National Technical Systems Test Report for EMI Testing of the 19CD0002 Switch Box

Prepared For
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Performed By
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Revision History

Rev.	Description	Issue Date
0	Initial Release	4/8/21

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1.0 Introduction

1.1 Purpose

The purpose of this report is to document the procedural steps for testing and criteria for evaluating the results of the Electromagnetic Interference (EMI) testing of the 19CD0002 Switch Box. The test program was conducted to determine the ability of the 19CD0002 Switch Box to successfully satisfy the requirements specified Section 4.

This EMI Test Report (EMITR) is contracted by Amphenol Aerospace. It is the end user who is ultimately responsible for the compliance of the equipment installed. The contracted test facility is National Technical Systems (NTS) in Tinton Falls, New Jersey.

Scope

This EMITR is applicable to the qualification of the 19CD0002 Switch Box. 19CD0002 Switch Box is required to meet the requirements of MIL-STD-461G.

1.2 Acronyms

EMC: Electromagnetic Compatibility

EMI: Electromagnetic Interference

EMITP: Electromagnetic Interference Test Procedure

EMITR: Electromagnetic Interference Test Report

EUT: Equipment Under Test

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

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.

2.0 References

The following references listed below form a part of this document to the extent specified herein.

- Test Specification: MIL-STD-461G, *Department of Defense Interface Standard, Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment*, dated 12/11/2015
- Source Control Drawing: 19CD0002, *Switch, 10 GbE*, Rev. B dated 03/30/2020
- Amphenol Corporation. Purchase Order(s) 310136, dated 01/12/2021, 312931, dated 01/29/2021, and 315759, dated 02/16/2021
- National Technical Systems (NTS) Quote(s) OP0570257-0, dated 12/18/2020, OP0574403-0, dated 04/03/2021 and OP0575816-0, dated 04/06/2021
- NTS QPM National Technical Systems Quality Policy Manual, Rev 10, 8/1/2019
- ISO/IEC 17025:2017(E) *General Requirements for the Competence of Testing and Calibration Laboratories,* dated 11/1/2017

3.0 Product Selection and Description

Amphenol Aerospace selected and provided the test sample(s) to be used as the Equipment Under Test. Details below:

Table 3.0-1: Product Identification - Equipment Under Test (EUT)

Item	Qty.	Name/Description	Part Number	Serial Number
1	1	19CD0002 Switch Box	19CD0001-1	None

The 19CD0002-1 has a configuration that consist of a chassis, including MIL-C-38999 Series III connectors, two (2) Marvell multi-layer switch, one (1) host management processor and one (1) interface board, including power supply. The Switch Box consists of a switch board and interface board.

Table 3.0-2: Switch Box Connector and Pinout List

Designator	Part Number	Description	Mating Connector P/N	Mating Contact
J1 Power	CF-971354-04P	D38999 Receptacle, 15-4P, N keying	TV06RF-15-4S	M39029/106-617 (Size 12 Socket, Extended Life)
J8 Debug	CF-971353-22P	D38999 Receptacle, 13-22P, N keying	TV06RF-13-22S	M39029/106-614 (Size 22D Socket, Extended Life)
J9 Status/Reset	CF-971351-35P	D38999 Receptacle, 09-35P, N keying	TV06RF-09-35S	M39029/56-614 (Size 22D Socket, Extended Life)
J2A CPU1	CF-971332-01S	MT38999 Receptacle, 11-01S, N keying	CF-594611-01P	12599 (48F MT) W/ CF-198234-001 (MT KIT)
J2B CPU1	CF-971332-01H	MT38999 Receptacle, 11-01S, A keying	CF-594611-01G	12599 (48F MT) W/ CF-198234-001 (MT KIT)
J3A CPU2	CF-971332-01J	MT38999 Receptacle, 11-01S, B keying	CF-594611-01I	12599 (48F MT) W/ CF-198234-001 (MT KIT)
J3B CPU2	CF-971332-01L	MT38999 Receptacle, 11-01S, C keying	CF-594611-01K	12599 (48F MT) W/ CF-198234-001 (MT KIT)
J4A TUNER	CF-971332-01N	MT38999 Receptacle, 11-01S, D keying	CF-594611-01M	12599 (48F MT) W/ CF-198234-001 (MT KIT)
J4B TUNER	CF-971332-01T	MT38999 Receptacle, 11-01S, E keying	CF-594611-01R	12599 (48F MT) W/ CF-198234-001 (MT KIT)
J5 10GBase-T	10-646402-612N	D38999 Receptacle, 25-8S, N keying	TV06RQF-25-8P	21-032904-021 (OCTONET) Compatible w/ PIC E6A3824 100ohm Cable
J6 1GBase-T	10-646402-612A	D38999 Receptacle, 25-8S, N keying	TV06RQF-25-8PA	21-032904-021 (OCTONET) Compatible w/ PIC E6A3824 100ohm Cable
J7 1GBase-T	10-646402-612B	D38999 Receptacle, 25-8S, N keying	TV06RQF-25-8PB	21-032904-021 (OCTONET) Compatible w/ PIC E6A3824 100ohm Cable

3.1 EUT Photographs

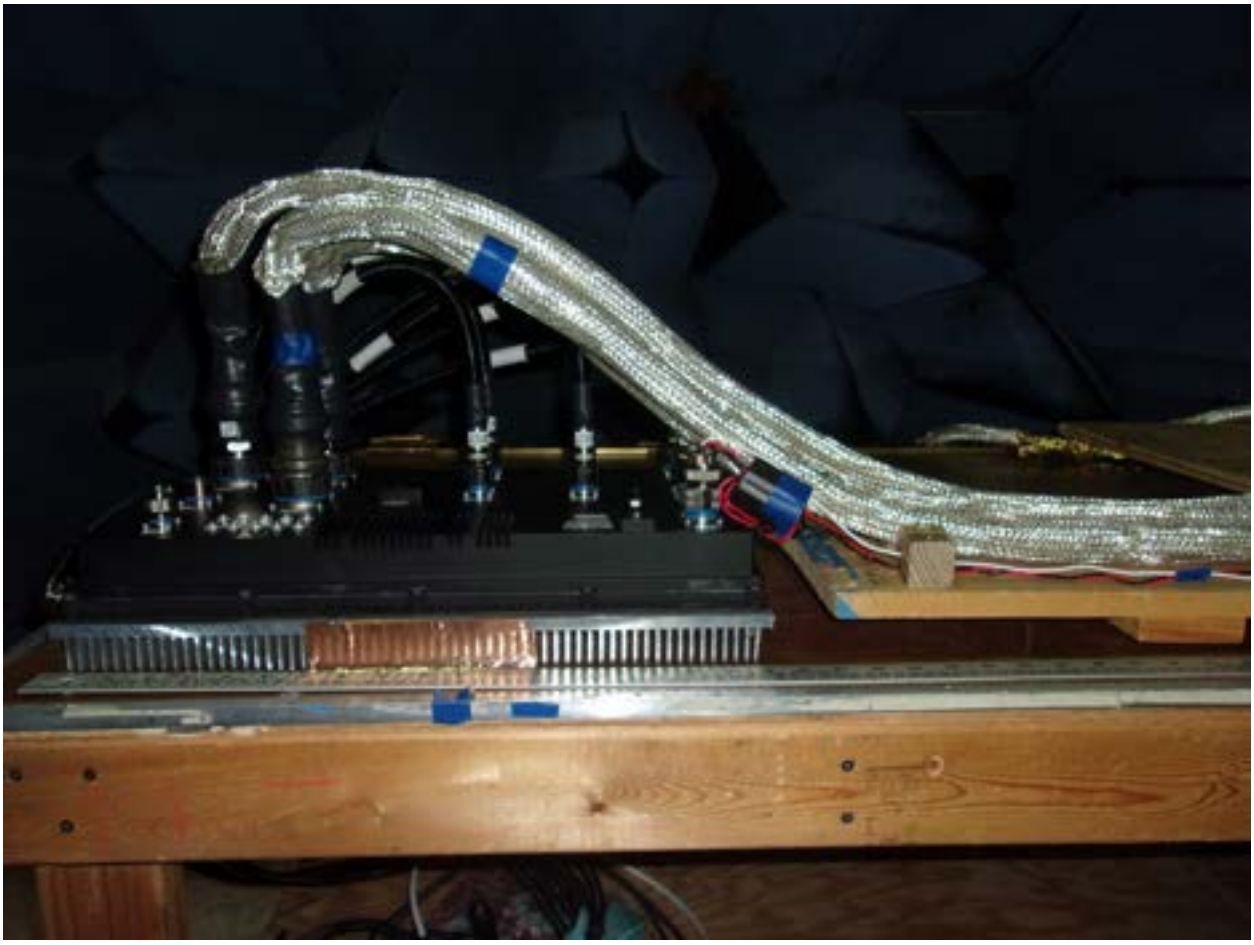


Table 3.1-1: EUT Info

Unit Designation	19CD0002 Switch Box
Model Number	None
Part Number	19CD0002-1
Serial Numbers	None

3.2 EUT System Setup

Figure 3.2-1 shows the general system setup and connections.

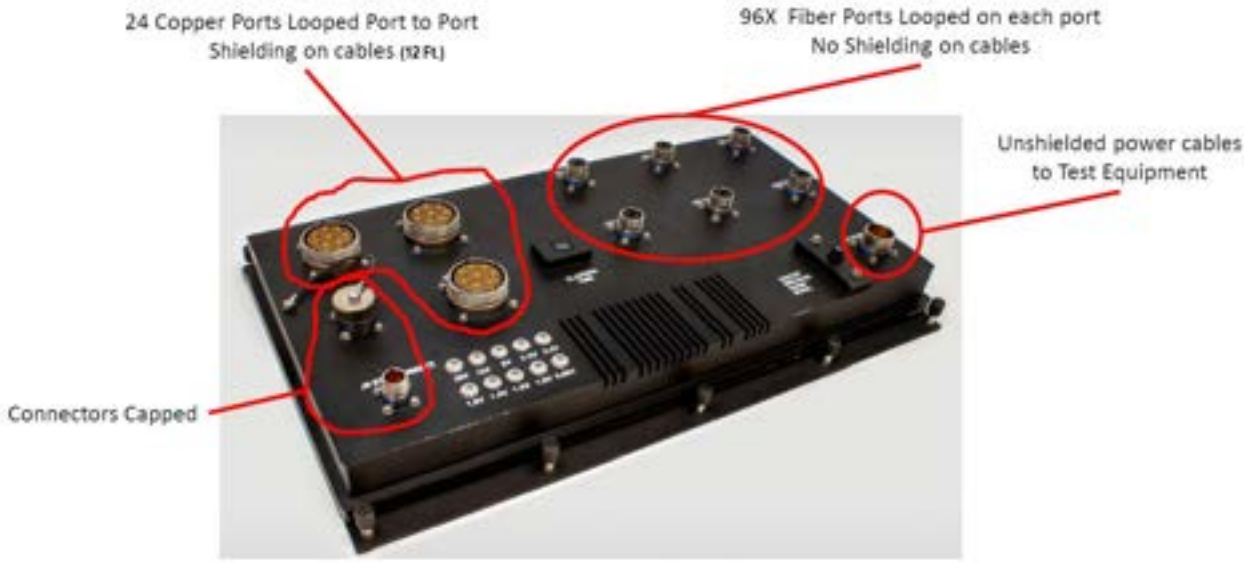


Figure 3.2-1: EUT Setup Overview

3.3 EUT Operation and Monitoring

The EUT was operated and monitored in accordance with Source Control Drawing, 19CD0002, Switch, 10 GbE, Rev. B.

3.4 Pass/Fail Criteria

The EUT shall meet the requirements of Source Control Drawing, 19CD0002, Switch, 10 GbE, Rev. B.

3.5 EUT Bonding / Grounding Requirements

The bonding / grounding requirements of MIL-STD-461G were met.

3.5.1 Bonding / Grounding Measurement Results

Date:	3/4/2021	**Location:**	AR1
Test(s):	CE102, CS101, CS114, CS115, CS116, CS118, RE102, RS103	**Tested By:**	Tristian Gaines

Measurement Number	Test Point 1	Test Point 2	Requirement (mΩ)	Measured (mΩ)	Result
1	Shielded Enclosure	Ground Plane	≤2.5	1.03	**PASS**
2	Ground Plane	EUT Chassis (J2A)	≤2.5	1.67	**PASS**

3.5.2 Bonding / Grounding Test Equipment

Table 3.5-1: Bonding / Grounding Test Equipment

Asset No.	Manufacturer	Item	Model	S/N	Cal Cycle (Months)	Cal. Due
WC058505	Extech	Milliohmeter	380560	410454	12	9/23/21

Calibration Abbreviation
NCR: No Calibration Required

3.6 Security Classification

The 19CD0002 Switch Box is considered an unclassified defense article. While unclassified, it should be handled only by authorized personnel.

4.0 General Test Requirements

4.1 Tests and Location

Table 4.1-1: Tests and Locations

Section	Test	MIL-STD-461G Section	Location [1]
5.1	CE102	5.5	Anechoic Chamber # AR1
5.2	CS101	5.7	Anechoic Chamber # AR1
5.3	CS114	5.12	Anechoic Chamber # AR1
5.4	CS115	5.13	Anechoic Chamber # AR1
5.5	CS116	5.14	Anechoic Chamber # AR1
5.6	CS118	5.16	Anechoic Chamber # AR1
5.7	RE102	5.18	Anechoic Chamber # AR1
5.8	RS103	5.19	Anechoic Chamber # AR1
Note 1: All testing was performed at NTS in Tinton Falls, NJ.			

4.2 Test Resources

4.2.1 Test Equipment

Lists of the NTS provided equipment used during testing will be included in each test section. This equipment is calibrated according to ISO/IEC 17025, ANSI NCSL Z540-1, and calibration is traceable to the National Institute of Standards and Technology (NIST). Calibration records are maintained on file at NTS.

4.2.2 Frequency Accuracy

In order for the EUT to successfully satisfy the requirements specified in the references listed in Section 2.0, the frequency accuracy of the recorded measurements were within ±2%. Verification with a frequency counter or other measuring device was required. Amplitude Accuracy was ±2 dB

4.2.3 Test Automation and Data Collection Software

Various software packages are used for test automation and data collection, depending on the test type. Refer to Table 4.2-1 below for information on the software used for each test.

Refer to Appendix A for detailed descriptions of each software package.

Table 4.2-1: Test Automation and Data Collection Software

Test	Manufacturer	Model	Rev	Date Verified
CE102	EMCware	AutoScan	7.4.4.15	3/9/2020
CS101	ETS Lindgren	TILE7	7.4.3.2	2/25/2019
CS114	Amplifier Research	emcware	4.0.8	5/17/2019
CS115	EMC Partner	TEMA 3000	4.2.1	8/15/19
CS116	EMC Partner	TEMA 3000	4.2.1	8/15/19
CS118	N/A	N/A	N/A	N/A
RE102	EMCware	AutoScan	7.4.4.15	9/12/2019
RS103	ETS Lindgren	TILE!	7.4.3.2	2/25/2019

4.3 General Test Requirements

4.3.1 Test Facility

All testing occurred within a shielded semi anechoic enclosure or shielded room, located in Tinton Falls, NJ. Semi anechoic chambers are lined with anechoic Radio Frequency (RF) absorbing tiles and cones on the walls and the ceiling. Peripheral equipment are located outside the shielded enclosure. All power leads entering the shielded enclosures will be 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 are routed via feed-through ports when practical. Shielding effectiveness to electric fields and plane waves of this EMI test chamber exceed 80 dB from 14 kHz-10 GHz, and 60 dB from 10 GHz-40 GHz.

4.3.2 Ground Plane and General Setup

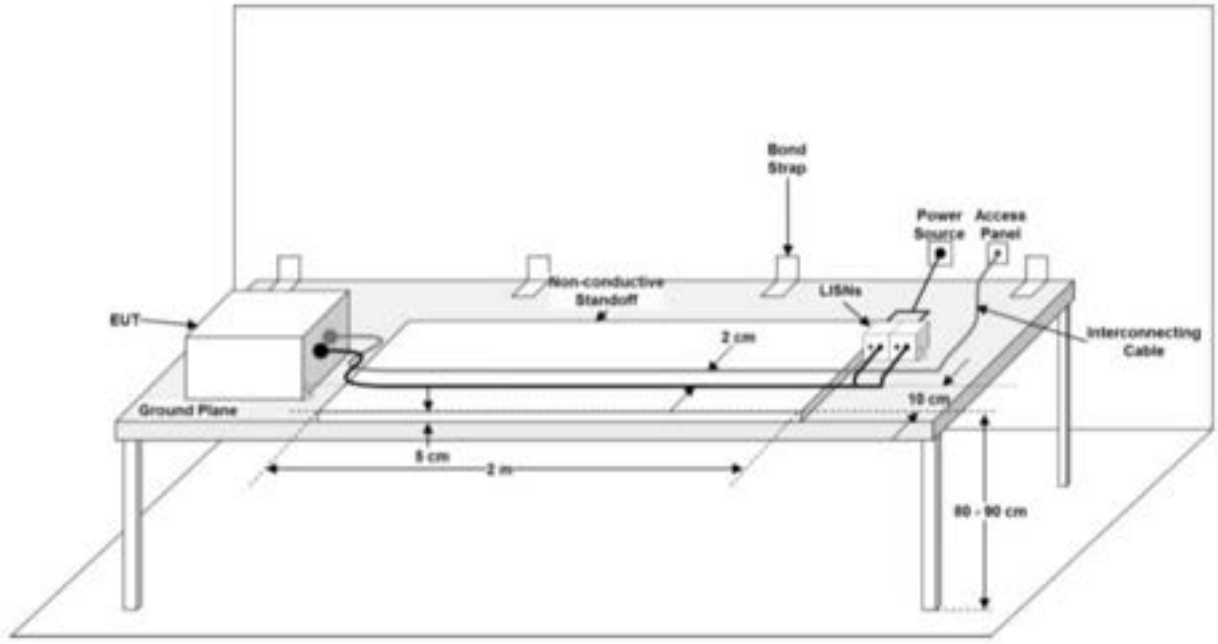


Figure 4.3-1: General Test Setup Example

4.3.3 Power Source Impedance

The impedance of power sources providing input power to the EUT are controlled by LISNs for all measurement procedures of this document unless otherwise stated in a particular test procedure. LISNs are not be used on output power leads. The LISNs are located at the power source end of the 2.5 m exposed length of power leads. The LISN impedance characteristics are in accordance with Figure 4.3-2. The LISN impedance are measured periodically under the following conditions:

- The impedance shall be measured between the power output lead on the load side of the LISN and the metal enclosure of the LISN.
- The LISN signal output port has a 50 Ω termination.
- The power input terminal on the power source side of the LISN shall be un-terminated.

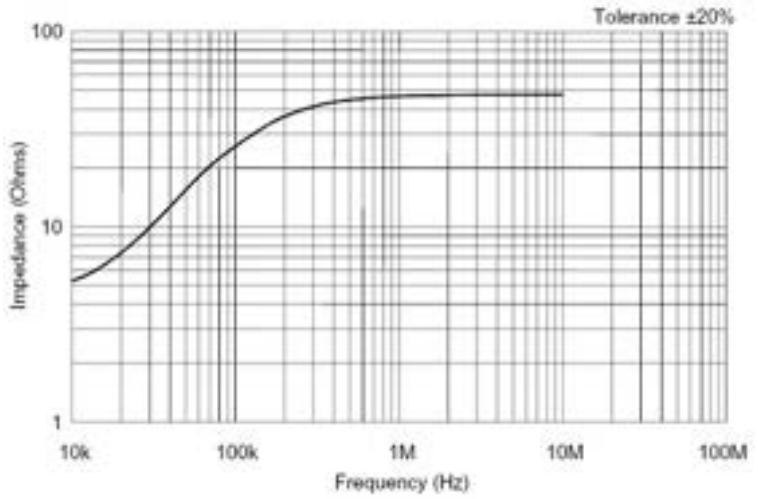


Figure 4.3-2: LISN Impedance Example

Refer to Appendix B for LISN Impedance plots for the specific LISNs used for tests in this report.

4.4 Emissions Testing

4.4.1 Receiver Bandwidth and Measurement Time

The measurement receiver bandwidths listed in Table 4.4-1, which are derived from MIL-STD-461G, are used for emissions testing. These bandwidths are specified at the 6 dB down points for the overall selectivity curve of the receivers. Video filtering is not used to bandwidth limit the receiver response. A controlled video bandwidth is available on the measurement receivers used; it was set to its greatest value. This value was 50 MHz.

Table 4.4-1: Bandwidth and Measurement Times

Frequency Range	6 dB Bandwidth	Dwell Time[1]	Min Measurement Time of Analog Measurement Receiver
30 Hz-1 kHz	10 Hz	0.15 sec	0.015 sec/Hz
1 kHz-10 kHz	100 Hz	0.015 sec	0.15 sec/kHz
10 kHz-150 kHz	1 kHz	0.015 sec	0.015 sec/kHz
150 kHz-30 MHz	10 kHz	0.015 sec	1.5 sec/MHz
30 MHz-1 GHz	100 kHz	0.015 sec	0.15 sec/MHz
> 1GHz	1 MHz	0.015 sec	15 sec/GHz

Ambient Electromagnetic Level

During testing, the ambient electromagnetic level is measured with EUT de-energized and all auxiliary equipment turned on and shall be at least 6 dB below the allowable specified limits. Ambient conducted levels on power leads are measured with the leads disconnected from the EUT and connected to a resistive load which draws the same current as the EUT. The ambient are recorded in the EMITR.

4.5 Susceptibility Testing

For susceptibility measurements, the entire frequency range for each applicable test are scanned. For swept frequency susceptibility testing, frequency scan rates and frequency step sizes of signal sources did not exceed the values listed in Table 4.5-1. The rates and step sizes are specified in terms of a multiplier of the tuned frequency (f_o) of the signal source. Analog scans refer to signal sources which are continuously tuned. Stepped scans refer to signal sources which are sequentially tuned to discrete frequencies. Stepped scans dwell at each tuned frequency for 3 seconds. Scan rates and step sizes are decreased when necessary to permit observation of a response.

Table 4.5-1: Susceptibility Scanning

Frequency Range	Analog Scans Max Scan Rates	Stepped Scans Max Step Size
30 Hz - 1 MHz	0.0333f_o/sec	0.05 f_o
1 MHz - 30 MHz	0.00667 f_o/sec	0.01 f_o
30 MHz - 1 GHz	0.00333 f_o/sec	0.005 f_o
1 GHz - 40 GHz	0.000667 f_o/sec	0.0025 f_o

Susceptibility Criteria
The susceptibility criteria are defined by Section 3.4.

Modulation of Susceptibility RF Signals
Susceptibility test signals for RS103 and CS114 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 are noticed in EUT operation, a threshold level shall be determined when possible, and where the susceptible condition shall be no longer present. Thresholds of susceptibility are determined as follows:

- When a susceptibility condition is detected, the interference signal shall be reduced until the EUT recovered.
- The interference shall be reduced by an additional 6 dB.
- The interference signal shall be 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 will be recorded.

5.0 Test Descriptions and Results

Table 5.0-1: Summary of Test Information & Results

Section	Test	Specification	Test Facility	Test Date	Part #	Serial #	Test Result
5.1	CE102, Conducted Emissions, Power Leads, 10 kHz to 30 MHz	19CD0002 Rev B	Tinton Falls, NJ	03/04/2021	19CD0002-1	None	Compliant
5.2	CS101, Conducted Susceptibility, Power Leads, 30 Hz to 150 kHz	19CD0002 Rev B	Tinton Falls, NJ	03/12/2021	19CD0002-1	None	Compliant
5.3	CS114, Conducted Susceptibility, Bulk Cable Injection, 10 kHz to 30 MHz	19CD0002 Rev B	Tinton Falls, NJ	03/17/2021	19CD0002-1	None	Compliant
5.4	CS115, Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation	19CD0002 Rev B	Tinton Falls, NJ	03/15/2021	19CD0002-1	None	Compliant
5.5	CS116, Conducted Susceptibility, Damped Sinusoidal Transients, Cables and Power Leads, 10	19CD0002 Rev B	Tinton Falls, NJ	03/16/2021	19CD0002-1	None	Compliant
5.6	CS118, Conducted Susceptibility, Personnel Borne Electrostatic Discharge	19CD0002 Rev B	Tinton Falls, NJ	03/18/2021	19CD0002-1	None	Compliant
5.7	RE102, Radiated Emissions, Electric Field, 2 MHz to 18 GHz	19CD0002 Rev B	Tinton Falls, NJ	03/05/2021 , 03/08/2021	19CD0002-1	None	Compliant
5.8	RS103, Radiated Susceptibility, Electric Field, 30 MHz to 18 GHz	19CD0002 Rev B	Tinton Falls, NJ	03/05/2021 – 03/11/2021	19CD0002-1	None	Compliant

5.1 Method CE102, Conducted Emissions, Power Leads, 10 kHz to 30 MHz

5.1.1 CE102 Purpose

This test verifies that electromagnetic emissions from the 19CD0002 Switch Box do not exceed the limit specified in Figure 5.1-1 (extended to 30MHz) for input leads, including returns, in the frequency range of 10 kHz-30 MHz.

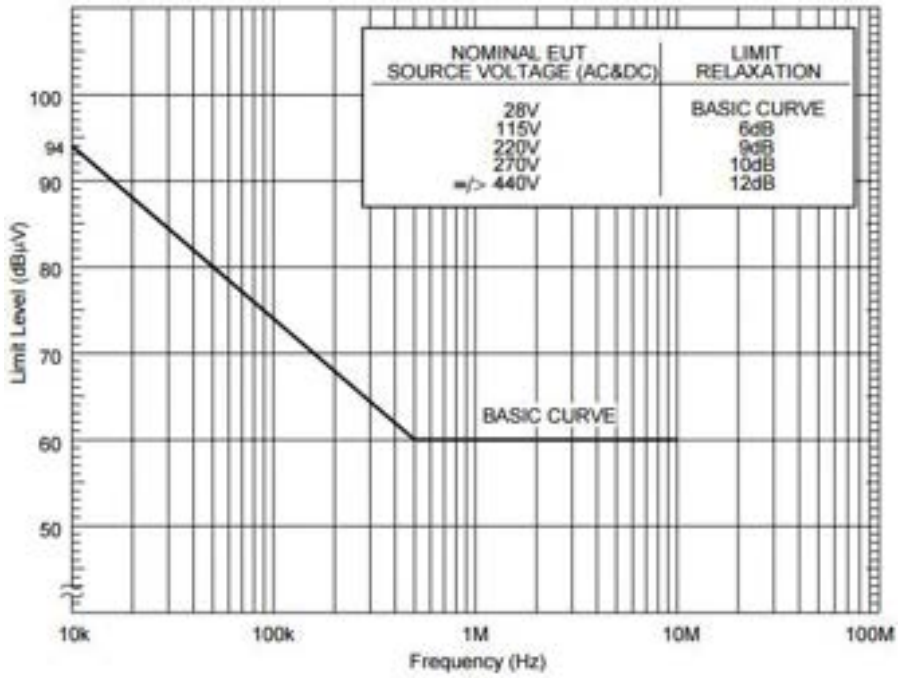


Figure 5.1-1: CE102 Limit (EUT power leads, AC and DC) for all Applications

5.1.2 CE102 Power Leads to be Tested

Test Case	Connector	Description	Classification	LISN Type	Limit
1	J1	+28VDC	Input Power Lead	50µH	Basic Curve
2	J1	28VDC Return	Input Power Lead	50µH	Basic Curve

5.1.3 CE102 EUT Test Setup

The EUT was setup in accordance with Section 3.2, Figure 3.2-1, 4.3-1 and operated according to Section 3.3.

5.1.4 CE102 Measurement System Check

With the EUT power off, the test setup was configured for the system check in accordance with Figure 5.1-2.

1. The measurement system check was performed prior to testing the EUT.
2. The measurement equipment was turned on, and sufficient time was allowed for stabilization.
3. Apply a signal level of 90 dBµV at 10.5 kHz and 100 kHz to the power output terminal of the LISN. At 10.5 kHz and 100 kHz, use an oscilloscope, in high impedance mode, to verify that there is a proper signal level at the LISN and verify that it is sinusoidal. After establishing the proper signal at the LISN, disconnect LISN and measure resulting voltage using an oscilloscope with 50 ohm input impedance. The ratio of the LISN voltage to the 50 ohm voltage measurement must be within the following tolerances: at 10.5 kHz = -14 dB (+1 dB/-2 dB) and at 100 kHz = -3 dB (+1 dB/-2 dB).
4. Apply a signal level that is at least 6 dB below the limit at 10.5 kHz, 100 kHz, 1.95 MHz and 9.8 MHz to the power output terminal of the LISN. At 10.5 kHz and 100 kHz, use an oscilloscope to calibrate the signal level. At 1.95 MHz and 9.8 MHz, use a calibrated output level directly from a 50 Ω signal generator.
5. The measurement receiver was scanned for each frequency in the same manner as a normal data scan.
6. The measurement receiver must indicate a level ±3 dB of the calibrated injected level.
7. Steps 3-6 will be repeated for each LISN.
8. An ambient measurement was performed across the frequency range with the EUT power leads disconnected and with a resistor rated to draw the same current as the EUT. All auxiliary support equipment was powered during this measurement.
9. Corrections factors for the 20 dB attenuator cables and the voltage drop due to the LISN 0.25 microfarad coupling capacitor will be added to the raw data collected from the measurement receiver. For example: *Attenuator (dB) + Cable (dB) + LISN insertion loss (dB) + Raw Data (dBµV) = corrected data (dBµV).*

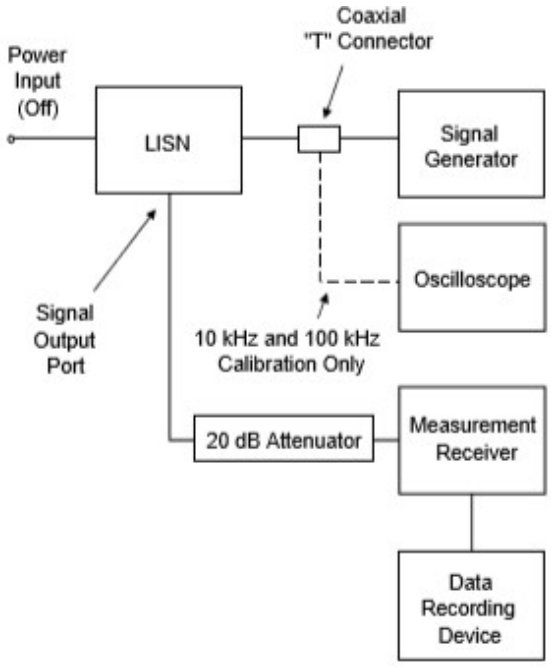


Figure 5.1-2: CE102 Measurement System Check Setup

5.1.5 CE102 Test Procedure

The test setup was configured in accordance with Figure 5.1-3.

1. An appropriate lead was selected for testing.
2. The measurement receiver was scanned over the frequency range of 10 kHz - 10 MHz, using the band-widths and minimum measurement times specified in Table 4.4-1.
3. Steps 1 and 2 will be repeated for each power lead.
4. Corrections factors for the 20 dB attenuator cables and the voltage drop due to the LISN 0.25 microfarad coupling capacitor will be added to the raw data collected from the measurement receiver. For example: *Attenuator (dB) + Cable (dB) + LISN insertion loss (dB) + Raw Data (dBµV) = corrected data (dBµV).*

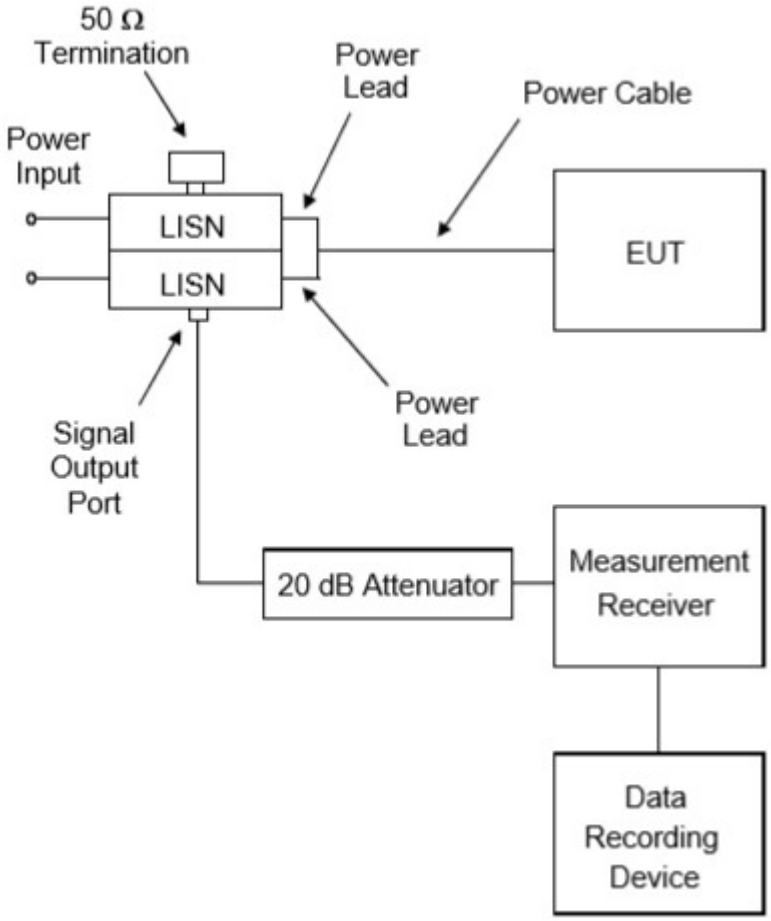


Figure 5.1-3: CE102 Measurement Setup

5.1.6 CE102 Test Log Sheet

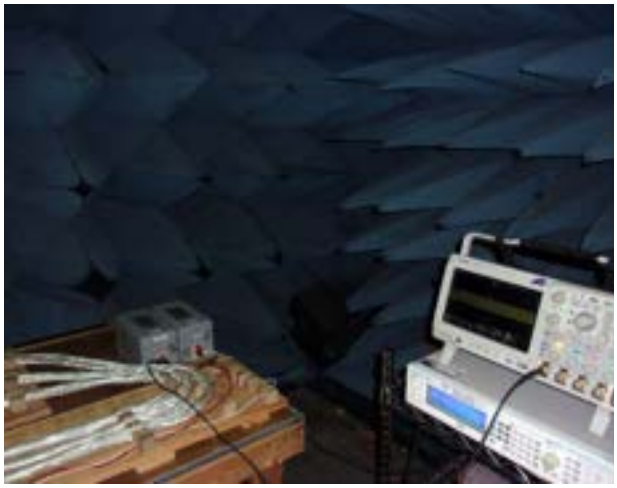
EMI LOG SHEET			
Job Number:	PR131850	**Date:**	3/4/21
Standard:	MIL-STD-461G	**Method:**	CE102
Test Personnel:	Tristian Gaines	**Procedure:**	19CD0002 Rev B

Date	Time	Log Entries	Init.
3/4/21	1310	Tearing down RE and beginning CE102 Formal	TG
↓	1356	Began System Checks.	↓
↓	1452	CE102 System Checks complete, setting up for ambient	↓
↓	1526	CE102 **PASS**	↓

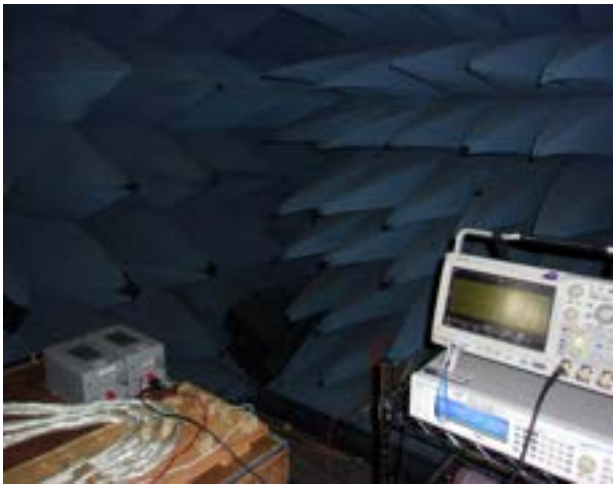
5.1.7 CE102 Test Photographs

Chamber to Table Bonding Measurement

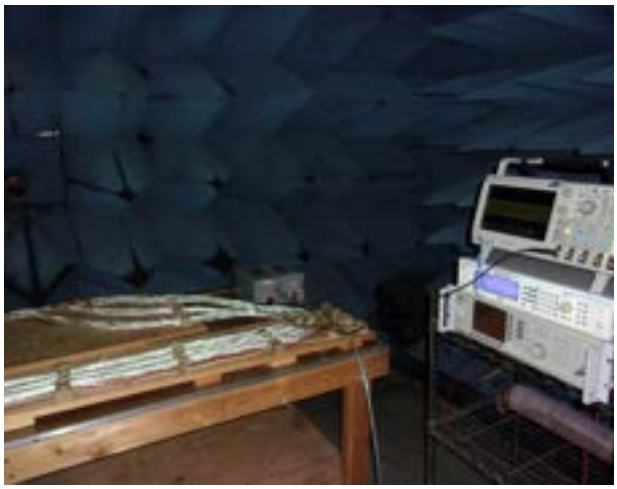
Table to EUT Bonding Measurement



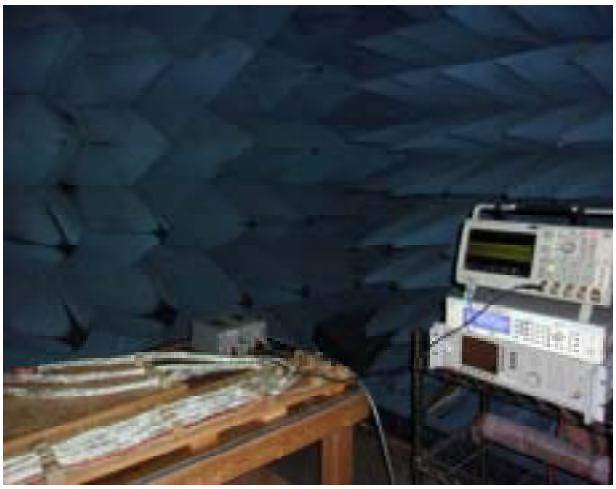
LISN V Drop Line 1



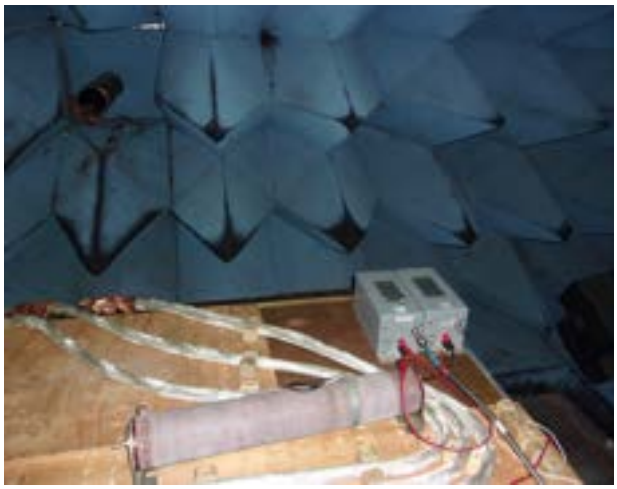
LISN V Drop Line 2



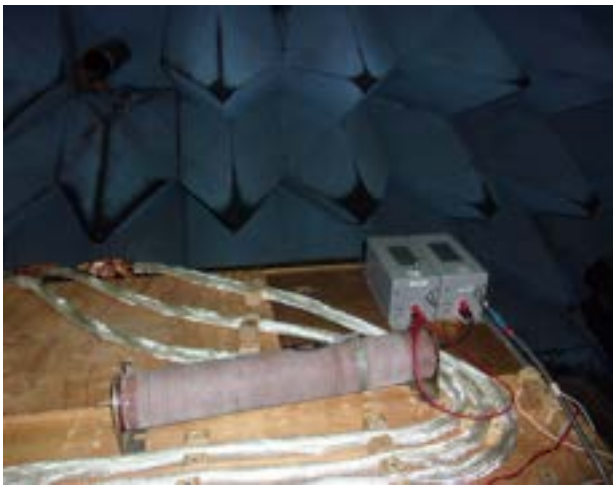
Line 1 System Check



Line 2 System Check



Line 1 Ambient Scan



Line 2 Ambient Scan

Line 1 Test

Line 2 Test

5.1.8 CE102 Test Data

CE102 Datasheet

Project Number:	PR131850	**Standard:**	MIL-STD-461G
		Procedure:	19CD0002 Rev B
Date:	3/4/2021	**EUT:**	SwitchBox
P/N:	19CD0002-1	**S/N:**	N/A
Test Personnel:	Tristian Gaines	**Manufacturer:**	Amphenol Aerospace

CE102 Test Specification:

Test Type	Test Specification	Performance Criteria
Conducted Emissions, Power Leads, 10kHz – 10MHz	MIL-STD-461G, Figure CE102-1 (Basic Curve, Extended to 30MHz)	The EUT emissions must not excede the limit.

LISN Drop Verification:

10.5 kHz:	LISN (mV)	LISN (dBµV)	Direct (mV)	Direct (dBµV)	Radio (dB)	Result
WC005290	31.60	89.99	166	104.40	14.41	**PASS**
WC005647	31.50	89.97	171	104.66	14.69	**PASS**

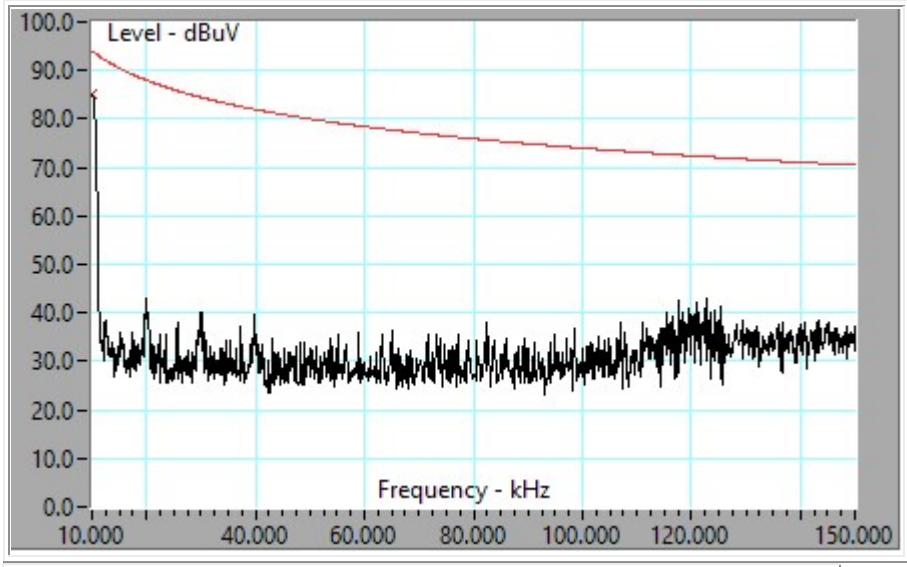
100 kHz	LISN (mV)	LISN (dBµV)	Direct (mV)	Direct (dBµV)	Radio (dB)	Result
WC005290	31.70	90.02	41.2	92.30	2.28	**PASS**
WC005647	31.60	89.99	41.3	92.32	2.33	**PASS**

CE102 Test Results Summary:

Line Tested	Frequency (MHz)	Test Limit (dBuV)	Results (Pass/Fail)
+28VDC Line	0.01 – 0.5 0.5 - 10	94 – 60 60	**PASS**
28VDC Return Line	0.02 – 0.5 0.5 - 10	94 – 60 60	**PASS**

CE102 Data:

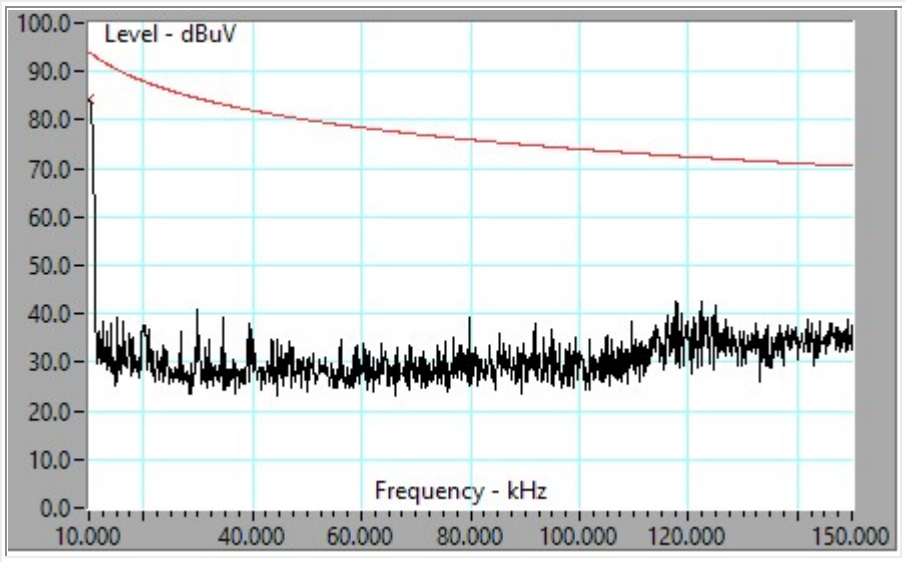
CE102 System Check: Calibrated Injected Signal = 84.61 dBuV @ 10 kHz



Thu, Mar 4, 2021
2:03:46 PM
AutoScan 7.4.4.16
Res BW (kHz) 1
Vid BW (kHz) 50000
Line 1
WC005290_WC005647
20dB Pad WC005821
Graph # 11
Sweep Time 30.0000

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
kHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
10.0000	**85.1**	94.0	-8.9	60.20	5.10	0.00	19.84	-24.94

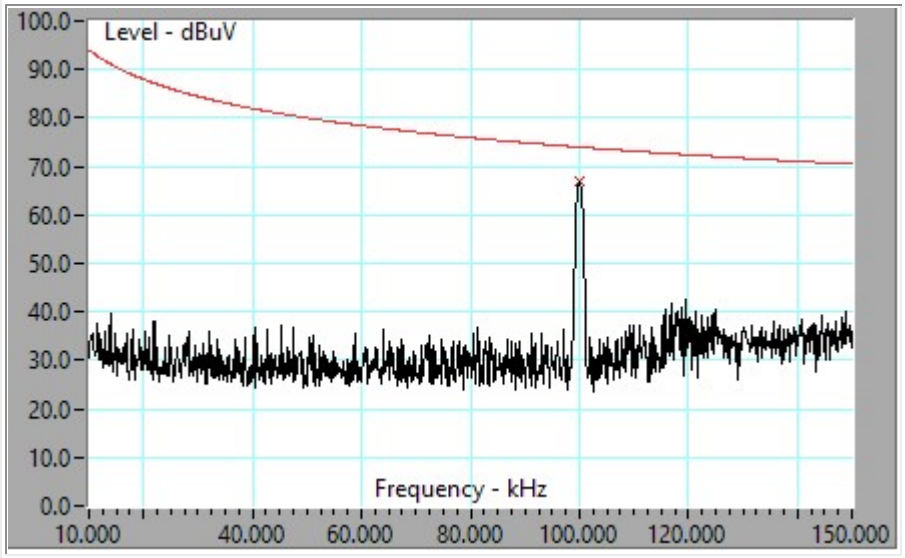
CE102 System Check: Calibrated Injected Signal = 84.76 dBuV @ 10 kHz



Thu, Mar 4, 2021
2:07:21 PM
AutoScan 7.4.4.16
Res BW (kHz) 1
Vid BW (kHz) 50000
Line 2
WC005290_WC005647
20dB Pad WC005821
Graph # 12
Sweep Time 30.0000

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
kHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
10.0000	**84.4**	94.0	-9.6	59.80	4.77	0.00	19.84	-24.61

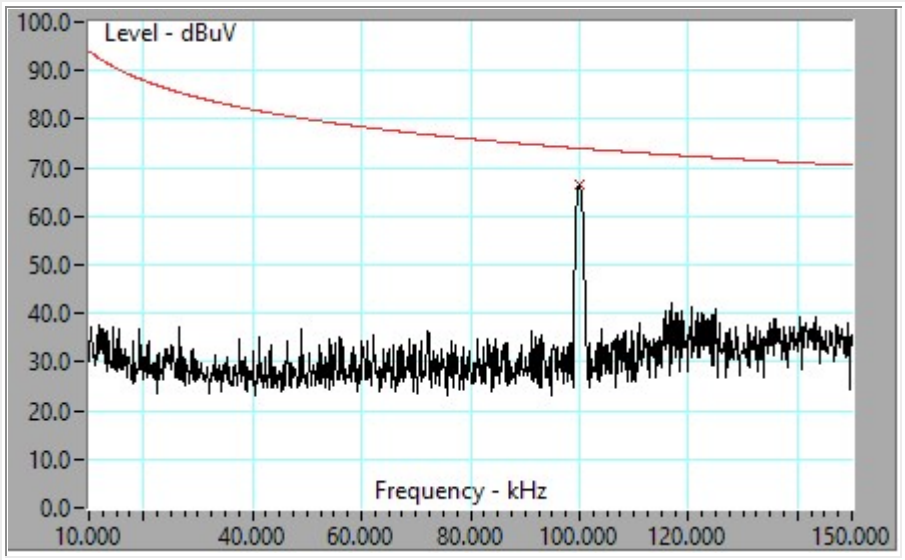
CE102 System Check: Calibrated Injected Signal = 66.73 dBuV @ 100 kHz



Thu, Mar 4, 2021
2:30:17 PM
AutoScan 7.4.4.16
Res BW (kHz) 1
Vid BW (kHz) 50000
Line 1
WC005290_WC005647
20dB Pad WC005821
Graph # 13
Sweep Time 30.0000

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
kHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
100.0200	**66.8**	74.0	-7.2	46.55	0.35	0.02	19.84	-20.21

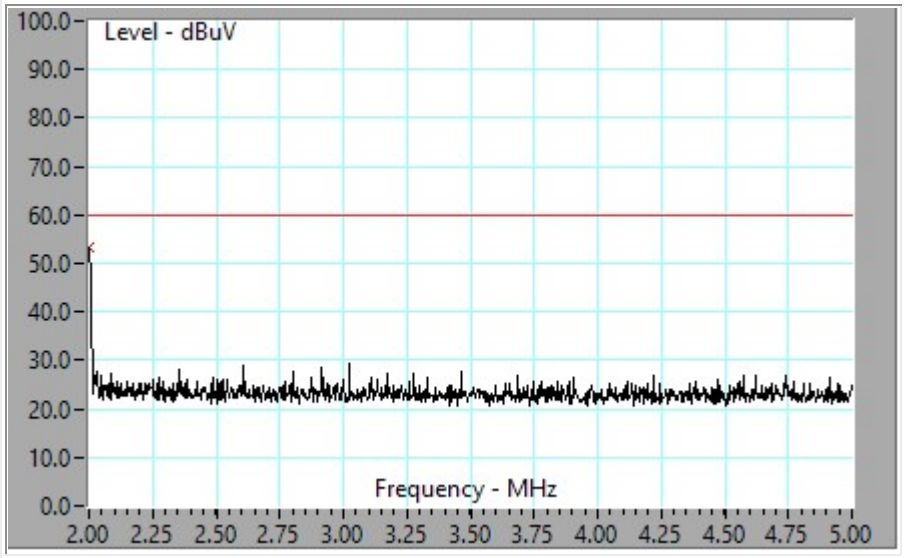
CE102 System Check: Calibrated Injected Signal = 66.65 dBuV @ 100 kHz



Thu, Mar 4, 2021
2:38:13 PM
AutoScan 7.4.4.16
Res BW (kHz) 1
Vid BW (kHz) 50000
Line 2
WC005290_WC005647
20dB Pad WC005821
Graph # 15
Sweep Time 30.0000

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
kHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
99.8800	**66.6**	74.0	-7.4	46.59	0.17	0.02	19.84	-20.03

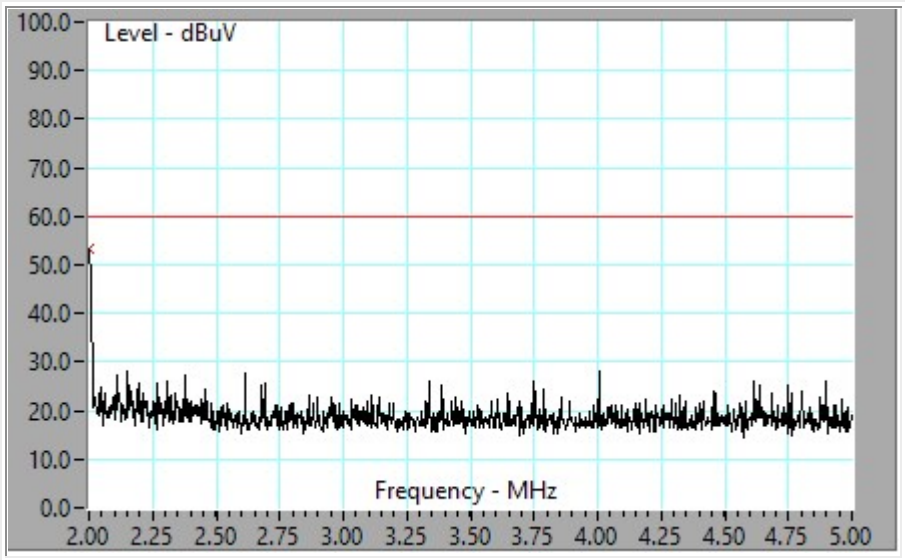
CE102 System Check: Calibrated Injected Signal = 53 dBuV @ 2 MHz



Thu, Mar 4, 2021
2:42:06 PM
AutoScan 7.4.4.16
Res BW (kHz) 10
Vid BW (kHz) 50000
Line 2
WC005290_WC005647
20dB Pad WC005821
Graph # 16
Sweep Time 10.0000

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
MHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
2.000	**53.3**	60.0	-6.7	33.02	0.04	0.35	19.85	-20.23

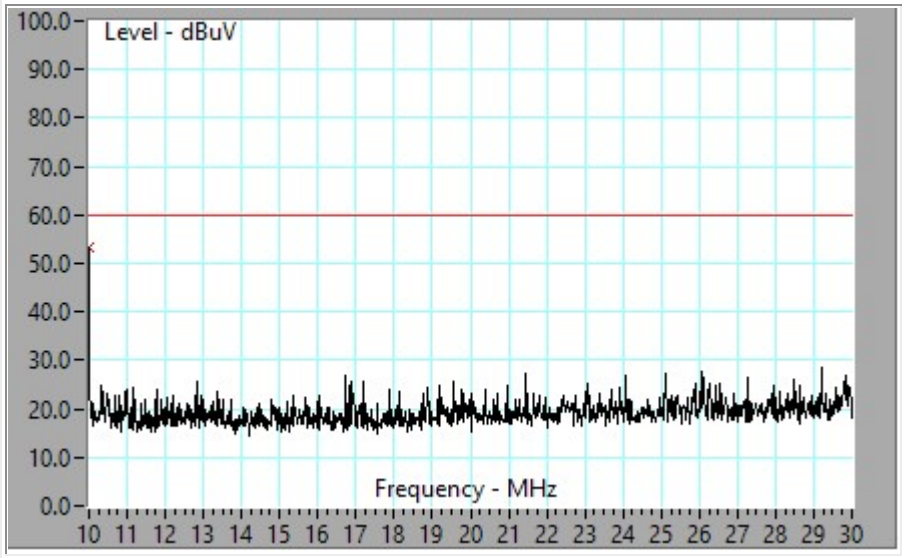
CE102 System Check: Calibrated Injected Signal = 53 dBuV @ 2 MHz



Thu, Mar 4, 2021
2:44:36 PM
AutoScan 7.4.4.16
Res BW (kHz) 10
Vid BW (kHz) 50000
Line 1
WC005290_WC005647
20dB Pad WC005821
Graph # 17
Sweep Time 10.0000

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
MHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
2.000	**53.2**	60.0	-6.8	32.99	0.04	0.35	19.85	-20.23

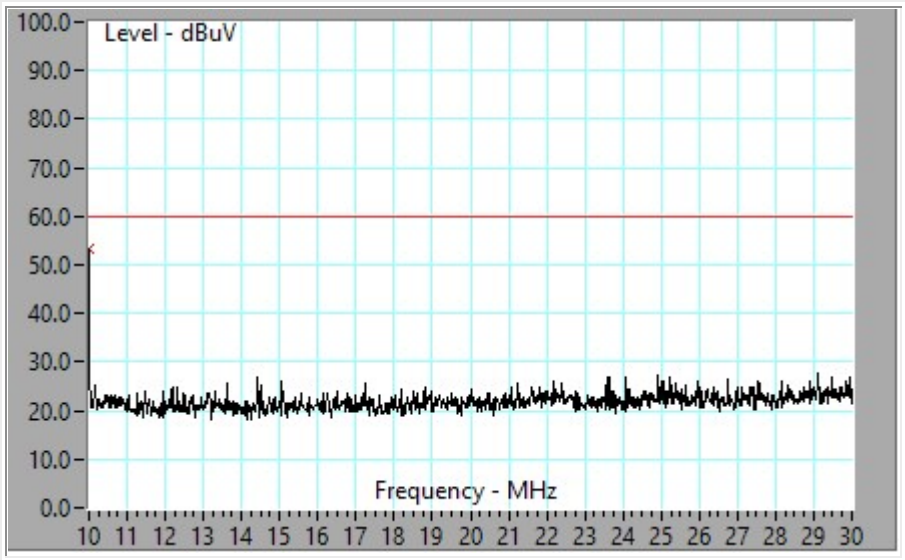
CE102 System Check: Calibrated Injected Signal = 53 dBuV @ 10 MHz



Thu, Mar 4, 2021
2:48:59 PM
AutoScan 7.4.4.16
Res BW (kHz) 10
Vid BW (kHz) 50000
Line 1
WC005290_WC005647
20dB Pad WC005821
Graph # 18
Sweep Time 10.0000

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
MHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
10.0	**53.3**	60.0	-6.7	32.36	0.05	1.02	19.86	-20.93

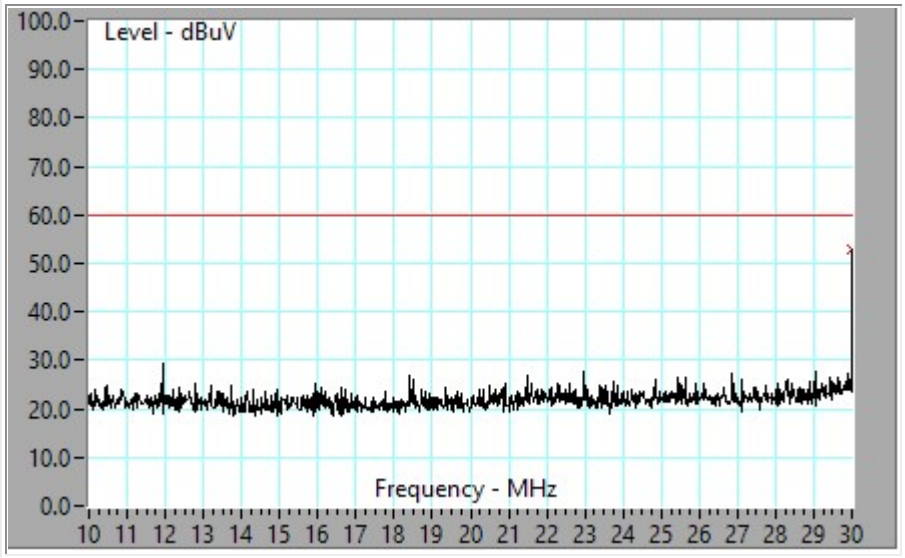
CE102 System Check: Calibrated Injected Signal = 53 dBuV @ 10 MHz



Thu, Mar 4, 2021
2:50:36 PM
AutoScan 7.4.4.16
Res BW (kHz) 10
Vid BW (kHz) 50000
Line 2
WC005290_WC005647
20dB Pad WC005821
Graph # 19
Sweep Time 10.0000

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
MHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
10.0	**53.2**	60.0	-6.8	32.22	0.06	1.02	19.86	-20.94

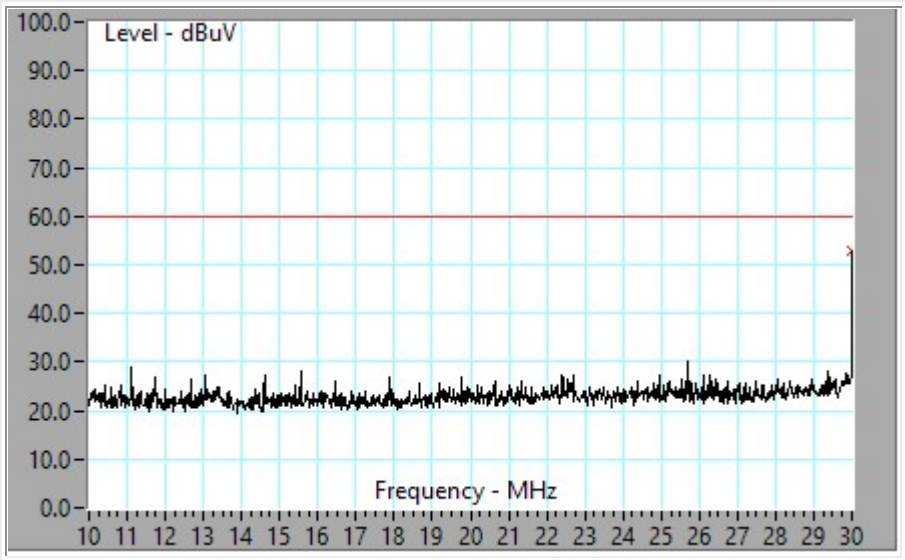
CE102 System Check: Calibrated Injected Signal = 53 dBuV @ 30 MHz



Thu, Mar 4, 2021
2:52:13 PM
AutoScan 7.4.4.16
Res BW (kHz) 10
Vid BW (kHz) 50000
Line 2
WC005290_WC005647
20dB Pad WC005821
Graph # 20
Sweep Time 10.0000

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
MHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
30.00	**52.7**	60.0	-7.3	31.13	0.22	1.50	19.87	-21.59

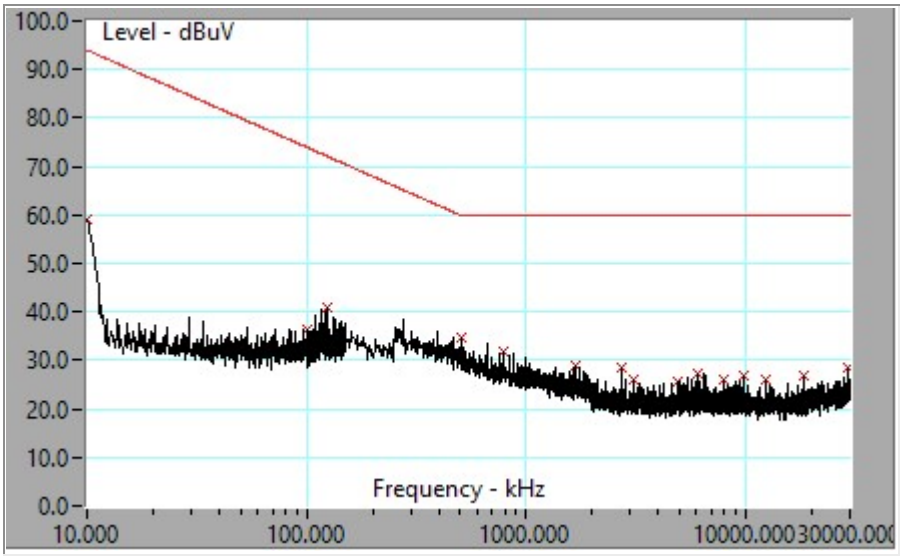
CE102 System Check: Calibrated Injected Signal = 53 dBuV @ 30 MHz



Thu, Mar 4, 2021
2:54:35 PM
AutoScan 7.4.4.16
Res BW (kHz) 10
Vid BW (kHz) 50000
Line 1
WC005290_WC005647
20dB Pad WC005821
Graph # 21
Sweep Time 10.0000

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
MHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
30.00	**52.8**	60.0	-7.2	31.27	0.16	1.50	19.87	-21.53

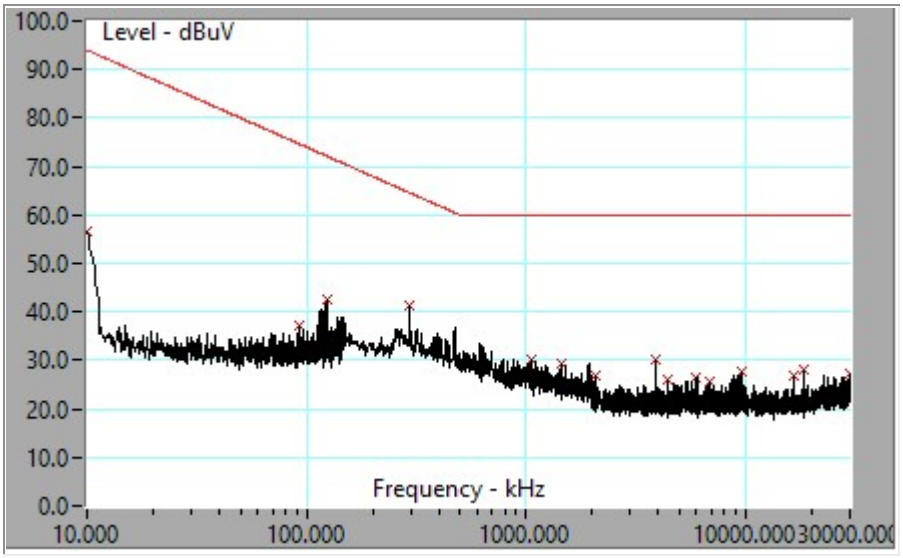
CE102 System Check: Ambient Scan



Thu, Mar 4, 2021
3:00:12 PM
AutoScan 7.4.4.16
Res BW (kHz) 1, 10
Vid BW (kHz) 50000
Line 1
WC005290_WC005647
20dB Pad WC005821
Graph # 22

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
kHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
10.0000	59.1	94.0	-34.9	34.13	5.10	0.00	19.84	-24.94
101.4200	36.2	73.9	-37.7	15.97	0.34	0.02	19.84	-20.21
124.5200	40.7	72.1	-31.4	20.59	0.26	0.03	19.84	-20.12
510.7500	34.5	60.0	-25.5	14.48	0.06	0.13	19.85	-20.04
786.4000	31.6	60.0	-28.4	11.54	0.05	0.21	19.85	-20.10
1702.1500	28.9	60.0	-31.1	8.70	0.04	0.32	19.85	-20.21
2740.9999	28.5	60.0	-31.5	8.23	0.04	0.41	19.85	-20.29
3098.0000	25.8	60.0	-34.2	5.52	0.04	0.44	19.84	-20.32
4909.9998	25.6	60.0	-34.4	5.08	0.04	0.59	19.84	-20.47
6040.0000	27.3	60.0	-32.7	6.69	0.04	0.68	19.84	-20.57
7960.0000	25.9	60.0	-34.1	5.15	0.04	0.85	19.85	-20.74
9810.0004	27.0	60.0	-33.0	6.06	0.05	1.00	19.86	-20.91
12520.0005	26.0	60.0	-34.0	5.02	0.05	1.08	19.86	-20.99
18319.9997	26.8	60.0	-33.2	5.58	0.08	1.22	19.86	-21.17
29659.9998	28.3	60.0	-31.7	6.81	0.16	1.50	19.87	-21.52

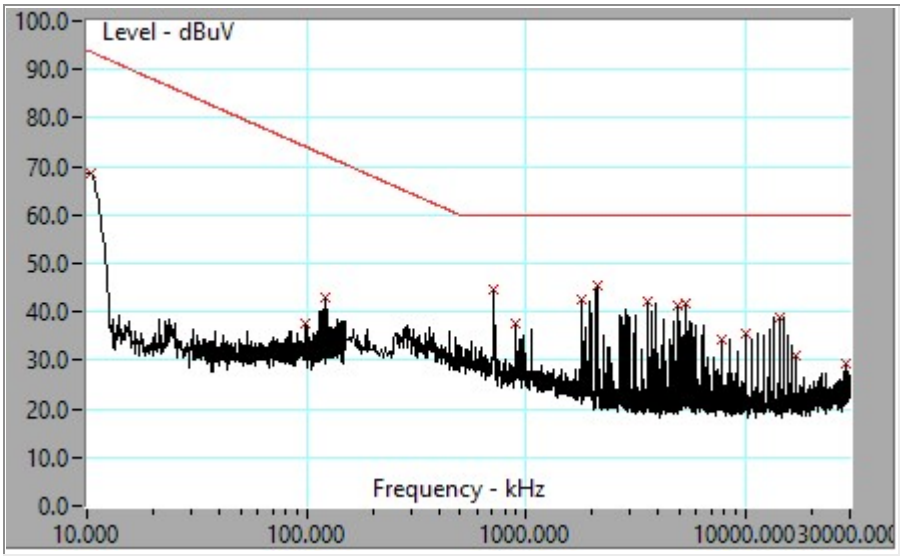
CE102 System Check: Ambient Scan



Thu, Mar 4, 2021
3:03:18 PM
AutoScan 7.4.4.16
Res BW (kHz) 1, 10
Vid BW (kHz) 50000
Line 2
WC005290_WC005647
20dB Pad WC005821
Graph # 23

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
kHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
10.0000	56.7	94.0	-37.3	32.10	4.77	0.00	19.84	-24.61
92.1800	37.0	74.7	-37.7	16.99	0.18	0.02	19.84	-20.03
124.2400	42.4	72.1	-29.7	22.43	0.13	0.03	19.84	-20.00
294.3000	41.3	64.6	-23.3	21.26	0.08	0.07	19.84	-20.00
1058.3500	30.3	60.0	-29.7	10.14	0.04	0.27	19.85	-20.16
1459.8000	29.3	60.0	-30.7	9.09	0.04	0.30	19.85	-20.19
2099.0000	26.9	60.0	-33.1	6.61	0.04	0.35	19.85	-20.24
3890.0001	30.3	60.0	-29.7	9.93	0.04	0.50	19.84	-20.39
4474.9999	25.9	60.0	-34.1	5.49	0.04	0.55	19.84	-20.44
5905.0002	26.6	60.0	-33.4	6.05	0.05	0.67	19.84	-20.57
6855.0000	25.5	60.0	-34.5	4.90	0.05	0.75	19.85	-20.65
9579.9999	27.5	60.0	-32.5	6.58	0.06	0.98	19.86	-20.90
16600.0004	26.8	60.0	-33.2	5.69	0.10	1.18	19.86	-21.14
18420.0001	28.0	60.0	-32.0	6.80	0.10	1.22	19.86	-21.19
29959.9991	27.4	60.0	-32.6	5.83	0.22	1.50	19.87	-21.59

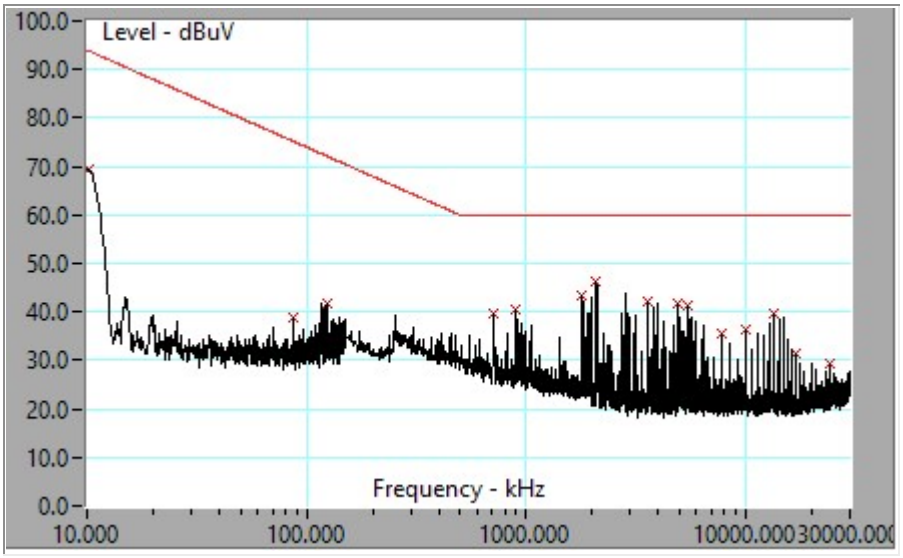
CE102: SwitchBox



Thu, Mar 4, 2021
3:16:13 PM
AutoScan 7.4.4.16
Res BW (kHz) 1, 10
Vid BW (kHz) 50000
Line 1
WC005290_WC005647
20dB Pad WC005821
Graph # 24

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
kHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
10.4200	68.7	93.6	-25.0	44.28	4.55	0.00	19.84	-24.39
99.1800	37.7	74.1	-36.3	17.70	0.17	0.02	19.84	-20.03
122.1400	43.1	72.2	-29.2	23.08	0.14	0.03	19.84	-20.00
714.2500	44.6	60.0	-15.4	24.50	0.05	0.19	19.85	-20.08
901.1000	37.4	60.0	-22.6	17.27	0.05	0.24	19.85	-20.14
1798.3500	42.6	60.0	-17.4	22.37	0.04	0.33	19.85	-20.22
2114.0001	45.3	60.0	-14.7	25.06	0.04	0.36	19.85	-20.24
3602.0000	42.0	60.0	-18.0	21.65	0.04	0.48	19.84	-20.36
4925.0002	41.4	60.0	-18.6	20.91	0.04	0.59	19.84	-20.47
5405.0002	41.6	60.0	-18.4	21.10	0.04	0.63	19.84	-20.51
7840.0002	34.2	60.0	-25.8	13.50	0.05	0.84	19.85	-20.74
9984.9997	35.5	60.0	-24.5	14.58	0.06	1.01	19.86	-20.93
14260.0002	39.0	60.0	-21.0	17.94	0.08	1.12	19.86	-21.06
17120.0008	30.9	60.0	-29.1	9.78	0.10	1.19	19.86	-21.15
29000.0000	29.4	60.0	-30.6	7.83	0.21	1.48	19.87	-21.56

CE102: SwitchBox



Thu, Mar 4, 2021
3:19:05 PM
AutoScan 7.4.4.16
Res BW (kHz) 1, 10
Vid BW (kHz) 50000
Line 2
WC005290_WC005647
20dB Pad WC005821
Graph # 25

Frequency	Level	Limit	Delta	Raw	LISN	Cable	Xducer	All Factors
kHz	dBuV	dBuV	dB	dBuV	dB	dB	dB	dB
10.1400	69.4	93.9	-24.5	44.85	4.70	0.00	19.84	-24.54
86.5800	38.9	75.2	-36.4	18.82	0.19	0.02	19.84	-20.05
125.2200	41.6	72.0	-30.4	21.60	0.13	0.03	19.84	-20.00
714.2500	39.6	60.0	-20.4	19.49	0.05	0.19	19.85	-20.08
906.6500	40.7	60.0	-19.3	20.53	0.05	0.24	19.85	-20.14
1813.1500	43.4	60.0	-16.6	23.14	0.04	0.33	19.85	-20.22
2081.0001	46.1	60.0	-13.9	25.85	0.04	0.35	19.85	-20.24
3622.9999	42.3	60.0	-17.7	21.96	0.04	0.48	19.84	-20.37
4948.9999	41.9	60.0	-18.1	21.42	0.04	0.59	19.84	-20.47
5434.9999	41.5	60.0	-18.5	20.99	0.04	0.63	19.84	-20.52
7840.0002	35.3	60.0	-24.7	14.61	0.05	0.84	19.85	-20.74
9975.0004	36.2	60.0	-23.8	15.25	0.06	1.01	19.86	-20.93
13540.0000	39.9	60.0	-20.1	18.84	0.07	1.10	19.86	-21.03
17100.0004	31.4	60.0	-28.6	10.25	0.10	1.19	19.86	-21.15
24360.0006	29.2	60.0	-30.8	7.86	0.14	1.37	19.87	-21.38

5.1.9 CE102 Test Equipment List

Table 5.1-1: CE102 Test Equipment List

Asset No.	Manufacturer	Item	Model	S/N	Cal. Cycle (Months)	Cal. Due
WC058456	Agilent	MXE EMI Receiver	N9038A	MY57190108	12	5/19/21
WC005290	Solar	LISN	8028-50-TS-24-BNC	0511189	36	6/5/23
WC005647	Solar	LISN	8028-50-TS-24-BNC	075513	36	3/6/22
WC058501	Winchester Interconnect	SRC-215, 2.9mm Coax Cable, 96”	E50-E50-2150960	None	24	6/2/22
WC058502	Winchester Interconnect	SRC-215, 2.9mm Coax Cable, 312”	E50-E50-2153120	None	24	6/2/22
WC005821	Narda	20dB Attenuator	766A-20	100230	36	10/4/21
WC005477	Marconi	9kHz – 1.2GHz Signal Generator	2023	112253143	12	01/13/22
WC058386	Tektronix	Digital Oscilloscope	MDO3034	C011435	12	1/28/22

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

NCR = No Calibration Required; as per NTS QA policy, the equipment does not require calibration as long as the test signal being generated can be verified with other calibrated equipment prior to or during the test.

5.2 Method CS101, Conducted Susceptibility, Power Leads, 30 Hz to 150 kHz

5.2.1 CS101 Purpose

This test verifies the ability of the EUT to withstand signals coupled onto input power leads, not including returns.

5.2.2 CS101 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 with voltage levels as specified by Curve #1 in Figure 5.2-1. The requirement is also met when the power source is adjusted to dissipate the power level shown in Figure 5.2-2 in a 0.5 Ω load and the EUT is not susceptible. The limit is applicable from 120 Hz - 150 kHz for 60 Hz power lines.

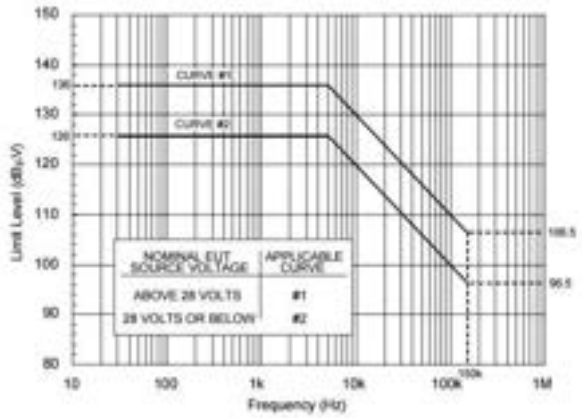


Figure 5.2-1: CS101 Voltage Limit

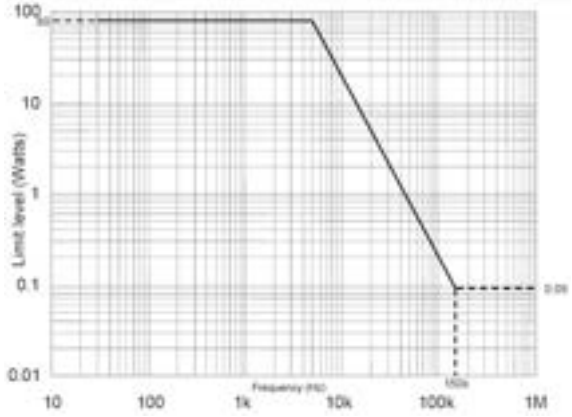


Figure 5.2-2: CS101 Power Limit

5.2.3 CS101 Power Leads to be Tested

Test Case	Connector	Description	Classification	Limit
1	J1	+28VDC	Input Power Lead	Curve 2

5.2.4 CS101 EUT Test Setup

The EUT was setup in accordance with Section 3.2, Figure 3.2-1, 4.3-1 and operated according to Section 3.3.

5.2.5 CS101 System Calibration

The test equipment was configured according to Figure 5.2-3. The Spectrum Analyzer and Power Line Ripple Detector was set up to monitor the voltage across the 0.5 Ω resistor connected to the coupling transformer.

1. The measurement equipment was turned on and sufficient time was allowed for stabilization.
2. The signal generator was set to the lowest test frequency.
3. The applied signal was increased until the indicated voltage level, corresponding to the maximum required power level specified for the limit is achieved.
4. The setting of the signal source was recorded.
5. The required frequency range was scanned, using the step size specified in Table 4.5-1.
6. The signal source setting needed to maintain the required level was recorded.

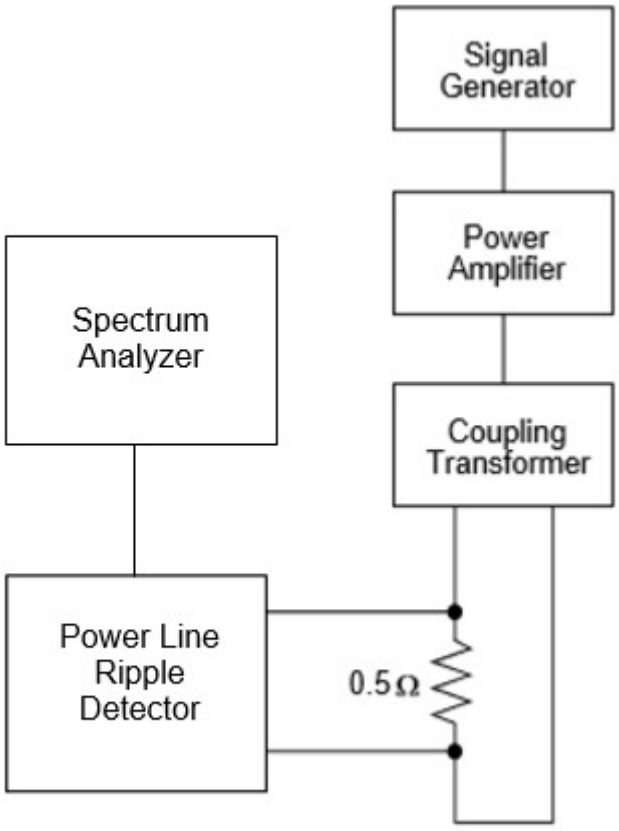


Figure 5.2-3: CS101 System Calibration

5.2.6 CS101 Test Procedure

The test setup was configured in accordance with Figure 5.2-4.

1. The EUT was turned on, and sufficient time was allowed for stabilization.
2. The signal generator was set to the lowest test frequency.
3. The signal was increased until the required voltage or power level is achieved on the power lead. Note that power was limited to the level calibrated in step 4 of System Calibration.
4. While maintaining the required signal level, the frequency range was scanned to150 kHz, using the step size specified in Table 4.5-1.
5. The EUT was monitored for degradation of performance.
6. If susceptibility was noted, the threshold level was determined.
7. The voltage and drive level for each line and each applicable frequency was recorded.

Note: Testing is not required for return leads.

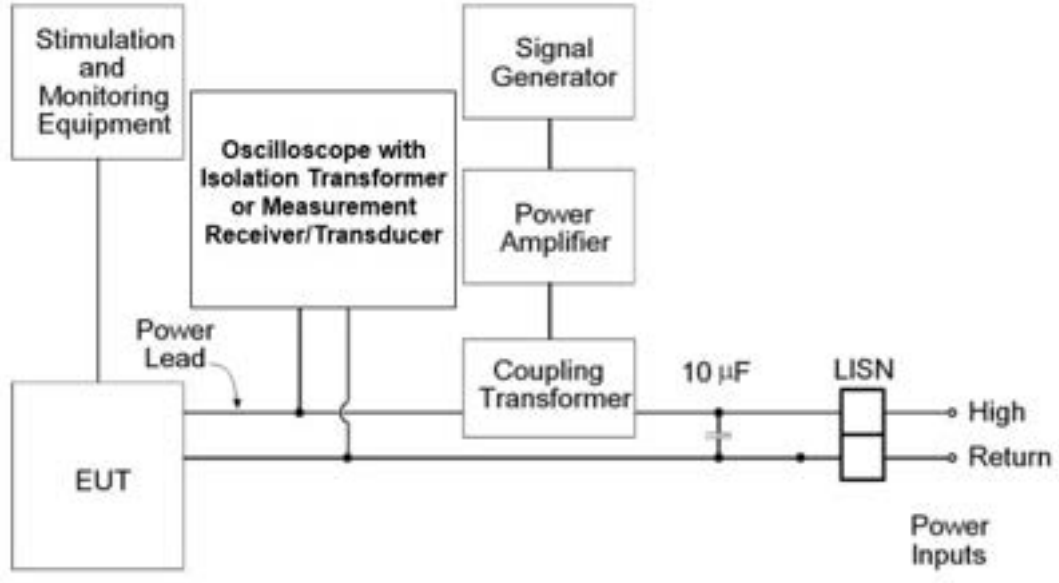


Figure 5.2-4: Signal Injection, DC or Single Phase AC

5.2.7 CS101 Test Log Sheet

CS101 LOG SHEET			
Job Number:	PR131850	**Date:**	3/12/2021
Standard:	MIL-STD-461G	**Method:**	CS101
Test Personnel:	Tristian Gaines	**Procedure:**	19CD0002 Rev B

Date	Time	Log Entries	Init.
3/12/2021	1100	Setting up for CS101 Calibration	TG
↓	1230	Calibration complete.	↓
↓	1305	CS101 **PASS.**	↓

Tested By: Tristian Gaines

5.2.8 CS101 Test Photographs

CS101 Calibration Setup

CS101 Calibration Setup (Alternate View)

CS101 Test

CS101 Test (Alternate View)

5.2.9 CS101 Test Data

CS101 Datasheet

Project Number:	PR131850	**Standard:**	MIL-STD-461G
		Procedure:	19CD0002 Rev B
Date:	3/12/2021	**EUT:**	SwitchBox
P/N:	19CD0002-1	**S/N:**	N/A
Test Personnel:	Tristian Gaines	**Manufacturer:**	Amphenol Aerospace

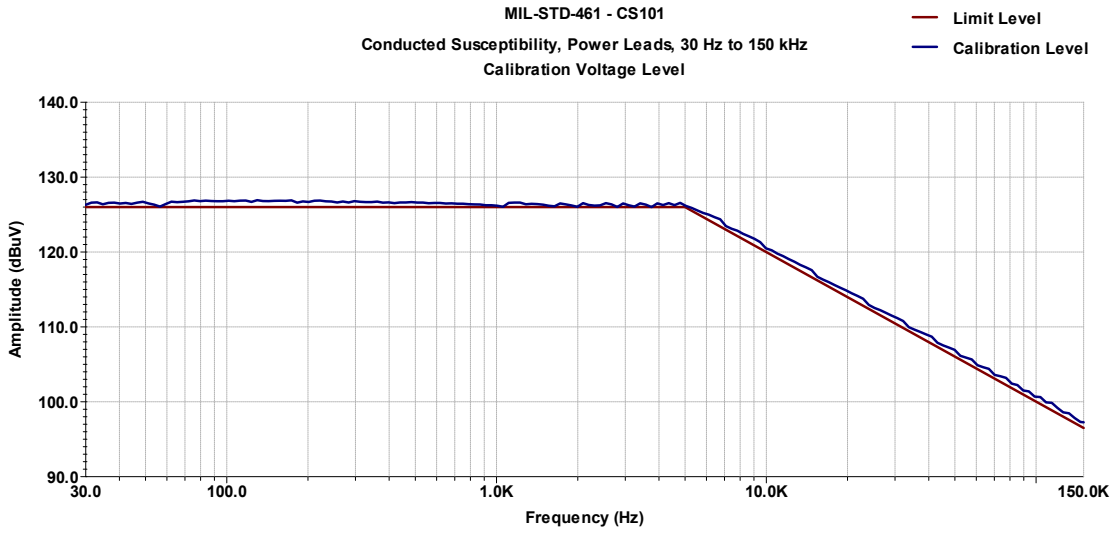
CS101 Specification Limits:

Signal Applied	Test Specification	Performance Criteria
Conducted Disturbance	Curve 2: 120Hz – 5KHz: 126dBµV 5kHz – 150kHz: 126 – 96.5dBµV	The EUT must continue to operate normally, within manufacturer specifications.

CS101 Test Results Summary:

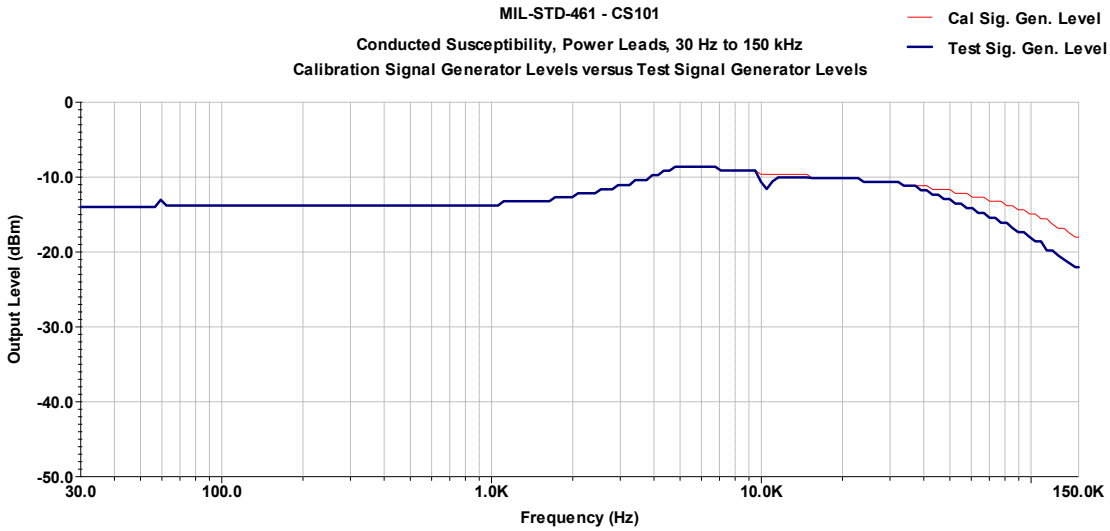
Line Tested	Frequency (kHz)	Test Level (dBuV)	Test Limit (W)	Observations / Abnormalities	Results (Pass/Fail)
+12VDC Line	0.120 – 5.0 5.0 – 150.0	126 126 – 96.5	80 80 – 0.9	None	**PASS**

CS101 Calibration Data

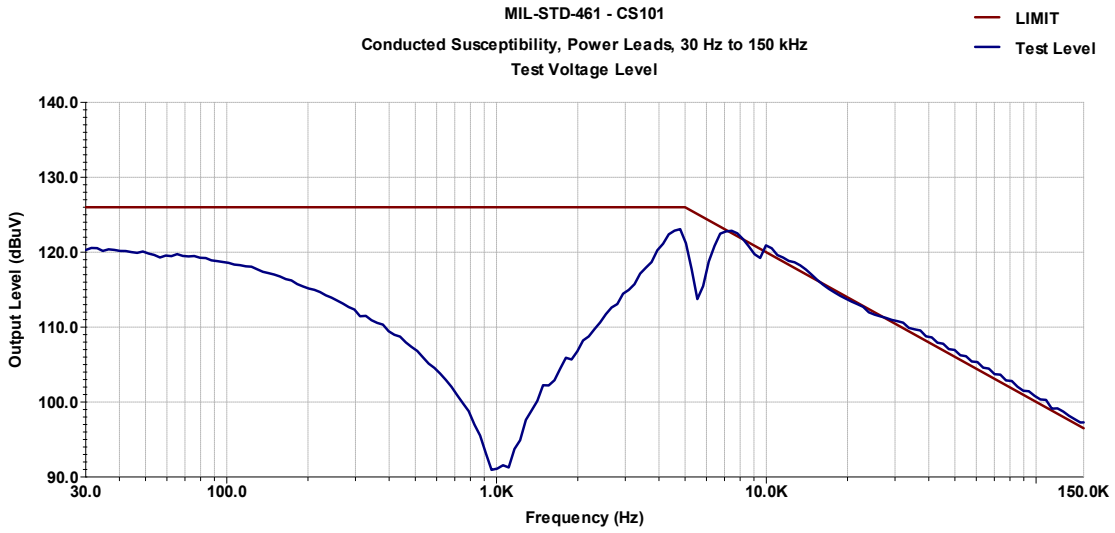


Last Data Update 09:39:07 AM, Friday, March 12, 2021

CS101 Test Data



Last Data Update 11:12:50 AM, Friday, March 12, 2021



Last Data Update 11:12:50 AM, Friday, March 12, 2021

5.2.10 CS101 Test Equipment List

Table 5.2-1: CS101 Test Equipment List

Asset No.	Manufacturer	Item	Model	S/N	Cal Cycle (Months)	Cal. Due
WC058452	Agilent Technologies	Arbitrary Waveform Generator	33250A	MY40033119	12	4/12/21
WC058455	AE Techron	Amplifier	7794	7794-0419-0021	NCR	NCR
WC058456	Agilent	MXE EMI Receiver	N9038A	MY57190108	12	5/19/21
WC005433	Solar	Coupling Transformer	6220-2	None	NCR	NCR
WC005312	Solar	Precision Resistor Assembly	6920-0.5	None	NCR	NCR
WC058487	Pearson	Power Line Ripple Detector	PRD-240	82877	12	4/3/21
WC058386	Tektronix	Digital Oscilloscope	MDO3034	C011435	12	1/25/22
WC058403	Solar	LISN	8028-50-TS-24-BNC	0511189	36	6/5/23
WC058404	Solar	LISN	8028-50-TS-24-BNC	075513	36	3/6/22
WC005728	Solar	10µF Capacitor	6512-106R	None	NCR	NCR
WC058505	Extech	Milliohmeter	380560	H410454	12	09/23/21

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

NCR = No Calibration Required; as per NTS QA policy, the equipment does not require calibration as long as the test signal being generated can be verified with other calibrated equipment prior to or during the test.

5.3 Method CS114, Conducted Susceptibility, Bulk Cable Injection, 10 kHz to 30 MHz

5.3.1 CS114 Purpose

This test verifies the ability of the EUT to withstand RF signals coupled onto all interconnecting cables including power cables. For EUTs intended to be installed on ships or submarines, an additional common mode limit of 77 dBµA is applicable from 4 kHz to 1 MHz on complete power cables (Common mode).

5.3.2 CS114 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 subsystems specification when subjected to an injection probe drive signal level which has been pre-calibrated to the appropriate current limit as shown in Figure 5.3-1 and modulated according to Section 4.5.
Requirements are also met if the EUT is not susceptible at forward power levels sensed by the directional coupler that are below those determined during calibration provided that the actual current induced in the cable under test is is Curve 5 = 115 dBµA, Curve 4 = 103 dBµA, Curve 3 = 95 dBµA, Curve 2 = 89 dBµA and Curve 1 = 83 dBµA across the frequency range.

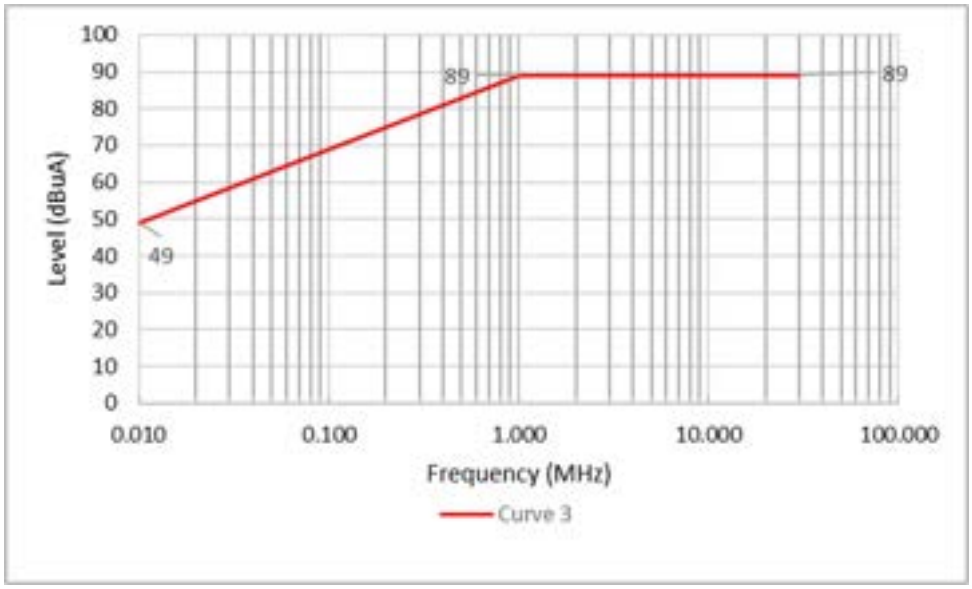


Figure 5.3-1: CS114 Calibration Limit.

5.3.3 CS114 Current Injection Probes

All current injection probes met the requirement for insertion loss as shown in Figure 5.3-2.

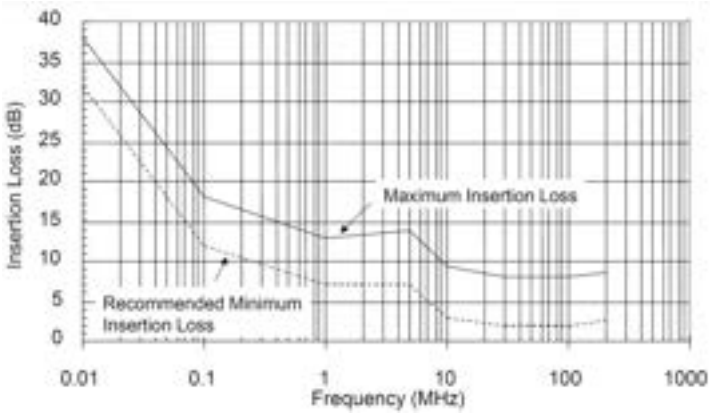


Figure 5.3-2: CS114 Maximum Insertion Loss for Injection Probes

5.3.4 CS114 Cables Tested

Test Case	Connector	Description	Classification	Calibration Limit
1	J1	Power Bundle, Unshielded	Input Power Lead	Curve 3
2	J1	+28VDC Only, Unshielded	Input Power Lead	Curve 3
3	J5	10GBase-T Bundle, Shielded	Signal Lead	Curve 3
4	J6	1GBase-T Bundle, Shielded	Signal Lead	Curve 3
5	J7	1GBase-T Bundle, Shielded	Signal Lead	Curve 3

5.3.5 CS114 EUT Test Setup

The EUT was setup in accordance with Section 3.2, Figure 3.2-1, 4.3-1 and operated according to Section 3.3

5.3.6 CS114 Calibration and Verification

Calibration procedure:

The test equipment was configured according to Figure 5.3-3.
The injection probe was placed around the center conductor of the calibration fixture. One end of the calibration fixture was terminated with a 50 Ω load, and the other end was terminated to measurement receiver A.

1. The signal generator was set to lowest test frequency, unmodulated.
2. The applied signal was increased until measurement receiver A indicates that the current level specified in the limit is flowing in the center conductor of the calibration fixture.
3. The forward power to the injection probe indicated on measurement receiver B was recorded.
4. The frequency band up to 200 MHz was scanned, using the step size indicated in Table 4.5-1.
5. The forward power needed to maintain the required current amplitude was recorded.

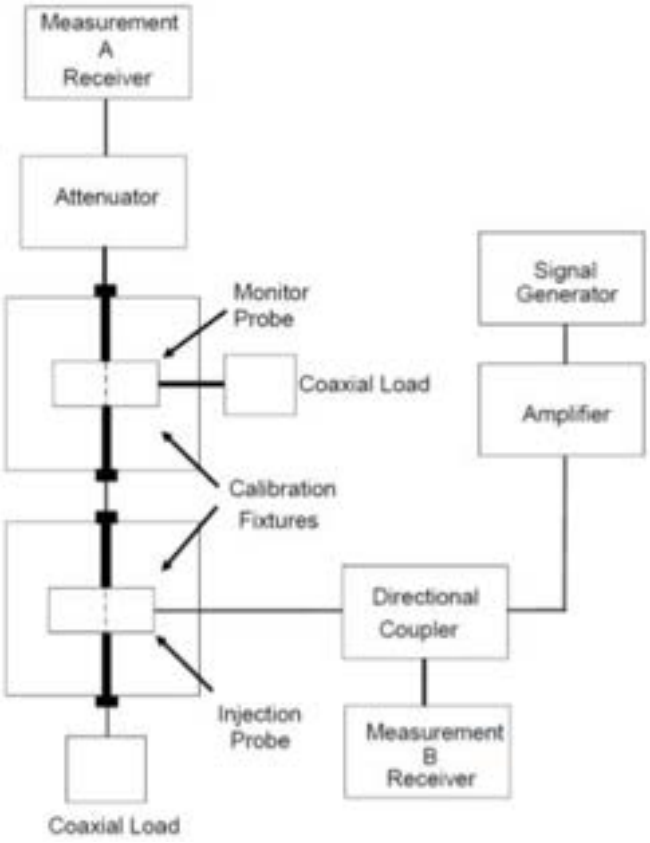


Figure 5.3-3: CS114 Calibration Setup

Verification procedure:

1. Configure the verification of the test system using Figure 5.3-4.
2. Set the signal generator to the lowest test frequency.
3. Apply the forward power level determined during calibration to the injection probe, while monitoring the induced current on the monitor probe.
4. Scan the required frequency range with step sizes twice those in Table 4.5-1, while maintaining the forward power level at the calibrated level determined during calibration.
5. Verify that the forward power follows the calibration and that the developed current is within a ±3 dB of the current test limit.
6. If the current is not within ±3 dB tolerance, then identify the issue and correct it.

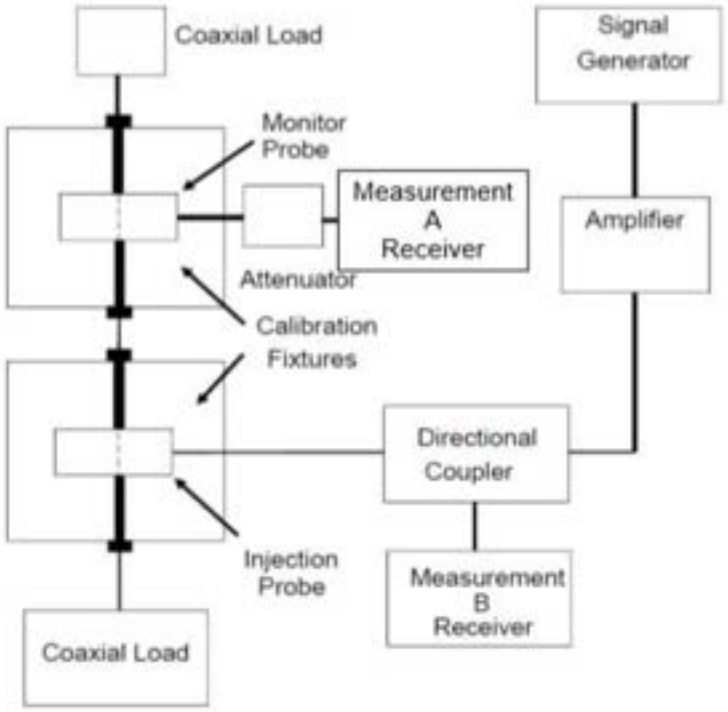


Figure 5.3-4: CS114 Verification Setup

5.3.7 CS114 Test Procedure

The test setup was configured in accordance with Figure 5.3-5, and as follows:

1. The injection and monitor probes were placed around the cable bundle interfacing with a EUT connector, with the EUT turned on and in normal operation mode.
2. The monitor probe was placed 5 cm from the connector. If the connector and back shell's overall length exceed 5 cm, the monitor probe was positioned as close to the connector's back shell as possible.
3. The injection probe was positioned 5 cm from the monitor probe.

Testing proceeded as follows on all required cables:

1. The EUT was turned on and put into normal operation mode.
2. Susceptibility Evaluation:
   A. The signal generator was set to the lowest test frequency, with 1 kHz pulse modulation, 50% duty cycle.
   B. The forward power from Measurement System Calibration was applied to the injection probe while the induced current is monitored.
   C. The required frequency range was scanned in accordance with Table 4.5-1, while maintaining the forward power level at the calibration level determined in the Measurement System Calibration, or the maximum current level for the applicable limit (whichever is less stringent).
   D. The EUT was monitored for degradation of performance.

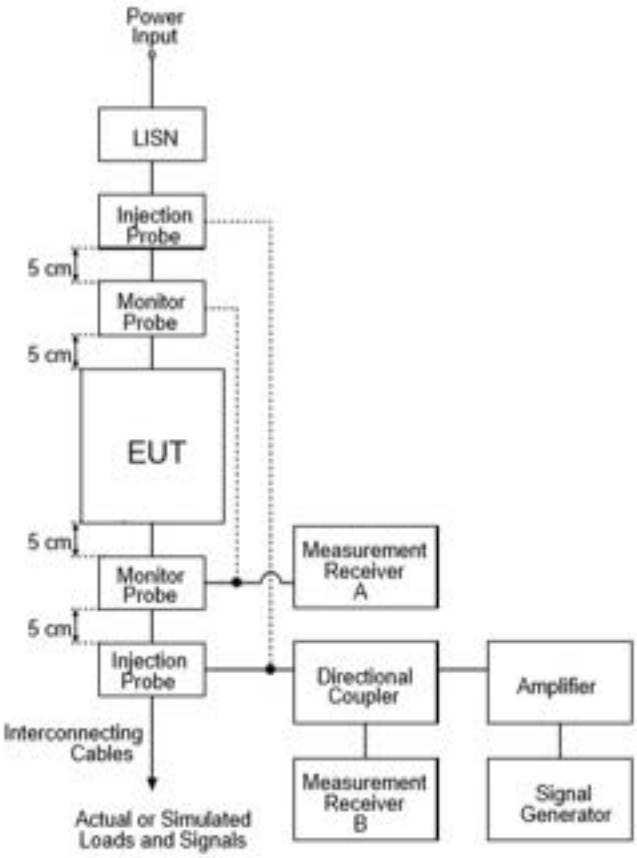


Figure 5.3-5: CS114 Bulk Cable Injection Evaluation

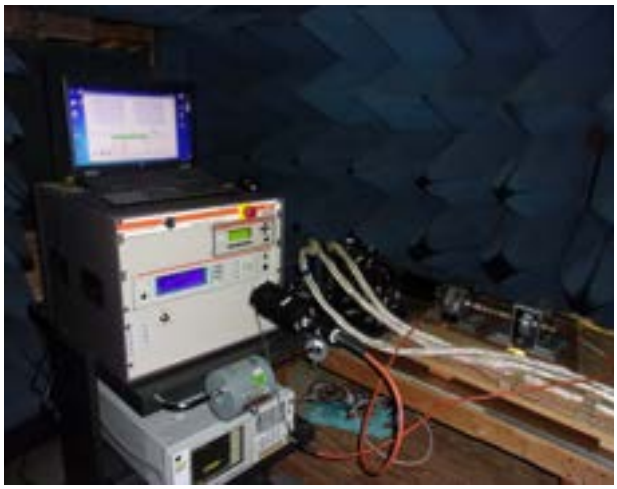
5.3.8 CS114 Test Log Sheet

CS114 LOG SHEET			
Job Number:	PR131850	**Date:**	3/17/21 – 3/18/2021
Standard:	MIL-STD-461G	**Method:**	CS114
Test Personnel:	Tristian Gaines	**Procedure:**	19CD0002 Rev B

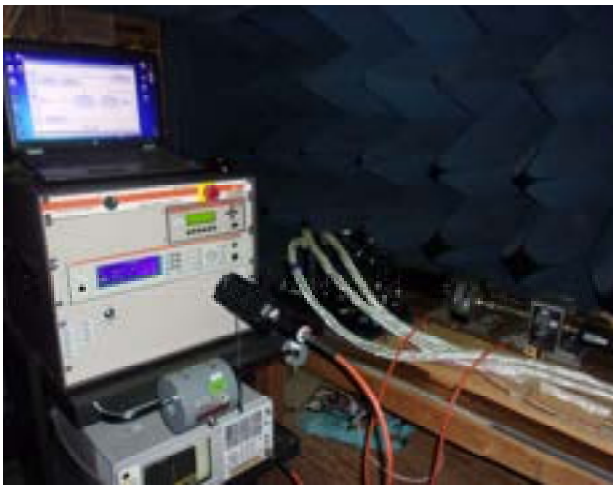
Date	Time	Log Entries	Init.
3/17/21	0730	Began CS114 Cal	TG
	0855	CS114 Cal complete beginning verification.	↓
	0930	Verification complete, beginning test.	↓
	1600	Stopped at J7.	↓
3/18/21	0935	CS114 PASS	↓

Tested By: Tristian Gaines

5.3.9 CS114 Test Photographs



CS114 Calibration



CS114 Verification

CS114 Power Bundle

CS114 +28 VDC

CS114 J5

CS114 J6

CS114 J7

5.3.10 CS114 Test Data

CS114 Datasheet

Project Number:	PR131850	**Standard:**	MIL-STD-461G
		Procedure:	19CD0002 Rev B
Date:	3/17/2021	**EUT:**	SwitchBox
P/N:	19CD0002-1	**S/N:**	N/A
Test Personnel:	Tristian Gaines	**Manufacturer:**	Amphenol Aerospace

CS114 Specification Limits:

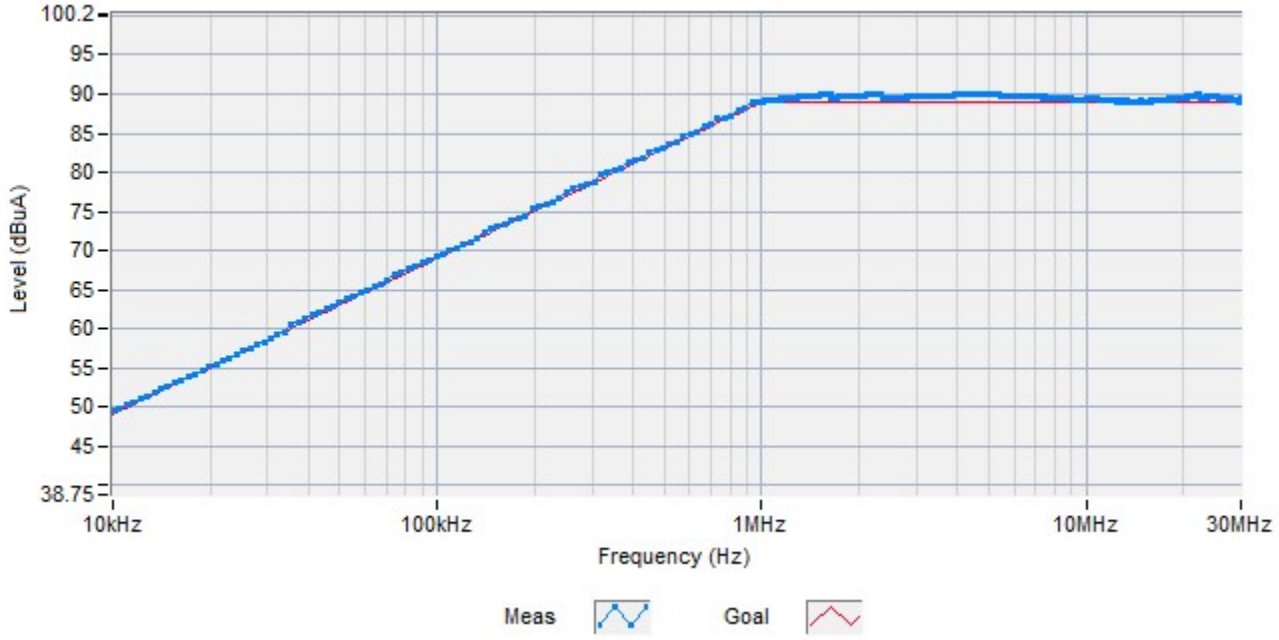
Signal Applied	Test Specification	Performance Criteria
RF Bulk Cable Injection	10kHz - 30MHz Curve 3 Calibration Current Limits 1 kHz PM, 50% duty cycle (3 Second Dwell)	The EUT was monitored for any degradation in performance according to test procedure 19CD0002 Rev B

CS114 Test Results Summary:

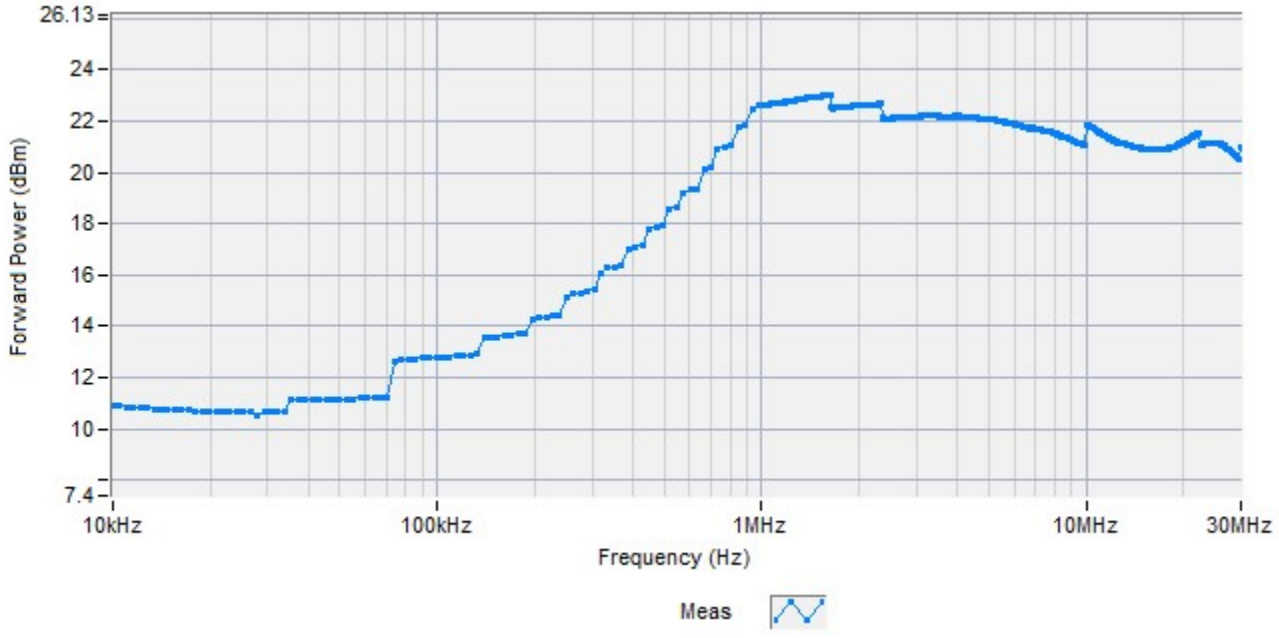
Line Tested	Frequency (MHz)	Cal Level (Curve 3, dBµA)	Step Size	Modulation	Limit	EUT Observation	Results (Pass/Fail)
J1 Bundle	0.01 – 2.0	49 - 89	0.05f_o	1 kHz PM, 50% duty cycle	Calibrated Forward Power or 95 dBµA	None	**PASS**
	2.0 – 30	89	0.01f_o				
J1 (+28V Only)	0.01 – 2.0	49 - 89	0.05f_o	1 kHz PM, 50% duty cycle	Calibrated Forward Power or 95 dBµA	None	**PASS**
	2.0 – 30	89	0.01f_o				
J5 Bundle	0.01 – 2.0	49 – 89	0.05f_o	1 kHz PM, 50% duty cycle	Calibrated Forward Power or 95 dBµA	None	**PASS**
	2.0 – 30	89	0.01f_o				
J6 Bundle	0.01 – 2.0	49 - 89	0.05f_o	1 kHz PM, 50% duty cycle	Calibrated Forward Power or 95 dBµA	None	**PASS**
	2.0 – 30	89	0.01f_o				
J7 Bundle	0.01 – 2.0	49 - 89	0.05f_o	1 kHz PM, 50% duty cycle	Calibrated Forward Power or 95 dBµA	None	**PASS**
	2.0 – 30	89	0.01f_o				

CS114 Calibration Data

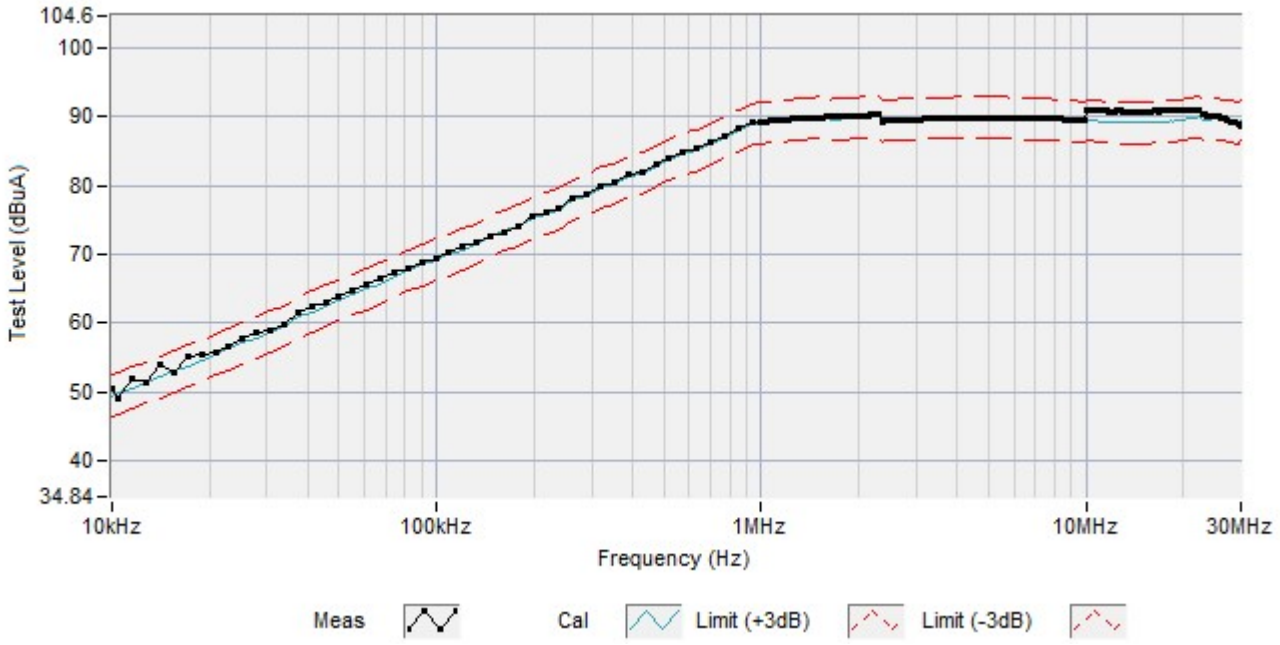
Calibrated Current



Calibrated Forward Power



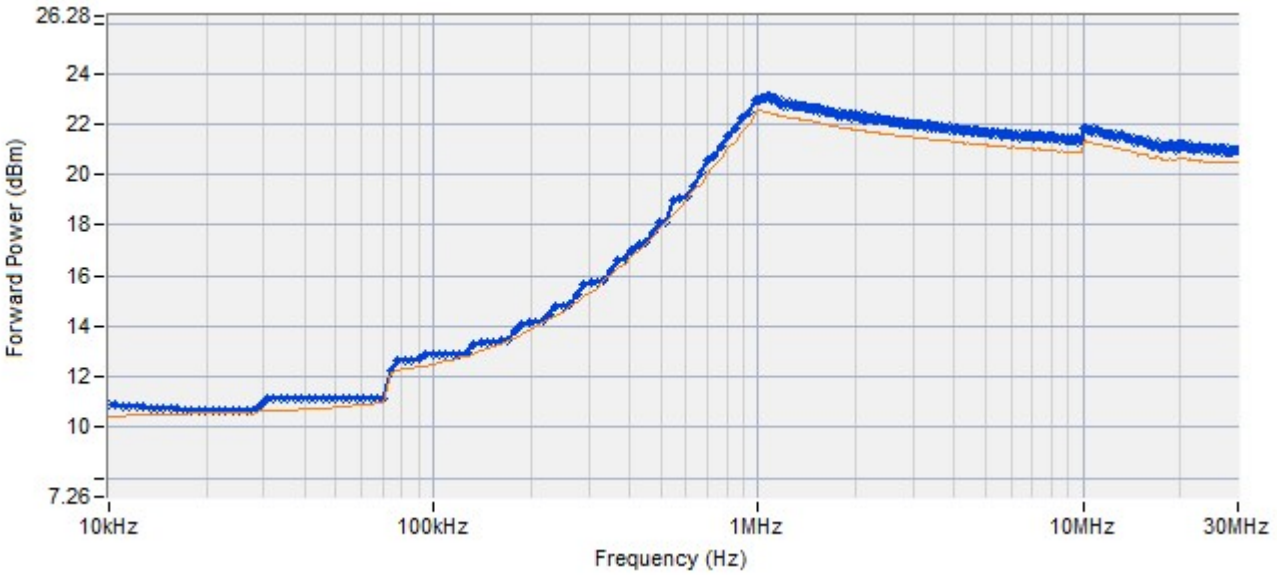
CS114 Verification Data



CS114 Test Data

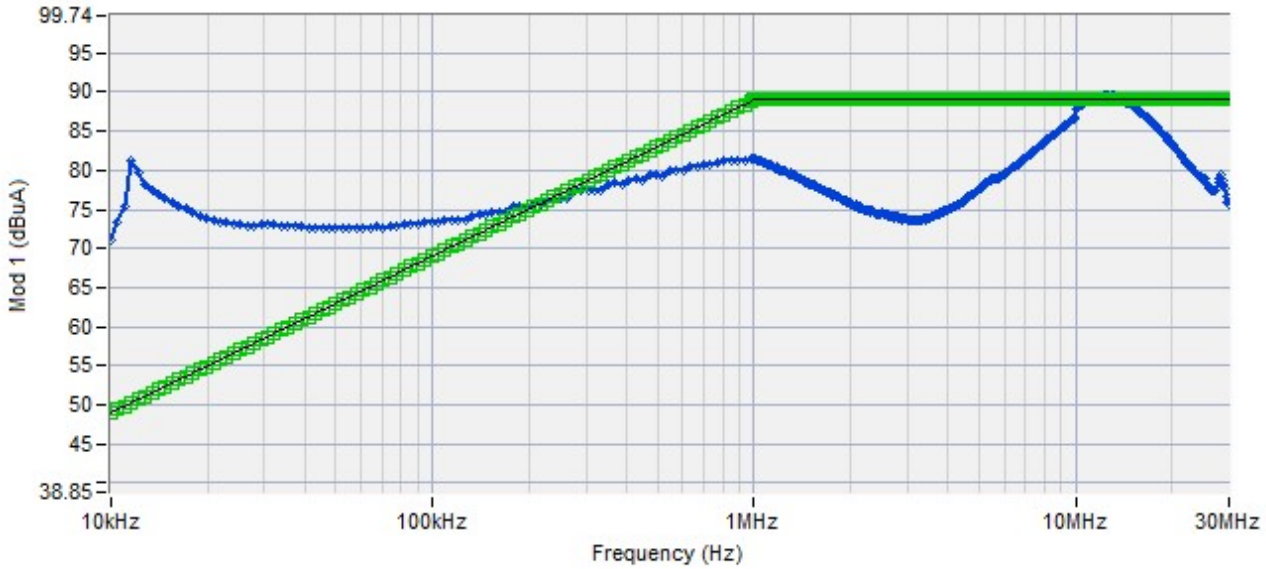
Calibrated Forward Power / Actual Forward Power Graph

J1 (+28V Only)



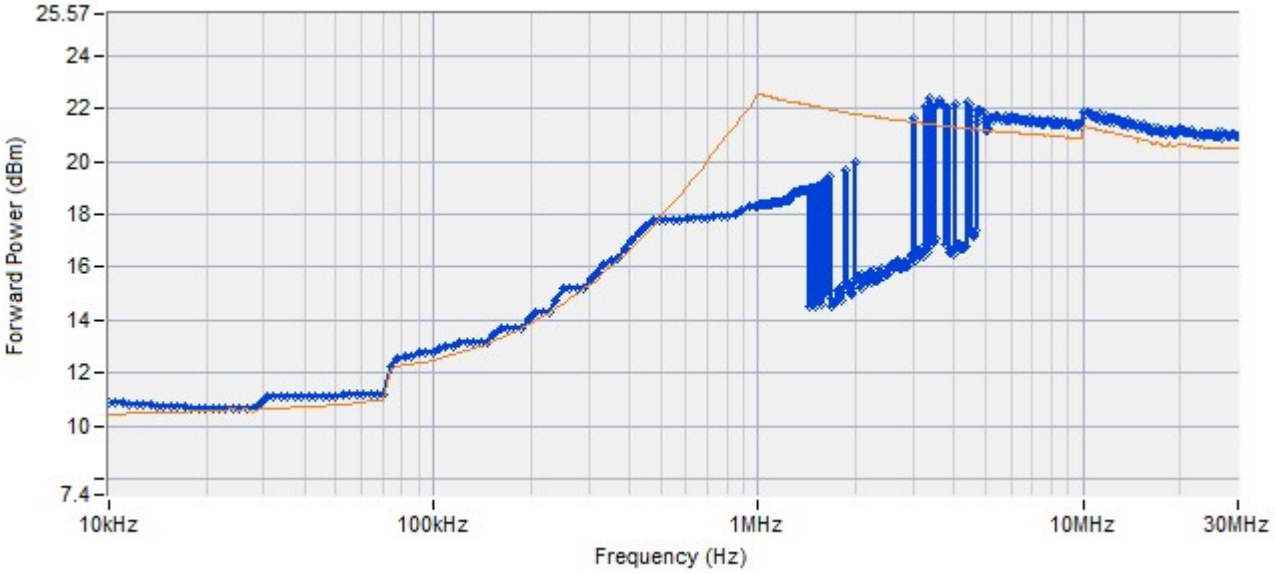
Calibration Test Level / Measured Test Level Graph

J1 (+28V Only)



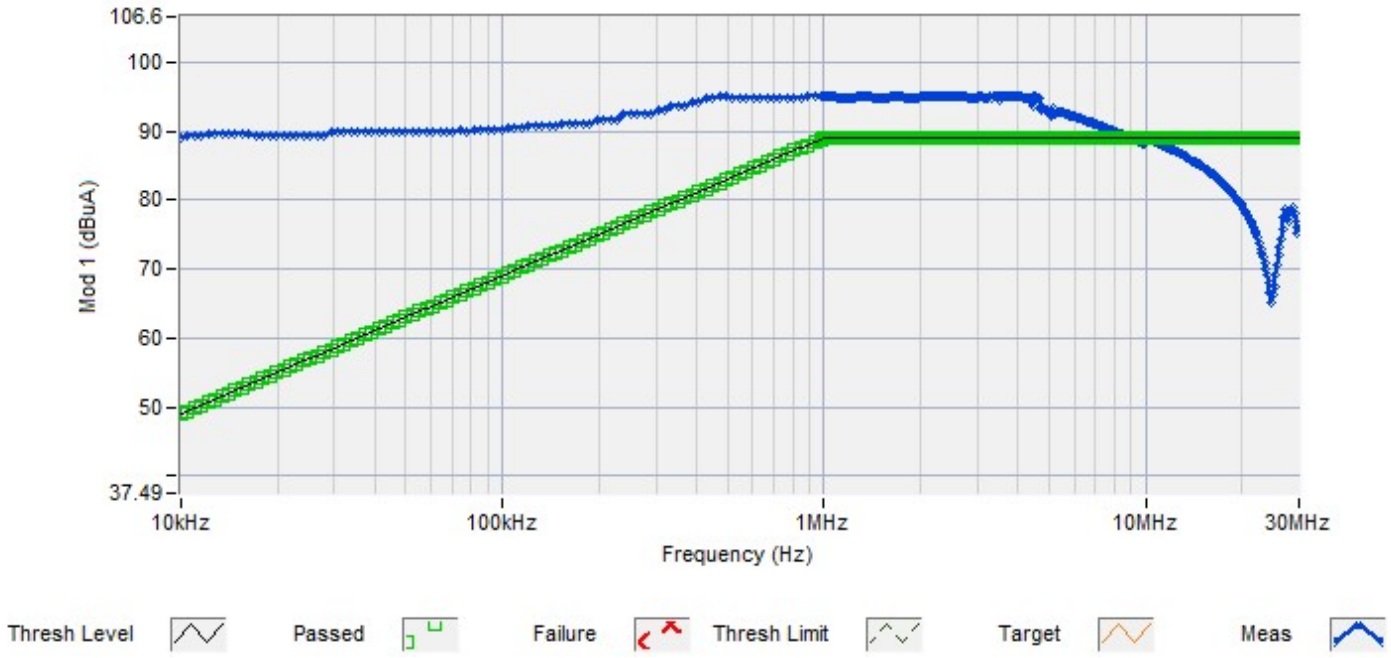
Calibrated Forward Power / Actual Forward Power Graph

J1 Bundle



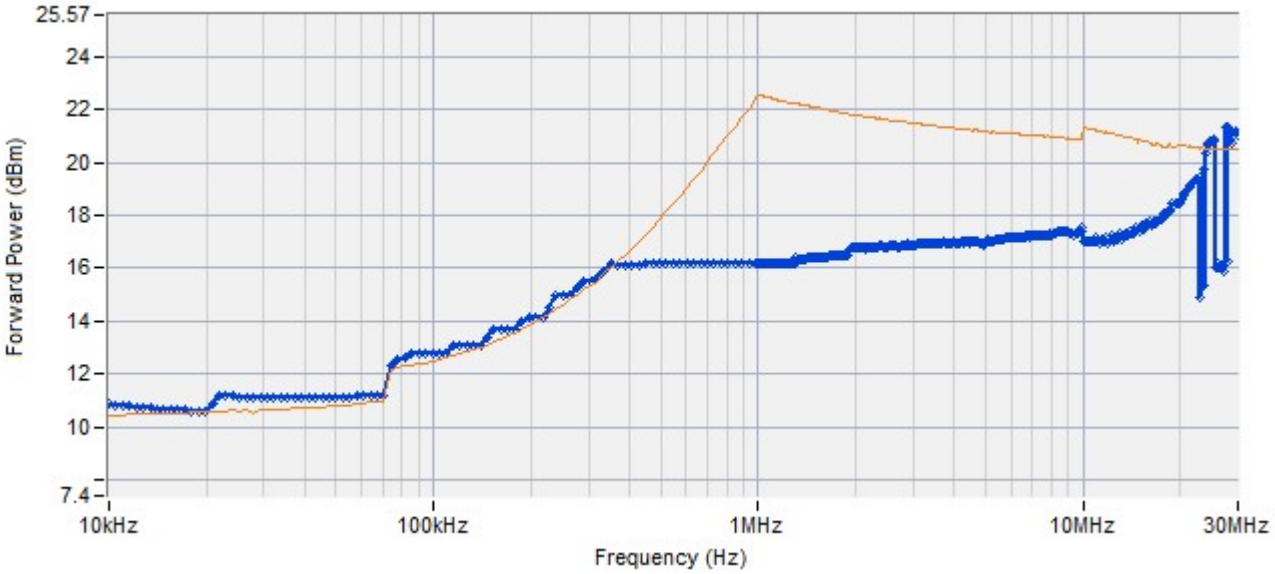
Calibration Test Level / Measured Test Level Graph

J1 Bundle



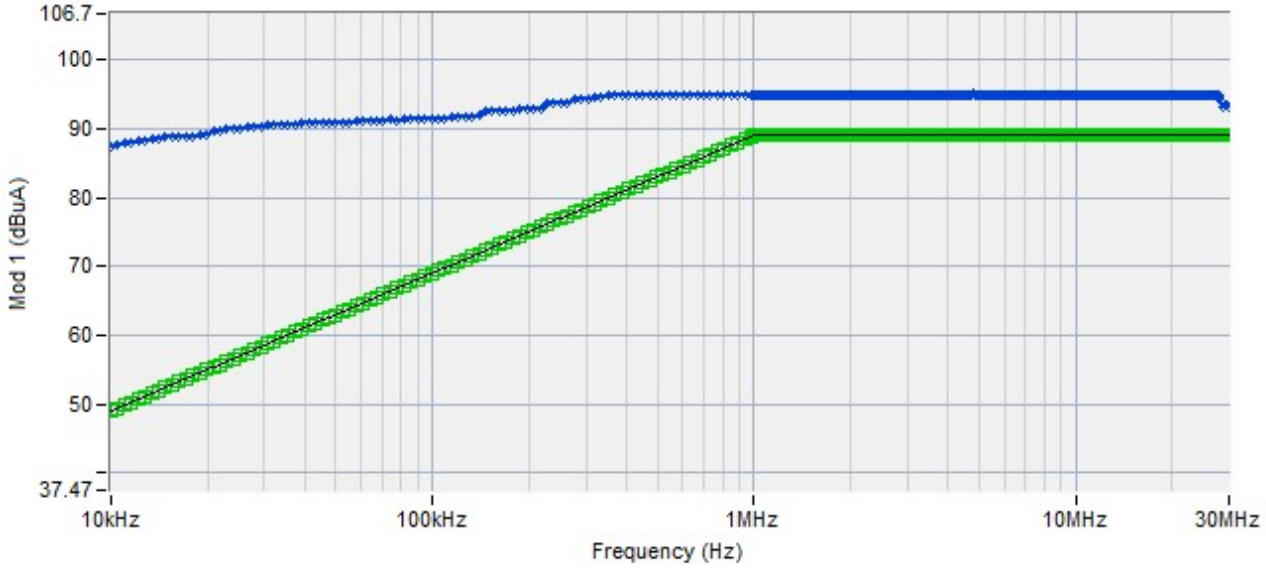
Calibrated Forward Power / Actual Forward Power Graph

J5 Bundle



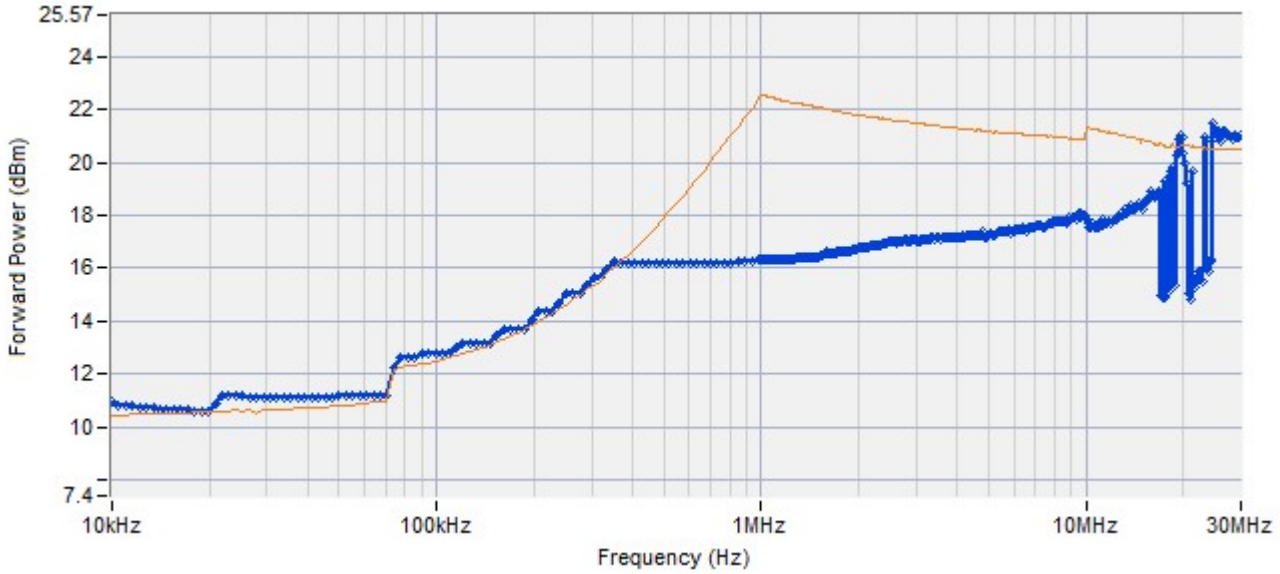
Calibration Test Level / Measured Test Level Graph

J5 Bundle



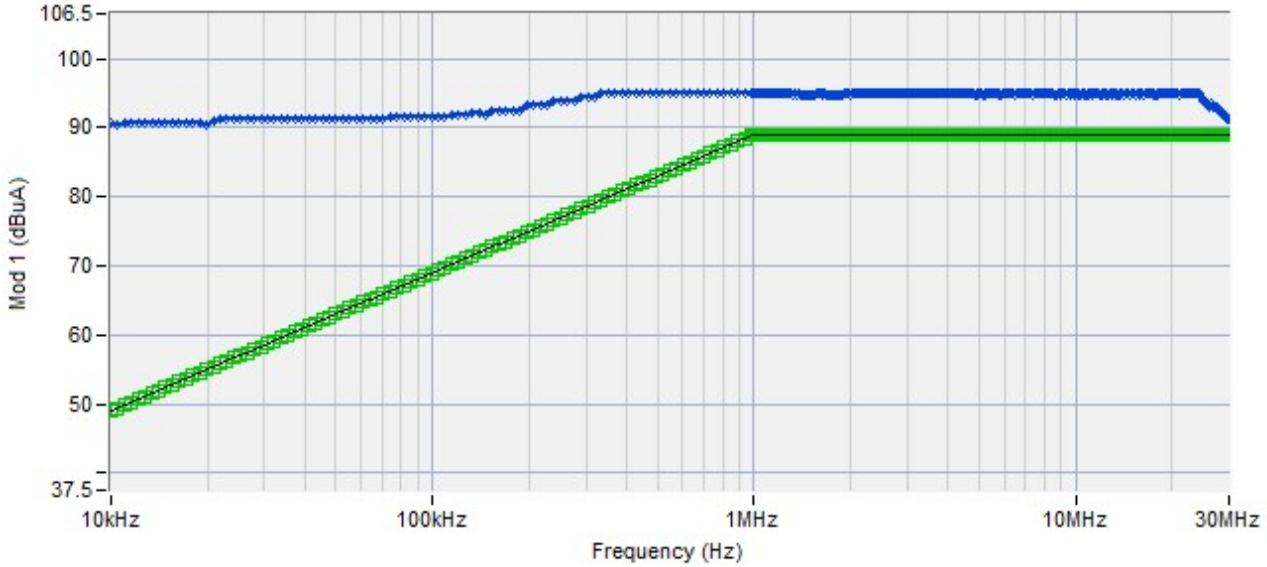
Calibrated Forward Power / Actual Forward Power Graph

J6 Bundle



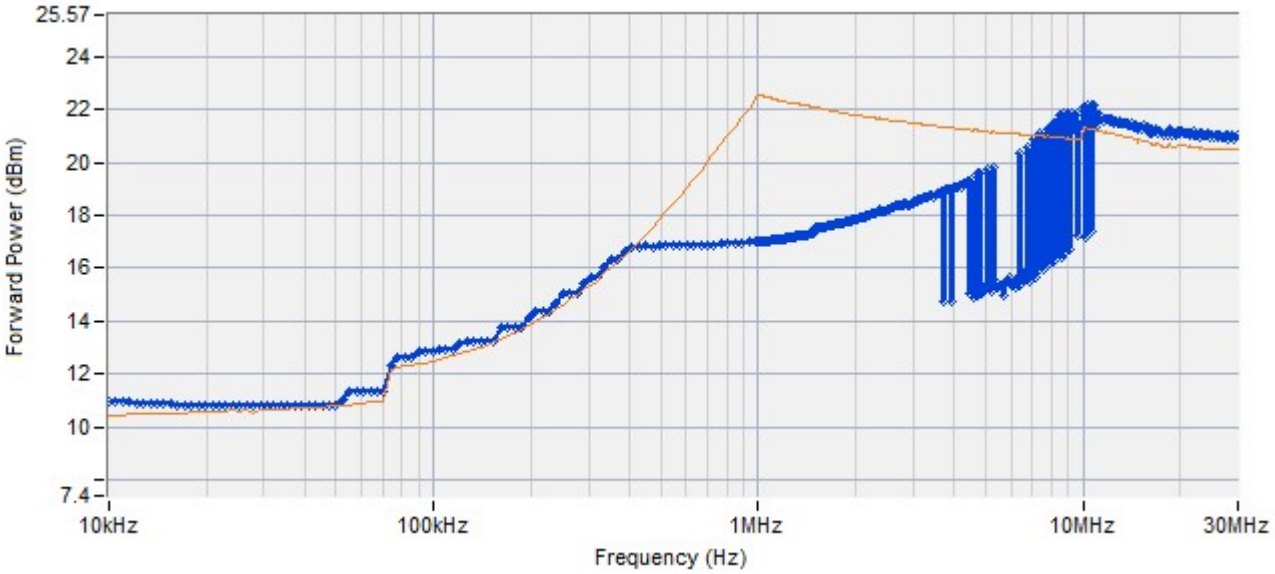
Calibration Test Level / Measured Test Level Graph

J6 Bundle



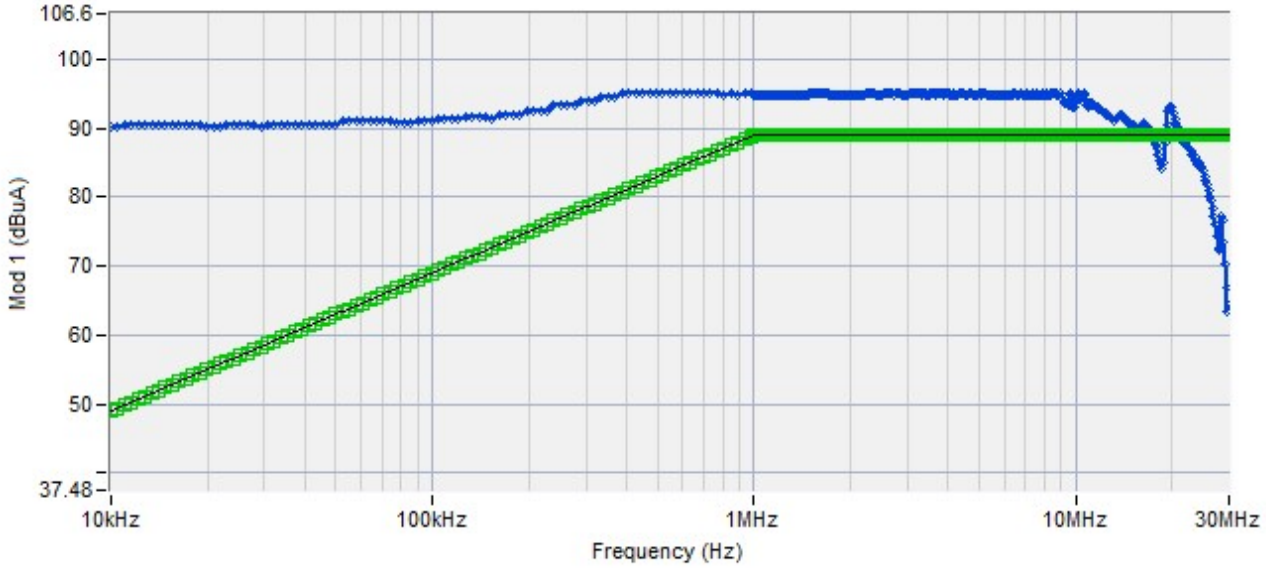
Calibrated Forward Power / Actual Forward Power Graph

J7 Bundle



Calibration Test Level / Measured Test Level Graph

J7 Bundle



5.3.11 CS114 Test Equipment List

Table 5.3-1: CS114 Test Equipment List

Asset No.	Manufacturer	Item	Model	S/N	Cal Cycle (Months)	Cal. Due
WC005801	AR	RF Power Amplifier	C100400AM4	336844	NCR	NCR
WC005872	AR	Signal Generator	SG1200	202308/251	12	9/1/21
WC024100	AR	Power Meter	PM2003	333874	12	4/7/21
WC024101	AR	Power Head	PH2000	332668	12	4/7/21
WC024102	AR	Power Head	PH2000	333551	12	4/7/21
WC006566	AR	Directional Coupler	DC3400A	0336204	36	9/1/23
WC058464	Agilent	PSA Spectrum Analyzer	E4440A	MY446187964	24	9/6/21
WC005806	Fischer	Bulk Current Injection Probe	F-120-6A	110769	NCR	NCR
WC005808	Fischer	Current Monitor Probe	F-35A	149	24	8/15/21
WC005809	Fischer	Current Monitor Probe	F-55	337361	24	8/15/21
WC005802	AR	10dB Attenuator	AF10050	337403	36	5/3/21
WC005803	AR	20dB Attenuator	AF20050	337284	36	5/3/21
WC005804	AR	6dB Attenuator	AF06250	337171	36	5/3/21
WC005805	AR	50 Ohm Terminator	TL50050	337172	NCR	NCR
WC005807	AR	Probe Calibration Fixture	CF00400	337359	NCR	NCR
WC005727	Fischer	Probe Calibration Fixture	FCC-BCIF-1	162	NCR	NCR
WC005647	Solar	LISN	8028-50-TS-24-BNC	0511189	36	6/5/23
WC005290	Solar	LISN	8028-50-TS-24-BNC	075513	36	3/6/22

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

NCR = No Calibration Required; as per NTS QA policy, the equipment does not require calibration as long as the test signal being generated can be verified with other calibrated equipment prior to or during the test.

5.4 Method CS115, Conducted Susceptibility, Bulk Cable Injection, Impulse Excitation

5.4.1 CS115 Purpose

This test procedure is used to verify the ability of the EUT to withstand impulse signals coupled onto EUT associated signal and cabling. Power returns and neutrals need not be tested individually.

5.4.2 CS115 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 subsystems specification, when subjected to a pre-calibrated signal having rise and fall times, pulse width, and amplitude as specified on Figure 5.4-1 at a 30 Hz rate for one minute.

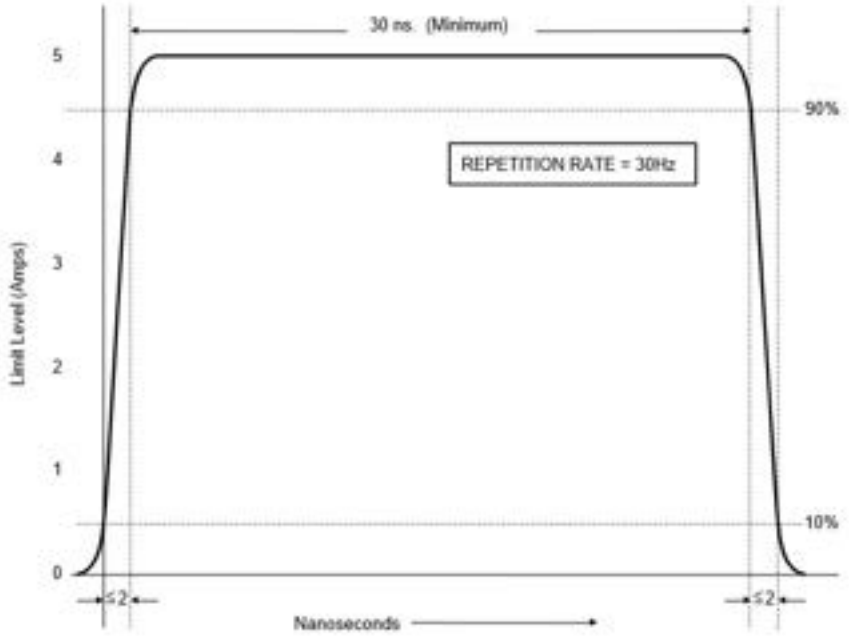


Figure 5.4.1: CS115 Signal Characteristics for all Applications

5.4.3 CS115 Cables Tested

Test Case	Connector	Description	Classification	Calibration Limit
1	J1	Power Bundle, Unshielded	Input Power Lead	5A
2	J1	+28VDC Only, Unshielded	Input Power Lead	5A
3	J5	10GBase-T Bundle, Shielded	Signal Lead	5A
4	J6	1GBase-T Bundle, Shielded	Signal Lead	5A
5	J7	1GBase-T Bundle, Shielded	Signal Lead	5A

5.4.4 CS115 EUT Test Setup

The EUT was setup in accordance with Section 3.2, Figure 3.2-1, 4.3-1 and operated according to Section 3.3

5.4.5 CS115 Calibration

This procedure was performed prior to the start of testing, to ensure that the overall system was operating properly.

1. The test equipment was setup in accordance with Figure 5.4-2.
2. The test equipment was turned on and sufficient time was allowed for stabilization.
3. The injection probe was placed in the 50Ω calibration fixture.
4. One end of the calibration fixture was terminated into a 50Ω load while the other end was connected through an attenuator to the 50Ω oscilloscope input.
5. The injection probe was connected to the output of the pulse generator through the calibrated CS115 Drive Cable, WC058436.
6. The pulse generator was adjusted to produce 5 Amps, and pulse repetition rate of 30 Hz.
7. The pulse produced by the generator was captured with the oscilloscope.
8. The pulse generator's output level setting was recorded at the calibrated level.

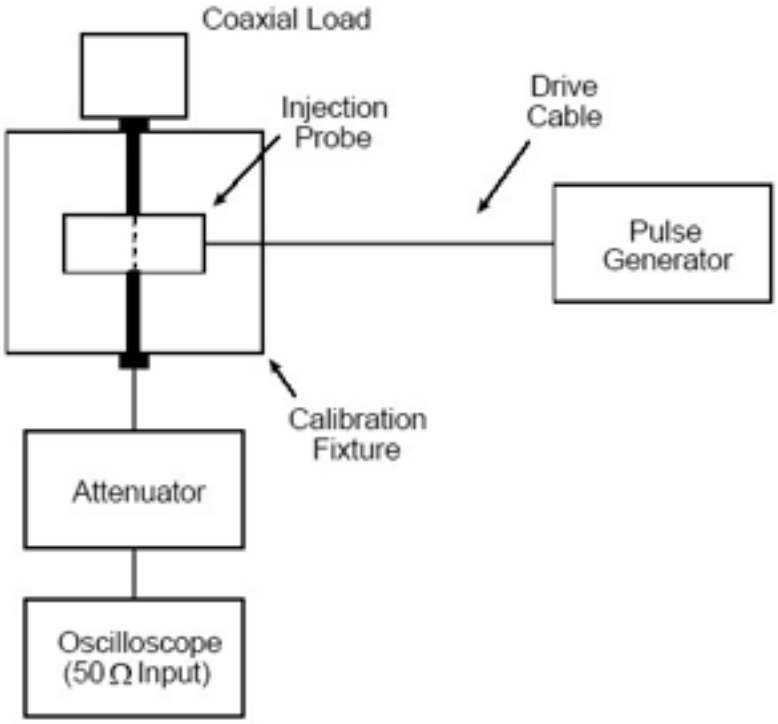


Figure 5.4-2: CS115 Calibration Setup

5.4.6 CS115 Test Procedure

1. The EUT was setup in accordance with Figure 5.4-3.
2. The test equipment was turned on and sufficient time was allowed for stabilization.
3. A current monitor probe was placed around the selected lead under test, 5cm from the connector and connected to the oscilloscope.
4. The injection probe was placed 5cm from the current monitor probe and connected to the pulse generator using the calibrated CS115 Drive Cable.
5. The pulse generator was set to the level recorded during calibration.
6. The test signal was set at a 30Hz rate for 1 minute in each polarity.
7. The system was monitored for susceptibility. If susceptibility was noted, the threshold level was determined.

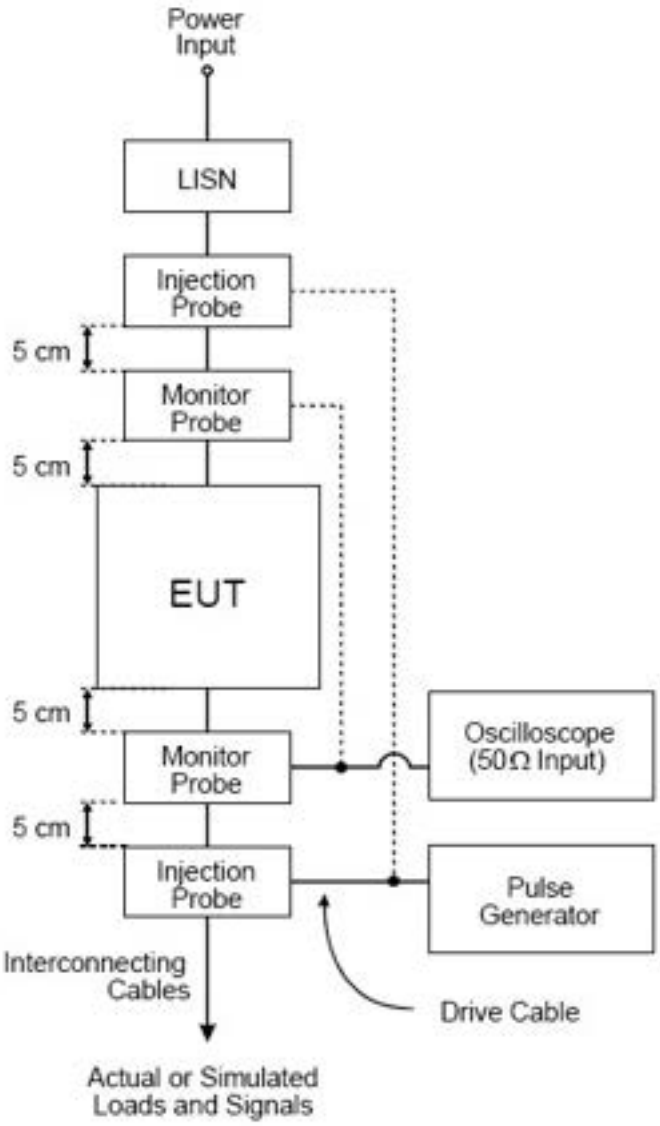


Figure 5.4-3: CS115 Bulk Cable Injection

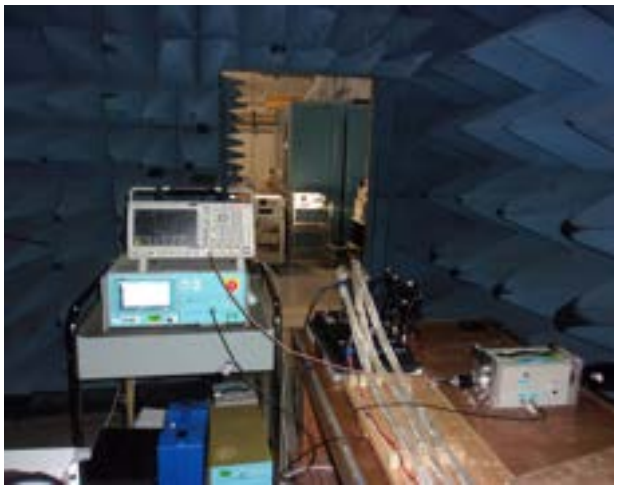
5.4.7 CS115 Test Log Sheet

CS115 LOG SHEET			
Job Number:	PR131850	**Date:**	3/15/21
Standard:	MIL-STD-461G	**Method:**	CS115
Test Personnel:	Tristian	**Procedure:**	None

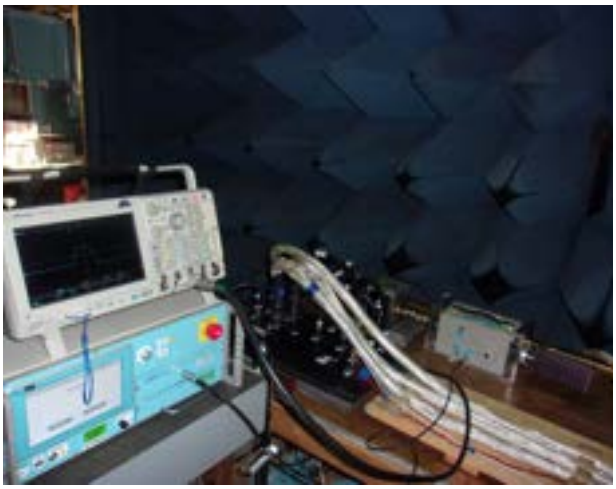
Date	Time	Log Entries	Init.
3/15/21	0800	Setting up CS115 Calibration	TG
↓	1000	Began testing.	↓
↓	1050	Issues with new NTS security implementation. Testing impeded.	↓
↓	1358	Testing complete. PASS. Reviewing data.	↓

Tested By: Tristian Gaines

5.4.8 CS115 Test Photographs



CS115 Generator Calibration

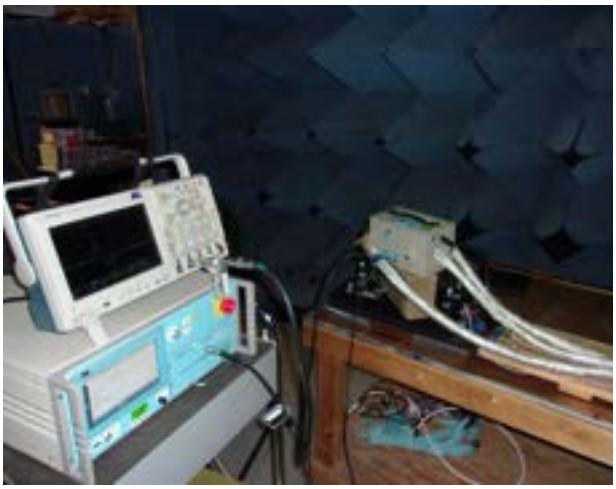


CS115 Monitor Probe Calibration

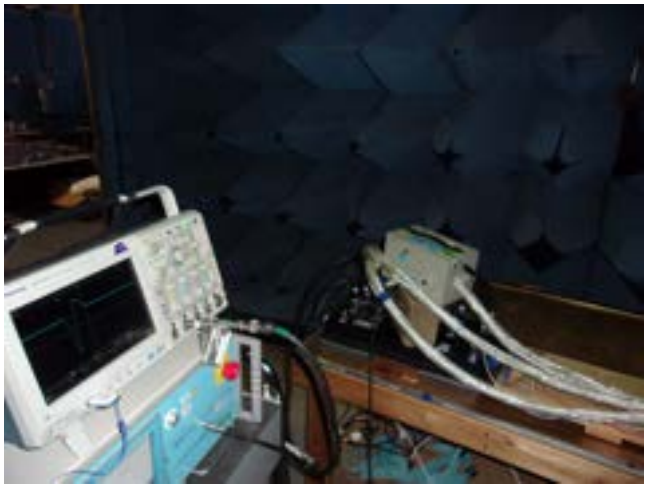
CS115 Power Bundle

CS115 +28 VDC

CS115 J5



CS115 J6



CS115 J7

5.4.9 CS115 Test Data

CS115 Test Data Sheet

Project Number:	PR131850	**Standard:**	MIL-STD-461G
		Procedure:	19CD0002 Rev B
Date:	03/15/2021	**EUT:**	Switch Box
Serial Number	None	**Part Number:**	19CD0002-1
Manufacturer:	Amphenol Aerospace	**Tet Personnel**	Tristian Gains

CS115 Specification Limits:

Signal Type	Specification	Performance Criteria
Bulk Cable Injection, Impulse Excitation	5 Amps, ≥30nS Pulse Width, ≤2nS Rise and Fall Times, 30 Hz, 1 Minute Per. Polarity	The EUT was monitored for any degradation in performance according to customer's procedure; 19CD0002 Rev B.

EUT Test Plan:

Test #	Connector / Lead Under Test	Classification	Calibration Limit
1	Power Bundle	Power Lead	5A
2	+28 VDC	Power Lead	5A
3	J5	Signal Lead	5A
4	J6	Signal Lead	5A
5	J7	Signal Lead	5A

CS115 Generator Calibration Data:

Specification Level (Amps)	Generator Level Setting (Amps)	Measured Level (Amps)	Rise Time (nS)	Fall Time (nS)	Pulse Width (nS)	Results
+5	+5.0	5.36	1.153	1.991	34.39	**PASS**
-5	-5.0	-5.38	1.951	1.091	34.39	**PASS**

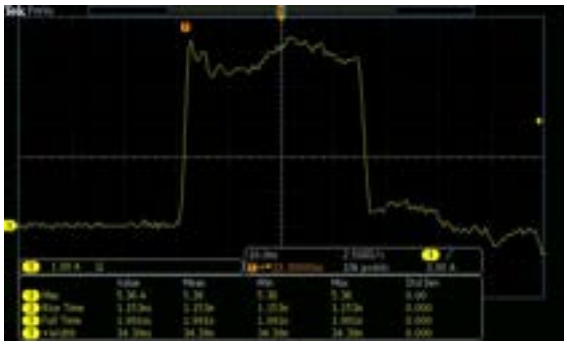
CS115 Monitor Probe Calibration Data:

Specification Level (Amps)	Generator Level Setting (Amps)	Measured Level (Amps)	Results
+5	+5.0	5.17	**PASS**
-5	-5.0	-5.25	**PASS**

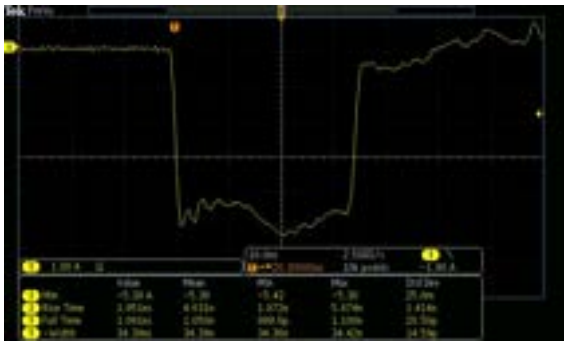
CS115 Test Data:

Test #	Spec. Level (Amps)	Generator Cal. Level (Amps)	Measured Level (Amps)	Rate (Hz)	Duration (sec)	EUT Observa-tions	Results
1	+5	+5.0	2.98	30	60	None	**PASS**
1	-5	-5.0	-3.07	30	60	None	**PASS**
2	+5	+5.0	4.91	30	60	None	**PASS**
2	-5	-5.0	-5.00	30	60	None	**PASS**
3	+5	+5.0	18.2	30	60	None	**PASS**
3	-5	-5.0	-18.4	30	60	None	**PASS**
4	+5	+5.0	16.2	30	60	None	**PASS**
4	-5	-5.0	-16.2	30	60	None	**PASS**
5	+5	+5.0	18.4	30	60	None	**PASS**
5	-5	-5.0	-18.4	30	60	None	**PASS**

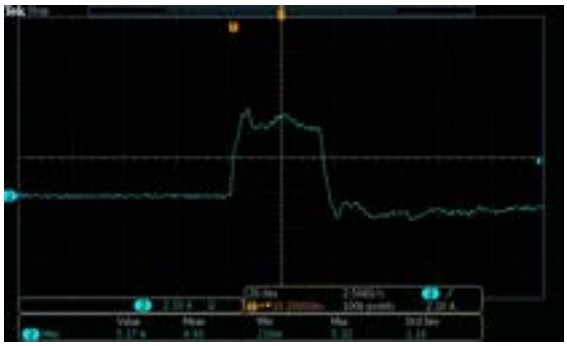
CS115 Scope Captures:



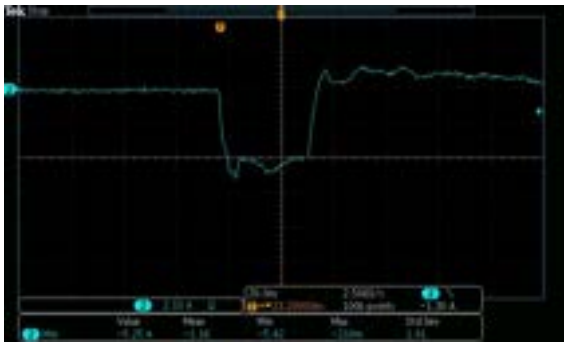
Generator Calibration (+)



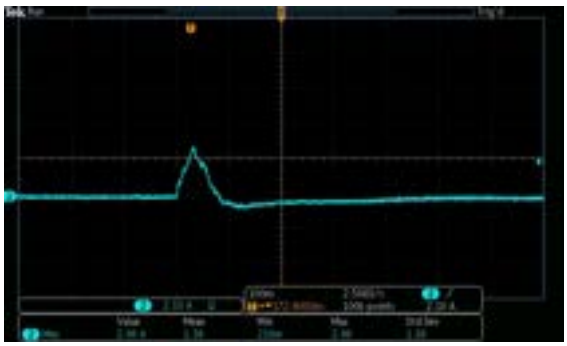
Generator Calibration, (-)



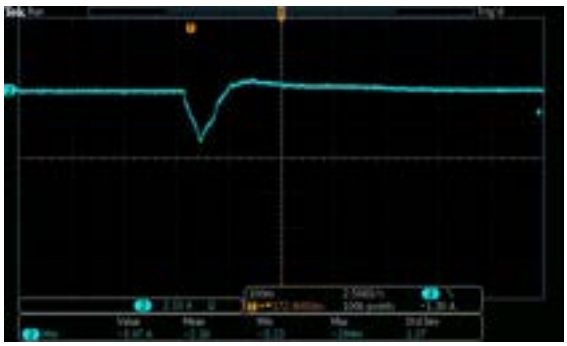
Probe Calibration, (+)



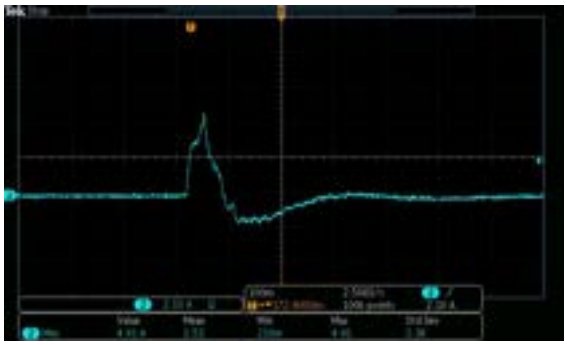
Probe Calibration (-)



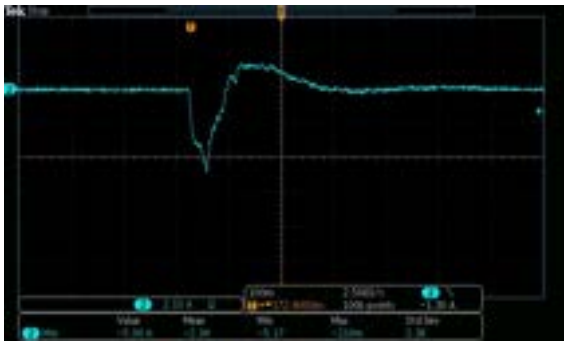
Test 1 (+)



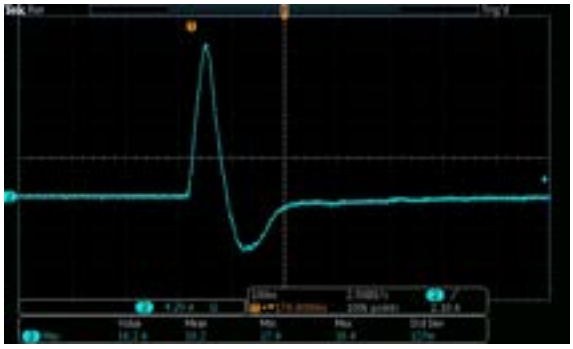
Test 1 (-)



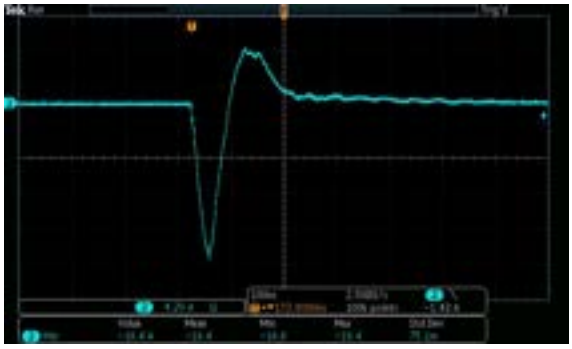
Test 2 (+)



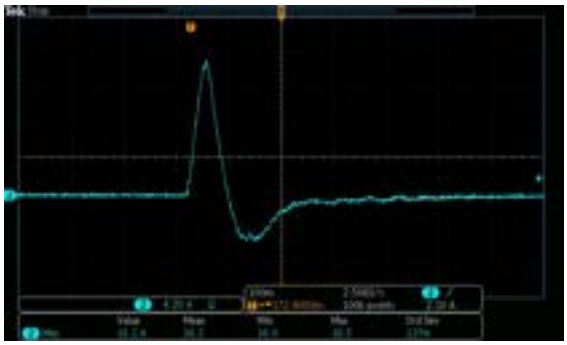
Test 2 (-)



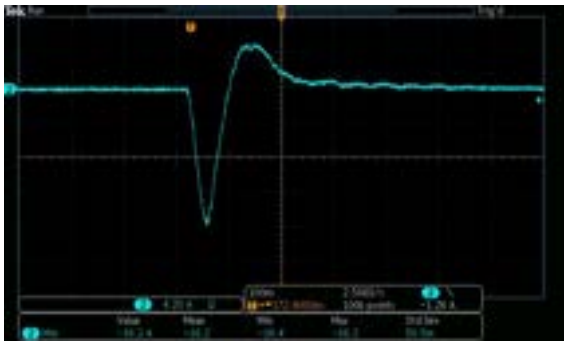
Test 3 (+)



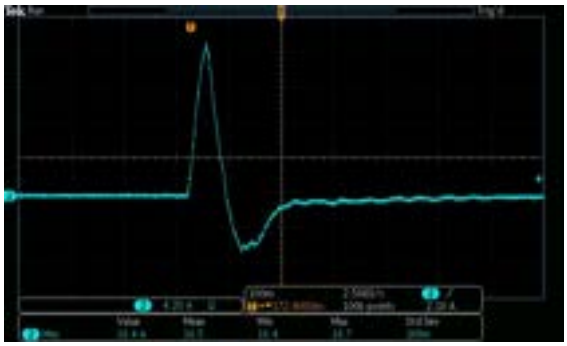
Test 3 (-)



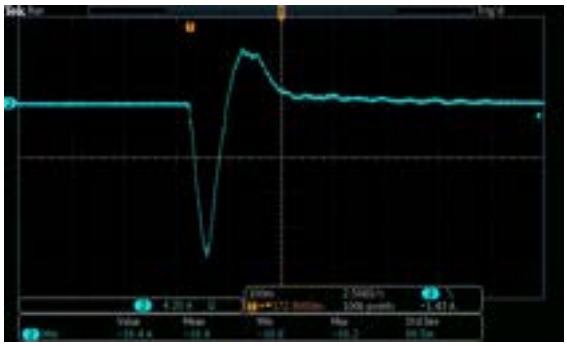
Test 4 (+)



Test 4 (-)



Test 5 (+)



Test 5 (-)

5.4.10 CS115 Test Equipment List

Table 5.4-1: CS115 Test Equipment List

Asset No.	Manufacturer	Item	Model	S/N	Cal. Cycle (Months)	Cal. Due
WC058431	EMC Partner	MIL3000 Test System	107243	MIL3000-1572	NCR	NCR
WC058475	EMC Partner	CS115 Module	MIL3-REC	1590	NCR	NCR
WC058435	EMC Partner	Bulk Current Injection Probe	CN-BT6	CN-BT6-1569	NCR	NCR
WC058445	EMC Partner	Calibration Fixture	VERI-MIL3	N/A	NCR	NCR
None	Tektronix	Digital Oscilloscope	MDO3034	C000410	36	01/25/22
WC024130	Decibel	50 Ohm Load	DB4303B	None	NCR	NCR
WC005254	Tegam	Current Probe	91550-1L	12206	24	02/02/23
WC005727	Fischer	Probe Calibration Fixture	FCC-BCICF-1	162	NCR	NCR
WC005802	AR	10dB Attenuator	AF10050	337403	NCR	NCR
WC005803	AR	20dB Attenuator	AF20050	337284	NCR	NCR
WC058436	EMC Partner	20dB Attenuator	34-20-34	BP8157	NCR	NCR
WC058437	EMC Partner	20dB Attenuator	34-20-34	BP8101	NCR	NCR
WC058439	EMC Partner	20dB Attenuator	JO 1006A0837	None	NCR	NCR
WC058438	EMC Partner	20dB Attenuator	JO 1006A0837	None	NCR	NCR
WC058442	EMC Partner	2 Meter HV Cable	None	None	NCR	NCR

Asset No.	Manufacturer	Item	Model	S/N	Cal. Cycle (Months)	Cal. Due
WC058403	Solar	LISN	8028-50-TS-24-BNC	0511189	36	6/5/23
WC058404	Solar	LISN	8028-50-TS-24-BNC	075513	36	3/6/22

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

NCR = No Calibration Required; as per NTS QA policy, the equipment does not require calibration as long as the test signal being generated can be verified with other calibrated equipment prior to or during the test.

5.5 Method CS116: Conducted Susceptibility, Damped Sinusoidal Transients, Cables and Power Leads, 10 kHz to 100 MHz

5.5.1 CS116 Purpose

This test verifies the ability of the EUT to withstand damped sinusoidal transients coupled onto its cables and power leads. Power returns and neutrals need not be tested individually.

5.5.2 CS116 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 the signal shown in Figure 5.5-1, and having a maximum current as specified in Figure 5.5-2.

The limit is applicable across the entire specified frequency range. As a minimum, compliance shall be demonstrated at the following frequencies: 0.01, 0.1, 1, 10, 30, and 100 MHz. If there are other frequencies known to be critical to the equipment installation, such as platform resonances, compliance shall also be demonstrated at those frequencies. The test signal repetition rate shall be no greater than one pulse per second and no less than one pulse every two seconds. The pulses shall be applied for a period of five minutes.

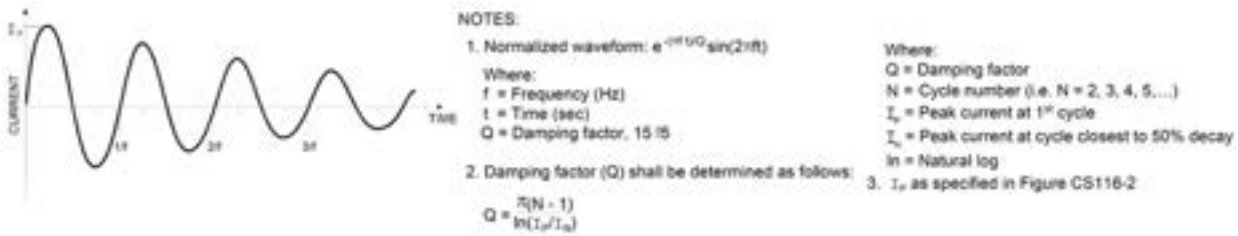


Figure 5.5-1: CS116 Damped Sinusoidal Waveform

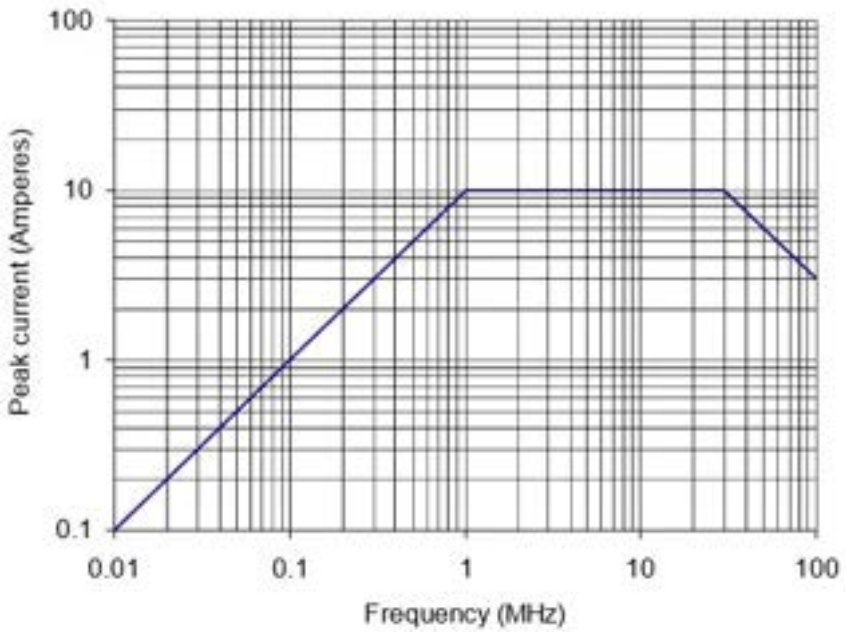


Figure 5.5-2: CS116 Limit for all Applications

5.5.3 CS116 Cables Tested

Test Case	Connector	Description	Classification	Calibration Limit
1	J1	Power Bundle, Unshielded	Input Power Lead	Figure 5.5-2
2	J1	+28VDC Only, Unshielded	Input Power Lead	Figure 5.5-2
3	J5	10GBase-T Bundle, Shielded	Signal Lead	Figure 5.5-2
4	J6	1GBase-T Bundle, Shielded	Signal Lead	Figure 5.5-2
5	J7	1GBase-T Bundle, Shielded	Signal Lead	Figure 5.5-2

5.5.4 CS116 EUT Test Setup

The EUT was setup in accordance with Section 3.2, Figure 3.2-1, 4.3-1 and operated according to Section 3.3.

5.5.5 CS116 Calibration

The test equipment was configured according to Figure 5.5-3.

1. The measurement equipment was turned on and sufficient time was allowed for stabilization.
2. The frequency of the damped sine generator was set to one of the test frequencies defined in Section 5.5.2.
3. The signal from the damped sine generator was adjusted to the level specified in Figure 5.5-2.
4. The damped sine generator settings were recorded.
5. The waveform shall comply with the requirements of Figure 5.5-1.
6. Frequency, amplitude, and damping factor was recorded.
7. Steps 2 - 6 were repeated for each frequency specified in Section 5.5.2.

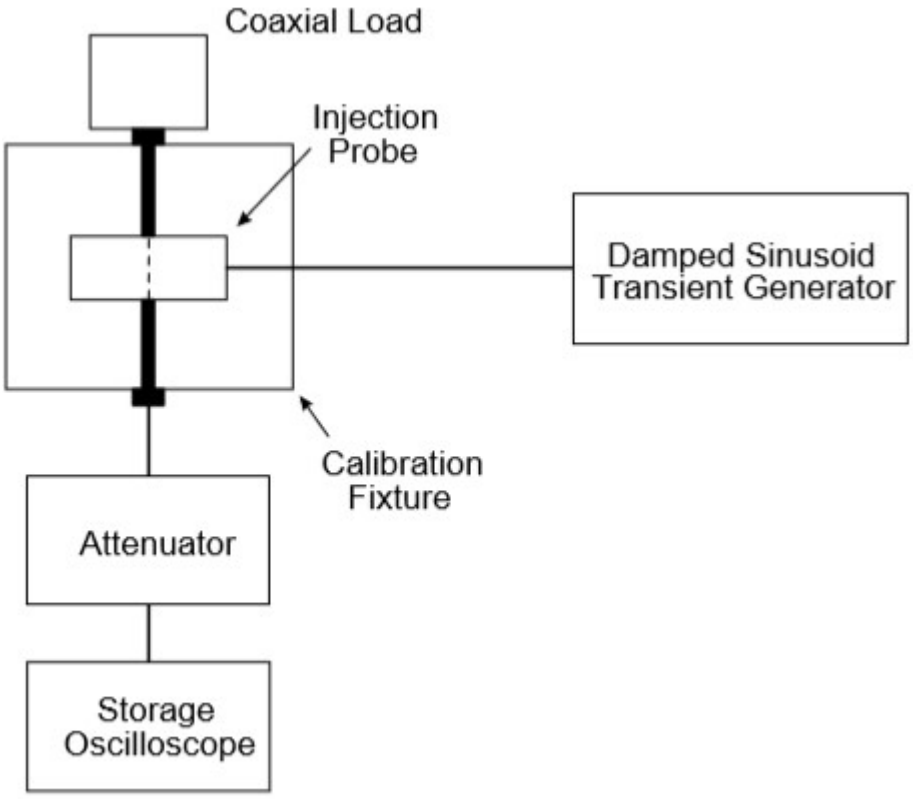


Figure 5.5-3: CS116 Typical Test Setup for Calibration of Test Waveform

5.5.6 CS116 Test Procedure

The test setup was configured for compliance testing in accordance Figure 5.5-4, and as follows:

1. The injection and monitor probe were placed around the cable bundle interfacing with an EUT connector.
2. The monitor probe was placed 5 cm from the EUT connector. If the connector and back shell's overall length exceed 5 cm, the monitor probe was positioned as close to the connector's back shell as possible.
3. The injection probe was positioned 5 cm from the monitor probe.
4. Testing proceeded as follows on all required cables and power leads:
5. EUT and measurement equipment was turned on and sufficient time was allowed for stabilization.
6. The damped sine generator was set to a test frequency.
7. The test signals were applied to each cable or power lead sequentially.
    A. The damped sine wave generator's output level was slowly increased to provide current, without exceeding the pre-calibrated generator output level.
    B. The peak current was recorded.
    C. The EUT was monitored for degradation of performance per Section 4.5 during the 5 minute pulsing period.
8. Step 3 was repeated for each test frequency, as specified in the requirement. If susceptibility is noted, the threshold level was determined.

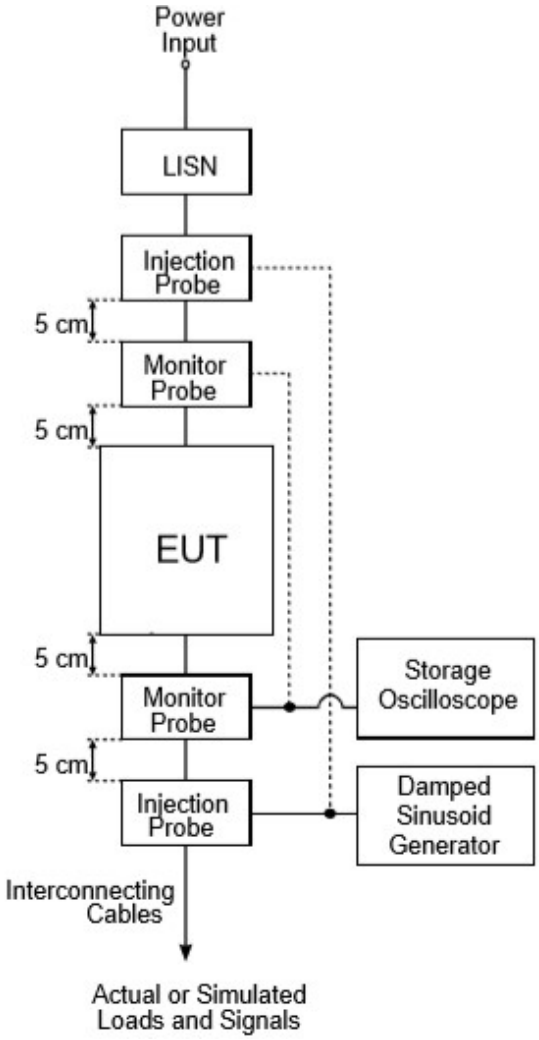


Figure 5.5-4: CS116 Bulk Cable Injection of Damped Sinusoidal Transients Test Setup

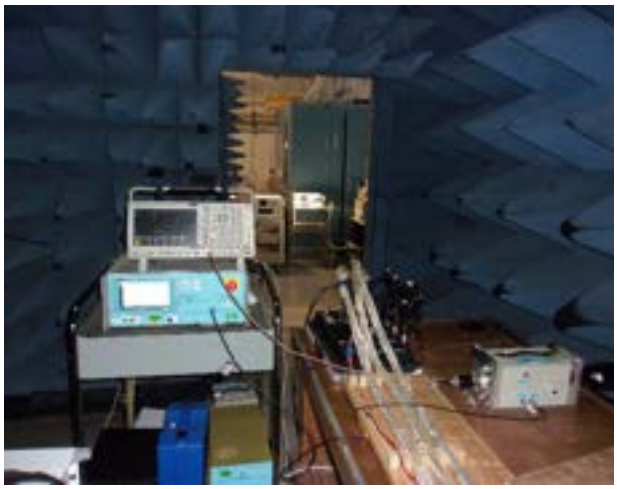
5.5.7 CS116 Test Log Sheet

CS116 LOG SHEET			
Job Number:	PR131850	**Date:**	3/16/21
Standard:	MIL-STD-461G	**Method:**	CS116
Test Personnel:	Tristian Gaines	**Procedure:**	19CD0002 Rev B

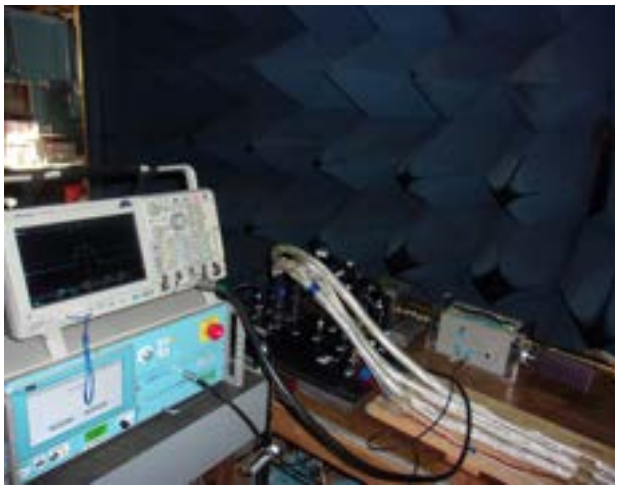
Date	Time	Log Entries	Init.
3/16/21	0830	Began setting up for CS116 Calibration	TG
	1045	Began CS116.	↓
	1515	CS116 PASS	↓

Tested By: Tristian Gaines

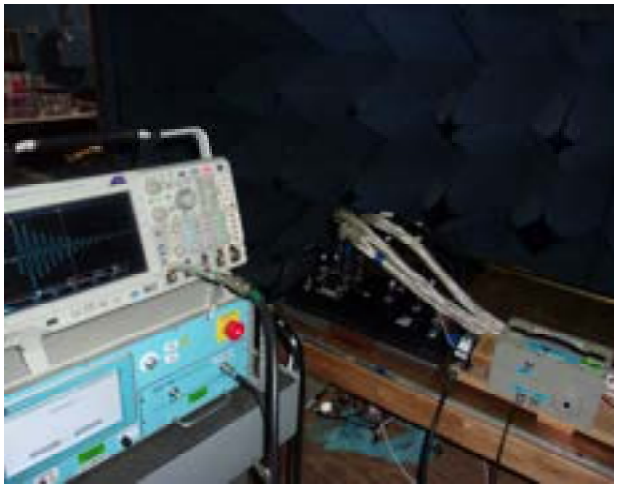
5.5.8 CS116 Test Photographs



CS116 Generator Calibration



CS116 Probe Calibration

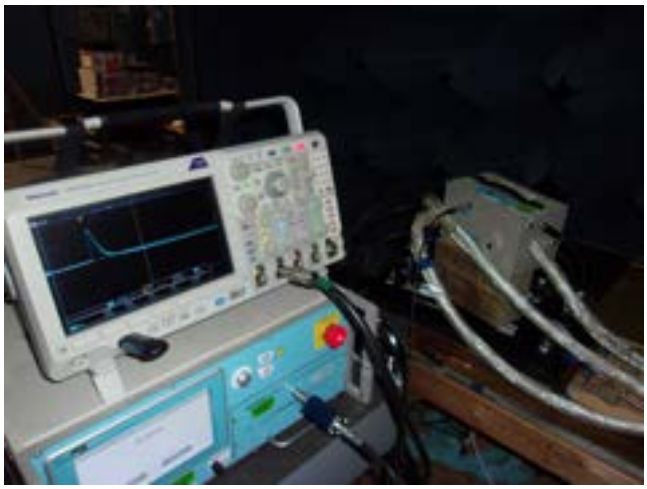


CS116 Power Bundle

CS116 +28 VDC

CS116 J5

CS116 J6



CS116 J7

5.5.9 CS116 Test Data

CS116 Test Data Sheet

Job Number:	PR131850	**Standard:**	MIL-STD-461G
		Procedure:	19CD0002 Rev B
Date:	3/16/2021	**EUT:**	SwitchBox
P/N:	19CD0002-1	**S/N:**	N/A
Test Personnel:	Tristian Gaines	**Manufacturer:**	Amphenol Aerospace

Specification Limits:

Signal Applied	Test Specification	Performance Criteria
Damped Sinusoidal Transient	10KHz - 100MHz 1 Pulse/Sec for 5 minutes	The EUT was monitored for any degradation in performance according to customer's procedure; 19CD0002 Rev B.

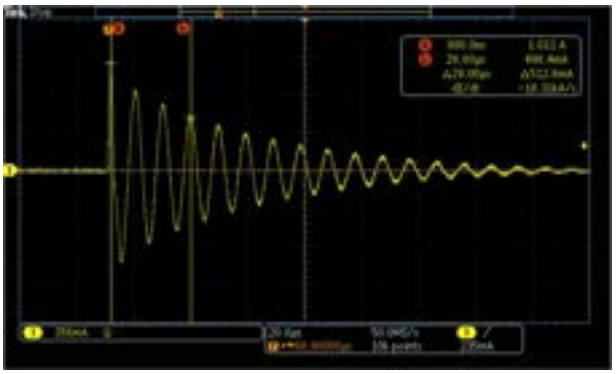
EUT Test Plan:

TEST CASE	CONNECTOR	CLASSIFICATION
1	Power Bundle	Input Power Lead
2	+28VDC Power	Input Power Lead
3	J5	Signal Lead
4	J6	Signal Lead
5	J7	Signal Lead

CS116 Generator Calibration Data			
PR#:	**PR131850**	**Test Date(s):**	**3/16/2021**
Customer:	**Amphenol Aerospace**	**EMITP:**	**19CD0002 Rev B**
Test Method:	**CS116**	**EUT:**	**SwitchBox**
Test Specification:	**MIL-STD-461G**	**PN:**	**19CD0002-1**
Para./Sect.:	**5.14**	**SN:**	**N/A**

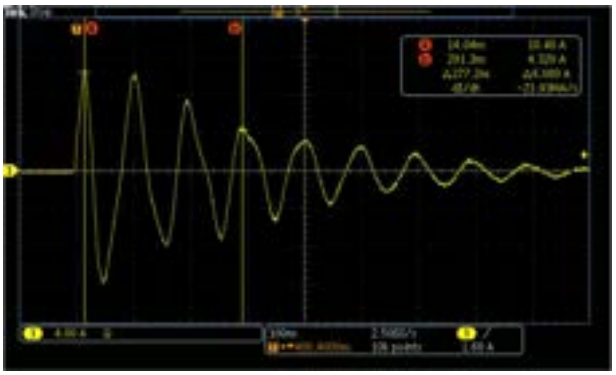
Calibration Frequency (MHz)	Peak Current at 1st Cycle (Peak Amps)	Measure the Cycle Closest to 50% Decay		Damping Factor (Q)	Within Spec?	Generator Setting
		Cycle Number (N)	Scope Reading (Peak Amps)			
0.01	0.106	5	0.0496	16.63	**Yes**	0.1
0.1	1.011	4	0.4984	13.33	**Yes**	1.1
1	10.240	4	5.12	13.60	**Yes**	10.5
10	10.880	4	5.12	12.50	**Yes**	10
30	10.080	4	4.736	12.48	**Yes**	10.8
100	3.04	4	1.56	14.11	**Yes**	3.2
Test Performed By:		**Tristian Gaines**				

CS116 Generator Calibration: 10kHz

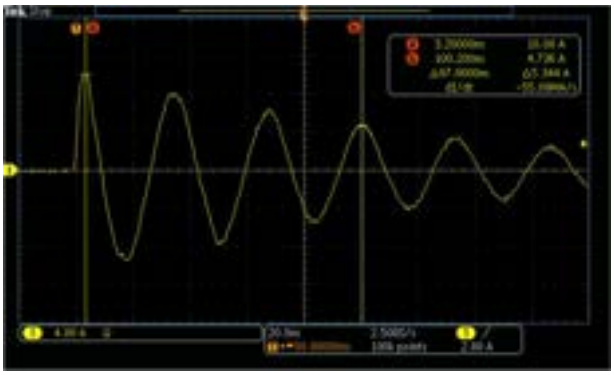


CS116 Generator Calibration: 100kHz

CS116 Generator Calibration: 1MHz



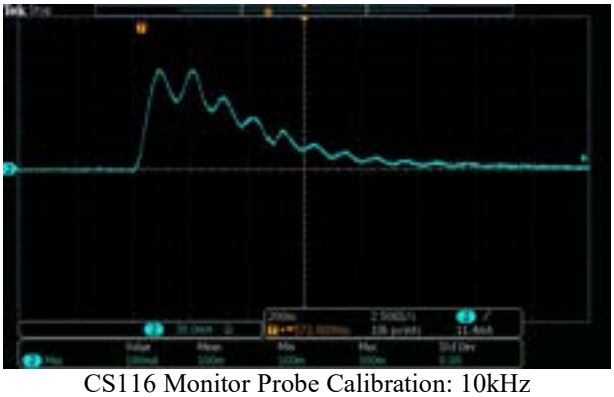
CS116 Generator Calibration: 10MHz



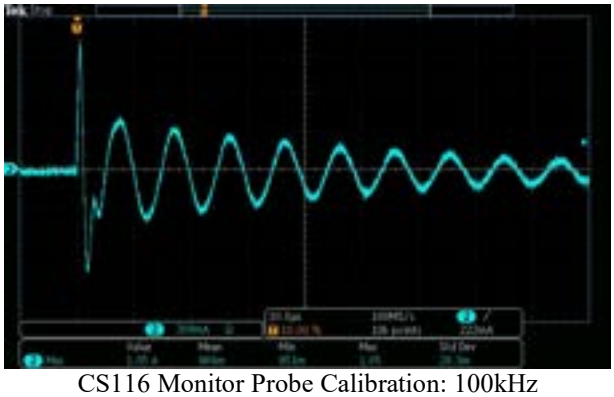
CS116 Generator Calibration: 30MHz

CS116 Generator Calibration: 100MHz

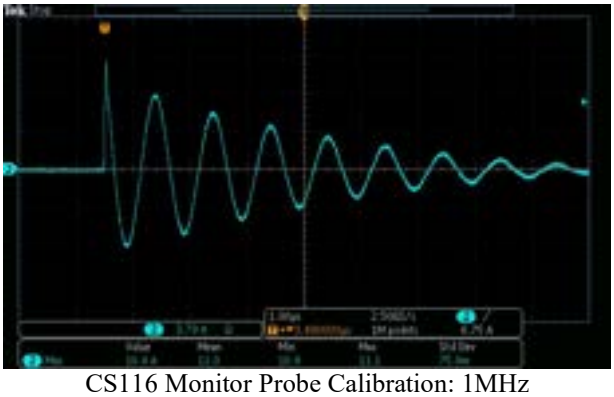
CS116 Monitor Probe Calibration Data							
PR#:	**PR131850**		**Test Date(s):**	**3/16/2021**			
Customer:	**Amphenol Aerospace**		**EMITP:**	**19CD0002 Rev B**			
Test Method:	**CS116**		**EUT:**	**SwitchBox**			
Test Specification:	**MIL-STD-461G**		**PN:**	**19CD0002-1**			
Para./Sect.:	**5.14**		**SN:**	**N/A**			
Calibration Frequency (MHz)	**Spec Level (Amps)**	**Generator Setting (Amps)**	**Generator Calibrated Peak Current at 1st Cycle (Amps)**	**Fischer Monitor Probe Model**	**Monitor Probe Peak Current at 1st Cycle (Amps)**	**Acceptance Level (-0 to +10%) Amps**	**Within Spec?**
0.01	0.1	0.1	0.106	91550-1L	0.10	0.116	**Yes**
0.1	1.0	1.1	1.011	91550-1L	1.050	1.112	**Yes**
1	10.0	10.5	10.240	91550-1L	10.900	11.264	**Yes**
10	10.0	10	10.880	91550-1L	10.300	11.968	**Yes**
30	10.0	10.8	10.080	91550-1L	10.900	11.088	**Yes**
100	3.0	3.2	3.04	91550-1L	3.20	3.347	**Yes**
Test Performed By:			**Tristian Gaines**				



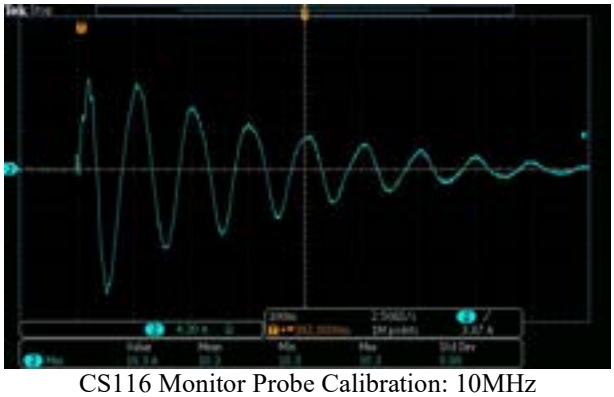
CS116 Monitor Probe Calibration: 10kHz



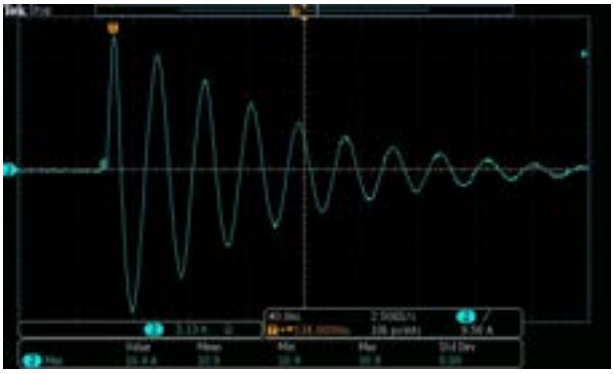
CS116 Monitor Probe Calibration: 100kHz



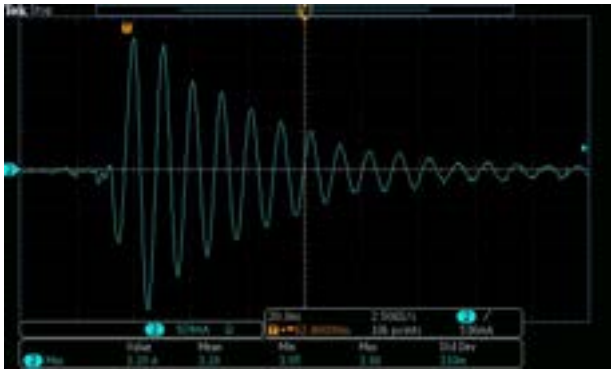
CS116 Monitor Probe Calibration: 1MHz



CS116 Monitor Probe Calibration: 10MHz



CS116 Monitor Probe Calibration: 30MHz



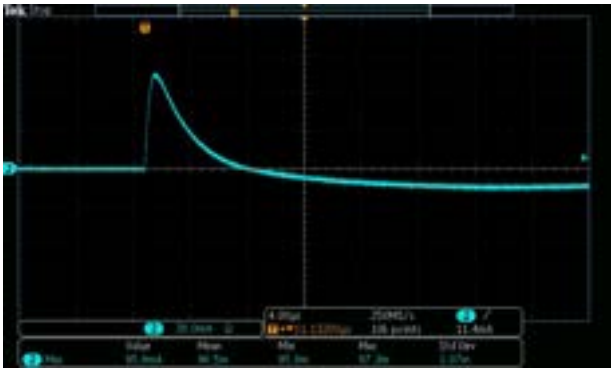
CS116 Monitor Probe Calibration: 100MHz

CS116 Test Data:

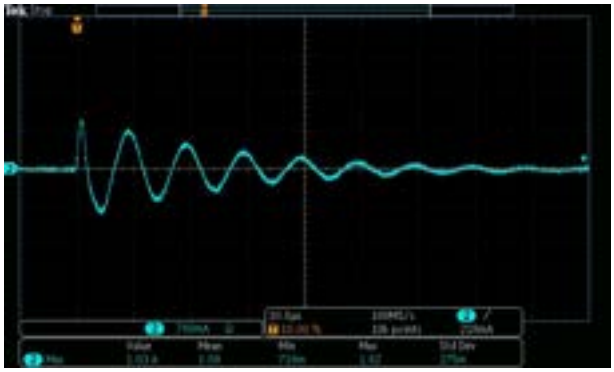
Power Bundle

Freq. (MHz)	Target Level (Amps)	Calibrated Generator Level	Tested Generator Level	Measured Level (Amps)	Test Time (min.)	Pulse Interval (Sec.)	No. of Pulses	Notes	Result
0.01	0.1	0.1	0.1	0.0958	5	1	300	1	**PASS**
0.1	1.0	1.1	0.7	1.03	5	1	300	1	**PASS**
1	10	10.5	3.0	10.0	5	1	300	-	**PASS**
10	10	10	10	6.54	5	1	300	-	**PASS**
30	10	10.8	10.8	6.94	5	1	300	-	**PASS**
100	3.0	3.2	3.2	1.65	5	1	300	-	**PASS**

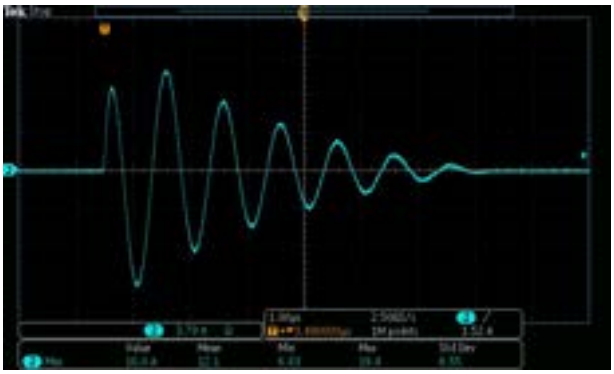
Note : Added 20dB of attenuation to output



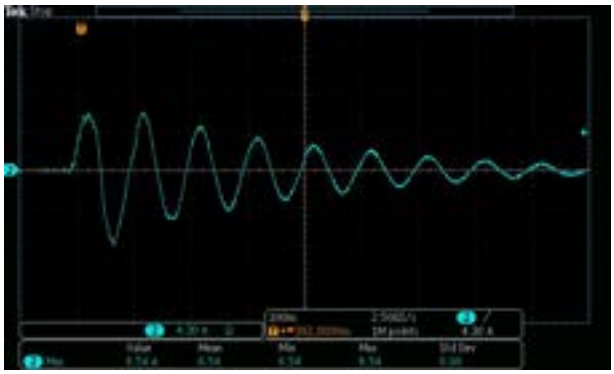
CS116 Test: 10kHz



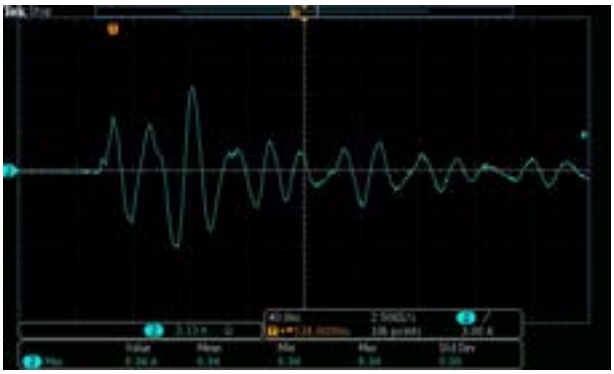
CS116 Test: 100kHz



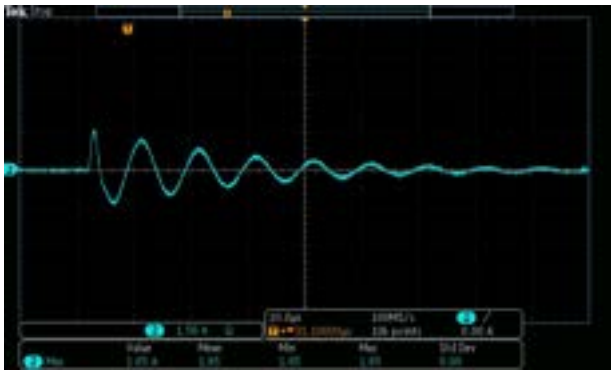
CS116 Test: 1MHz



CS116 Test: 10MHz



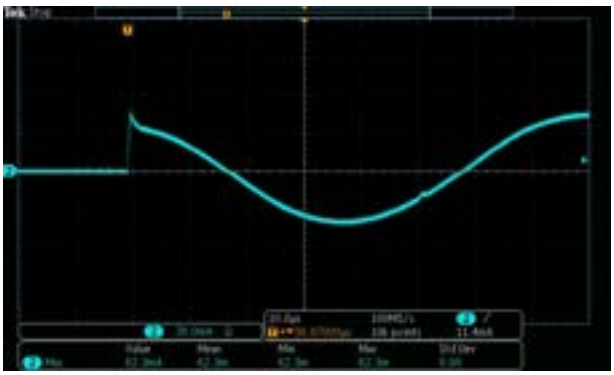
CS116 Test: 30MHz



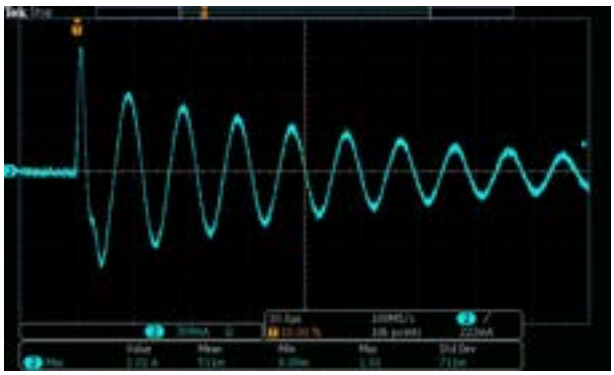
CS116 Test: 100MHz

+28VDC:

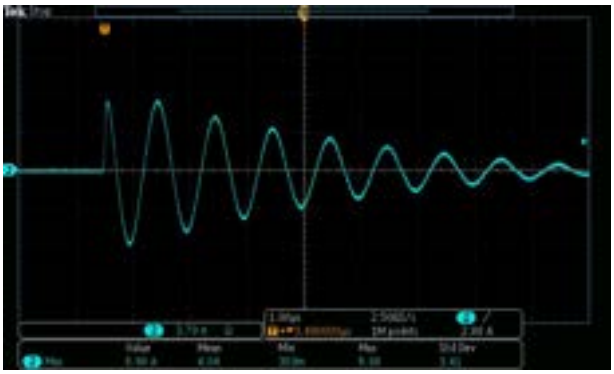
Freq. (MHz)	Target Level (Amps)	Calibrated Generator Level	Tested Generator Level	Measured Level (Amps)	Test Time (min.)	Pulse Interval (Sec.)	# of Pulses	Notes	Result
0.01	0.1	0.1	0.1	0.0623	5	1	300	-	**PASS**
0.1	1.0	1.1	1.1	1.01	5	1	300	-	**PASS**
1	10	10.5	10.5	6.98	5	1	300	-	**PASS**
10	10	10	10	4.30	5	1	300	-	**PASS**
30	10	10.8	10.8	2.43	5	1	300	-	**PASS**
100	3.0	3.2	3.2	0.574	5	1	300	-	**PASS**



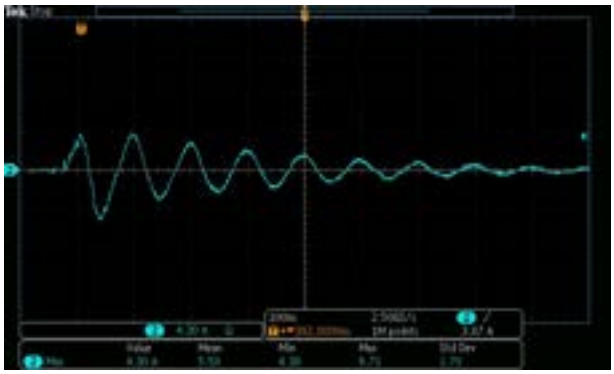
CS116 Test: 10kHz



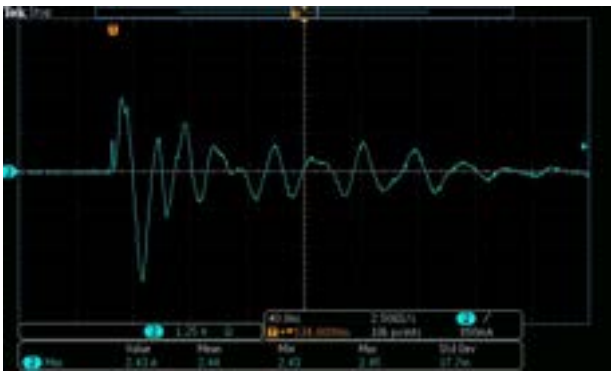
CS116 Test: 100kHz



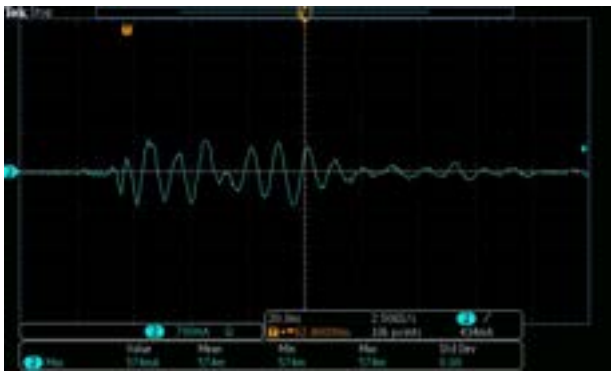
CS116 Test: 1MHz



CS116 Test: 10MHz



CS116 Test: 30MHz

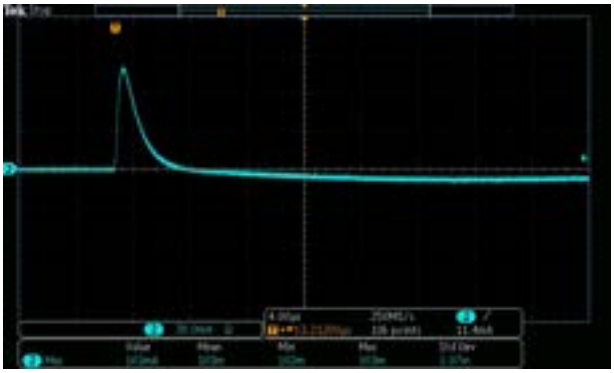


CS116 Test: 100MHz

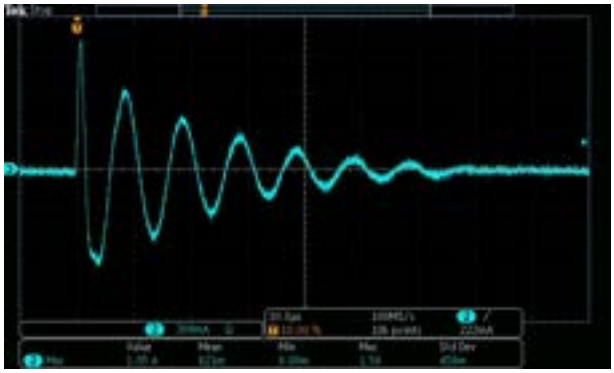
J5:

Freq. (MHz)	Target Level (Amps)	Calibrated Generator Level	Tested Generator Level	Measured Level (Amps)	Test Time (min.)	Pulse Interval (Sec.)	# of Pulses	Notes	Result
0.01	0.1	0.1	0.05	0.103	5	1	300	1	**PASS**
0.1	1.0	1.1	0.35	1.05	5	1	300	1	**PASS**
1	10	10.5	1.3	10.2	5	1	300	-	**PASS**
10	10	10	4.0	10.5	5	1	300	-	**PASS**
30	10	10.8	10.0	10.3	5	1	300	-	**PASS**
100	3.0	3.2	3.2	1.05	5	1	300	-	**PASS**

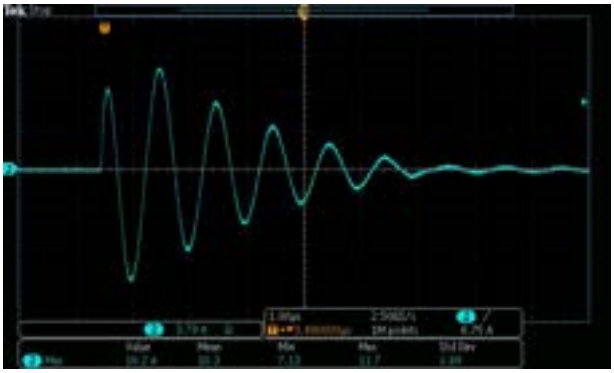
Note: Added 20dB of attenuation to output.



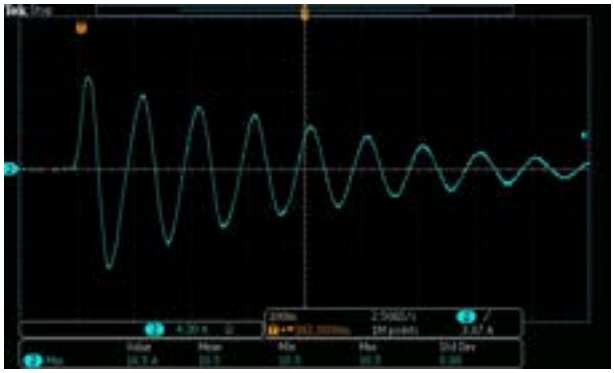
CS116 Test: 10kHz



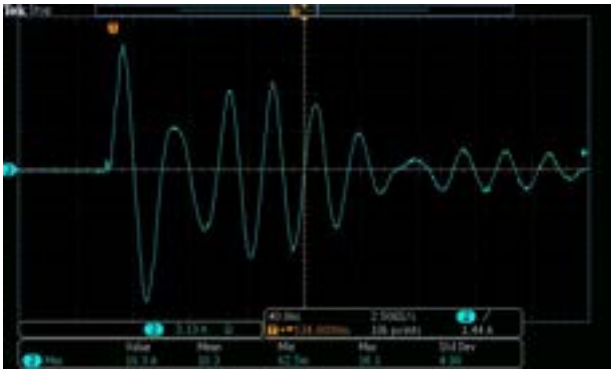
CS116 Test: 100kHz



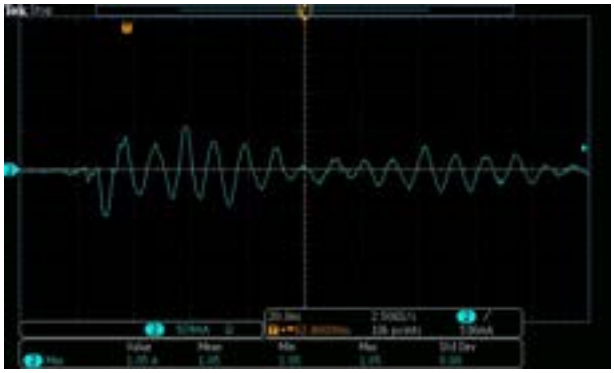
CS116 Test: 1MHz



CS116 Test: 10MHz



CS116 Test: 30MHz

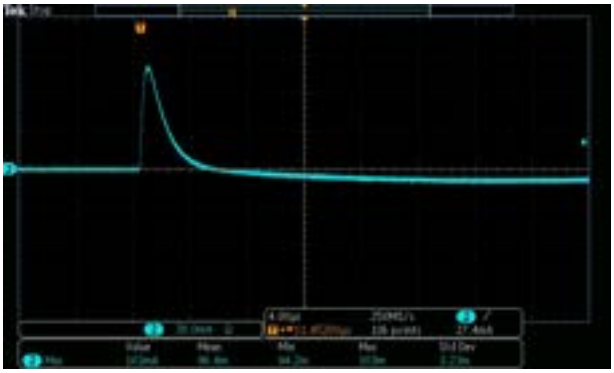


CS116 Test: 100MHz

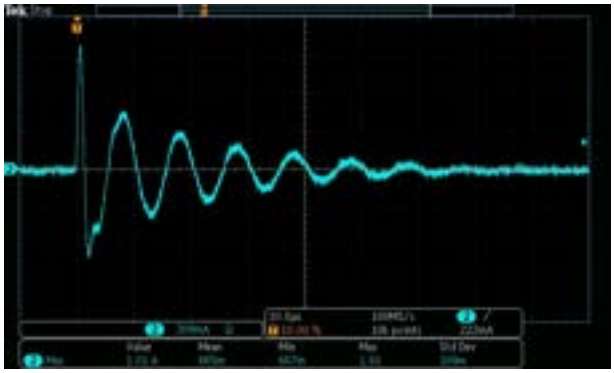
J6:

Freq. (MHz)	Target Level (Amps)	Calibrated Generator Level	Tested Generator Level	Measured Level (Amps)	Test Time (min.)	Pulse Interval (Sec.)	No. of Pulses	Notes	Result
0.01	0.1	0.1	0.055	0.103	5	1	300	1	**PASS**
0.1	1.0	1.1	0.43	1.01	5	1	300	1	**PASS**
1	10	10.5	1.7	10.5	5	1	300	-	**PASS**
10	10	10	3.0	10.1	5	1	300	-	**PASS**
30	10	10.8	10.0	10.1	5	1	300	-	**PASS**
100	3.0	3.2	3.2	1.50	5	1	300	-	**PASS**

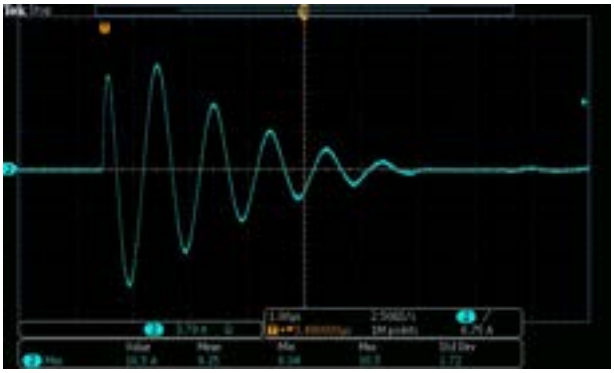
Note : Added 20dB of attenuation to output.



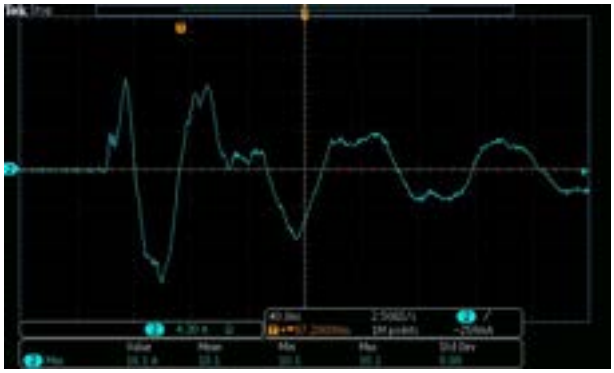
CS116 Test: 10kHz



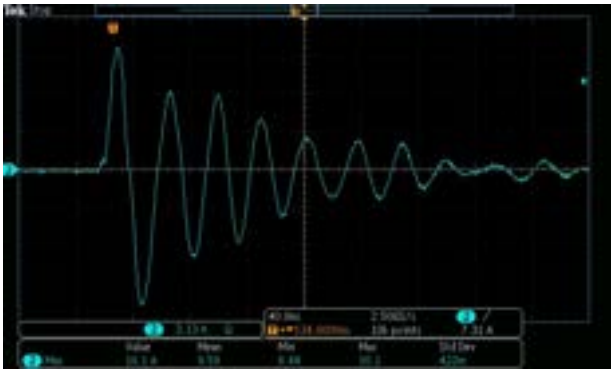
CS116 Test: 100kHz



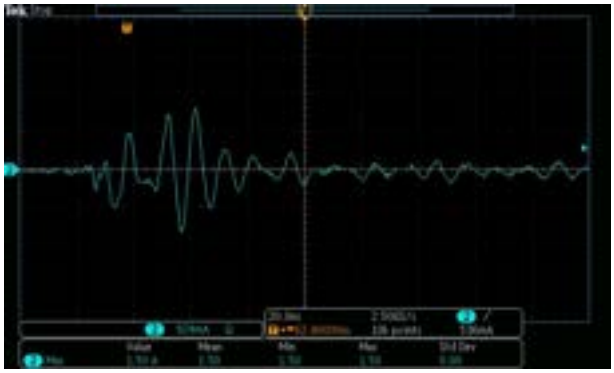
CS116 Test: 1MHz



CS116 Test: 10MHz



CS116 Test: 30MHz

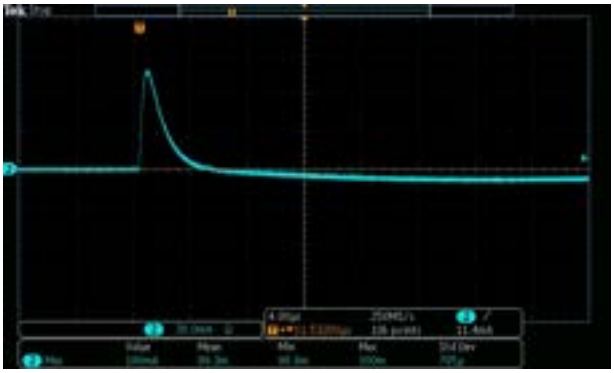


CS116 Test: 100MHz

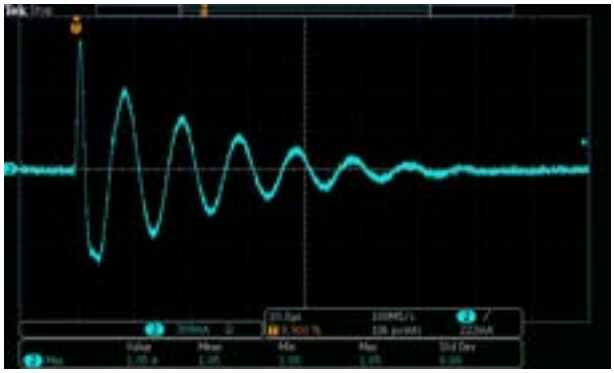
J7:

Freq. (MHz)	Target Level (Amps)	Calibrated Generator Level	Tested Generator Level	Measured Level (Amps)	Test Time (min.)	Pulse Interval (Sec.)	No. of Pulses	Notes	Result
0.01	0.1	0.1	0.05	0.100	5	1	300	-	**PASS**
0.1	1.0	1.1	0.35	1.05	5	1	300	1	**PASS**
1	10	10.5	1.3	10.0	5	1	300	1	**PASS**
10	10	10	4.0	10.1	5	1	300	-	**PASS**
30	10	10.8	10.0	10.1	5	1	300	-	**PASS**
100	3.0	3.2	3.2	2.42	5	1	300	-	**PASS**

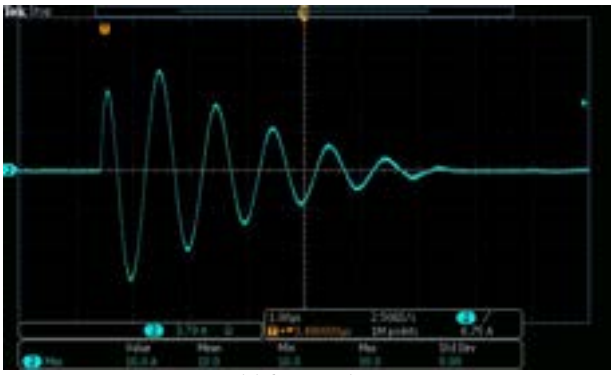
Note: Added 20dB of attenuation to output.



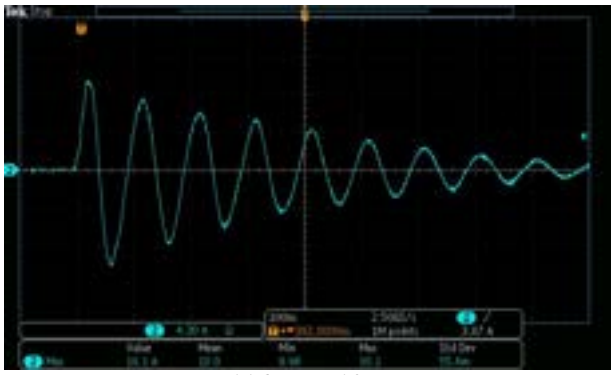
CS116 Test: 10kHz



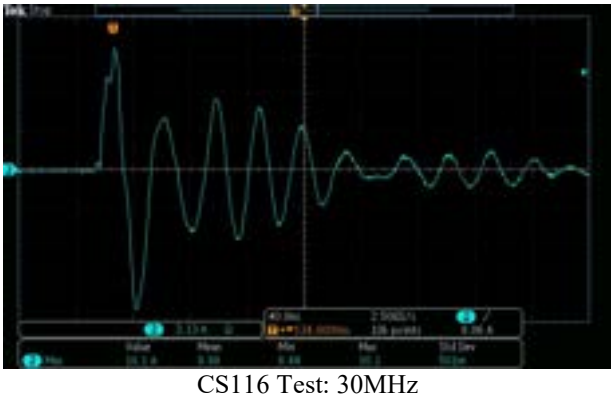
CS116 Test: 100kHz



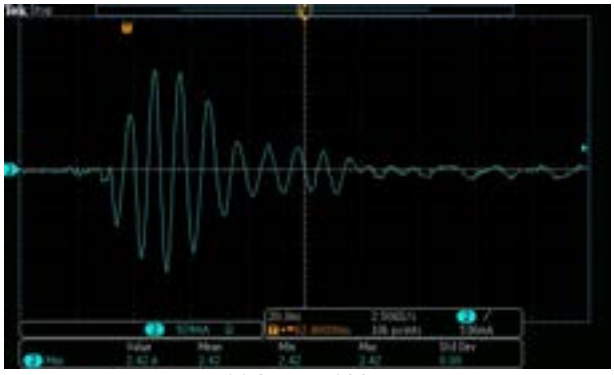
CS116 Test: 1MHz



CS116 Test: 10MHz



CS116 Test: 30MHz



CS116 Test: 100MHz

5.5.10 CS116 Test Equipment List

Table 5.5-1: CS116 Test Equipment List

Asset No.	Manufacturer	Item	Model	S/N	Cal. Cycle (Months)	Cal. Due
WC058431	EMC Partner	MIL3000 Test System	107243	MIL3000-1572	NCR	NCR
WC058432	EMC Partner	10kHz-10MHz CS116 Module	MIL3-10K10M	1566	NCR	NCR
WC058434	EMC Partner	30-100MHz CS116 Module	MIL3-30M 100M	1566	NCR	NCR
WC058435	EMC Partner	Bulk Current Injection Probe	CN-BT6	CN-BT6-1569	NCR	NCR
WC058445	EMC Partner	Calibration Fixture	VERI-MIL3	N/A	NCR	NCR
WC058386	Tektronix	Oscilloscope	MDO3034	C011435	12	01/21/22
WC024130	Decibel	50 Ohm Load	DB4303B	None	NCR	NCR
WC005727	Fischer	Probe Calibration Fixture	FCC-BCICF-1	162	NCR	NCR
WC005254	Tegam	Current Probe	91550-1L	12206	24	02/02/23
WC005802	AR	10dB Attenuator	AF10050	337403	NCR	NCR
WC005803	AR	20dB Attenuator	AF20050	337284	NCR	NCR
WC058436	EMC Partner	20dB Attenuator	34-20-34	BP8157	NCR	NCR
WC058437	EMC Partner	20dB Attenuator	34-20-34	BP8101	NCR	NCR
WC058439	EMC Partner	20dB Attenuator	JO 1006A0837	None	NCR	NCR
WC058438	EMC Partner	20dB Attenuator	JO 1006A0837	None	NCR	NCR

Asset No.	Manufacturer	Item	Model	S/N	Cal. Cycle (Months)	Cal. Due
WC058435	EMC Partner	1 Meter HV Cable	None	None	NCR	NCR
WC058442	EMC Partner	2 Meter HV Cable	None	None	NCR	NCR
WC005290	Solar	LISN	8028-50-TS-24-BNC	0511189	36	6/5/23
WC005647	Solar	LISN	8028-50-TS-24-BNC	075513	36	3/6/22

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

NCR = No Calibration Required; as per NTS QA policy, the equipment does not require calibration as long as the test signal being generated can be verified with other calibrated equipment prior to or during the test.

5.6 Method CS118, Conducted Susceptibility, Personnel Borne Electrostatic Discharge

This requirement is applicable to electrical, electronic, and electromechanical subsystems and equipment that have a man-machine interface.

5.6.1 CS118 Purpose

This test procedure is used to verify the ability of the EUT to withstand personnel borne electrostatic discharge (ESD) in a powered-up configuration.

5.6.2 CS118 Limit

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 the values shown in Table 5.6-1, while discharging from a 150pF capacitor through a 330 ohm resistor with a circuit inductance not to exceed 5µH. Contact discharge at 8kV is required for conductive surfaces. Air discharge is only required where contact discharge cannot be applied.

Table 5.6-1: ESD test levels.

Level	Test Voltage (±kV)	Method
1	2	Air
2	4	Air
3	8	Contact/Air
4	15	Air

5.6.3 CS118 Calibration

The calibration procedure was as follows:

1. Install the 150 pF/330 ohm ESD network and contact discharge tip onto the ESD generator.
2. Turn on the measurement equipment and allow sufficient time for stabilization.
   ESD generator voltage verification:
3. Configure the test equipment in accordance with Figure 5.6-1. Setup the electrostatic voltmeter to monitor voltage from ESD generator.
4. Set the ESD generator output voltage to 2 kV.
5. Verify the output of the ESD generator is within +/-10% of the desired level.
6. Repeat step (3) for each ESD test level in Table 5.6-1.

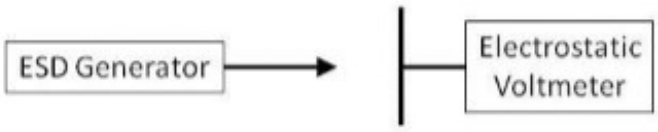


Figure 5.6-1: Measurement System Check Setup, Tip Voltage Verification

Discharge current verification:

1. Setup the ESD current target, attenuator, and oscilloscope as shown on Figure 5.6-2.
2. Configure the ESD simulator to use the contact discharge mode.
3. Place the tip of the ESD simulator in contact with the target, discharge it, and measure the waveform using the oscilloscope. Verify that each parameter in Table 5.6-2 and on Figure 5.6-3 is met.

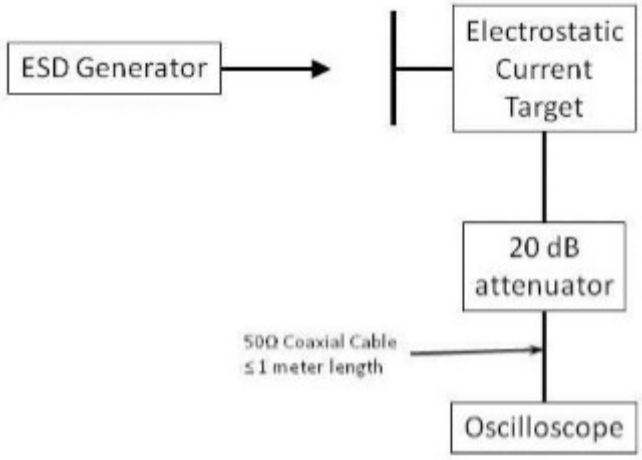


Figure 5.6-2: Measurement System Check Setup, Discharge Current Verification

Table 5.6-2: ESD Simulator Contact Discharge Current Verification Values

Displayed Voltage (±KV)	First Peak Current, ±15% (A)	Rise Time, ±30% (nS)	Current @ 30nS, ±30% (A)	Current @ 60nS, ±30% (A)
8	30	0.6≤ tr ≤1.0	16	8

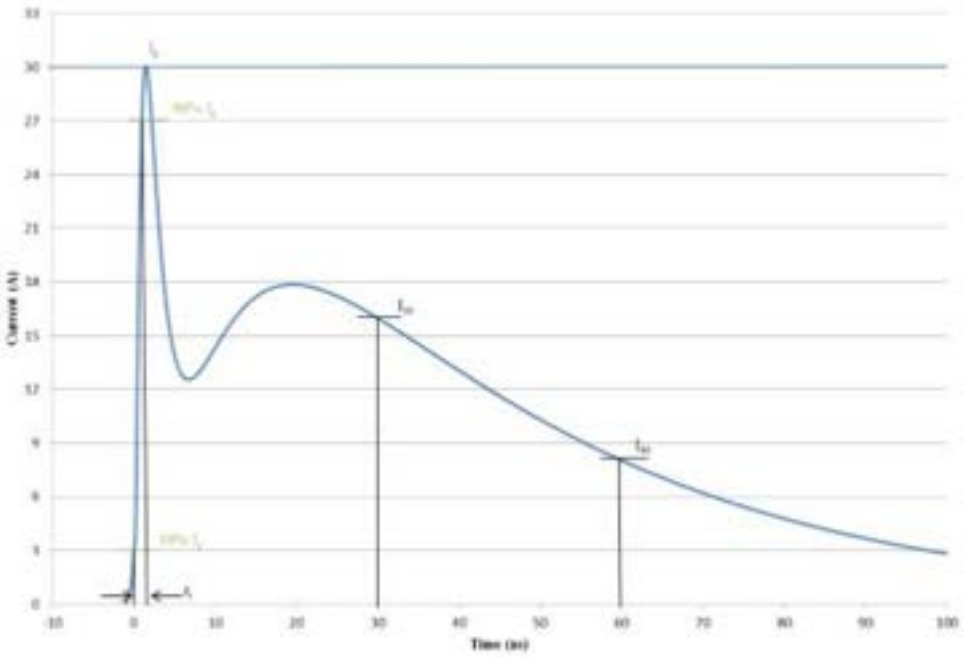


Figure 5.6-3: Ideal Contact Discharge Current Waveform at 8 kV

5.6.4 CS118 EUT Test Setup

The EUT was setup in accordance with Section 3.2, Figure 3.2-1, 4.3-2 and operated according to Section 3.3.

5.6.5 CS118 Test Point Selection

The electrostatic discharges shall be applied to those points and surfaces of the EUT which are accessible to the operator/installer during normal use. Test points to be considered shall include the following locations as applicable: any conductive or non-conductive points in the control or keyboard area and any other point of human contact such as switches, knobs, buttons, indicators LEDs, seams slots, grilles, connector shells and other accessible areas. As a minimum, each face shall be included.

5.6.6 CS118 Test Procedure

1. Maintaining ESD Generator's ground strap length used in the calibration procedure, ground the ESD Generator to the EUT's chassis ground point in the test setup.
2. The EUT shall be powered and operating during this test in a manner sufficient to verify its operation.
3. Set the ESD generator's tip voltage to the selected test level as specified in Table 5.6-1.
4. Apply five (5) positive discharges and five (5) negative discharges to each EUT test point.
5. Apply the discharges using the following techniques:
   - For contact discharges, place the ESD simulator tip directly on the test point and discharge the ESD simulator.
   - For air discharges, start at a distance from the test point where no discharge occurs as the ESD simulator is energized, and slowly move the tip perpendicular towards the test point at a rate no faster than 0.3 m per second (0.3m/sec) until the discharge occurs or the tip physically contacts the test point. In between discharges, remove the residual charge from the test point by briefly grounding the test point through a one 1MΩ (±10%) resistor, use of ionizer, or by waiting for the charge to dissipate. NOTE: Not all voltage levels may result in a discharge onto a dielectric surface. If the test point withstands the voltage, the requirement is met for that test point.
6. Monitor the EUT for degradation of performance during testing.
7. Repeat for each applicable level in 5.6-1.

5.6.7 CS118 Test Log Sheet

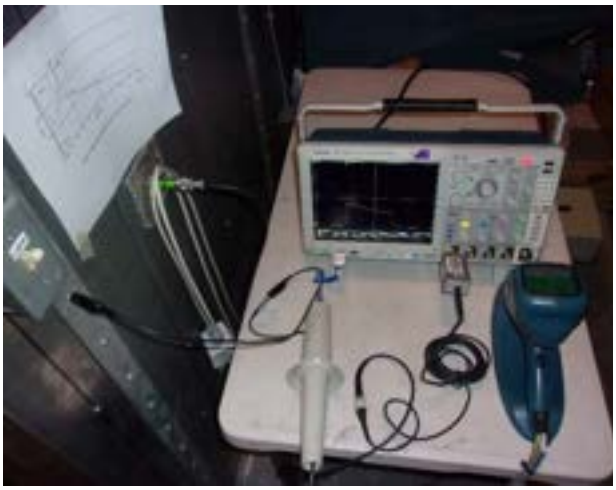
EMI LOG SHEET			
Job Number:	PR131850	**Date:**	3/18/21
Standard:	MIL-STD-461G	**Method:**	Electrostatic Discharge / CS118
Test Personnel:	Tristian Gaines	**Procedure:**	19CD0002 Rev B

Date	Time	Log Entries	Init.
3/18/21	1130	Began ESD setup.	TG
↓	1350	ESD Cal complete.	↓
↓	1520	ESD PASS	↓

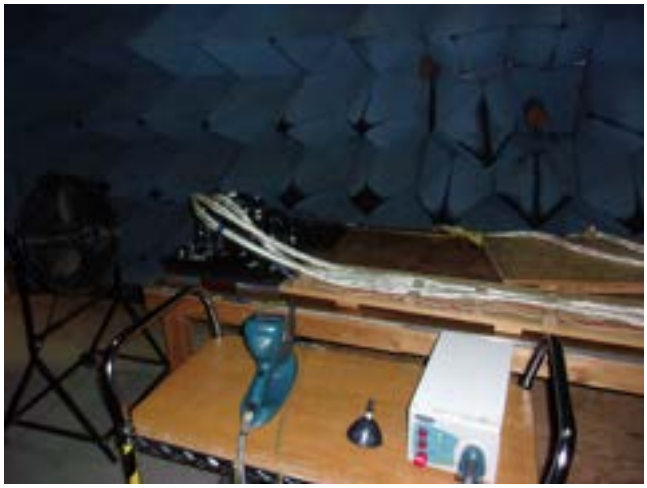
Tested By: Tristian Gaines

5.6.8 CS118 Test Photographs

CS118 Verification, Current



CS118 Verification, Voltage



CS118 Test Setup

5.6.9 CS118 Test Data

Electrostatic Discharge Data Sheet

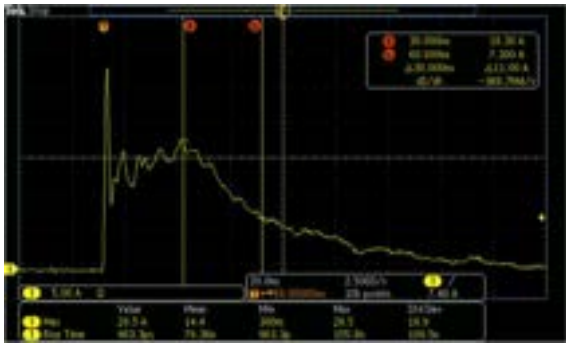
Job Number:	PR131850	**Standard:**	MIL-STD-461G
		Procedure:	19CD0002 Rev B
Date:	3/18/2021	**EUT:**	SwitchBox
P/N:	19CD0002-1	**S/N:**	N/A
Test Personnel:	Tristian Gaines	**Manufacturer:**	Amphenol Aerospace

Specification Limits:

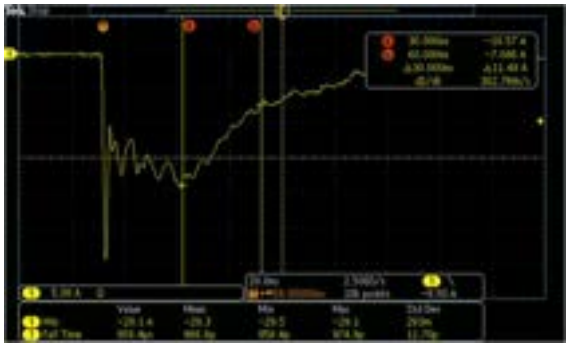
Signal Applied	Specification Limits	Required Performance Criteria
Electrostatic Discharge	±8kV Contact Discharge and ±15kV Air Discharge, 5 pulses/polarity @ 1 second intervals	The EUT shall continue to operate according to Test Procedure 19CD0002 Rev B

ESD Generator Verification:

Specification:	1st Peak Current = 30.0A ±15% (25.5 – 34.5A)	Rise/Fall Time = 0.6 – 1.0nS	Current @ 30nS = 16A ±30% (11.2– 20.8A)	Current @ 30nS = 8A ±30% (5.6 – 10.4A)
Measured (+8kV):	28.5	0.963	18.30	7.3
Measured (-8kV):	-29.1	0.958	-18.57	-7.09



ESD Generator Current: +8A



ESD Generator Current: -8A

Specification:	2kV, ±10% (1.8 – 2.2)	4kV, ±10% (3.6 – 4.4)	8kV, ±10% (7.2 - 8.8kV)	15kV, ±10% (13.5 - 16.5kV)
Measured (+):	1.95	3.80	7.52	14.1
Measured (-):	-1.98	-3.80	-7.48	-14.0

Electrostatic Discharge Test Results:

Discharge Point	Discharge Level (±kV)	# of Dis-charges	Discharge Type	Observation	Result (Pass/Fail)
Circuit Breaker	8	10	Contact	None	PASS
LEDs x10	8	100	Contact	None	PASS
Top Cover - Center	8	10	Contact	None	PASS
Side Panel Right - Center	8	10	Contact	None	PASS
Side Panel Left - Center	8	10	Contact	None	PASS
Rear Panel - Center	8	10	Contact	None	PASS
Front Panel - Center	8	10	Contact	None	PASS
ETI	8	10	Contact	None	PASS
J1	8	10	Contact	None	PASS
J2A	8	10	Contact	None	PASS
J2B	8	10	Contact	None	PASS
J3A	8	10	Contact	None	PASS
J3B	8	10	Contact	None	PASS
J4A	8	10	Contact	None	PASS
J4B	8	10	Contact	None	PASS
J5	8	10	Contact	None	PASS
J6	8	10	Contact	None	PASS
J7	8	10	Contact	None	PASS
J8	8	10	Contact	None	PASS
J9	8	10	Contact	None	PASS

Discharge Point	Discharge Level (±kV)	# of Dis-charges	Discharge Type	Observation	Result (Pass/Fail)
Top Cover - Center	2,4,8 & 15	40	Air	None	PASS
Side Panel Right - Center	2,4,8 & 15	40	Air	None	PASS
Side Panel Left - Center	2,4,8 & 15	40	Air	None	PASS
Rear Panel - Center	2,4,8 & 15	40	Air	None	PASS
Front Panel - Center	2,4,8 & 15	40	Air	None	PASS
ETI	2,4,8 & 15	40	Air	Note 1	PASS

Note 1: Partial discharges at 2kV.

5.6.10 CS118 Test Equipment List

Table 5.6-3: CS118 Test Equipment List

Asset No.	Manufacturer	Item	Model	S/N	Cal. Cycle (Months)	Cal. Due
WC005581	Schaffner	ESD Generator	NSG438	867	11/25/20	11/25/21
WC005755	Keytek	ESD Target	CTC-1	8802118	NCR	NCR
WC005511	NTS	Chamber (EMI, Semi-Anechoic)	n/a	AR3	NCR	NCR
WC040767	Tektronix	High Voltage Probe	P6015A	B056614	12	8/13/21
WC058386	Tektronix	Oscilloscope	MDO3034	C011435	12	01/21/22
WC005290	Solar	LISN	8028-50-TS-24-BNC	0511189	36	6/5/23
WC005647	Solar	LISN	8028-50-TS-24-BNC	075513	36	3/6/22

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

NCR = No Calibration Required; as per NTS QA policy, the equipment does not require calibration as long as the test signal being generated can be verified with other calibrated equipment prior to or during the test.

5.7 Method RE102, Radiated Emissions, Electric Field, 2 MHz to 18 GHz

5.7.1 RE102 Purpose

This test verifies that electric field emissions from the EUT shall not exceed the limit specified in Figure 5.7-1 over the frequency range of 2 MHz to 18 GHz.

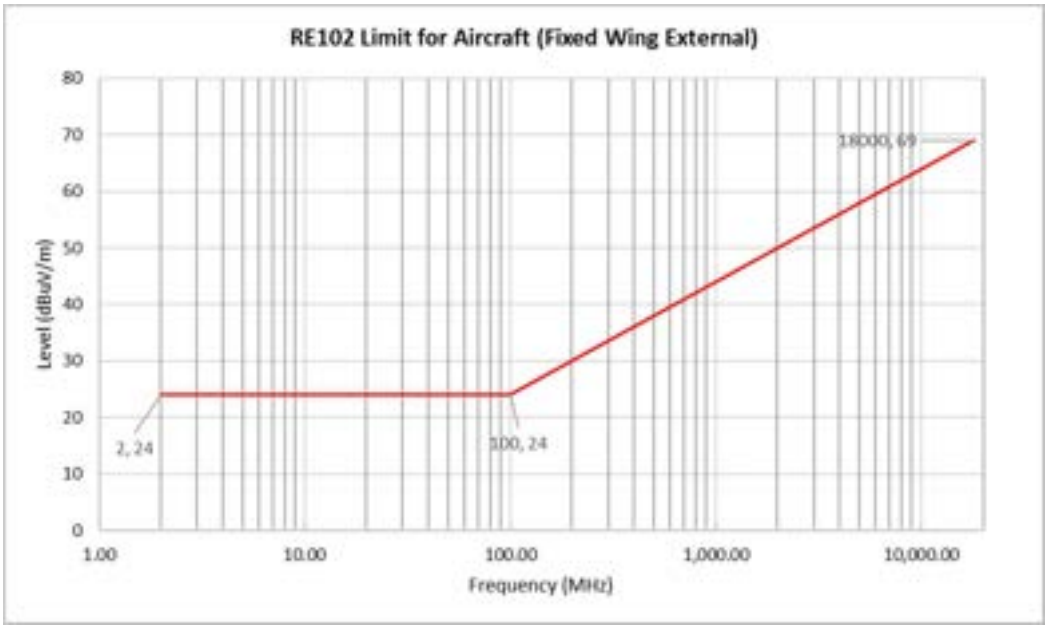


Figure 5.7-1: RE102 Limit for Aircraft (Fixed wing external)

5.7.2 RE102 Measurement System Check

1. The measurement system check was performed prior to testing.
2. The measurement system was set up per Figure 5.7-2.
3. The evaluation was performed on the overall measurement system from each antenna to the data output device at the highest measurement frequency of the antenna. For the active rod antenna, the evaluation was performed at the lowest frequency of test, at a mid-band frequency, and at its highest measurement frequency.
4. A signal generator was connected to the coax in place of the measurement antenna. For the active rod antenna, the active rod antenna calibration fixture was used in place of the rod element and the signal was injected across a 10 pF capacitor in the calibration fixture.
5. The signal generator was adjusted to produce a signal 6 dB below the RE102 limit shown in Figure 5.7-1.
6. The signal detected at the measurement receiver was within ±3 dB of the calibrated level.
7. This process was repeated for each frequency defined as follows:
   - Active rod Antenna: 10.5 kHz (only for testing performed between 10 kHz and 2 MHz), 2.1MHz, 12MHz, 29.5 MHz
   - Biconical Antenna: 197 MHz
   - Large Double Ridged Horn Antenna: 990 MHz
   - Small Double Ridged Horn Antenna: 17.5 GHz
8. Correction factors were added to the raw data collected from the measurement receiver. For example:
   Cable loss (dB) + Antenna factors (dB) + Raw Data (dBµV) - Preamplifier gain (dB) = corrected data (dBµV/m)
9. Using the measurement path of Figure 5.7-2, the following evaluation for each antenna was performed to demonstrate that there is electrical continuity through the antenna:
   A. A signal was radiated using an antenna or stub radiator at the highest measurement frequency of each antenna.
   B. The measurement receiver was tuned to the frequency of the applied signal and the received signal of appropriate amplitude was present.

   Note: This evaluation is intended to provide a coarse indication that the antenna is functioning properly. There is no requirement to accurately measure the signal level.
10. An ambient measurement was performed across the frequency range with the EUT power leads disconnected. All auxiliary support equipment was powered during this measurement.

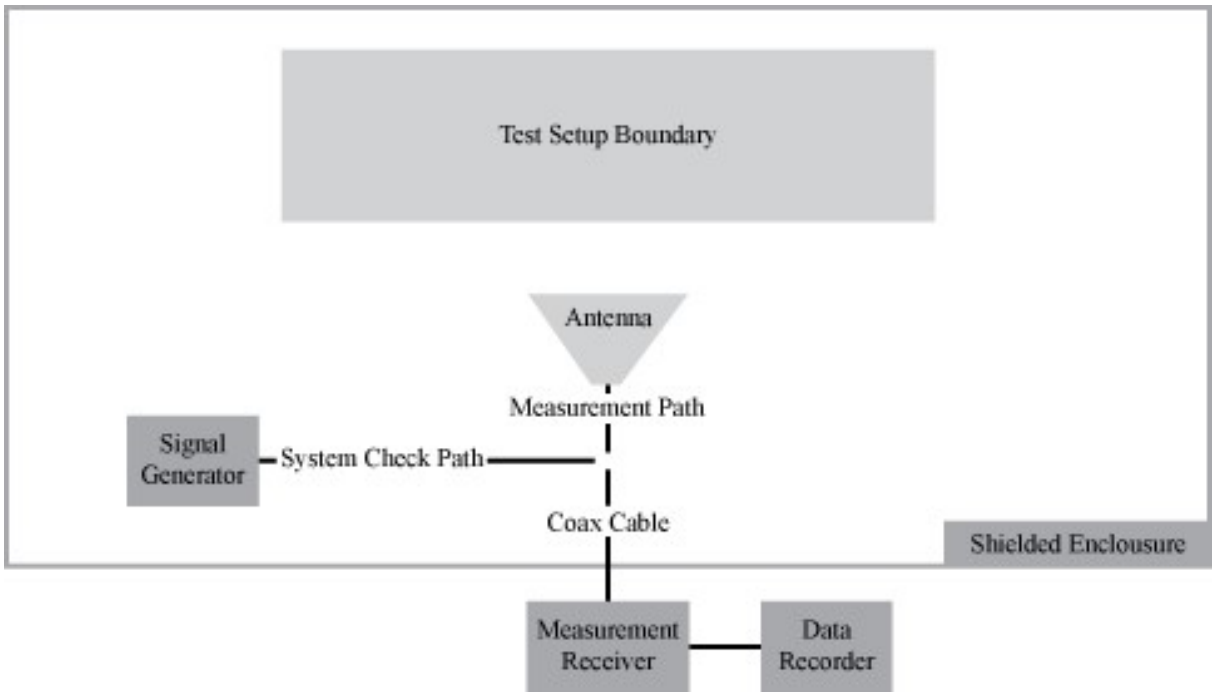


Figure 5.7-2: RE102 Measurement System Check Setup

5.7.3 RE102 EUT Test Setup

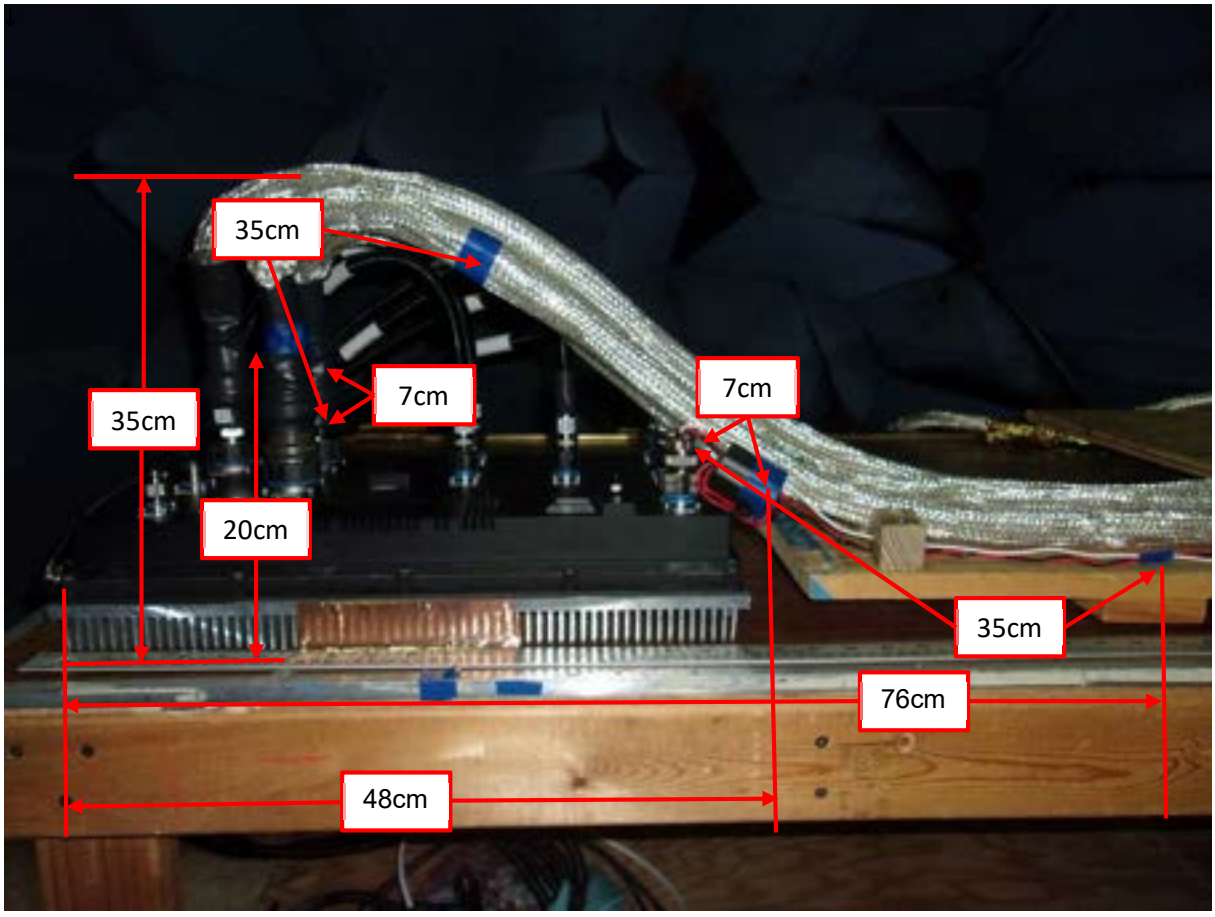
The EUT was setup in accordance with Section 3.2, Figure 3.2-1, 4.3-1 and operated according to Section 3.3

5.7.4 RE102 Antenna Positioning

1. Measure the EUT and test setup boundary for use in positioning of antennas.
2. Position antennas 1 meter from the front edge of the test setup boundary for all setups.
3. Position antennas other than the 104 cm rod antenna 120 cm above the floor ground plane.
4. Ensure that no part of any antenna is closer than 1 meter from the walls and 0.5 meter from the ceiling of the shielded enclosure.
5. The number of required antenna positions depends on the size of the EUT and test setup boundary and the number of enclosures included in the setup.
6. For testing below 200 MHz, use the following criteria to determine the individual antenna positions.
   a. For setups with the side edges of the boundary 3 meters or less, one position is required and the antenna was centered with respect to the side edges of the boundary.
   b. For setups with the side edges of the boundary greater than 3 meters, use multiple antenna positions at spacings as shown in MIL-STD-461G RE102-7. Determine the number of antenna positions (N) by dividing the edge-to-edge boundary distance (in meters) by 3 and rounding up to an integer.
7. For testing from 200 MHz up to 1 GHz, place the antenna in a sufficient number of positions such that the entire width of each EUT enclosure and the first 35 cm of cables and leads interfacing with the EUT enclosure are within the 3 dB beamwidth of the antenna.
8. For testing at 1 GHz and above, place the antenna in a sufficient number of positions such that the entire width of each EUT enclosure and the first 7 cm of cables and leads interfacing with the EUT enclosure are within the 3 dB beamwidth of the antenna.

Table 5.7-1: RE102 Antenna Position Calculations, 2 MHz to 18 GHz

RE102 Antenna Positions Calculations							
Antenna	**3dB Beam-width (°)**	**Antenna Coverage (cm) [a]**	**Test Width (cm) [b]**	**Lateral Antenna Positions**	**EUT Height (cm) [b]**	**Antenna Height Po-sitions**	**Total Re-quired Po-sitions**
ETS 3301C	N/A	300.00	278	1	35	1	1
ETS 3109	N/A	300.00	278	1	35	1	1
ETS 3106	28	49.87	76	2	35	1	2
EMCO 3115	8	13.99	48	4	20	2	8
Note a: Antenna Coverage = 2*(TAN(Θ)*a) Where Θ = 1/2 (antenna 3dB beamwidth) a = antenna distance from setup boundary			**Note b**: Includes all applicable EUT cabling (first 35cm below 1GHz or first 7cm above 1GHz). See figure below.				



5.7.5 RE102 Test Procedure

1. The frequency range from 2 MHz – 18 GHz was scanned using the bandwidths and minimum measurement times specified in Table 4.4-1.
2. Above 30 MHz, both horizontal and vertical polarities were tested. Below 30 MHz, only vertical polarity measurements were performed.
3. Correction factors were added to the raw data collected from the measurement receiver. For example:
4. Cable loss (dB) + Antenna factors (dB) + Raw Data (dBµV) - Preamplifier gain (dB) = corrected data (dBµV/m)
5. The following types of antennas, listed in Table 5.7-2, were used to scan the entire frequency range:

Table 5.7-2: Antenna Type and Applicable Frequencies

Antenna	Characteristics	Frequency Range
41" Active Rod	104 cm with impedance matching network, preamplifier, and square counterpoise measuring 60cm on a side	10 kHz - 30 MHz
Biconical	137 cm tip to tip	30 MHz - 200 MHz
Double Ridged Horn	69 x 94.5 cm opening	200 MHz - 1 GHz
Double Ridged Horn	24.2 x 13.6 cm opening	1 GHz - 18 GHz

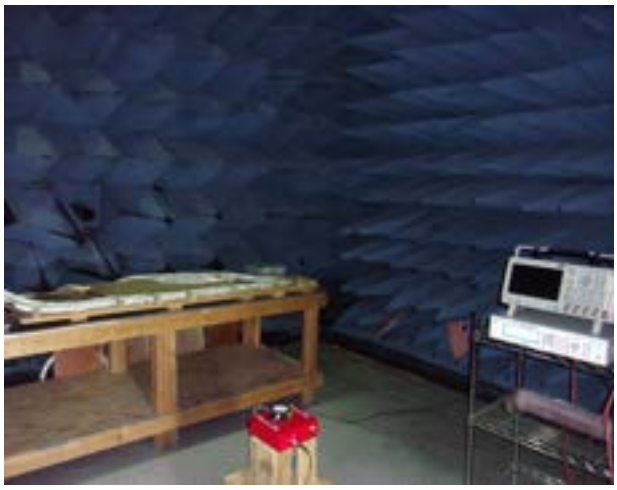
5.7.6 RE102 Test Log Sheet

EMI LOG SHEET			
Job Number:	PR131850	**Date:**	3/5/21 – 3/8/21
Standard:	MIL-STD-461G	**Method:**	RE102
Test Personnel:	Tristian Gaines	**Procedure:**	19CD0002 Rev B

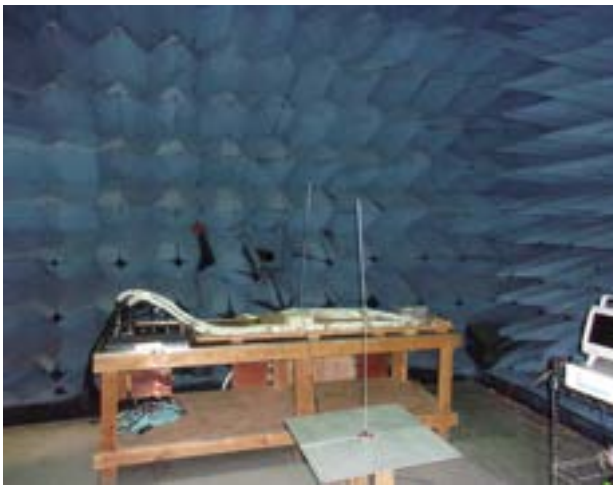
Date	Time	Log Entries	Init.
3/5/21	1000	Began System Check	TG
	1044	2-30MHz Passed	↓
	1100	Setting up for 30-200MHz	↓
	1200	Lunch	↓
	1230	30-200MHz Pass	↓
	1300	Setting up for 200MHz-1GHz and calculating positions.	↓
	1500	200MHz-1GHz Pass. Organizing data.	↓
3/8/21	0730	Setting up for 1-18GHz	↓
	1251	RE102 PASS	↓

Tested By: Tristian Gaines

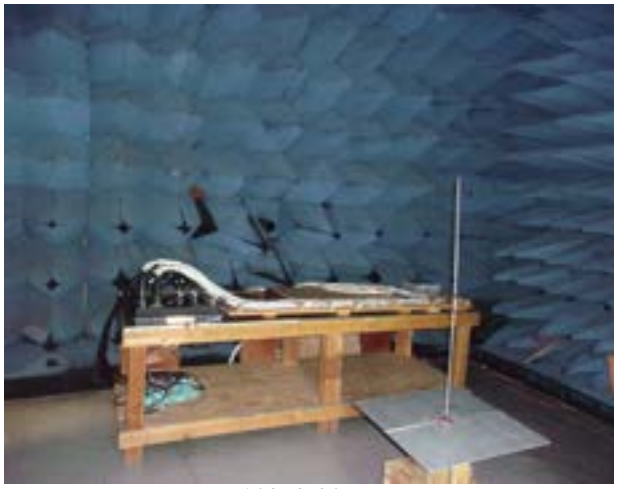
5.7.7 RE102 Test Photographs



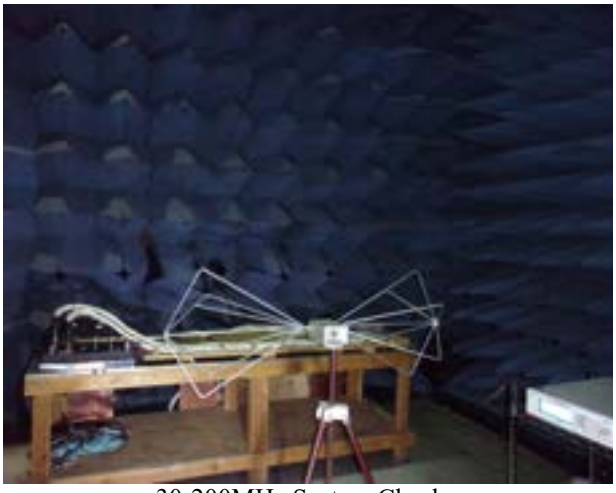
2-30MHz System Check



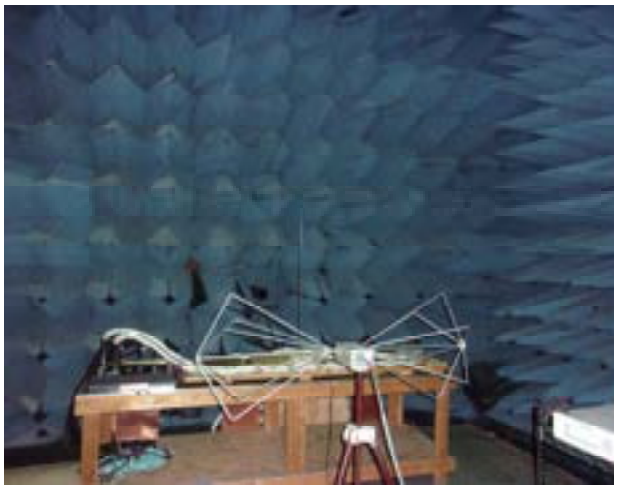
2-30MHz Stub Radiator



RE102, 2-30MHz

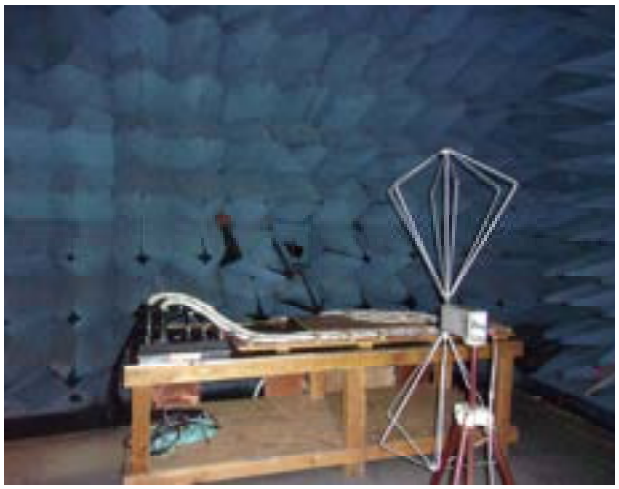


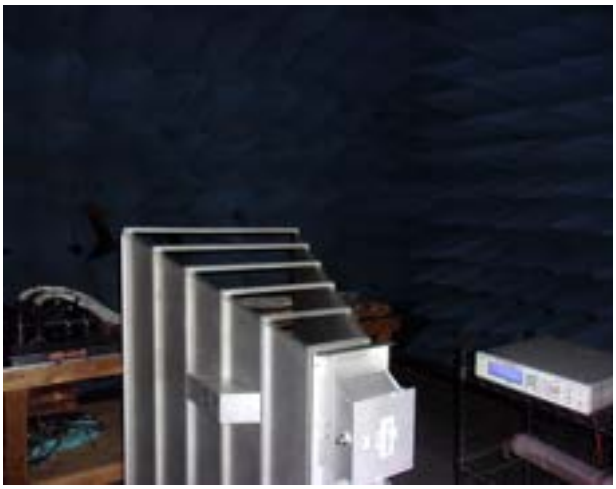
30-200MHz System Check



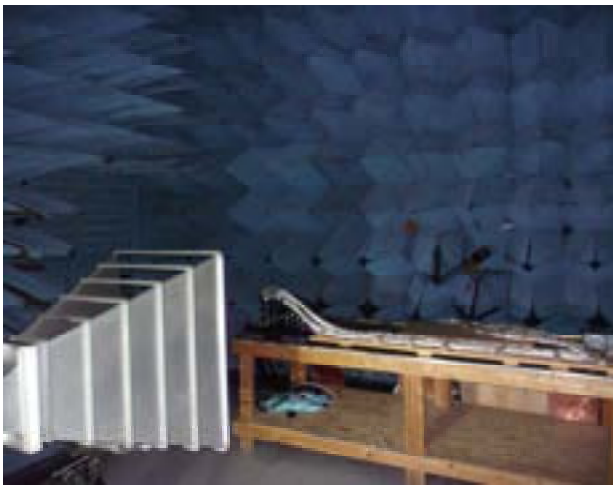
30-200MHz Stub Radiator

RE102, 30-200MHz Horizontal

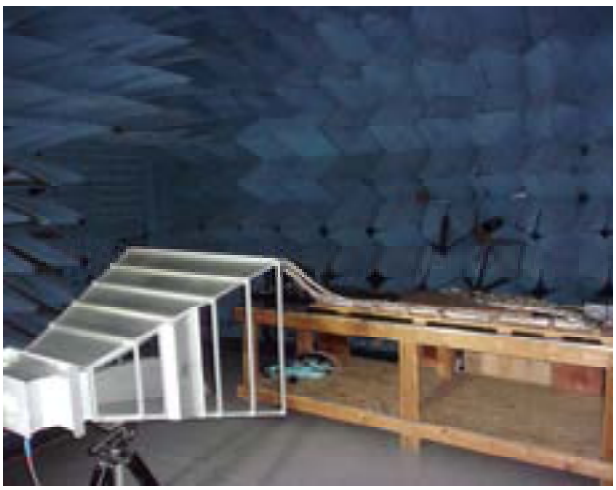

RE102, 30-200MHz Vertical


200MHz-1GHz System Check


200MHz-1GHz Stub Radiator

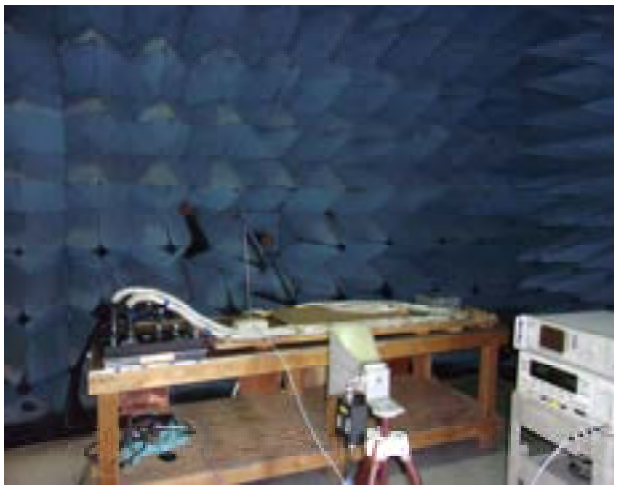

RE102, 200MHz-1GHz Horizontal Position 1

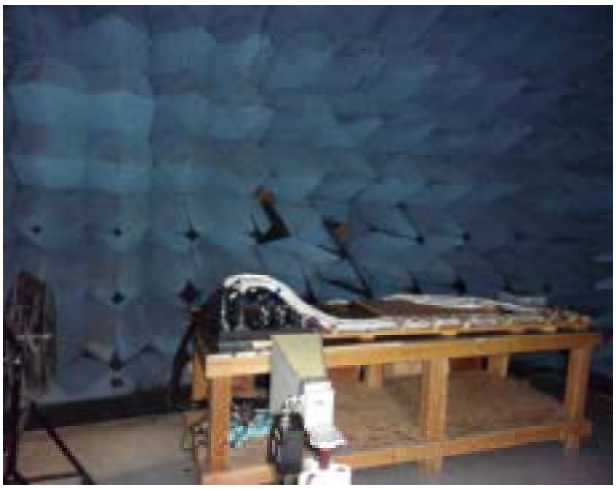

RE102, 200MHz-1GHz Horizontal Position 2

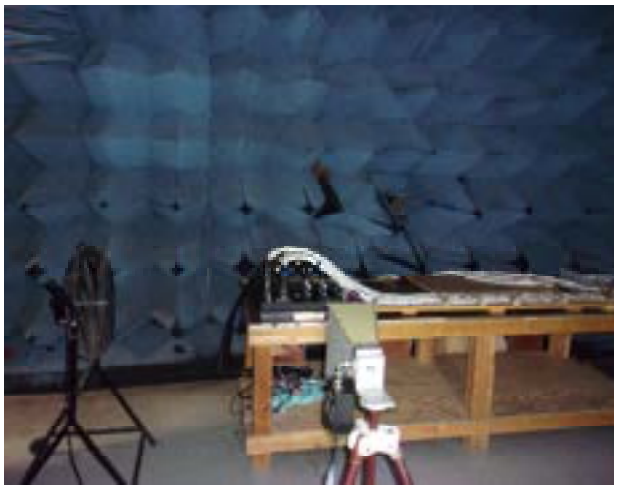

RE102, 200MHz-1GHz Vertical Position 2

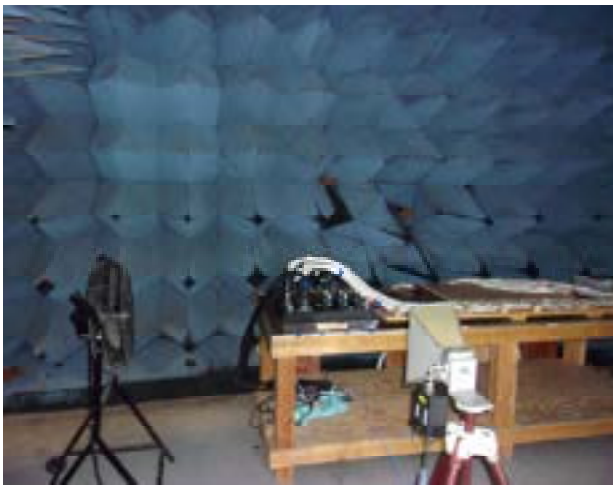

RE102, 200MHz-1GHz Vertical Position 1

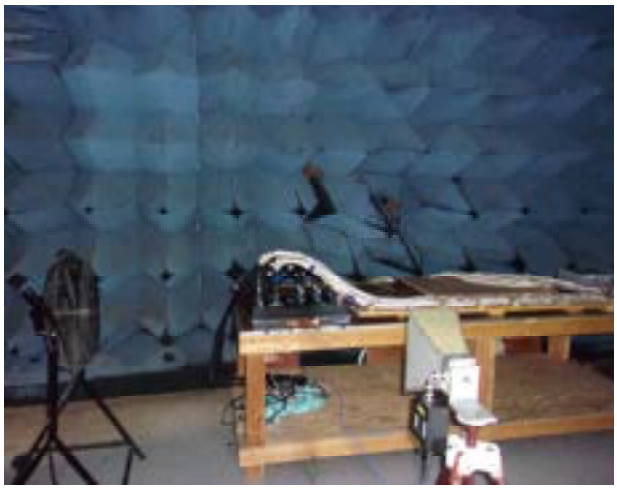

1-18GHz System Check

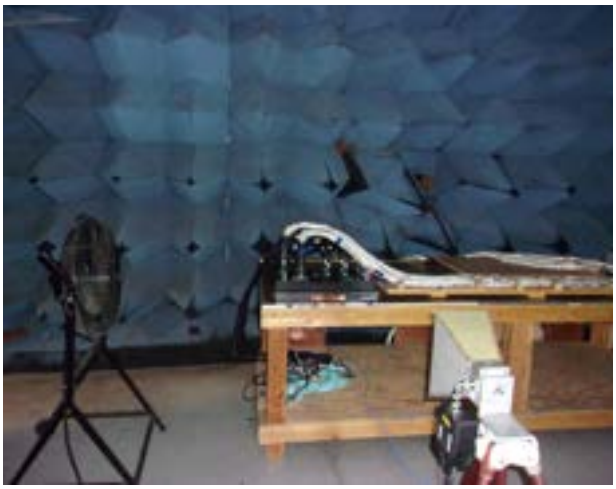

1-18GHz Stub Radiator


RE102, 1-18GHz Horizontal, Position 1


RE102, 1-18GHz Horizontal, Position 2


RE102, 1-18GHz Horizontal, Position 3

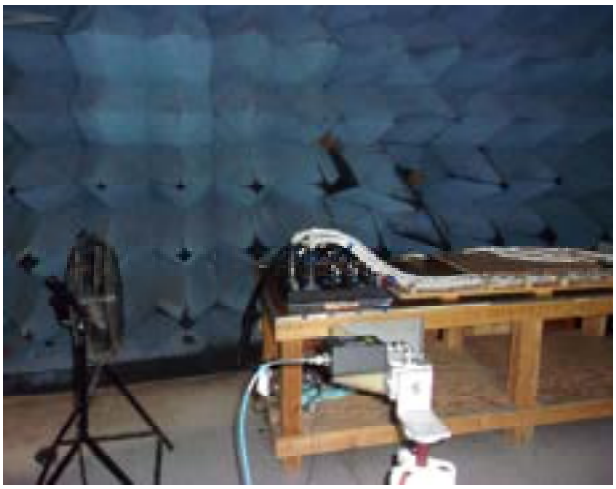

RE102, 1-18GHz Horizontal, Position 4

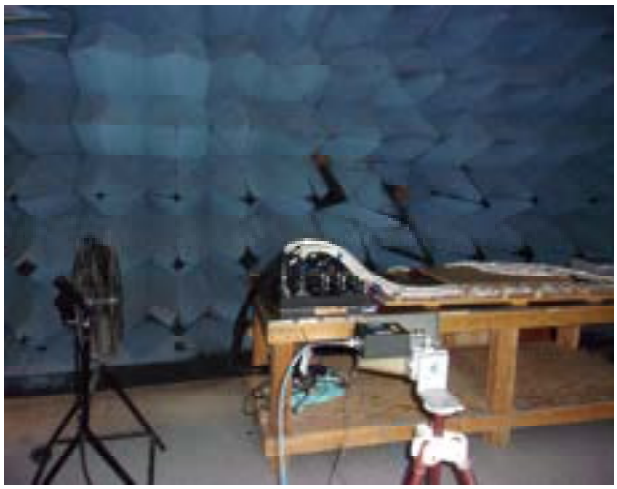

RE102, 1-18GHz Horizontal, Position 5

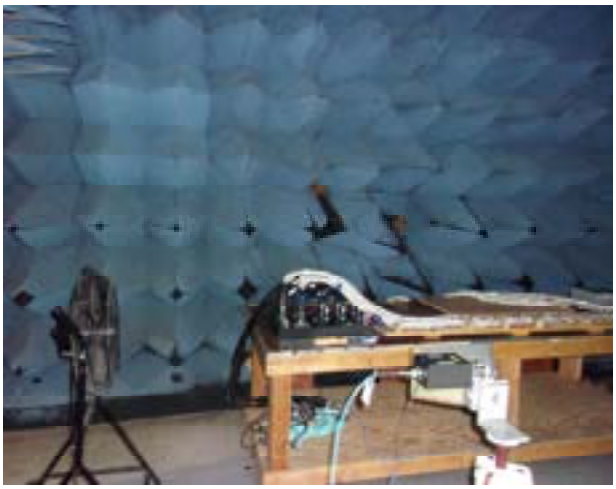

RE102, 1-18GHz Horizontal, Position 6

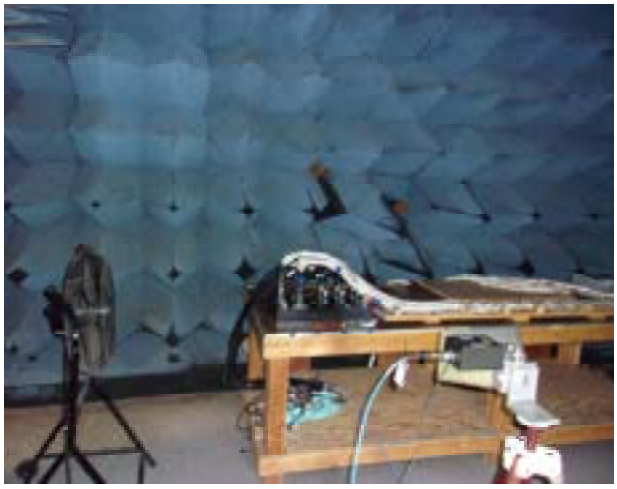

RE102, 1-18GHz Horizontal, Position 7

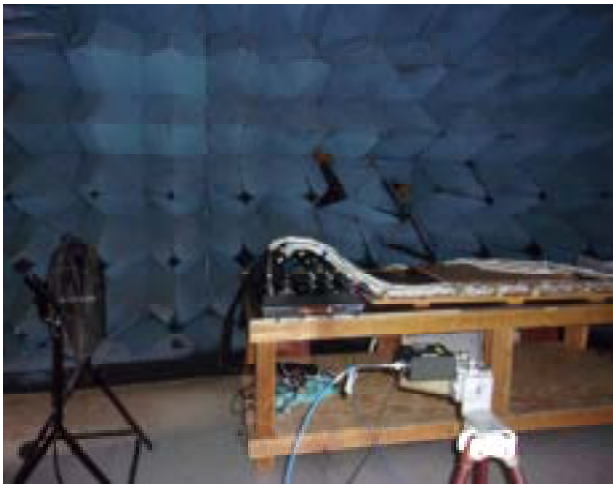

RE102, 1-18GHz Horizontal, Position 8

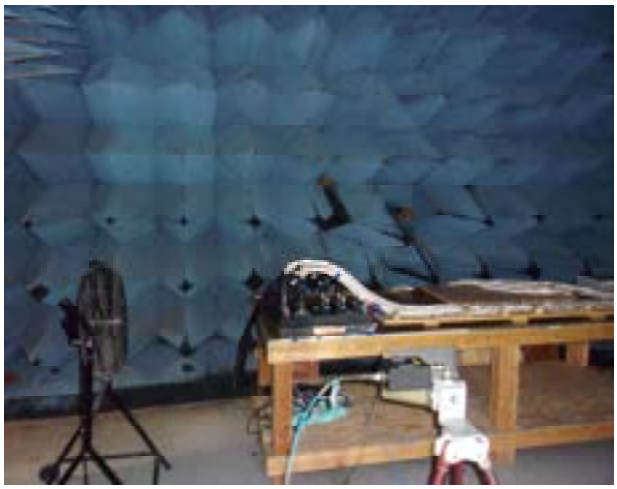

RE102, 1-18GHz Vertical, Position 1

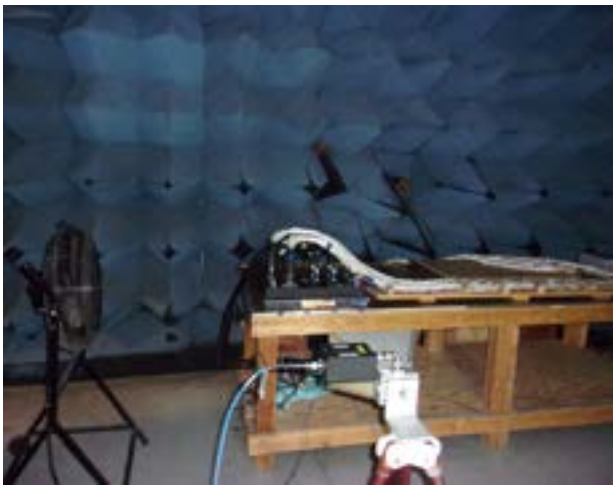

RE102, 1-18GHz Vertical, Position 2

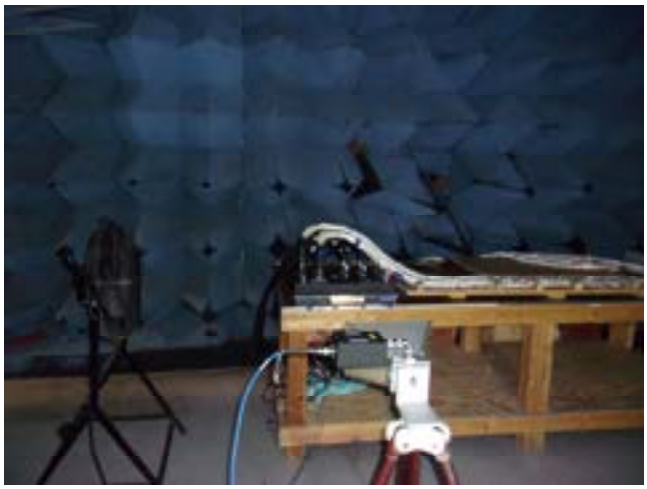

RE102, 1-18GHz Vertical, Position 3


RE102, 1-18GHz Vertical, Position 4


RE102, 1-18GHz Vertical, Position 5


RE102, 1-18GHz Vertical, Position 6


RE102, 1-18GHz Vertical, Position 7



RE102, 1-18GHz Vertical, Position 8

5.7.9 RE102 Test Data

RE102 Datasheet

Job Number:	PR131850	**Standard:**	MIL-STD-461G
		Procedure:	19CD0002 Rev B
Date:	3/5/2021, 3/8/2021	**EUT:**	SwitchBox
P/N:	19CD0002-1	**S/N:**	N/A
Test Personnel:	Tristian Gaines	**Manufacturer:**	Amphenol Aerospace

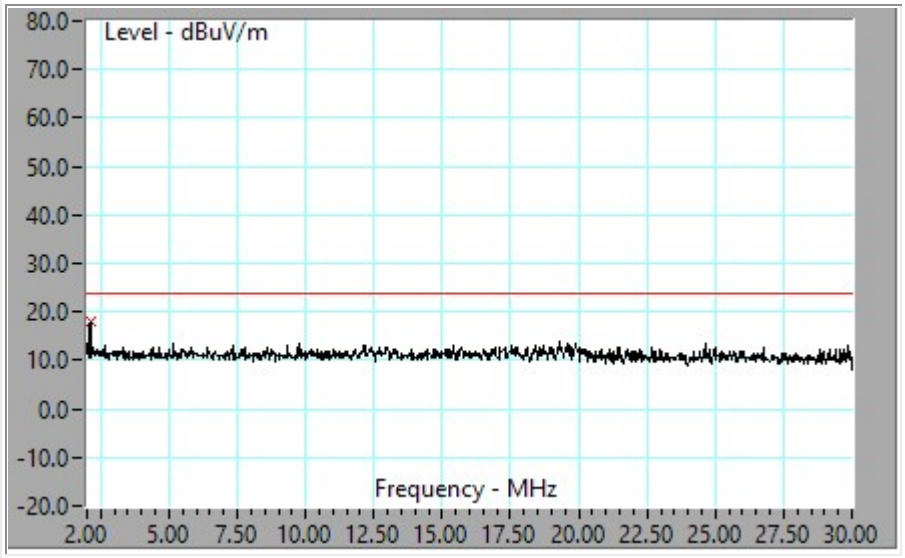
RE102 Specification:

Test Type	Test Specification	Performance Criteria
Radiated Emissions, Electric Field, 2 MHz to 18 GHz	MIL-STD-461F, Figure RE102-4 (Fixed Wing Ext. and Helicopter)	The EUT emissions must not excede the limit.

RE102 Test Results Summary:

Frequency Range (MHz)	Polarization	Results (Under/Over Limit)
2 – 30	Vertical	**PASS**
30 - 200	Horizontal	**PASS**
30 - 200	Vertical	**PASS**
200 - 1000	Horizontal	**PASS**
200 - 1000	Vertical	**PASS**
1,000 – 18,000	Horizontal	**PASS**
1,000 – 18,000	Vertical	**PASS**

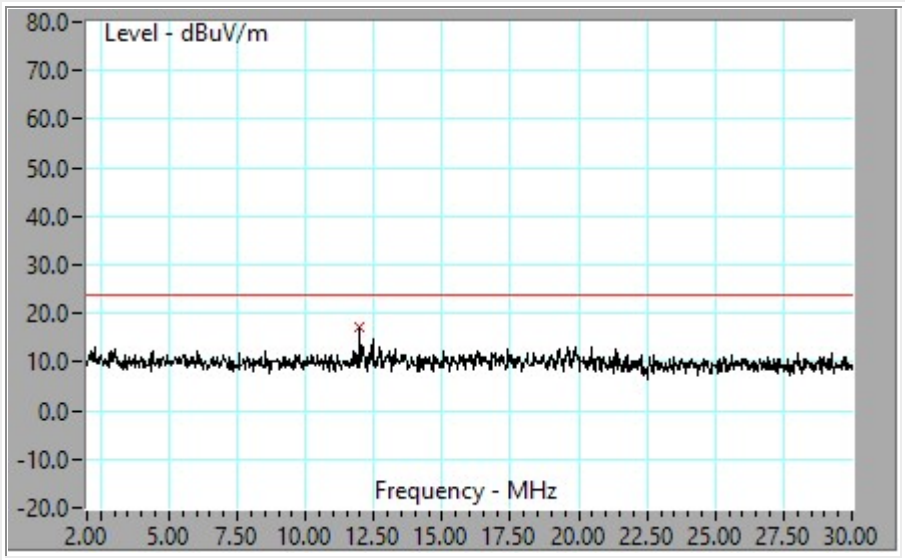
RE102 System Check: Calibrated Injected Signal = 17.63 dBuV @ 2.1 MHz



Fri, Mar 5, 2021
9:51:41 AM
AutoScan 7.4.4.16
Res BW (kHz) 10
Vid BW (kHz) 50000
VERTICAL
ETS-Lindgren 3301C Active Monopole
Graph # 1

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
2.112	**17.8**	24.0	-6.2	19.16	-1.67	0.36	0.00	1.31

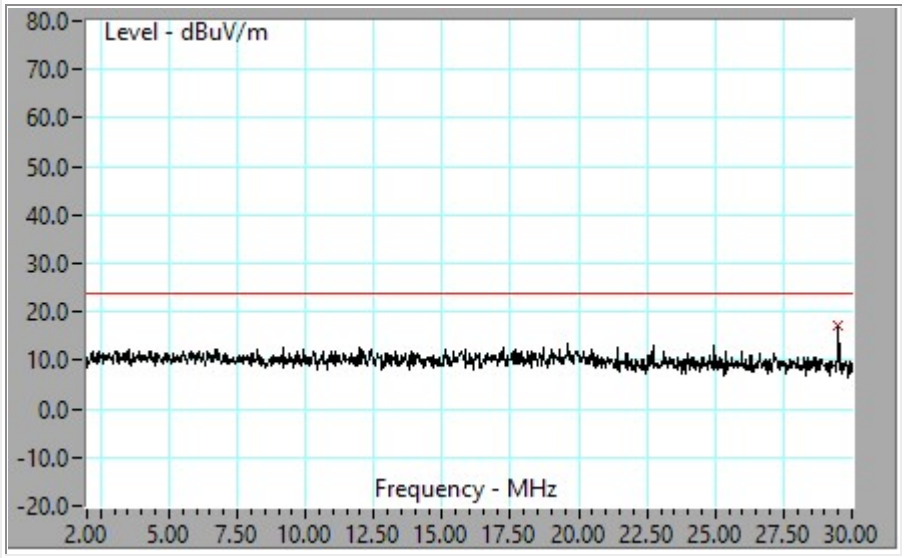
RE102 System Check: Calibrated Injected Signal = 17. 32 dBuV @ 12 MHz



Fri, Mar 5, 2021
10:06:25 AM
AutoScan 7.4.4.16
Res BW (kHz) 10
Vid BW (kHz) 50000
VERTICAL
ETS-Lindgren 3301C Active Monopole
Graph # 2

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
11.996	**17.3**	24.0	-6.7	17.44	-1.18	1.06	0.00	0.12

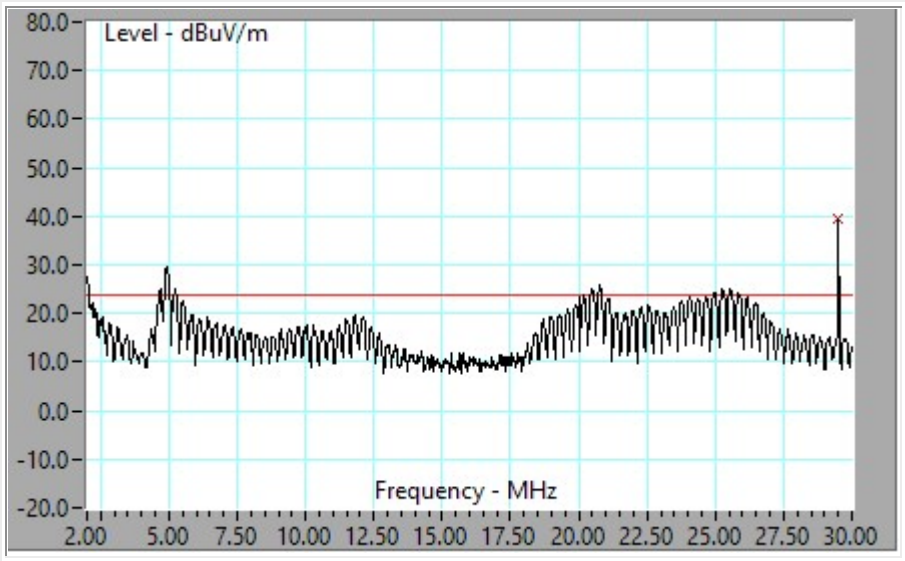
RE102 System Check: Calibrated Injected Signal = 17. 55 dBuV @ 29.5 MHz



Fri, Mar 5, 2021
10:12:58 AM
AutoScan 7.4.4.16
Res BW (kHz) 10
Vid BW (kHz) 50000
VERTICAL
ETS-Lindgren 3301C Active Monopole
Graph # 3

Frequency	Level	Limit	Delta		Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB		dBuV	dB	dB	dB	dB
29.50	**17.3**	24.0	-6.7		14.97	0.80	1.49	0.00	-2.30

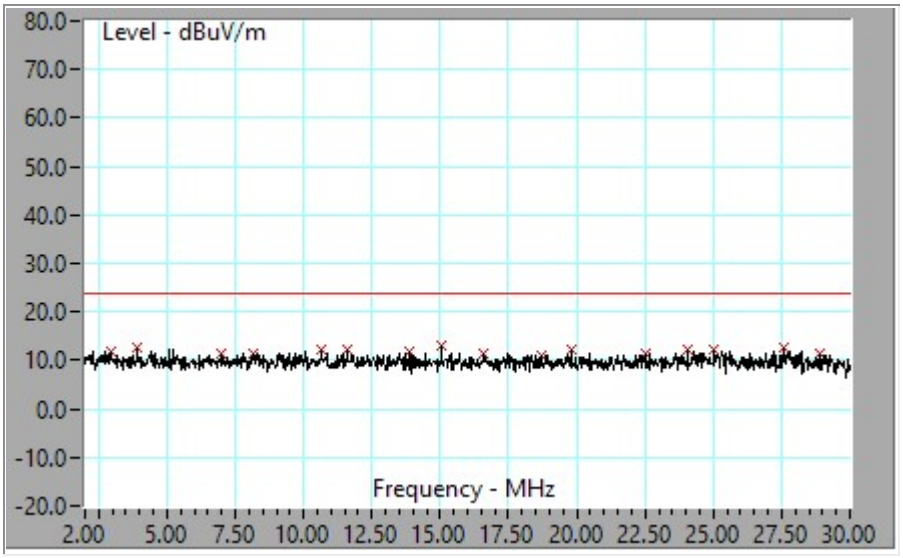
RE102 System Check: Stub Radiator @ 29.5 MHz



Fri, Mar 5, 2021
10:20:33 AM
AutoScan 7.4.4.16
Res BW (kHz) 10
Vid BW (kHz) 50000
VERTICAL
ETS-Lindgren 3301C Active Monopole
Graph # 4

Frequency	Level	Limit	Delta		Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB		dBuV	dB	dB	dB	dB
29.50	**39.7**	24.0	15.7	F	37.36	0.80	1.49	0.00	-2.30

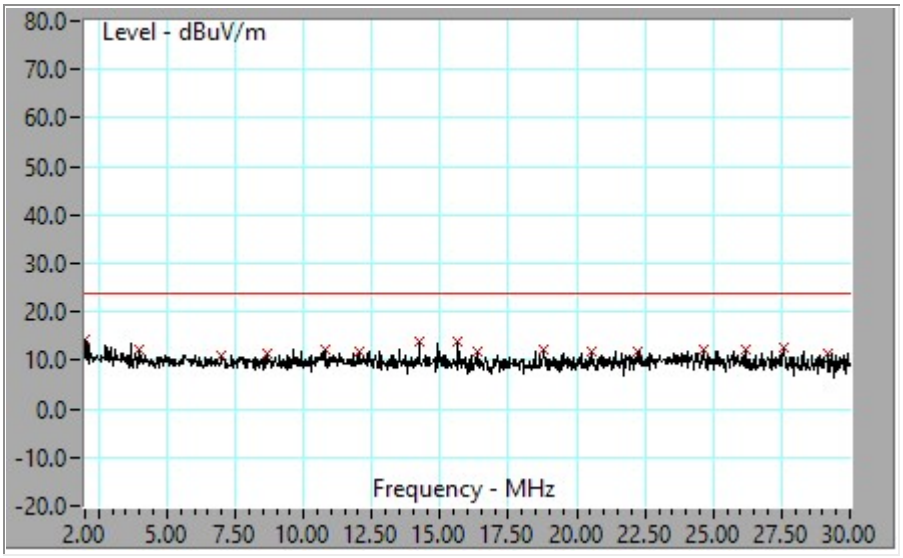
RE102 System Check: Ambient Scan



Fri, Mar 5, 2021
10:24:01 AM
AutoScan 7.4.4.16
Res BW (kHz) 10
Vid BW (kHz) 50000
VERTICAL
ETS-Lindgren 3301C Active Monopole
Graph # 5

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
2.924	11.8	24.0	-12.2	13.06	-1.66	0.42	0.00	1.24
3.904	12.6	24.0	-11.4	13.72	-1.64	0.51	0.00	1.14
6.984	11.3	24.0	-12.7	12.09	-1.53	0.76	0.00	0.77
8.160	11.5	24.0	-12.5	12.12	-1.46	0.86	0.00	0.60
10.652	12.1	24.0	-11.9	12.32	-1.29	1.03	0.00	0.26
11.604	12.0	24.0	-12.0	12.20	-1.21	1.06	0.00	0.16
13.872	11.8	24.0	-12.2	11.74	-1.01	1.11	0.00	-0.10
15.048	13.0	24.0	-11.0	12.74	-0.90	1.14	0.00	-0.24
16.616	11.5	24.0	-12.5	11.07	-0.73	1.18	0.00	-0.45
18.688	11.1	24.0	-12.9	10.39	-0.51	1.23	0.00	-0.72
19.780	12.2	24.0	-11.8	11.34	-0.38	1.25	0.00	-0.87
22.552	11.5	24.0	-12.5	10.23	-0.06	1.32	0.00	-1.26
24.064	12.1	24.0	-11.9	10.66	0.12	1.36	0.00	-1.48
25.016	12.3	24.0	-11.7	10.72	0.24	1.38	0.00	-1.62
27.564	12.6	24.0	-11.4	10.63	0.56	1.44	0.00	-2.00
28.936	11.4	24.0	-12.6	9.18	0.73	1.48	0.00	-2.21

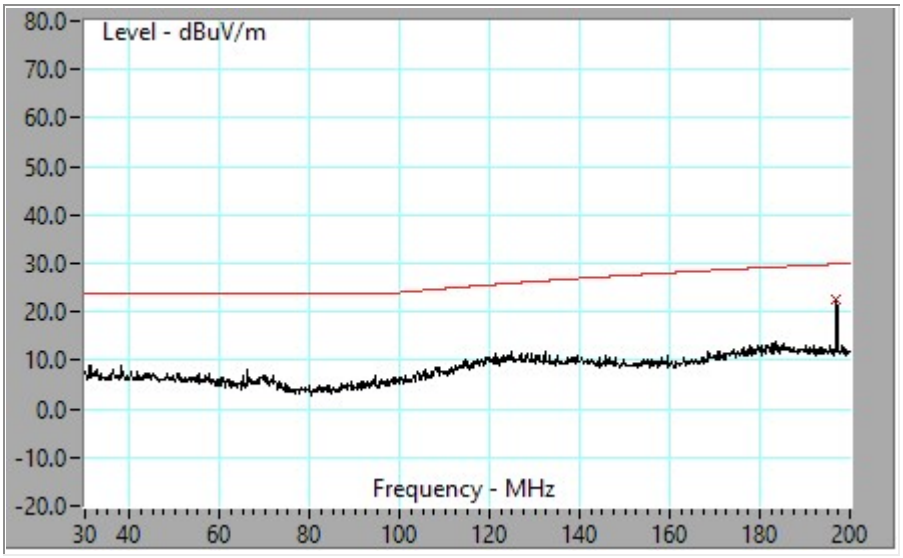
RE102: SwitchBox



Fri, Mar 5, 2021
10:44:16 AM
AutoScan 7.4.4.16
Res BW (kHz) 10
Vid BW (kHz) 50000
VERTICAL
ETS-Lindgren 3301C Active Monopole
Graph # 6

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
2.000	14.2	24.0	-9.8	15.51	-1.67	0.35	0.00	1.32
3.988	12.4	24.0	-11.6	13.55	-1.64	0.51	0.00	1.13
7.012	10.9	24.0	-13.1	11.71	-1.53	0.77	0.00	0.76
8.636	11.4	24.0	-12.6	11.94	-1.43	0.90	0.00	0.53
10.764	12.4	24.0	-11.6	12.59	-1.28	1.03	0.00	0.24
12.024	11.8	24.0	-12.2	11.87	-1.18	1.07	0.00	0.11
14.236	13.9	24.0	-10.1	13.76	-0.98	1.12	0.00	-0.14
15.664	13.9	24.0	-10.1	13.58	-0.83	1.15	0.00	-0.32
16.364	11.9	24.0	-12.1	11.47	-0.76	1.17	0.00	-0.41
18.800	12.1	24.0	-11.9	11.37	-0.49	1.23	0.00	-0.74
20.508	11.7	24.0	-12.3	10.69	-0.30	1.27	0.00	-0.97
22.244	11.8	24.0	-12.2	10.63	-0.10	1.31	0.00	-1.21
24.624	12.2	24.0	-11.8	10.63	0.19	1.37	0.00	-1.56
26.220	12.3	24.0	-11.7	10.46	0.39	1.41	0.00	-1.80
27.592	12.8	24.0	-11.2	10.78	0.56	1.45	0.00	-2.01
29.216	11.5	24.0	-12.5	9.27	0.77	1.49	0.00	-2.25

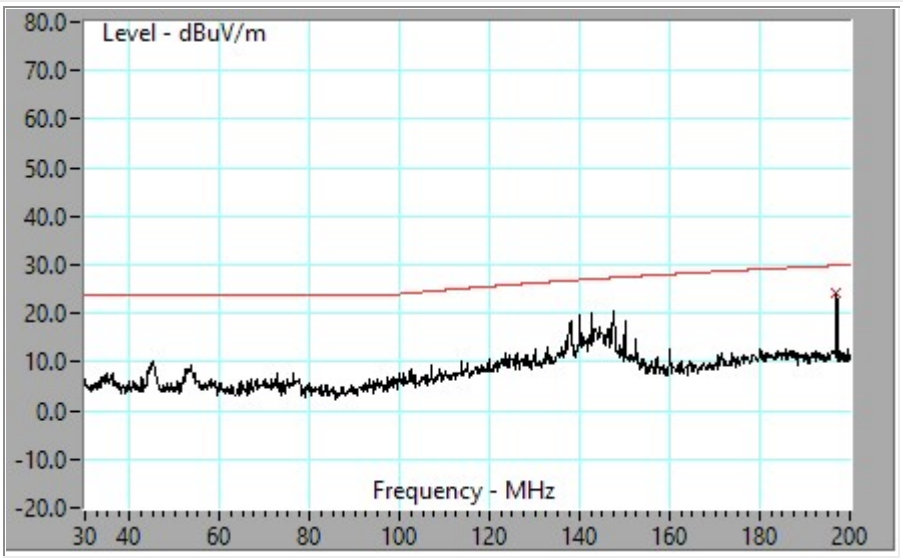
RE102 System Check: Calibrated Injected Signal = 22.23 dBuV @ 197 MHz



Fri, Mar 5, 2021
11:04:52 AM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
HORIZONTAL
EMCO 3109
Pasternack PE15A1012
Graph # 7

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
196.94	**22.5**	29.9	-7.4	43.86	14.77	4.52	40.69	21.40

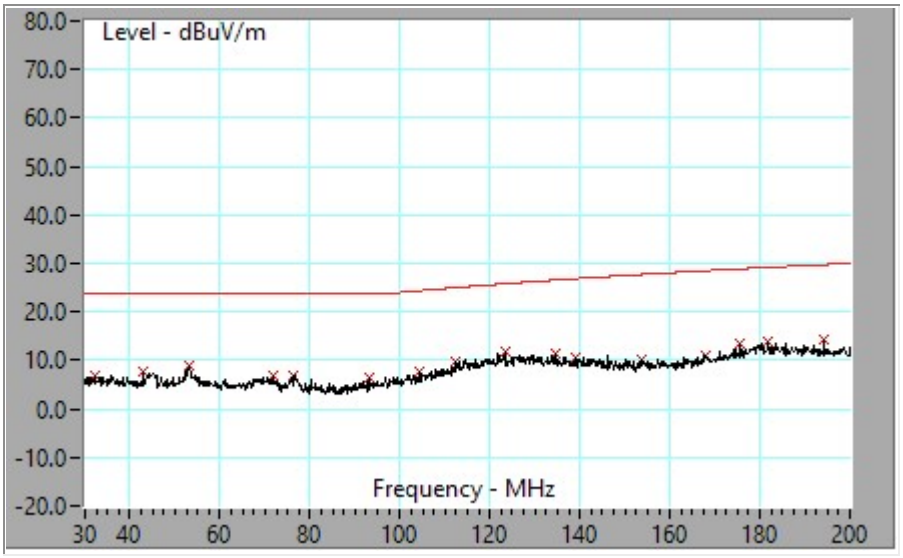
RE102 System Check: Stub Radiator @ 197 MHz



Fri, Mar 5, 2021
11:11:19 AM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
HORIZONTAL
EMCO 3109
Pasternack PE15A1012
Graph # 8

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
196.94	**24.1**	29.9	-5.8	45.47	14.77	4.52	40.69	21.40

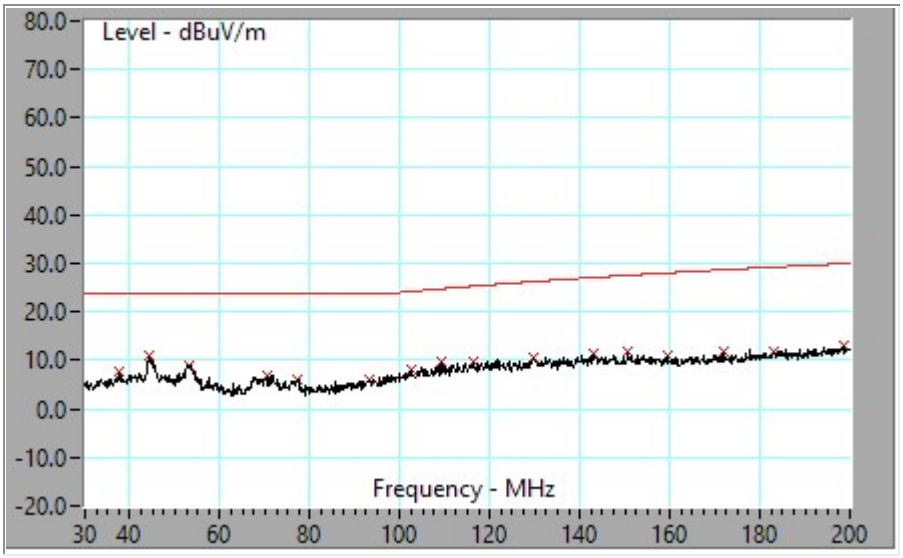
RE102 System Check: Ambient Scan



Fri, Mar 5, 2021
11:14:18 AM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
HORIZONTAL
EMCO 3109
Pasternack PE15A1012
Graph # 9

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
32.04	6.8	24.0	-17.2	33.54	12.37	1.55	40.71	26.78
43.09	7.5	24.0	-16.5	34.36	11.97	1.82	40.63	26.83
53.12	9.0	24.0	-15.0	36.02	11.47	2.07	40.59	27.05
71.65	6.9	24.0	-17.1	34.93	10.03	2.52	40.60	28.04
76.41	7.0	24.0	-17.0	36.34	8.60	2.64	40.60	29.36
93.41	6.4	24.0	-17.6	34.66	9.35	3.05	40.62	28.22
104.29	7.6	24.4	-16.8	34.15	10.80	3.27	40.62	26.55
112.28	9.9	25.0	-15.1	34.80	12.30	3.38	40.61	24.93
123.33	12.0	25.8	-13.9	34.96	14.11	3.53	40.63	23.00
134.55	11.6	26.6	-15.0	34.84	13.73	3.68	40.64	23.23
139.14	10.6	26.9	-16.3	33.88	13.61	3.74	40.64	23.29
153.59	10.3	27.7	-17.4	34.29	12.76	3.93	40.65	23.96
167.87	11.1	28.5	-17.4	34.00	13.60	4.13	40.66	22.93
175.69	13.4	28.9	-15.5	34.86	14.94	4.23	40.67	21.50
181.81	14.0	29.2	-15.2	34.88	15.45	4.31	40.68	20.92
194.22	14.2	29.8	-15.6	35.46	14.93	4.48	40.69	21.28

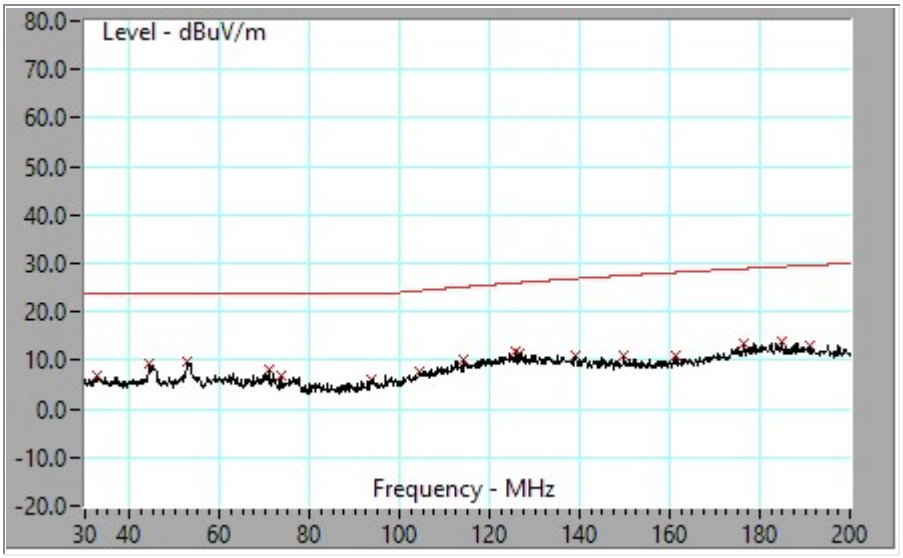
RE102 System Check: Ambient Scan



Fri, Mar 5, 2021
11:17:22 AM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
VERTICAL
EMCO 3109
Pasternack PE15A1012
Graph # 10

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
37.65	7.6	24.0	-16.4	34.15	12.43	1.69	40.66	26.54
44.11	10.8	24.0	-13.2	36.80	12.80	1.85	40.62	25.97
53.29	8.9	24.0	-15.1	35.80	11.66	2.07	40.59	26.86
70.46	7.0	24.0	-17.0	34.75	10.38	2.49	40.60	27.72
77.26	6.0	24.0	-18.0	35.62	8.35	2.66	40.60	29.59
93.41	6.1	24.0	-17.9	33.77	9.90	3.05	40.62	27.67
102.42	8.1	24.2	-16.1	34.27	11.23	3.25	40.63	26.15
109.05	9.8	24.8	-15.0	35.09	11.96	3.33	40.61	25.32
116.36	9.8	25.3	-15.5	34.30	12.69	3.43	40.62	24.50
129.62	10.7	26.2	-15.5	34.59	13.13	3.61	40.63	23.89
143.05	11.4	27.1	-15.7	34.39	13.87	3.79	40.64	22.98
150.70	11.6	27.6	-15.9	34.66	13.74	3.89	40.65	23.02
159.37	11.0	28.0	-17.1	33.83	13.78	4.01	40.65	22.85
171.78	11.8	28.7	-16.9	34.56	13.75	4.18	40.67	22.74
183.17	12.0	29.2	-17.2	34.15	14.20	4.33	40.68	22.15
198.47	12.9	29.9	-17.1	33.80	15.22	4.54	40.69	20.93

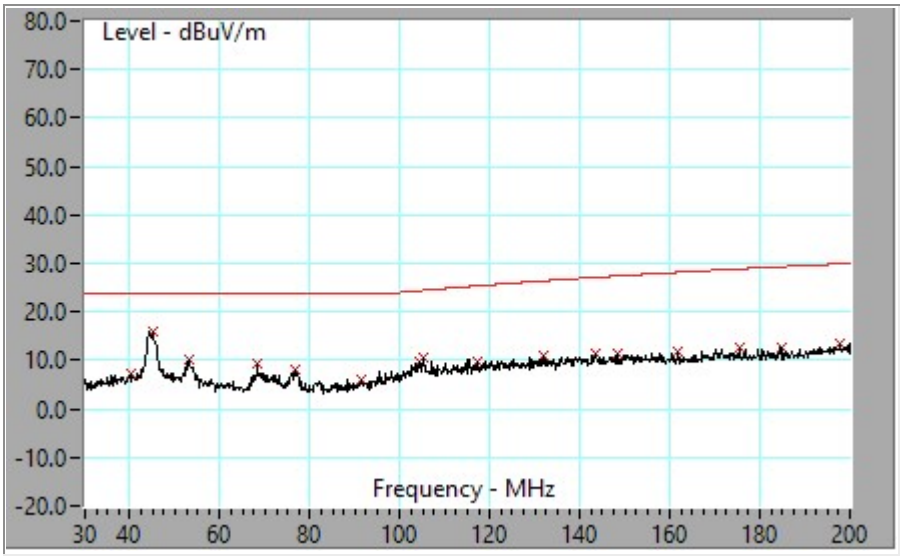
RE102: SwitchBox



Fri, Mar 5, 2021
11:40:29 AM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
HORIZONTAL
EMCO 3109
Pasternack PE15A1012
Graph # 11

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
32.89	6.9	24.0	-17.1	33.70	12.33	1.57	40.70	26.79
44.45	9.3	24.0	-14.7	36.15	11.89	1.86	40.62	26.87
52.78	9.7	24.0	-14.3	36.78	11.50	2.06	40.59	27.03
70.97	8.2	24.0	-15.8	35.80	10.45	2.50	40.60	27.65
73.52	6.7	24.0	-17.3	35.51	9.20	2.57	40.60	28.84
93.58	6.0	24.0	-18.0	34.20	9.37	3.06	40.62	28.19
104.46	7.5	24.4	-16.8	34.05	10.83	3.27	40.62	26.51
114.32	10.0	25.2	-15.1	34.53	12.73	3.41	40.62	24.48
125.88	11.7	26.0	-14.3	34.57	14.16	3.56	40.63	22.91
126.39	11.3	26.0	-14.8	34.16	14.16	3.57	40.63	22.91
138.97	11.2	26.9	-15.7	34.45	13.61	3.74	40.64	23.29
149.68	10.8	27.5	-16.7	34.77	12.79	3.88	40.65	23.98
161.24	11.1	28.1	-17.0	34.71	13.00	4.04	40.65	23.61
176.54	13.7	28.9	-15.3	35.03	15.06	4.24	40.67	21.37
184.70	13.7	29.3	-15.6	34.60	15.41	4.35	40.68	20.92
190.99	13.1	29.6	-16.5	34.25	15.11	4.44	40.69	21.14

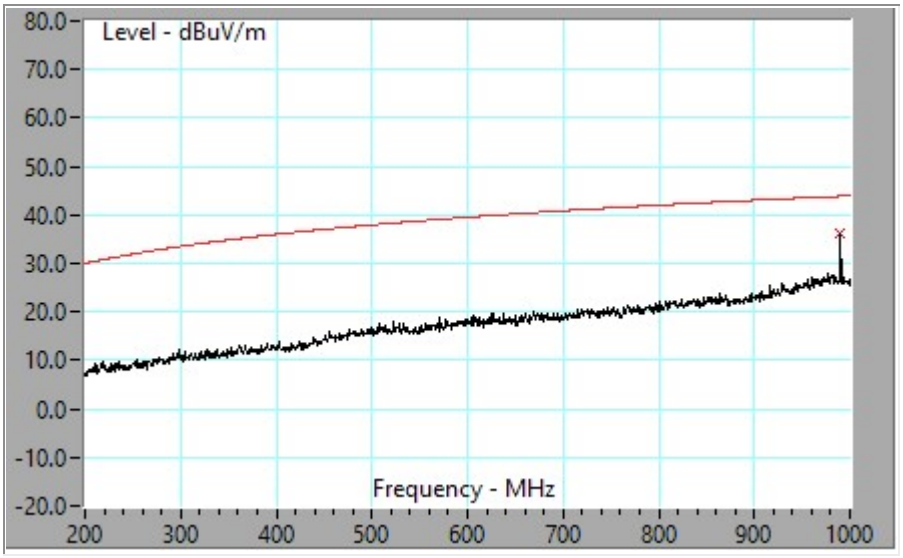
RE102: SwitchBox



Fri, Mar 5, 2021
11:43:45 AM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
VERTICAL
EMCO 3109
Pasternack PE15A1012
Graph # 12

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
40.03	7.4	24.0	-16.6	33.67	12.65	1.75	40.64	26.24
44.96	16.1	24.0	-7.9	42.06	12.78	1.87	40.62	25.97
53.12	10.1	24.0	-13.9	36.94	11.72	2.07	40.59	26.81
68.25	9.2	24.0	-14.8	36.88	10.49	2.44	40.60	27.66
76.75	7.9	24.0	-16.1	37.49	8.37	2.65	40.60	29.59
91.54	6.2	24.0	-17.8	34.17	9.63	3.01	40.62	27.98
104.29	9.9	24.4	-14.5	35.84	11.40	3.27	40.62	25.94
105.31	10.6	24.4	-13.8	36.41	11.52	3.28	40.62	25.81
117.04	9.6	25.4	-15.8	34.02	12.73	3.44	40.63	24.45
131.83	11.0	26.4	-15.4	34.81	13.22	3.64	40.63	23.78
143.56	11.2	27.1	-15.9	34.22	13.84	3.80	40.64	23.00
148.32	11.3	27.4	-16.1	34.39	13.67	3.86	40.65	23.11
161.92	11.9	28.2	-16.3	34.76	13.73	4.05	40.65	22.87
175.35	12.8	28.9	-16.0	35.40	13.87	4.23	40.67	22.57
185.04	12.8	29.3	-16.5	34.90	14.24	4.36	40.68	22.09
197.96	13.5	29.9	-16.4	34.52	15.18	4.53	40.69	20.98

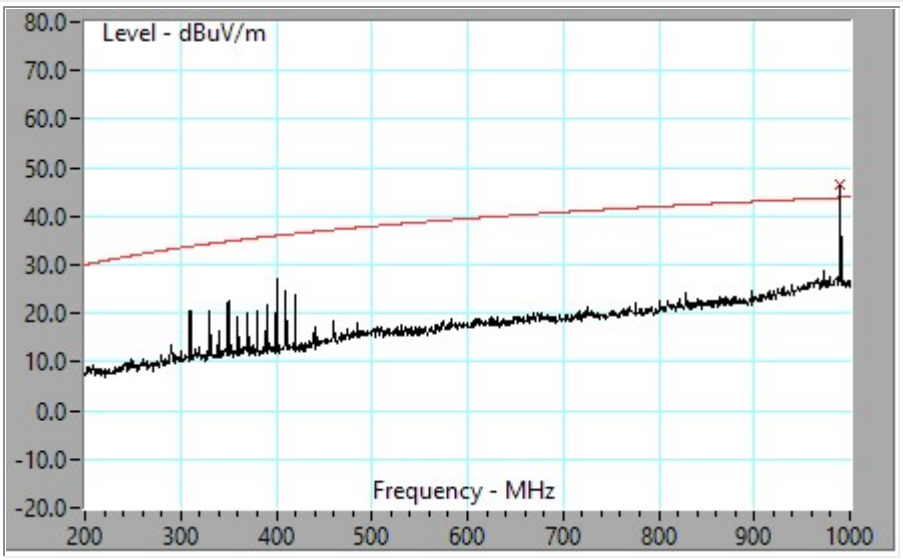
RE102 System Check: Calibrated Injected Signal = 37.23 dBuV @ 990 MHz



Fri, Mar 5, 2021
1:25:36 PM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
HORIZONTAL
ETS 3106 Large Horn
Pasternack PE15A1012
Graph # 13

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
989.6	**36.4**	43.9	-7.5	41.93	22.79	10.96	39.30	5.55

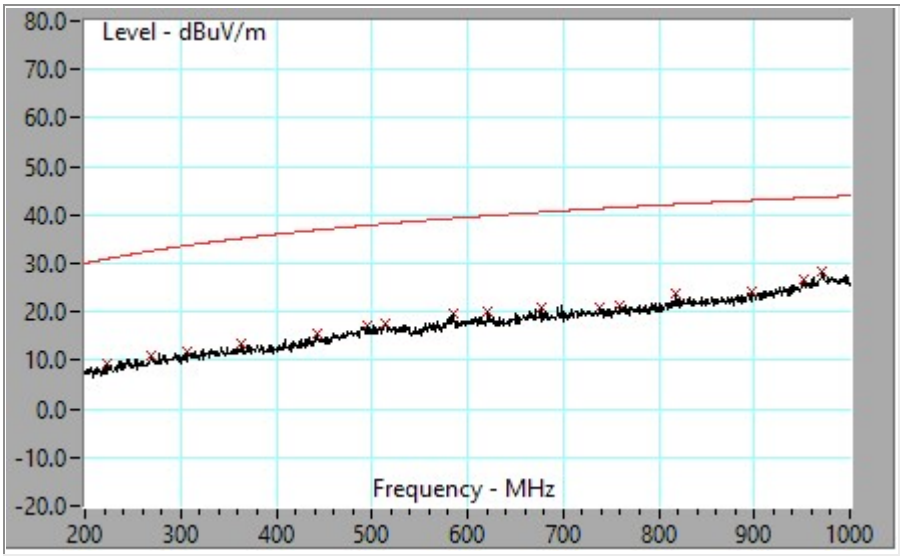
RE102 System Check: Stub Radiator @ 990 MHz



Fri, Mar 5, 2021
1:33:11 PM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
HORIZONTAL
ETS 3106 Large Horn
Pasternack PE15A1012
Graph # 14

Frequency	Level	Limit	Delta		Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB		dBuV	dB	dB	dB	dB
989.6	**46.4**	43.9	2.5	F	51.93	22.79	10.96	39.30	5.55

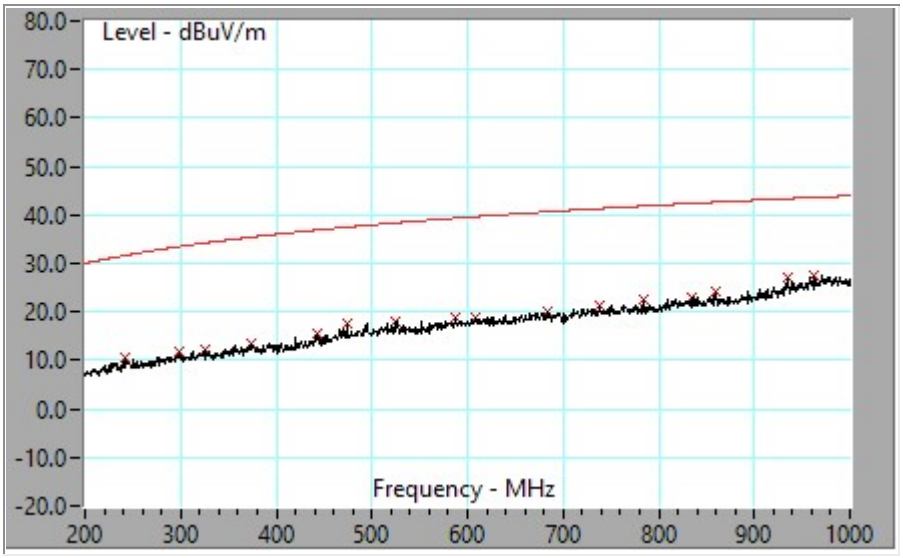
RE102 System Check: Ambient Scan Position 1



Fri, Mar 5, 2021
1:43:54 PM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
HORIZONTAL
ETS 3106 Large Horn
Pasternack PE15A1012
Graph # 15

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
224.00	9.5	31.0	-21.5	34.42	10.94	4.82	40.72	24.97
269.60	11.0	32.6	-21.6	34.69	11.73	5.31	40.74	23.70
307.20	11.8	33.7	-22.0	34.23	12.61	5.70	40.77	22.46
364.00	13.3	35.2	-21.8	34.54	13.40	6.24	40.84	21.19
442.40	15.5	36.9	-21.4	34.87	14.53	6.94	40.87	19.40
494.40	17.4	37.8	-20.5	34.72	16.18	7.37	40.89	17.34
514.40	17.5	38.2	-20.7	34.59	16.27	7.53	40.87	17.07
585.60	19.6	39.3	-19.7	35.32	16.92	8.09	40.73	15.73
620.80	19.9	39.8	-19.9	35.01	17.23	8.36	40.65	15.06
678.40	21.0	40.6	-19.6	34.97	17.76	8.79	40.52	13.97
739.20	21.1	41.3	-20.2	34.04	18.13	9.23	40.29	12.93
759.20	21.5	41.6	-20.1	34.06	18.22	9.37	40.20	12.60
818.40	23.6	42.2	-18.6	34.52	19.24	9.80	39.94	10.91
898.40	24.3	43.0	-18.8	33.45	20.04	10.40	39.62	9.19
952.00	26.5	43.5	-17.0	33.08	22.11	10.73	39.42	6.58
971.20	28.3	43.7	-15.4	33.84	23.00	10.85	39.36	5.51

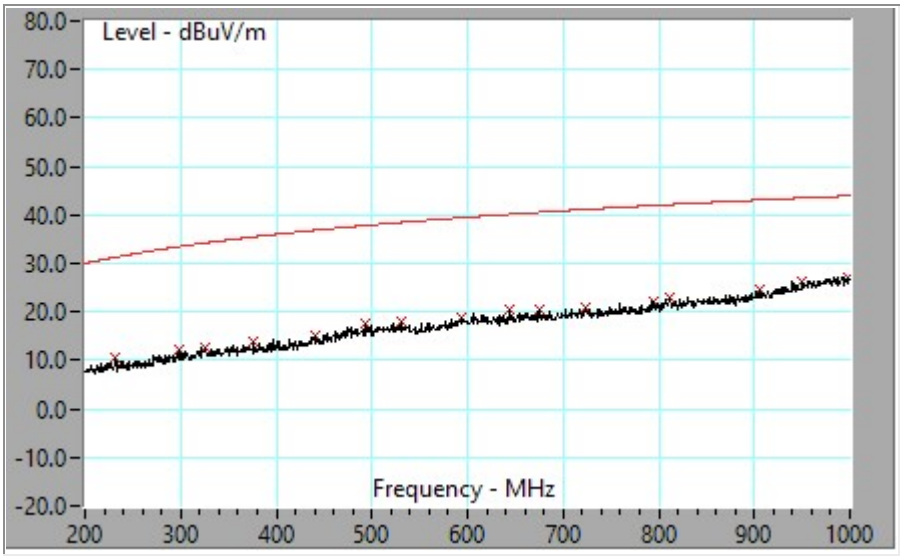
RE102 System Check: Ambient Scan Position 2



Fri, Mar 5, 2021
1:47:58 PM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
HORIZONTAL
ETS 3106 Large Horn
Pasternack PE15A1012
Graph # 16

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
242.40	10.7	31.7	-21.0	35.10	11.29	5.02	40.71	24.40
297.60	12.0	33.5	-21.4	34.72	12.42	5.61	40.75	22.72
325.60	12.2	34.2	-22.0	34.26	12.92	5.88	40.82	22.02
374.40	13.6	35.4	-21.9	34.63	13.46	6.34	40.86	21.06
442.40	15.3	36.9	-21.5	34.75	14.53	6.94	40.87	19.40
473.60	17.8	37.5	-19.7	35.75	15.71	7.20	40.88	17.98
524.80	18.0	38.4	-20.4	34.98	16.25	7.61	40.85	16.99
586.40	18.7	39.3	-20.6	34.41	16.93	8.10	40.73	15.70
608.80	18.8	39.7	-20.9	33.92	17.24	8.27	40.68	15.17
684.00	20.1	40.7	-20.6	34.06	17.70	8.83	40.51	13.97
737.60	21.4	41.3	-19.9	34.34	18.13	9.22	40.30	12.94
784.00	22.4	41.8	-19.4	34.48	18.47	9.55	40.09	12.07
833.60	23.1	42.4	-19.3	33.52	19.52	9.91	39.88	10.45
859.20	24.3	42.6	-18.4	34.36	19.58	10.10	39.78	10.10
934.40	26.9	43.4	-16.4	34.49	21.31	10.62	39.48	7.55
963.20	27.4	43.6	-16.3	33.30	22.63	10.80	39.38	5.95

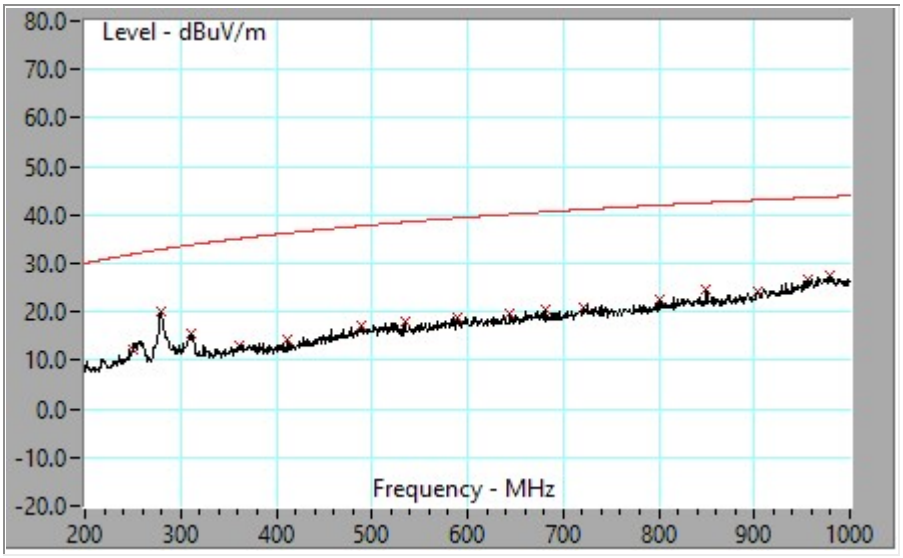
RE102 System Check: Ambient Scan Position 2



Fri, Mar 5, 2021
2:08:27 PM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
VERTICAL
ETS 3106 Large Horn
Pasternack PE15A1012
Graph # 17

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
232.00	10.4	31.3	-20.9	35.00	11.21	4.90	40.72	24.61
297.60	12.2	33.5	-21.2	34.96	12.39	5.61	40.75	22.76
325.60	12.8	34.2	-21.5	34.58	13.13	5.88	40.82	21.81
376.80	14.0	35.5	-21.5	35.02	13.46	6.36	40.86	21.03
440.00	14.9	36.8	-21.9	34.48	14.39	6.92	40.87	19.56
493.60	17.5	37.8	-20.3	34.76	16.25	7.36	40.89	17.27
530.40	17.9	38.5	-20.6	34.65	16.43	7.66	40.84	16.76
593.60	18.6	39.4	-20.8	33.91	17.29	8.15	40.72	15.27
644.80	20.7	40.2	-19.5	35.17	17.55	8.54	40.60	14.51
674.40	20.5	40.5	-20.0	34.60	17.70	8.76	40.53	14.07
723.20	20.9	41.1	-20.3	33.97	18.16	9.12	40.36	13.08
795.20	22.1	42.0	-19.8	33.66	18.87	9.63	40.03	11.54
812.00	23.2	42.1	-19.0	34.20	19.19	9.75	39.97	11.02
904.80	24.4	43.1	-18.6	33.17	20.44	10.44	39.60	8.72
950.40	26.4	43.5	-17.1	32.96	22.13	10.72	39.42	6.57
998.40	27.2	43.9	-16.7	32.63	22.83	11.01	39.27	5.42

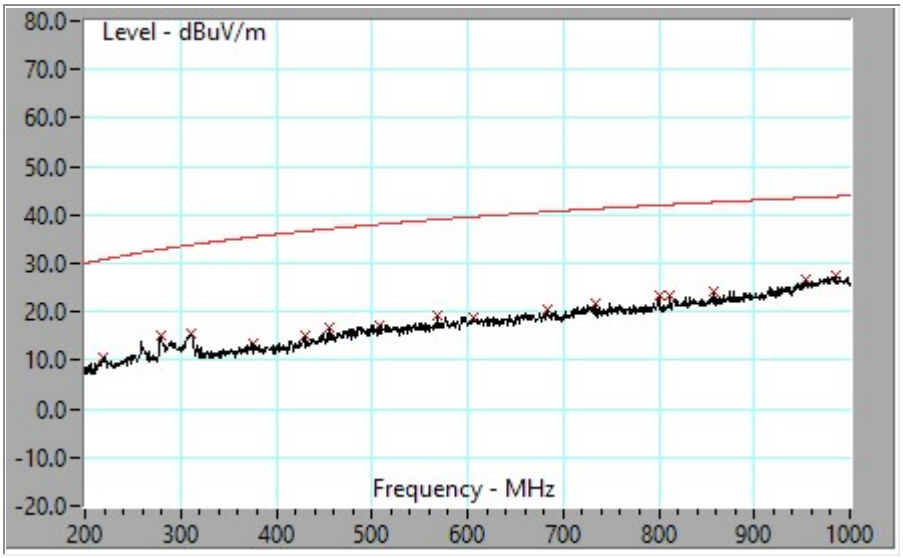
RE102: SwitchBox Position 1



Fri, Mar 5, 2021
2:21:53 PM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
HORIZONTAL
ETS 3106 Large Horn
Pasternack PE15A1012
Graph # 18

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
249.60	12.4	31.9	-19.5	36.59	11.43	5.09	40.71	24.18
279.20	20.1	32.9	-12.8	43.48	11.92	5.41	40.75	23.41
311.20	15.4	33.8	-18.4	37.79	12.68	5.74	40.78	22.36
360.80	13.0	35.1	-22.1	34.24	13.38	6.21	40.83	21.24
412.00	14.5	36.3	-21.8	34.99	13.67	6.68	40.85	20.50
489.60	17.2	37.8	-20.5	34.70	16.08	7.33	40.89	17.48
534.40	18.0	38.5	-20.5	35.06	16.12	7.69	40.83	17.03
590.40	18.9	39.4	-20.4	34.51	17.03	8.13	40.72	15.57
644.80	19.8	40.2	-20.4	34.56	17.25	8.54	40.60	14.80
680.80	20.6	40.6	-20.0	34.62	17.73	8.81	40.51	13.97
721.60	21.1	41.1	-20.0	34.29	18.08	9.11	40.37	13.18
800.00	22.5	42.0	-19.6	34.28	18.53	9.66	40.01	11.82
849.60	24.5	42.5	-18.1	34.69	19.57	10.03	39.82	10.22
904.00	24.1	43.1	-19.0	33.07	20.20	10.43	39.60	8.97
955.20	26.6	43.6	-16.9	33.01	22.26	10.75	39.41	6.40
979.20	27.6	43.8	-16.2	32.93	23.07	10.90	39.33	5.37

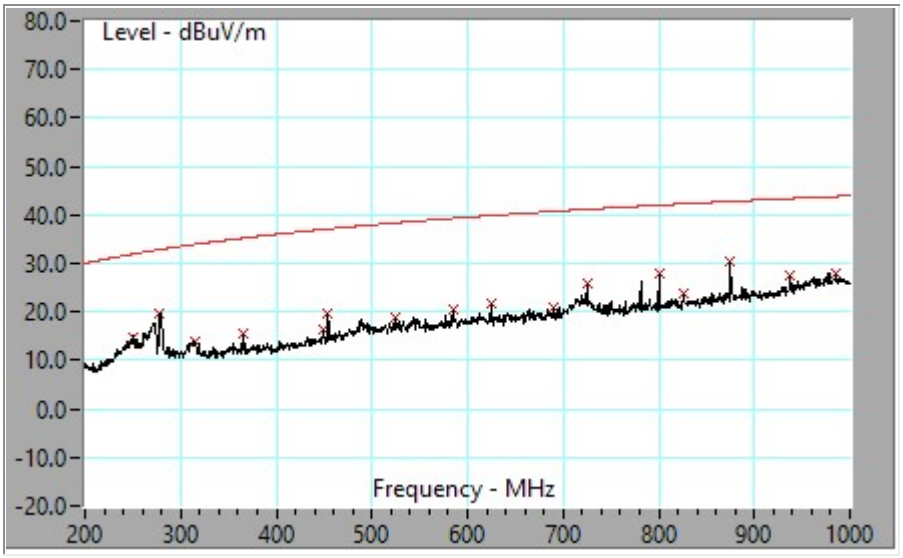
RE102: SwitchBox Position 2



Fri, Mar 5, 2021
2:25:09 PM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
HORIZONTAL
ETS 3106 Large Horn
Pasternack PE15A1012
Graph # 19

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
218.40	10.7	30.8	-20.1	35.83	10.80	4.76	40.71	25.16
279.20	15.0	32.9	-17.9	38.41	11.92	5.41	40.75	23.41
311.20	15.6	33.8	-18.3	37.91	12.68	5.74	40.78	22.36
375.20	13.4	35.5	-22.1	34.41	13.46	6.35	40.86	21.05
431.20	15.2	36.7	-21.5	35.15	14.05	6.84	40.86	19.97
456.00	16.8	37.1	-20.4	35.53	15.08	7.05	40.88	18.75
508.00	17.3	38.1	-20.8	34.41	16.28	7.48	40.88	17.11
569.60	19.2	39.1	-19.8	35.55	16.50	7.96	40.77	16.30
607.20	18.8	39.6	-20.8	34.03	17.24	8.26	40.69	15.18
684.80	20.4	40.7	-20.3	34.39	17.69	8.84	40.50	13.97
733.60	21.6	41.3	-19.7	34.55	18.15	9.19	40.32	12.98
800.00	23.3	42.0	-18.7	35.16	18.53	9.66	40.01	11.82
812.00	23.4	42.1	-18.8	34.62	18.99	9.75	39.97	11.23
858.40	24.0	42.6	-18.6	34.13	19.58	10.10	39.79	10.11
954.40	26.6	43.5	-16.9	33.06	22.22	10.74	39.41	6.44
984.80	27.4	43.8	-16.4	32.91	22.92	10.93	39.31	5.47

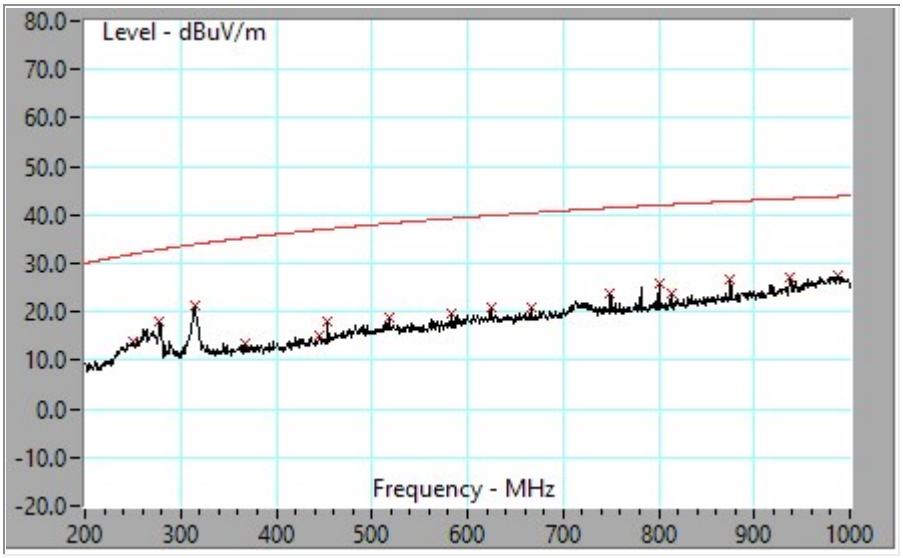
RE102: SwitchBox Position 2



Fri, Mar 5, 2021
2:29:33 PM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
VERTICAL
ETS 3106 Large Horn
Pasternack PE15A1012
Graph # 20

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
249.60	14.9	31.9	-17.1	39.14	11.33	5.09	40.71	24.29
278.40	19.9	32.9	-13.0	43.08	12.13	5.40	40.75	23.22
314.40	13.8	33.9	-20.2	35.96	12.82	5.77	40.79	22.19
364.80	15.4	35.2	-19.9	36.51	13.43	6.25	40.84	21.15
449.60	16.2	37.0	-20.9	35.37	14.67	7.00	40.88	19.21
454.40	19.9	37.1	-17.2	38.80	14.91	7.04	40.88	18.93
524.80	18.9	38.4	-19.4	35.62	16.56	7.61	40.85	16.68
584.80	20.4	39.3	-19.0	36.02	16.98	8.08	40.74	15.67
624.80	21.5	39.9	-18.3	36.44	17.36	8.39	40.64	14.89
689.60	20.9	40.7	-19.8	34.82	17.74	8.88	40.49	13.88
724.80	25.8	41.2	-15.4	38.82	18.19	9.13	40.36	13.04
800.00	27.9	42.0	-14.1	39.28	19.01	9.66	40.01	11.34
826.40	23.8	42.3	-18.5	34.40	19.41	9.86	39.91	10.65
875.20	30.3	42.8	-12.5	39.92	19.83	10.22	39.72	9.66
937.60	27.4	43.4	-16.0	34.65	21.55	10.64	39.47	7.28
985.60	27.9	43.8	-15.9	33.37	22.94	10.93	39.31	5.44

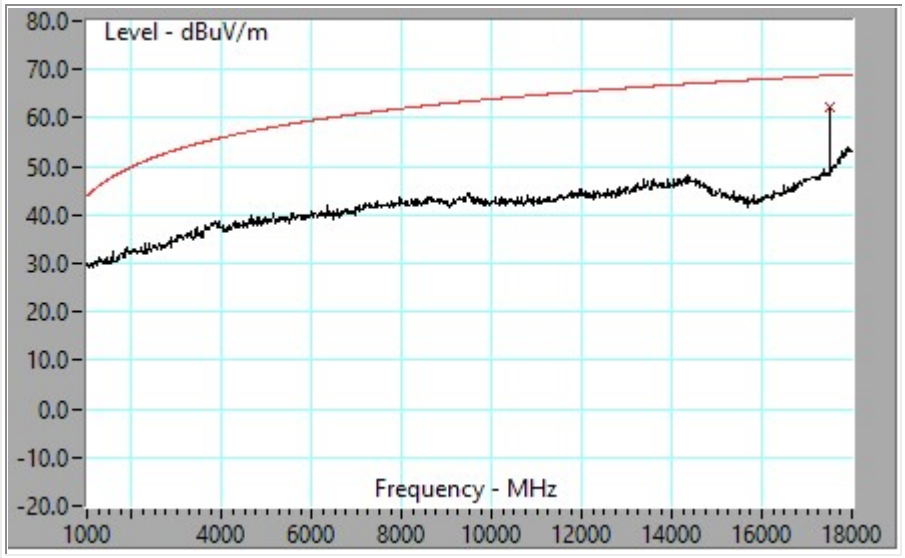
RE102: SwitchBox Position 1



Fri, Mar 5, 2021
2:32:58 PM
AutoScan 7.4.4.16
Res BW (kHz) 100
Vid BW (kHz) 50000
VERTICAL
ETS 3106 Large Horn
Pasternack PE15A1012
Graph # 21

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
249.60	14.0	31.9	-17.9	38.32	11.33	5.09	40.71	24.29
278.40	18.1	32.9	-14.8	41.34	12.13	5.40	40.75	23.22
315.20	21.2	33.9	-12.8	43.32	12.85	5.78	40.79	22.17
368.00	13.4	35.3	-21.9	34.48	13.44	6.28	40.84	21.13
445.60	15.3	36.9	-21.7	34.64	14.55	6.96	40.87	19.36
454.40	17.8	37.1	-19.3	36.77	14.91	7.04	40.88	18.93
517.60	18.8	38.2	-19.4	35.62	16.50	7.55	40.86	16.81
584.00	19.6	39.3	-19.7	35.26	16.95	8.08	40.74	15.71
624.80	20.7	39.9	-19.1	35.64	17.36	8.39	40.64	14.89
666.40	20.7	40.4	-19.7	34.88	17.67	8.70	40.55	14.18
749.60	23.7	41.5	-17.8	36.41	18.22	9.30	40.24	12.72
800.00	25.9	42.0	-16.1	37.22	19.01	9.66	40.01	11.34
812.80	23.7	42.2	-18.4	34.73	19.20	9.76	39.96	11.00
875.20	26.7	42.8	-16.1	36.38	19.83	10.22	39.72	9.66
937.60	27.3	43.4	-16.1	34.57	21.55	10.64	39.47	7.28
988.00	27.6	43.8	-16.2	33.08	22.92	10.95	39.30	5.44

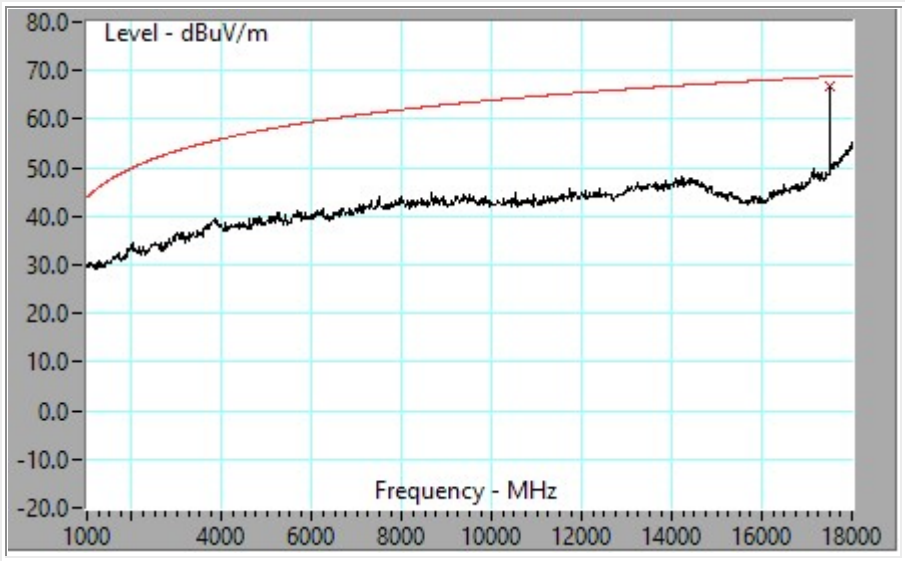
RE102 System Check: Calibrated Injected Signal = 62.46 dBuV @ 17.5 GHz



Mon, Mar 8, 2021
8:28:01 AM
AutoScan 7.4.4.16
Res BW (kHz) 1000
Vid BW (kHz) 50000
VERTICAL
EMCO 3115
AH Systems PAM-0118P
Graph # 1

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
17507.0	**62.1**	68.8	-6.6	42.10	44.54	16.48	40.97	-20.05

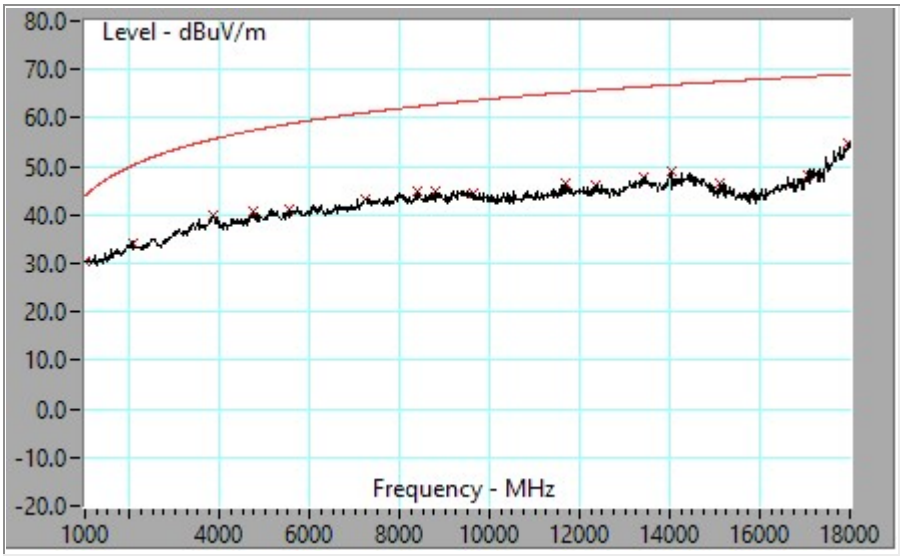
RE102 System Check: Stub Radiator @ 17.5 GHz



Mon, Mar 8, 2021
8:39:48 AM
AutoScan 7.4.4.16
Res BW (kHz) 1000
Vid BW (kHz) 50000
VERTICAL
EMCO 3115
AH Systems PAM-0118P
Graph # 2

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
17507.0	**66.7**	68.8	-2.1	46.62	44.54	16.48	40.97	-20.05

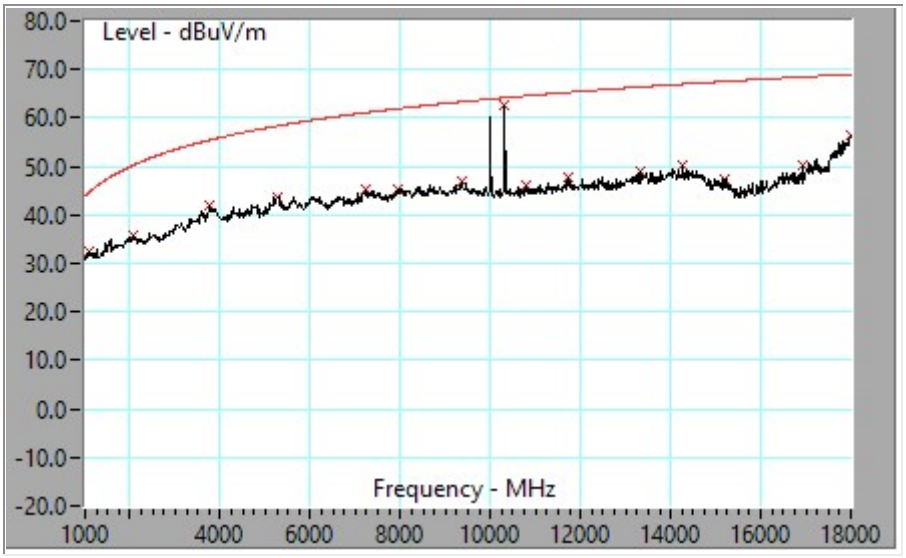
RE102 System Check: Ambient Scan Position 1



Mon, Mar 8, 2021
9:01:30 AM
AutoScan 7.4.4.16
Res BW (kHz) 1000
Vid BW (kHz) 50000
VERTICAL
EMCO 3115
AH Systems PAM-0118P
Graph # 3

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1000.0	30.4	44.0	-13.6	45.06	24.40	3.84	42.89	14.66
2088.0	34.0	50.3	-16.4	43.02	28.08	5.48	42.61	9.06
3839.0	40.0	55.6	-15.6	41.72	33.26	7.33	42.31	1.73
4723.0	40.8	57.4	-16.6	41.24	33.38	8.42	42.25	0.45
5539.0	41.2	58.8	-17.6	40.04	34.87	8.87	42.56	-1.18
7222.0	43.4	61.1	-17.7	38.83	37.39	10.36	43.18	-4.57
8378.0	45.0	62.4	-17.4	38.55	38.10	11.20	42.90	-6.40
8769.0	44.8	62.8	-18.0	38.16	38.41	11.27	43.04	-6.65
9619.0	44.6	63.6	-19.0	36.89	38.49	12.28	43.06	-7.71
11676.0	46.5	65.2	-18.8	36.11	39.80	13.14	42.57	-10.36
12339.0	46.2	65.7	-19.6	34.81	39.50	13.79	41.93	-11.37
13410.0	47.9	66.4	-18.6	33.11	41.48	14.42	41.13	-14.77
14022.0	49.0	66.8	-17.8	33.37	42.14	14.53	41.03	-15.64
15127.0	46.7	67.5	-20.8	32.12	40.39	15.23	41.01	-14.61
17048.0	48.3	68.5	-20.2	30.17	42.70	16.25	40.79	-18.16
17966.0	54.9	69.0	-14.1	30.35	47.60	16.87	39.95	-24.52

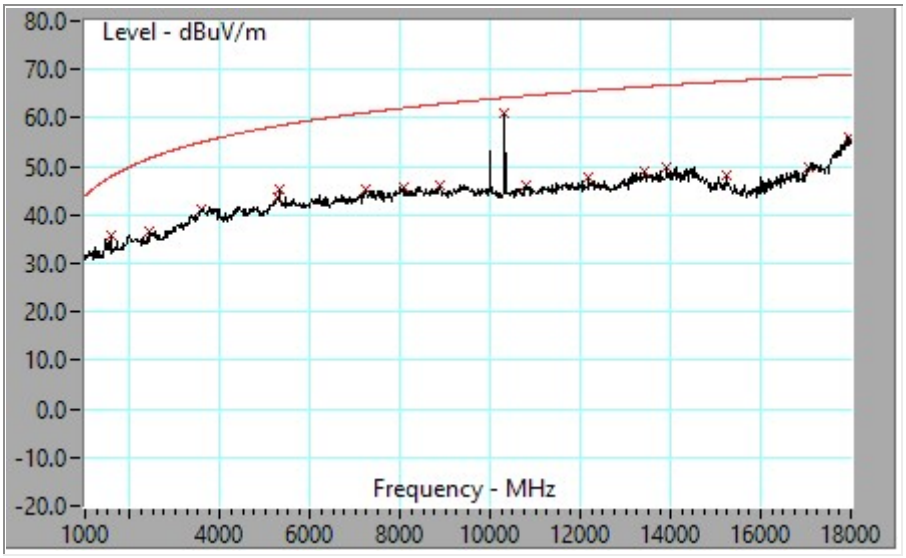
RE102: SwitchBox Position 1



Mon, Mar 8, 2021
10:34:08 AM
AutoScan 7.4.4.16
Res BW (kHz) 1000
Vid BW (kHz) 50000
HORIZONTAL
EMCO 3115
AH Systems PAM-0118P
Graph # 10

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1102.0	32.6	44.8	-12.2	45.62	25.80	4.02	42.87	13.05
2071.0	35.9	50.3	-14.4	44.25	28.77	5.46	42.62	8.38
3754.0	41.9	55.4	-13.5	42.86	34.02	7.29	42.30	0.99
5267.0	43.8	58.4	-14.6	42.10	35.60	8.58	42.50	-1.68
5284.0	43.6	58.4	-14.8	41.93	35.60	8.60	42.51	-1.69
7239.0	45.5	61.1	-15.6	39.76	38.53	10.37	43.17	-5.73
7936.0	45.1	61.9	-16.8	38.68	38.63	10.96	43.16	-6.43
9347.0	46.9	63.3	-16.4	38.12	39.69	12.12	43.05	-8.76
10316.0	62.5	64.2	-1.7	53.82	39.87	12.24	43.41	-8.70
10775.0	46.2	64.6	-18.3	36.72	39.75	12.98	43.21	-9.52
11710.0	47.9	65.3	-17.4	36.42	40.80	13.19	42.53	-11.46
13342.0	49.1	66.4	-17.3	33.86	42.13	14.35	41.25	-15.24
14277.0	50.4	67.0	-16.6	33.16	43.09	14.77	40.67	-17.20
15178.0	47.5	67.5	-20.0	32.27	41.00	15.25	40.97	-15.27
16929.0	50.3	68.5	-18.1	31.58	43.18	16.25	40.68	-18.75
18000.0	56.6	69.0	-12.4	31.13	48.50	16.86	39.87	-25.49

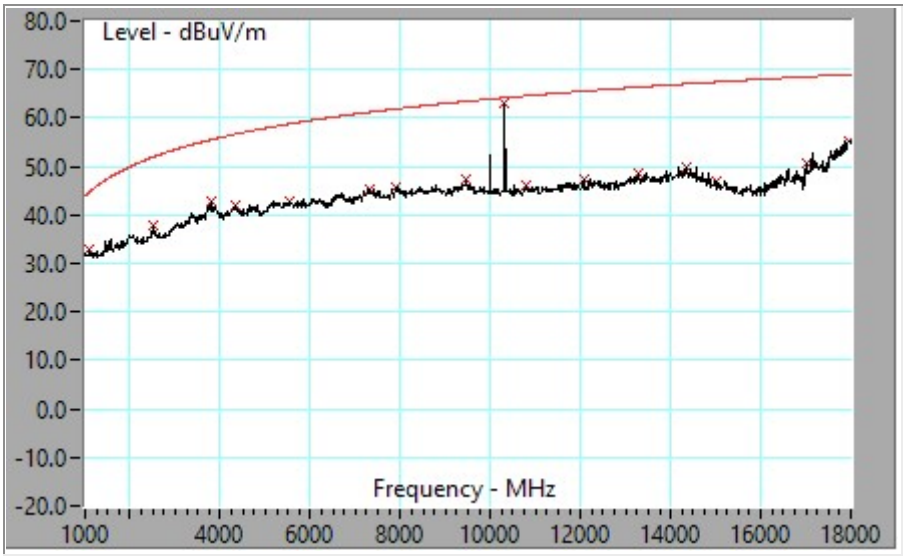
RE102: SwitchBox Position 2



Mon, Mar 8, 2021
10:40:43 AM
AutoScan 7.4.4.16
Res BW (kHz) 1000
Vid BW (kHz) 50000
HORIZONTAL
EMCO 3115
AH Systems PAM-0118P
Graph # 11

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1561.0	35.7	47.8	-12.1	47.33	26.37	4.80	42.76	11.59
2445.0	36.5	51.7	-15.2	43.44	29.79	5.86	42.57	6.92
3567.0	41.3	55.0	-13.7	43.59	32.77	7.19	42.26	2.31
5267.0	43.7	58.4	-14.6	42.04	35.60	8.58	42.50	-1.68
5318.0	45.1	58.4	-13.3	43.27	35.71	8.64	42.52	-1.83
7239.0	45.4	61.1	-15.7	39.66	38.53	10.37	43.17	-5.73
8055.0	45.7	62.0	-16.3	38.96	38.78	11.09	43.14	-6.73
8871.0	46.2	62.9	-16.6	38.51	39.53	11.34	43.12	-7.74
10316.0	61.1	64.2	-3.0	52.43	39.87	12.24	43.41	-8.70
10792.0	46.1	64.6	-18.5	36.53	39.72	13.00	43.20	-9.52
12186.0	47.6	65.6	-18.0	35.40	40.40	13.87	42.05	-12.22
13427.0	49.1	66.5	-17.4	33.67	42.09	14.42	41.11	-15.40
13903.0	49.9	66.8	-16.9	33.91	42.51	14.50	41.04	-15.97
15246.0	48.1	67.6	-19.5	33.10	40.63	15.30	40.93	-15.01
17048.0	49.9	68.5	-18.6	30.77	43.70	16.25	40.79	-19.16
17949.0	56.0	69.0	-13.0	30.57	48.50	16.88	39.99	-25.39

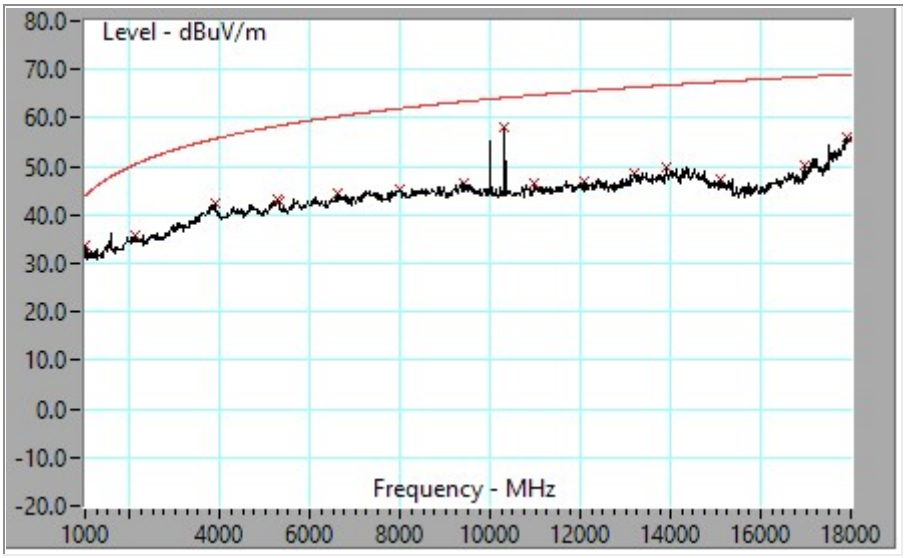
RE102: SwitchBox Position 3



Mon, Mar 8, 2021
10:56:22 AM
AutoScan 7.4.4.16
Res BW (kHz) 1000
Vid BW (kHz) 50000
HORIZONTAL
EMCO 3115
AH Systems PAM-0118P
Graph # 12

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1102.0	33.0	44.8	-11.8	46.01	25.80	4.02	42.87	13.05
2530.0	37.7	52.0	-14.3	44.37	29.96	5.96	42.55	6.64
3822.0	42.8	55.6	-12.7	43.59	34.24	7.32	42.31	0.74
4349.0	42.1	56.7	-14.6	43.06	33.50	7.75	42.18	0.93
5556.0	42.8	58.8	-16.0	40.60	35.90	8.89	42.55	-2.24
7341.0	45.3	61.2	-15.9	39.23	38.80	10.40	43.11	-6.09
7902.0	45.9	61.9	-16.0	39.43	38.70	10.90	43.15	-6.45
9466.0	47.2	63.4	-16.2	38.45	39.53	12.23	42.98	-8.78
10316.0	62.9	64.2	-1.3	54.20	39.87	12.24	43.41	-8.70
10809.0	46.0	64.6	-18.6	36.45	39.70	13.01	43.18	-9.53
12067.0	47.3	65.5	-18.2	35.10	40.60	13.75	42.15	-12.20
13274.0	48.6	66.4	-17.7	33.66	42.04	14.27	41.36	-14.96
14345.0	50.0	67.0	-17.0	32.73	43.00	14.83	40.57	-17.26
15008.0	47.0	67.4	-20.4	31.65	41.27	15.18	41.09	-15.36
17014.0	50.6	68.5	-17.9	31.41	43.70	16.26	40.77	-19.19
17966.0	55.4	69.0	-13.6	29.98	48.50	16.87	39.95	-25.42

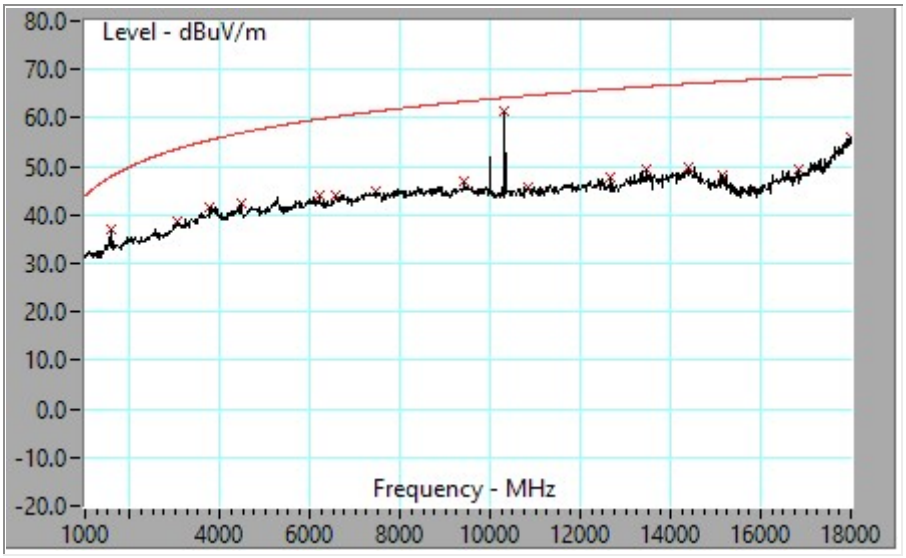
RE102: SwitchBox Position 4



Mon, Mar 8, 2021
11:03:27 AM
AutoScan 7.4.4.16
Res BW (kHz) 1000
Vid BW (kHz) 50000
HORIZONTAL
EMCO 3115
AH Systems PAM-0118P
Graph # 13

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1017.0	33.9	44.1	-10.2	47.87	25.07	3.87	42.89	13.95
2105.0	35.9	50.4	-14.5	44.01	28.99	5.50	42.61	8.12
3890.0	42.2	55.7	-13.5	42.94	34.22	7.35	42.32	0.75
5267.0	43.3	58.4	-15.0	41.64	35.60	8.58	42.50	-1.68
5301.0	42.7	58.4	-15.7	41.01	35.61	8.62	42.51	-1.71
6627.0	44.3	60.3	-16.0	40.54	36.91	9.84	42.95	-3.80
8004.0	45.4	62.0	-16.5	38.84	38.71	11.07	43.18	-6.60
9415.0	46.5	63.4	-16.8	37.77	39.57	12.20	43.01	-8.76
10316.0	58.0	64.2	-6.1	49.33	39.87	12.24	43.41	-8.70
10979.0	46.6	64.7	-18.2	36.81	39.80	12.99	43.04	-9.75
12067.0	47.0	65.5	-18.5	34.82	40.60	13.75	42.15	-12.20
13189.0	48.6	66.3	-17.8	33.85	42.01	14.18	41.50	-14.70
13886.0	49.9	66.8	-16.9	33.96	42.47	14.50	41.04	-15.93
15093.0	47.6	67.5	-19.9	32.28	41.10	15.21	41.03	-15.28
16963.0	50.1	68.5	-18.4	31.27	43.26	16.26	40.72	-18.79
17898.0	56.0	69.0	-13.0	30.61	48.58	16.89	40.10	-25.38

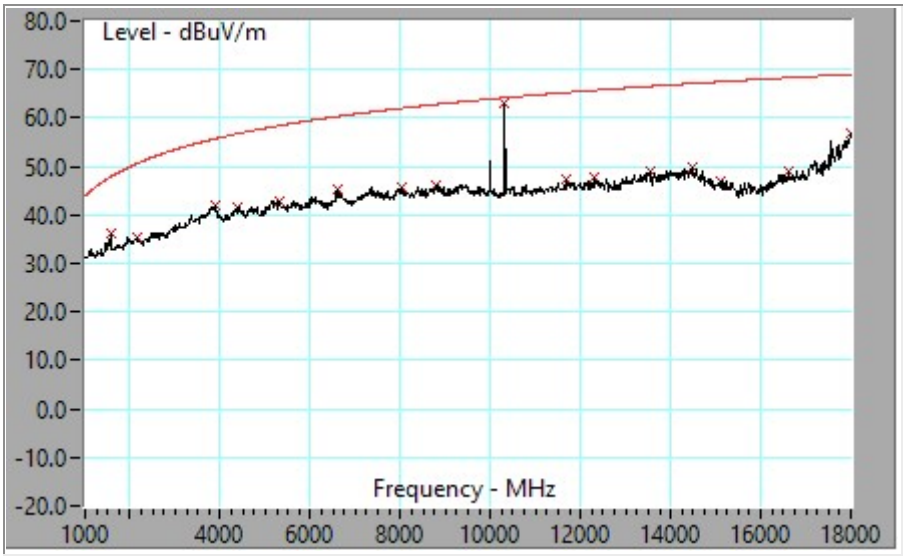
RE102: SwitchBox Position 5



Mon, Mar 8, 2021
11:10:14 AM
AutoScan 7.4.4.16
Res BW (kHz) 1000
Vid BW (kHz) 50000
HORIZONTAL
EMCO 3115
AH Systems PAM-0118P
Graph # 14

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1561.0	37.2	47.8	-10.6	48.82	26.37	4.80	42.76	11.59
3040.0	38.6	53.6	-15.0	42.73	31.74	6.56	42.41	4.11
3754.0	41.5	55.4	-13.9	42.48	34.02	7.29	42.30	0.99
4451.0	42.3	56.9	-14.6	42.62	33.90	7.92	42.14	0.31
6202.0	44.1	59.8	-15.7	40.60	36.50	9.58	42.60	-3.48
6559.0	44.1	60.3	-16.1	40.65	36.64	9.75	42.89	-3.50
7443.0	44.9	61.3	-16.5	38.76	38.73	10.43	43.06	-6.10
9432.0	47.0	63.4	-16.4	38.25	39.54	12.21	43.00	-8.74
10316.0	61.4	64.2	-2.8	52.70	39.87	12.24	43.41	-8.70
10843.0	45.9	64.6	-18.7	36.33	39.70	13.01	43.15	-9.56
12679.0	47.7	66.0	-18.2	34.85	40.82	13.87	41.80	-12.89
13461.0	49.3	66.5	-17.2	33.88	42.07	14.41	41.05	-15.42
14379.0	49.8	67.1	-17.2	32.64	42.83	14.86	40.52	-17.17
15144.0	48.4	67.5	-19.1	33.13	41.01	15.23	41.00	-15.25
16827.0	49.4	68.4	-19.0	31.18	42.55	16.23	40.57	-18.21
17983.0	55.9	69.0	-13.1	30.40	48.50	16.86	39.91	-25.45

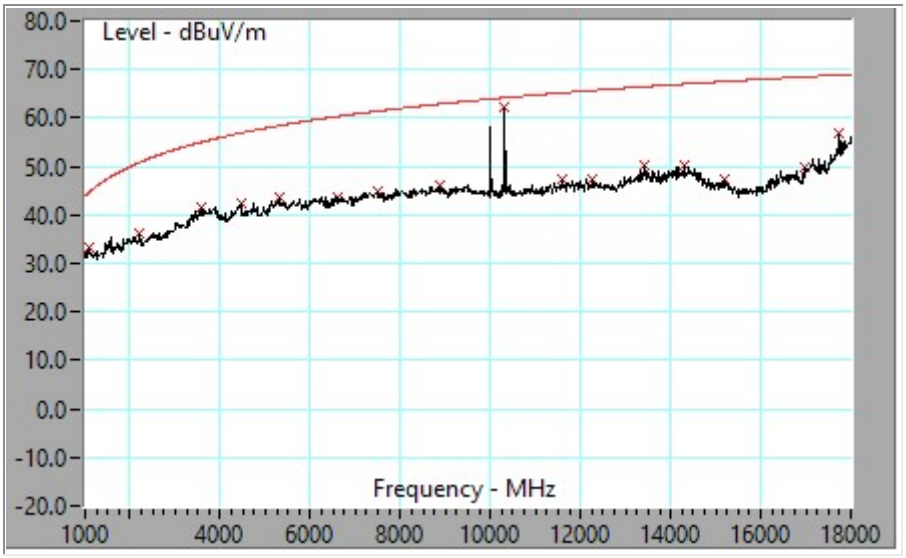
RE102: SwitchBox Position 6



Mon, Mar 8, 2021
11:16:35 AM
AutoScan 7.4.4.16
Res BW (kHz) 1000
Vid BW (kHz) 50000
HORIZONTAL
EMCO 3115
AH Systems PAM-0118P
Graph # 15

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1561.0	36.0	47.8	-11.8	47.60	26.37	4.80	42.76	11.59
2139.0	35.4	50.5	-15.2	43.53	28.92	5.54	42.61	8.15
3890.0	41.9	55.7	-13.8	42.70	34.22	7.35	42.32	0.75
4383.0	41.6	56.8	-15.2	42.34	33.63	7.78	42.17	0.76
5318.0	42.7	58.4	-15.7	40.87	35.71	8.64	42.52	-1.83
6593.0	45.1	60.3	-15.2	41.50	36.77	9.79	42.92	-3.64
8021.0	45.6	62.0	-16.4	38.90	38.74	11.07	43.16	-6.65
8769.0	46.1	62.8	-16.7	38.41	39.41	11.27	43.04	-7.65
10316.0	63.0	64.2	-1.2	54.27	39.87	12.24	43.41	-8.70
11693.0	47.3	65.3	-17.9	35.95	40.79	13.16	42.55	-11.40
12322.0	47.8	65.7	-17.9	35.44	40.50	13.80	41.94	-12.36
13563.0	49.1	66.5	-17.4	33.52	42.23	14.38	41.00	-15.61
14464.0	49.7	67.1	-17.4	32.53	42.67	14.91	40.40	-17.18
15127.0	46.9	67.5	-20.6	31.61	41.05	15.23	41.01	-15.27
16623.0	49.0	68.3	-19.3	31.65	41.61	16.10	40.33	-17.37
17983.0	56.9	69.0	-12.1	31.46	48.50	16.86	39.91	-25.45

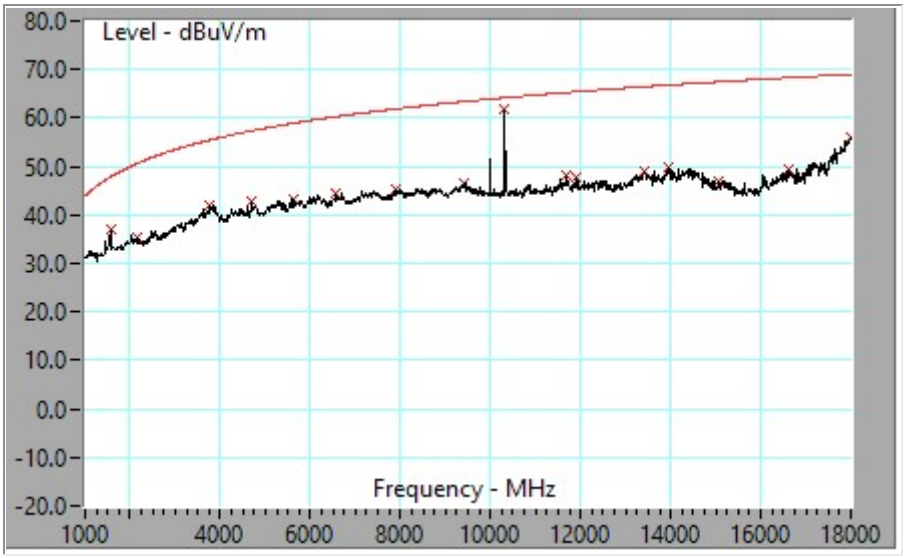
RE102: SwitchBox Position 7



Mon, Mar 8, 2021
11:26:21 AM
AutoScan 7.4.4.16
Res BW (kHz) 1000
Vid BW (kHz) 50000
HORIZONTAL
EMCO 3115
AH Systems PAM-0118P
Graph # 16

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1068.0	33.2	44.5	-11.3	46.58	25.54	3.96	42.88	13.37
2207.0	36.2	50.8	-14.6	44.19	28.97	5.61	42.60	8.02
3584.0	41.5	55.0	-13.5	43.73	32.84	7.20	42.26	2.22
4451.0	42.3	56.9	-14.6	42.65	33.90	7.92	42.14	0.31
5301.0	43.5	58.4	-14.9	41.78	35.61	8.62	42.51	-1.71
6593.0	43.8	60.3	-16.5	40.17	36.77	9.79	42.92	-3.64
7494.0	44.8	61.4	-16.6	38.61	38.79	10.44	43.04	-6.19
8871.0	46.1	62.9	-16.7	38.41	39.53	11.34	43.12	-7.74
10316.0	62.1	64.2	-2.1	53.37	39.87	12.24	43.41	-8.70
11591.0	47.3	65.2	-17.9	36.32	40.60	13.01	42.67	-10.94
12254.0	47.4	65.7	-18.3	35.09	40.41	13.85	41.99	-12.26
13410.0	50.1	66.4	-16.4	34.63	42.16	14.42	41.13	-15.45
14311.0	50.1	67.0	-16.9	32.94	43.00	14.80	40.62	-17.19
15212.0	47.4	67.5	-20.1	32.21	40.90	15.27	40.95	-15.22
16963.0	49.9	68.5	-18.6	31.08	43.26	16.26	40.72	-18.79
17745.0	56.8	68.9	-12.1	33.04	47.38	16.84	40.44	-23.78

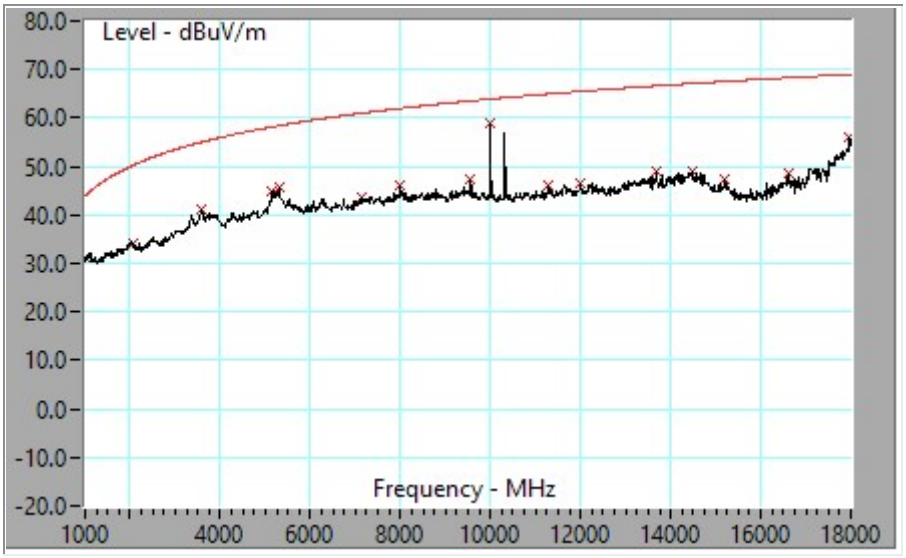
RE102: SwitchBox Position 8



Mon, Mar 8, 2021
11:32:25 AM
AutoScan 7.4.4.16
Res BW (kHz) 1000
Vid BW (kHz) 50000
HORIZONTAL
EMCO 3115
AH Systems PAM-0118P
Graph # 17

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1561.0	36.8	47.8	-11.0	48.42	26.37	4.80	42.76	11.59
2139.0	35.4	50.5	-15.1	43.59	28.92	5.54	42.61	8.15
3754.0	41.8	55.4	-13.6	42.84	34.02	7.29	42.30	0.99
4689.0	43.0	57.3	-14.4	42.61	34.20	8.39	42.23	-0.35
5641.0	43.3	58.9	-15.6	41.18	35.74	8.95	42.53	-2.16
6576.0	44.5	60.3	-15.8	40.93	36.70	9.77	42.90	-3.57
7919.0	45.2	61.9	-16.7	38.76	38.66	10.93	43.16	-6.44
9398.0	46.7	63.4	-16.7	37.93	39.60	12.19	43.02	-8.77
10316.0	61.7	64.2	-2.5	53.00	39.87	12.24	43.41	-8.70
11676.0	48.3	65.2	-16.9	36.98	40.75	13.14	42.57	-11.32
11914.0	47.9	65.4	-17.5	36.05	40.63	13.54	42.30	-11.86
13410.0	48.9	66.4	-17.6	33.41	42.16	14.42	41.13	-15.45
13971.0	49.9	66.8	-16.9	33.74	42.74	14.50	41.05	-16.19
15076.0	47.1	67.5	-20.4	31.83	41.10	15.21	41.04	-15.27
16640.0	49.5	68.3	-18.9	32.16	41.54	16.11	40.35	-17.30
18000.0	56.0	69.0	-13.0	30.48	48.50	16.86	39.87	-25.49

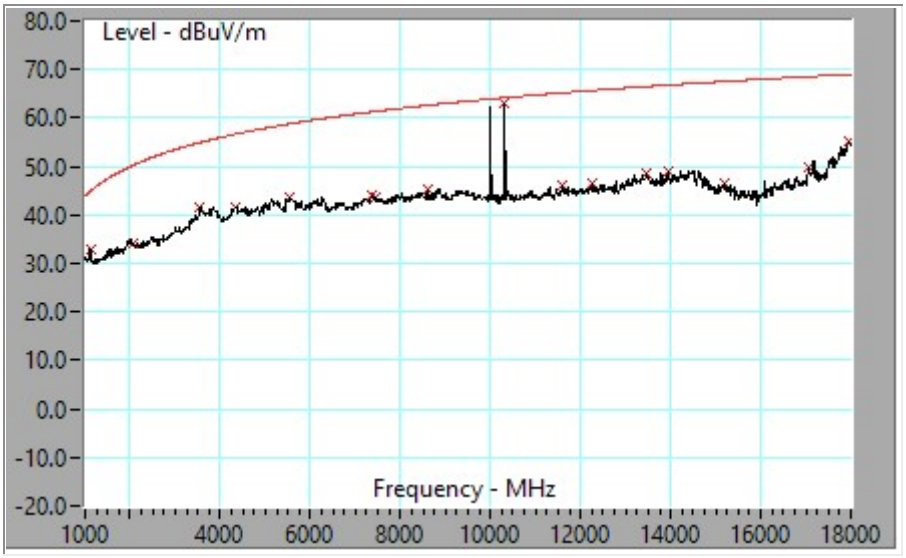
RE102: SwitchBox Position 1



Mon, Mar 8, 2021
11:42:22 AM
AutoScan 7.4.4.16
Res BW (kHz) 1000
Vid BW (kHz) 50000
VERTICAL
EMCO 3115
AH Systems PAM-0118P
Graph # 18

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1017.0	31.3	44.1	-12.8	45.94	24.40	3.87	42.89	14.62
2071.0	33.9	50.3	-16.3	43.04	28.04	5.46	42.62	9.11
3601.0	41.1	55.1	-14.0	44.10	32.01	7.22	42.27	3.04
5148.0	45.0	58.2	-13.2	44.65	34.30	8.49	42.47	-0.32
5318.0	45.9	58.4	-12.6	45.19	34.57	8.64	42.52	-0.69
7120.0	43.7	61.0	-17.3	39.62	36.98	10.30	43.23	-4.05
8004.0	46.1	62.0	-15.9	40.48	37.72	11.07	43.18	-5.61
9551.0	47.5	63.5	-16.0	39.60	38.60	12.27	43.01	-7.87
9993.0	58.8	63.9	-5.1	51.48	38.60	12.08	43.35	-7.34
11302.0	46.3	65.0	-18.7	36.99	39.30	12.88	42.87	-9.30
11999.0	46.3	65.5	-19.2	35.34	39.51	13.68	42.20	-10.99
13682.0	48.9	66.6	-17.7	34.14	41.40	14.42	41.01	-14.81
14481.0	49.0	67.1	-18.2	32.28	42.14	14.92	40.38	-16.68
15212.0	47.2	67.5	-20.3	32.78	40.15	15.27	40.95	-14.47
16606.0	48.6	68.3	-19.7	32.34	40.51	16.09	40.31	-16.28
17966.0	55.9	69.0	-13.1	31.34	47.60	16.87	39.95	-24.52

RE102: SwitchBox Position 2



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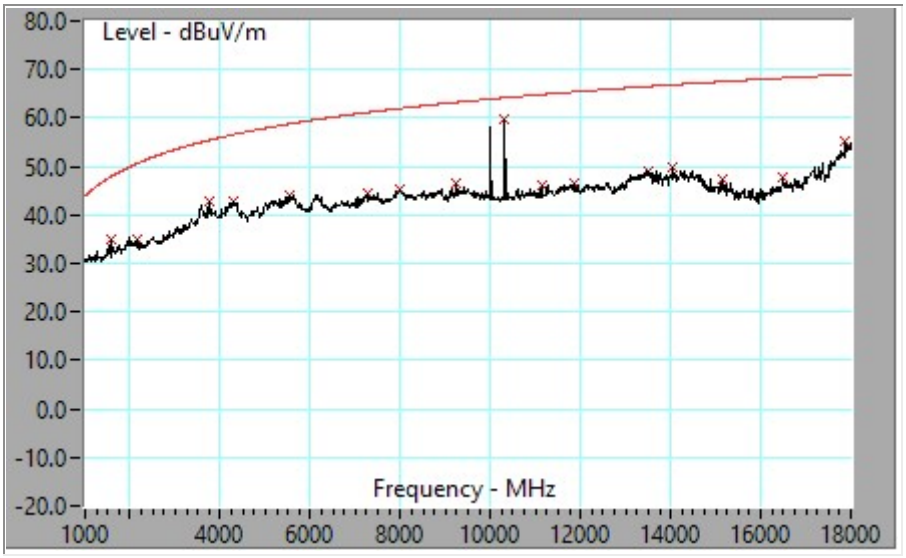
Vid BW (kHz) 50000
VERTICAL
EMCO 3115
AH Systems PAM-0118P
Graph # 19

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1119.0	33.0	44.9	-11.9	47.03	24.82	4.05	42.86	13.99
2088.0	34.2	50.3	-16.1	43.30	28.08	5.48	42.61	9.06
3533.0	41.5	54.9	-13.3	44.78	31.87	7.15	42.26	3.24
4349.0	41.7	56.7	-15.0	43.57	32.60	7.75	42.18	1.83
5556.0	43.6	58.8	-15.2	42.43	34.82	8.89	42.55	-1.16
7375.0	44.2	61.3	-17.1	39.17	37.70	10.41	43.10	-5.02
7460.0	43.7	61.4	-17.6	38.68	37.68	10.43	43.05	-5.06
8599.0	45.5	62.6	-17.1	38.90	38.20	11.25	42.89	-6.55
10316.0	62.9	64.2	-1.3	55.26	38.77	12.24	43.41	-7.60
11608.0	46.0	65.2	-19.2	35.89	39.72	13.03	42.65	-10.09
12254.0	46.5	65.7	-19.2	35.12	39.50	13.85	41.99	-11.35
13478.0	48.5	66.5	-18.0	33.69	41.46	14.40	41.02	-14.84
13937.0	49.2	66.8	-17.6	33.97	41.75	14.50	41.05	-15.20
15212.0	46.6	67.5	-20.9	32.13	40.15	15.27	40.95	-14.47
17048.0	49.9	68.5	-18.6	31.77	42.70	16.25	40.79	-18.16
17949.0	55.3	69.0	-13.6	30.96	47.50	16.88	39.99	-24.39

RE102: SwitchBox Position 3



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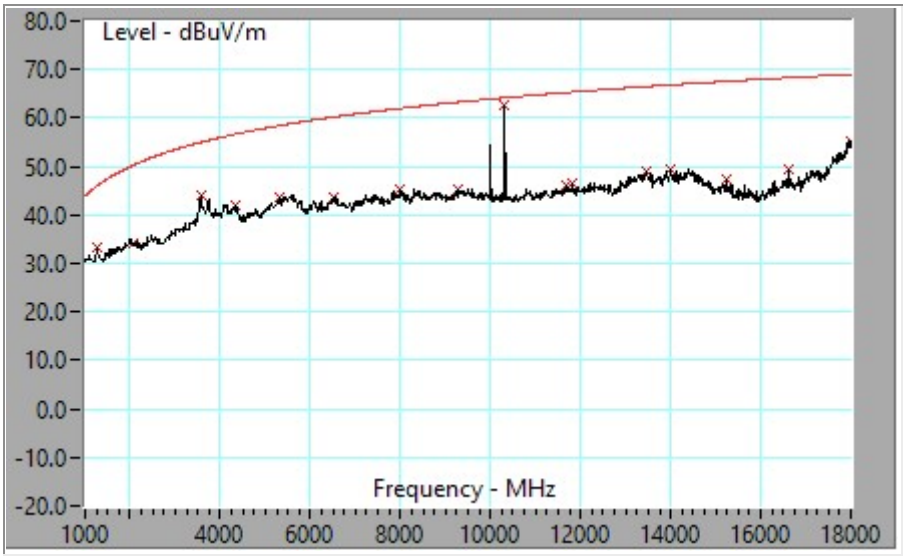
Vid BW (kHz) 50000
VERTICAL
EMCO 3115
AH Systems PAM-0118P
Graph # 20

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1561.0	34.9	47.8	-12.9	47.43	25.44	4.80	42.76	12.52
2173.0	34.9	50.7	-15.8	44.06	27.90	5.57	42.60	9.13
3754.0	42.8	55.4	-12.6	44.83	33.01	7.29	42.30	2.00
4281.0	42.8	56.6	-13.7	44.67	32.66	7.69	42.21	1.86
5539.0	44.0	58.8	-14.7	42.86	34.87	8.87	42.56	-1.18
7256.0	44.5	61.1	-16.7	39.73	37.51	10.37	43.16	-4.73
8004.0	45.5	62.0	-16.5	39.87	37.72	11.07	43.18	-5.61
9245.0	46.4	63.2	-16.8	38.84	38.68	11.99	43.10	-7.57
10316.0	59.8	64.2	-4.4	52.20	38.77	12.24	43.41	-7.60
11132.0	46.2	64.8	-18.6	37.29	38.96	12.90	42.96	-8.91
11880.0	46.4	65.4	-19.0	35.46	39.78	13.48	42.34	-10.92
13495.0	49.0	66.5	-17.5	34.08	41.49	14.40	41.00	-14.89
14056.0	49.9	66.9	-17.0	34.09	42.21	14.56	40.98	-15.79
15144.0	47.3	67.5	-20.2	32.73	40.32	15.23	41.00	-14.56
16504.0	47.7	68.2	-20.5	31.99	39.91	16.02	40.20	-15.73
17881.0	55.1	68.9	-13.8	30.86	47.49	16.90	40.14	-24.25

RE102: SwitchBox Position 4



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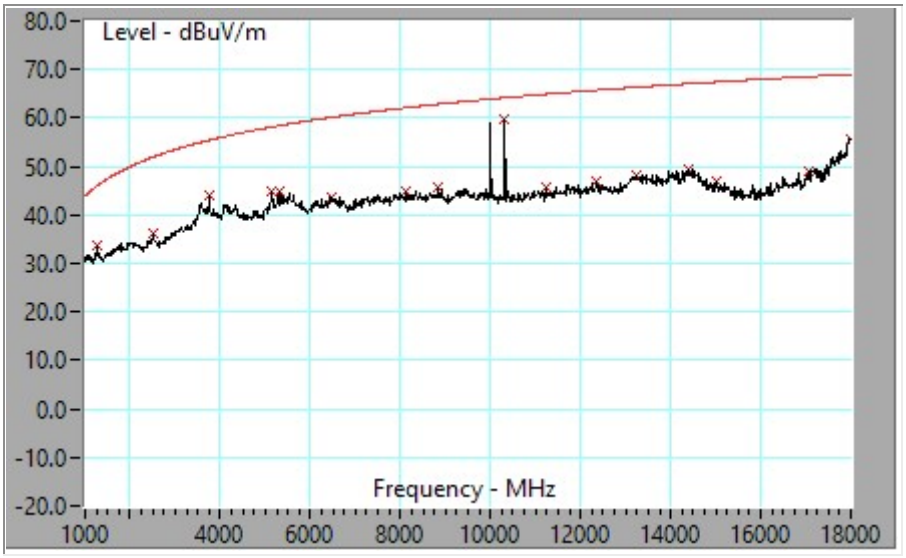
Vid BW (kHz) 50000
VERTICAL
EMCO 3115
AH Systems PAM-0118P
Graph # 21

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1255.0	33.3	45.9	-12.6	46.65	25.22	4.30	42.83	13.32
2088.0	34.3	50.3	-16.0	43.37	28.08	5.48	42.61	9.06
3567.0	44.1	55.0	-10.9	47.19	31.93	7.19	42.26	3.14
4332.0	41.9	56.7	-14.7	43.73	32.64	7.73	42.19	1.82
5318.0	43.7	58.4	-14.8	42.99	34.57	8.64	42.52	-0.69
6508.0	43.5	60.2	-16.7	41.31	35.33	9.70	42.84	-2.19
8004.0	45.3	62.0	-16.7	39.69	37.72	11.07	43.18	-5.61
9262.0	45.3	63.2	-17.9	37.73	38.65	12.01	43.09	-7.57
10316.0	62.8	64.2	-1.3	55.25	38.77	12.24	43.41	-7.60
11659.0	45.9	65.2	-19.3	35.59	39.80	13.11	42.59	-10.32
11812.0	46.4	65.3	-19.0	35.62	39.82	13.36	42.42	-10.77
13478.0	48.8	66.5	-17.7	34.01	41.46	14.40	41.02	-14.84
14005.0	49.5	66.8	-17.4	33.88	42.11	14.51	41.05	-15.57
15229.0	47.5	67.6	-20.0	33.10	40.08	15.29	40.94	-14.43
16606.0	49.5	68.3	-18.8	33.18	40.51	16.09	40.31	-16.28
17983.0	55.4	69.0	-13.6	30.74	47.70	16.86	39.91	-24.65

RE102: SwitchBox Position 5



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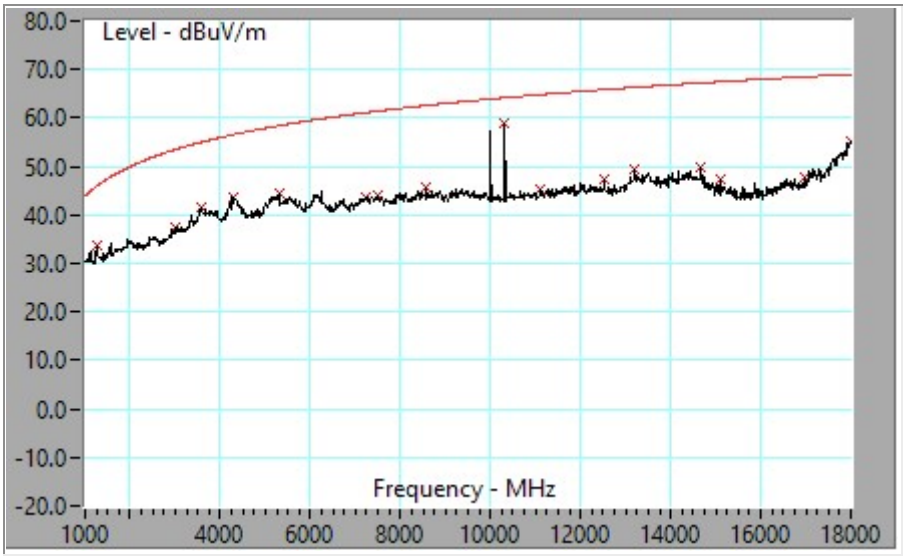
Vid BW (kHz) 50000
VERTICAL
EMCO 3115
AH Systems PAM-0118P
Graph # 22

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1255.0	33.6	45.9	-12.3	46.89	25.22	4.30	42.83	13.32
2496.0	36.3	51.9	-15.6	43.87	29.08	5.92	42.56	7.57
3754.0	44.1	55.4	-11.3	46.10	33.01	7.29	42.30	2.00
5148.0	44.7	58.2	-13.5	44.35	34.30	8.49	42.47	-0.32
5301.0	44.7	58.4	-13.7	44.08	34.50	8.62	42.51	-0.61
6474.0	43.7	60.1	-16.4	41.60	35.30	9.66	42.81	-2.14
8123.0	44.9	62.1	-17.2	39.03	37.84	11.12	43.09	-5.87
8837.0	45.7	62.8	-17.2	38.91	38.53	11.31	43.10	-6.74
10316.0	59.7	64.2	-4.4	52.14	38.77	12.24	43.41	-7.60
11251.0	45.9	64.9	-19.0	36.72	39.20	12.87	42.90	-9.17
12356.0	47.0	65.7	-18.8	35.57	39.51	13.78	41.91	-11.38
13223.0	48.3	66.3	-18.1	34.29	41.21	14.21	41.44	-13.98
14379.0	49.6	67.1	-17.5	33.11	42.14	14.86	40.52	-16.48
15025.0	46.8	67.4	-20.7	32.00	40.65	15.19	41.07	-14.76
17048.0	49.0	68.5	-19.5	30.83	42.70	16.25	40.79	-18.16
17983.0	55.7	69.0	-13.2	31.09	47.70	16.86	39.91	-24.65

RE102: SwitchBox Position 6



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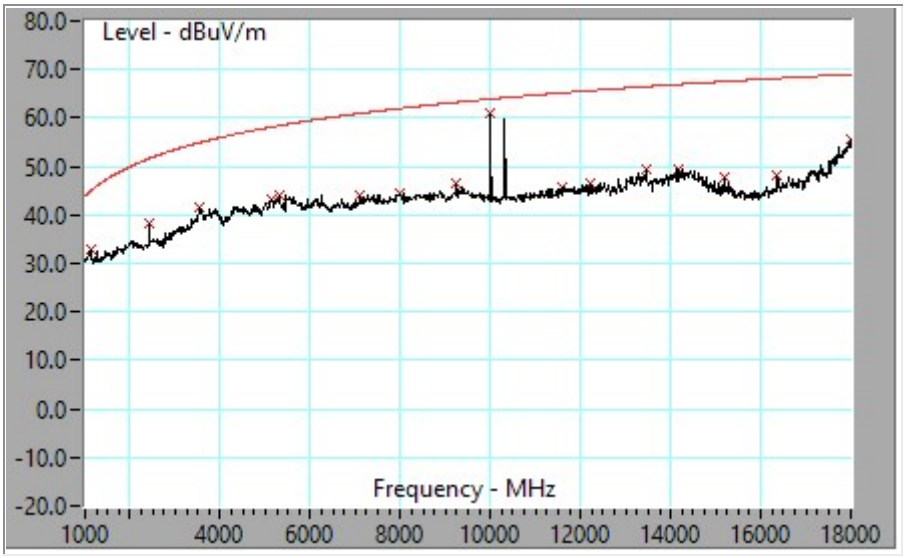
Vid BW (kHz) 50000
VERTICAL
EMCO 3115
AH Systems PAM-0118P
Graph # 23

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1255.0	33.8	45.9	-12.2	47.07	25.22	4.30	42.83	13.32
2989.0	37.5	53.4	-16.0	42.88	30.50	6.51	42.43	5.42
3584.0	41.7	55.0	-13.3	44.81	31.97	7.20	42.26	3.09
4281.0	43.8	56.6	-12.8	45.66	32.66	7.69	42.21	1.86
5301.0	44.4	58.4	-14.0	43.82	34.50	8.62	42.51	-0.61
7239.0	43.7	61.1	-17.4	39.06	37.46	10.37	43.17	-4.65
7477.0	44.2	61.4	-17.2	39.15	37.65	10.44	43.04	-5.04
8582.0	45.7	62.6	-16.9	39.14	38.20	11.24	42.88	-6.56
10316.0	58.9	64.2	-5.3	51.30	38.77	12.24	43.41	-7.60
11115.0	45.5	64.8	-19.4	36.58	38.93	12.91	42.96	-8.88
12526.0	47.2	65.9	-18.7	35.46	39.70	13.83	41.80	-11.74
13206.0	49.6	66.3	-16.7	35.62	41.28	14.19	41.47	-14.00
14668.0	50.0	67.2	-17.2	33.62	41.93	15.08	40.60	-16.41
15110.0	47.3	67.5	-20.2	32.63	40.46	15.22	41.02	-14.66
16997.0	47.7	68.5	-20.8	29.50	42.67	16.26	40.76	-18.17
18000.0	55.2	69.0	-13.8	30.45	47.80	16.86	39.87	-24.79

RE102: SwitchBox Position 7



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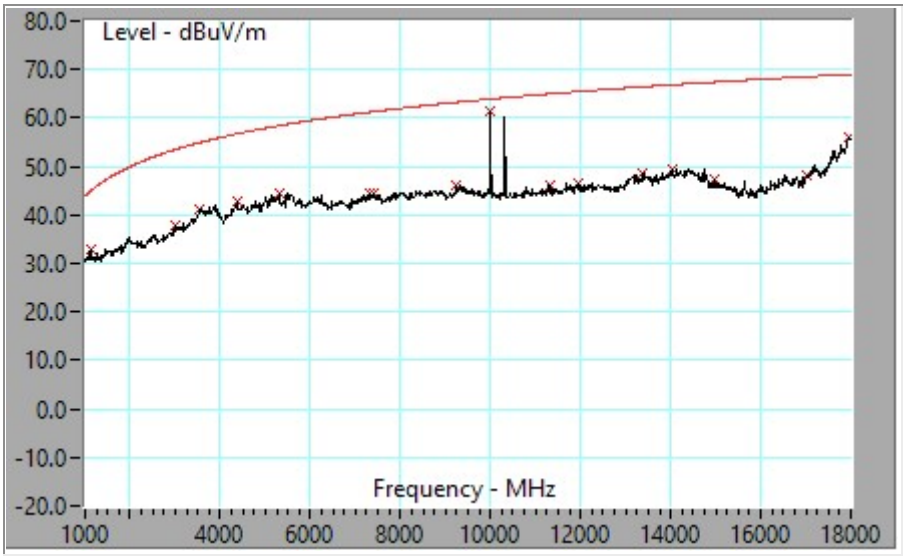
Vid BW (kHz) 50000
VERTICAL
EMCO 3115
AH Systems PAM-0118P
Graph # 24

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1119.0	33.0	44.9	-11.9	47.01	24.82	4.05	42.86	13.99
2428.0	38.4	51.6	-13.2	46.30	28.84	5.84	42.57	7.88
3550.0	41.5	54.9	-13.5	44.67	31.90	7.17	42.26	3.19
5131.0	43.4	58.1	-14.7	43.06	34.30	8.49	42.47	-0.32
5301.0	43.9	58.4	-14.5	43.27	34.50	8.62	42.51	-0.61
7103.0	44.0	60.9	-16.9	40.04	36.91	10.29	43.24	-3.97
7987.0	44.6	62.0	-17.4	38.99	37.70	11.04	43.18	-5.57
9245.0	46.5	63.2	-16.7	38.93	38.68	11.99	43.10	-7.57
9993.0	60.9	63.9	-3.0	53.58	38.60	12.08	43.35	-7.34
11608.0	45.9	65.2	-19.3	35.76	39.72	13.03	42.65	-10.09
12203.0	46.5	65.6	-19.2	35.22	39.41	13.88	42.04	-11.25
13444.0	49.3	66.5	-17.2	34.52	41.41	14.41	41.08	-14.75
14175.0	49.3	66.9	-17.6	33.06	42.40	14.68	40.81	-16.27
15195.0	47.8	67.5	-19.7	33.32	40.21	15.26	40.96	-14.50
16368.0	48.1	68.2	-20.1	32.97	39.53	15.92	40.34	-15.11
17983.0	55.6	69.0	-13.4	30.96	47.70	16.86	39.91	-24.65

RE102: SwitchBox Position 8



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Vid BW (kHz) 50000
VERTICAL
EMCO 3115
AH Systems PAM-0118P
Graph # 25

Frequency	Level	Limit	Delta	Raw	Ant.	Cable	Amp	All Factors
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB	dB	dB
1119.0	33.1	44.9	-11.9	47.06	24.82	4.05	42.86	13.99
3023.0	38.0	53.5	-15.6	43.11	30.73	6.54	42.41	5.14
3550.0	41.3	54.9	-13.6	44.51	31.90	7.17	42.26	3.19
4383.0	42.9	56.8	-13.9	44.58	32.67	7.78	42.17	1.72
5301.0	44.4	58.4	-14.0	43.76	34.50	8.62	42.51	-0.61
7341.0	44.4	61.2	-16.8	39.45	37.68	10.40	43.11	-4.97
7426.0	44.4	61.3	-17.0	39.32	37.70	10.43	43.07	-5.06
9245.0	46.2	63.2	-17.0	38.64	38.68	11.99	43.10	-7.57
9993.0	61.4	63.9	-2.5	54.08	38.60	12.08	43.35	-7.34
11319.0	46.2	65.0	-18.7	36.97	39.26	12.88	42.86	-9.28
11948.0	46.7	65.4	-18.7	35.57	39.80	13.59	42.26	-11.13
13376.0	48.5	66.4	-17.9	33.93	41.36	14.40	41.19	-14.56
14056.0	49.4	66.9	-17.4	33.63	42.21	14.56	40.98	-15.79
14991.0	47.4	67.4	-20.0	32.52	40.75	15.18	41.08	-14.86
17014.0	48.4	68.5	-20.1	30.18	42.70	16.26	40.77	-18.19
17949.0	55.9	69.0	-13.1	31.50	47.50	16.88	39.99	-24.39

5.7.10 RE102 Test Equipment List

Table 5.7-3: RE102 Test Equipment List

Asset No.	Manufacturer	Item	Model	S/N	Cal. Cycle (Months)	Cal. Due
WC058456	Keysight	MXE EMI Receiver	N9038A	MY5190108	12	05/19/21
WC005829	ETS-Lindgren	Active Rod Antenna	3301C	00114485	12	1/19/22
WC006573	EMCO	Biconical Antenna	3109	9411-2853	36	4/2/23
WC005310	ETS-Lindgren	Large Horn Antenna	3106	35382	36	4/13/23
WC005283	Electrometrics	Horn Antenna	RGA-60	6150	36	05/19/23
WC005615	A.H. Systems	Preamplifier	PAM-0118P	393	12	4/16/21
WC005647	Solar	LISN	8028-50-TS-24-BNC	0511189	36	6/5/23
WC005290	Solar	LISN	8028-50-TS-24-BNC	075513	36	3/6/22
WC005510	National Technical Systems	Anechoic Chamber AR1, 30' x 22' x 19'	N/A	N/A	N/A	N/A
WC005733	NTS	Stub Radiator	MIL-STD-461 Stub Radiator	None	NCR	NCR
WC058498	Winchester Interconnect	SRC-215, 2.9mm Coax Cable, 420”	E50-E50-2154200	None	24	6/2/22
WC058501	Winchester Interconnect	SRC-215, 2.9mm Coax Cable, 120”	E50-E50-2151200	None	24	6/2/22
WC005477	Marconi	9kHz – 1.2GHz Signal Generator	2023	112253143	12	01/13/22
WC005556	Agilent	10MHz-20GHz Signal Generator	8372B	US34490403	12	8/18/21
WC005470	Sorenson	DC Power Supply	0011B155	125T5M05	NCR	NCR

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

NCR = No Calibration Required; as per NTS QA policy, the equipment does not require calibration as long as the test signal being generated can be verified with other calibrated equipment prior to or during the test.

5.8 Method RS103, Radiated Susceptibility, Electric Field, 30 MHz to 18 GHz

5.8.1 RS103 Purpose

This test verifies the ability of the EUT, and their associated cabling, to withstand electric fields and continue to operate as intended.

5.8.2 RS103 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 the radiated electric fields listed in Figure 5.8-1.
Up to 30 MHz, the EUT shall meet the requirement for vertically polarized fields, and above 30 MHz it shall meet the requirement vertically and horizontally. Circular polarized fields are not acceptable.

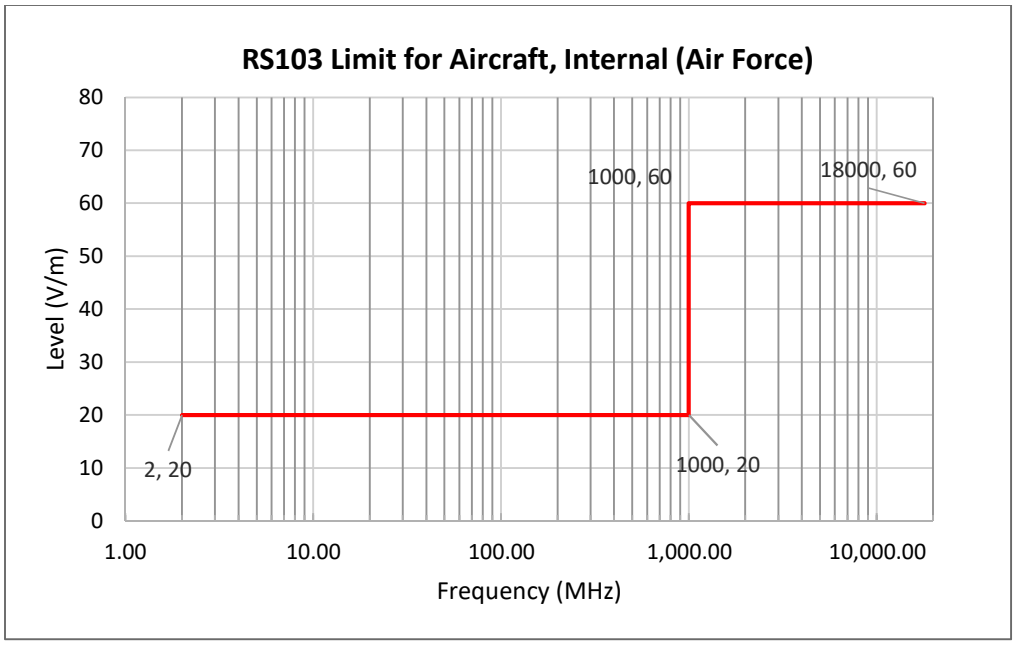


Figure 5.8-1: RS103 Limit, Aircraft Internal (Air Force)

5.8.3 RS103 Test Setup

The EUT was setup in accordance with Section 3.2, Figure 3.2-1, 4.3-1 and operated according to Section 3.3

5.8.3.1 Placement of Electronic Field Sensors

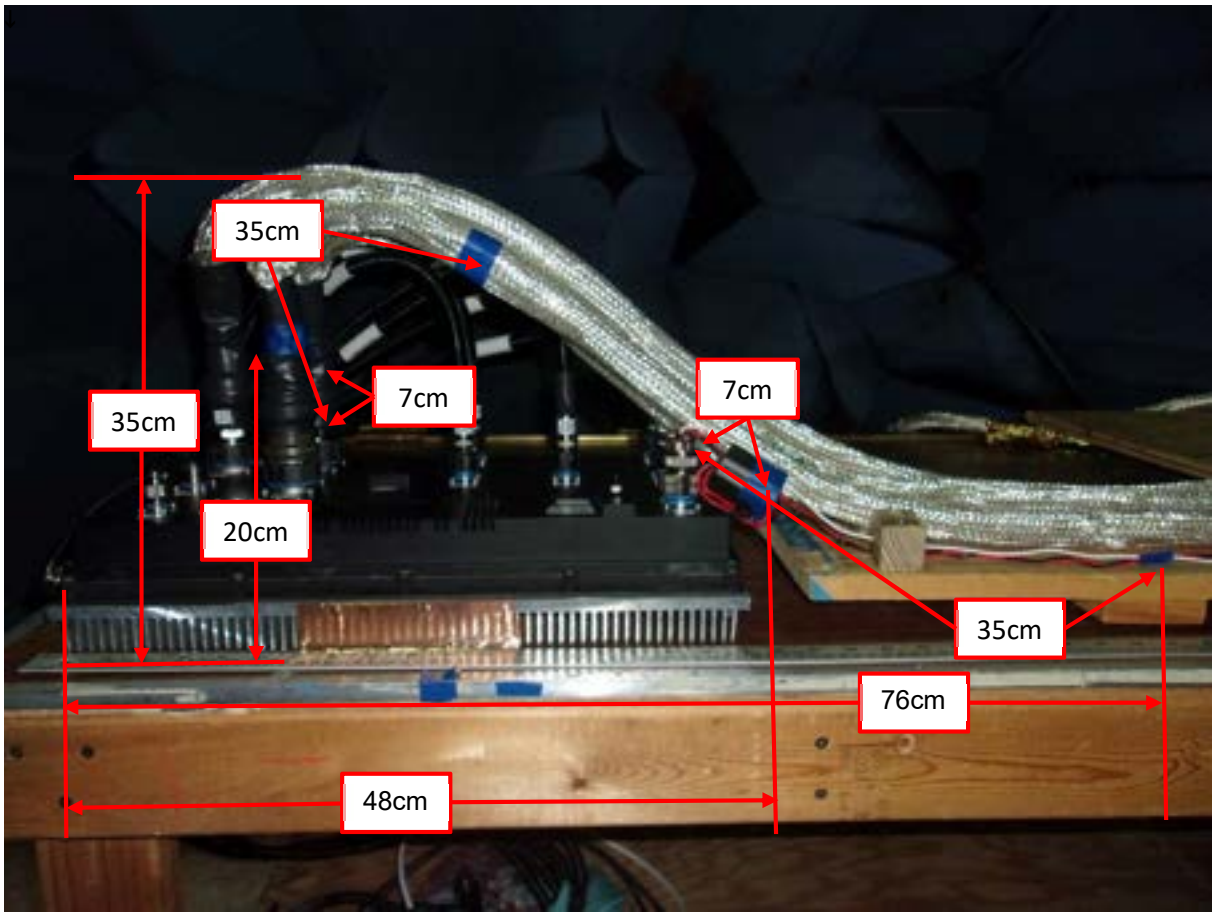
1. Place the sensors at the same distance as the EUT is located from the transmit antenna while staying in the plane of the test setup boundary edge closest to the antenna.
2. Position the sensors directly opposite the transmit antenna, while a minimum of 30 cm above the ground plane at or below 1 GHz. Above 1 GHz, place the sensors at the height corresponding to the area of the EUT being illuminated.
3. Do not place sensors directly at corners or edges of components.

5.8.3.2 Placement of Transmit Antennas

1. Antennas were placed 1 meter or greater from EUT.
2. For 200 MHz and below, center the transmit antenna between the edges of the test setup boundary. This boundary should include all enclosures of the EUT and the 2 meters of exposed interconnecting and power leads.
3. At and above 200 MHz, testing may require multiple antenna positions. Determine the number of position (N) as follows:
   A. 200 MHz to 1 GHz: Place the antenna in a sufficient number of positions such that the entire area of each EUT face and the first 35 cm of cable and leads interfacing the EUT are within 3 dB beam width of the antenna.
   B. 1 GHz and above place the antenna in a sufficient number of positions such that the entire area of each EUT face and the first 7 cm of cable and leads interfacing the EUT are within 3 dB beam width of the antenna.

Table 5.8-1: RS103 Antenna Position Calculations, 30 MHz to 18 GHz

Transmit Antenna Positions Calculations								
Antenna	**Range Used**	**3dB Beam-width (°)**	**Antenna Distance (Meters)**	**Antenna Coverage (cm) [a]**	**Test Width (cm) [b]**	**Number of Lateral Positions**	**EUT Height (cm)**	**Number of Height Positions**
ETS 3109	30-200MHz	N/A	1	300.00	278	1	35	1
ETS 3106	200MHz-1GHz	28	2	99.74	76	1	35	1
AR ATH800M6G	1-2GHz	26	2	92.34	48	1	20	1
AR ATH800M6G	2-4GHz	13.5	2.5	59.18	48	1	20	1
AR ATH800M6G	4-6GHz	8	2	27.98	48	2	20	1
AR ATH6G18	6-8GHz	15.5	2	54.22	48	1	20	1
ETS 3115	8-18GHz	8	2	27.98	48	2	20	1
Note a: Antenna Coverage = 2*(TAN(Θ)*a) Where Θ = 1/2 (antenna 3dB beamwidth) a = antenna distance from setup boundary.				**Note b**: Includes all applicable EUT cabling (first 35cm below 1GHz or first 7cm above 1GHz). See figure below.				



5.8.4 RS103 Test Procedure

Testing proceeded as follows:

1. The measurement equipment and EUT were turned on, and sufficient time was allowed for stabilization.
2. E-field sensor procedure:
   A. The signal source was set to 1 kHz pulse modulation, 50% duty cycle.
   B. Using an appropriate amplifier and transmit antenna, an electric field was established at the test start frequency.
   C. The electric field level was gradually increased until it reaches the applicable limit.
   D. The required frequency ranges will be scanned in accordance with the step size specified in Table 4.5-1. The field strength was maintained in accordance with the applicable limit.
   E. The EUT performance was monitored for susceptibility effects.
3. If susceptibility was noted, the threshold level was determined and it was verified to be above the limit.
4. Testing was performed over the required frequency range with the transmit antenna vertically polarized.
5. Testing above 30 MHz was repeated with transmit antenna horizontally as well as vertically polarized.
6. Steps 1-5 were repeated for each transmits antenna position.

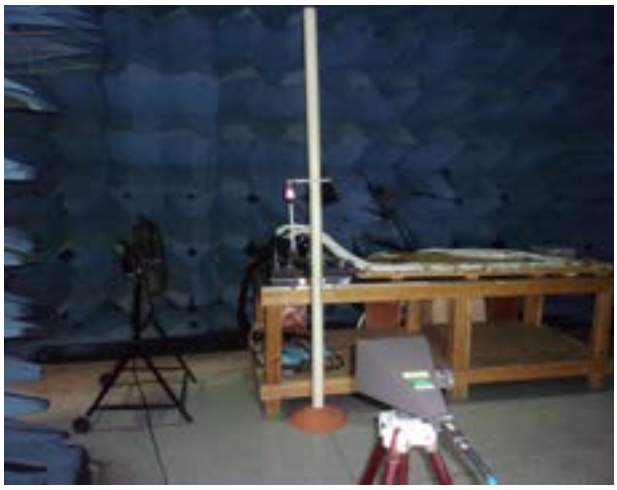
5.8.5 RS103 Test Log Sheet

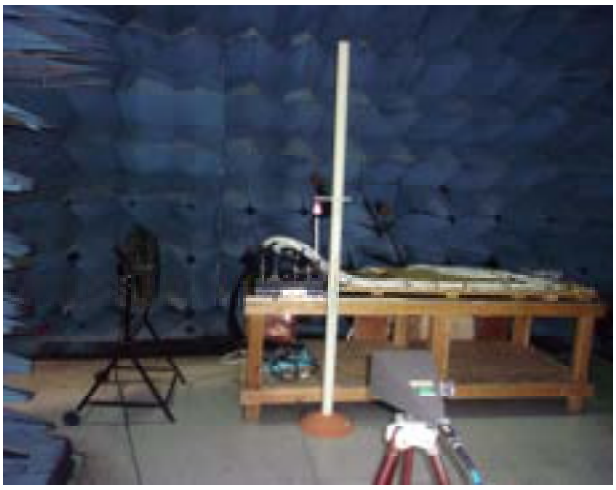
EMI LOG SHEET			
Job Number:	PR131850	**Date:**	3/9/21 – 3/11/21
Standard:	MIL-STD-461G	**Method:**	RS103
Test Personnel:	Tristian Gaines	**Procedure:**	19CD0002 Rev B

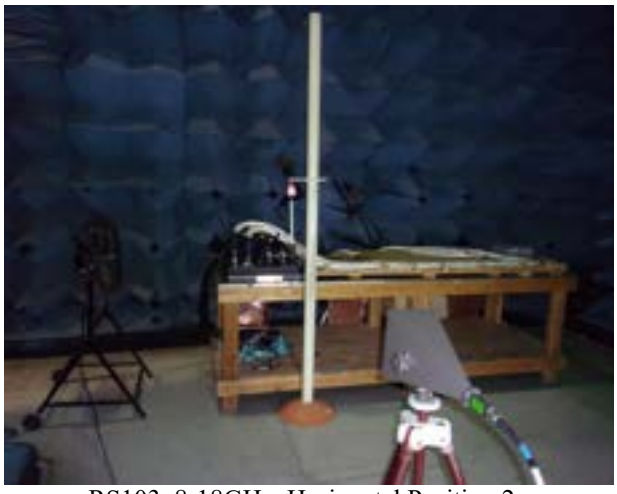
Date	Time	Log Entries	Init.
3/9/21	0730	Susceptibility monitoring instructed by the customer may violate ITAR. Consulting with QA.	TG
	0900	Found a way to do it within compliance. Beginning to test.	↓
	1000	Issue with post test data on first scan. Rescanning at customer's request.	↓
	1010	No Issues. Operator error.	↓
	1600	Stopped at 4-6GHz Vertical.	↓
3/10/21	0730	Cont RS103	↓
	1345	Stopped at 200-1GHz. Testing halted for today due to appointment.	↓
3/11/21	0730	Cont testing.	↓
	1236	RS103 Pass	↓

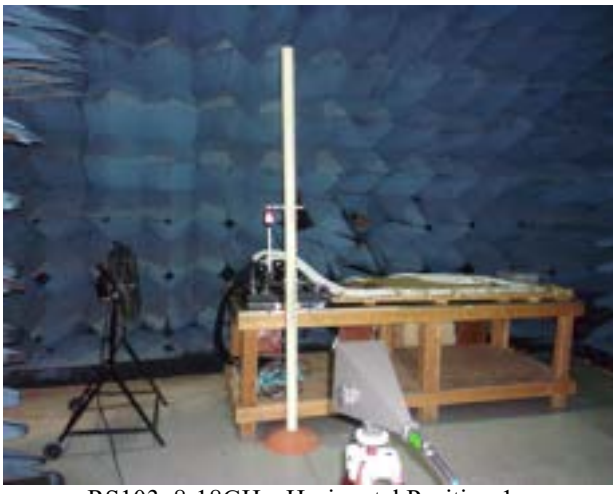
Tested By: Tristian Gaines

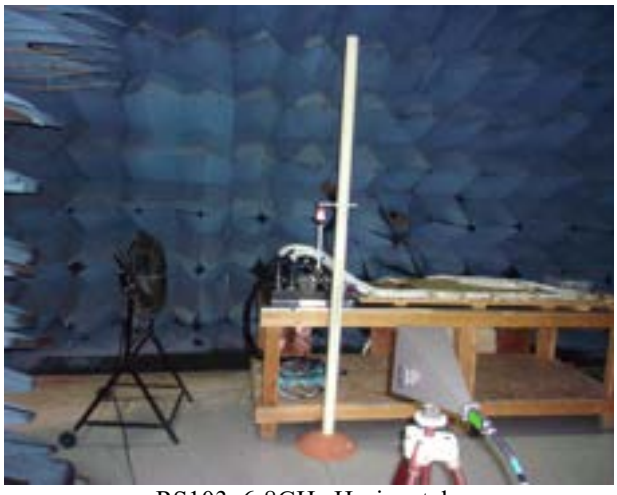
5.8.6 RS103 Test Photographs

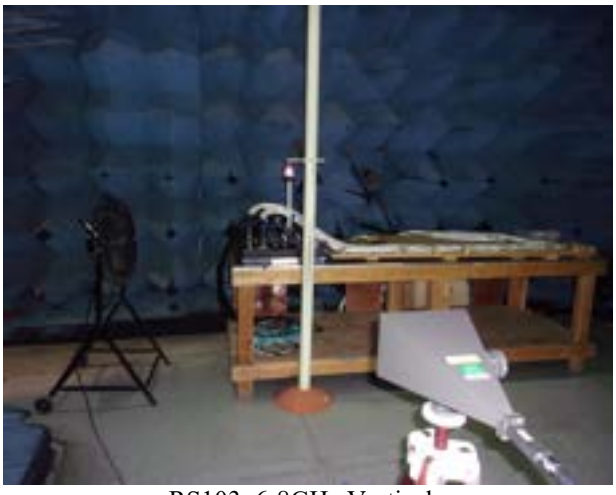

RS103, 8-18GHz, Vertical Position 1

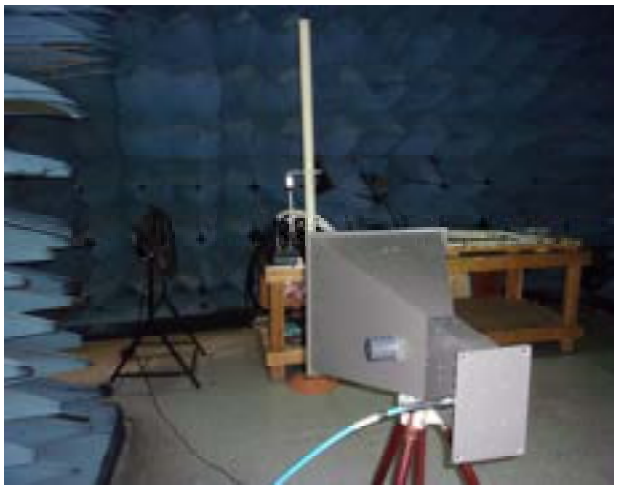

RS103, 8-18GHz, Vertical Position 2

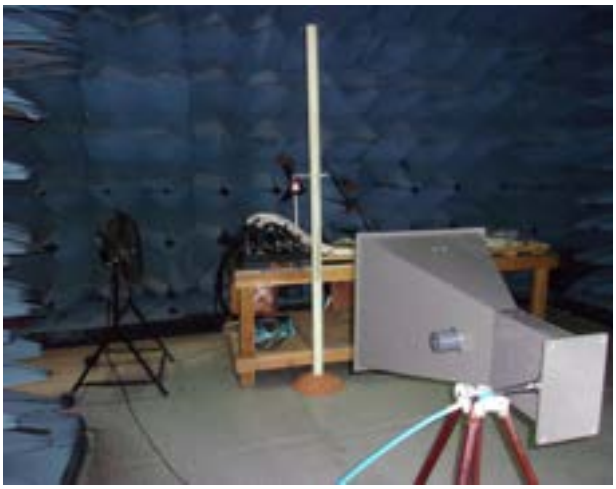

RS103, 8-18GHz, Horizontal Position 2

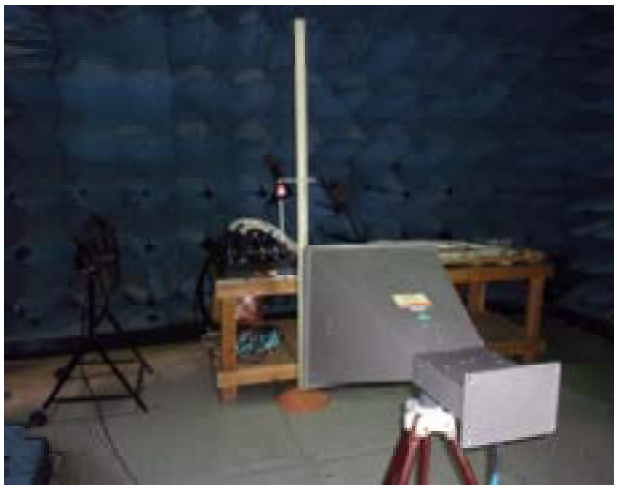

RS103, 8-18GHz, Horizontal Position 1

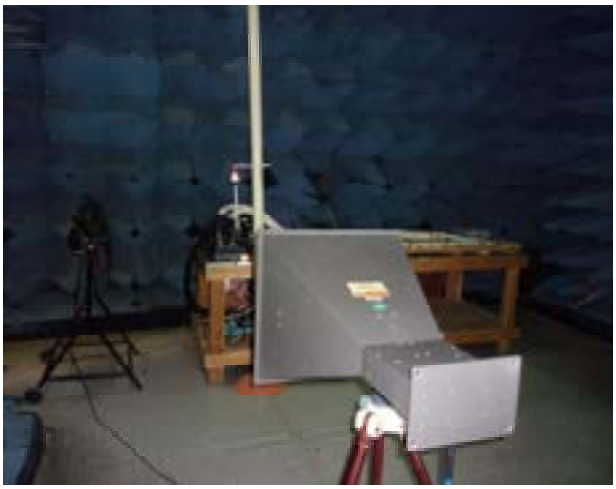

RS103, 6-8GHz Horizontal

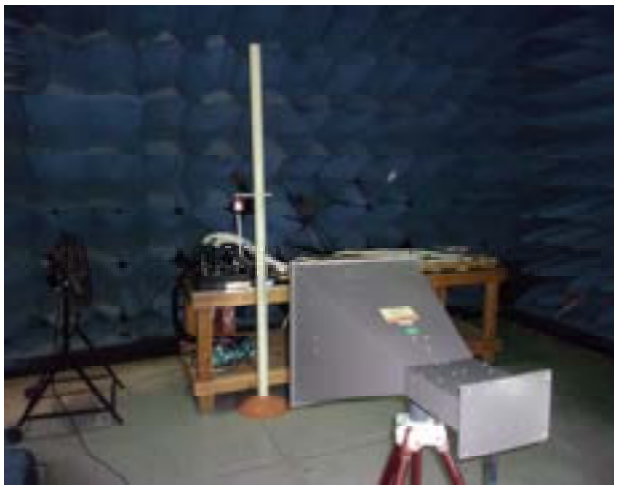

RS103, 6-8GHz Vertical

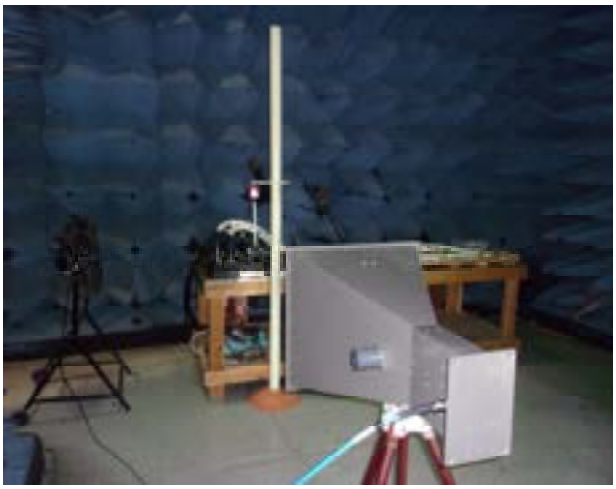

RS103, 4-6GHz Horizontal, Position 1

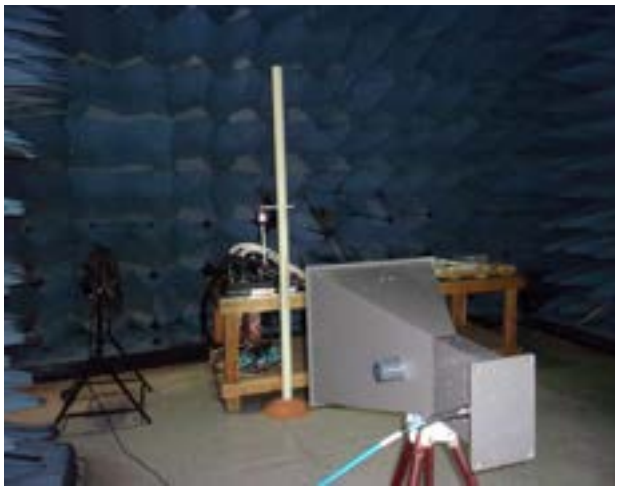

RS103, 4-6GHz Horizontal, Position 2


RS103, 4-6GHz Vertical, Position 2

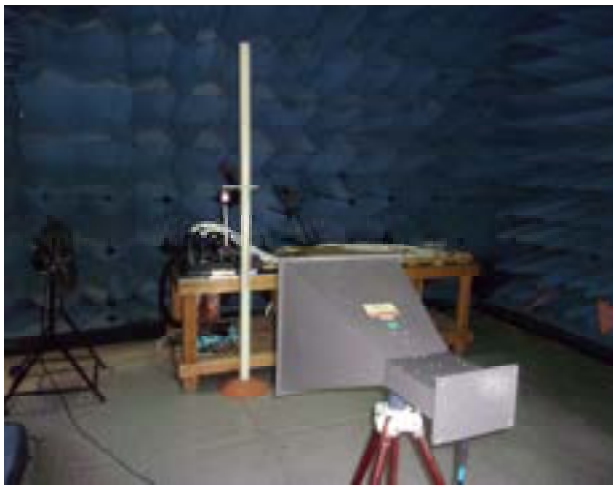

RS103, 4-6GHz Vertical, Position 1


RS103, 2-4GHz Vertical


RS103, 2-4GHz Horizontal

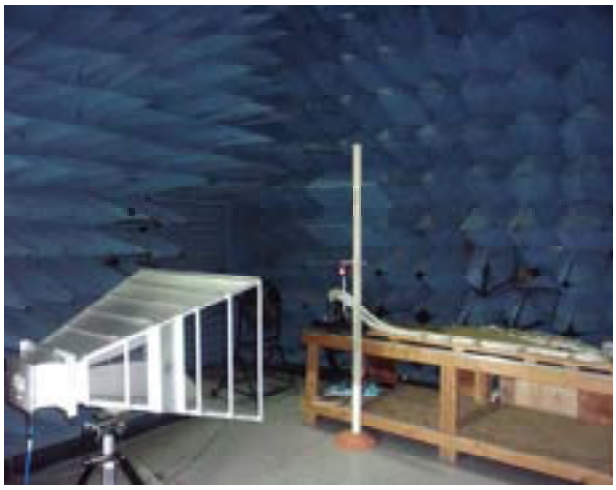


RS103, 1-2GHz Horizontal

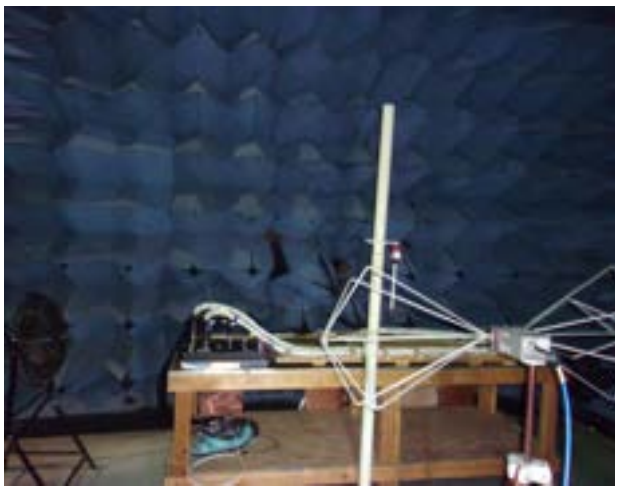


RS103, 1-2GHz Vertical

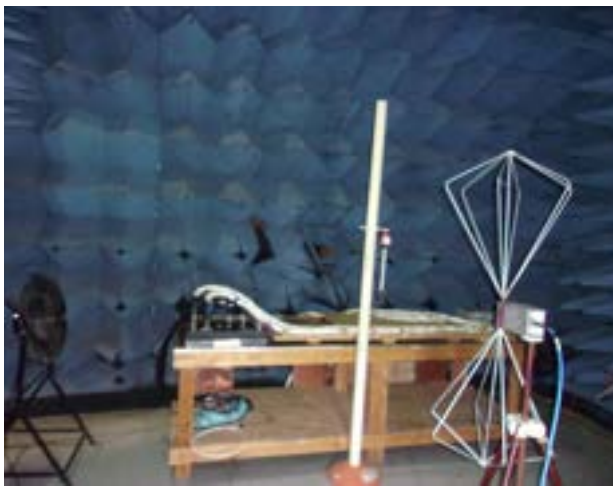
RS103, 200MHz-1GHz Horizontal



RS103, 200MHz-1GHz Vertical



RS103, 30-200MHz Horizontal



RS103, 30-200MHz Vertical

5.8.7 RS103 Test Data

RS103 Data Sheet

Job Number:	PR131850	**Standard:**	MIL-STD-461G
		Procedure:	19CD0002 Rev B
Date:	3/5/2021-3/11/2021	**EUT:**	SwitchBox
P/N:	19CD0002-1	**S/N:**	N/A
Test Personnel:	Tristian Gaines	**Manufacturer:**	Amphenol Aerospace

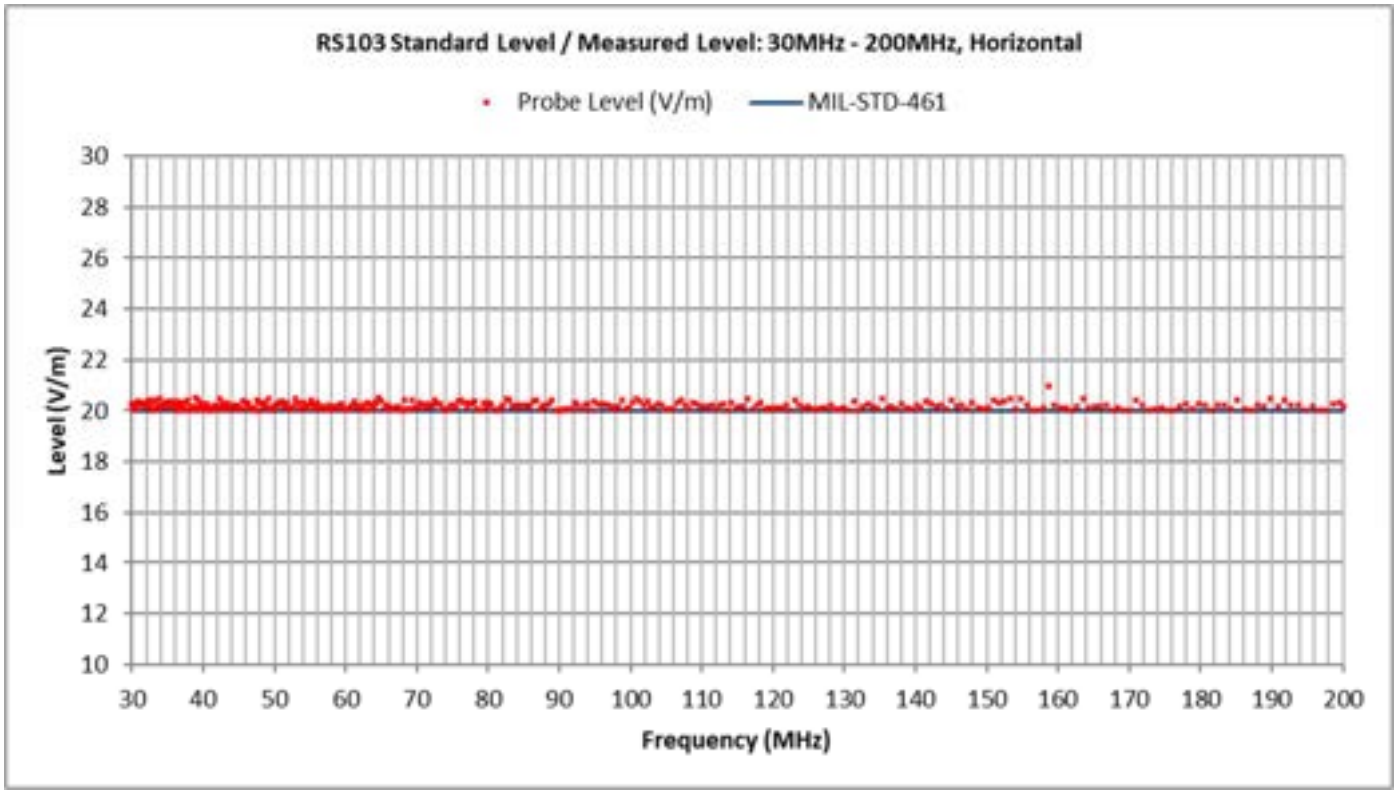
Signal Applied	Test Specification	Performance Criteria
Radiated E-Field	30MHz – 1GHz, 20V/m, 1 - 18GHz, 60V/m, Modulated per Test Procedure 19CD0002 Rev B	The EUT was monitored for any degradation in performance according to 19CD0002 Rev B

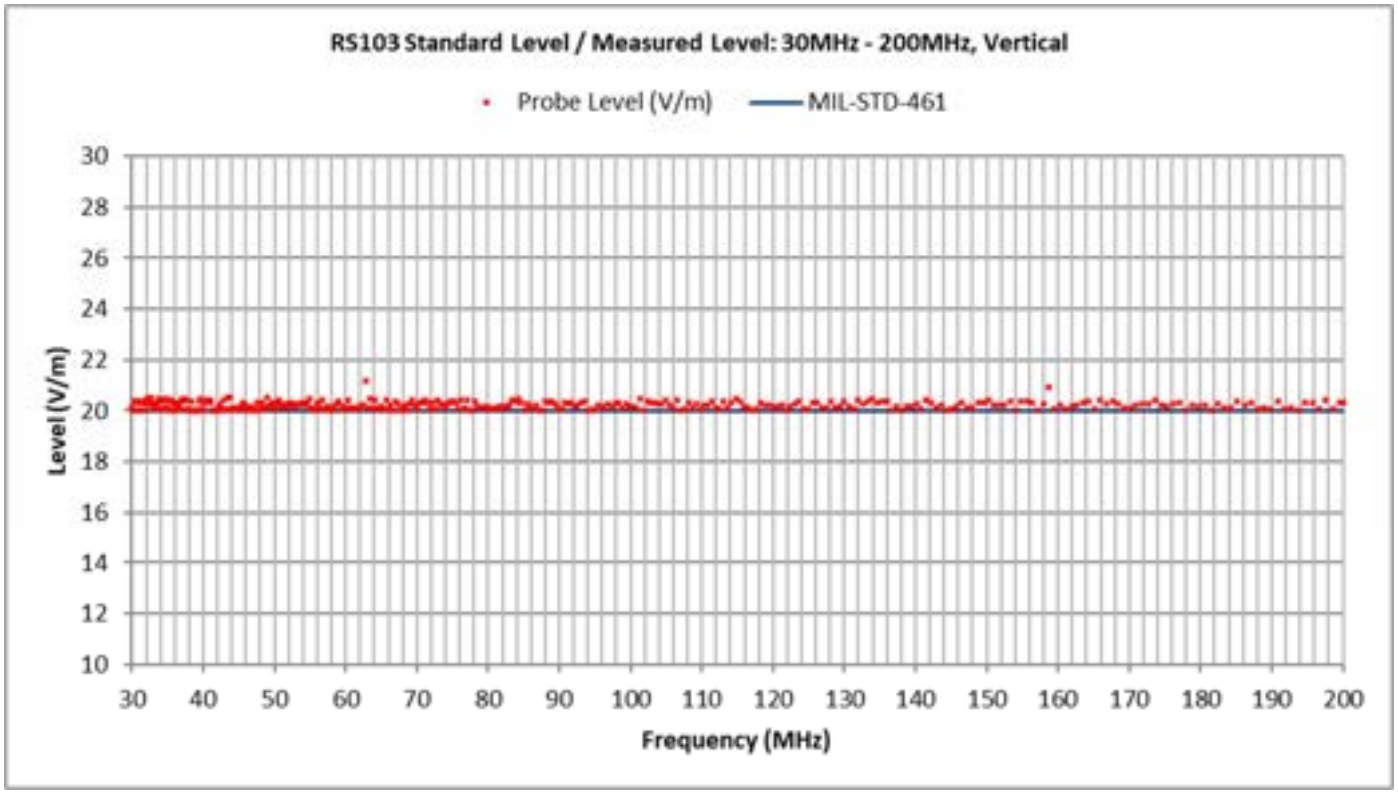
RS103 Test Results:

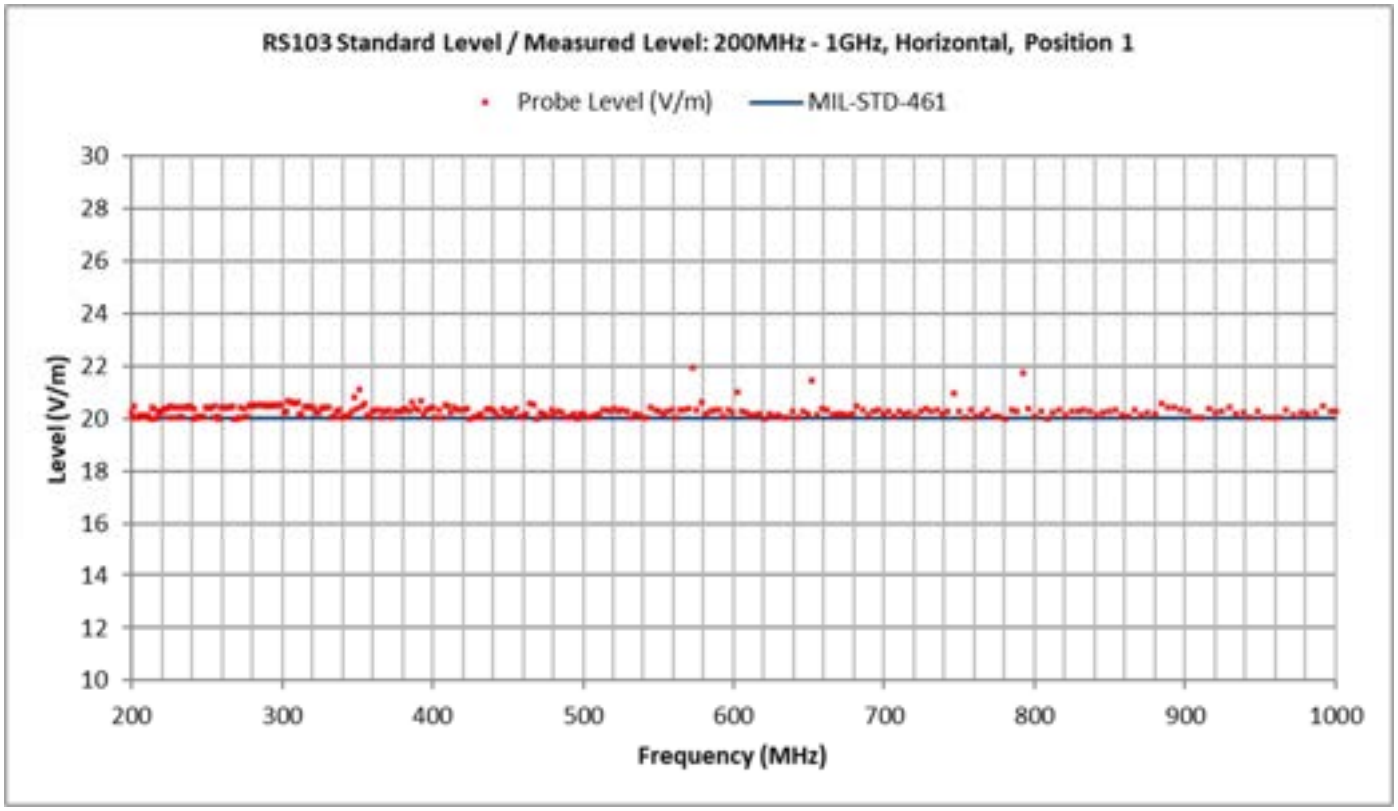
Frequency (MHz)	Pol. (H/V)	Antenna Position	Step Size (%f)	Level (V/m)	Dwell (Sec)	Modulation	Observation	Results (Pass/Fail)
30 - 200	H	1	0.5	20	3	1kHz PM	None	**PASS**
30 - 200	V	1	0.5	20	3	1kHz PM	None	**PASS**
200 - 1000	H	1	0.5	20	3	1kHz PM	None	**PASS**
200 - 1000	V	1	0.5	20	3	1kHz PM	None	**PASS**

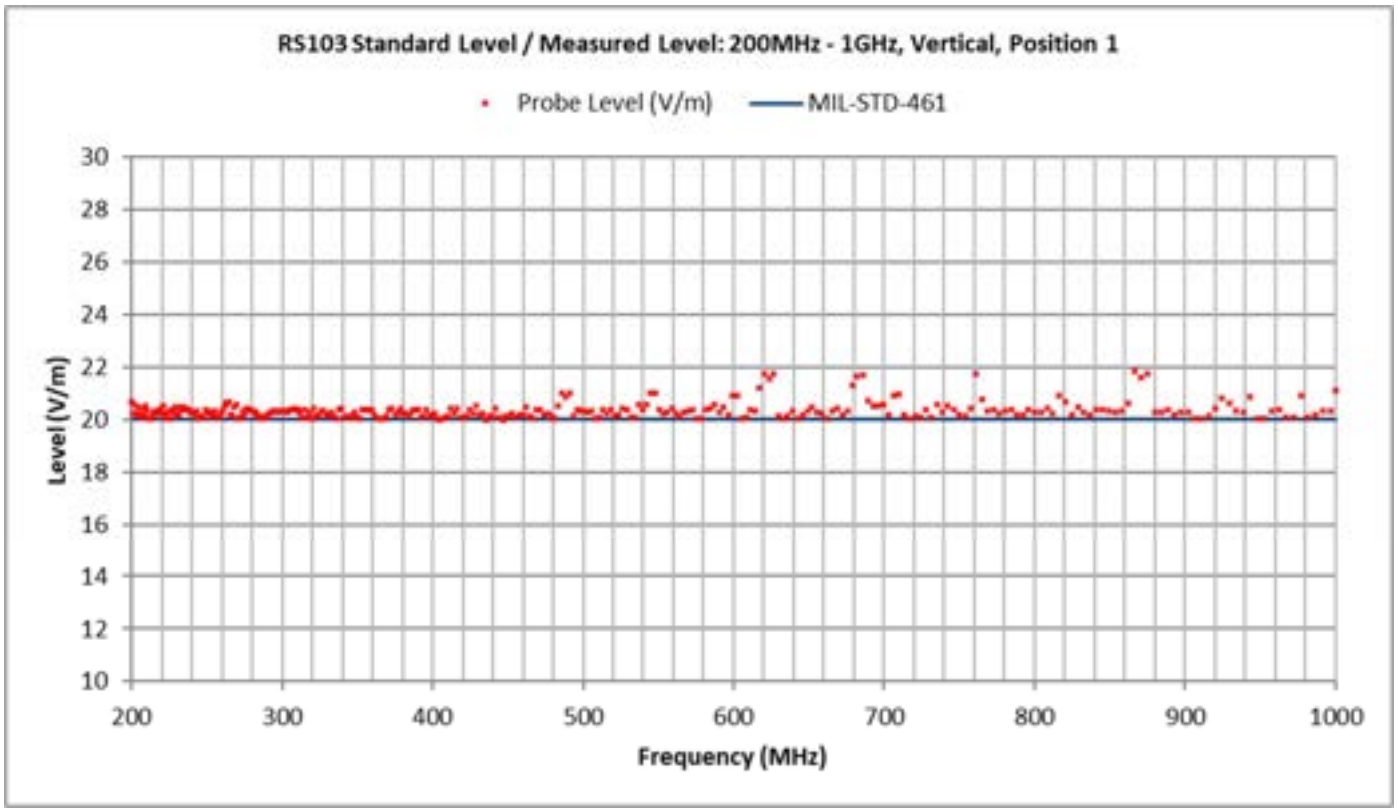
Frequency (GHz)	Pol. (H/V)	Antenna Position	Step Size (%f)	Level (V/m)	Dwell (Sec)	Modulation	Observation	Results (Pass/Fail)
1 - 2	V	1	0.25	60	3	1kHz PM	None	**PASS**
1 - 2	H	1	0.25	60	3	1kHz PM	None	**PASS**
2 - 4	H	1	0.25	60	3	1kHz PM	None	**PASS**
2 - 4	V	1	0.25	60	3	1kHz PM	None	**PASS**
4 - 6	V	1	0.25	60	3	1kHz PM	None	**PASS**
4 - 6	H	1	0.25	60	3	1kHz PM	None	**PASS**
4 - 6	V	2	0.25	60	3	1kHz PM	None	**PASS**
4 - 6	H	2	0.25	60	3	1kHz PM	None	**PASS**
6 - 8	V	1	0.25	60	3	1kHz PM	None	**PASS**
6 - 8	H	1	0.25	60	3	1kHz PM	None	**PASS**
8 - 18	V	1	0.25	60	3	1kHz PM	None	**PASS**
8 - 18	H	1	0.25	60	3	1kHz PM	None	**PASS**
8 - 18	V	2	0.25	60	3	1kHz PM	None	**PASS**
8 - 18	H	2	0.25	60	3	1kHz PM	None	**PASS**

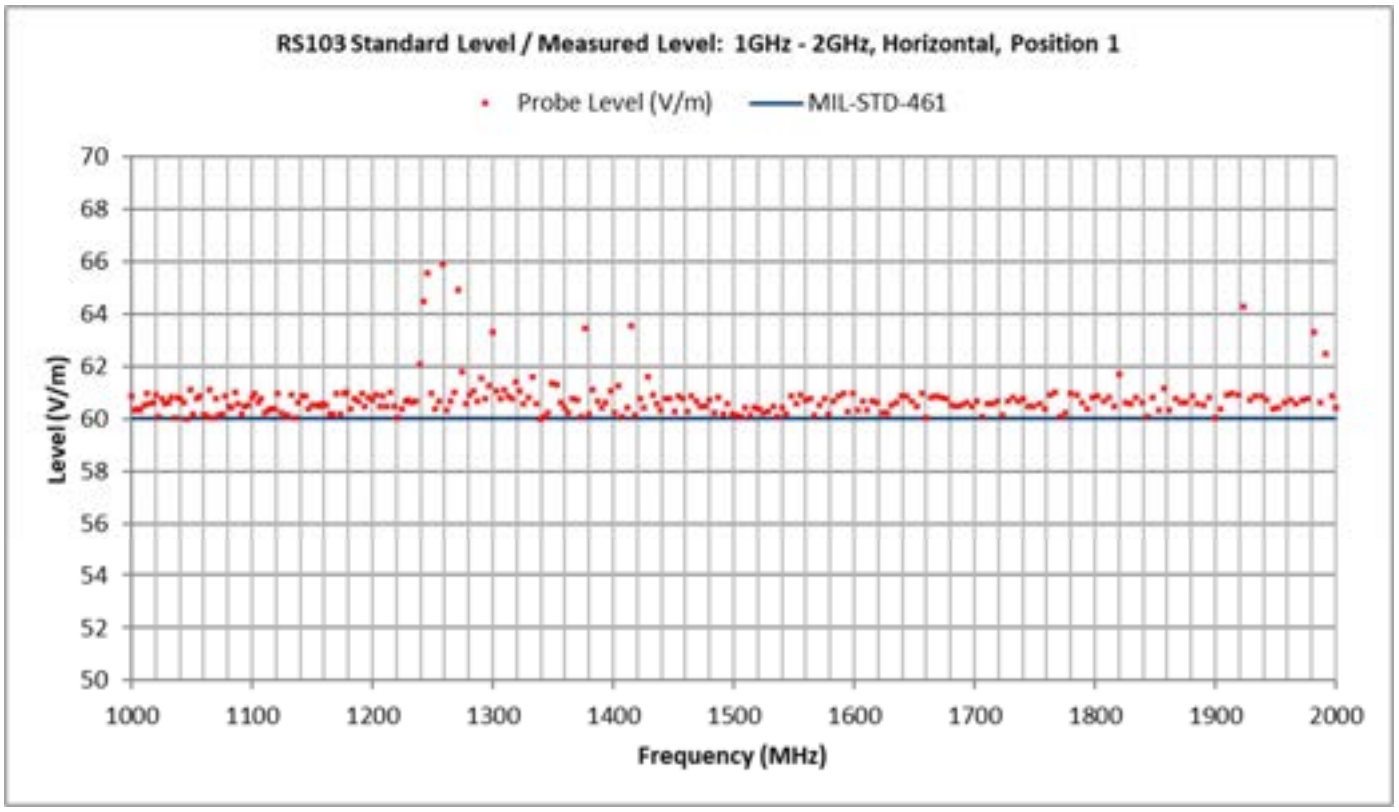
RS103 Graphs

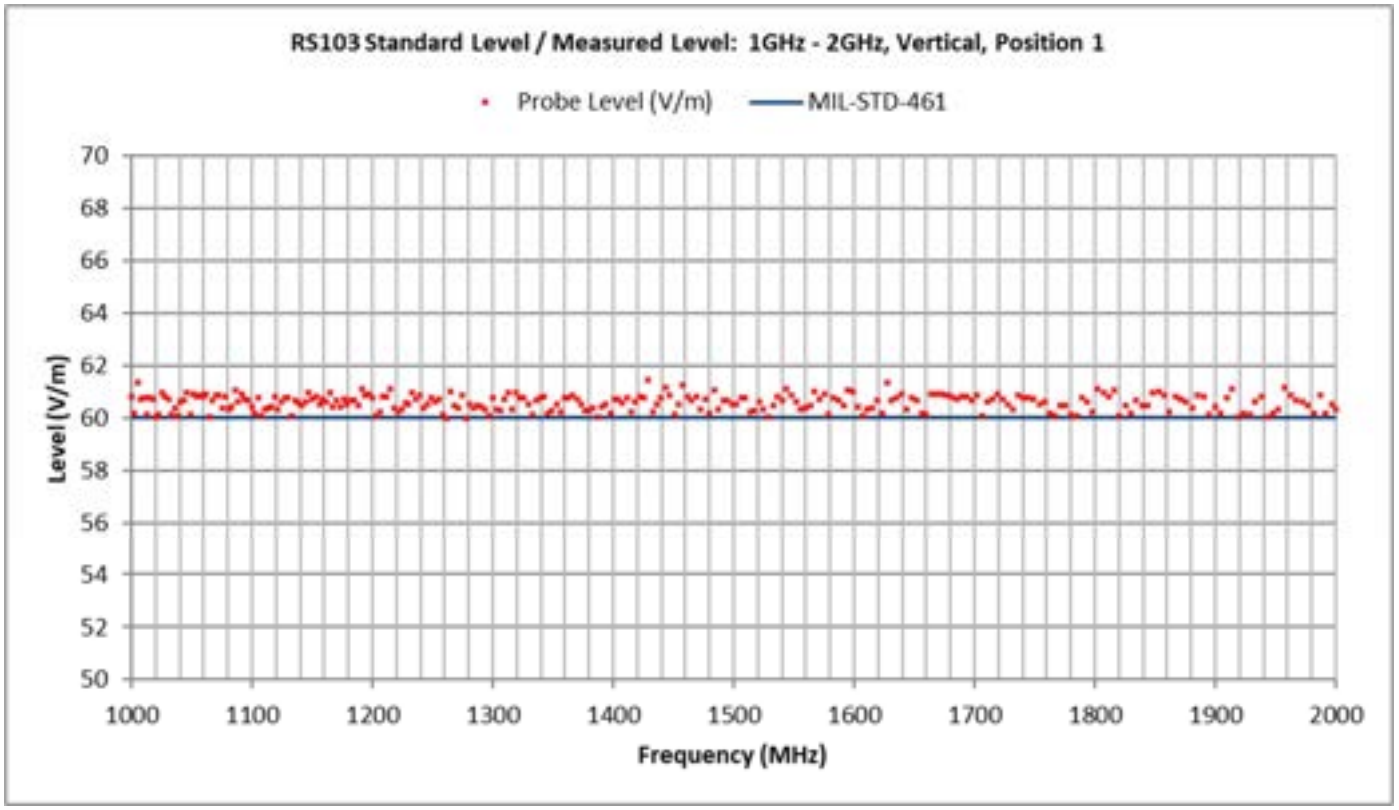





RS103 Standard Level / Measured Level: 200MHz - 1GHz, Horizontal, Position 1
Probe Level (V/m)
MIL-STD-461
Level (V/m)
30
28
26
24
22
20
18
16
14
12
10
200
300
400
500
600
700
800
900
1000
Frequency (MHz)


RS103 Standard Level / Measured Level: 200MHz - 1GHz, Vertical, Position 1
Probe Level (V/m)
MIL-STD-461
Level (V/m)
30
28
26
24
22
20
18
16
14
12
10
200
300
400
500
600
700
800
900
1000
Frequency (MHz)


RS103 Standard Level / Measured Level: 1GHz - 2GHz, Horizontal, Position 1
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
54
52
50
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Frequency (MHz)


RS103 Standard Level / Measured Level: 1GHz - 2GHz, Vertical, Position 1
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
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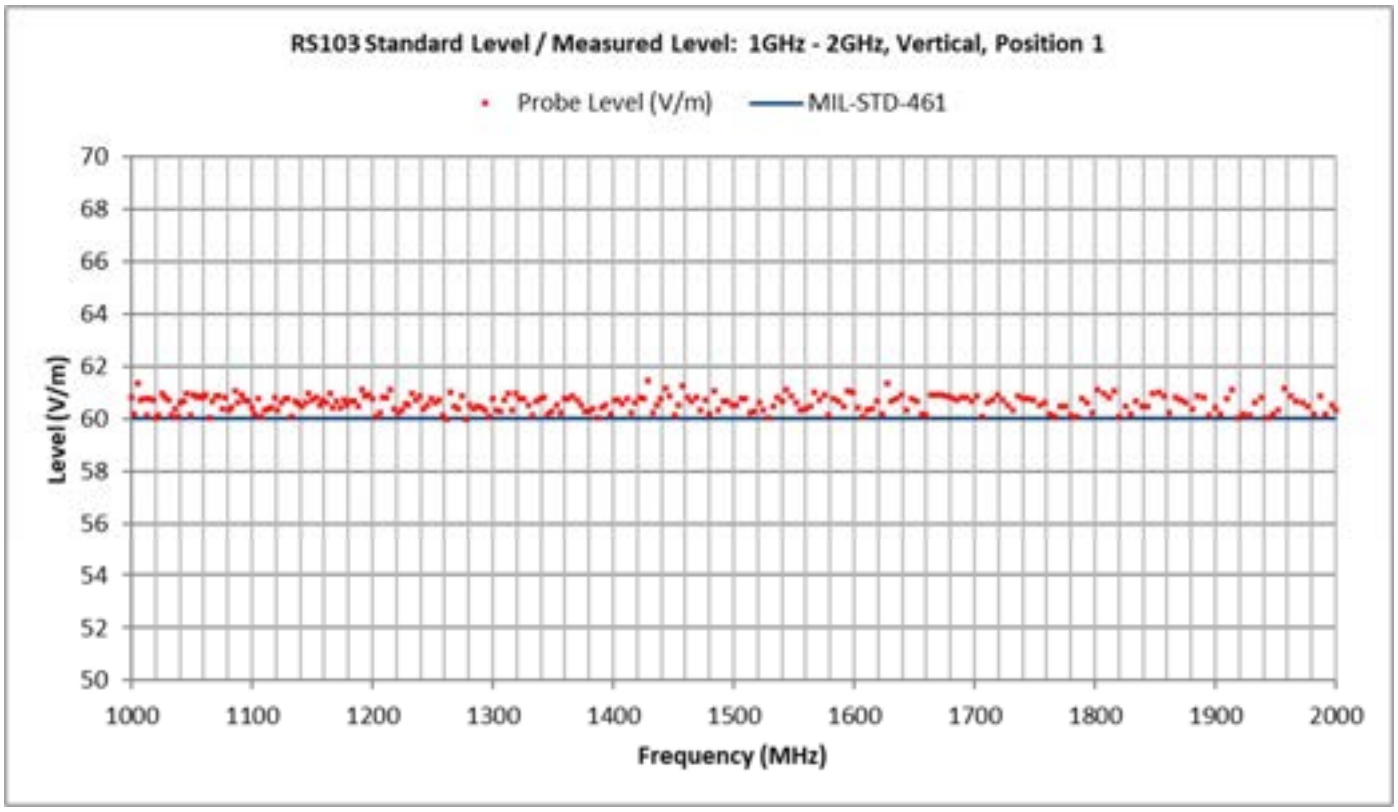
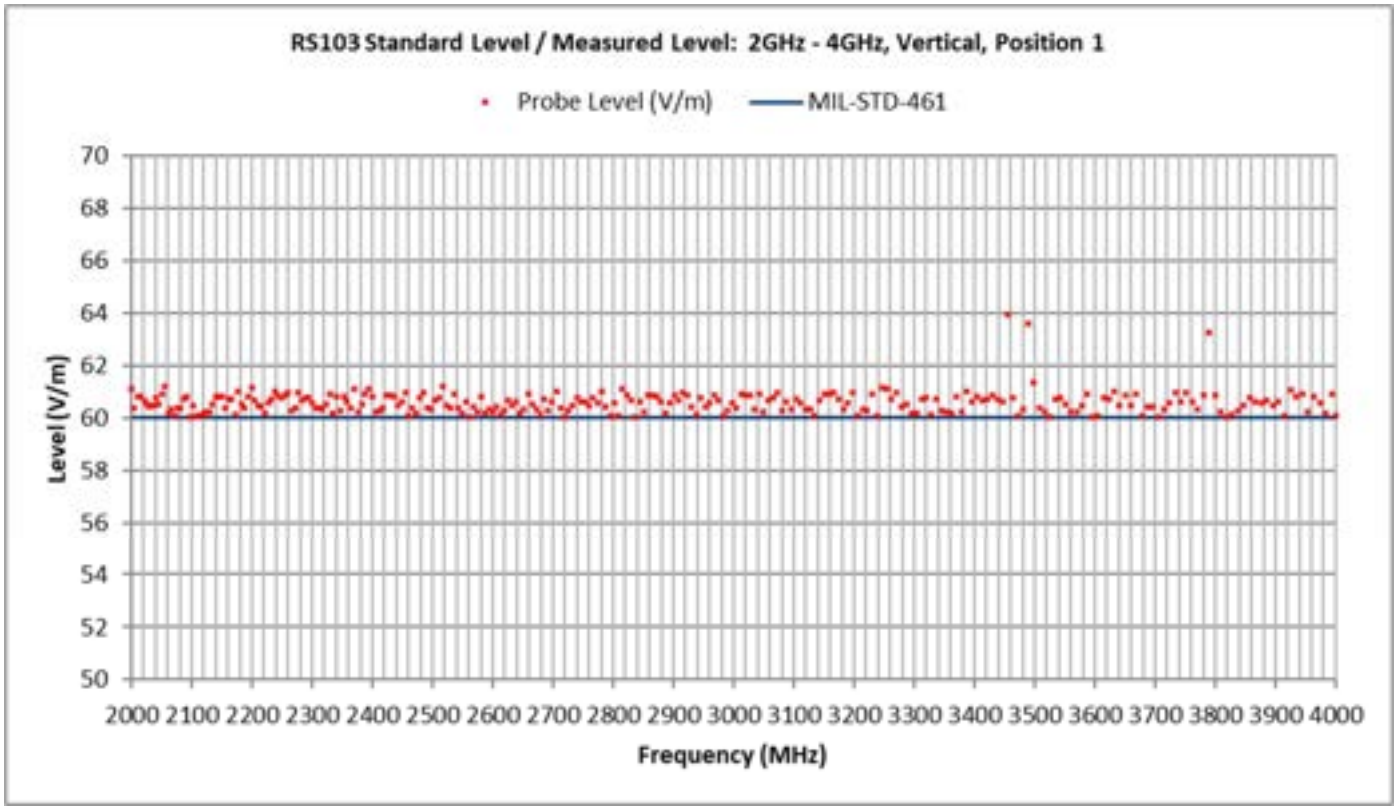
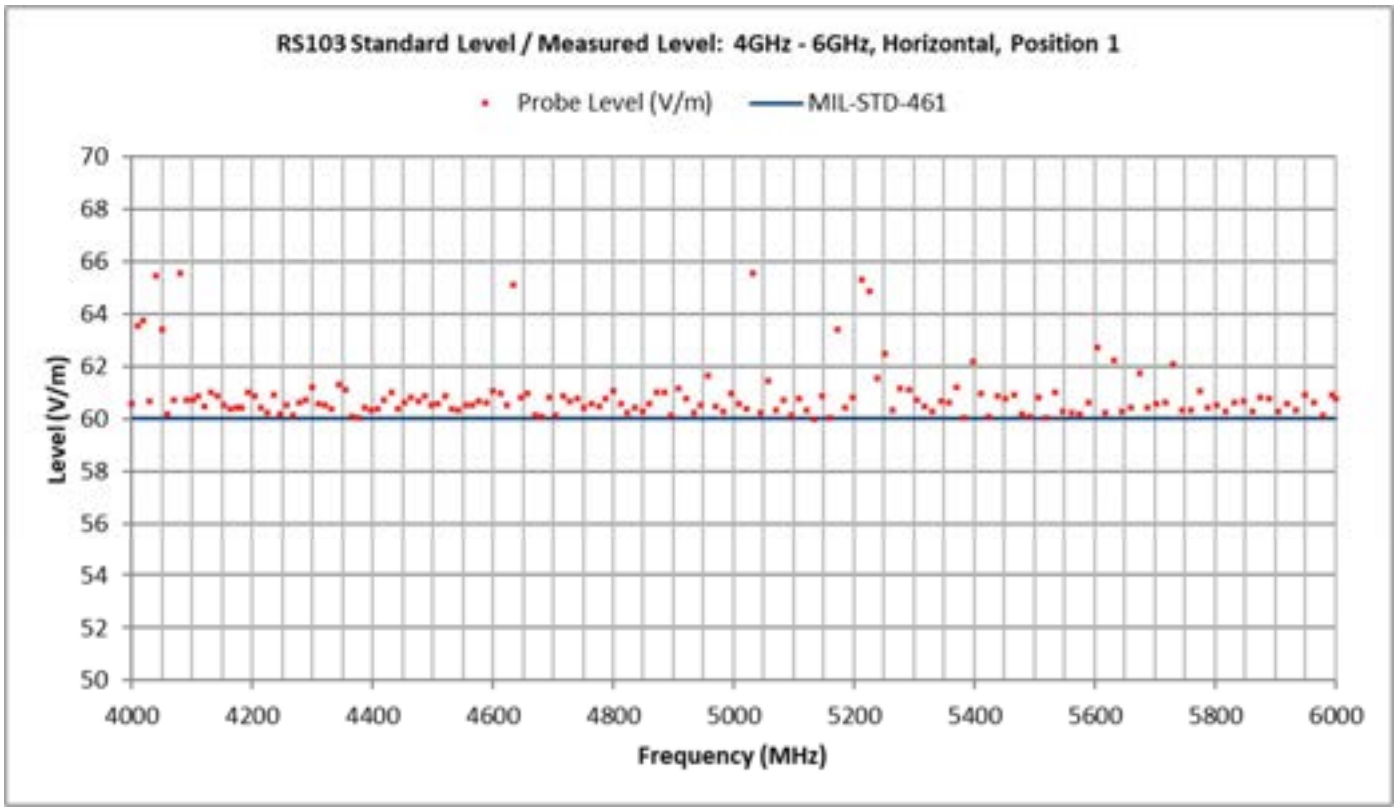
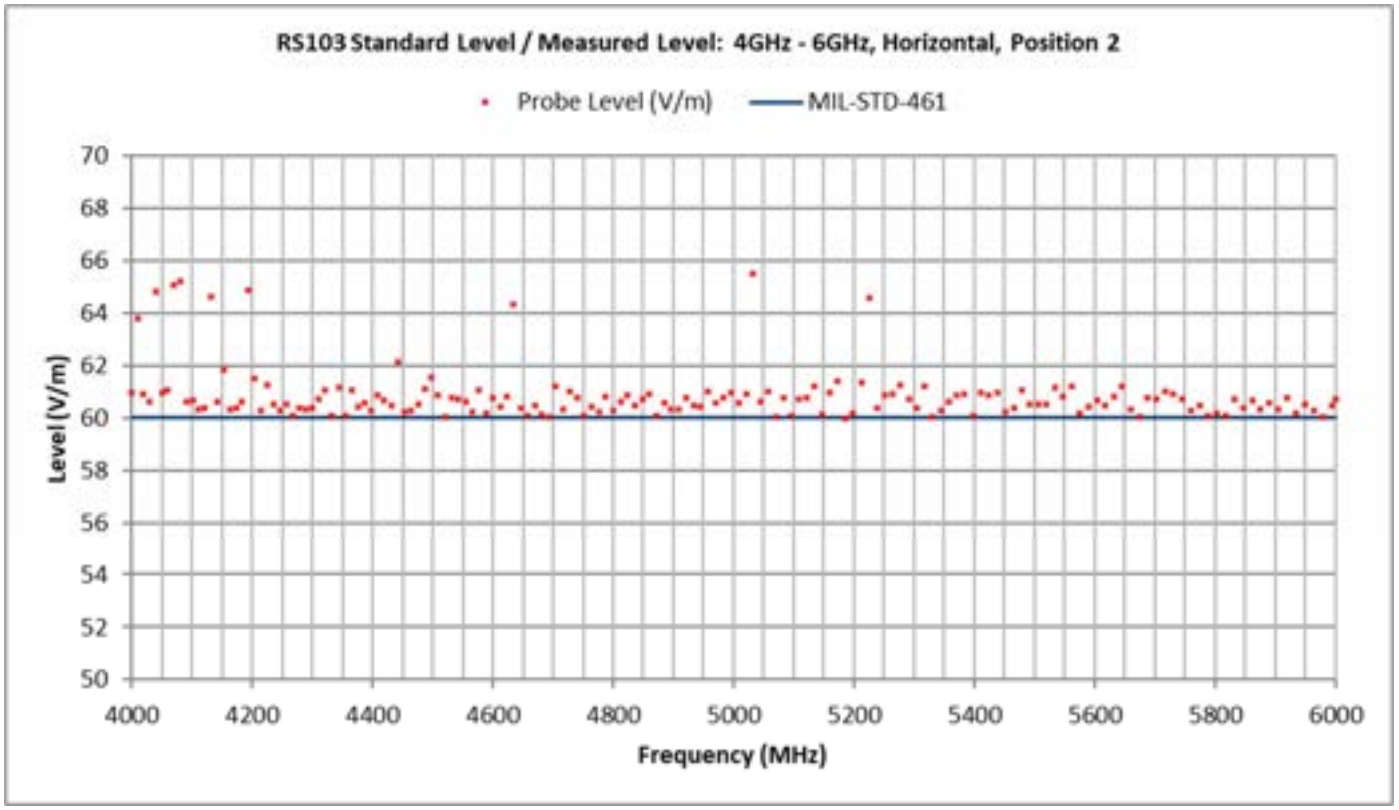
58
56
54
52
50
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Frequency (MHz)


RS103 Standard Level / Measured Level: 1GHz - 2GHz, Vertical, Position 1
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
54
52
50
1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000
Frequency (MHz)


RS103 Standard Level / Measured Level: 2GHz - 4GHz, Vertical, Position 1
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
54
52
50
2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 3100 3200 3300 3400 3500 3600 3700 3800 3900 4000
Frequency (MHz)


RS103 Standard Level / Measured Level: 4GHz - 6GHz, Horizontal, Position 1
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
54
52
50
4000
4200
4400
4600
4800
5000
5200
5400
5600
5800
6000
Frequency (MHz)


RS103 Standard Level / Measured Level: 4GHz - 6GHz, Horizontal, Position 2
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
54
52
50
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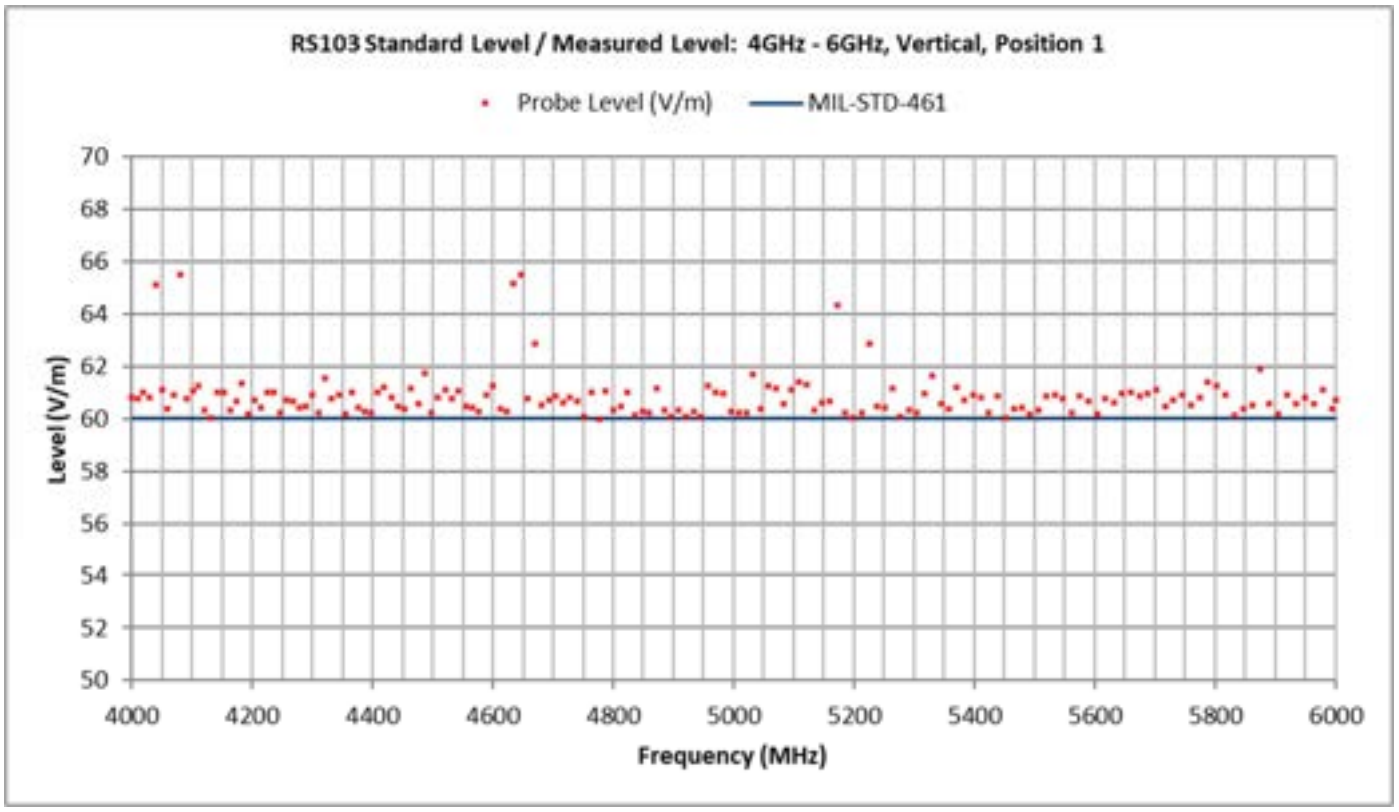
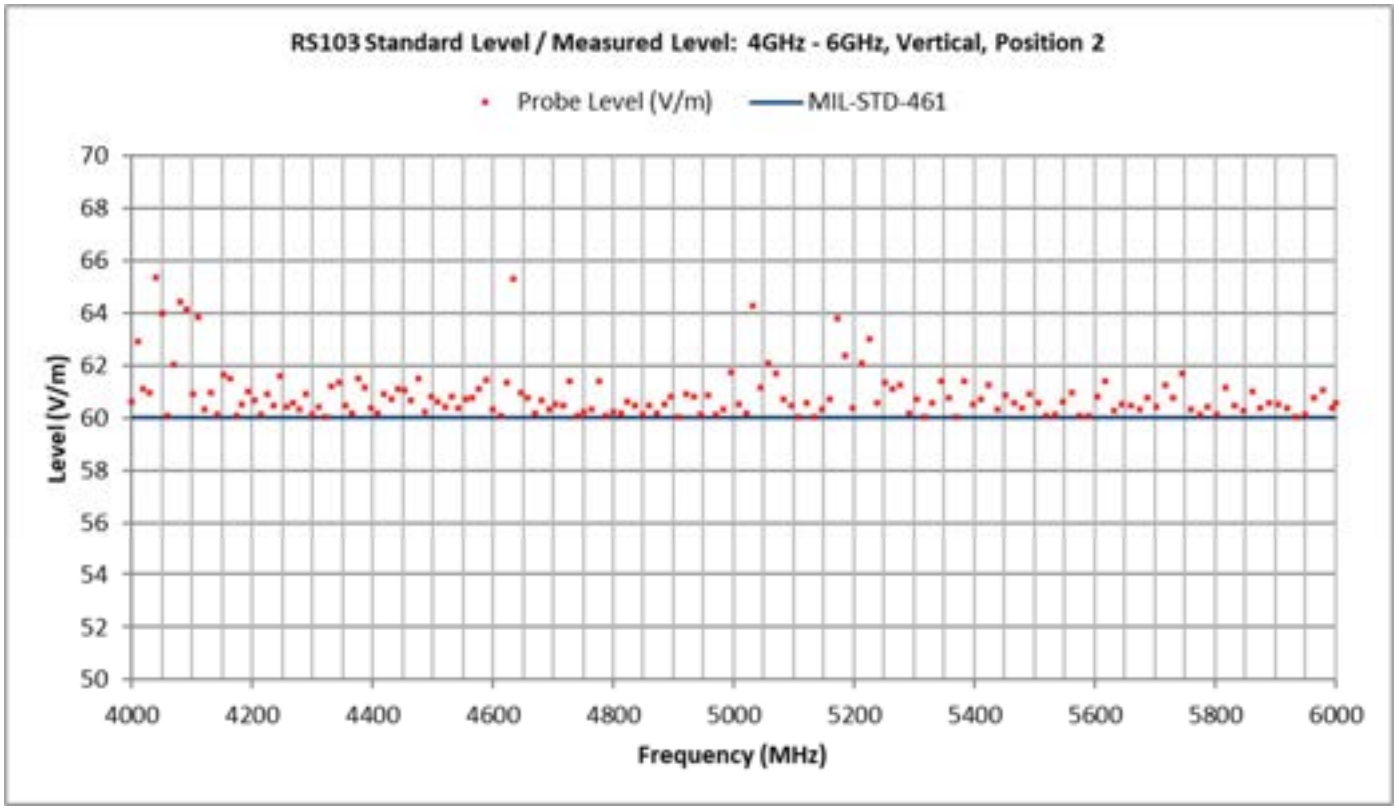
4200
4400
4600
4800
5000
5200
5400
5600
5800
6000
Frequency (MHz)


RS103 Standard Level / Measured Level: 4GHz - 6GHz, Vertical, Position 1
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
54
52
50
4000
4200
4400
4600
4800
5000
5200
5400
5600
5800
6000
Frequency (MHz)


RS103 Standard Level / Measured Level: 4GHz - 6GHz, Vertical, Position 2
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
54
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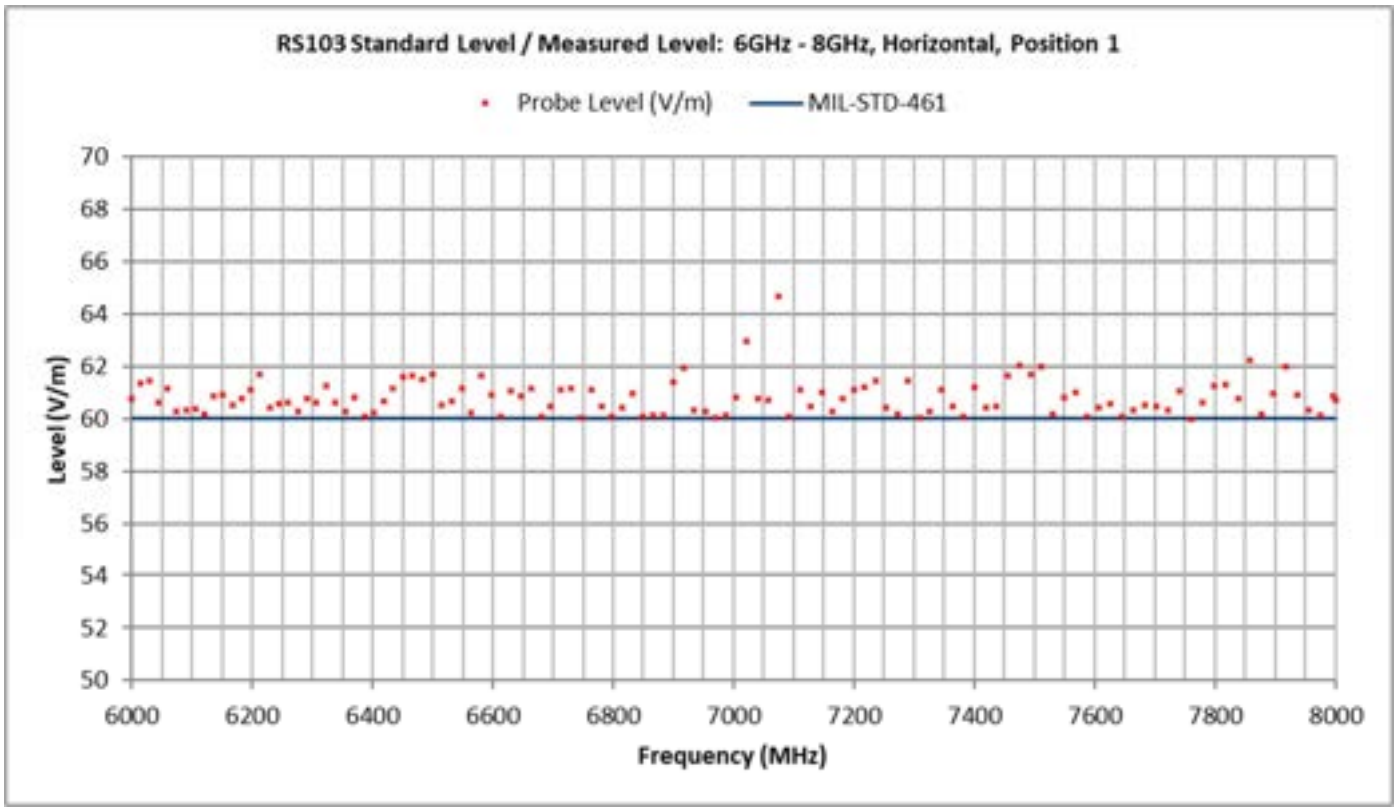
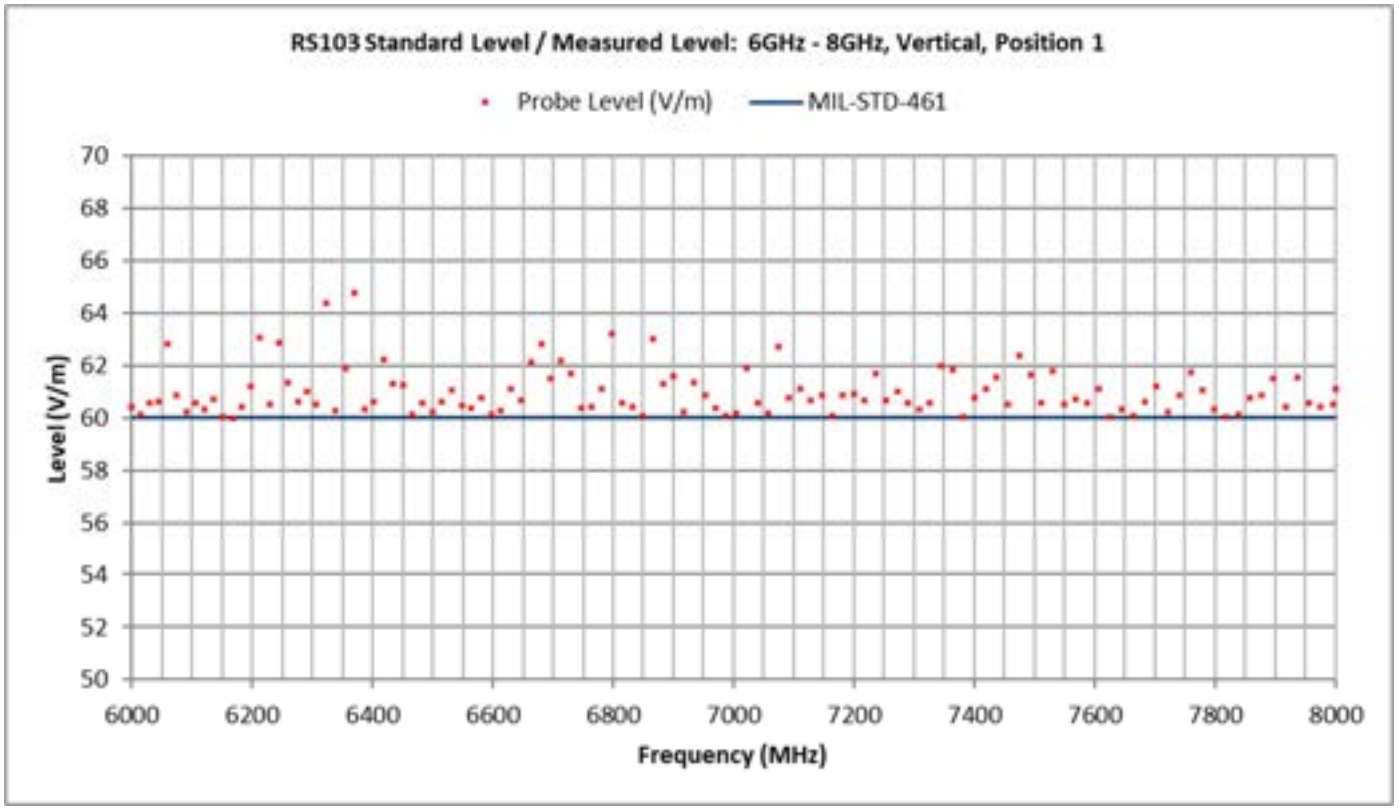
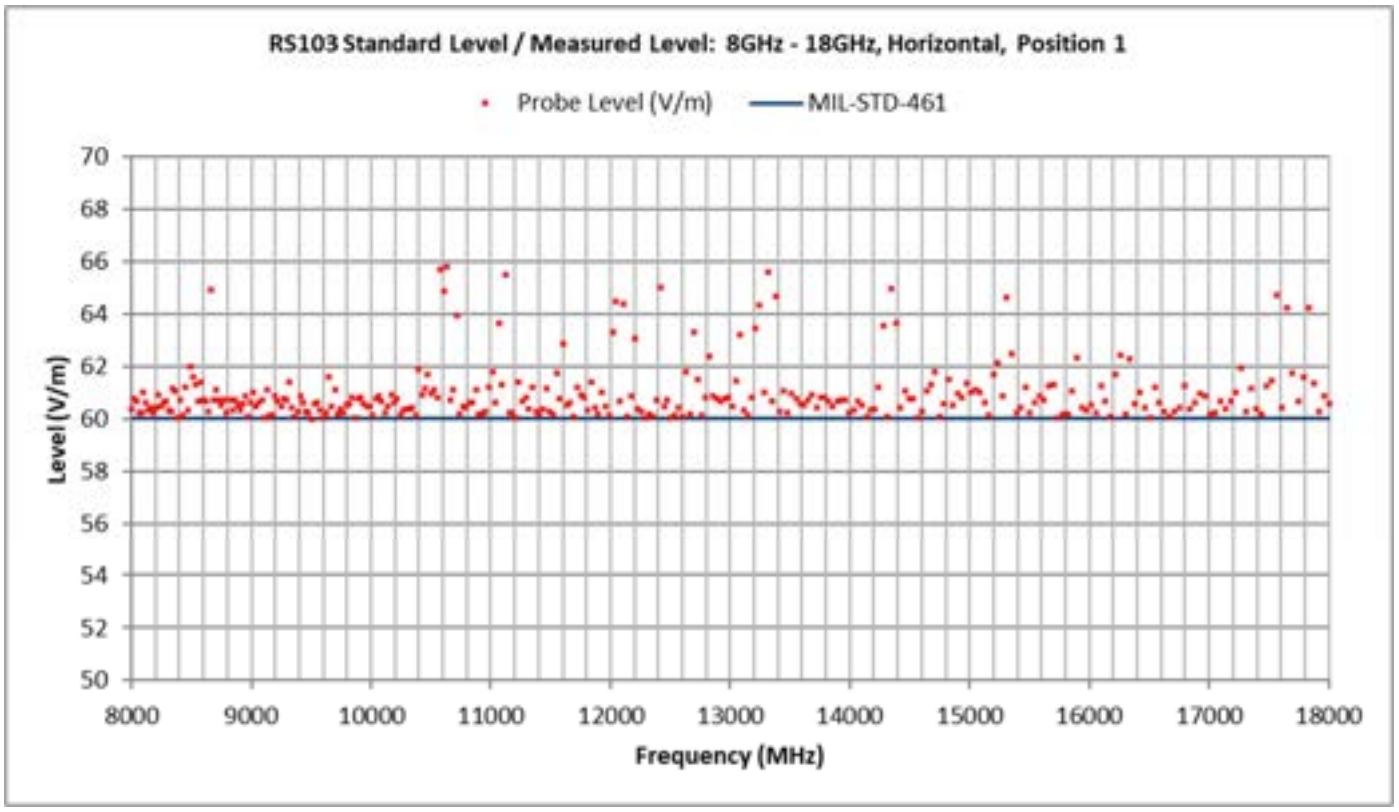
4000
4200
4400
4600
4800
5000
5200
5400
5600
5800
6000
Frequency (MHz)


RS103 Standard Level / Measured Level: 6GHz - 8GHz, Horizontal, Position 1
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
54
52
50
6000
6200
6400
6600
6800
7000
7200
7400
7600
7800
8000
Frequency (MHz)


RS103 Standard Level / Measured Level: 6GHz - 8GHz, Vertical, Position 1
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
54
52
50
6000
6200
6400
6600
6800
7000
7200
7400
7600
7800
8000
Frequency (MHz)


RS103 Standard Level / Measured Level: 8GHz - 18GHz, Horizontal, Position 1
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
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52
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9000
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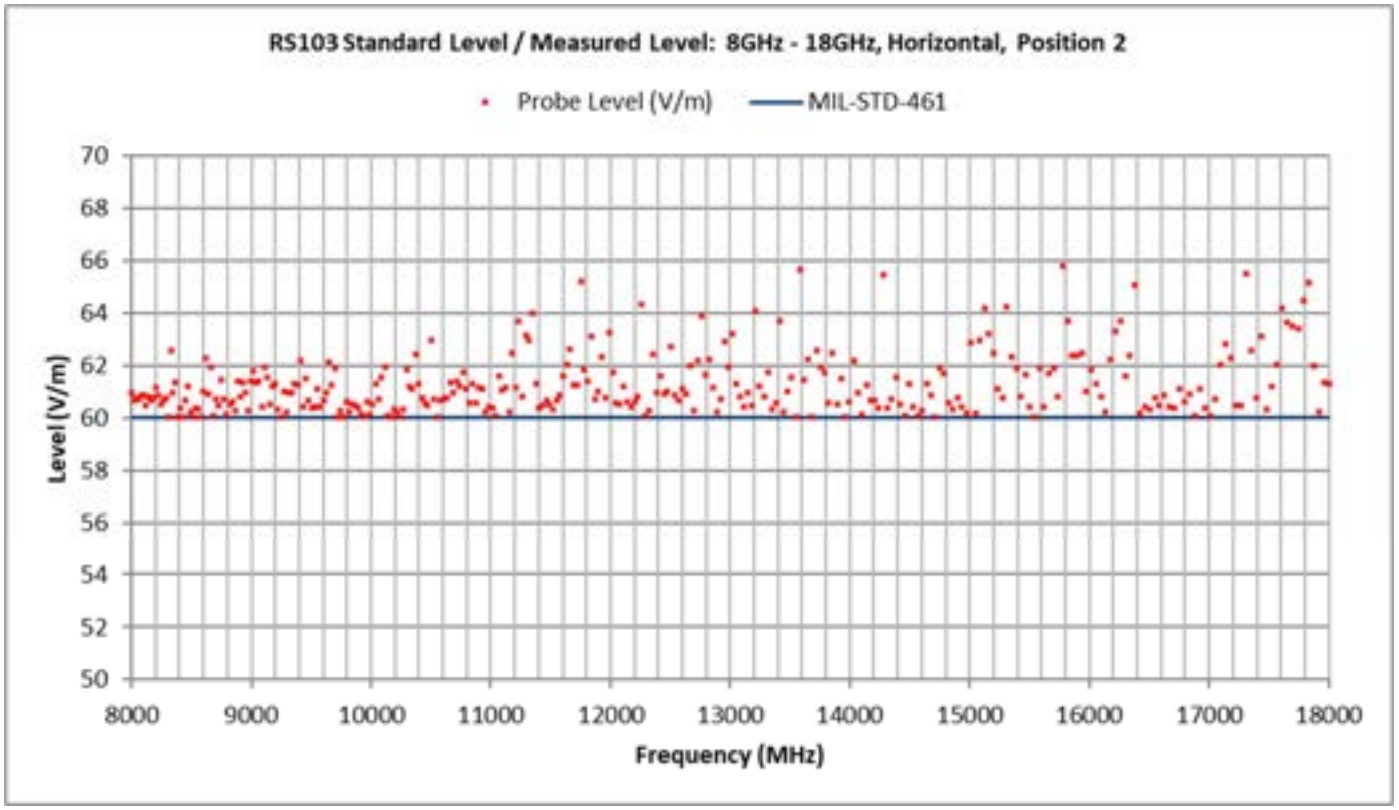
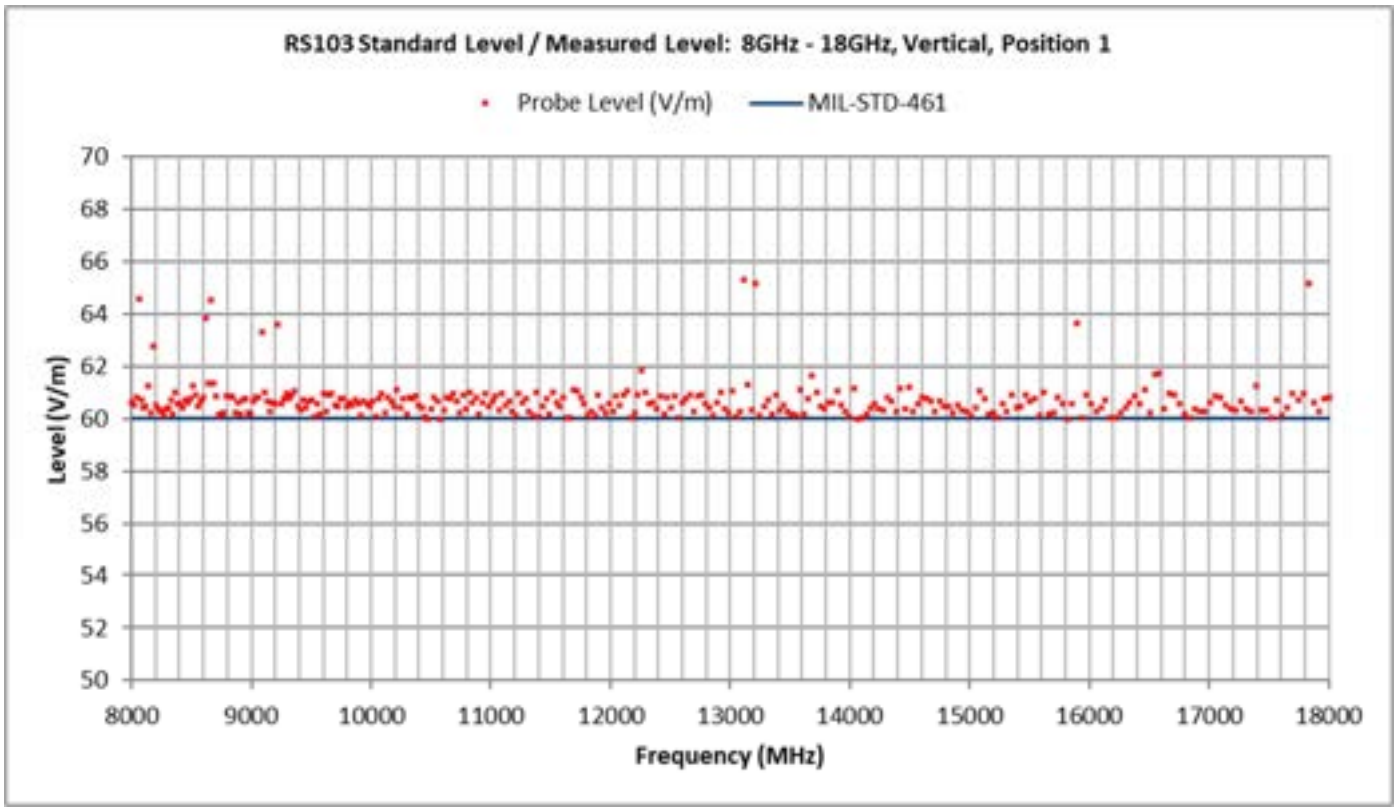
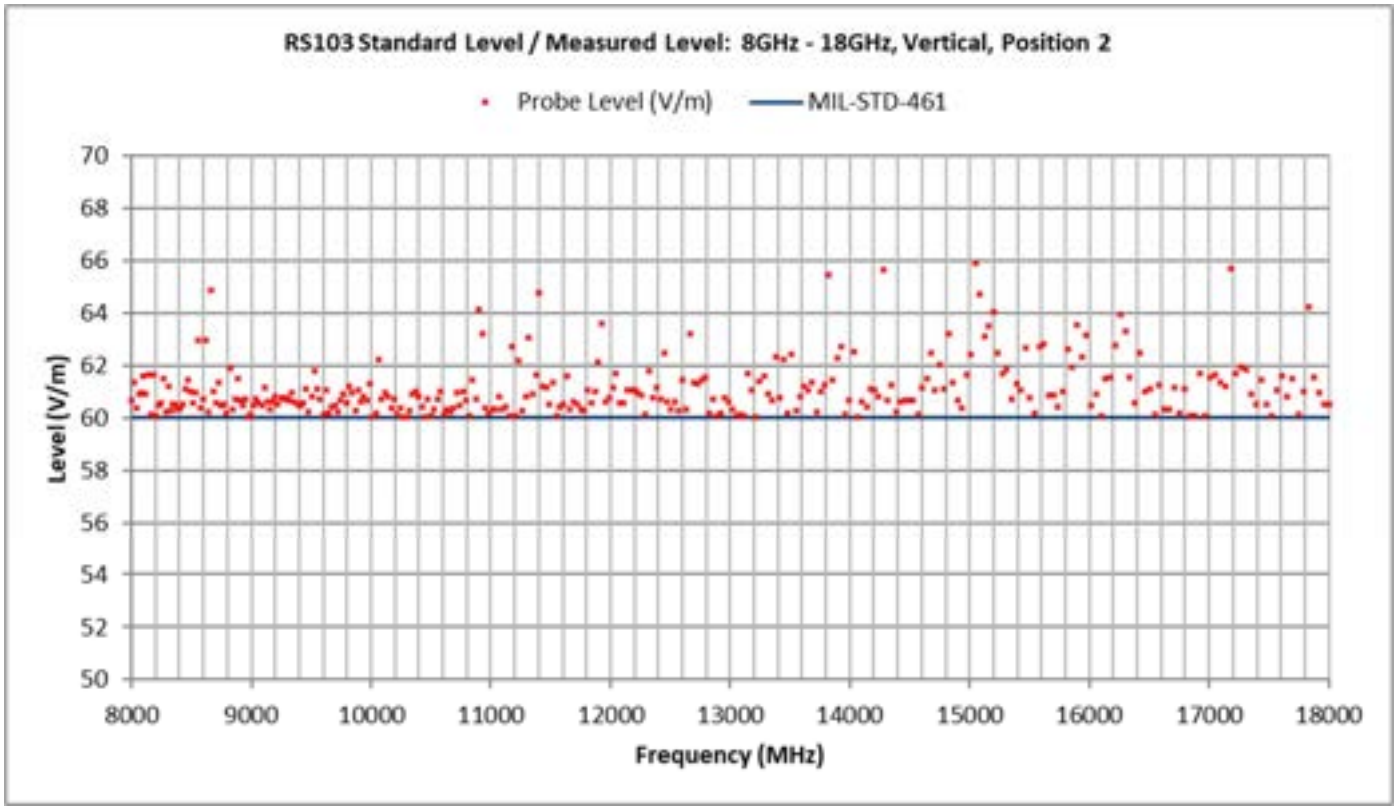
11000
12000
13000
14000
15000
16000
17000
18000
Frequency (MHz)


RS103 Standard Level / Measured Level: 8GHz - 18GHz, Horizontal, Position 2
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
54
52
50
8000
9000
10000
11000
12000
13000
14000
15000
16000
17000
18000
Frequency (MHz)


RS103 Standard Level / Measured Level: 8GHz - 18GHz, Vertical, Position 1
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
54
52
50
8000
9000
10000
11000
12000
13000
14000
15000
16000
17000
18000
Frequency (MHz)


RS103 Standard Level / Measured Level: 8GHz - 18GHz, Vertical, Position 2
Probe Level (V/m)
MIL-STD-461
Level (V/m)
70
68
66
64
62
60
58
56
54
52
50
8000
9000
10000
11000
12000
13000
14000
15000
16000
17000
18000
Frequency (MHz)

RS103 Field Probe Modulation Correction Factor					
PR#:	PR131850		**Test Date(s):**		3/9/2021 - 3/11/2021
Customer:	Amphenol Aerospace		**P.O.#:**		
Test Method:	MIL-STD-416G		**EUT Nomenclature:**		SwitchBox
Test Spec.:	RS103		**EUT Model or Part Number:**		19CD0002 Rev B
Para./Sect.:	5.19		**EUT Serial Number:**		N/A

Field Probe Asset Number and Model Number		Modulation Used	Frequency Under test (MHz)	Polarization	CW Reading (V/m)	Modulated Reading (V/m)	Correction Factor (multiplier)
WC005814	HI-6022	1kHz PM, 50% duty cycle	2	Vertical	20.20	14.20	1.423
WC005814	HI-6022	1kHz PM, 50% duty cycle	30	Horizontal	20.13	14.07	1.431
WC005814	HI-6022	1kHz PM, 50% duty cycle	30	Vertical	20.69	14.10	1.467
WC005814	HI-6022	1kHz PM, 50% duty cycle	200	Horizontal	20.23	14.33	1.412
WC005814	HI-6022	1kHz PM, 50% duty cycle	200	Vertical	20.30	14.05	1.445
WC005790	HI-6053	1kHz PM, 50% duty cycle	1000	Horizontal	60.22	42.89	1.404
WC005790	HI-6053	1kHz PM, 50% duty cycle	1000	Vertical	60.41	42.77	1.412
WC005790	HI-6053	1kHz PM, 50% duty cycle	2500	Horizontal	60.22	42.84	1.406
WC005790	HI-6053	1kHz PM, 50% duty cycle	2500	Vertical	60.90	42.71	1.426
WC005790	HI-6053	1kHz PM, 50% duty cycle	4000	Horizontal	60.80	43.20	1.407
WC005790	HI-6053	1kHz PM, 50% duty cycle	4000	Vertical	60.51	42.15	1.436
WC005790	HI-6053	1kHz PM, 50% duty cycle	6000	Horizontal	60.30	43.05	1.401
WC005790	HI-6053	1kHz PM, 50% duty cycle	6000	Vertical	60.59	42.70	1.419
WC005790	HI-6053	1kHz PM, 50% duty cycle	8000	Horizontal	60.89	42.37	1.437
WC005790	HI-6053	1kHz PM, 50% duty cycle	8000	Vertical	60.33	43.01	1.403
WC005790	HI-6053	1kHz PM, 50% duty cycle	18000	Horizontal	63.30	45.15	1.402
WC005790	HI-6053	1kHz PM, 50% duty cycle	18000	Vertical	63.50	45.20	1.405
Test Engineer:		**Tristian Gaines**					
Program Engineer:		**Jeff Maselli**					

5.8.8 RS103 Test Equipment List

Table 5.8-2: RS103 Test Equipment List

Asset No.	Manufacturer	Item	Model	S/N	Cal. Cycle (Months)	Cal. Due
WC005630	National Technical Systems	E-Field - Parallel Element Antenna 10 kHz - 220 MHz	n/a	n/a	NCR	NCR
WC006573	EMCO	Antenna (Biconical)	3109	9411-2853	3 Yrs.	05/23/2022
WC005310	ETS-Lindgren	Large Ridged Guide Antenna	3106	35382	3 Yrs.	04/21/2023
WC058429	Amplifier Research	Antenna .8 - 6.0 GHz, 900W	AR ATH800M6G	0351558	3 Yrs.	7/2/2021
WC058430	Amplifier Research	Antenna 6-18 GHz, 3kW	AR ATH6G18	0351643	3 Yrs.	7/2/2021
WC005477	Marconi	9kHz – 1.2GHz Signal Generator	2023	112253143	12	01/13/2022
WC005556	Agilent Technologies	Signal Generator 10MHz to 40GHz	HP83620B	3844A00809	1 Yr.	08/19/2021
WC005628	IFI	Amplifier 200 MHz – 1GHz	SMCC1000	L374-0507	NCR	NCR
WC005660	IFI	1-2GHz Amplifier	GT251-500A	L500-0408	NCR	NCR
WC005776	IFI	2-4 GHz Amplifier	SMX100	M701-0508	NCR	NCR
WC005662	Amplifier Research	4-8 GHz Amplifier	200T4GB	326913	NCR	NCR
WC005682	Communications & Power Industries	8-18GHz Amplifier	VZM6993J5	SJ7213C7	NCR	NCR
WC005511	National Technical Systems	Chamber (EMI, Semi-Anechoic)	n/a	n/a	NCR	NCR
WC005814	ETS-Lindgren	Field Probe 1 kHz - 1GHz	HI-6022	00114361	1 Yr.	01/07/2022
WC005790	ETS Lindgren	Field Probe 10MHz - 40GHz	HI-6053	00149346	1 Yr.	04/22/2021

Asset No.	Manufacturer	Item	Model	S/N	Cal. Cycle (Months)	Cal. Due
WC005647	Solar	LISN	8028-50-TS-24-BNC	0511189	36	6/5/23
WC005290	Solar	LISN	8028-50-TS-24-BNC	075513	36	3/6/22

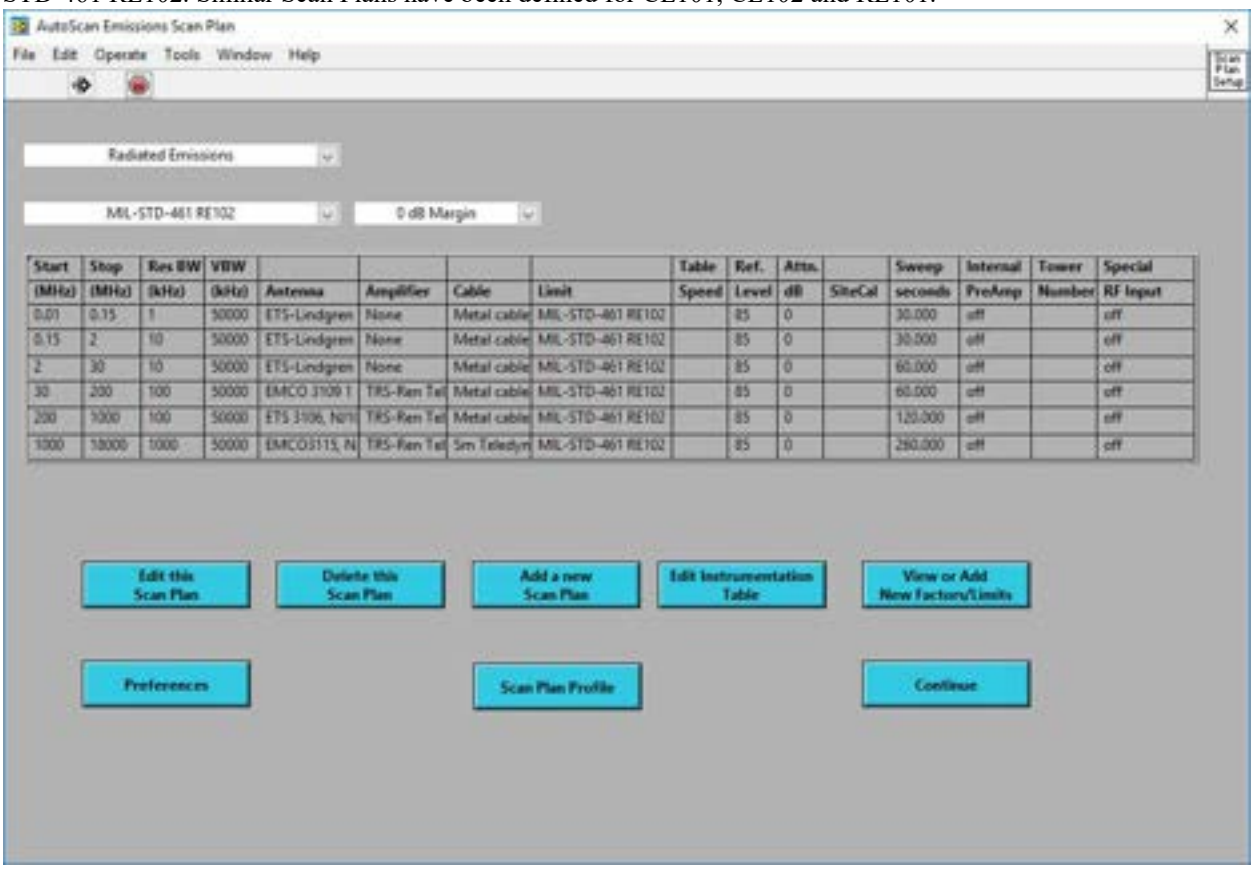
Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

NCR = No Calibration Required; as per NTS QA policy, the equipment does not require calibration as long as the test signal being generated can be verified with other calibrated equipment prior to or during the test.

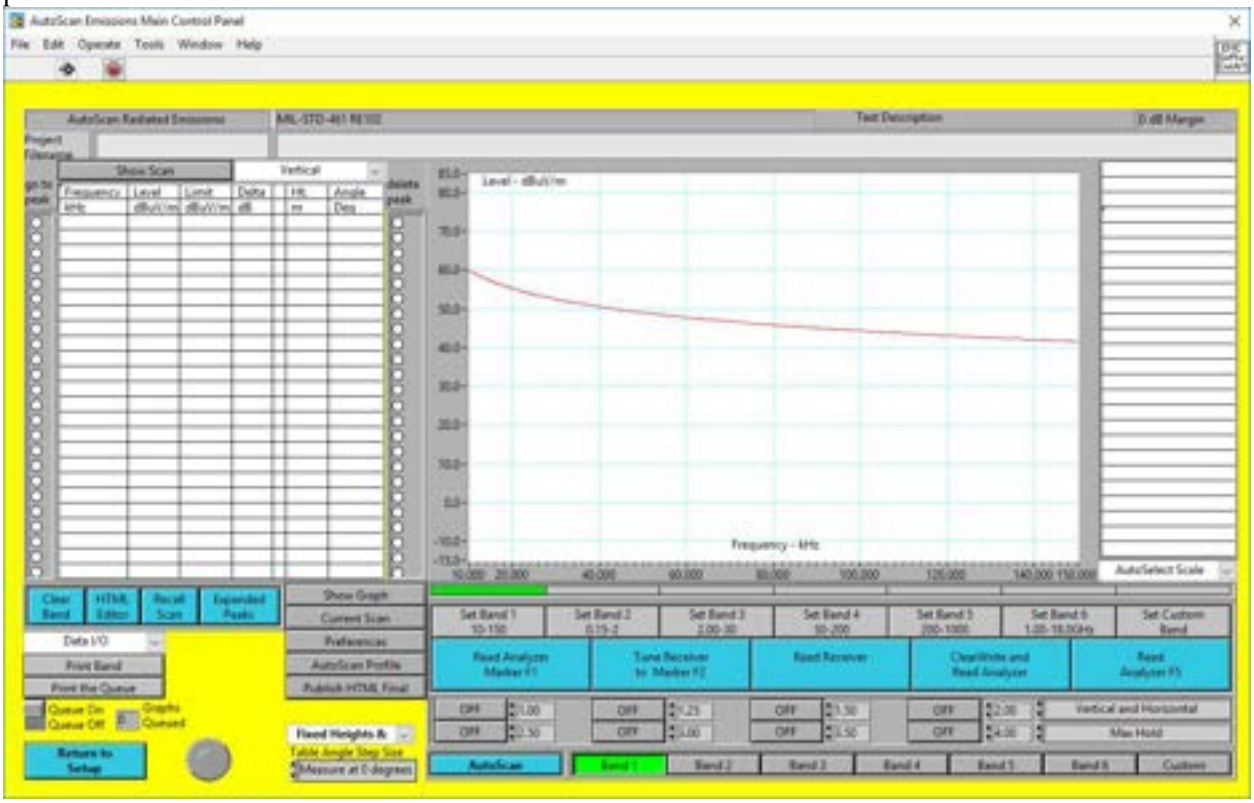
Appendix A: Test Software Description

AutoScan™ EMI Measurement Software

The AutoScan software is a National Instruments LabVIEW™ compiled package, specifically designed by EMCware for automation of Radiated and Conducted RF Emission measurements.
The AutoScan Emissions Scan Plan window shows the administrator defined test parameters including Start Frequency, Stop Frequency, Resolution Bandwidth, Video Bandwidth, Antenna, Amplifier, Cable, Limit, Reference Level, Attenuation and Sweep Time.
The Scan Plan shown below has been defined in order to perform the radiated emissions test in accordance with MIL-STD-461 RE102. Similar Scan Plans have been defined for CE101, CE102 and RE101.

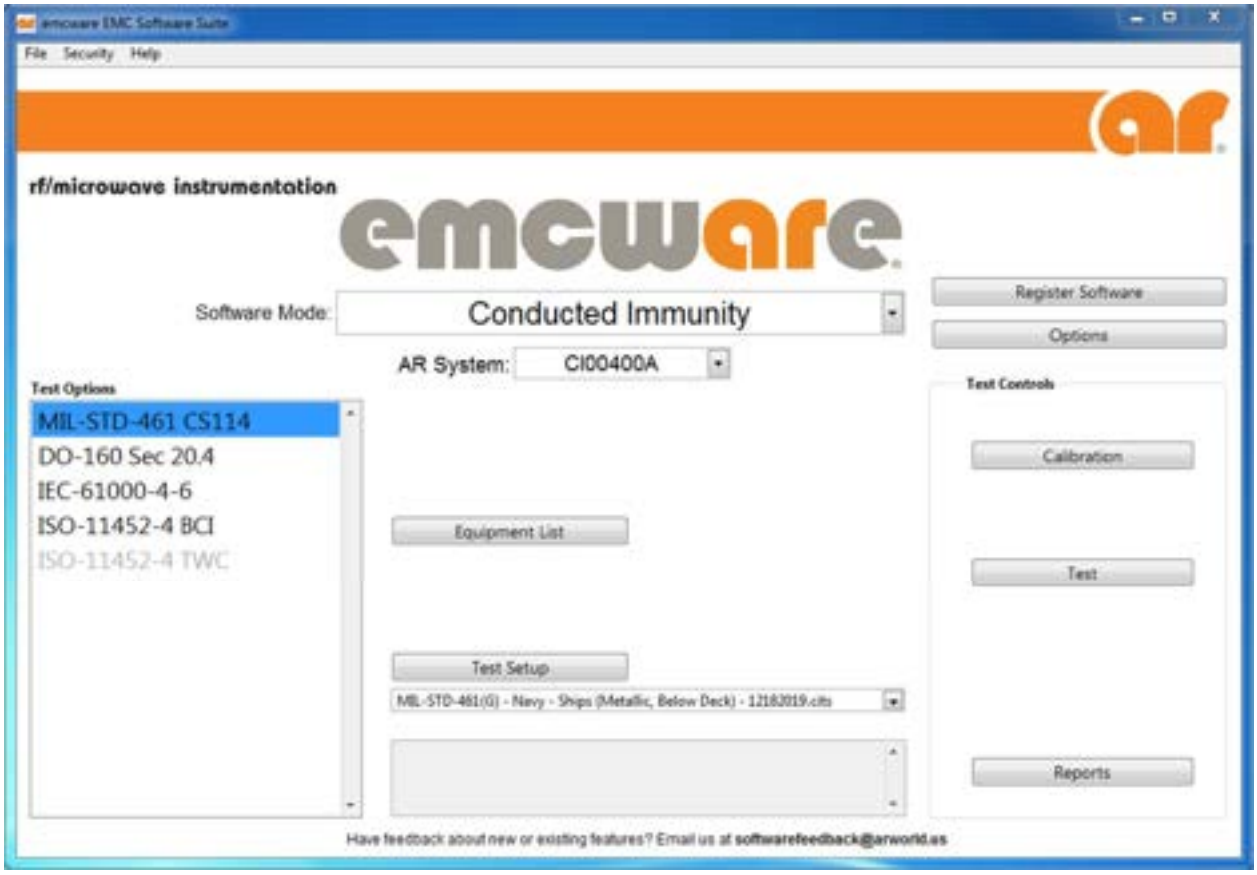


The AutoScan Emissions Main Control Panel window shown below was used to execute the test, using the parameters defined in the Scan Plan.

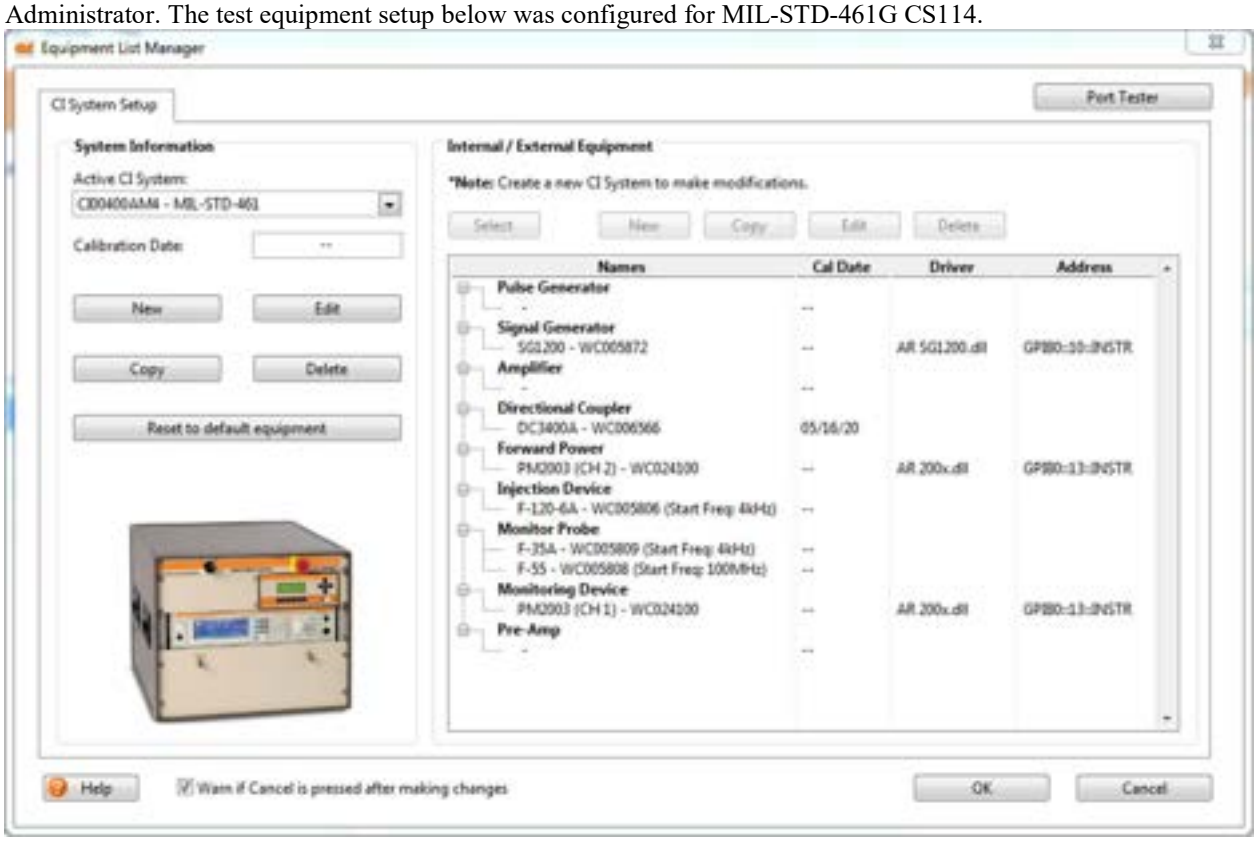


Amplifier Research emcware™

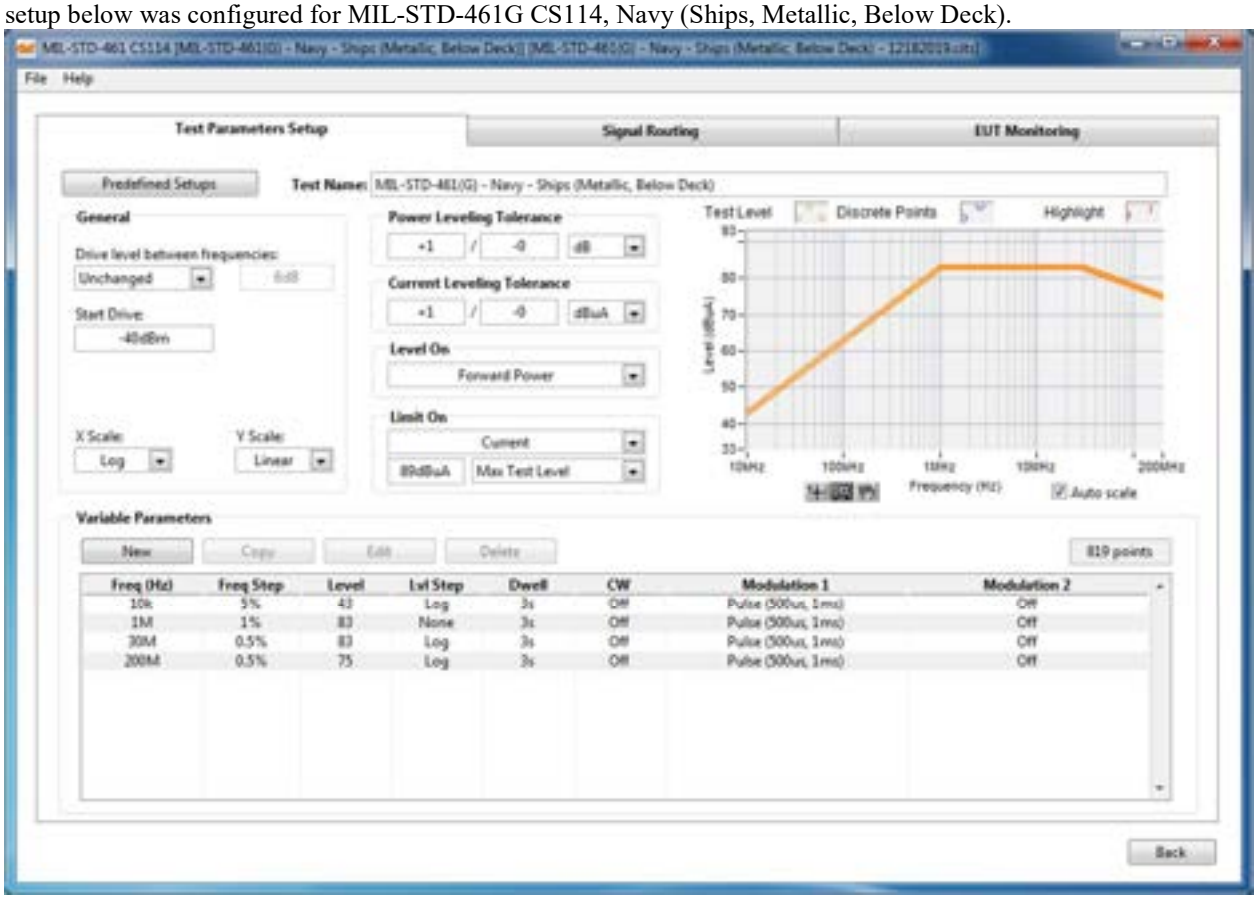
The National Instruments LabVIEW™ compiled emcware™ software by Amplifier Research controlled an Amplifier Research hardware package, that consists of a signal generator, power amplifier and a three channel power meter for performing both MIL-STD and commercial conducted immunity tests.
The start window allows the user to select the test type, test standard, test equipment setup, test parameters setup, start test or start calibration.



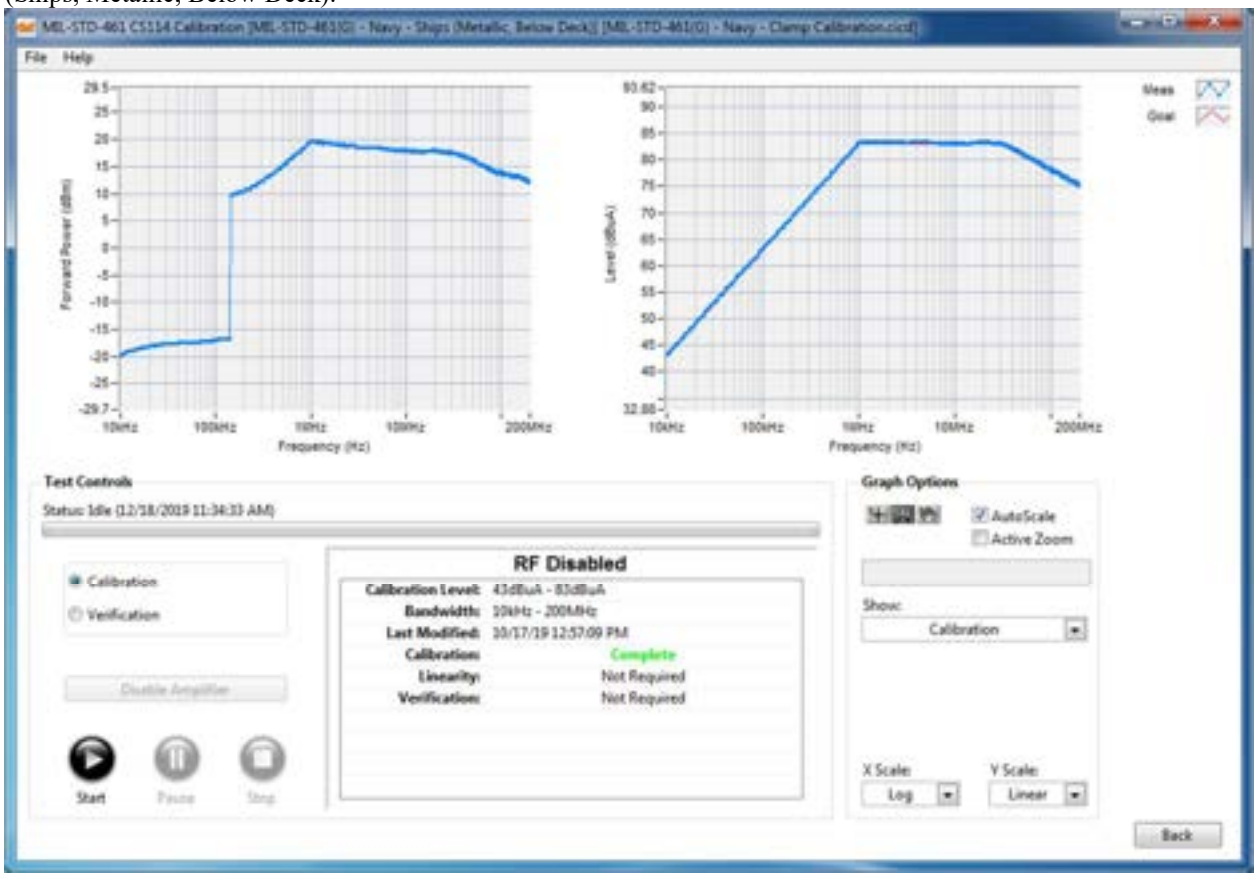
The test equipment screen shown below allows the user to select pre-defined test equipment setups, defined by the Administrator. The test equipment setup below was configured for MIL-STD-461G CS114.



The Test Setup screen shown below allows the user to select the test parameters set by the Administrator. The test setup below was configured for MIL-STD-461G CS114, Navy (Ships, Metallic, Below Deck).

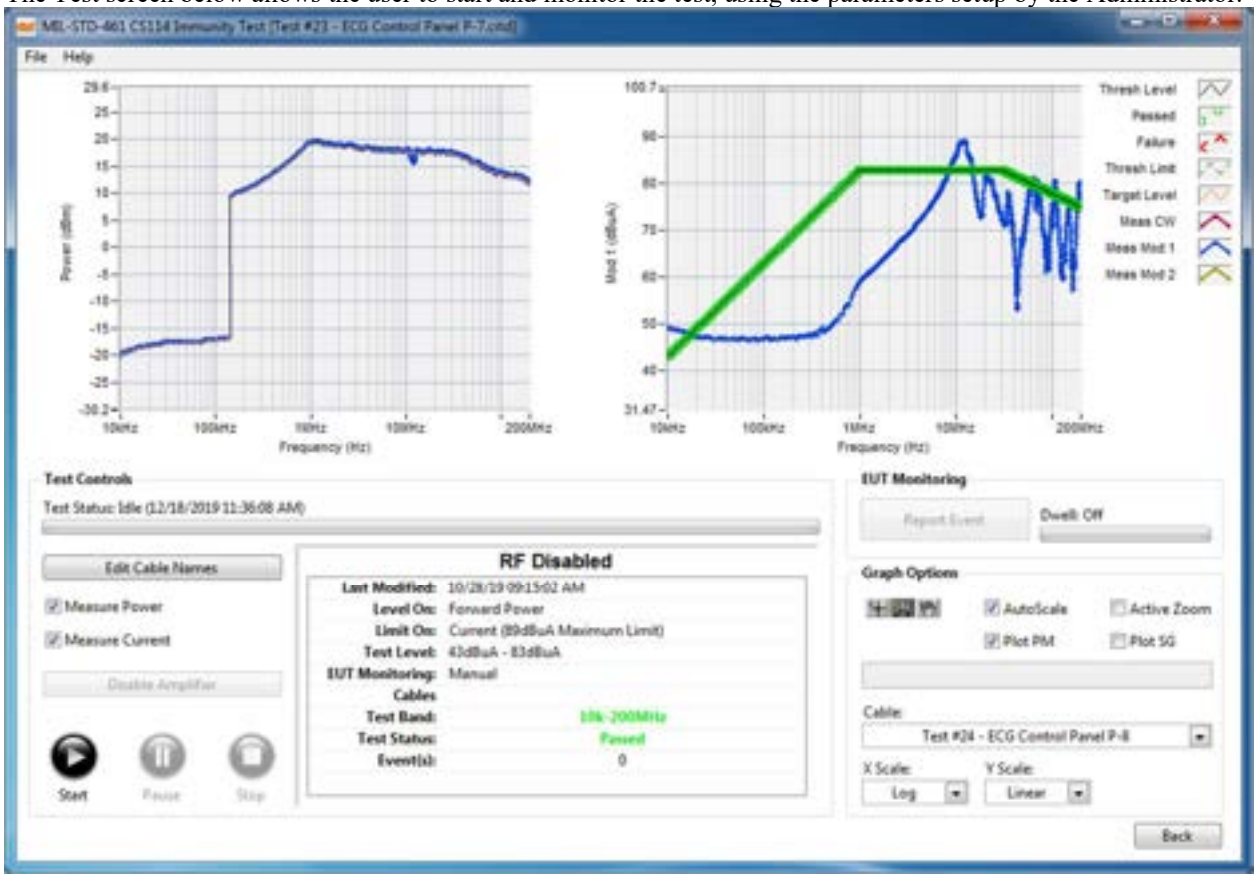


The Calibration screen shown below allows the user to select and start either the pre-test system calibration or test equipment / calibration verification. The screen below shows the calibration window for MIL-STD-461 CS114, Navy (Ships, Metallic, Below Deck).



The screen below shows the verification window for MIL-STD-461 CS114, Navy (Ships, Metallic, Below Deck).

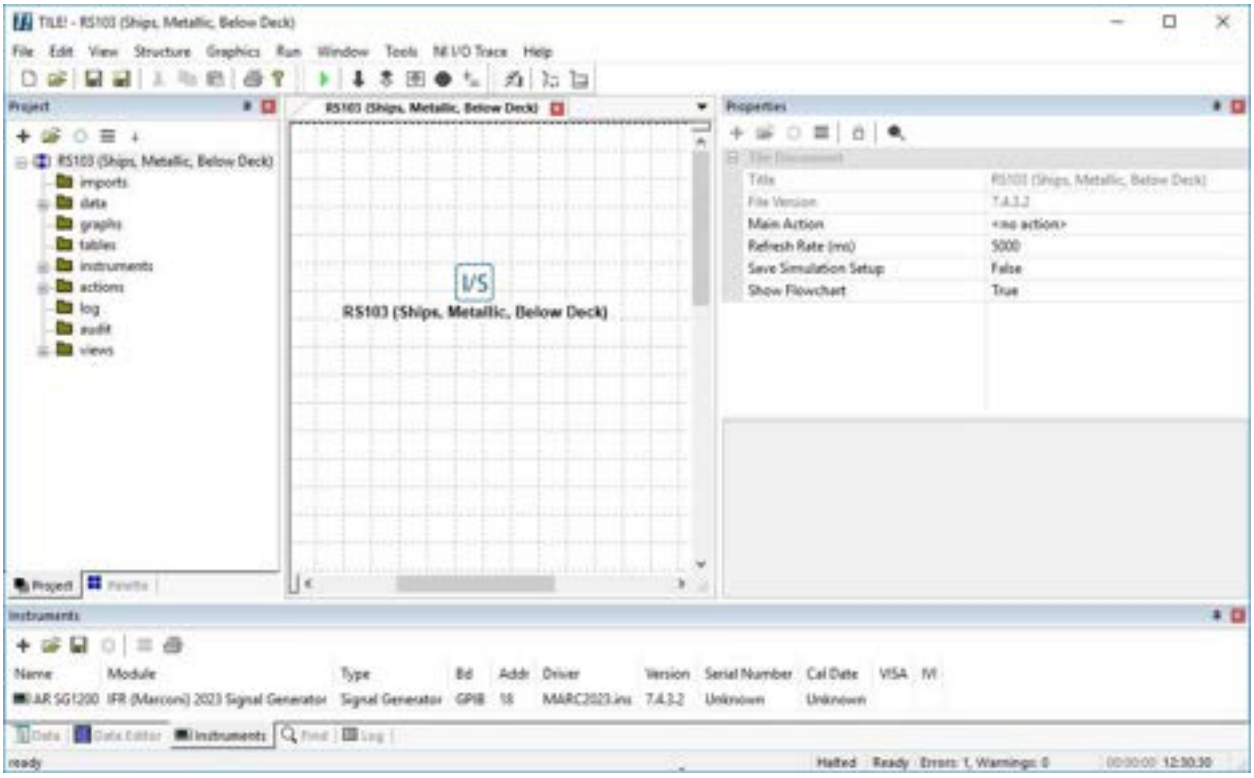
The Test screen below allows the user to start and monitor the test, using the parameters setup by the Administrator.



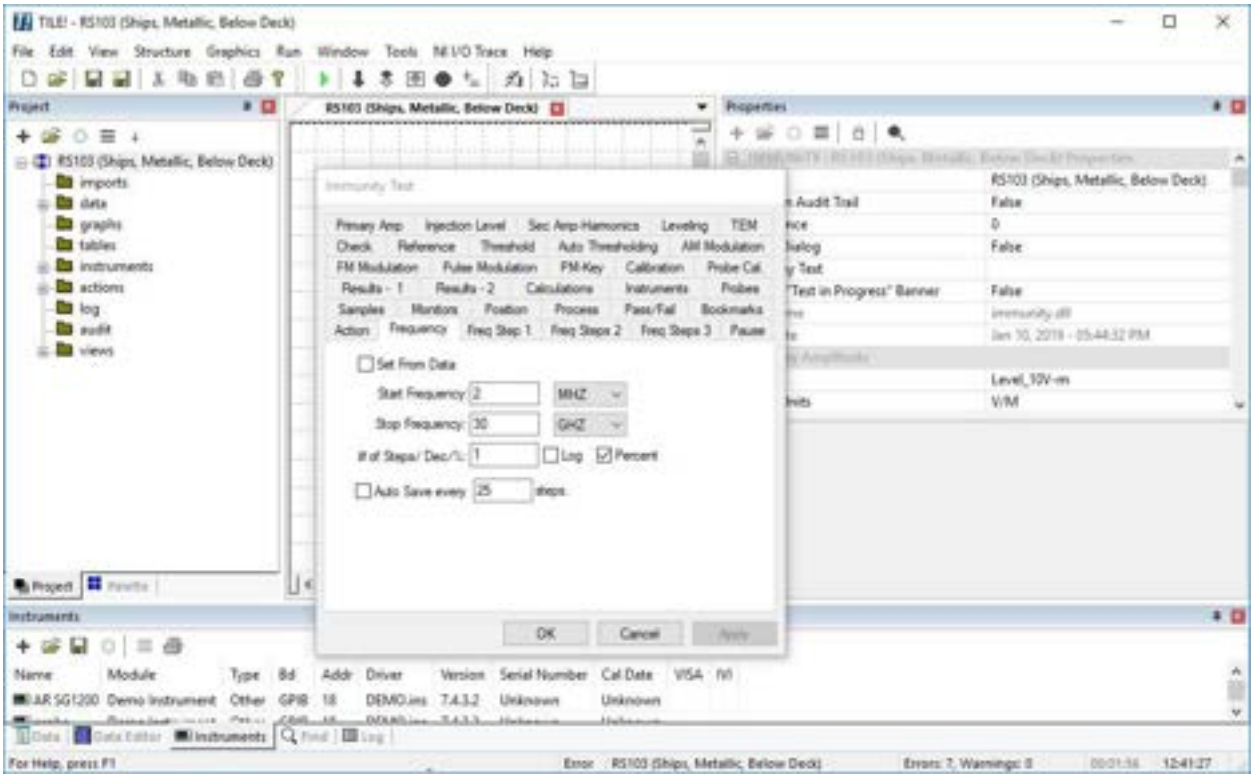
ETS-Lindgren Totally Integrated Laboratory Environment (TILE!)

The C++ compiled Totally Integrated Laboratory Environment (TILE! ™) software by ETS-Lindgren is used for RS103 and CS101 testing.

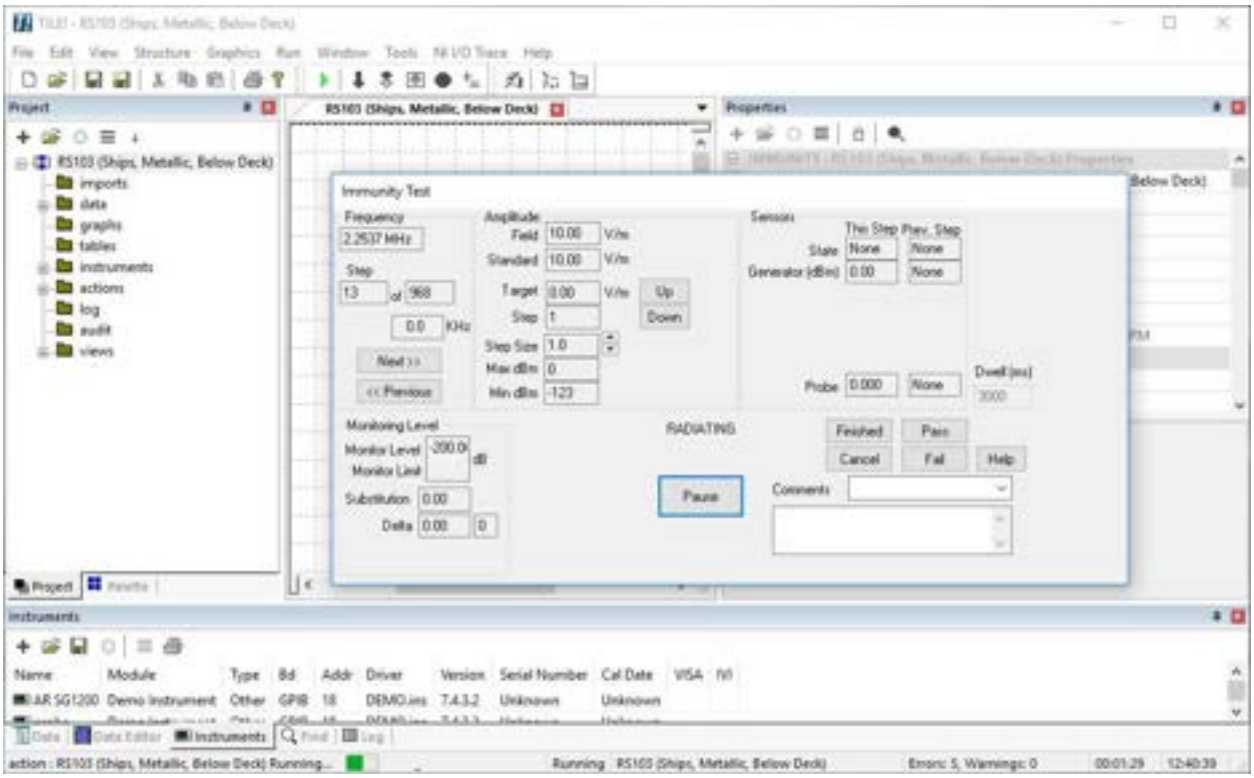
The screen below shows the main TILE! Program with the Administrator defined profile opened for MIL-STD-461 RS103 (Ships, Metallic, Below Deck). Similar profiles have been defined for CS101.



The screen below shows the properties tabs of the Administrator defined profile. In these tabs, the administrator has defined the frequency range, step size, test level, modulation type, dwell time, instrumentation, etc.



The screen below shows the running profile, where the user can monitor the test in progress.

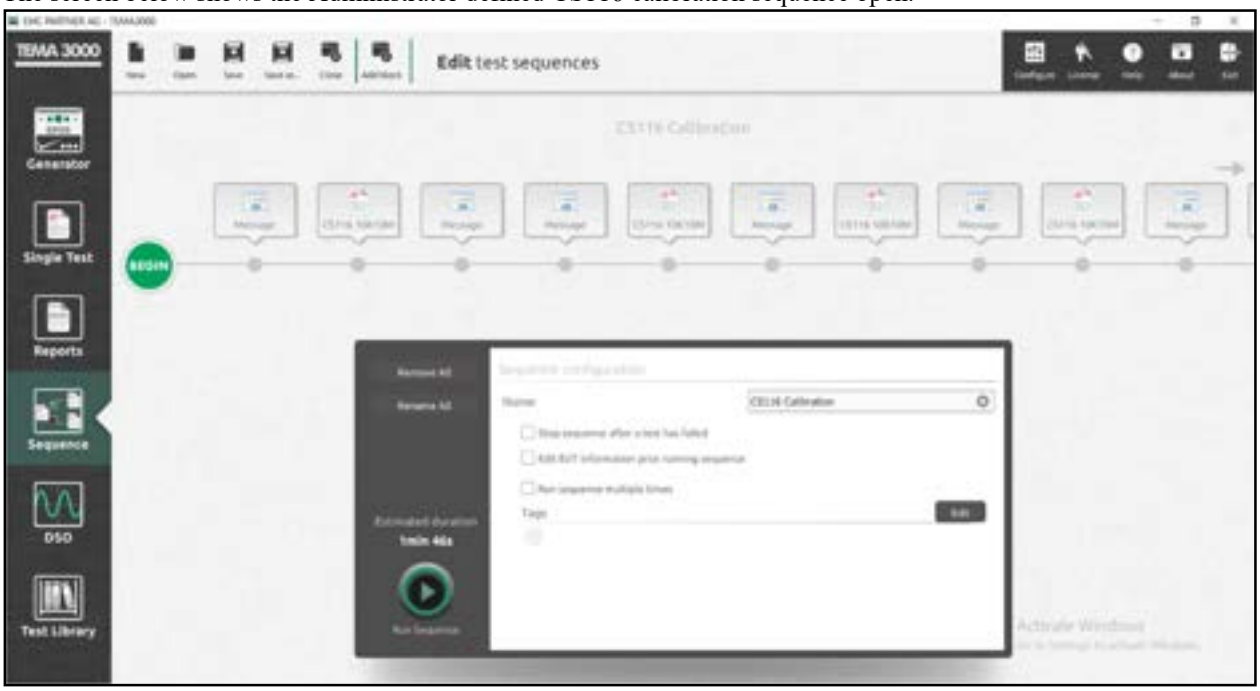


EMC Partner TEMA3000™

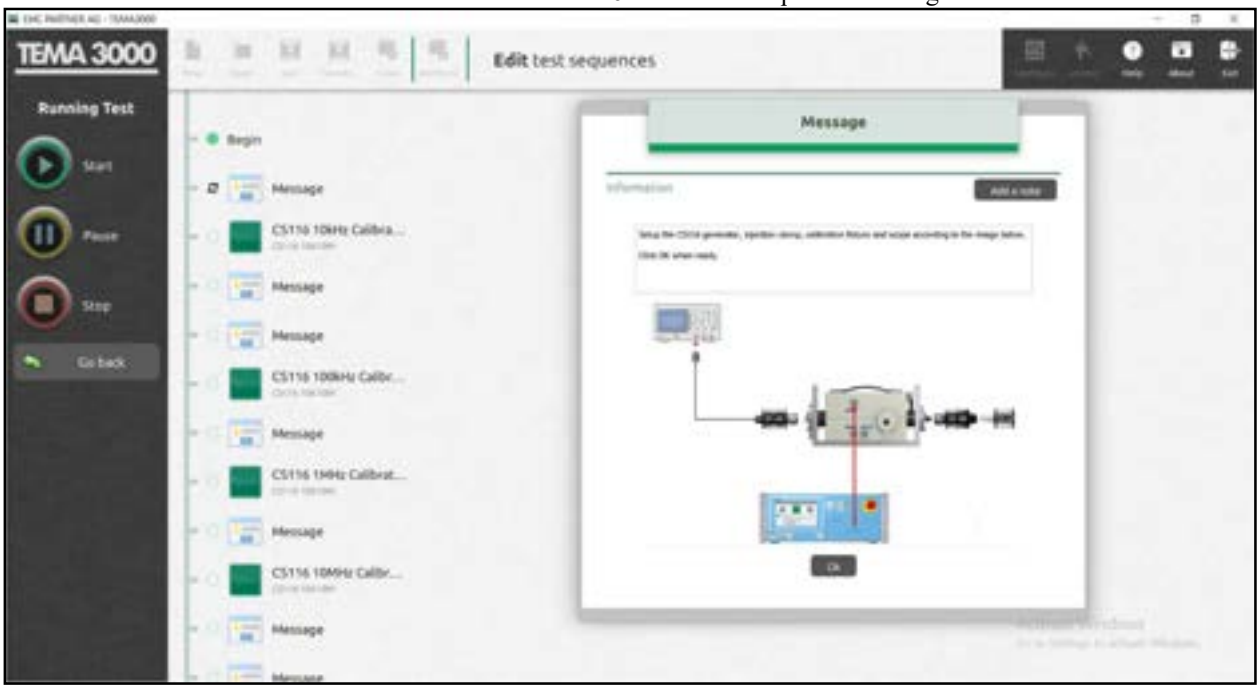
The EMC Partner TEMA3000 software package was used to control the EMC Partner MIL3000 test system to perform CS116 and CS115 testing.

The screen below shows the start screen, where the user can select Administrator defined sequences or single tests.

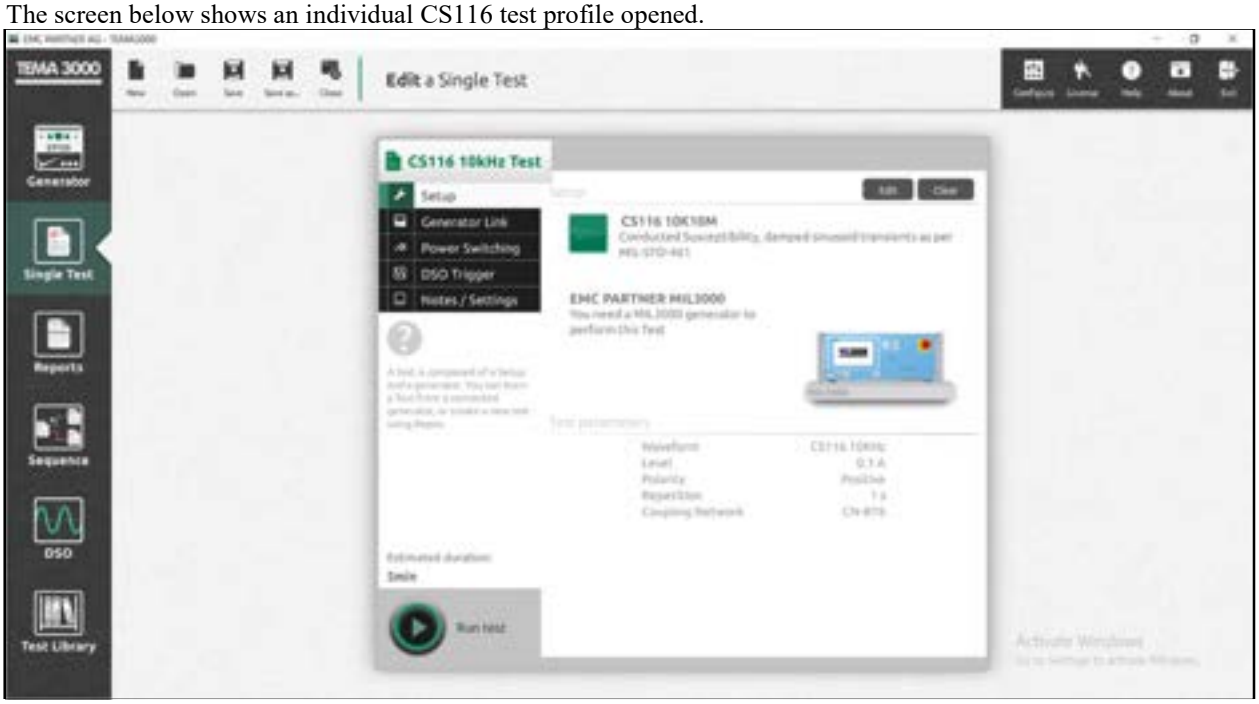
The screen below shows the Administrator defined CS116 calibration sequence open.



The screen below shows the Administrator defined CS116 calibration sequence running.

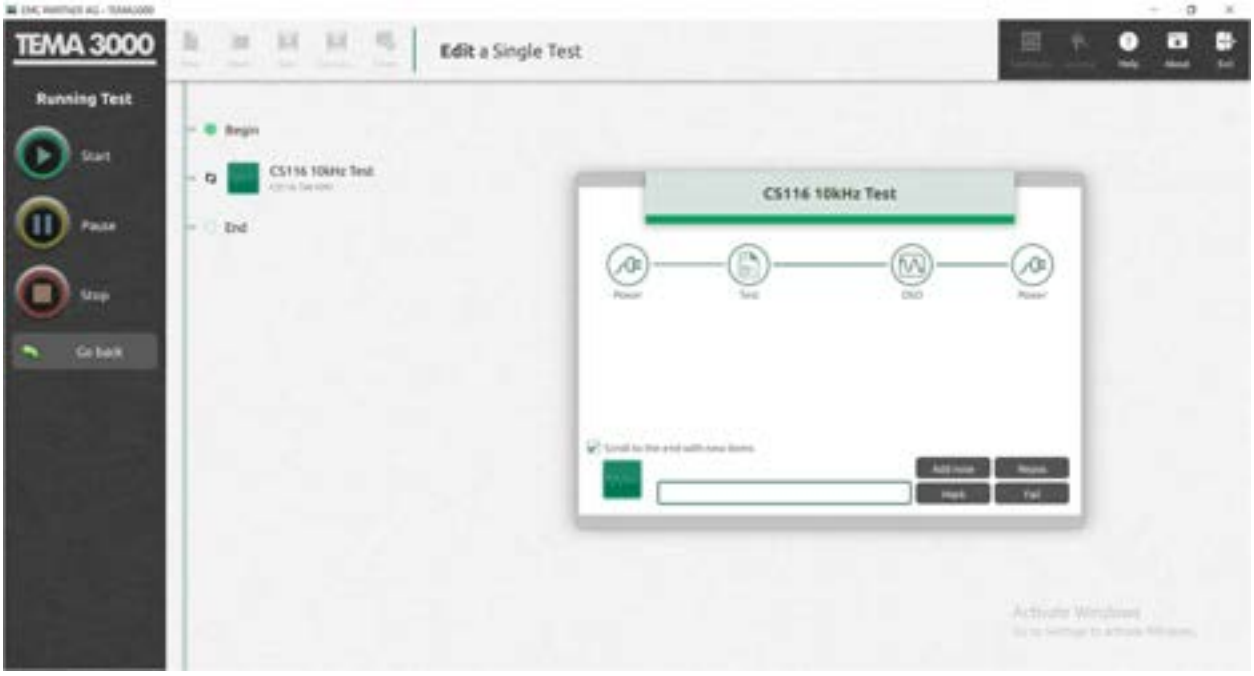


The screen below shows an individual CS116 test profile opened.



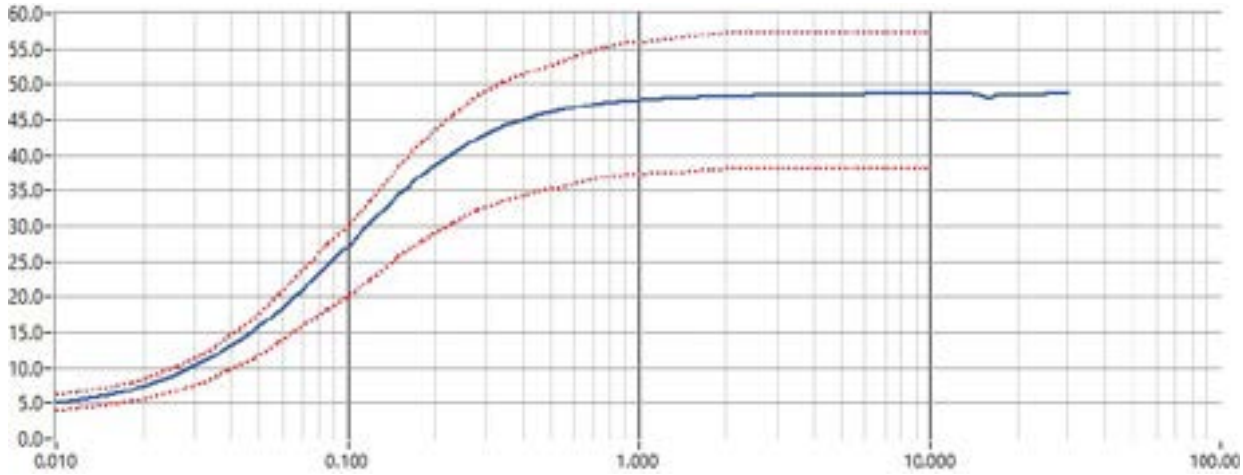
The screen below shows the edit CS116 test window, where the user can set the test level to a level lower than the calibrated level when required by MIL-STD-461.

The screen below shows the CS116 test running.

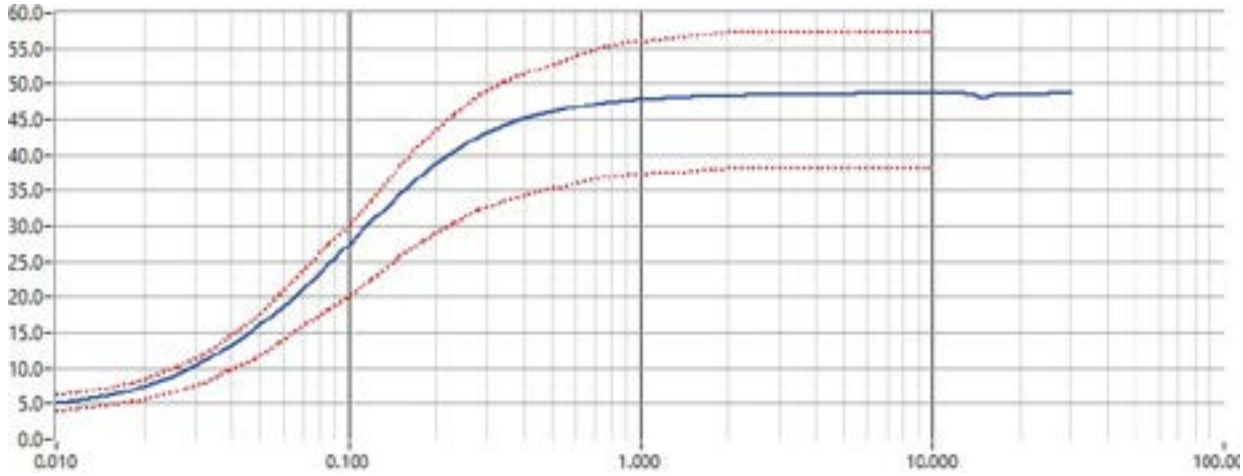


Appendix B: LISN Impedance

Asset #:	WC005647	Manuf.:	Solar	Model:	8028-50-TS-24-BNC	Cal. Due:	6/5/23



Asset #:	WC005290	Manuf.:	Solar	Model:	8028-50-TS-24-BNC	Cal. Due:	3/6/22



---------- End of Test Report ----------