Test Report TR-PR078809 461G, Rev. 1
MIL-STD-461G Testing of the
Combined DC/DC Solar Charge
Controller + DC to AC Inverter Solar Unit
Part Number: Sol-Ark 8K

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Record of Revisions and Alterations		
Revision	**Brief Description of Individual Change**	**Date Incorporated**
0	Initial Issue	May 21, 2018
1	Updated Test Log	June 1, 2018

Signatures

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Reviewed by: Chelsie Morrow
Chelsie Morrow, NTS Quality Representative

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1 Introduction

1.1 Purpose

The purpose of this document is to present the procedures used and the results obtained during the performance of a MIL-STD-461G test program on the Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit. The test program was conducted to determine the ability of the Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit to successfully satisfy the requirements specified in the references listed in Section 2.0.

Client Information

This EMITR is contracted by Oracle Systems Technology, Broomfield, CO.

Scope

This EMITR is applicable to the qualification of the Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit, a component of SYSTEM. The Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit is required to meet the requirements in MIL-STD-461G.

1.2 Acronyms

EUT: Equipment Under Test

EMC: Electromagnetic Compatibility

EMI: Electromagnetic Interference

EMITP: Electromagnetic Interference Test Procedure

EMITR: Electromagnetic Interference Test Report

ICS: Instrument Control System

LISN: Line Impedance Stabilization Network

ODBC: Open Database Connectivity

OLE: Object Linking and Embedding

PSA: Performance Spectrum Analyzer

RF: Radio Frequency

TEM: Transverse Electromagnetic

TPD: Terminal Protection Device

TILE: Total Integrated Laboratory Environment Software

1.3 Definitions

Above Deck is an area on ships which is not considered to be “below deck” as defined herein.

Below Deck is an area on ships which is surrounded by a metallic structure, or an area which provides significant attenuation to electromagnetic radiation, such as the metal hull or superstructure of a surface ship, the pressure hull of a submarine and the screened rooms in non-metallic ships.

Decibel (dB) is a logarithmic unit of measurement that expresses the magnitude of a physical quantity (usually power or intensity) relative to a specified or implied reference level.

Metric Units are a system of measures defined by the International System on Units based on the “Le System International d’ Unites (SI)”, of the International Bureau of Weights and Measures. These units are described in ASTM E3380

Non-Developmental Item is a broad, generic term that covers material available from a wide variety of sources both industry and Government with little or no development effort required by the procuring activity.

Octave refers to the interval between one frequency and another with double its frequency.

Semi-Anechoic Chamber refers to a chamber with RF absorber lining on all walls and ceiling, but not the floor.

Safety Critical is a category of subsystems and equipment whose degraded performance could result in loss of life or loss of vehicle platform.

Test Setup Boundary includes all enclosures of the EUT and the 2 m of exposed interconnecting leads (except for leads which are shorter in actual installation) and power leads required by MIL-STD-461G.

2 References

The following listed in Tables 2-1 and 2-2 form a part of this document to the extent specified herein.

Table 2-1 Government Specifications, Standards, and Handbooks

No	Specification	Rev	Title
1	MIL-STD-461	G	Department of Defense Interface Standard, Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems And Equipment, dated December 11, 2015
2	MIL-STD-220	B	Method of Insertion Loss Measurement, dated June 25, 2004, with Change 1
3	DI-EMCS-80201C	C	Data Item Description Electromagnetic Interference Test Procedures (EMITP), dated August 30, 2007
4	S9407-AB-HBK-010	2	Handbook of Shipboard Electromagnetic Shielding Practices, dated September 30, 1989
5	DoDI 6055.11	N/A	Protecting Personnel from Electromagnetic Fields, dated August 19, 2009

Table 2-2 Other Documents, Drawings, and Publications

No	Specification	Title
6	VISA 1158	Portable Solar LLC Purchase Order, dated April 6, 2018
7	OP0245813-01	NTS Quotation to Portable Solar LLC, dated March 6, 2018
8	ISO/IEC 17025L:2005(E)	General Requirements for the Competence of Testing and Calibration Laboratories, May 15, 2005
9	NTS SOP 110	Standard Operating Procedure – Electrical Safety dated June 4, 2012
10	NTS SOP 114	Lock Out/Tag Out Procedure, dated November 2, 2010
11	ANSI C63.4-2003	American National Standard for Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz–40 GHz, 2003

3 Equipment Under Test

Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit cartridges with stored test practice data.

3.1 Description

Table 3.1-1 lists key parametric data for the Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit.

3.2 Test Configurations

The Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit were mounted 5 cm above the ground plane supported by dielectric material that produces a minimum distortion of the EM fields. See Figure 3.3-1 for details of the Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit.

Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit were loaded with data prior to being exposed to the EM fields. They were subsequently shipped to the customer for evaluation to determine if there was any sort of data corruption and/or damage to the tapes themselves.

Description	P/N	Revision	S/N
Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit	Sol-Ark 8K	N/A	N/A

Figure 3.3-1 Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit

3.3 Security Classification

UNCLASSIFIED. The data on the Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit is unclassified test data.

4 Test Requirements

This section provides an overview of the EMI test plan.

4.1 Test Dates and Location

Table 4.1-1 Test Dates and Locations

Section	Test	MIL-STD-461G Section	Dates
5	RS105	5.22	05/08/2018
Note: All testing was performed at NTS in Plano, TX.			

The following signatures record the testing that was performed in accordance with test procedures contained herein.

Table 4.1-2 MIL-STD-461G Test Completion Verification

Signature indicates the test was supervised by NTS representative.			
Test	**Verified by**	**Signature**	**Date**
RS105	Daniel Ramirez		05/17/2018

4.2 Test Resources

List of the NTS provided equipment used during testing are included in each test section. This equipment is calibrated according to ISO/IEC 17025:2005(E) and calibration is traceable to the National Institute of Standards and Technology (NIST). Calibration records are maintained on file at NTS.

TILE Software

TILE is an integrated approach to designing, performing, reporting, and archiving complex Electromagnetic Compatibility (EMC) tests. TILE/ICS (Instrument Control System) is the portion of the TILE system that provides simple, direct control of EMC measurement instruments. TILE provides a common user interface for all testing, coupled with tight integration into standard report writing programs (Microsoft Word) and spreadsheets (Microsoft Excel). It provides the ability to perform EMC tests as well as manipulate the data generated during these measurements.

By using the latest software techniques, such as OLE 2.0 and ODBC (Open Database Connectivity), TILE allows for rapid design and testing within the laboratory environment. The use of 32-bit code is of particular significance within the EMC community given the large data sizes inherent in EMC testing.

TILE/ICS uses a flowchart to simplify the user interface. Each step in the process is represented on the flowchart with an icon, which are referred to as actions. The icons are each a unique test, information step or prompt. The flowchart provides a powerful tool for symbolizing communications with the instruments and data manipulation/correction.

Instrument control is based on the General Purpose Instrument Bus (GPIB or IEEE-488-2), Serial Communications (IEEE-232), or other standards. The TILE system is hardware independent within these constraints and the abilities of the hardware used. Most EMC instrumentation is supported by TILE. The emphasis on hardware independence allows for quick introduction of new instrumentation into the laboratory environment. No new code has to be written by the user, only a new instrument driver by subcontractor ETS-Lindgren. These instrument drivers are provided free of charge to registered users.

The TILE automation profiles used in this EMITP are included in each applicable test section. These Profile snapshots represent the parameters and characteristics used in the automation process, such as bandwidth settings, frequency step rates, and dwell times for the applicable test frequency range.

Since TILE is a widely used software program, its main programs have been validated. Only user information must be verified and is included in the individual test method. The system verifications performed in each emission test verifies the software at the same time as the rest of the measurement system. Verifications performed for susceptibility are included in each test method of the test procedure. TILE software defaults all receiver video bandwidth resolutions to 3 MHz which is the maximum video bandwidth resolution setting for all NTS receivers.

The output from TILE software is in the form of graphs or tables. The graphs are used to graphically display the data gathered across the frequency range tested. The tables are used to capture the 4 highest peaks detected during test or any peak which approaches within 6 dB of the test limit. This would include any peaks that exceed the limit. TILE is the data recording device for all testing. The completed TILE profiles are stored on a secure server that is continually backed up on another secure server.

Whether the software is set to logarithmic or linear scale does not impact the final result displayed. All data gathered from the analyzer is gathered with the analyzer in a linear mode and converted to a logarithmic scale by the software.

The receiver settings defined in the Parameters tab of the Measure Range TILE icon are irrelevant as the driver loaded into the software is for a spectrum analyzer. TILE recognizes the driver as a spectrum analyzer and only uses the settings for an analyzer (ignoring all portions marked for receiver).

The TILE profile is reviewed for accuracy before and after a test is performed by the shift supervisor. Additionally, NTS' accrediting body requires NTS to provide proof of functionality of test profiles. TILE profiles are used.

NTS uses internal quality processes to ensure the software meets MIL-STD-461G requirements. A technical justification can be provided for each group of software subsets used to perform testing, but NTS considers such to be unsuitable for presentation in a test procedure due to the length and technical detail such justifications would require. Factors are manually entered by the technician performing the test before each test and the use of the correct factor is verified by a pre-test inspection before the technician is allowed to perform the test. Additionally, a post-test inspection is performed to ensure the data gathered is valid. This software has been repeatedly proved and is accurate in all aspects.

Table 4.2-1 TILE Software

Manufacturer	Model	Rev	Date
ETS Lindgren	TILE 6	6.0.2.409	08/14/2013

Test Personnel

NTS provided a test operator and supervisory personnel to perform the test steps for each of the test procedures described in Section 5. The client provided support personnel to monitor the EUT performance and determine susceptibility of the EUT in accordance with criteria and procedures in Sections 3.3 and 4.5. During the performance of RS105 these and all personnel were outside the test chamber with the door closed.

Test Equipment

The test chamber contained only necessary equipment to perform the test; anything that does not support the test was removed from the test chamber.

Ambient Electromagnetic Level

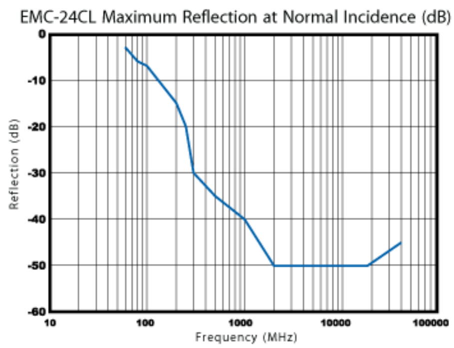
During testing, the ambient electromagnetic level measured with the EUT de-energized and all auxiliary equipment turned on was at least 6 dB below the allowable specified limits when the tests are performed in a shielded enclosure. Ambient conducted levels on power leads were measured with the leads disconnected from the EUT and connected to a resistive load which draws the same rated current as the EUT. When tests are performed in a shielded enclosure and the EUT is in compliance with required limits, the ambient profile need not be recorded in this EMITR. When measurements are made outside a shielded enclosure, the tests were performed during times and conditions when the ambient is at its lowest level. The ambient was recorded in this EMITR and did not compromise the test results.

4.3 General Test Requirements

4.3.1 Test Facility

All testing occurred within a shielded semi anechoic enclosure, located in Plano, TX. The chamber is lined with anechoic Radio Frequency (RF) absorbing cones on the walls and the ceiling. Peripheral equipment was located outside the shielded enclosure. All power leads entering the shielded enclosures were routed via electromagnetic interference filters to provide at least 80 dB of attenuation above 10 kHz when measured in accordance with MIL-STD-220B. Interconnecting cables were routed via feed-through ports mounted on the enclosure. Shielding effectiveness to electric fields and plane waves of this EMI test chamber exceeded 80 dB from 14 kHz–10 GHz, and 60 dB from 10 GHz–40 GHz.

The anechoic RF absorber material shown in Figure 4.3-1 (carbon impregnated foam pyramids) is used when performing electric field radiated emissions or radiated susceptibility testing inside a shielded enclosure. It is intended to reduce reflections of electromagnetic energy and to improve accuracy and repeatability.



MHz	dB
60	– 3
80	– 6
100	–7
200	–15
250	– 20
300	– 30
500	– 35
1,000	– 40
2,000	– 50
3,000	– 50
6,000	– 50
10,000	– 50
18,000	– 50
40,000	– 45

MIL-STD-461D/E Performance Requirement

FREQUENCY	MINIMUM ABSORBTION
80 MHz - 250 MHz	6 dB
250 MHz - 40 GHz	10 dB

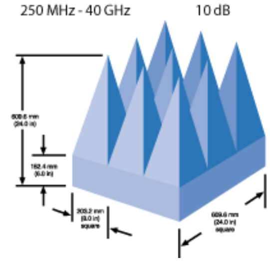


Figure 4.3-1 EMC 24PCL RF Absorber Performance Data

4.3.2 Ground Plane

4.4 Susceptibility Testing

Susceptibility Criteria
EUT CRITERIA SUPPLIED BY CLIENT

Modulation of Susceptibility
Susceptibility test signals for RS105 are pulse modulated (on/off ratio of 40 dB minimum) at 1 kHz rate with a 50% duty cycle.

Thresholds of Susceptibility
When susceptibility indications were noticed in EUT operation, a threshold level was determined when possible, and where the susceptible condition was no longer present. Thresholds of susceptibility were determined as follows:

- When a susceptibility condition was detected, the interference signal was reduced until the EUT recovered.
- The interference was reduced by an additional 6 dB.
- The interference signal was gradually increased until the susceptibility condition reoccurred.
- The level, frequency range of occurrence, frequency and level of greatest susceptibility, and other test parameters, as applicable were recorded.

Notice of Deviation
In accordance with NTS' quality procedures, when a EUT was observed to exceed an emission limit or display susceptibility to a susceptibility test, a Notice of Deviation document was generated by the technician performing the test. This NOD documents the emission/susceptibility requirement, how the EUT deviated from the requirement, and allows room for resolution of the deviation. This document was signed by the NTS program engineer and the NTS quality representative. It was then forwarded to the customer contact provided by the client. Once mitigated (or passed over), the steps taken to correct the deviation (or simply instruction from the customer to continue testing) were recorded in the NOD and it was integrated into the body of this EMITR in the appropriate location.

4.5 General Test Precautions

Excess Personnel and Equipment
The test area was kept free of unnecessary personnel, equipment, cable racks, and desks. Only the equipment essential to the test being performed was in the test area or enclosure. Only personnel actively involved in the test was permitted in the enclosure.

Overload Precautions
Measurement receivers and transducers are subject to overload, especially receivers without pre-selectors and active transducers. Periodic checks were performed to assure that an over-load condition did not exist. Instrumentation changes were implemented to correct any overload condition.

Linear Response of Signal
In accordance with ANSI C63.4-2003 Clause 4.2, the measuring system satisfied the following condition:

- The measuring system shall have a linear response.

If a non-linear response was suspected due to an overload condition, the linearity response of the measurement system was verified. This was accomplished by performing a continuous sweep across the measurement range. A second sweep was performed with external RF attenuation added to the front end of the spectrum analyzer to confirm that the measurement amplitude at the suspect frequencies were reduced corresponding to the amount of attenuation applied.

For example, a linear response would be verified if a 30 dB signal measured through a 10 dB attenuator reads 20 dB, and reads 10 dB through a 20 dB attenuator. A non-linear response would be verified if a 30 dB signal reads a value high than expected through a given attenuator (non-linear response: 30 dB input – 10 dB attenuator = 27.5 dB)

If a non-linear response was verified, the addition of more external attenuation or internal attenuation with an RF reference level adjustment was required to regain a linear measurement response. Newer models of EMI Receivers such as the Agilent E4446A series indicate where an IF or RF overload exists. In this case, the attenuation of the analyzer's input signal was adjusted until the overload indication was removed.

RF Hazards
Some tests in this report result in electromagnetic fields that were potentially dangerous to personnel. The permissible exposure levels in DoDI 6055.11 did not exceed in areas where personnel are present. Safety procedures and devices were used to prevent accidental exposure of personnel to RF hazards. RS105 was performed in a shielded EMI test chamber with all doors, panels, and apertures sealed. At no time were personnel allowed in the sealed chamber area while transmitting. The input signal to the transmit antenna was removed, and the amplifier placed in standby prior to entering the chamber.

Shock Hazard
Some tests require potentially hazardous voltages to be present. Extreme caution was taken by all personnel to assure that all safety precautions were observed.

See the NTS Standard Operating Procedure SOP 110 for electrical safety and SOP114 for Lock-Out Tag-Out procedures.

4.6 Test Descriptions and Results

- The Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit was inspected upon receipt for damage. The Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit had no apparent damage.
- All tests were performed in accordance with Section 2.0.

4.7 Test Summary

Table 5.1-1 Test Results Summary

Section	Test	Results
5	MIL-STD-461G RS105	Passed

5 Radiated Susceptibility: Method RS105

This requirement is applicable to equipment and subsystem enclosures which are exposed to the external electromagnetic environment.

5.1 RS105 Purpose

This test procedure is used to verify the ability of the EUT enclosure to withstand a transient electromagnetic field.

5.1.1 RS105 Limits

The EUT shall not exhibit any malfunction, degradation of performance, or deviation from specified indications, beyond the tolerances indicated in the individual equipment or subsystem specification, when subjected to a test signal having the waveform and amplitude shown on Figure RS105-1. At least five pulses shall be applied at the rate of not more than one pulse per minute.

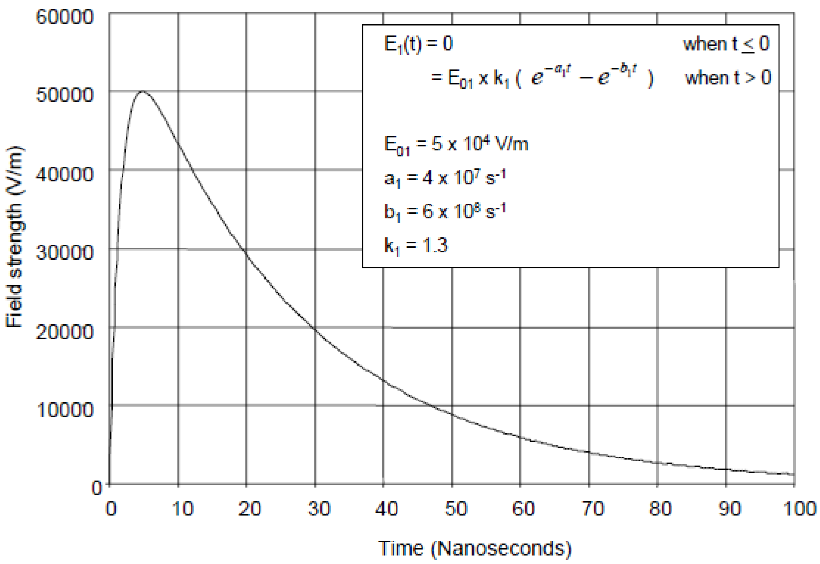


Figure RS105-1 Limits

5.1.2 RS105 Test Setup

Set up the EUT as described below. CAUTION: Exercise extreme care if an open radiator is used for this test.

a. Calibration. Configure the test equipment in accordance with Figure RS105-2.

(1) Before installing the EUT in the test volume, place the B-dot or D-dot sensor probe in the center position of the five point grid in the vertical plane where the front face of the EUT will be located (see Figure RS105-2).

(2) Place the high-voltage probe across the input to the radiation system at the output of the transient pulse generator. Connect the probe to a storage oscilloscope.

b. EUT testing. Configure the test equipment as shown on Figure RS105-3 for testing of the EUT.

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(1) Place the EUT centerline on the centerline of the working volume of the radiation system in such a manner that it does not exceed the usable volume of the radiation system (h/3, B/2, A/2)/(x,y,z) as shown on Figure RS105-3 (h is the maximum vertical separation of the plates). If the EUT is mounted on a ground plane in the actual installation, the EUT shall be placed on the radiating system ground plane. The EUT shall be bonded to the ground plane in a manner that duplicates the actual installation. Otherwise, the EUT shall be supported by dielectric material that produces a minimum distortion of the EM fields.
(2) The EUT orientation shall be such that the maximum coupling of electric and or magnetic fields is simulated. This may require more than one test orientation.
(3) Cables for EUT operation and monitoring shall be oriented to minimize induced currents and voltages on the cables. Cabling shall be oriented normal to the electric field vector and in a manner that minimizes the loop area normal to the magnetic field vector. Cables extending out of the parallel plate working volume should remain normal to the electric field vector for a minimum distance equal to 2 times h.
(4) Bond the bottom plate of the radiation system to an earth reference.
(5) Keep the top plate of the radiation system at least 2 times h from the closest metallic ground, including ceiling, building structural beams, metallic air ducts, shielded room walls, and so forth.
(6) Place the EUT actual or simulated loads and signals for electrical interfaces in a shielded enclosure when an open radiator is used.
(7) Place transient protection devices (TPDs) in the EUT power lines near the power source to protect the power source.
(8) Connect the transient pulse generator to the radiation system.

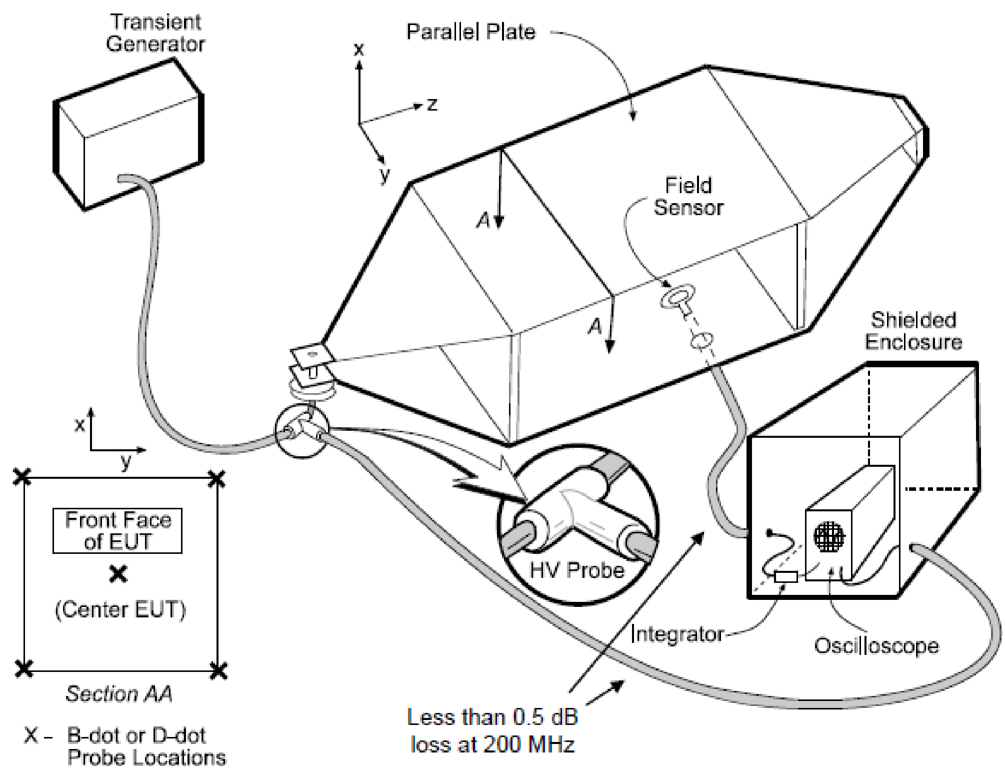


Figure RS105-2 Calibration

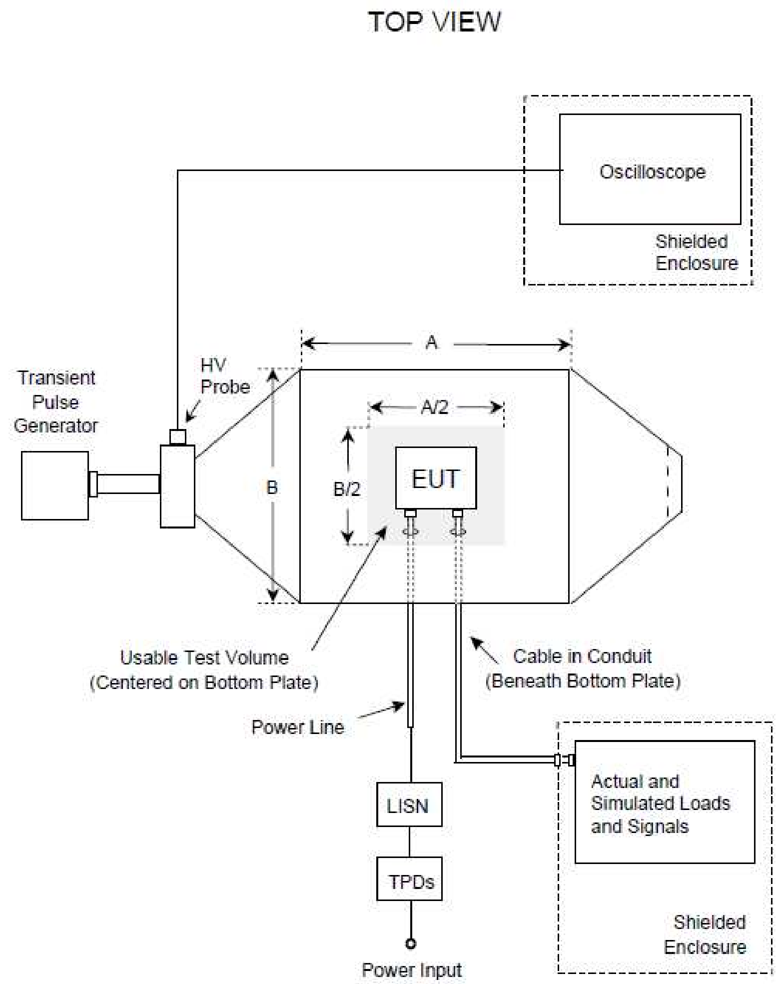


Figure RS105-3 Test Setup

5.1.3 RS105 Test Procedures

The test procedures shall be as follows:
a. Turn on the measurement equipment and allow a sufficient time for stabilization.
b. Calibration. Perform the following procedures using the calibration setup:
(1) Generate a pulse and adjust the pulse generator to produce a pulsed field, as measured with the B-dot or D-dot probes, which meets the peak amplitude, rise time, and pulse width requirements. CAUTION: High voltages are used which are potentially lethal. Record the drive pulse waveform as displayed on the oscilloscope.
(2) Tolerances and characteristics of the RS105 limit shall be as follows:
(a) Rise time (between 10% and 90% points) between 1.8 ns and 2.8 ns (electric field continuously increasing).
(b) Full width half maximum (FWHM) pulse width equal to 23 ns ± 5 ns.
(c) Peak value of the electric or magnetic field for each grid position: 0 dB ≤ magnitude ≤ 6 dB above limit.
(3) Repeat steps (1) and (2) for the other four test points on Figure RS105-2.
(4) Determine the pulse generator settings and associated pulse drive amplitude which simultaneously satisfies the field requirements for all five grid positions.

c. EUT testing. Perform the following procedures using the test setup:

(1) Turn on the EUT and allow sufficient time for stabilization.

(2) Test the EUT in its orthogonal orientations whenever possible.

(3) Apply the pulse starting at 10% of the pulse peak amplitude determined in (4) with the specified wave shape where practical. Increase the pulse amplitude in step sizes of 2 or 3 until the required level is reached.

(4) Ensure that the drive pulse waveform characteristics at the required test level are consistent with those noted in (2).

(5) Apply the required number of pulses at a rate of not more than 1 pulse per minute.

(6) Monitor the EUT during and after each pulse for signs of susceptibility or degradation of performance.

(7) If an EUT malfunction occurs at a level less than the specified peak level, terminate the test and record the level.

(8) If susceptibility is noted, determine the threshold level.

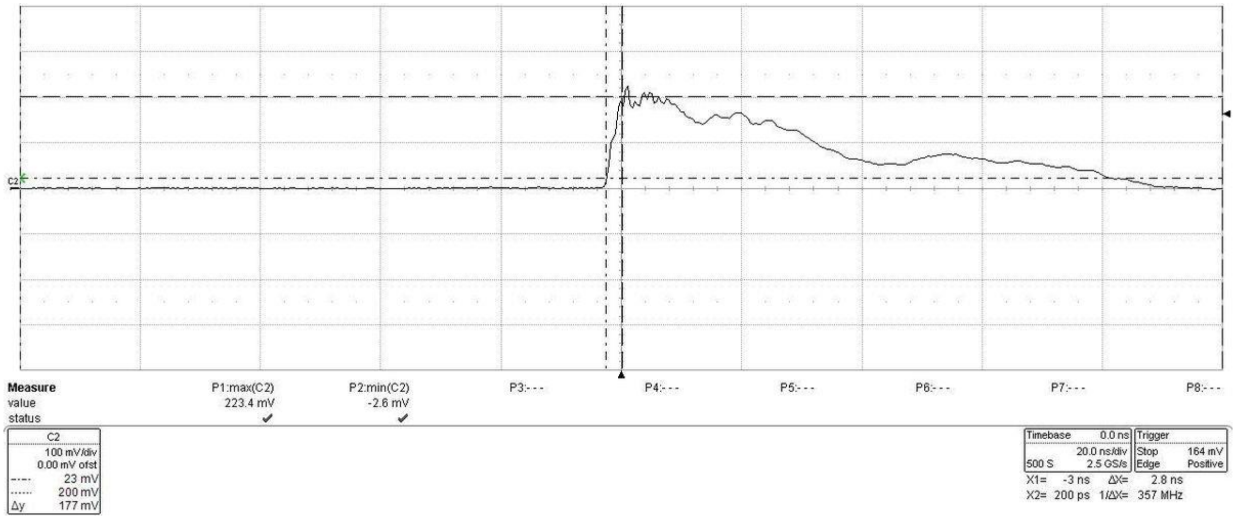
5.1.4 RS105 Verification Results

50kV Verification Results

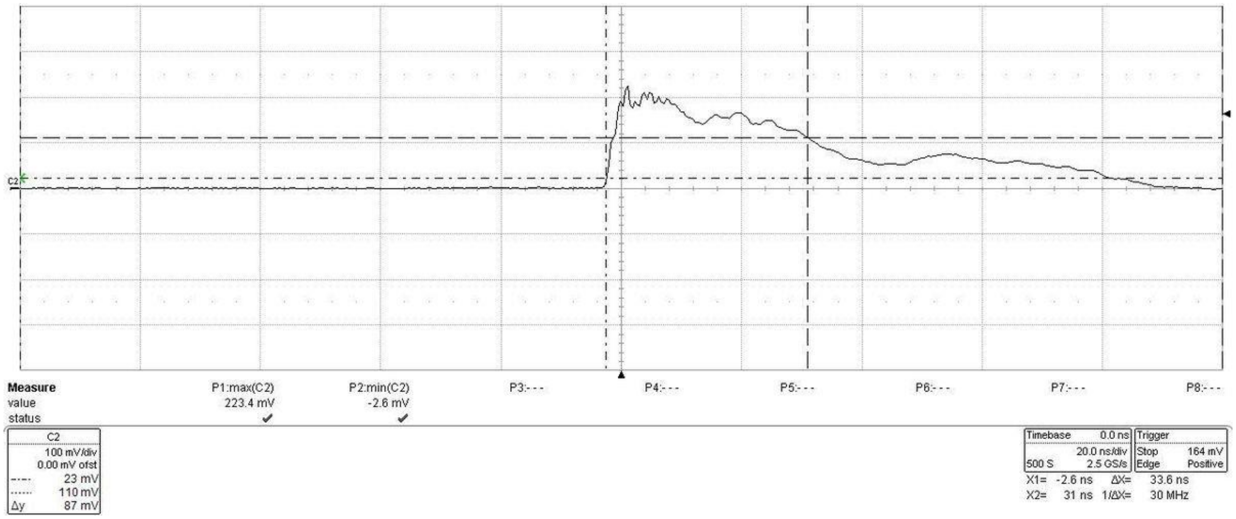
D-Dot Sensor Asset Number and Model Number		Location	Oscilloscope Peak Voltage (mV)	Calculated Voltage (kV)	Waveform within Tolerance
BX2830	Montena ACD-4CR D-Dot Sensor	Front Lower Right	223	50372712.9	Yes
		Front Lower Left	238	53761011.97	Yes
		Center	254	57375197.65	Yes
		Front Upper Right	274	61892929.75	Yes
		Front Upper Left	264	59634063.7	Yes
Test Performed By:		**Christian Mason**			
Program Manager:		**Phil Tran**			

100kV Verification Results

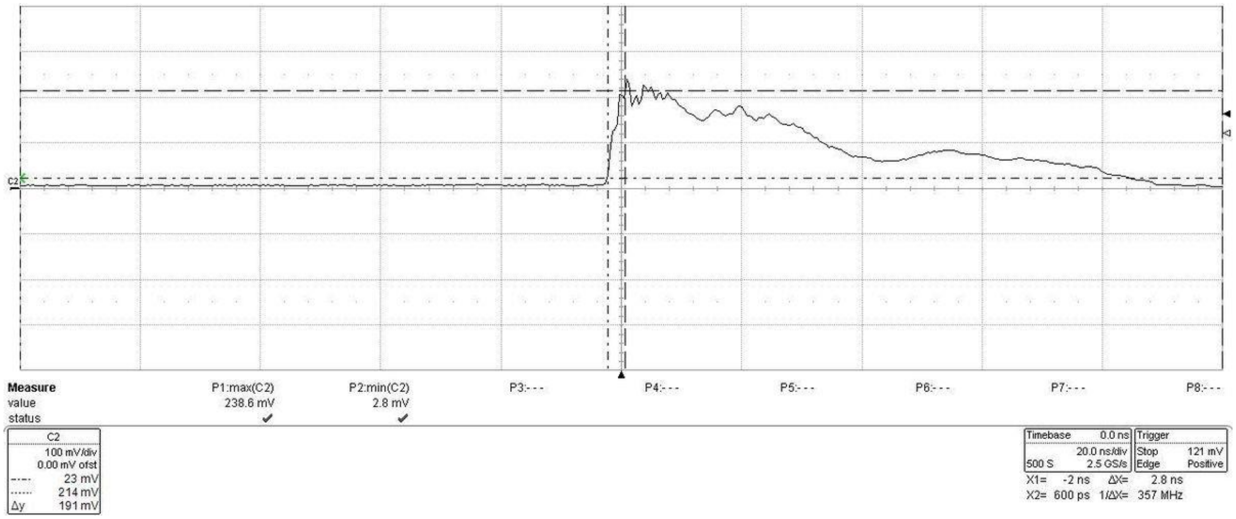
D-Dot Sensor Asset Number and Model Number		Location	Oscilloscope Peak Voltage (V)	Calculated Voltage (V)	Waveform within Tolerance
BX2830	Montena ACD-4CR D-Dot Sensor	Front Lower Right	0.448	101197.199	Yes
		Front Lower Left	0.371	83803.93043	Yes
		Center	0.48	108425.5704	Yes
		Front Upper Right	0.486	109780.89	Yes
		Front Upper Left	0.454	102552.5186	Yes
Test Performed By:		**Christian Mason**			
Program Manager:		**Phil Tran**			



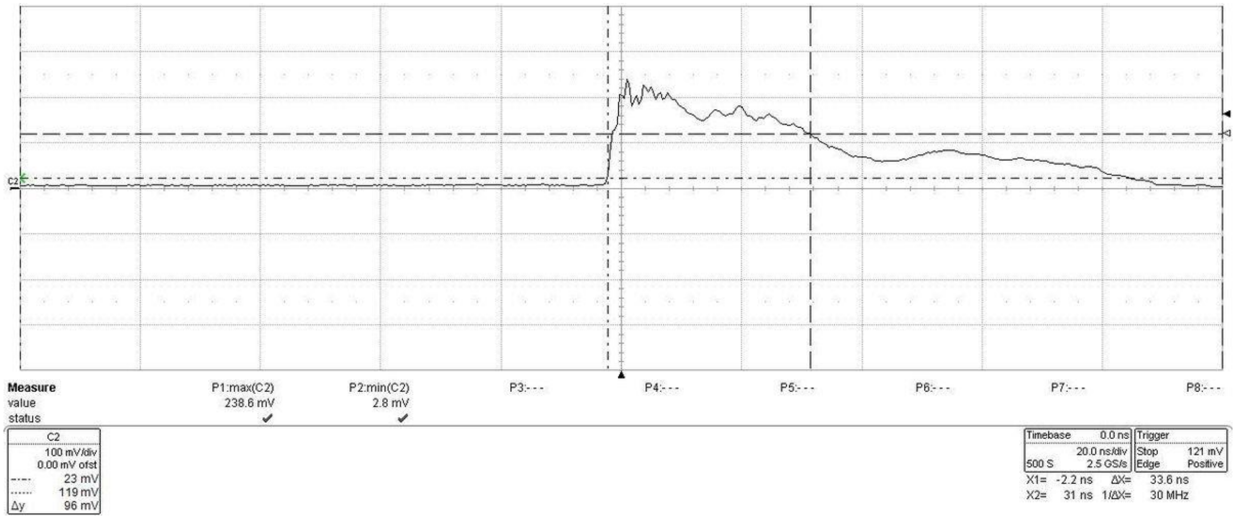
50kV - RS105 Front Lower Right Rise Time Calibration



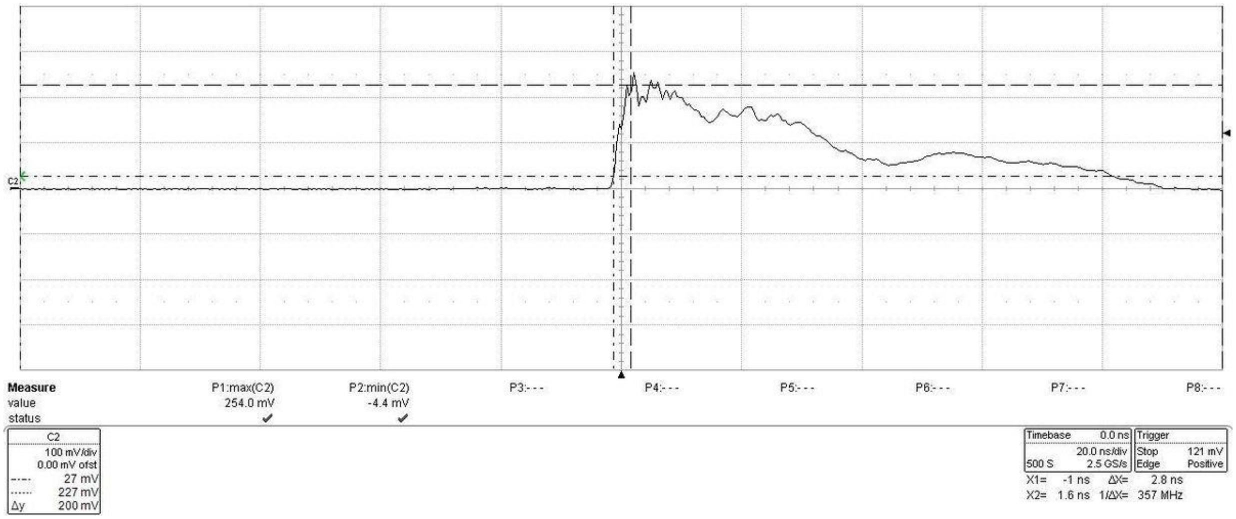
50kV - RS105 Front Lower Right Pulse Width Calibration



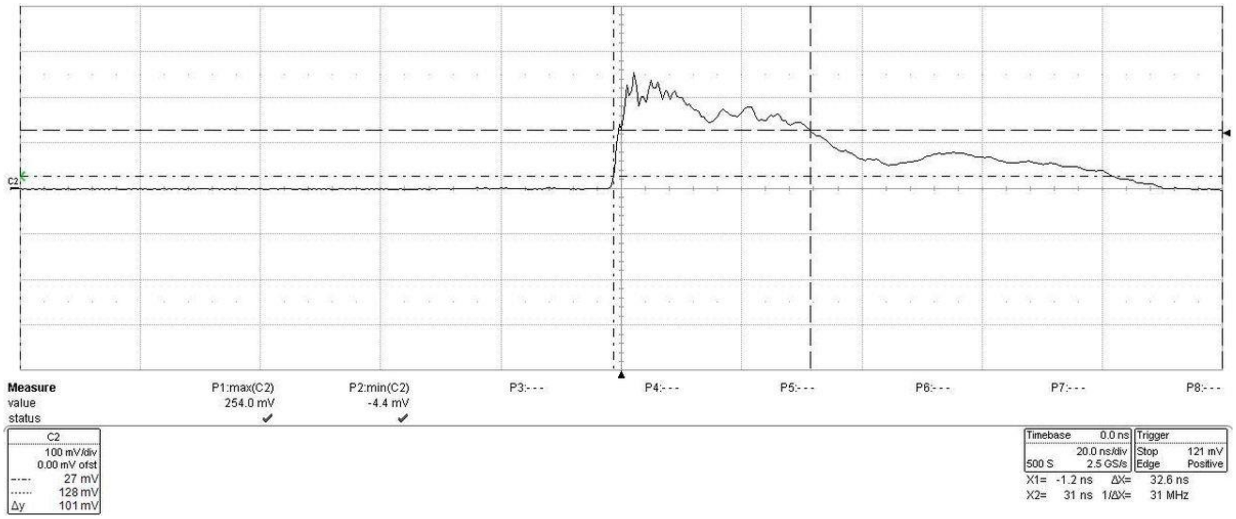
50kV - RS105 Front Lower Left Rise Time Calibration



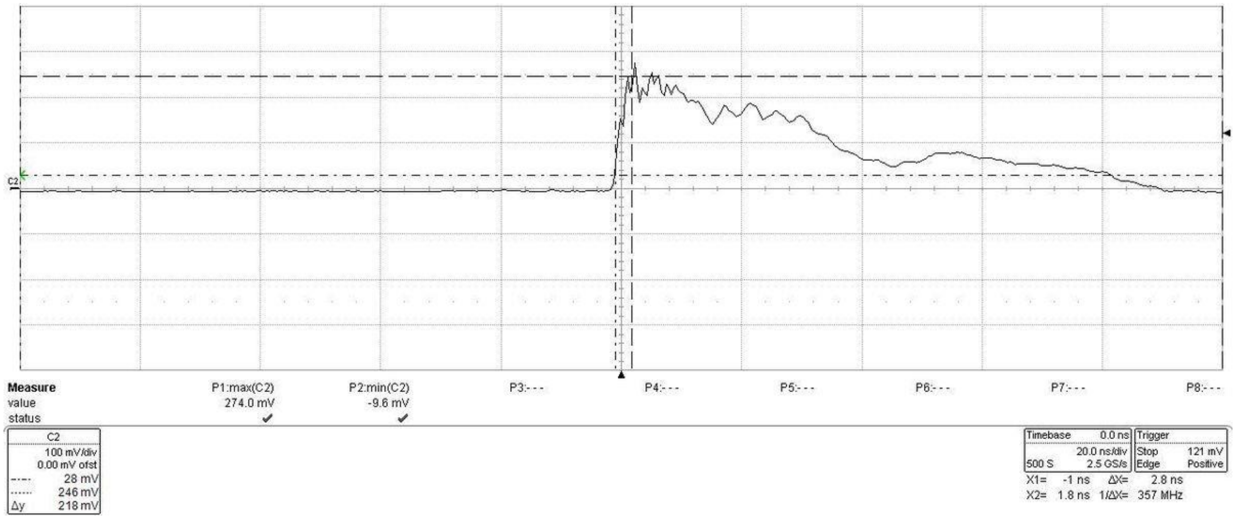
50kV - RS105 Front Lower Left Pulse Width Calibration



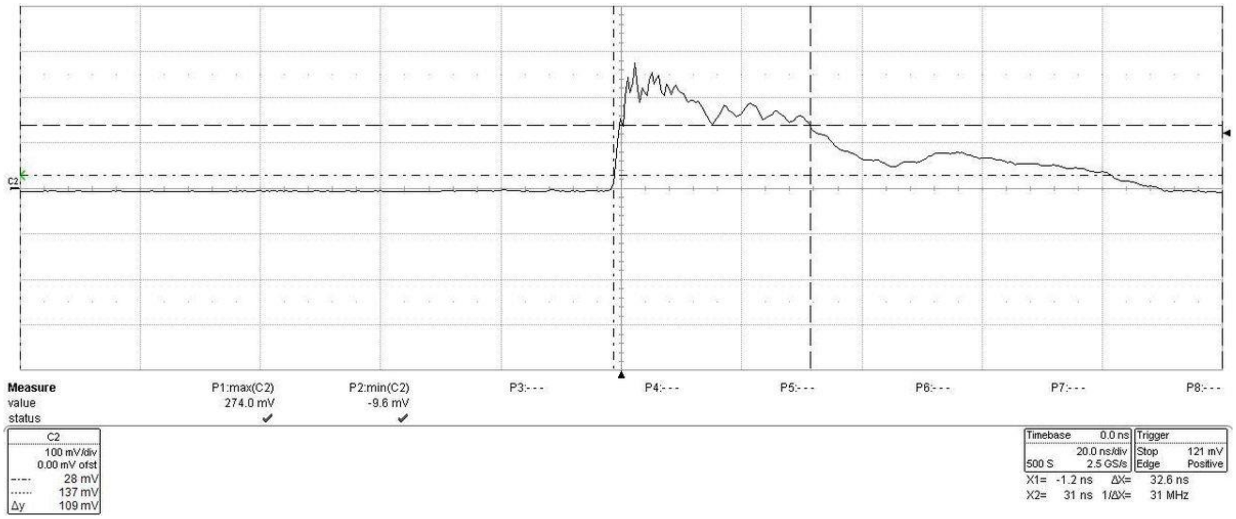
50kV - RS105 Center Rise Time Calibration



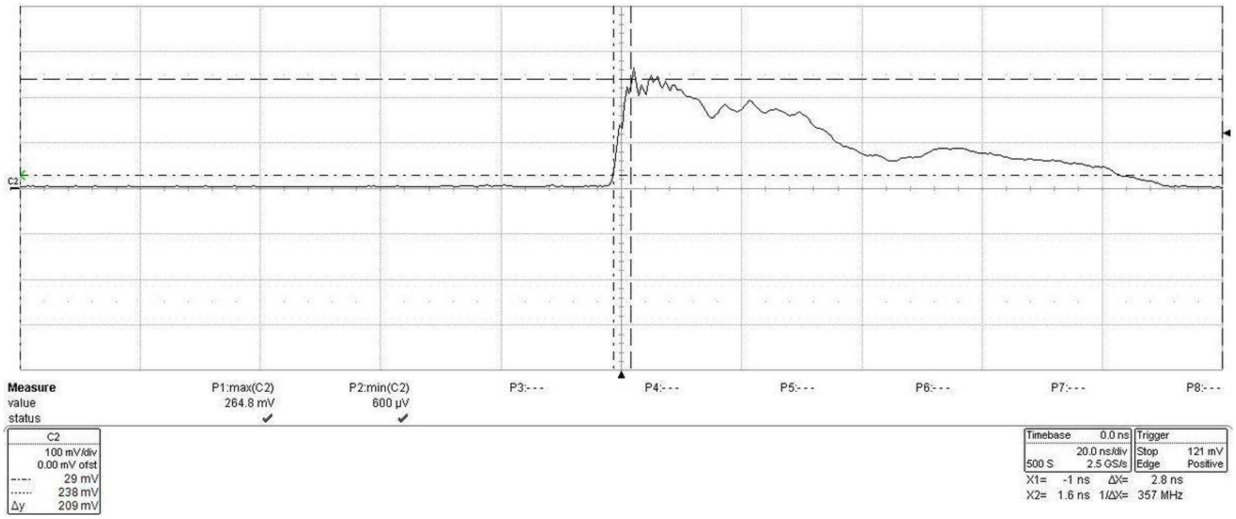
50kV - RS105 Center Pulse Width Calibration



50kV - RS105 Front Upper Right Rise Time Calibration



50kV - RS105 Front Upper Right Pulse Width Calibration



50kV - RS105 Front Upper Left Rise Time Calibration

5.1.5 RS105 Test Results

The Combined DC/DC Solar Charge Controller + DC to AC Inverter Solar Unit **complied** with the requirements in Section 2.0.

50kV Results

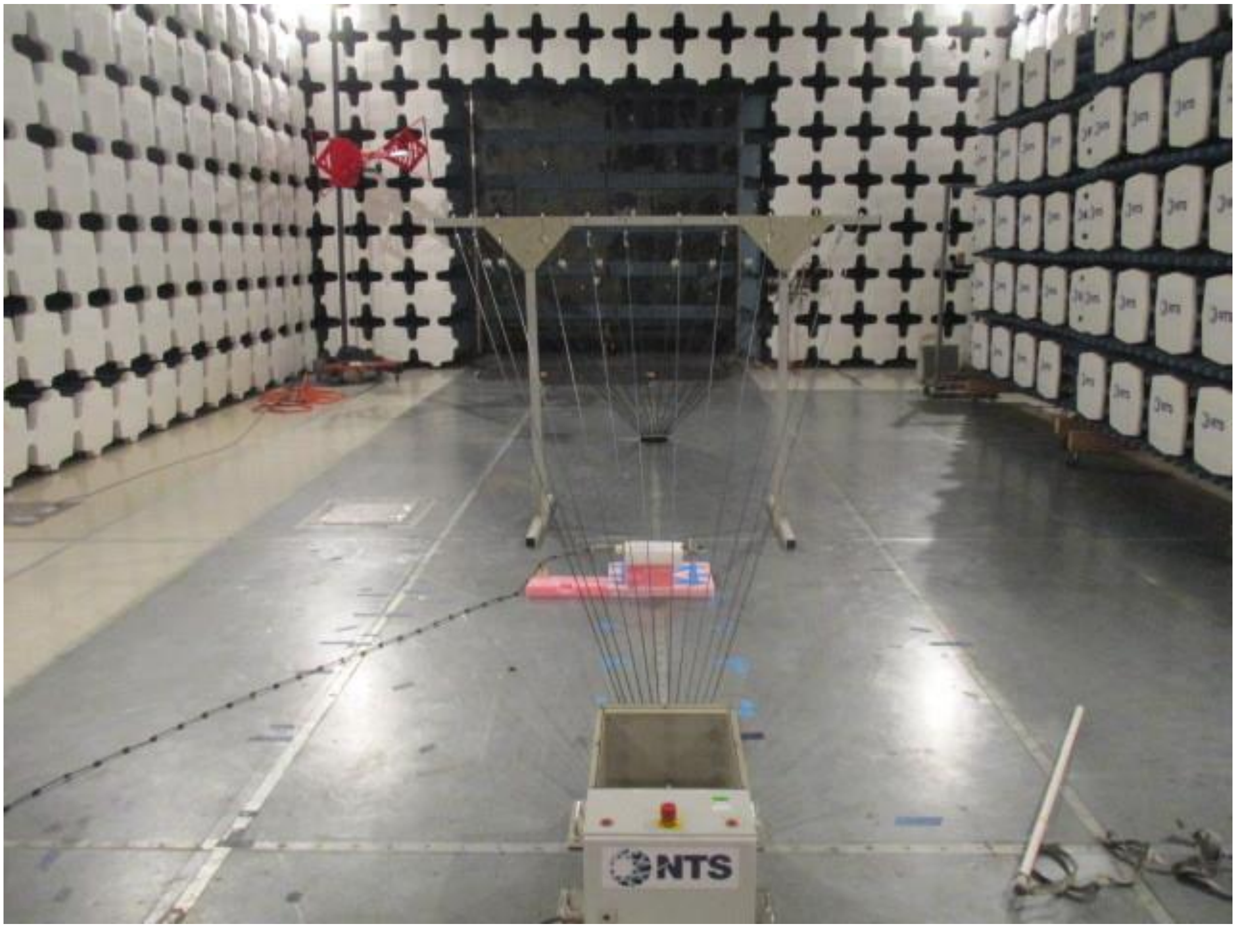
Generator Setting	Number Applied	Mode of Operation	Measured Voltage (mV)	Field Strength (kV)	Test Results	Observations (Susceptibility Threshold)
100%	10	Normal	>226mv	>50kV	Pass	X-Axis
100%	10	Normal	>226mv	>50kV	Pass	Y-Axis
100%	10	Normal	>226mv	>50kV	Pass	Z-Axis
Test Performed By:	**Christian Mason**					
Program Manager:	**Phil Tran**					

100kV Results

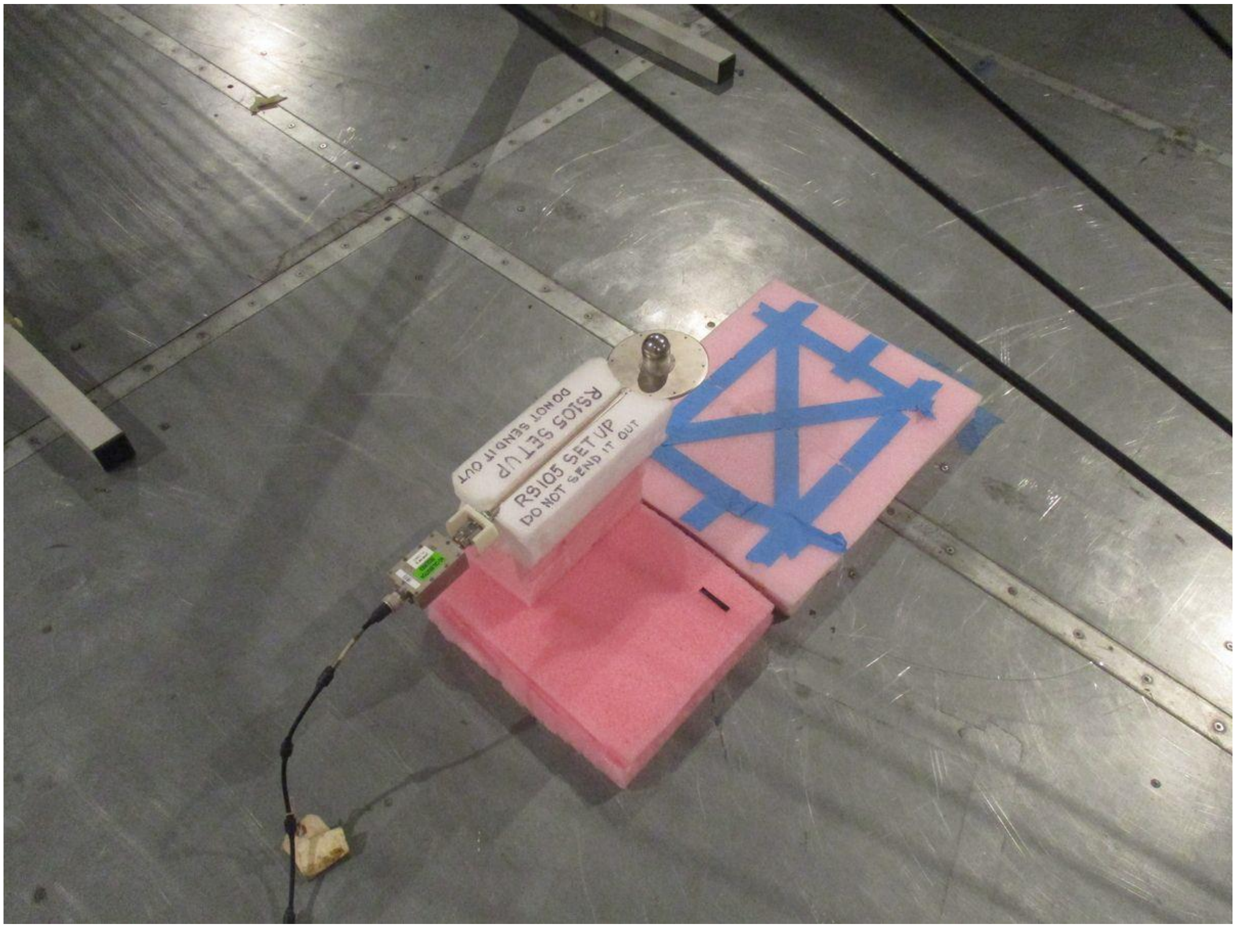
Generator Setting	Number Applied	Mode of Operation	Measured Voltage (mV)	Field Strength (kV)	Test Results	Observations (Susceptibility Threshold)
100%	10	Normal	>480mv	>100kV	Pass	X-Axis
100%	10	Normal	>480mv	>100kV	Pass	Y-Axis
Test Performed By:	**Christian Mason**					
Program Manager:	**Phil Tran**					

Note – Z-Axis not tested due to limited clearance.

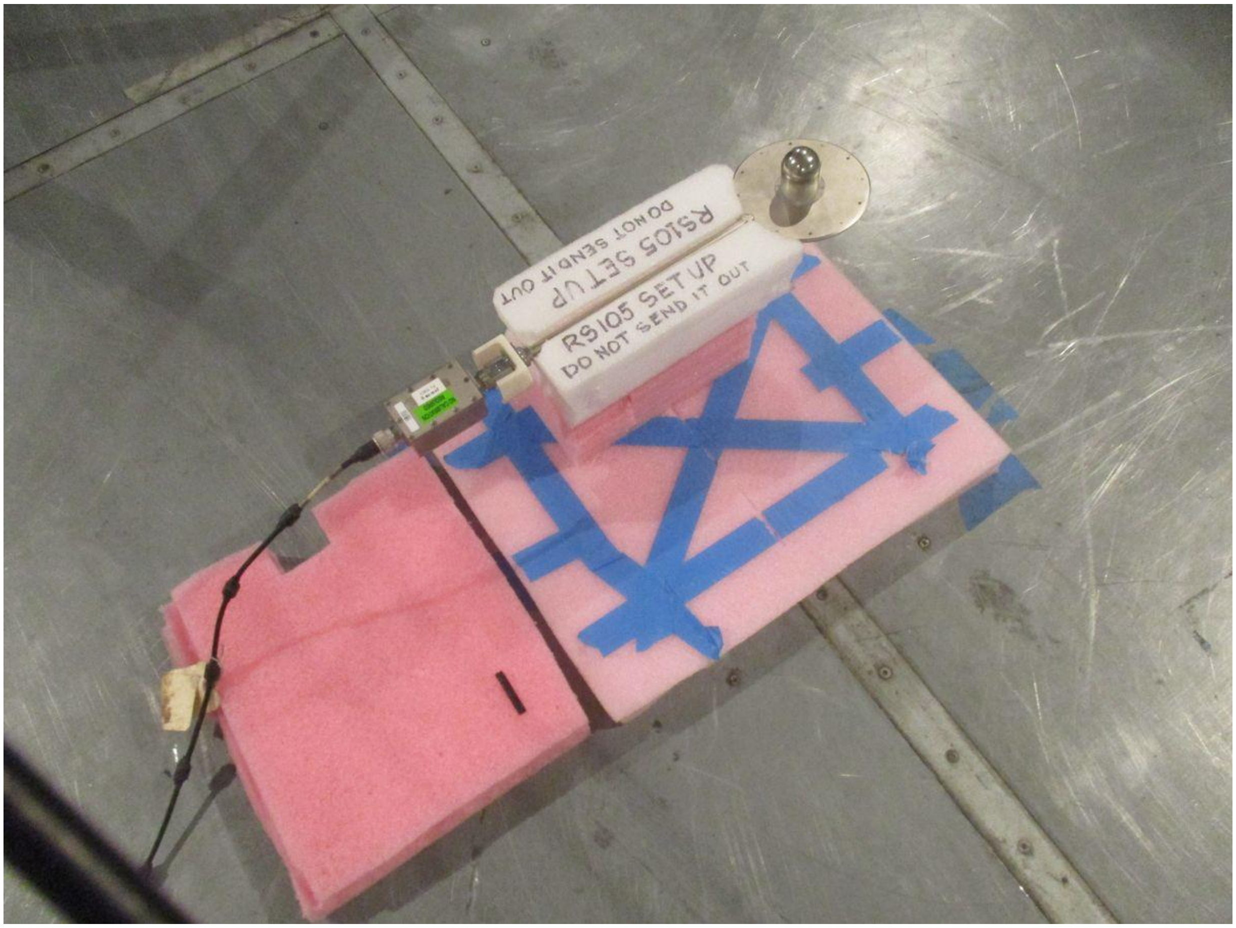
5.1.6 RS105 Test Photographs



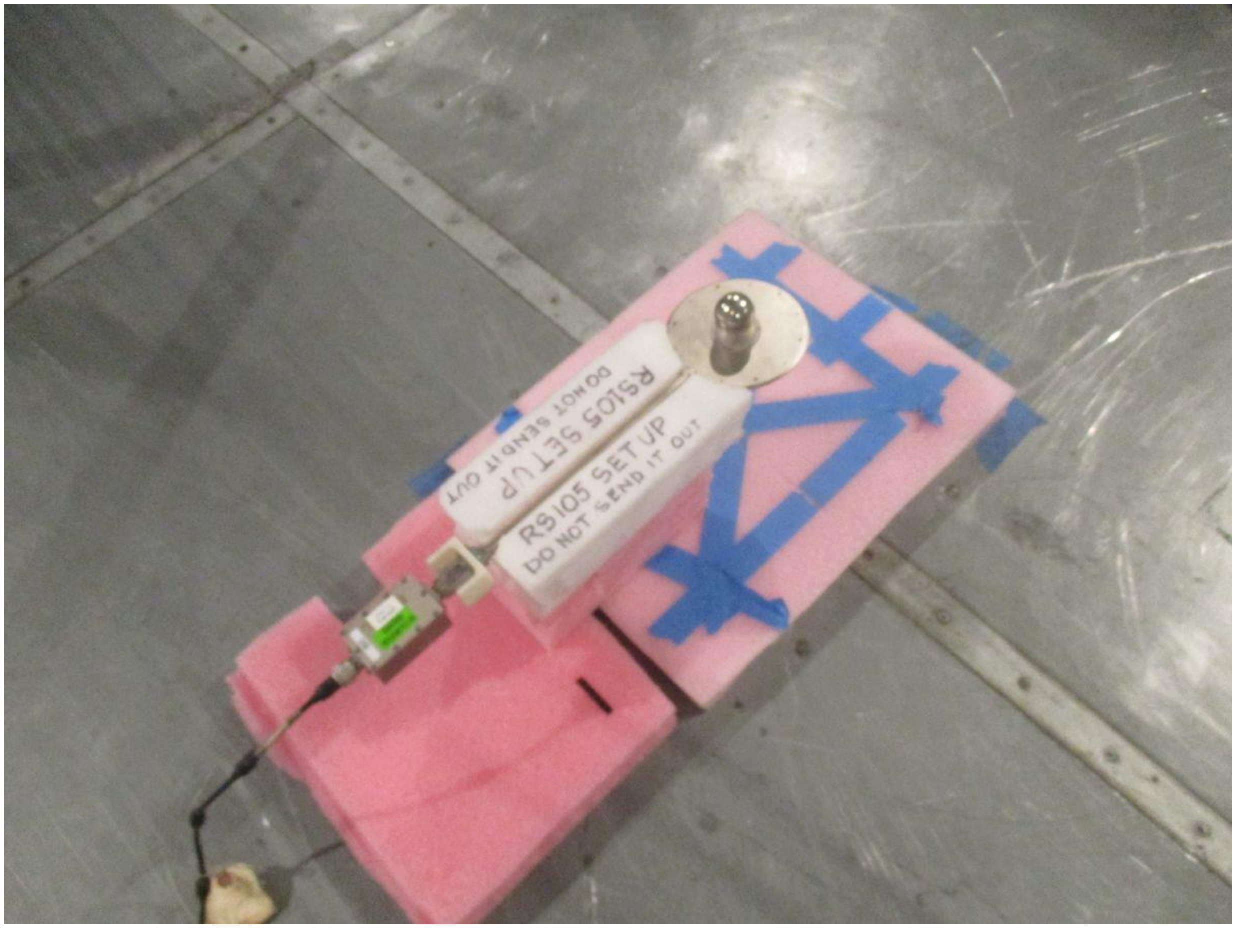
50kV - RS105 Calibration Test Setup



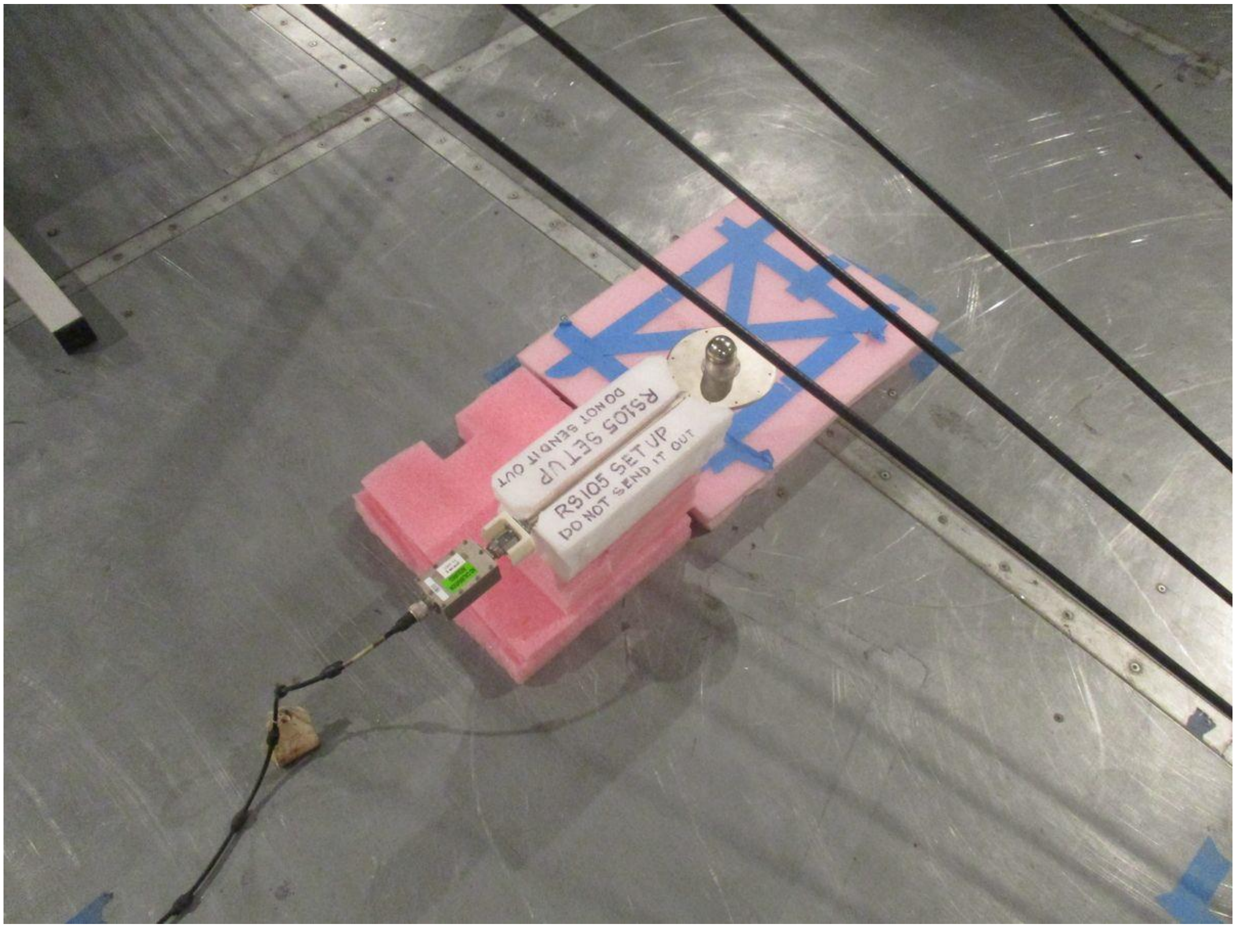
50kV - RS105 Front Lower Right Calibration



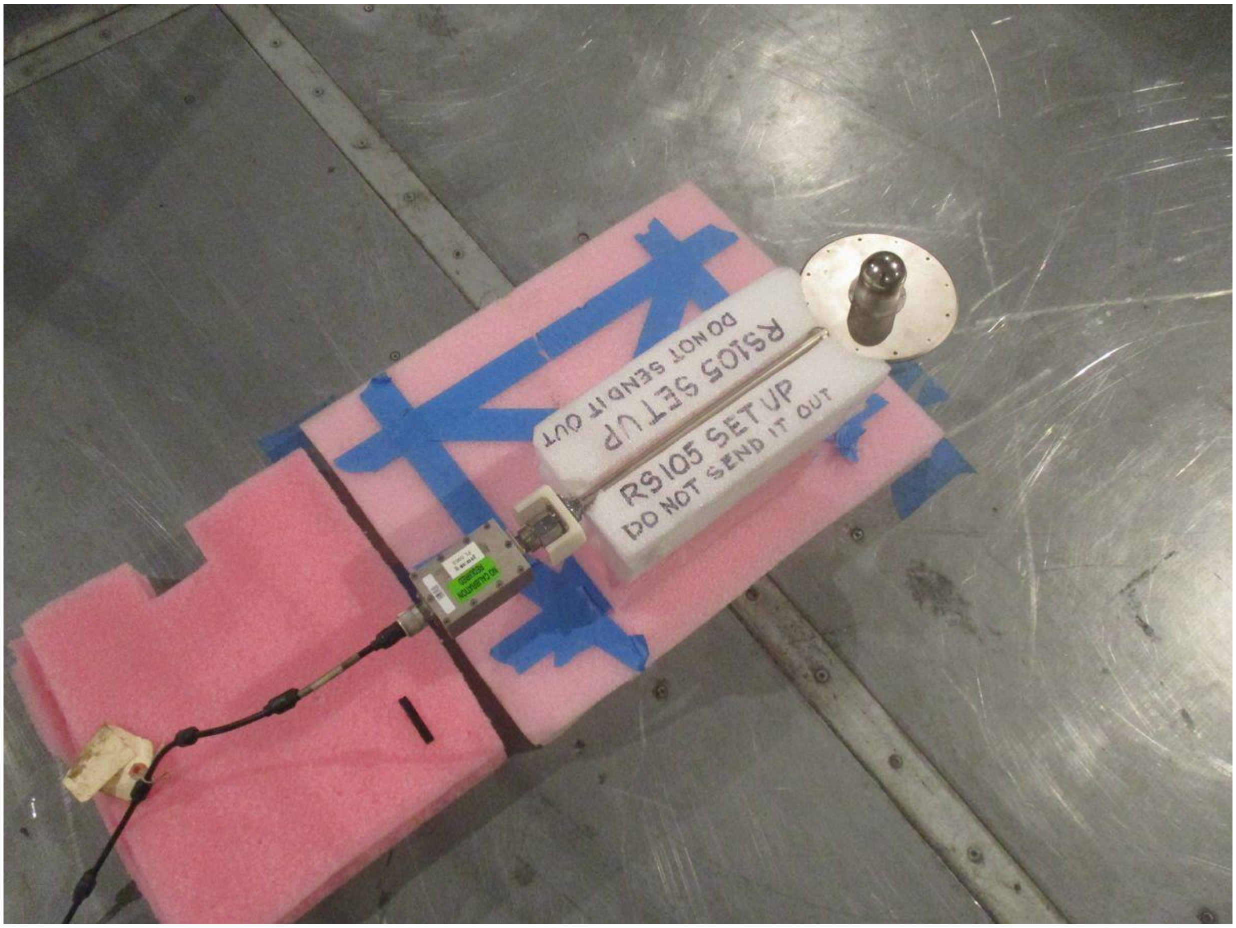
50kV - RS105 Front Lower Left Calibration



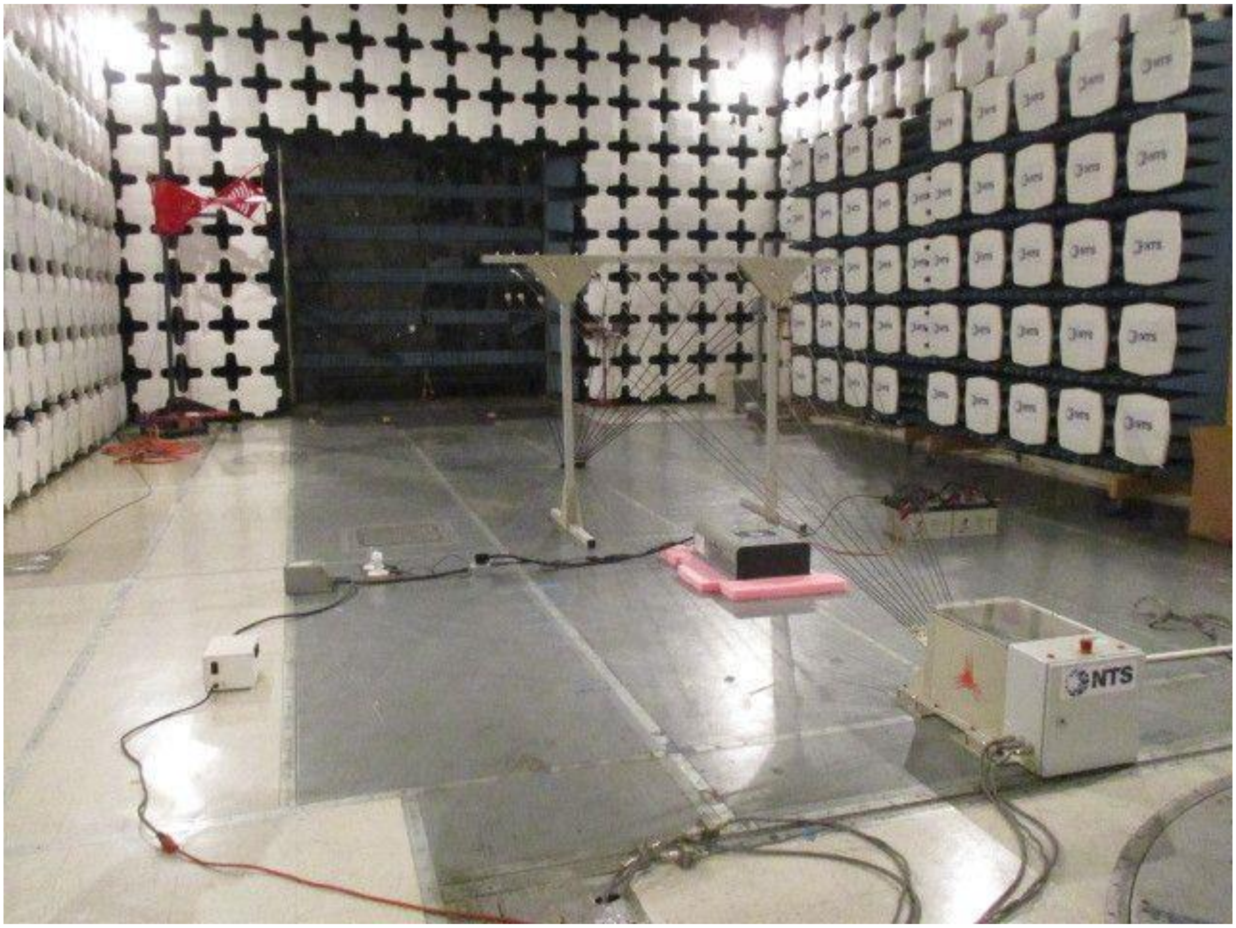
50kV - RS105 Center Calibration



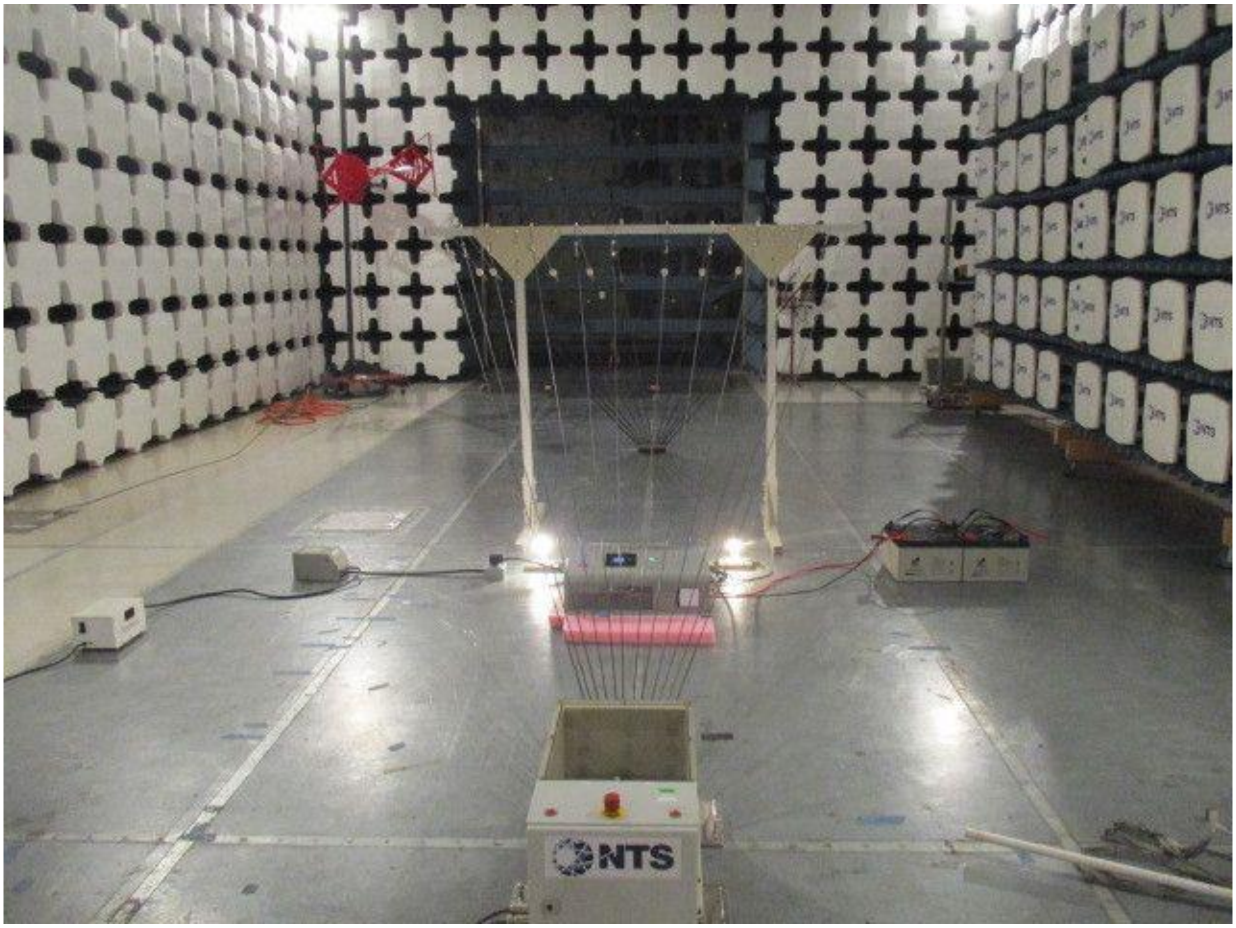
50kV - RS105 Front Upper Right Calibration



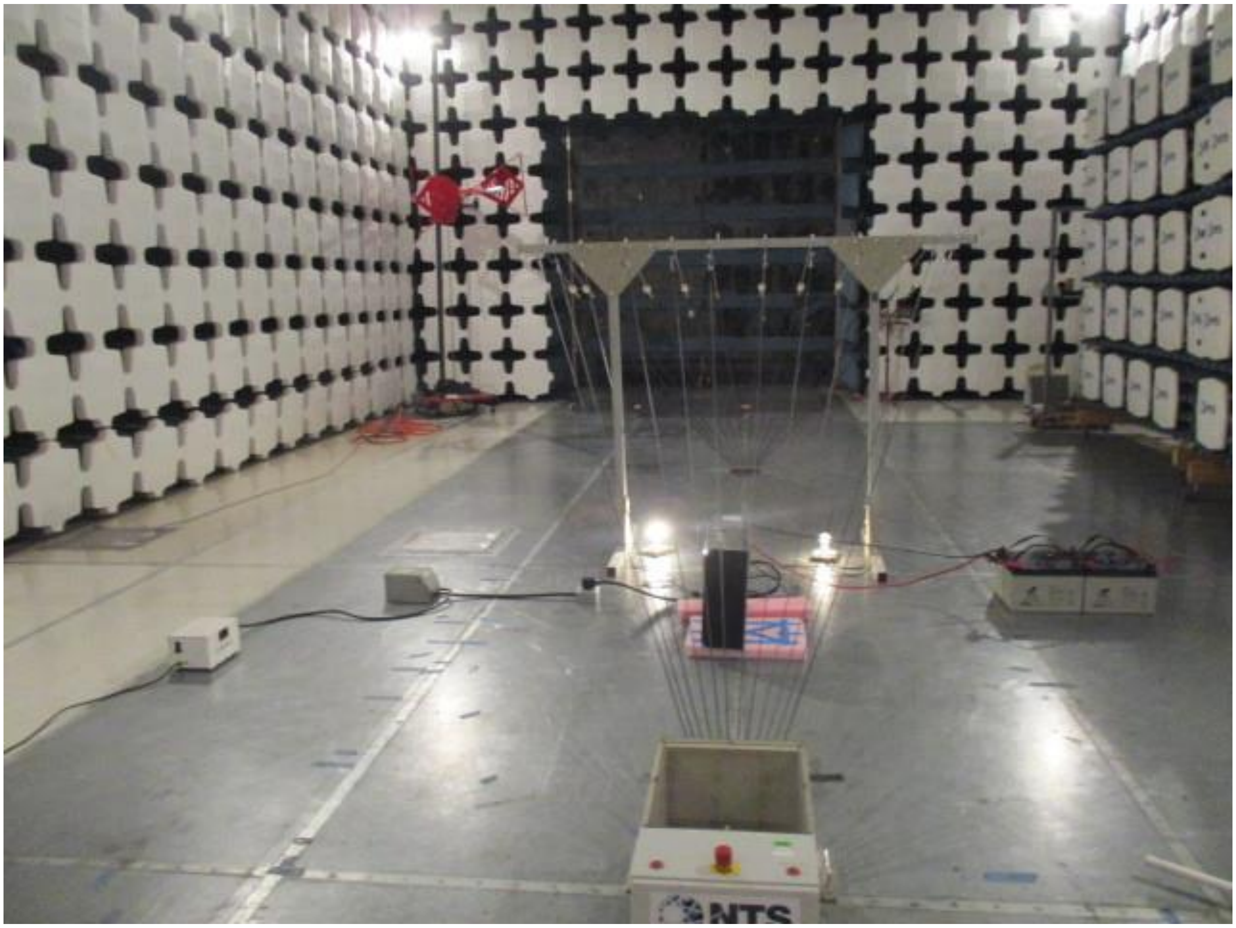
50kV - RS105 Front Upper Left Calibration



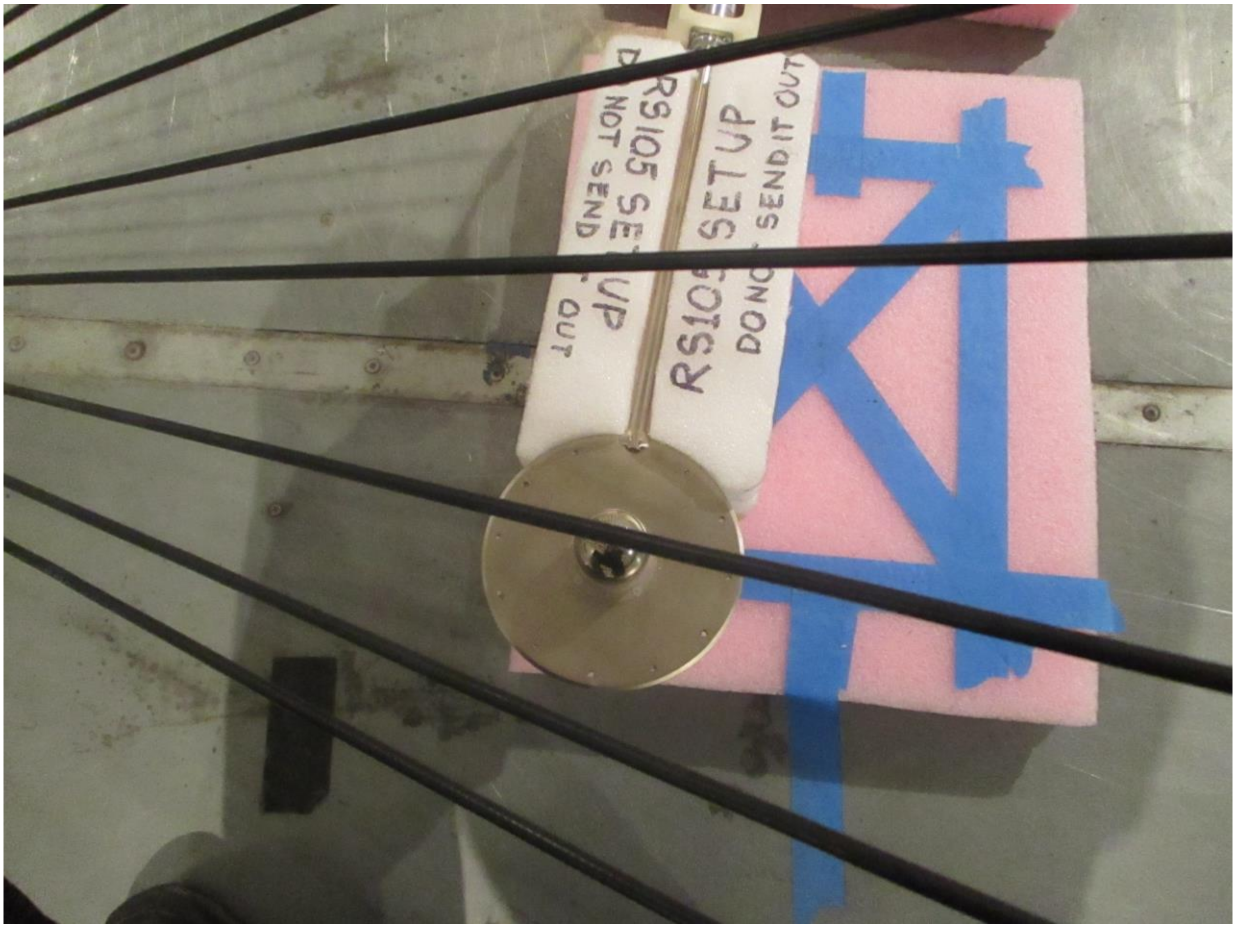
50kV - RS105 EUT 50kV Test Setup X-Axis



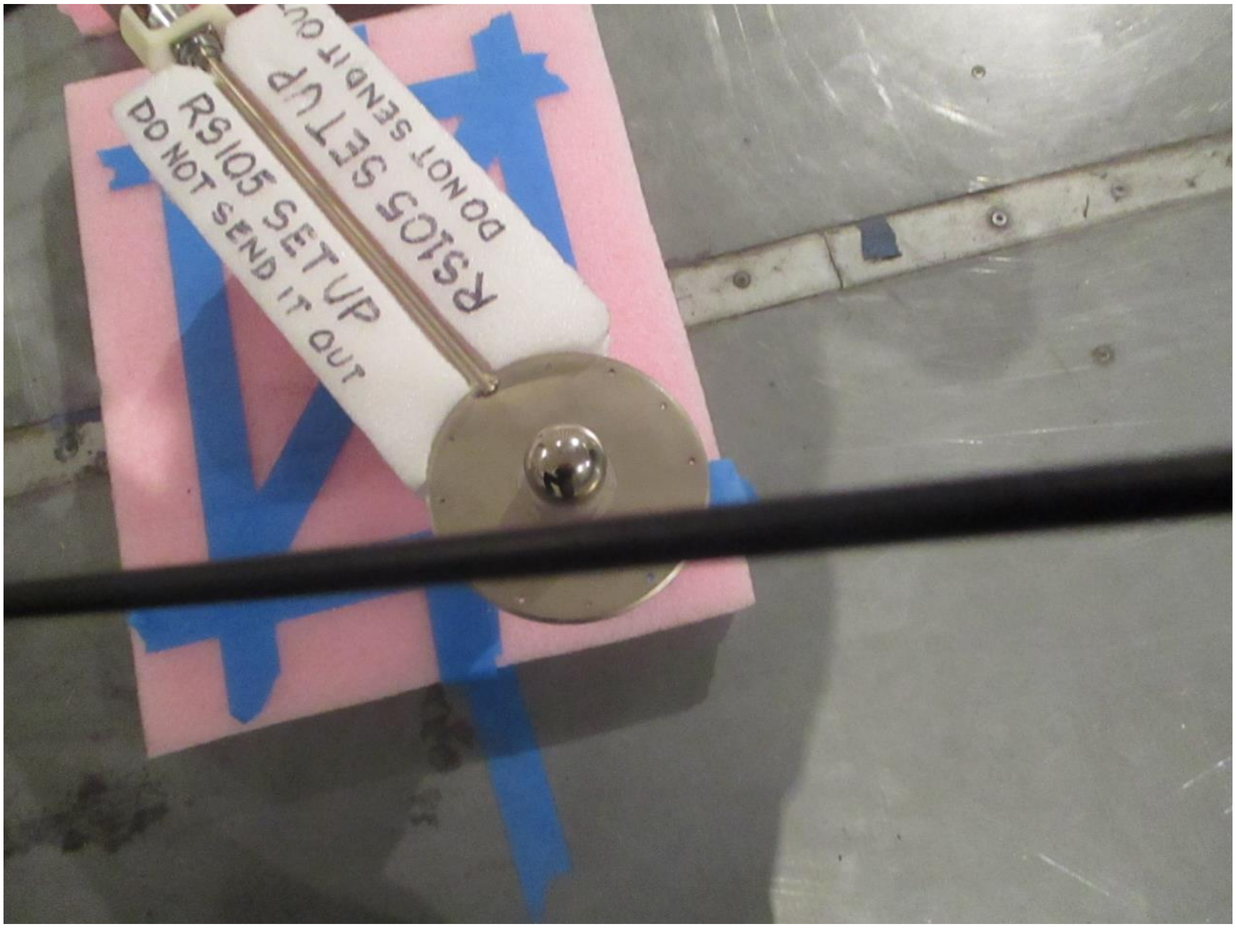
50kV - RS105 EUT 50kV Test Setup Y-Axis



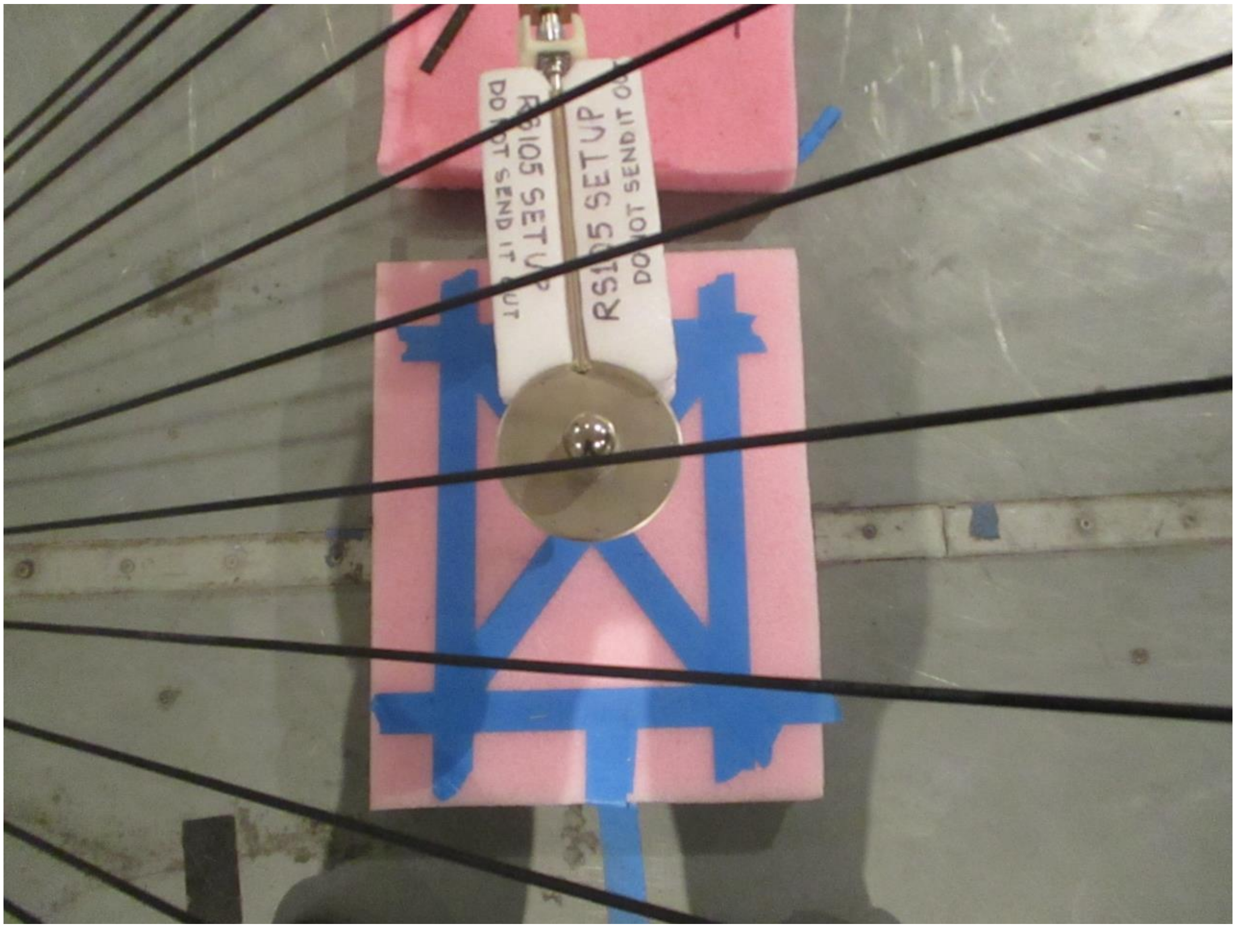
50kV - RS105 EUT 50kV Test Setup Z-Axis



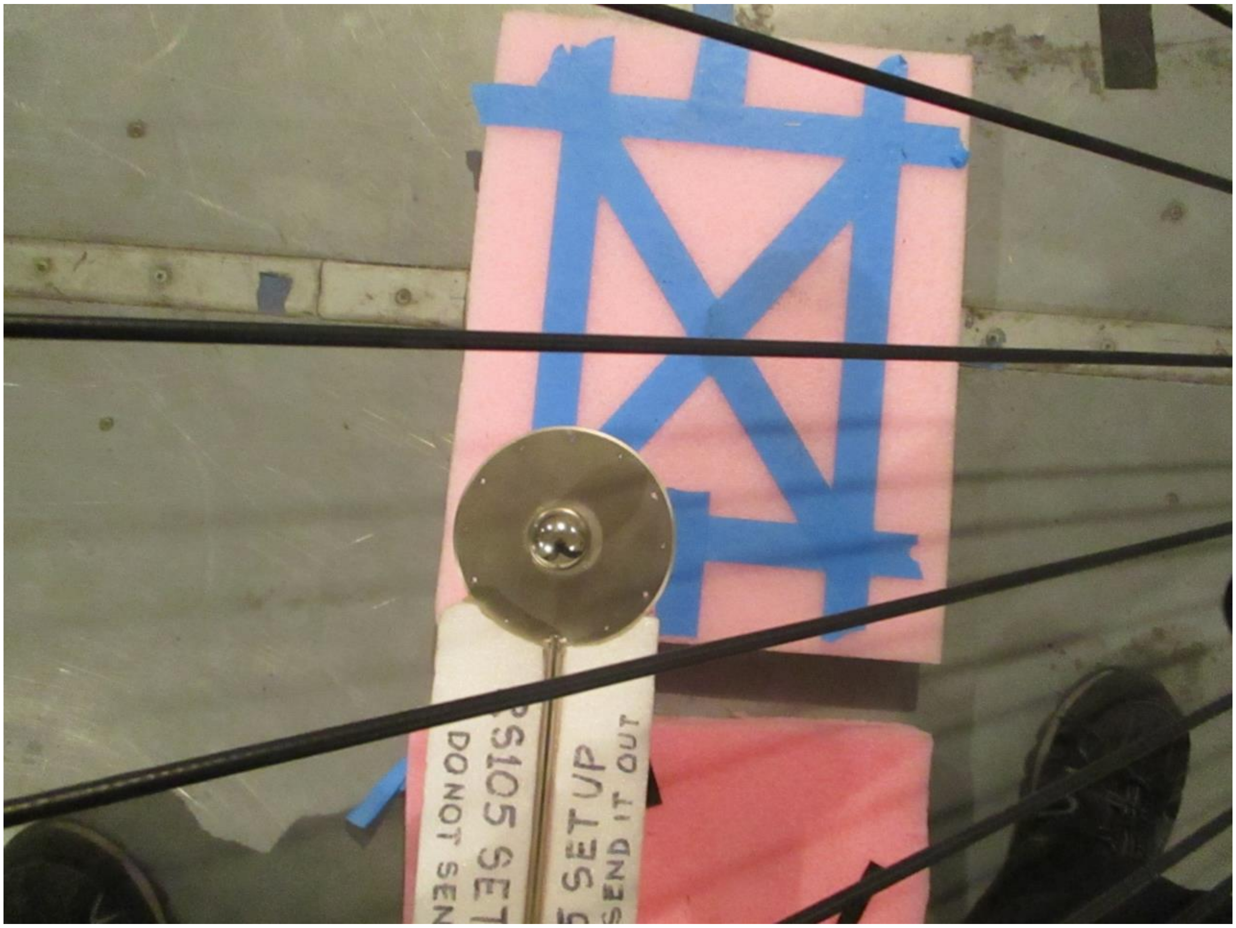
100kV - RS105 Front Lower Right Calibration



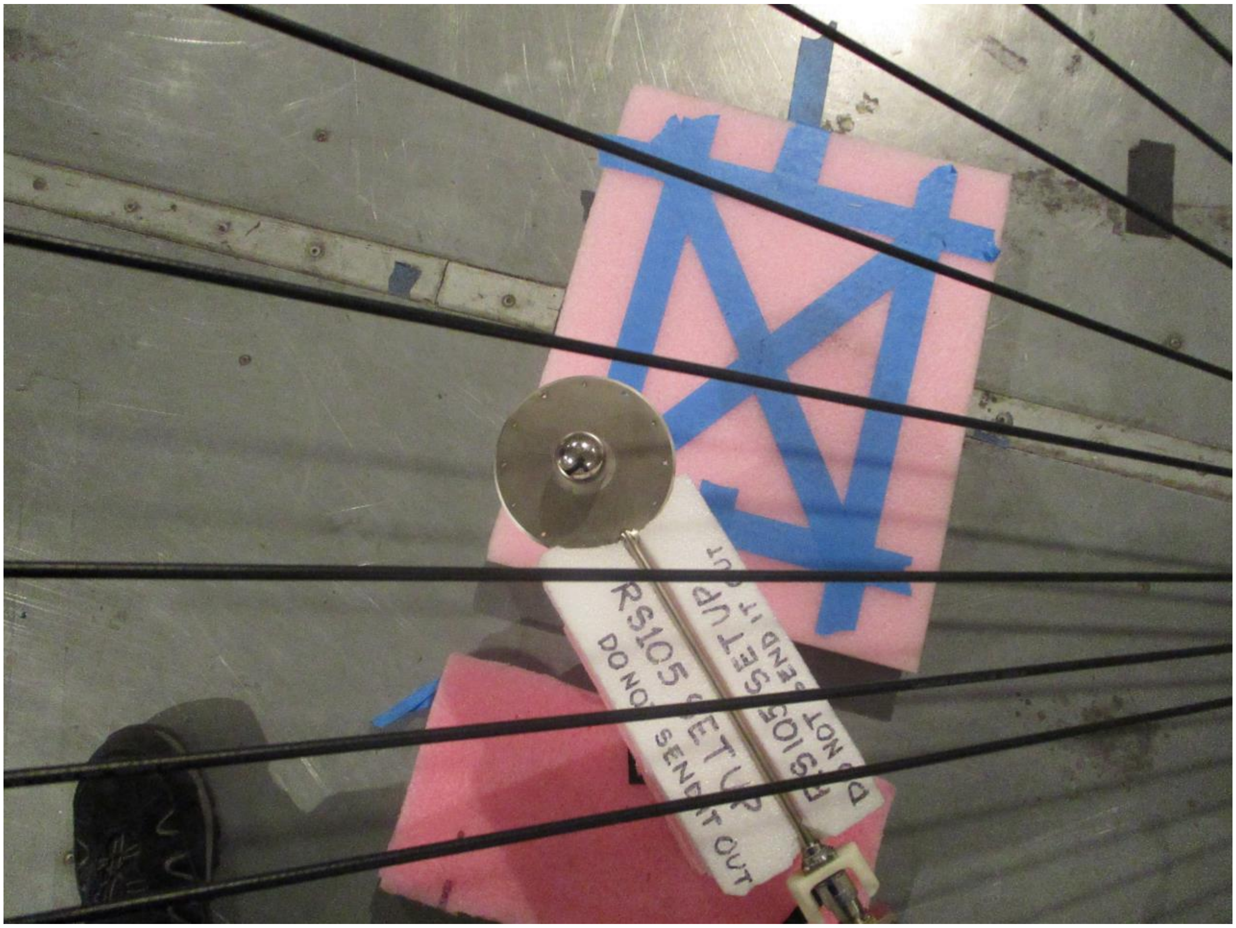
100kV - RS105 Front Lower Left Calibration



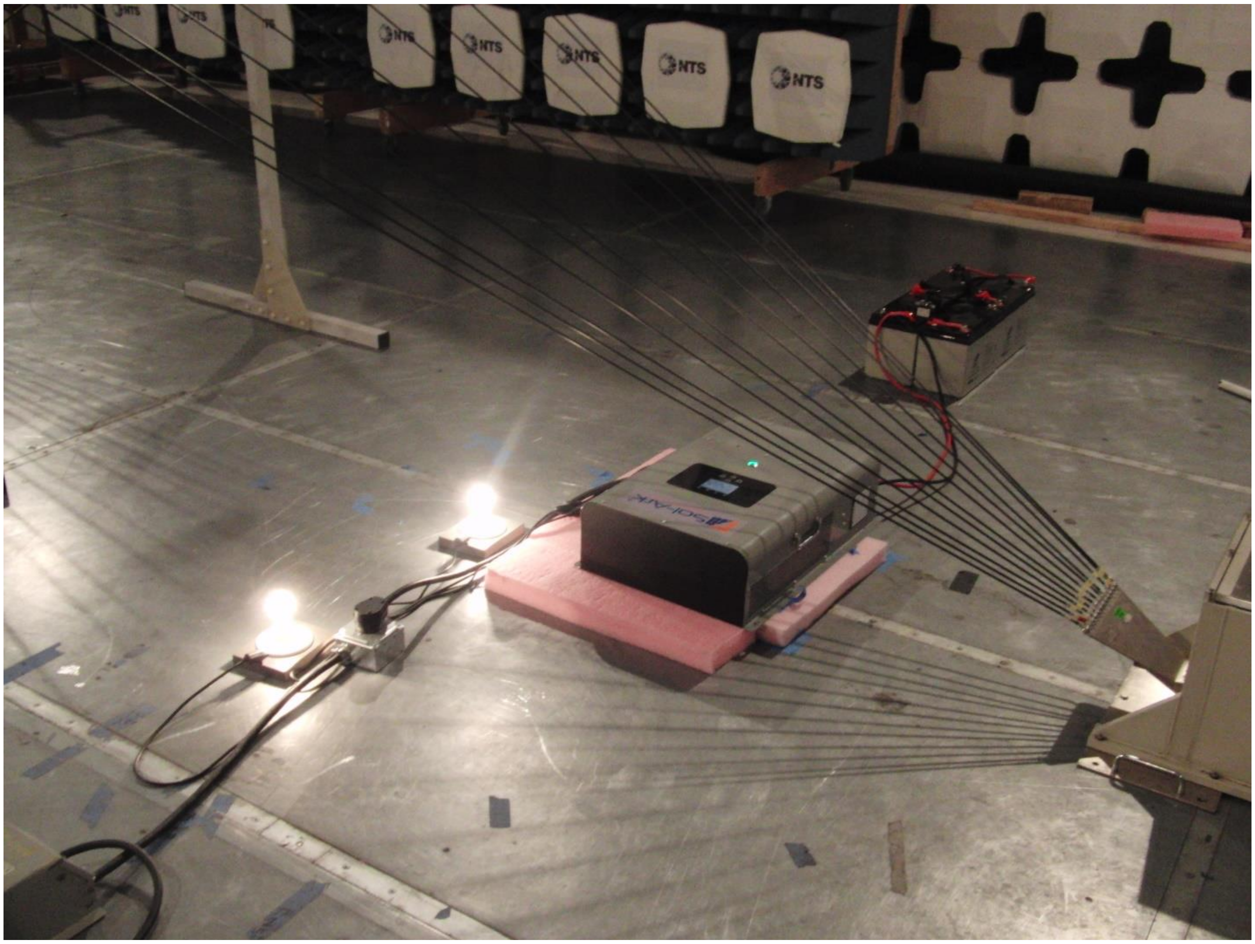
100kV - RS105 Center Calibration



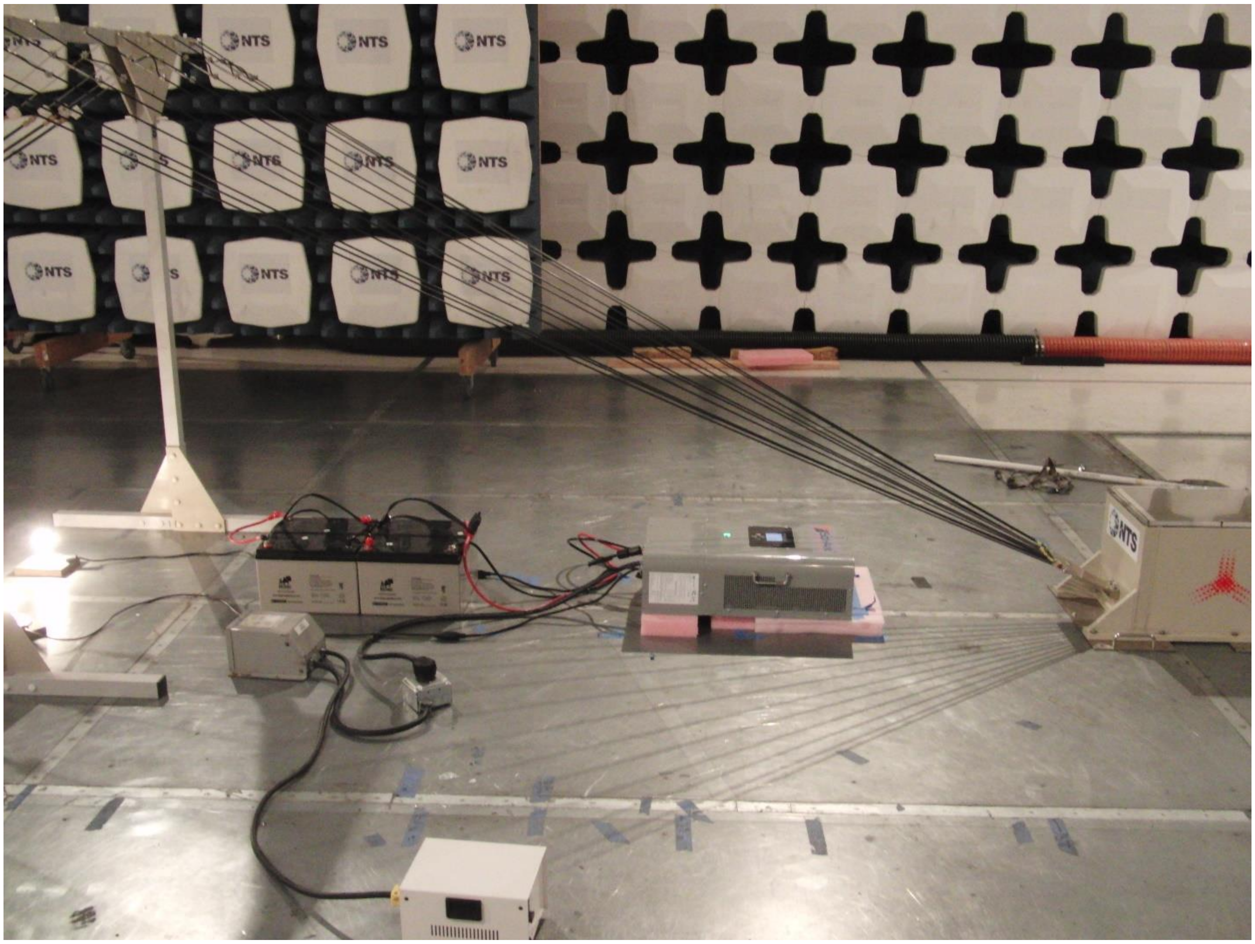
100kV - RS105 Front Upper Right Calibration



100kV - RS105 Front Upper Left Calibration



100kV - RS105 Test Orientation 1



100kV - RS105 Test Orientation 2

5.1.7 RS105 Test Equipment

NTS Inventory Number	Equipment Description	Calibration Due Date	Comments (i.e. Extension)
WCO21775	HDO4104 1GHz High Definition Oscilloscope	6/13/2019	
WCO04487	EG&G RC1-1D Integrator	NCR	
WCO25681	ETC Model 2090 Multi Device Controller	NCR	
WCO04455	Montena Pulse Generator Control Unit	NCR	
BX2832	Montena Nemp 80K/DE/2/23G	NCR	
E1382P	Montena Nemp 80K/DE/2/230OP	NCR	
BX2830	Dot Sensor ACD-4C®	NCR	

Calibration Abbreviation
NCR: No Calibration Required

Appendix A Log Sheet

National Technical Systems

RS105 Log Sheet

PR#:	**PR078809**		**Test Date(s):**	**5/8/2018**
Client:	**Sol-Ark**		**Client P.O.#:**	**VISA 1158**
Test Method:	**RS105, radiated susceptibility, transient electromagnetic field.**		**EUT Nomenclature:**	**Combined DC/DC Solar charge controller + DC to AC inverter solar unit**
Test Specification:	**RS105 461G**		**EUT Model or Part Number:**	**Sol-Ark 8K**

Temperature:	**19**	**° C**	**Humidity:**	**59**	**% RH**	**Barometer:**	**99.7**	**kPa**

Date	Time	Log Entries	Initials
5/7/18	1430	Started RS105 Testing EUT with load in 3 positions.	CM
	1500	Completed RS105 Testing on EUT (Passed)	CM
5/8/18	0830	Started testing solar panel (1) with EUT connected. (Passed)	CM
	0900	Started testing solar panel (2) with EUT connected. (Passed)	CM
	0931	Started setting up 2500W generator with load.	CM
	1000	Started testing 2500W generator with load. (Passed in 3 positions)	CM
	1001	Started setting up 2500W generator with load and solar panel.	CM
	1045	Started testing 2500W generator with load and solar panel. (Passed in 3	CM
	1500	Recalibrated RS105 levels to 100KV/m.	CM
	1530	tarted RS105 Testing EUT with load in 2 positions. (Passed)	CM
	1555	Started RS105 Testing EUT with load and Grid Off/On. (Passed)	CM
	1700	Finished testing different configurations. EUT undamaged after ~140 pulses.	CM

Witnessed By:	**Tom Brennan**
Test Performed By:	**Christian Mason**
Program Manager:	**Phil Tran**

End of Report