Performance comparison of three consumer notebook PCs with Intel and AMD processors

Executive summary

Intel Corporation (Intel) commissioned Principled Technologies (PT) to run a set of performance tests on the following OEM notebook systems:

- an AMD Turion 64 X2 TL-52 mobile processor-based system (which we will refer to as OEM System A)
- an Intel Core Duo T2300E mobile processor-based system (which we will refer to as OEM System B)
- an Intel Core Duo T2400 mobile processor-based system (which we will refer to as OEM system C)

The goal of the testing was to gauge the performance and energy consumption that buyers would experience when performing common tasks. Intel specified the test systems and provided the tests, test procedures, and test settings. PT purchased and set up the systems and executed all tests. To keep the focus of this report on the relative performance of the Intel and AMD processors at the core of the test systems, Intel requested we not disclose the OEM name.

KEY FINDINGS

- The Intel Core Duo T2400 processor-based system ran from 15 to 43 percent faster than the AMD Turion 64 X2 TL-52 processor-based system on our performance tests.
- The Intel Core Duo T2400 processor-based system consumed from 56 to 84 percent less energy than the AMD Turion 64 X2 TL-52 processor-based system during the performance tests.
- The Intel Core Duo T2300E processor-based system ran from 8 to 30 percent faster than the AMD Turion 64 X2 TL-52 processor-based system on the performance tests.
- The Intel Core Duo T2300E processor-based system consumed from 44 to 72 percent less energy than the AMD Turion 64 X2 TL-52 processor-based system during the performance tests.

We measured system performance and energy consumption with the following five custom tests designed to simulate tasks that users commonly perform on notebook PCs:

- **Music ripping,** which uses Apple iTunes 6.0.5 to rip a .wav music file to mp3 format
- **Photo editing,** which opens and automatically adjusts exposure, contrast, and color in a group of 200 digital photos using ACD Systems ACDSee 8 Photo Manager
- **Photo editing,** which opens and automatically "smart fixes" a group of 103 digital photos using Adobe Photoshop Elements 4.0
- **Video encoding for iPod,** which converts a raw DV file to an iPod-compatible MP4 file using InterVideo iVideoToGo for iPod 4.5
- **Video encoding for home use,** which encodes a wmv file from a raw DV video file using Microsoft Windows Movie Maker 2.1

As the Key Findings detail, the systems with the Intel processors ran faster and used less energy on all the tests than the system with the AMD processor.

Appendix A provides the price of the test systems, and Appendix B details their configurations.

Test results

Table 1 summarizes the performance results and energy consumption measurements of each test. Each result is the median of three runs on each system. (In the event of a tie, we chose the run with the higher energy consumption. If the energy consumption score was also tied, we then chose the first run we executed with those scores.) For these performance and energy consumption measurement tests, lower scores are better because they represent the time or the energy the system required to complete each workload.

We used the Intel Power Acquisition Recording Kit (iPARK) to gauge energy consumption. The iPARK device is an external unit that connects to a host computer through a USB cable. It also has a DC power cable that powers the system under test. We used the iPARK device to monitor the average DC energy consumption of each system while under load. We then multiplied iPARK's average DC power score by the time the workload took to complete to calculate the Workload Energy Consumption (WEC) in Watt-seconds. We divided the WEC Watt-seconds score by 3600 (the number of seconds in an hour) to calculate the WEC Watt-hours we reported below.

Because screen brightness can affect the amount of energy a system consumes, for each pair of comparison systems we set the brightness to be as close as we could make it to the brightness of the dimmer of the two systems. Consequently, each Intel Core Duo processor-based system was actually slightly brighter than its AMD Turion processor-based comparison system. The nits measurements in parentheses below each system name in Table 1 gives the brightness at which we tested each system.

In the rightmost column of each result set, we compare the median results of the systems. We calculate this comparison by dividing the AMD Turion processor-based system's score by the Intel Core Duo processor-based system's score. Consequently, comparative results above 1.00 indicate tests on which the Intel Core Duo processor-based system performed better or was more energy-efficient, and those below 1.00 indicate tests on which the AMD Turion processor-based system performed better or was more energy-efficient.

Benchmark or Test	Performance Results (seconds)			Comparative Ratings		
	OEM System A AMD Turion 64 X2 TL-52 1.6 GHz (61 nits)	OEM System B Intel Core Duo T2300E 1.66 GHz (69 nits)	OEM System C Intel Core Duo T2400 1.83 GHz (75 nits)	OEM System A AMD Turion 64 X2 TL-52 1.6 GHz (61 nits)	OEM System B Intel Core Duo T2300E 1.66 GHz (69 nits)	OEM System C Intel Core Duo T2400 1.83 GHz (75 nits)
Custom Tests						
ADC Systems ACDSee8 Photo Manager	220	203	191	1.00	1.08	1.15
Adobe Photoshop Elements 4.0	381	293	266	1.00	1.30	1.43
Apple iTunes 6.0.5	157	134	124	1.00	1.17	1.27
InterVideo iVideoToGo for iPod 4.5	85	69	61	1.00	1.23	1.39
Microsoft Windows Movie Maker 2.1	106	91	85	1.00	1.16	1.25

Table 1: Performance results and comparative performance ratings for the three test systems. For performance results, lower numbers are better. For comparative ratings, higher numbers are better.

Benchmark or Test	Energy Consumption Results (watt hours)			Comparative Ratings		
	OEM System A AMD Turion 64 X2 TL-52 1.6 GHz (61 nits)	OEM System B Intel Core Duo T2300E 1.66 GHz (69 nits)	OEM System C Intel Core Duo T2400 1.83 GHz (75 nits)	OEM System A AMD Turion 64 X2 TL-52 1.6 GHz (61 nits)	OEM System B Intel Core Duo T2300E 1.66 GHz (69 nits)	OEM System C Intel Core Duo T2400 1.83 GHz (75 nits)
Custom Tests						
ADC Systems ACDSee8 Photo Manager	2.65	1.84	1.70	1.00	1.44	1.56
Adobe Photoshop Elements 4.0	4.29	2.49	2.41	1.00	1.72	1.78
Apple iTunes 6.0.5	2.15	1.40	1.31	1.00	1.54	1.64
InterVideo iVideoToGo for iPod 4.5	1.07	0.65	0.58	1.00	1.65	1.84
Microsoft Windows Movie Maker 2.1	1.49	0.99	0.92	1.00	1.51	1.62

Table 2: Energy consumption results and comparative energy consumption ratings for the three test systems

Test methodology

Configuration differences
We purchased the built-to-order systems online. We made them as identical as possible and as close in price as possible, but we could not avoid the following differences:

- The hard drive controllers in the systems differ. Though all three are SATA 150 devices, the AMD Turion processor-based system uses the nForce 410/430 MCP controller, while the two Intel Core Duo processor-based systems use the Intel 82801GBM (ICH7-M) controller.
- The Intel Core Duo processor-based systems came with the integrated Intel GMA 950 video adapter with 128 MB of video RAM. The AMD Turion processor-based system, by contrast, came with an NVIDIA GeForce Go 6150 graphics adapter with 256 MB of video RAM.
- The prices differ. (We exclude shipping and tax charges.) The AMD Turion processor-based system cost $1,213.99, the comparison Intel Core Duo T2300E processor-based system cost $1,023.99, and the comparison Intel Core Duo T2400 processor-based system cost $1,218.99.

Initial setup
When the systems arrived, we unpacked and set up each one. We went through the following process with each mobile PC the first time we booted it:

1. Press Next at the Welcome to Microsoft Windows screen.
2. Select United States, English and U.S. keyboard. Press Next.
3. Select Eastern Time. Press Next.
4. Select Yes, I accept the Microsoft End User License Agreement. Press Next.
5. Select Not right now to automatic updates (because our goal is to test each PC as it came directly out of the box). Press Next.
6. Name each computer with its model.
7. Leave the computer description blank. Press Next.
8. Select Skip at the registration screen.

9. Enter User in the Your name field. Press Next.
10. Select Finish.
11. Select Exit at the Easy Internet Sign-up screen.
12. Select No, do not send any data and check the box that says do not show me this again at the Customer Experience Enhancements screen. Press Continue.
13. Click Start at the Easy Setup screen.
14. Uncheck the Notify me when critical product updates are available option. Press Next.
15. Press Next at the Support Tools screen.
16. Press Next at the Extended Service Plans screen.
17. Press Next at the Register screen.
18. Select the Microsoft Internet Explorer 6 option at the Select your Browser screen, and press Next.
19. Select Launch Norton Internet Security AntiSpyware Edition when I finish Easy Setup. Press Next.
20. Press Finish at the Setup Complete screen.
21. Press Next at the Norton Internet Security 2006 screen.
22. Select I accept the License Agreement, and press Next.
23. Press Next at the Subscription Status screen.
24. Press Finish at the Next Steps screen.
25. Press Next at the Welcome to LiveUpdate screen.
26. Press Finish.
27. Close the Norton Internet Security Protection Center.
28. Select No, never show this message again at the Recovery Disc Reminder. Press OK.
29. Click Cancel to the Software Updates pop-up.
30. Right-click the desktop, and select Properties.
31. Under the Screen Saver tab select None for the Screen saver, and click Apply.
32. Also under the Screen Saver tab, select the Power button.
33. Under the Power Schemes tab leave the default Portable/Laptop power scheme and select Never for all power settings.
34. Under the Hibernate tab uncheck Enable hibernation, and press OK.
35. Select Notify me again in 14 days, and uncheck Enable automatic LiveUpdate at the Norton AntiVirus Definition Alert dialog box.

We used Symantec's Ghost product to capture an exact image of the hard disk to a DVD using the internal DVD-RW drive. Each time we ran a new benchmark or test on a machine, we used the Ghost image DVD to return that machine to the above configuration. After re-imaging, we installed the software necessary to run each test and rebooted.

Before starting a test, we allowed each notebook PC's screen to warm up for at least 15 minutes. We did this by opening Microsoft Paint, pressing Ctrl-E, and setting the width and height larger than the screen resolution. We then pressed Ctrl-F to make the entire screen display a white background.

Before each test run we used a Gossen Mavolux 5032C luminance meter on the white background to try to normalize the screen brightness of all the systems. We did this because screen brightness can affect the amount of energy a system consumes. We set the brightness to be as close as we could make it to the brightness of the dimmest of the systems. Consequently, we set the AMD Turion processor-based system to approximately 61 nits and the Intel Core Duo processor-based models to 69 and 75 nits. Tables 1 and 2 show the actual screen brightness during the test of each system.

Before each run, we manually deactivated each system's wireless adapter using the external toggle button, because of the effect of the wireless adapter on energy consumption.

We rebooted before running each test.

We measured each system's energy consumption with an Intel Pentium 4 Extreme Edition 3.73 GHz host computer using the Intel Power Acquisition Recording Kit (iPARK).

We followed these steps for setting up and running iPARK:

iPARK setup and test procedure

We followed this process to set up the iPARK device and software.

1. Power off the notebook PC under test.
2. Remove the battery from the notebook PC.
3. Connect the iPARK DC power cable into the notebook PC's power port.
4. Plug both AC power cables from the iPARK device into the wall. Verify that the blue light on the Targus power brick is on.
5. Connect the iPARK USB cable to the host computer.
6. Turn on the iPARK power switch. A red light should glow on the power switch.
7. Turn on the host computer.
8. Insert the iPARK software installation CD into the host computer, and install the software as follows:
    a. Click Next at the Welcome screen.
    b. Click Yes at the Software License Agreement screen.
    c. Click Next at the Choose Destination Location screen.
    d. Click Next at the Select Program Folder screen.
    e. Uncheck View the README file and click Finish.
    f. Click OK to the Microsoft .NET Framework v1.1.x not found warning.
    g. Click Run at the next two Windows Security Warnings.
    h. Click Yes at the Microsoft .NET Framework 1.1 Setup screen.
    i. Select I agree at the license agreement and click Install.
    j. Click OK at the Installation Complete screen.
    k. Reboot the system.
    l. Insert the iPARK patch CD, and uncompress the files to the C:\iPARK directory.
    m. Select Yes To All when the installation software asks about overwriting files.
9. Calibrate the iPARK software by going to Start→All Programs→Intel Power Acquisition Recording Kit→Intel Power Acquisition Recording Kit Calibration.
10. Click OK at the PMD-1208LS (serial# 130) dialog.
11. Highlight the Bd#0-PMD-1208LS (serial# 130), and click on the Configure icon found in the menu bar.
12. Select 8 Single Ended from the no. of Channels field, and click OK.
13. Exit the iPARK calibration tool.

We followed the process below to measure energy consumption during a test.

1. Power on the notebook PC, and make sure you have prepped it to run a test.
2. Start the Intel Power Acquisition Recording Kit Logging Tool.
3. In the Name field, type a name that appropriately describes the platform and configuration. We used the following naming convention: test_processor_RunX (e.g., iTunes_CoreDuo_Run1).
4. Use the same naming convention in the Log File field (e.g., iTunes_CoreDuo_Run1).
5. Click the iPARK start button at the same time you start a test to begin logging immediately.
6. Click the iPARK Stop button at the same time you stop a test.
7. Click the Log File button to view the test log.
8. Multiply the time (in seconds) that the system took to complete the test by the Average DC Power (Watts) score. Divide this number by 3600 to calculate the Workload Energy Consumption (WEC) in Watt-Hours.

The following subsections summarize the steps we followed to obtain each of the test results in this report.

Test using ACD Systems ACDSee 8 Photo Manager

Intel provided the 200 .jpeg images this test uses. These files have the following key characteristics:

- Resolution: Range from 2000W x 3008H to 3008W x 2000H (all 300 dpi horizontal x 300 dpi vertical)
- Size: Range from 1,492KB (1,527,628 bytes) to 3,241KB (3.318,019 bytes); average size is about 2,367KB
- Bit depth: 24-bit color

We performed the following steps to run this test:

Installing ACDSee 8 Photo Manager
1. Reset the system to the base test image.
2. Install ACDSee 8 Photo Manager with its default settings.
3. Reboot the system.

Running the ACDSee 8 Photo Manager performance test
1. Launch ACDSee 8 via its desktop icon.
2. If a Quick Start Guide dialog appears, uncheck Always show when ACDSee starts, and click Close.
3. If a myACD Daily Offer dialog appears, click Close.
4. If a Catalog Files Wizard dialog appears, click Cancel.
5. The ACDSee 8 Photo Manager main interface should appear.
6. On the Folders sub-window in the upper left, navigate to the folder that contains the photo workload. The photos should appear in the middle sub-window.
7. Click in the middle sub-window that shows those photos, and press Ctrl-A to select all photos in the folder.
8. From the Tools Menu, click Tools→Adjust Image Exposure…
9. The Batch Adjust Exposure dialog will appear.
10. Make sure the following settings are selected:
    - On the Auto Exposure Tab: Auto Contrast and Color
    - On the main window: Apply settings to all selected images
11. Prepare the stopwatch.
12. Start the stopwatch, and click the Filter All Images button at the same time.
13. A Changing the Exposure of Your Files dialog will appear. It will include two progress bars that indicate the scenario's progress.
14. When ACDSee has finished the scenario, the progress bars in the dialog above will be full, and a Done button will appear at the bottom of the dialog.
15. Stop the stopwatch.
16. Record the elapsed time on the stopwatch.
17. Close the above dialog, and exit ACDSee Photo Manager.
18. Navigate to the folder with the photo workload, and delete all the edited versions of the photos that ACDSee Photo Manager created.
19. Empty the Recycle Bin.
20. Reboot the system
21. Repeat the test two more times.

We report the time, in seconds, that ACDSee 8 Photo Manager took to process the photos. Lower times indicate faster performance and so are better.

Test using Adobe Photoshop Elements 4.0
Intel provided the 103 .jpeg images this test uses. These files have the following key characteristics:

- Resolution: Range from 640W x 480H to 2048W x 1536H (all 180 dpi horizontal x 180 dpi vertical)
- Size: Range from 60KB (61,440 bytes) to 988KB (1,011,712 bytes); avg size is about 600KB
- Bit depth: 24-bit color

We performed the following steps to run this test:

Installing Adobe Photoshop Elements 4.0 and preparing for the test
1. Reset the system to the base test image.
2. Install Adobe Photoshop Elements 4.0 with its default settings.
3. Reboot the system.
4. Copy the workload to a flash drive.

Running the Adobe Photoshop Elements 4.0 performance test
1. Insert the flash drive into a USB port.
2. Adobe Photo Downloader will automatically launch.
3. Deselect the automatically fix red eyes feature in the Adobe Photo Downloader.
4. Click the Get Photos button.
5. The program automatically imports all the photos from the flash drive to the system's hard disk.
6. Adobe Photoshop Elements 4.0 launches immediately after the import completes.
7. Select all the imported pictures by pressing Ctrl-A.
8. Prepare the stopwatch.
9. Do the following three things simultaneously:
    a. Press Ctrl-Alt-M to run the Auto Smart Fix Selected Photos function.
    b. Start the stopwatch.
    c. Start the iPARK device.
10. A progress dialog will appear.
11. When Photoshop Elements has finished fixing all the photos, the progress dialog will disappear. Stop the stopwatch and the iPARK device when that happens.
12. Record the elapsed time on the stopwatch.
13. Delete all the imported pictures from the system's hard disk.
14. Empty the Recycle Bin.
15. Reboot the system.
16. Repeat the test two more times.

We report the time, in seconds, that Photoshop Elements 4.0 took to auto smart fix the images. Lower times indicate faster performance and so are better

Test using Apple iTunes 6.0.5
Intel provided the file, mixTest.wav, this test uses. The file has the following key characteristics:

- Length (hh:mm:ss): 01:09:29
- Size: 701 MB (735,557,138 bytes)

We performed the following steps to run this test:

Installing iTunes 6.0.5
1. Reset the system to the base test image.
2. Download iTunes 6.0.5 from http://www.apple.com/itunes/download/.
3. Launch the iTunes installer with setup defaults.
    a. Choose Setup Language.
    b. Click OK.
    c. Click Next at the Welcome to iTunes 6 Installer screen.
    d. Select the I accept the terms of the license agreement radio button.
    e. Click Next.
    f. Click Next at the About iTunes screen.
    g. Accept all defaults.
    h. Click Next at the Setup Type screen.
    i. Click Next at the Choose Destination Location screen.
    j. Click Next at the Born to be together screen.
    k. Click Finish at the Installation Successful screen.
4. Copy the mixTest.wav file to My Music.
5. Launch iTunes via its desktop icon.
6. Click Agree at the License Agreement.
7. Click Next at the Welcome to iTunes screen.
8. Uncheck the Add MP3 and AAC files option.
9. Uncheck the Add WMA files option, and click Next.
10. Choose No, I'll change the file and folder names myself, and click Next at the Keep iTunes Music Folder Organized screen.

11. Choose No, take me to my iTunes Library, and click Finish at the iTunes Music Store screen.
12. Under the Edit menu, select Preferences.
13. Click the Advanced tab.
14. Click the Importing tab.
15. From the drop-down menu next to Import Using, choose MP3 Encoder.
16. Uncheck Play songs while importing.
17. Uncheck Create filenames with track number.
18. Click OK.
19. Exit iTunes.
20. Reboot the system.

Running the iTunes 6.0.5 performance test
1. Launch iTunes via its desktop icon.
2. From the file menu, select Add File to Library.
3. Browse to the My Music directory, and choose the test file (mixTest.wav) to add to the library.
4. Click Open after you select the file.
5. iTunes will now show this file in its song-list pane.
6. Right-click the file, and select the option Convert Selection to MP3.
7. Start the iPARK device at the same time as the conversion process.
8. During the encoding process, iTunes shows that it is creating a new mixTest file with an Incomplete in the Time column beside that file.
9. When the converting progress bar disappears, iTunes has finished the encoding.
10. Stop the iPARK device when encoding completes.
11. Use Windows Explorer to locate the output mixTest.mp3 file in the iTunes directory within the My Music folder.
12. Right-click the file, and choose Properties.
13. Calculate the difference between the file Created and Modified times. This time is how long iTunes took to encode the file to .mp3 format.
14. Highlight the two mixTest items in the iTunes Library.
15. Right-click, and select Clear.
16. Check the box that says Do not ask me again, and click Remove.
17. Click Move to Recycle Bin.
18. Empty the Recycle Bin.
19. Repeat the test two more times.

We report the time, in seconds, that iTunes took to convert the file. The time we report is the difference of the file creation and modification times. Lower times indicate faster performance and so are better.

Test using InterVideo iVideoToGo for iPod 4.5
Intel provided the file, kitesurfing.avi, this test uses. The file has the following key characteristics:

- Length (mm:ss): 02:01
- Size: 416 MB (436,644,352 bytes)
- Video resolution: 720 x 480

We performed the following steps to run this test:

Installing the InterVideo iVideoToGo test
1. Reset the system to the base test image.
2. Download InterVideo iVideoToGo for iPod from http://www.InterVideo.com/jsp/iVideoToGo_Profile.jsp.
3. Install iVideoToGo with its default settings.
4. Copy the file kitesurfing.avi to My Videos.
5. Reboot the system.

Running the InterVideo iVideoToGo test
1. Launch iVideoToGo for iPod via its desktop icon.
2. Click the Convert File button.

3. Drag the kitesurfing.avi file from My Videos to the Source region with the label Import item(s). The main screen will appear.
4. Create a folder on the Desktop named iPod.
5. Specify the Desktop as the Target location at which iVideoToGo should store its output.
6. In the Copy as setting, select MP4-Apple iPod, and select iPod as the device.
7. Click the button with the hammer icon to open the Optional Settings dialog.
8. The General and MP4 settings should appear.
9. On the General Tab, select NTSC in the Output Video System drop-down menu.
10. Click OK.
11. Prepare the stopwatch.
12. Do the following three things simultaneously:
    a. Click the Start Copying button at the bottom right of the main screen.
    b. Start the stopwatch.
    c. Start the iPARK device.
13. The progress dialog will appear.
14. When iVideoToGo finishes the copy operation, a dialog box will appear. Stop the stopwatch and the iPARK device at the same time.
15. Record the elapsed time on the stopwatch.
16. Open the output folder, the iPod folder on the desktop, and delete the file iVideoToGo created.
17. Empty the Recycle Bin.
18. Reboot the system.
19. Repeat the test two more times.

We report the time, in seconds, that InterVideo iVideoToGo for iPod took to convert an mpeg file to an iPod-compatible MP4 file. Lower times indicate faster performance and so are better.

Test using Microsoft Windows Movie Maker 2.1

Intel provided the file, kitesurfing.avi, this test uses. The file has the following key characteristics:

- Length (mm:ss): 02:01
- Size: 416 MB (436,644,352 bytes)
- Video resolution: 720 x 480

We performed the following steps to run this test:

Setup
1. Reset the system to the base test image.
2. Copy the kitesurfing.avi to the desktop

This application is part of Windows XP Service Pack 2, so we did not need to install it.

Running the Microsoft Windows Movie Maker test
1. Launch Movie Maker by clicking the start button and going to programs → Windows Movie Maker.
2. In the Movie Maker window, click the File menu item, and select Import into Collections.
3. Navigate to the DV test file, select it, and click the OPEN button.
4. Select the DV video scenes by pressing Ctrl-A.
5. Drag those scenes to the video time line at the bottom of the screen.
6. Click the File menu item, and select Save Movie File.
7. In the Save Movie Wizard (Movie Location), select My computer, and click Next.
8. Click Next in the Saved Movie File dialog.
9. In the Movie Setting dialog, click Next and start the iPARK device at the same time.
10. The DV movie will start encoding, and a progress bar will appear in the Saving Movie dialog.
11. Windows Movie Maker has finished encoding when the progress bar disappears.
12. Stop the iPARK device when encoding is complete.
13. On the Movie Maker screen, a Completing the Save Movie Wizard dialog will appear. Uncheck the box "Play movie when I click Finish".
14. Click Finish.

15. Find the Movie.wmv output file.
16. Right-click the file, and select properties.
17. You will see a Created field and a Modified field.
18. Subtract the Created time from the Modified time to get the time Windows Movie Maker took to encode the file.
19. Delete the Movie.wmv file.
20. Select and delete all scenes in the Movie Maker window.
21. Empty the recycle bin.
22. Reboot the system.
23. Repeat the test two more times.

We report the time, in seconds, that Windows Movie Maker 2.1 took to encode a wmv file from a raw DV video file. Lower times indicate faster performance and so are better.

Appendix A – Price information

Figure 1 below presents the price information for the test systems.

System	OEM System A	OEM System B	OEM System C
Processor	AMD Turion 64 X2 Mobile TL-52	Intel Core Duo T2300E	Intel Core Duo T2400
Processor frequency	1.6 GHz	1.66 GHz	1.83 GHz
Unit price ($)	1,213.99	1,023.99	1,218.99

Figure 1: Purchase information for the three systems.

We show only the unit price here, and not the taxes or shipment fees, because of complications we encountered in placing the order. For example, due to having to replace a defective system, we had different types of shipping and thus different shipping costs. We felt the unit price was the fairest basis for comparison.

Appendix B – Test system configuration information

This appendix provides detailed configuration information about each of the test mobile PCs, which we list in alphabetical order.

System	OEM System A	OEM System B	OEM System C
General			
Processor and OS kernel: (physical, core, logical) / (UP, MP)	1P2C2L / MP	1P2C2L / MP	1P2C2L / MP
Number of physical processors	1	1	1
Single/Dual Core processors	Dual	Dual	Dual
System power management policy	Windows Power Management-Portable / Laptop	Windows Power Management-Portable / Laptop	Windows Power Management-Portable / Laptop
Processor power-saving option	AMD PowerNow! Technology	Enhanced Intel SpeedStep Technology	Enhanced Intel SpeedStep Technology
System dimensions (length x width x height)	13" x 9 ½" x 2 3/8"	13" x 9 ½" x 2 3/8"	13" x 9 ½" x 2 3/8"
System weight	6 lbs.	6 lbs.	6 lbs.
CPU			
Vendor	AMD	Intel	Intel
Name	Turion 64 X2 Mobile	Core Duo	Core Duo
Model number	TL-52	T2300E	T2400
Stepping	2	8	8
Socket type and number of pins	Socket S1g1	mPGA-479M	mPGA-479M
Core frequency (GHz)	1.6	1.66	1.83
Front-side bus frequency	1600MHz HyperTransport technology	667MHz	667MHz
L1 Cache	64 KB + 64 KB	32 KB + 32 KB	32 KB + 32 KB
L2 Cache	1 MB (512 KB per core)	2 MB (Shared)	2 MB (Shared)
Platform			
Motherboard model number	HP 30B5	HP 30B2	HP 30B2
Motherboard chipset	NVIDIA GeForce 6150	Intel i945GM	Intel i945GM
Motherboard revision number	A2	03	03
System/motherboard serial number	2CE6250L2R	2CE62901XB	2CE6250L3R
Bios name and version	Phoenix F.06	Phoenix F.0B	Phoenix F.09
BIOS settings	Setup default	Setup default	Setup default
Memory module(s)			
Vendor and model number	Samsung M470T6554CZ3-CD5	Samsung M470T6554CZ3-CD5	Samsung M470T6554CZ3-CD5
Type	PC2-4200	PC2-4200	PC2-4200
Speed (MHz)	533	533	533
Speed running in the system (MHz)	266	266	266
Timing/Latency (tCL-tRCD-tRP-tRASmin)	4-4-4-11	4-4-4-11	4-4-4-11

Size	1024 MB	1024 MB	1024 MB
Number of memory module(s)	2 x 512 MB	2 x 512 MB	2 x 512 MB
Chip organization (Single-sided, Double-sided)	Double-sided	Double-sided	Double-sided
Channel (Single/Dual)	Dual	Dual	Dual
Hard disk			
Vendor and model number	Hitachi HTS541080G9SA00	Fujitsu MHV2080BH PL	Hitachi HTS541080G9SA00
Size	80 GB	80 GB	80 GB
Buffer Size	8 MB	8 MB	8 MB
RPM	5400	5400	5400
Type	SATA 150 Mb/s	SATA 150 Mb/s	SATA 150 Mb/s
Controller	nForce 410/430 MCP	Intel 82801GHM (ICH7-M)	Intel 82801GHM (ICH7-M)
Driver	NVIDIA 5.10.2600.650	Intel 5.5.0.1035	Intel 5.5.0.1035
Operating system			
Name	Windows XP Home	Windows XP Home	Windows XP Home
Build number	2600	2600	2600
Service pack	2	2	2
File system	NTFS	NTFS	NTFS
Kernel	ACPI Multiprocessor PC	ACPI Multiprocessor PC	ACPI Multiprocessor PC
Language	English	English	English
Microsoft DirectX version	DirectX 9.0c	DirectX 9.0c	DirectX 9.0c
Graphics			
Vendor and model number	NVIDIA GeForce Go 6150	Intel Mobile 945GM Express Chipset Family	Intel Mobile 945GM Express Chipset Family
Type (P=PCI Express, A=AGP 8X, I=Integrated)	I	I	I
Chipset	GeForce Go 6150	Intel GMA 950	Intel GMA 950
BIOS version	5.51.28.39.30	1313	1313
Memory size	256 MB	128 MB	128 MB
Resolution	1280 x 800 x 32-bit color (60Hz)	1280 x 800 x 32-bit color (60Hz)	1280 x 800 x 32-bit color (60Hz)
Driver	NVIDIA 8.4.6.1	Intel 6.14.10.4543	Intel 6.14.10.4543
Sound card/subsystem			
Vendor and model number	Conexant High Definition Audio	Conexant High Definition Audio	Conexant High Definition Audio
Driver	Conexant 3.21.0.0	Conexant 3.21.0.0	Conexant 3.21.0.0
Ethernet			
Vendor and model number	NVIDIA nForce Networking Controller	Intel PRO/100 VE	Intel PRO/100 VE
Driver	NVIDIA 50.2.4.0	Intel 8.0.19.0	Intel 8.0.19.0
Wireless			
Vendor and model number	Broadcom 802.11a/b/g WLAN	Intel Pro/Wireless 3945ABG	Intel Pro/Wireless 3945ABG
Driver	Broadcom 4.10.40.1	Intel 10.1.0.15	Intel 10.1.0.15
Modem			
Vendor and model number	HDAUDIO Soft Data Fax Modem with SmartCP	HDAUDIO Soft Data Fax Modem with SmartCP	HDAUDIO Soft Data Fax Modem with SmartCP
Driver	CXT 7.47.0.50	CXT 7.33.0.52	CXT 7.33.0.52

Optical drive(s)			
Vendor and model number	Philips SCB5265	Philips SCB5265	Philips SCB5265
Type (CD-ROM, CD-RW, DVD-ROM, DVD-W)	CD-RW/DVD-ROM	CD-RW/DVD-ROM	CD-RW/DVD-ROM
USB ports			
Number	3	3	3
Type	USB 2.0	USB 2.0	USB 2.0
Other	Ricoh SD/MS/Pro/MMC/xD Card Reader	Ricoh SD/MS/Pro/MMC/xD Card Reader	Ricoh SD/MS/Pro/MMC/xD Card Reader
IEEE 1394 ports			
Number	1	1	1
Monitor			
LCD type	WXGA	WXGA	WXGA
Screen size	14.1”	14.1”	14.1”
Battery			
Type	HP HSTNN-IB32 Lithium-Ion	HP HSTNN-IB32 Lithium-Ion	HP HSTNN-IB32 Lithium-Ion
Size (length x width x height)	8” x 2 1/4” x 1 5/8”	8” x 2 1/4” x 1 5/8”	8” x 2 1/4” x 1 5/8”
Rated capacity	8800mAh / 10.8V (95Wh)	8800mAh / 10.8V (95Wh)	8800mAh / 10.8V (95Wh)
Weight	1 lb. 6 oz.	1 lb. 6 oz.	1 lb. 6 oz.

Figure 2: Detailed system configuration information for the three test notebook PCs.

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