MET Laboratories, Inc. *Safety Certification - EMC - Telecom - Environmental Simulation*
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13301 MCCALLEN PASS • AUSTIN, TEXAS 78753 • PHONE (512) 287-2500 • FAX (512) 287-2513

August 26, 2014

Linear Technology Corporation
1630 McCarthy Blvd
Milpitas, CA 95035-7417

Dear Dan Eddleman

Enclosed is the EMC report for the Linear Technology Corporation, LTC4366/LT4363 MIL-STD-1275D Surge Stopper Model DC2150A-C tested to the requirements of MIL-STD-1275D.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.

Jill Valdes
Documentation Department

Reference: (\Linear Technology Corporation\EMCS42676-MIL)

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Electromagnetic Compatibility Criteria Test Report

For The:

Linear Technology Corporation
LTC4366/LT4363 MIL-STD-1275D Surge Stopper Model DC2150A-C

Tested Under:

MIL-STD-1275D

MET Report: EMCS42676-MIL

August 26, 2014

Prepared For:

Linear Technology Corporation
1630 McCarthy Blvd
Milpitas, CA 95035-7417

Prepared By:
MET Laboratories, Inc.
3162 Belick Street
Santa Clara, CA 95054

Electromagnetic Compatibility Criteria
Test Report

For the:

Linear Technology Corporation
LTC4366/LT4363 MIL-STD-1275D Surge Stopper Model DC2150A-C

Tested under:

MIL-STD-1275D

Testing Reviewed By:

Joseph Dizon
MIL EMC Test Engineer, Electromagnetic Compatibility Lab

Report Prepared By:

Jill Valdes
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the applicable limits. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of MIL-STD-1275D, December 10, 2007 under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	August 26, 2014	Initial Issue.

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List of Terms and Abbreviations

The following abbreviations may be referenced within this report.

AC	**A**lternating **C**urrent
Amp or **A**	**Amp**eres
ASW	**A**nti-**s**ubmarine **w**arfare
dB	**D**eci**b**els
dBpT	**D**eci**b**els above one **p**ico-**t**esla
dBµA	**D**eci**b**els above one **microa**mp
dBµV	**D**eci**b**els above one **microv**olt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
cm	**c**enti**m**eter
DC	**D**irect **C**urrent
EMITR	**E**lectro**m**agnetic **I**nterference **T**est **R**eport
EDUT	**E**quipment **U**nder **T**est
G	**G**ig
H	Magnetic Field
H/V	**H**orizontal/**V**ertical
Hz	**H**ert**z**
in	**in**ch
I_p	**P**eak current at 1st cycle
kHz	**k**ilo**h**ert**z**
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
m	**M**eter
max	**Max**imum
MHz	**M**ega**h**ertz
nS	**N**ano-**s**econd
μ**H**	**Microh**enry
V/m	**V**olts **per m**eter
W	**W**att
Ω	Ohm
%	Percent

I. Executive Summary

A. Executive Summary

Tests were conducted on a sample of the equipment for the purpose of determining compliance with the applicable specifications of MIL-STD-1275D EMC requirements as listed in Table 1. Unless otherwise documented, all testing was performed in accordance with the Linear Technology Corporation Purchase Order X11128F.

Specification and Section Number	Test Description	Conformance
MIL-STD-1275D Section 4.3	EDUT Compatibility	Compliant
MIL-STD-1275D Section 5.1.2 Starting Mode Testing		
MIL-STD-1275D Section 5.1.2	Starting Disturbances- Initial Engagement Surge and Cranking Surge (according to Section 3.1.6)	Compliant
MIL-STD-1275D Section 5.3.2 Vehicle Equipment		
MIL-STD-1275D Section 5.3.2.2	Voltage spikes exported from EDUT	Compliant
MIL-STD-1275D Section 5.3.2.3	Voltage spikes imported into EDUT	Compliant
MIL-STD-1275D Section 5.3.2.4	Voltage surges imported into EDUT	Compliant
MIL-STD-1275D Section 5.3.2.5	Ripple voltage imported into EDUT	Compliant

Table 1. Executive Summary of MIL-STD-1275D ComplianceTesting

II. Equipment Configuration

A. Overview

Tests were conducted on a sample of the Linear Technology Corporation, LTC4366/LT4363 MIL-STD-1275D Surge Stopper Model DC2150A-C equipment for the purpose of determining compliance with the applicable specifications limits to the Department of Defense Interface Standard; Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment, 10 December 2007. The results obtained relate only to the item(s) tested.

Model(s) Tested:	LTC4366/LT4363 MIL-STD-1275D Surge Stopper Model DC2150A-C
Model(s) covered:	LTC4366/LT4363 MIL-STD-1275D Surge Stopper Model DC2150A-C
Power Specifications:	28 VDC, 4A
Physical Dimensions:	Size: (HxWxD): 2.5 x 5 x 3.5 inches Weight: 0.25 lbs.
Evaluated by:	Joseph Dizon
Test date(s) covered:	07/28/2014 – 07/30/2014

B. References

MIL-STD-1275D	Characteristics of 28 Volt DC Electrical Systems in Military Vehicles
SAE J1113-2	Society of Automotive Engineers, Electromagnetic Compatibility Measurement Procedure for Vehicle Components - Part 2: Conducted Immunity 15Hz to 250kHz All Leads
ANSI/ISO/IEC 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories

C. Test Site

All testing was performed at MET Laboratories, Inc., 3162 Belick Street, Santa Clara, CA 95054. All test equipment used in making EMC Compliance determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

D. Description of Test Sample

The LTC4366/LT4363 MIL-STD-1275D Surge Stopper provides an output voltage that is limited to 44V when faced with MIL-STD-1275D's surge, spike, and ripple conditions. In most circumstances, MIL-STD-1275D compliance may be achieved by placing this circuit in front of a 44V tolerant device. This circuit provides up to 4 Amps to the output in all conditions except the ±7V ripple condition (14Vpeak-to-peak). During the ripple condition, up to 2.8A is provided to the load.

E. Mode of Operation

The EDUT was operated in normal mode of operation by loading the output with a 10 ohm resistor during the MIL-STD-1275D input test conditions. The output remained powered during all conditions.

F. Method of Monitoring EDUT Operation

The EDUT was monitored during testing by observing the EDUT's input and output voltages with an oscilloscope. The output voltage did not drop to less than 2V below the input voltage except when the input voltage was greater than 44V, in which case the output voltage was limited to less than 46V.

G. Modifications

a) Modifications to EDUT

No modifications were made to the EDUT.

b) Modifications to Test Procedure

No modifications were made to the Test Procedure.

c) Modifications to Test Standard

No modifications were made to the Test Standard.

H. Equipment Configuration

The EDUT was set up as outlined in Figure 1. All equipment incorporated as part of the EDUT is included in the following list.

Ref. ID	Name / Description	Model Number	Part Number	Serial Number	Rev. #
A	LTC4366/LT4363 MIL-STD-1275D Surge Stopper	DC2150A-C	N/A	N/A	2

Table 2. Equipment Configuration

I. Support Equipment

All support equipment necessary for the operation and testing of the EDUT is included in the following list.

Name / Description	Manufacturer	Model Number	Customer Supplied Calibration Data
10 ohm load	N/A	N/A	N/A

Table 3. Support Equipment

J. Ports and Cabling Information

Ref. ID	Port Name	Cable Description	Qty.	Length Tested (m)	Max Length (m)	Shielded (Y/N)	Termination Box ID & Port Name
1	INPUT	Banana	1	1	2	No	Test Fixture
2	GND	Banana	1	1	2	No	Test Fixture
3	OUTPUT	Banana	1	0.5	1	No	10 ohm load
4	GND	Banana	1	0.5	1	No	10 ohm load

Table 4. Ports and Cabling Information

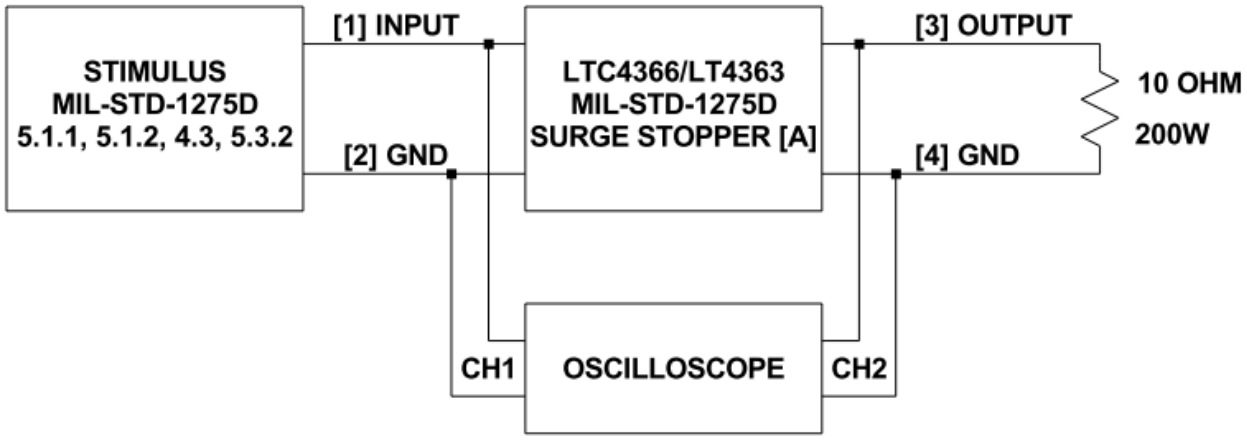


Figure 1. Block Diagram of Test Configuration

K. General Test Setup

For table top equipment, a 2.25 square meter copper ground plane was positioned atop a non-conductive test bench and electrically bonded to the shielded enclosure at intervals of 90cm or less. The EDUT was placed on the copper ground plane and bonded using MIL-STD-1275D test setup methods. As per MIL-STD-1275D, the DC bonding resistance was verified to be less than 2.5mΩ between the ground plane and the shielded enclosure.

Where bonding of the test sample was necessary to simulate actual installations, connections were made identically to those specified in the installation, and all corrosion at the interface of the chamber floor and bonding surface of the EDUT was completely removed prior to fastening.

L. Disposition of EDUT

The test sample including all support equipment (if any), submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Linear Technology Corporation upon completion of testing.

III. Electromagnetic Compatibility Criteria

4.3 EDUT Compatibility

Test Requirement(s): **MIL-STD-1275D, Section 4.3:** All EDUT units shall be able to withstand voltage transients as specified herein. The EDUT shall continue normal operation without damage to its components. The EDUT shall provide protection against polarity reversal as a result of slave starting or other improper connections.

Test Procedure: A reverse polarity voltage was applied at the input of the EDUT while the output was observed. There shall be no damage on the components of the EDUT and functionality shall maintain after the application of the test.

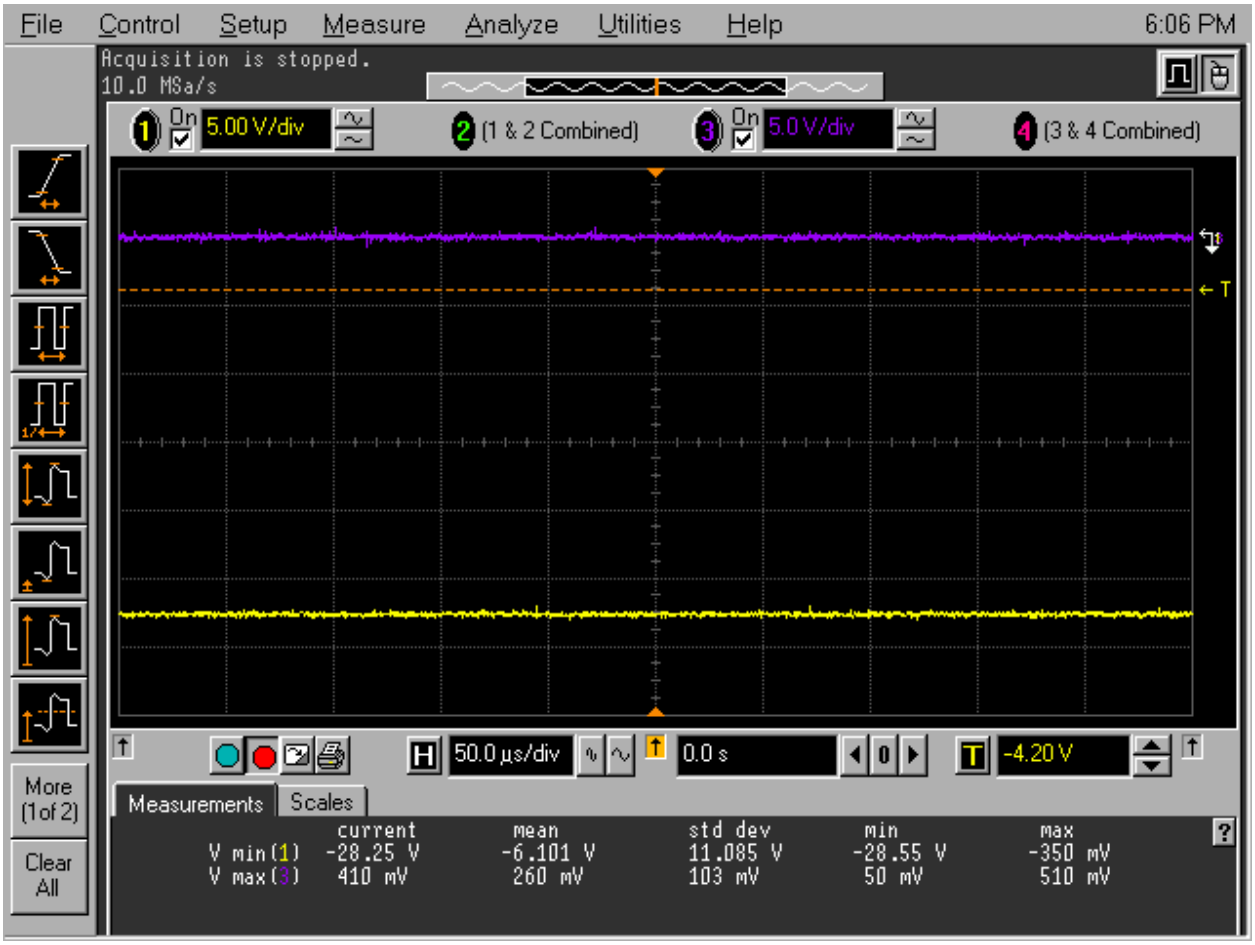
Test Results: The EDUT was **compliant** with the specifications of *MIL-STD-1275D,* Section 4.3.

Test Engineer(s): Joseph Dizon

Test Date(s): 07/29/2014

Test	Result	Notes
Reverse Polarity	Pass	No Anomalies Observed EDUT continued to work after performing the test.

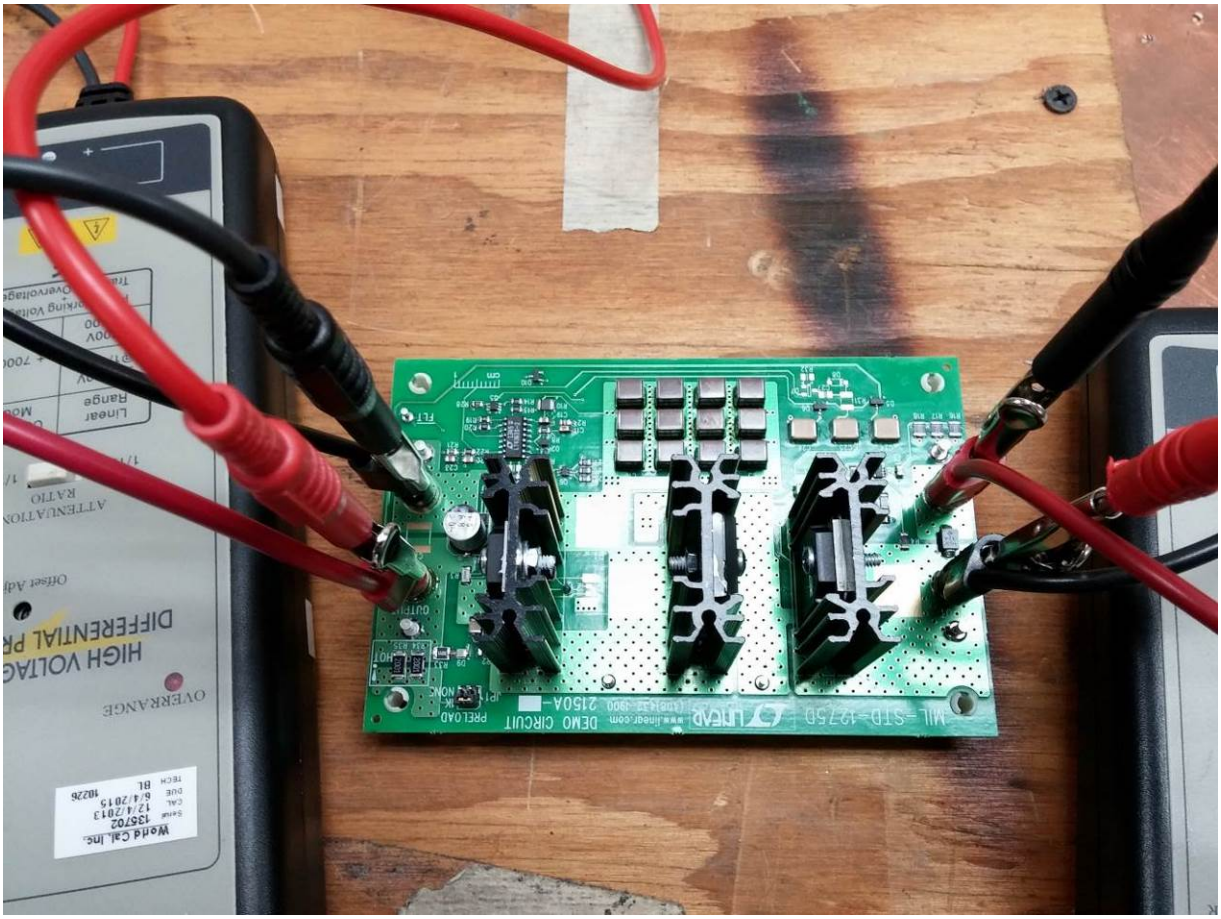
Table 5. 4.3 EDUT Compatibility Test Results



Plot 1. 4.3 EDUT Compatibility Test Results

Trace 1		**: INPUT**
Trace 3		**: OUTPUT**

Test Setup



Photograph 1. 4.3 EDUT Compatibility Test Setup

5.1.2 Starting Mode

Test Requirement(s): **MIL-STD-1275D, Section 5.1.2:**

5.1.2.2: Initial Engagement Surges
During the starting disturbance outlined in 5.1.2.1, the voltage shall not fall below 6 VDC and the duration shall not exceed 1 second.

5.1.2.3: Cranking
The steady voltage during cranking shall not fall below 16 VDC. No more than three cranking attempts of 30 seconds each with 2 minute cranking level pauses between attempts.

Test Procedure: Under-voltage variations from the steady-state nominal voltage source are caused by engine starter engagement and cranking. A typical profile showing "Initial Engagement Surge" (IES) and "Cranking Level" is given in Figure 2. Using a digital Oscilloscope, the 'overall' IES duration was recorded from which the nominal voltage level departed towards 6VDC to the instant at which it reached the cranking level. The cranking duration was no more than 30 seconds in length and had a minimum delay of 2 minutes in between cranking sets. During the initial engagement surge, the voltage was not allowed to fall below 6 VDC and the ramp duration towards cranking did not exceed 1 second. The steady voltage during cranking did not fall below 16 VDC (no more than three cranking attempts of 30 seconds each with 2 minute cranking level pauses between attempts).

Prior to testing, the Initial Engagement Surge and Cranking Surge were verified from a Programmable AC/DC Power Supply on a digital Oscilloscope. Once the waveform was pre-calibrated, the pre-programmed waveforms were simultaneously applied to the DC Power input port of the product, while monitoring the performance of the product.

Per the requirements of MIL-STD-1275, all voltage measurements were performed at the utilization equipment power input terminals.

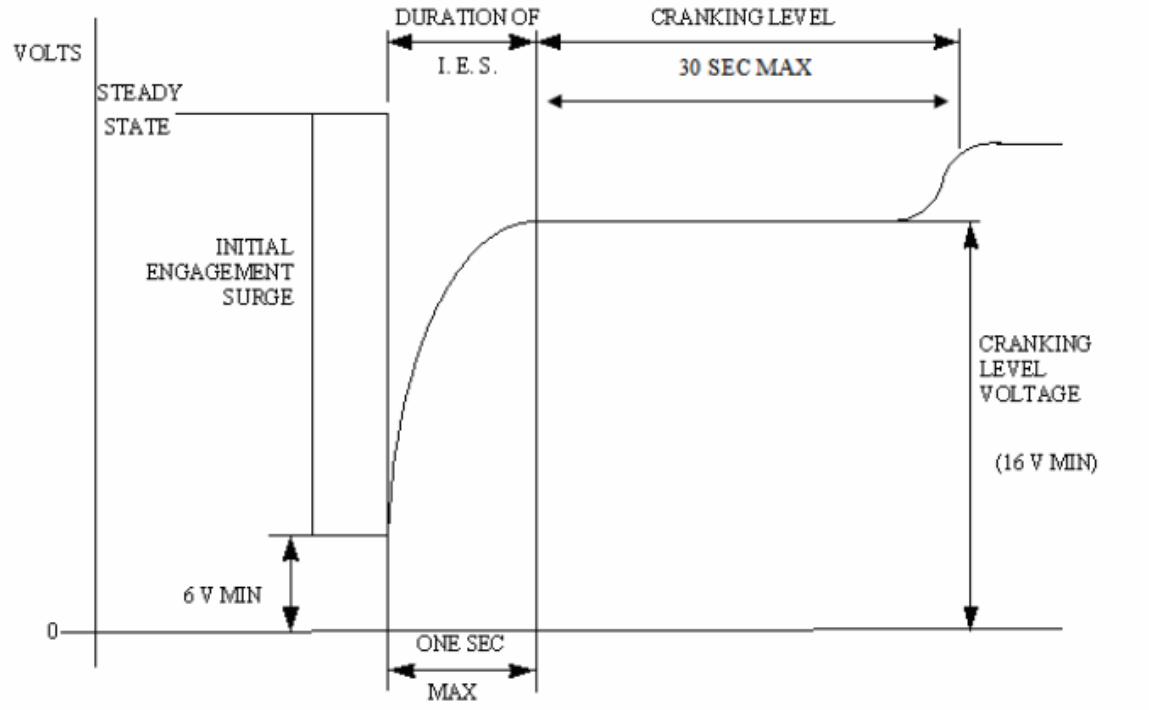


Figure 2. Starting Disturbances

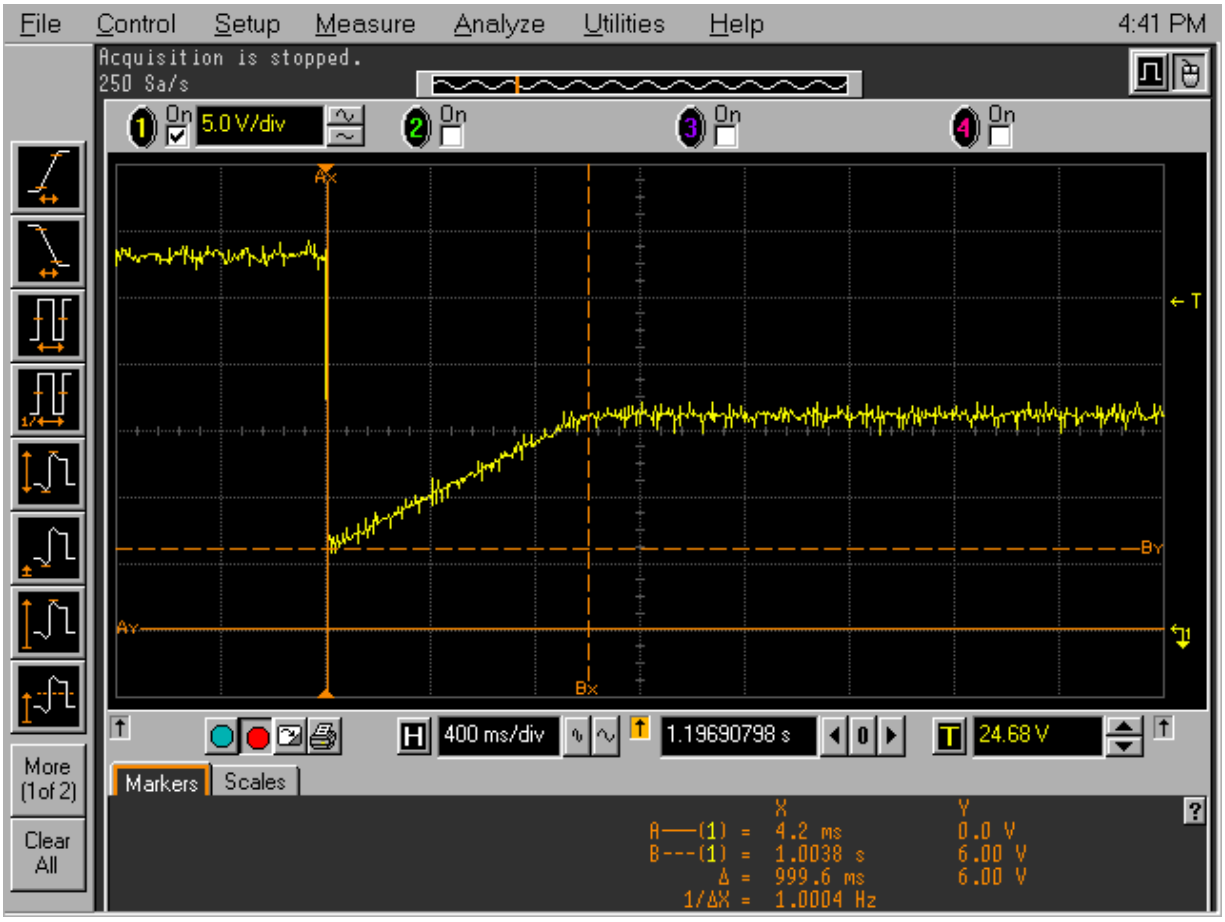
Test Results: The EDUT was **compliant** with the specifications of *MIL-STD-1275D,* Section 5.1.2.

Test Engineer(s): Joseph Dizon

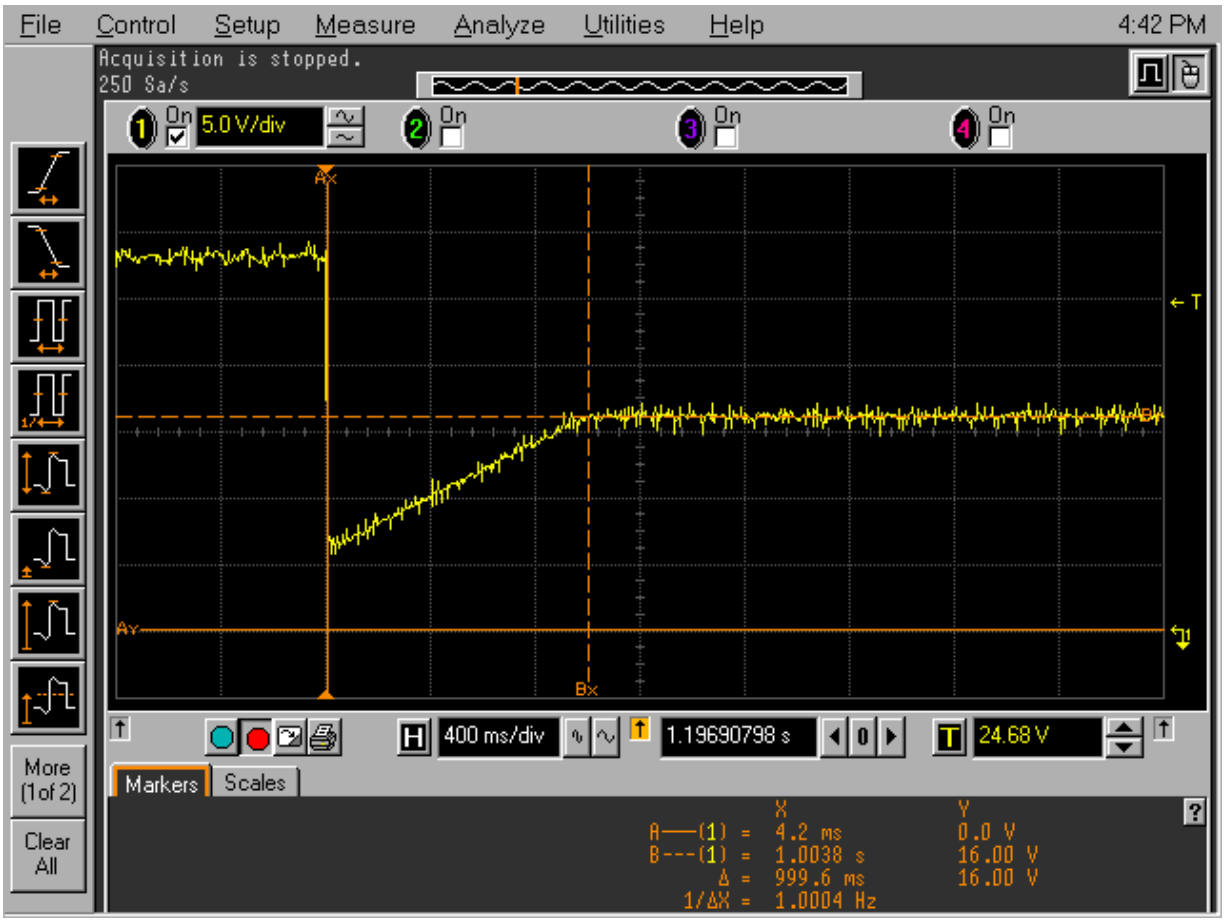
Test Date(s): 07/30/2014

	IES target Voltage	IES Duration	Cranking Level voltage	Cranking Duration	Repetition
Target	6 VDC	1 s max.	16 VDC min.	30s max.	3 max
Actual	6 VDC	999.6 ms	16 VDC	30s	3

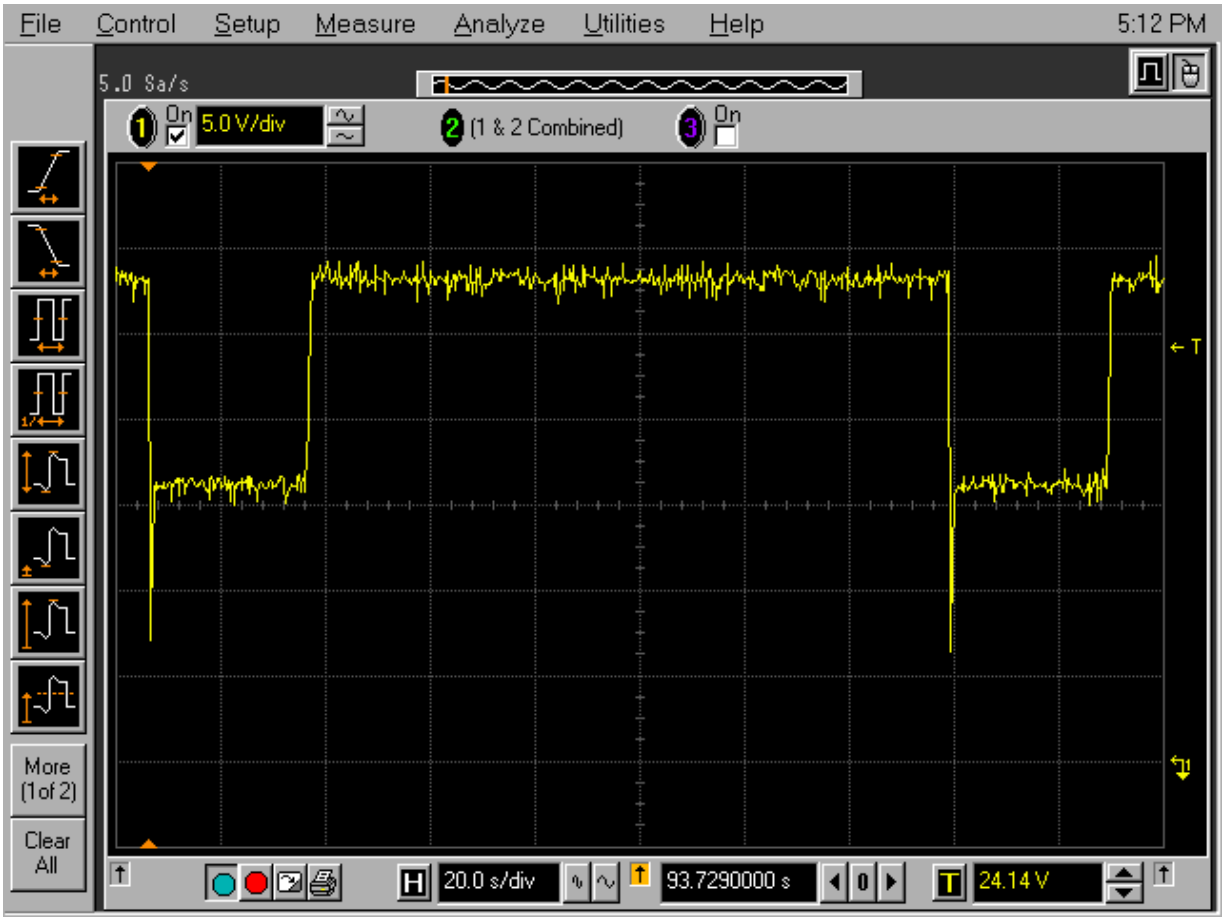
Table 6. 5.1.2 Calibration Result



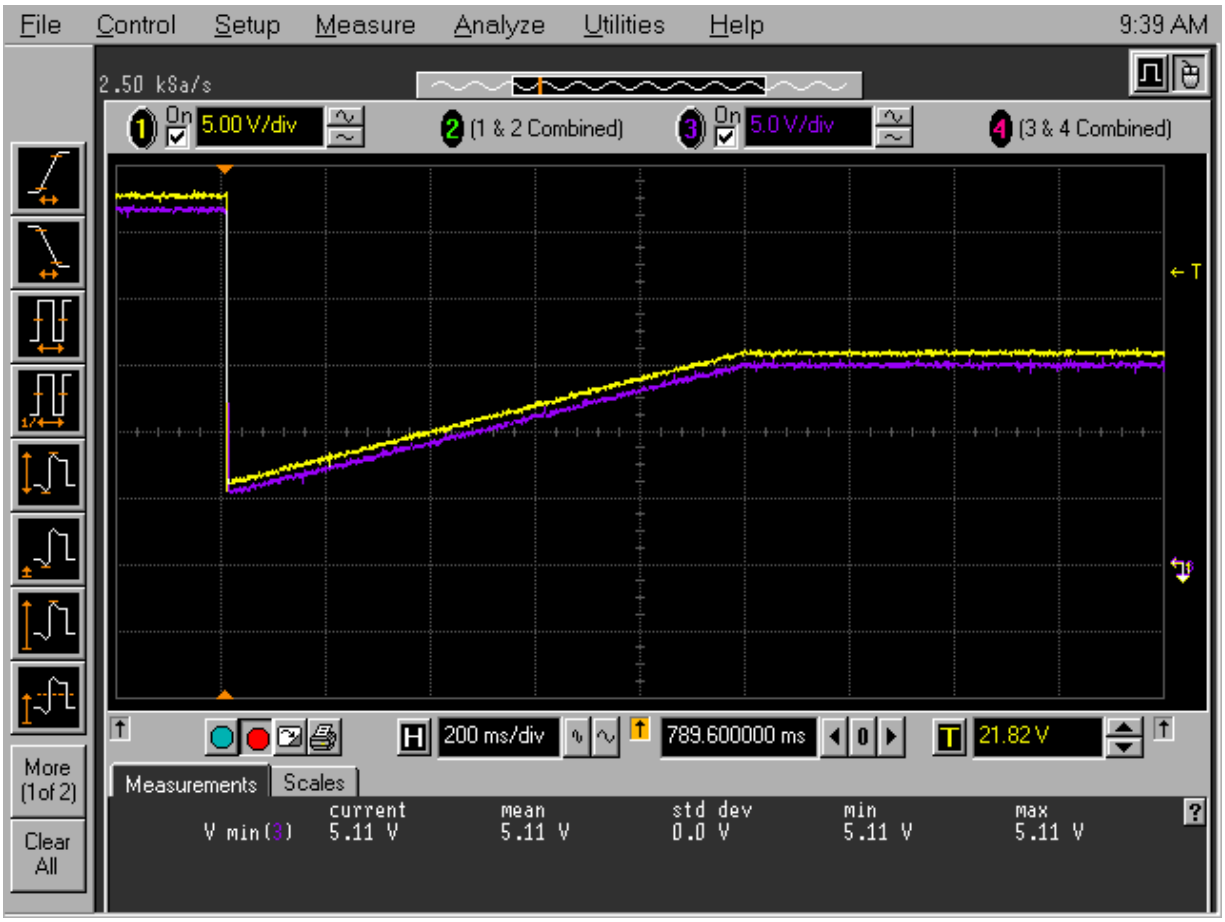
Plot 2. Initial Engagement Surge and Cranking Level, Calibration, IES Voltage and Duration



Plot 3. Initial Engagement Surge and Cranking Level, Calibration, Cranking Voltage Level

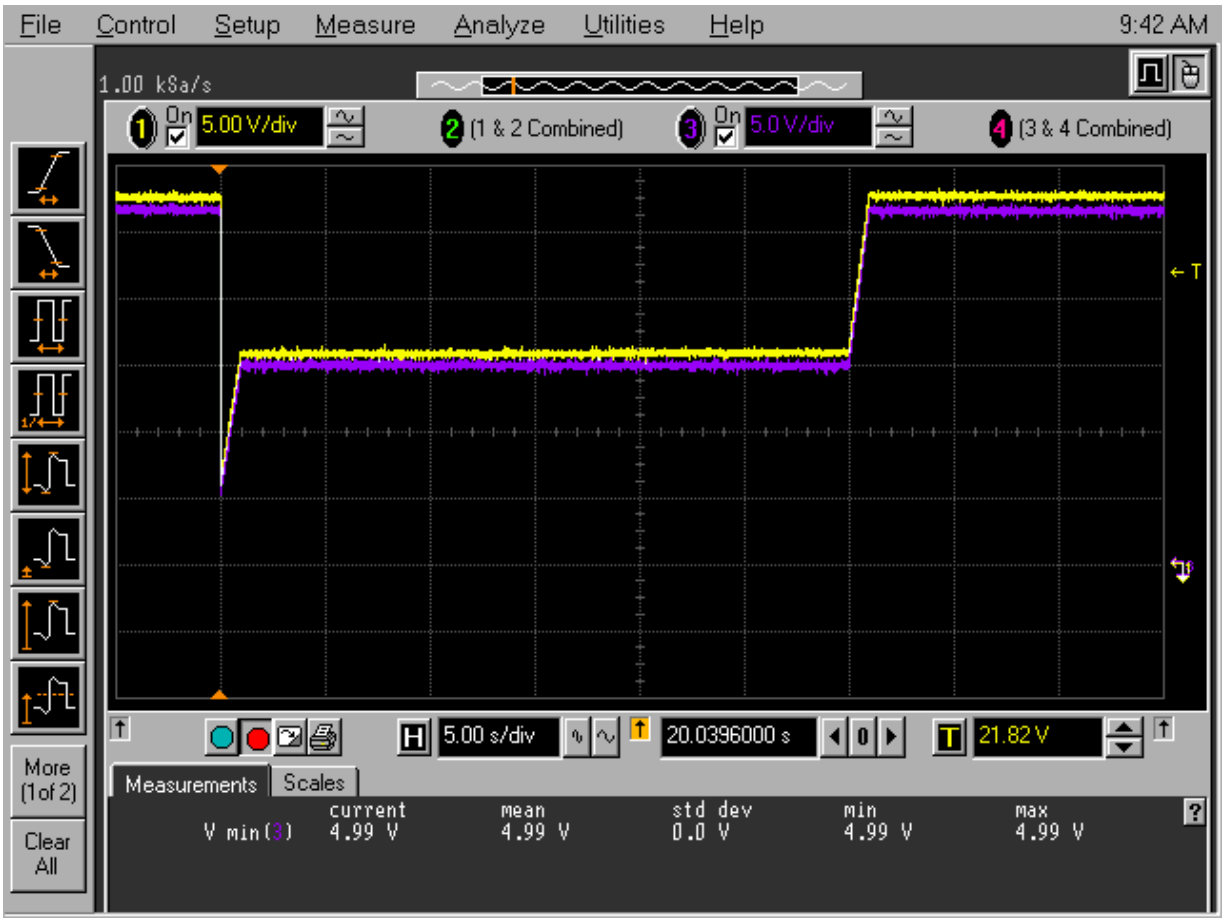


Plot 4. Initial Engagement Surge and Cranking Level, Calibration, IES and Cranking Repetition Rate



Plot 5. Initial Engagement Surge, Test Results

Trace 1		**: INPUT**
Trace 3		**: OUTPUT**



Plot 6. Initial Engagement Surge and Cranking Level, Test Results

Trace 1		**: INPUT**
Trace 3		**: OUTPUT**

Test Setup

Photograph 2. 5.1.2 Starting Mode Test Results Setup

5.3.2 Vehicle Equipment

5.3.2.2: Voltage spikes exported from EDUT

Test Requirement(s): No EDUT exported voltage spike (transient) shall exceed the given envelopes of the normal operating and generator-only modes for the appropriate voltage system when measured with the EDUT "switching". No spike or combination of spikes arising from a single switching event shall have an energy content exceeding 15 milli-joules.

The "Spike" voltage test limit is ±250V for the first 75mS, then decreasing linearly from ±250V to ±100V at 75mS to 1000mS, respectively.

Test Procedure: Using the test circuit shown in Figure 3, the EDUT was operated over its specified range of functions.

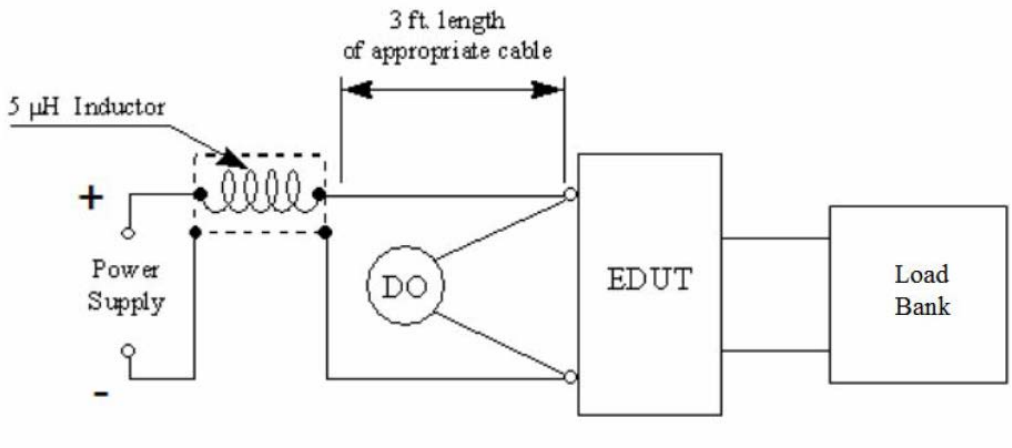


Figure 3. MIL-STD-1275D Exported Spike Test Circuit

Any switching operation capable of producing spikes was repeated a sufficient number of times to give a reasonable probability that the maximum spike voltage was recorded (e.g. 20 operations). In addition, where the power supply to the EDUT is normally provided via an independent vehicle mounted switch, the test was repeated using this switch connected as shown in Figure 4.

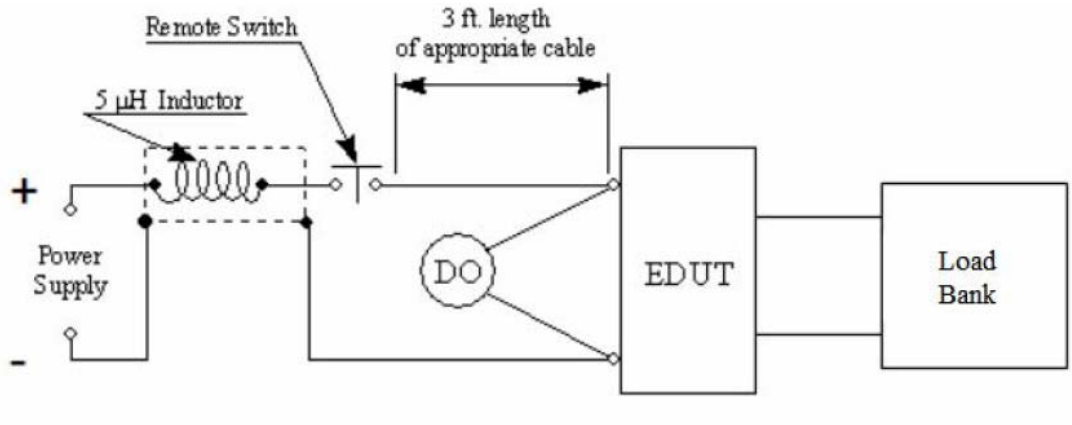


Figure 4. MIL-STD-1275D Exported Spike Test Circuit (EDUT with Remote Switch)

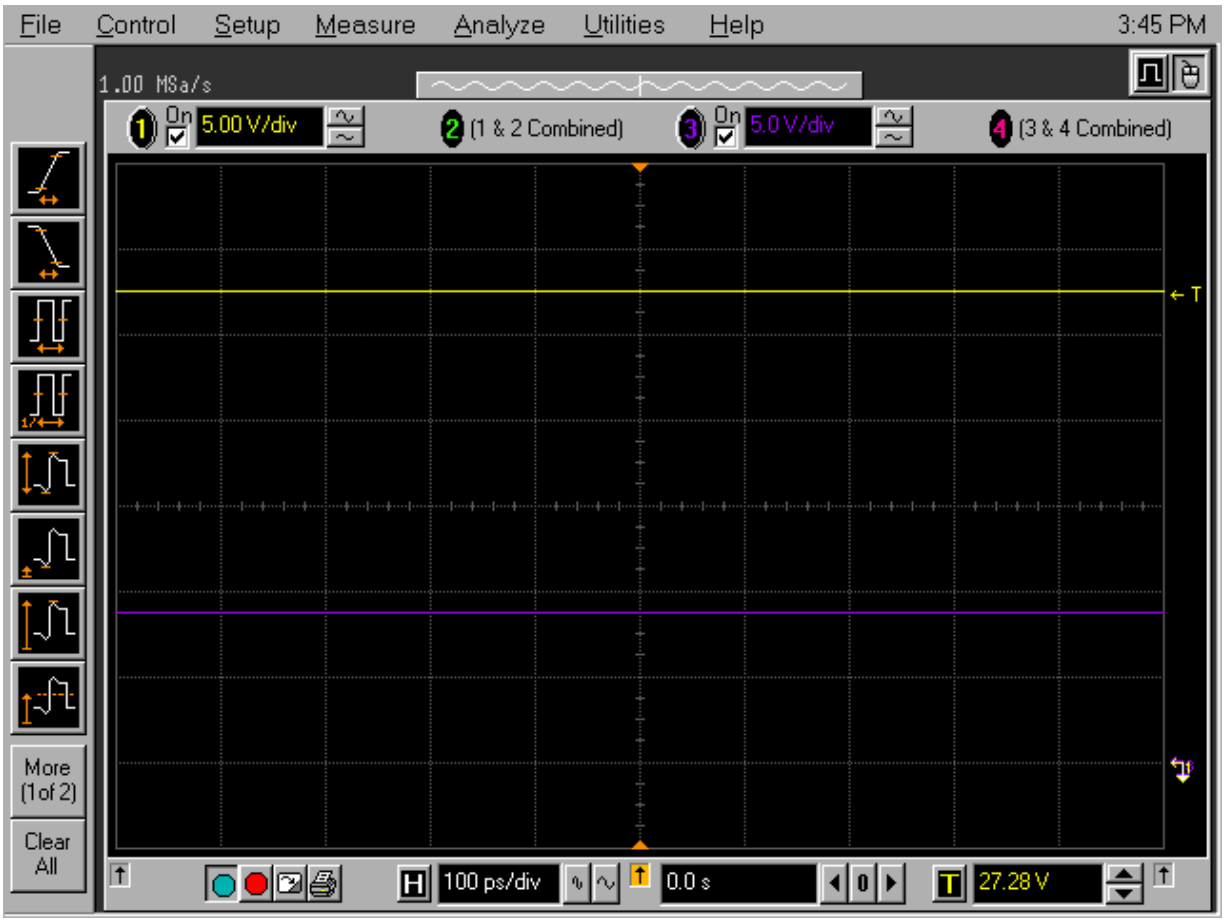
Test Results: The EDUT was **compliant** with the specifications of *MIL-STD-1275D,* Section 5.3.2.2

Test Engineer(s): Joseph Dizon

Test Date(s): 07/30/2014

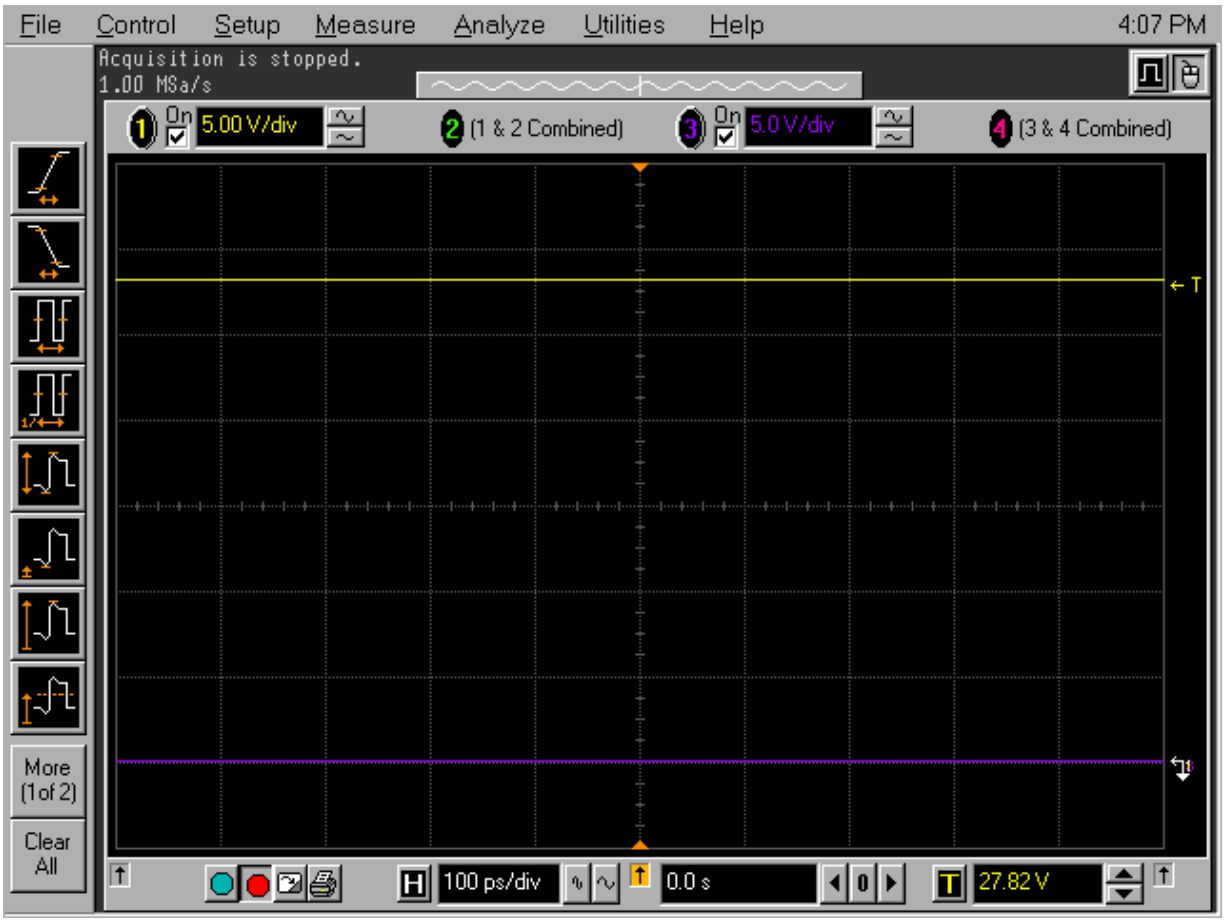
Test	Result	Notes
Exported Spike Test without switch	Pass	No spikes observed
Exported Spike Test with switch	Pass	No spikes observed

Table 7. 5.3.2.2: Voltage spikes exported from EDUT Test Results



Plot 7. 5.3.2.2 Voltage spikes exported from EDUT, Without Switch, Test Results

Trace 1	: INPUT



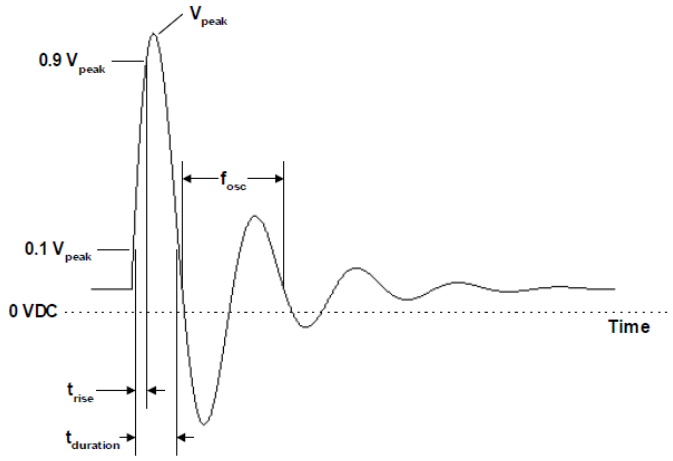
Plot 8. 5.3.2.2 Voltage spikes exported from EDUT, With Switch, Test Results

Trace 1	**: INPUT**

5.3.2.3: Voltage spikes imported into EDUT

Test Requirement(s): The EDUT shall not be damaged by Normal Mode- Imported Spikes as described in MIL-STD-1275D paragraph 5.3.2.3.

A spike is a high frequency oscillatory variation from the controlled steady state level of a characteristic. The spike results from a very high frequency current of complex waveforms produced when reactive loads are switched. An individual damped sinusoidal spike waveform generally has an interval lasting less than 50µS, but may take up to 1mS to decay from the steady state (nominal) level.



The following figure represents a theoretical representation of the Imported Spike waveform.

Test Procedure: An acceptable test circuit is shown in Figure 5.

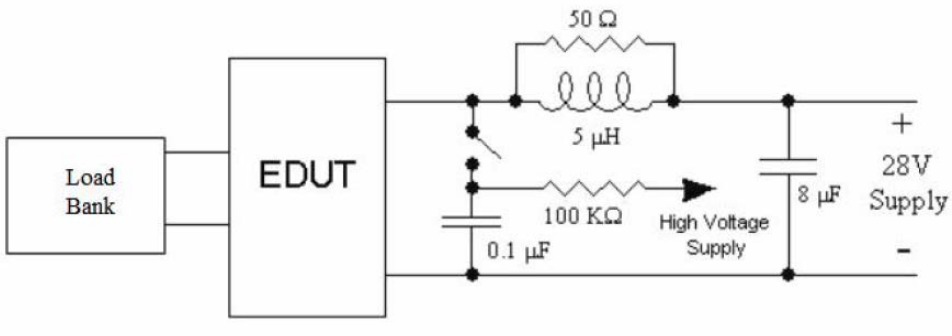


Figure 5. MIL-STD-1275D Imported Spike Test Circuit

Tests were carried out with both polarities of voltage spikes. The number of applications of spikes will depend upon the EDUT. A minimum of fifty 250V spikes, of each polarity, were applied at one (1) second intervals. Each test spike shall have peak amplitude of 250V, a rise-time not exceeding 50 ns, a frequency of oscillation greater than 100 kHz and less than 500 kHz, and a maximum energy content of 15 milli-joules. The voltage spikes so imposed shall not damage the EDUT components, nor affect the normal operation of the EDUT. Any deviation from normal operation, even an intermittent anomaly, such that it eventually returns to normal operation, was recognized as a failure of the EDUT.

Test Results: The EDUT was **compliant** with the specifications of *MIL-STD-1275D,* Section 5.3.2.3

Test Engineer(s): Joseph Dizon

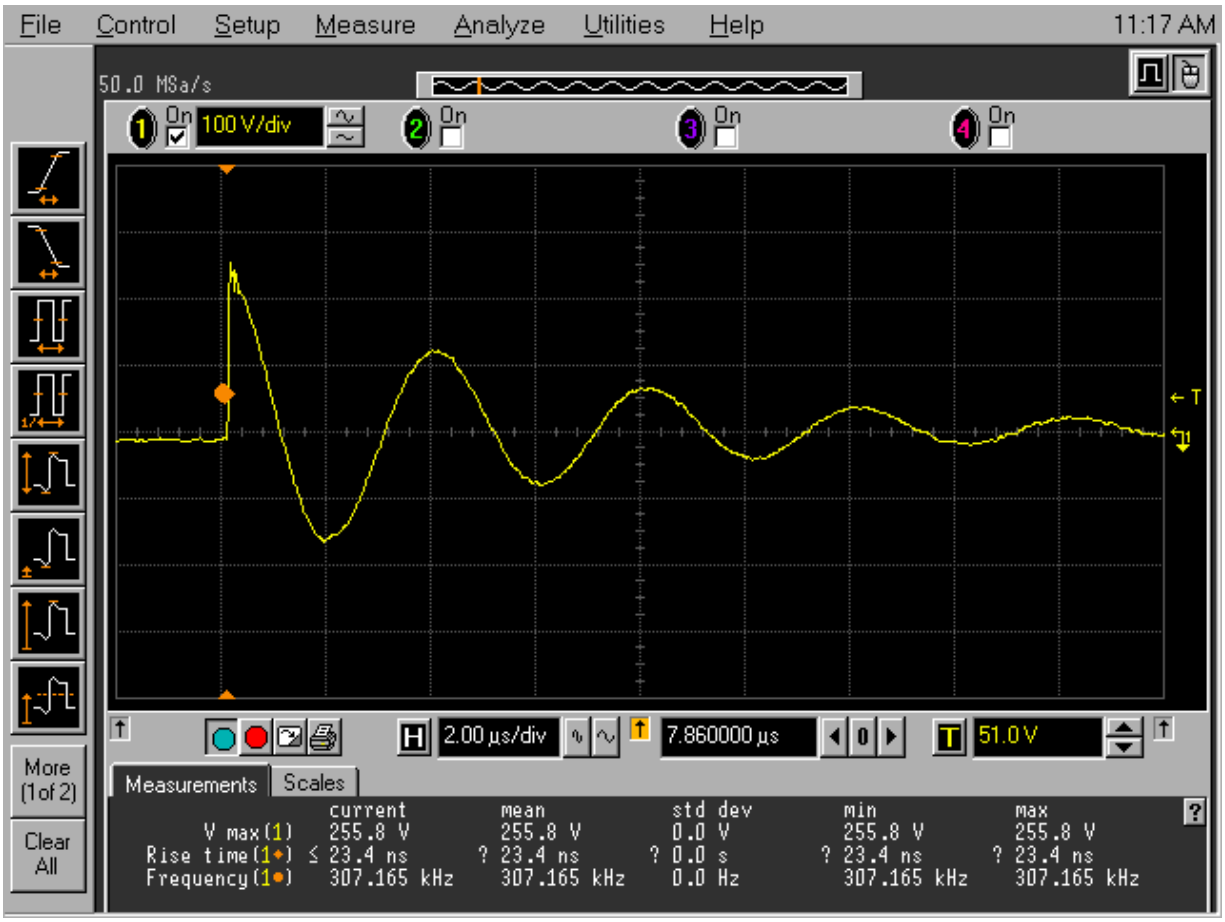
Test Date(s): 07/30/2014

	Peak Amplitude	Rise Time	Frequency of oscillation	Energy content
Target	250 V	<50 ns	100 kHz – 500 kHz	<15 millijoules
+ Spike Calibration	255.8 V	<23.4 ns	307.165 kHz	6.65 millijoules
- Spike Calibration	260.7 V	<16.2 ns	305.156 kHz	6.70 millijoules

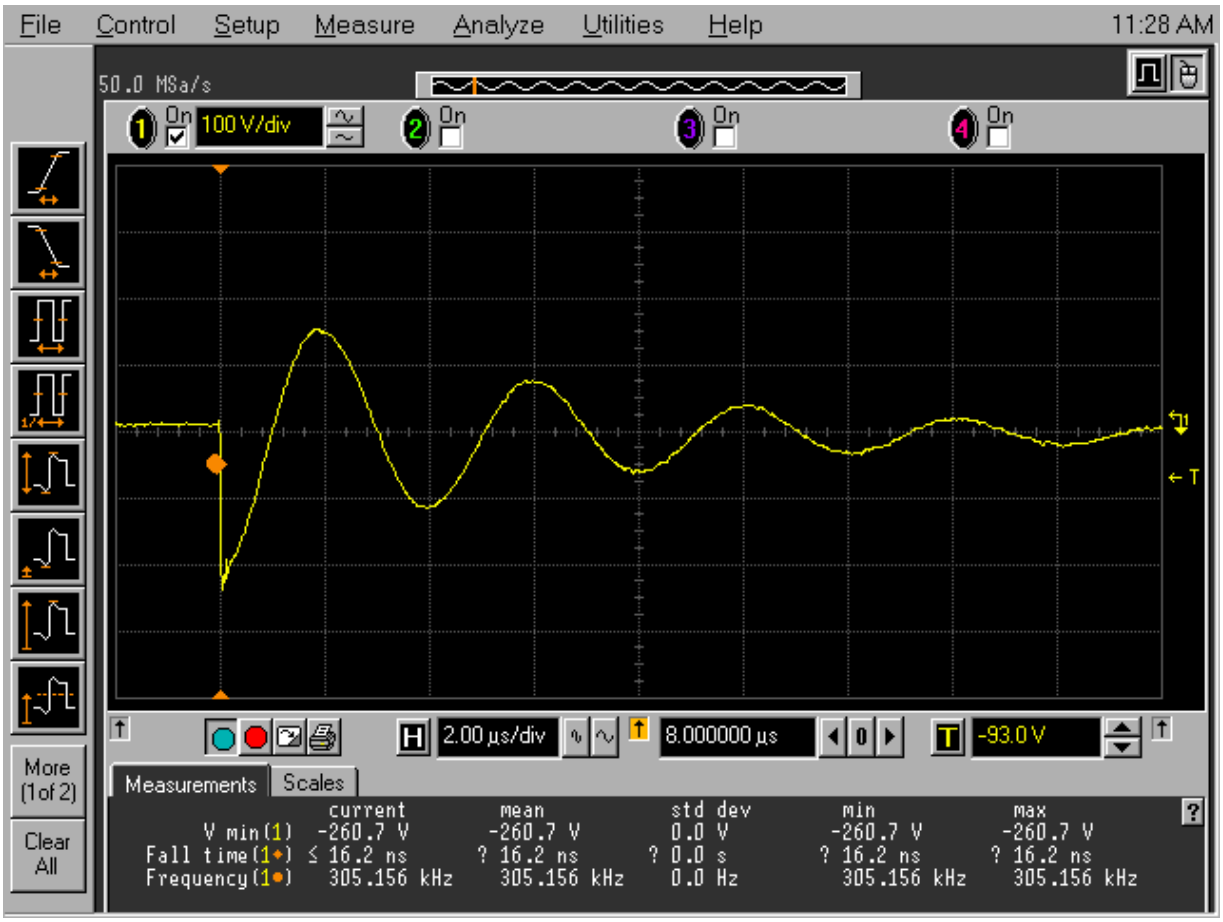
Table 8. Voltage spikes imported into EDUT, Calibration Result

Test	Result	Notes
Positive Spike	Pass	No Anomalies Observed
Negative Spike	Pass	No Anomalies Observed

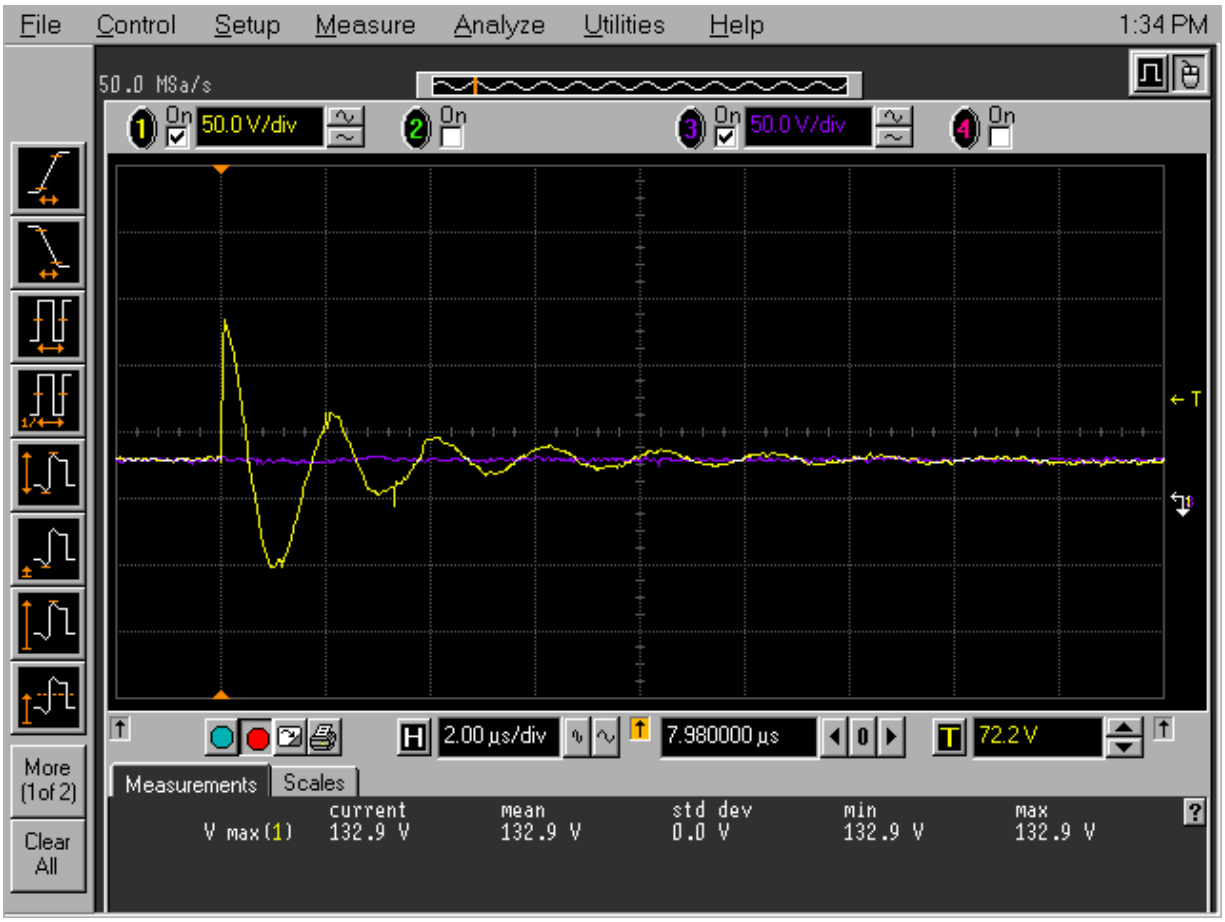
Table 9. Voltage spikes imported into EDUT, Test Result



Plot 9. 5.3.2.2 Voltage spikes imported into EDUT, Positive Spike Calibration

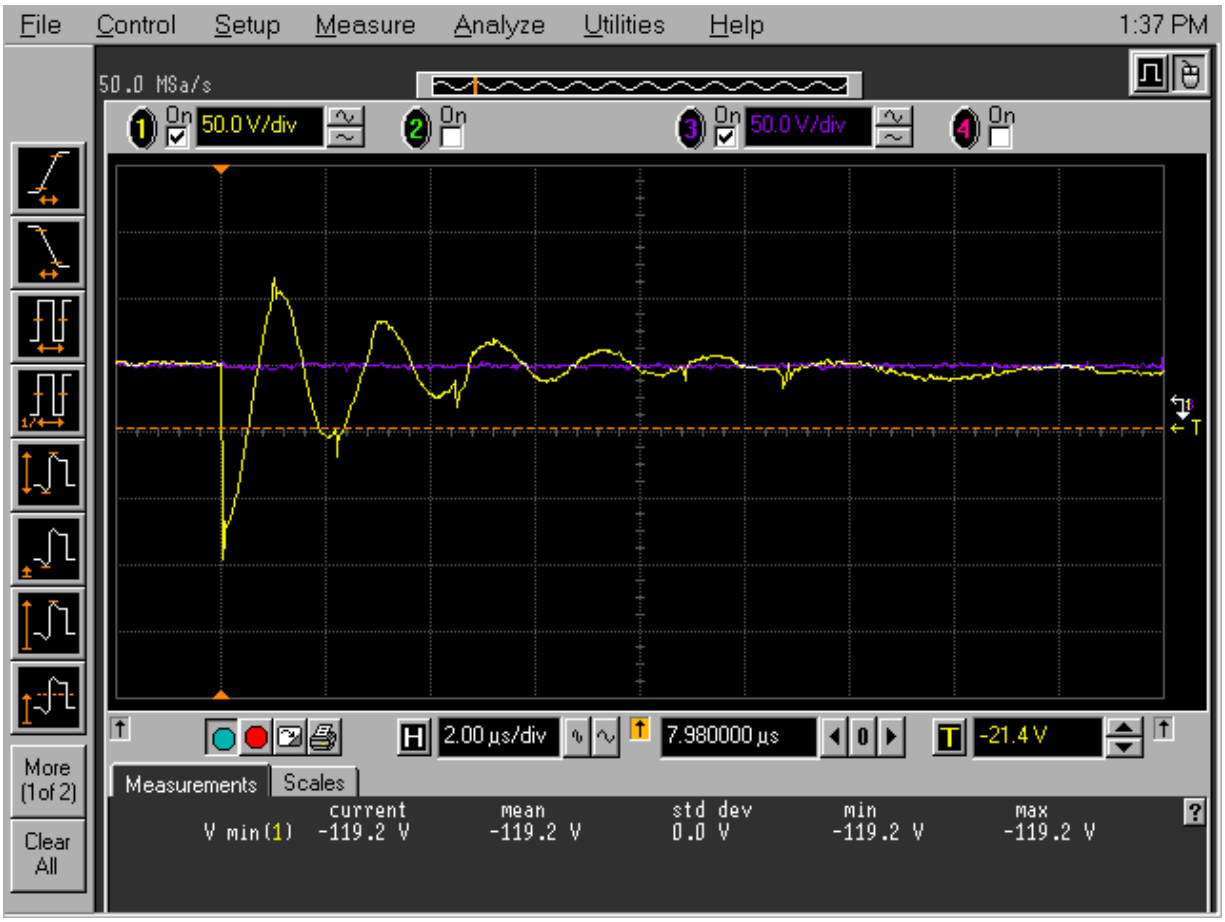


Plot 10. 5.3.2.2Voltage spikes imported into EDUT, Negative Spike Calibration



Plot 11. 5.3.2.2 Voltage spikes imported into EDUT, Positive Test Results

Trace 1		**: INPUT**
Trace 3		**: OUTPUT**



Plot 12. Voltage spikes imported into EDUT, Negative Test Results

Trace 1		: INPUT
Trace 3		: OUTPUT

5.3.2.4: Voltage surges imported into EDUT

Test Requirement(s): The voltage surges imposed shall not damage the EDUT components, nor affect the Normal Mode or Generator Only mode of operation of the EDUT. Any deviation from normal operation, even an intermittent anomaly, such that it eventually returns to normal operation, is recognized as a failure of the EDUT.

A surge is a variation from the controlled steady-state (typically nominal) level of a characteristic, resulting from inherent regulation of the electrical power supply system and remedial action by the regulator, except for battery only operation. Surges may also occur due to the application of loads in a battery only condition. Surges are transient with duration greater than 1mS, and have a recovery time limitation.

Test Procedure(s): For these tests, simulated voltage surge pulses in both the normal operating and generator-only modes were applied to the EDUT while it was operating within steady state conditions. The vehicle electrical system was represented in both the normal operating and generator-only modes. An acceptable circuit is shown in Figure 6.

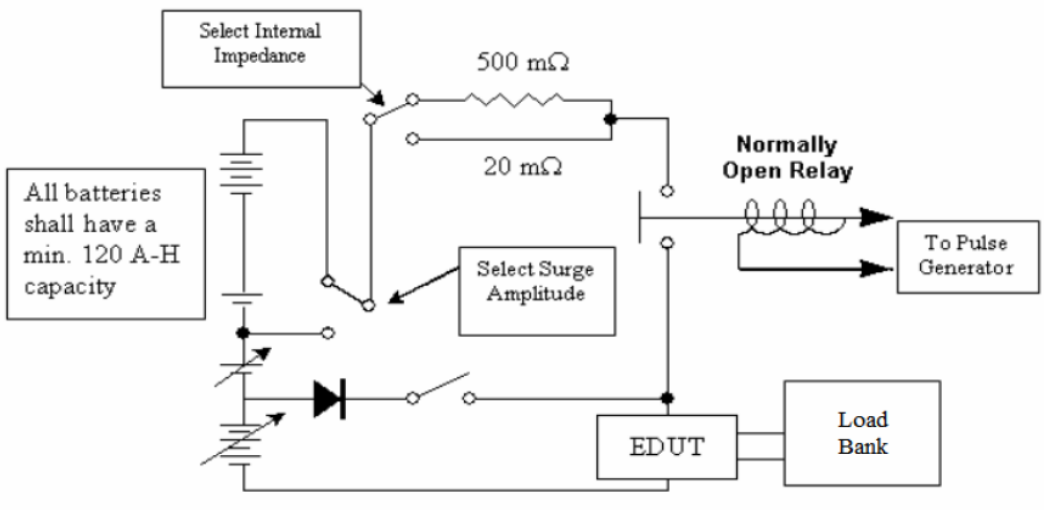


Figure 6. MIL-STD-1275D Imported Surge Test Circuit for 28 VDC Systems

When simulating voltage surges in the Normal Mode, pulses of +40V total amplitude with 50mS duration, from a source impedance of 20mΩ (i.e. representative of vehicle wire), were applied. The nominal supply voltage was maintained both before and after each pulse. The pulses were applied 5 times, with a 1 second delay between pulses.

After simulating voltage surges in the normal operating mode, pulses of +100V total amplitude with 50mS duration, from a source impedance of 500mΩ (i.e. 50W or higher rated power resistor) were applied to simulate voltage surges in the Generator Only mode. The nominal supply voltage was maintained both before and after each surge. The pulses were applied 5 times, with a 1 second delay between pulses.

The voltage surges specified in 5.3.2.4b and 5.3.2.4c had the amplitude established before connection of the EDUT. The power source was maintained constant during the surge. The rise and fall times of the surge were approximately 1mS. A minimum total of five +40V surges, and five +100V surges, were applied to the EDUT sample.

Test Results: The EDUT was **compliant** with the specifications of *MIL-STD-1275D,* Section 5.3.2.4

Test Engineer(s): Joseph Dizon

Test Date(s): 07/30/2014

	Surge Voltage	Pulse Duration	Delay per pulse	# of Pulses
Target	40 VDC	50 ms	1 s	5
Calibrated	41.88 VDC	49.861 ms	1 s	5

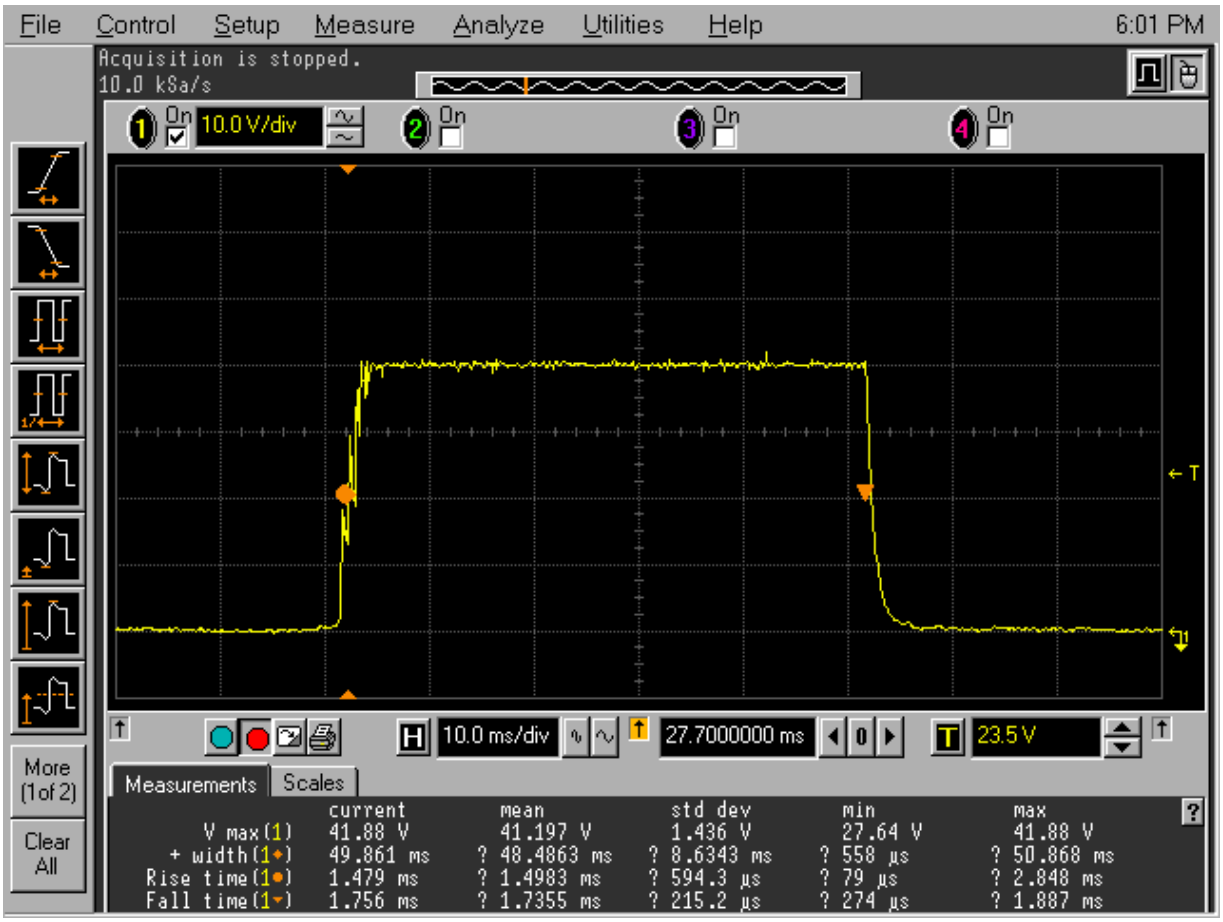
Table 10. Voltage surges imported into EDUT, 40VDC surge calibration on 20mΩ source impedance

	Surge Voltage	Pulse Duration	Delay per pulse	# of Pulses
Target	100 VDC	50 ms	1 s	5
Calibrated	100.9 VDC	49.955 ms	999.9 ms	5

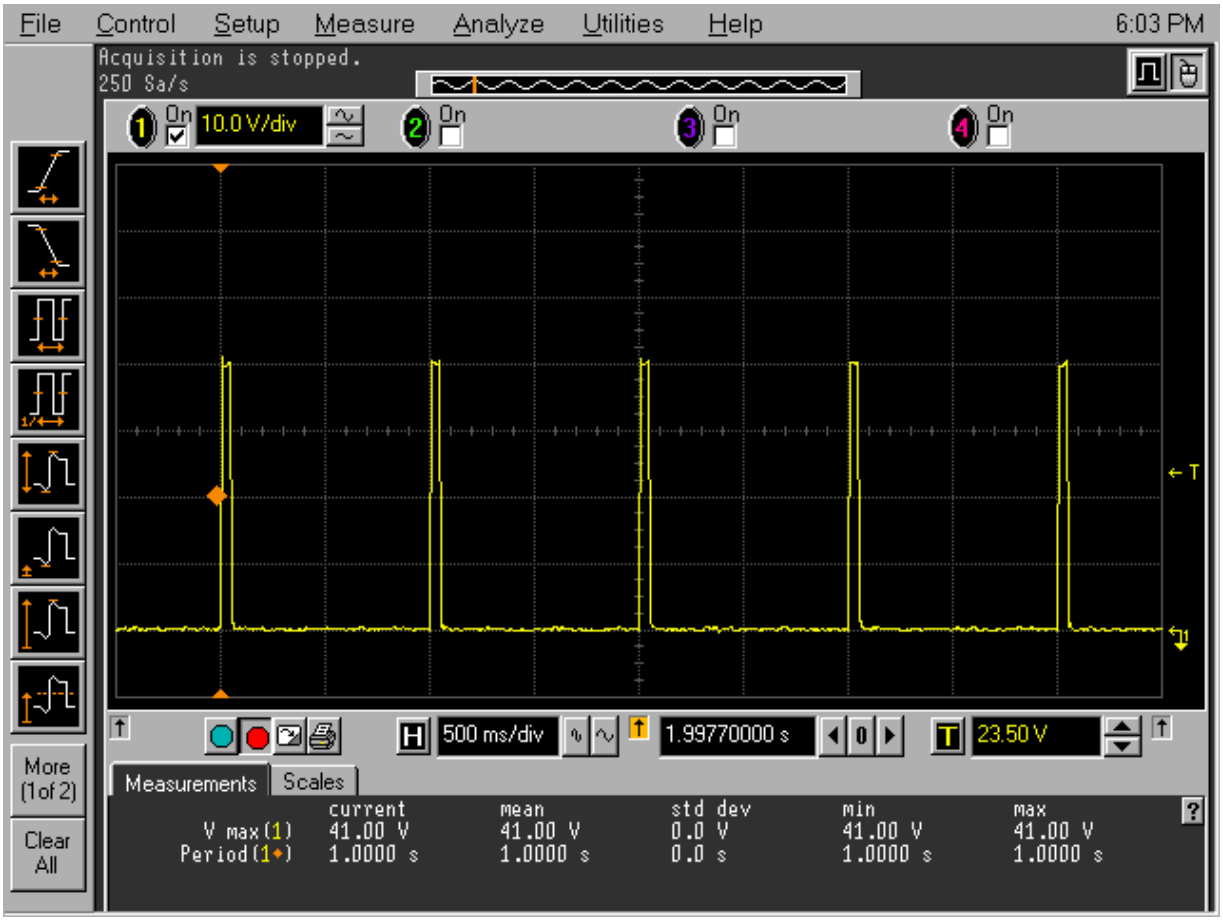
Table 11. Voltage surges imported into EDUT, 100VDC surge calibration on 500mΩ source impedance

	Result	Notes
40 VDC Surge	Pass	No anomalies observed
100 VDC Surge	Pass	No anomalies observed

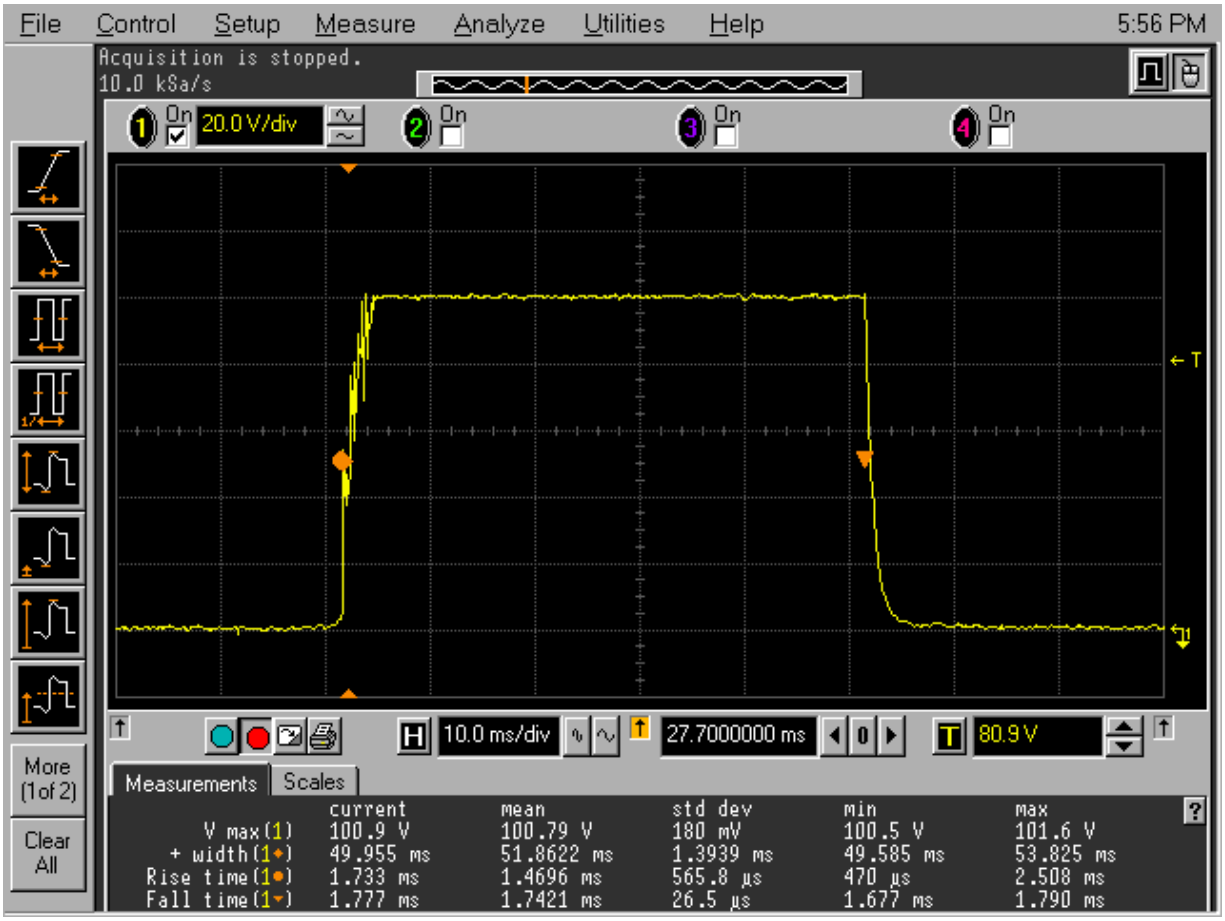
Table 12. Voltage surges imported into EDUT, Test Result



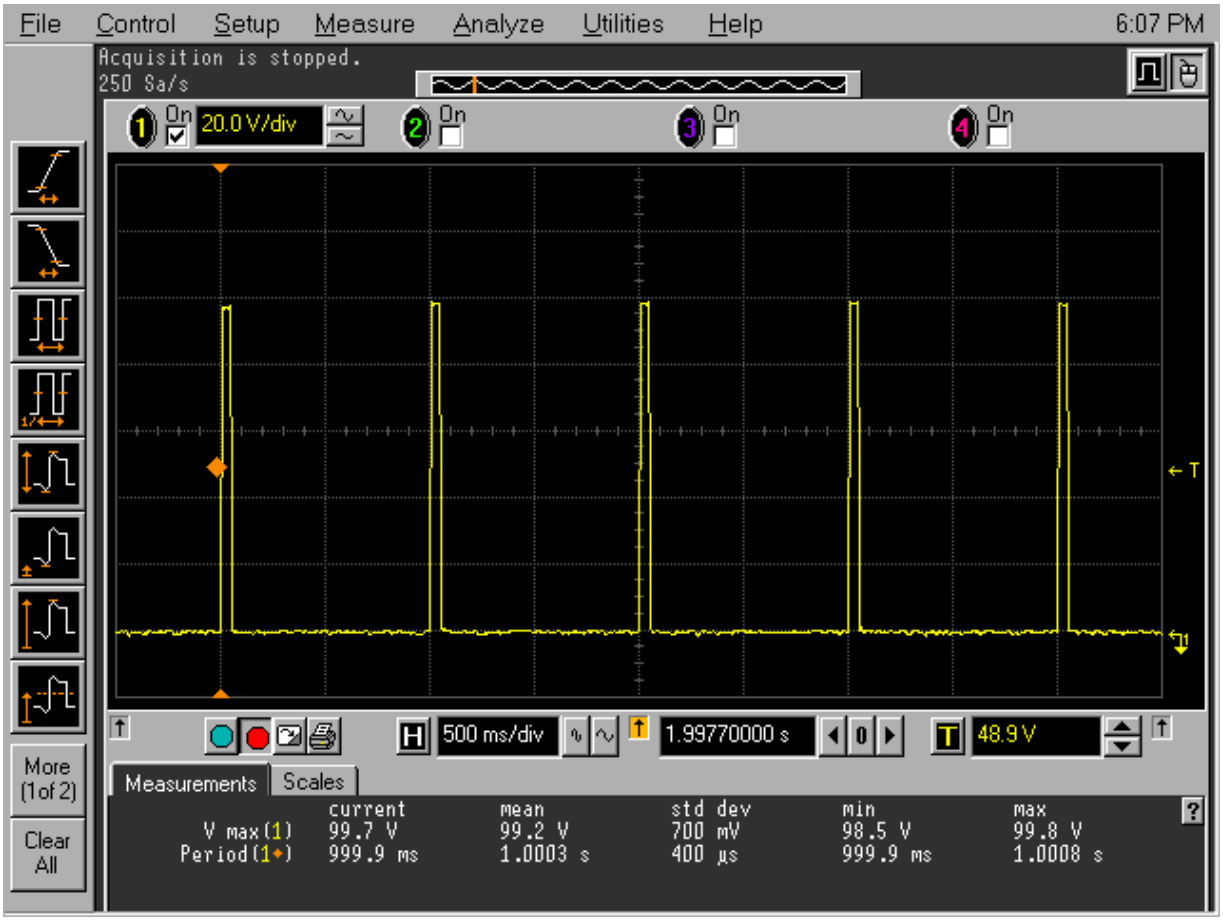
Plot 13. 5.3.2.4 Voltage surges imported into EDUT, 40 VDC surge with 20 mΩ source impedance, Surge voltage and Pulse duration Calibration



Plot 14. 5.3.2.4 Voltage surges imported into EDUT, 40 VDC surge with 20 mΩ source impedance, Pulse period Calibration



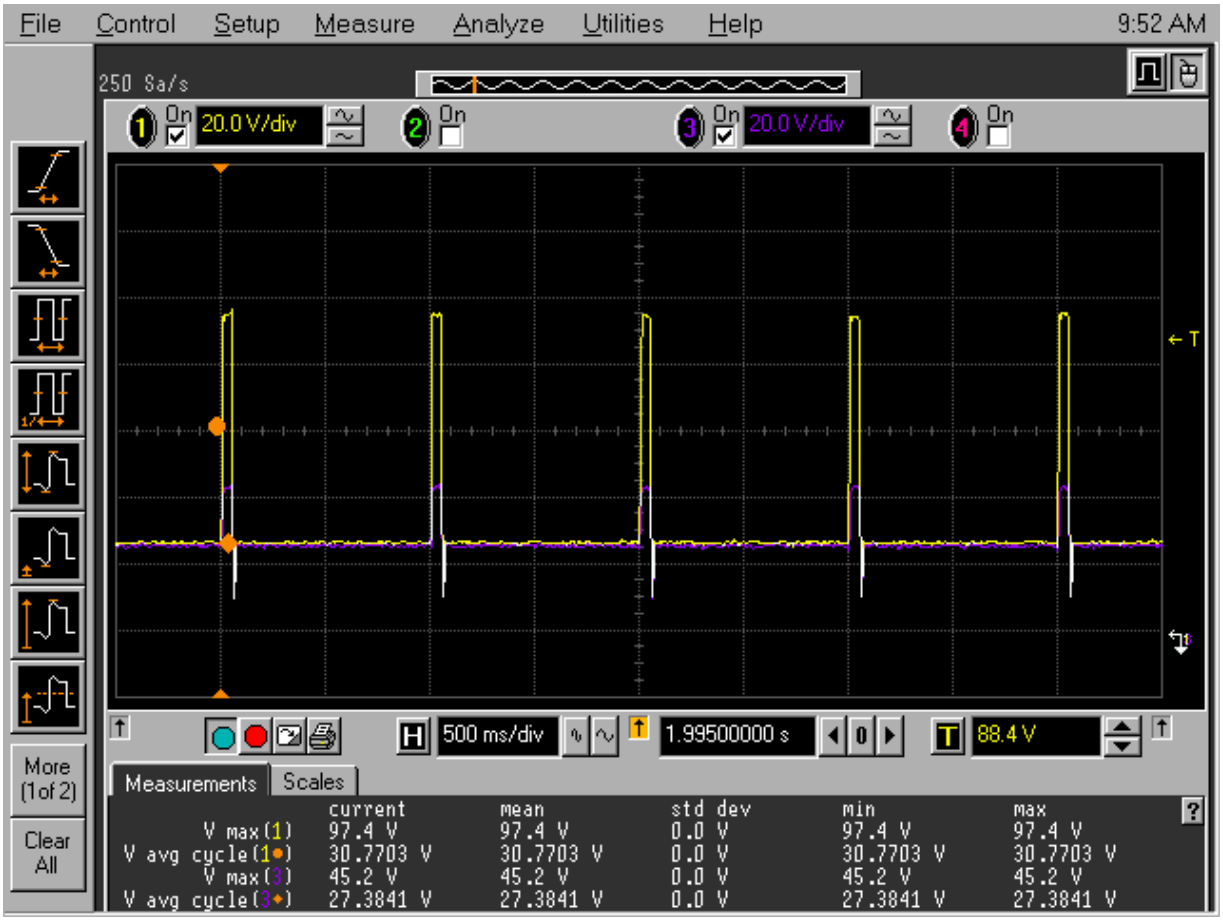
Plot 15. 5.3.2.4 Voltage surges imported into EDUT, 100 VDC surge with 500 mΩ source impedance, Surge voltage and Pulse duration Calibration



Plot 16. 5.3.2.4 Voltage surges imported into EDUT, 100 VDC surge with 500 mΩ source impedance, Pulse period Calibration

Plot 17. 5.3.2.4 Voltage surges imported into EDUT, 40 VDC Surge Test Results

Trace 1		**: INPUT**
Trace 3		**: OUTPUT**



Plot 18. 5.3.2.4 Voltage surges imported into EDUT, 100 VDC Surge Test Results

Trace 1		**: INPUT**
Trace 3		**: OUTPUT**

5.3.2.4: Ripple voltage imported into EDUT

Test Requirement(s): The ripple voltage imposed shall not damage the EDUT components nor affect the normal operation of the EDUT. Any deviation from normal operation, even an intermittent anomaly, such that it eventually returns to normal operation, is recognized as a failure of the EDUT.

The regular and/or irregular variations of voltage about a fixed DC voltage level during steady state operation of a DC system. The upper and lower ripple limits are called "Upper Peak of the Ripple Voltage" and "Lower Peak of the Ripple Voltage", respectively.

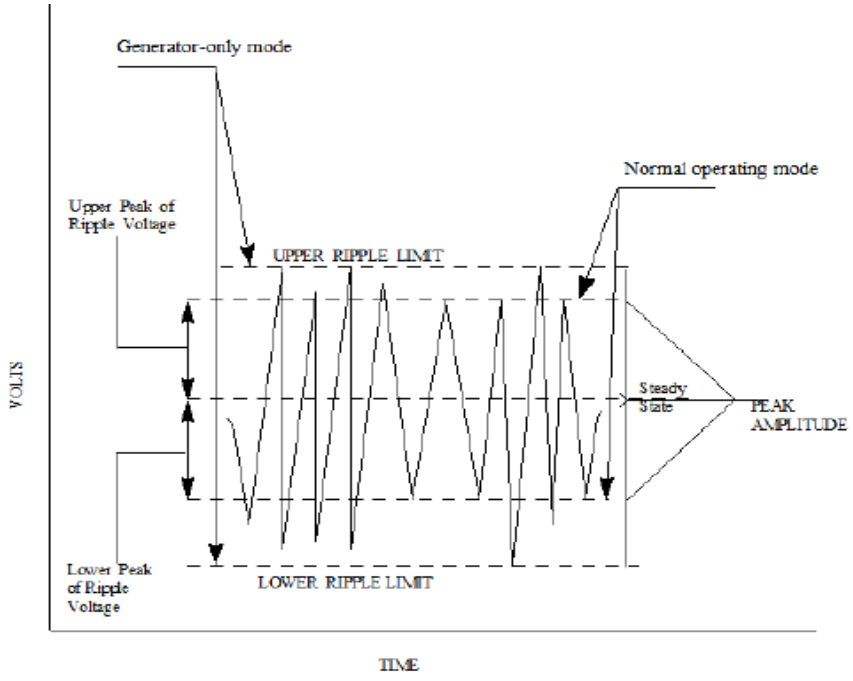


Figure 7. 5.3.2.4: Ripple voltage imported into EDUT

Test Procedures: A Digital Phosphorus Oscilloscope was used to monitor the ripple onto the EDUT power terminals. Using the test methods from SAE J1113-2, simulated ripple voltage of a sinusoidal waveform was applied to the EDUT power lead(s), while it was operating over its specified range of functions, in order to demonstrate indefinite immunity to ripple voltage over the frequency range of 50 Hz to 200 kHz. The upper and lower peaks of ripple voltage were 7V from the generator-only steady state voltage limits; thus, by default, the lower Normal Mode test limits were covered. The EDUT was tested for a minimum of 1 minute at each ripple voltage frequency: 50Hz, 12 kHz, 48 kHz, and 200 kHz.

The source impedance of the transformer was verified as described in Appendix A of SAE J1113-2.

Source Impedance: Z = 0.429 ohm
V_{OC} = 13V
V_{CC} = 7V
R_L = 0.5ohm

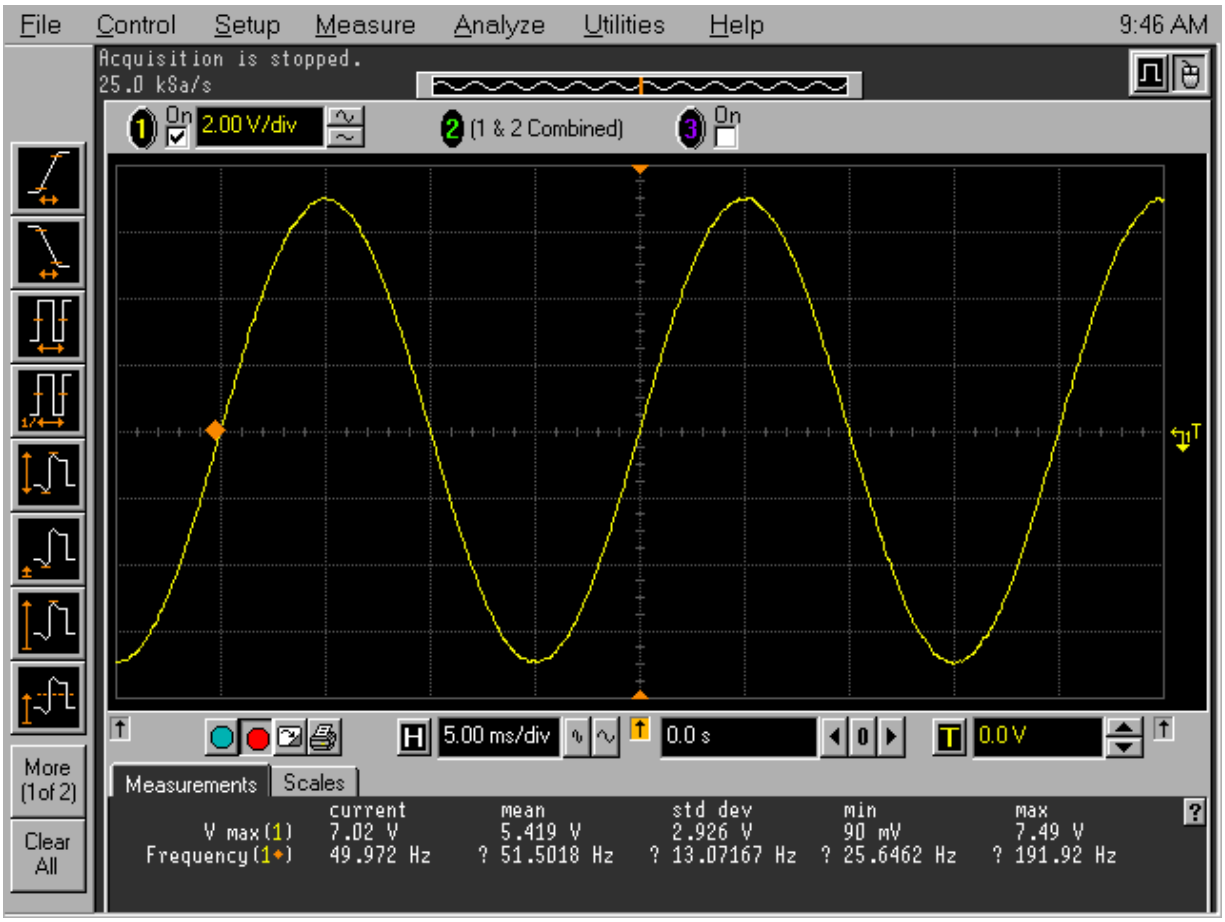
Test Results: The EDUT was **compliant** with the specifications of *MIL-STD-1275D,* Section 5.3.2.4

Test Engineer(s): Joseph Dizon

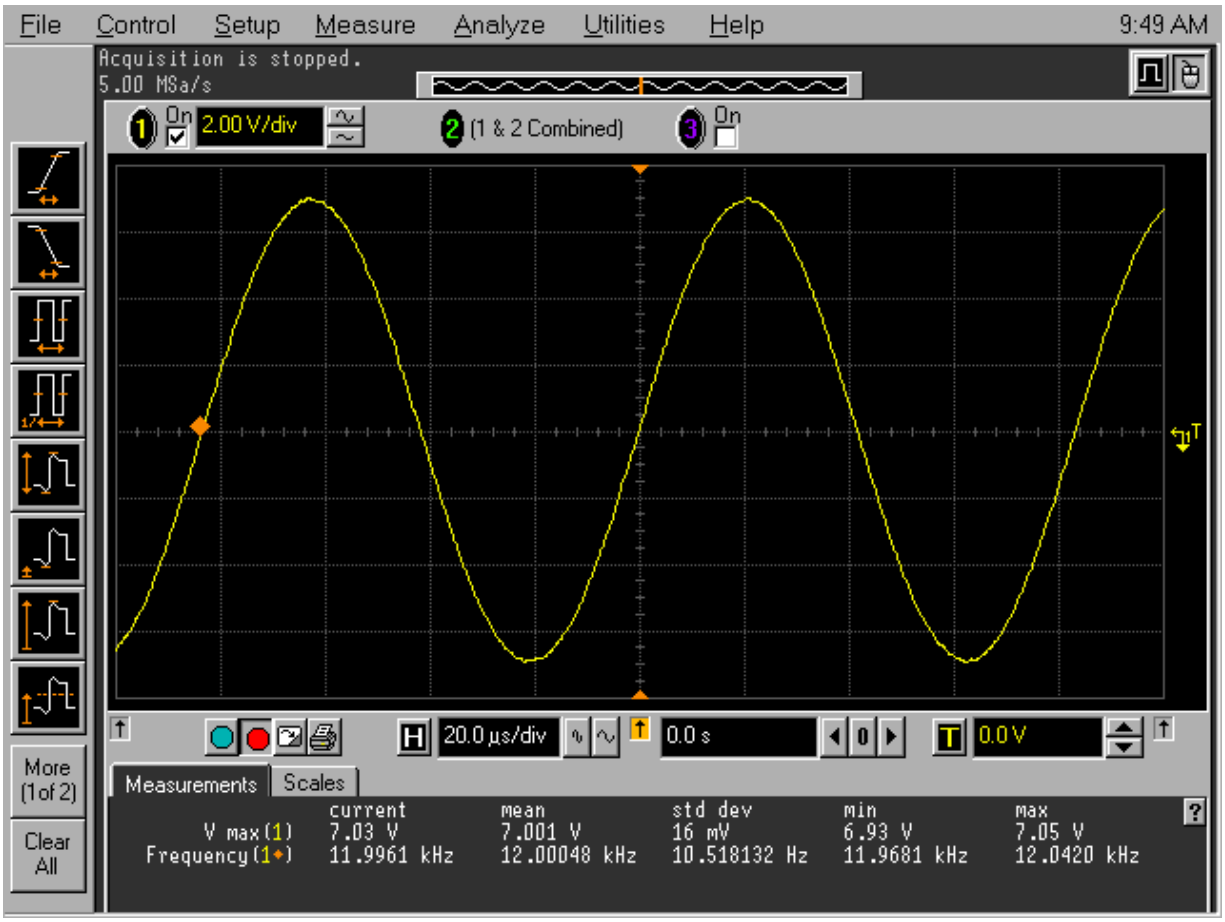
Test Date(s): 07/30/2014

Frequency	Test Level	Dwell Time	Notes
50 Hz	14 Vpp	1 minute	No Anomalies Observed
12 kHz	14 Vpp	1 minute	No Anomalies Observed
48 kHz	14 Vpp	1 minute	No Anomalies Observed
200 kHz	14 Vpp	1 minute	No Anomalies Observed

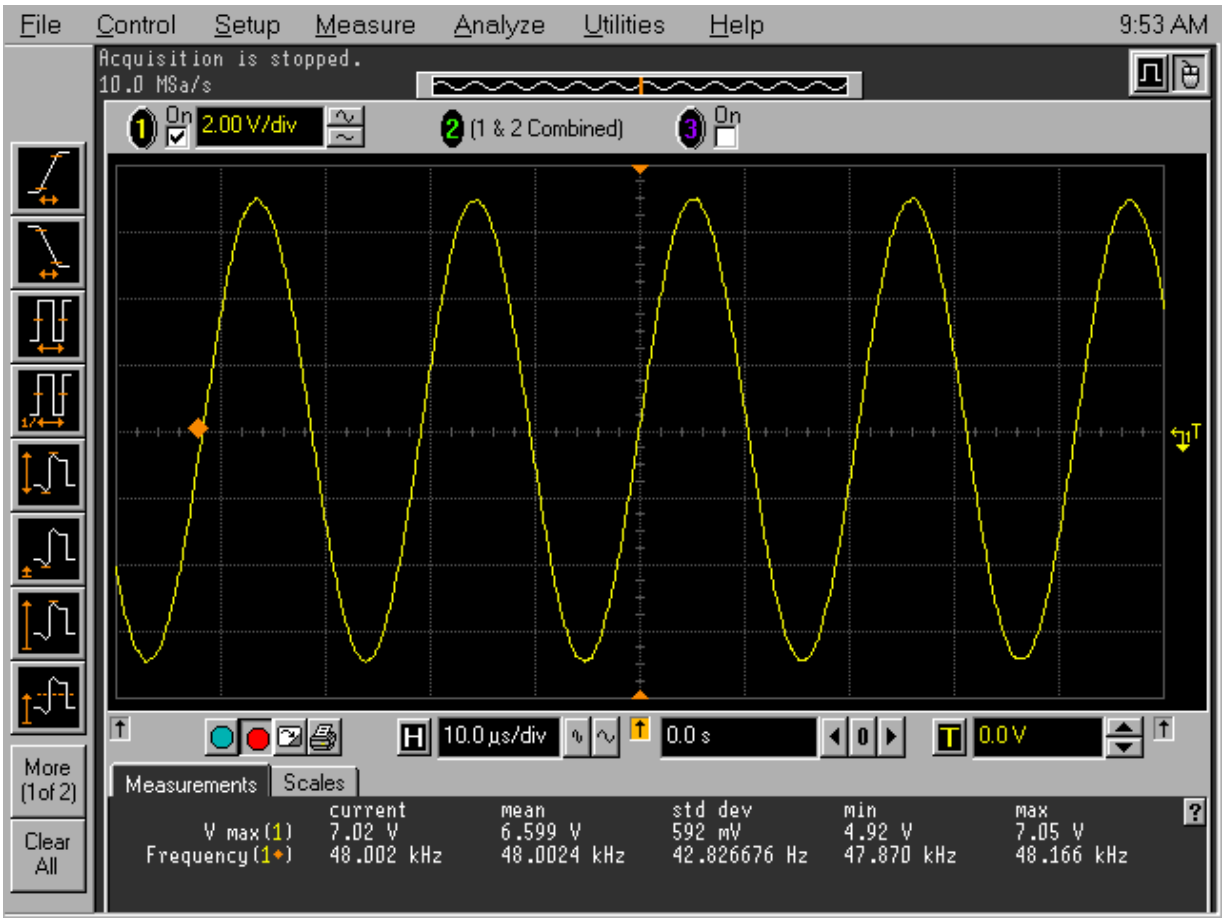
Table 13. Ripple voltage imported into EDUT Test Results



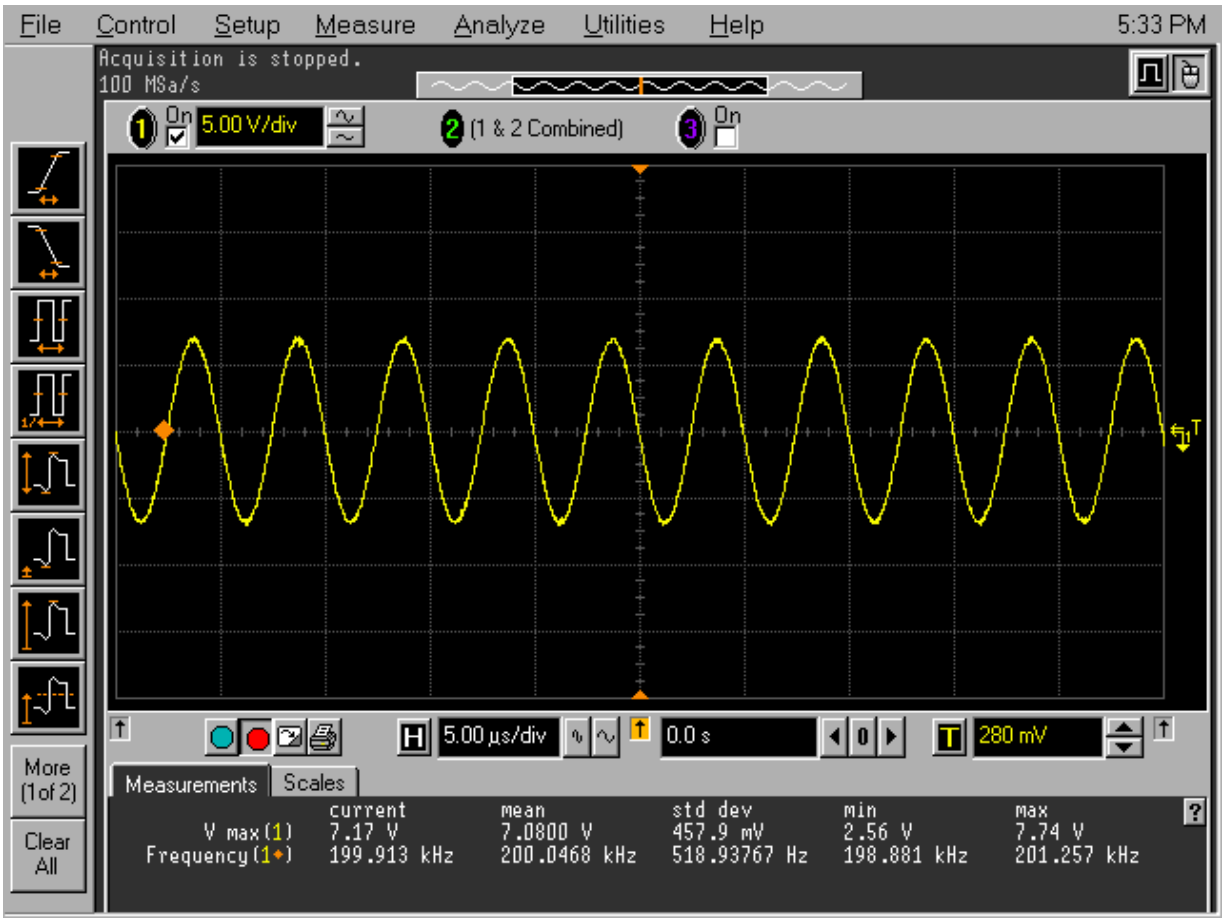
Plot 19. 5.3.2.4 Ripple voltage imported into EDUT, 50 Hz Calibration



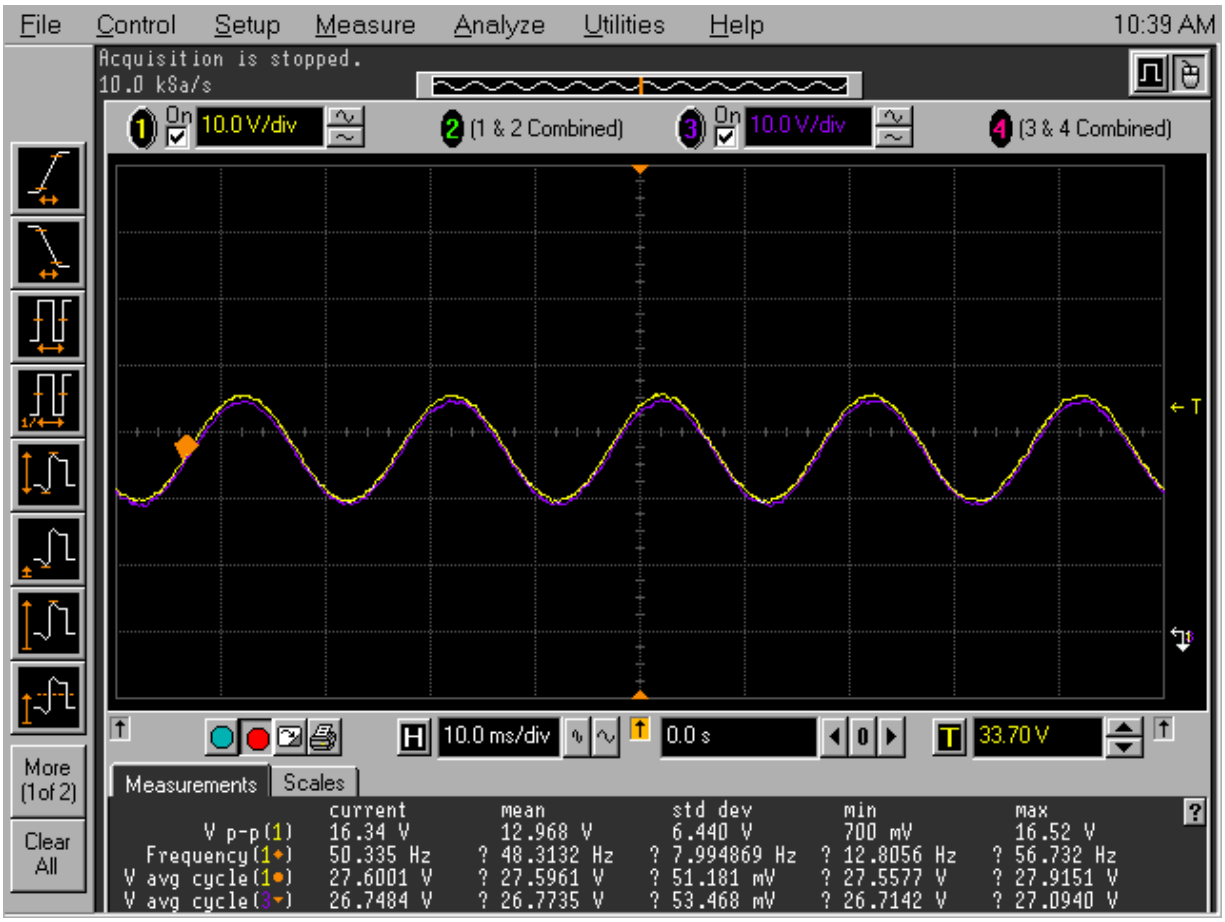
Plot 20. 5.3.2.4 Ripple voltage imported into EDUT, 12 kHz Calibration



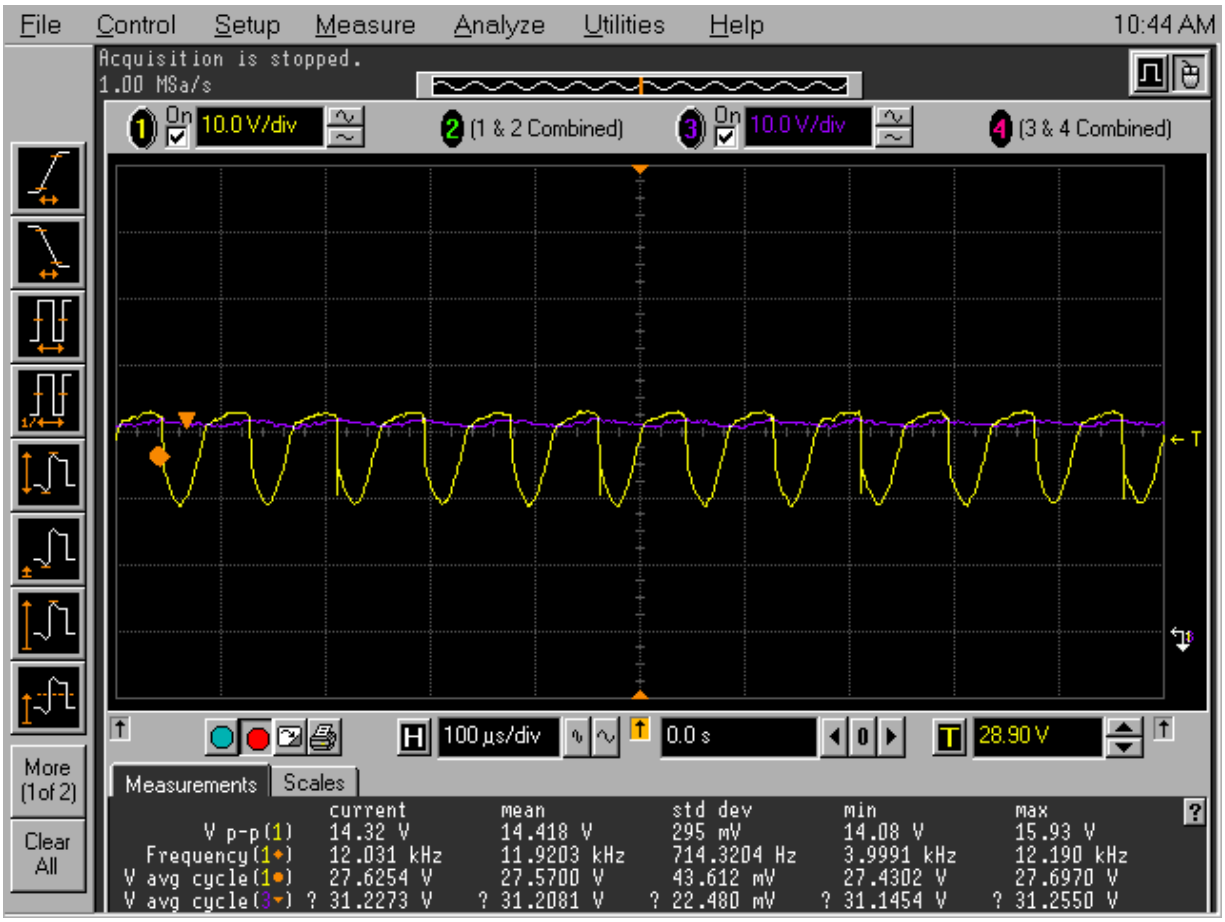
Plot 21. 5.3.2.4 Ripple voltage imported into EDUT, 48 kHz Calibration



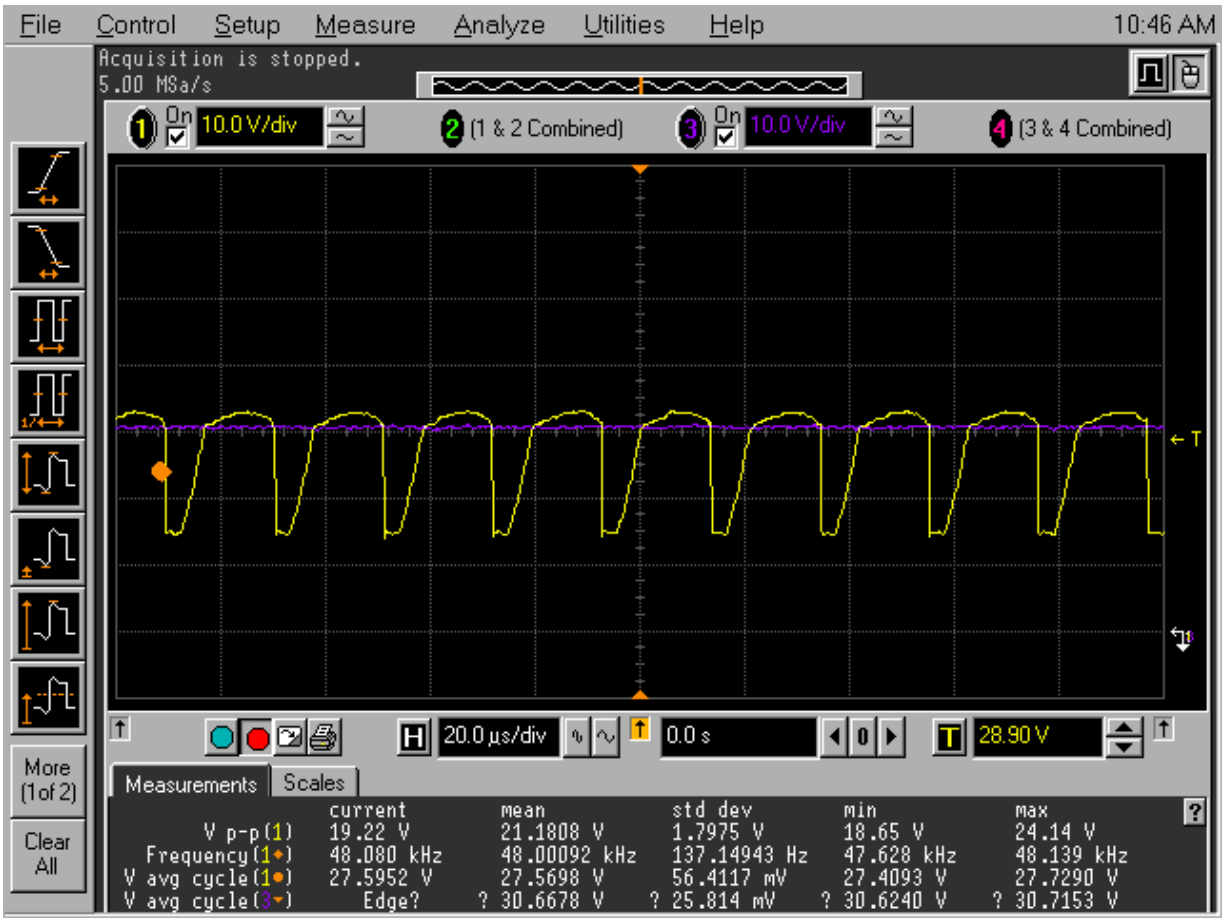
Plot 22. 5.3.2.4 Ripple voltage imported into EDUT, 200 kHz Calibration



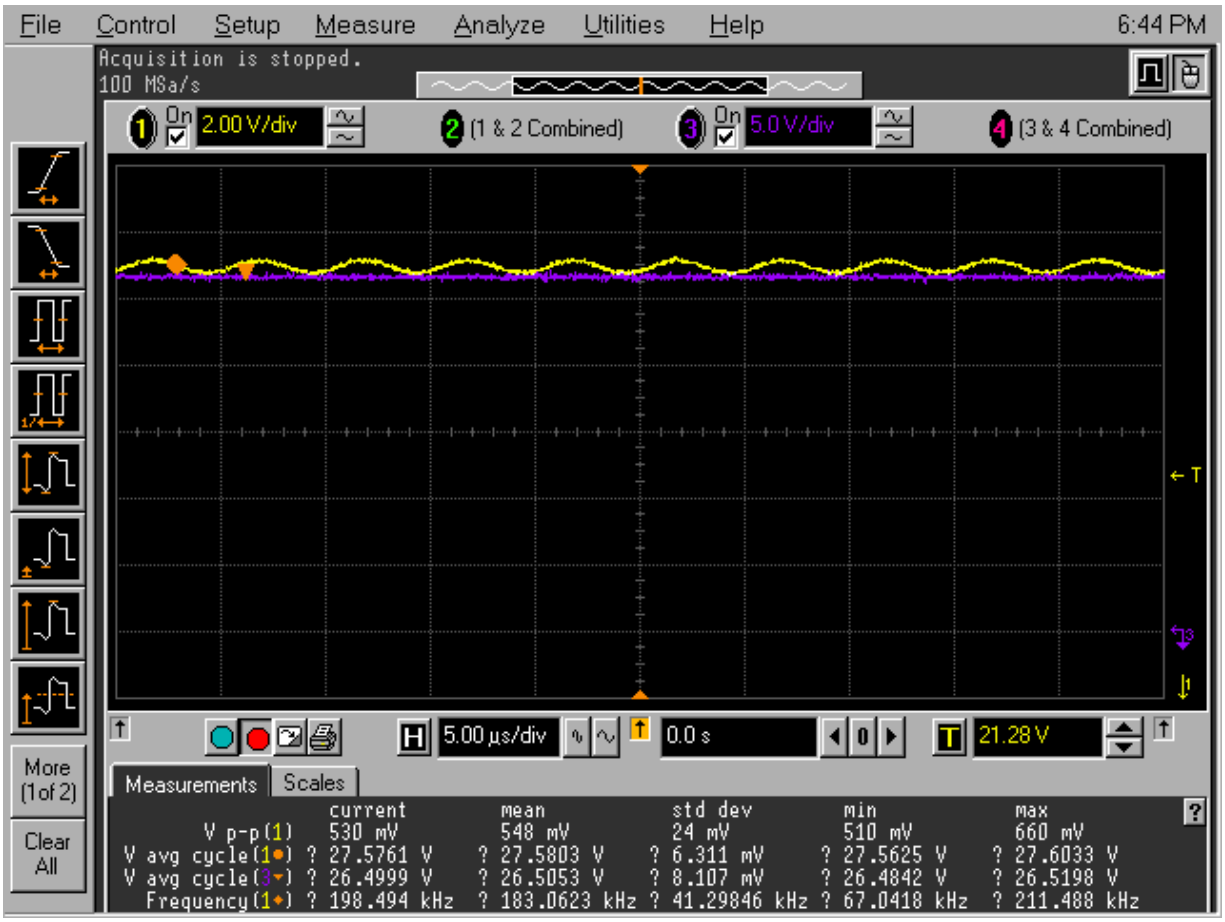
Plot 23. 5.3.2.4 Ripple voltage imported into EDUT, 50 Hz Test Results



Plot 24. 5.3.2.4 Ripple voltage imported into EDUT, 12 kHz Test Results



Plot 25. 5.3.2.4 Ripple voltage imported into EDUT, 48 kHz Test Results



Plot 26. 5.3.2.4 Ripple voltage imported into EDUT, 200 kHz Test Result

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

Test Name: 4.3 EDUT Compatibility			Test Date(s): 07/29/2014		
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2544	LISN	Solar Electronics	9233-50-TS-50-N	12/16/2013	06/16/2015
1S2545	LISN	Solar Electronics	9233-50-TS-50-N	12/16/2013	06/16/2015
1T4754	DC Power Supply	Chroma	62006P-300-8	See Note	
1S3812	Oscilloscope	Agilent	54845A	05/08/2014	11/08/2015
4S3782	Differential Probe	Sapphire Instruments	SI 9101	10/21/2013	04/21/2015
1S3831	Passive High Voltage Probe	Tektronix	P5100A	See Note	
1S2636	Digital Micro-Ohmmeter	NDB Technologies	DRM-1A	01/31/2014	07/31/2015
1S3795	Thermal Clock & Humidity Monitor	Traceable Fisher Scientific	06-662-4, FB70258	11/27/2012	11/27/2014
4S3777	High Voltage Differential Probe	Cal Test	SI-9010	10/14/2013	04/14/2015
Test Name: 5.1.2 Starting Mode			**Test Date(s): 07/30/2014**		
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1S2634	Variable Power Supply	Ametek	MX30-480-160-704-A350-ABD-AMD-HF	See Note	
1T4754	DC Power Supply	Chroma	62006P-300-8	See Note	
1S3812	Oscilloscope	Agilent	54845A	05/08/2014	11/08/2015
4S3782	Differential Probe	Sapphire Instruments	SI 9101	10/21/2013	04/21/2015
1S3831	Passive High Voltage Probe	Tektronix	P5100A	See Note	
1S2636	Digital Micro-Ohmmeter	NDB Technologies	DRM-1A	01/31/2014	07/31/2015
1S3795	Thermal Clock & Humidity Monitor	Traceable Fisher Scientific	06-662-4, FB70258	11/27/2012	11/27/2014
4S3777	High Voltage Differential Probe	Cal Test	SI-9010	10/14/2013	04/14/2015
Test Name: 5.3.2 Vehicle Equipment			**Test Date(s): 07/30/2014**		
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
1T4754	DC Power Supply	Chroma	62006P-300-8	See Note	
1S3812	Oscilloscope	Agilent	54845A	05/08/2014	11/08/2015
4S3782	Differential Probe	Sapphire Instruments	SI 9101	10/21/2013	04/21/2015
1S3831	Passive High Voltage Probe	Tektronix	P5100A	See Note	
1S2636	Digital Micro-Ohmmeter	NDB Technologies	DRM-1A	01/31/2014	07/31/2015
1S3795	Thermal Clock & Humidity Monitor	Traceable Fisher Scientific	06-662-4, FB70258	11/27/2012	11/27/2014
4S3777	High Voltage Differential Probe	Cal Test	SI-9010	10/14/2013	04/14/2015
1T4716	Test Fixture: MIL-STD-1275 Exported Spike Test	MET Laboratories	NA	See Note	

Table 14. Detailed List of Test Equipment

Note: Functionally verified test equipment is verified using calibrated instrumentation at the time of testing.