TCG NEBS COMPLIANCE TEST REPORT FOR :

SCHROFF

Product: VARISTAR Seismic Rack with Standard Socket (Earthquake Zone 4)

PART: 19
EARTHQUAKE, OFFICE VIBRATION, AND TRANSPORTATION VIBRATION

Section 4.4, GR-63-CORE
Telcordia Technologies, Issue 3, March 2006

Date: Jun 06, 2007

Report: U0TRSCHROFF0019

Prepared By:__ _____Date: Jun 06, 2007

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Approved By:_____Date: Jun 06, 2007

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

TEST RESULTS SUMMARY

The **Error! Reference source not found.** was tested acc. to the requirements of GR 63 CORE, Issue 3, 2006, ch.4.4 "Earthquake, Office Vibration, and Transportation Vibration Test Methods". ; details s. Table 19-1.
The **Error! Reference source not found.** complies with all applicable requirements and objectives.

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 Equipment Under Test met the requirements of the corresponding criteria.
  - **Non-compliant:** The Equipment Under Test did not meet the requirements of the corresponding criteria.
  - **NA:** The criteria were Not Applicable to Equipment Under Test {Explanation Required}
  - **ENR:** An Evaluation, to these criteria, was Not Requested by the customer.
- **Page** column gives the page number, in this report, for the corresponding criteria.

Table 19-1 Earthquake, Office and Transportation Vibration Summary of Test Results

Section	Section Name	Criteria	Results Pass/ Fail/ NA	Comments	Page
4.4	**Earthquake, Office Vibration, and Transportation Vibration**	-	**-**		-
4.4.1	Earthquake Environment and Criteria	-	**-**		-
4.4.1.2	Physical Performance Criteria	R4-68 [110]	**Compliant**		7
		R4-69 [111]	**Compliant**		7
		R4-70 [112]	**Compliant**		7
		O4-71 [113]	**Non-compliant**		7
4.4.1.3	Functional Performance	R4-72 [114]	**Compliant**		7
		O4-73 [115]	**Compliant**		7

Section	Section Name	Criteria	Results Pass/ Fail/ NA	Comments	Page
4.4.2	Framework and Anchor Criteria	O4-74 [116]	**Compliant**		24
		R4-75 [117]	**Compliant**		24
		O4-76 [118]	**NA**	Framework are synthesized waveform tested	24
		R4-77 [119]	**NA**	Mounting kit concrete anchors not included in suppliers delivery	24
		O4-78 [120]	**NA**	Mounting kit concrete anchors not included in suppliers delivery	24
		O4-79 [121]	**NA**	Mounting kit concrete anchors not included in suppliers delivery	24
4.4.3	Wall-Mounted Equipment Anchor Criterion	R4-80 [175]	NA	The **Error! Reference source not found.** is not wall mounted equipment	28
4.4.4	Office Vibration Environment and Criteria	-	-		-
4.4.4.2	Physical Performance Criteria	R4-81 [122]	**Compliant**		29
4.4.4.3	Functional Performance Criteria	R4-82 [123]	**Compliant**		29
4.4.5	Transportation Vibration Criteria	-	-		-
4.4.5.1	Transportation Environment	R4-83 [124]	**Compliant**		31

OVERVIEW

Project Objective

Testing was performed to determine if the **Error! Reference source not found.** met the requirements for Section 4.4, *Earthquake, Office Vibration, and Transportation Vibration*, of Telcordia Technologies GR-63-CORE, Issue 3, April 2006.

The Equipment Configuration, Operating Conditions and Pass/Fail Criteria are described in the Executive Summary, which is part of this documentation.

EARTHQUAKE ENVIRONMENT AND CRITERIA (4.4.1)

Physical Performance (4.4.1.2)

Criteria:

Permanent structural damage is defined to be 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 to be any dislocation or separation of components. Examples of mechanical damage are disengaged circuit cards and modules, and opened (including partially) doors, drawers, or covers.

R4-68 [110] All equipment shall be constructed to sustain the waveform testing of Section 5.4.1, "Earthquake Test Methods," without permanent structural or mechanical damage.

During frame-level testing, the physical performance of the equipment shelves, framework, and fastening hardware are considered. Permanent structural or mechanical damage of any of these elements constitutes a test failure. During shelf-level and wall-mounted testing, 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.) Repairs or replacements that can be made without interrupting service are acceptable. An example of such a repair is an anchor that has loosened, but can be retightened.

R4-69 [111] Frame-level equipment shall be constructed so that during the waveform testing of Section 5.4.1, "Earthquake Test Methods," the maximum single-amplitude deflection at the top of the framework, relative to the base, does not exceed 75 mm *(3 in)*.

R4-70 [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, "Earthquake Test Methods."

O4-71 [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, "Earthquake Test Methods."

Functional Performance (4.4.1.3)

Criteria:

The criterion 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.

R4-72 [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, "Earthquake Test Methods." The equipment shall sustain operation without replacement of components, manual rebooting, or human intervention.

O4-73 [115] All equipment should be constructed to meet applicable functionality requirements continuously during waveform testing of Section 5.4.1, "Earthquake Test Methods." 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 Mr. Knier between 08 May 2007 and 10 May 2007 at

Nokia Siemens Networks GmbH & Co. KG
Center for Quality Engineering
Hofmannstraße 51
81359 München
Germany

Test Method

Test Configuration - Frame-Level

The frame-level configuration shall be used for network equipment supplied with a framework.

Mount the equipment to its supporting framework.

Mount the equipment frame to the shaker table similar to how it will be installed in service. This may include using a concrete slab and anchors to simulate equipment installed on concrete building floors. In all cases use recommended fastener size, quantities, torque values, hold-down plates, shims, isolation devices, etc. Where concrete expansion anchors are normally used to fasten the framework base to the building floor, the mounting to shaker table may be substituted by welded studs, bolts, or cap-screws of equal quantities and diameter as the concrete expansion anchors.

The equipment shall be fastened to the shaker table (or concrete slab) using typical anchor locations. If the framework base allows for a variety of anchor locations, locate one fastener in the inner most location.

Record the torque value of each anchor or fastener.

Frames intended to support overhead cable shall be loaded with a weight of 23 kg *(50.0 lb)* on top of the framework. Less weight may be used if it can be demonstrated that the above value is excessive. Where less weight is used, the computations for such weight shall be provided as part of the test plan.

Frame-Level Instrumentation Configuration

Locate the accelerometers so they record the following: acceleration of the shaker table, acceleration at the top of the framework, and acceleration at the mid-height level.

Install anchor load measurement equipment to record the peak anchor loads if the concrete slab and concrete expansion anchors are omitted from the frame-level test.

Install deflection measurement equipment to measure the deflection at the top of the framework relative to its base.

Test Sequence

1. Perform a swept sine survey with an acceleration amplitude of 0.2 g from 1 to 50 Hz at a sweep rate of 1.0 octave per minute. (Higher sweep rates are permitted to reduce equipment stress.)
2. Verify equipment functionality and physical condition.
3. Subject the equipment to the VERTEQII waveform. Verify the TRS meets or exceeds the RRS in the frequency range from 1.0 to 50 Hz. If the TRS is below the RRS at any point, use the last drive signal and table acceleration to update the transfer function. Apply it to the Telcordia waveform to generate a new drive signal, and retest the equipment. Repeat this step as necessary.

   The TRS should not exceed the RRS by more than 30% in the frequency range of 1 to 7 Hz. A test may be invalid if an equipment failure occurs when the TRS exceeds the RRS by more than 30% in this frequency range.
4. Record the displacement and acceleration data during the shaking.
5. Thoroughly inspect the equipment and note all changes to its physical condition.
6. Record any reductions in anchor or fastener torques.
7. Reverify equipment functionality.

The test severity corresponds to Zone 4, the time history signal applied was Verteq II.

The rack itself was fixed with screws (M12) to an aluminum plate of 40mm thickness.

Definition of axes:
x : horizontally side to side
y : horizontally front to back
z : vertical

Deviations from prescribed Test Sequence

Resonance Search

The resonance search was performed on an electrodynamic shaker. Due to its performance, the following deviations from GR 63 CORE occurred:
1. Start of sine sweep was 1,25 Hz (instead of 1 Hz)
2. Amplitude was 0,13 g (instead of 0,2 g)

3 axes ; 1 sweep cycle per axis

Frequency Range (Hz)	Acceleration	Sweep Rate (oct. / min)
1,25 – 50 *	0,13 g	1

Resonance Search

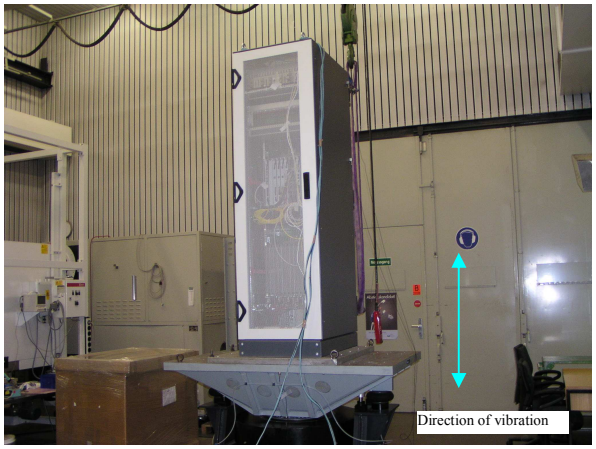

Fig. 19-1 Resonance search: axis of acceleration vertical (z)

Fig. 19-2 Resonance search: axis of acceleration horizontal (x)

Fig. 19-3 Resonance search: axis of acceleration vertical (y)

Fig. 19-4 Measuring point at middle of EUT

Fig. 19-5 Measuring point at top of EUT

Waveform Testing

The waveform testing was performed on a MTS seismic table. The entire built-up is shown in fig. 22-6 – 22-8. For the y-axis test, the EUT is rotated about 90 °. For z-axis test, a vertically oriented piston underneath the table is used.
The displacement at top of the rack is measured in the direction of excitation (x +y) with a LVDT. For the z-axis test, no LVDT is applied.

An additional weight of 23Kg was mounted to simulate overhead cable support.

All earthquake tests are documented by video.

Fig. 22-9 – Fig. 22-12 show the applied accelerometers (one at the table and two at the rack's top and middle respectively).

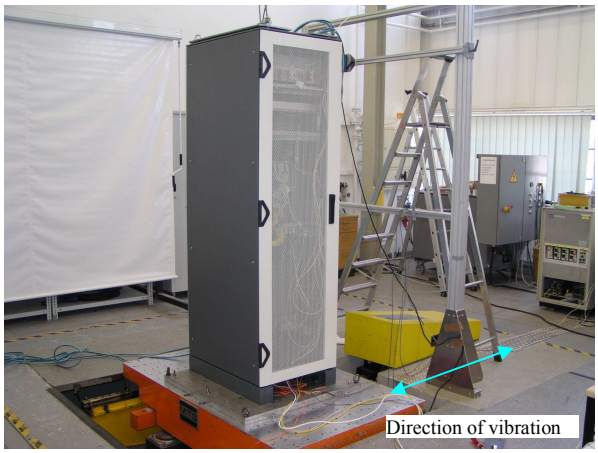

Fig. 22-6 Entire built-up for waveform testing (x-axis)

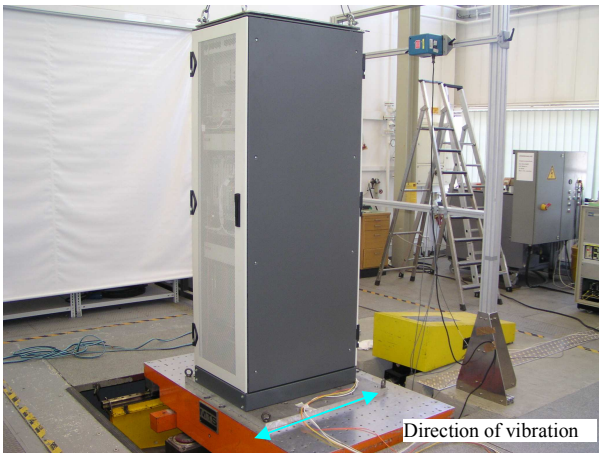

Fig. 22-7 Entire built-up for waveform testing (y-axis)

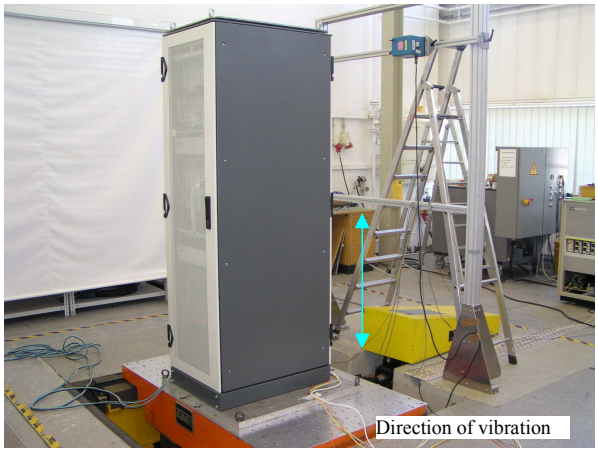

Fig. 22-8 Entire built-up for waveform testing (z-axis)

Fig. 22-9 LVDT measuring system

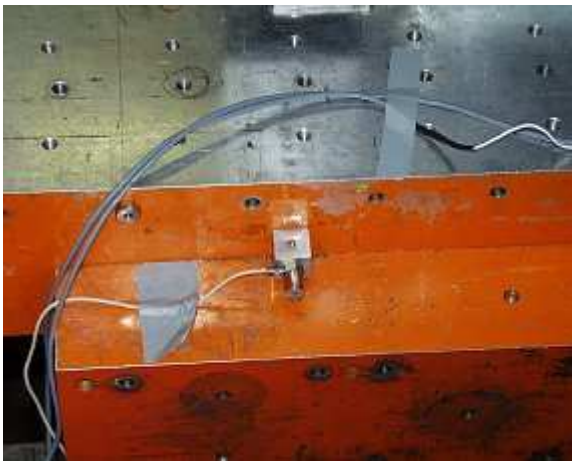

Fig. 22-10 Measuring point at table

Fig. 22-11 Measuring point at middle of EUT

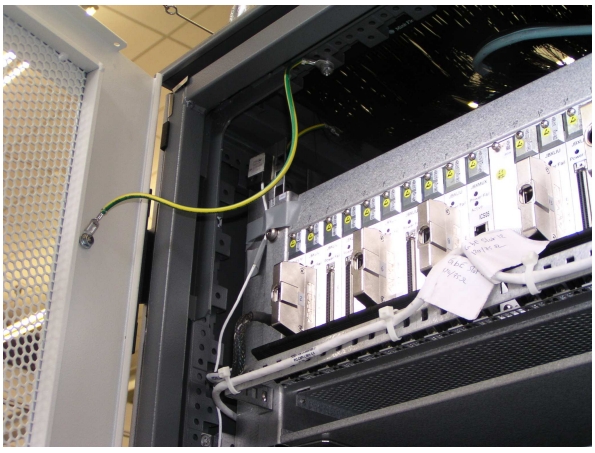

Fig. 22-12 Measuring point at top of EUT

Test Results

Resonance Search

The resonance search was performed in three axes with the following results (figs. 19-9 to 19-14) :
lowest natural gross frequency for excitation in x-direction : 4,5 Hz
lowest natural gross frequency for excitation in y-direction : 11,4 Hz
lowest natural gross frequency for excitation in z-direction : >20 Hz

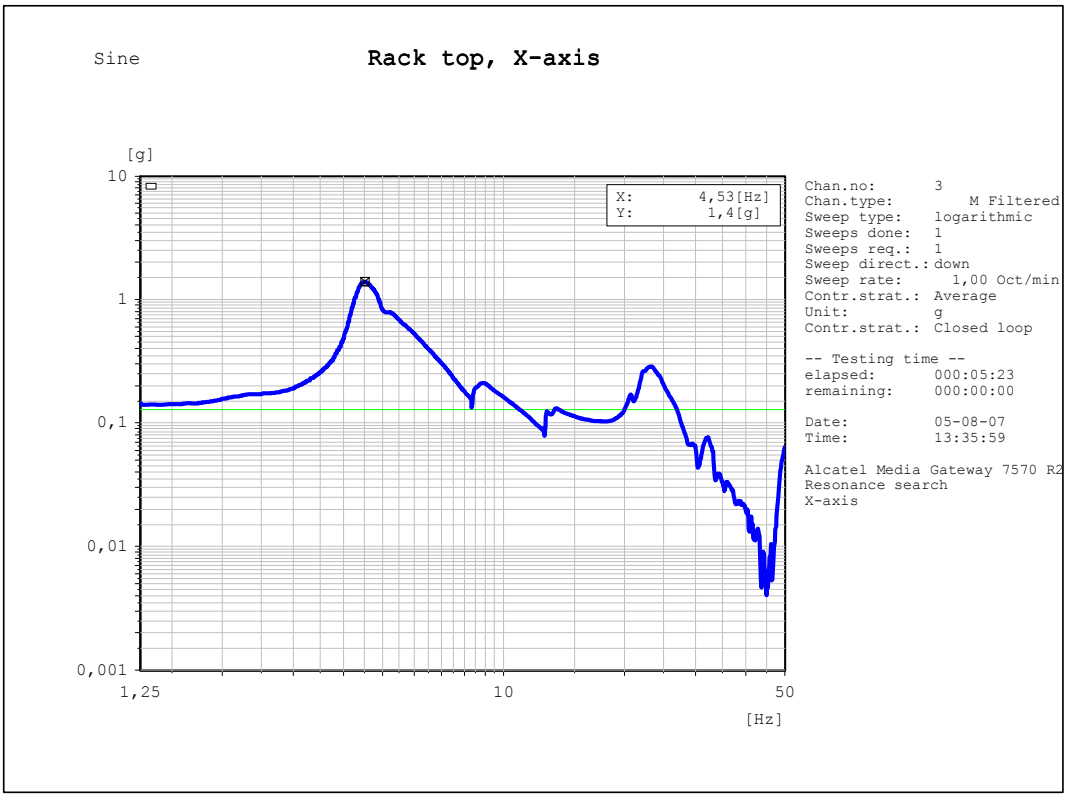

Fig. 19-13 Resonance search : excitation in x-dir. ; top of the rack

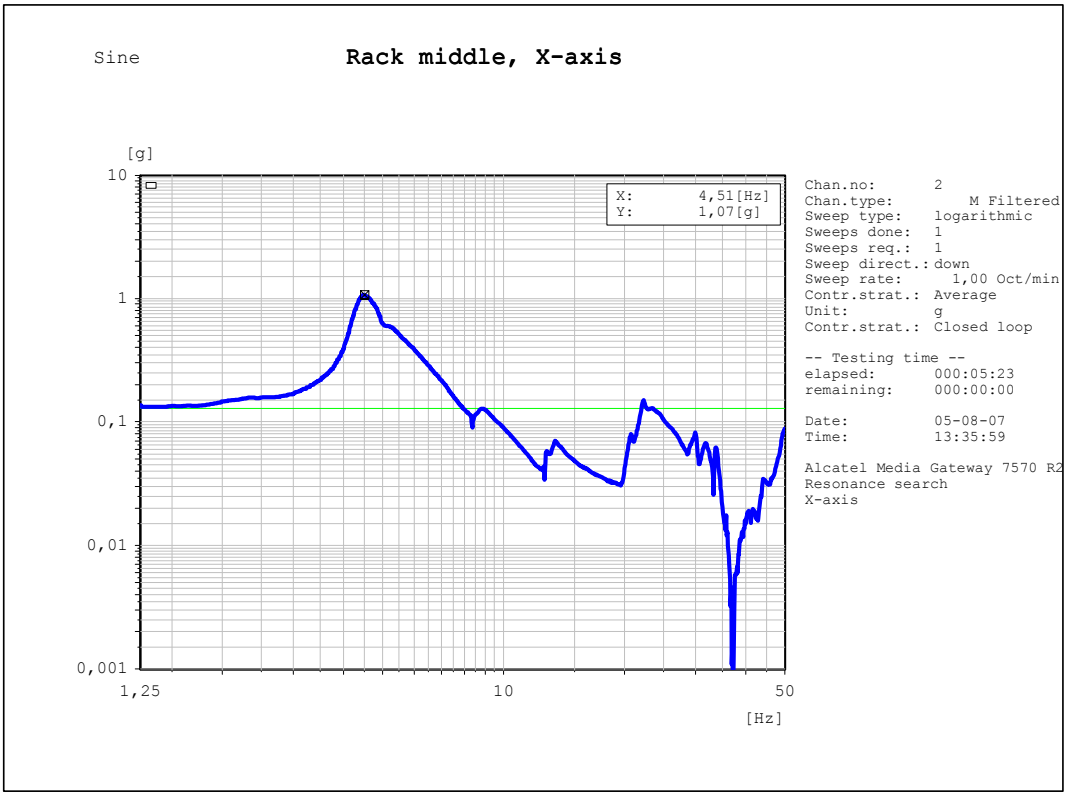

Fig. 19-14 Resonance search : excitation in x-dir. ; middle of the rack

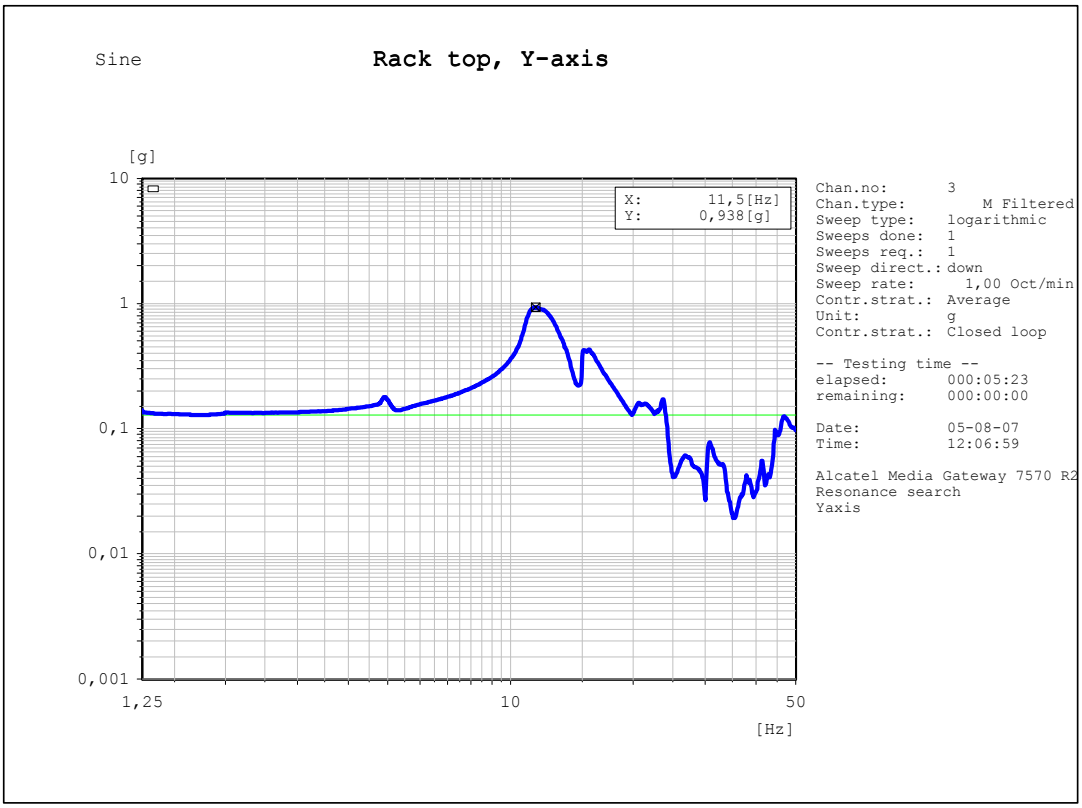

Fig. 19-15 Resonance search : excitation in y-dir. ; top of the rack

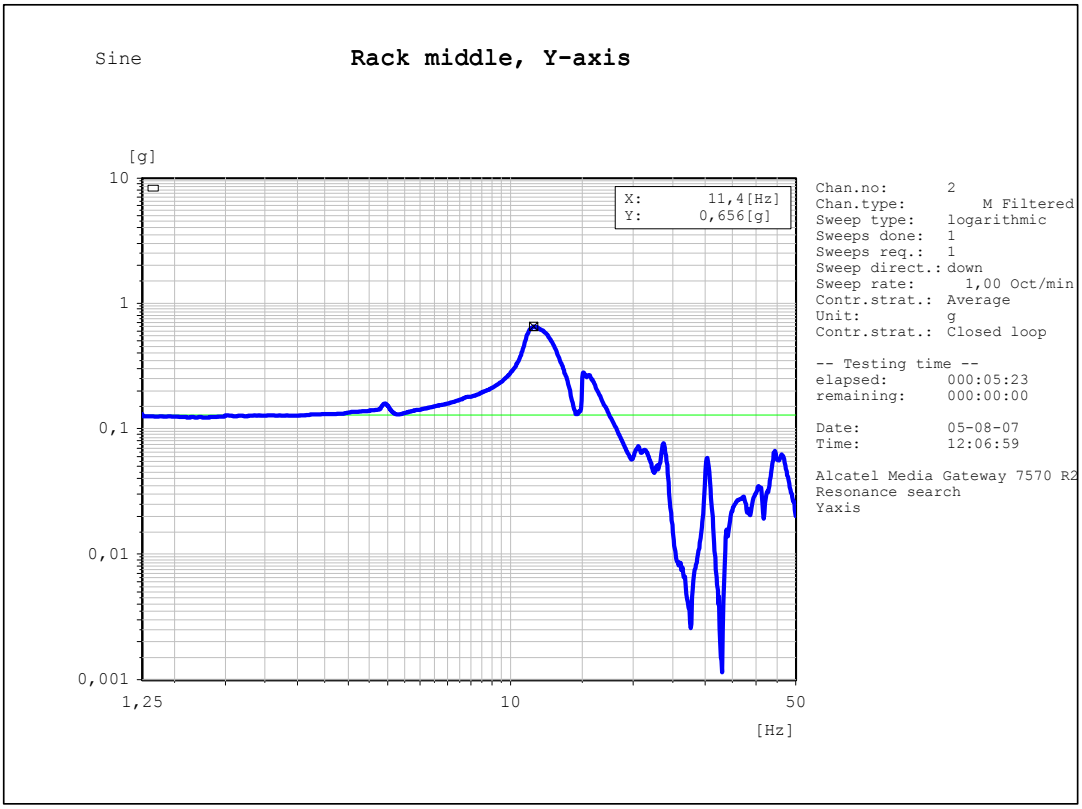

Fig. 19-16 Resonance search : excitation in y-dir. ; middle of the rack

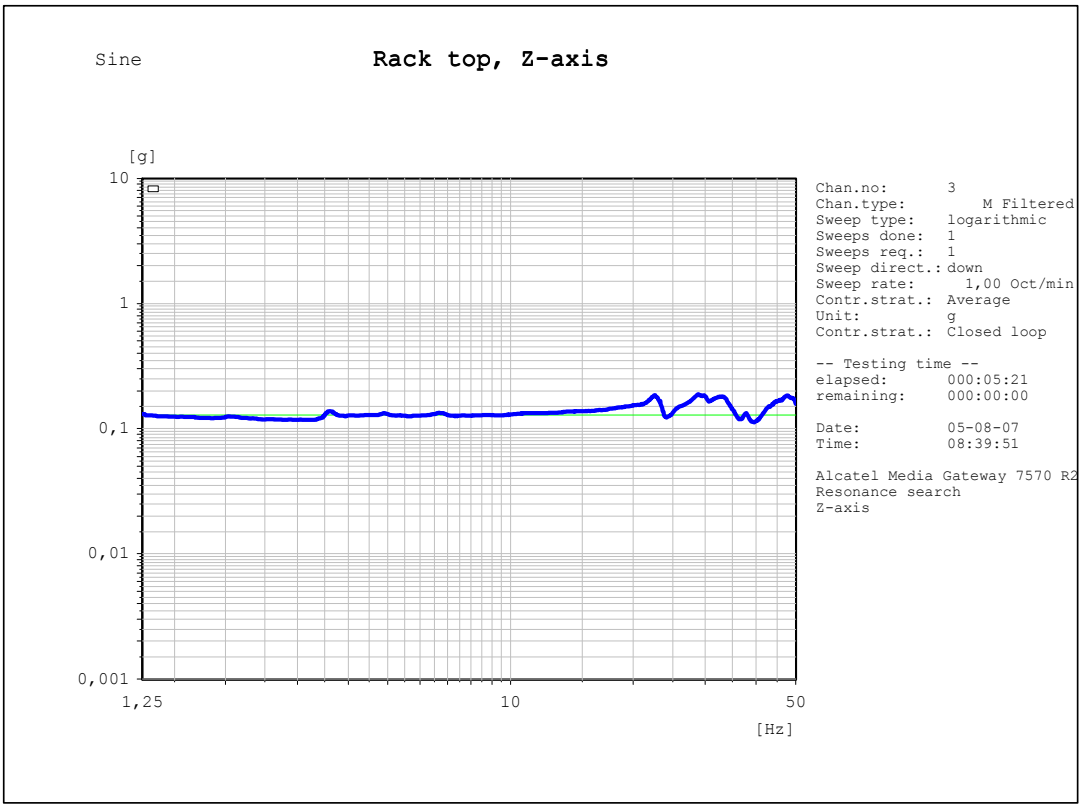

Fig. 19-17 Resonance search : excitation in z-dir. ; top of the rack

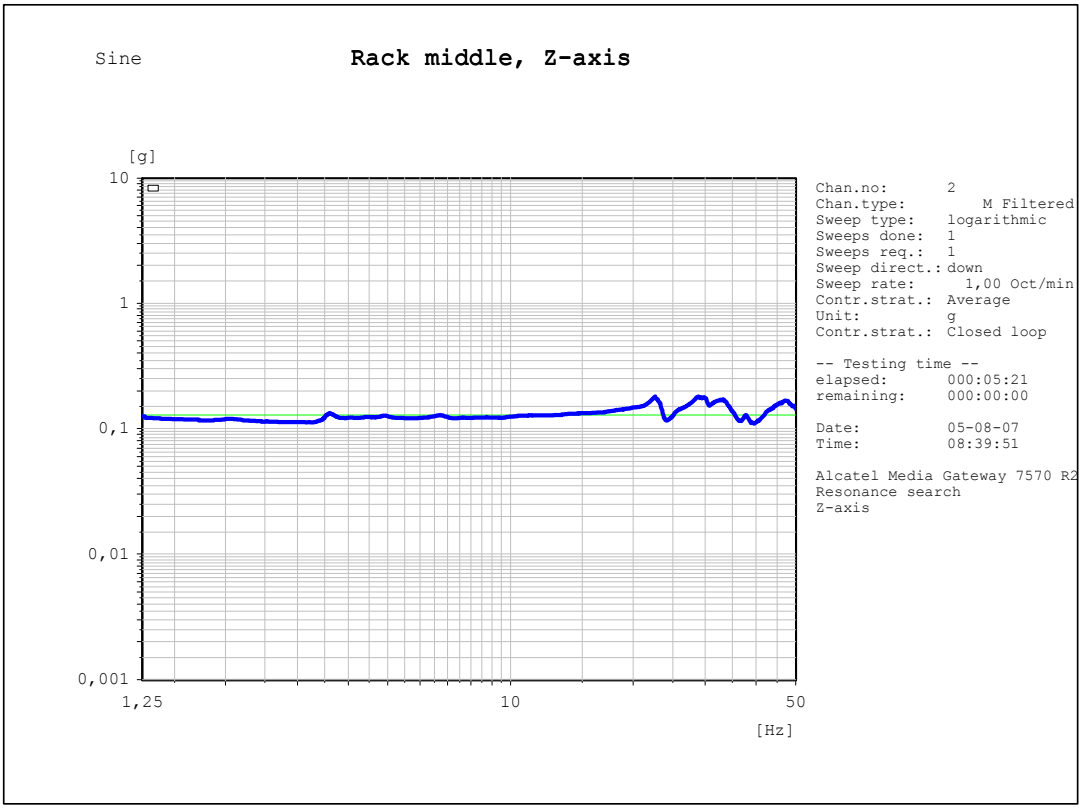

Fig. 19-18 Resonance search : excitation in z-dir. ; middle of the rack

Waveform Testing

Excitation in direction of x-axis

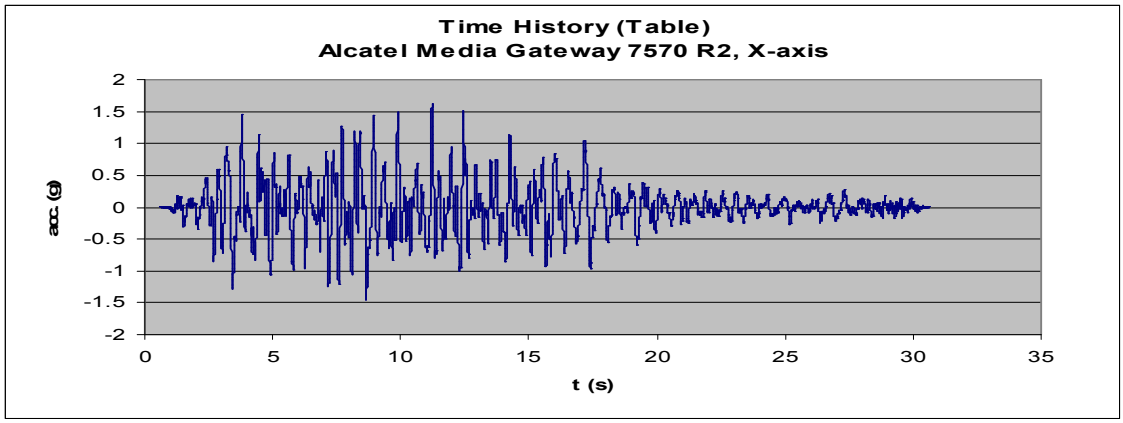

Fig. 19-19 Time history signal at the table

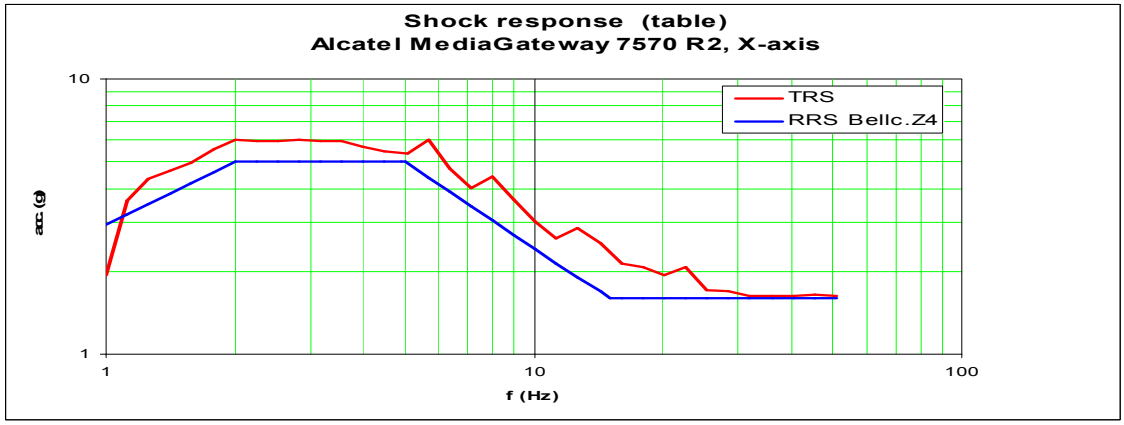

Fig. 19-20 RRS and TRS at the table

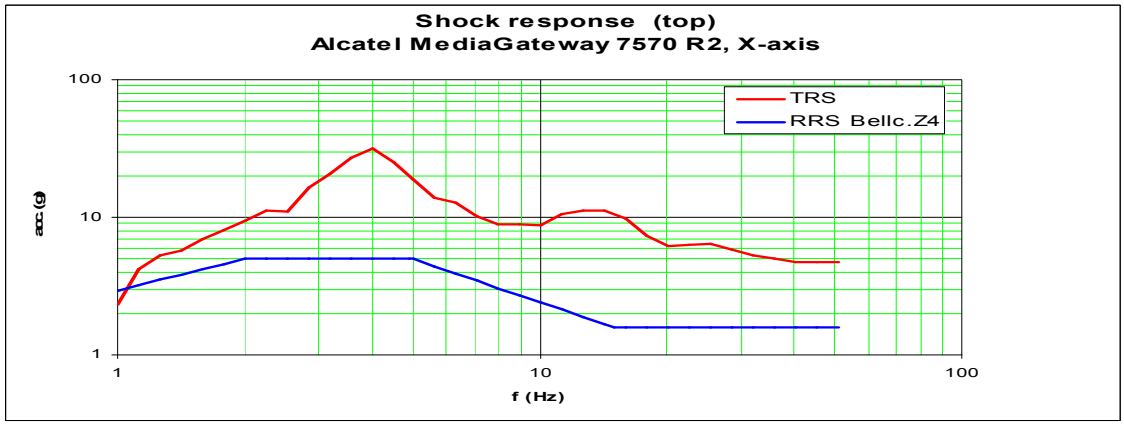

Fig. 19-21 RRS and TRS at the top of the rack

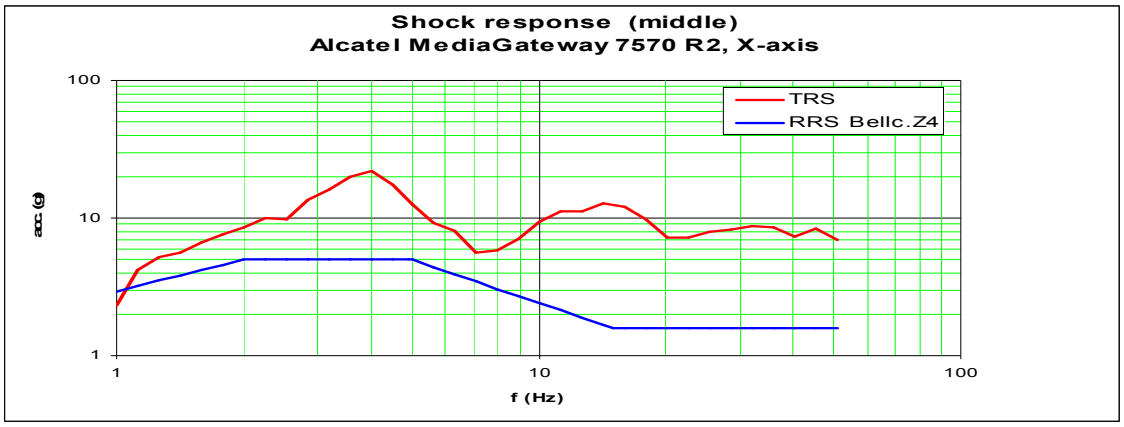

Fig. 19-22 RRS and TRS in the middle of the rack

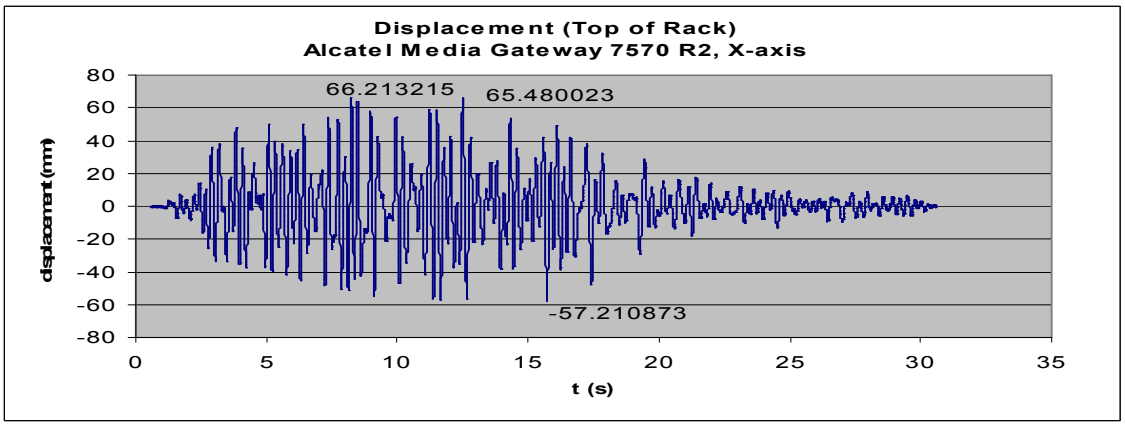

Fig. 19-23 Displacement at top of the rack

After waveform testing, no mechanical or structural damages were detected.

The EUT operated properly before, during and after test (the operation mode and pass/fail criteria are described in detail in the Executive Summary).

The maximum displacement at top of the rack was 66,2 mm.

Excitation in direction of y-axis

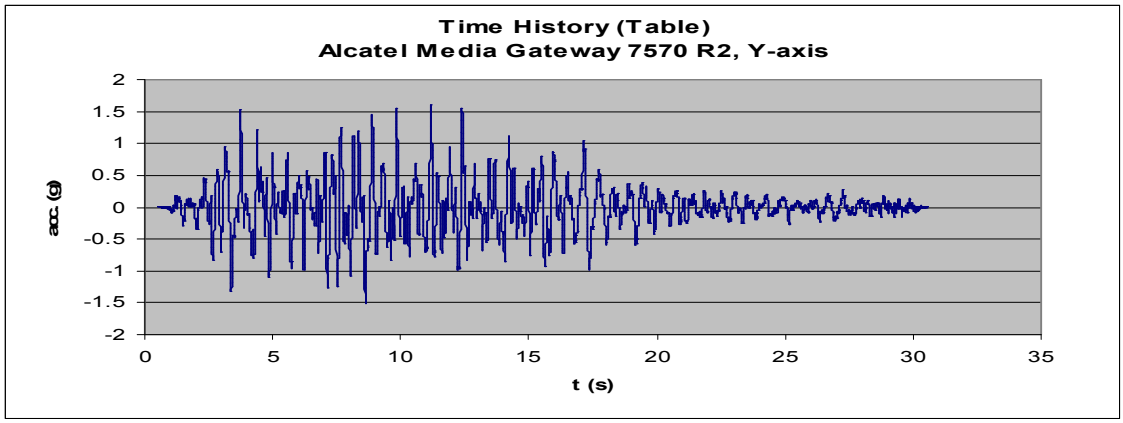

Fig. 19-24 Time history signal at the table

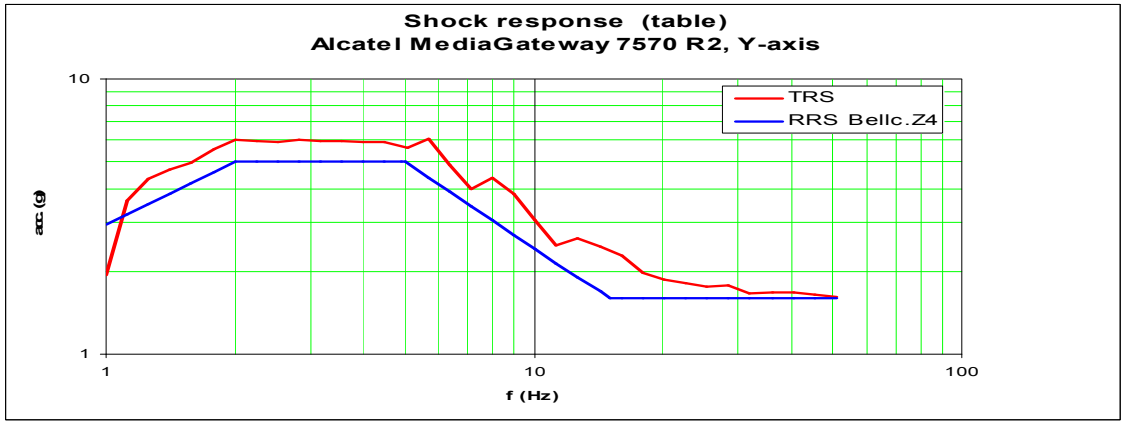

Fig. 19-25 RRS and TRS at the table

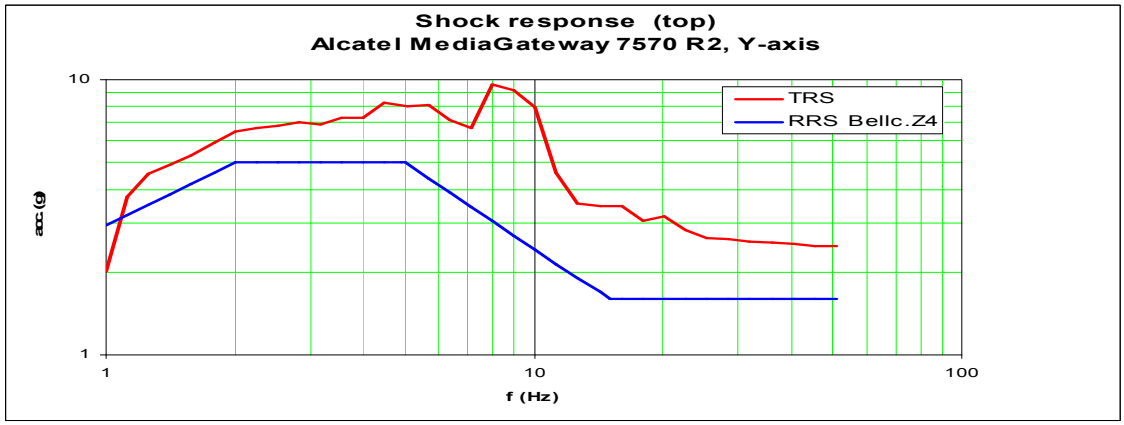

Fig. 19-26 RRS and TRS at the top of the rack

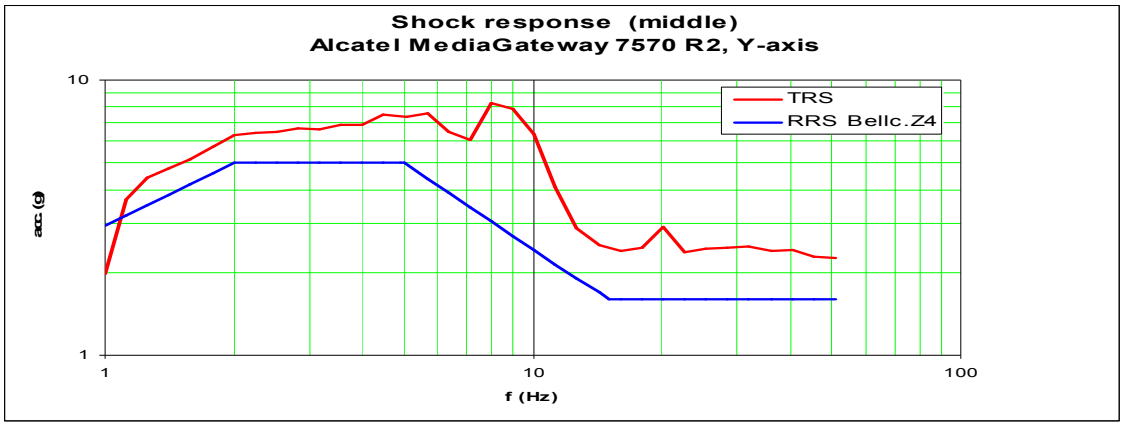

Fig. 19-27 RRS and TRS in the middle of the rack

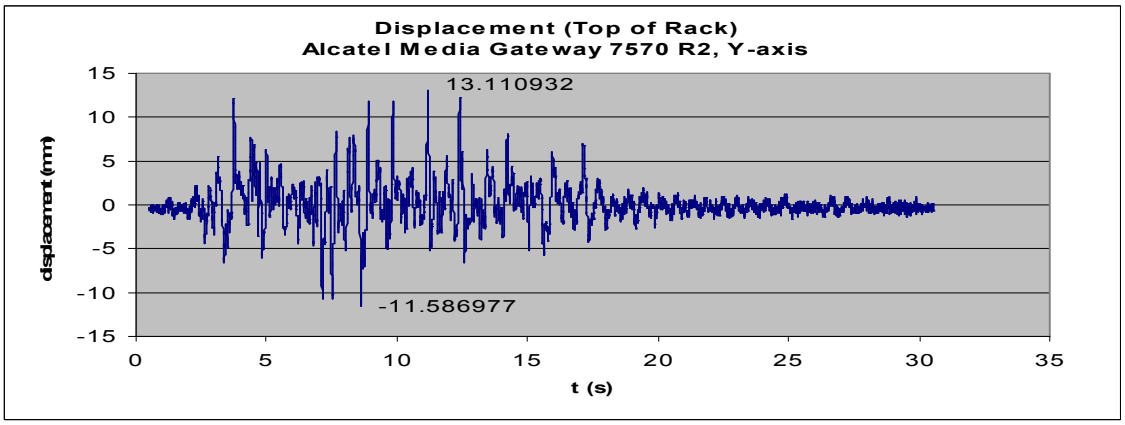

Fig. 19-28 Displacement at top of the rack

After waveform testing, no mechanical or structural damages were detected.

The EUT operated properly before, during and after test (the operation mode and pass/fail criteria are described in detail in the Executive Summary).

The maximum displacement at top of the rack was 13,1 mm.

Excitation in direction of z-axis

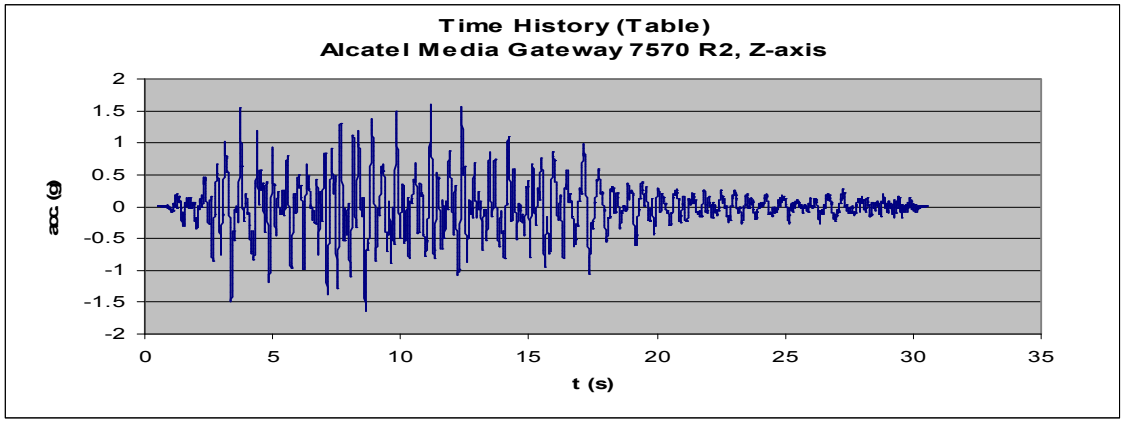

Fig. 19-29 Time history signal at the table

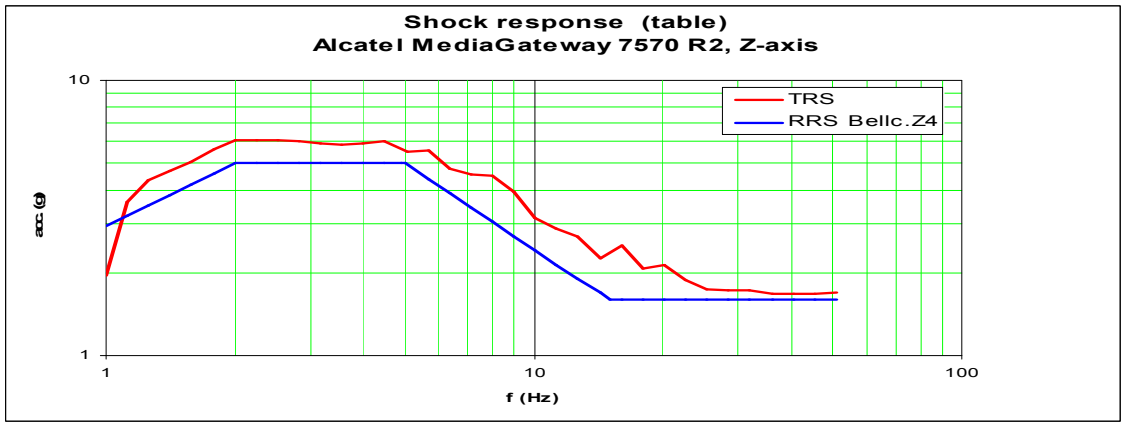

Fig. 19-30 RRS and TRS at the table

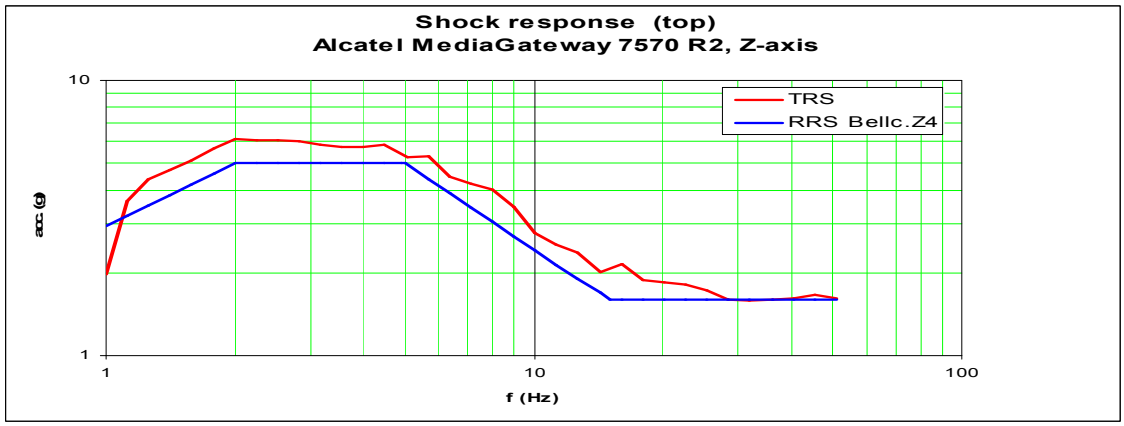

Fig. 19-31 RRS and TRS at the top of the rack

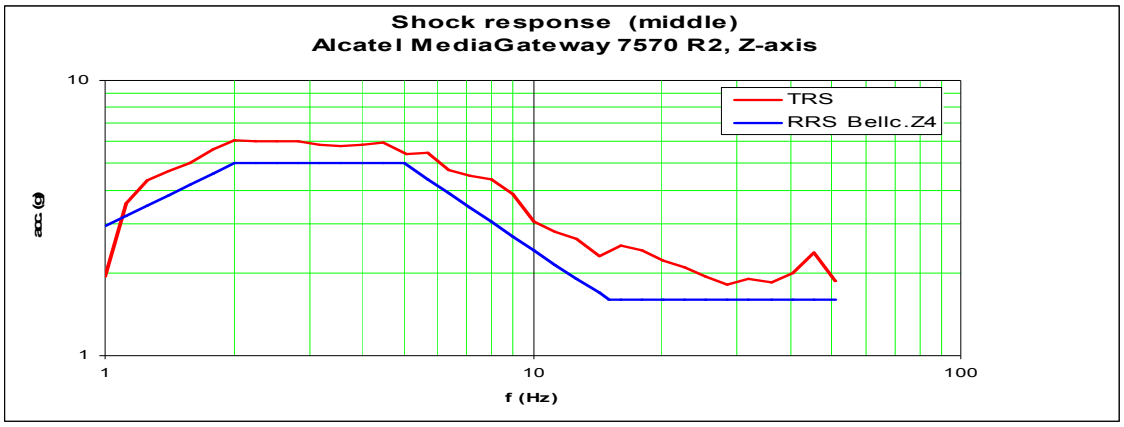

Fig. 19-32 RRS and TRS in the middle of the rack

After waveform testing, no mechanical or structural damages were detected.

The EUT operated properly before, during and after test (the operation mode and pass/fail criteria are described in detail in the Executive Summary).

The **Error! Reference source not found.** is **compliant** with **R4-68 [110], R4-69 [111], R4-70 [112], R4-72 [114], O4-73 [115]**

The **Error! Reference source not found.** is **non compliant** with **O4-71 [113].**

Test Equipment Used

Table 19-2 Earthquake Environment Detailed List of Test Equipment

Electro-dynamic Shaker 80 A

ID No.	Equipment	Manufacturer	Status	Calibration date	Calibration due
S0795	Frequency Counter	Newport	ind		
S0854	Frequency Display	Newport	ind		
S1406	Charge Amplifier (VIB9000)	Unholtz Dickie	cal	Feb 20, 2007	Feb 29, 2008
S1407	Charge Amplifier (VIB9000)	Unholtz Dickie	cal	Feb 20, 2007	Feb 29, 2008
S1408	Charge Amplifier (VIB9000)	Unholtz Dickie	cal	Feb 20, 2007	Feb 29, 2008
S1419	80A Vibration Exciter VIB9000	RMS	cal	Feb 20, 2007	Feb 29, 2008
S5004	Oscilloscope	Siemens	ind		
S5005	Stroboscope	Chadwick	ind		
S5452	Software Version 2.9.0	M&P	cnn		
S5528	Personal Computer (VIB9000)	Fujitsu Siemens	cnn		
S5662	Vibration Control and Analysis System (VIB9000)	Agilent	cal	Feb 20, 2007	Feb 29, 2008
S5137	Accelerometer	Endevco	cal	Dec 13, 2006	Dec 31, 2008
S5281	Accelerometer	Bruel & Kjaer	cal	Jan 26, 2006	Jan 31, 2008
S5282	Accelerometer	Bruel & Kjaer	cal	Jan 26, 2006	Jan 31, 2008

cal = Calibration, car = Calibration restricted use, chk = Check, chr = Check restricted use, cpu = Check prior to use, cnn = Calibration not necessary, ind = for indication only

Seismic Test System 86 A

ID No.	Equipment	Manufacturer	Status	Calibration date	Calibration due
S0353	Earthquake Test System	MTS	cnn		
S0896	Control System for Earthquake		cnn		
S0919	Amplifier	Endevco	cal	Feb 09, 2007	Feb 29, 2008
S0920	Amplifier	Endevco	cal	Feb 09, 2007	Feb 29, 2008
S0922	Power Supply	Endevco	cnn		
S5298	Charge Amplifier	Bruel & Kjaer	cal	Feb 09, 2006	Feb 29, 2008
S5317	Accelerometer	Sensotec	cal	May 24, 2006	May 31, 2008
S5324	Force Sensor	PCB Piezotronics	cal	Aug 29, 2006	Aug 31, 2008
S5396	Accelerometer	Sensotec	cal	May 27, 2005	May 31, 2007
S5398	Accelerometer	Endevco	cal	Feb 09, 2007	Feb 29, 2008
S5453	Software Version 3.3A	MTS	cnn		
S5293	Power Supply	TET Electronic	ind		
S5544	Position Transducer	National Oilwell	chk	Apr 17, 2006	Apr 30, 2007

cal = Calibration, car = Calibration restricted use, chk = Check, chr = Check restricted use, cpu = Check prior to use, cnn = Calibration not necessary, ind = for indication only

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.

O4-74 [116] Framework should be of welded construction.

R4-75 [117] Framework shall be constructed for base mounting to the floor without auxiliary support or bracing from the building walls or ceilings.

O4-76 [118] For framework used in earthquake risk zones, the static pull testing procedures of Section 5.4.1.4, "Static Test Procedure," 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.

The static pull objective does not need to be performed on:
- *Equipment intended to be provided without framework,*
- *Equipment provided with framework that has previously been tested and found compliant with this objective, or*
- *Framework (loaded or unloaded) that has been synthesized waveform tested per Section 5.4.1.5, "Waveform Test Procedure."*

R4-77 [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).

O4-78 [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.

NOTE*: Typical concrete anchors are not designed for dynamic loads, such as earthquakes. The above criterion specifies that the selected anchors should be designed to meet the dynamic loads specified in this document.*

O4-79 [121] Concrete expansion anchors should use steel construction to minimize creep.

Concrete expansion anchors used for frame-level waveform testing must conform to the physical performance requirements of Section 4.4.1, "Earthquake Environment and Criteria." If substitute fasteners are used in place of concrete expansion anchors GR-63-CORE Environmental Criteria Issue 3, March 2006 4–26 during frame-level testing, the peak fastener load calculated or measured during the tests must not exceed the preload specified for the concrete expansion anchors by the manufacturer.

Test Location

The following evaluation was performed by Mr. Knier between 08 May 2007 and 10 May 2007 at

Nokia Siemens Networks GmbH & Co. KG
Center for Quality Engineering
Hofmannstraße 51
81359 München
Germany

Test Method

The mounting on the floor and anchors are unknown and therefore omitted from the test configuration. Therefore acc. to GR 63 CORE, the dynamic load during waveform testing was recorded using a load-cell washer positioned underneath the bolt head of one of the screws attaching the EUT to the aluminium plate mounted on the shaker table.

Test Results

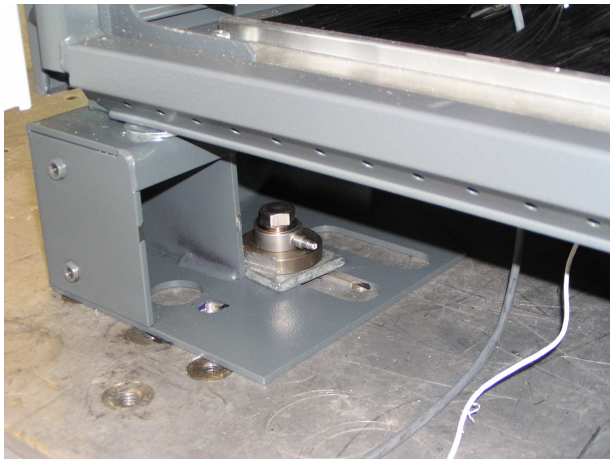

Fig. 22-33 Load cell

Test Results

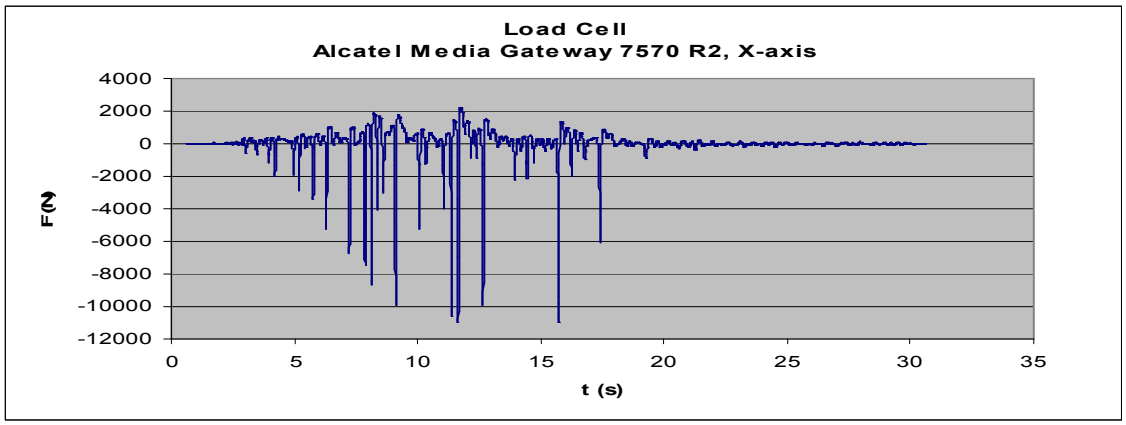

Fig. 22-34 Load-cell force X-axis

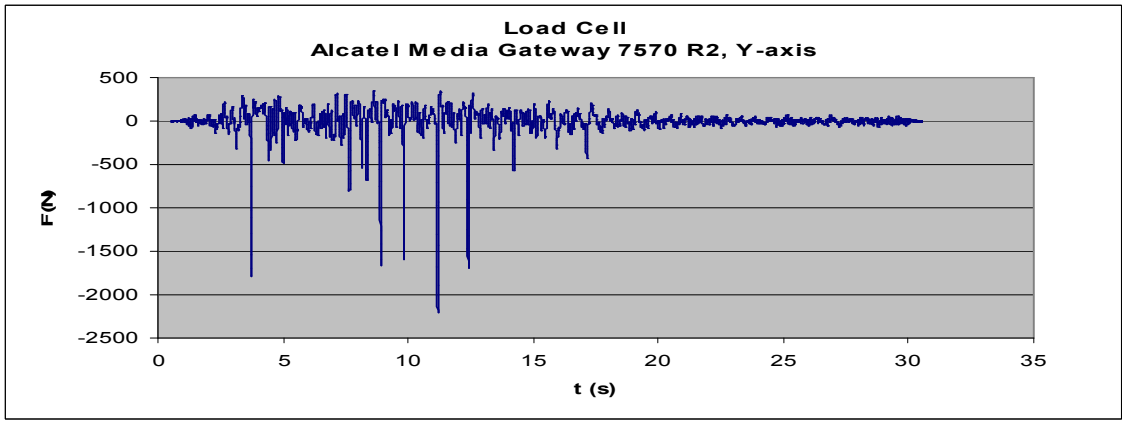

Fig. 22-35 Load-cell force Y-axis

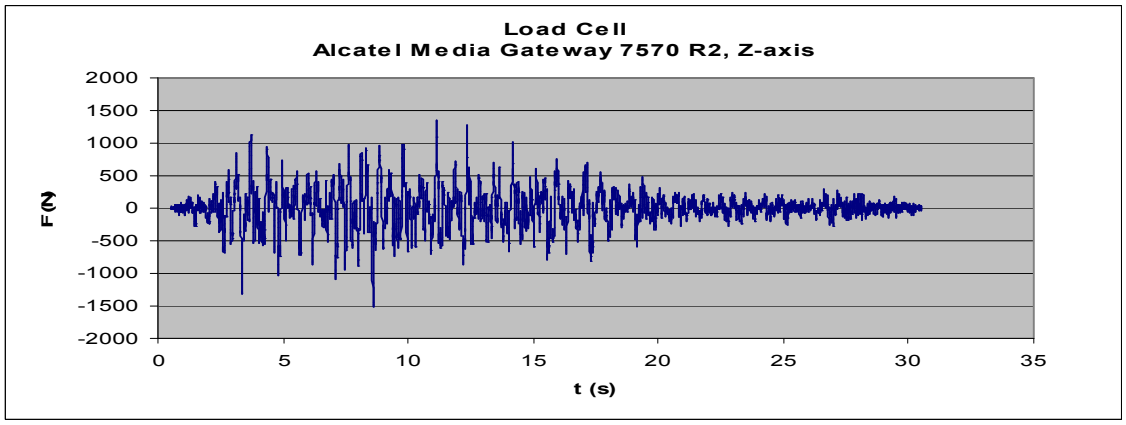

Fig. 22-36 Load-cell force Z-axis

After waveform testing, no mechanical or structural damages were detected.

The EUT operated properly before, during and after test (the operation mode and pass/fail criteria are described in detail in the Executive Summary).

Test Results

The **Error! Reference source not found.** is **compliant** with **R4-75 [117] and O4-74 [116].**

The Mounting kit concrete anchors not included in suppliers delivery, therefore **R4-77 [119], O4-78 [120], O4-79 [121** are **not applicable (NA).**

Static pull test are **not performed O4-76 [118]**, because waveform testing was done.

Test Equipment Used

Seismic Test System 86 A

ID No.	Equipment	Manufacturer	Status	Calibration date	Calibration due
S0353	Earthquake Test System	MTS	cnn		
S0896	Control System for Earthquake		cnn		
S0919	Amplifier	Endevco	cal	Feb 09, 2007	Feb 29, 2008
S0920	Amplifier	Endevco	cal	Feb 09, 2007	Feb 29, 2008
S0922	Power Supply	Endevco	cnn		
S5298	Charge Amplifier	Bruel & Kjaer	cal	Feb 09, 2006	Feb 29, 2008
S5317	Accelerometer	Sensotec	cal	May 24, 2006	May 31, 2008
S5324	Force Sensor	PCB Piezotronics	cal	Aug 29, 2006	Aug 31, 2008
S5396	Accelerometer	Sensotec	cal	May 27, 2005	May 31, 2007
S5398	Accelerometer	Endevco	cal	Feb 09, 2007	Feb 29, 2008
S5453	Software Version 3.3A	MTS	cnn		
S5293	Power Supply	TET Electronic	ind		
S5544	Position Transducer	National Oilwell	chk	May 07, 2007	May 07, 2008

cal = Calibration, car = Calibration restricted use, chk = Check, chr = Check restricted use, cpu = Check prior to use, cnn = Calibration not necessary, ind = for indication only

WALL-MOUNTED EQUIPMENT ANCHOR CRITERION (4.4.3)

Criteria:

R4-80 [175] Fastening systems used for wall-mounted equipment shall withstand a force of 3 times the weight of the equipment applied to the equipment in any direction.

Wall-mounted equipment listed to the latest edition of **UL 60950**, *Safety of Information Technology Equipment,* conform to this requirement.

As the EUT is not designed to be wall-mounted, **R4-80 [175]** is not applicable (**NA**):

OFFICE VIBRATION ENVIRONMENT AND CRITERIA (4.4.4)

Physical Performance Criteria (4.4.4.2)

Criteria:

R4-81 [122] All equipment shall be constructed to sustain the office vibration testing of Section 5.4.2, "Office Vibration Test Procedure," without permanent structural or mechanical damage.

Functional Performance Criteria (4.4.4.3)

Criteria:

R4-82 [123] All equipment shall be constructed to meet applicable functionality requirements continuously during each axis of the office vibration testing of Section 5.4.2, "Office Vibration Test Procedure." The equipment shall sustain operation without replacement of components, manual rebooting, or human intervention.

Test Location

The following evaluation was performed by Mr. Knier between 29 Jan 2007 and 2 Feb 2007 at

Nokia Siemens Networks GmbH & Co. KG
Center for Quality Engineering
Hofmannstraße 51
81359 München
Germany

Test Method

Test Procedure for All Frame-Mounted or Wall-Mounted Equipment

1. Mount the equipment being tested.

2. Subject the equipment to a swept sine survey at an acceleration amplitude of 0.1 g from 5 to 100 Hz and back to 5 Hz at a rate of 0.1 octave/minute. The duration of this sweep is approximately 90 minutes.

3. Repeat the sweep for each of three (3) mutually perpendicular framework axes.

The test configuration was identical to that applied for the resonance search and waveform tests.

Tests were performed in three mutually perpendicular axes (definition of axes identical to earthquake testing).

Test Results

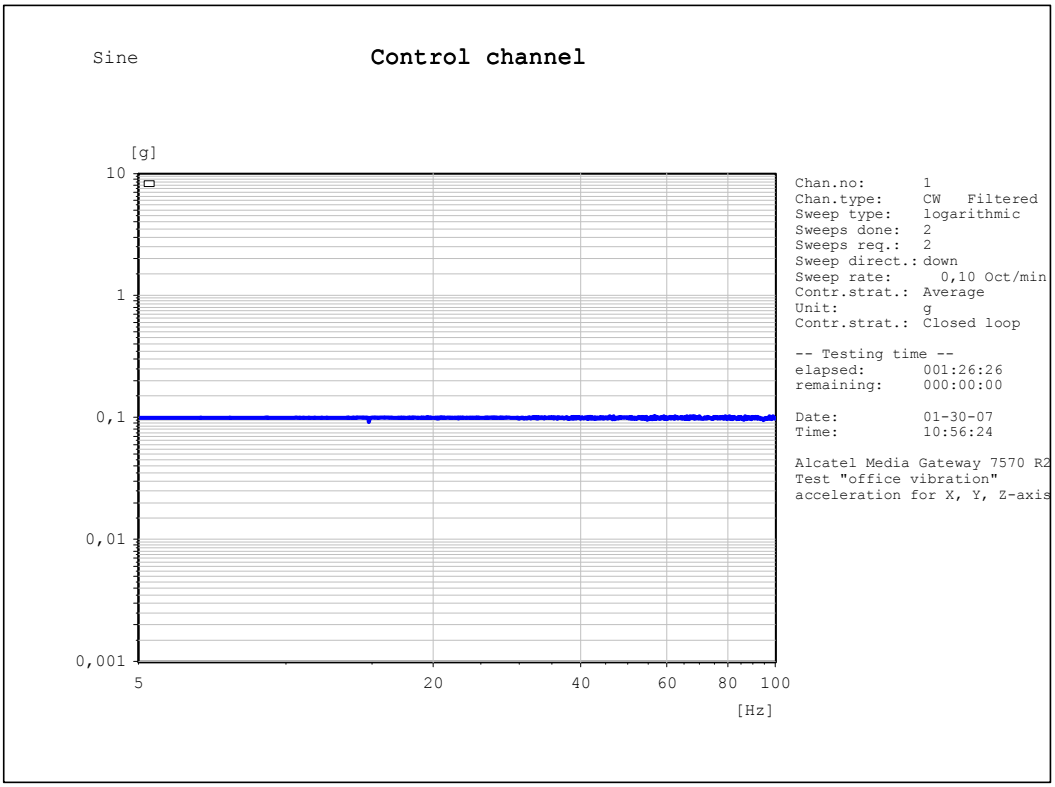

Fig. 19-37 Acceleration at the shaker table for all three axes

After sine sweeps in all three axes, no mechanical or structural damages were detected.

The EUT operated properly before, during and after test (the operation mode and pass/fail criteria are described in detail in the Executive Summary).

The **Error! Reference source not found.** is **compliant** with **R4-81 [122]**, **R4-82 [123].**

Test Equipment Used

Table 19-3 Office Vibration Detailed List of Test Equipment

Electro-dynamic Shaker 80 A

ID No.	Equipment	Manufacturer	Status	Calibration date	Calibration due
S0795	Frequency Counter	Newport	ind		
S0854	Frequency Display	Newport	ind		
S1406	Charge Amplifier (VIB9000)	Unholtz Dickie	cal	Feb 23, 2006	Feb 28, 2007
S1419	80A Vibration Exciter VIB9000	RMS	cal	Feb 23, 2006	Feb 28, 2007
S5004	Oscilloscope	Siemens	ind		
S5452	Software Version 2.9.0	M&P	cnn		
S5528	Personal Computer (VIB9000)	Fujitsu Siemens	cnn		
S5662	Vibration Control and Analysis System (VIB9000)	Agilent	cal	Feb 23, 2006	Feb 28, 2007
S5286	Accelerometer	DJB	cal	Jan 24, 2006	Jan 31, 2008

cal = Calibration, car = Calibration restricted use, chk = Check, chr = Check restricted use, cpu = Check prior to use, cnn = Calibration not necessary, ind = for indication only

TRANSPORTATION VIBRATION CRITERIA (4.4.5)

Criteria:

R4-83 [124] Equipment shall not sustain any physical damage or deteriorate in functionalperformance when subjected to vibration levels expected during transportation.

Test Location

The following test was performed by Mr. Knier between 29 Jan 2007 and 02 Feb 2007 at

Nokia Siemens Networks GmbH & Co. KG
Center for Quality Engineering
Hofmannstraße 51
81359 München
Germany

Test Method

Test Sequence

Perform the test once along each of three (3) mutually perpendicular axes of the equipment.

1. Mount the packaged equipment (resting on its normal shipping base or side) securely on the vibration machine.
2. Measure the input acceleration with a suitable transducer.
3. Subject the package to the prescribed random vibration per Table 19-4. For palletized containers, where the normal attitude during transportation is specified, then the severity for the horizontal axes is reduced by a factor of 10.
4. Subject the package to the prescribed random vibration for 30 minutes in each test axis.
5. Inspect the equipment for physical damage and verify operation following the vibration testing.

Table 19-4 Transportation Vibration Test Severity

Frequency Range (Hz)	Test Severity PSD Level
5 - 20	0.01 g2/Hz
20 - 200	-3 dB/octave

The packaged equipment is palletized. It is attached to the shaker table resting on its normal shipping side using straps (s. figs. 19-30 to 19-32).

The total weight of the packaged EUT was 316 kg.

Fig. 19-38 Transportation vibration : x-axis (horizontal)

Fig. 19-39 Transportation vibration : y-axis (horizontal)

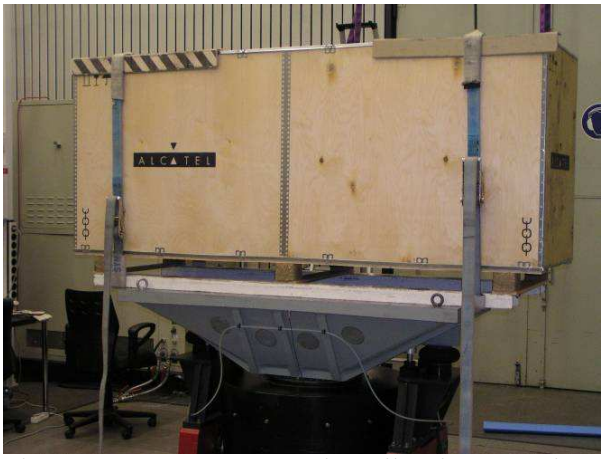

Fig. 19-40 Transportation vibration : z-axis (vertical)

Test Results

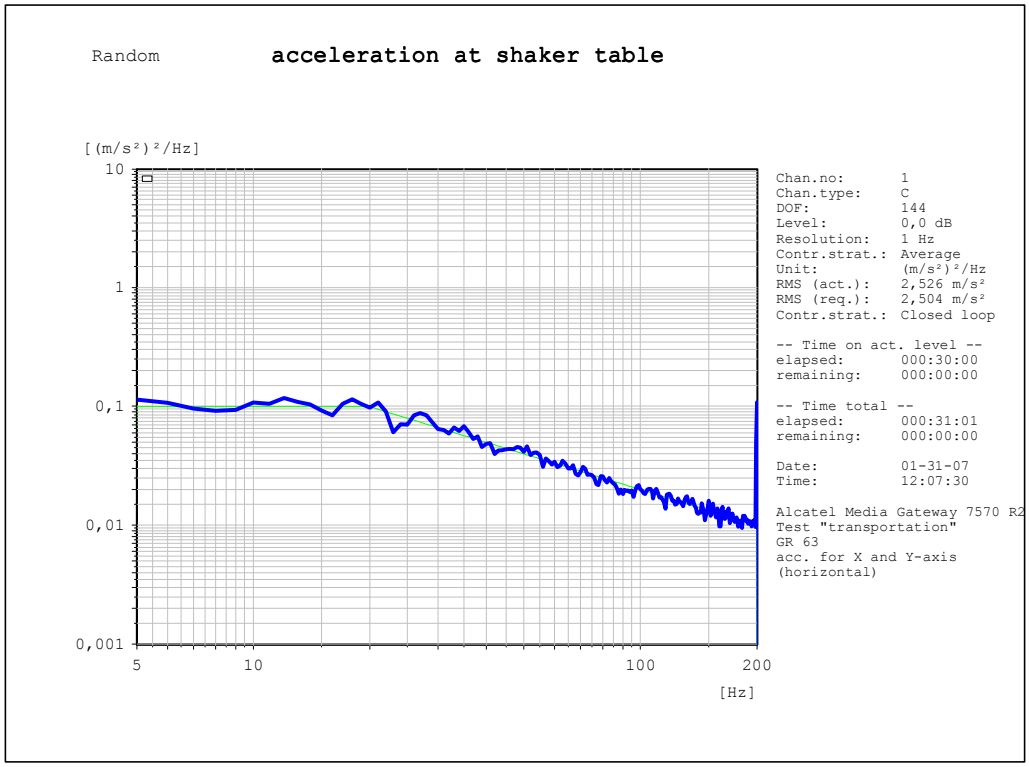

Fig. 19-41 Acceleration at the shaker table for transp. vibration horizontal

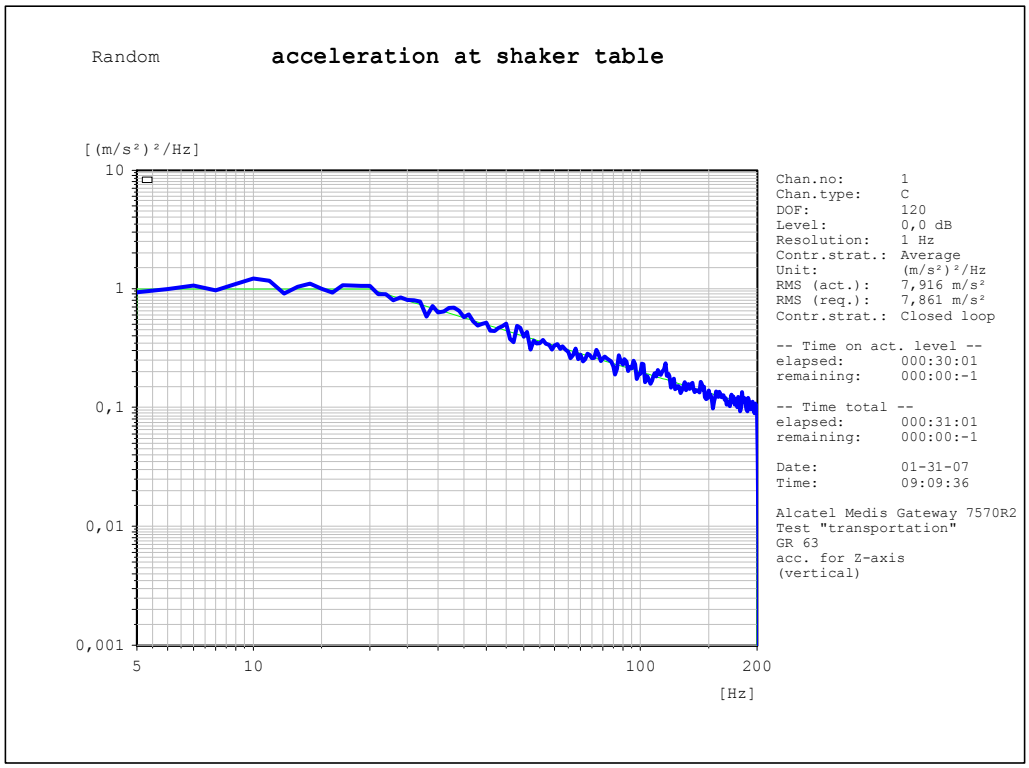

Fig. 19-42 Acceleration at the shaker table for transp. vibration vertical

The tested EUT didn't show any physical damage after the tests.
A functional test after transportation vibration was passed.

The **Error! Reference source not found.** is **compliant** with **R4-83 [124]**.

Test Equipment Used

Table 19-5 Transportation Vibration Detailed List of Test Equipment

Electro-dynamic Shaker 80 A

ID No.	Equipment	Manufacturer	Status	Calibration date	Calibration due
S0795	Frequency Counter	Newport	ind		
S0854	Frequency Display	Newport	ind		
S1406	Charge Amplifier (VIB9000)	Unholtz Dickie	cal	Feb 23, 2006	Feb 28, 2007
S1419	80A Vibration Exciter VIB9000	RMS	cal	Feb 23, 2006	Feb 28, 2007
S5004	Oscilloscope	Siemens	ind		
S5452	Software Version 2.9.0	M&P	cnn		
S5528	Personal Computer (VIB9000)	Fujitsu Siemens	cnn		
S5662	Vibration Control and Analysis System (VIB9000)	Agilent	cal	Feb 23, 2006	Feb 28, 2007
S5286	Accelerometer	DJB	cal	Jan 24, 2006	Jan 31, 2008

cal = Calibration, car = Calibration restricted use, chk = Check, chr = Check restricted use, cpu = Check prior to use, cnn = Calibration not necessary, ind = for indication only