Vibration & Shock Test Report

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Contact: Richard Ridenour

Product/EUT: RS363SF Rack-Mount Computer

Test Report No.: R110309-60-03C

Approved By: Robert McElroy
Senior Test Engineer

Report Date: 17 December 2009

Number of Pages: 20
<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Revision Notes/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2009-12-05</td>
<td>In order to reduce test report file size, the following changes were made to this revision of the test report:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Section 3.1.6: Number of photographs was reduced from 12 photographs to 6 photographs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Section 3.1.7: Random Vibration Test Response Plots were removed and only 1 Random Vibration plot was retained</td>
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<tr>
<td></td>
<td></td>
<td>• Section 3.2.7: Operating Shock Test Response Plots were removed and only 2 Operating Shock plots were retained</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Section 3.3.7: Crash Safety Shock Test Response Plots were removed and only 2 Crash Safety Shock plots were retained</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This revision of the test report does not replace the original test report; this revision of the test report is a supplement to the original test report (dated 05 December 2009)</td>
</tr>
<tr>
<td>B</td>
<td>2009-12-17</td>
<td>The full version of the test report (R110309-60-03) was updated to include the completion of the Crash Safety Shock Test.</td>
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<tr>
<td>C</td>
<td>2009-12-17</td>
<td>The reduced file size version of the test report (R110309-60-03A) was updated to include the completion of the Crash Safety Shock Test.</td>
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1.0 Summary of Test Results

<table>
<thead>
<tr>
<th>Test Name</th>
<th>Test Procedure/Standard</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random Vibration Test</td>
<td>MIL-STD-810G, Method 514.6, Procedure I, Category 7, Figure 514.6C-5, C17 Profile</td>
<td>compliant</td>
</tr>
<tr>
<td>Operating Shock Test</td>
<td>MIL-STD-810G, Method 516.6, Procedure I, Classical Shock Pulses</td>
<td>compliant</td>
</tr>
</tbody>
</table>

† Test results shown in this table are only a summary of the test results described in this test report.

2.0 Description of Equipment Under Test (EUT)

2.1 RS363SF Rack Mount Computer

- The RS363SF Rack Mount Computer is a server computer housed in an enclosure designed to fit in a standard 19 inch electronics rack. The RS363SF Rack Mount Computer enclosure uses 3 standard rack units (3U) of space in a standard 19 inch electronics rack.

2.1.2 Configuration As Tested

- The RS363SF Rack Mount Computer was subjected to this testing in the configuration provided by the customer.

- NCEE made no modifications to this test sample prior to the performance of this testing project or during the performance of this testing project.
3.0 Test Description & Results

3.1 Random Vibration Test

3.1.1 Test Description

- For the X-axis & the Y-axis, the customer’s test fixture was bolted to the dynamics test system slip table, which was bolted to the dynamics test system exciter via an interface adapter. For the Z-axis, the customer’s test fixture was bolted to a head-expander, which was bolted directly to the dynamics test system exciter. The test sample was installed in the customer’s test fixture.

- The vibration control signal for the X-axis & the Y-axis was achieved with the use of one control accelerometer, which was mounted on the front-center of the dynamics test system slip table. The vibration control signal for the Z-axis was achieved with the use of one control accelerometer, which was mounted under the head expander table, as near to the center of the head expander as practical. The Z-axis control accelerometer was mounted in an orientation that swapped the positive and negative polarities of the accelerometer, so the dynamics control software was adjusted to account for the inverted control accelerometer.

- In each axis of this test, one tri-axial response measurement accelerometer was mounted to the rear-center of the top of the case, and a second tri-axial response measurement accelerometer was mounted to the front-center of the top of the case.

- The vibration controller was programmed with the broadband random vibration profile listed in Table 2 on the next page.

- The customer placed the test sample into its operating state, and the operating test sample was exposed to the specified vibration testing for 1 hour in each axis.

- The customer monitored the test sample for proper operation during the performance of this test and upon the completion of this test.
### Table 2

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Acceleration Spectral Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Hz</td>
<td>0.005 g²/Hz</td>
</tr>
<tr>
<td>66.897 Hz</td>
<td>0.005 g²/Hz</td>
</tr>
<tr>
<td>150 Hz</td>
<td>0.025 g²/Hz</td>
</tr>
<tr>
<td>500 Hz</td>
<td>0.025 g²/Hz</td>
</tr>
<tr>
<td>2,000 Hz</td>
<td>0.0016 g²/Hz</td>
</tr>
</tbody>
</table>

#### 3.1.2 Date(s) of Testing
- This test was performed between November 17\textsuperscript{th}, 2009 and November 19\textsuperscript{th}, 2009.

#### 3.1.3 Standard Laboratory Conditions
- Laboratory temperature is maintained at 20 °C ± 3 °C.
- Laboratory humidity is maintained at 40% R.H. ± 15% R.H.
- Laboratory barometric pressure is maintained at 30 inches of mercury (in.\textsubscript{Hg}) ± 0.5 inches of mercury (in.\textsubscript{Hg}).

#### 3.1.4 Test Equipment Used
- The test equipment used for the performance of this test is shown below in Table 3.

#### Table 3

<table>
<thead>
<tr>
<th>Test Equipment Name</th>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Serial Number</th>
<th>Calibration Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration Control</td>
<td>Vibration Research</td>
<td>VR8500</td>
<td>15add9</td>
<td>May 26, 2009</td>
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<tr>
<td>System</td>
<td>Vibration Research</td>
<td>VR8500</td>
<td>1def24</td>
<td>July 16, 2009</td>
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<td>Accelerometer</td>
<td>Dytran Instruments</td>
<td>3273A4T</td>
<td>269</td>
<td>July 31, 2009</td>
</tr>
<tr>
<td>Accelerometer</td>
<td>Dytran Instruments</td>
<td>3273A4T</td>
<td>270</td>
<td>July 31, 2009</td>
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<tr>
<td>Accelerometer</td>
<td>PCB Piezotronics</td>
<td>J353B34</td>
<td>65584</td>
<td>June 10, 2009</td>
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<tr>
<td>Accelerometer</td>
<td>PCB Piezotronics</td>
<td>J353B34</td>
<td>65587</td>
<td>June 10, 2009</td>
</tr>
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</table>

#### 3.1.5 Test Results
- The customer did not report any out of specification conditions during the performance of this test or upon the completion of this test.
3.1.6 Representative Photographs

- Representative photographs begin on the next page.
3.1.7 Representative Vibration Plot

- A representative vibration plot is shown on the next page.
3.2 Operating Shock Test

3.2.1 Test Description

• For the X-axis & the Y-axis, the customer’s test fixture was bolted to the dynamics test system slip table, which was bolted to the dynamics test system exciter via an interface adapter. For the Z-axis, the customer’s test fixture was bolted to a head-expander, which was bolted directly to the dynamics test system exciter. The test sample was installed in the customer’s test fixture.

• The shock control signal for the X-axis & the Y-axis was achieved with the use of one control accelerometer, which was mounted on the front-center of the dynamics test system slip table. The shock control signal for the Z-axis was achieved with the use of one control accelerometer, which was mounted under the head expander table, as near to the center of the head expander as practical. The Z-axis control accelerometer was mounted in an orientation that swapped the positive and negative polarities of the accelerometer, so the dynamics control software was adjusted to account for the inverted control accelerometer.

• In each axis of this test, one tri-axial response measurement accelerometer was mounted to the rear-center of the top of the case, and a second tri-axial response measurement accelerometer was mounted to the front-center of the top of the case.

• The shock pulse was a terminal-peak sawtooth pulse with an 11 millisecond duration and a peak amplitude of 20 G.

• The customer placed the test sample into its operating state, and the operating test sample was exposed to the specified shock pulse 3 times in the positive polarity of each axis and 3 times in the negative polarity of each axis. The test sample was allowed to settle for at least 1 second between each shock pulse.

• The customer monitored the test sample for proper operation during the performance of this test.
3.2.2 Date(s) of Testing
- This test was performed between November 19\textsuperscript{th}, 2009 and November 20\textsuperscript{th}, 2009.

3.2.3 Standard Laboratory Conditions
- Laboratory temperature is maintained at 20 °C ± 3 °C.
- Laboratory humidity is maintained at 40% R.H. ± 15% R.H.
- Laboratory barometric pressure is maintained at 30 inches of mercury (in.H\textsubscript{g}) ± 0.5 inches of mercury (in.H\textsubscript{g}).

3.2.4 Test Equipment Used
- The test equipment used for the performance of this test is shown in Table 3 in Section 3.1.4 of this test report.

3.2.5 Test Results
- The customer did not report any out of specification conditions during the performance of this test or upon the completion of this test.

3.2.6 Representative Photographs
- Representative photographs of this test are shown in Section 3.1.6 of this test report.

3.2.7 Representative Shock Plots
- Representative shock plots begin on the next page.
3.3 Crash-Safety Shock Test

3.3.1 Test Description

- For the X-axis & the Y-axis, the customer’s test fixture was bolted to the dynamics test system slip table, which was bolted to the dynamics test system exciter via an interface adapter. For the Z-axis, the customer’s test fixture was bolted to a head-expander, which was bolted directly to the dynamics test system exciter. The test sample was installed in the customer’s test fixture.

- The shock control signal for the X-axis & the Y-axis was achieved with the use of one control accelerometer, which was mounted on the front-center of the dynamics test system slip table. The shock control signal for the Z-axis was achieved with the use of one control accelerometer, which was mounted under the head expander table, as near to the center of the head expander as practical. The Z-axis control accelerometer was mounted in an orientation that swapped the positive and negative polarities of the accelerometer, so the dynamics control software was adjusted to account for the inverted control accelerometer.

- In each axis of this test, one tri-axial response measurement accelerometer was mounted to the rear-center of the top of the case, and a second tri-axial response measurement accelerometer was mounted to the front-center of the top of the case.

- The shock pulse was a terminal-peak sawtooth pulse with an 11 millisecond duration and a peak amplitude of 40 G.

- The customer placed the test sample into its operating state, and the operating test sample was exposed to the specified shock pulse 3 times in the positive polarity of each axis and 3 times in the negative polarity of each axis. The test sample was allowed to settle for at least 1 second between each shock pulse.

- The customer monitored the test sample for proper operation & structural integrity during the performance of this test.
3.3.2 Date(s) of Testing
• This test was performed between November 19\textsuperscript{th}, 2009 and November 20\textsuperscript{th}, 2009.

3.3.3 Standard Laboratory Conditions
• Laboratory temperature is maintained at 20 °C ± 3 °C.

• Laboratory humidity is maintained at 40% R.H. ± 15% R.H.

• Laboratory barometric pressure is maintained at 30 inches of mercury (in.H\textsubscript{g}) ± 0.5 inches of mercury (in.H\textsubscript{g}).

3.3.4 Test Equipment Used
• The test equipment used for the performance of this test is shown in Table 3 in Section 3.1.4 of this test report.

3.3.5 Test Results
• The customer did not report any out of specification structural or operational issues during the performance of the Z-axis or X-axis of this test or upon the completion of the Z-axis or X-axis of this test.

• NCEE Labs personnel did not observe any out of specification structural or operational issues during the performance of the Y-axis of this test. During post-test inspection, it was observed that the fan blade of the chassis fan behind the power supply had come loose. No other out of specification structural or operational issues were observed upon the completion of the Y-axis of this test.

3.3.6 Representative Photographs
• Representative photographs of this test are shown in Section 3.1.6 of this test report.

3.3.7 Representative Shock Plots
• Representative shock plots begin on the next page.