


Prüfbericht-Nr.: <i>Test Report No.:</i>	11032570 001	Auftrags-Nr.: <i>Order No.:</i>	114007119	Seite 1 von 50 <i>Page 1 of 50</i>	
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	8859900709/8859900716	Auftragsdatum: <i>Order date.:</i>	March 4, 2013		
Auftraggeber: <i>Client:</i>	AAEON Technology Inc.. 5F., No. 135, Lane 235, Pao Chiao Rd., Hsin-Tien Dist., New Taipei City 231, Taiwan, R.O.C.				
Prüfgegenstand: <i>Test item:</i>	Railway Embedded Computer				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	AEV-6356				
Auftrags-Inhalt: <i>Order content:</i>	TUV Rheinland - CoC approval				
Prüfgrundlage: <i>Test specification:</i>	EN 50155:2007 (for Visual inspection, Performance test (only: Voltage variation test , excluded the Voltage interruption test.), Cooling test, Dry heat test, Damp heat test, cyclic, Insulation test , Supply overvoltage test, and Low temperature storage test (Ambient temperature Class: TX)). EN 61373:2010 Class B (for Vibration and Shock test)				
Wareneingangsdatum: <i>Date of receipt:</i>	March 08, 2013				
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000023274				
Prüfzeitraum: <i>Testing period:</i>	03.12.2013~04.02.2013				
Ort der Prüfung: <i>Place of testing:</i>	No. 8, Lane 29, WenMing Rd, Leshan Tsuen Guishan Shiang, Taoyuan County 33383, Taiwan (R.O.C.)				
Prüflaboratorium: <i>Testing laboratory:</i>	Electronics Test Center, Taiwan				
Prüfergebnis*: <i>Test result*:</i>	Pass				
geprüft von / tested by:	kontrolliert von / reviewed by:				
May 28, 2013 YuHu Hsu/Senior Consultant	30 th May, 2013 Rover Jan/Manager				
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>
Sonstiges / Other:					
This test report is linked to EMC test report No.: 11032570 002					
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>			Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
<p>* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet</p> <p>Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specifications(s) F(ail) = failed a.m. test specifications(s) N/A = not applicable N/T = not tested</p>					
<p>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i></p>					

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1. Test Site

1.1. Testing Location

Electronics Test Center, Taiwan

No. 8, Lane 29, WenMing Rd, Leshan Tsuen Guishan Shiang, Taoyuan County 33383, Taiwan (R.O.C.)

1.2. Measurement Uncertainty

Testing Item	Frequency Range	Uncertainty
Conducted Emission	150kHz - 30MHz	2.3 dB
Disturbance Power	30MHz - 300MHz	2.8 dB

Note:

The uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $K=2$.

2. Description of the Test Samples

2.1. General Description of Equipment

The EUT is Railway Embedded Computer with the type designation **AEV-6356** intended to use on railroad. It mainly consists of computer control board, 4 sets of COM ports, 2 sets of LAN ports, 2 sets of hard disk, USB, DVI port, VGA port and compact flash card. All output cables are less than 30m length.

The operating voltage is 24VDC. The testing items included the visual test, performance test (only included voltage variation, not included voltage interruption test) cooling test, dry heat test, damp heat test, insulation test, supply overvoltage test, vibration & shock test & low temperature storage test.

The EUT's Function test is using the built in Burn-in Test software to check all the internal components, such as CPU, Port functions, etc., and during the test period, there has no error in any item.

2.2. Rating and Physical Characteristics

Type Designation:	AEV-6356
Input Voltage:	DC 16.8-30V
Rated Current:	5A
Protection Class:	III

2.3. Sources of Interference

Thermostat

2.4. Noise Suppression Parts

None

2.5. Submitted Documents

- (1) 2 test samples
- (2) Function test (Burn in Test) criteria
- (3) User Manual

3. Measurement Conditions

3.1. Modes of Operation

The subject equipment was investigated in 'Continuous ON or OFF' mode depending on test requirements.

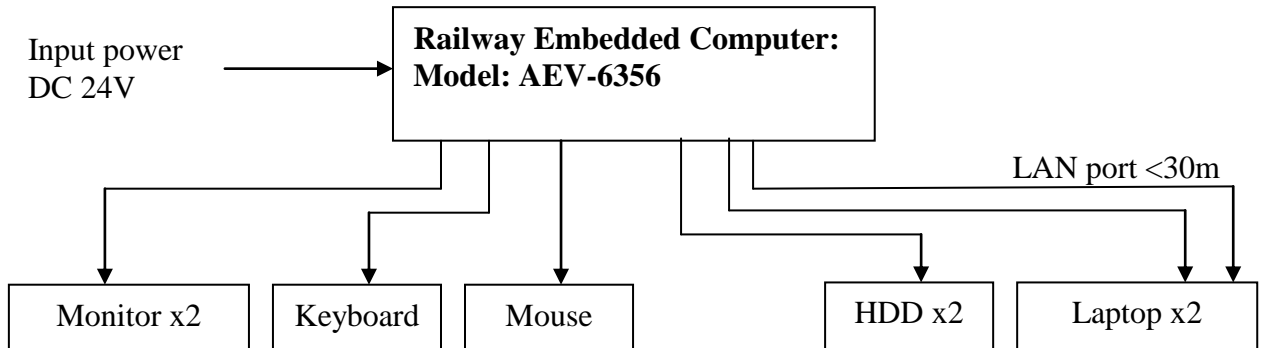
3.2. Additional Equipment

There's no any additional equipment in the EUT.

3.3. Test Setup

The test setup is depending on individual testing requirements which are shown in clauses 5.1 to 5.10 respectively.

The described test setup is according to the Basic Standard.



3.3.1. Connected Cables and Length

- All external cables are less than 30m

3.4. List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Item	Kind of Equipment	Manufacturer / Type No.	Calibration Date	Calibration Due Date
1	T & H Chamber	ESPEC PDL-4K	May 04, 2012	May 03, 2013
2	DC Power Supply	GW SPS-3610	May 25, 2012	May 24, 2013
3	DC Power Supply	GW GPS-3030DD	May 25, 2012	May 24, 2013
4	Vibration Test System	SHINKEN G-5230S	Jun. 29, 2012	Jun. 28, 2013
5	Accelerometer	SHINKEN V11-101S	Apr. 24, 2012	Apr. 23, 2013
6	Hipot Tester	CHROMA 19054	Aug. 23, 2012	Aug. 22, 2013
7	High Resistance Meter	HP 4339B	Dec. 24, 2012	Dec. 23, 2013
8	Harmonics/Flicker Test System	Teseq Proflin 2145	Aug. 10, 2012	Aug. 09, 2014

3.4.1. Calibration of Test and Measurement Instruments

Above listed equipment undergoes a regularly calibration. At the time of testing all the used equipment was within its period of calibration. The calibration documentation and dates are stored in the calibration record folder of the laboratory.

3.5. Abbreviations

PASS	means 'complied with requirement'	N/A	means 'not applicable'
FAIL	means 'not complied'	EUT	means 'Equipment Under Test'

4. Test Results

Summary of the Test Results is shown as below Table 2.

Table 2: Summary of the Test Results

No.	Test items	Standards to complied with	Criteria	Result
1	Visual inspection	EN 50155: 2007 Clause 12.2.1	No damage or deterioration occurred	PASS
2	Performance test*	EN 50155: 2007 Clause 12.2.2	Voltage variation test Test voltage : (1) 0.7Un (minimum voltage) (2) 1.15Un (rated voltage) (3) 1.25Un (maximum voltage) Note : U _n : Nominal voltage = 24V _{dc}	PASS
3	Cooling test*	EN 50155: 2007 Clause 12.2.3 EN 60068-2-1: 2007, test Ad.	Temperature: -40°C Test duration: 16 hours	PASS
4	Dry heat test*	EN 50155: 2007 Clause 12.2.4 EN 60068-2-2: 2007, test Bd.	Temperature: 70°C Test duration: 6 hours Extra over-temperature test Temperature: 85°C Test duration: 10 minutes	PASS
5	Damp heat test cyclic*	EN 50155: 2007 Clause 12.2.5 EN 60068-2-30: 2005, test Db.	Sample condition: Operating Temperature: 25°C ~55°C Humidity: 95%RH Duration: 24 hours/cycle Cycles: 2cycles, total times: 48 hours	PASS
6	Supply overvoltage test	EN 50155: 2007 Clause 12.2.6	Voltage: 1.4 Un Duration: d 0.1 second Duration: D 1.0 second	PASS
7	Insulation test	EN 50155: 2007 Clause 12.2.9	A. Insulation measurement test: Voltage: 500 V _{dc} Duration: 1 minute B. Voltage withstand Test: Power: 710Vdc Cut-off current: 5 mA Duration: 1 minute	PASS

No.	Test items	Standards to complied with	Criteria	Result
8	Vibration test*	EN 61373: 2010 Clause 12.2.11	A. Vibration test Refer to EN 61373 section 8 Table 1 Category 1 Class B Wave form: Random wave In operating condition Duration: 10 minutes B. Simulated long life test Refer to EN 61373 section 9 Table 2 Category 1 Class B Wave form: Random wave In operating condition Duration: 5 hours	PASS
9	Shock test*	EN 61373: 2010 Clause 12.2.11	Refer to EN 61373 section 10 Table 3 Category 1 Class B A. Sample condition: Operating Pulse shape: Half-sine pulse Peak acceleration: 3 g Duration of pulse: 30 ms Direction: ±Vertical and ±Transverse (4 directions) Number of shock: 3 shocks / direction, total 12 shocks B. Sample condition: Operating Pulse shape: Half-sine pulse Peak acceleration: 5 g Duration of pulse: 30 ms Direction: ±Longitudinal (2 directions) Number of shock: 3 shocks / direction, total 6 shocks	PASS
10	Low temperature storage test *	EN 50155: 2007 Clause 12.2.14 EN 60068-2-1: 2007	Temperature: -40°C Test duration: 16 hours	PASS

Note: * All the performance checks are excluded the voltage interruption test.

4.1. Visual Inspection

4.1.1. Visual Inspection Requirements

1. Standard Application: EN50155:2007.
2. Test sample: Number 1 & Number 2 of the test sample (As shown in Figure 1 and Figure 2)
3. The visual inspection shall be carried out to ensure that the equipment is of sound construction and, so far as can be ascertained, meets its specified requirements.
4. A visual inspection shall also be carried out after a type test has been performed to check whether any damage or deterioration has occurred resulting from the tests.

4.1.2. Test Date and Ambient Condition

1. Test date: Mar. 12th, 2013 to Mar. 29th, 2013
2. Ambient condition:
 - Temperature: 22~25°C
 - Humidity: 50~62%RH

4.1.3. Visual Inspection Result

The EUT has checked that there is no damage or deterioration occurred.

The visual inspection is also be carried out after the type test, such as cooling test, dry heat test, vibration test to check whether any damage or deterioration has occurred resulting from the tests.

And the result will determine whether those tests are pass or fail.

Test item	Result	
Dry heat test	No damage	PASS
Dry heat extra over-temperature test	No damage	PASS
Cooling test	No damage	PASS
Vibration and mechanical shock test	No damage	PASS
Damp heat cyclic test	No damage	PASS
Low temperature storage test	No damage	PASS



Figure 1 : Appearance of sample (Front view)



Figure 2 : Appearance of sample (Rear view)

4.2. Performance Test

4.2.1. Performance Test Requirement

1. Standard Application: EN50155:2007
2. Test sample: Number 1 of the test sample (As shown in Figure 1 and Figure 2)
3. Performance test shall include Supply variations not include the voltage interruption test.
Test voltage :
 - (1) $0.7 U_n$ (minimum voltage)
 - (2) $1.15 U_n$ (rated voltage)
 - (3) $1.25 U_n$ (maximum voltage)
Note : U_n : Nominal voltage = $24V_{dc}$
4. Requirement: tests shall be performed to prove correct functioning at minimum voltage ($0.7 U_n$), rated voltage ($1.15 U_n$) and maximum voltage ($1.25 U_n$)

4.2.2. Test Date and Ambient Condition

1. Test date: Mar. 12th, 2013 to Mar. 29th, 2013
2. Ambient condition:
 - Temperature: 22~25°C
 - Humidity: 50~62%RH

4.2.3. Performance Test Setup

The Performance Tests setup are accompany with the dry heat test, cooling test vibration test, damp heat test and low temperature storage test. Check on those sections.

4.2.4. Performance Test and Result

Test item	Result	
Dry heat test	No damage	PASS
Dry heat extra over-temperature test	No damage	PASS
Cooling test	No damage	PASS
Vibration and mechanical shock test	No damage	PASS
Damp heat cyclic test	No damage	PASS
Low temperature storage test	No damage	PASS

4.3. Cooling Test

4.3.1. Cooling Test Requirements

1. Standard application: (1) EN 50155:2007. (2) EN 60068-2-1: 2007, Test Ad.
2. Test sample: Number 1 of the test sample (As shown in Figure 1 and Figure 2)
3. Test criteria

Sample condition: Non-operating mode

Temperature: -40°C (Class TX Column 2)

Duration: 16 hours

4. Checking requirement

- At the end of test period the sample shall be switched on and a performance check shall be carried out, keeping the sample at the low temperature for performance check.
- The sample should perform visual inspection and function test after test
- The sample should perform performance test during and after test

4.3.2. Test Date and Ambient Condition

1. Test date: Mar. 13th, 2013

2. Ambient condition

Temperature: 22°C

Humidity: 56%RH

4.3.3. Cooling Test and Setup

1. Cooling test

Sample condition: Non-operating mode

Temperature: -40°C (Class TX Column 2)

Duration: 16 hours

2. Test setup

The cooling test setup is shown as in Figure 3 cooling test



Figure 3 : Cooling Test

4.3.4. Cooling Test Result

■ **Visual and Performance Checking Result**

Sample	Result		
	Visual inspection	Function test	Performance test
AEV 6356 (HDD) Number 1	No damage	PASS	PASS

■ Function test

The function test is satisfied the requirements of manufacture of EUT defined.

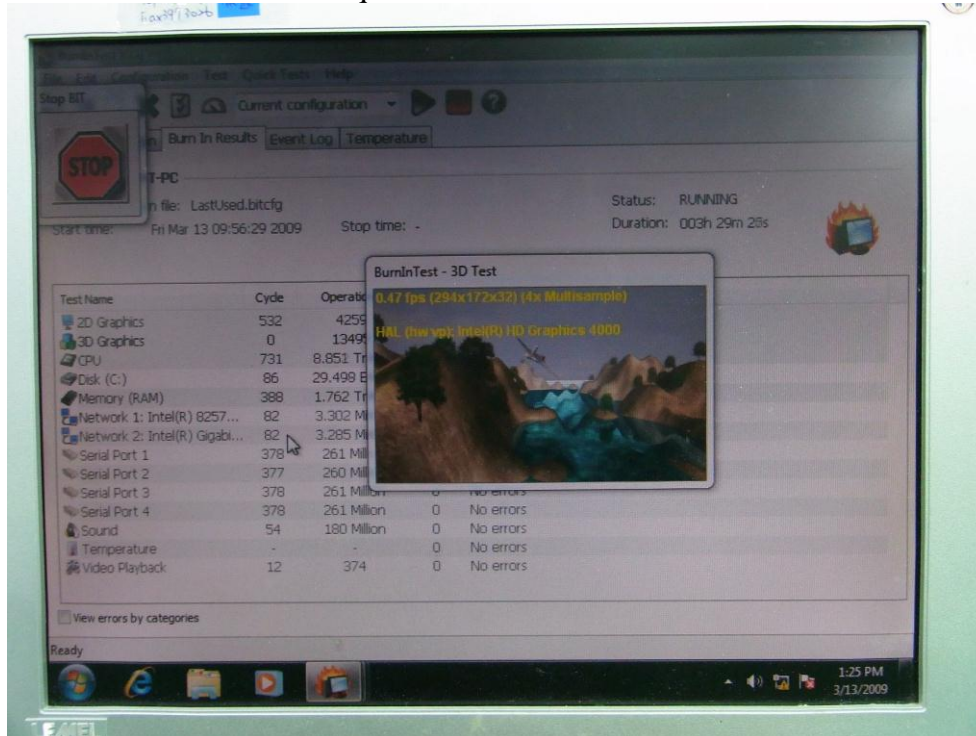


Figure 4 : Function test during Cooling Test

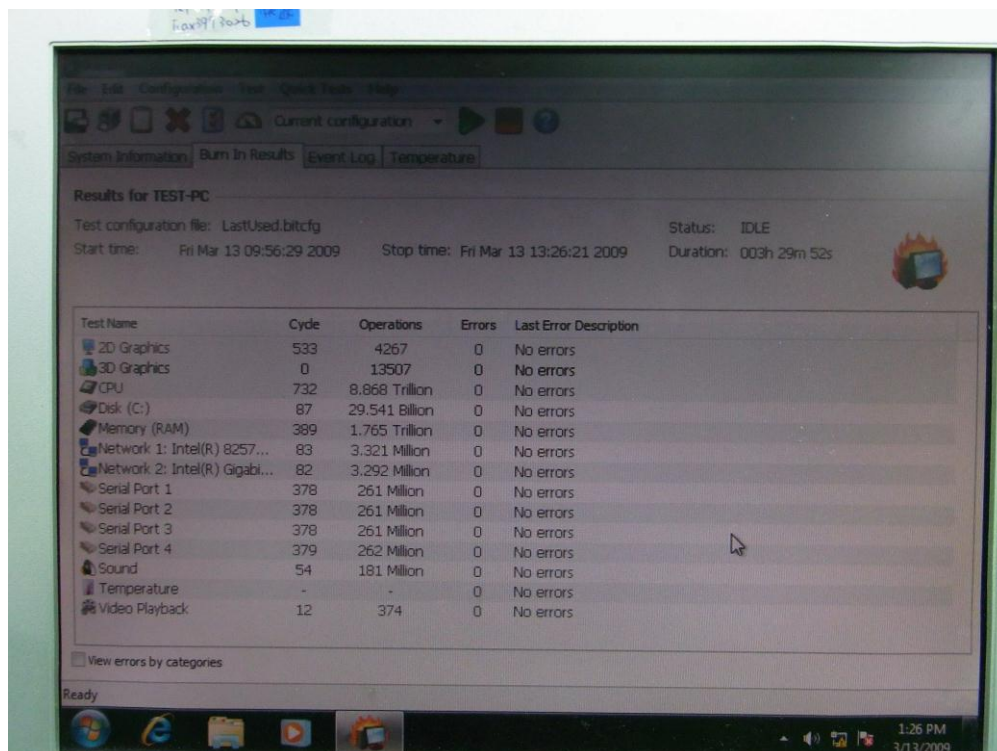


Figure 5 : Function test after Cooling Test

■ **Performance test during cooling test**

Test mode	Voltage variations	Result
Minimum voltage	0.7 U _n	PASS
Rated voltage	1.15 U _n	PASS
Maximum voltage	1.25 U _n	PASS

■ **Performance test after cooling test**

Test mode	Voltage variations	Result
Minimum voltage	0.7 U _n	PASS
Rated voltage	1.15 U _n	PASS
Maximum voltage	1.25 U _n	PASS

4.4. Dry Heat Test

4.4.1. Dry Heat Test Requirements

1. Standard application: (1) EN 50155:2007 (2) EN/IEC 60068-2-2: 2007, Ad.
2. Test sample: Number 1 of the test sample
3. Test criteria
 - A. Dry heat test
 - Sample condition: Operating mode
 - Temperature: 70°C (Class TX Column 2)
 - Duration: 6 hours
 - B. Extra over-temperature test
 - Sample condition: Operating mode
 - Temperature: 85°C (Class TX Column 2)
 - Duration: 10 minutes
4. Checking requirement (include dry heat and extra over-temperature test)
 - The sample should perform visual inspection and function test after test
 - The sample should perform performance test during and after test (dry heat test), and during test check should keep the temperature at the defined high temperature.
 - The sample should perform performance test during test (extra over-temperature test)

4.4.2. Test Date and Ambient Condition

1. A. Dry heat test
 - Test date: Mar. 12th, 2013
 - Temperature: 70°C
- B. Extra over-temperature test
 - Test date: Mar. 12th, 2013
 - Temperature: 85°C
2. Ambient condition
 - Temperature: 22°C
 - Humidity: 52%RH

4.4.3. Dry Heat Test Setup



Figure 6 : Dry heat and extra over-temperature test

4.4.4. Dry Heat Test Result (include dry heat and extra over-temperature test result)

The EUT had been checking the visual, function and performance test during and after the cooling test as below:

A. Dry heat test

■ Visual and Performance Checking Result

Sample	Result		
	Visual inspection	Function test	Performance test
AEV 6356 (HDD) Number 1	No damage	PASS	PASS

■ Function Test

The function test is satisfied the requirements of manufacture of EUT defined.

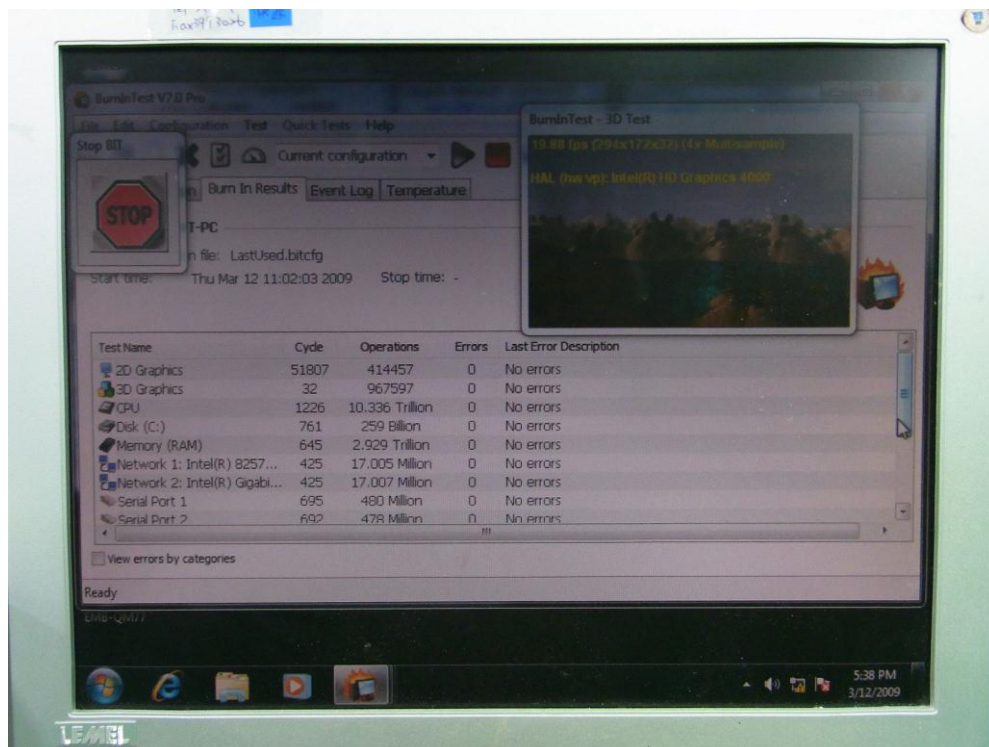


Figure 7 : Function test during Dry Heat Test

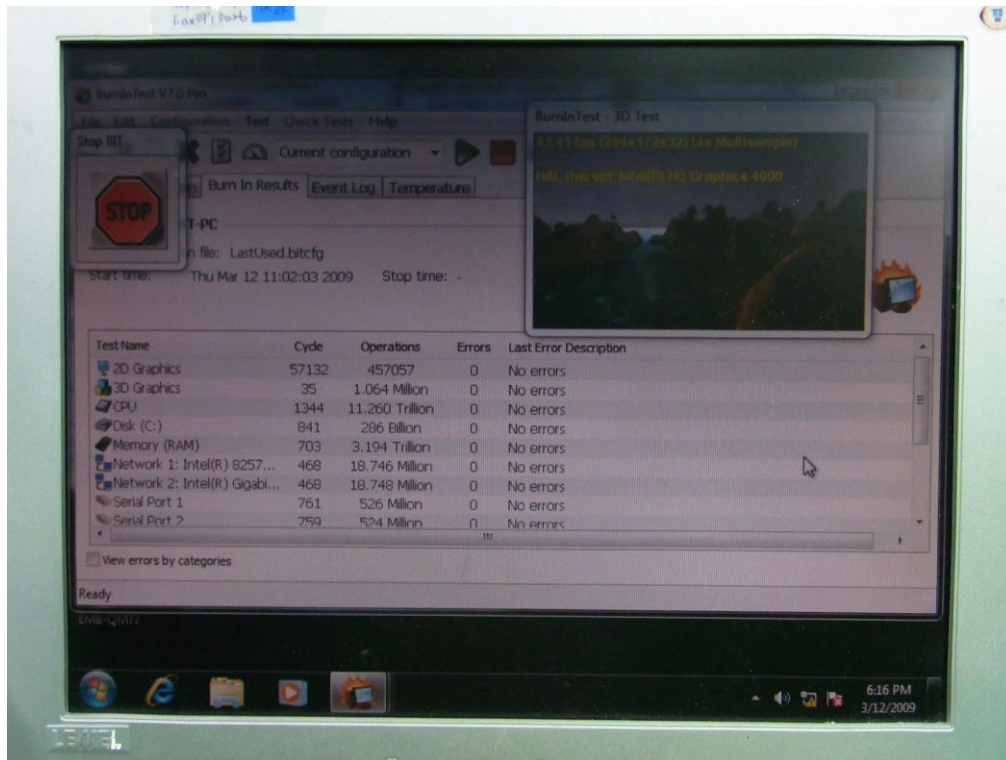


Figure 8 : Function test after Dry Heat Test

■ **Performance test during dry heat test**

Test mode	Voltage variations	Result
Minimum voltage	0.7 Un	PASS
Rated voltage	1.15 Un	PASS
Maximum voltage	1.25 Un	PASS

■ **Performance test after dry heat test**

Test mode	Voltage variations	Result
Minimum voltage	0.7 Un	PASS
Rated voltage	1.15 Un	PASS
Maximum voltage	1.25 Un	PASS

B. Extra over-temperature test
■ Visual and Performance Checking Result

Sample	Result		
	Visual inspection	Function test	Performance test
AEV 6356 (HDD) Number 1	No damage	PASS	PASS

■ Function Test

The function test is satisfied the requirements of manufacturer of EUT defined.

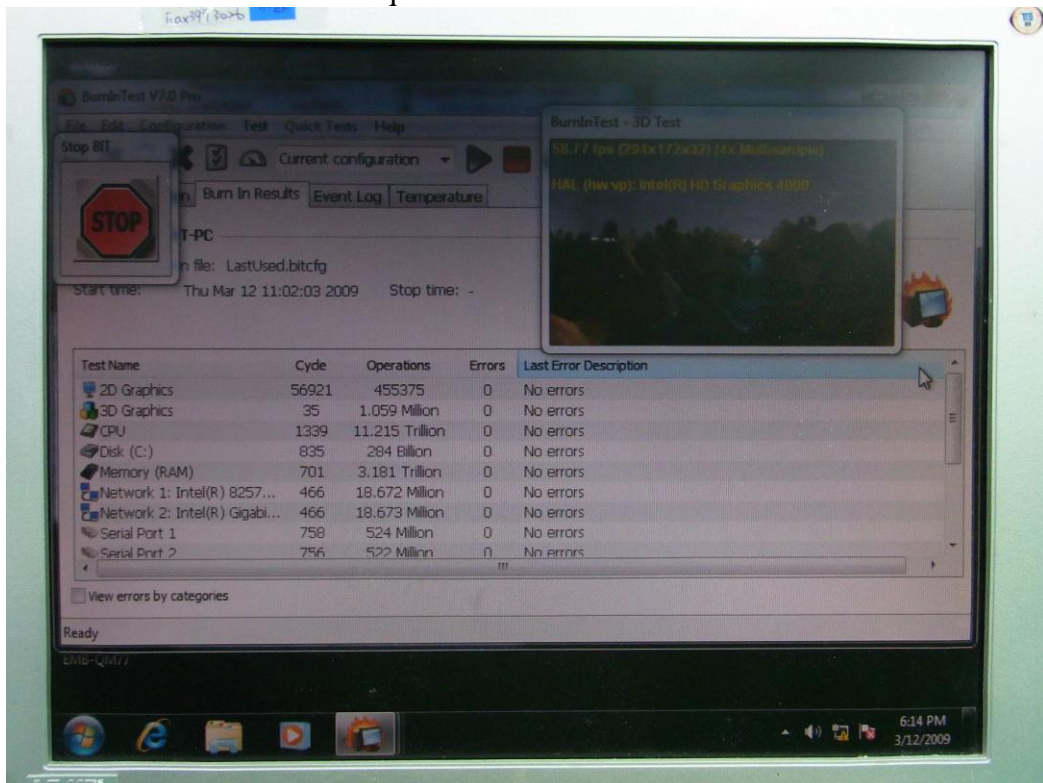


Figure 9 : Function Test during Extra Over-temperature Test

■ Performance test during dry heat over-temperature test

Test mode	Voltage variations	Result
Minimum voltage	0.7 Un	PASS
Rated voltage	1.15 Un	PASS
Maximum voltage	1.25 Un	PASS

4.5. Damp Heat Test, Cyclic

4.5.1. Damp Heat Test, Cyclic Requirements

1. Standard application: EN 50155:2007(EN/IEC 60068-2-30: 2005 test Db)

2. Test sample: Number 2 of the test sample

3. Test criteria

Sample condition: Non-operating mode

Temperature: 25°C ~55°C

Humidity: 95%RH

Duration: 24 hour/cycle

Cycles: 2cycles, total times: 48 hours

4. Checking requirement

- The sample should perform visual inspection and function test after test
- The sample should perform performance test during and after test
- Insulation check –> voltage withstand test –> insulation test

4.5.2. Test Date and Ambient Condition

1. Test date: Mar. 27th ~28th, 2013

2. Ambient condition

Temperature: 25°C

Humidity: 95%RH

4.5.3. Damp Heat Test, Cyclic Test Setup

Sample condition: Operating mode

Temperature: 25°C ~55°C

Humidity: 95%RH

Duration: 24 hour/cycle, 2cycles, total times: 48 hours

The temperature and humidity cycles is shown as below:

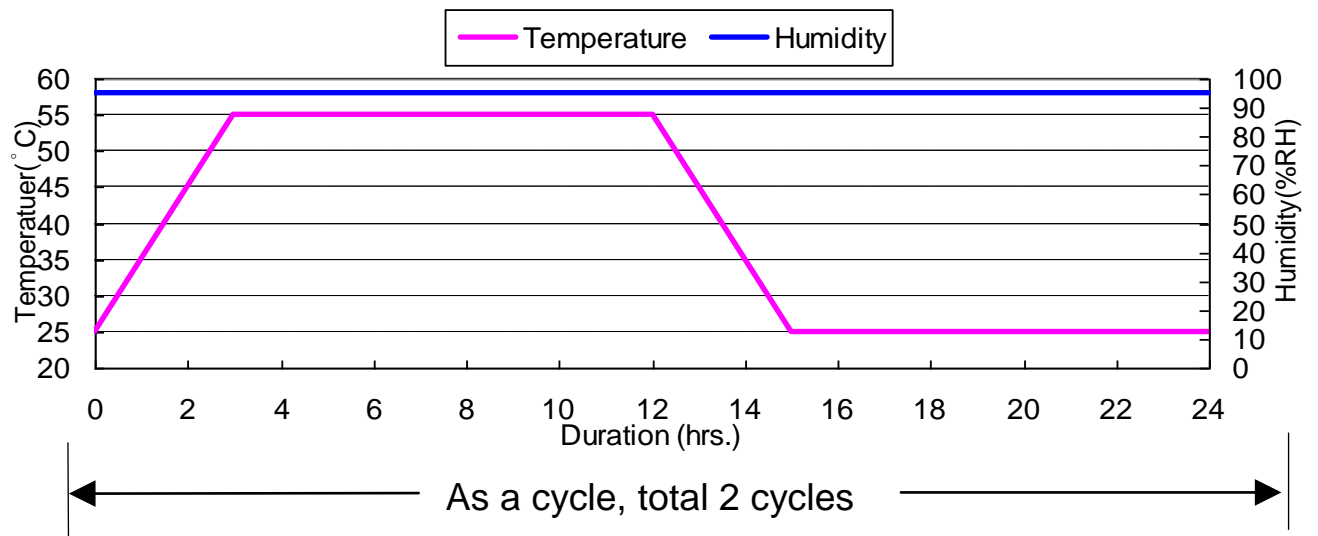


Figure 10 : Damp Heat Test, Cyclic

Test setup



Figure 11 : Damp Heat Test, Cyclic Setup

4.5.4. Damp Heat Test, Cyclic Test Result

■ Visual and Performance Checking Result

Sample	Result		
	Visual inspection	Function test	Performance test
AEV 6356 (HDD) Number 2	No damage	PASS	PASS

■ Function Test

The function test is satisfied the requirements of manufacture of EUT defined.

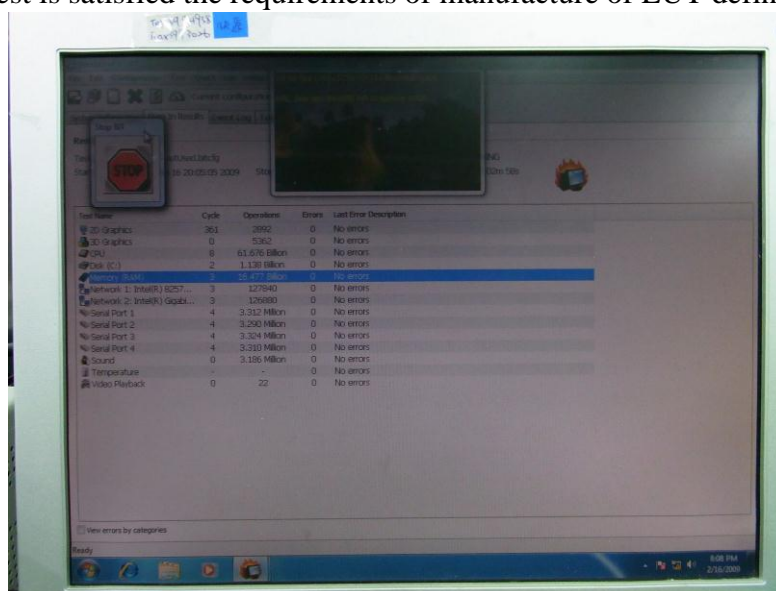


Figure 12 : Function test at the end of first cycle of Damp Heat Cyclic test

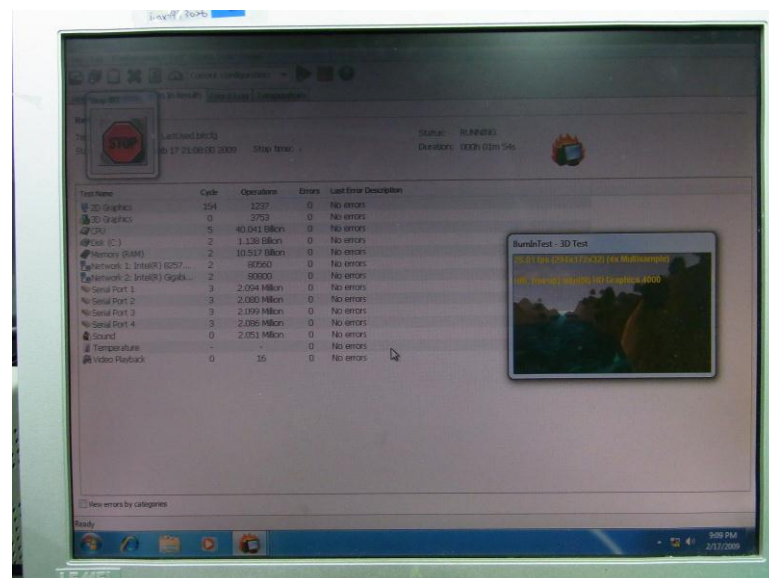


Figure 13 : Function test after damp heat cyclic test

■ Performance test at the end of first cycle of damp heat test, cyclic

Test mode	Voltage variations	Result
Minimum voltage	0.7 Un	PASS
Rated voltage	1.15 Un	PASS
Maximum voltage	1.25 Un	PASS

■ Performance test after damp heat test, cyclic

Test mode	Voltage variations	Result
Minimum voltage	0.7 Un	PASS
Rated voltage	1.15 Un	PASS
Maximum voltage	1.25 Un	PASS

■ Insulation check after the damp heat test, cyclic

Sequence		Result	
Step 1 Insulation resistance test	V+	6.7821x10 ¹⁰ Ω	PASS
	V-	6.4854x10 ¹⁰ Ω	PASS
Step 2 Dielectric withstanding voltage test	V+	No breakdown	PASS
	V-	No breakdown	PASS
Step 3 Insulation resistance test	V+	8.2922x10 ¹⁰ Ω	PASS
	V-	8.2922x10 ¹⁰ Ω	PASS

4.6. Supply Overvoltage Test

4.6.1. Supply Overvoltage Test Requirements

1. Standard application: EN50155:2007
2. Test sample: Number 2 of test sample
3. Test criteria

Sample condition: Operating mode

Nominal voltage (U_n): 24V_{dc}

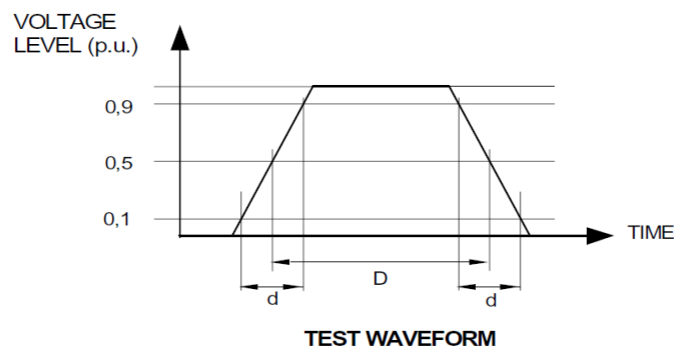
Power supply overvoltage as below

Voltage level: 1.4 U_n

Duration d: 0.1 second

Duration D: 1 second

Times: 10 times



Voltage level min.	Duration d max.	Duration D max.	Series resistor (Tol. ± 10 %)
1,4 U_n	0,1 s	1,0 s	1 Ω

Figure 14 : Test waveform of supply overvoltage test

4. Checking requirement

- The sample should perform visual inspection and function test after test
- The sample should perform performance test during and after test

4.6.2. Test Date and Ambient Condition

1. Test date: Apr. 2nd, 2013

2. Ambient condition

Temperature: 22°C

Humidity: 61%RH

4.6.3. Supply Overvoltage Test Setup

Test setup:

The test setup of Supply Overvoltage test is table-top equipment which is shown as Figure 15.



Figure 15 : Supply overvoltage test

4.6.4. Supply Overvoltage Test Result

Test mode	Voltage variations		Result
DC minimum voltage	1.4 Un	0.1 Second	PASS

4.7. Insulation test

4.7.1. Insulation Test Requirements

1. Standard application: N 50155:2007
2. Test sample: Number 2 of the test sample
3. Test criteria
 - A: Insulation resistance
 - Sample condition: Unpackaged, Non-operating
 - Testing voltage: 500 V_{dc}
 - Duration: 1 minute
 - B: Dielectric withstanding voltage
 - Sample condition: Unpackaged, Non-operating
 - Testing voltage: 707 V_{dc}
 - Cut-off current: 0.5 mA
 - Duration: 1 minute
4. Before and after Dielectric withstanding voltage test, measuring the insulation resistance value and recorded.

4.7.2. Test Date and Ambient Condition

1. Test date: Mar. 25th, 2013 for insulation test
2. Test sample: Number 2 of the test sample
3. Ambient condition
 - Temperature: 24°C on Mar. 25th, 2013 and 22°C on Mar. 28th, 2013
 - Humidity: 52%RH on Mar. 25th, 2013 and 52%RH on Mar. 28th, 2013

4.7.3. Insulation Test Setup

1. Insulation resistance
 - Sample condition: Unpackaged, Non-operating
 - Testing voltage: 500 V_{dc}
 - Duration: 1 minute

2. Dielectric withstanding voltage

Sample condition:	Unpackaged Non-operating
Power 2:	Testing voltage: 707 V _{dc}
Cut-off current:	0.5 mA
Duration:	1 minute

Test setup

The insulation test setup includes insulation resistance test and dielectric withstanding voltage test are shown as in Figure 16 and 17.

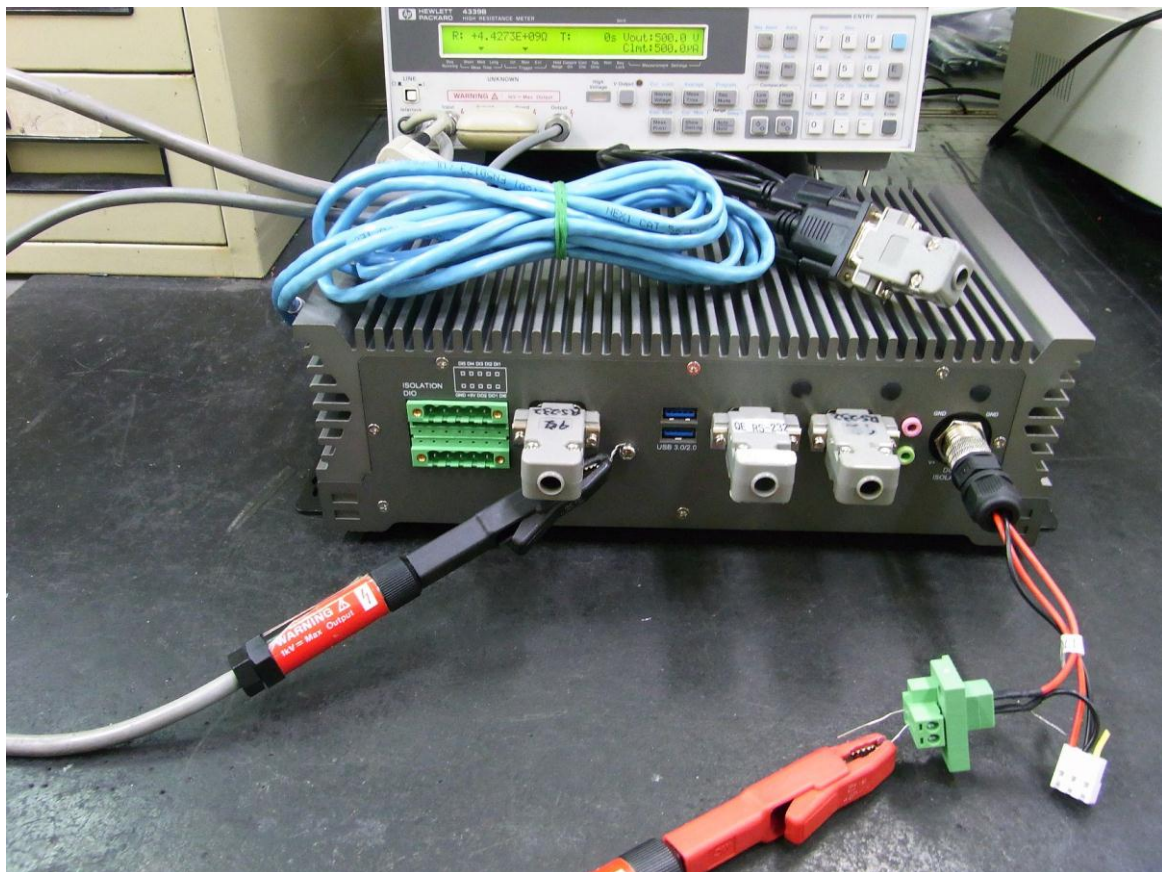


Figure 16 : Insulation resistance test



Figure 17 : Dielectric withstanding voltage test

4.7.4. Insulation Test Result

- The test result of insulation resistance and dielectric withstanding voltage test**
 The value recorded of insulation resistance measurements are shown below:

Sequence		Result	
Step 1 Insulation resistance test	V+	$9.9604 \times 10^{10} \Omega$	PASS
	V-	$9.9669 \times 10^{10} \Omega$	PASS
Step 2 Dielectric withstanding voltage test	V+	No breakdown	PASS
	V-	No breakdown	PASS
Step 3 Insulation resistance test	V+	$1.0408 \times 10^{11} \Omega$	PASS
	V-	$1.1469 \times 10^{11} \Omega$	PASS

4.8. Vibration Test

4.8.1. Vibration Test Requirements

1. Standard application: IEC 61373:2010
2. Test Sample: Number 1 of the test sample
2. Test criteria

A: Random vibration test condition

Refer to IEC 61373:2010 Section 8 Table 1 Category 1 Class B

Sample condition: Operating

Waveform: Random wave

Duration: 10 minutes

■ Direction: Vertical axis

Frequency (Hz)	PSD (g^2/Hz)	Slope (dB/oct.)
5	0.00031	-----
20	0.00031	-6
150	$5.5876 \cdot 10^{-6}$	-----
0.1 g_{rms}		

Duration: 10 minutes



Figure 18 : Vibration test for vertical axis

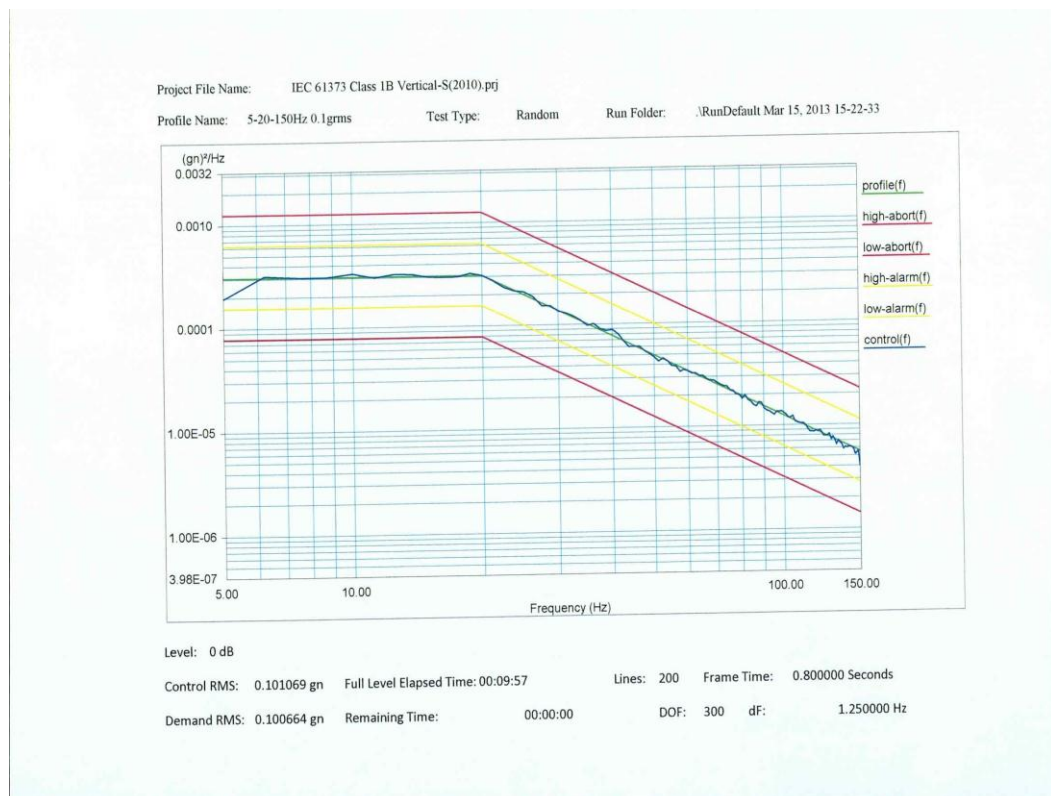
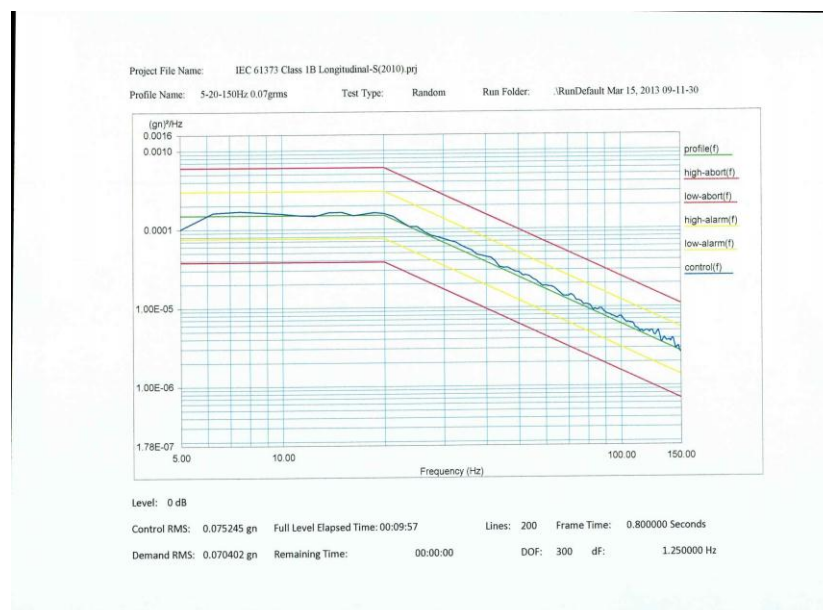


Figure 19 : The waveform of vertical axis of random vibration test

■ Direction: Longitudinal axis

Frequency (Hz)	PSD (g^2/Hz)	Slope (dB/oct.)
5	0.0001515	-----
20	0.0001515	-6
150	$2.73073 \cdot 10^{-6}$	-----
$0.07 g_{rms}$		

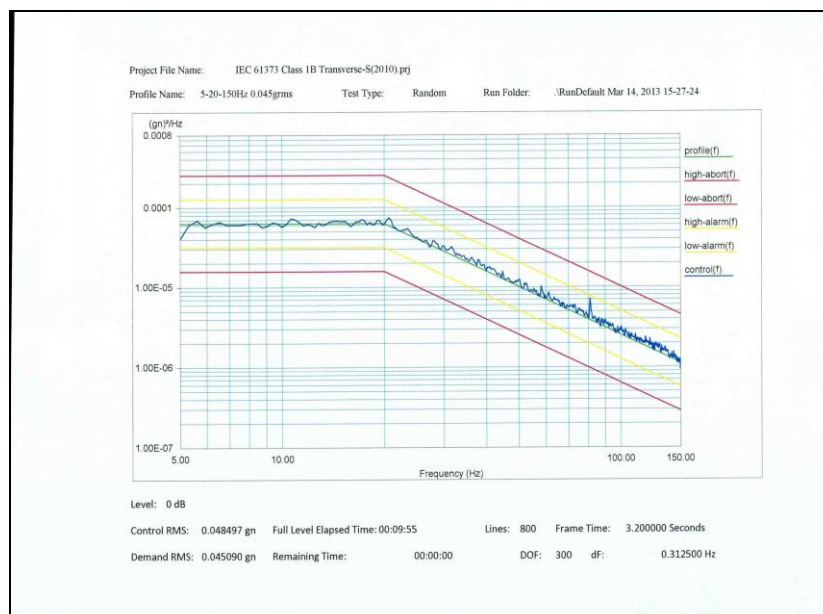
Duration: 10 minutes


Figure 20 : Vibration test for longitudinal axis

Figure 21 : The waveform of longitudinal axis of random vibration test

■ Direction: Transverse axis

Frequency (Hz)	PSD (g^2/Hz)	Slope (dB/oct.)
5	0.0000626	-----
20	0.0000626	-6
150	$1.12834 \cdot 10^{-6}$	-----
0.045 g_{rms}		

Duration: 10 minutes


Figure 22 : Vibration test for transverse axis

Figure 23 : The waveform of transverse axis of random vibration test

B: Simulated long life vibration test

Refer to IEC 61373:2010 Section 9 Table 2 Category 1 Class B

Sample condition: Non-operating

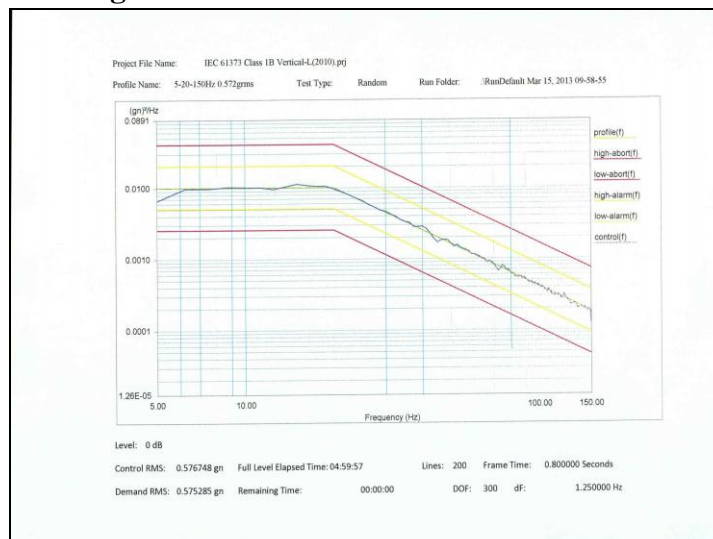
Waveform: Random wave

 ■ **Direction: Vertical axis**

With non-operating condition

Frequency (Hz)	PSD (g^2/Hz)	Slope (dB/oct.)
5	0.0101246	-----
20	0.0101246	-6
150	$1.82492 \cdot 10^{-4}$	-----
0.572 g_{rms}		

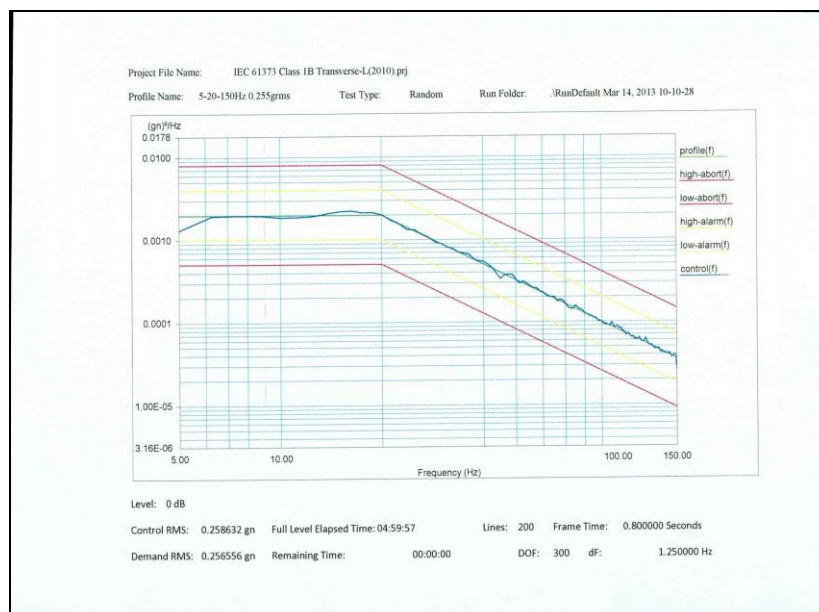
Duration: 5 hours


Figure 24 : Vibration test for vertical axis

Figure 25 : The waveform of vertical axis of random vibration test

- Direction: Longitudinal axis
 With non-operating condition

Frequency (Hz)	PSD (g^2/Hz)	Slope (dB/oct.)
5	0.00485263	-----
20	0.00485263	-6
150	$8.74667 \cdot 10^{-5}$	-----
0.396 g_{rms}		

Duration: 5 hours


Figure 26 : Vibration test for longitudinal axis

Figure 27 : The waveform of longitudinal axis of random vibration test

- Direction: Transverse axis
 With non-operating condition

Frequency (Hz)	PSD (g^2/Hz)	Slope (dB/oct.)
5	0.00201361	----
20	0.00201361	-6
150	$3.62945 \cdot 10^{-5}$	----
0.255 grms		

Duration: 5 hours


Figure 28 : Vibration test for transverse axis

Figure 29 : The waveform of transverse axis of random vibration test

2. Checking requirement

- The sample should perform visual inspection and function test after test
- The sample should perform performance test after test

4.8.2. Test Date and Ambient Condition

 1. Test date: Mar. 14th~15th, 2013

2. Ambient condition

Temperature: 22°C~30°C

Humidity: 51%RH~59%RH

4.8.3. Vibration Test Setup

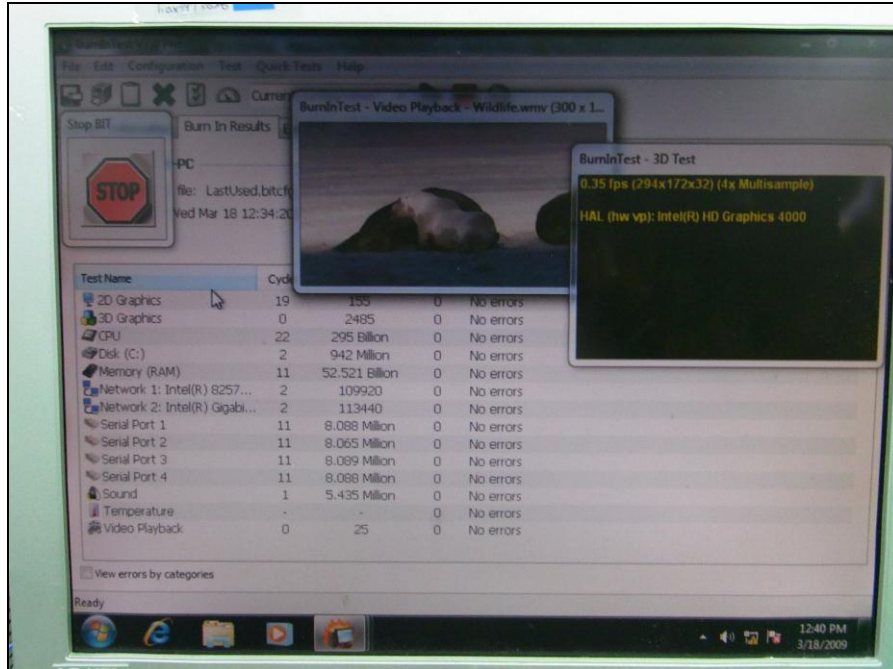
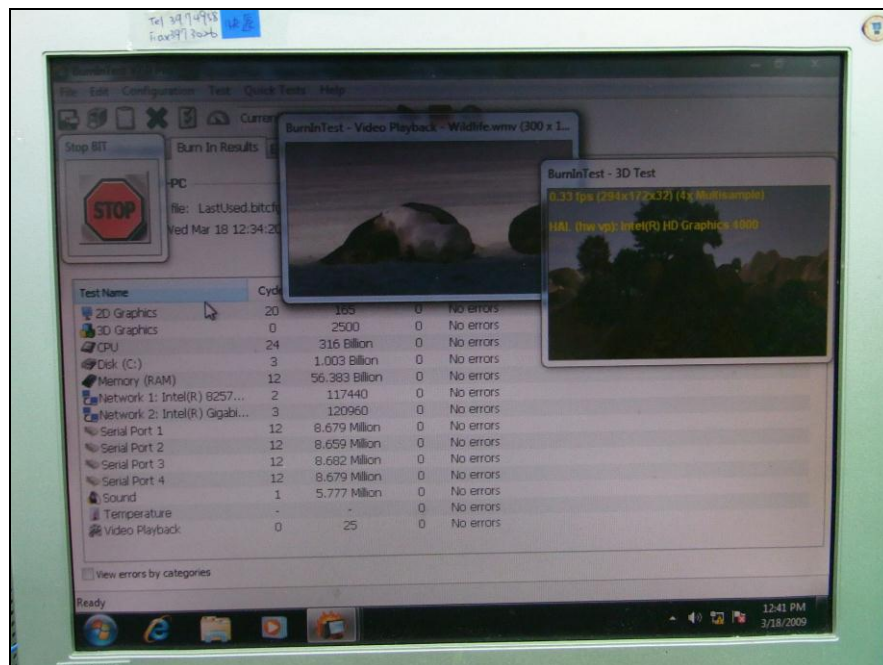
A: Random vibration test setup shown as in Figure 18 to Figure 23.

B: Simulated long life vibration test setup shown as in Figure 24 to Figure 29.

4.8.4. Vibration Test Result

 ■ **Visual and Performance Checking Result**

Sample	Result		
	Visual inspection	Function test	Performance test
AEV 6356 (HDD) Number 1	No damage	PASS	PASS

■ Function Check

Figure 30 : Function test after vibration test item A

Figure 31 : Function test after vibration test item B
■ Performance test after vibration test

Test mode	Voltage variations	Result
Minimum voltage	0.7 Un	PASS
Rated voltage	1.15 Un	PASS
Maximum voltage	1.25 Un	PASS

4.9. Shock Test

4.9.1. Shock Test Requirements

1. Standard application: IEC 61373:2010
2. Test Sample: Number 1 of test sample
3. Test criteria

Shock test: Refer to IEC 61373 Section 10 Table 3 Category 1 Class B

Sample condition: Non-Operating
Pulse shape: Half-sine pulse
Peak acceleration: 3 g
Duration of pulse: 30 ms
Direction: \pm Vertical and \pm Transverse (4 directions)
Number of shock: 3 shocks / direction, total 12 shocks

Sample condition: Non-Operating
Pulse shape: Half-sine pulse
Peak acceleration: 5 g
Duration of pulse: 30 ms
Direction: \pm Longitudinal (2 directions)
Number of shock: 3 shocks / direction, total 6 shocks



Figure 32 : Mechanical shock test for vertical axis

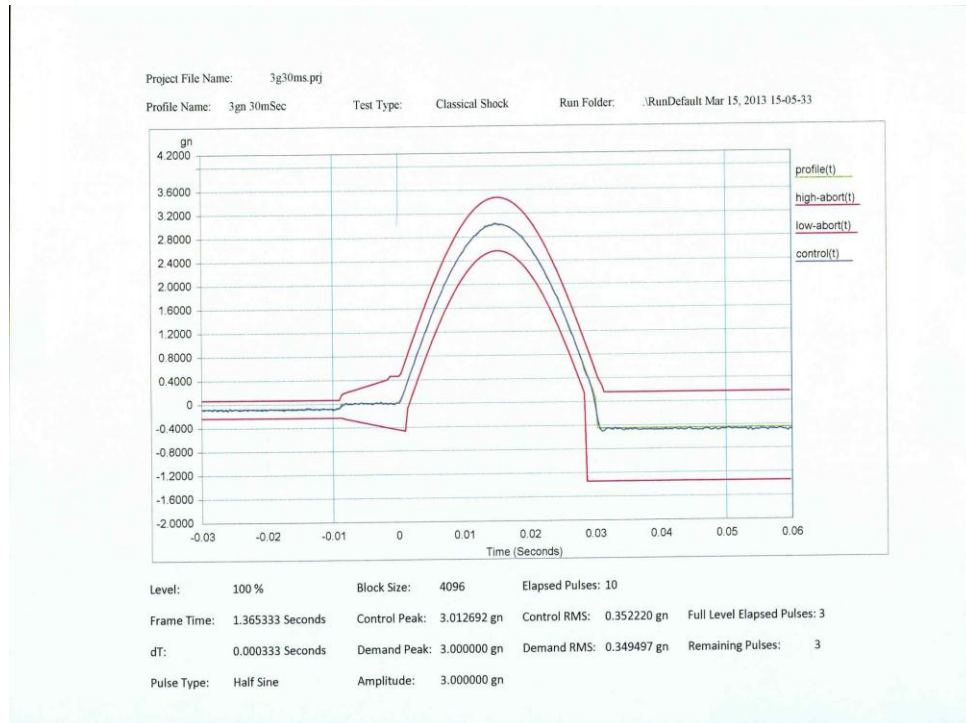
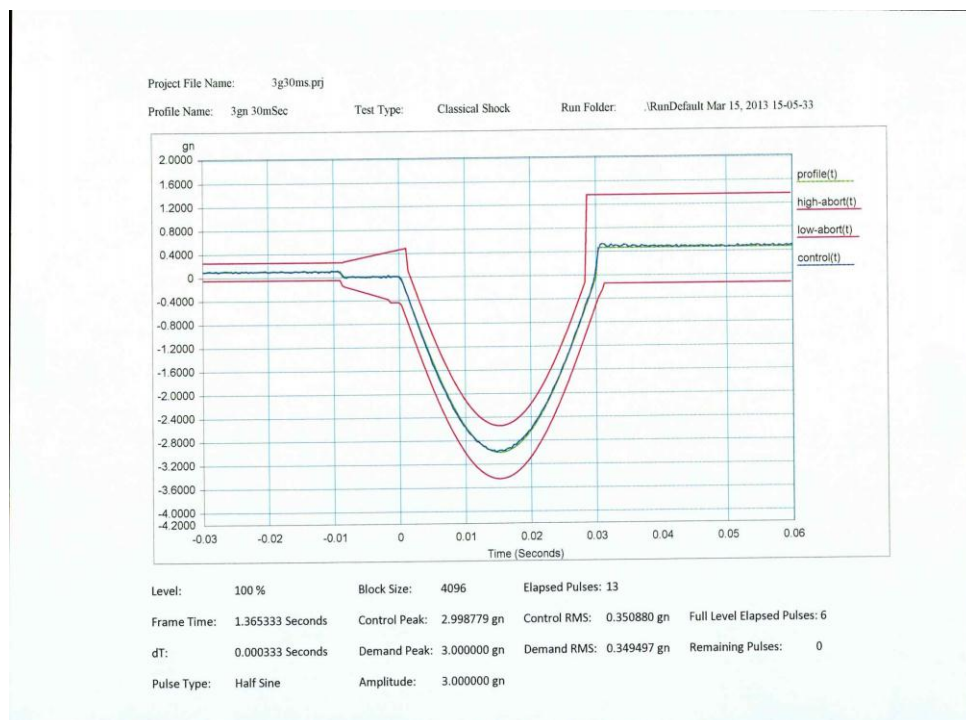
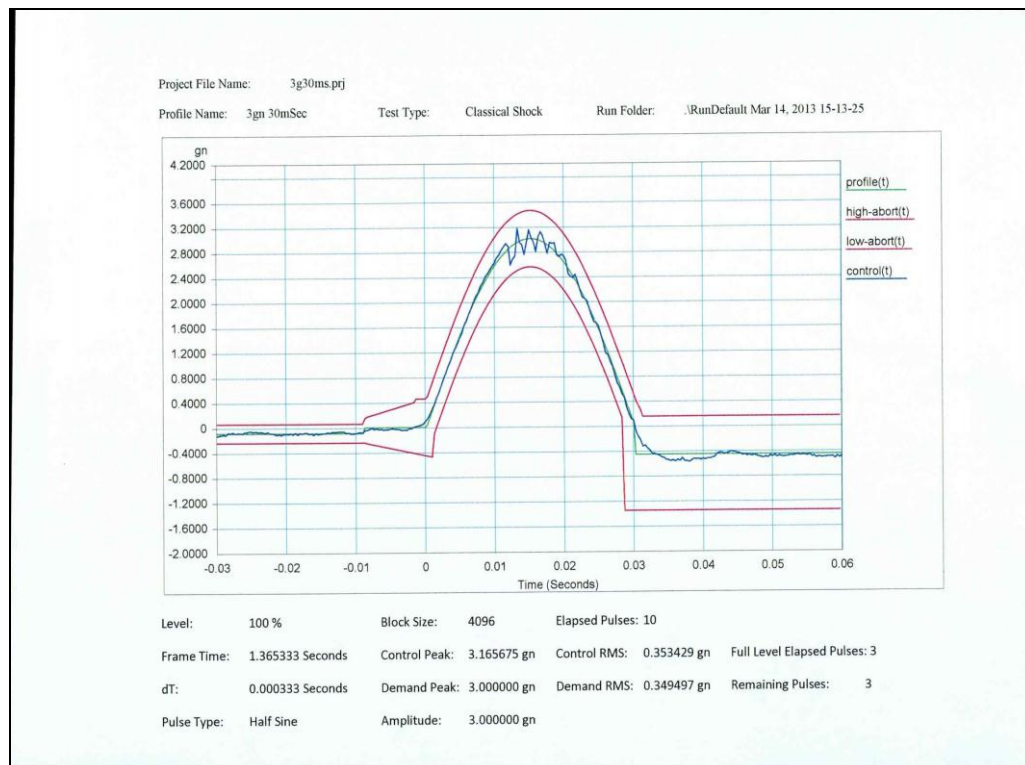

Figure 33 : The waveform of +vertical axis of mechanical shock test

Figure 34 : The waveform of -vertical axis of mechanical shock test


Figure 35 : Mechanical shock test for transverse axis

Figure 36 : The waveform of +transverse axis of mechanical shock test

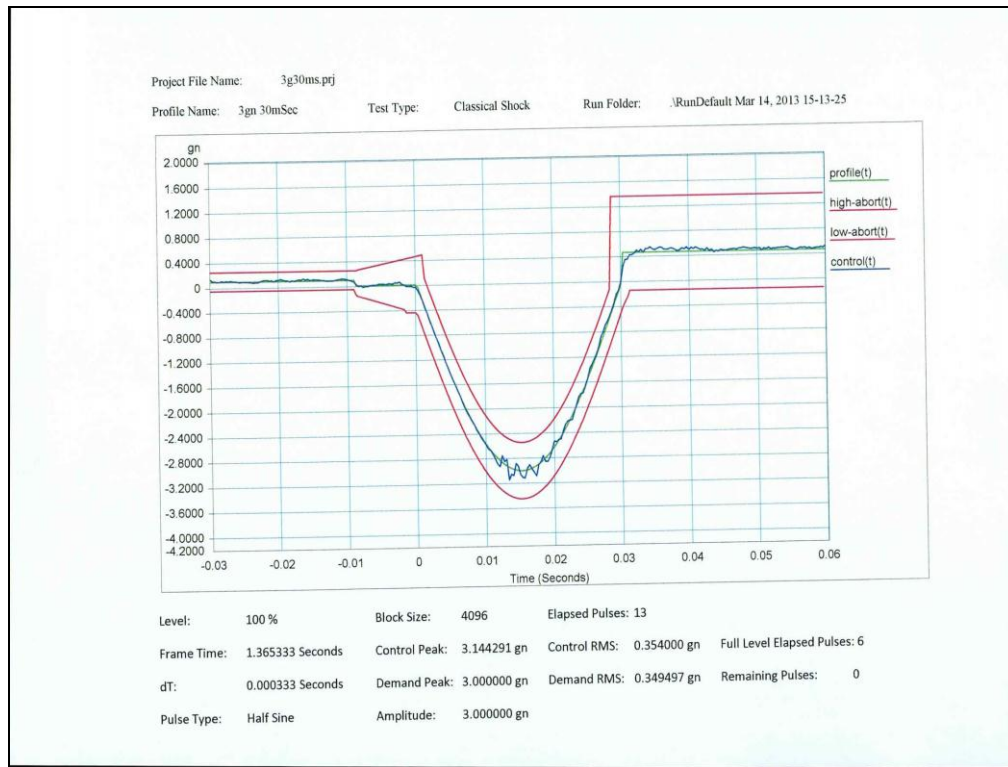
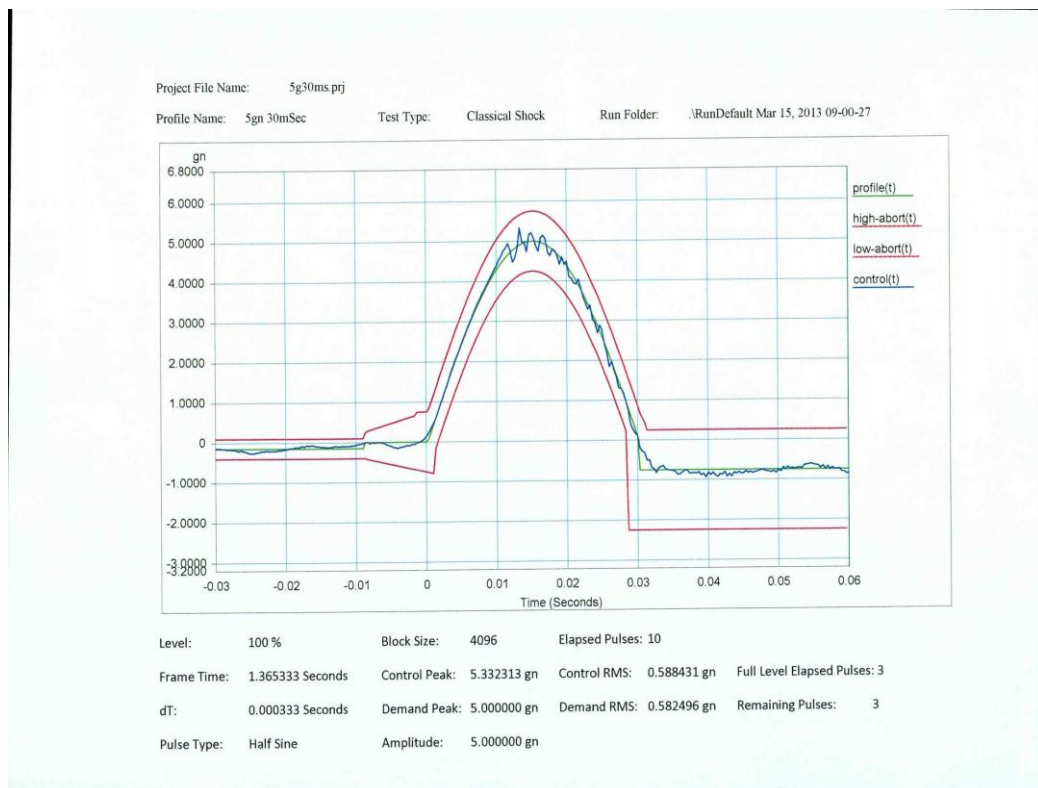
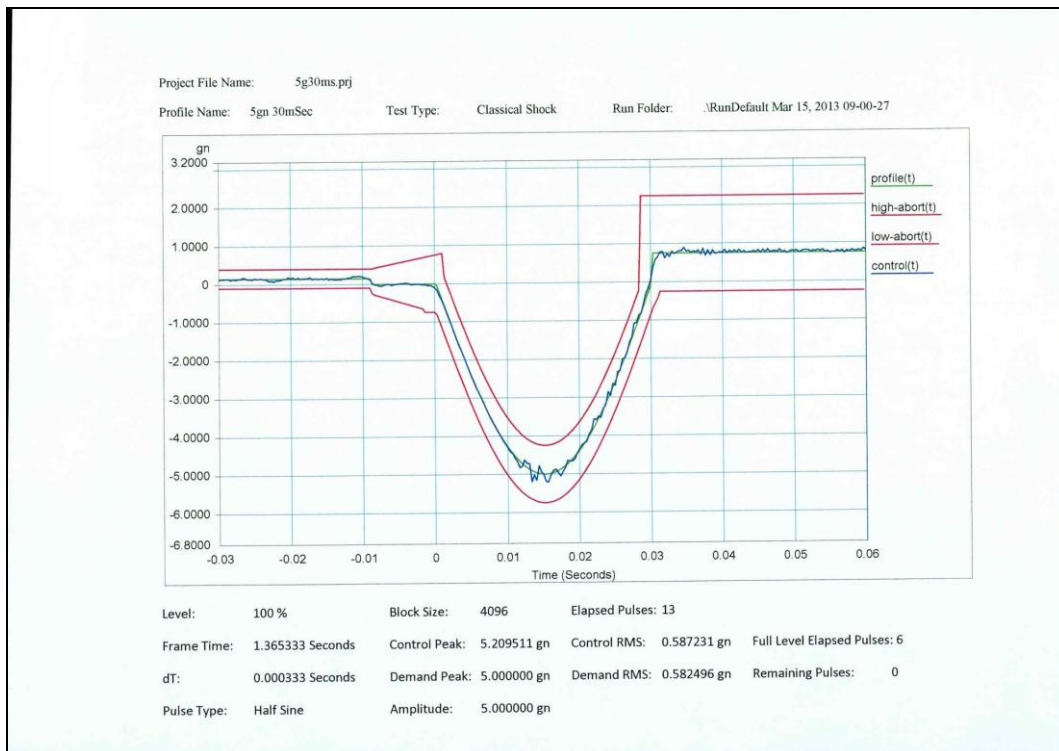

Figure 37 : The waveform of -transverse axis of mechanical shock test

Figure 38 : Mechanical shock test for longitudinal axis


Figure 39 : The waveform for +longitudinal axis of mechanical shock test

Figure 40 : The waveform of -longitudinal axis of mechanical shock test

4.9.2. Test Date and Ambient Condition

1. Test date: Mar. 14th ~ 15th, 2013
2. Ambient condition
 - Temperature: 22~30°C
 - Humidity: 51~59%RH

4.9.3. Shock Test Setup

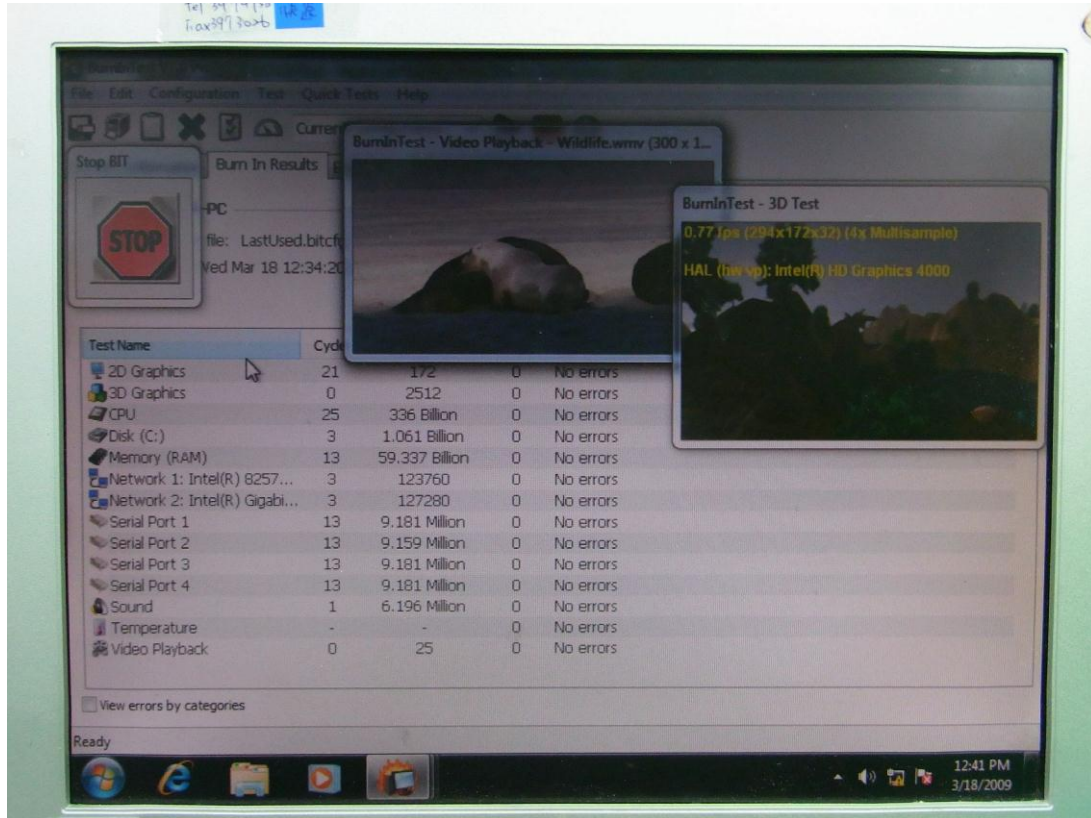
1. Shock tests set up are shown as in Figure 32 to Figure 40 in section 5.9.1
2. Checking requirement
 - The sample should perform visual inspection and function test after test
 - The sample should perform performance test after test

4.9.4. Shock Test Result

The EUT had been checking the visual, function and performance test after the Mechanical Shock test as below:

■ Visual and Performance Checking Result

Sample	Result		
	Visual inspection	Function test	Performance test
AEV 6356 (HDD) Number 1	No damage	PASS	PASS

■ Function test

Figure 41 : Performance test after mechanical shock test
■ Performance test after shock test

Test mode	Voltage variations	Result
Minimum voltage	0.7 U _n	PASS
Rated voltage	1.15 U _n	PASS
Maximum voltage	1.25 U _n	PASS

4.10. Low Temperature Storage Test

4.10.1. Low Temperature Storage Test Requirements

1. Test criteria

Sample condition: Non-operating mode

Temperature: -40°C

Duration: 16 hours

2. Checking requirement

- The sample should perform visual inspection and function test after test
- The sample should perform performance test after test

4.10.2. Test Date and Ambient Condition

1. Test date: Mar. 29 2013

2. Ambient condition

Temperature: 23°C

Humidity: 55%RH

4.10.3. Low Temperature Storage Test Setup

1. Low Temperature Storage test

Sample condition: Non-operating mode

Temperature: -40°C

Duration: 16 hours

2. Test setup

The test setup is shown as in Figure 42



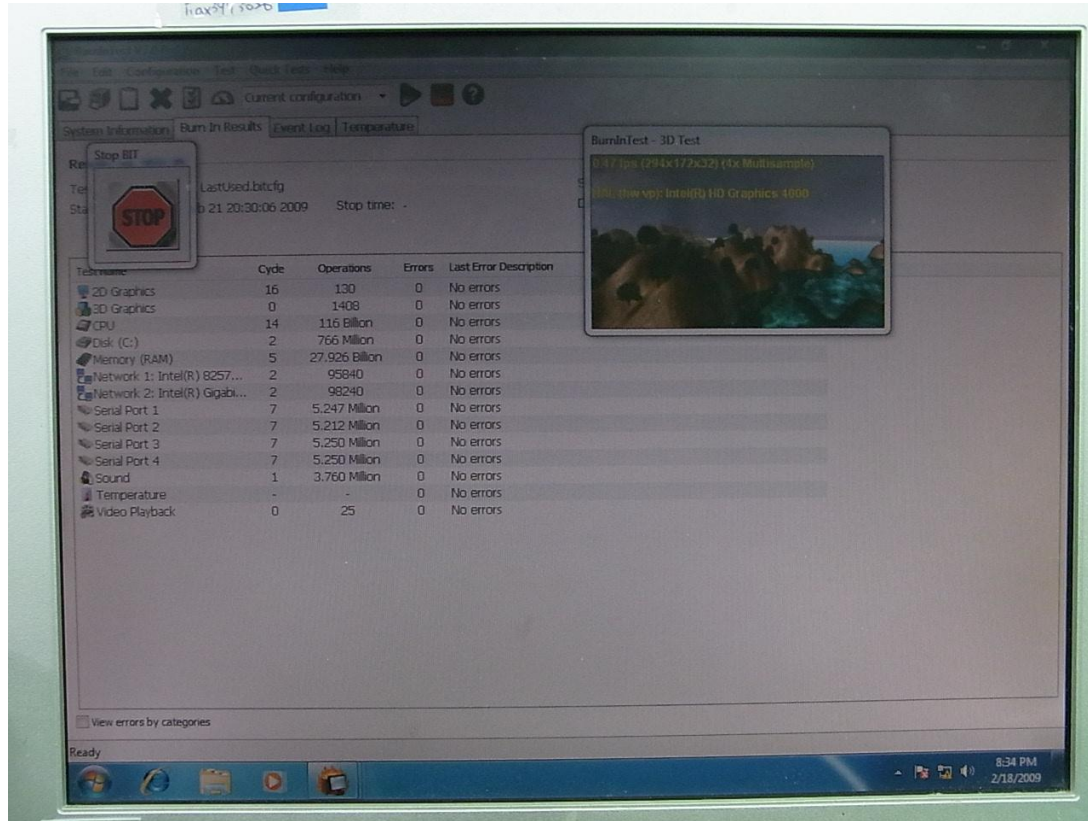
Figure 42 : Low temperature storage test

4.10.4. Low Temperature Storage Test Result

The EUT had been checking the visual, function and performance test during and after the Low Temperature Storage test as below:

■ Visual and Performance Checking Result

Sample	Result		
	Visual inspection	Function test	Performance test
AEV 6356 (HDD) Number 1	No damage	PASS	PASS

■ Function test

Figure 43 : Function test at room temperature after low temperature storage test
■ Performance test after low temperature storage test

Test mode	Voltage variations	Result
Minimum voltage	0.7 U _n	PASS
Rated voltage	1.15 U _n	PASS
Maximum voltage	1.25 U _n	PASS

5. Extra test for customer special requirement

5.1. Test requirement

1. Test item: Dielectric withstanding voltage
2. Position to be test: output link to ground (As shown in Figure 44)
3. Sample condition: Non-operating
 - Testing voltage: 1000 Vdc
 - Cut-off current: 0.5 mA
 - Duration : 1 minute

5.2. Test Date and Ambient Condition

1. Test date: Apr. 1st, 2013
2. Ambient conditions
 - Temperature: 22°C
 - Humidity: 57% RH

5.3. Test setup



Figure 44 : Dielectric withstanding voltage test

5.4. Test result

Result	EUT not break down	PASS
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