



# Shock and Vibration Test report

Revision -: October, 26th, 2003

## TABLE OF CONTENTS

<b>1</b>	<b><i>SCOPE</i></b> .....	<b>4</b>
<b>2</b>	<b><i>APPLICABLE DOCUMENTS</i></b> .....	<b>4</b>
<b>3</b>	<b><i>Identification of Items Being Tested</i></b> .....	<b>4</b>
	Test Items .....	<b>4</b>
<b>4</b>	<b><i>Shock tests:</i></b> .....	<b>5</b>
	Shock Test Category .....	<b>5</b>
	Shock Grade .....	<b>5</b>
	Equipment Class .....	<b>5</b>
	Shock Test Type .....	<b>5</b>
	Equipment Mounting Locations .....	<b>5</b>
	Mounting Orientation aboard Ship.....	<b>5</b>
	Shock: FSP and Fixture Instrumentation.....	<b>7</b>
	Shot 3 result summary .....	<b>9</b>
	Summary of hardware observations after the tests: .....	<b>13</b>
<b>5</b>	<b><i>VIBRATION tests:</i></b> .....	<b>15</b>
	Vibration Type .....	<b>15</b>
	Vibration Test Range.....	<b>15</b>
	Equipment Mounting Locations .....	<b>15</b>
	Vibration: Instrumentation of racks under test.....	<b>15</b>
	Vibration result summary.....	<b>16</b>
	Comments on vibration tests:.....	<b>20</b>
	Summary of hardware observations after the vibration tests: .....	<b>20</b>
	<b><i>Appendix A: Installation and interface drawing of the</i></b> .....	<b>21</b>

DOCUMENT REFERENCE														
Project number				TYPE				FORMAT		PAGE				
D00318				Calculation report				Lt		3				
													-	REV

# Shock and Vibration Test report

Revision -: October, 26th, 2003

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## 4 **SHOCK TESTS:**

### ***Shock Test Category***

Heavyweight

### ***Shock Grade***

Class II

12-16 Hz Deck Simulator Fixture (DSF)

### ***Equipment Class***

Grade A

### ***Shock Test Type***

Type A

### ***Equipment Mounting Locations***

The Base of the racks is mounted on a Deck Simulator Fixture during barge test. The DSF also simulates bulkhead interface.

### ***Mounting Orientation aboard Ship***

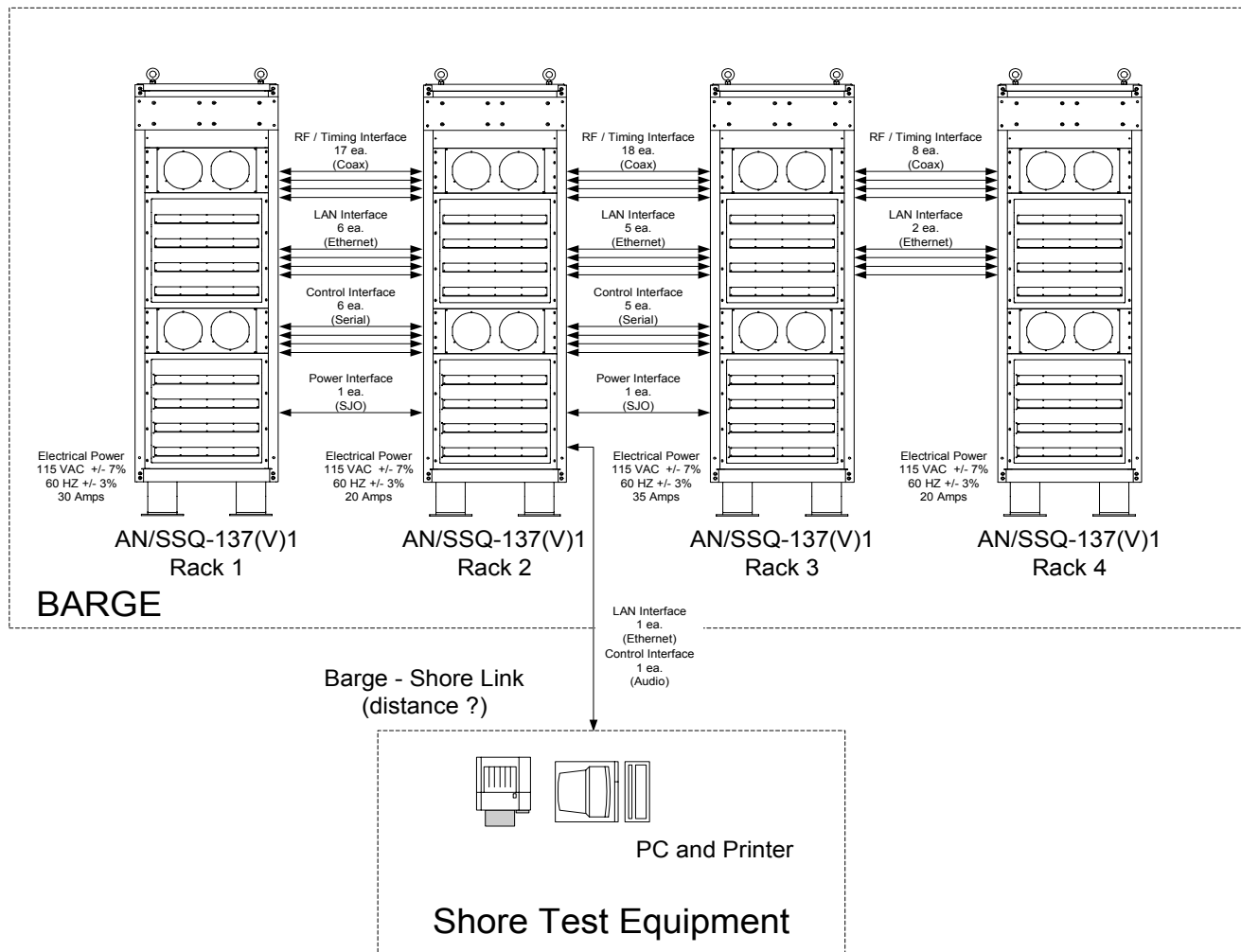
Vertical orientation, front door facing forward for the first 3 shots. Racks are rotated 90 degrees for the last shot.

	DOCUMENT REFERENCE			
	Project number	TYPE	FORMAT	PAGE
	D00318	Calculation report	Lt	5
				- REV

# Shock and Vibration Test report

Revision -: October, 26th, 2003

## TEST SETUP FOR BARGE TEST



DOCUMENT REFERENCE			
Project number	TYPE	FORMAT	PAGE
D00318	Calculation report	Lt	6
			- REV

# Shock and Vibration Test report

Revision -: October, 26th, 2003

## ***Shock: FSP and Fixture Instrumentation***

Accelerometers are installed on the DSF to verify proper test geometry and to monitor the shock input parameters. Accelerometers are placed on the cabinet and test fixture to verify proper shock conditions and to monitor shock at cabinet level. Accelerometer locations for the Class II equipment and DSF are listed in Table below. In addition to the accelerometers listed below, clay cones have been installed below each rack to monitor vertical deflection during shock.

Gage	Orientation	Cabinet PN	Location
Acc-1	vertical		DSF center, middle of 4 racks
Acc-2	athwart ship		DSF center, middle of 4 racks
Acc-5	vertical	Rack #1	Front Top of rack (right side)
Acc 6	vertical	Rack #2	Front Top of rack (right side)
Acc 7	athwart ship	Rack #2	Front Top of rack (right side)
Acc 8	vertical	Rack #2	Front Bottom of rack (left side)
Acc 9	athwart ship	Rack #2	Front Bottom of rack (left side)
Acc 10	vertical	Rack #3	Front Top of rack (side)
Acc 11	vertical	Rack #4	Front Top of rack (side)

### *Shock Test Accelerometer Location for Class II Equipment*

DOCUMENT REFERENCE														
Project number				TYPE				FORMAT		PAGE				
D00318				Calculation report				Lt		7				
													-	REV



# Shock and Vibration Test report

Revision -: October, 26th, 2003

## **Shot 3 result summary**

List of test conducted:

Shot no	Test fixture frequency Hz +/- 1	Equipment operating Mode	Charge depth	Horizontal standoff	Charge location	Orientation of SSEE system @ FSP
1	Class II-14	ON	24 ft	30 ft	athwart	Fore / aft
2	Class II-14	ON	24 ft	25 ft	athwart	Fore / aft
3	Class II-14	ON	24 ft	20 ft	athwart	Fore / aft
4	Class II-14	ON	24 ft	20 ft	athwart	athwart

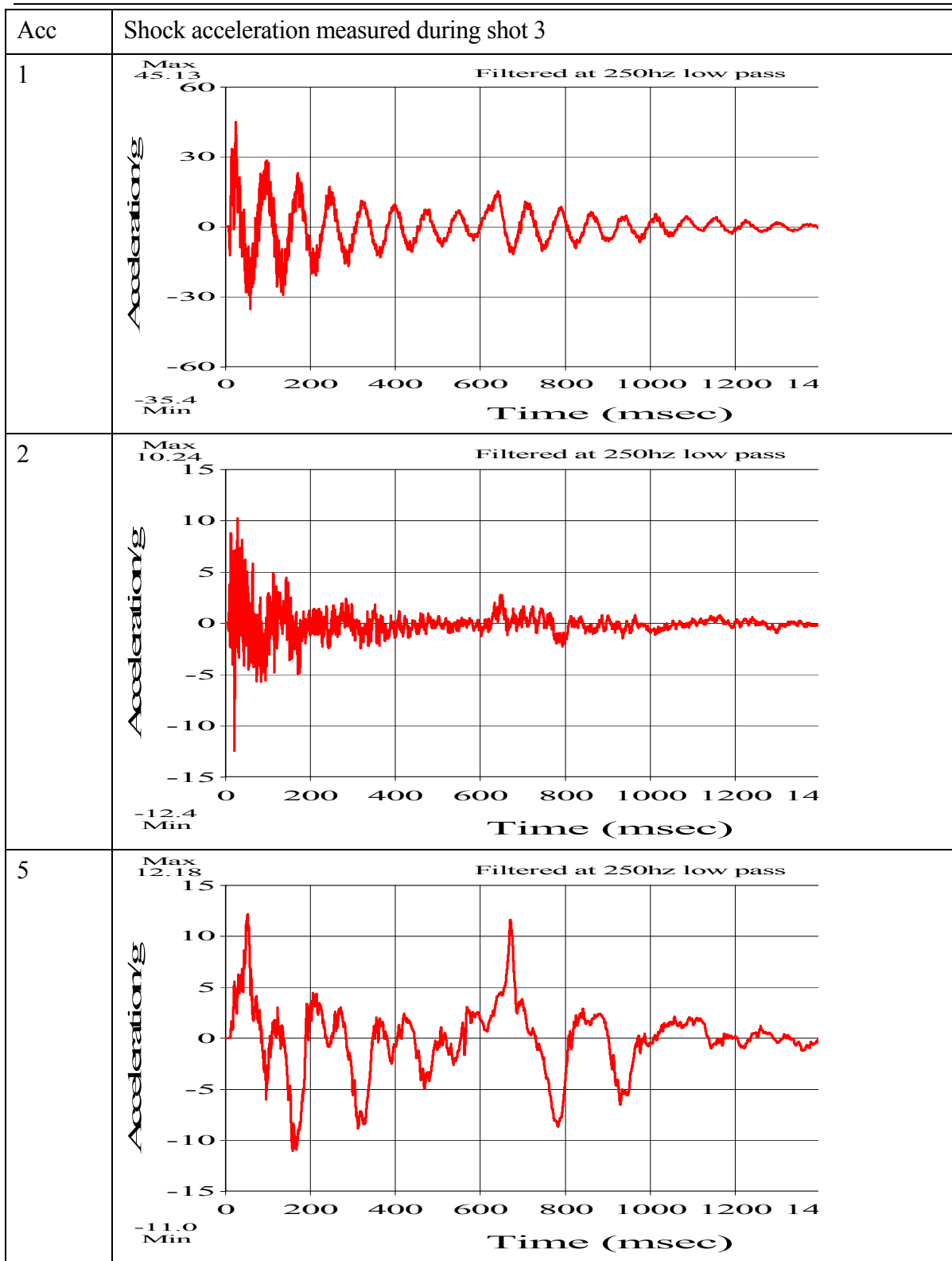
Test results have been limited to the most severe and representative test (shot 3 with the 60lbs explosive charge horizontally located at 20 ft from the barge). Other results are fully documented in the shock and vibration test report (DTI document reference 655).



<b>DOCUMENT REFERENCE</b>												
Project number				TYPE				FORMAT		PAGE		
D00318				Calculation report				Lt		9		
											-	<b>REV</b>

# Shock and Vibration Test report

Revision -: October, 26th, 2003

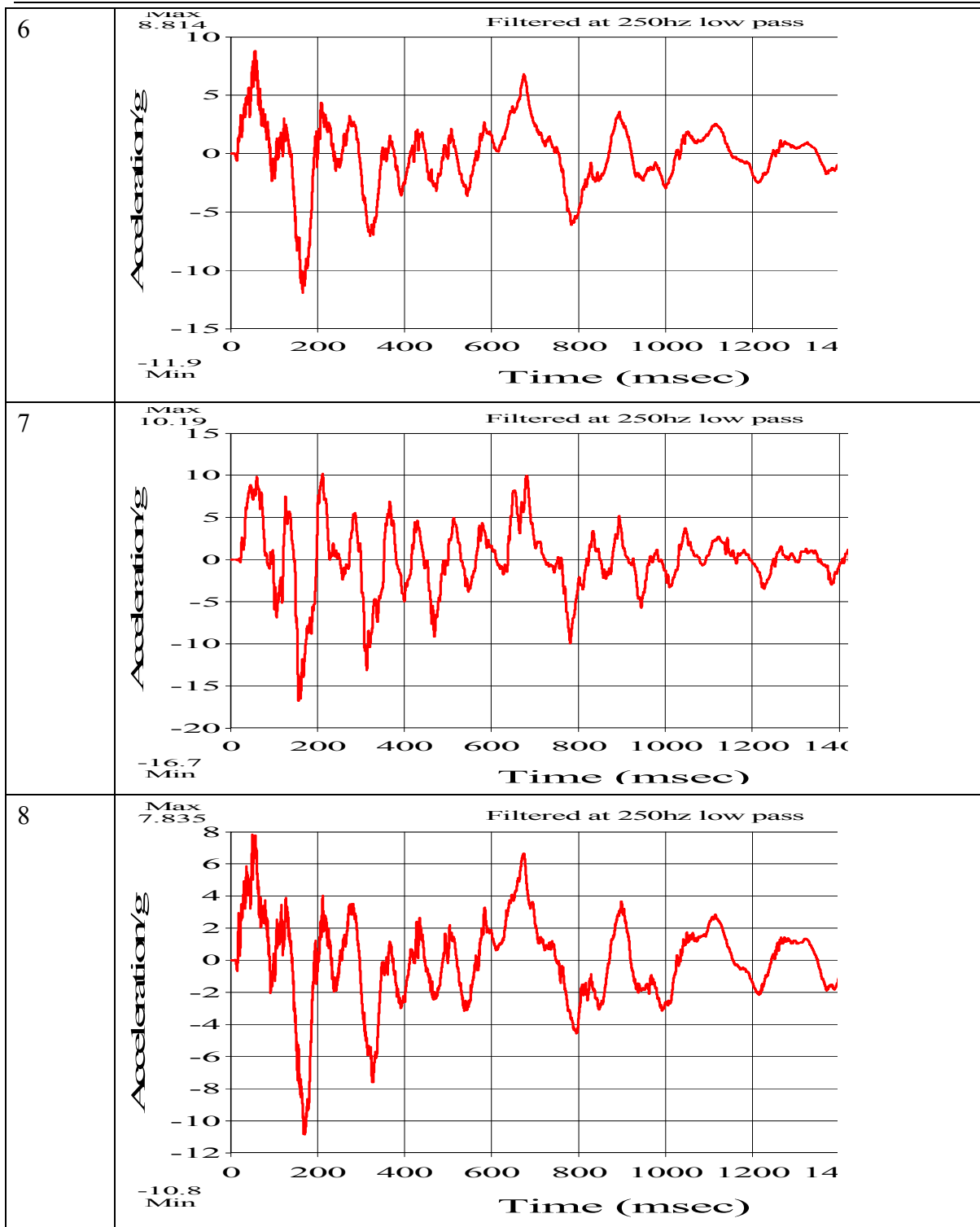


DOCUMENT REFERENCE			
Project number	TYPE	FORMAT	PAGE
D00318	Calculation report	Lt	10
			- REV



# Shock and Vibration Test report

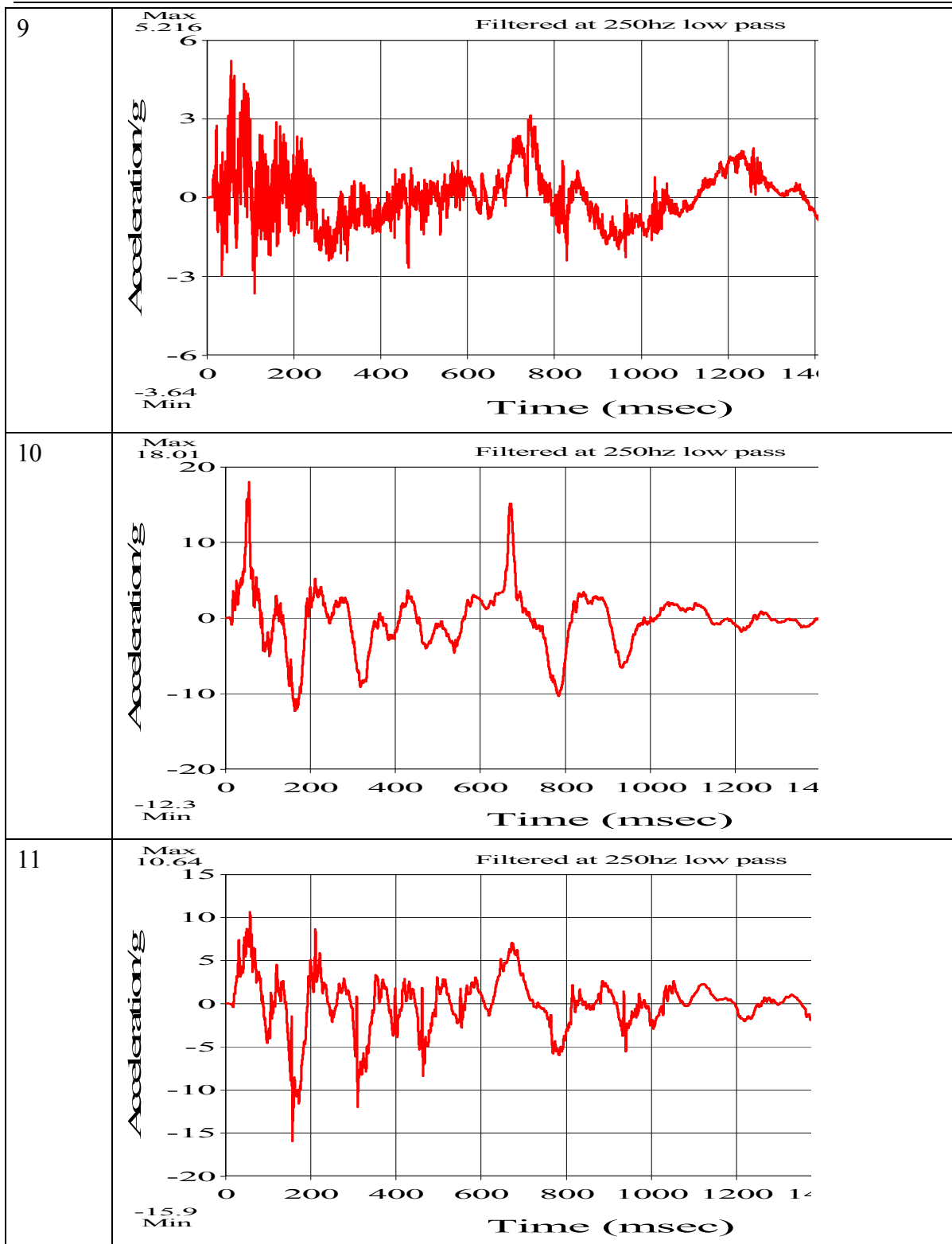
Revision -: October, 26th, 2003



DOCUMENT REFERENCE										
Project number			TYPE			FORMAT	PAGE			
D00318			Calculation report			Lt	11			
									-	REV

# Shock and Vibration Test report

Revision -: October, 26th, 2003



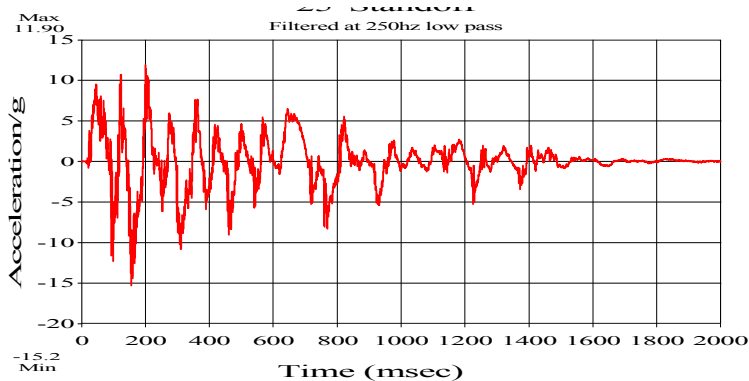
DOCUMENT REFERENCE			
Project number	TYPE	FORMAT	PAGE
D00318	Calculation report	Lt	12
			- REV

# Shock and Vibration Test report

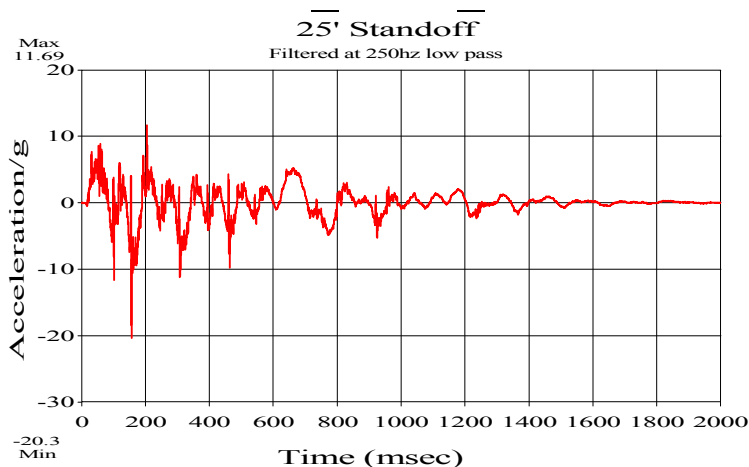
Revision -: October, 26th, 2003

## **Summary of hardware observations after the tests:**

- No defect has been noted on racks (no loose hardware, scratch, dent...)
- The shock isolators did not bottom during the most severe shots (3 and 4).
- Vertical deflection (sway space downward) was measured at 3.5" on clay cone.
- The sway space measured and the level of G response inside the racks is in good accordance with the calculation performed to select the shock mounts. This validates the theoretical model and L/D data used by 901D,LLC to perform barge test shock analysis.
- During shot 2, accelerometers 7 and 11 were moved and relocated on the side of one of the servers. The first accelerometer was mounted on the rack side, the other one at its very proximity but on the server side (the general device slide being in between the 2 sensors). An acceleration spike was noted on the sensor located on the server during the shot: this confirms a mechanical interference between the 2 parts of the general device slide during the shock pulse, giving rise to a higher level of Gs. In order to reduce the level of stress generated on the server (the hard disk could more specifically be affected), a new slide with a tighter fit between the 2 members would be beneficial.



Accelerometer 7 on  
rack



Accelerometer 11  
close to Acc 7 but on  
server: High  
frequency spike due  
to slide bottoming is  
noted on first rebound  
(20g)

DOCUMENT REFERENCE												
Project number				TYPE				FORMAT		PAGE		
D00318				Calculation report				Lt		13		
											-	REV



## 5 VIBRATION TESTS:

### ***Vibration Type***

In accordance with the MIL STD 167, type I. Test will include, for each axis:

- Exploratory test, as detailed in paragraph 5.1.3.3.1 of the MIL STD 167
- Variable frequency test, as detailed in paragraph 5.1.3.3.2 of the MIL STD 167
- Endurance test: as described in paragraph 5.1.3.3.3 of the MIL STD 167.

Amplitude and frequency range are as defined in table I of the MIL STD 167

### ***Vibration Test Range***

As defined in table I of MIL STD 167. Frequency range is limited to 33 Hz.

### ***Equipment Mounting Locations***

A chassis simulating the ship interface (floor and bulkhead) is used to secure the racks on the shaker during vibration tests. This chassis shall be such that no frequency resonance is found during the survey over all the frequency range.

### ***Vibration: Instrumentation of racks under test***

Accelerometers are installed on the test chassis bolted to the vibration machine table to verify proper test geometry and to monitor the vibration input parameters. Accelerometers are placed on the cabinet to verify proper vibration conditions and to monitor vibration level at cabinet level. Accelerometer locations are listed in Table below.

Gage	Location
Acc-1	On vibration table (bottom)
Acc-2	On top of test fixture (chassis), close to the stabilizer plate
Acc-5	Front bottom left side of rack under test
Acc 6	Front Top right side of rack under test

*Vibration Test Accelerometer Location*

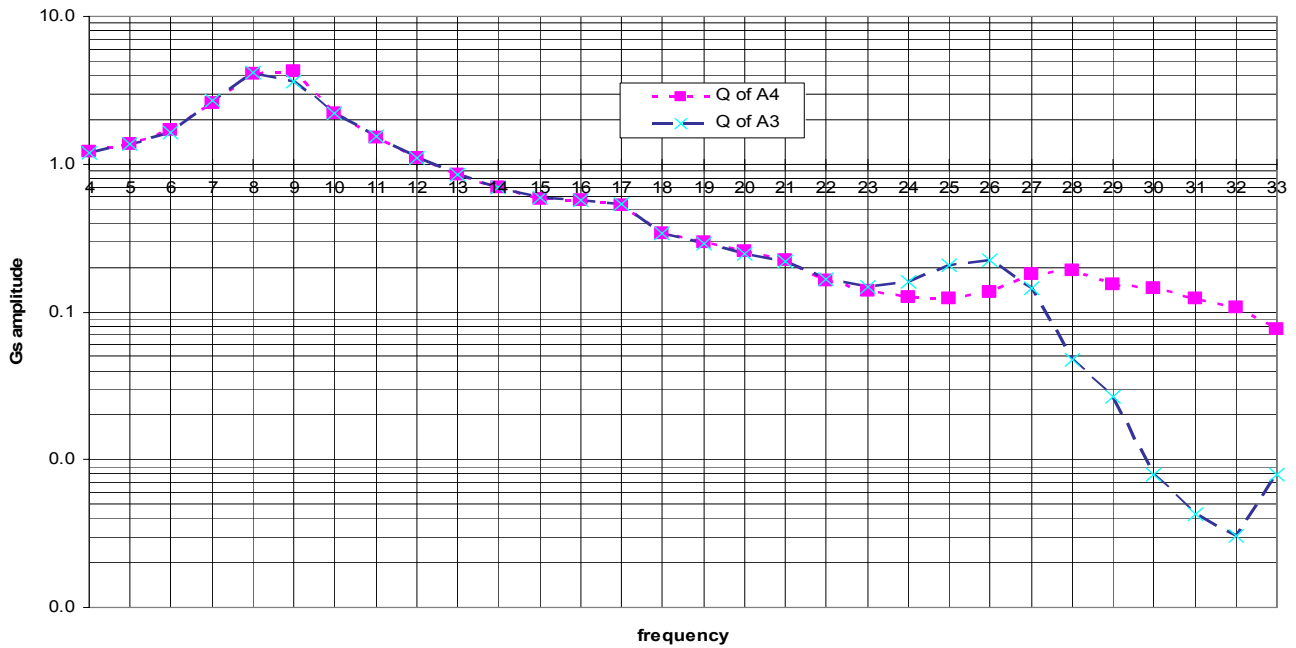
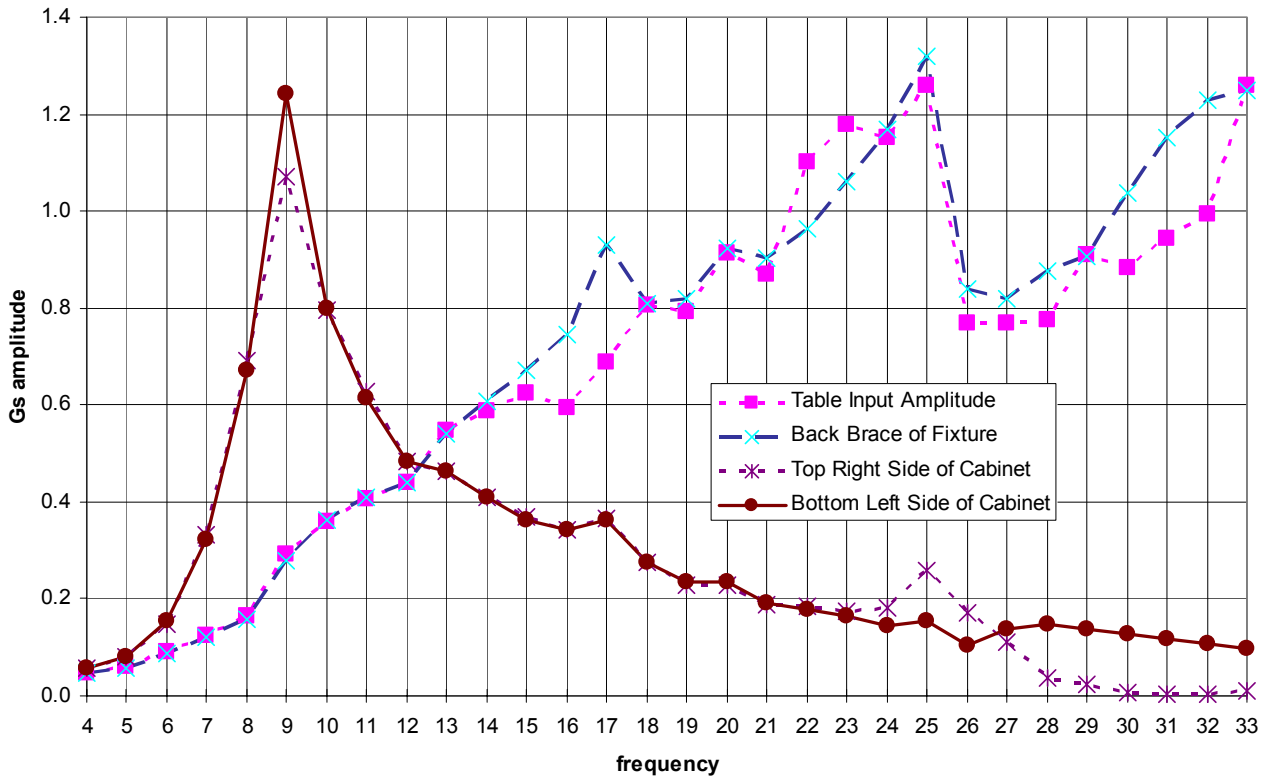
DOCUMENT REFERENCE			
Project number	TYPE	FORMAT	PAGE
D00318	Calculation report	Lt	15
			- REV



# Shock and Vibration Test report

Revision -: October, 26th, 2003

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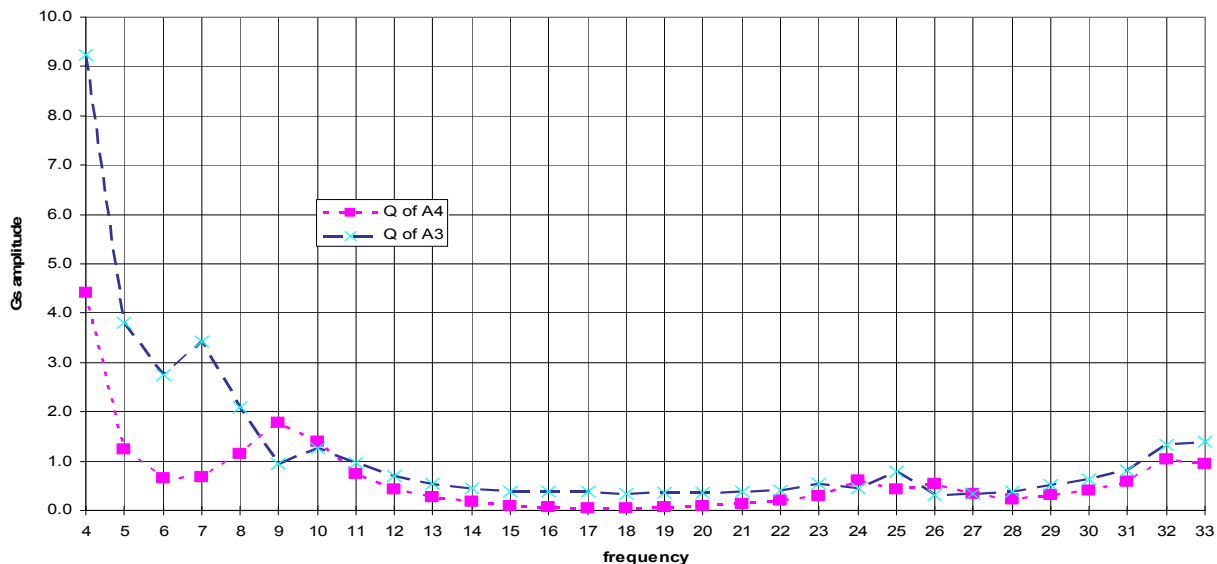
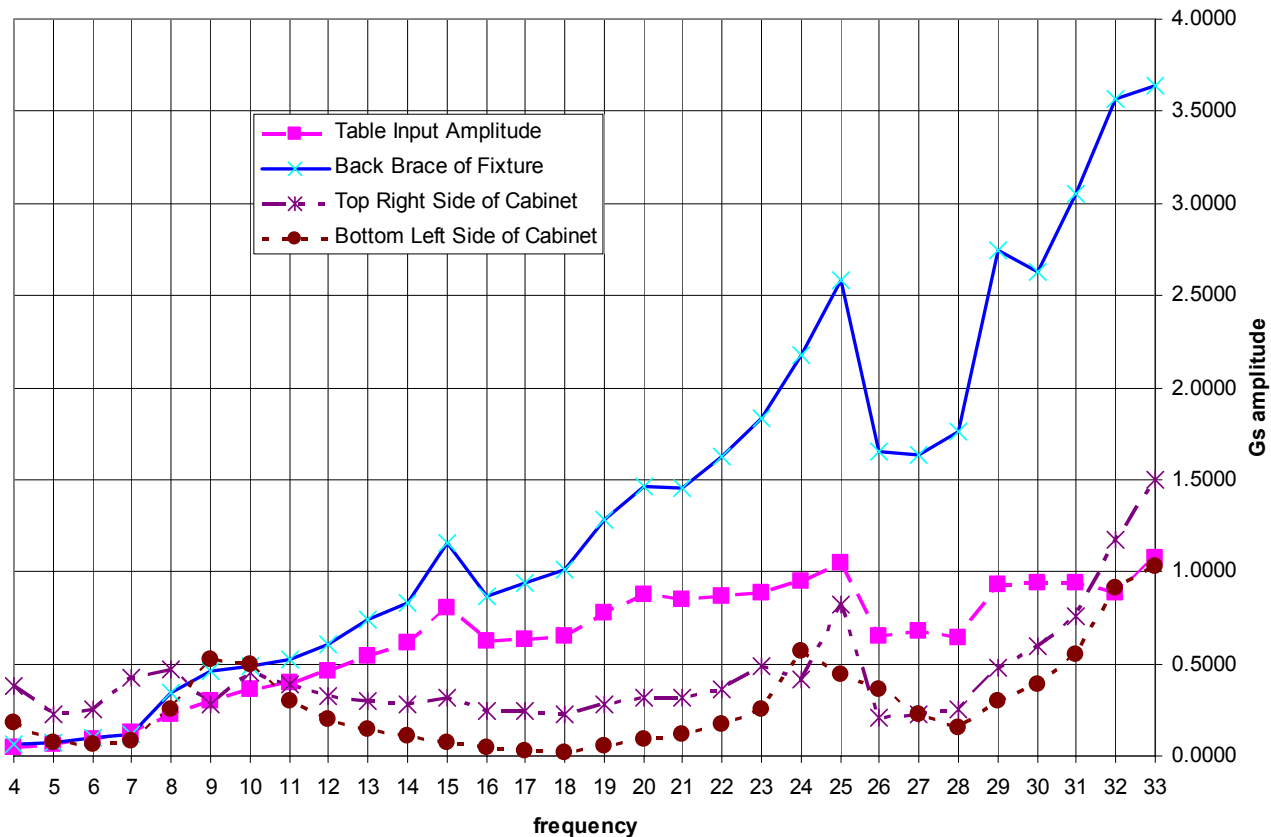


DOCUMENT REFERENCE			
Project number	TYPE	FORMAT	PAGE
D00318	Calculation report	Lt	17
			- REV

# Shock and Vibration Test report

Revision -: October, 26th, 2003

Direction:	Side to side
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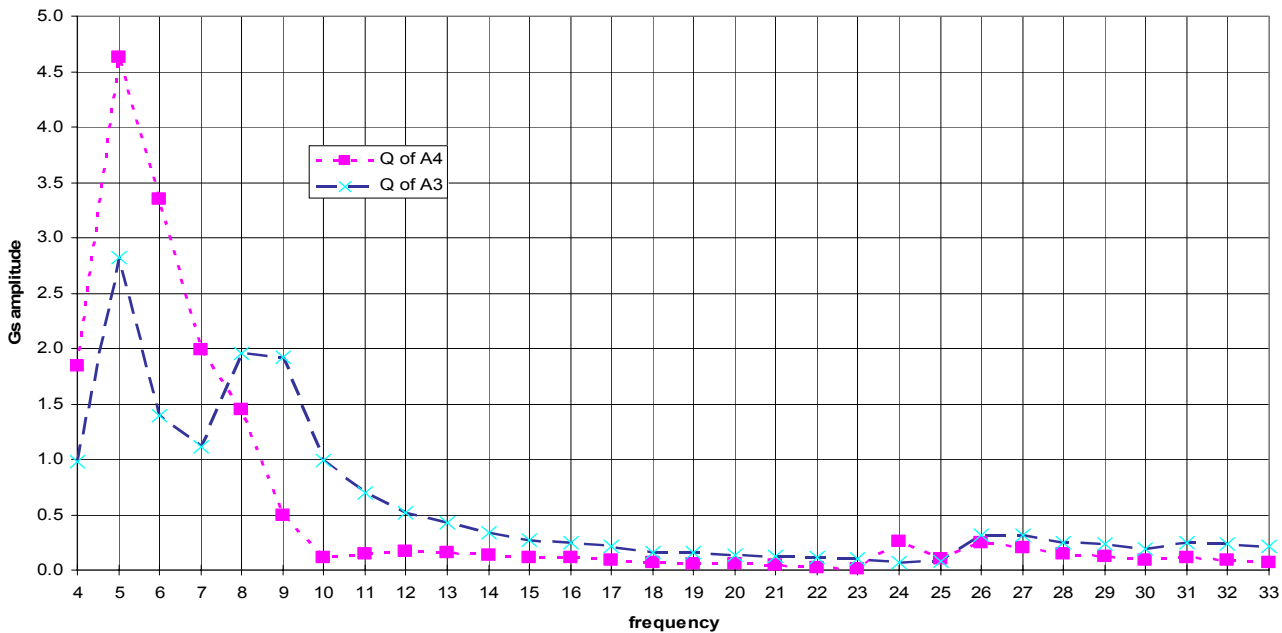
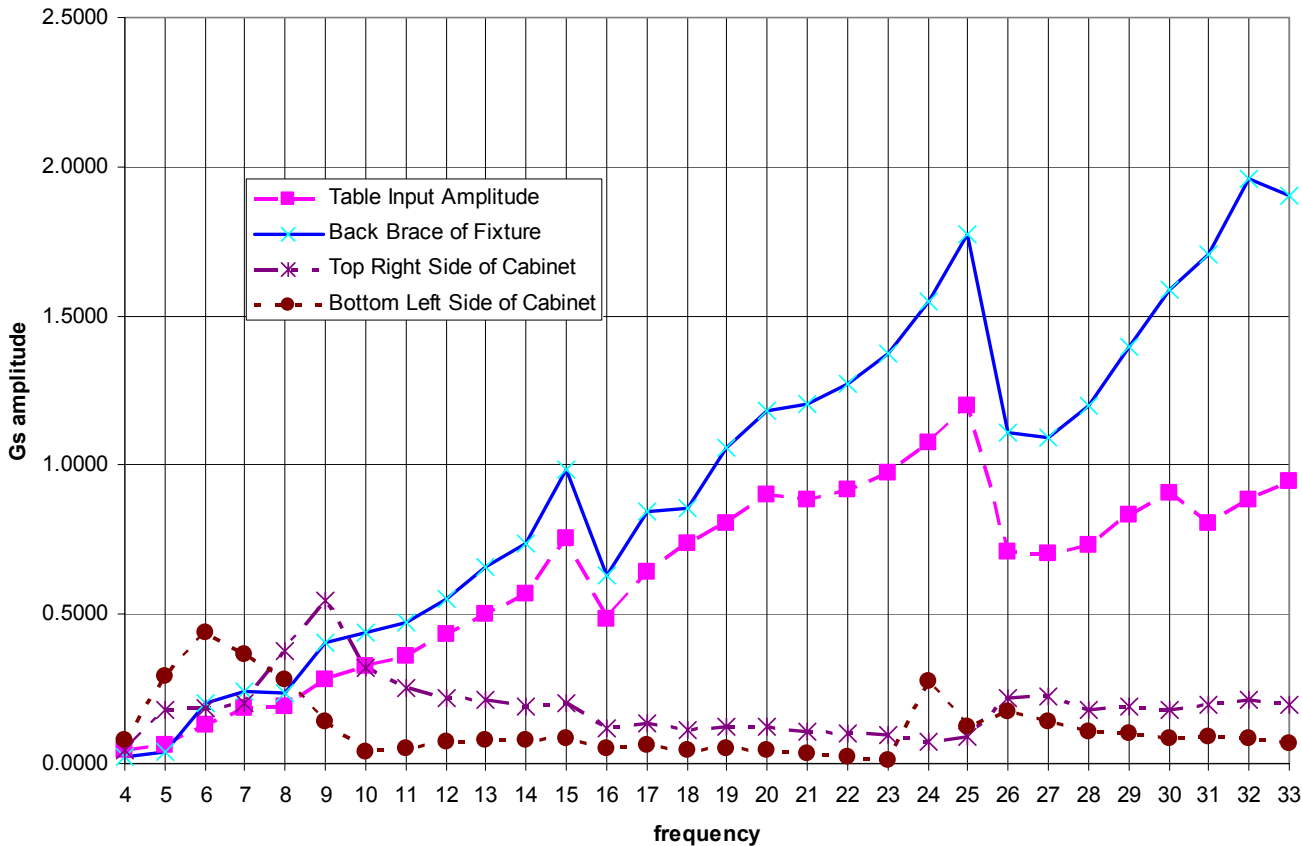
DOCUMENT REFERENCE			
Project number	TYPE	FORMAT	PAGE
D00318	Calculation report	Lt	18
			- REV



# Shock and Vibration Test report

Revision -: October, 26th, 2003

Direction:	Front to back
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DOCUMENT REFERENCE			
Project number	TYPE	FORMAT	PAGE
D00318	Calculation report	Lt	19
			- REV



