1250 Peterson Dr., Wheeling, IL 60090

Company: Spider Tracks Limited
Model Tested: 6000S5
Report Number: 19829
Project No. 6387

TEST SPECIFICATIONS:

RTCA/DO-160G (December 8, 2010)

RADIO TECHNICAL COMMISSION FOR AERONAUTICS

ENVIRONMENTAL CONDITIONS

AND

TEST PROCEDURE FOR AIRBORNE EQUIPMENT

THE FOLLOWING **MEETS** SECTION 17 TEST PROCEDURE OF THE ABOVE TEST SPECIFICATION

Formal Name:	Spider S3 and Spider S5
Kind of Equipment:	Aircraft Tracking Unit
Test Configuration:	Tabletop (Tested at 28 Vdc)
Model Number(s):	6000S3 and 6000S5
Model(s) Tested:	6000S5
Serial Number(s):	QQ7KM44LW3
Date of Tests:	March 12, 2014
Test Conducted for:	Spider Tracks Limited 203/150 Karangahape Road Auckland, New Zealand 1010

NOTICE: “This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government”. Please see the "Additional Description of Equipment Under Test" page listed inside of this report.

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Model Tested: 6000S5
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SIGNATURE PAGE

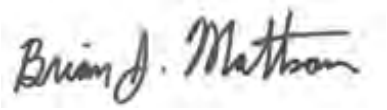
Report Written By:

Arnom C. Rowe
Test Engineer
EMC-001375-NE

Report Reviewed By:

Jack Prawica
Lab Manager
EMC-002412-NE

Report Approved By:



Brian J. Mattson
General Manager

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United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 100276-0

D.L.S. Electronic Systems, Inc.
Wheeling, IL

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2013-10-01 through 2014-09-30
Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)

1.0 INTRODUCTION:

On March 12, 2014, a series of susceptibility tests were made to demonstrate that the Spider S3 and Spider S5, Model Number 6000S5, serial number QQ7KM44LW3, manufactured by Spider Tracks Limited was tested to the requirements of RTCA/DO-160G (December 8, 2010), Environmental conditions and Test Procedures for Airborne Equipment using the following test procedure: SECTION 17.

2.0 TEST FACILITY:

D.L.S. Electronic Systems, Inc. is a full service EMC Testing Laboratory accredited to ISO Guide 17025. NVLAP Certificate and Scope can be viewed at http://www.dlsemc.com/certificate. Our facilities are registered with the FCC, Industry Canada, and VCCI. All tests were performed by personnel of D.L.S. Electronic Systems, Inc. at the following location(s):

Main Test Facility:
D.L.S. Electronic Systems, Inc.
1250 Peterson Drive
Wheeling, Illinois 60090

A list of the test equipment used, along with identification and calibration data, is included in the Table of each Appendix of this report. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.

3.0 TEST SET-UP:

All susceptibility tests were performed at D.L.S. Electronic Systems, Inc. The Spider S5 was placed on a copper bench measuring 24' long and 40" wide. The following describes the Lab that was used for testing:

LAB S***** 36' long x 25' wide x 20' high anechoic/ferrite tile lined enclosure.

*****Electromagnetic field absorbers were strategically placed according to Figure 21-11 of the RTCA/DO-160 Standard. All lines leaving the room were filtered. The auxiliary equipment was located outside the main room.

The tests were run in the following lab:

LAB S Section 17, Voltage Spike

4.0 OPERATING CONDITIONS OF TEST SAMPLE:

All test measurements were made at a laboratory temperature of **72˚F** at **32%** humidity with the following mode of operation:

The EUT is powered using 28 Vdc and is tested in it's normal operation mode.

5.0 PERFORMANCE MONITORED:

The Spider S5 performance was monitored as follows:

The EUT will be monitored for normal operation before and after the test is applied.

6.0 DESCRIPTION OF TEST SAMPLE: (See also Paragraph 7.0)

6.1 DESCRIPTION

GPS and Iridium based aircraft tracking unit that is powered off battery power from the aircraft at between 12 and 28 Vdc. Transmits location information every 2 minutes during operation.

6.2 PHYSICAL DIMENSIONS OF EQUIPMENT UNDER TEST:

130 mm x 89 mm x 26 mm

7.0 ADDITIONAL DESCRIPTION OF EQUIPMENT UNDER TEST:
(See also Paragraph 6.0)

There were no changes made during testing.

8.0 PHOTO ID INFORMATION:

The test set up can be seen in the accompanying photograph.

Item 0 Spider S5
Model Number: 6000S5 Serial Number: QQ7KM44LW3

Item 1 Unshielded DC Power Cable.

Item 2 Unshielded USB to micro-USB Cable.

9.0 PHOTO ID TAKEN DURING TESTING:

Photo ID

10.0 REFERENCES:

1. Document No. RTCA/DO-160G, December 8, 2010
Prepared by: SC-135

11.0 TEST RESULTS:

The Spider S5 was subject to the test procedure(s) SECTION 17. A detailed explanation of how these tests and their measurements were made is shown in Appendix A at the end of this report.

12.0 CONCLUSION OF SUSCEPTIBILITY TESTS:

The Spider S3 and Spider S5, Model Number(s) 6000S3 and 6000S5, **meets** SECTION 17 RTCA/DO-160G (December 8, 2010), Environmental conditions and Test Procedures for Airborne Equipment. See the Appendix A for a detailed explanation of the test results.

APPENDIX A

RTCA/DO-160G

SECTION 17

PARAGRAPH 17.4

VOLTAGE SPIKE

1.0 PURPOSE OF THE TEST:

This test determines whether the equipment can withstand the effects of voltage spikes arriving at the equipment on its power leads, either AC or DC. The main adverse effects to be anticipated are:

a. Permanent damage, component failure, insulation breakdown.

b. Susceptibility degradation, or changes in equipment performance.

2.0 EQUIPMENT CATEGORIES:

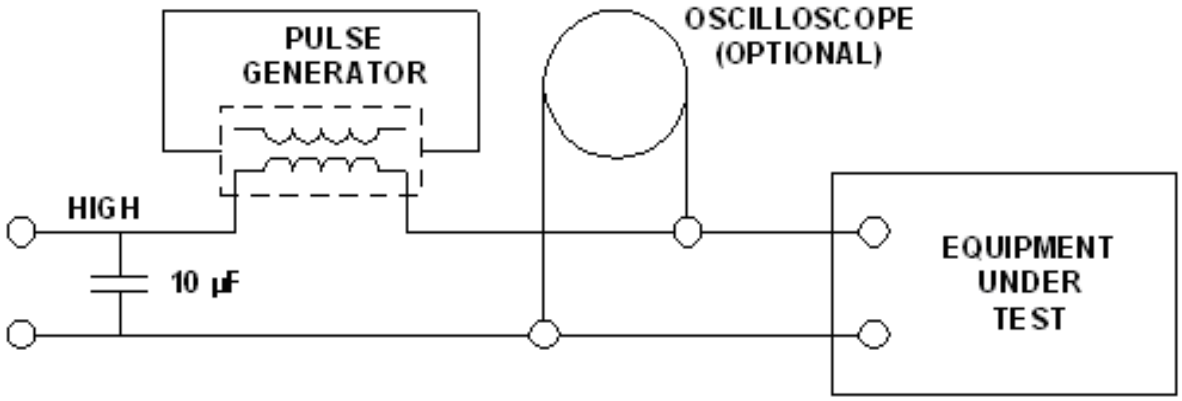
The Spider S5 was subjected to **Category B**.

Category B

Equipment intended primarily for installations where a lower standard of protection against voltage spikes is acceptable is identified as Category B.

3.0 TEST SETUP AND APPARATUS:

The transient generator used produced the waveform shown in Figure 17-1 of the test specification. A typical test setup is shown in Figure 17-2. Any method of generating the spike may be used if the waveform complies with Figure 17-1. The generator was inserted in series with the Spider S5.



NOTE: FOR EQUIPMENTS DRAWING HIGH CURRENTS, ALTERNATE TEST METHODS MAY BE REQUIRED (To avoid saturating transformer etc.).

Figure 17-2 Voltage Spike Test Setup, DC or Single Phase AC

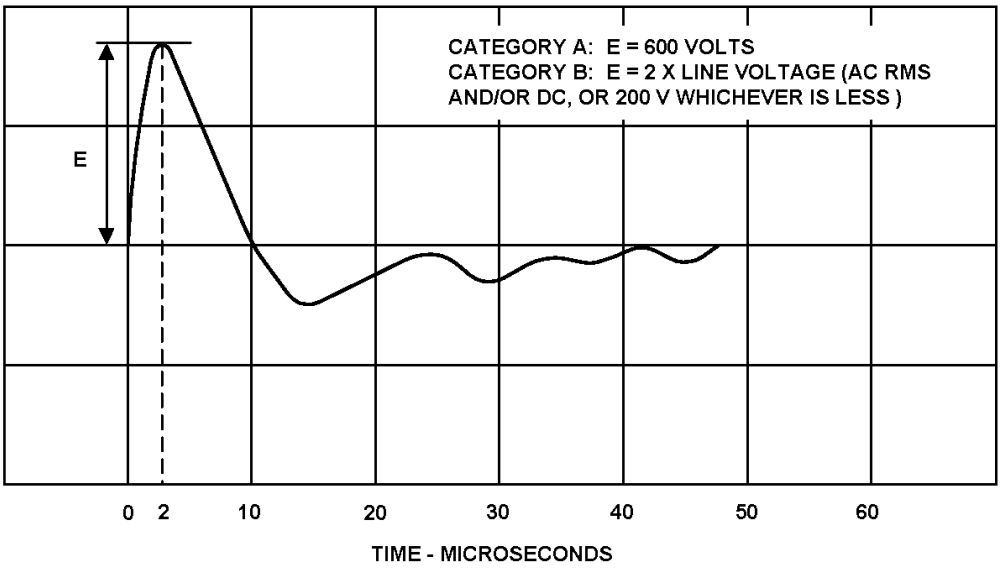
4.0 TEST PROCEDURE:

With the equipment under test disconnected, the transient wave shape was verified to be within specification. The Spider S5 was powered by 28 Vdc. A series of positive and negative spikes (described in Figure 17-1 of the Standard) were injected to each of the primary inputs of the equipment under test. A minimum of 50 transients of each polarity were injected within a period of one minute. The test was repeated for each operating mode or function of the equipment.

5.0 LIMITS & RESULTS:

5.1 LIMITS:

A following Voltage Spike Waveform was used for the test:



THE GENERATOR SOURCE IMPEDANCE SHALL BE 50 Ω NOMINAL. THE SPECIFIED VOLTAGE AND DURATIONS ARE FOR OPEN CIRCUIT CONDITIONS ONLY. THE PEAK VOLTAGE MAY BE SUBSTANTIALLY LOWER WITH THE EQUIPMENT CONNECTED. THE GENERATOR SOURCE IMPEDANCE SHALL BE VERIFIED BY TESTING WITH A 50 Ω ±10% LOAD RESISTOR, AND SHALL PRODUCE ONE HALF OF THE SPECIFIED VOLTAGE ±10%.

Note: The waveform shown above is typical. The wa veform requirement is accomplished if the pulse rise time is less than or equal to 2 µsec and the total pulse duration is at least 10 µsec.

Figure 17-1 Voltage Spike Waveform

FIGURE 17-1

5.0 LIMITS & RESULTS (CON'T):

5.2 RESULTS:

The Spider S3 and Spider S5 **meets** the following conditions:

Lab used: S

Summary:

During testing the EUT was located inside a shielded EMI test chamber and was not able to communicate with the GPS satellites. Before testing, the EUT was taken outside the building where satellite communication was verified. During the test, the EUT was visually monitored to ensure a shut down did not occur. At the completion of the test, the EUT was once again brought outside the building to recheck satellite communication. Normal operation was achieved at the conclusion of the test. See the data sheets at the end of this appendix for the test results.

6.0 PHOTOS TAKEN DURING TESTING

Section 17 Test 28 Vdc Positive Line

6.0 PHOTOS TAKEN DURING TESTING

Section 17 Test 28 Vdc Return Line

6.0 PHOTOS TAKEN DURING TESTING

Section 17 Calibration

SECTION 17

TEST INSTRUMENTATION

TABLE 1

Description	Manufacturer	Model Number	Serial Number	Range	Cal On	Cal Due Dates
LISN, 50 Amp	Solar Electronics Co.	9117-5-TS-50-N	17574	150 kHz-1 GHz	10/2/2013	10/2/2014
LISN, 50 Amp	Solar Electronics Co.	9117-5-TS-50-N	21107	150 kHz-1 GHz	10/2/2013	10/2/2014
Oscilloscope, Digital, 1.5GHz	Agilent Technologies	54845A	US40240434	DC-1.5 GHz, 8MS/s	6/10/2013	6/10/2014
Probe, 100MHz Active Differential	Agilent Technologies	N2791A	PH50291007	25 MHz	1/30/2014	1/30/2015

All primary equipment is calibrated against known reference standards with a verified traceable path NIST.

SECTION 17

TEST EQUIPMENT

TABLE 2

Description	Manufacturer	Model Number	Serial Number	Range
Capacitor	Mallory	10000AFC	JSU23X106AQC, #896	10uF 230V 50/60 Hz
Generator, Spike	Solar Electronics Co.	7054-1	969701	N/A
Transformer, Pulse	Solar Electronics Co.	2201-1	DLS# 000386	2x10us 600V

NOTE: The above test equipment is verified upon use.

SECTION 17

VOLTAGE SPIKE TEST OSCILLOGRAMS

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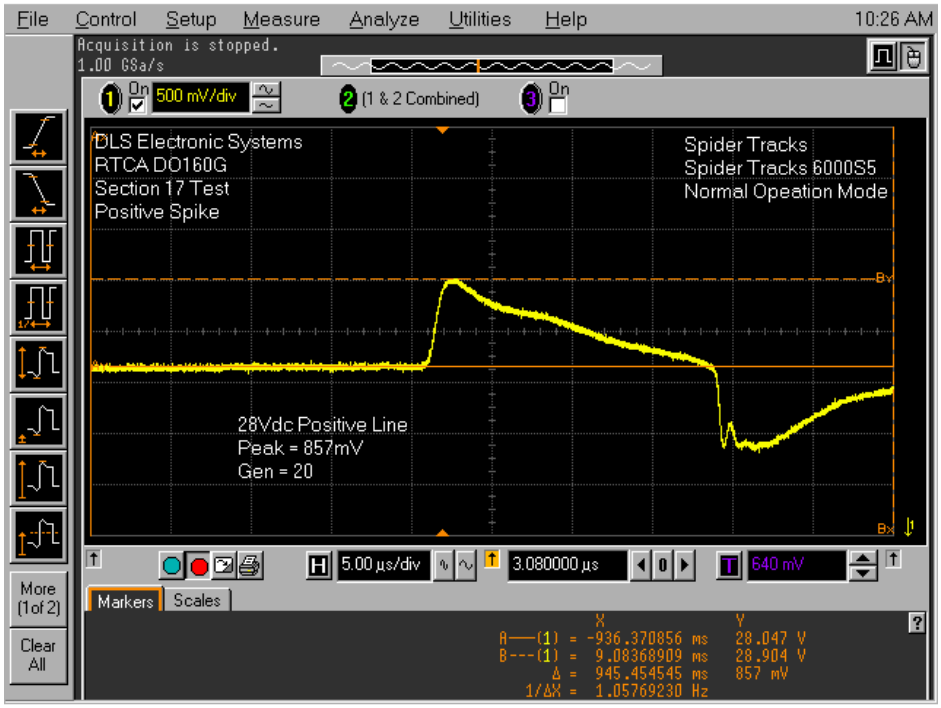

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Sampling mode real time Configuration 8GSa/s
Memory depth manual Memory depth 65536pts
Sampling rate automatic Sampling rate 1.00 GSa/s
Averaging off
9-bit BW Filter off Interpolation on

Channel 1
Scale 500 mV/div Offset 28.390 V Coupling DC Impedance 1M Ohm
Attenuation 10.00 : 1 Atten units ratio Skew 0.0 s
Ext adapter None Ext coupler None
Ext gain 1.00E+00 Ext offset 0.0E+00

Channel 3
Scale 1.00 V/div Offset 0.0 V Coupling AC Impedance 1M Ohm
Attenuation 10.00 : 1 Atten units ratio Skew 0.0 s
Ext adapter None Ext coupler None
Ext gain 1.00E+00 Ext offset 0.0E+00

Time base
Scale 5.00 µs/div Position 3.080000 µs Reference center

Trigger
Mode edge Sweep triggered
Hysteresis normal Holdoff time 60 ns Coupling DC
Source channel 3 Trigger level 640 mV Slope rising

Marker

	X	Y
A—(1) =	-936.370856 ms	28.047 V
B---(1) =	9.08368909 ms	28.904 V
Δ =	945.454545 ms	857 mV
1/ΔX =	1.05769230 Hz	

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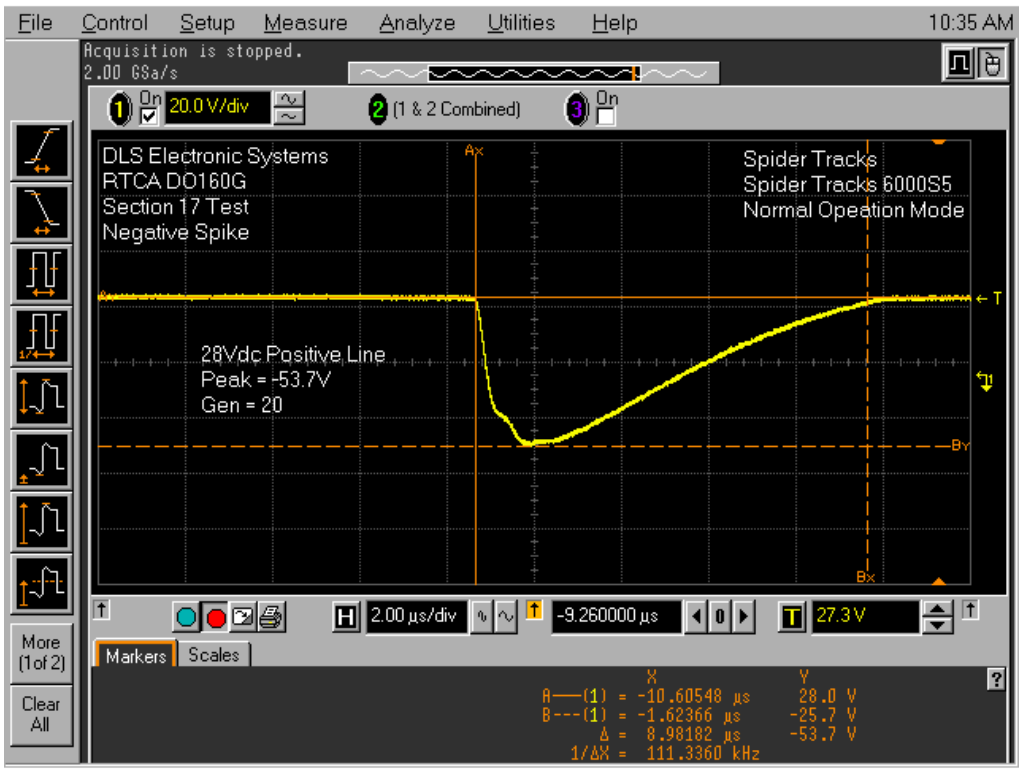

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Memory depth manual Memory depth 65536pts
Sampling rate automatic Sampling rate 2.00 GSa/s
Averaging off
9-bit BW Filter off Interpolation on

Channel 1 Scale 20.0 V/div Offset 4.60 V Coupling DC Impedance 1M Ohm
Attenuation 10.00 : 1 Atten units ratio Skew 0.0 s
Ext adapter None Ext coupler None
Ext gain 1.00E+00 Ext offset 0.0E+00

Time base Scale 2.00 µs/div Position -9.260000 µs Reference center

Trigger Mode edge Sweep triggered
Hysteresis normal Holdoff time 60 ns Coupling DC
Source channel 1 Trigger level 27.3 V Slope rising

Marker

	X	Y
A—(1) =	-10.60548 µs	28.0 V
B---(1) =	-1.62366 µs	-25.7 V
Δ =	8.98182 µs	-53.7 V
1/ΔX =	111.3360 kHz	

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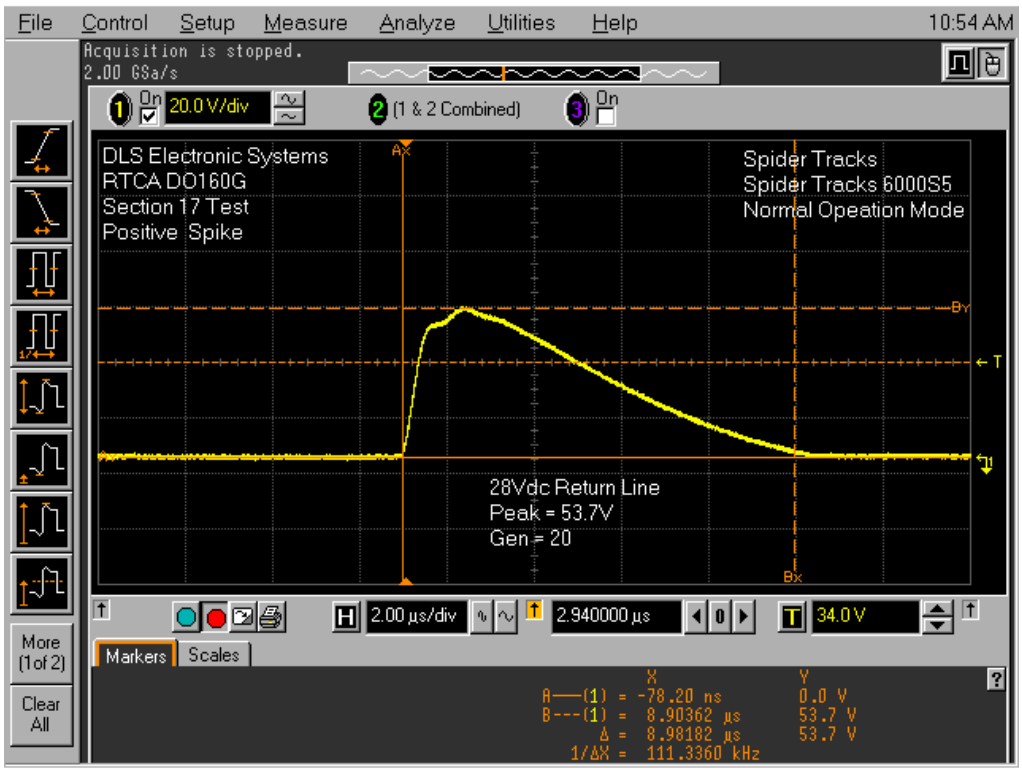

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Memory depth manual Memory depth 65536pts
Sampling rate automatic Sampling rate 2.00 GSa/s
Averaging off
9-bit BW Filter off Interpolation on

Channel 1
Scale 20.0 V/div Offset 34.23 V Coupling DC Impedance 1M Ohm
Attenuation 10.00 : 1 Atten units ratio Skew 0.0 s
Ext adapter None Ext coupler None
Ext gain 1.00E+00 Ext offset 0.0E+00

Time base
Scale 2.00 µs/div Position 2.940000 µs Reference center

Trigger
Mode edge Sweep triggered
Hysteresis normal Holdoff time 60 ns Coupling DC
Source channel 1 Trigger level 34.0 V Slope rising

Marker

	X	Y
A—(1) =	-78.20 ns	0.0 V
B---(1) =	8.90362 µs	53.7 V
Δ =	8.98182 µs	53.7 V
1/ΔX =	111.3360 kHz	

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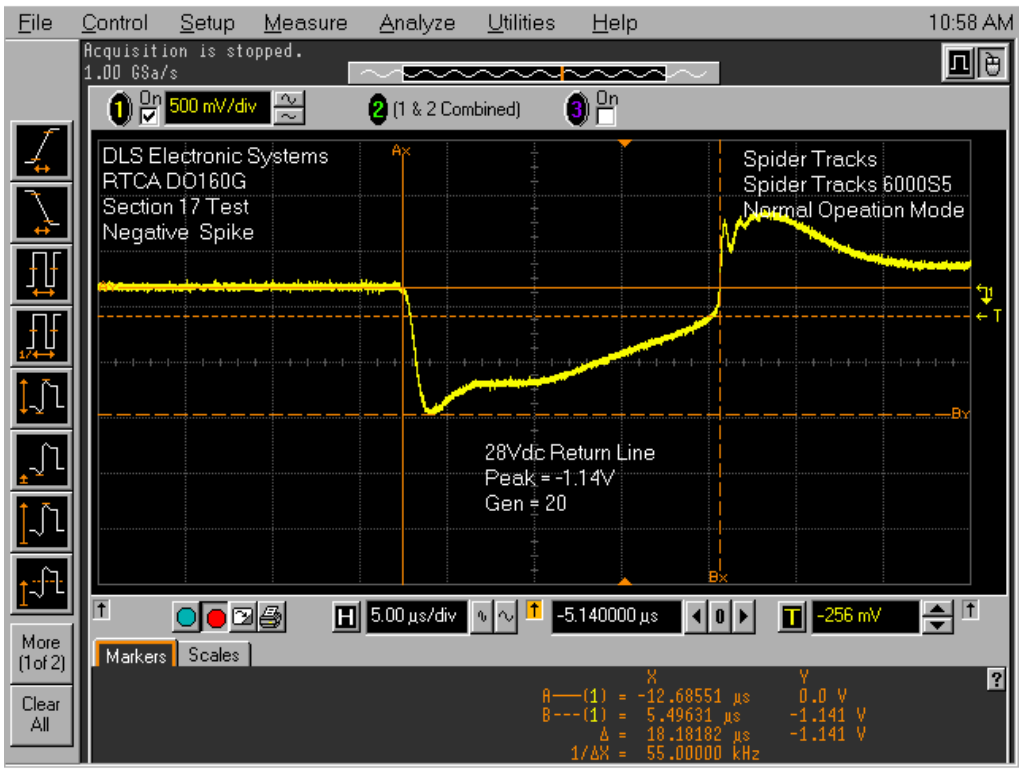

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Memory depth manual Memory depth 65536pts
Sampling rate automatic Sampling rate 1.00 GSa/s
Averaging off
9-bit BW Filter off Interpolation on

Channel 1 Scale 500 mV/div Offset -670 mV Coupling DC Impedance 1M Ohm
Attenuation 10.00 : 1 Atten units ratio Skew 0.0 s
Ext adapter None Ext coupler None
Ext gain 1.00E+00 Ext offset 0.0E+00

Time base Scale 5.00 µs/div Position -5.140000 µs Reference center

Trigger Mode edge Sweep triggered
Hysteresis normal Holdoff time 60 ns Coupling DC
Source channel 1 Trigger level -256 mV Slope rising

Marker

	X	Y
A—(1) =	-12.68551 µs	0.0 V
B---(1) =	5.49631 µs	-1.141 V
Δ =	18.18182 µs	-1.141 V
1/ΔX =	55.00000 kHz	

SECTION 17

VOLTAGE SPIKE

CALIBRATION OSCILLOGRAMS

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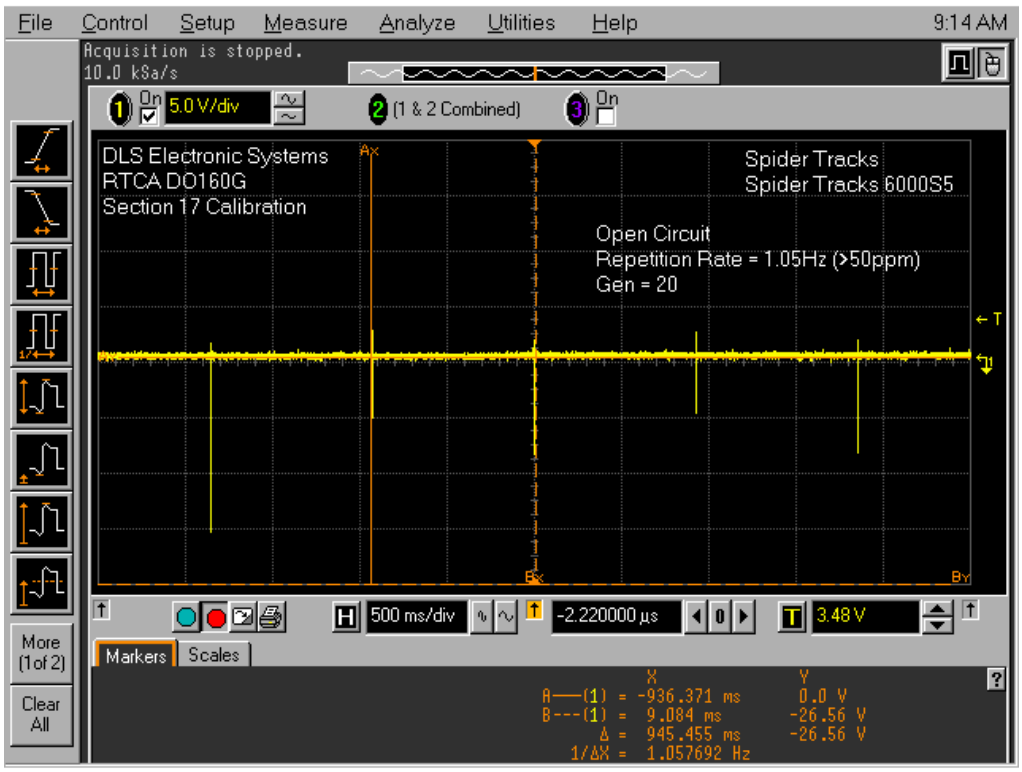

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Sampling rate automatic Sampling rate 10.0 kSa/s
Averaging off
9-bit BW Filter off Interpolation on

Channel 1 Scale 5.0 V/div Offset -400 mV Coupling DC Impedance 1M Ohm
Attenuation 100.0 : 1 Atten units ratio Skew 0.0 s
Ext adapter None Ext coupler None
Ext gain 1.00E+00 Ext offset 0.0E+00

Time base Scale 500 ms/div Position -2.220000 µs Reference center

Trigger Mode edge Sweep triggered
Hysteresis normal Holdoff time 60 ns Coupling DC
Source channel 1 Trigger level 3.48 V Slope rising

Marker

	X	Y
A——(1) =	-936.371 ms	0.0 V
B---(1) =	9.084 ms	-26.56 V
Δ =	945.455 ms	-26.56 V
1/ΔX =	1.057692 Hz	

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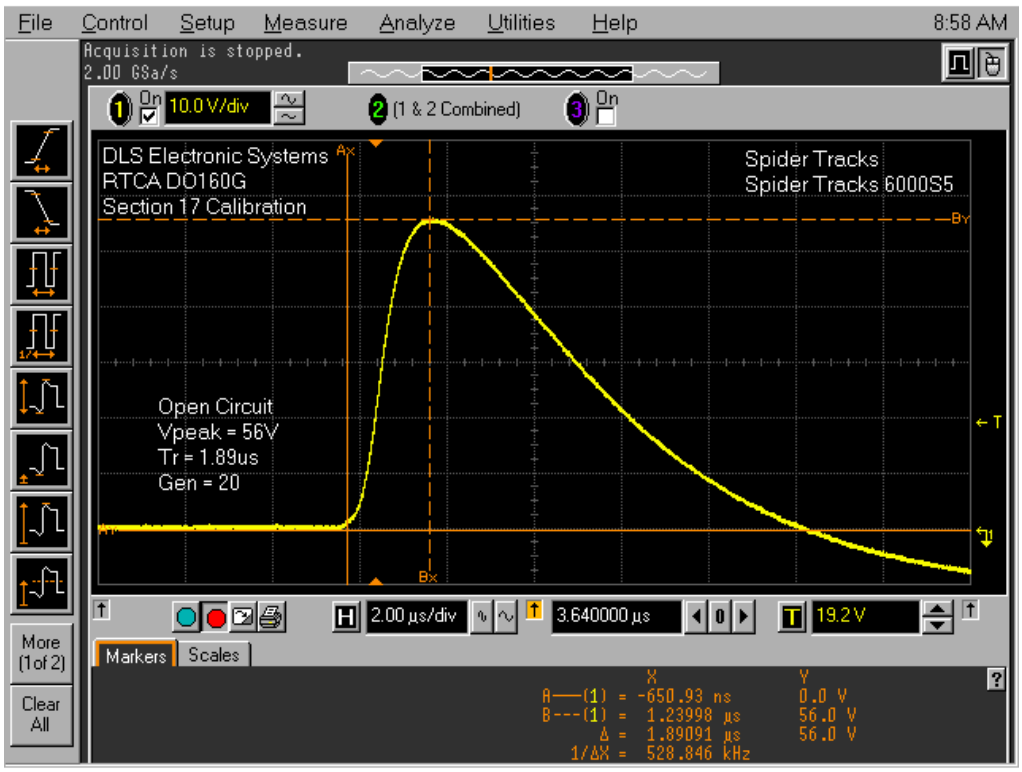

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Channel 1	Scale 10.0 V/div Offset 30.2 V Coupling DC Impedance 1M Ohm Attenuation 100.0 : 1 Atten units ratio Skew 0.0 s Ext adapter None Ext coupler None Ext gain 1.00E+00 Ext offset 0.0E+00
Time base	Scale 2.00 µs/div Position 3.640000 µs Reference center
Trigger	Mode edge Sweep triggered Hysteresis normal Holdoff time 60 ns Coupling DC Source channel 1 Trigger level 19.20 V Slope rising

Marker

	X	Y
A—(1) =	-650.93 ns	0.0 V
B---(1) =	1.23998 µs	56.0 V
Δ =	1.89091 µs	56.0 V
1/ΔX =	528.846 kHz	

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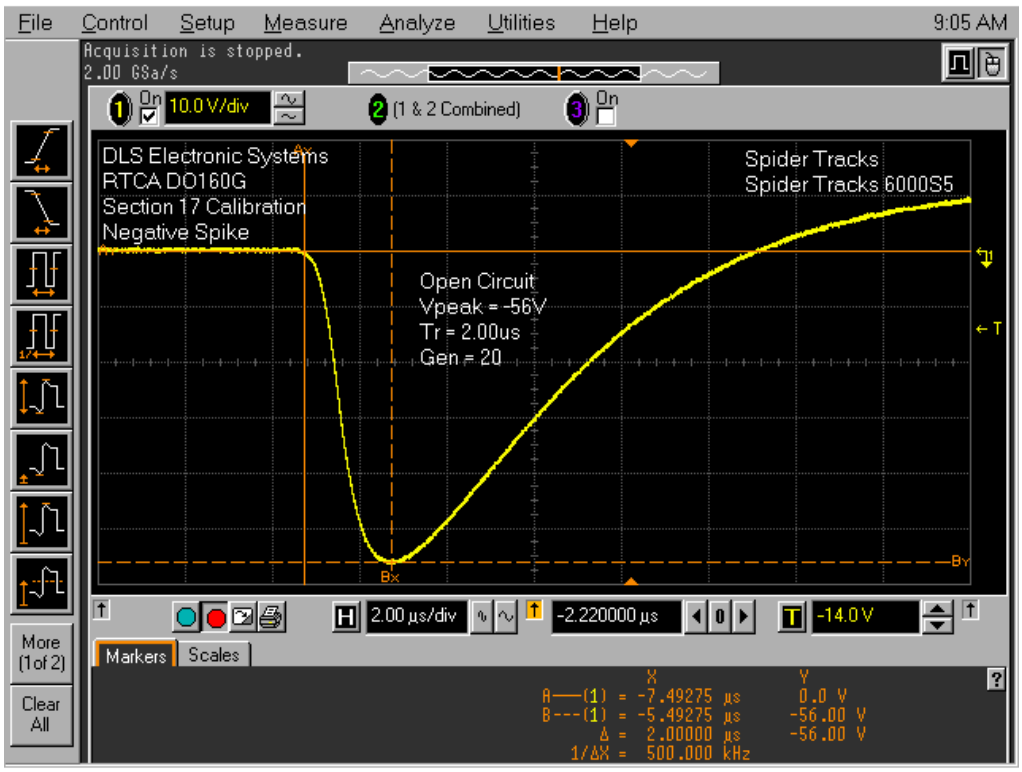

Acquisition
Sampling mode real time Configuration 8GSa/s
Memory depth manual Memory depth 65536pts
Sampling rate automatic Sampling rate 2.00 GSa/s
Averaging off
9-bit BW Filter off Interpolation on

Channel 1
Scale 10.0 V/div Offset -19.9 V Coupling DC Impedance 1M Ohm
Attenuation 100.0 : 1 Atten units ratio Skew 0.0 s
Ext adapter None Ext coupler None
Ext gain 1.00E+00 Ext offset 0.0E+00

Time base
Scale 2.00 µs/div Position -2.220000 µs Reference center

Trigger
Mode edge Sweep triggered
Hysteresis normal Holdoff time 60 ns Coupling DC
Source channel 1 Trigger level -14.00 V Slope rising

Marker

	X	Y
A—(1) =	-7.49275 µs	0.0 V
B---(1) =	-5.49275 µs	-56.00 V
Δ =	2.00000 µs	-56.00 V
1/ΔX =	500.000 kHz	

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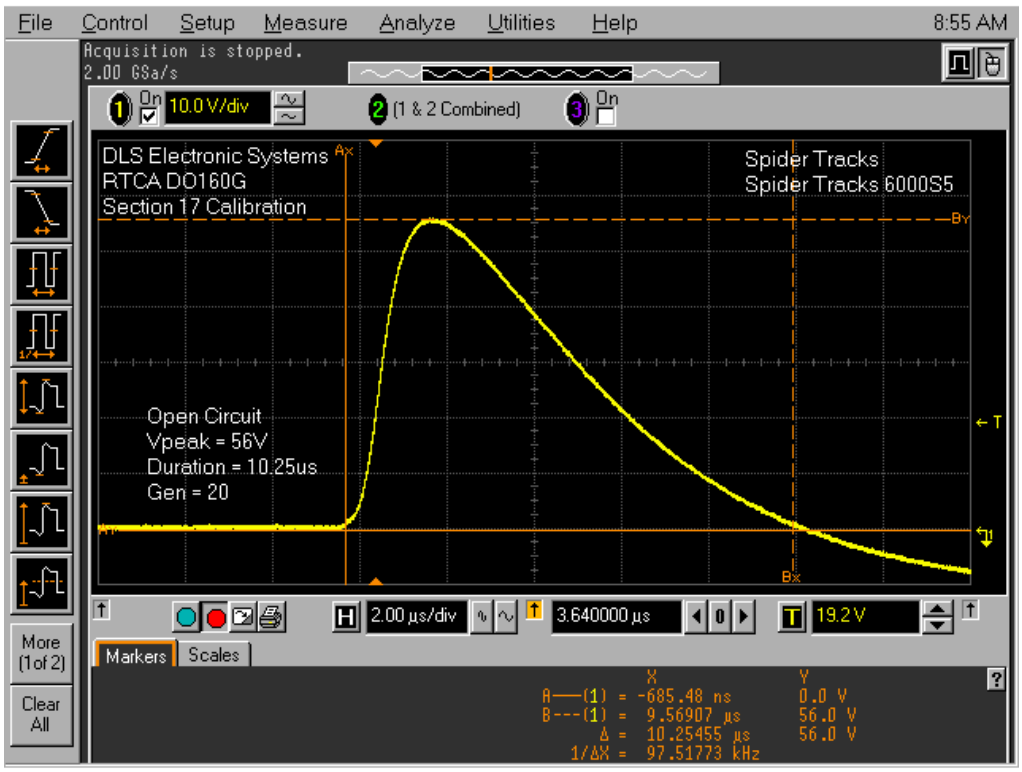

Acquisition	Sampling mode real time Configuration 8GSa/s Memory depth manual Memory depth 65536pts Sampling rate automatic Sampling rate 2.00 GSa/s Averaging off 9-bit BW Filter off Interpolation on
Channel 1	Scale 10.0 V/div Offset 30.2 V Coupling DC Impedance 1M Ohm Attenuation 100.0 : 1 Atten units ratio Skew 0.0 s Ext adapter None Ext coupler None Ext gain 1.00E+00 Ext offset 0.0E+00
Time base	Scale 2.00 µs/div Position 3.640000 µs Reference center
Trigger	Mode edge Sweep triggered Hysteresis normal Holdoff time 60 ns Coupling DC Source channel 1 Trigger level 19.20 V Slope rising

Marker

	X	Y
A—(1) =	-685.48 ns	0.0 V
B---(1) =	9.56907 µs	56.0 V
Δ =	10.25455 µs	56.0 V
1/ΔX =	97.51773 kHz	

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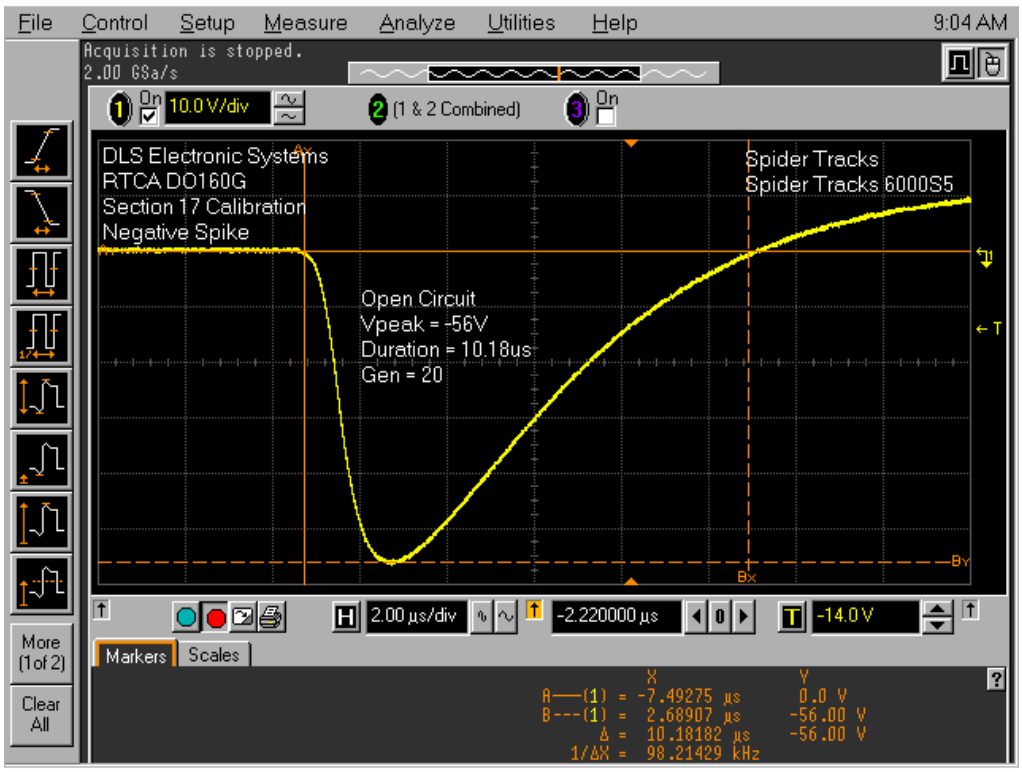

Acquisition
Sampling mode real time Configuration 8GSa/s
Memory depth manual Memory depth 65536pts
Sampling rate automatic Sampling rate 2.00 GSa/s
Averaging off
9-bit BW Filter off Interpolation on

Channel 1
Scale 10.0 V/div Offset -19.9 V Coupling DC Impedance 1M Ohm
Attenuation 100.0 : 1 Atten units ratio Skew 0.0 s
Ext adapter None Ext coupler None
Ext gain 1.00E+00 Ext offset 0.0E+00

Time base
Scale 2.00 µs/div Position -2.220000 µs Reference center

Trigger
Mode edge Sweep triggered
Hysteresis normal Holdoff time 60 ns Coupling DC
Source channel 1 Trigger level -14.00 V Slope rising

Marker

	X	Y
A—(1) =	-7.49275 µs	0.0 V
B---(1) =	2.68907 µs	-56.00 V
Δ =	10.18182 µs	-56.00 V
1/ΔX =	98.21429 kHz	

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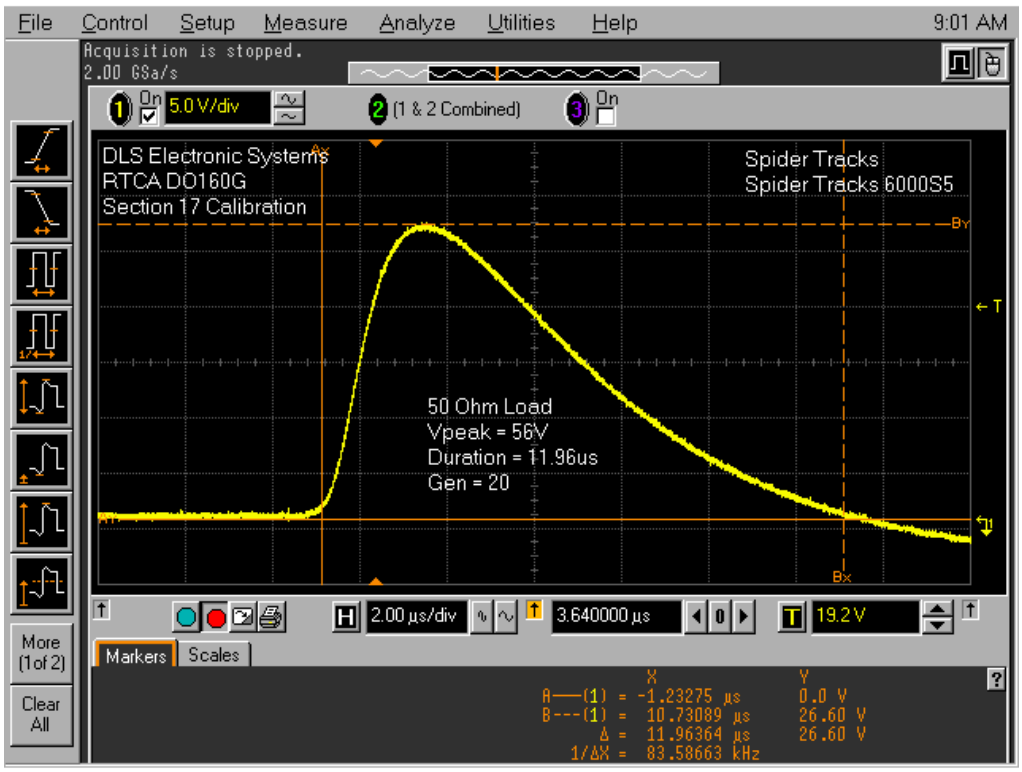

Acquisition
Sampling mode real time Configuration 8GSa/s
Memory depth manual Memory depth 65536pts
Sampling rate automatic Sampling rate 2.00 GSa/s
Averaging off
9-bit BW Filter off Interpolation on

Channel 1
Scale 5.0 V/div Offset 14.15 V Coupling DC Impedance 1M Ohm
Attenuation 100.0 : 1 Atten units ratio Skew 0.0 s
Ext adapter None Ext coupler None
Ext gain 1.00E+00 Ext offset 0.0E+00

Time base
Scale 2.00 µs/div Position 3.640000 µs Reference center

Trigger
Mode edge Sweep triggered
Hysteresis normal Holdoff time 60 ns Coupling DC
Source channel 1 Trigger level 19.20 V Slope rising

Marker

	X	Y
A—(1) =	-1.23275 µs	0.0 V
B---(1) =	10.73089 µs	26.60 V
Δ =	11.96364 µs	26.60 V
1/ΔX =	83.58663 kHz	

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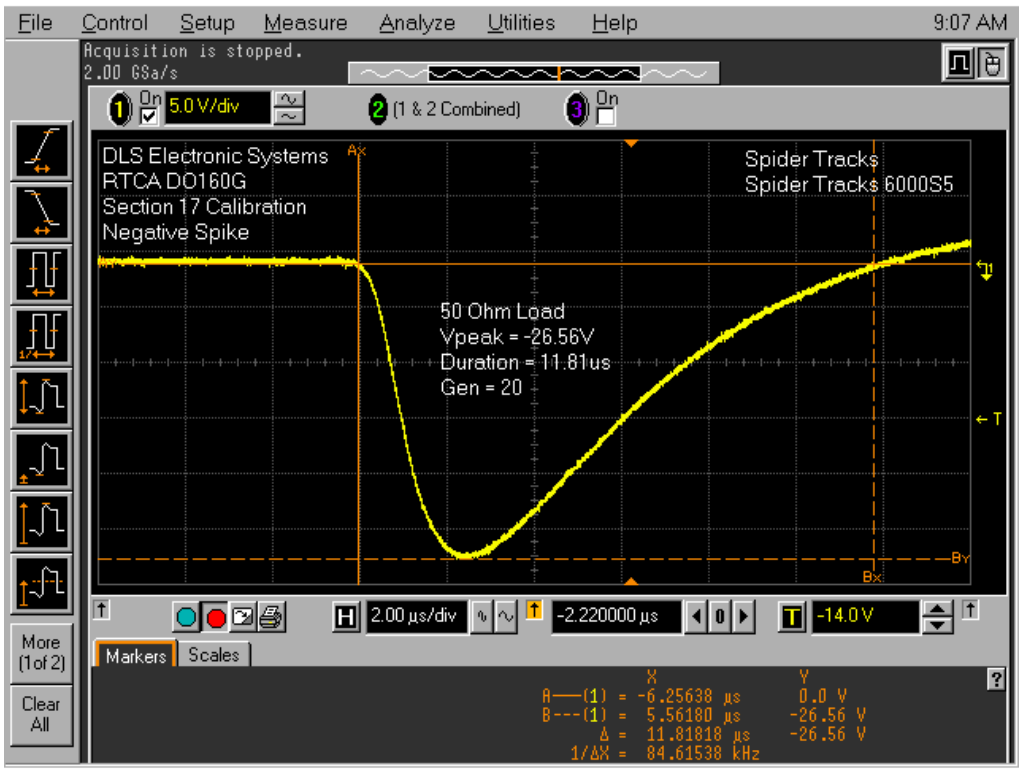

Acquisition
Sampling mode real time Configuration 8GSa/s
Memory depth manual Memory depth 65536pts
Sampling rate automatic Sampling rate 2.00 GSa/s
Averaging off
9-bit BW Filter off Interpolation on

Channel 1
Scale 5.0 V/div Offset -8.85 V Coupling DC Impedance 1M Ohm
Attenuation 100.0 : 1 Atten units ratio Skew 0.0 s
Ext adapter None Ext coupler None
Ext gain 1.00E+00 Ext offset 0.0E+00

Time base
Scale 2.00 µs/div Position -2.220000 µs Reference center

Trigger
Mode edge Sweep triggered
Hysteresis normal Holdoff time 60 ns Coupling DC
Source channel 1 Trigger level -14.00 V Slope rising

Marker

	X	Y
A—(1) =	-6.25638 µs	0.0 V
B---(1) =	5.56180 µs	-26.56 V
Δ =	11.81818 µs	-26.56 V
1/ΔX =	84.61538 kHz	