APENDIX A: SPECIMEN INSIDE OF CLIMATIC CHAMBER.

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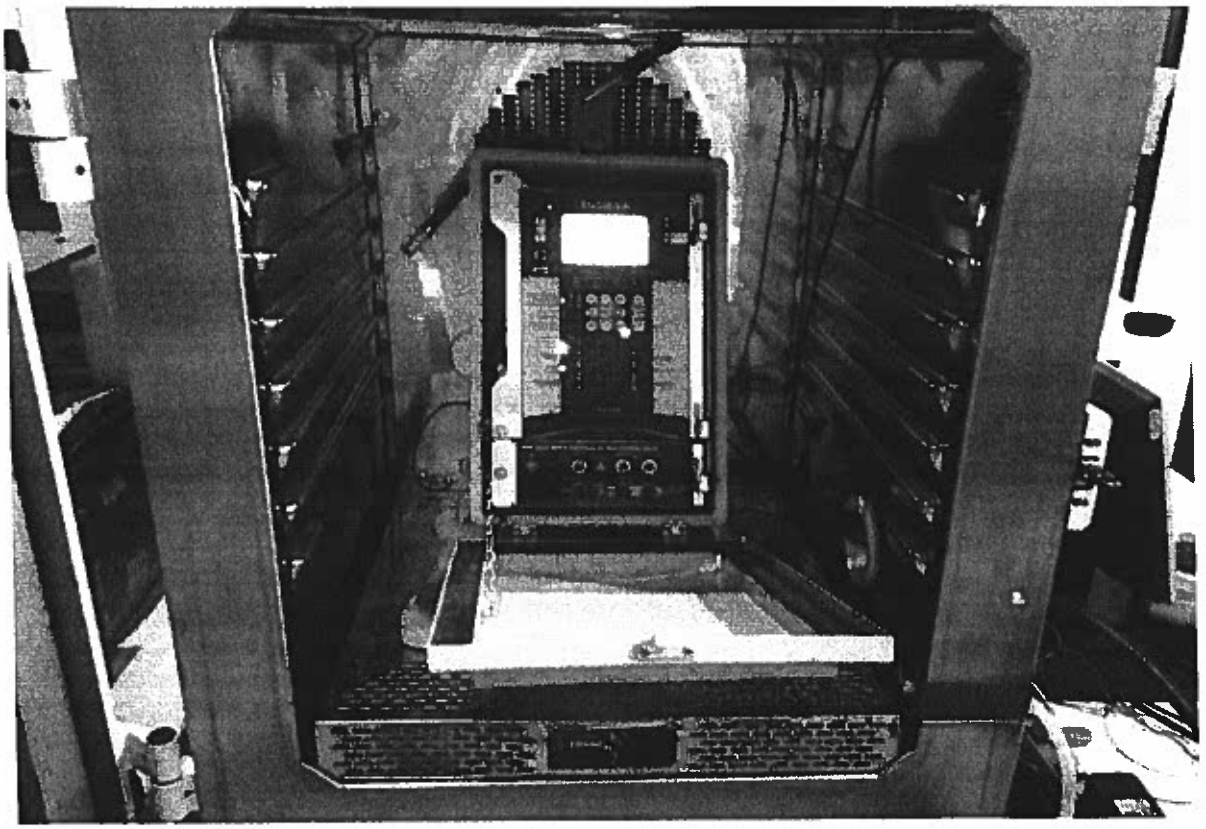

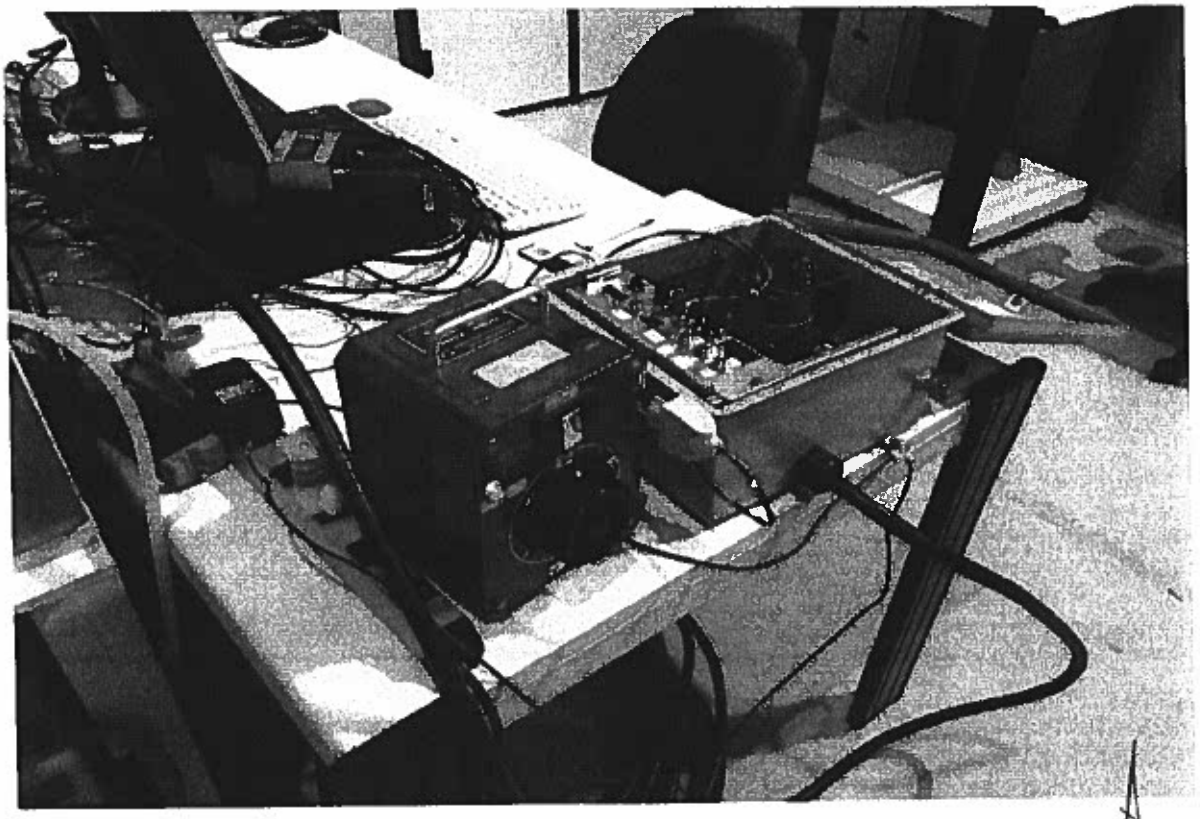

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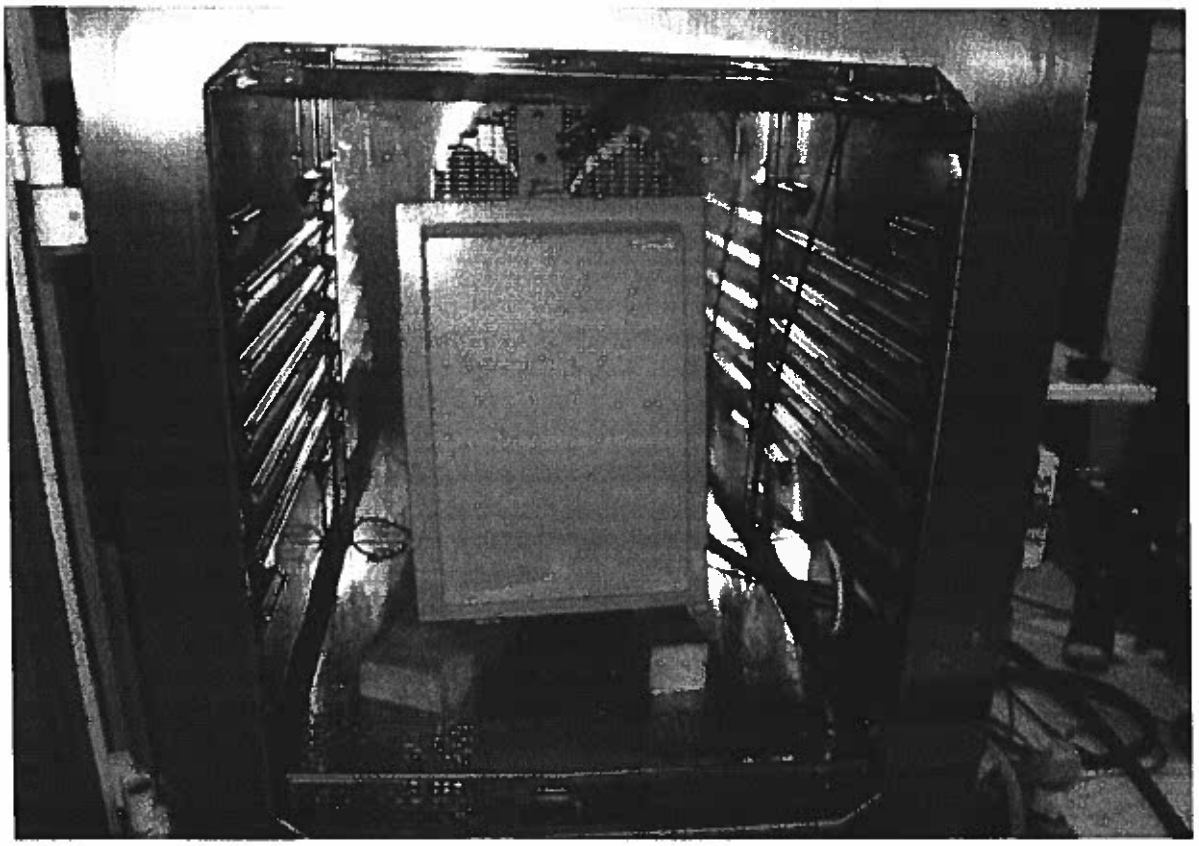

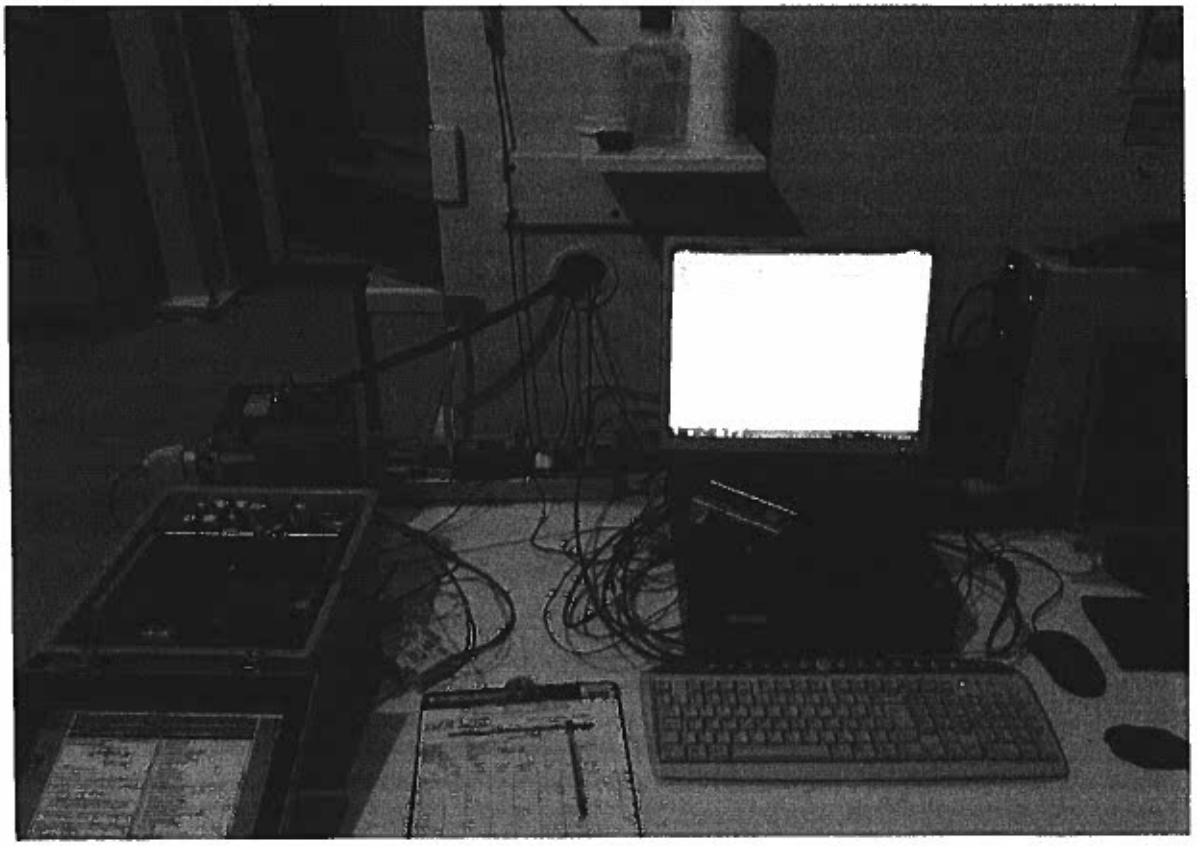

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APENDIX B: GRAPHICS – TEST GRAPHIC DATA.

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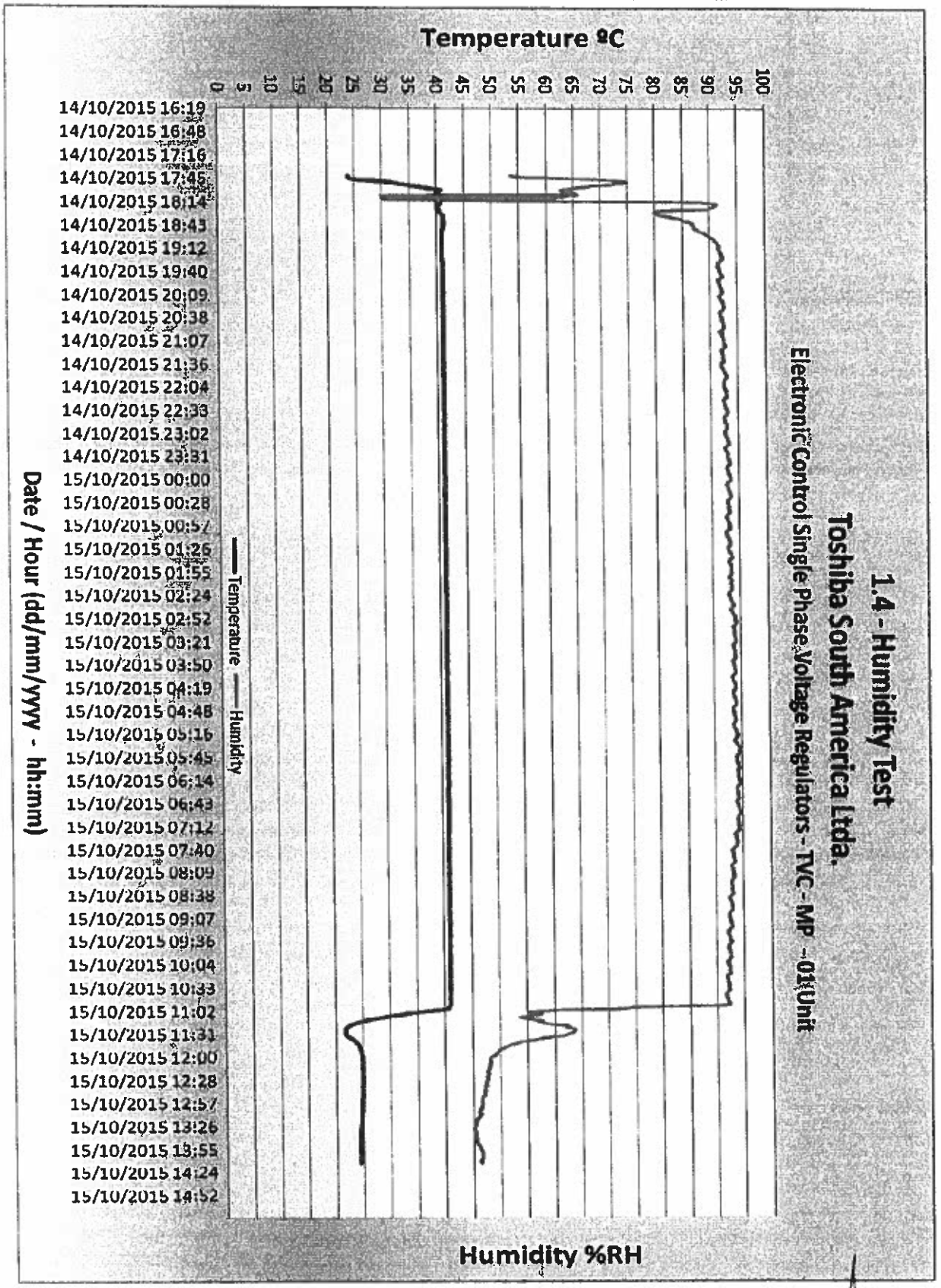

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MINISTÉRIO DA CIÊNCIA, TECNOLOGIA, INOVAÇÕES E COMUNICAÇÕES
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

0000174

São José dos Campos, 17 de junho de 2016.

LIT.0151/16

À
Toshiba América do Sul Ltda
A/C. Sr. José Roberto Medeiros
Rodovia BR 381, 3045 - Bairro Amazonas ,
Contagem, MG, Brasil,
32240-090

Prezado Senhor,

Segue relatório conforme descrição abaixo:

THBTD02-R05 – Relatório de Vibração (Versão Inglês)
Equipamento: Controle Multifásico para Reguladores de Tensão, modelo TVC – MP – S/N: 0018.

Atenciosamente,

Marcia Patricia de Carvalho
PAC – Planejamento, Análise e Custos
LIT – Laboratório de Integração e Testes

RODOLFO FERRIS
Representante Legal
ELECTROPAR S.A.

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VIBRATION TEST REPORT

CUSTOMER:	TOSHIBA AMÉRICA DO SUL Ltda.
EQUIPMENT:	ELECTRONIC CONTROL FOR SINGLE-PHASE VOLTAGE REGULATORS
MODEL:	TVC - MP (*S/N:* 0018)
REPORT Nº:	THBTD02-R05 VERSION: 1

INPE/LIT.PX.034/15

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VIBRATION TEST REPORT - SUMMARY

➢ Document No.	**THBTD02-R05**
➢ Version / Issue date	Version 1 issued on June 14th, 2016)
➢ Total No. of pages	60 pages
➢ Customer	**TOSHIBA AMÉRICA DO SUL Ltda.** Att.: Sr. José Roberto Medeiros
➢ Address	Rodovia 381, No. 3045 - B. Amazonas (CEP: 32240-090) Contagem - MG - Brazil
➢ Tested item(s)	**ELECTRONIC CONTROL FOR SIGNLE-PHASE VOLTAGE REGULATORS** *Model:* **TVC - MP** *Serial Number:* **0018**
➢ Quantity	01 (one)
➢ Test specification	Based on the IEC 60255-21-1 (Class 1), including the following tests: a) Vibration Response Test; b) Vibration Endurance Test.
➢ Test start date	March 8th, 2016
➢ Test end date	March 9th, 2016
➢ The series of tests was completed?	(x) Yes ( ) No {Reason: }
➢ Functional test of specimen during the tests	(x) Ok ( ) Not Ok ( ) N.A.
➢ Test results	See the next pages in this document
➢ LIT/PAC Process No.	ELIT.1589.15.PRO (Service ID: 423380)
➢ Proposal No.	PLANO DE TRABALHO - 1494/15 (issued on May 29th, 2015)
➢ LIT Area No. // Laboratory	LIT02 / Dynamic Testing Laboratory
➢ Service Order No.	0011.16.LIT02

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DOCUMENT CHANGE LOG

Page	Version	Date	Change reference
1 to 11; A1 to A5; B1 to B27; C1 o C17	1	14/June/2016	--

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VIBRATION TEST REPORT

ELECTRONIC CONTROL FOR SINGLE-PHASE VOLTAGE REGULATORS

1 INTRODUCTION

This report describes the vibration tests performed in a prototype unit of one equipment called Electronic Control for Single-Phase Voltage Regulators, at the Integration and Testing Laboratory - LIT, of INPE, in accordance with specification provided by Customer. The tests were followed by representatives of the Customer and the test conditions and the results are presented herein.

The planned series of tests was completed successfully without any abnormal occurrence in the test sample. It should be noted, however, that during the vibration endurance test applied to the third axis (Y) it was observed that the resonant frequency changed gradually during the test run (see item 8). A visual inspection carried out at the end of the test found that the equipment did not show signs of external mechanical damage; however, the fixing screw of specimen located at the bottom position was partially loose.

As defined in the applicable standard, the "Vibration Response Tests" were conducted with the test sample powered on and under functional supervision, and the "Endurance Vibration Tests" with sample turned off, being performed, however, a functional check after complete them. According to the verbal information of representatives of Toshiba and responsible for these checks, the equipment remained always under normal operating conditions during the vibration test campaign.

In this document the words: sample, the test sample, specimen, module or equipment, are used interchangeably having the meaning of unit under test.

2 PURPOSE OF THE TEST

The tests were performed to demonstrate the mechanical strength and performance of the equipment when subjected to a dynamic vibration environment in the three main axes of excitation (X, Y, Z) for the test conditions specified by the Customer.

3 TEST SCHEDULE TIME

The tests were performed at the LIT's System Qualification Area - Environmental Tests - Dynamic Testing Laboratory, from March 8th to March 9th, 2016.

4 TEST ITEM IDENTIFICATION

The unit under test was a prototype of the Electronic Control for Single-Phase Voltage Regulators, developed by Toshiba South America Ltda. The identification of the equipment and its principal features are shown below.

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- *Test item*.....: **ELECTRONIC CONTROL FOR SINGLE-PHASE VOLTAGE CONTROL**;
- *Model*.....: **TVC - MP**;
- *Serial Number (S/N)*.....: **0018**;
- *Overall dimension [mm]*.....: 310.5 x 163 x 574 (h);
- *Net weight*.....: 11.0 kg (nominal);
- *Quantity*.....: 01 (one).

5 APPLICABLE AND REFERENCE DOCUMENTS

5.1 APPLICABLE DOCUMENTS

- DA1: E-mails Toshiba dated from May 21st, 22nd and 27th, 2015 (Test request and messages of technical clarifications);
- DA2: IEC 60255-21-1 (1988), Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment, Section One - Vibration tests (sinusoidal).

5.2 REFERENCE DOCUMENTS

- DR1: SD2560 Vibration Controller System manuals;
- DR2: LDS V964LS/MPA3324 Vibration Testing System manuals.

6 TECHNICAL REQUIREMENTS

6.1 TESTING AREA

The tests were conducted at the LIT's System Qualification Area - Dynamic Testing Laboratory that has the following controlled environmental conditions (only authorized personnel have the access to this area):

- *Cleanliness condition*.....: 100,000 (ISO 8);
- *Temperature*.....: 23°C +/- 2°C;
- *Relative humidity*.....: 50% +/- 10%.

6.2 PERSONNEL

The following manpower was used to perform the vibration tests:

- LIT team.....: Mauro T. Sakita;
  Flavio Alexandre;
  André B. Aguiar;
  Carlos E. Correa;
  José Lucas Ferraz Marques.
- Toshiba team.....: Mr. Augusto Henrique Cascelli;
  Mr. Felipe Vilaça Marchezini.

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The activities related to installation/removal of control and measuring accelerometers, mounting the adapter on the vibration table and of conducting the tests were under the responsibility of INPE / LIT team.

The activities related to the assembly and disassembly of the test sample in the adapter device and performing the functional tests were under the responsibility of the Customer team.

6.3 TESTING FACILITIES

Table 6.3.1 presents the list of equipment used to perform the tests.

Table 6.3.1 - List of Equipment

Equipment	Manufacturer	Model	Serial Number	Calibration date	Supplier
Vibration Testing System	LDS	V964LS	–	(*)	LIT
Vibration Controller	Spectral Dynamics	SD2560 (#2)	–	03/09/2015	LIT
Accelerometers	Endevco	Divers	(see Appendix B)	(see Appendix B)	LIT
Charge Amplifier	Endevco	2721B	DK44/DK35	06/07/2015	LIT
Variable Voltage	STP	ATV-215-M	260	(*)	LIT
Portable Multimeter	Fluke	85-III	--	09/02/2015	Toshiba
Functional Test Setup	Toshiba	--	--	(not informed)	Toshiba
Torque Wrench	Gedore	No. 4550-10	F018326	26/06/2015	LIT
Vibration Adapter	Toshiba	--	--	(N.A.)	Toshiba

(*) Testing facilities not subject to calibration;
(**) Testing facilities verified using calibrated instrumentation.

7 TEST CONDITIONS

7.1 TEST SPECIFICATION

Copies of the test request and of the clarification messages are presented in Appendix A of this report. A summary of the test specifications is shown below.

7.1.1 VIBRATION RESPONSE TEST

- *Applicable standard*.....: **IEC 60255-21-1** (1988), item 4.2.1 - Vibration response test; Table 1, Class 1;
- *Test Method*.....: Sinusoidal cycling test;
- *Frequency range*.....: 10 - 150 Hz;
- *Vibration levels*.....: 10 - 60 Hz // 0.07 mm DA; 60 - 150 Hz // $0.5g_n$;
- *Sweep rate*.....: 1 octave per minute;
- *Number of sweep cycles*.....: 01 (10-150-10 Hz);
- *Test axes*.....: 03 (X,Y,Z);
- *Test item status*.....: In operation and continuously monitored throughout the test;
- *Other information*.....: Tests carried out at RT (23°C ± 2°C).

NOTE: *It was considered the approximate value of the gravitational acceleration: $1g_n \cong 10$ m/s².*

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7.1.2 VIBRATION ENDURANCE TEST

- *Applicable standard* .....: **IEC 60255-21-1** (1988), item 4.2.2 - Vibration endurance test; Table 1, Class 1;
- *Test Method*.....: Sinusoidal cycling test;
- *Frequency range* .....: 10 - 150 Hz;
- *Vibration levels* .....: 10 - 150 Hz // $1g_n$;
- *Sweep rate*.....: 1 octave per minute;
- *Number of sweep cycles* .....: 10 (10-150-10 Hz);
- *Test axes* .....: 03 (X,Y,Z);
- *Test item status* .....: Turned off;
- *Other information*.....: Tests carried out at RT (23°C ± 2°C).

7.2 REFERENCE AXES

The three mutually perpendicular axes of the test sample were defined as follows (see figure on page A4 and pictures in Appendix C):

- X axis: Longitudinal (front-aft of the equipment);
- Y axis: Transverse (left-right of the equipment);
- Z axis: Vertical (up-and down, parallel to the height of the equipment).

7.3 MOUNTING OF THE TESTED ITEM

For the tests, the Customer has developed a special L-shaped device, in aluminum, with proper holes for mounting the equipment in the planned configuration for use. The test sample was rigidly mounted on the mentioned device by means of two attachment points (one at upper and another at lower position) applying torque of 35 Nm in the M10 screws (hex head), as defined by the Customer. Flat washers and pressure washers were used in both heads of bolts for the seats of M10 nuts. After completion of the first mounting, the assembly comprising the device and the test sample was maintained as a "monolithic body" throughout the campaign of dynamic tests.

During the pre-assembling it has been identified interference between the screw head of the grounding attachment of the equipment and the vertical plate of the adapter device. To mitigate this problem it was used two spacers (disks, in aluminum with a thickness of 6.5 mm, provided by the laboratory) under the test sample mounting brackets, as shown in the photos of Appendix C of this document.

For tests in the horizontal directions (X and Y axes), the device (with sample already mounted) was fixed on a head plate adapter previously assembled on the slip table and for testing in the vertical direction (Z axis) on the same interface, which had been mounted on the armature of the vibrator.

As requested by the representatives of Toshiba, a grounding grid of the laboratory was connected to the unit under test and also to the functional monitoring setup to avoid disturbance during the functional evaluation of the equipment.

Photos illustrating the general assembling of the test sample on the vibration testing system are shown in Appendix C of this document.

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7.4 CONTROL AND MEASURING ACCELEROMETERS

The control of the vibrating table was made by monitoring the signal from a control accelerometer (AC*E*01, where ***E*** = X, Y or Z direction corresponds to the excitation axis) installed on the vibration table.

In order to find the equipment resonance frequency it was installed a uniaxial accelerometer at a selected point on the outside of the sample (top right, near the upper attachment point of the Panel "A"). This sensor identified as A*E*01 (where ***E*** = X, Y or Z direction corresponds to the reference axis of the equipment) was relocated during the changing of the test axes to measure vibration along the excitation direction.

The photographs presented in Appendix C of this document illustrate the location of the control and the measuring accelerometers used in the tests.

The relevant characteristics of the accelerometers can be found in the accelerometers Control Data Sheets of Appendix B.

7.5 FUNCTIONAL TEST

The vibration response tests were performed with the sample powered on and under functional supervision, and the vibration endurance tests with the sample turned off. Functional tests were always carried out by the representatives of the Customer using one specific setup.

It follows a description of the procedure used by the Toshiba representatives for setting up the parameters in the functional monitoring setup of the Electronic Control for Single-Phase Voltage Regulators (text in blue color, provided by Customer and written originally in Portuguese language):

"O controle foi ajustado para tensão de referência de 120,00 V e insensibilidade de 2,00 V e modo automático.

Foram realizadas inspeções funcionais antes, durante e depois dos ensaios. A inspeção funcional consistiu basicamente em variar a tensão de entrada do controle através de um varivolt e observar a regulagem da tensão de saída. Quando a tensão de entrada estava abaixo ou acima do valor de tensão selecionado no regulador (120 V a.c.), o motor do comutador do tap era acionado automaticamente para corrigir a tensão de saída e ajusta-la ao valor selecionado.

Durante o ensaio de resposta à vibração foram monitorados, segundo item 4.3.3, saídas do relé auxiliar (RELE_CM e RELE_NO) e acionamento do motor (MOTOR_SUBIR) via osciloscópio ajustado com uma varredura horizontal de 2ms, a comunicação DNP3 via fibra ótica e via cabo DB9."

8 DEVELOPMENT OF TEST

The planned series of vibration tests was performed in six test steps, numbered and identified each one as a particular test, as shown in Appendix B herein.

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The test sample was visually inspected after completing each test, and it was found no signs of external mechanical damage. However, in the last test run (Test 06 - Y axis / Vibration / Durability) it was observed a progressive change of the resonance peak during its elapsing (the peak of the upward scan was at ~ 50 Hz at the start of the test (sweep # 1) and fell to approximately ~ 30 Hz in the last up-scan (sweep # 39)). The visual inspection performed after completion of this test showed there was no evidence of mechanical degradation of the test sample; however, during the check of the residual torque of the sample fixing screws, it was observed that the bolt located at the bottom position was partially loose (torque value lower than 30 Nm).

All tests were completed successfully without any abnormal occurrence in the test sample. For each test axis (Z, X and Y) it was performed consecutively, the following tests:

- Vibration Response Test;
- Vibration Endurance Test.

The vibration response tests were performed with equipment powered on and under continuously monitoring, and the vibration endurance tests, with equipment turned off. At the end of the vibration endurance tests, the representatives of Toshiba performed a functional test of the test sample, and following their information, the unit remained always under normal operating conditions.

The Table 8.1 presents, for information purposes only, a summary table with the most relevant resonance peak values (frequency and the acceleration levels with amplification factor Q ≥ 2) measured by the measuring accelerometers aligned with the test excitation axis in up-sweep (Sweep # 1) and down-sweep (Sweep # 2) of the Vibration Response Tests.

Table 8.1 - Summary of the resonant peaks (Freq. & Amplitude) with Q ≥ 2

	Z axis (Test 01)		X axis (Test 03)		Y axis (Test 05)	
Accel. ID	Sweep #1	Sweep #2	Sweep #1	Sweep #2	Sweep #1	Sweep #2
AZ01	0.6g @ 150 Hz (*)	0.6 @ 150 Hz (*)	–	–	–	–
AX01	–	–	109.,8 Hz // 1.5g 2.3g @ 150 Hz (*)	108.6 Hz // 1.6g 2.4g @ 150 Hz (*)	–	–
AY01	–	–	–	–	57.0 Hz // 2.7g	51.0 Hz // 3.4g

(*) Maximum value measured by the accelerometer (this is not peak resonance)

9 TEST RESULTS AND COMMENTS

The planned series of tests was completed successfully without any abnormal occurrence, except for the occurrence of detachment of one fixing screw as mentioned in the previous section of this document.

The records of the signals obtained from the vibration tests are presented in Appendix B of this report and represent the peak amplitude [g] of the signals (control and measuring) in function of the frequency [Hz]. In the case of Test 06, it was also presented solely for information purposes, the records of two consecutive sweeps obtained at different times aiming to demonstrate the variation of the sample resonant frequency during the test run.

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During the changing of the test axes and at the end of each test, the test sample was visually inspected, finding that it showed no signs of mechanical external damage or loose parts. More detailed inspections and additional functional tests (if any) will be under the responsibility of the Customer.

With regards to the occurrence of detachment (loose) of one fixing screw of the equipment on the adapter device, we have the following comments:

- There is evidence that the painting of the mounting brackets (seating surface) does not have a control of the painting thickness and finishing;
- Bolted joints assume that the friction between the parts under load (which is a function of the applied torque on the screws and the material of the parties) is to ensure the performance of the joint;
- In the case of the bottom attachment bracket of the equipment, which is of fork-like, the film of the applied painting can be considered as a spring (elastic member) between the joints and as far as the test was going on, it was crushed and generated a local slack on the junction (there was no indication of rotation occurrence of the screw or of the nut);
- The using of a standard flat washer does not seem to be appropriate for the area of the fork, because it is an "open" structure. It is recommended to verify the possibility of using a high-load washer with outer diameter greater than or equal to the width of support and with at least twice the thickness of the standard washer;
- Evaluate the possibility of using screws with higher strength class than the ones used (class 5.8), thus allowing the application of a higher value fastening torque;
- Evaluate the possibility of applying a surface protection against atmospheric corrosion different from the conventional painting (for example, electroplating, galvanizing, chrome plating, etc.) in the mounting brackets.

Since the adapter device was designed for dynamic testing of other similar equipment, but with greater external dimension, it is recommended to evaluate, a priori, the need to provide spacers with adequate thickness to the equipment shall be tested. This will be essential if the equipment grounding point is located in a similar position to that of the sample mentioned in this document.

The results presented in this document are restricted to the sample listed in item 4 and to the general test conditions described in item 7 herein.

It is presented in Appendix C some photographs of the specimen when mounted on the vibration table and from the control and measuring instrumentation.

Test Engineer: _____ - 14 / June / 2016
Mauro T. Sakita – Technical Staff

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APPENDIX A

COPY OF THE TEST REQUEST

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0000187

Assunto: **Orçamento para execução de ensaios**
De: **Jose Roberto Medeiros <jose.roberto@toshiba.com.br>**
Data: **21/05/2015 15:19**
Para: **"pac@lit.inpe.br" <pac@lit.inpe.br>**

Bom dia.

Favor verificar sua capacitação para realizar os ensaios climáticos, elétricos e mecânicos segundo a norma IEEE Std C57.15™-2009 (Revision of IEEE Std C57.15-1999) IEEE Standard Requirements, Terminology, and Test Code for Step-Voltage Regulators.(trecho copiado abaixo) e encaminhar orçamentos individuais por grupo (climáticos, elétricos e mecânicos).

O equipamento a ser ensaiado é um controle eletrônico para reguladores de tensão monofásicos. Em anexo encaminho dados cadastrais e dois relatórios de ensaios realizados em um equipamento semelhante ao que será ensaiado.

Utilizar o CNPJ da unidade de Belo Horizonte.

9.4.1.3 Environmental tests
9.4.1.3.1 Temperature
The control shall meet all requirements specified herein when operated in an operating environment (air temperature, solar radiation, and other heat sources) with temperature range –40 °C to +65 °C. Control device components shall withstand a temperature range –40 °C to +85 °C without loss of control. This requirement includes powering up of a control not in service or a control disconnected from the primary power source and does include the effects of any internal heat source (i.e., self-heating).
The following tests shall be completed:
a) IEC 60068-2-1, cold, –40 oC, 96 h
b) IEC 60068-2-2, dry heat, +65 oC, 96 h
9.4.1.3.2 Humidity
Tests are to be conducted per IEC 60068-2-30, 55 oC, 6 cycles.
9.4.1.3.3 Vibration
Tests shall be completed per IEC 60255-21-1 (Class 1).
9.4.1.4 Insulation coordination tests
Tests shall to be completed per IEC 60255-5, impulse voltage (category III), dielectric test (2 kV).: IEC 60255-5:2000 substituda pela IEC 60255-27:2013
9.4.1.5 Electrostatic discharge test
Tests shall be completed per either IEEE Std C37.90.3 or IEC 60255-22-2 as specified. Testing shall be completed for all voltage levels specified, highest level being 8 kV contact discharge, 15 kV air discharge. IEC 60255-22-2 substituda pela IEC 60255-26:2013
9.4.1.6 RFI and interference tests
9.4.1.6.1 Radiated RFI
Tests shall be completed per either IEEE Std C37.90.2 or IEC 60255-22-3 as specified. IEC 60255-22-3 substituda pela IEC 60255-26:2013
9.4.1.6.2 Surge withstand capability
Tests shall be completed per either IEEE Std C37.90.1 or both IEC 60255-22-1 and IEC 60255-22-4 (Class A) as specified. IEC 60255-22-1 e IEC 60255-22-1 substitudas pela IEC 60255-26:2013
9.4.1.6.3 Surge immunity
Tests shall be completed per IEC 60255-22-5 IEC 60255-22-5 substituda pela IEC 60255-26:2013
9.4.1.6.4 Conducted immunity
Tests shall be completed per IEC 60255-22-6. IEC 60255-22-5 substituda pela IEC 60255-26.2013

Atenciosamente,

Eng. José Roberto Medeiros
Dep. Técnico - Coordenador de pesquisa e desenvolvimento
Fone: (0xx31) 3329-6684
Fax: (0xx31) 3329-6698
TOSHIBA INFRAESTRUTURA AMÉRICA DO SUL LTDA
Rodovia Fernão Dias nº. 3045 B. Bandeirantes
CEP : 32240-090 Contagem - MG

RODOLFO PEREZ
Representante Legal
ELECTROPAR S.A.

Assunto: RES: INFO: Ensaios Mecânicos-Dinâmicos em Controle Eletrônico para Regulador de Tensão
Data: Fri, 22 May 2015 20:32:07 +0000
De: Jose Roberto Medeiros <jose.roberto@toshiba.com.br>
Para: Mauro Sakita <sakita@lit.inpe.br>

Boa tarde Mauro.

Segue em anexo o desenho dimensional da caixa onde o equipamento será instalado para execução do ensaio.

Ainda não temos o valor exato, receberemos a caixa de controle na próxima segunda feira, porem estimamos que a massa total fique entre 15 a 20kg, acredito que na terça feira de manha já terei a informação exata.

Atenciosamente,

Eng. José Roberto Medeiros
Dep. Técnico - Coordenador de pesquisa e desenvolvimento
Fone: (0xx31) 3329-6684
Fax: (0xx31) 3329-6698
TOSHIBA INFRAESTRUTURA AMÉRICA DO SUL LTDA
Rodovia Fernão Dias nº. 3045 B. Bandeirantes
CEP : 32240-090 Contagem - MG

De: Mauro Sakita [mailto:sakita@lit.inpe.br]
Enviada em: sexta-feira, 22 de maio de 2015 14:43
Para: Jose Roberto Medeiros
Cc: PAC@lit.inpe.br
Assunto: INFO: Ensaios Mecânicos-Dinâmicos em Controle Eletrônico para Regulador de Tensão
Prioridade: Alta

Prezado Sr. José Roberto,

Boa tarde!
Com relação aos ensaios mecânicos-dinâmicos (Vibração) especificados para o equipamento suprareferenciado, solicitamos algumas informações, a saber:

1) Quais as dimensões externas e massa;

2) Fornecer detalhes da forma normal de fixação/montagem (desenhos e/ou fotos ilustrativas seriam de interesse).

Ficamos no aguardo.

Atenciosamente,

Mauro Sakita - INPE/LIT - Ensaios Dinâmicos de Vibração
Fone: (12) 3208-6288/6258
Email: sakita@lit.inpe.br

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Representante Legal
SOLUTIONAR S.A.

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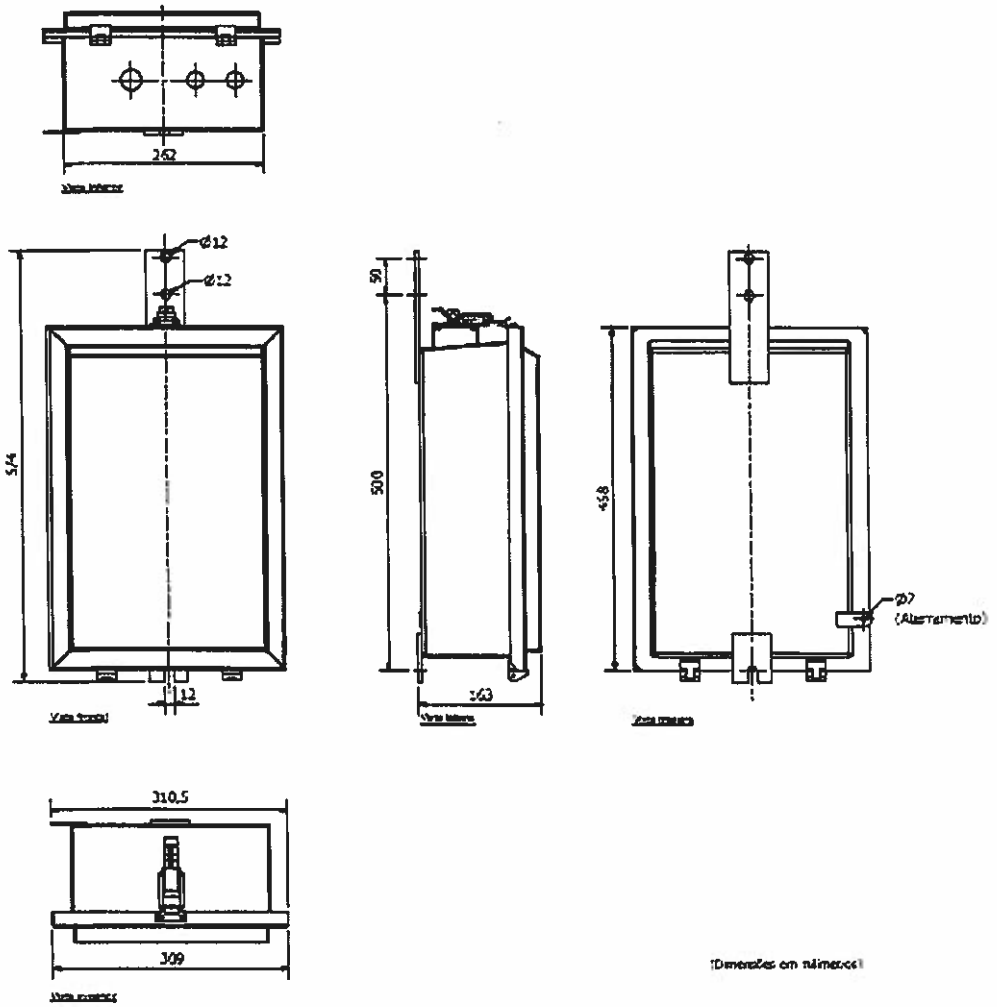
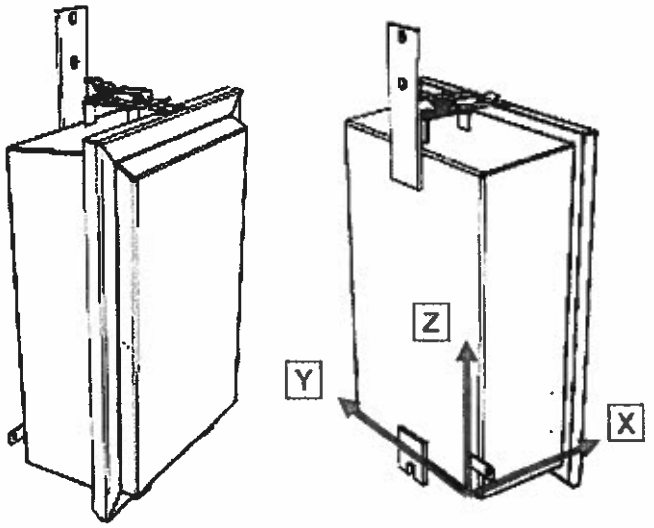
Dimensões externas do controle



(Dimensões em milímetros)



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Representante Legal
ELECTROPAR S.A.

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Assunto:ENC: INFO: Ensaios Mecânicos-Dinâmicos em Controle Eletrônico para Regulador de Tensão
Data: Wed, 27 May 2015 15:06:31 +0000
De: Jose Roberto Medeiros <jose.roberto@toshiba.com.br>
Para: Mauro Sakita <sakita@lit.inpe.br>

Boa tarde.

Executamos a pesagem do equipamento sendo o valor exato de 11kg.

Atenciosamente,

Eng. José Roberto Medeiros
Dep. Técnico - Coordenador de pesquisa e desenvolvimento
Fone: (0xx31) 3329-6684
Fax: (0xx31) 3329-6698
TOSHIBA INFRAESTRUTURA AMÉRICA DO SUL LTDA
Rodovia Fernão Dias nº. 3045 B. Bandeirantes
CEP : 32240-090 Contagem - MG

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APPENDIX B

GRAPHICAL RECORDS

NOTE: *The labels of the graphic records are written in Portuguese because at the time the tests were ordered there was no requirement to issue the report in English language.*

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Representante Legal
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B1 - INTRODUCTION

The test sequence summary and the test control data sheets are presented in Tables B1.1 and B1.2, and the list of figures, in Table B2.

TABLE B1.1 - TEST SEQUENCE SUMMARY

Test #	Axis	Test / Type	Test ID.	Comments
01	Z	Sinusoidal Vibration / Vibration Response Test	CMZS01	(Completed!)
02		Sinusoidal Vibration / Vibration Endurance Test	CMZS02	(Completed!)
03	Y	Sinusoidal Vibration / Vibration Response Test	CMYS03	(Completed!)
04		Sinusoidal Vibration / Vibration Endurance Test	CMYS04	(Completed!)
05	X	Sinusoidal Vibration / Vibration Response Test	CMXS05	(Completed!)
06		Sinusoidal Vibration / Vibration Endurance Test	CMXS06	(Completed!)

TABLE B1.2 - INSTRUMENTATION DATA SHEET CONTROL

Nº	Model	S/N	Sensit. [pC/g]	Function	Calibration Certificate #	Calibration Date [d/m/y]	Install'n Date [d/m/y]	Isolation Check [GΩ]	Cable #
ACE01	2221D	ET90	17.473	Ctrl	CC-10188	26/10/15	08/03/16	N.A.	Y1010
AE01	226C	JJ18	2.341	Aux.	CC-10036	30/04/14	08/03/16	N.A.	Y1015

NOTES: (i) N.A. = Not Applicable;
(ii) E = X, Y or Z (excitation direction).

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B2 - LIST OF FIGURES

Figure Nº	Ref. Test #	Axis	Measuring Accel.	Control data plots	Comments
B2.1	01	Z	--	Run 1 - Ok	--
B2.2			AZ01	--	(Sweep #1)
B2.3				--	(Sweep #2)
B2.4	02		--	Run 1 - Ok	--
B2.5			AZ01	--	(Sweep #40)
B2.6	03	X	--	Run 1 - Ok	--
B2.7			AX01	--	(Sweep #1)
B2.8				--	(Sweep #2)
B2.9	04		--	Run 1 - Ok	--
B2.10			AX01	--	(Sweep #40)
B2.11	05	Y	--	Run 1 - Ok	--
B2.12			AY01	--	(Sweep #1)
B2.13				--	(Sweep #2)
B2.14	06		--	Run 1 - Ok	--
B2.15			AY01	--	(Sweep #1)
B2.16				--	(Sweep #2)
B2.17				--	(Sweep #11)
B2.18				--	(Sweep #12)
B2.19				--	(Sweep #21)
B2.20				--	(Sweep #22)
B2.21				--	(Sweep #31)
B2.22				--	(Sweep #32)
B2.23				--	(Sweep #39)
B2.24				--	(Sweep #40)

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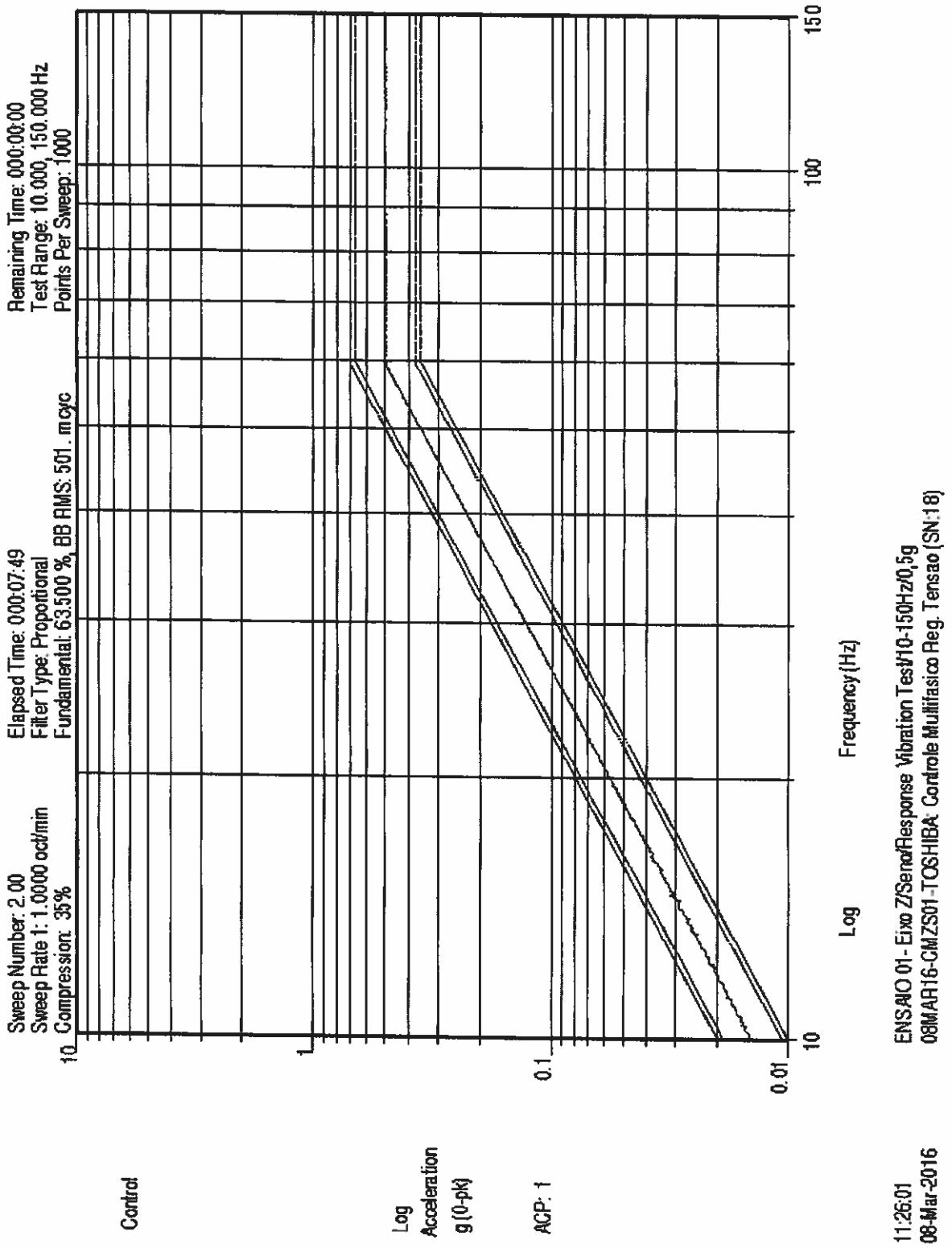

Fig. B2.1.

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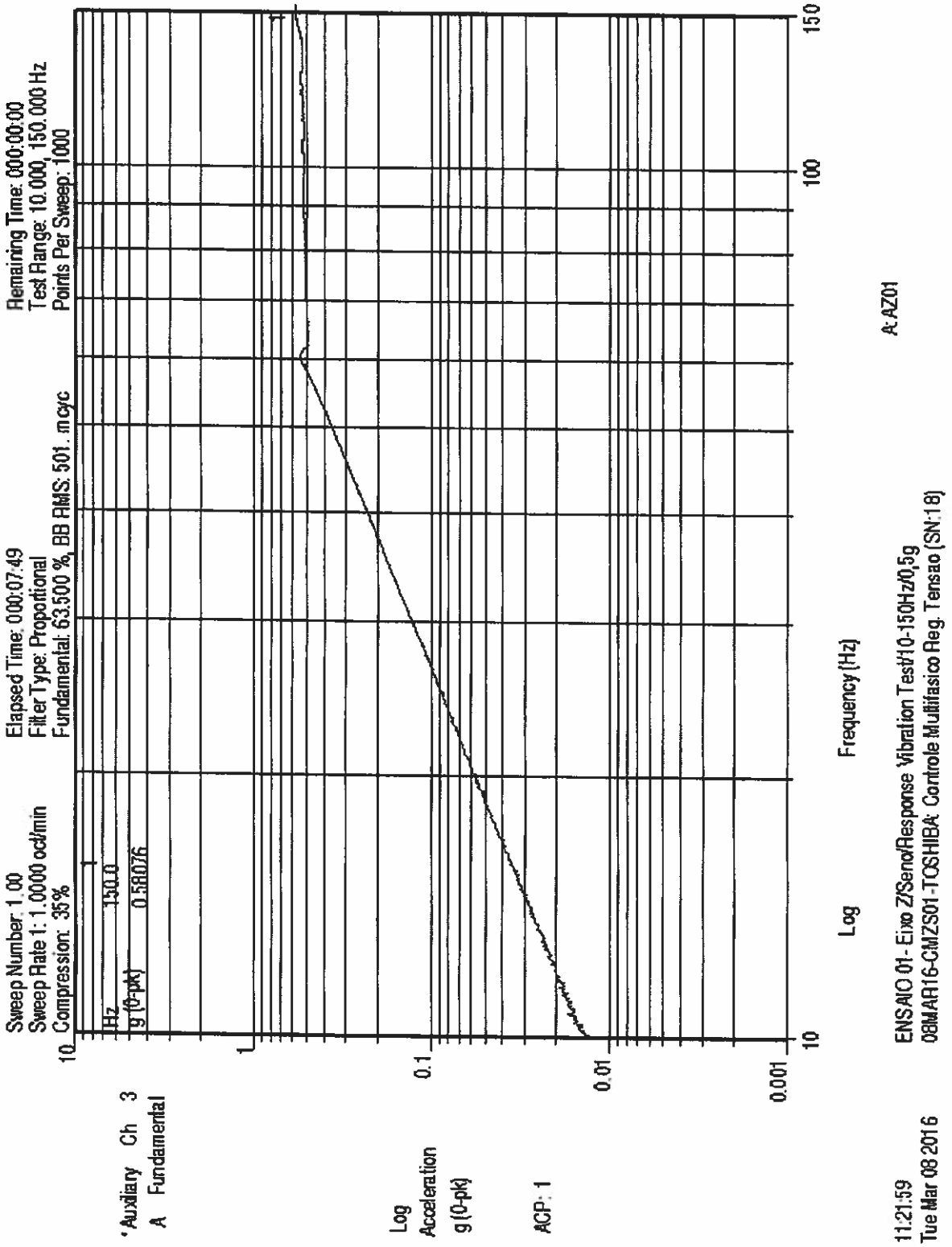

Fig. B2.2.

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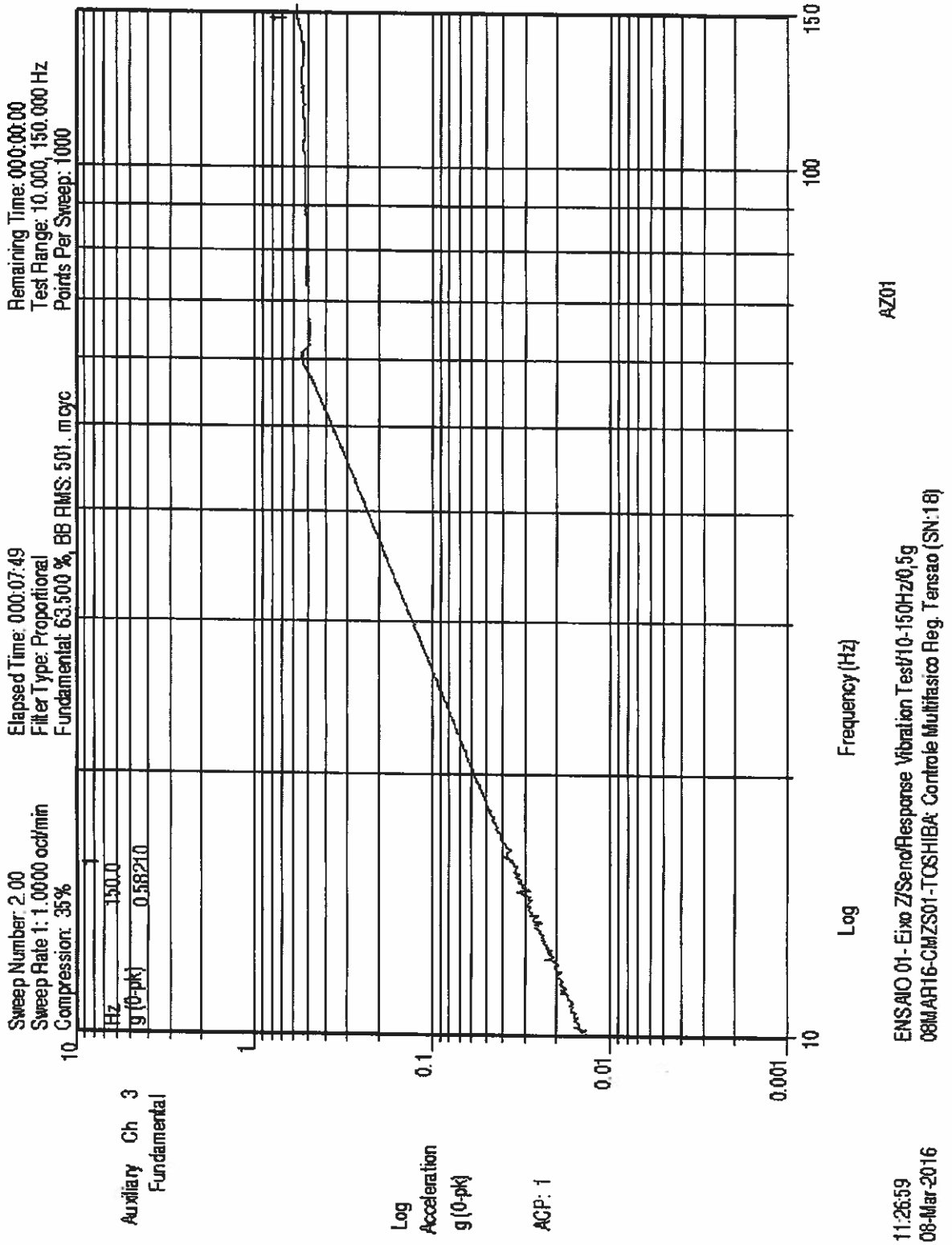

Fig. B2.3.

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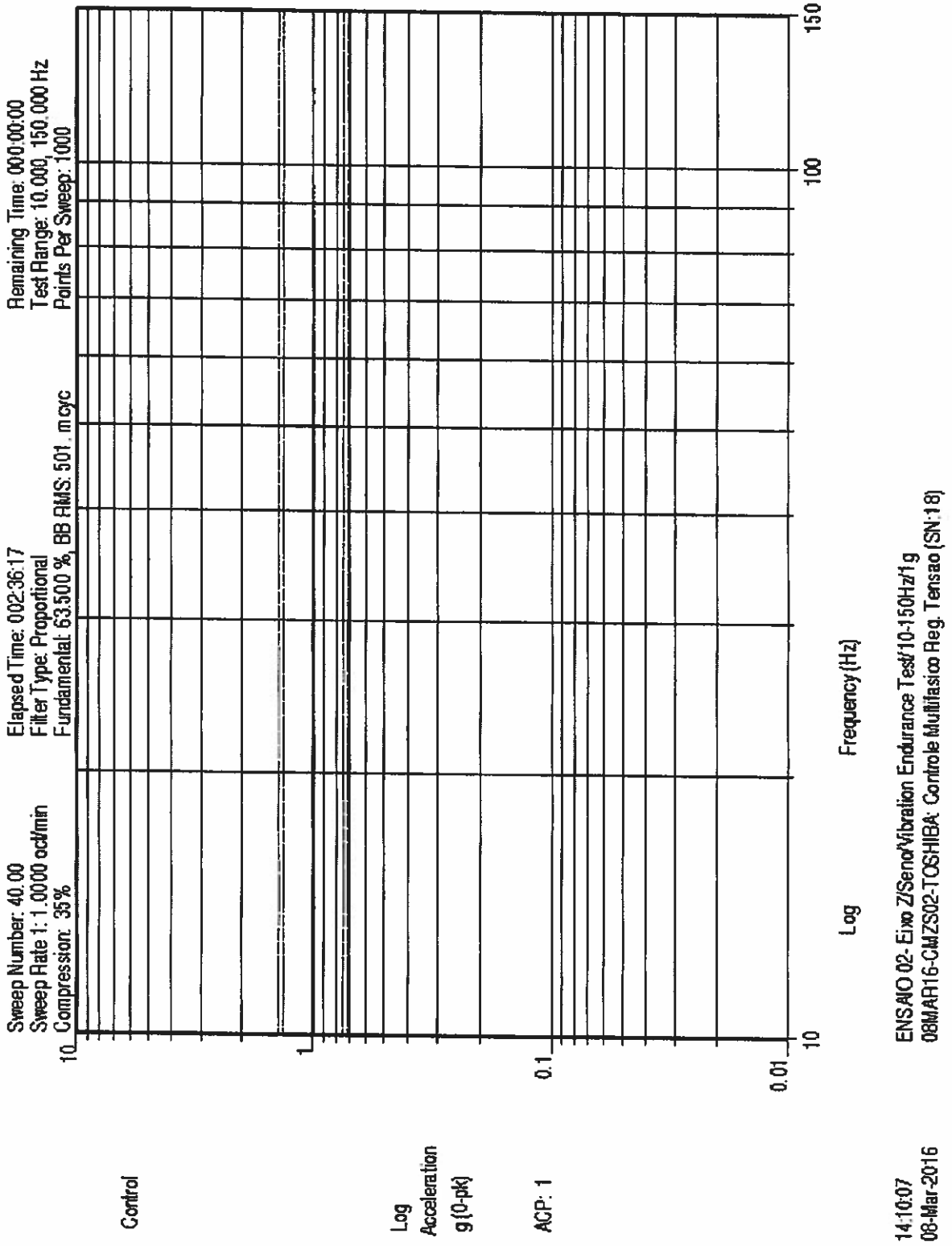

Fig. B2.4.

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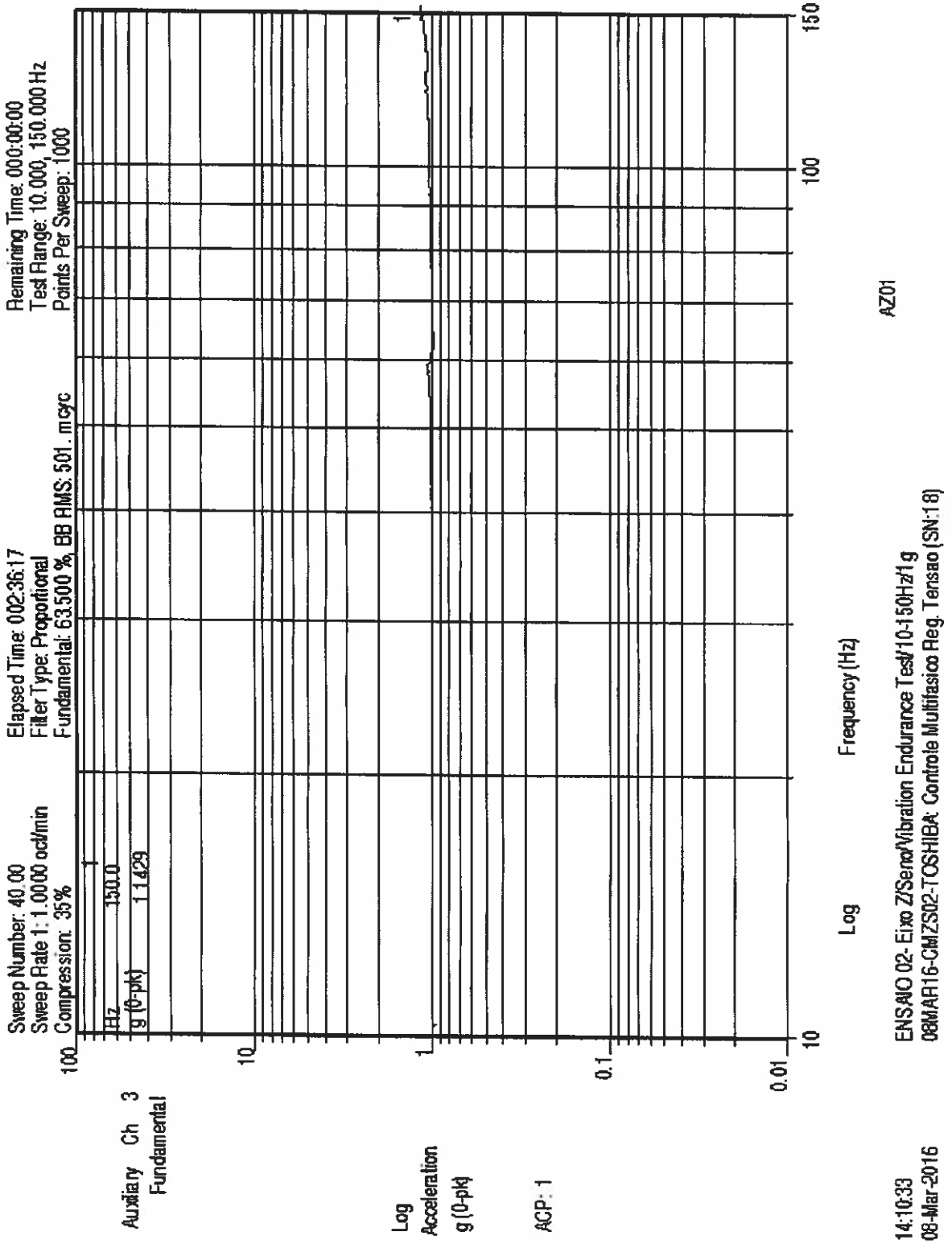

Fig. B2.5.

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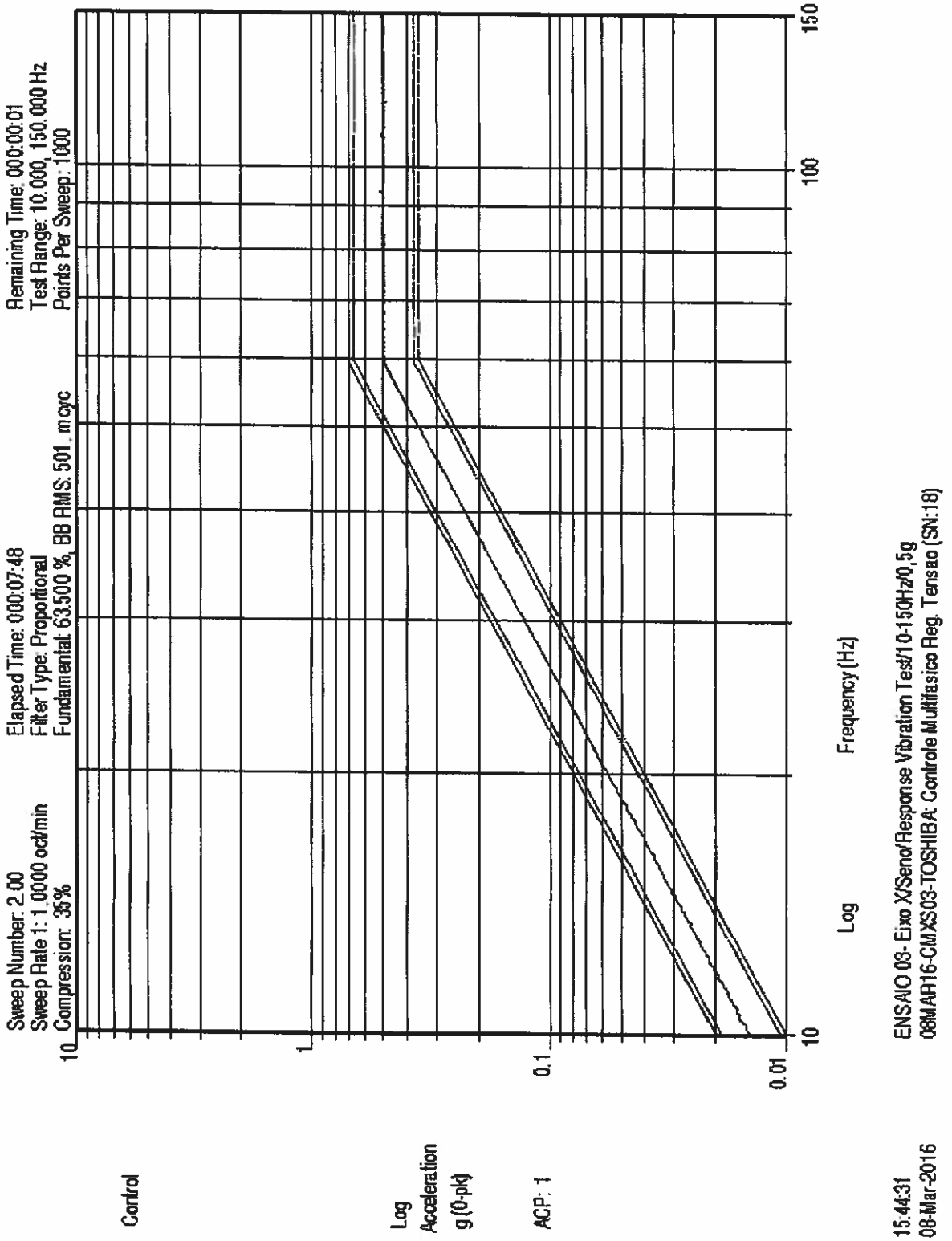

Fig. B2.6.

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Representante Legal
DIRETOR TÉCNICO

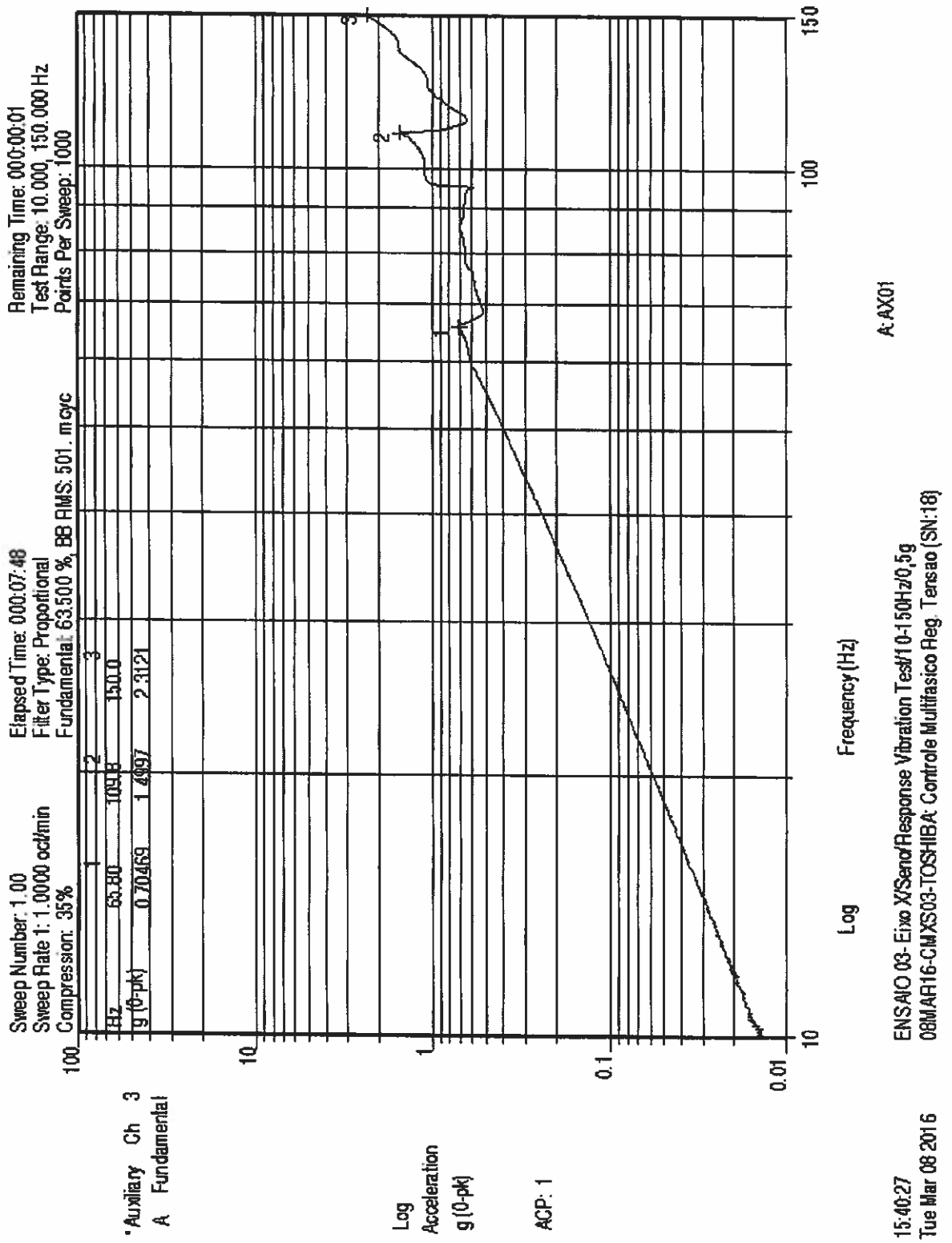

Fig. B2.7.

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