AMENDED TCG NEBS COMPLIANCE TEST REPORT FOR:

Crenlo Inc.
1600 Fourth Avenue N. W.
Rochester, MN 55901

Product: 055210 Frame Assembly

EARTHQUAKE (ZONE 4)

Section 4.4.1 and 4.4.2, GR-63-CORE
Telcordia Technologies' Issue 2, April 2002

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REASON FOR ADMENDMENT

This report has been amended due to the following reasons:

1. The detail of the total weight was modified to report the weight of the actual shelving, which was 80 lbs. This was modified on pages 8 and 15.
2. The details for the test results of Objective **O4-49 [113]** were corrected to show correct top cable network weight used. Both configurations originally listed the cable network weight as 100 lbs but should have listed one configuration as 50 lbs. The sentence structure was also changed to help improve the readability of the text. The text was modified to list the 100 lbs cable network configuration first, which was the first test performed.
3. The following sentence was added to the note listed on page 18:
    - The testing in the side-to-side orientation using the 100 lbs and 50 lbs cable network weight was performed sequentially.
4. The statement that indicated, incorrectly, that the first additional side-to-side swept sine test was not recorded, was modified. The sentence that described that it was not recorded was changed to show that it was recorded.

TEST RESULTS SUMMARY

The 055210 Frame Assembly was **compliant** with all mechanical criteria of Section 4.4.1 and 4.4.2 of GR-63-CORE. The 055210 Frame Assembly was tested in three orientations; front-to-back, side-to-side, and vertical. After the 055210 Frame Assembly was judged to be compliant with all mechanical criteria of Section 4.4.1 and 4.4.2 of GR-63-CORE, it was subjected to additional testing in the side-to-side orientation. It was the opinion of the Intertek Seismic Engineer that the cabinet was weaker in the side-to-side orientation compared to the test data gathered up to this point in testing. The additional testing was performed to determine the cabinets' characteristics using a less weight to simulate the cable network on the top of the frame and the addition of generic plates added to the rear-mounting flange of the cabinet.

Column Heading Definitions for Summary of Test Results Table

The following Summary of Test Results table contains these columns of information:

- **Section** column gives the Section numbers from GR-63-CORE.
- **Section Name** column gives the Section name from GR-63-CORE.
- **Criteria** column gives the local number of the requirement (e.g., R3-1) from GR-63-CORE and the absolute number of the requirement (e.g., [2]).
- **Results** column gives the results of the evaluation (Compliant, Non-compliant, etc.).
    - **Compliant:** The 055210 Frame Assembly met the requirements of the corresponding criteria.
    - **Non-compliant:** The 055210 Frame Assembly did not meet the requirements of the corresponding criteria.
    - **NA:** The criteria were Not Applicable to the 055210 Frame Assembly.
    - **ENR:** An Evaluation, to these criteria, was Not Requested by the customer.
- **Comments** column gives an explanation if the results are non-compliant or not applicable.
- **Page** column gives the page number, in this report, for the corresponding criteria.

Table 1: Earthquake Summary of Test Results

Section	Section Name	Criteria	Results	Comments	Page
4.4.1	**Earthquake**	-	-	-	-
4.4.1.2	Physical Performance Criteria	R4-46 [110]	**Compliant**	-	13
		R4-47 [111]	**Compliant**	-	13
		R4-48 [112]	**Compliant**	-	13
		O4-49 [113]	**Non-compliant**	The 055210 Frame Assembly did not meet the objective for a natural mechanical frequency greater than 6.0 Hz in the side-to-side orientation for both configurations tested.	13
4.4.1.3	Functional Performance	R4-50 [114]	**NA**	The 055210 Frame Assembly had no functional components. The 055210 Frame Assembly was only evaluated for mechanical criteria.	13
		O4-51 [115]	**NA**		13
4.4.2	Framework and Anchor Criteria	O4-52 [116]	**Compliant**	-	24
		R4-53 [117]	**Compliant**	-	24
		O4-54 [118]	**Compliant**	-	24
		R4-55 [119]	**NA**	These criteria pertain to concrete anchors. During this evaluation, no concrete anchors were evaluated for compliance.	24
		O4-56 [120]	**NA**		24
		O4-57 [121]	**NA**		24

OVERVIEW

Project Objective

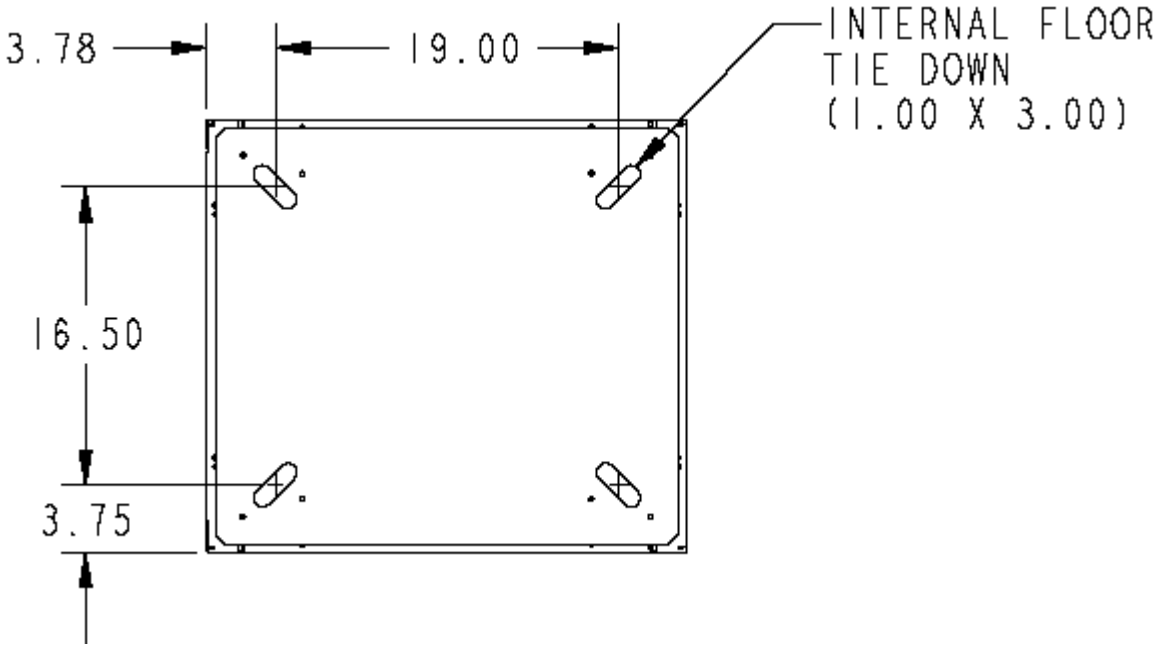
Testing was performed to determine if the 055210 Frame Assembly met the applicable criteria for Section 4.4.1, *Earthquake,* and Section 4.4.2, *Framework and Anchor Criteria,* of Telcordia Technologies' GR-63-CORE, Issue 2, April 2002.

Product Description

The 055210 Frame Assembly was a 4-post equipment cabinet with panels covering the side of the cabinet. See Figure 1 for photographs of the 055210 Frame Assembly as tested during this evaluation. The cabinet does not have any front or rear doors. During the testing performed, panels were added to the front of the cabinet to simulate equipment mounted to the front mounting flange. The 055210 Frame Assembly had physical dimensions of 44 inches high, 26.5 inches wide, and 24 inches deep. The 055210 Frame Assembly utilizes 4 internal mounting points to secure the cabinet to the floor. See Figure 2 for a drawing of the internal mounting locations.

Figure 1: 055210 Frame Assembly

Figure 2: Internal Mounting Locations



Equipment Configuration and Test Conditions

The 055210 Frame Assembly was mounted onto a 360-pound aluminum adapter plate, which was secured to the Intertek hydraulic vibration table. The 055210 Frame Assembly was tested using dead weight distributed throughout the cabinet at a specified height by Crenlo Inc. The dead weight was mounted onto shelves manufactured by Crenlo Inc. specifically for testing purposes only. The 055210 Frame Assembly was loaded with 280 lbs of dead weight and 80 lbs for the shelving, a total of 360 lbs. In addition to the internally mounted dead weight, a simulated cable network weight was added to the top of the frame. Testing was performed using both 50 lbs and 100 lbs for the simulated cable network weight. See Figure 3 and Figure 5 for drawings indicating the weight distribution. The 055210 Frame Assembly had a center of gravity of 39.56 inches for the 50 lbs test configuration and 42.75 inches for the 100 lbs test configuration. See Figure 4 and Figure 6 for additional drawings indicating more detail of the test configuration.

Figure 3: Weight Distribution and Shelf Mounting Height - 50 Pound Simulated Cable Network Weight

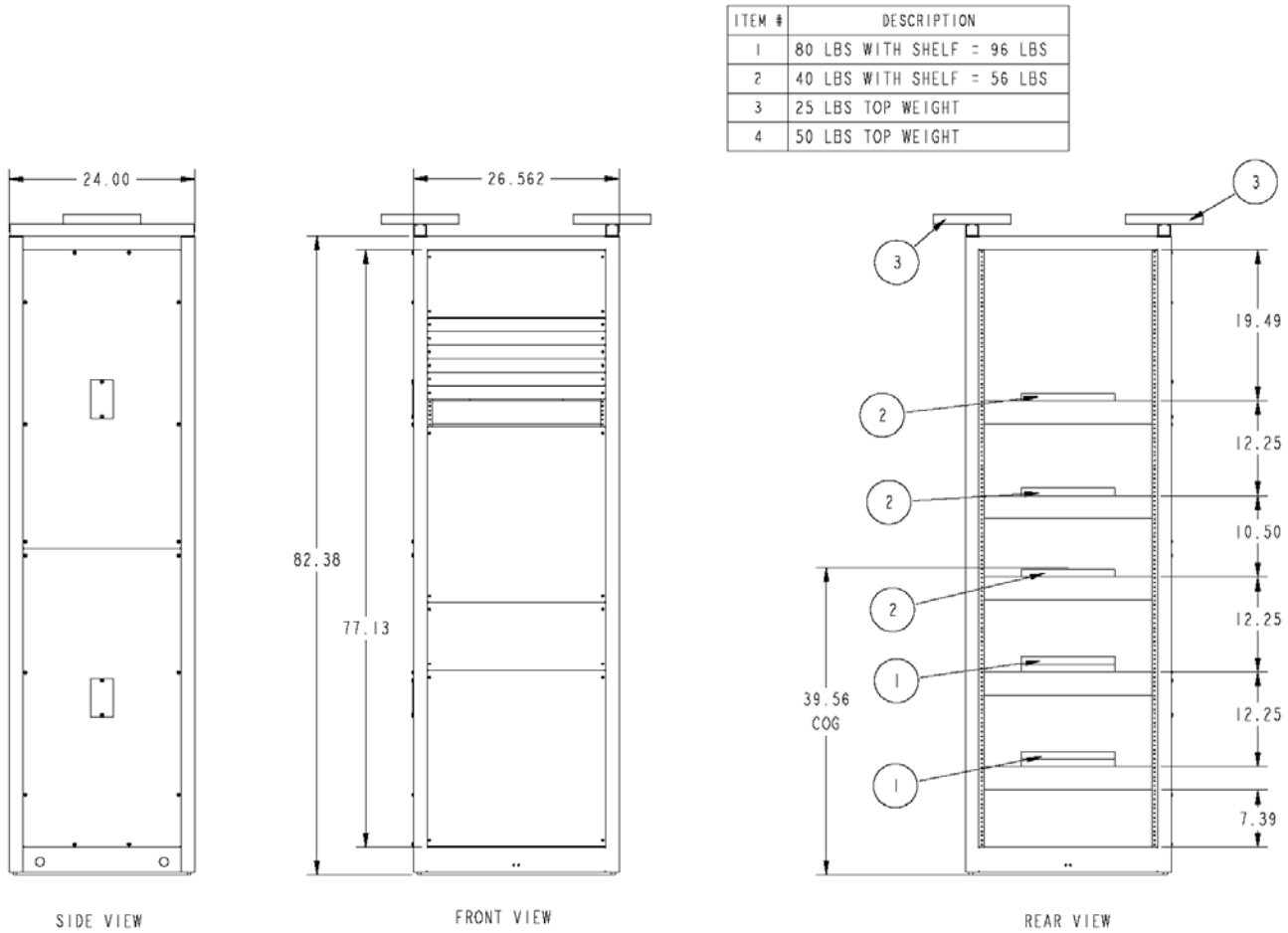


Figure 4: Detailed Drawing of the Test Configuration - 50 Pound Simulated Cable Network Weight

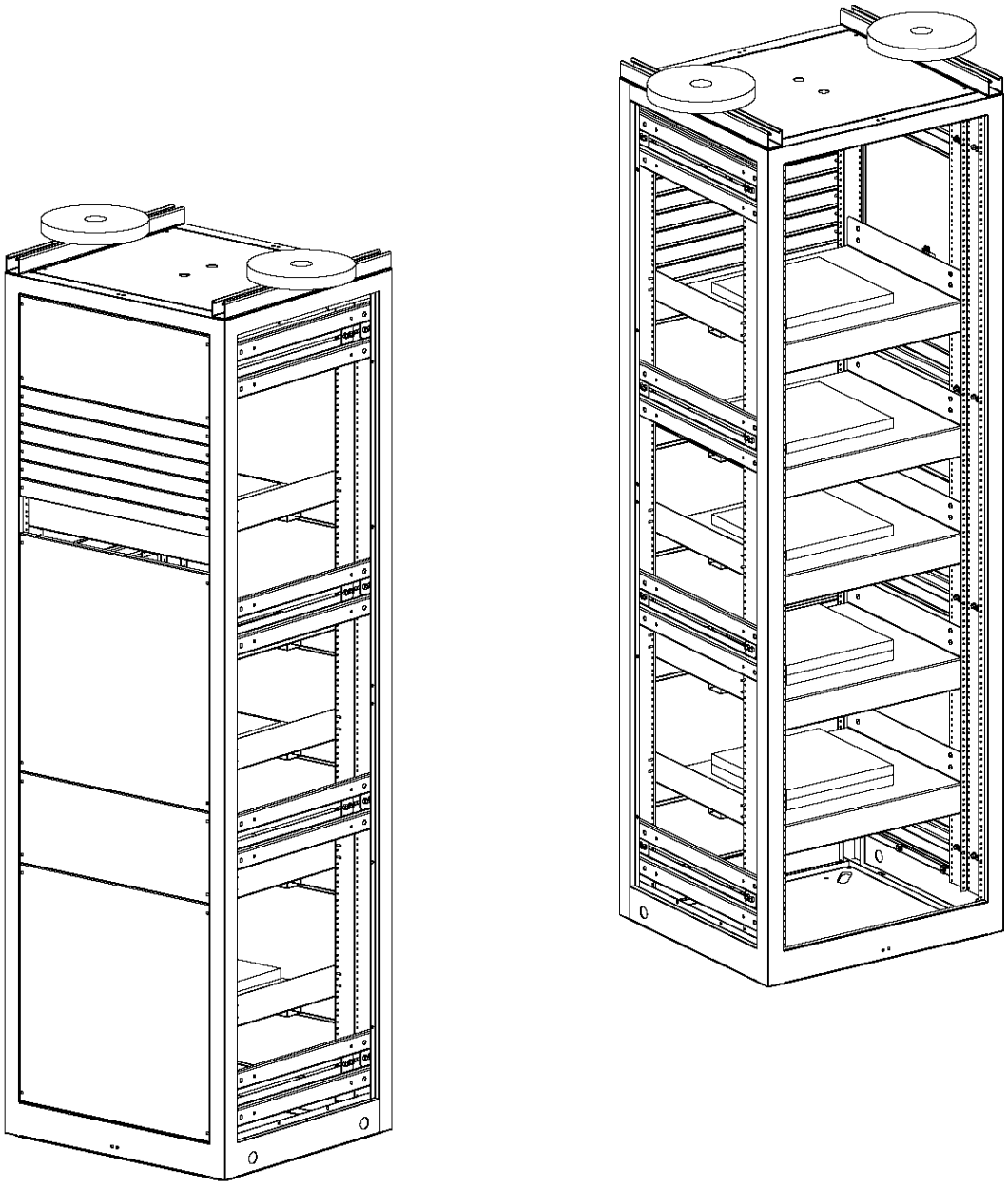


Figure 5: Weight Distribution and Shelf Mounting Height - 100 Pound Simulated Cable Network Weight

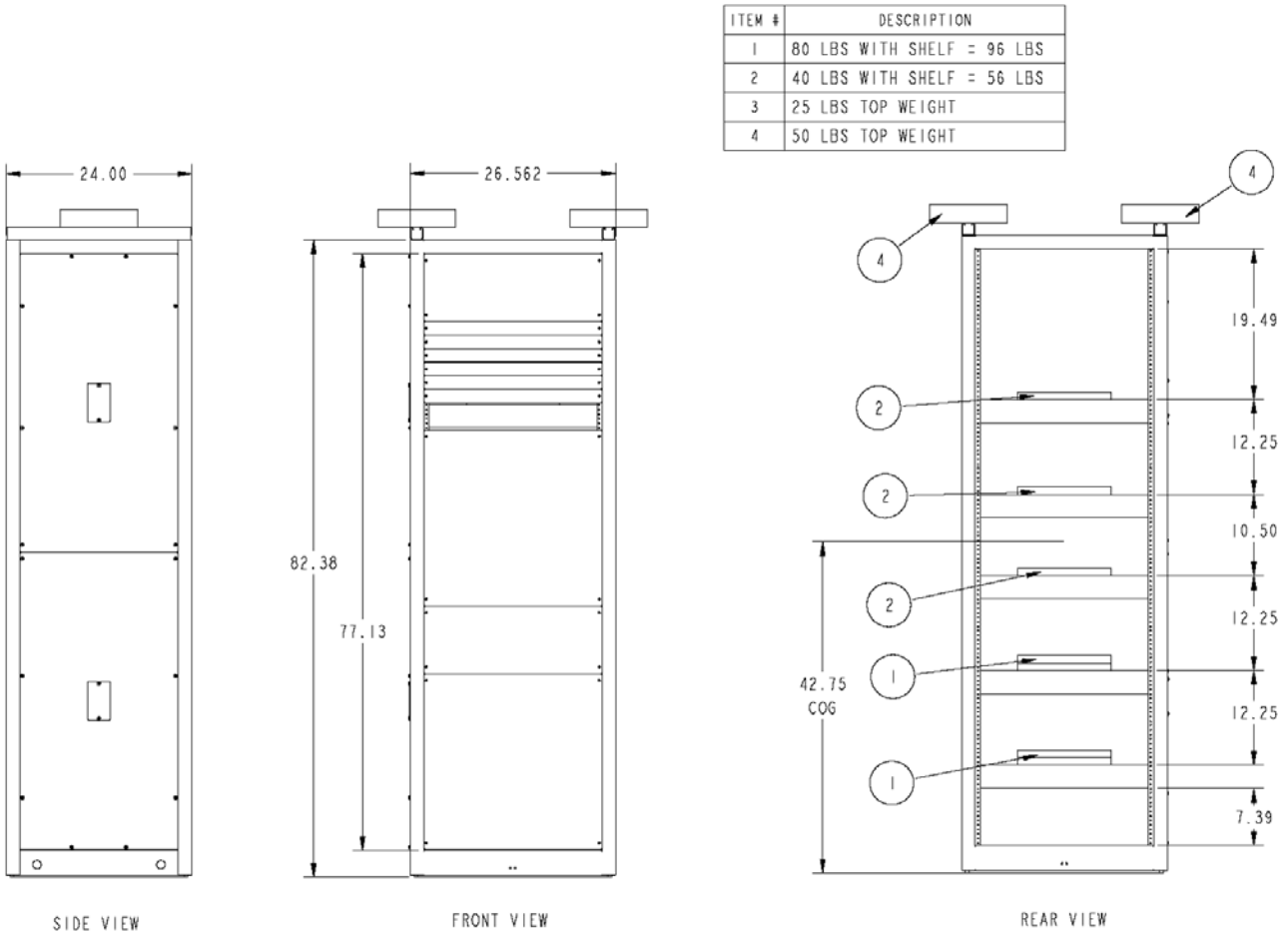
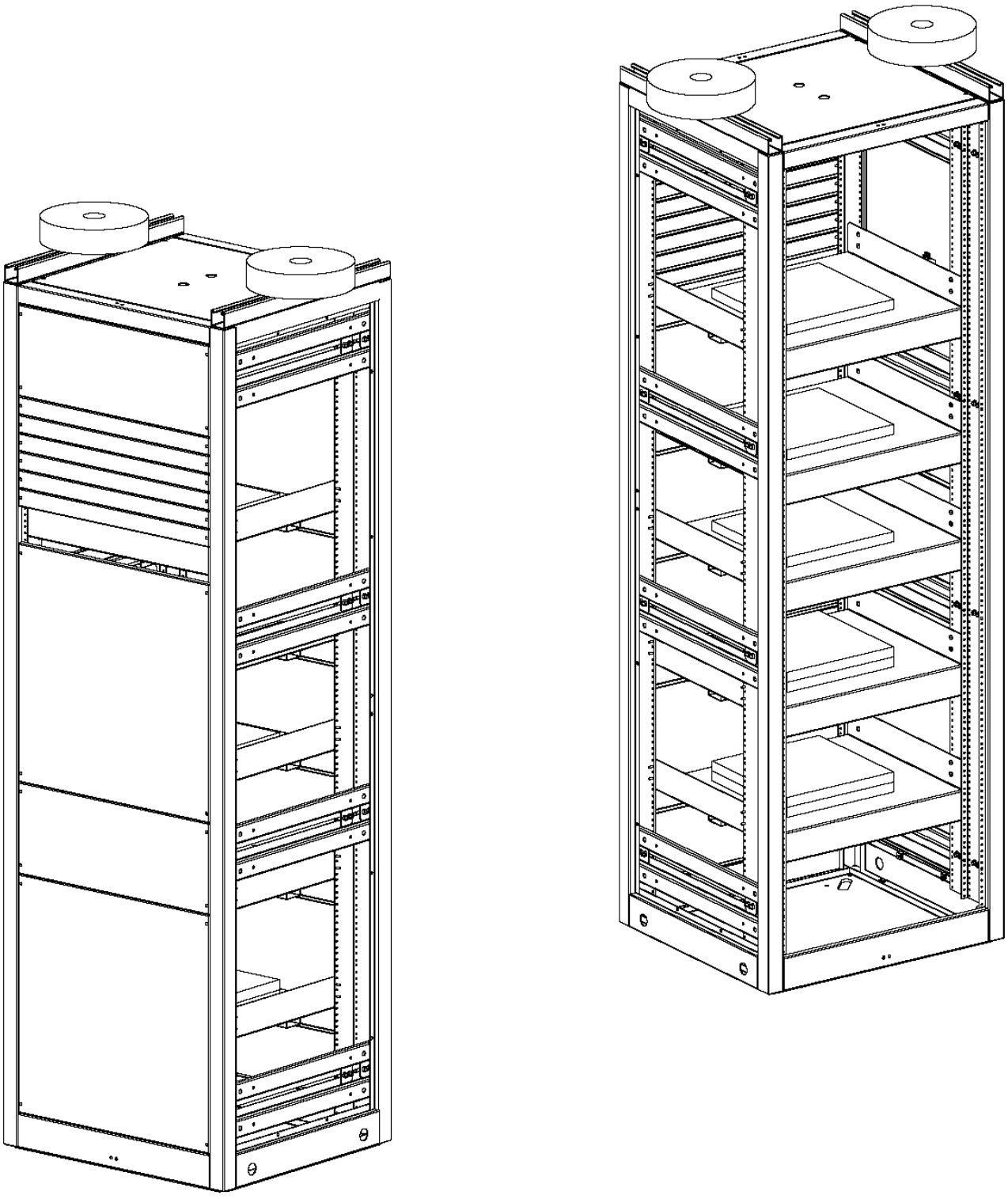


Figure 6: Detailed Drawing of the Test Configuration - 100 Pound Simulated Cable Network Weight



Equipment Operating Conditions

The 055210 Frame Assembly was evaluated for mechanical criteria only. There was no electronic equipment installed inside of the framework during the testing period.

Pass/Fail Criteria

The mechanical pass/fail criteria listed within Sections 4.4.1 and 4.4.2 of GR-63-CORE was utilized for the 055210 Frame Assembly.

EARTHQUAKE ENVIRONMENT AND CRITERIA (4.4.1)

PHYSICAL PERFORMANCE CRITERIA (4.4.1.2)

Criteria:

During this test, only the equipment shelf's physical performance is considered. Permanent structural or mechanical damage of the framework or its fastening hardware would not constitute a failure, but may invalidate the test.

Permanent structural damage is defined as deformation of any load-bearing element of the equipment being tested, or any connection failure. Typical examples of permanent structural damage are bent or buckled uprights, deformed bases, cracks, and failed anchors or fastening hardware.

Mechanical damage is defined as any dislocation or separation of components. Examples of mechanical damage are disengaged cards and modules, and opened (ajar) doors, drawers, or covers.

R4-46 [110] All equipment shall be constructed to sustain the waveform testing of Section 5.4.1 without permanent structural or mechanical damage.

R4-47 [111] Frame-level equipment shall be constructed so that during the waveform testing of Section 5.4.1, the maximum single-amplitude deflection at the top of the framework, relative to the base, does not exceed 75 mm (3 in).

R4-48 [112] Frame-level equipment shall have a natural mechanical frequency greater than 2.0 Hz as determined by the swept sine survey of Section 5.4.1.

O4-49 [113] Frame-level equipment should have a natural mechanical frequency greater than 6.0 Hz as determined by the swept sine survey of Section 5.4.1.

FUNCTIONAL PERFORMANCE (4.4.1.3)

Criteria:

The criteria for assessing functionality depends on the service provided by the equipment being tested. The criteria are determined by applying appropriate Telcordia generic requirements or, if none exist, by reviewing the supplier's or purchaser's own performance specifications.

R4-50 [114] All equipment shall be constructed to meet applicable functionality requirements immediately before and after each axis of waveform testing of Section 5.4.1. The equipment shall sustain operation without replacement of components, manual rebooting, or human intervention.

O4-51 [115] All equipment should be constructed to meet applicable functionality requirements continuously during waveform testing of Section 5.4.1. These functionality criteria shall demonstrate that the equipment has sustained operation without loss of service during the testing.

Test Location:

The following evaluation was performed by Brian D. McFarland on 6/29/2005 at Intertek, located at 731 Enterprise Drive, in Lexington, Kentucky 40510.

Test Method:

Waveform Test Procedure (5.4.1.5)

Note: Testing was initiated in the side-to-side orientation as it was agreed to be the weaker of the three axes for testing purposes.

The following procedure was used for side-to-side, front-to-back, and vertical framework axes:

1. The 055210 Frame Assembly was subjected to a low-level sine sweep during Tests 1, 4, and 6 to verify the resonance point was greater than 2 Hz, as outlined in Requirement **R4-48 [112]**. The frequency was swept from 1 to 50 Hz at a sweep rate of 1.0 octave per minute with an acceleration level of 0.2 g. Recordings of the table, mid-level, and top transducers are shown in Appendix A.

2. The 055210 Frame Assembly was verified for functionality as outlined in Requirement **R4-50 [114]** and Objective **O4-51 [115]**, and the physical condition was verified as described in Requirements **R4-46 [110]**, **R4-47 [111]**, and **R4-48 [112]** and Objective **O4-49 [113]**.

3. The 055210 Frame Assembly was subjected to the Zone 4 acceleration-time waveform, VERTEQII of GR-63-CORE during Tests 2, 3, 5, and 7. A Test Response Spectra (TRS) was generated by analyzing the time domain acceleration data measured at the control accelerometer located on the table. The TRS must have met or exceeded the Required Response Spectrum (RRS) for Earthquake Risk Zone 4 in the range from 1.0 to 50 Hz. The error is the ratio of the TRS to the RRS in decibels (dB). Test results may be invalid if the TRS exceeds the RRS by more than 2.28 dB (30 percent) in the frequency range 1 to 7 Hz.

4. The equipment was thoroughly inspected and all changes in physical condition were noted. In conjunction with the inspection, a video was taken before and during the test. Table 2 identifies details of the videotape.

5. Anchor or fastener's torque was recorded as 45 ft-lbs.

Table 2: Video Test Log

Test Number	Taped	Date	Time	Remarks
1	Yes	6/29/2005	00:00:07	Side-to-Side Swept Sine (100 lbs)
2	Yes	6/29/2005	00:45:40	Side-to-Side Earthquake at 0 dB (full-power) (100 lbs)
3	Yes	6/29/2005	02:34:35	Side-to-Side Swept Sine (50 lbs)
4	Yes	6/29/2005	02:48:24	Side-to-Side Earthquake at 0 dB (full-power) (50 lbs)
5	Yes	6/29/2005	03:19:32	Front-to-Back Swept Sine (50 lbs)
6	Yes	6/29/2005	03:32:48	Front-to-Back Earthquake at 0 dB (full-power) (50 lbs)
7	Yes	6/29/2005	03:46:18	Front-to-Back Swept Sine (100 lbs)
8	Yes	6/29/2005	04:07:19	Front-to-Back Earthquake at 0 dB (full-power) (100 lbs)
9	Yes	6/29/2005	04:45:05	Vertical Swept Sine (100 lbs)
10	Yes	6/29/2005	05:00:21	Vertical Earthquake at 0 dB (full-power)

The 055210 Frame Assembly was mounted onto a 360-pound aluminum adapter plate, which was secured to the Intertek hydraulic vibration table. The 055210 Frame Assembly was tested using dead weight distributed throughout the cabinet at a specified height by Crenlo Inc. The dead weight was mounted onto shelves manufactured by Crenlo Inc. specifically for testing purposes only. The 055210 Frame Assembly was loaded with 280 lbs of dead weight and 80 lbs for the shelving, a total of 360 lbs. In addition to the internally mounted dead weight, a simulated cable network weight was added to the top of the frame. Testing was performed using both 50 lbs and 100 lbs for the simulated cable network weight. See Figure 3 and Figure 5 for drawings indicating the weight distribution. The 055210 Frame Assembly had a center of gravity of 39.56 inches for the 50 lbs test configuration and 42.75 inches for the 100 lbs test configuration. See Figure 4 and Figure 6 for additional drawings indicating more detail of the test configuration.

An accelerometer was mounted on a 1.5-inch x 1.5-inch x 4-inch block on the table, close to the rack. Two other accelerometer transducers were mounted using magnetic mounting hardware midway (approximately 42 inches) up on the rack and on top of the rack. A displacement transducer was mounted at the top of the framework and a load bolt was used to secure the framework to the table.

Data from all transducers are recorded by a multiple-channel system for processing dynamic data in both the time and frequency domains and stored onto a computer for analysis.

Figure 7: Front View of the 055210 Frame Assembly

Figure 8: Rear View of the 055210 Frame Assembly

Test Results:

The 055210 Frame Assembly was **compliant** with Requirement **R4-46 [110]** for both configurations. There was no permanent structural or mechanical damage to the frame.

The 055210 Frame Assembly was **compliant** with Requirement **R4-47 [111]** for both configurations. The 055210 Frame Assembly maximum single-amplitude deflection at the top of the framework, relative to the base, did not exceed 75 mm (3 in.). The 055210 Frame Assembly had a maximum displacement of 0.41 inches in the front-to-back orientation and 2.87 inches[1] in the side-to-side orientation using the 50 lbs cable network weight. The 055210 Frame Assembly had a maximum displacement of 0.53 inches in the front-to-back orientation and 2.82 inches in the side-to-side orientation using the 100 lbs cable network weight. Figure 9 through Figure 12 show the displacement during the waveform testing for the frame.

The 055210 Frame Assembly was **compliant** with Requirement **R4-48 [112]** for both configurations. The 055210 Frame Assembly had a natural mechanical frequency greater than 2.0 Hz.

The 055210 Frame Assembly was **non-compliant** with Objective **O4-49 [113]** for both configurations. The 055210 Frame Assembly did not meet the objective for a natural mechanical frequency greater than 6.0 Hz in the side-to-side orientation for both configurations tested. The 055210 Frame Assembly had a natural mechanical frequency of 8.97 Hz in the front-to-back orientation and 4.67 Hz in the side-to-side orientation using the 100 lbs cable network weight. The 055210 Frame Assembly had a natural mechanical frequency of 9.89 Hz in the front-to-back orientation and 4.29 Hz in the side-to-side orientation using the 50 lbs cable network weight.

Requirement **R4-50 [114]** and Objective **O4-51 [115]** were **not applicable** to the 055210 Frame Assembly in both configurations. The 055210 Frame Assembly was only evaluated for mechanical criteria and had no functional components installed within the cabinet.

Note: Testing was initiated in the side-to-side axis because this orientation was judged to be weakest structurally compared to the other two axes. The test results in the side-to-side orientation are similar between the 50 lbs and 100 lbs configurations. The testing in the side-to-side orientation using the 100 lbs and 50 lbs cable network weight was performed sequentially. This is believed to be a direct result of having the center of gravity at the optimum height with the weight loading shown in Figure 3 and Figure 5.

[1] The displacement of 2.87 inches was recorded using a frame that was previously subjected to the side-to-side test with a 100 lbs cable network weight. Additional testing was performed as shown in the Additional Testing Performed on page 27. The additional testing was performed using a fresh 055210 Frame Assembly and subjected to the seismic profile in the side-to-side orientation to record data without the additional stress of the previous test subjected to the framework. The additional test produced a side-to-side displacement of 2.83 inches.

Figure 9: Front-to-Back Displacement - 50 lbs Cable Network Weight

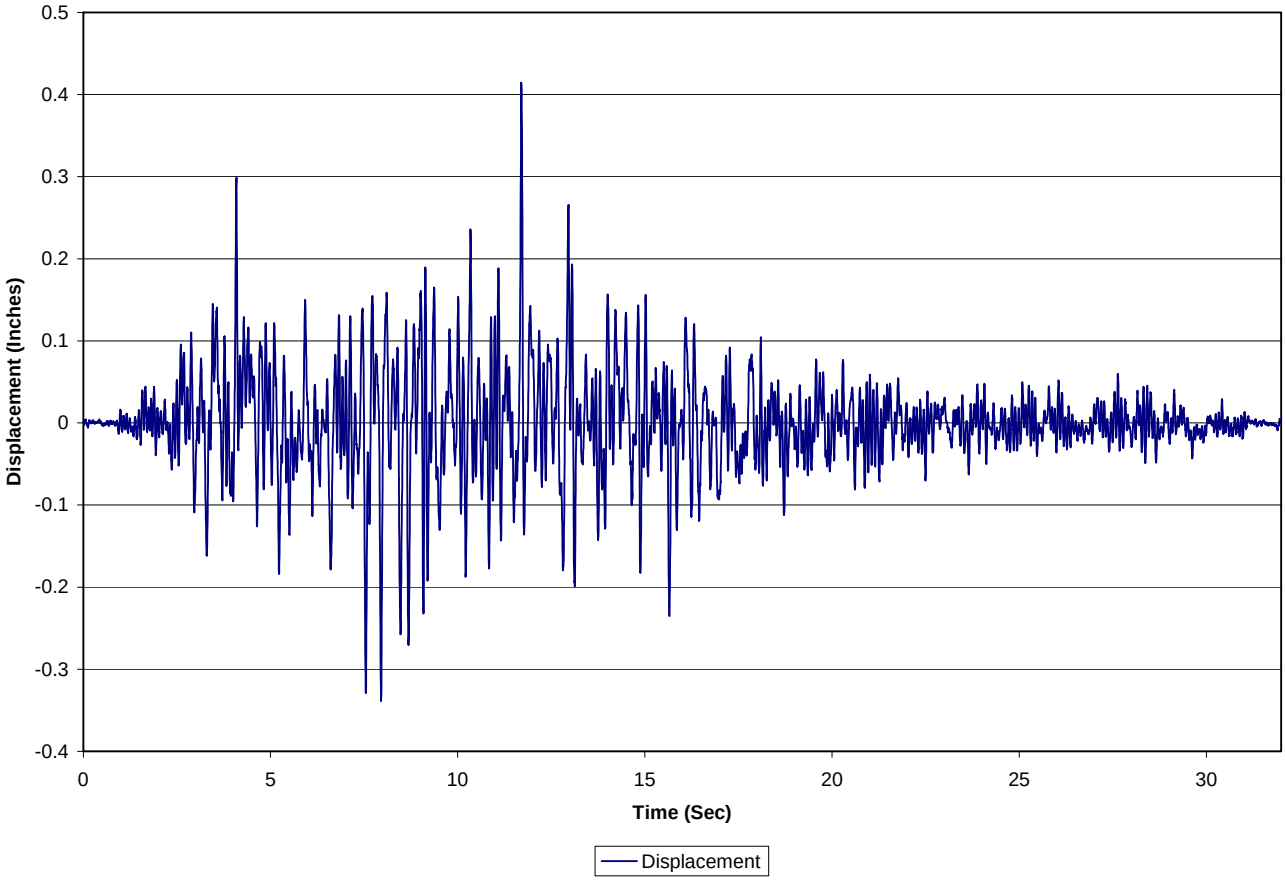


Figure 10: Side-to-Side Displacement - 50 lbs Cable Network Weight

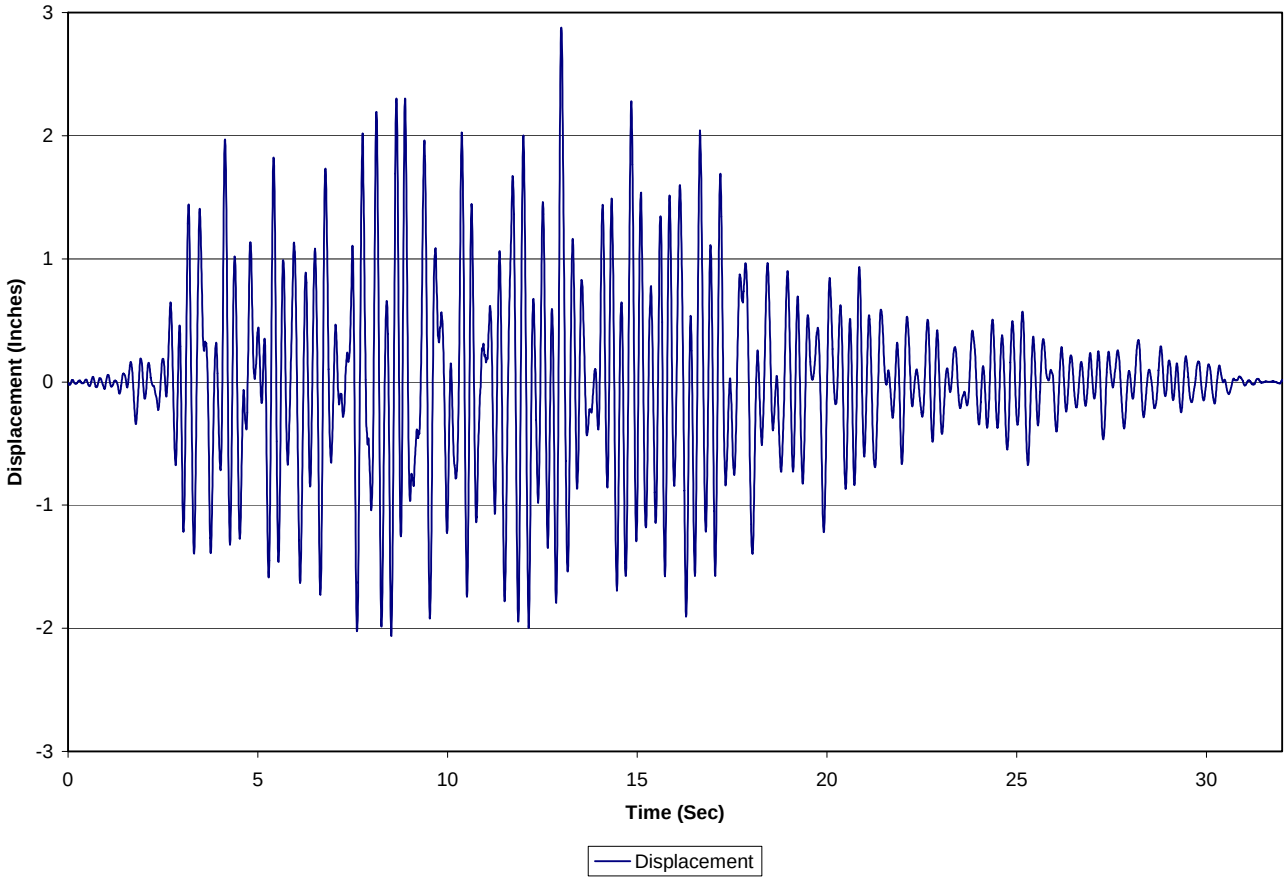


Figure 11: Front-to-Back Displacement - 100 lbs Cable Network Weight

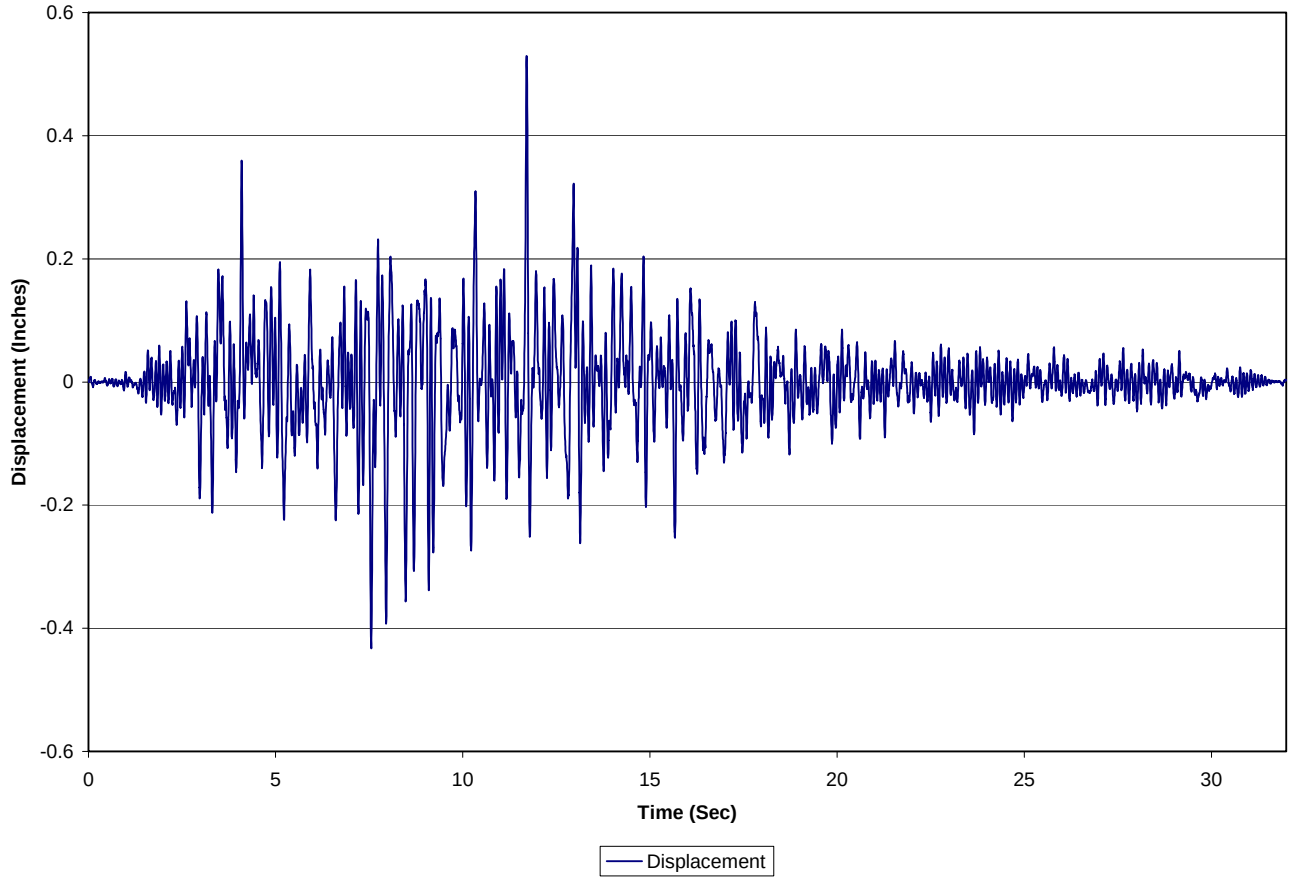
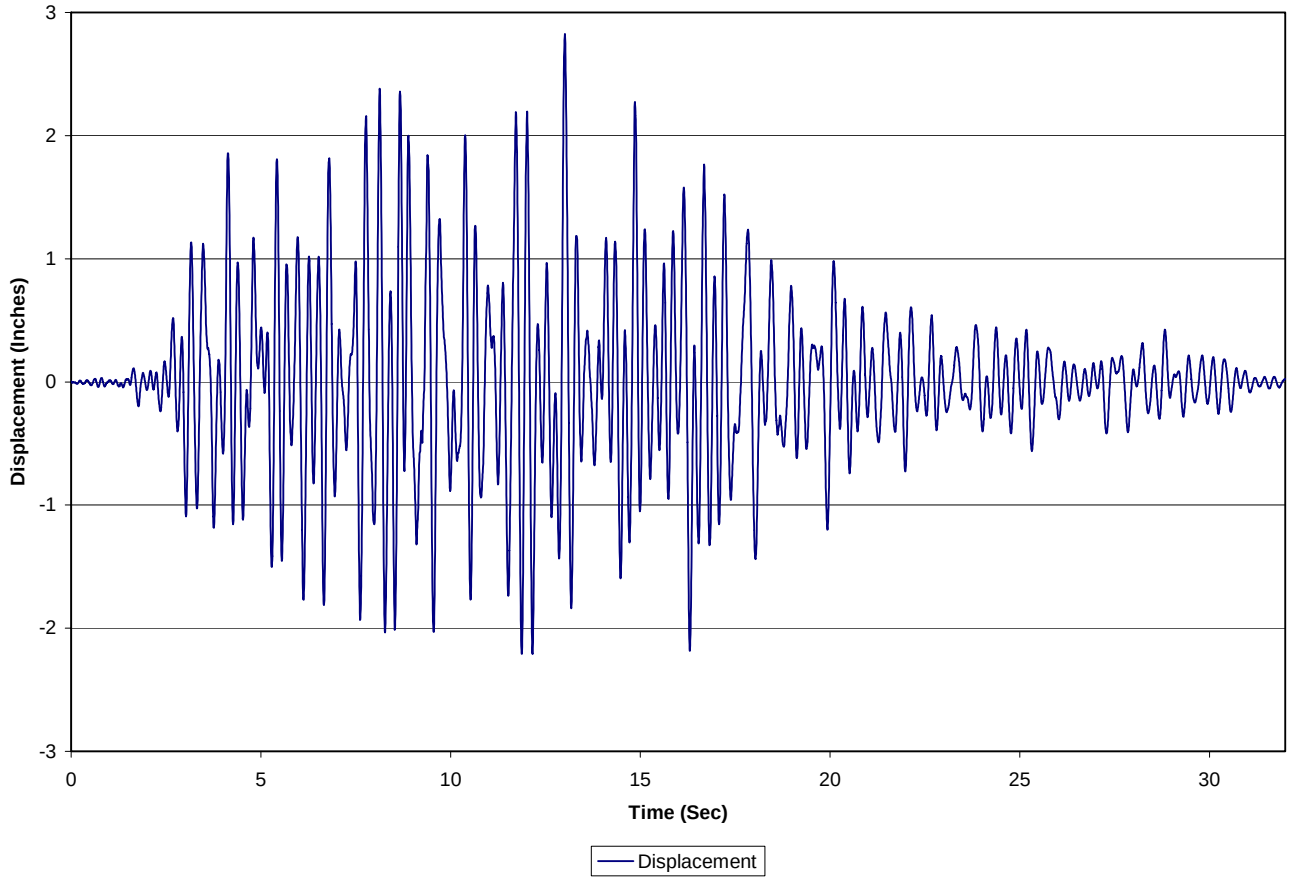


Figure 12: Side-to-Side Displacement - 100 lbs Cable Network Weight



Test Equipment Used:

Table 3: Earthquake Environment Detailed List of Test Equipment

Description	Intertek Number	Manufacturer	Model	Calibration Date	Calibration Due Date
Controller and Measurement System	2438	Spectral Dynamics	PUMA	6/1/2005	6/1/2006
80/5.5 Horizontal Amplifier	2107	Team	4050500		
90/5.5 Vertical Amplifier	2108	Team	4050500		
Hydraulic Power Supply	2093	Team	HPS-230F		
Horizontal Actuator	2090	Team	80/5.5		
Horizontal Slip Table	2092	Team	483.48-16		
Vertical Actuator	2089	Team	90/5.5		
Control Accelerometer	3040	PCB	393A03	2/17/2005	2/17/2006
Mid Accelerometer	2464	PCB	352C34	3/28/2005	3/28/2006
Top Accelerometer	2463	PCB	352C34	6/20/2005	6/20/2006
Load Bolt	-	Omega	LCS-1/2-2L	Time of Use	
Strain Gauge	1869	Measurement Group	3800	Time of Use	
Top Displacement Transducer	3077	Celesco	PT101-0020-111-1110	1/28/2005	1/28/2006

FRAMEWORK AND ANCHOR CRITERIA (4.4.2)

Criteria:

The following criteria apply to all framework and concrete expansion anchors used in network facilities. They are intended to ensure minimum limits for structural performance in earthquake environments are met.

O4-52 [116] Framework should be of welded construction.

R4-53 [117] Framework shall be constructed for base mounting to the floor without auxiliary support or bracing from the building walls or ceilings.

O4-54 [118] For framework used in earthquake risk zones, the static pull testing procedures of Section 5.4.1.4 should be followed, meeting these objectives:

- The maximum single amplitude deflection at the top of the framework should not exceed 75 mm (3 in).
- The top of the framework should return to its original position, within 6 mm (0.24 in) when the load is removed.
- The framework should sustain no permanent structural damage during static framework testing.

R4-55 [119] Concrete expansion anchors used to base mount framework to the floor shall meet the following requirements:

- Maximum embedment depth of 90 mm (3.5 in)
- Maximum bolt diameter of 13 mm (0.5 in).

O4-56 [120] Concrete expansion anchors used to base mount the framework to the floor should be suitable for earthquake (dynamic) applications, as specified by the manufacturer.

O4-57 [121] Concrete expansion anchors should use steel construction to minimize creep.

Test Location:

The following evaluation was performed by Brian D. McFarland on 6/29/2005 at Intertek, located at 731 Enterprise Drive, in Lexington, Kentucky 40510.

Test Method:

For Objective **O4-52 [116]** and Requirement **R4-53 [117]**, the 055210 Frame Assembly framework was inspected for compliance.

For Objective **O4-54 [118]**, the 055210 Frame Assembly was subjected to the static pull testing procedures contained in Section 5.4.1.4 of GR-63-CORE, if it did not meet Requirement **R4-47 [111]**. If the 055210 Frame Assembly was compliant with Requirement **R4-47 [111]**, the static pull testing procedures contained in Section 5.4.1.4 of GR-63-CORE were not performed. The waveform testing of Section 5.4.1 of GR-63-CORE is considered a more severe test.

For Objective **O4-56 [120]**, the peak fastener load was measured using a load bolt during the exposure to the Zone 4 acceleration-time waveform.

Test Results:

The 055210 Frame Assembly was **compliant** with Objective **O4-52 [116]**. The 055210 Frame Assembly was of welded construction.

The 055210 Frame Assembly was **compliant** with Requirement **R4-53 [117]**. The 055210 Frame Assembly was constructed to be mounted to the floor without auxiliary support or bracing from the building walls or ceilings.

The 055210 Frame Assembly was **compliant** with Objective **O4-54 [118]**. The 055210 Frame Assembly was subjected to the waveform of Section 5.4.1 of GR-63-CORE and was **compliant** with Requirement **R4-47 [111]**. Objective **O4-54 [118]** was considered compliant as the criterion of Requirement **R4-47 [111]** was considered a more severe test.

Requirement **R4-55 [119]** was **not applicable** to the 055210 Frame Assembly. This requirement applies to concrete expansion anchors used to base mount the framework. For testing purposes, Intertek utilized 1/2 x 13-inch hardened bolts, which were threaded into a magnesium alloy plate surface or onto an adapter plate that has been drilled and tapped. No concrete anchors were supplied for evaluation purposes.

Objective **O4-56 [120]** was **not applicable** to the 055210 Frame Assembly. There was no mounting hardware submitted for testing. Crenlo Inc. stated that the concrete mounting hardware was to be supplied by the end customer at the time of installation. See the following note for more detail:

- During the evaluation of the 055210 Frame Assembly, a load bolt was utilized to monitor the maximum force applied to the mounting hardware. During the front-to-back orientation, the maximum load measured was approximately 1756 lbs with the 100 lbs cable network weight configuration. During the side-to-side orientation, the maximum load measured was approximately 1480 lbs with the 100 lbs cable network weight configuration. It is the opinion of the Intertek Seismic Engineer that the mounting hardware used to secure the 055210 Frame Assembly in a Zone 4 location, would need to exceed the maximum ultimate tensile strength of 2000 lbs or more. A common concrete anchor for this purpose would be an M12 anchor or equivalent.

Objective **O4-57 [121]** was **not applicable** to the 055210 Frame Assembly. This objective applies to concrete expansion anchors used to mount the base of the framework. During seismic testing, the system framework was mounted on an aluminum plate, which was bolted to the vibration table.

Test Equipment Used:

Table 4: Detailed List of Test Equipment

Description	Intertek Number	Manufacturer	Model	Calibration Date	Calibration Due Date
Controller and Measurement System	2438	Spectral Dynamics	PUMA	6/1/2005	6/1/2006
80/5.5 Horizontal Amplifier	2107	Team	4050500		
90/5.5 Vertical Amplifier	2108	Team	4050500		
Hydraulic Power Supply	2093	Team	HPS-230F		
Horizontal Actuator	2090	Team	80/5.5		
Horizontal Slip Table	2092	Team	483.48-16		
Vertical Actuator	2089	Team	90/5.5		
Control Accelerometer	3040	PCB	393A03	2/17/2005	2/17/2006
Mid Accelerometer	2464	PCB	352C34	3/28/2005	3/28/2006
Top Accelerometer	2463	PCB	352C34	6/20/2005	6/20/2006
Load Bolt	-	Omega	LCS-1/2-2L	Time of Use	
Strain Gauge	1869	Measurement Group	3800	Time of Use	
Top Displacement Transducer	3077	Celesco	PT101-0020-111-1110	1/28/2005	1/28/2006

ADDITIONAL TESTING PERFORMED

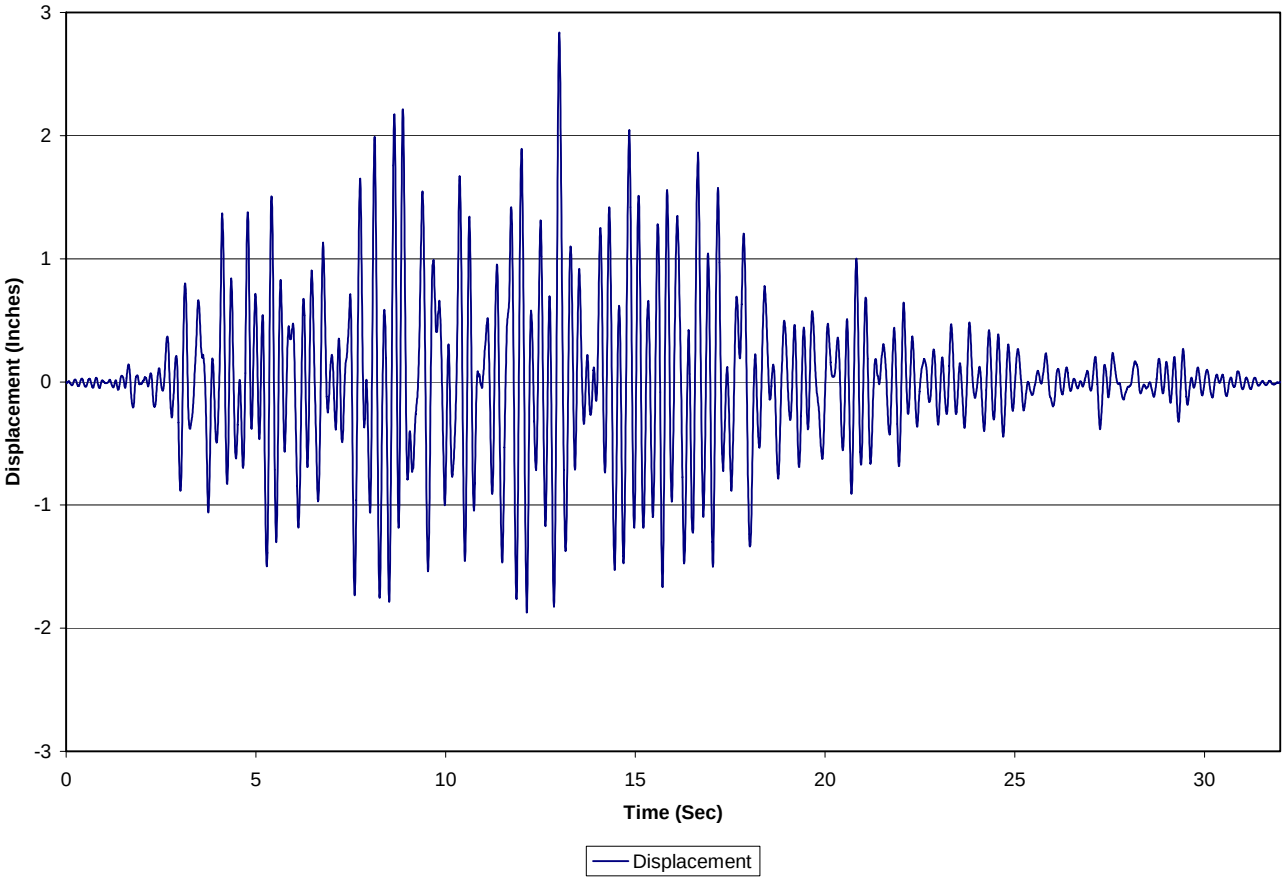
Once the 055210 Frame Assembly was judged to be **compliant** with all mechanical criteria for Zone 4 qualification, additional testing was performed. The additional testing was performed to gather more data regarding cable network weight loading effects to the 055210 Frame Assembly to provide better test results. It was judged by the Intertek Seismic Engineer, that testing would only be performed in the side-to-side orientations for the additional testing. This judgment was made using the previous test results stated in the **Test Results s**ection. The test results in the front-to-back and vertical orientations were sufficient enough for testing from the recorded data shown above for these orientations. As mentioned previously in this report, the side-to-side axis of this cabinet was the weakest axis of this framework. The additional testing was also recorded and can be seen at the end of the videotape provided. See Table 5 for a continuation of the Video Test Log.

Table 5: Video Test Log - Additional Testing

Test Number	Taped	Date	Time	Remarks
11	Yes	6/29/2005	07:21:00	Side-to-Side Swept Sine (New Cabinet with 50 lbs)
12	Yes	6/29/2005	07:34:09	Side-to-Side Earthquake at 0 dB (full-power) (New Cabinet with 50 lbs)
13	Yes	6/29/2005	07:56:05	Side-to-Side Earthquake at 0 dB (full-power) (New Cabinet with 50 lbs and additional dummy plates)
14	Yes	6/29/2005	08:05:23	Side-to-Side Swept Sine (New Cabinet with 50 lbs and additional dummy plates)

Prior to the additional testing, the cabinet was exchanged for a fresh cabinet. The new cabinet was populated using the same weights and shelving as shown in Figure 3 and then mounted to the table. The first additional test was performed in the side-to-side orientation using the 50 lb cable network weight. This test was performed to record data to provide test data in the side-to-side orientation using a frame that was not weakened from previous testing. A swept sine survey was performed and determined that the natural mechanical frequency in this test configuration was 4.83 Hz. The 055210 Frame Assembly was then subjected to the seismic profile. The maximum displacement was measured to be 2.83 inches. This test configuration produced compliant test results for the displacement criteria but was non-compliant for the resonant frequency objective. The 055210 Frame Assembly produced a natural resonant frequency less than the 6.0 Hz objective in the side-to-side orientation. See Figure 13 for a plot of the displacement of the 055210 Frame Assembly as tested in this orientation.

Figure 13: Displacement - Side-to-Side: New Cabinet with 50 lbs Cable Network Weight



The second additional test was performed in the side-to-side orientation using the 50 lb cable network weight with the addition of generic dummy plates added to the rear of the cabinet. It was the opinion of the Intertek Seismic engineer that the addition of rear plates in several locations would improve the characteristics of the cabinet. After locating 4 generic dummy plates in the lab, they were installed on the rear-mounting flange evenly from top to bottom. The 055210 Frame Assembly was subjected to the seismic profile. The maximum displacement was measured to be 2.30 inches. A swept sine survey was then performed and it was determined that the natural mechanical frequency in this test configuration was 4.09 Hz. This test configuration produced compliant test results for the displacement criteria but still produced a natural resonant frequency less than the 6.0 Hz objective in the side-to-side orientation. See Figure 14 for a plot of the displacement of the 055210 Frame Assembly as tested in this orientation. See Figure 15 for a photograph of the 055210 Frame Assembly with the dummy panels installed on the rear-mounting flange.

Figure 14: Displacement - Side-to-Side: New Cabinet with 50 lbs Cable Network Weight and Generic Dummy Plates

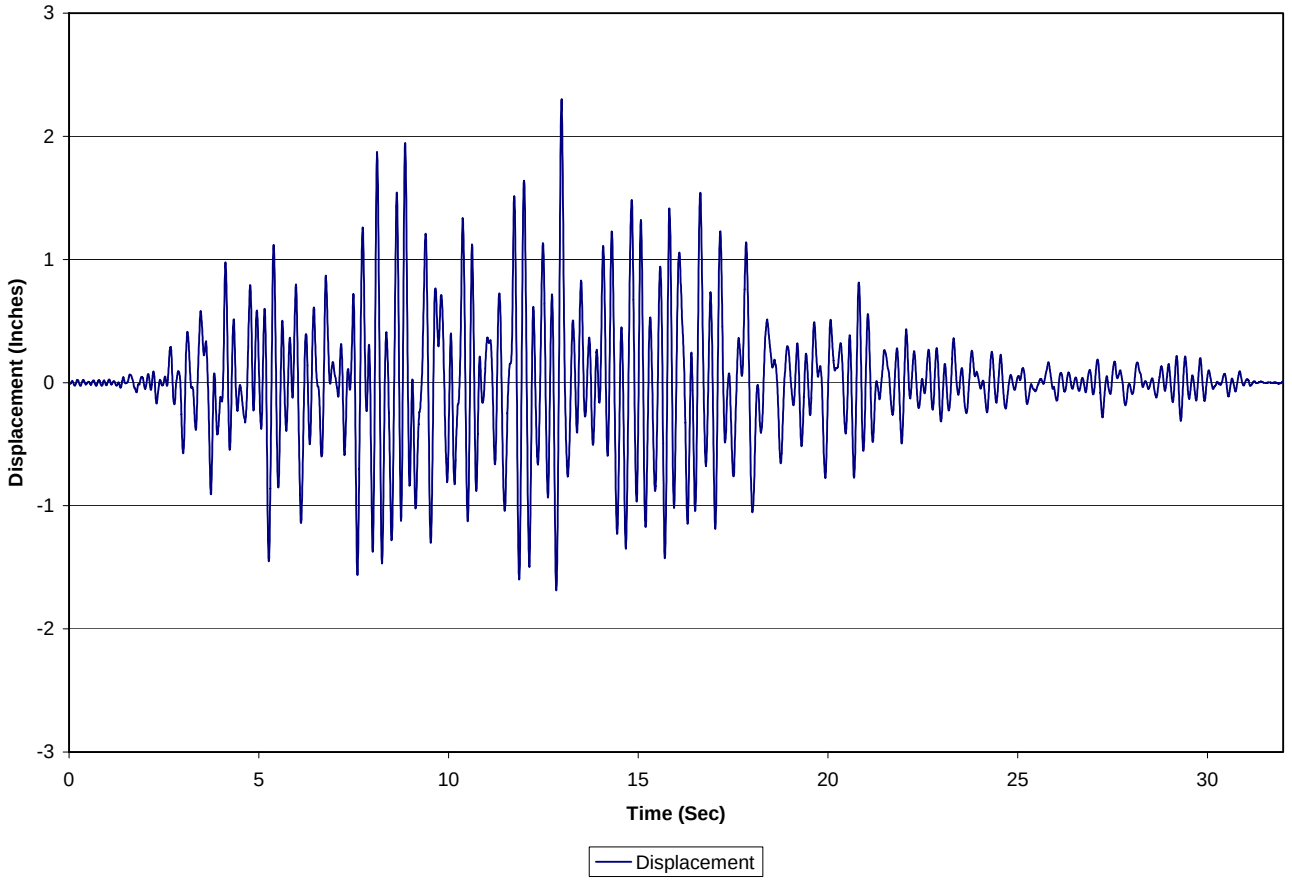


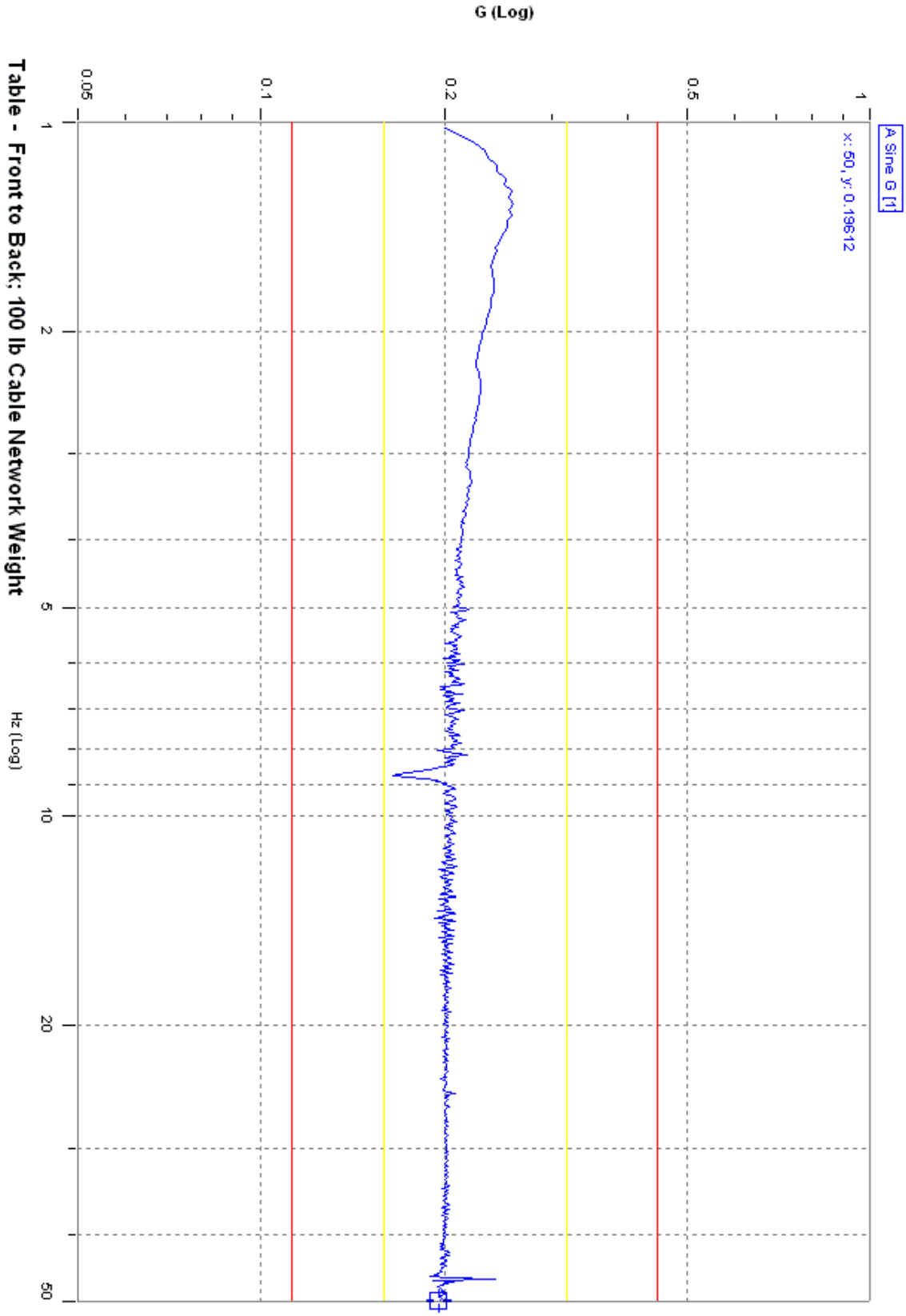
Figure 15: 055210 Frame Assembly with Rear-Mounted Dummy Panels

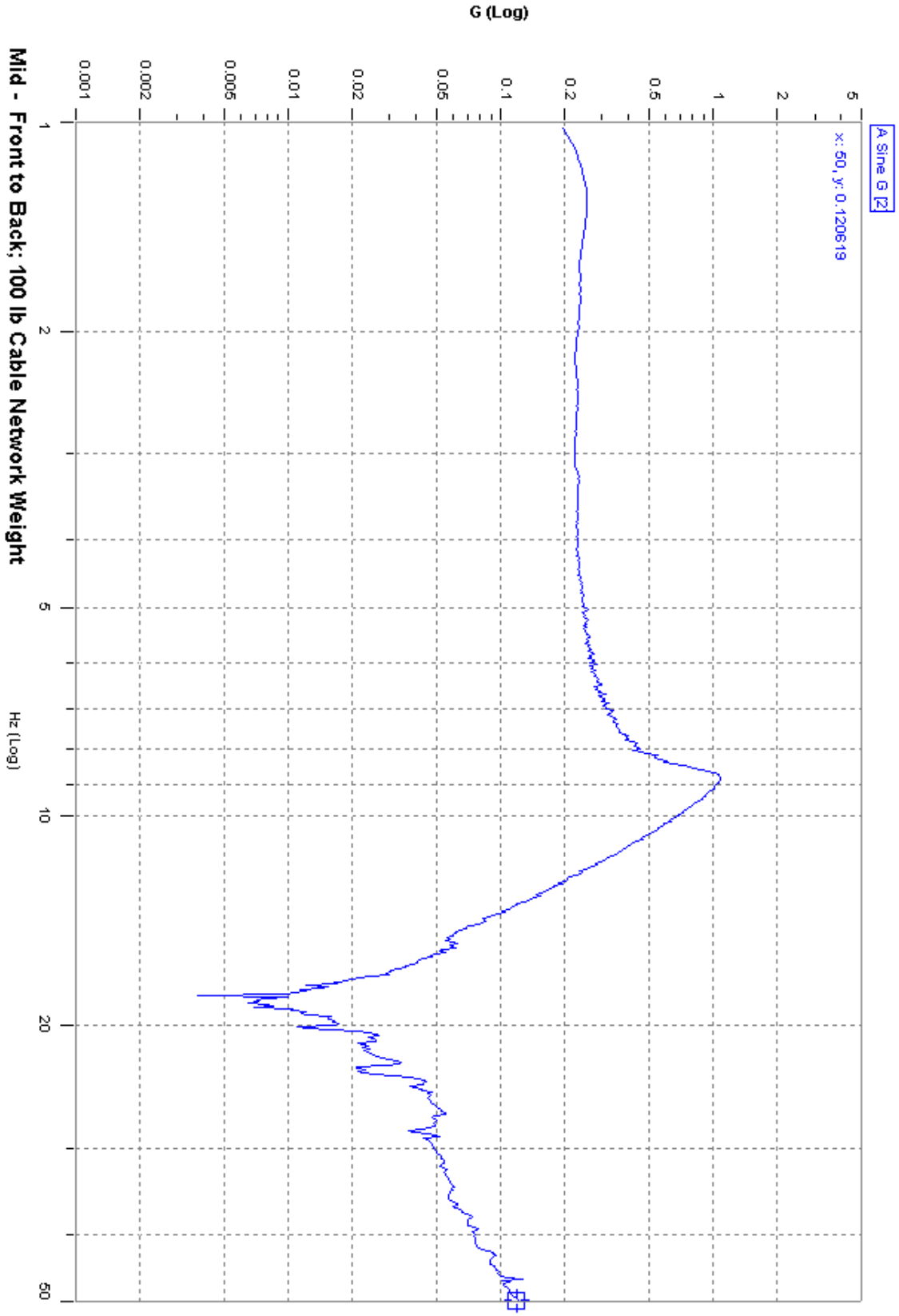
Summary of Additional Testing Performed

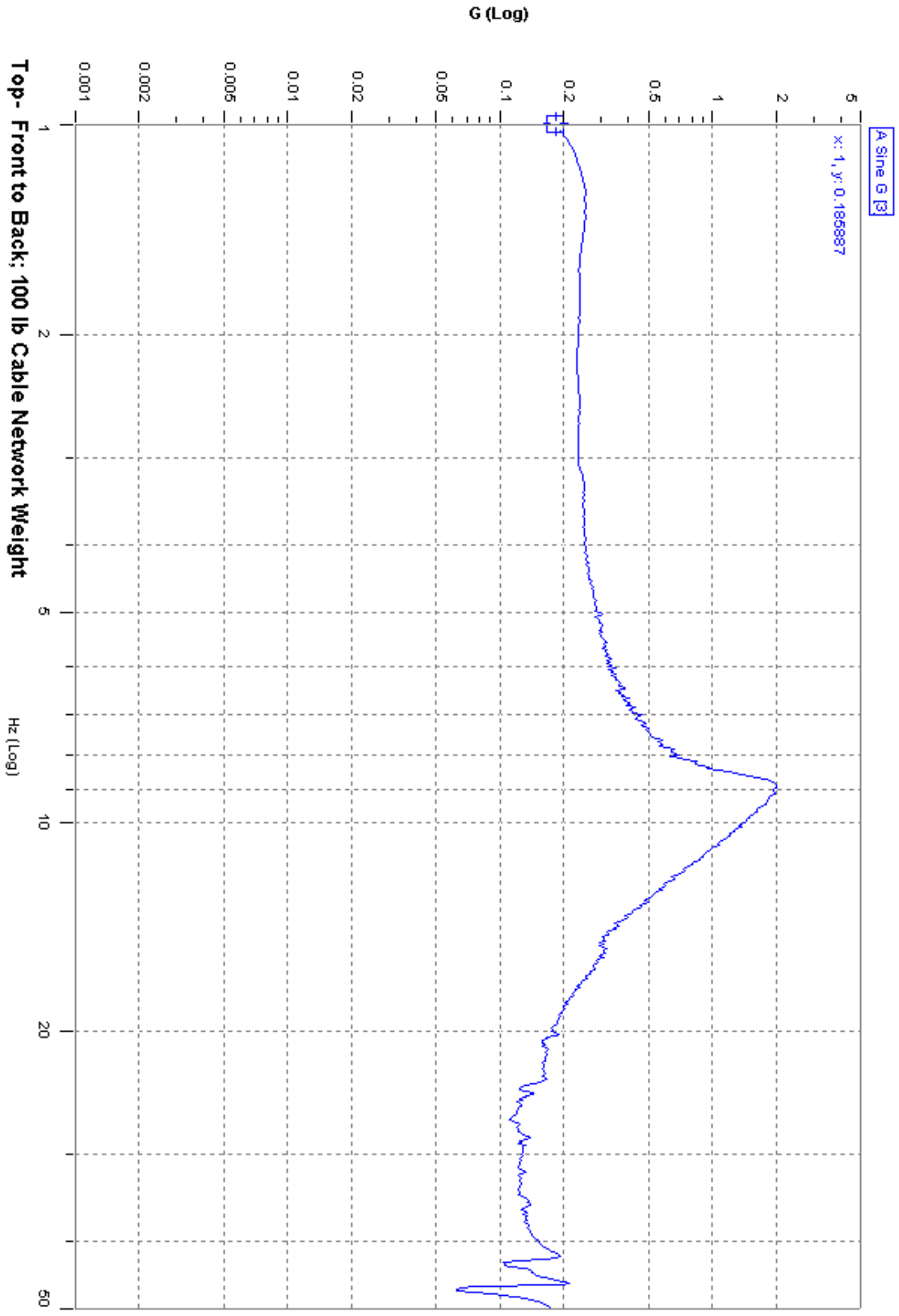
The test results monitored during additional testing were within the stated criteria of Section 4.4.1 and 4.4.2 of GR-63-CORE with the exception of the resonant frequency objective.

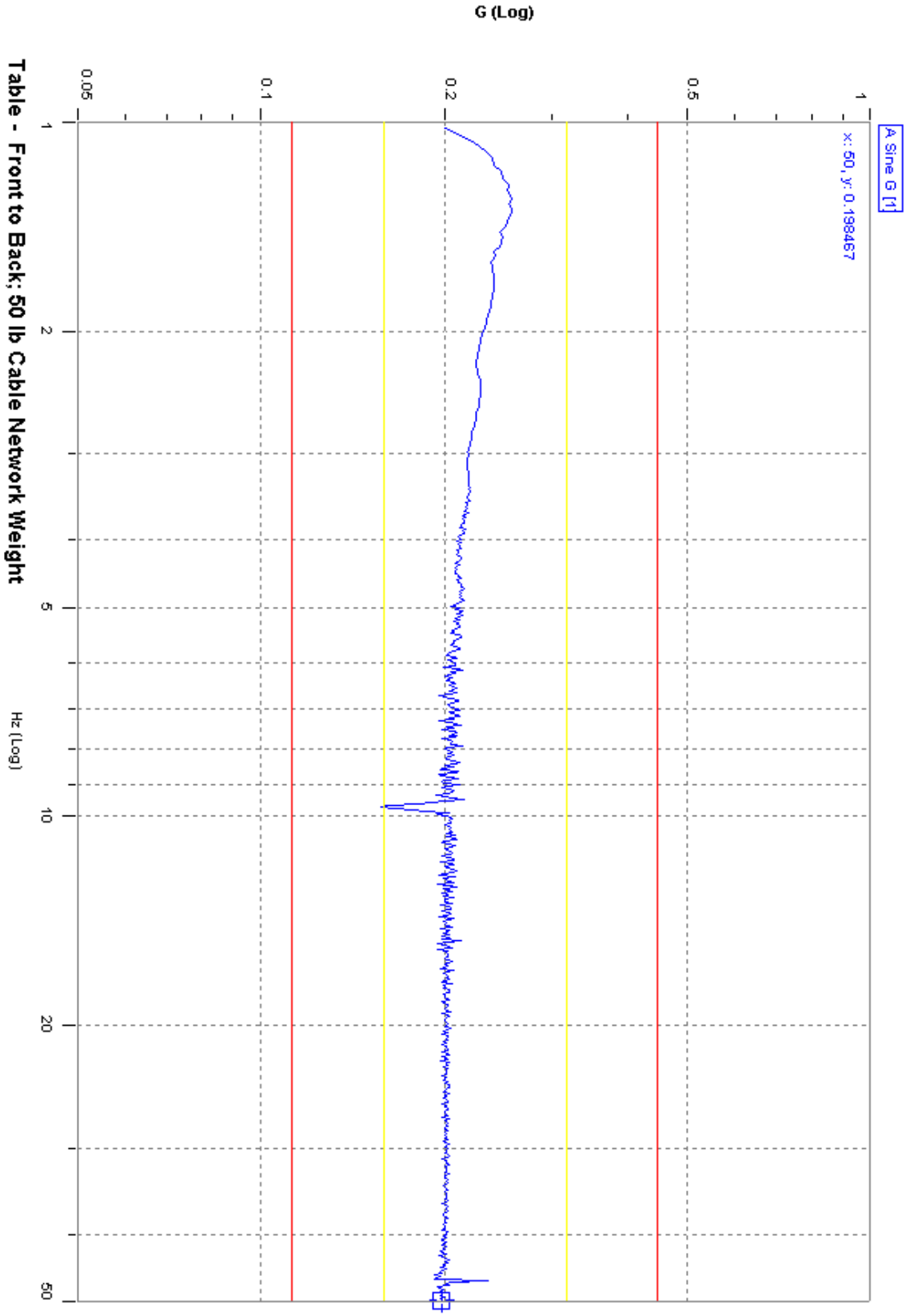
APPENDIX A

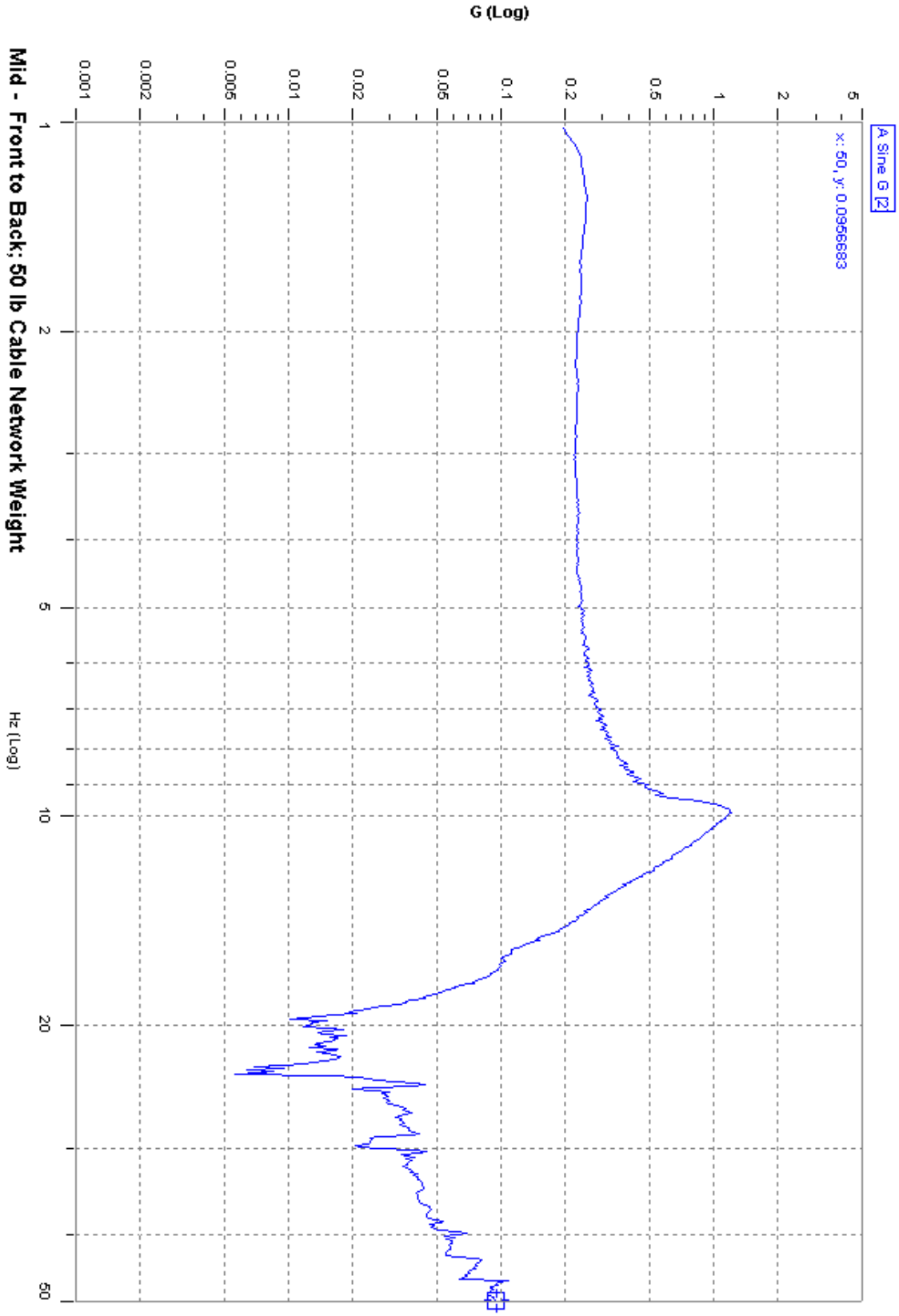
A-1: Swept Sine Survey

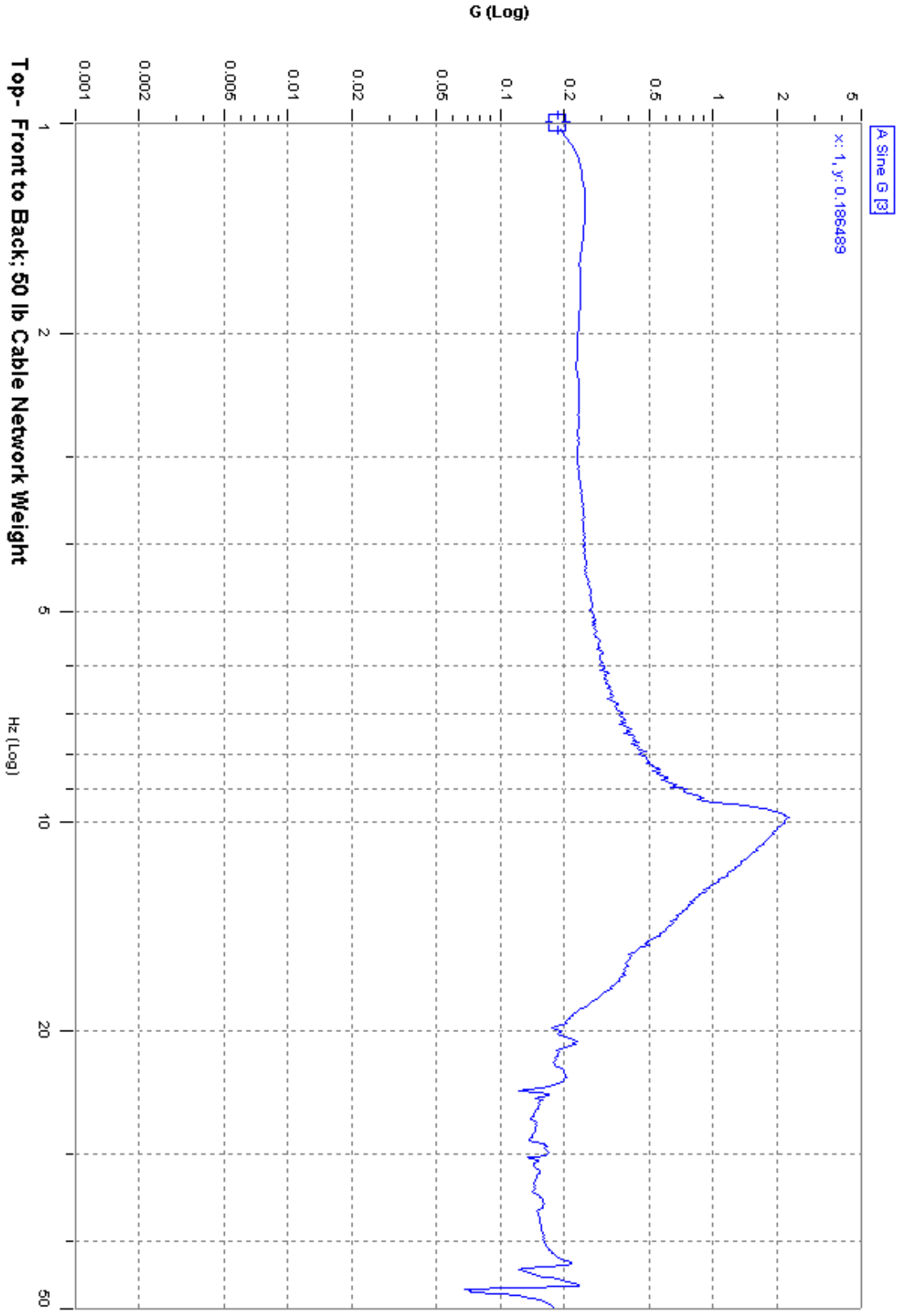

G (Log)
0.05
0.1
0.2
0.5
1
A Sine G [1]
x: 50, y: 0.19612
Table - Front to Back; 100 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50

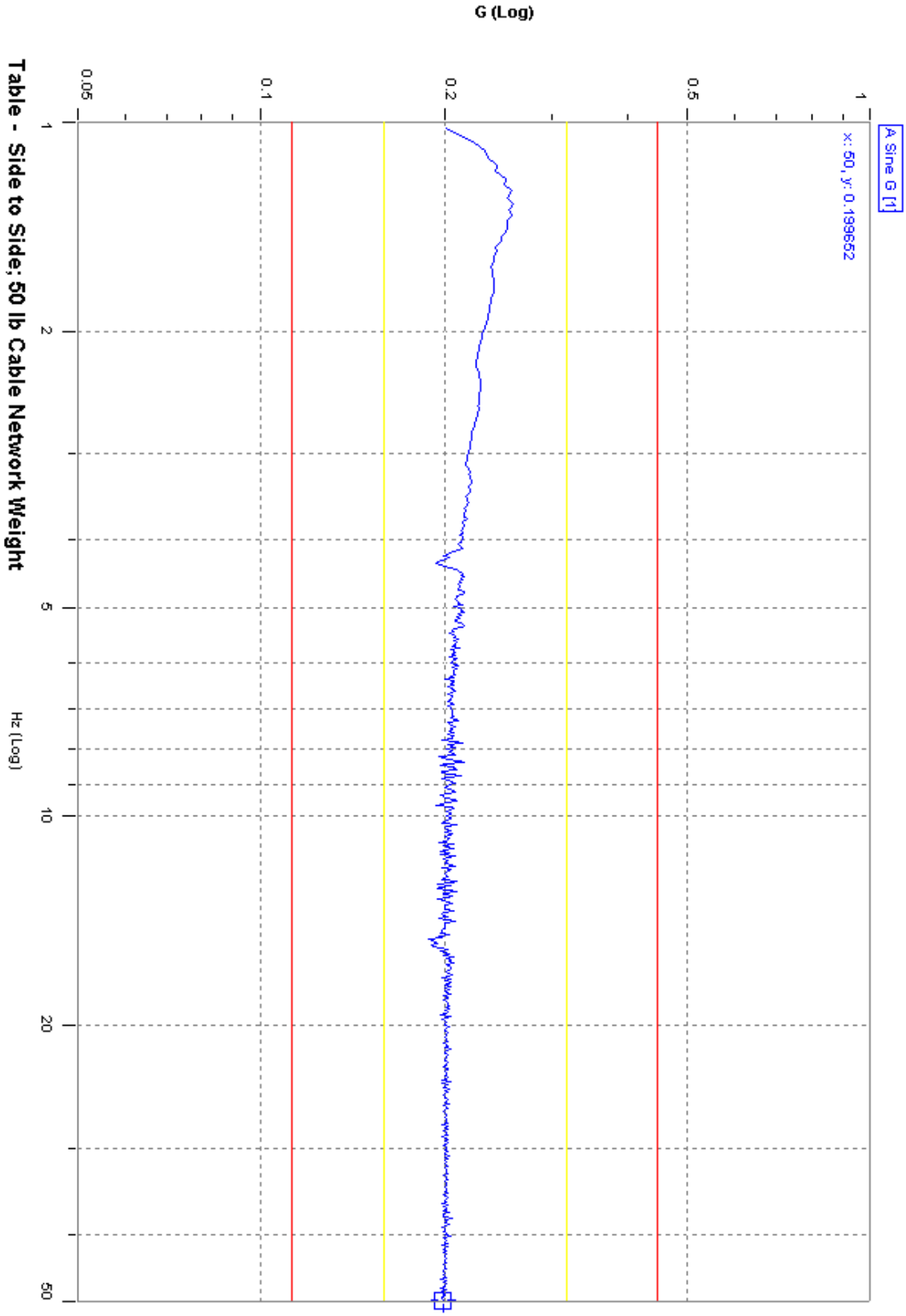

G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [2]
x: 50, y: 0.120619
Mid - Front to Back; 100 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50

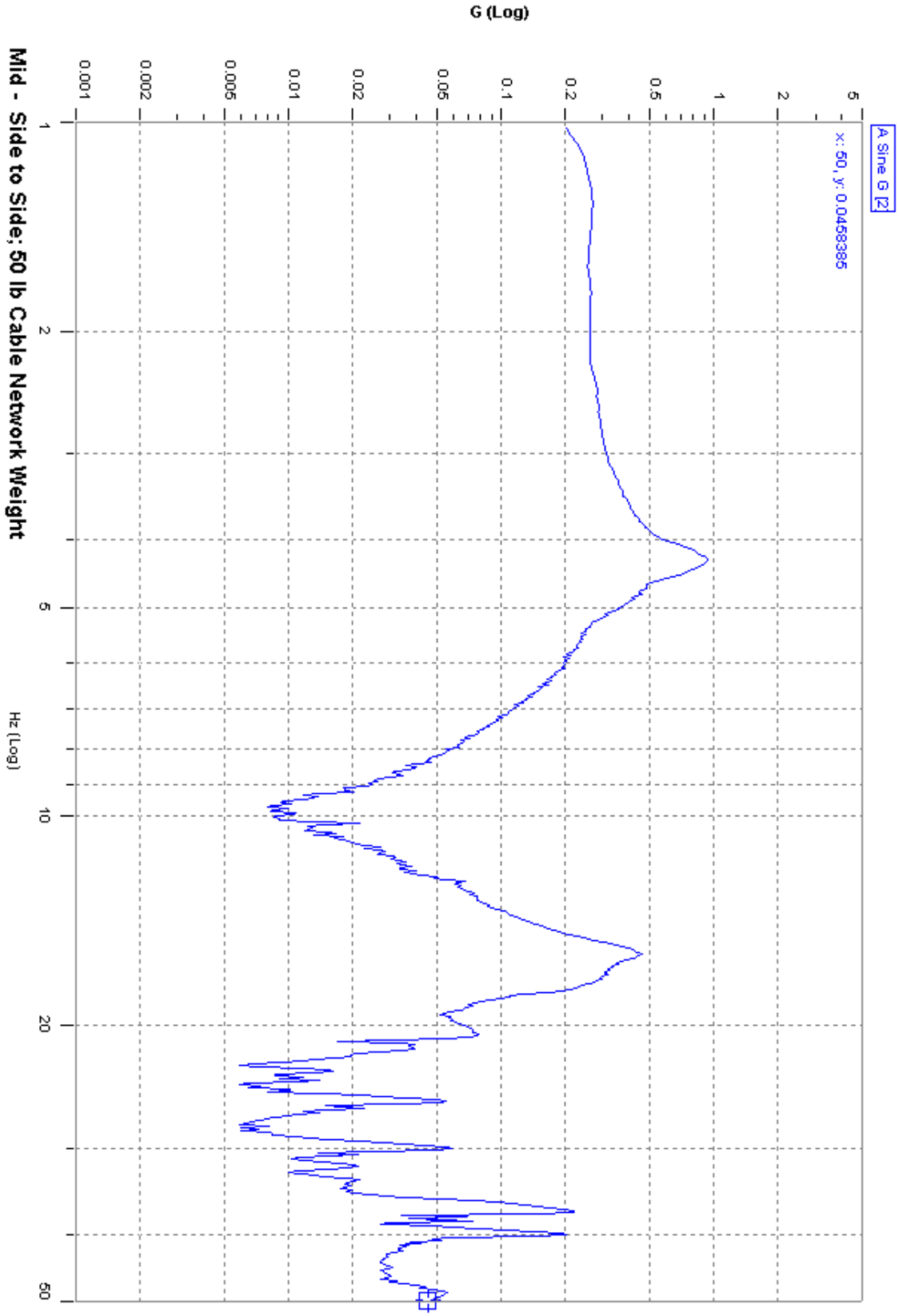

G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [3]
x: 1, y: 0.185887
Top- Front to Back; 100 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50

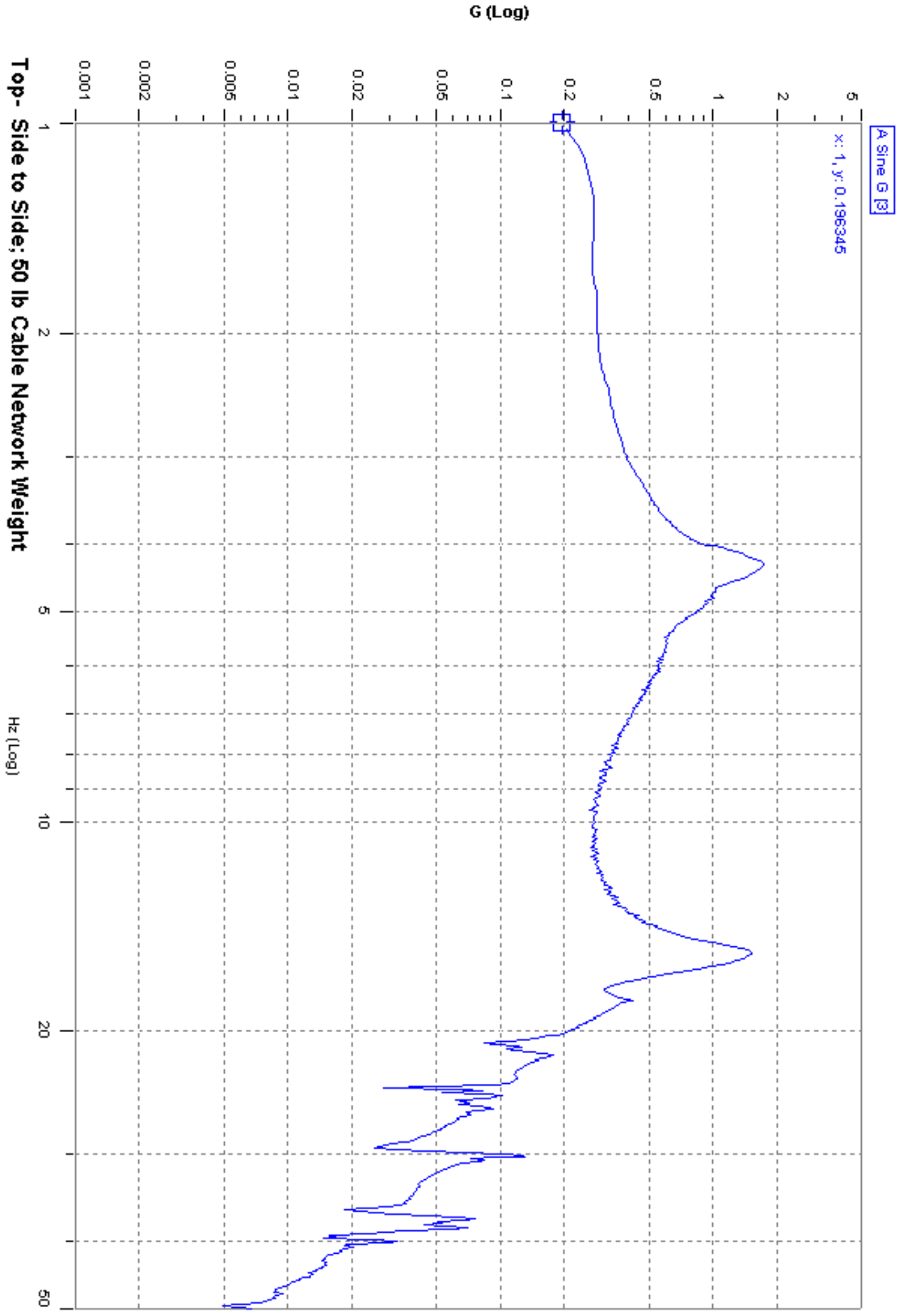

G (Log)
0.05
0.1
0.2
0.5
1
A Sine G [1]
x: 50, y: 0.198467
Table - Front to Back; 50 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50


G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [2]
x: 50, y: 0.0956683
Mid - Front to Back; 50 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50


G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [3]
x: 1, y: 0.186489
Top- Front to Back; 50 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50


G (Log)
0.05
0.1
0.2
0.5
1
A Sine G [1]
x: 50, y: 0.199652
Table - Side to Side; 50 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50


G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [2]
x: 50, y: 0.0458385
Mid - Side to Side; 50 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50


G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [3]
x: 1, y: 0.196345
Top- Side to Side; 50 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50

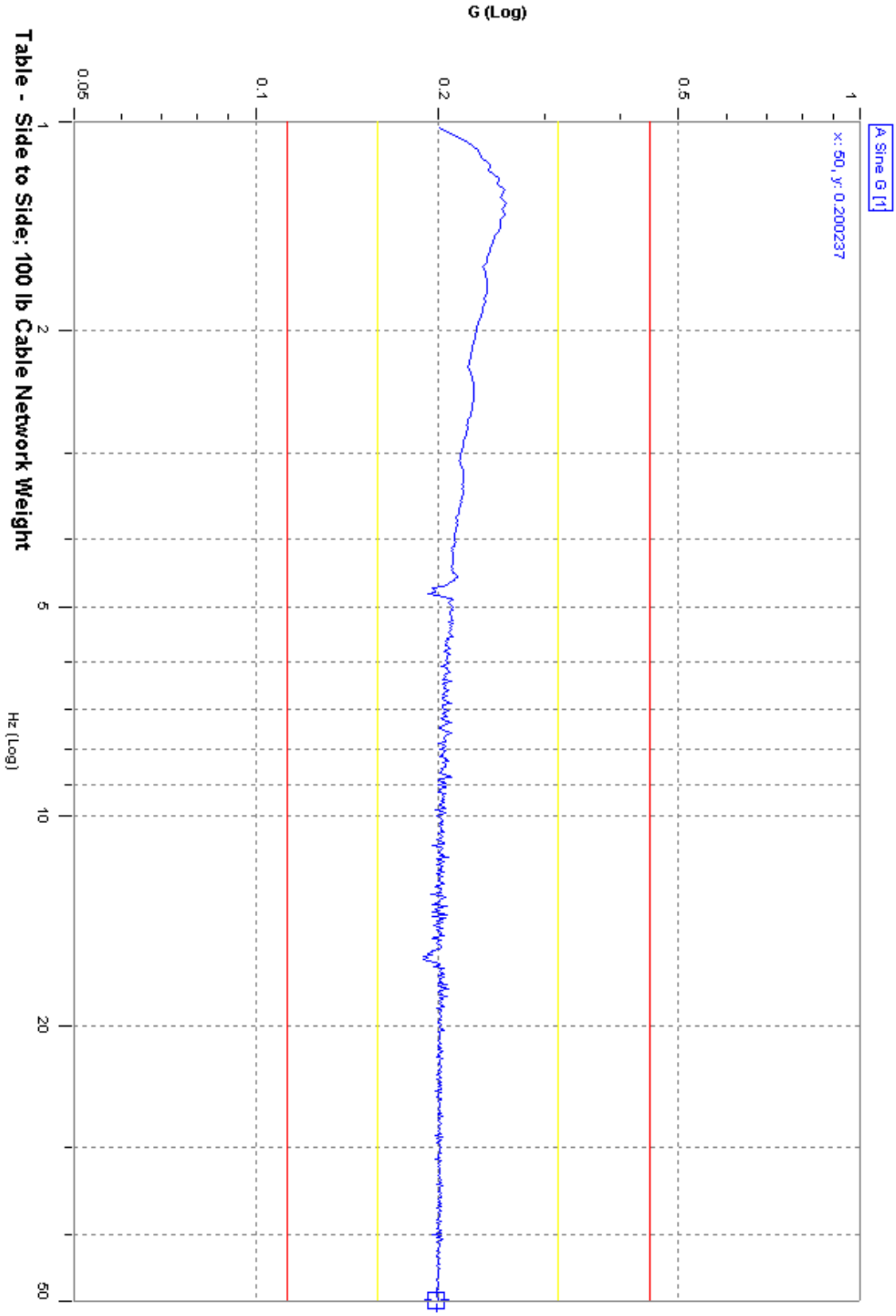
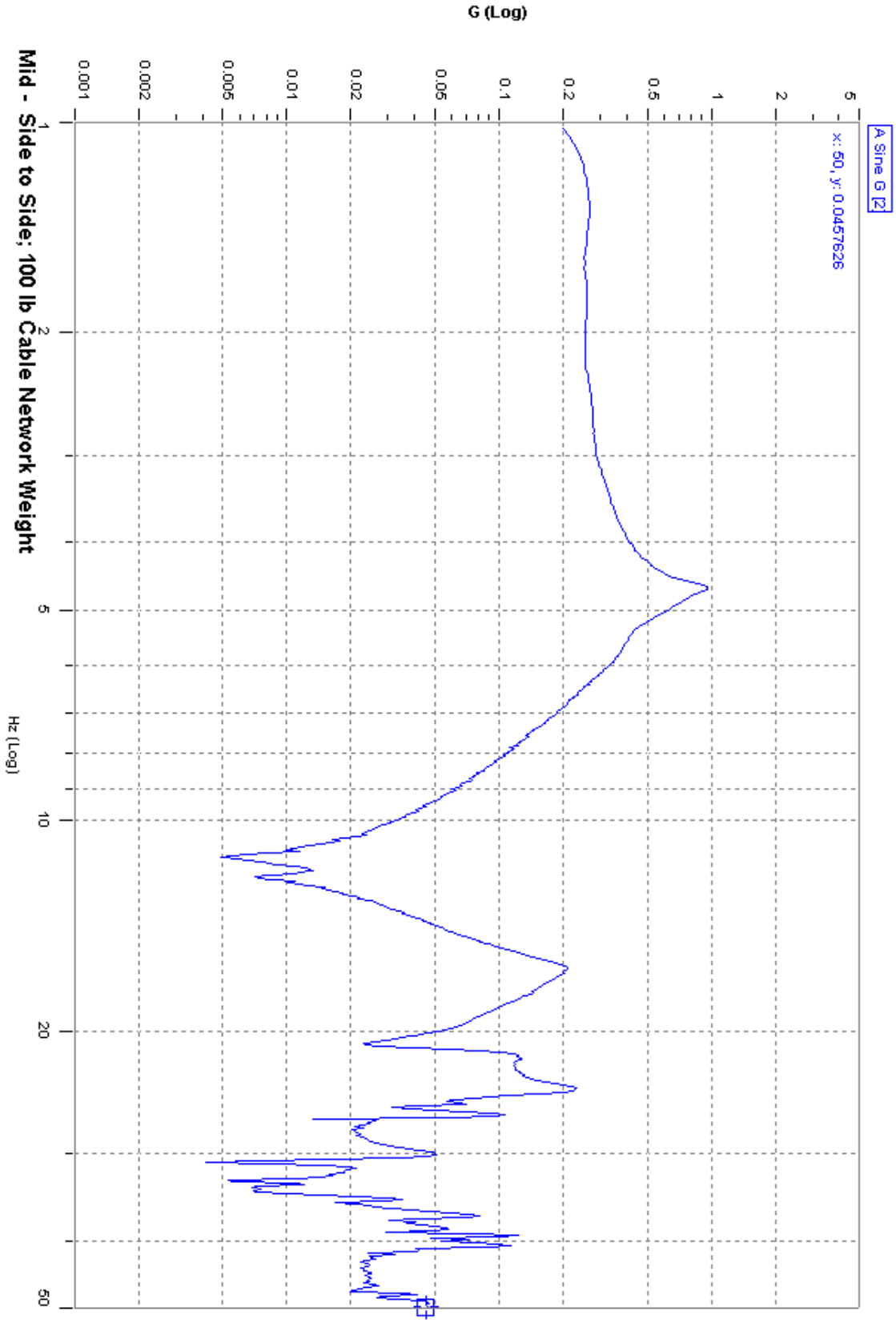
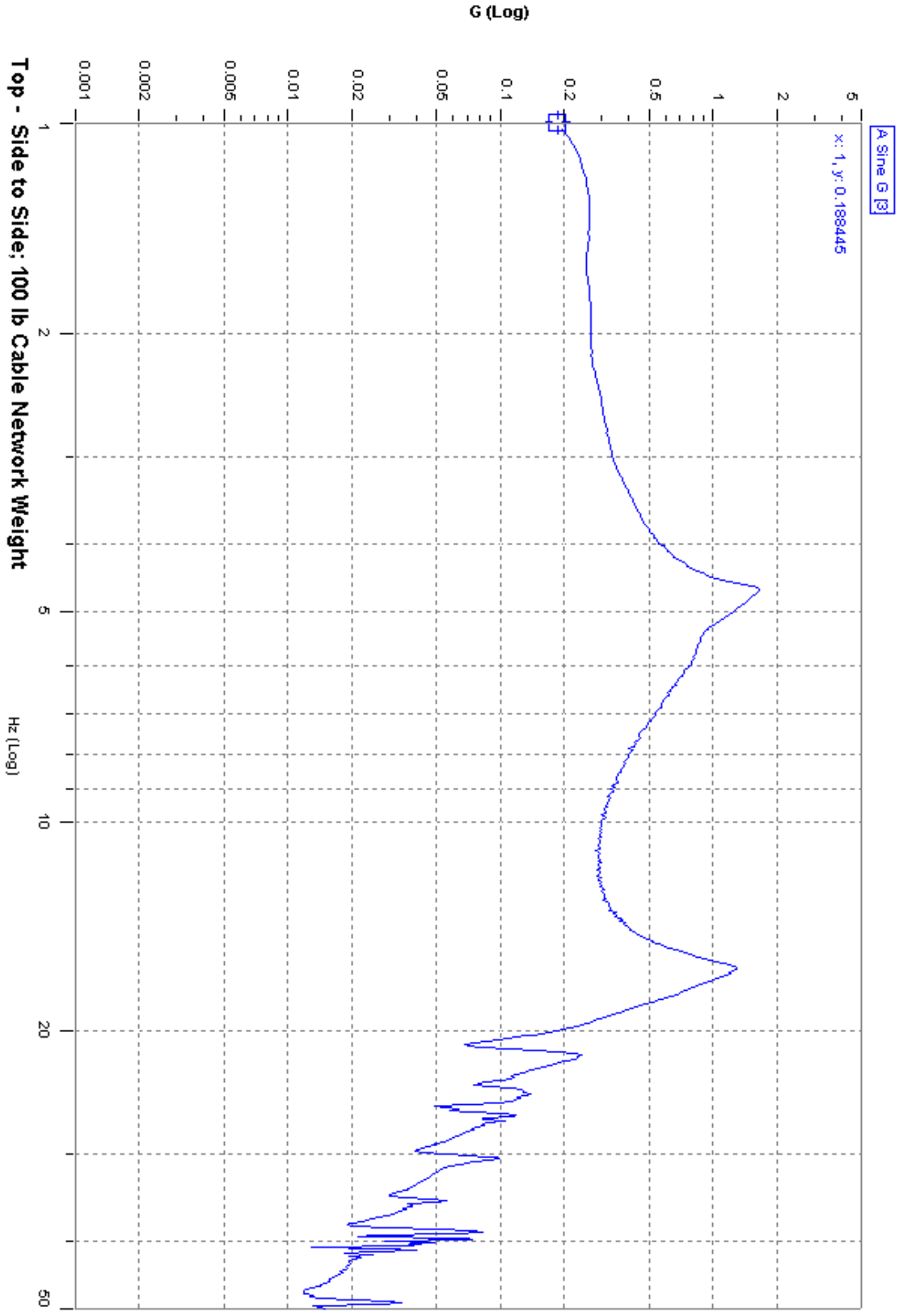


Table - Side to Side; 100 lb Cable Network Weight
G (Log)
0.05
0.1
0.2
0.5
1
A Sine G [1]
x: 50, y: 0.200237
Hz (Log)
1
2
5
10
20
50


G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
Mid - Side to Side; 100 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50
A Sine G [2]
x: 50, y: 0.0457626


G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [3]
x: 1, y: 0.188445
Top - Side to Side; 100 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50

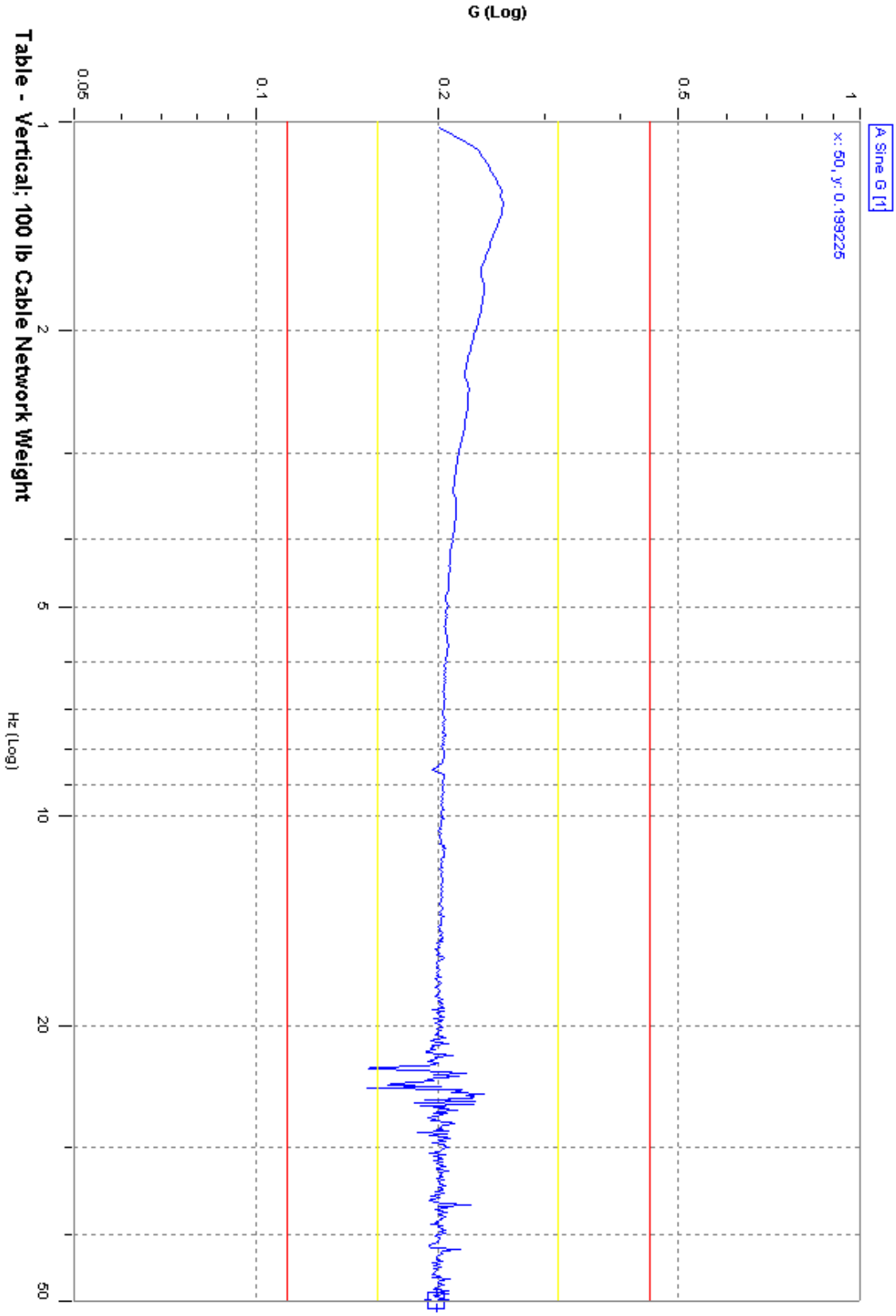
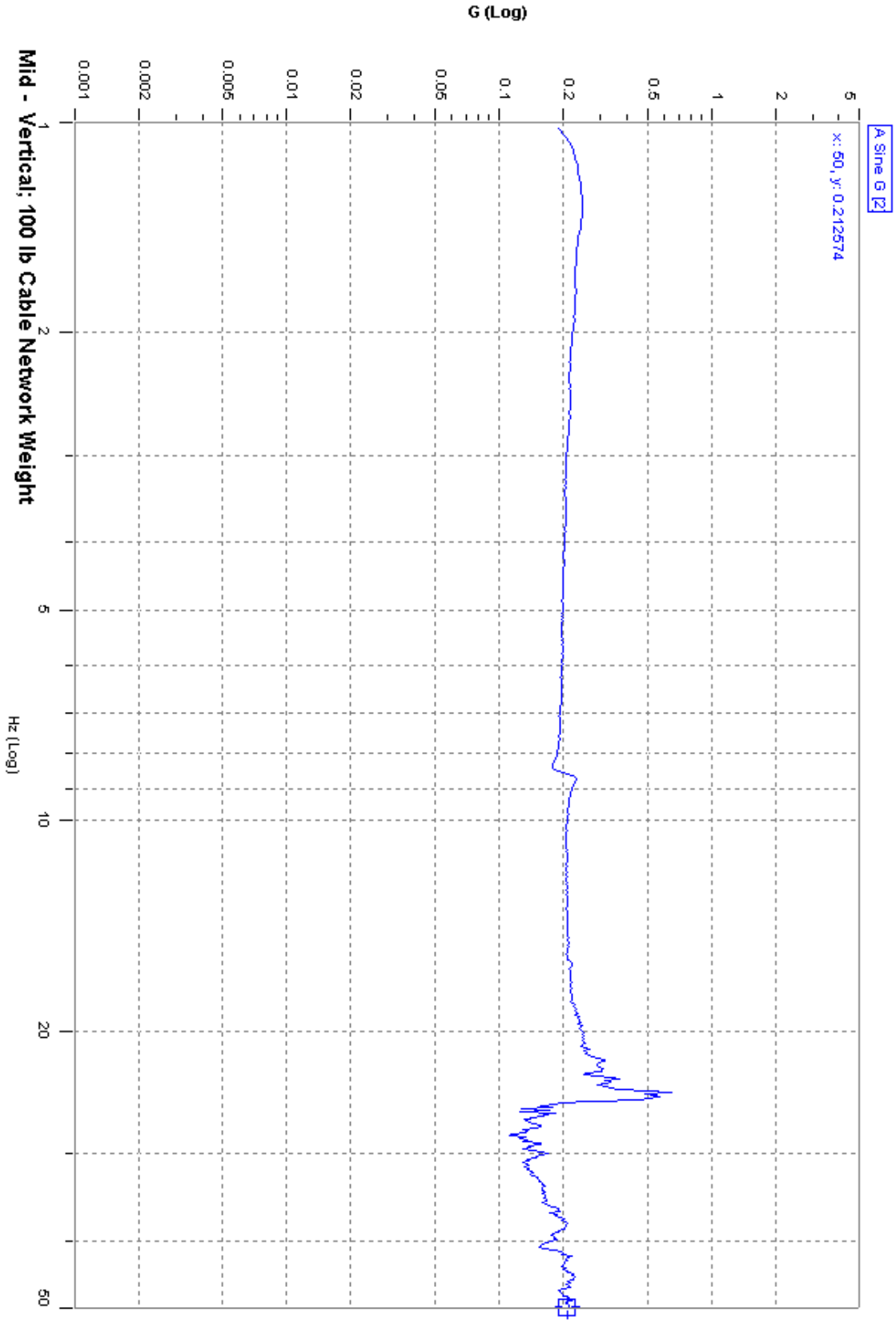
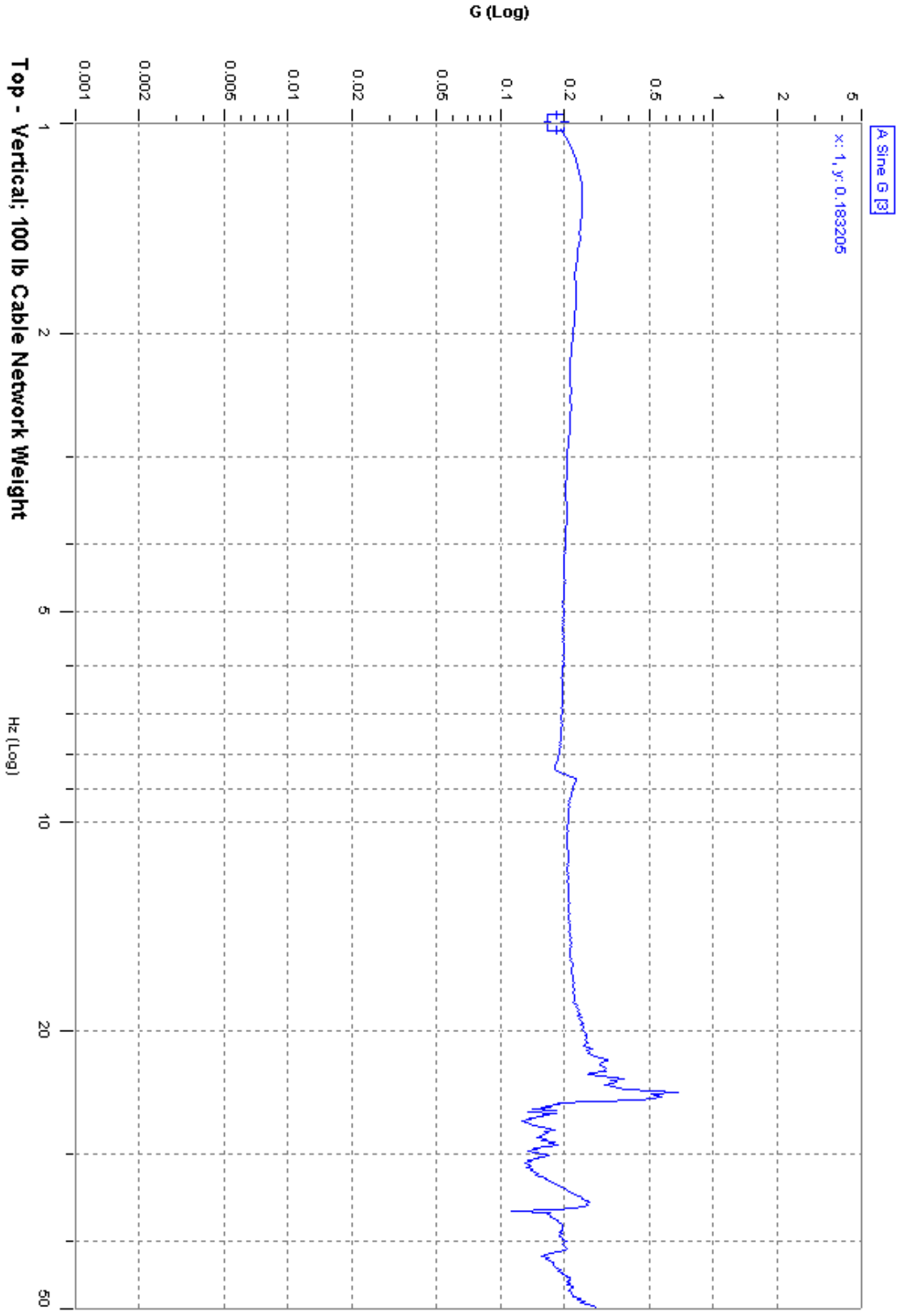


Table - Vertical; 100 lb Cable Network Weight
G (Log)
0.05
0.1
0.2
0.5
1
Hz (Log)
1
2
5
10
20
50
A Sine G [1]
x: 50, y: 0.199225


G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [2]
x: 50, y: 0.212574
Mid - Vertical; 100 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50


G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [3]
x: 1, y: 0.183205
Top - Vertical; 100 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50

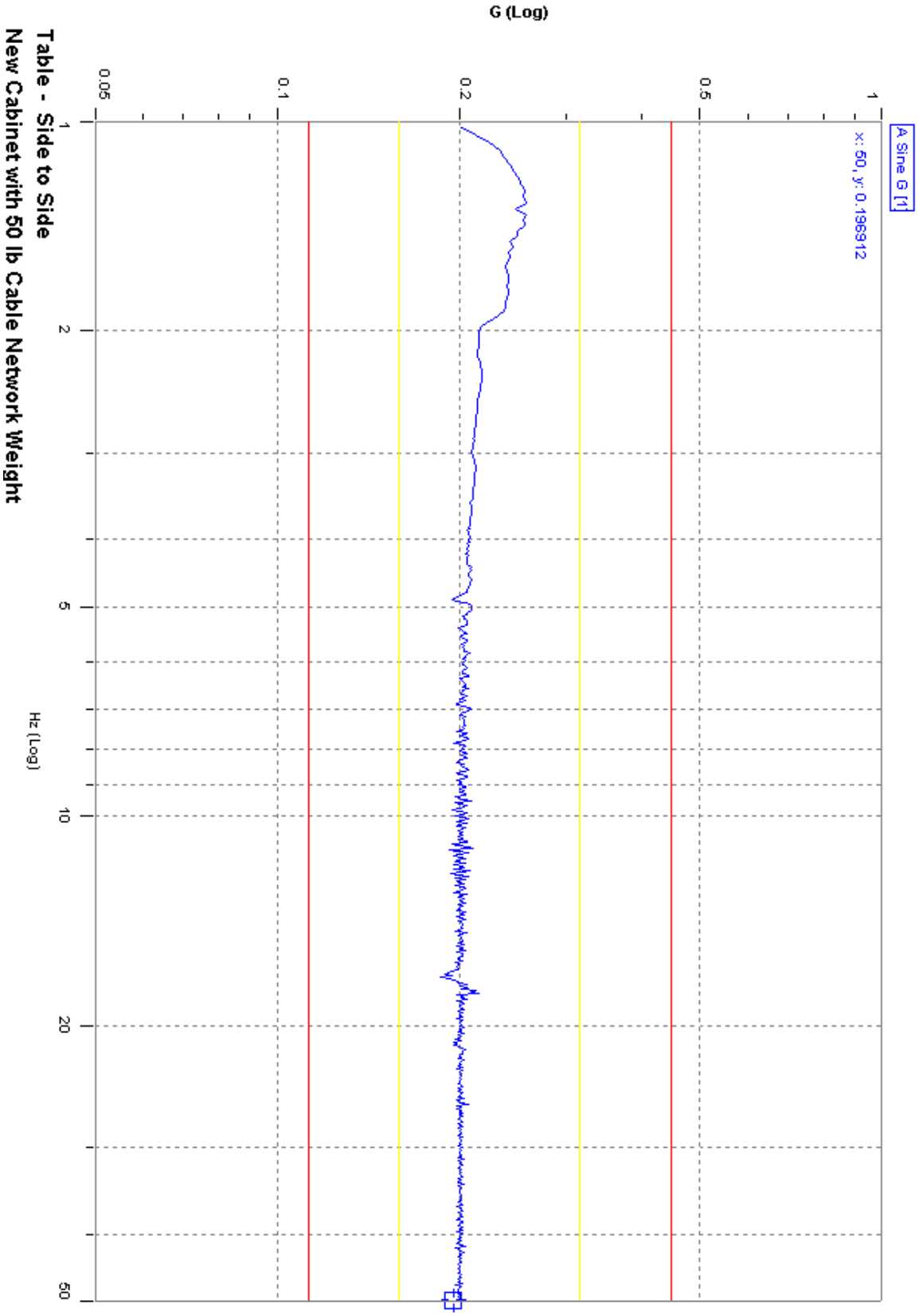
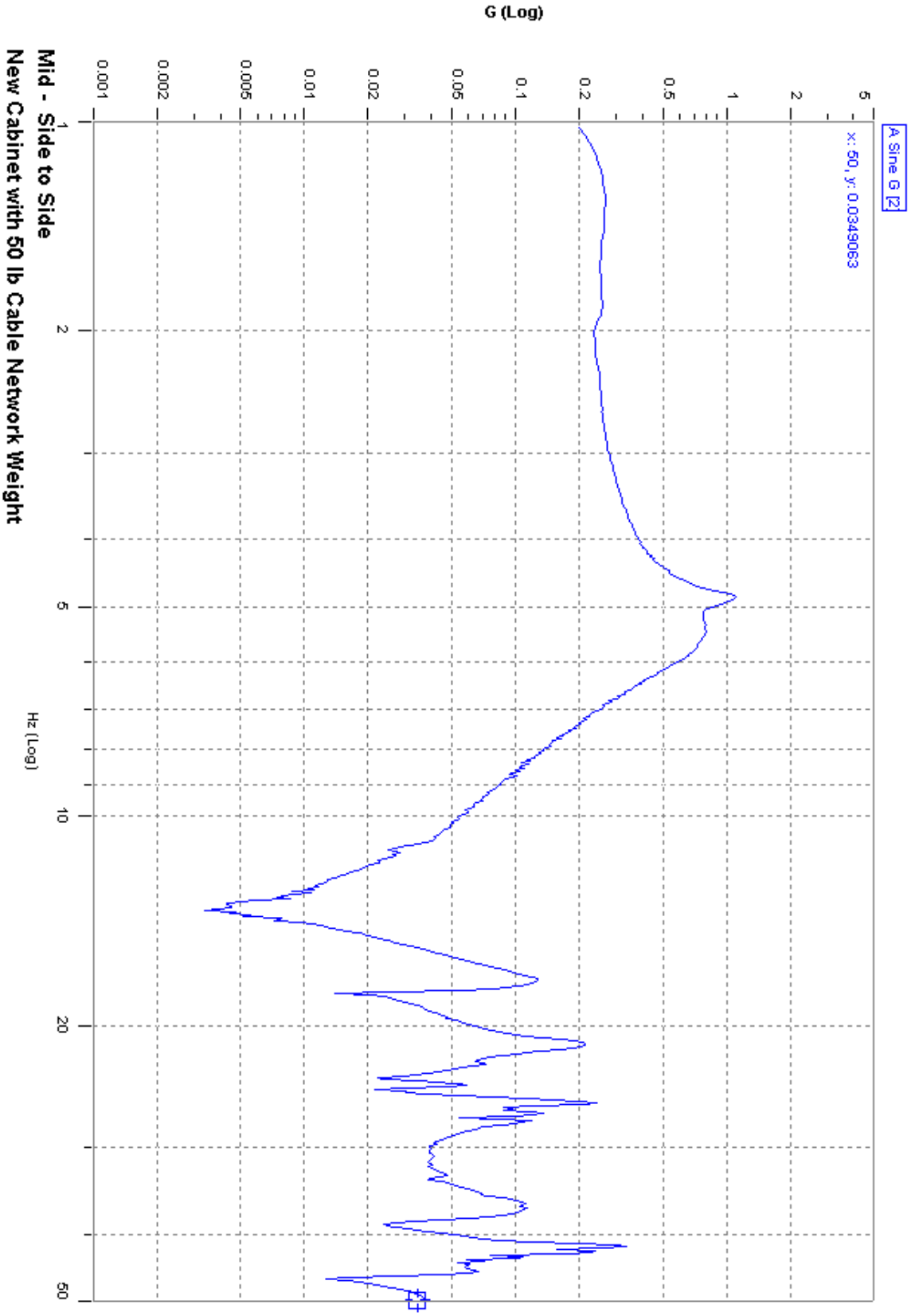
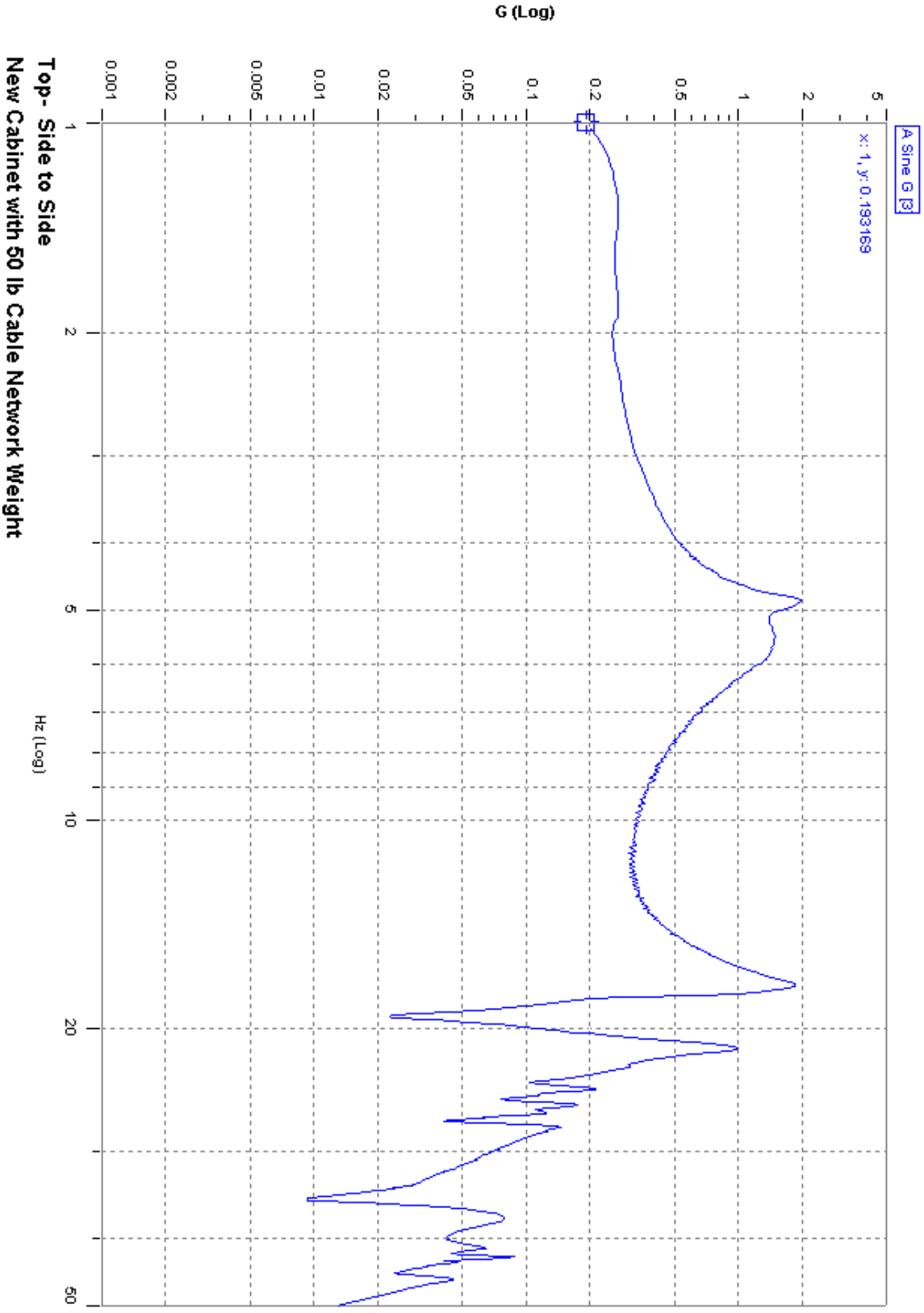
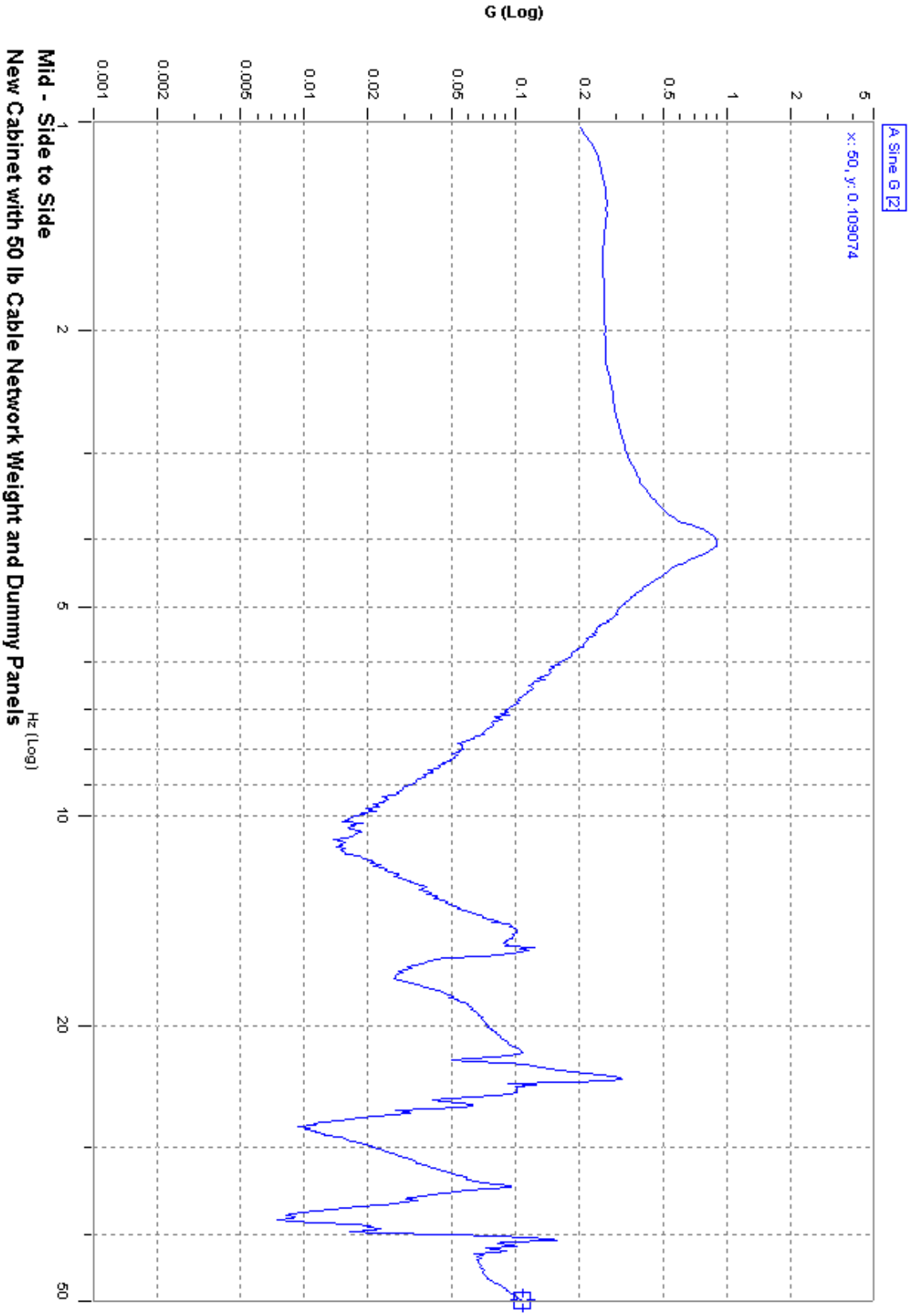
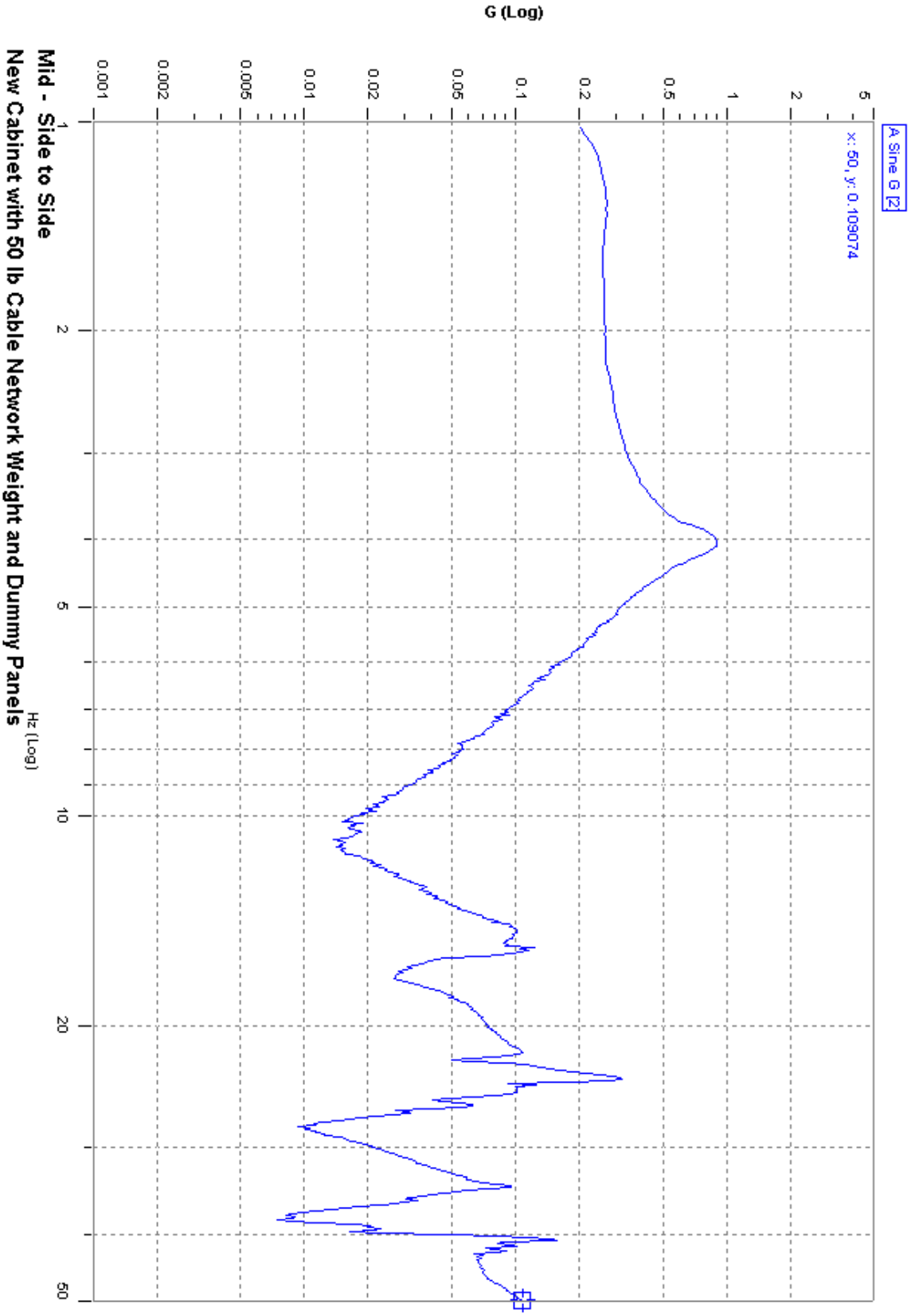


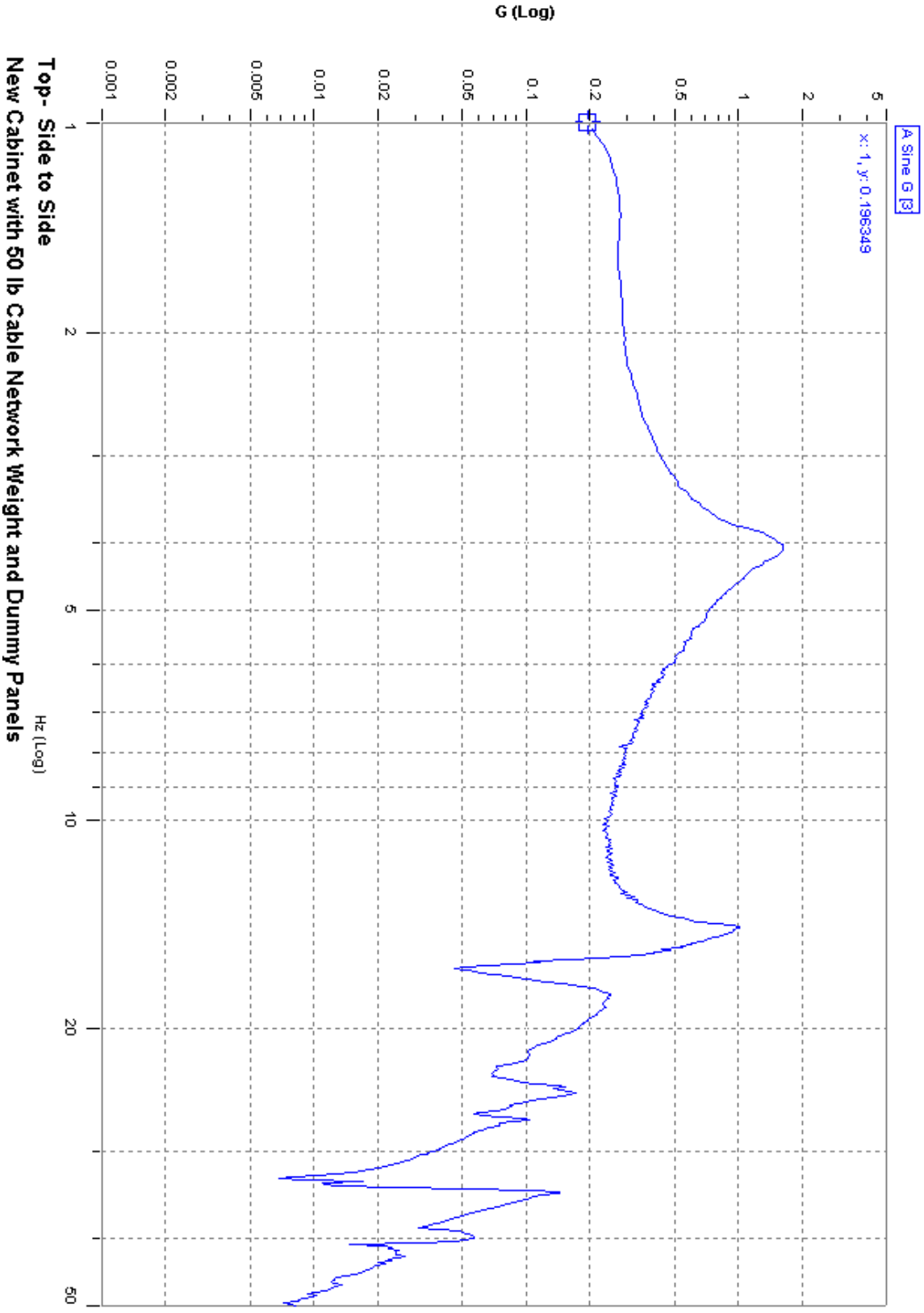
Table - Side to Side
New Cabinet with 50 lb Cable Network Weight
G (Log)
0.05
0.1
0.2
0.5
1
A Sine G [1]
x: 50, y: 0.196912
Hz (Log)
1
2
5
10
20
50


G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [2]
x: 50, y: 0.0349063
Mid - Side to Side
New Cabinet with 50 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50

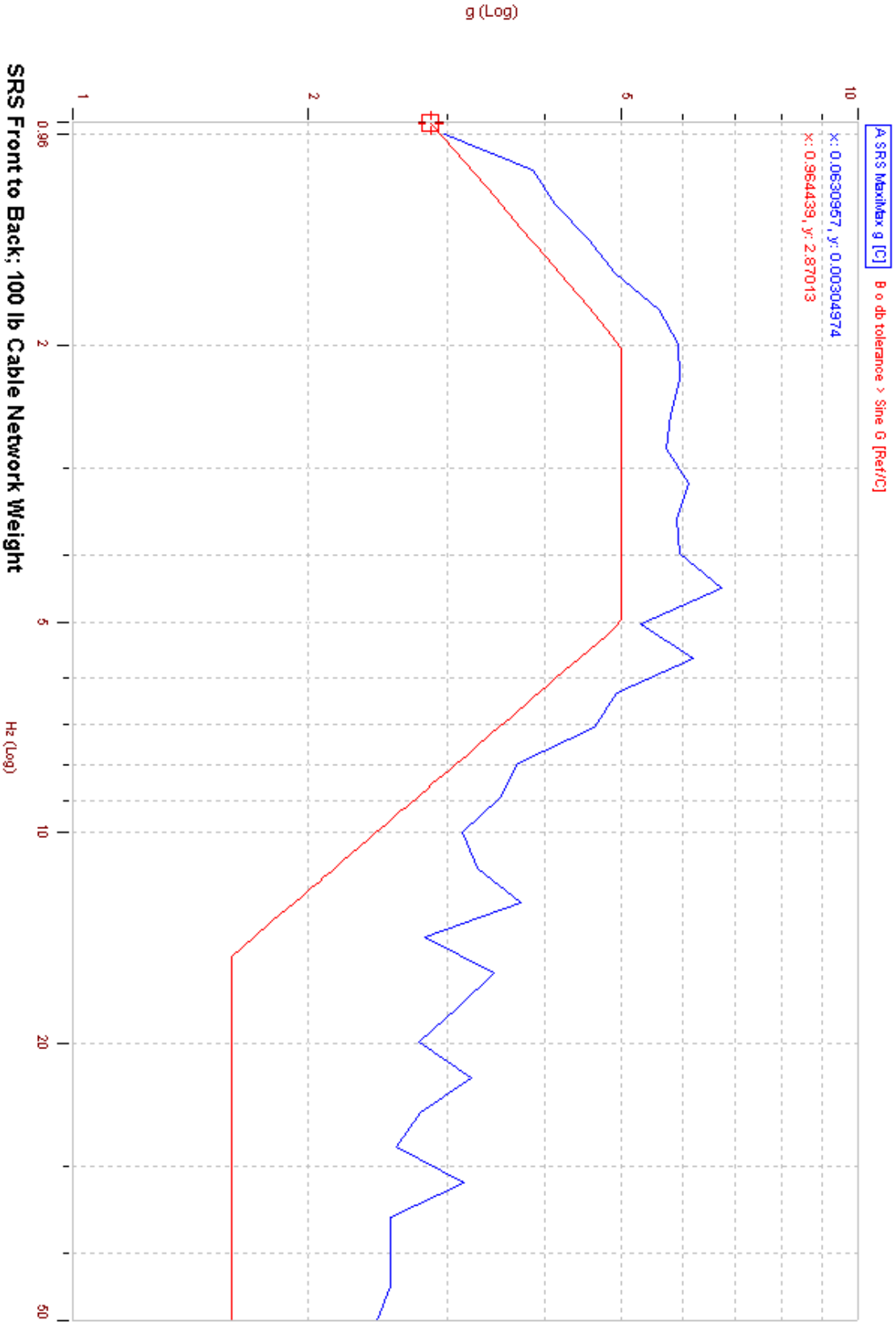

G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [3]
x: 1, y: 0.193169
Top- Side to Side
New Cabinet with 50 lb Cable Network Weight
Hz (Log)
1
2
5
10
20
50

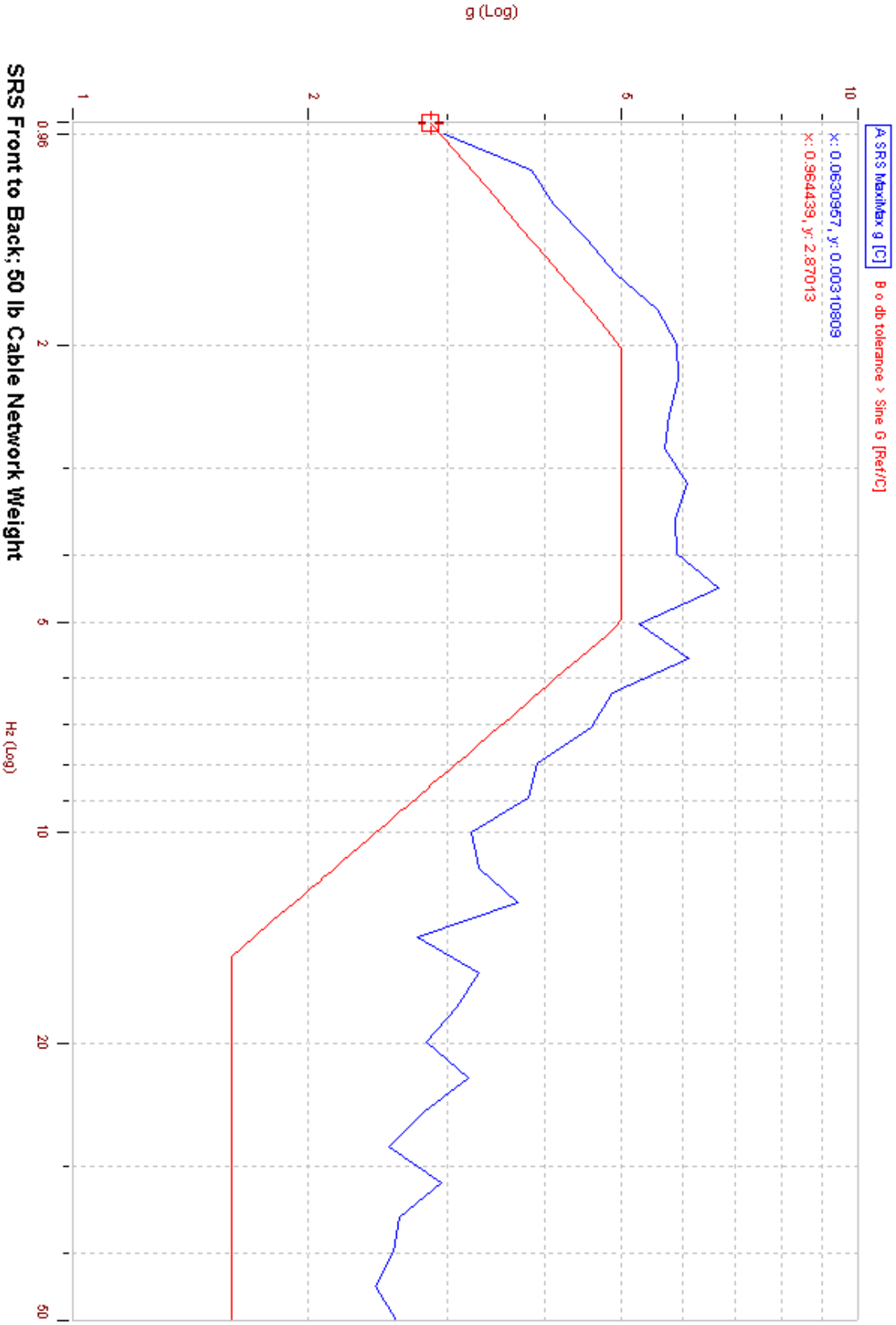

G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [2]
x: 50, y: 0.109074
Mid - Side to Side
New Cabinet with 50 lb Cable Network Weight and Dummy Panels
Hz (Log)
1
2
5
10
20
50

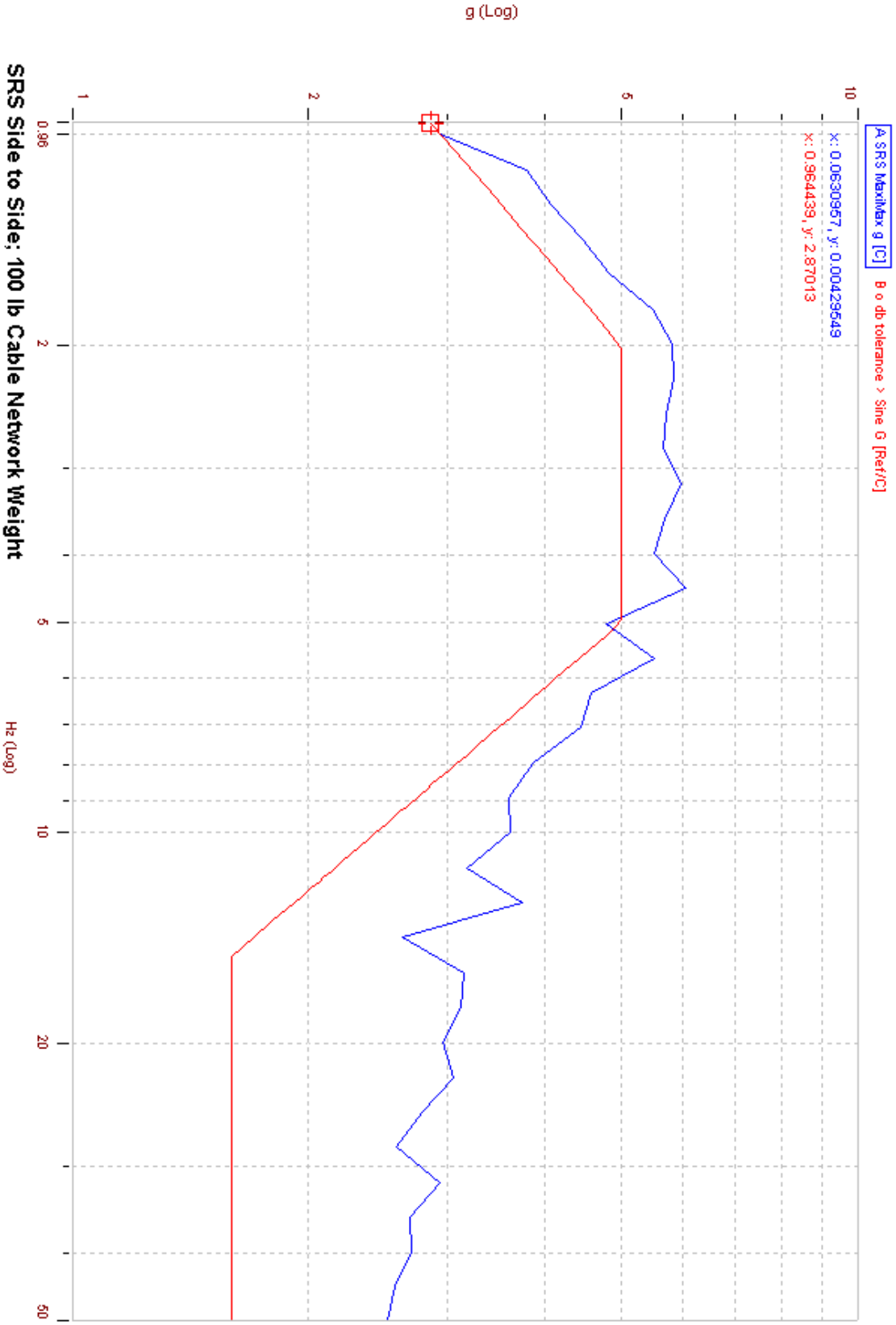

G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [2]
x: 50, y: 0.109074
Mid - Side to Side
New Cabinet with 50 lb Cable Network Weight and Dummy Panels
Hz (Log)
1
2
5
10
20
50

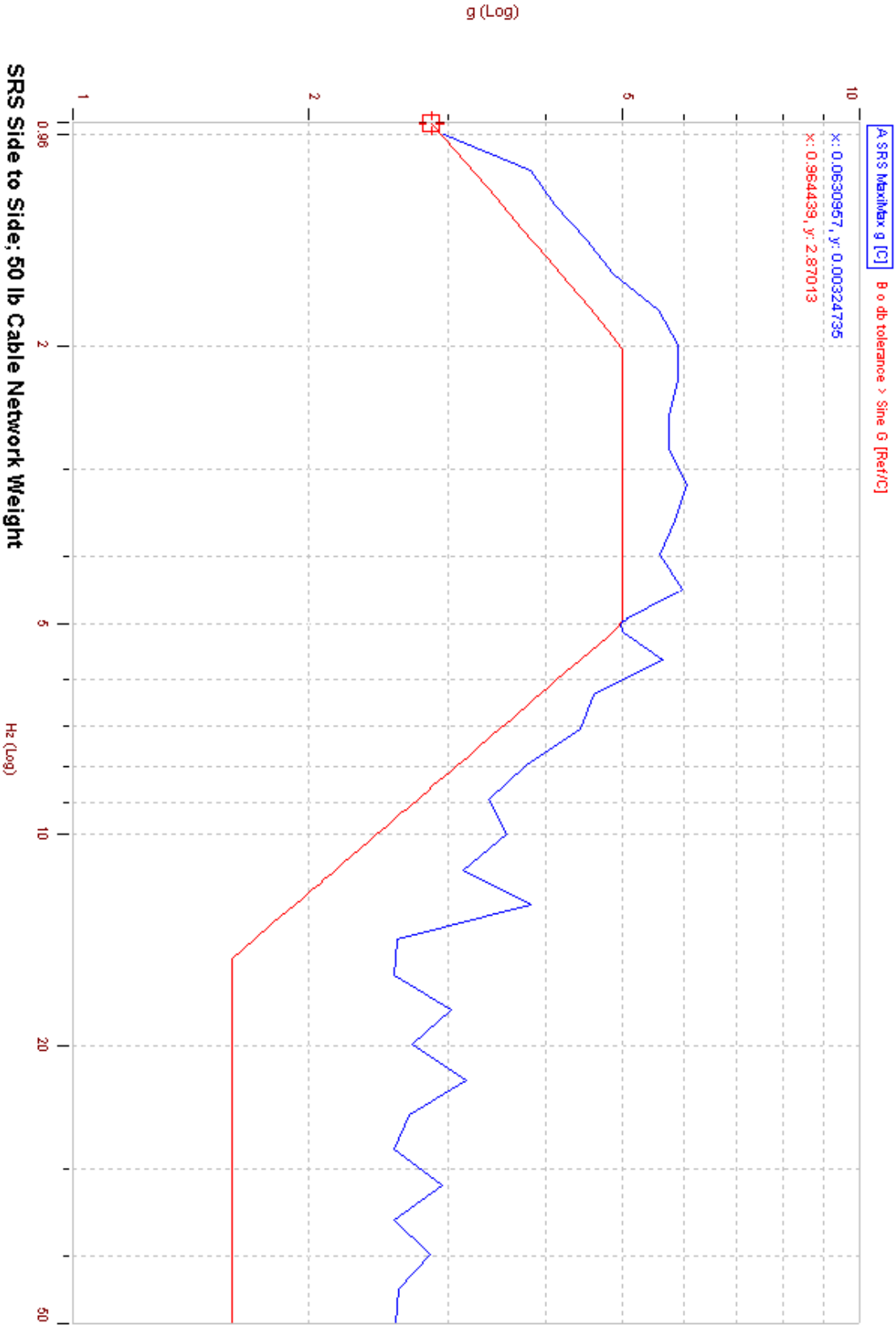

G (Log)
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
A Sine G [3]
x: 1, y: 0.196349
Top- Side to Side
New Cabinet with 50 lb Cable Network Weight and Dummy Panels
Hz (Log)
1
2
5
10
20
50

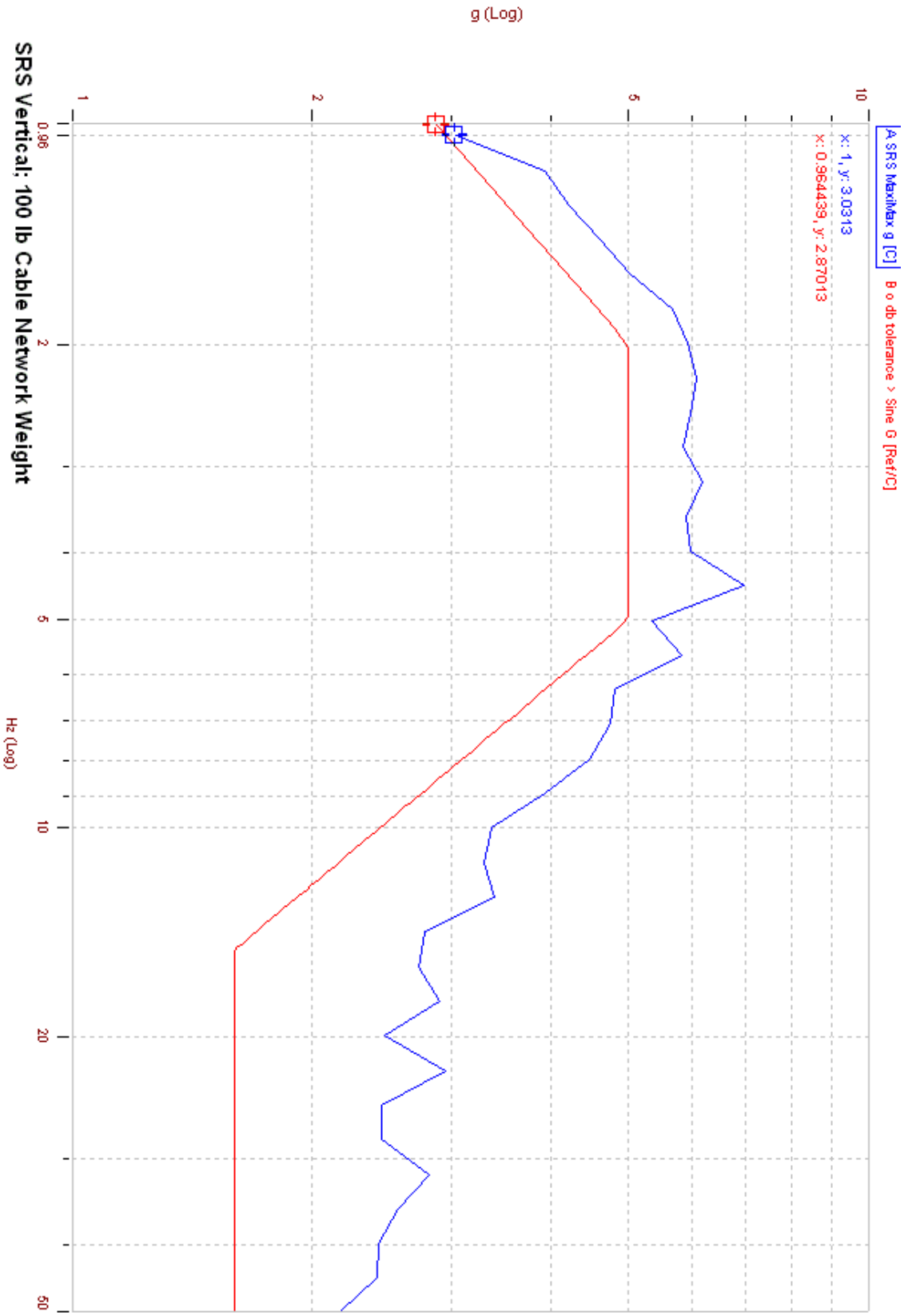
A-2: Earthquake Frequency Response

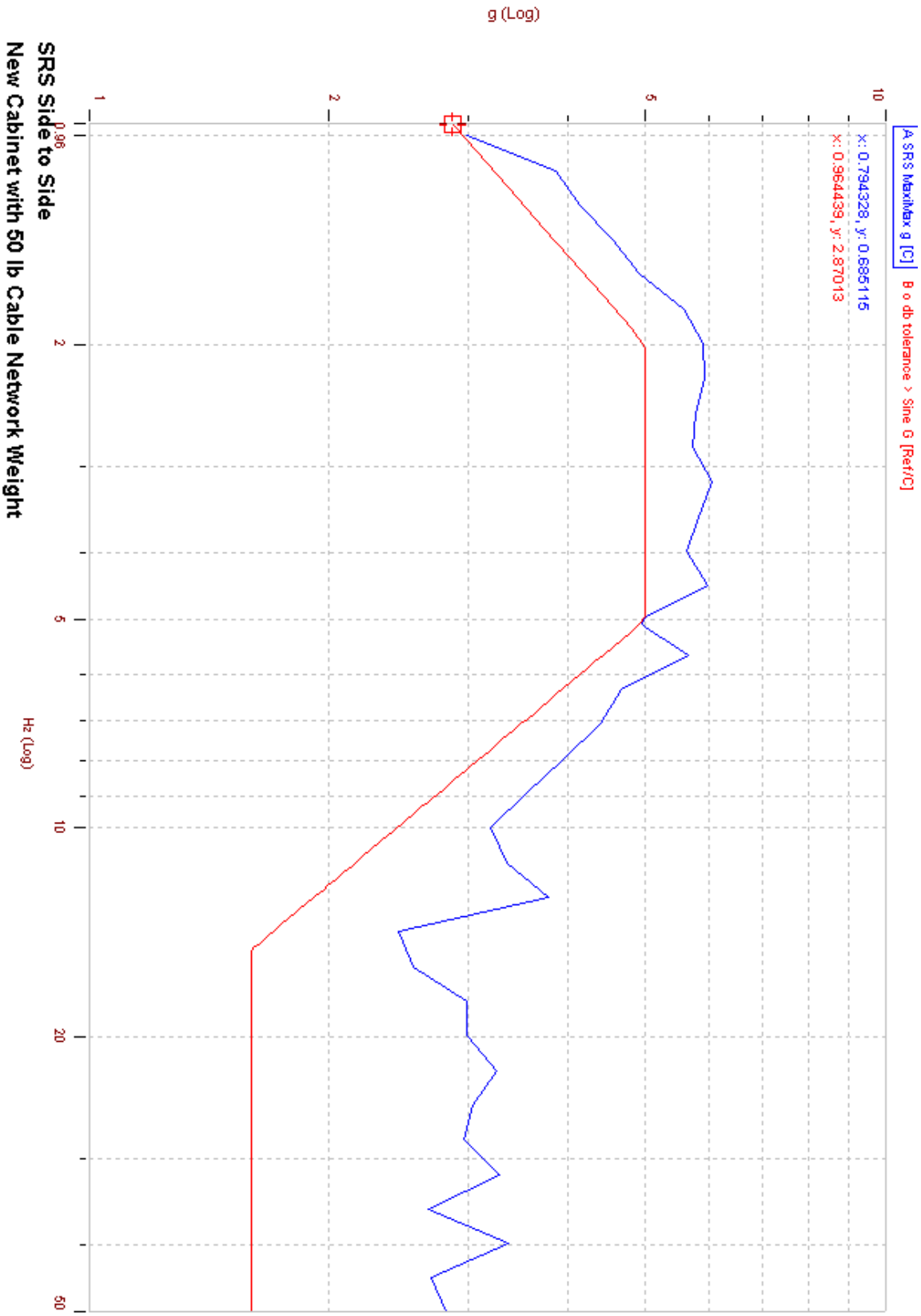

g (Log)
SRS Front to Back; 100 lb Cable Network Weight
Hz (Log)
A SRS Maximax g [C]
B o db tolerance > Sine G [Ref/C]
x: 0.0630957, y: 0.00304974
x: 0.964439, y: 2.87013

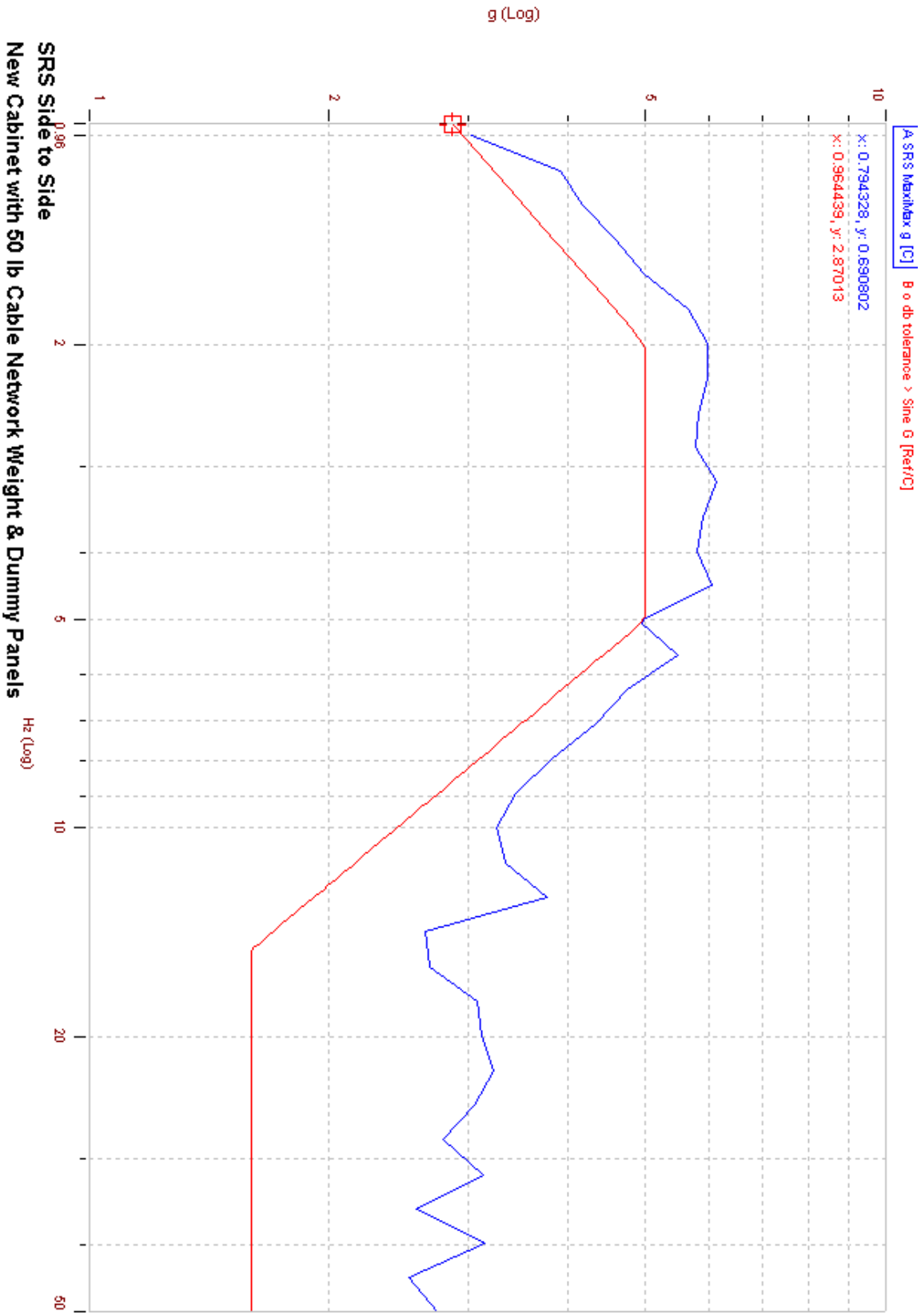

g (Log)
SRS Front to Back; 50 lb Cable Network Weight
Hz (Log)
A SRS Maximax g [C]
B o db tolerance > Sine G [Ref/C]
x: 0.0630957, y: 0.00310809
x: 0.964439, y: 2.87013


g (Log)
1
2
5
10
SRS Side to Side; 100 lb Cable Network Weight
Hz (Log)
0.96
2
5
10
20
50
A SRS Maximax g [C]
B o db tolerance > Sine G [Ref/C]
x: 0.0630957, y: 0.00429549
x: 0.964439, y: 2.87013


g (Log)
1
2
5
10
SRS Side to Side; 50 lb Cable Network Weight
Hz (Log)
0.96
2
5
10
20
50
A SRS Maximax g [C]
B o db tolerance > Sine G [Ref/C]
x: 0.0630957, y: 0.00324735
x: 0.964439, y: 2.87013


SRS Vertical: 100 lb Cable Network Weight
g (Log)
Hz (Log)
A SRS Maximax g [C]
B o db tolerance > Sine G [Ref/C]
x: 1, y: 3.0313
x: 0.964439, y: 2.87013


SRS Side to Side
New Cabinet with 50 lb Cable Network Weight
g (Log)
Hz (Log)
A SRS MaxiMax g [C]
B o db tolerance > Sine G [Ref/C]
x: 0.794328, y: 0.685115
x: 0.964439, y: 2.87013


SRS Side to Side
New Cabinet with 50 lb Cable Network Weight & Dummy Panels
g (Log)
Hz (Log)
1
2
5
10
0.98
2
5
10
20
50
A SRS Maximax g [C]
B o db tolerance > Sine G [Ref/C]
x: 0.794328, y: 0.690802
x: 0.964439, y: 2.87013

A-3: Time-Acceleration History

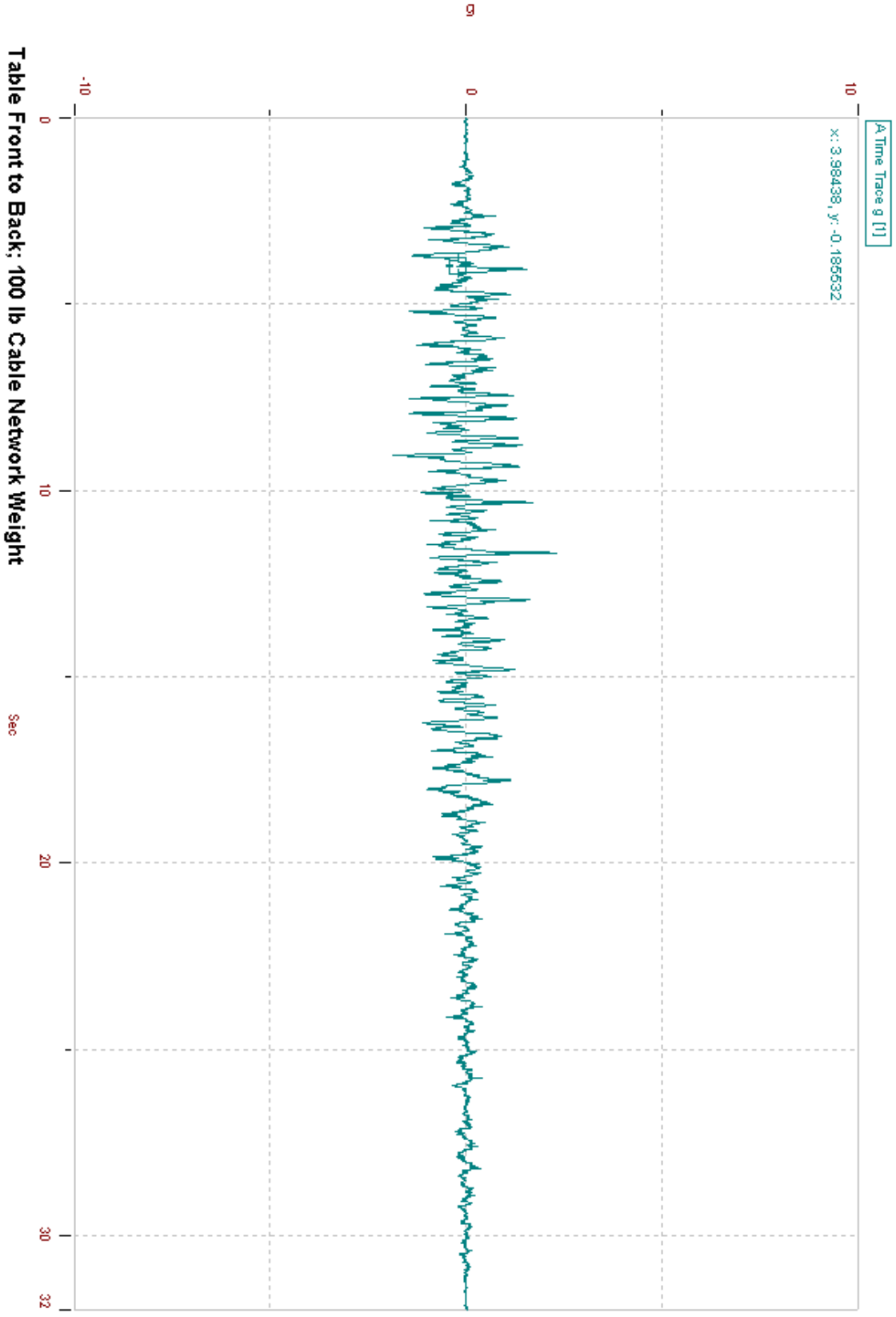
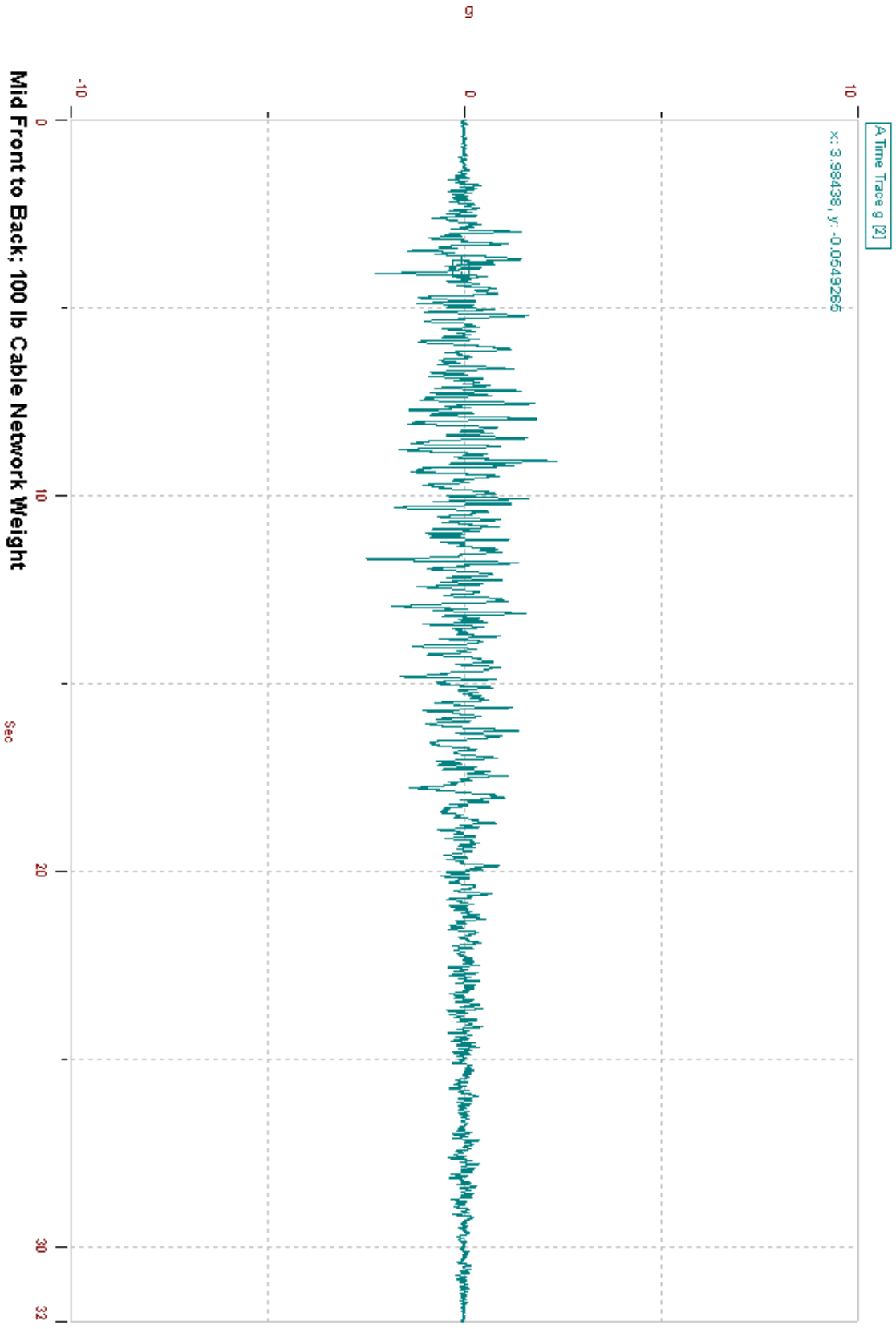
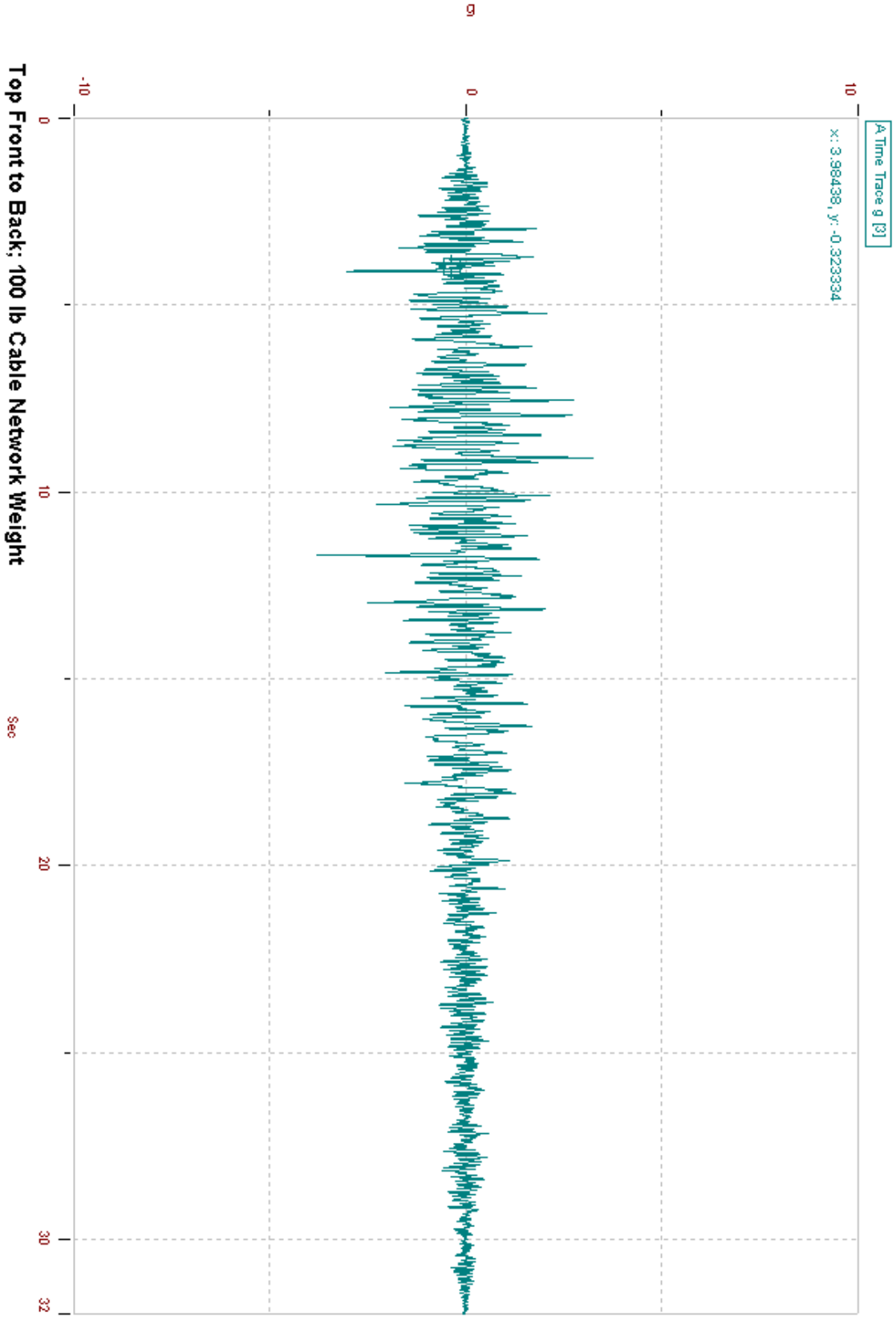


Table Front to Back; 100 lb Cable Network Weight
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [1]
x: 3.98438, y: -0.185532


g
-10
0
10
A Time Trace g [2]
x: 3.98438, y: -0.0549265
Mid Front to Back; 100 lb Cable Network Weight
0
10
20
30
32
Sec


Top Front to Back; 100 lb Cable Network Weight
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [3]
x: 3.98438, y: -0.323334

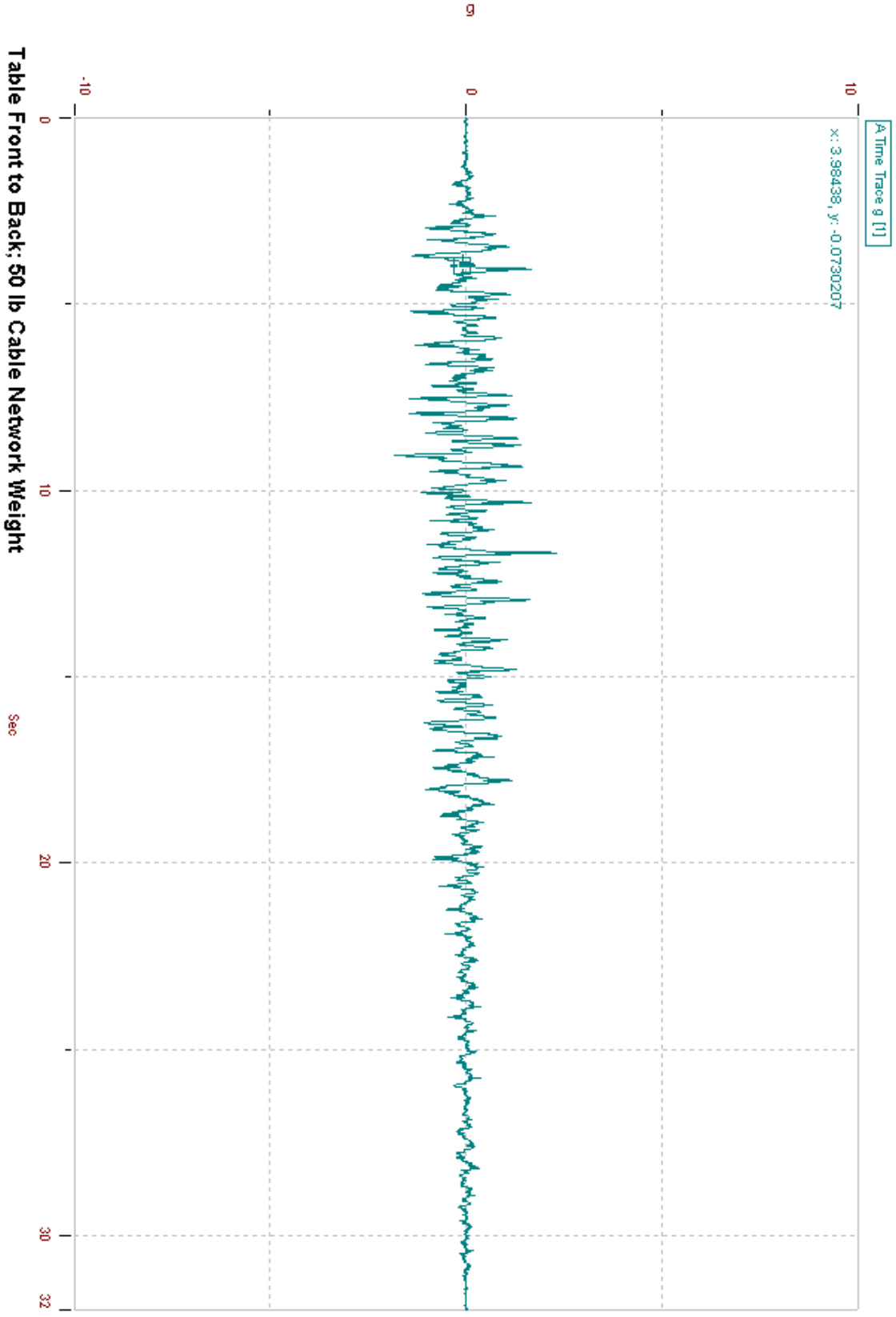
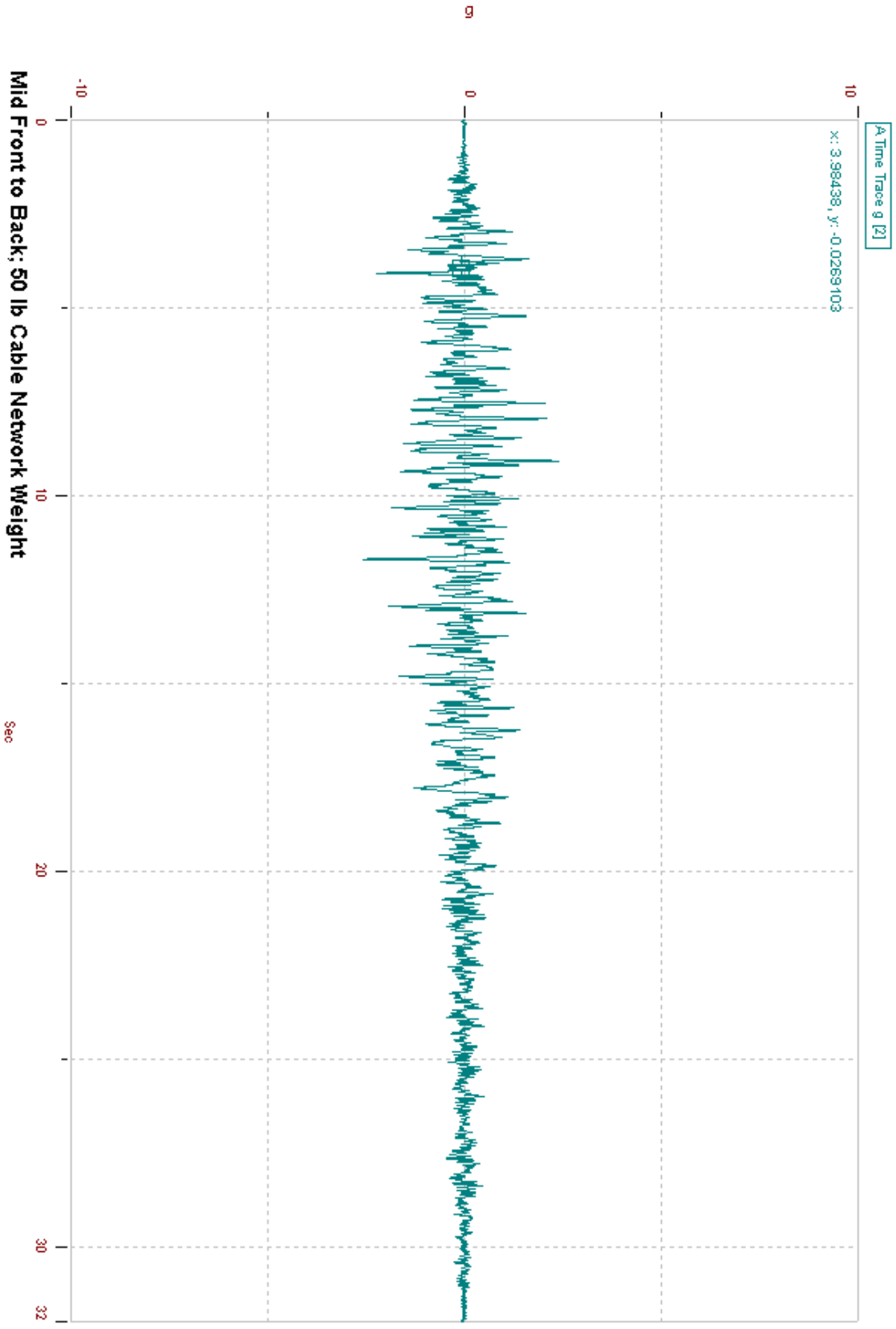
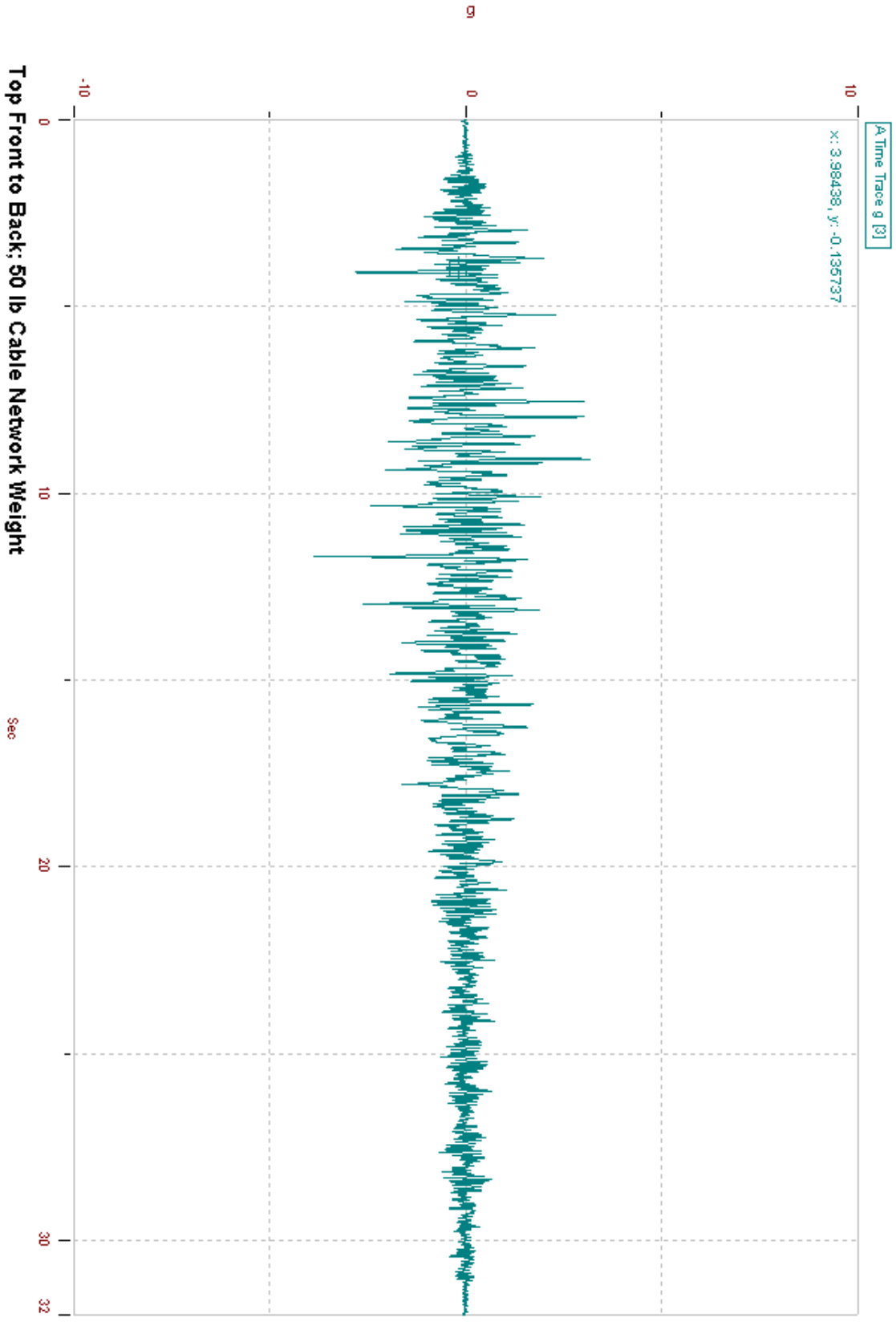


Table Front to Back; 50 lb Cable Network Weight
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [1]
x: 3.98438, y: -0.0730207


g
-10
0
10
Mid Front to Back; 50 lb Cable Network Weight
0
10
20
30
32
Sec
A Time Trace g [2]
x: 3.98438, y: -0.0269103


Top Front to Back; 50 lb Cable Network Weight
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [3]
x: 3.98438, y: -0.135737

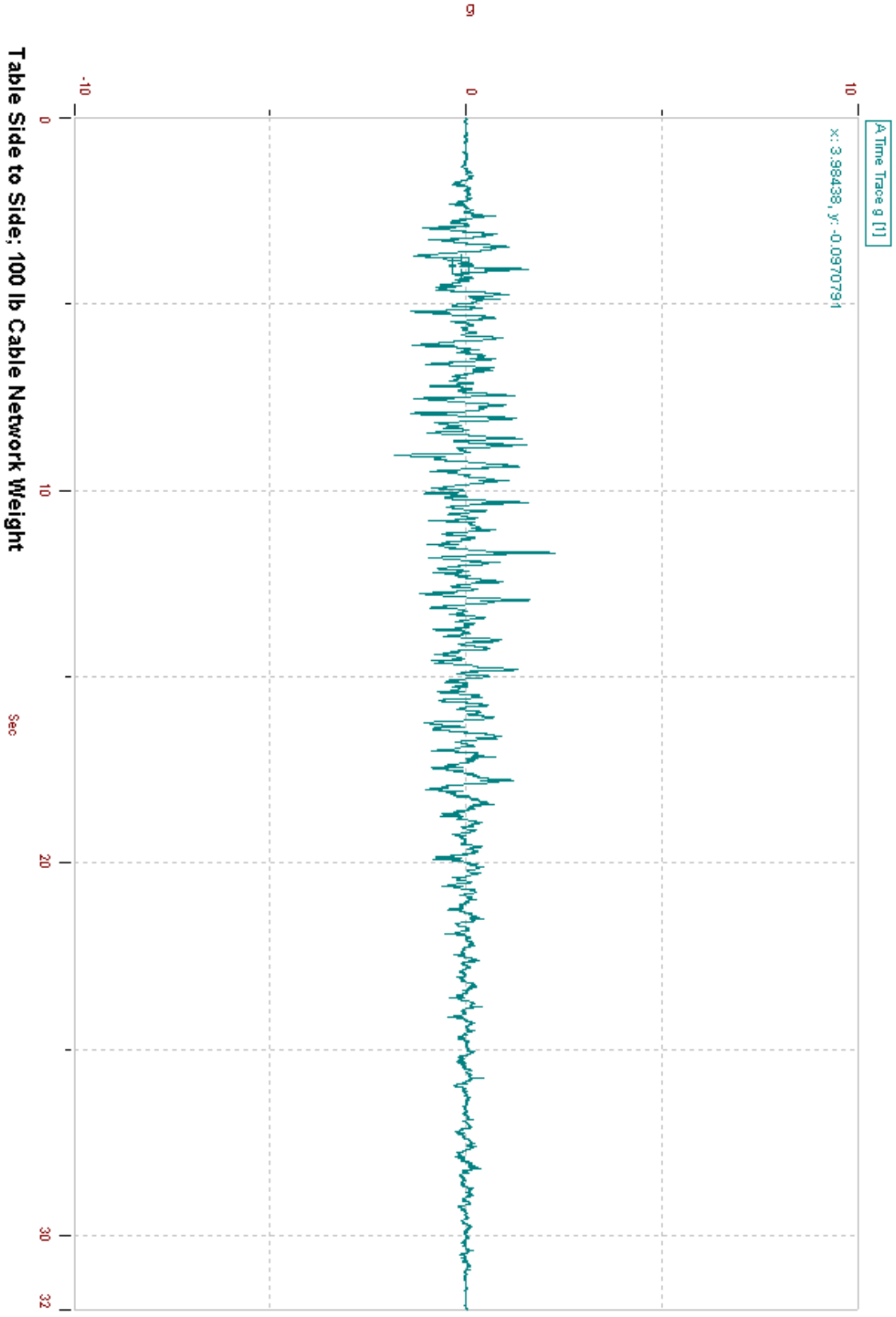
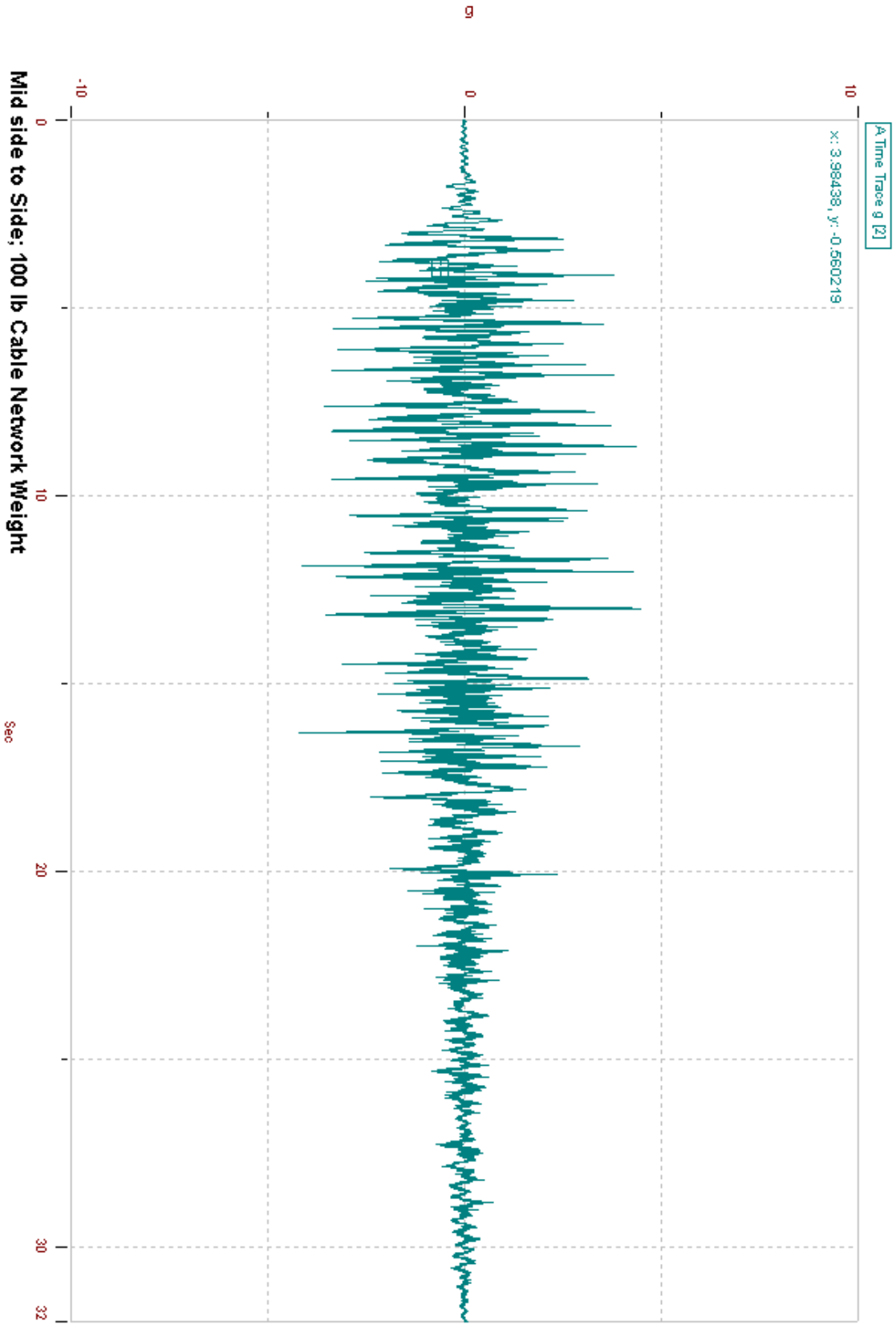
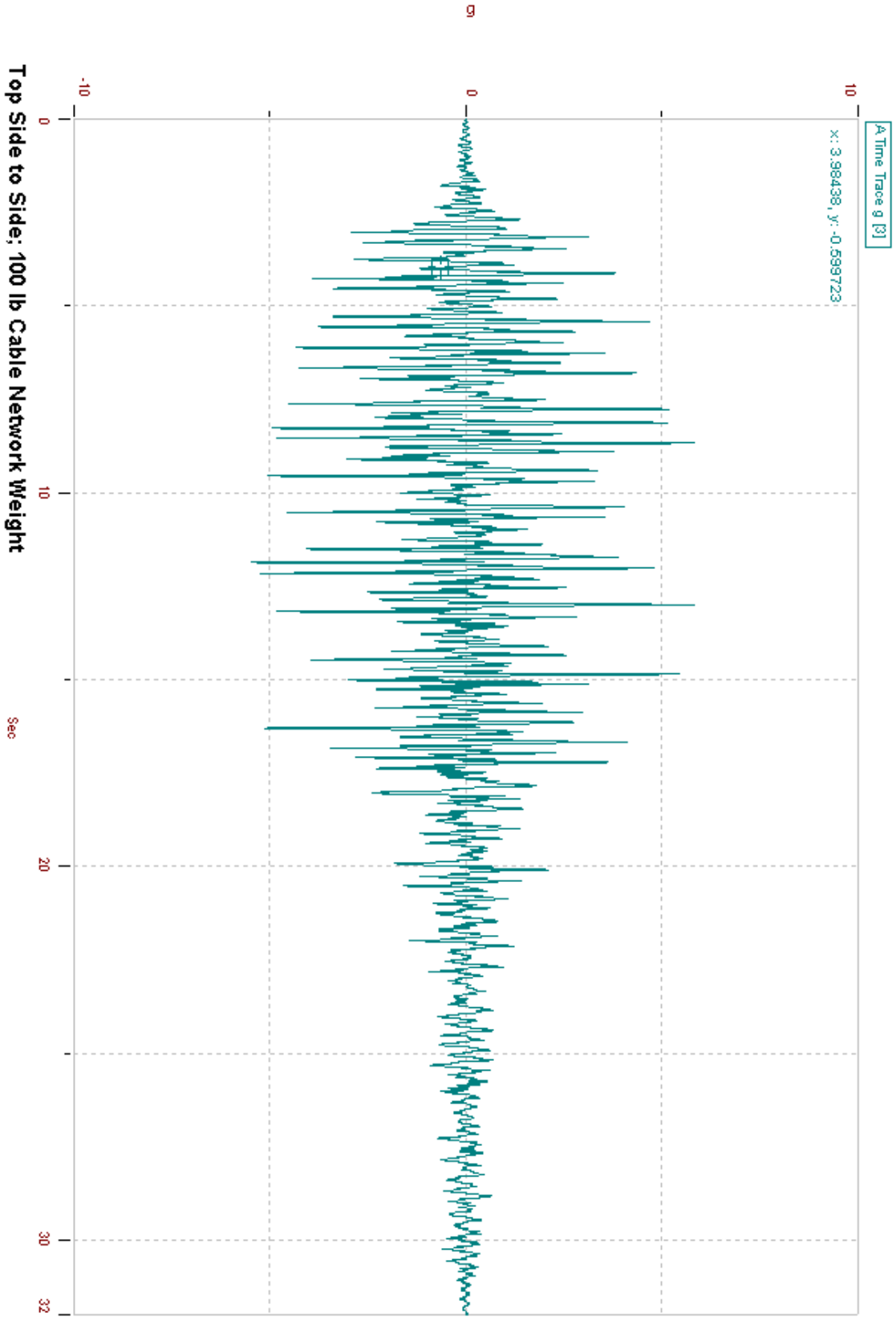


Table Side to Side; 100 lb Cable Network Weight
g
-10
0
10
0
10
20
30
32
Sec
A Time Trace g [1]
x: 3.98438, y: -0.0970791


g
-10
0
10
Mid side to Side; 100 lb Cable Network Weight
0
10
20
30
32
Sec
A Time Trace g [2]
x: 3.98438, y: -0.560219


Top Side to Side; 100 lb Cable Network Weight
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [3]
x: 3.98438, y: -0.599723

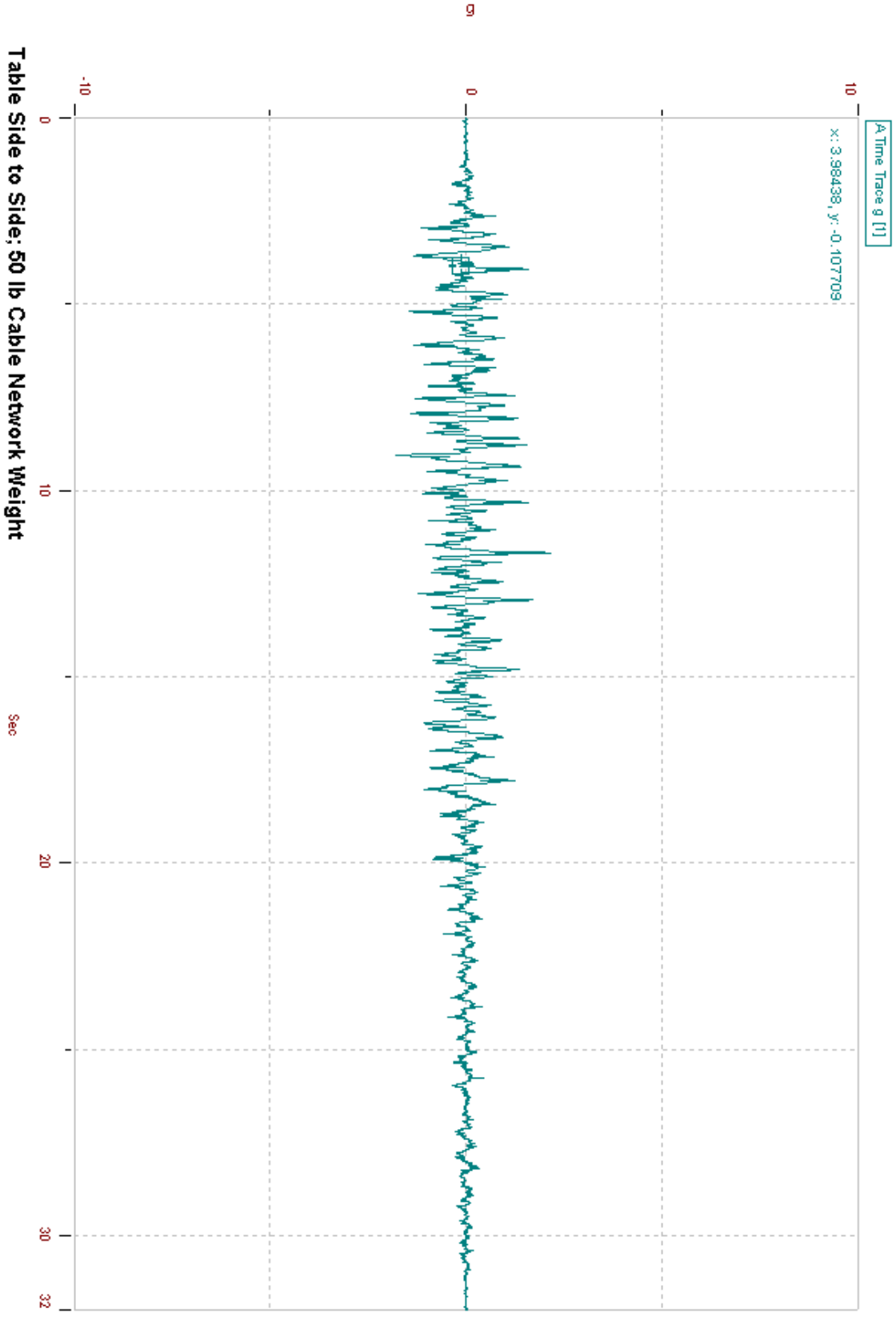
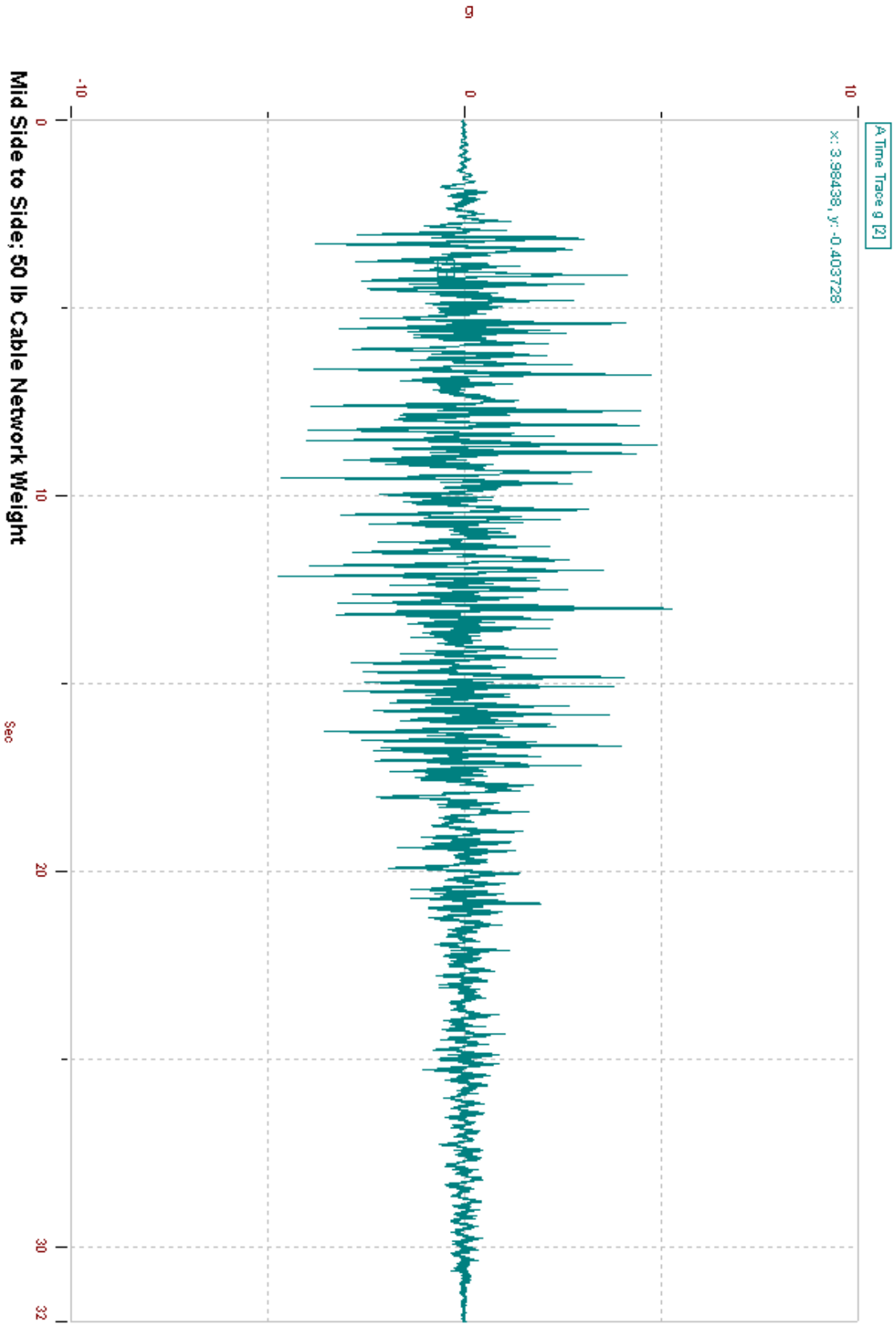
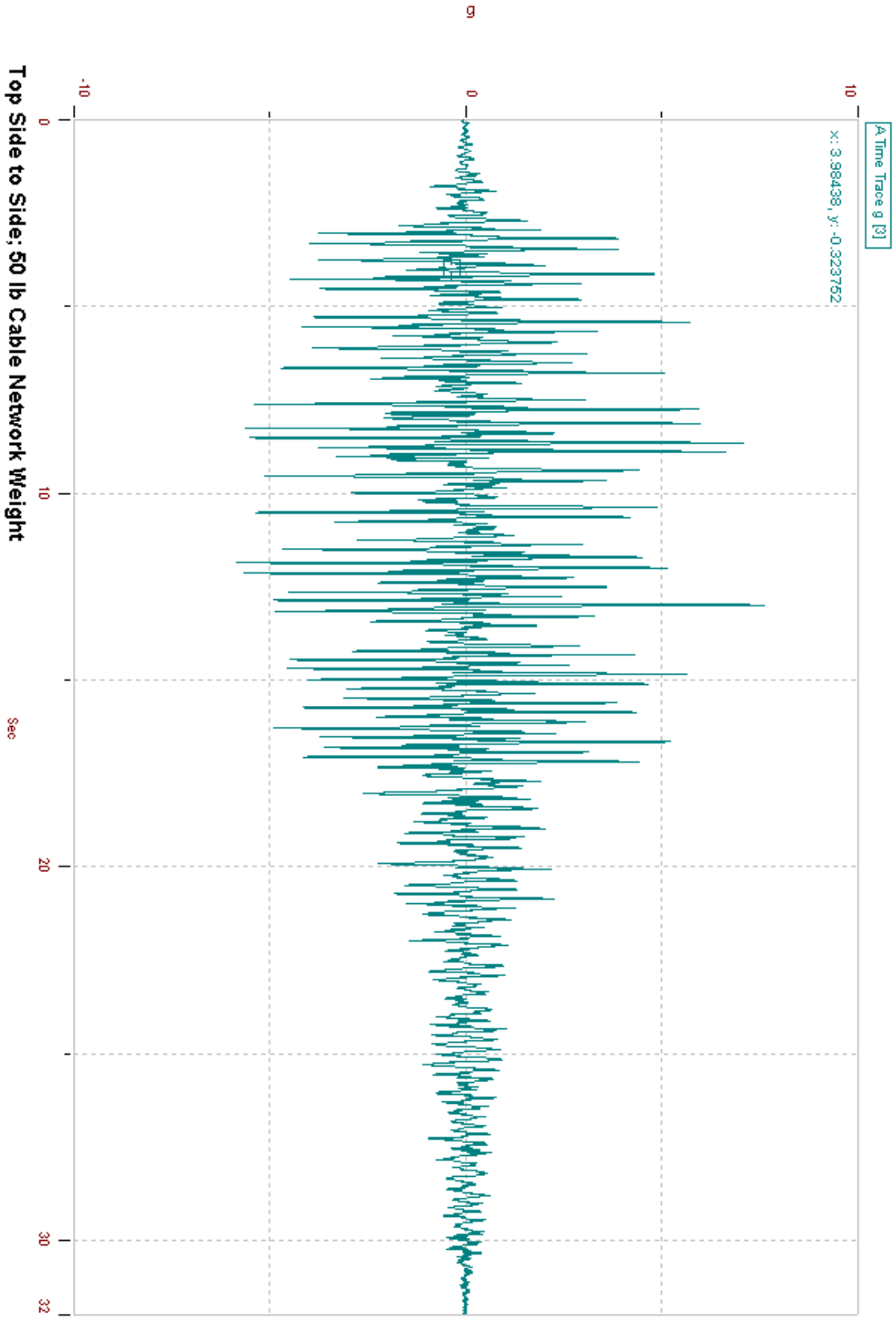


Table Side to Side; 50 lb Cable Network Weight
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [1]
x: 3.98438, y: -0.107709


g
-10
0
10
Mid Side to Side; 50 lb Cable Network Weight
0
10
20
30
32
Sec
A Time Trace g [2]
x: 3.98438, y: -0.403728


Top Side to Side; 50 lb Cable Network Weight
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [3]
x: 3.98438, y: -0.323752

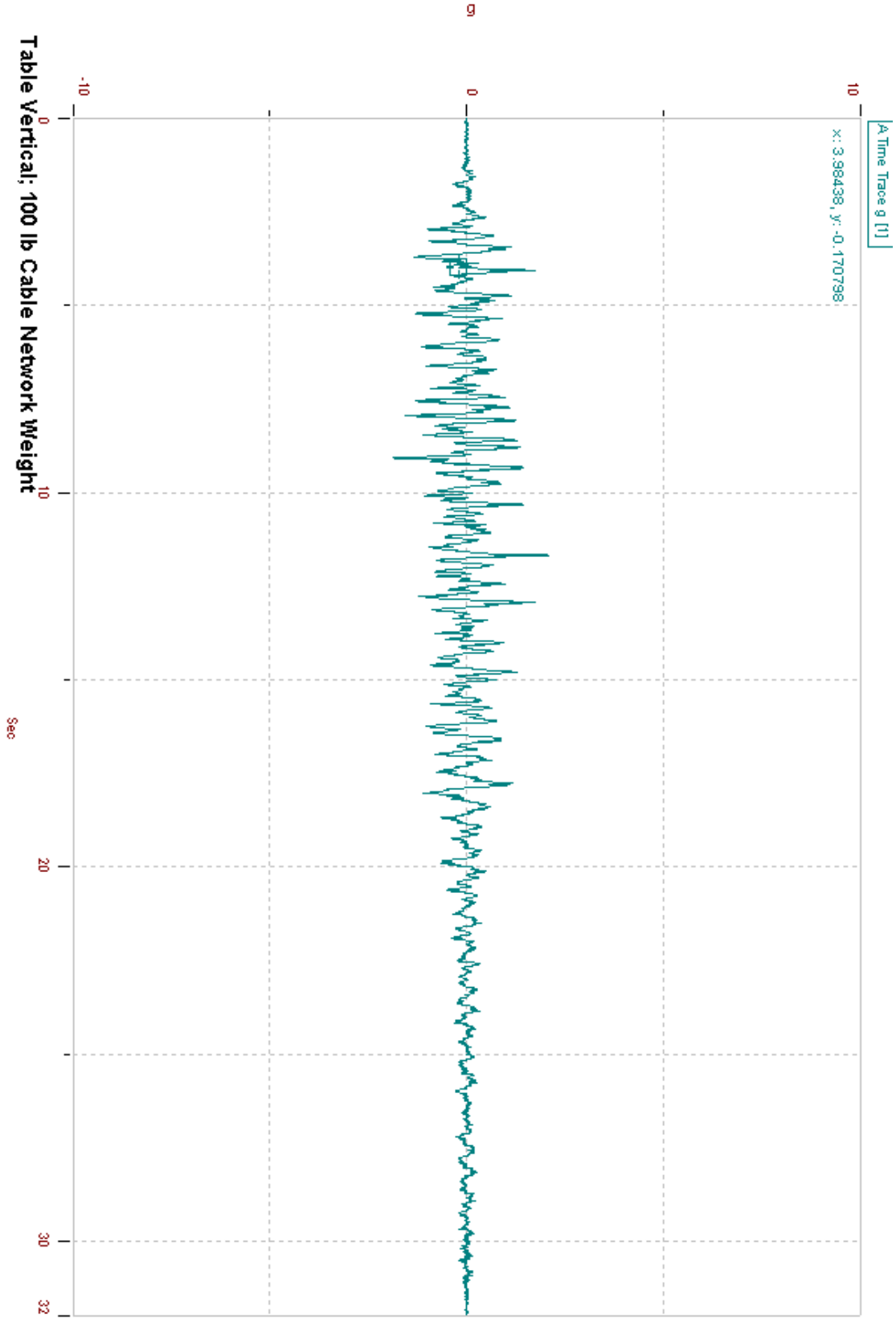
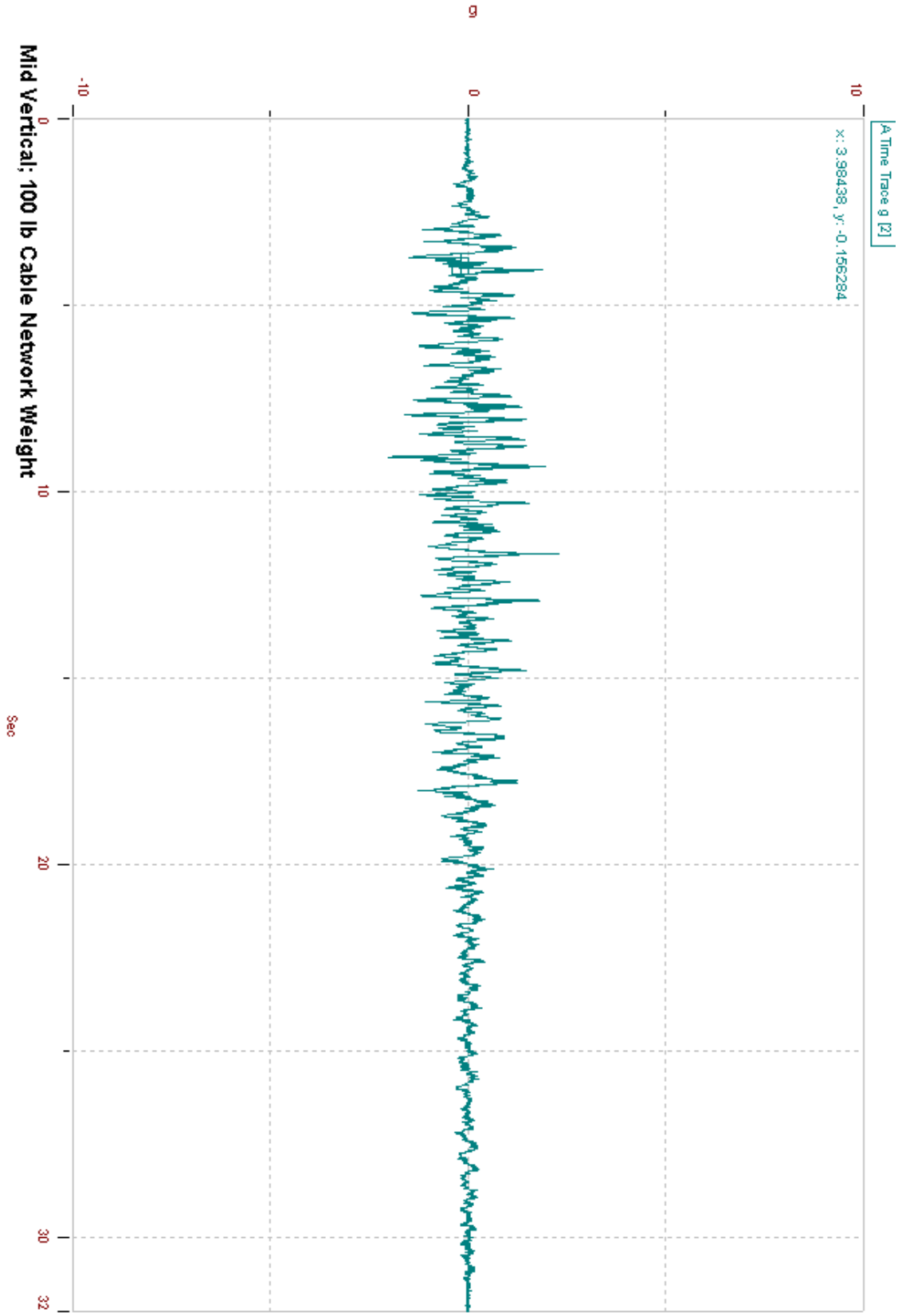
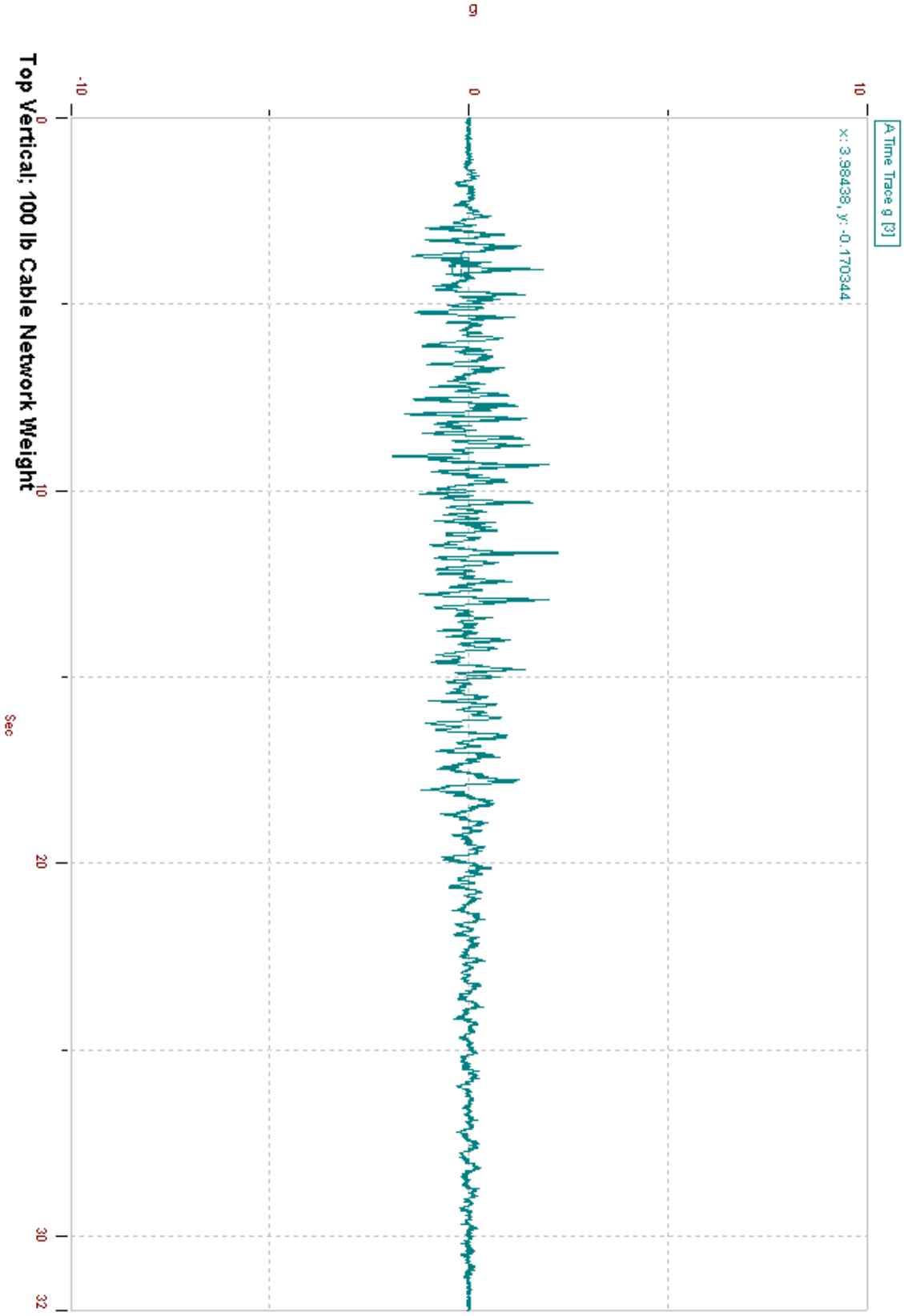


Table Vertical; 100 lb Cable Network Weight
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [1]
x: 3.98438, y: -0.170798


Mid Vertical; 100 lb Cable Network Weight
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [2]
x: 3.98438, y: -0.156284


Top Vertical; 100 lb Cable Network Weight
g
-10
0
10
A Time Trace g [3]
x: 3.98438, y: -0.170344
Sec
0
10
20
30
32

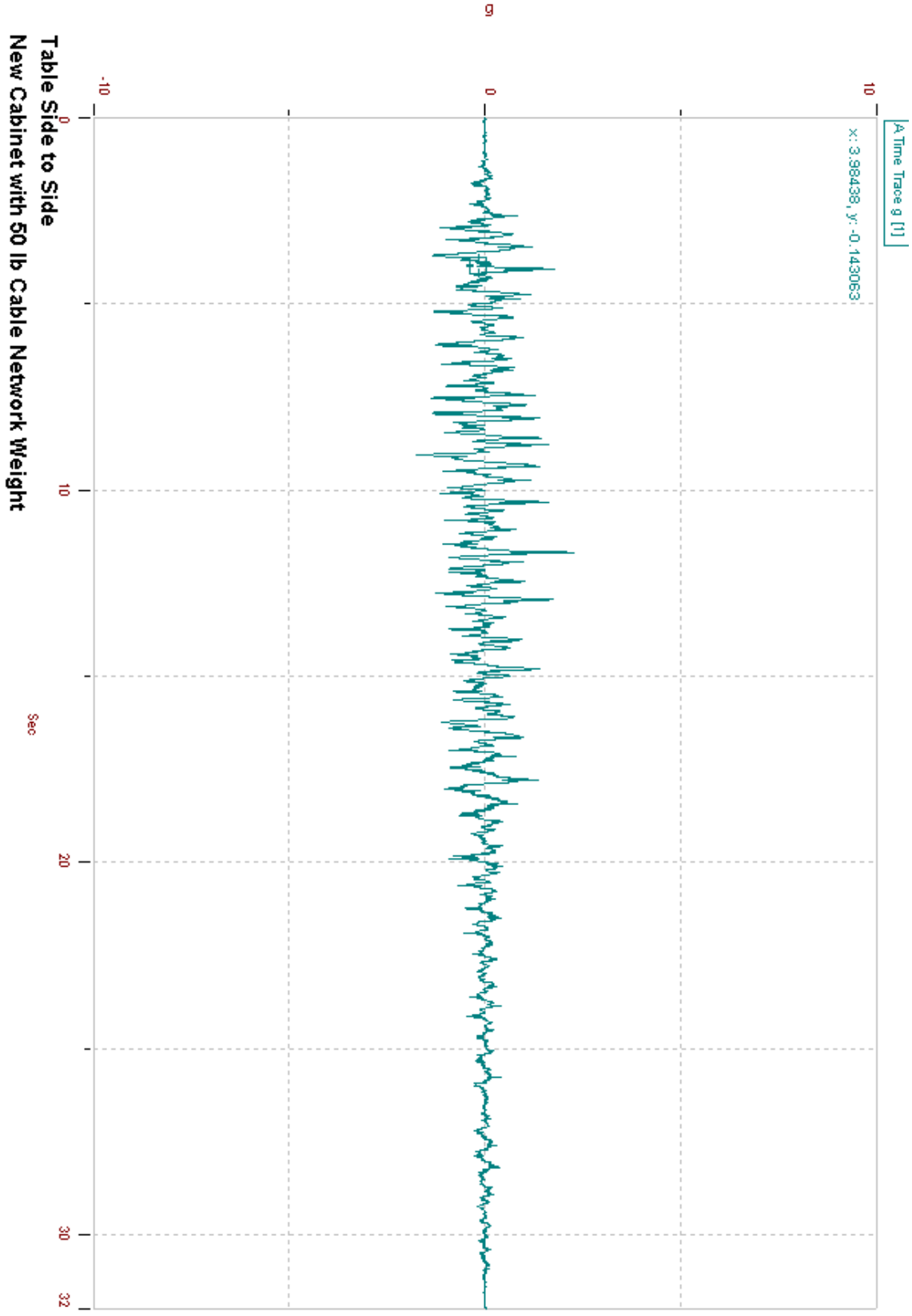
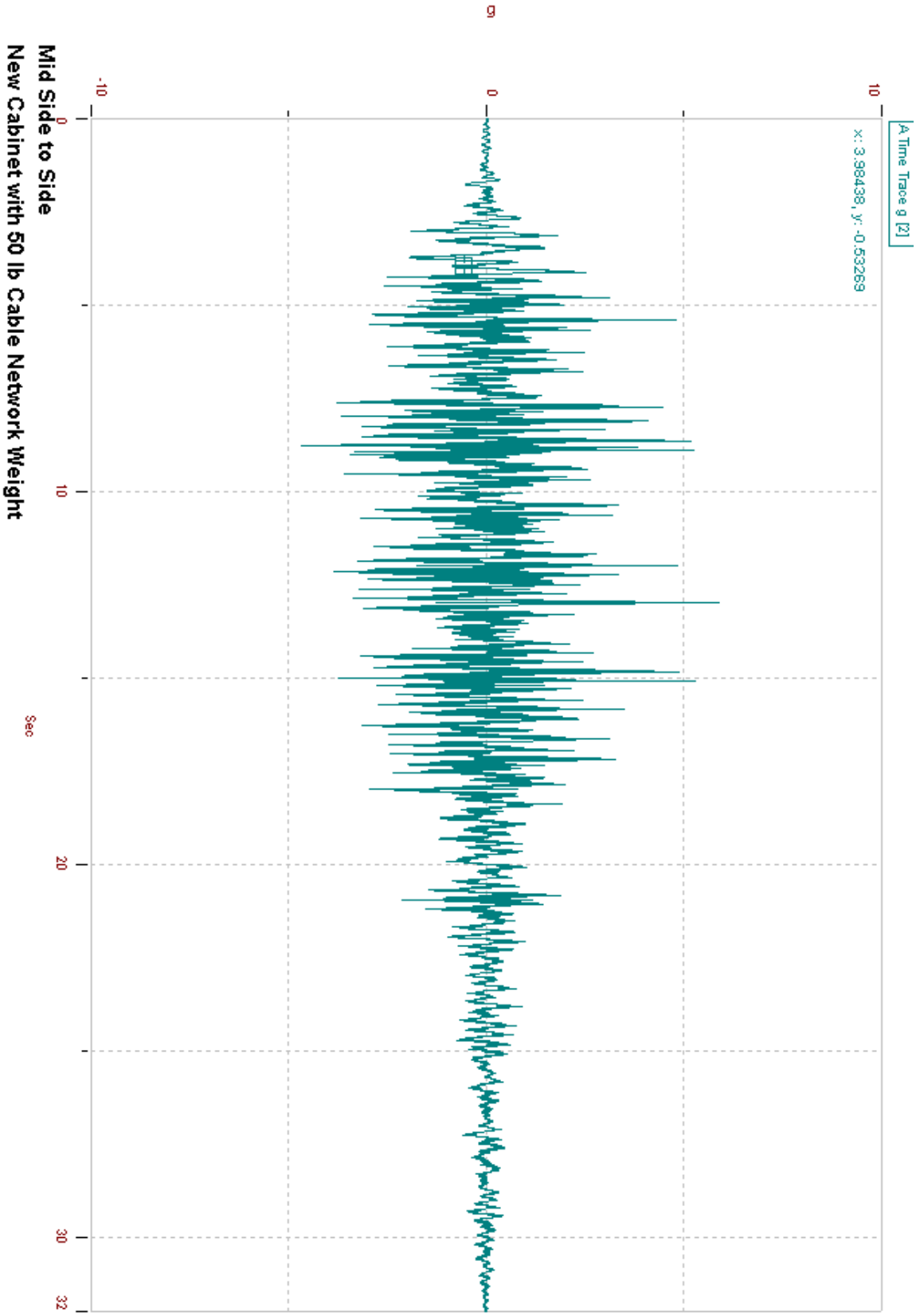
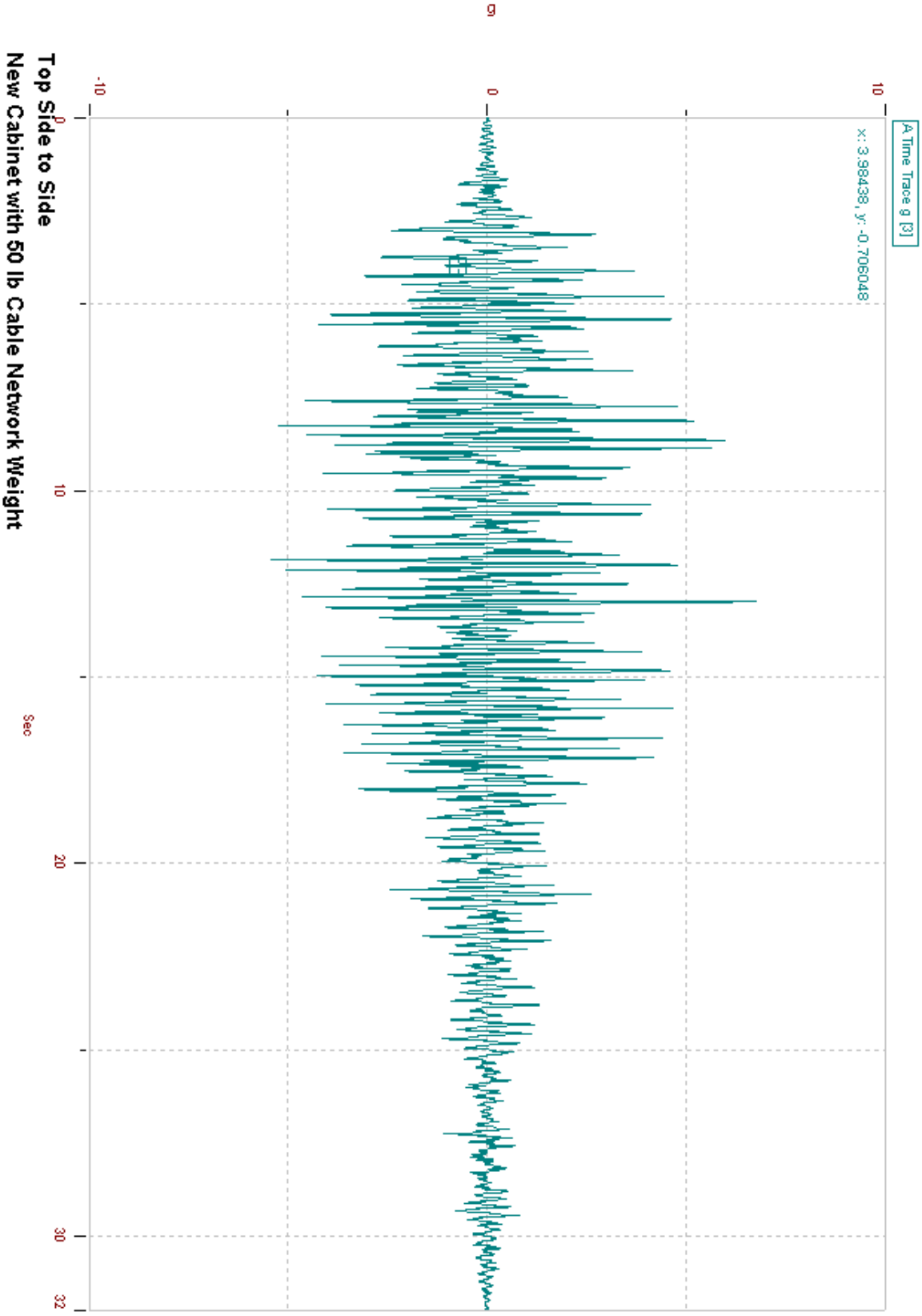


Table Side to Side
New Cabinet with 50 lb Cable Network Weight
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [1]
x: 3.98438, y: -0.143063


Mid Side to Side
New Cabinet with 50 lb Cable Network Weight
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [2]
x: 3.98438, y: -0.53269


Top Side to Side
New Cabinet with 50 lb Cable Network Weight
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [3]
x: 3.98438, y: -0.706048

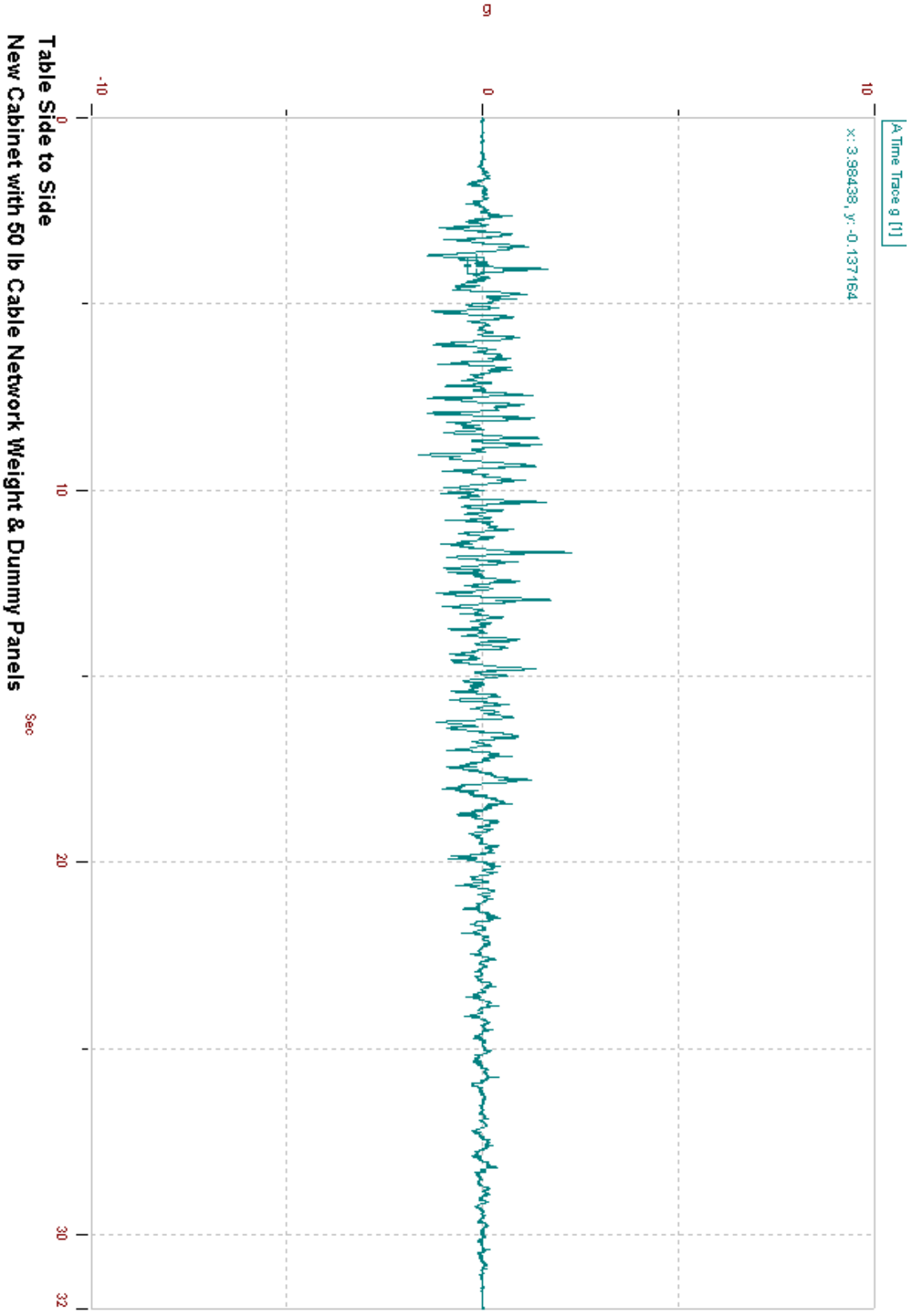
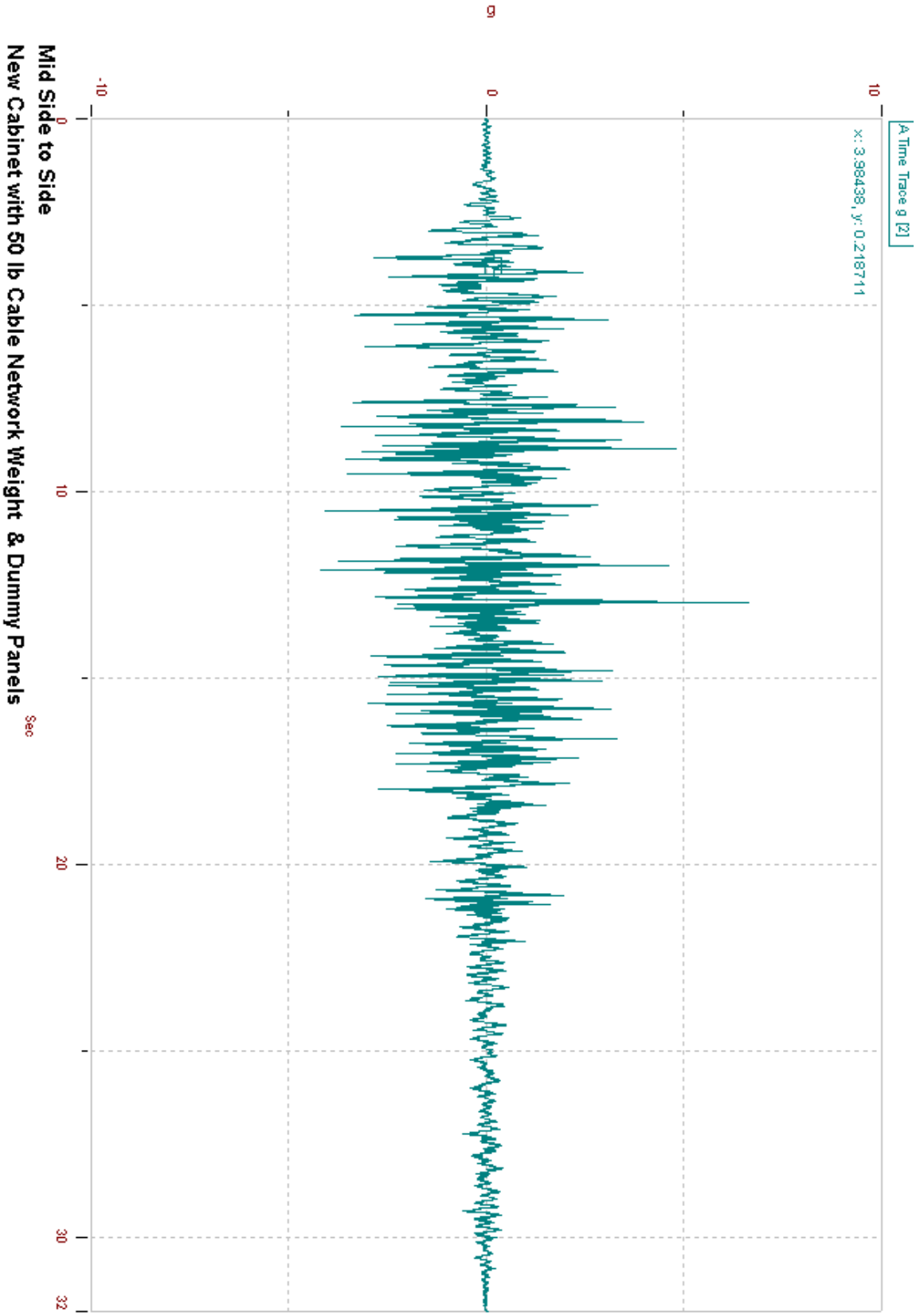
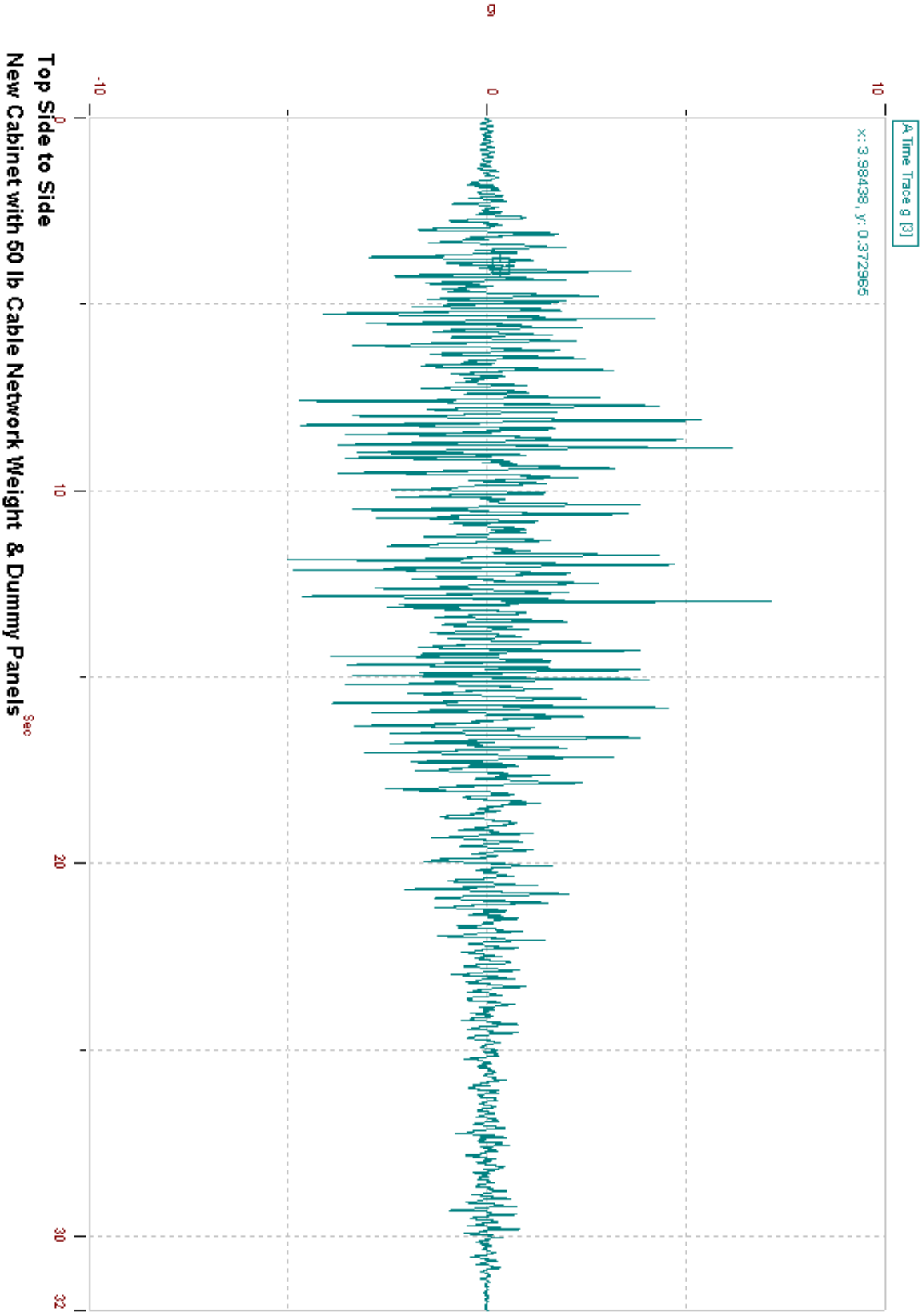
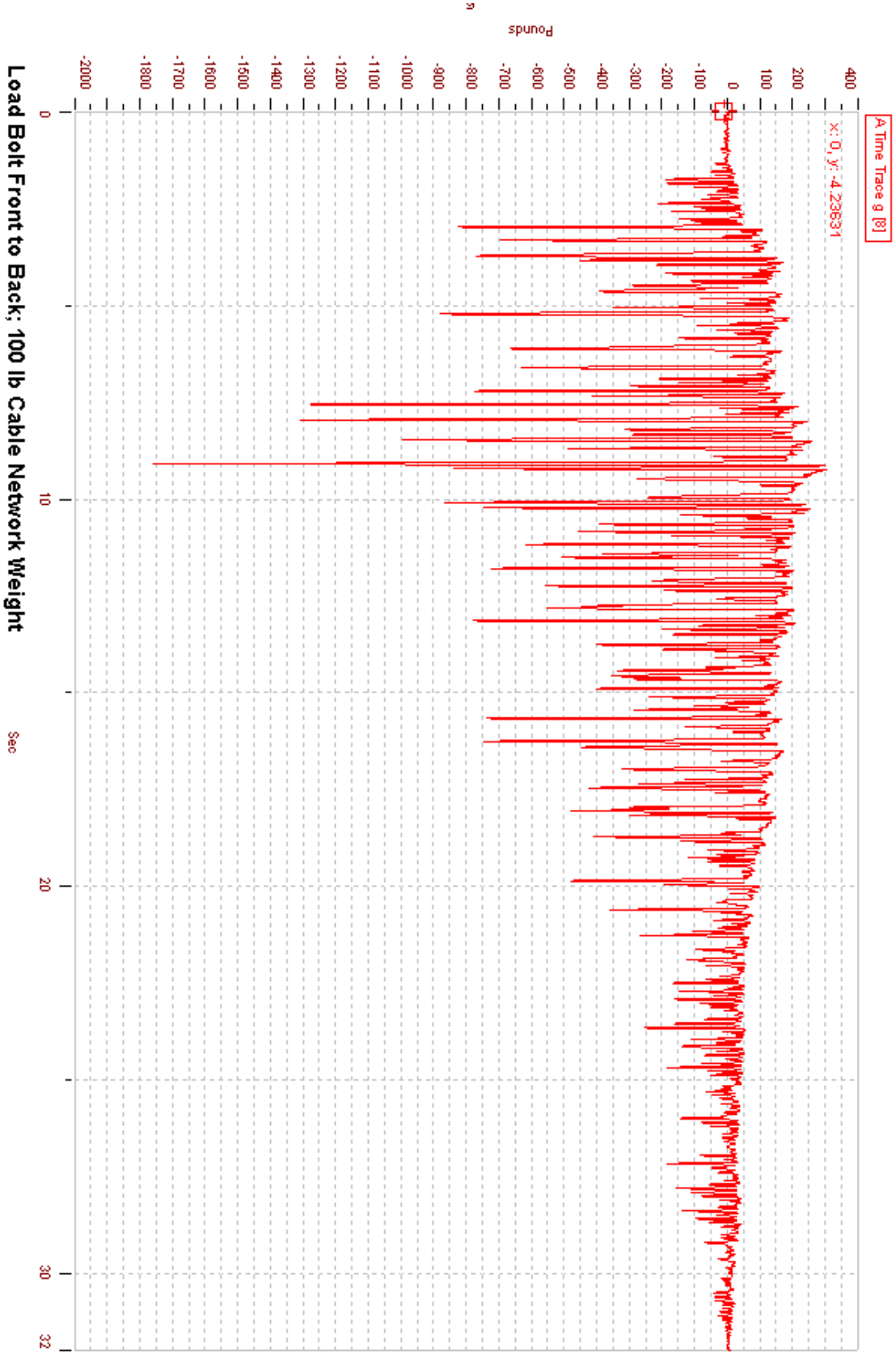


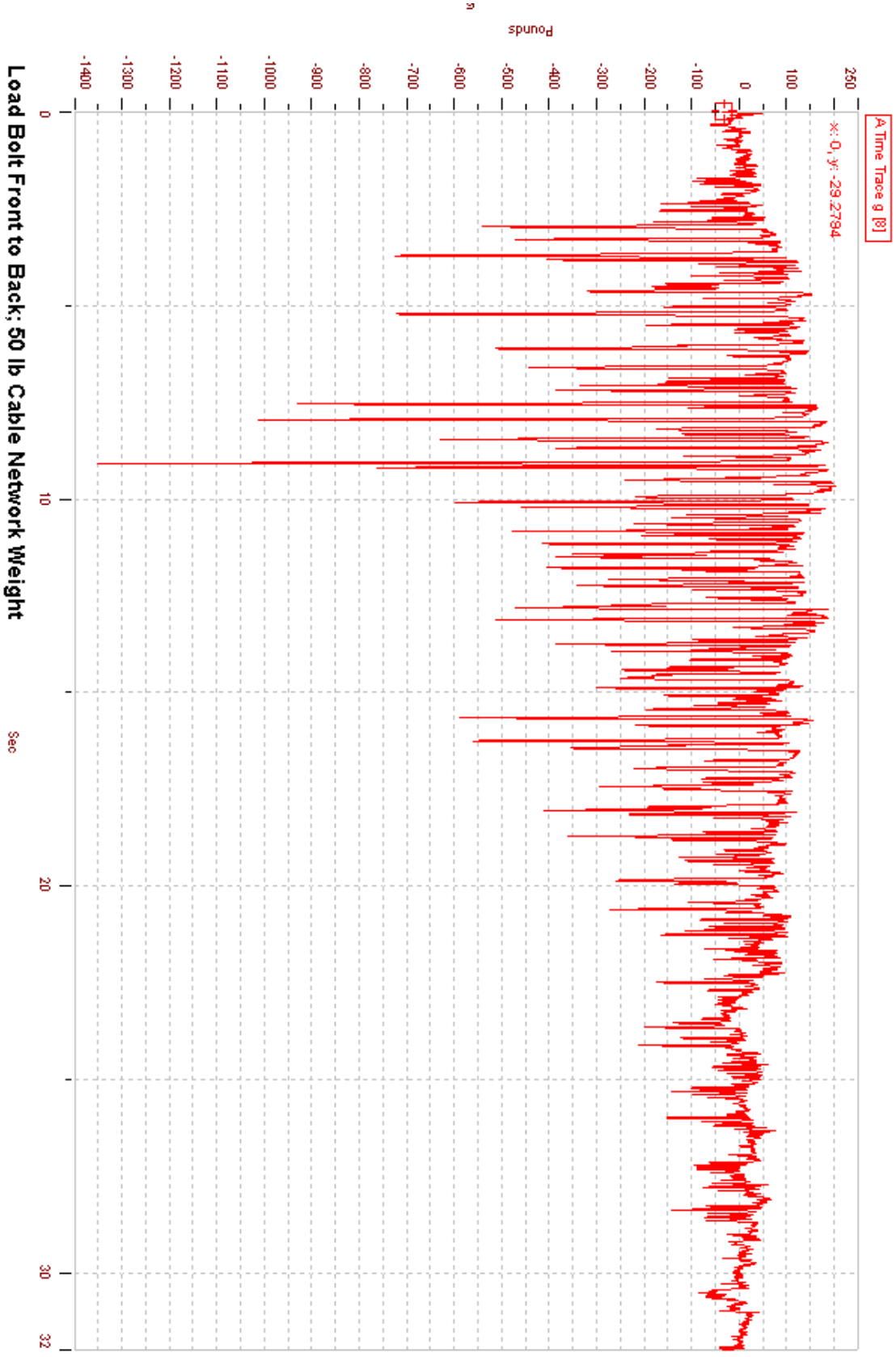
Table Side to Side
New Cabinet with 50 lb Cable Network Weight & Dummy Panels
g
Sec
A Time Trace g [1]
x: 3.98438, y: -0.137164
-10
0
10
0
10
20
30
32

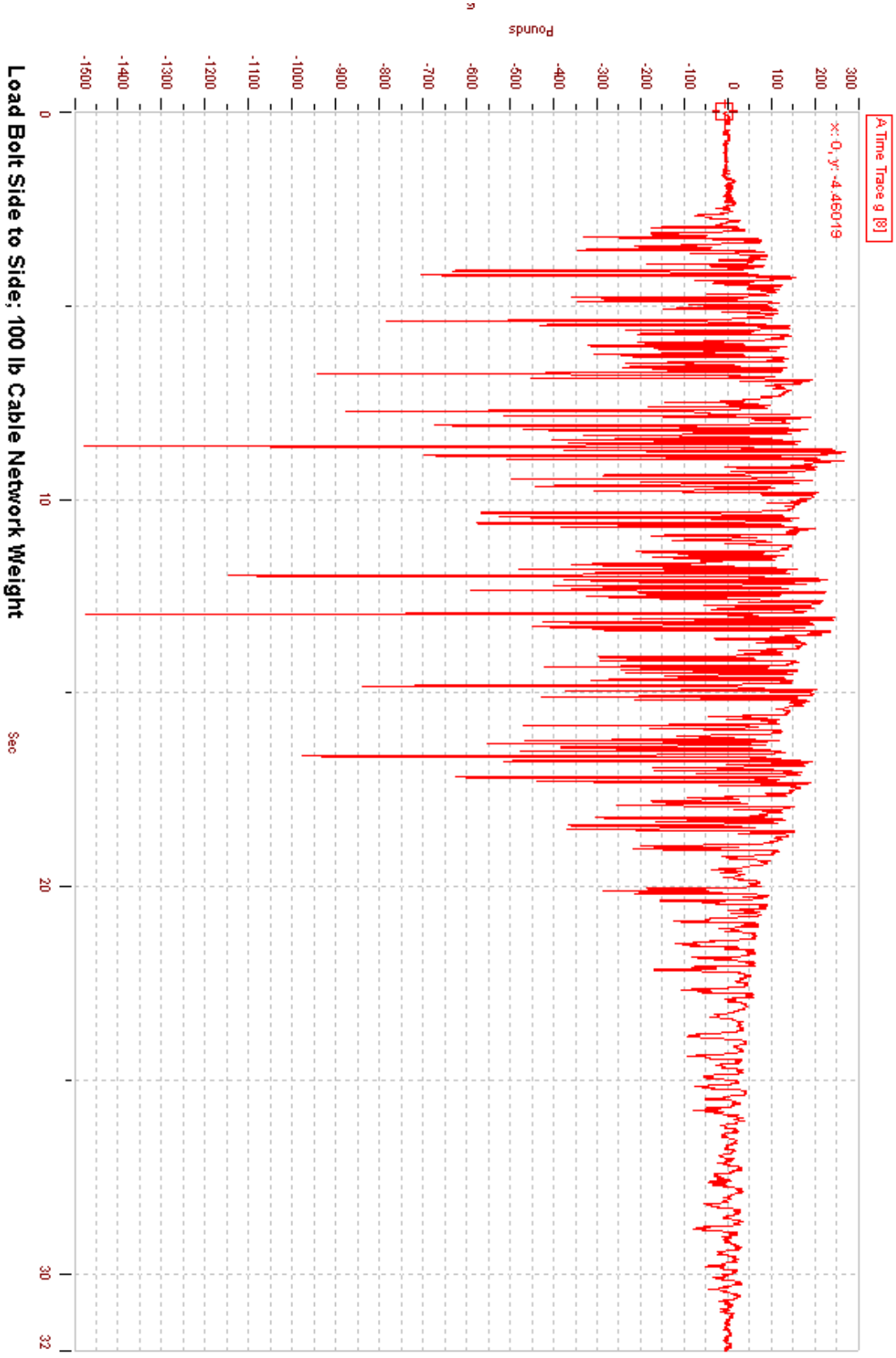

Mid Side to Side
New Cabinet with 50 lb Cable Network Weight & Dummy Panels
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [2]
x: 3.98438, y: 0.218711

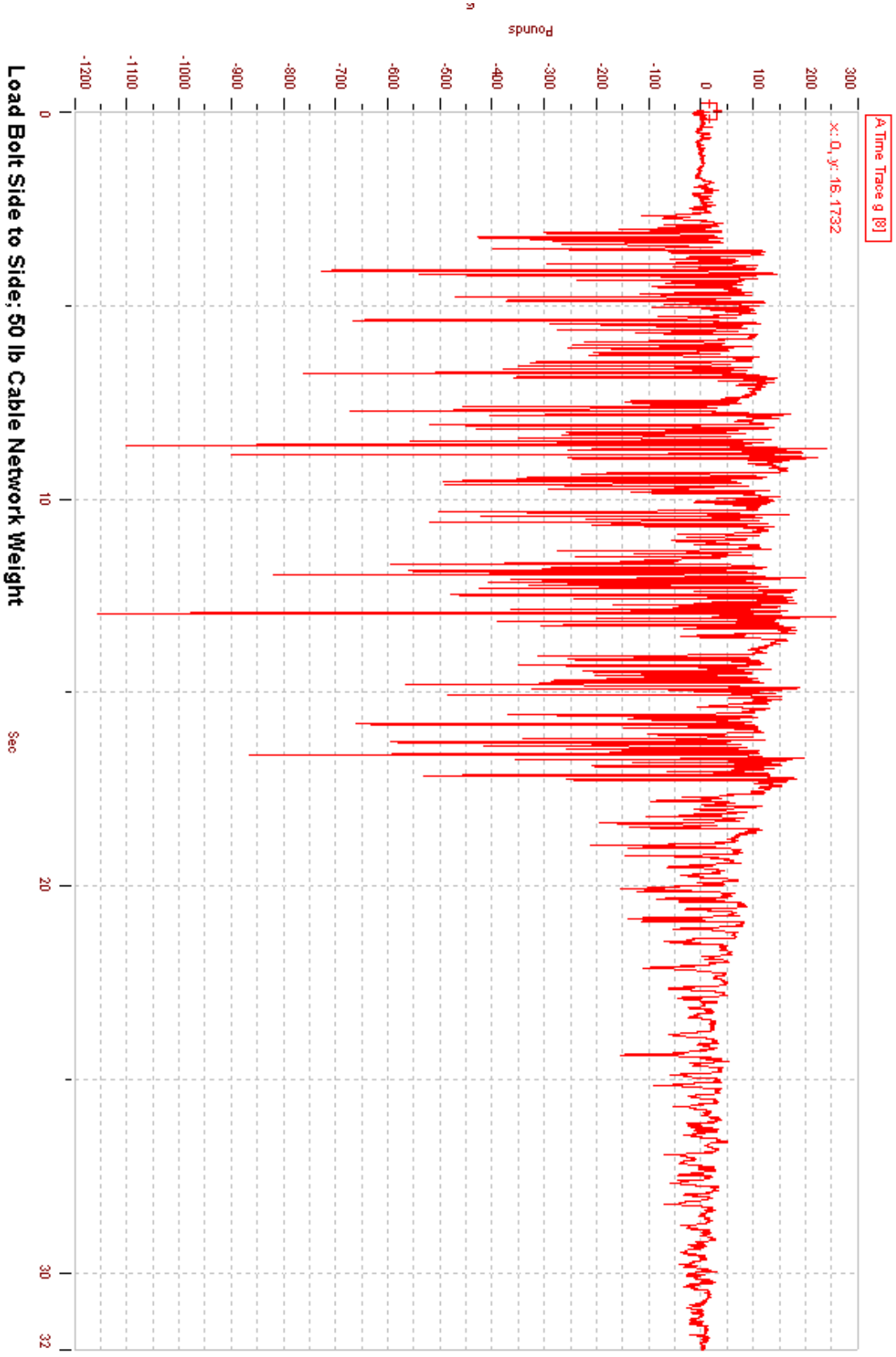

Top Side to Side
New Cabinet with 50 lb Cable Network Weight & Dummy Panels
g
-10
0
10
Sec
0
10
20
30
32
A Time Trace g [3]
x: 3.98438, y: 0.372965

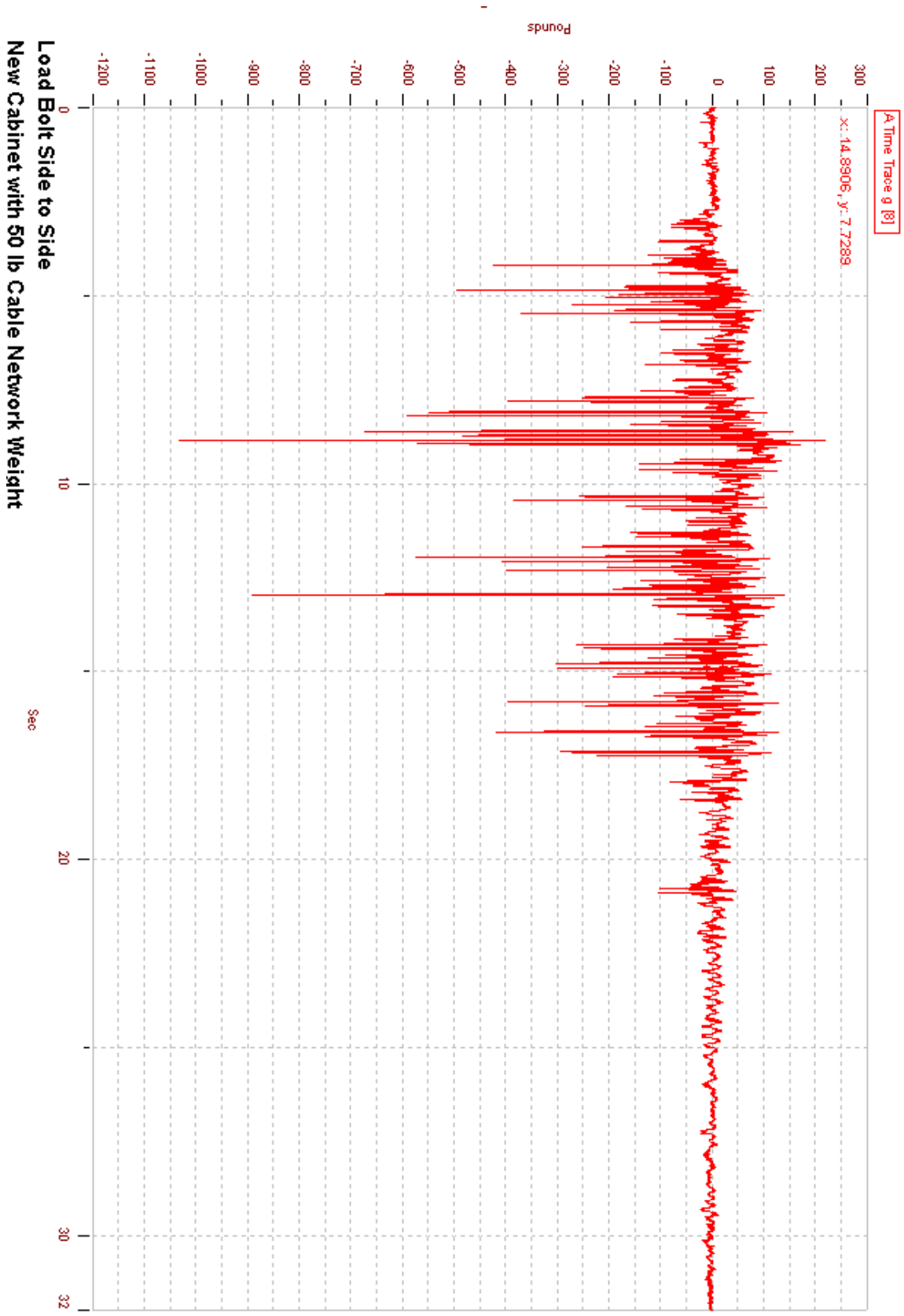
A-4: Load Bolt


Load Bolt Front to Back; 100 lb Cable Network Weight
Pounds
Sec
A Time Trace g [8]
x: 0, y: -4.23631


Load Bolt Front to Back; 50 lb Cable Network Weight
Pounds
Sec
A Time Trace g [8]
x: 0, y: -29.2784
-1400
-1300
-1200
-1100
-1000
-900
-800
-700
-600
-500
-400
-300
-200
-100
0
100
250
0
10
20
30
32


Load Bolt Side to Side; 100 lb Cable Network Weight
Pounds
Sec
A Time Trace g [8]
x: 0, y: -4.45019
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000
-1100
-1200
-1300
-1400
-1500
0
10
20
30
32


Load Bolt Side to Side; 50 lb Cable Network Weight
Pounds
Sec
A Time Trace g [8]
x: 0, y: 16.1732
-1200
-1100
-1000
-900
-800
-700
-600
-500
-400
-300
-200
-100
0
100
200
300
0
10
20
30
32


Load Bolt Side to Side
New Cabinet with 50 lb Cable Network Weight
Pounds
Sec
A Time Trace g [8]
x: 14.8906, y: 7.7289