FACILITIES (SCIF)

ATSI staff members have provided services to U.S. government facilities and Defense contractors in the design, installation, and modification of SCIF rooms to the Director of Central Intelligence Directive (DCID 1/21) physical security standards. ATSI has also provided testing and certification of these facilities for both RF and acoustic requirements.

THE PEOPLE

The engineering and technical diversity that ATSI possesses provides customers with accurate solutions to their RF Shielding, Electromagnetic Interference, and Compatibility problems, as well as providing testing services for certification of their EMI/EMC test chambers. Our staff has provided services at many locations worldwide; Europe, Canada, Panama, the Middle East, and Africa. ATSI's field test teams are geared up to respond immediately and travel to any location in the world. The principal at ATSI, Antonio L. Cardenas, is an EMI/EMC Certified Engineer by the National Association of Radio and Telecommunications Engineers (NARTE).

ATSI

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Advanced Testing Services, Inc.

With his experience, education and specialized expertise, the customer will always get the best testing documentation and professional effort that the industry has to offer. Enclosed, please find a partial list of projects in which ATSI and or its staff members have been the on-site testing agency.



Advanced Testing Services, Inc.

CLIENT LIST: (Partial)

Braden Shielding Systems, Inc.
Tulsa, OK
918-624-2888

Advanced Global Construction
Ashburn, VA
703-723-5595

Department of State
Arlington, VA
703-875-6140

ATEC Shielding Systems, Inc.
Elkridge, MD
443-550-5080

Advanced Electromagnetic, Inc.
Santee, CA
619-449-9492

SRG
Tulsa, OK
918-663-1985

ETS-Lindgren RF Enclosures
Chicago, IL
800-772-7153

AT&T Corporation
Vienna, VA
703-624-6095

Cuming-Lehman
Avon, MA
508-580-2660

ETS-Lindgren RF Enclosures
Austin, TX
512-531-6400

Chamber Services, Inc.
Garden Grove, CA
714-893-5034

Ellis & Watts
Batavia, OH
513-943-3327

Cuming Microwave
Avon, MA
508-580-2660

Cuming Lehman Chambers
Chambersburg, PA
717-263-4101

L-3 Communications
San Diego, CA
858-404-7889

CACI
3825 Edith Blvd. NE
Albuquerque, NM 87107
505-344-4436

Linnindustries, LLC
10010 B Trumbull Ave. SE
Albuquerque, NM 87123
505-980-8492



Advanced Testing Services, Inc.

ADVANCED TESTING SERVICES, INC. RF SHIELDING PROJECTS (Partial List)

HEMP

Mission Control Facility

LONG RANGE DISCRIMINATING RADAR, CLEAR AFS, ALASKA

ATSI completed the MIL-STD-188-125-1, Appendix A HEMP SE Testing and Appendix B, PCI testing. Work Performed for ATEC, Industries of Elkridge, MD.

Contact: Stan Przewlocki, 443-459-5080

Work Completed 2019

HEMP

Communications and Data Center

San Antonio, TX

ATSI completed the MIL-STD-188-125-1, Appendix B and C, PCI and CWI Verification measurements on the HEMP facility. Work Performed for Linnindustries, LLC of Albuquerque, NM for CenturyLink

Contact: Larry Linn, 505-980-8492

Work Completed 2019

HEMP

AEGIS ASHORE MISSILE DEFENSE SYSTEM

HEMP SHIELDED SYSTEM

Redzikowo, Poland

ATSI Contracted to provide MIL-STD-188-125-1, Appendix A, SE Testing and Appendix B PCI Testing on Shielded Facility RDH, DSB, Utility Buildings, and Manholes

Work Contracted thru ATEC Industries

Contact: Stan Przewlocki, 443-459-5080

Work Completed 2019



Advanced Testing Services, Inc.

RF Shielded BAMS Mission Control Complex

Jacksonville Naval Air Station, Florida

ATSI Conducted RF Shielding Effectiveness measurements on Shielded Room Complex (110ft x 89ft x 18ft) Work Conducted for L-3 Applied Technologies, Inc.

Contact: Larry Linn, 505-344-6176 x114

Work Completed 2018

HEMP

Communications Shelters

Albuquerque, NM

ATSI completed the MIL-STD-188-125-1, Appendix B, and C, CWI, PCI, Verification Testing on Mobile Communications Shelters. Work Performed for CACI of Albuquerque, NM.

Contact: Kieth Farmer, 505-344-4436

Work Completed 2016, 2017, 2018, 2019

HEMP

Ground Based Missile Defense

Ft. Greely, Alaska

ATSI completed the MIL-STD-188-125-1, Appendix C, CWI Verification measurements on SIVs. Work Performed for L-3 of Colorado Springs, CO for Harris Corp.

Contact: Charles Crain, 719-650-0718

Work Completed 2016

HEMP

USSTRATCOM Replacement Facility

Offutt AFB, NE

ATSI completed the MIL-STD-188-125-1, Appendix A, RF shielding effectiveness measurements. Also Completed MIL-STD-188-125-1, Appendix B, PCI Testing.

Work Performed for ATEC of Elkridge, MD.

Contact: Stan Przewlocki, 443-459-5080

Work Completed 2016



Advanced Testing Services, Inc.

HEMP

AEGIS ASHORE MISSILE DEFENSE SYSTEM

HEMP SHIELDED SYSTEM

Deveselu, Romania

ATSI Contracted to provide RF Shielding Effectiveness measurement and Inspections for Shielded Facility RDH, DSB, and Utility Buildings. Conducted Conduit and Filter Appendix B, PCI testing. Work Contracted through L-3 Communications, Applied Technology Division.

Contact: Larry Linn, 505-344-6176

Work in progress 2015-2016

HEMP

FT. DRUM IDT BUILDING

GROUND-BASED MISSILE DEFENSE SYSTEM, FT. Drum, NY

ATSI completed the MIL-STD-188-125-1 HEMP shielding effectiveness measurements. Also completed extended frequency testing from 1 GHz to 50 GHz. Work Performed for ATEC of Elkridge, MD.

Contact: Stan Przewlocki, 443-459-5080

Work Completed 2014

HEMP

AEGIS ASHORE MISSILE DEFENSE SYSTEM

HEMP SHIELDED SYSTEM

BARKING SANDS MISSILE RANGE, KAUAI, HI

ATSI Conducted RF Shielding Effectiveness measurements on Shielded RDH, LSB, and DHSBS Buildings (200'x200'20). Also conducted Current Injection testing on conduit systems Work Conducted for ATEC Industries, Ltd.

Contact: Stan Przewlocki, 443-459-5080

Work Completed 2013



Advanced Testing Services, Inc.

HEMP

AEGIS ASHORE MISSILE DEFENSE SYSTEM

HEMP SHIELDED FACILITY

MOORESTOWN, NJ

ATSI Conducted RF Shielding Effectiveness measurements on Shielded MSB Support Building (25'x20'13). Work Conducted for ATEC Industries, Ltd.

Contact: Stan Przewlocki, 443-459-5080

Work Completed 2012

RF Shielded Room Complex, NAVFAC Engineering Command

Patuxent River Naval Air Station, Maryland

ATSI Conducted RF Shielding Effectiveness measurements on Shielded Room Complex (90'x45'x14'). Work Conducted for L-3 Applied Technologies, Inc.

Contact: Larry Linn, 505-344-6176 x114

Work Completed 2012

Conversion for Advanced Power and Thermal Research Facility

Wright Patterson AFB, Ohio

ATSI Conducted RF Shielding Effectiveness measurements on Anechoic Test Facility (38'x45'x20') Control Rms. 2ea (18'x45'x12'). Work Conducted for Braden Shielding Systems, Ltd.

Contact: Dave Moss, 918-624-2888 x111

Work Completed 2012

HEMP

Composite HEMP Shelter

Will-Burt Company, Orville, OH

ATSI Conducted the MIL 188-125-1 and E1851 RF Shielding Effectiveness Testing of Composite HEMP Portable Shelters. Work conducted for Will-Burt Company

Contact: Mike Bohurjak, 330-684-5204

Completed in 2012 and 2013



Advanced Testing Services, Inc.

HEMP

POWER PLANT FACILITY, 21 SPACE WING, 13 SPACE WARNING SQUADRON, CLEAR AFS, ALASKA

ATSI completed the MIL STD 188-125-1 HEMP shielding effectiveness measurements.

Work Performed for ATEC of Elkridge, MD.

Contact: Stan Przewlocki, 443-459-5080

Work Completed 2011

DOCCC Eastern Processing Facility

Cape Canaveral Air Force Station, Bldg 67750

ATSI Conducted the RF Shielding Effectiveness Testing of Eastern Processing Facility.

2ea 90'x90'x 120' Chambers. Work conducted for ETS-Lindgren, Chicago, IL

Contact: Mike Eagon, 630-307-7200

Completed in 2011

RF Shielded Anechoic PIM Test Chamber

LOCKHEED-MARTIN SPACE SYSTEMS, Littleton, CO

ATSI conducted all RF Shielding Effectiveness Testing of Large PIM chamber

(84'x50'x42'). Work Performed for ETS-Lindgren, Cedar Park, TX

Contact: Jim Barteau, 806-535-5196

Completed in 2011

HEMP

Room Study and Consultation

NORAD/NORTH-COM, Peterson AFB, CO

ATSI completed Consulting and Inspection Services for HEMP Shield Construction.

Reviewed drawings and witnessed testing of NORAD/NORTH-COM HEMP Shielded

Emergency Command Center. Work Performed for Sandia National Laboratories

Contact: Ross Burchard, 505-844-2295

Completed in 2009



Advanced Testing Services, Inc.

HEMP

GMD Capability Enhancement/Initial Defense Operations

Upgrade to FGA Facilities

GROUND-BASED MISSILE DEFENSE SYSTEM, FT. Greely, Alaska

ATSI completed the MIL STD 188-125-1 HEMP shielding effectiveness measurements and PCI testing prior to and after work completed on HEMP shielding systems. Various Upgrades to Mechanical and Electrical Systems at GBMD. Work Performed for ATEC of Laurel, MD.

Contact: Stan Przewlocki, 443-459-5080

2010, 2011, 2012, 2013

HEMP

FUTURE POWER PLANT FACILITY

GROUND-BASED MISSILE DEFENSE SYSTEM, FT. Greely, Alaska

ATSI completed MIL STD 188-125-1 RF shielding effectiveness measurements on the Ft. Greely Power Plant facility welded steel enclosure. Work Performed for ATEC of Laurel, MD.

Contact: Stan Przewlocki, , 443-459-5080

Work Completed 2009-2011.

HEMP

GMD Capability Enhancement/Initial Defense Operations

Upgrade to FGA Facilities

GROUND-BASED MISSILE DEFENSE SYSTEM, FT. Greely, Alaska

ATSI completed the MIL STD 188-125-1 HEMP shielding effectiveness measurements on the Electrical Manholes Shielded (EMHS) and conduit runs for the Ft. Greely, Missile Field #3.

Work Performed for ATEC of Laurel, MD.

Contact: Stan Przewlocki, , 443-459-5080

Work Completed 2009, 2010



Advanced Testing Services, Inc.

AMRAAM and ESSM Dual Anechoic Chambers

Naval Air Warfare Center, China Lake, CA

ATSI completed MIL STD 285/IEEE-299 RF shielding effectiveness measurements
And the Free Space VSWR measurements on these EMC Anechoic test facilities. Work
Performed for Chamber Services, Inc. of Garden Grove, CA

Contact: Mark Bellman, 714-893-5034

Work Completed in 2010

NASA GODDARD SPACE FLIGHT CENTER

GREENBELT, MD

Conducted RF Shielding Effectiveness Testing and Repair of RF Shielded Anechoic EMC
test facilities. Work conducted for Jackson & Tull

Contact: Robert Houle, Greg Jamroze, 301-286-2579

Work Completed in 2009

Electromagnetic Vulnerability Assessment Facility (EMVAF)

WHITE SANDS MISSILE RANGE, Las Cruces, New Mexico

ATSI completed MIL STD 285/IEEE-299 RF shielding effectiveness measurements on this
40,000 sq. ft. EMC test facility. Work Performed for ATEC of Eldridge, MD.

Contact: Stan Przewlocki, 443-459-5080

Work Completed in 2007

HEMP

Aircraft Alert Communications HEMP Shelters

7 Locations Continental US (Contract FA4890-06-P-0036)

ATSI completed the MIL STD 188-125-1 HEMP shielding effectiveness measurements
and the HM/HS maintenance and repair on 7 AACE HEMP shelters. Work Performed for
Project Developers, Inc.

Contact: Dominic Carducci, 703-661-0300

Work Completed 2006 – 2007



Advanced Testing Services, Inc.

HEMP

AT&T Government Systems

Raptor Project – Communications Enclosures

ATSI has conducted semi-annual HM/HS – MIL-STD-188-125-1 RF Shielding Effectiveness measurements on HEMP Protected Communications Enclosures.

Contact: Tina Gorman , 703-624-6095

Work Completed 2003 - 2019

HEMP

Mechanical/Electrical Building (MEB) OUTFITTING

GROUND-BASED MISSILE DEFENSE SYSTEM, FT. Greely, Alaska

ATSI completed MIL STD 188-125-1 RF shielding effectiveness measurements on the MEB welded steel HEMP enclosure. Work Performed for ATEC of Laurel, MD.

Contact: Stan Przewlocki, 443-459-5080

Work Completed 2004-2005.

HEMP

MECHANICAL/ELECTRICAL BUILDING (MEB) SHELL

GROUND-BASED MISSILE DEFENSE SYSTEM, FT. Greely, Alaska

ATSI completed SELDS Testing of the MEB welded steel HEMP enclosure.

Work Performed for ATEC of Laurel, MD.

Contact: Stan Przewlocki, 443-459-5080

Work Completed 2004



Advanced Testing Services, Inc.

HEMP

BALLISTIC MISSILE DEFENSE TEST BED

GROUND-BASED MISSILE DEFENSE SYSTEM,

FT. Greely, Alaska and Eareckson AS, Shemya, Alaska

ATSI was responsible for the RF Shielding Effectiveness Testing and the Pulse Current Injection testing of 6 HEMP/EMI shielded buildings, 4 at Ft. Greely, Alaska, and 2 located at Eareckson AS, on Shemya, Alaska. Work Performed for ATEC (Construction Contractor) of Laurel, MD.
Contact: Stan Przewlocki, , 443-459-5080

2004-2005

HEMP

POWER SYSTEM REPACKAGING

GROUND-BASED MIDCOURSE DEFENS, Shemya, Alaska

ATSI conducted MIL STD 188-125-1 RF shielding effectiveness measurements on two each 45'L x 15'W x 10'H welded steel HEMP enclosures.

Work Performed for A-TEK of Leesburg, VA.

Contact: Matthew Fox, (443) 310-4231.

2003.

ADVANCED SYSTEM INTEGRATION LABORATORY

NAVAL AIR WARFARE CENTER

PATUXENT RIVER, MARYLAND

180'L x 180'W x 78'H, continuously welded 11 gauge and ¼" plate steel bldg.

ATSI was the testing laboratory on site providing the Preliminary and Final Acceptance Testing of this facility.

Ref: Stan Przewlocki, ATEC Industries, 443-459-5080

Work Completed June 1999.



Advanced Testing Services, Inc.

SPACE SURVEILLANCE FACILITY

NAVAL SURFACE WEAPONS CENTER - HEMP

DAHLGREN, VIRGINIA

100'L x 105'W x 30'H continuously welded 16 gauge stainless steel bldg.

ATSI was the testing laboratory on site providing the Final Acceptance Testing of this facility.

Ref: Stan Przewlocki, ATEC Industries, (301) 595-1960.

Work Completed December 1993.

MILSTAR GROUND COMMUNICATIONS TERMINAL BLDG.

LANGLEY AFB, VIRGINIA HEMP

40'L x 30'W x 12'H continuously welded 1/8" steel enclosure.

ATSI provided Preliminary and Final Acceptance Testing of this facility.

Ref: Dave Rustand, Project Developers, Inc., (703) 709-0000.

Work completed March 1994.

SYSTEMS ENGINEERING LABORATORY ADDITION

REDSTONE ARSENAL, ALABAMA

20'L x 10'W x 14'H enclosure constructed of 28 gauge galvanized steel sheets laminated to wood panels and clamped together with galvanized metal strips.

ATSI performed Preliminary and Final Acceptance Testing of this enclosure.

Ref: Irwin Newman, Universal Shielding Corporation, (516) 667-7903.

Work Completed January 1994.

HEMP

PENTAGON, Arlington, Virginia

Shielded area, three-story shield, approximately 20,000 sq. ft.

11 gauge continuously welded steel.

ATSI provide testing of all RF doors for this Facility (6 ea).

Ref: Lou White, Pentagon, (703) 614-5115.

Work Completed June 1993.



Advanced Testing Services, Inc.

PATUXENT NAVAL AIR WARFARE CENTER/EMI TEST FACILITY

2 Shielded Enclosures.

One welded steel and one modular.

Ref: Mr. Lee Guy, (301) 826-4791.

ATSI performed annual certification and repair of these test enclosures.

Performed Certification for 1992, 1993, 1994, 1995, 1996, 1998.

HEMP

COMMUNICATIONS CENTER IMPROVEMENTS, BLDG. 409 WAHIAWA, HI (NAVY)

170'L x 150'W x 24'H 18 gauge welded stainless steel facility.

ATSI performed SELDS testing and is approved contractor to perform Preliminary and Final Acceptance testing of this facility.

Ref: Bob Hartson, ATEC Industries, (301) 595-1960.

Performed SELDS December 1993, Final in 1995, Continued Tests 1996,1997,1998, 2000, 2001.

LC-40 LAUNCH COMPLEX, CAPE CANAVERAL, FLORIDA BECHTEL NATIONAL, INCORPORATED

RF Shielded Launch Facility.

14 gauge welded steel facility, approximately 70,000 sq. ft.

Ref: Mr. Lyle Bennett, (407) 730-3801.

Antonio Cardenas/ATSI employed as Quality Control Shielding Consultant and testing agency.

Work performed from April 1992 to June 1993.



Advanced Testing Services, Inc.

HEMP

RF SHIELDED FACILITY

WORLDWIDE MILITARY COMMAND CONTROL SYSTEM

FORT SHAFTER, OAHU, HAWAII – DEPARTMENT OF THE ARMY

Employed by: Tower Construction, Mr. Harry Pak, (808) 839-1942.

Corp of Engineers, Gerald Young, (808) 433-6470.

RF Shielding Effectiveness Testing for Final Certification under
contract #DACA83-89-C-0043.

Work performed in 1992 & 2003