

**EVALUATION OF THE
ZARGES INC
MITRASET TRANSIT CASE**

Date: MAY 4, 2011
Test Report Number: SR5821.11 REVISION 1

**IN ACCORDANCE WITH
IEEE STD 299-1997**

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REVISION RECORD SHEET

Revision	Description	Date	Approval
--	Created Test Report	2011-03-08	--
1	Updated report per Tracy Johnson's e-mail dated 2011-04-29	2011-05-04	<i>[Signature]</i>

The latest revision of the report is valid, all prior revisions are superseded.

LIST OF DEFINITIONS/ABBREVIATIONS

AC	Alternating Current
BB	Broadband
BW	Bandwidth
cm	Centimeter
CPU	Calibrate Prior to Use
dB	Decibel
DC	Direct Current
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ER	Electric Radiation
EUT	Equipment Under Test
GHz	GigaHertz
Hz	Hertz
I-face	Interface
kHz	KiloHertz
m	Meter
MHz	MegaHertz
mm	Millimeter
mS	Millisecond
mV	MilliVolt
MR	Magnetic Radiation
NB	Narrowband
NCR	No Calibration Required
PLC	Power Line Conduction
PPS	Pulses Per Second
RF	Radio Frequency
uF	MicroFarad
uH	MicroHenry
uS	Microsecond
uV	MicroVolt
UWC	Use With Calibrated Equipment

1.0 GENERAL

1.1 Introduction

1.1.1 Purpose

The purpose of this test is to evaluate a sequence of electromagnetic shielding tests. At the request of Zarges, the tests were performed by Chomerics, Inc. of Woburn, Massachusetts. The assessment will determine the compliance or non-compliance to some of the requirements set forth in IEEE STD 299.

The test method followed for this series of tests is IEEE STD 299-1997 Standard Test Method for Electromagnetic Shielding Effectiveness of Shielded Enclosures.

Tracy Johnson, Ryan Meaux, and Peter George of Zarges were present for testing. Testing was performed on March 3, 2011 under purchase order number 450015244.

This document is written to report test results of Shielding Effectiveness performed in accordance with IEEE STD 299.

1.1.2 Requirements

The customer defined shielding requirements for the Mitrasat Transit Case are as follows:

The shielded enclosure shall meet the minimum shielding effectiveness requirements of 60dB in the frequency range of 150kHz to 18GHz (E-Field).

The tests were performed at Chomerics Inc., Woburn, Massachusetts. The tests have satisfied the requirements of IEEE STD 299.

1.2 Summary

The Zarges Mitrasat Transit Case passes the minimum requirements of 60dB from 150kHz to 18GHz.

The terms "Passed" or "Failed" are intended to guide the reader as to whether or not the enclosure met the Zarges minimum requirements. The "Results" paragraph in each test section to follow and the test data sheets will outline specifically how the test samples performed during each test.

The following antennas were used:

Test Frequency Range	Transmit antenna	Receive antenna
150kHz to 20MHz	Chomerics Spiral Loop	Chomerics Spiral Loop
20MHz to 200MHz	Chomerics Spiral Loop	3109 Biconical
200MHz to 1GHz	Chomerics Spiral Loop	Log Spiral Antenna
2GHz to 18GHz	3115 Horn Antenna	3115 Horn Antenna

Due to the nature of this test cycle, the transmit antenna was placed inside the Mitrasat Case. The cabinet dimensions only allowed for a custom spiral antenna and horn antenna to fit inside. This setup allowed the enclosure to be probed for RF leakage if there were any test failures.

Zarges Mitrasat Transit Case
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1.3 Administrative Data

1.3.1 Test Facility

Chomerics Test Services in Woburn, Massachusetts is an American Association for Laboratory Accreditation (A2LA) accredited facility as defined on Certification Number 1980-01. The Scope of Accreditation is limited to the following tests:

Emissions

Radiated (up to 18 GHz) + Conducted	Code of Federal Regulation (CFR) 47, FCC Part 15 (Subpart B, ITE devices) using ANSI C63.4 (2001, 2003); CISPR 11; EN 55011; KN 11 (RAA Announce 2008-11, Dec. 16, 2008); CISPR 14-1; EN 55014-1; KN 14-1 (RAA Announce 2008-11, Dec. 16, 2008); CISPR 15; EN 55014-1; KN 14-1 (RAA Announce 2008-11, Dec. 16, 2008); CISPR 15; EN 55015; CNS 14115; CISPR 22; EN 55022; AS/NZS CISPR 14; AS/NZS CISPR 11; AS/NZS CISPR 22; CNS 13438; CNS 13803; CNS 13783-1; VCCI V-3; CAN/CSA CISPR 22; KN 22 (RAA Announce 2008-11, Dec. 16, 2008)
Current Harmonics	EN 61000-3-2:2006; IEC 61000-3-2:2005; AS/NZS 61000.3.2
Voltage Fluctuations + Flicker	EN 61000-3-3:2005+A3:2006; IEC 6100-3-3:2004+A1:2001+A2:2005; AS/NZS 61000.3.3
Generic Standards	EN 61000-6-3:2007; IEC 61000-6-3:2006; EN 61000-6-4:2007; IEC 61000-6-4:2006

Immunity

Electrostatic Discharge (ESD)	EN 61000-4-2:1995+A1:1998+A2:2001; IEC 61000-4-2:1995+A1:1998+A2:2000; IEC 61000-4-2:2001; KN 61000-4-2 (RAA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.2
Radiated Immunity	EN 61000-4-3:1996+A1:2002; EN 61000-4-3:2006; IEC 61000-4-3:1995+A1:2002; IEC 61000-4-3:2007; KN 61000-4-3 (RAA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.3
Electrical Fast Transient/Burst	EN 61000-4-4:1995+A1:2000+A2:2001; EN 61000-4-4: 2004; EN 61000-4-4:2005+A1:2008; IEC 61000-4-4:1995+A1:2000 + A2:2001; IEC 61000-4-4:2004; IEC 61000-4-4:2007; KN 61000-4-4 (RAA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.4
Surge Immunity	EN 61000-4-5:1995+A1:2001; EN 61000-4-5:2006; IEC 61000-4-5:1995+A1:2000; IEC 61000-4-5:2005; KN 61000-4-5 (RAA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.5
Conducted Immunity	EN 61000-4-6:1996+A1:2001; IEC 61000-4-6:2007; IEC 61000-4-6:1996+A1:2000; IEC 61000-4-6: 2003+A1:2004; IEC 61000-4-6:2006; KN 61000-4-6 (RAA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.6
Power Frequency Magnetic Field Immunity	EN 61000-4-8:1993+A1:2001; IEC 61000-4-8:1993+A1:2000; IEC 61000-4-8:2001+A1:2000; KN 61000-4-8 (RAA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.8
Voltage Dips, Short Interruptions, and Line Voltage Variations	EN 61000-4-11:1994+A1:2000; IEC 61000-4-11:1994+A1:2000; EN 61000-4-11:2004; IEC 61000-4-11:2004; KN 61000-4-11 (RAA Announce 2008-12, Dec. 16, 2008); AS/NZS 61000.4.11

Generic Standards EN 61000-6-1:2007; IEC 61000-6-1:2005; EN 61000-6-2:2007; IEC 61000-6-2:2005
Product Standards IEC/EN 60601-1-2, KN 60601-1-2 (RAA Announce 2008-12, Dec. 16, 2008); EN 300 386, EN 61326-1; CISPR 24; EN 55024; KN 24 (RAA Announce 2008-12, Dec. 16, 2008); EN 50083-2; EN 55103-1; EN 55103-2; EN 61547; EN 55014-2; CISPR 14-2; KN 14-2 (RAA Announce 2008-12, Dec. 16, 2008)

Military EMI/EMC

MIL-STD-461C

Radiated Emissions	RE01, RE02, RE03;
Conducted Emissions	CE01, CE03, CE06, CE07;
Radiated Susceptibility	RS01, RS02, RS03 (200 v/m);
Conducted Susceptibility	CS01, CS02, CS03, CS04, CS05, CS06, CS09, CS10, CS11

MIL-STD-461D – E – F

Radiated Emissions	RE101, RE102, RE103;
Conducted Emissions	CE101, CE102, CE106;
Radiated Susceptibility	RS101, RS103 (200 v/m);
Conducted Susceptibility	CS101, CS103, CS104, CS105, CS109, CS114, CS115, CS116

Any tests in this report that are not listed above are not covered by the A2LA Accreditation.

ALL tests included within this report are not covered under Chomerics' A2LA Scope of Accreditation.

Chomerics' Open Area Test Site B is listed by the Federal Communications Corporation (FCC) for Radiated and Conducted Emissions testing under FCC Registration number 90499.

Chomerics' Open Area Test Site B is accredited for Radiated and Conducted Emissions through Industry Canada under file number IC2959B.

Chomerics' Open Area Test Site B is accredited to the Voluntary Control Council for Interference (VCCI) for Radiated and Conducted Emissions testing under file R-2454 (3 and 10 meters) and C-2689 respectively.

Chomerics' Test Chamber A is accredited to the Voluntary Control Council for Interference (VCCI) for Conducted Emissions testing under file C-2688.

Chomerics test facility operates under the current revision of Chomerics Quality Assurance (QA) Manual Document Number QA002.

The QA Manual has been constructed to reflect a quality program in accordance with the requirements of the National Institute of Standards and Technology (NIST), ISO 9002, ISO Guide 25, NIST Handbook 150, EN 45001, MIL-I-45208A, MIL-STD-461D, 462D and Chomerics Quality Assurance Program (QAP).

The QA Manual outlines and describes the procedures for establishing and maintaining the quality of analysis, research, inspection, and testing within Chomerics Test Service (CTS).

This test report does not represent an endorsement by the U.S. Government.

The results and/or conclusions within this test report refer and/or apply only to the unit(s) tested as defined by this report.

Measurements performed for this test are traceable to the National Institute of Standards and Technology (NIST) based on the fact that all test equipment used for the measurements were previously calibrated using standards traceable to NIST.

1.3.2 Equipment Calibration

The calibration of Chomerics test facility equipment is controlled under the current revision of Chomerics Laboratory Test Equipment Calibration Manual Document Number QA001.

The test equipment used throughout this test sequence conforms to laboratory calibration standards, MIL-STD-45662, traceable to the National Institute of Standards and Technology (NIST). The date of the last calibration is listed in each test section for the applicable equipment.

We certify that the test equipment used to perform this test was in calibration at the time of the test and are calibrated per MIL-STD-45662 at least once per year.

1.3.3 Test Personnel

The test personnel performing or supervising the tests are accredited by the National Association of Radio and Telecommunications Engineers, Inc. (NARTE) as Certified Electromagnetic Compatibility Engineers (N.C.E.) and Technicians (N.C.T.).

1.4 Test Set-up

1.4.1 Test Site Descriptions

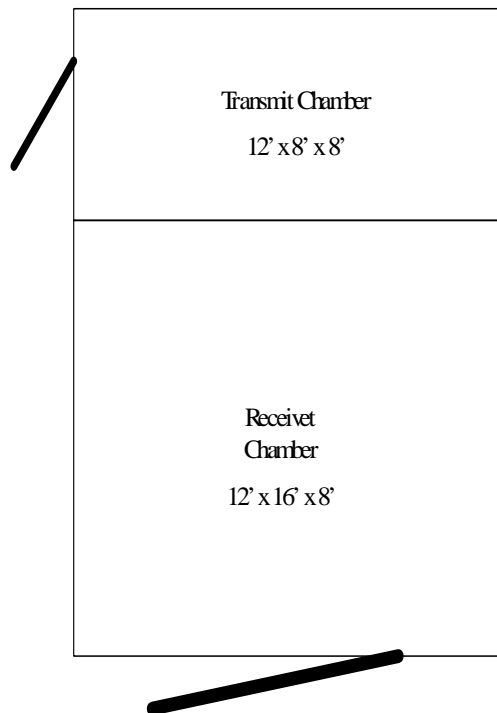
“SE” Lab: Chomerics’ "Shielding Effectiveness" Test Chamber is used for this test program and is located in the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts. The shielded enclosure was manufactured by Sprague Shielding Corporation. Attenuation tests have demonstrated that the shielded enclosure meets the attenuation requirements of MIL-STD-285.

The receive chamber is a 1/4 inch plate steel structure measuring 12 x 16 x 8 feet in size. The structure is heated and/or air conditioned.

The transmit chamber is a 1/4 inch plate steel structure measuring 12 x 8 x 8 feet in size. The structure is heated and/or air conditioned.

The available AC power within the shielded enclosure is 110V AC, 220V AC, single and three phase, 60 cycle. The power line filters are rated for 100dB of attenuation from 10kHz to 10GHz.

Chomerics EMI/ ‘SE’ Lab Layout
Figure 1



1.4.2 Equipment Under Test

The Zarges Mitrasnet Transit Case is made of aluminum and measures 22”W x 29”H x 38”D. The box is basically a welded aluminum enclosure with no access points except for the front and back covers (identical/symmetrical). Latches at the 4 corners of each cover pull it in and compress a conductive elastomeric gasket.

The Mitrasnet Transit Case was tested for shielding effectiveness.

The available AC power within the shielded enclosure is 110V AC, 220V AC, single and three phase, 60 cycle. The power line filters are rated for 100dB of attenuation from 10kHz to 10GHz.

Zarges Mitrasnet Transit Case
Document #: SR5821.11 Rev.1
Date: 2011-05-04

2.0 TESTS PERFORMED

2.1 Electric Field and Plane Wave Shielding Effectiveness (SE)

2.1.1 Equipment Used

	Test Equipment	Asset #	Serial #	Last Cal Date
X	HP 3326A Signal Generator	37	2519A00753	4/10
X	HP 83620B Signal Generator	625	3844A00955	12/10
X	ENI 600L Amplifier	568	298	NCR
X	AR 30W100 Amplifier	480	15657	NCR
X	Agilent E4440A Spectrum Analyzer	704	USA 41421236	12/10
X	Solar 8552-1A Audio Amplifier	162	821095	NCR
X	Chomerics Spiral Loop Antenna	NA	NA	NCR
X	EMCO 3101 Log Spiral Antenna	79	2495	NCR
X	Logimetrics A300/S-08 Amplifier	133	3016	NCR
X	Logimetrics A300/C-08 Amplifier	132	3012	NCR
X	Logimetrics A300/IJ Amplifier	134	3094	NCR
X	EMCO 3109 Biconical Antenna	87	2123	1/11
X	EMCO 3106 Ridge Guide Horn Antenna	117	2213	1/11
X	ETS Lindgren T.I.L.E. 4! Software Version 4.0.A.9	N/A	N/A	NCR

2.1.2 Test Method

The Zarges Mitrasat Transit Case was placed inside Chomerics' Shielding Effectiveness Test Chamber. The case was tested per Chomerics Test Procedure TP08 and IEEE STD 299-1997.

The test was performed at frequencies which meet the requirements of Section C.3.2 of IEEE STD 299-1997.

The test was performed in the shielded enclosure manufactured by Sprague Shielding Corporation. Attenuation tests have demonstrated that the shielded enclosure meets the attenuation requirements of MIL-STD-285.

Prior to the actual shielding effectiveness tests, a system reference test was performed to obtain a detection system dynamic range of at least 66dB (6dB beyond the test limit). During this test, transmit and receive antennas were placed in front of each other inside the test chamber. From 150kHz to 20MHz, the antenna to antenna distance was 0.6 meters. From 20MHz to 18GHz the antenna to antenna distance was 1 meter. The transmit antenna was placed at the position where the case was to be placed. An Open reference was taken for each frequency range.

For the qualification tests, the transmit antenna was placed in the case and connected to the transmit equipment using Huber+Suhner Sucoflex-106 coaxial cable. The receive antenna was placed outside of the enclosure and connected to the receiving equipment using standard Pasternack microwave coaxial cable.

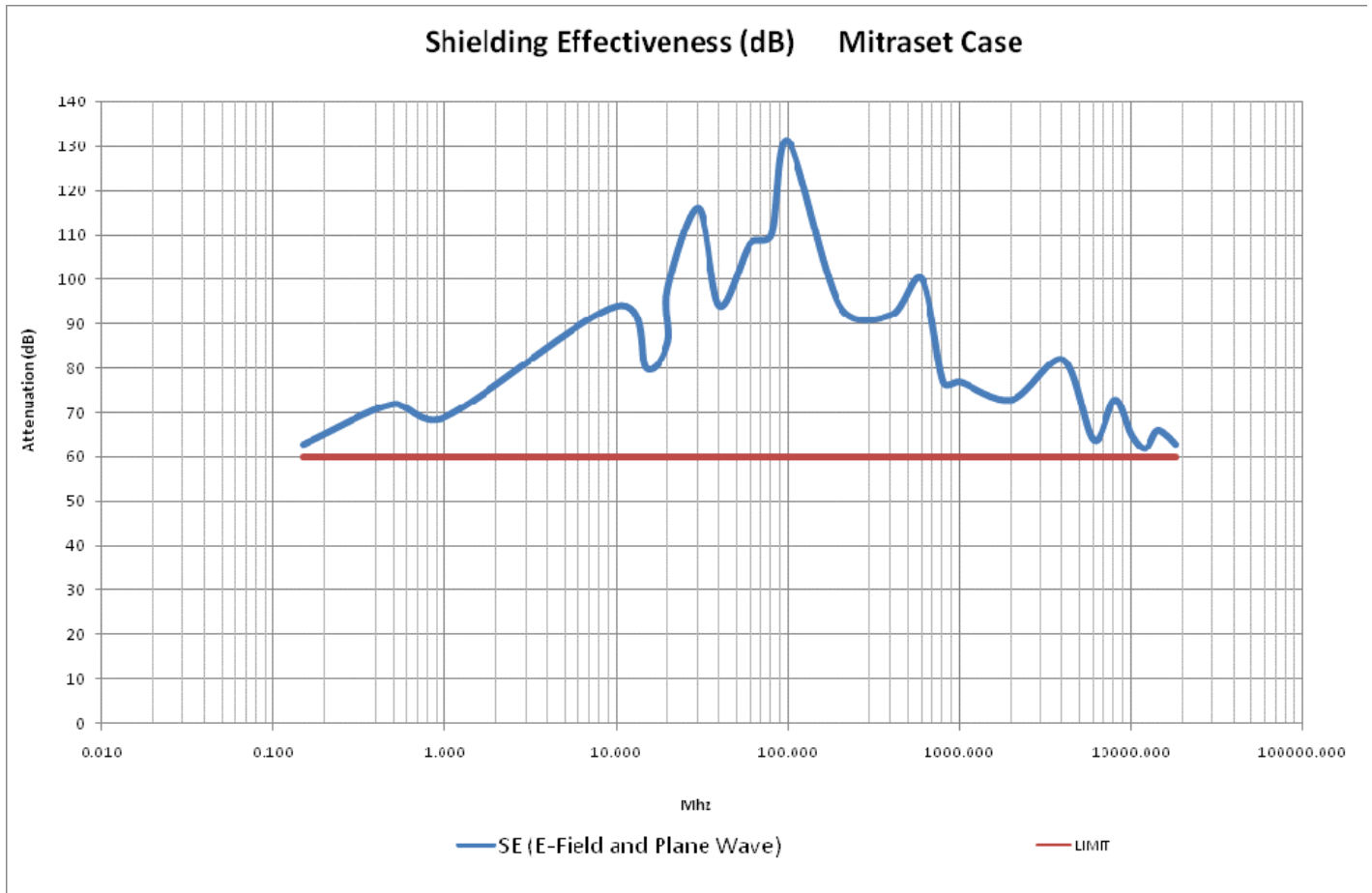
The transmitter and amplifiers were placed outside of the test chamber. The receiving equipment was located outside of the test chamber, in an adjacent support room.

The case was placed above a copper ground plane located in the test chamber. The case was bonded to the ground plane through a 4 inch wide strip of copper tape.

2.1.3 Results

The Zarges Mitraset Transit Case passes the minimum 60dB shielding requirement.

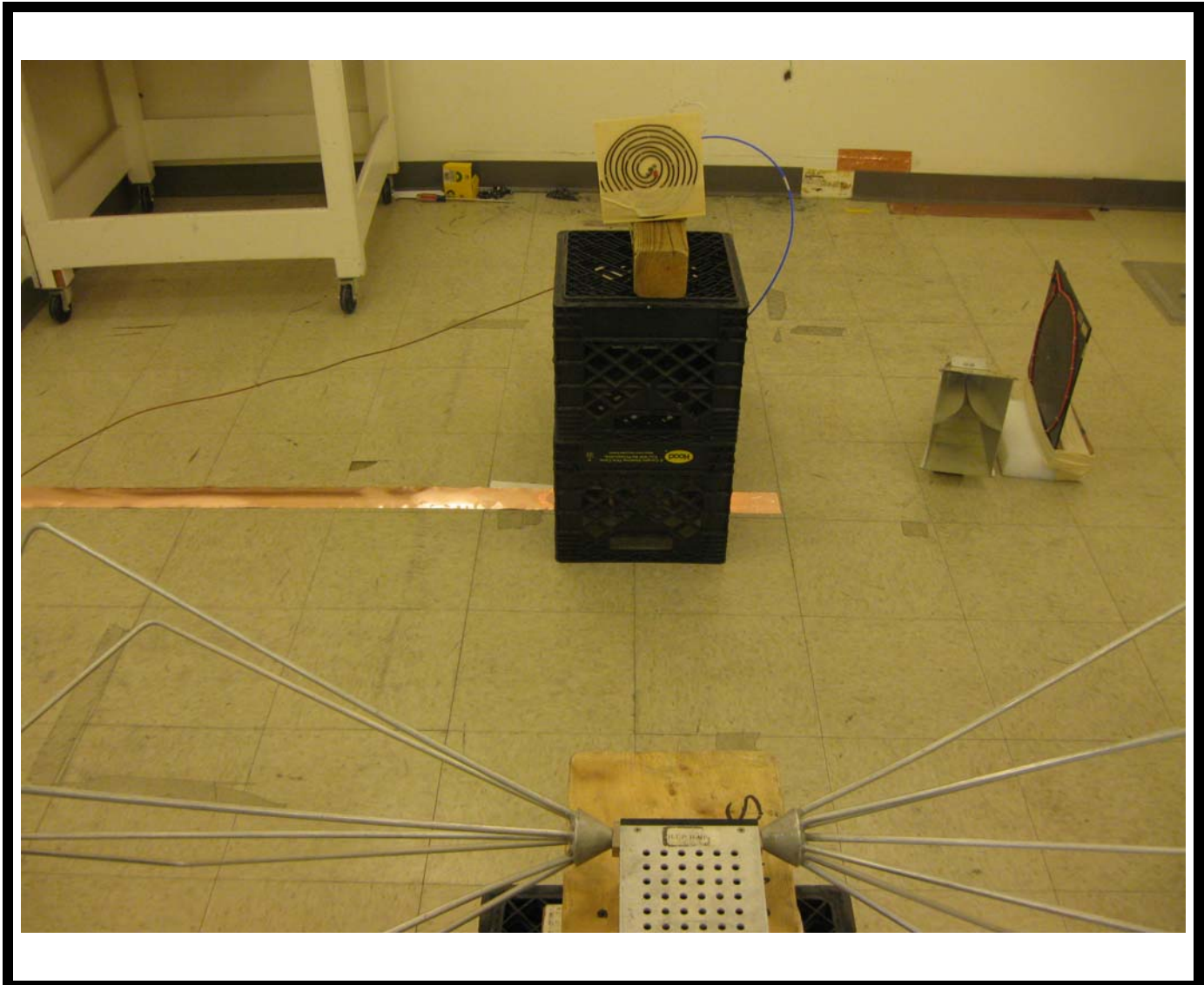
Test Data



2.1.5 Photographic Documentation

CUSTOMER: ZARGES
EQUIPMENT: MITRASET TRANSIT CASE
TESTED BY: WILLIAM COUTURE

DATE: 2011-03-03
TEST NUMBER: N/A



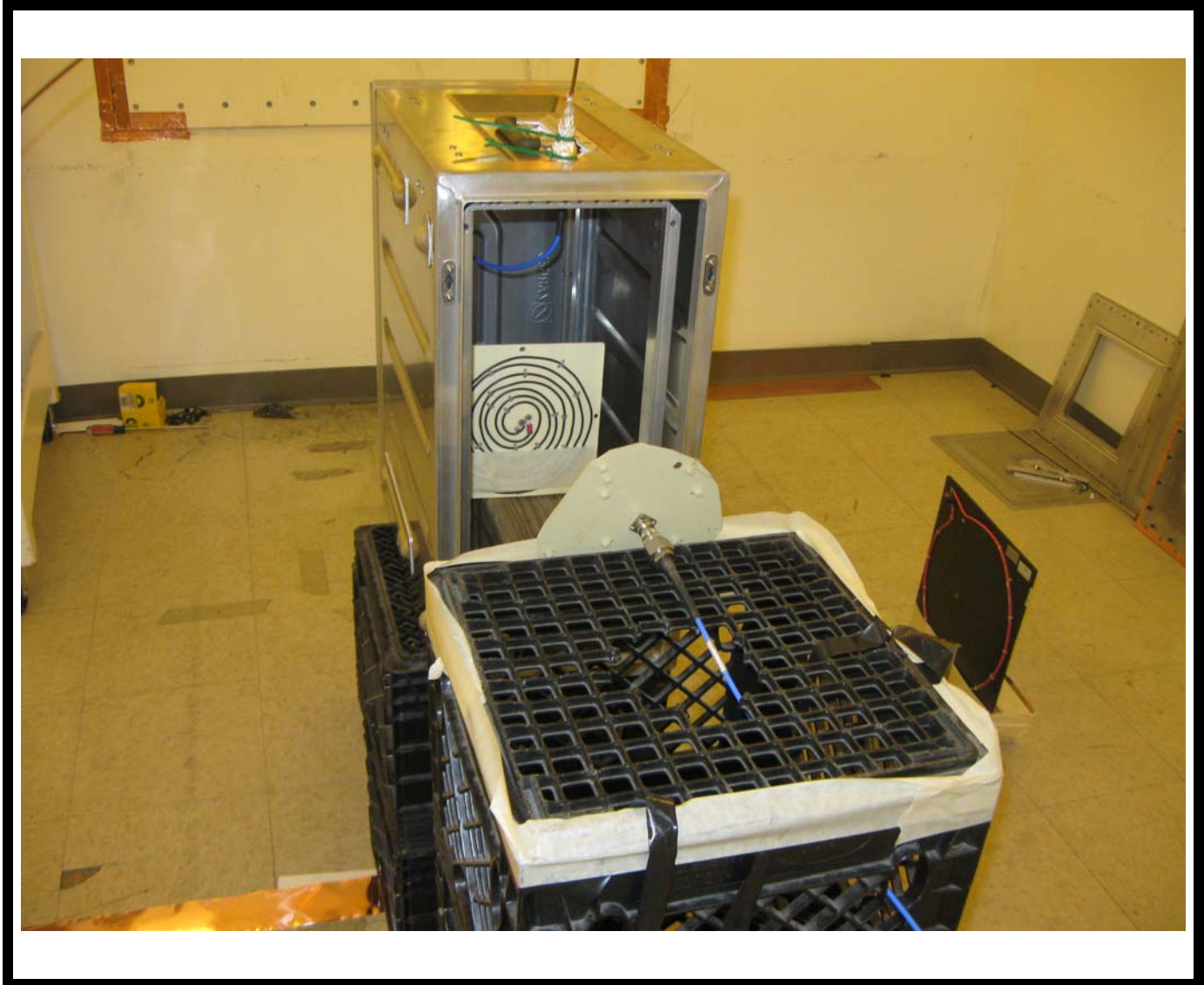
Photograph Description: General Open Reference Test Setup (Open Field)

FORM CTS-PHOTO

Photographic Documentation

CUSTOMER: ZARGES
EQUIPMENT: MITRASET TRANSIT CASE
TESTED BY: WILLIAM COUTURE

DATE: 2011-03-03
TEST NUMBER: N/A



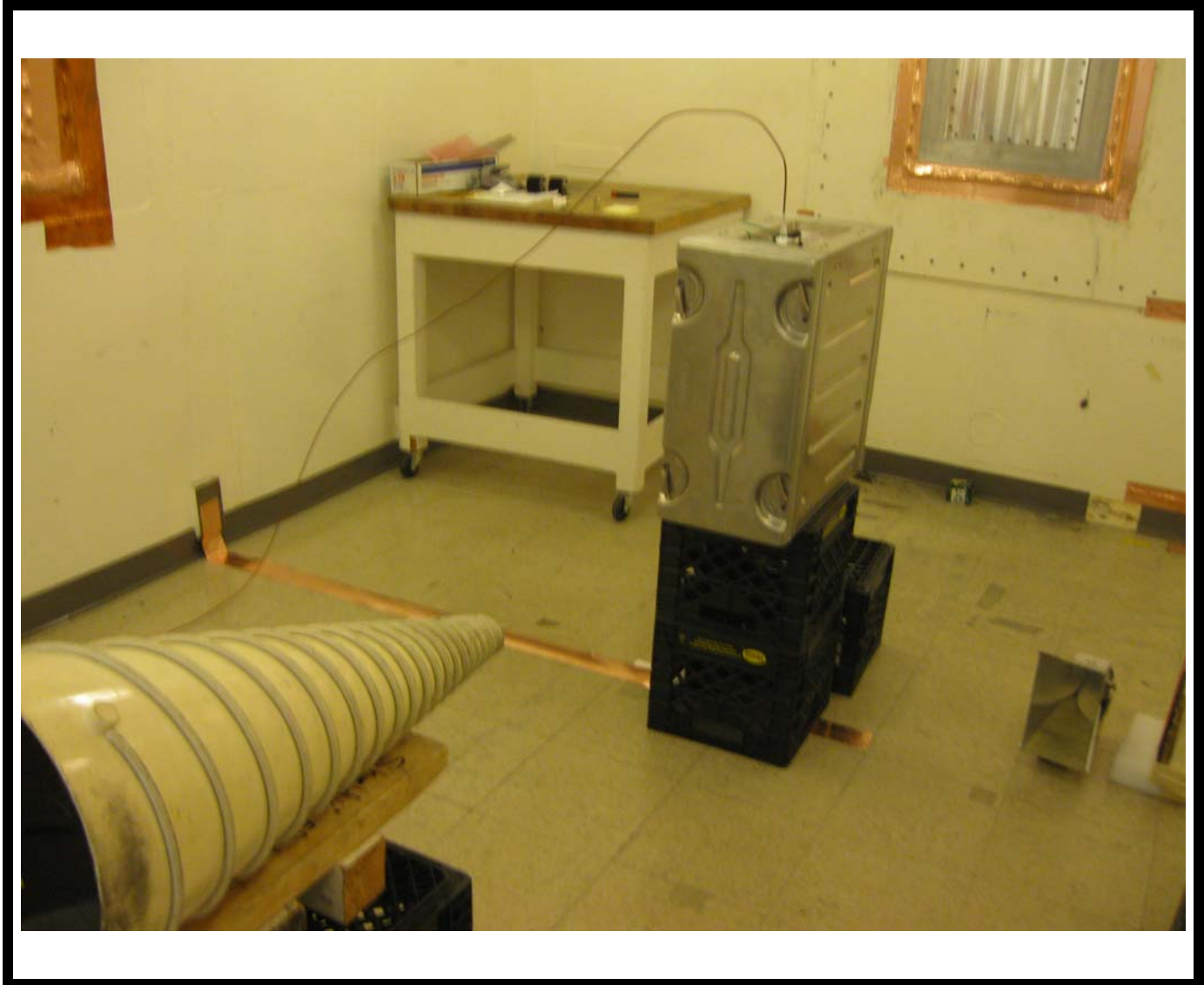
Photograph Description: Transmit Antenna Placement in Case (150kHz to 1GHz)

FORM CTS-PHOTO

Photographic Documentation

CUSTOMER: ZARGES
EQUIPMENT: MITRASET TRANSIT CASE
TESTED BY: WILLIAM COUTURE

DATE: 2011-03-03
TEST NUMBER: N/A



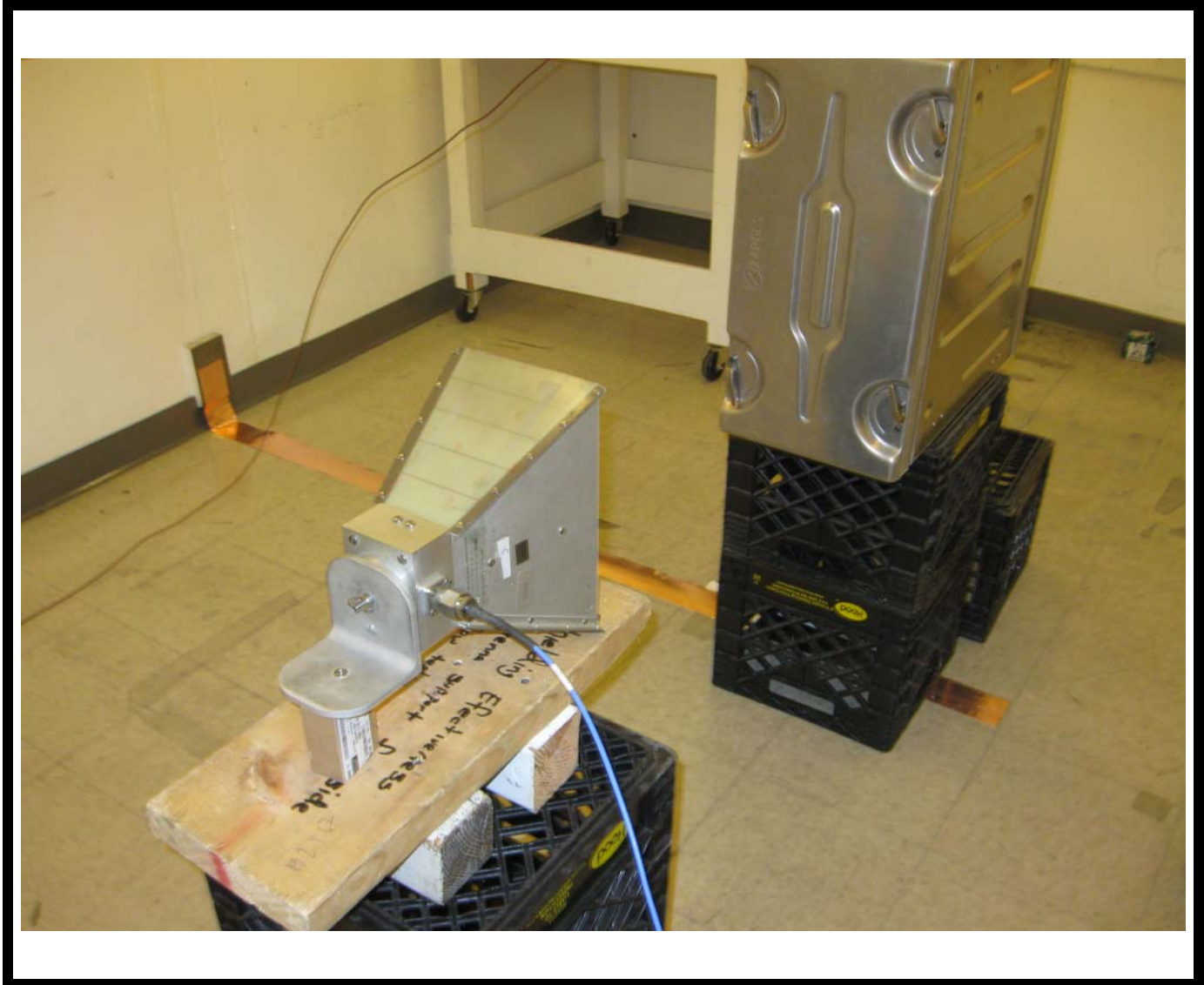
Photograph Description: General Test Setup (200MHz to 1GHz)

FORM CTS-PHOTO

Photographic Documentation

CUSTOMER: ZARGES
EQUIPMENT: MITRASET TRANSIT CASE
TESTED BY: WILLIAM COUTURE

DATE: 2011-03-03
TEST NUMBER: N/A



Photograph Description: General Test Setup (2GHz to 18GHz)

FORM CTS-PHOTO


APPENDIX A

TEST LOG

TEST LOG

CUSTOMER: ZARGES INC.
EQUIPMENT: MITRASET TRANSIT CASE

PROGRAM: SHIELDING EFFECTIVENESS
TESTED BY: WILLIAM COUTURE

Pre-Test Checklist	Date	Comments					
	2011-03-03	<p>Test Plan/Procedure: per test spec</p> <p>Test Specification: IEEE STD 299</p> <p>Chomerics Procedure: TP08</p> <p>EUT Power Requirement Verified:</p> <p style="padding-left: 40px;">Voltage NA Frequency Phase</p> <p>EUT Functional Operational Check: <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail</p> <p>Environmental:</p> <p style="padding-left: 40px;">Bonding/Grounding: N/A Safety Issues: N/A</p>					
In-Process Test Checklist	Date	Test #	Test Type	Test Equipment Calibrated	Test Performed Properly – Data Accepted	EUT Set-up Check/ Operational Check	EUT Pass/ Fail
	2011-03-03	1	IEEE 299 SE	X	X	X	PASS
Post Test Checklist	Date: 2011-03-03	EUT Functional Operation Check: <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail					

FORM CTS-010

Zarges Mitrasets Transit Case
 Document #: SR5821.11 Rev.1
 Date: 2011-05-04