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Masate, September 23<sup>rd</sup>, 2016

## COVER PAGE

Elaborated for: NERI SPA

Address: SS EMILIA 1622  
LONGIANO (FC)  
47020

Test begun on: September 20<sup>th</sup>, 2016

At presence of: Mr. Simone ZOFFOLI NERI SPA

Performed by: Ing. Marco SANNICANDRO

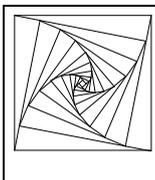
Elaborated by: Ing. Marco SANNICANDRO

Approved by: Ing. Barbara GABELLA

Test performed in: Centrotecnica S.r.l.  
Via F. Confalonieri, 23  
20060  
Masate (MI)

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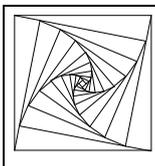
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## 2. HARDWARE DESCRIPTION

### 2.1 ITEMS

The object to be tested in these tests is described in the following:

Street lighting appliance

mod. Light POLARIS

Overall dimensions of unit:

Length: 375 mm

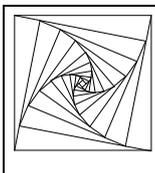
Height: 290 mm

Weight: 9,9 kg

The sampling has been performed at Client responsibility

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## 2.2 FIXTURES

To interface the unit to be tested to the shaker, the following fixtures have been used:

Fixture N.: --

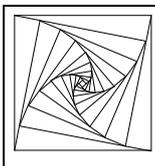
Type: Customer  
Material: Fe  
Dimensions:  
Length: 180 mm  
Width: 180 mm  
Height: 110 mm  
Mass: 2,5 kg  
Mounting: 16 M8 screws

Fixture N.: 49

Type: Plate  
Material: Aluminium  
Dimensions:  
Diameter: 335 mm  
Height: 25 mm  
Mass: 5,6 kg  
Mounting: 17 M8 screws

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### 3. TEST METHOD

According to Customer's Test Plan, the following specifications and test sequence have been applied:

#### 3.1 STANDARD

These tests are aimed to impose to the item the following test levels:

<b>REFERENCE DOCUMENT:</b>	<b>ANSI C136.31-2010</b>
<b>PROFILE:</b>	R.S.) RESONANCE SEARCH  D.) DWELL TEST

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### 3.1.1 TESTS PROFILES

#### R.S.) RESONANCE SEARCH

##### Profile Parameters

##### Profile 1

Profile Maximum Acceleration (Peak): 0.5000 gn  
 Profile Maximum Velocity (Peak): 0.2138 m/s  
 Profile Maximum Displacement (Peak-Peak): 18.6455 mm

##### Profile Table:

Frequency	Acceleration	Velocity	Displacement	Segment	High Abort	High Alarm	Low Alarm	Low Abort
Hz	(gn) Peak	(m/s) Peak	(mm) Peak-Peak	Type	dB	dB	dB	dB
2.0	0.150122	0.117153	18.6455	Const. Ampl.	3.00	1.50	-1.50	-3.00
3.7	0.5	0.213805	18.6455		3.00	1.50	-1.50	-3.00
30.0	0.5	0.0260129	0.276006		3.00	1.50	-1.50	-3.00

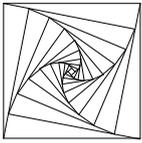
##### Schedule Parameters

##### Schedule 1

Bwd Swp From 30.00Hz Btwn 2.00Hz And 30.00Hz for 1.00Sweeps at 1.00 Oct/Min  
 Auto-Save Signals  
 Save All Panes  
 Quick Report

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VIBRATION TESTS REPORT****Elaborated for: NERI SPA**

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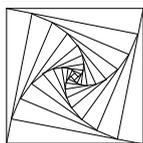
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**Control Parameters****Test Parameters**

Max. Test Frequency:	75.00 Hz
Sweep Type:	Logarithmic
Sweep Rate:	1.000000 Oct/Min
Measurement Strategy:	Single Channel
Filter Type:	Proportional
Band Width:	25%
Drive Limit:	2.00 Volts
Abort Latency:	0.30 seconds
Compression Speed Type:	Adaptive
Compression Speed:	Fast
Initial Ramp-up Parameters	
Initial Peak Drive:	0.009000 Volts
Ramp-Up Rate:	Fast
Maximum Drive during Ramp-up:	0.800000 Volts
Preferences Parameters	
Abort Rate	20 (dB/Second)
Level Log Change Rate	20 (dB/Second)
Time Resolution	21 ms

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## LIGHT POLARIS VIBRATION TESTS REPORT

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### D.) DWELL TEST

#### Profile Parameters

#### Profile 1

Profile Maximum Acceleration (Peak): 3.0000 gn  
Profile Maximum Velocity (Peak): 0.3122 m/s  
Profile Maximum Displacement (Peak-Peak): 6.6241 mm

#### Profile Table:

Frequency	Acceleration	Velocity	Displacement	Segment	High Abort	High Alarm	Low Alarm	Low Abort
Hz	(gn) Peak	(m/s) Peak	(mm) Peak-Peak	Type	dB	dB	dB	dB
15.0	3	0.312155	6.62414	Const. Ampl.	3.00	1.50	-1.50	-3.00
30.0	3	0.156078	1.65604		3.00	1.50	-1.50	-3.00

#### Schedule Parameters

#### Schedule 1 – Dwell test at 26.8411 Hz on X axis

Dwell At 26.84 Hz for 100000 Cycles

Auto-Save Signals

Save All Panes

Quick Report

#### Schedule 2 - Dwell test at 30 Hz on Y and Z axes

Dwell At 30 Hz for 100000 Cycles

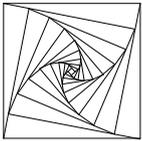
Auto-Save Signals

Save All Panes

Quick Report

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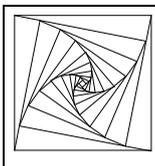
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**Control Parameters****Test Parameters**

Max. Test Frequency:	75.00 Hz
Sweep Type:	Logarithmic
Sweep Rate:	1.000000 Oct/Min
Measurement Strategy:	Single Channel
Filter Type:	Proportional
Band Width:	25%
Drive Limit:	1.40 Volts
Abort Latency:	0.30 seconds
Compression Speed Type:	Adaptive
Compression Speed:	Fast
Initial Ramp-up Parameters	
Initial Peak Drive:	0.001000 Volts
Ramp-Up Rate:	Fast
Maximum Drive during Ramp-up:	0.700000 Volts
Preferences Parameters	
Abort Rate	20 (dB/Second)
Level Log Change Rate	20 (dB/Second)

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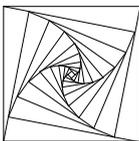
### 3.2 TEST SEQUENCE

Test Profile	Unit Axis*	Notes
R.S.) RESONANCE SEARCH	X	
D.) DWELL TEST	X	AT 26.8411 HZ
R.S.) RESONANCE SEARCH	Y	
D.) DWELL TEST	Y	AT 30 HZ
R.S.) RESONANCE SEARCH	Z	
D.) DWELL TEST	Z	AT 30 HZ

\* See following paragraph 4.3 for the reference test axes.

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## 4. TEST DESCRIPTION

### 4.1 HARDWARE PREPARATION

The item has been mounted on Customer fixture.

For tests on horizontal axes (X / Y) Customer fixture with item has been mounted directly on 824LS shaker slip table.

For tests on vertical axis (Z) Customer fixture with item has been mounted directly on 824LS shaker armature

Environmental Condition measured at the beginning of Test:

Temperature: 23.5°C +/- 1°C

Relative Humidity : 44%+/- 5%

### 4.2 ACCELEROMETERS MOUNTING

The accelerometers property of Centrotecnica have been mounted by way of dedicated biadhesive labels or cyanoacrylic glue or screw.

Accelerometers mounting procedure is in agreement with UNI ISO 5348 "Montaggio meccanico degli accelerometri".

### 4.3 GENERAL CONTROL AND MEASUREMENT STRATEGIES. CHANNELS AND TEST POINTS (T.P.) DESCRIPTION.

In all the runs on one control accelerometer has been used to keep control of the test level imposed by the shaker.

One accelerometer has been used to acquire the response of the item during the tests.

Pictures at para 4.4 and following table make clear the disposition of the Tests Points.

#### Channel Parameters

Input Channel Parameters on X and Y axes					
Input	Type	mv/(EU)	Quantity	I.D.	Location
1	Control	10.7 mv/(m/s <sup>2</sup> )	Acce.	T.P.1-CTRL SLIP TABLE	CPA 96
2	Monitor	0.988 mv/(m/s <sup>2</sup> )	Acce.	T.P.2-MEAS ITEM	CPA 99

Input Channel Parameters on Z axis					
Input	Type	mv/(EU)	Quantity	I.D.	Location
1	Control	10.7 mv/(m/s <sup>2</sup> )	Acce.	T.P.3-CTRL EXPANDER	CPA 96
2	Monitor	0.988 mv/(m/s <sup>2</sup> )	Acce.	T.P.2-MEAS ITEM	CPA 99

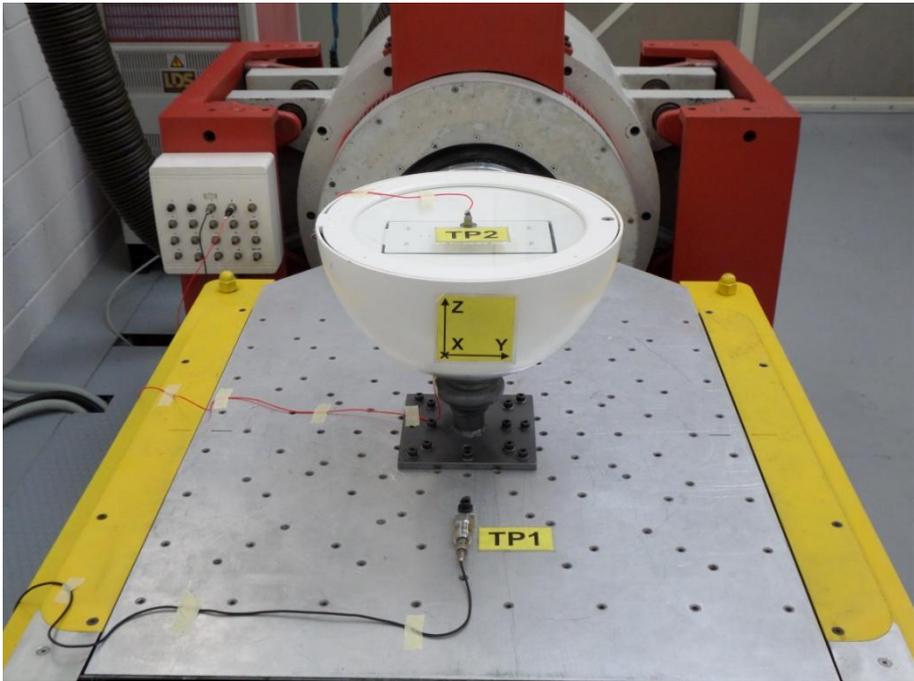
\* See following paragraph 5 for link between run numbers and performed tests.

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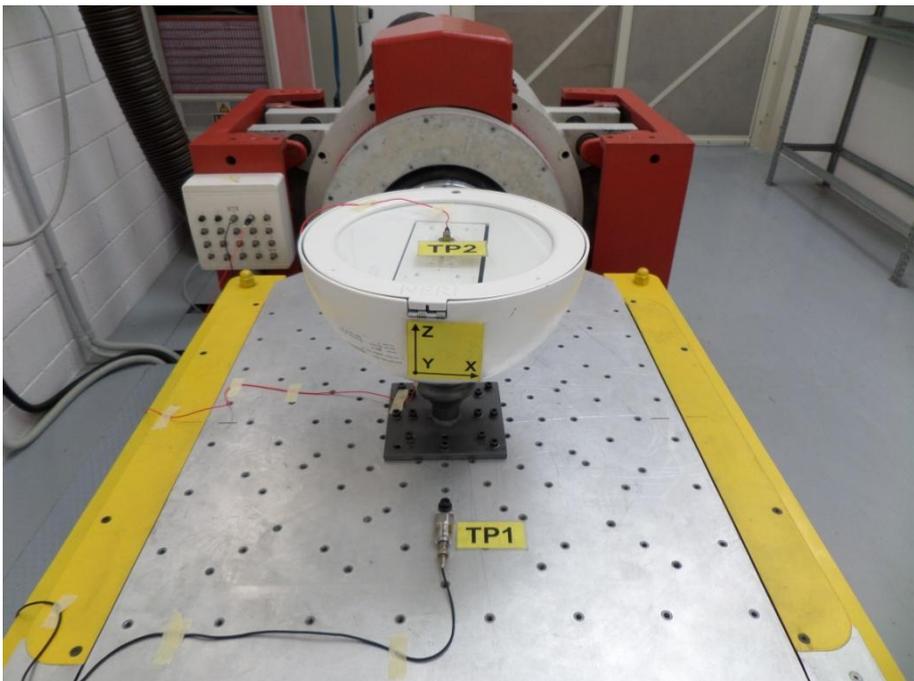
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4.4 PICTURES

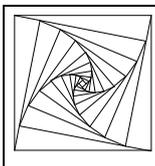
HARDWARE SETUP FOR TESTS ON X AXIS



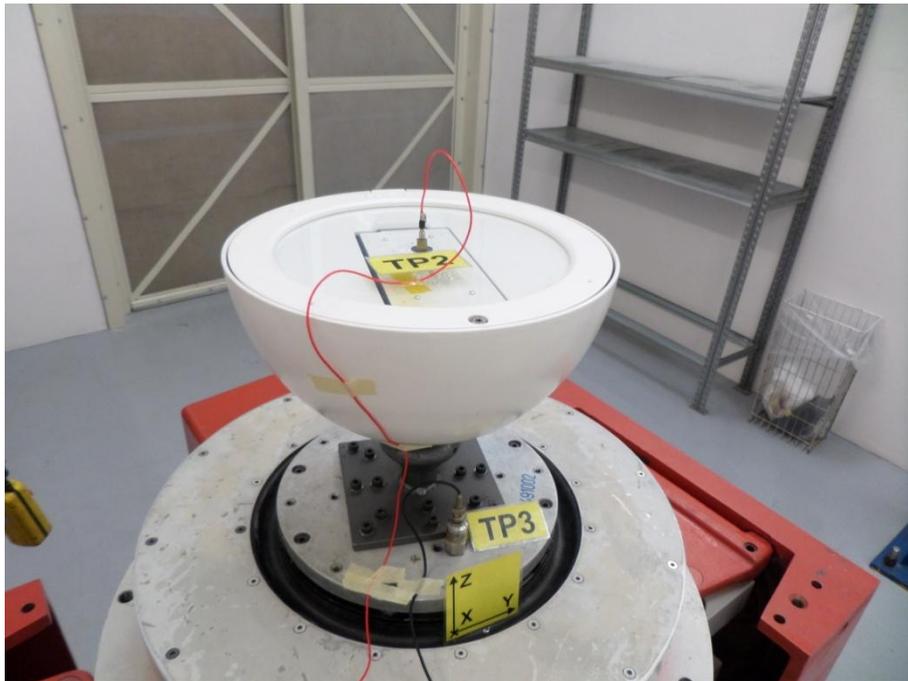
4.4.1 HARDWARE SETUP FOR TESTS ON Y AXIS



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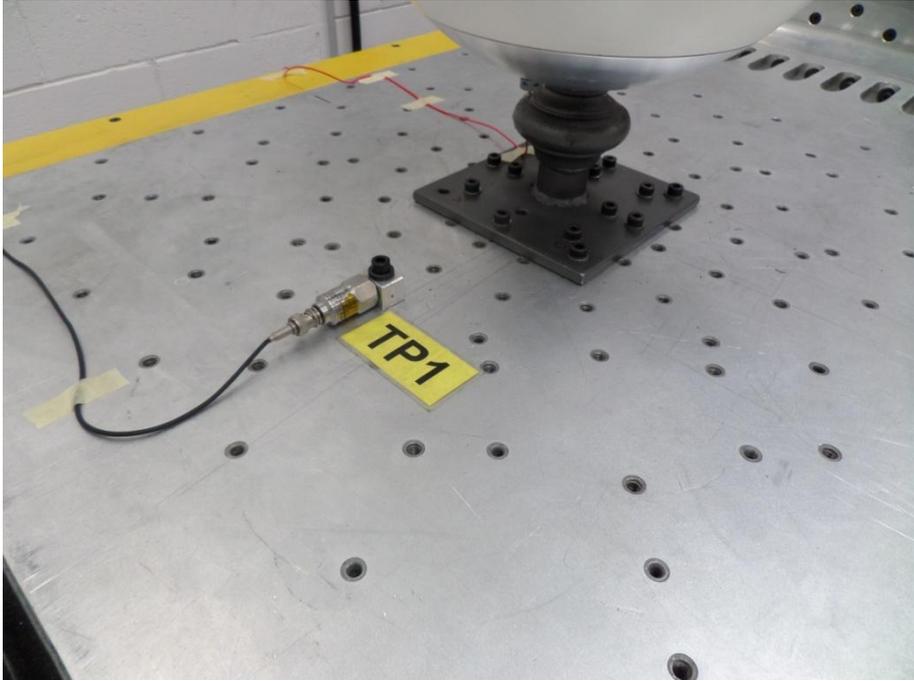
#### 4.4.2 HARDWARE SETUP FOR TESTS ON Z AXIS



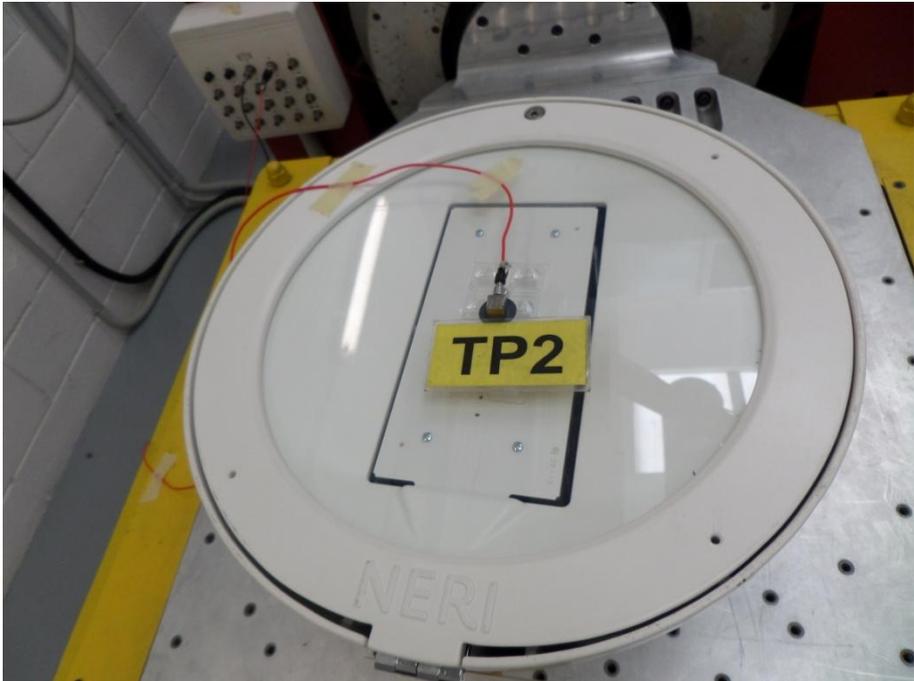
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4.4.3 TEST POINTS DETAILS



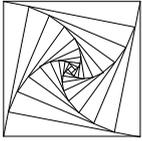
T.P.1



T.P.2

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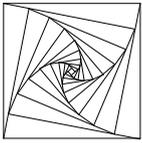
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T.P.3

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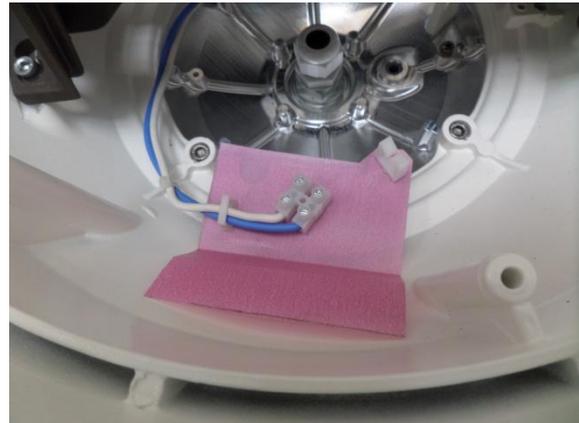
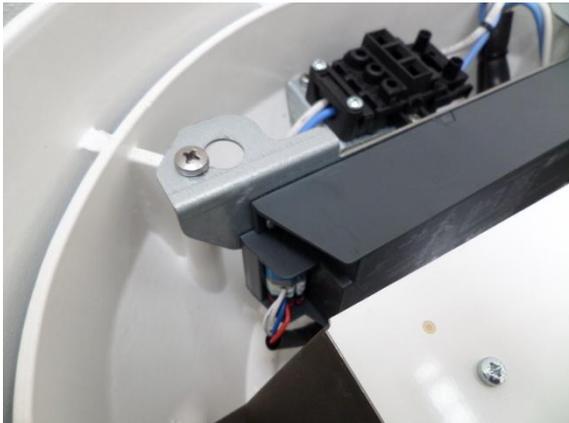
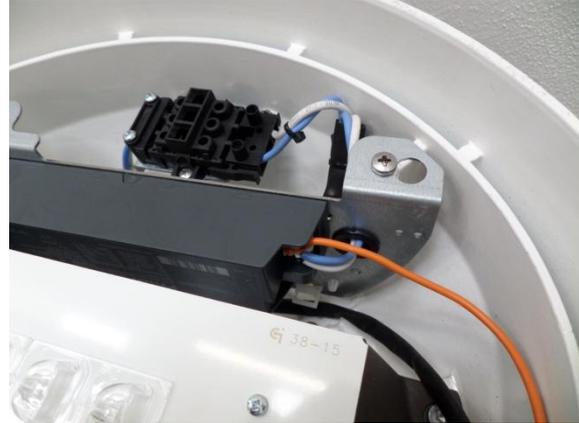
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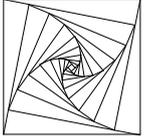
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#### 4.4.4 FINAL CHECK



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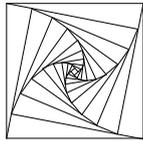
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## 5. TEST HISTORY

DATE	HOUR	RUN	TEST PROFILE	NOTE
Sep 20 <sup>th</sup> '16	9.00			Customer arrival with own fixture and EUT
	--			Customer fixture mounting on shaker slip table
	--			Item mounting on Customer fixture
	--			Accelerometers gluing and setting in T.P.1 and T.P.2
	--			Controller programming
	9.45	1	R.S.	Start of resonance search on X axis
	--			Graph analysis: resonance frequency at 18.0906 Hz
	--			Accelerometer removing from T.P.2.
	--			Controller programming
	9.52	2	D.	Start of dwell test at <b>26.8411 Hz</b> on X axis Duration: 01:02:05
	--			Accelerometer removing
	--			Customer fixture with item rotation
	--			Accelerometers gluing and setting in T.P.1 and T.P.2
	--			Controller programming
	11.38	3	R.S.	Start of resonance search on Y axis
	--			Graph analysis: no resonance frequency
	--			Accelerometer removing from T.P.2.
	--			Controller programming
	11.44	4	D.	Start of dwell test at <b>30 Hz</b> on Y axis Duration: 00:55:33
	--			Visual check: positive
	--			Accelerometer removing
	--			Customer fixture with item removing
	13.00			End of day

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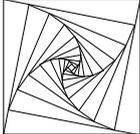
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DATE	HOUR	RUN	TEST PROFILE	NOTE
Sep 21 <sup>st</sup> '16	--			Shaker rotation
	--			Customer fixture mounting on shaker armature
	--			Item mounting on Customer fixture
	--			Accelerometers gluing and setting in T.P.3 and T.P.2
	--			Controller programming
	11.41	5	R.S.	Start of resonance search on X axis
	--			Graph analysis: no resonance frequency
	--			Accelerometer removing from T.P.2.
	--			Controller programming
	11.48	6	D.	Start of dwell test at <b>30 Hz</b> on X axis Duration: 00:55:33
				Lunch time
	--			Visual check: positive
	--			Accelerometer removing
	--			Item removing
	--			Customer fixture removing
	13.00			End of tests

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## 6. CONCLUSION

After having been subjected to environmental tests as described in this document a visual inspection doesn't show any mechanical damage on item

Street lighting appliance  
mod. Light POLARIS

## 7. USED FACILITIES AND CALIBRATION

### Shaker

LDS Mod. V824LS S/N 891411

### Control Instrumentation

Dactron Mod. Laser USB S/N 5540913 R22

LAST CALIBRATION : 05/10/2016  
CAL. DUE DATE : 05/10/2017  
CALIBRATED BY : Belotti Sistemi  
CERTIFICATE N. : 2015-0327

### Torque wrench

BETA Mod. 606/2 S/N 2011/118993  
BETA Mod. 608/2 S/N 2014/239422

### Accelerometers

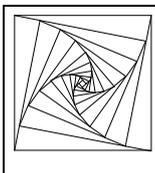
LABEL	MADE BY	MODEL	SERIAL NUM.	CALIB. DATE	CERTIF. NUM.	SENSITIVITY	MASS
CPA099	Bruel & kjaer	4508 001	30290	11/01/2016	30893	0,988 mV/(m/s <sup>2</sup> )	4,8 g
CPA096	Wilcoxon Reseach	786C	59778	13/01/2016	30918	10,7 mV/(m/s <sup>2</sup> )	90 g

### Thermoigrometer

PCE Mod. PCE-THB 40 S/N Q779816

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### Vibration amplitude tolerance

The measurement uncertainties stated in this document have been determined according to the ISO/IEC Guide 98 and to EA-4/02.

They have been estimated as expanded uncertainty obtained multiplying in the standard uncertainty by the coverage factor  $k=2$  corresponding to a confidence level of about 95%.

The calculated uncertainty for acceleration is 10%.

### Cross axis motion

The cross axis motion of the shaker has been measured and comply with test requirement of IEC 60068-2-6:2009-11 par 4.1.2.1, IEC 60068-2-64:2008 par 4.3 and IEC 60068-2-27:2008 hereafter specified:

sine vibration – not exceed 50% up to 500Hz and 100% up to 2000 Hz

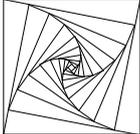
random vibration – not exceed -3db up to 500 Hz and 0 db up to 2000 Hz  
rms value not exceed 50%

shock test - not exceed 30%

In case of large items the above values can be verified during test.

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# ANNEXES

1.1 - X AXIS - RESONANCE SEARCH

1.2 - X AXIS - DWELL TEST (AT 26.8411 HZ)

2.1 - Y AXIS - RESONANCE SEARCH

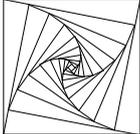
2.2 - Y AXIS - DWELL TEST (AT 30 HZ)

3.1 - Z AXIS - RESONANCE SEARCH

3.2 - Z AXIS - DWELL TEST (AT 30 HZ)

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## ANNEX 1.1

# LIGHT POLARIS

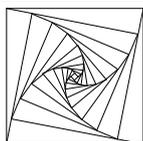
AXIS : X

RESONANCE SEARCH

(2 PLOTS)

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Project File Name: RESONANCE SEARCH.prj

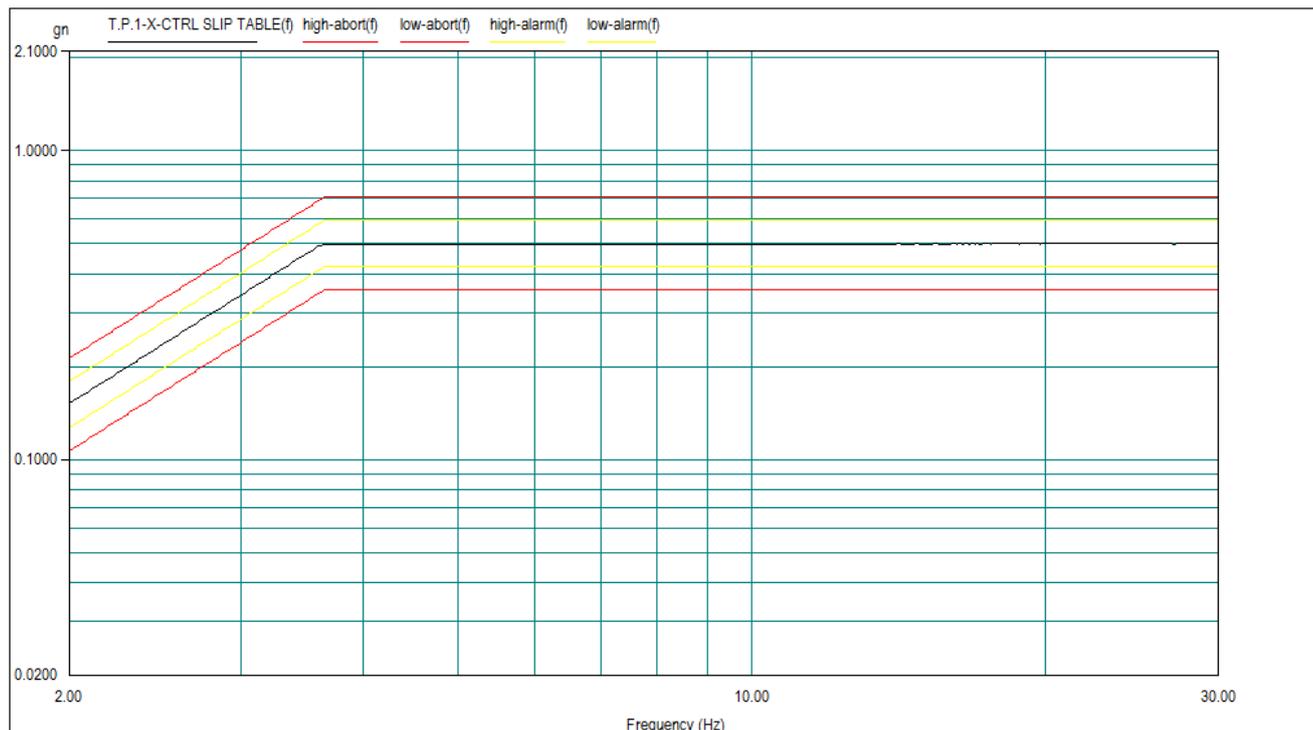
Profile Name: RUN 01 RESONANCE SEARCH ON X AXIS

Test Type:

Swept Sine

Run

Folder: .\RUN 01 RES SEA X Sep 20, 2016 09-45-44



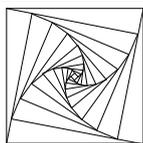
Level: 0 dB Full Level Time: 00:03:54 Sweep Type: Logarithmic  
Frequency: 2.002650 Hz Time Remaining: 00:00:00 Sweep Rate: 1 Oct/Min

Data saved at 09:49:43 AM, Tuesday, September 20, 2016

Report created at 09:49:46 AM, Tuesday, September 20, 2016

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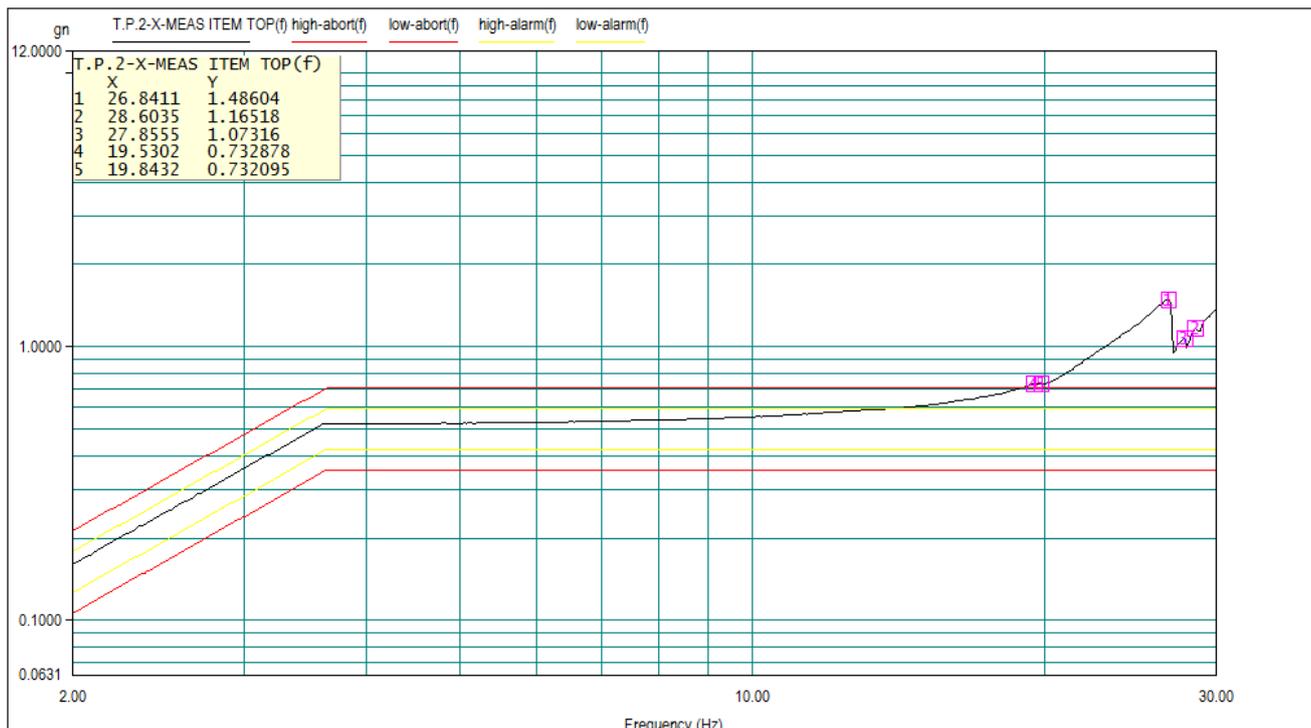
Project File Name: RESONANCE SEARCH.prj

Profile Name: RUN 01 RESONANCE SEARCH ON X AXIS

Test Type: Swept Sine

Run

Folder: .\RUN 01 RES SEA X Sep 20, 2016 09-45-44



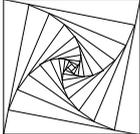
Level: 0 dB      Full Level Time: 00:03:54      Sweep Type: Logarithmic  
 Frequency: 2.002650 Hz      Time Remaining: 00:00:00      Sweep Rate: 1 Oct/Min

Data saved at 09:49:43 AM, Tuesday, September 20, 2016

Report created at 09:49:47 AM, Tuesday, September 20, 2016

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## ANNEX 1.2

# LIGHT POLARIS

AXIS : X

DWELL TEST (AT 26.8411 HZ)

(1 PLOTS)

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DUT: LIGHT POLARIS

Project File Name: DWELL TEST.prj

Profile Name: RUN 02 DWELL TEST AT 26.8411 HZ ON X AXIS - ITEM LIGHT POLARIS

Test Type:

Swept Sine

Run Folder: .\RUN 02 DWELL X Sep 20, 2016 09-52-58



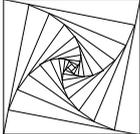
Level: 0 dB	Full Level Time: 01:02:06	Sweep Type: Logarithmic	
Frequency: 26.841101 Hz	Time Remaining: 00:00:00	Sweep Rate: 1 Oct/Min	

Data saved at 10:55:09 AM, Tuesday, September 20, 2016

Report created at 10:55:11 AM, Tuesday, September 20, 2016

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## ANNEX 2.1

# LIGHT POLARIS

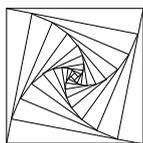
AXIS : Y

RESONANCE SEARCH

(2 PLOTS)

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DUT: LIGHT POLARIS

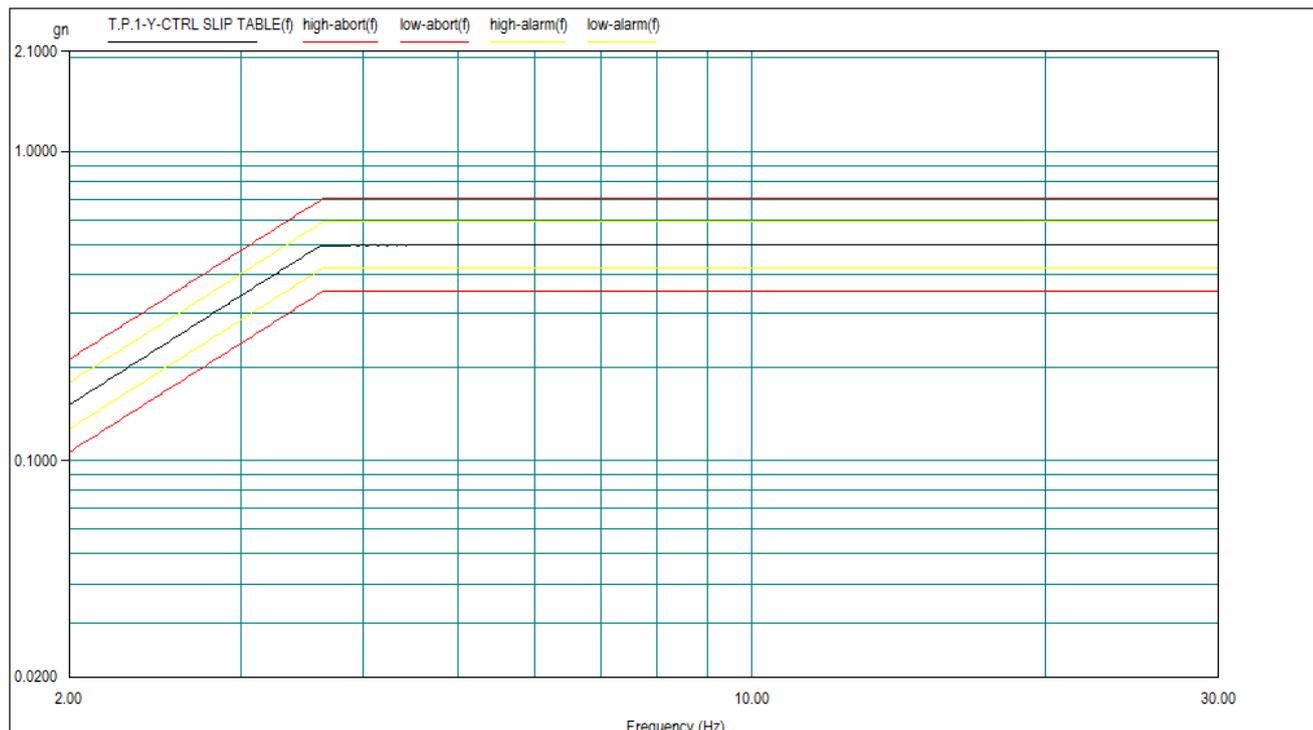
Project File Name: RESONANCE SEARCH.prj

Profile Name: RUN 03 RESONANCE SEARCH ON Y AXIS

Test Type: Swept Sine

Run

Folder: .\RUN 03 RES SEA Y Sep 20, 2016 11-38-12



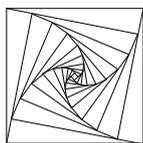
Level: 0 dB Full Level Time: 00:03:54 Sweep Type: Logarithmic  
Frequency: 2.002156 Hz Time Remaining: 00:00:00 Sweep Rate: 1 Oct/Min

Data saved at 11:42:11 AM, Tuesday, September 20, 2016

Report created at 11:42:12 AM, Tuesday, September 20, 2016

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DUT: LIGHT POLARIS

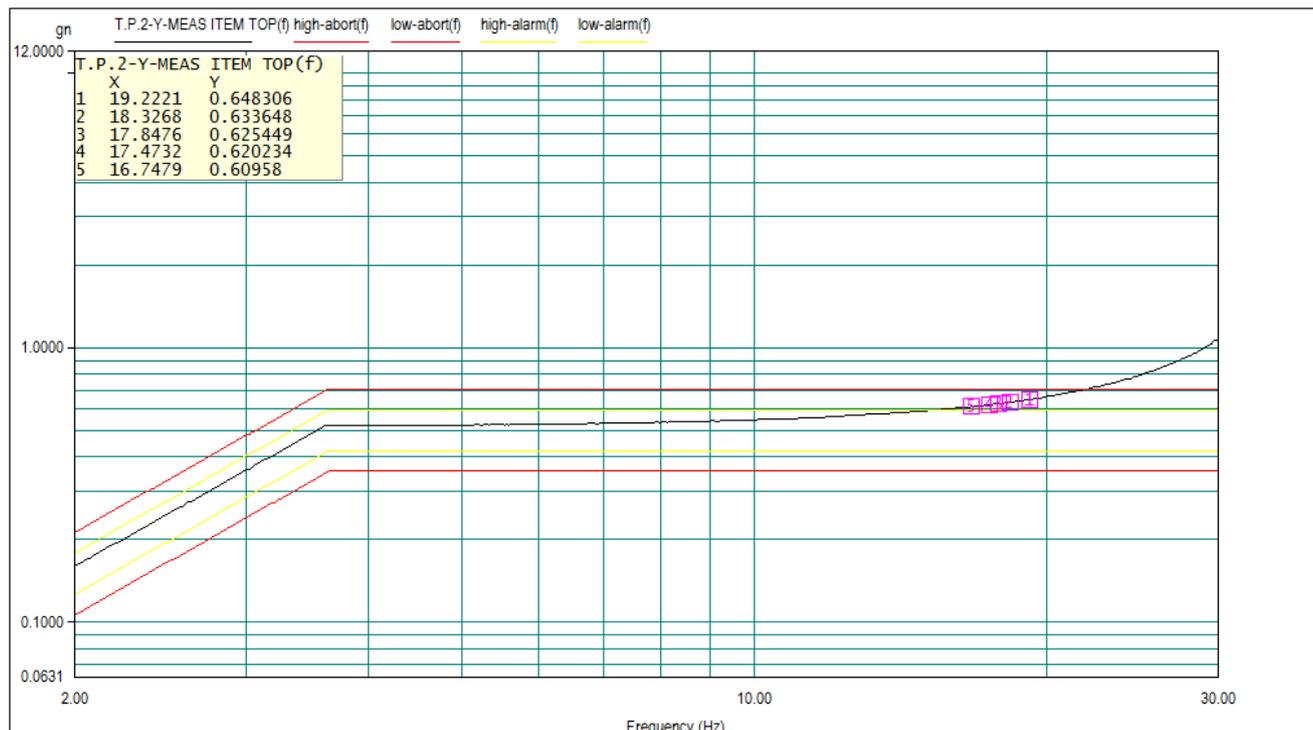
Project File Name: RESONANCE SEARCH.prj

Profile Name: RUN 03 RESONANCE SEARCH ON Y AXIS

Test Type: Swept Sine

Run

Folder: .\RUN 03 RES SEA Y Sep 20, 2016 11-38-12



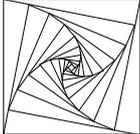
Level: 0 dB      Full Level Time: 00:03:54      Sweep Type: Logarithmic  
 Frequency: 2.002156 Hz      Time Remaining: 00:00:00      Sweep Rate: 1 Oct/Min

Data saved at 11:42:11 AM, Tuesday, September 20, 2016

Report created at 11:42:13 AM, Tuesday, September 20, 2016

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## ANNEX 2.2

# LIGHT POLARIS

AXIS : Y

DWELL TEST (AT 30 HZ)

(1 PLOTS)

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DUT: LIGHT POLARIS

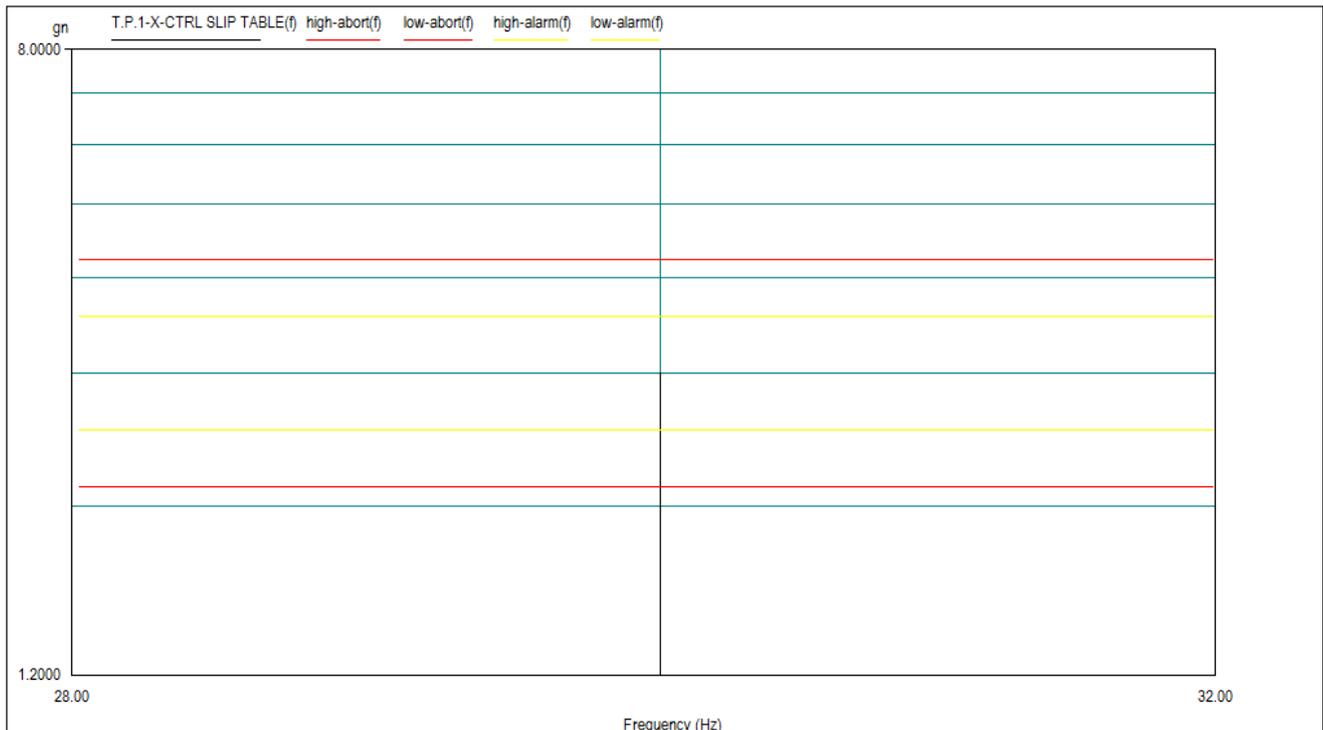
Project File Name: DWELL TEST.prj

Profile Name: RUN 04 DWELL TEST AT 30 HZ ON Y AXIS - ITEM LIGHT POLARIS

Test Type:

Swept Sine

Run Folder: .\RUN 04 DWELL Y Sep 20, 2016 11-44-25



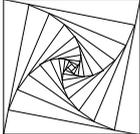
Level:	0 dB	Full Level Time:	00:55:34	Sweep Type:	Logarithmic
Frequency:	30.000000 Hz	Time Remaining:	00:00:00	Sweep Rate:	1 Oct/Min

Data saved at 12:40:05 PM, Tuesday, September 20, 2016

Report created at 12:40:08 PM, Tuesday, September 20, 2016

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	Document: VR1637701DILS-A.docx	Issue: 0

## ANNEX 3.1

# LIGHT POLARIS

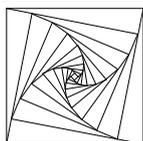
AXIS : Z

RESONANCE SEARCH

(2 PLOTS)

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DUT: LIGHT POLARIS

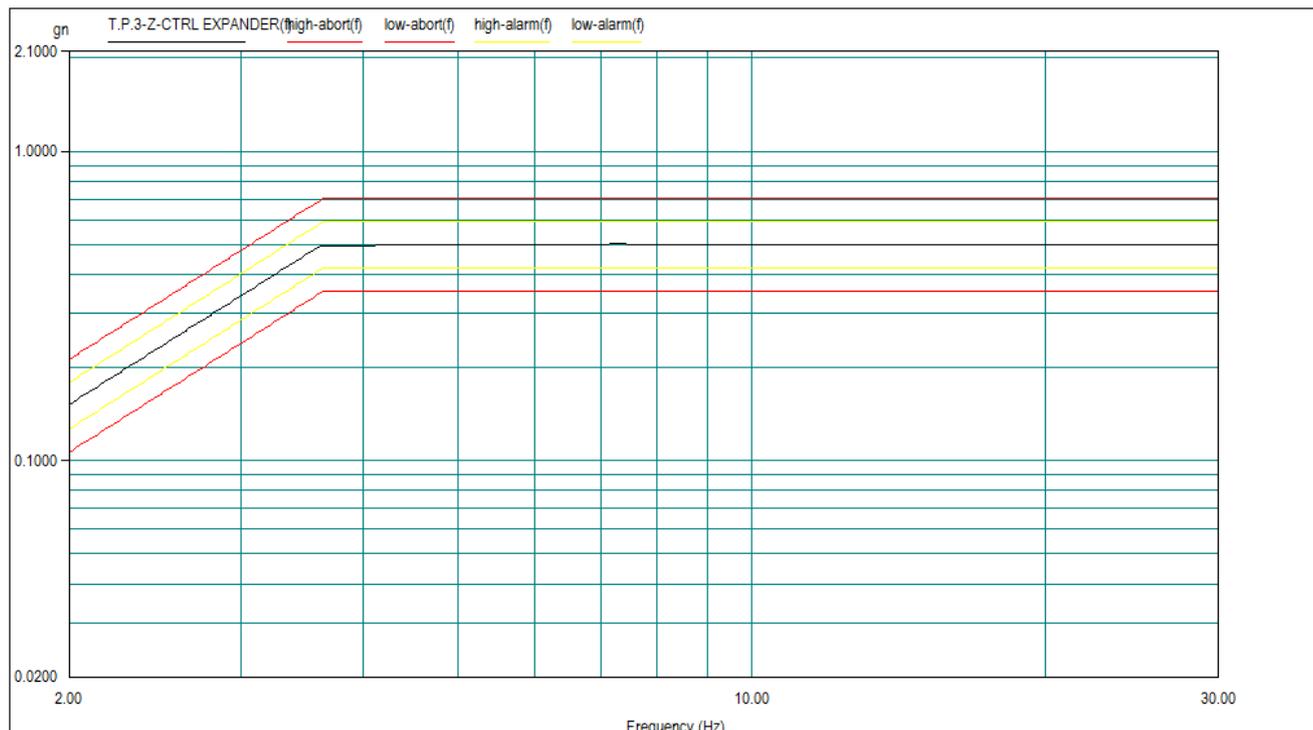
Project File Name: RESONANCE SEARCH.prj

Profile Name: RUN 05 RESONANCE SEARCH ON Z AXIS

Test Type: Swept Sine

Run

Folder: .\RUN 05 RES SEA Z Sep 21, 2016 11-41-25



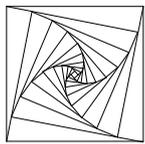
Level: 0 dB      Full Level Time: 00:03:54      Sweep Type: Logarithmic  
Frequency: 2.003391 Hz      Time Remaining: 00:00:00      Sweep Rate: 1 Oct/Min

Data saved at 11:45:23 AM, Wednesday, September 21, 2016

Report created at 11:45:28 AM, Wednesday, September 21, 2016

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DUT: LIGHT POLARIS

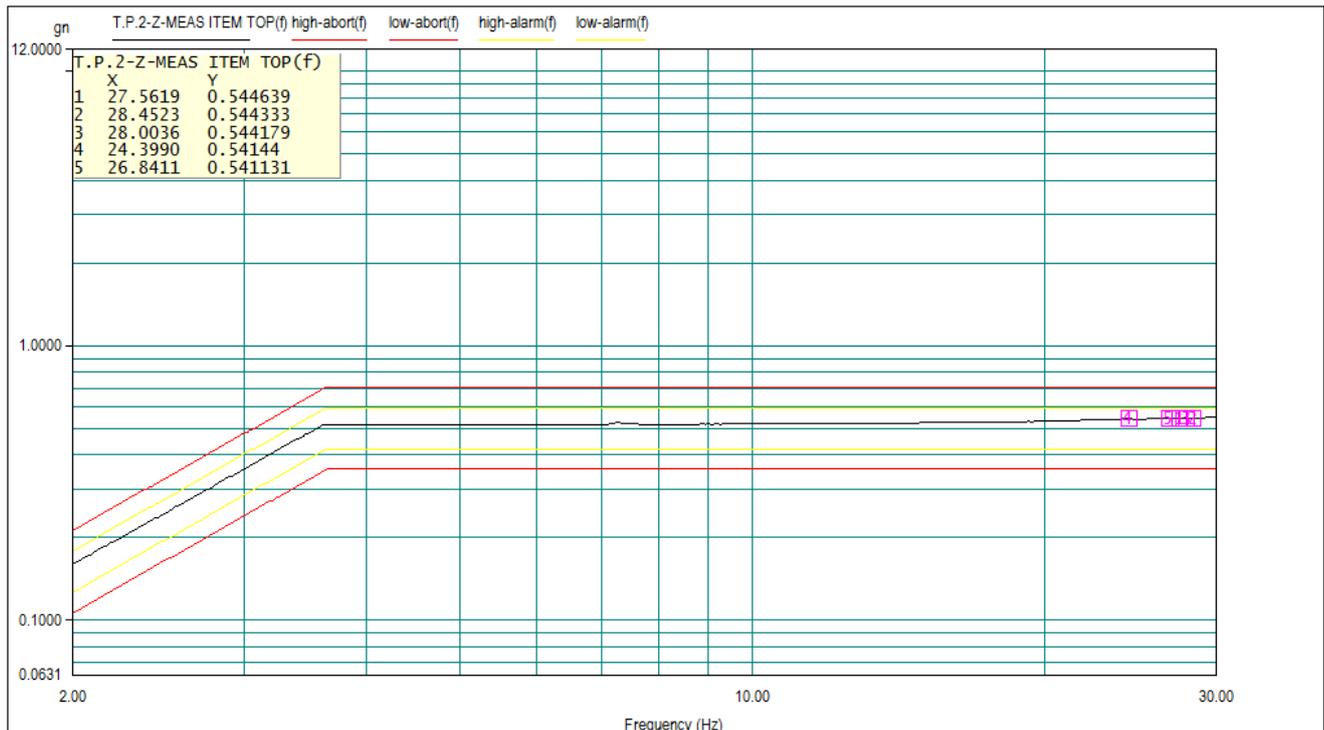
Project File Name: RESONANCE SEARCH.prj

Profile Name: RUN 05 RESONANCE SEARCH ON Z AXIS

Test Type: Swept Sine

Run

Folder: .\RUN 05 RES SEA Z Sep 21, 2016 11-41-25



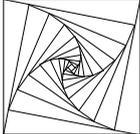
Level: 0 dB Full Level Time: 00:03:54 Sweep Type: Logarithmic  
Frequency: 2.003391 Hz Time Remaining: 00:00:00 Sweep Rate: 1 Oct/Min

Data saved at 11:45:23 AM, Wednesday, September 21, 2016  
September 21, 2016

Report created at 11:45:29 AM, Wednesday,  
September 21, 2016

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## ANNEX 3.2

# LIGHT POLARIS

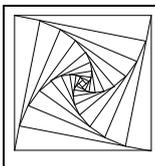
AXIS : Z

DWELL TEST (AT 30 HZ)

(1 PLOTS)

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DUT: LIGHT POLARIS

Project File Name: DWELL TEST.prj

Profile Name: RUN 06 DWELL TEST AT 30 HZ ON Z AXIS - ITEM LIGHT POLARIS Test Type:  
Swept Sine Run Folder: .\RUN 06 DWELL Z Sep 21, 2016 11-48-19



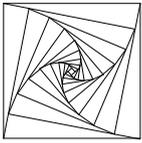
Level: 0 dB Full Level Time: 00:55:34 Sweep Type: Logarithmic  
Frequency: 30.000000 Hz Time Remaining: 00:00:00 Sweep Rate: 1 Oct/Min

Data saved at 12:43:58 PM, Wednesday, September 21, 2016  
September 21, 2016

Report created at 12:44:03 PM, Wednesday,  
September 21, 2016

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**LIGHT POLARIS**  
**VIBRATION TESTS REPORT**  
**Elaborated for: NERI SPA**

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