Thermal Test Report

Customer Confidential

Prepared on behalf of: Eurocase

on their: ML5412 350 X9

Lab Reference: PVCS 1894

Date: Tuesday, 08 February 2005

Revision 1.1
Application & Design-In Centre, EMEA

Revision History

Revision Number	Description	Revision Date
1.0	Initial Release.	August 7th 2003
1.1	Minor Title Page Change	June 2004

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1 Introduction

This document is designed to report and evaluate the thermal performance, of the Eurocase ML5412 350 X9, Lab Reference PVCS 1894 to Intel Thermal Specifications.

The equipment under test was assessed by Intel Corporation (UK) LTD, in their environmental test facilities located at

Pipers Way,
Swindon,
SN3 1RJ
United Kingdom.

1.1 Documentation Review & Approval

Date of Test Completion: Tuesday, 01 February 2005

Date of Report: Wednesday, 02 February 2005

Test Engineer

Imran Dhansey 

Approval

Gareth Lockwood 

2 Test Results Summary

2.1 Summary of Issues

A summary of thermal related test issues is given below. A priority has been assigned to each problem to estimate the potential impact to users. Additionally, there may be some issues that are identified in this report as “FYI” (For Your Information) that may be of interest, but are not considered of high enough priority to be listed in the summary.

2.1.1 Test Result

The equipment under test met Intel Thermal specifications.

2.1.2 Priority 1 Critical

[High impact issues requiring immediate attention]
N/A

2.1.3 Priority 2 Important

[Issues that should be corrected]
N/A

2.1.4 Priority 3 Future Impact

[Issues that have little impact now. Some may have future impact]
N/A

2.1.5 FYI

[For Your Information. Miscellaneous information that may be of interest]

3 System Configuration

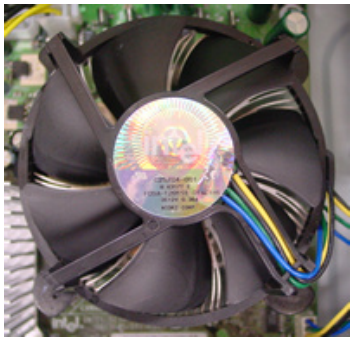
3.1 Overview

This section lists the original configuration of the equipment under test. If any changes are required for the system to pass thermal test specification, these will be stated in section 2.1, and only the system in this configuration is recognised as a qualifying result.

3.2 Equipment Under Test

3.2.1 System Pictures

3.2.2 Thermal Solution



3.2.3 EUT Configuration

Manufacturer	Description	Model/Part Number	Serial Number	Location
Eurocase*	ATX Midi Tower Chassis	ML5412 350 X9	Not Known	N/A
Eurocase	ATX12V 350W Switching Power Supply (W/PFC)	350X	F0046946	Top back of Chassis
Intel	Intel® D915GAG µATX Desktop Motherboard	AA C64123-303	BQAG44001907	N/A
Intel	Intel® Pentium® 4 Processor 530 (3.0GHz/800/HT/1MB)	JM80547PG0801M	Not Known	LGA775 Socket
Kingston*	256MB DDR 400MHz PC3200 SDRAM DIMM	KVR400X64C3A/256	P723812-4197143	Channel A DIMM 0 Channel B DIMM 0
EVGA*	GeForce* FX 128MB PCI Express* Graphics Card	GF-FX-5200	Not Known	PCI Express x16 Slot
Maxtor*	DiamondMax* Plus 9 200GB Ultra ATA/133/ SATA 150	6Y080M0	Y2DGP7XE	Internal HDD 3.5" bay
Samsung*	52x IDE CDRW/DVD Drive	SM-348B	Not Known	Top external 5.25"bay
Toshiba*	16x IDE DVD-Rom Drive	SD-M1612	Not Known	Bottom external 5.25"bay
Not Known	1.44 MB Floppy Drive	Not Known	Not Known	Internal FDD 3.5" bay
Not Known	USB/Audio Daughter Board	Not Known	Not Known	Bottom front of chassis

Full BIOS Revision	EV91510A.86A.0213
Operating System	Microsoft* Windows* XP Professional (SP2)

Additional information for fans, ferrites, etc <u>fitted</u> in the chassis

Manufacturer	Description	Model/ Part Number	Position in chassis
Nidec Corp*	Intel Branded Processor Fan Heatsink	C25704-001	N/A Processor Cooling
Not known	Plastic Chassis Air Guide	Not Known	Chassis Side Panel, positioned directly above processor cooling solution

Additional parts supplied with the chassis/system for test

Manufacturer	Description	Model/ Part Number	Position in chassis
Xinruilian* **(Note: 3 Chassis fans)**	80mm DC12V, 0.11A Chassis Fan	RDM8025S	N/A

4 Test Methodology

4.1 Thermal Test Equipment

Some or all of this equipment may have been used during thermal testing.

Supplier	Description	Model / Part Number
Thermotron*	Walk-In Thermal Chamber	WP-499-THCM-705
Thermotron*	Thermal Chamber	S-8SLE
Cambridge Accusense*	Airflow Monitoring Equipment	ATM-24 CAFS-220-5M
Testo*	Digital Anemometer	0560.4900
Anville Instruments*	Data Acquisition Unit	X-435
Fluke*	Hydra Data Logger	2625A
Fluke*	Themocouple Calibrators	51/52 & 714 Series
FLIR Systems*	Infra-Red Camera	Prism
Omega*	Hot-Point Cell	CL950-220

4.2 Tolerance/Accuracy

All thermal test equipment is maintained annually by traceable calibration. The accuracy of type T thermocouples is: -270 to +400ºC, greater of 0.5ºC or 0.4%.

4.3 Test Method

Thermal testing will be performed in a thermal chamber with a controlled ambient temperature of 35ºC. Case and ambient temperature measurements, T_c and T_a respectively, will be taken at 20 second intervals until thermal equilibrium (steady state) is reached. Steady state is reached when the difference between the current reading and the previous reading is less that 0.5%. Data will be collected for 5 minutes past the time determined to be steady state. The last data point is recorded in the test report with no averaging.

4.3.1 Thermocouple Calibration Check

It is important to ensure that the thermocouples used for ambient and case temperature measurements are calibrated. A Hot-Point* Calibration Cell is used to check the accuracy of thermocouples prior to any thermocouple being used for testing – each thermocouple is placed in the cell and then set to 0ºC and 100ºC. The thermocouple reading should be within +/-0.5ºC of the set point.

4.3.2 Thermocouple Placement

To record the ambient air temperature (T_a) measurements, place 4 thermocouples equally spaced 2.54mm (0.1") above the fan hub vertically, halfway between the fan hub and housing horizontally (See Figure 1).

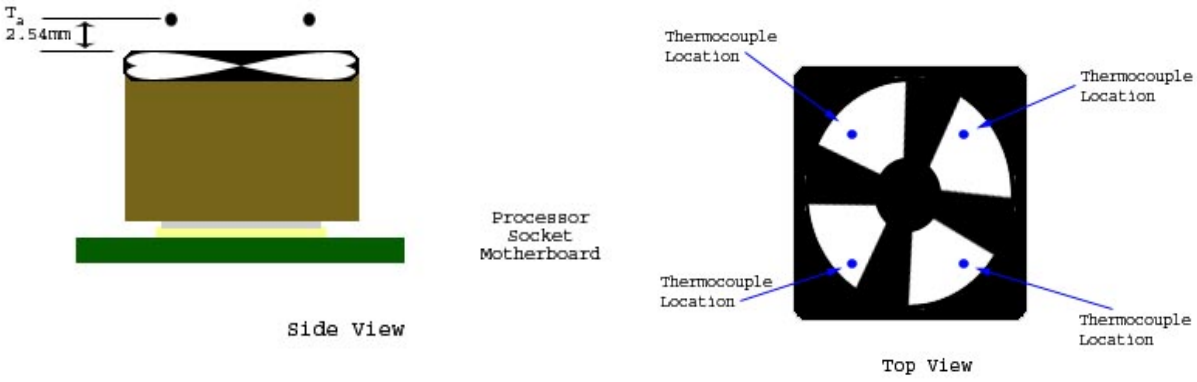


Figure 1

A characterised processor will be used during testing.

The case temperature (T_C) measurement will be taken with a thermocouple placed in the centre of the processor Integrated Heat Spreader (IHS). The IHS will be grooved to 0.508mm (0.02") – 0.635mm (0.025") deep, 0.889mm (0.035") – 1.016mm (0.04") wide, and half the length of the IHS. The thermocouple will be Type T, 36 gauge for processor case temperature measurement with Teflon* insulation. The thermocouple will be attached using Loctite* 315 thermally conductive adhesive in the manner shown in Figure 2 and 3. A continuity check will be performed to ensure contact between the thermocouple and the processor IHS.

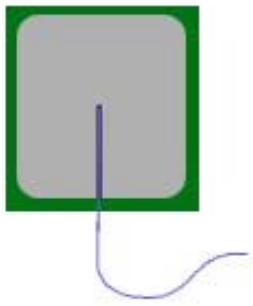


Figure 2 – Top View

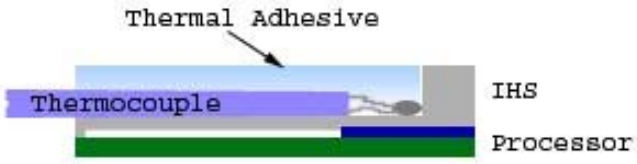


Figure 3 – Cross Section

4.3.3 Test Procedure

The BIOS of the system under test is reset to default settings where appropriate and all power saving features and system management functions are disabled. The system is then booted into the relevant Operating System and test software installed.

The applications used for thermal testing are:

Intel® P4MaxPower version 2.1 [set to 100% power level]
Intel® Frequency Display Utility
Intel® Active Monitor [if applicable]

P4MaxPower is activated to stress the processor to its Thermal Design Point and at no point during the test should the processor activate it's thermal control circuit (monitored by Frequency Display Utility).
The thermocouple temperatures throughout the system are logged by the chamber control software over a period as stated in section 4.3.

5 Thermal Test Results

All pass results are within the accuracy of the test equipment (see section 4.2).

Note.
The power level output of different processors and processor lines can vary, this can either have a positive or negative impact on the overall Tcase temperature specification for a processor/chassis/heatsink under test, an example:
A power output increase of 2.7Watts could approximately equate to an additional 1°C – 3°C* on the Tcase temperature measurement. A similar calculation can be made regarding a power output decrease.
These test results are only valid for the processor tested and should only be used as an indication unless specific processor measured power is stated.

*Based on the power versus max Tcase temperature increases of the P4 2.0GHz and 2.2GHz processors.

5.1 Test Specifications & Limits

The information in this section is taken from the relevant processor Electrical, Mechanical & Thermal Specification document (EMTS).

5.1.1 Intel® Pentium® 4 Processor 530 @ 3.0GHz

Criteria	Specification	Notes
Processor T_c	67.7ºC	84W Thermal Design Power
Processor T_a	38ºC	

5.2 Test Results

This section contains the Thermal test results for the equipment under test using the Intel® Pentium® 4 Processor 530@ 3.0GHz, to the specification in section 5.1.1.

5.2.1 Test Equipment/Test Deviations

None.

5.2.2 Thermal Stress Test Results

Monitor Point	Temperature	Status
Processor T_c	66.5ºC	PASS
Processor T_a	37.3ºC	PASS

6 References

6.1 Thermal Support Documentation

Refer to the following documentation for more information.

Relevant Intel® Processor Electrical, Mechanical & Thermal Specification (EMTS)
Relevant Intel® Processor Thermal Design Guidelines.
ATX and µATX specifications [http://www.formfactors.org]