ATI Radeon™ HD 3450

High Definition HTPC for the masses

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Introduction

High Definition (HD) content is gaining in popularity, driven by the increasing availability and affordability of HD-capable televisions, new releases of movies on HD media (Blu-ray^TM & HD DVD) and a desire by consumers for a more immersive entertainment experience.

It may be possible for consumers to upgrade their current PCs by adding new HD DVD and/or Blu-ray^TM optical drives; however, the remaining PC components might lack the required processing capabilities for fully featured and smooth HD content playback. HD content presents many challenges, including:

- Large quantities of data processing

    o up to six times the rendering required of standard-definition content

    o it is also memory bandwidth intensive

- Computational complexity of algorithms for decode (i.e. CABAC) and processing (i.e. advanced de-interlacing)

- High power consumption levels as PC resources run intensively to decode HD content, which can reduce battery life on notebooks and increase noise levels caused by the fans of the system running to dissipate heat

    o This is not ideal in a home theater scenario

- HDCP and content protection mechanisms included on most HD media by content providers (movies studios, cable providers…). If these requirements are not supported properly, consumers may encounter issues to playback HD protected content on their PCs.

In the past, the ATI Radeon™ X1000 series of graphics processors from AMD sought to overcome these challenges by harnessing the GPU processing power hardware to assist in the video decoding process. This innovation moved the major part of the video decoding off the CPU, while taking advantage of the GPU graphics power for post processing routines designed to enhance the image quality.

AMD continued its efforts to deliver an exceptional home entertainment experience for consumers with the ATI Radeon™ HD 2000 series. These products leveraged ATI's Avivo™ HD technology to provide a comprehensive solution to the challenges of HD playback.[1] These features have been further enhanced with the ATI Radeon™ HD 3000 series.

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[1] Not all ATI Avivo HD features may be available on all models.

Unified Video Decoder (UVD)

To enable the largest number of consumers to playback HD content on their PCs, from thin notebooks to entry-level PCs, AMD introduced the Unified Video Decoder, or UVD. Initially featured on the ATI Radeon™ HD 2400 series, ATI Radeon™ HD 2600 series, ATI Mobility Radeon ™ HD 2300, ATI Mobility Radeon ™ HD 2400 and the ATI Mobility Radeon ™ HD 2400 XT, UVD is a dedicated video decoding block that facilitates the full, bit accurate, decoding process of VC-1 or H.264/AVC encoded video. The entire range of ATI Radeon™ HD 3000 series desktop GPUs now feature UVD with further processing improvements.

By utilizing dedicated hardware for the decoding of VC-1 and H.264 encoded video, the CPU is alleviated from the decoding process and the graphics pipeline and CPU cycles are freed up. The decreased drain on system power is particularly beneficial in notebooks, where HD playback processing on the GPU places a lesser burden on the battery life. Less overall heat is produced, resulting in a quieter system as fans are not required to spin as fast and move as much air to dissipate the heat.

Processing of HD video requires large amounts of memory bandwidth. The initial implementation of UVD on the ATI Radeon™ HD 2000 series had restrictions dependant on the available memory bandwidth on a given board. The net result was, at launch, the lowest bandwidth ATI Radeon™ HD 2400 PRO solutions targeted playback of all HD content at 720p pixel resolutions. If the desktop resolution was set any higher than 720p, then HD video decoding would fall-back to software in order to save GPU bandwidth.

Subsequent Catalyst™ software updates have improved the situation such that VC-1 and H.264 content encoded in 1080p will play back using UVD at desktop resolutions as high as 1920x1200 (higher than 1080p), however 1080i VC-1 and H.264/AVC as well as HD MPEG-2 content still fall-back to fully software based decoding.

The ATI Radeon™ HD 3000 series of graphics processors features improvements to the UVD engine that both reduce CPU utilization under HD decode and also improve memory bandwidth utilization in order to maintain hardware HD decoding at higher resolutions. The net result is that even the DDR2 equipped ATI Radeon™ HD 3450 will facilitate hardware decoding of 1080p and 1080i VC-1 and H.264/AVC encoded content at 1920x1200 / 1080p desktop resolutions.

HDCP Support

The advent of new HD optical discs, such as Blu-ray™ and HD DVD, as well as digital cable on PCs, mandates certain requirements to playback protected content at HD resolutions. Certain technology licensing specifications mandate that these new technologies comply with content protection mechanisms. In particular, when stored on Blu-ray™ and HD-DVD discs, protected content may only be displayed at HD resolutions if HDCP is supported on **both the PC and the monitor**.

The ATI Radeon™ HD 2000 series and ATI Radeon™ HD 3000 series are designed with a comprehensive approach to provide exceptional quality video playback for HD content and carefree HDCP support[2] for easy playback of protected HD content from Blu-ray™ and HD DVD. The ATI Radeon™ HD 2000 series and ATI Radeon™ HD 3000 series supports HDCP on all DVI (single-link or dual-link), HDMI and DisplayPort interfaces, up to the maximum desktop resolution supported by that interface.

HDMI & Audio Support on the ATI Radeon™ HD 3000 Series

To be compliant with Windows Vista® Premium logo requirements, a system with enabled HDMI output must include two distinct audio sources – one main system source and one for HDMI output. Like the ATI Radeon™ HD 2000 series, the ATI Radeon™ HD 3000 series provides a comprehensive approach to ensure audio support for HDMI by including an HD-audio controller on the ASIC, creating a protected audio path separate from the system's audio, compliant with Windows Vista Premium requirements and without any additional connection or cable.

Combined with the ATI Radeon™ DVI-to-HDMI adapter, ATI Radeon™ HD 2000 series and ATI Radeon™ HD 3000 series[3] solutions enable end users to get full video and audio support via standard DVI for easy connectivity and a superior HD experience. Current DVI-to-HDMI connectors do not carry audio, thus do not enable HDMI. ATI Radeon™ adapters handshake with the board to enable audio via the DVI port; when the adapter is connected to the output of an ATI Radeon™ HD 2000 series or ATI Radeon™ HD 3000 series solution, it can provide seamless HDMI output.

ATI Radeon™ HD 2000 series and ATI Radeon™ HD 3000 series products support home theater audio formats such as Dolby Digital and DTS enabling an immersive multi-channel surround sound audio experience when playing back Blu-ray™ or HD DVD discs (when connecting to an HDMI receiver).

ATI Radeon™ HD 2000 series and ATI Radeon™ HD 3000 series innovate with the support of HDMI, bringing several benefits to the end user:

- 'Plug-n-play' HDMI solution

- Full audio experience, preserving the system's digital (S/PDIF or optical) sound output while also providing full HDMI audio output

- Flexibility through seamless support of different interfaces using ATI Radeon™ DVI-to-HDMI adapter when needed

- Immersive home theater audio with multi-channel digital surround sound support

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[2] Playing HDCP content requires additional HDCP ready components, including but not limited to an HDCP ready monitor, disc drive, multimedia application and computer operating system. While ATI Radeon™ HD 2000 series and ATI Radeon™ HD 3000 series ASICs have with HDCP keys integrated, AMD's add-in board manufacturers may choose not to enable HDCP on their specific ATI Radeon™ HD 2000 and ATI Radeon™ HD 3000 based products.
[3] Not yet available on AGP

Summary

The emergence and popularity of HD has created high expectations from consumers looking for a unique and immersive video experience, and this includes consumers choosing to use a PC as the hub of their entertainment center. But as a relatively new technology, HD brings new challenges related to the large quantity of data needed to be processed in HD, as well as its computational complexity, power consumption and need for content protection.

GPUs can play a critical role in providing consumers with a high quality and seamless HD playback experience. Unfortunately, many of the current graphics solutions on the market do not provide the performance for full-quality HD playback, and in some cases, lack the proper support for HDCP, audio and HDMI output preventing end users from fully enjoying the complete HD experience.

With ATI's Avivo™ HD and its unique video playback technologies such as UVD and advanced image post processing, a comprehensive approach to HDCP requirements and seamless support for audio and HDMI interfaces, the ATI Radeon™ HD 3000 series address HD playback challenges for The Ultimate Visual Experience™ for HD.

Video Benchmarking Checklist

Here is a list of hardware and software tools AMD recommends you use to evaluate a graphics card's video playback capabilities:

- ✓ Test system with Windows® XP or Windows Vista® (32-bit or 64-bit) operating system

- ✓ HDCP compliant monitor or HDTV with native resolution of at least 1920x1080

- ✓ DVD Optical Drive

- ✓ HD DVD Optical Drive

- ✓ Blu-ray^{TM} Optical Drive

- ✓ System monitoring software such as Windows® Reliability and Performance Monitor

- ✓ Playback software such as CyberLink PowerDVD

- ✓ Silicon Optix HQV and HD HQV Benchmarks

- ✓ HD DVD and Blu-ray^{TM} discs

- ✓ Power Analyzer

How To Evaluate Video Playback Performance

While video image quality is paramount in choosing the right solution, playback performance is of equal importance. This applies especially to PCs that are set up as media centers where multi-tasking is a necessity.

Here are some guidelines on how to properly measure video playback performance:

Step 1: Make sure that there aren't any unnecessary tasks running in the background. End all unnecessary tasks using Windows Task Manager.

Step 2: Set the desktop resolution to 1080P (1920x1080) through Windows Display Settings.

Step 3: Launch Window's performance monitor by pressing
Window key + r and typing "perfmon" in box. Alternatively, you can create a shortcut to this application located in the "C:\Windows\System32\perfmon.exe" folder.

Step 4: Once Windows' Reliability and Performance Monitor application launches, configure it to record CPU activity for at least 120 seconds (2 minutes). You can do so by first activating the **Performance Monitor** window:
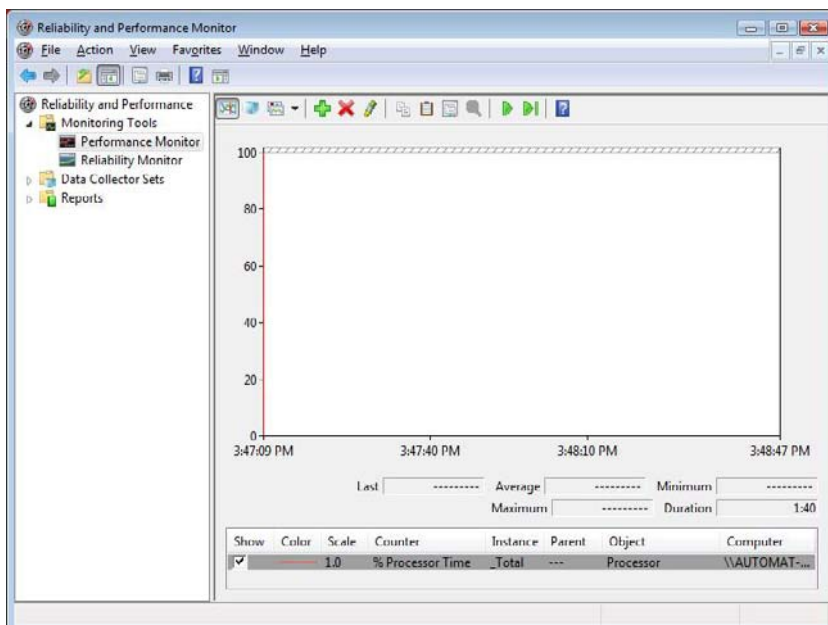

Proceed to the **Action → Properties** menu where you can change the duration and frequency of the CPU activity logger to the amount of time you plan to test each scene/clip in a movie:

AMD believes that 120 seconds of playback is sufficient for obtaining an accurate measurement of CPU utilization for video playback. AMD recommends that you test

scenes with high bit-rate to evaluate how the system will perform under heavy workload from decoding video streams.

Step 5: Launch your software player of choice and make sure that hardware acceleration is enabled for each test. You can enable and disable hardware acceleration by going to the **Configuration → Video** menu:
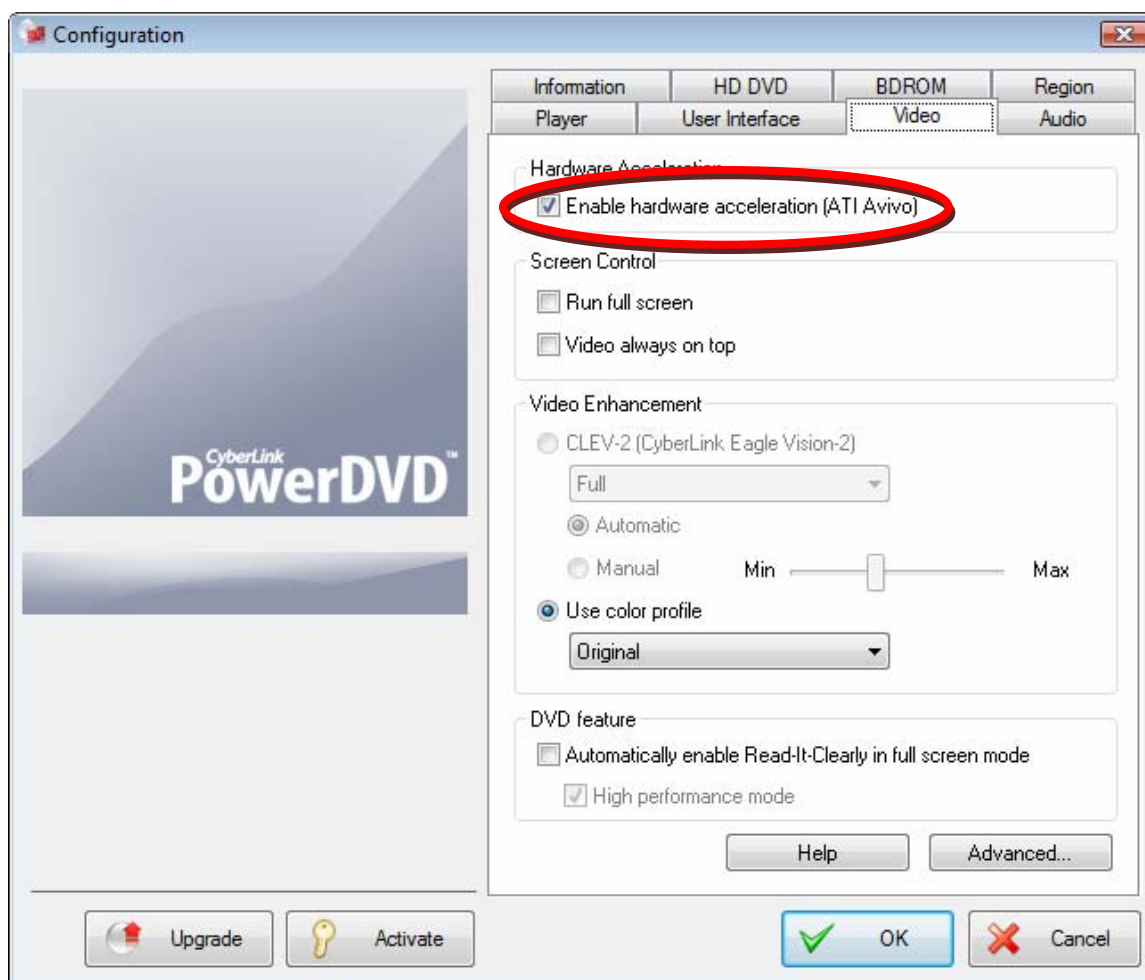
Step 6: Start the movie and navigate to the scene that you want to use for your testing. Right before the scene begins, switch to the Reliability and Performance Monitor window (by pressing **alt-tab**) and start the CPU utilization logger by pressing the "unfreeze display" button or by pressing **ctrl-f**. Return to the movie by choosing the Cyberlink window from the task bar or by pressing **alt-tab** again.

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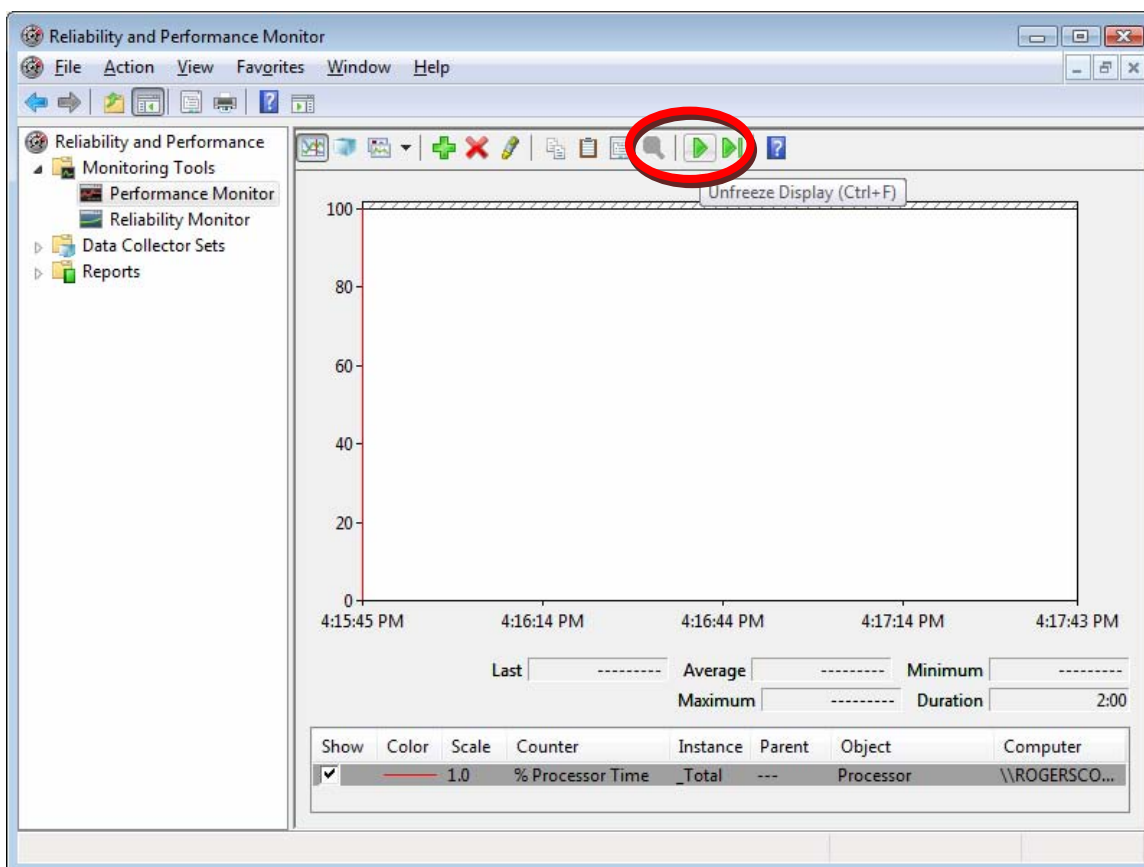
Step 7: After watching the movie for the amount of time you set in the Performance Monitor, **alt-tab** to the Performance Monitor and press the Freeze Display button. You can obtain the average CPU utilization in the information box near the bottom of the window.

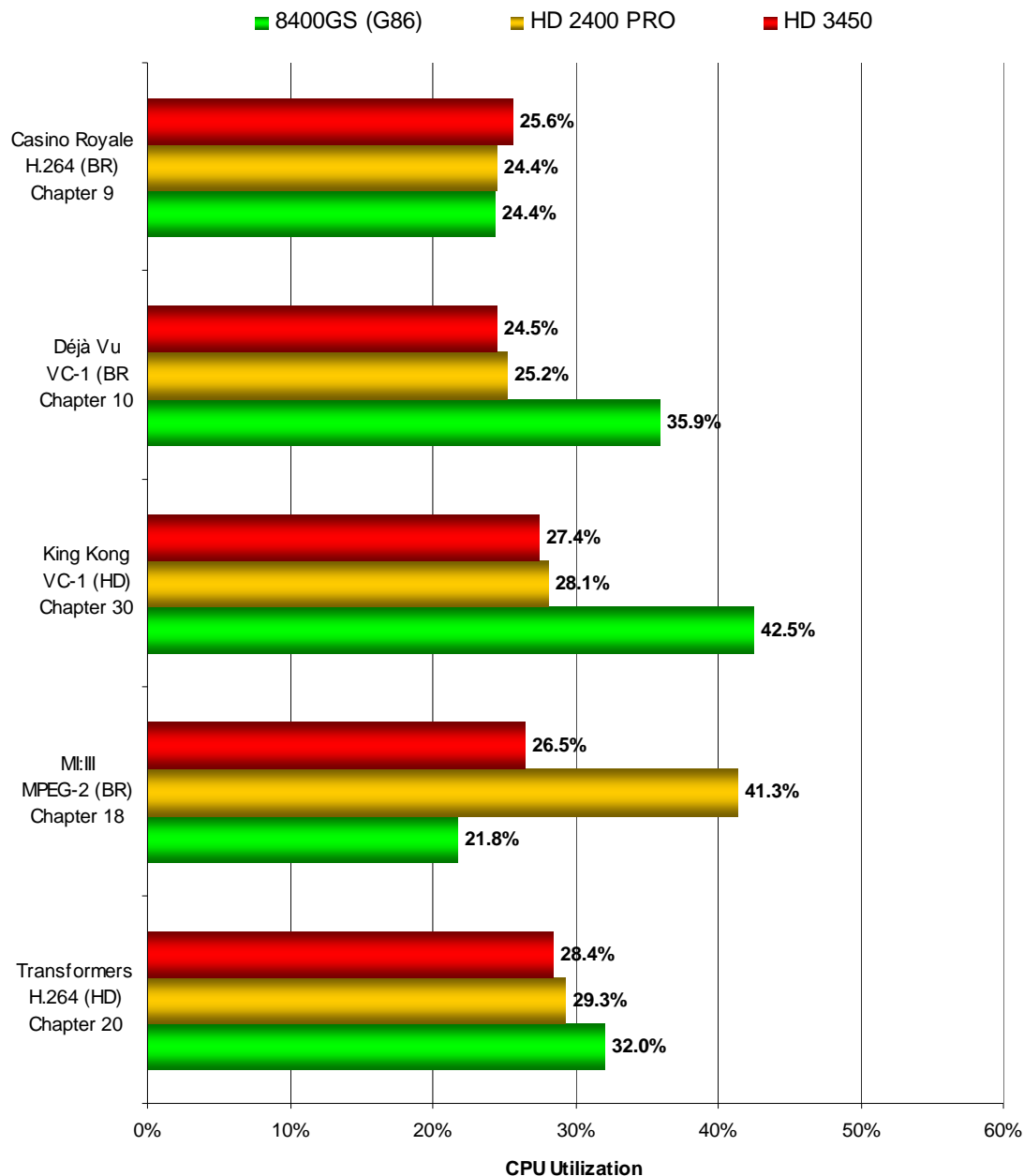*ATI Radeon™ HD 3450 - Video Review Guide*   *12*
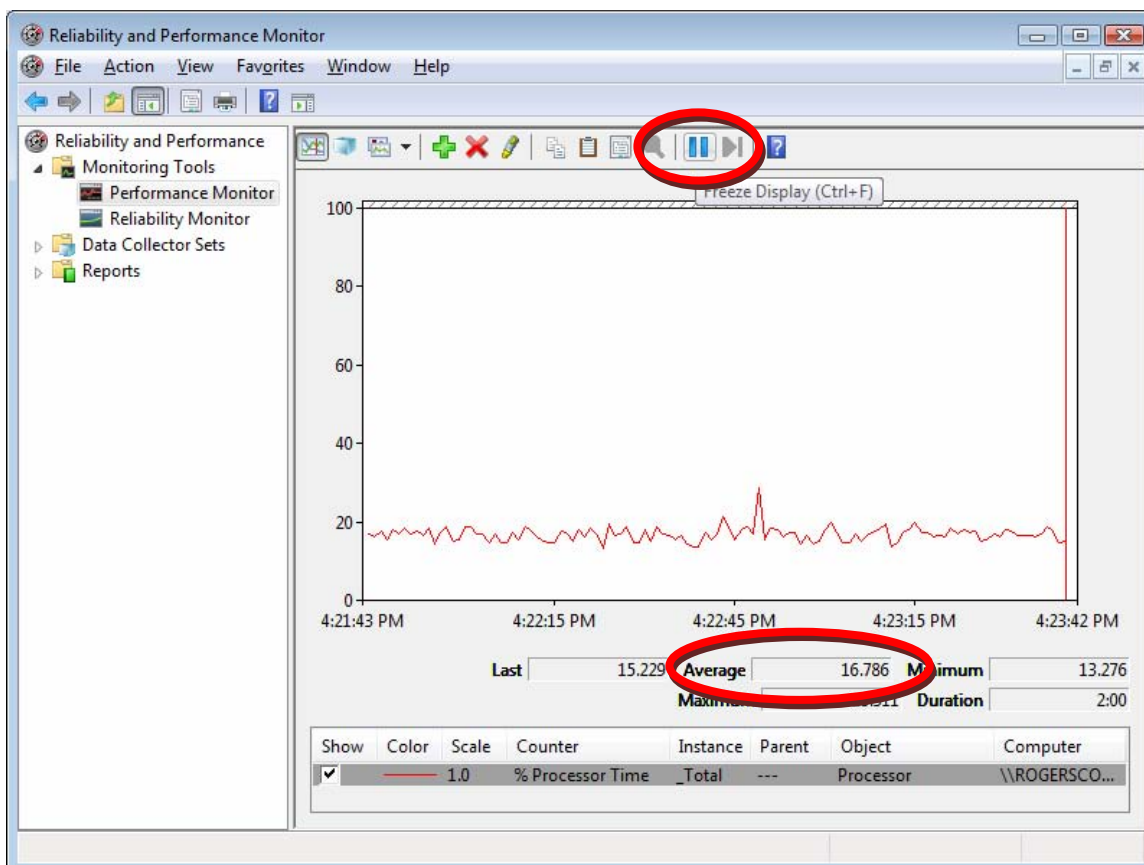
Video Playback Performance

In the following section, AMD has provided sample CPU utilization measurements during video playback of several high definition movies. Please use these scores as reference to verify that your platform is performing as expected.

Here are the exact specifications of the platform AMD used for its testing:

PLATFORM	Radeon System	GeForce System
CPU	AMD Athlon™ 64 X2 3800+ (2.0 GHz)	
Chipset	690G	
Motherboard	Gigabyte GA-MA69GM-S2H	
Memory	2 x 1024MB of 800MHz DDR2 (5-5-5-12)	
Operating System	Windows Vista® 64-bit Ultimate Edition	
Graphics Cards	ATI Radeon™ HD 3450 ATI Radeon™ HD 2400 PRO	GeForce™ 8400 GS (G86)
Playback Software	Cyberlink PowerDVD Ultra (ver. 3509)	
Optical Drive	LG GGC-H20L Super Multi Blue Blue-ray Disc & HD DVD-ROM	
Display Device	Dell 2407FPW 24″ LCD	
GPU Drivers	ATI Catalyst™ 8.1 (8.45)	Forceware 169.12 (Beta)
Date of Testing	December 12, 2007	

1080p Video Content Playback Performance
1920x1200

Legend: ■ 8400GS (G86) ■ HD 2400 PRO ■ HD 3450

Casino Royale H.264 (BR) Chapter 9
- HD 3450: 25.6%
- HD 2400 PRO: 24.4%
- 8400GS (G86): 24.4%

Déjà Vu VC-1 (BR Chapter 10
- HD 3450: 24.5%
- HD 2400 PRO: 25.2%
- 8400GS (G86): 35.9%

King Kong VC-1 (HD) Chapter 30
- HD 3450: 27.4%
- HD 2400 PRO: 28.1%
- 8400GS (G86): 42.5%

MI:III MPEG-2 (BR) Chapter 18
- HD 3450: 26.5%
- HD 2400 PRO: 41.3%
- 8400GS (G86): 21.8%

Transformers H.264 (HD) Chapter 20
- HD 3450: 28.4%
- HD 2400 PRO: 29.3%
- 8400GS (G86): 32.0%

X-axis: CPU Utilization (0% – 60%)

* Lower is Better ** BR = Blu-Ray *** HD = HD-DVD

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As noted previously 1080i VC-1 and H.264/AVC as well as HD MPEG-2 content still fall-back to fully software based decoding on the ATI Radeon™ HD 2400 PRO whereas the ATI Radeon™ HD 3450 can provide lower CPU utilization with hardware accelerated decoding

1080i Video Content Playback Performance
1920x1200

■ 8400GS (G86)　　□ HD 2400 PRO　　■ HD 3450

Content	8400GS (G86)	HD 2400 PRO	HD 3450
Sabra Super Extra VC-1 (HD) Title 4	41.2%	57.7%	22.0%
NIN VC-1 (BR) Chapter 17	46.5%	86.5%	37.0%
Yozakura H.264 (HD) Chapter 11	26.6%	97.0%	22.6%

CPU Utilization
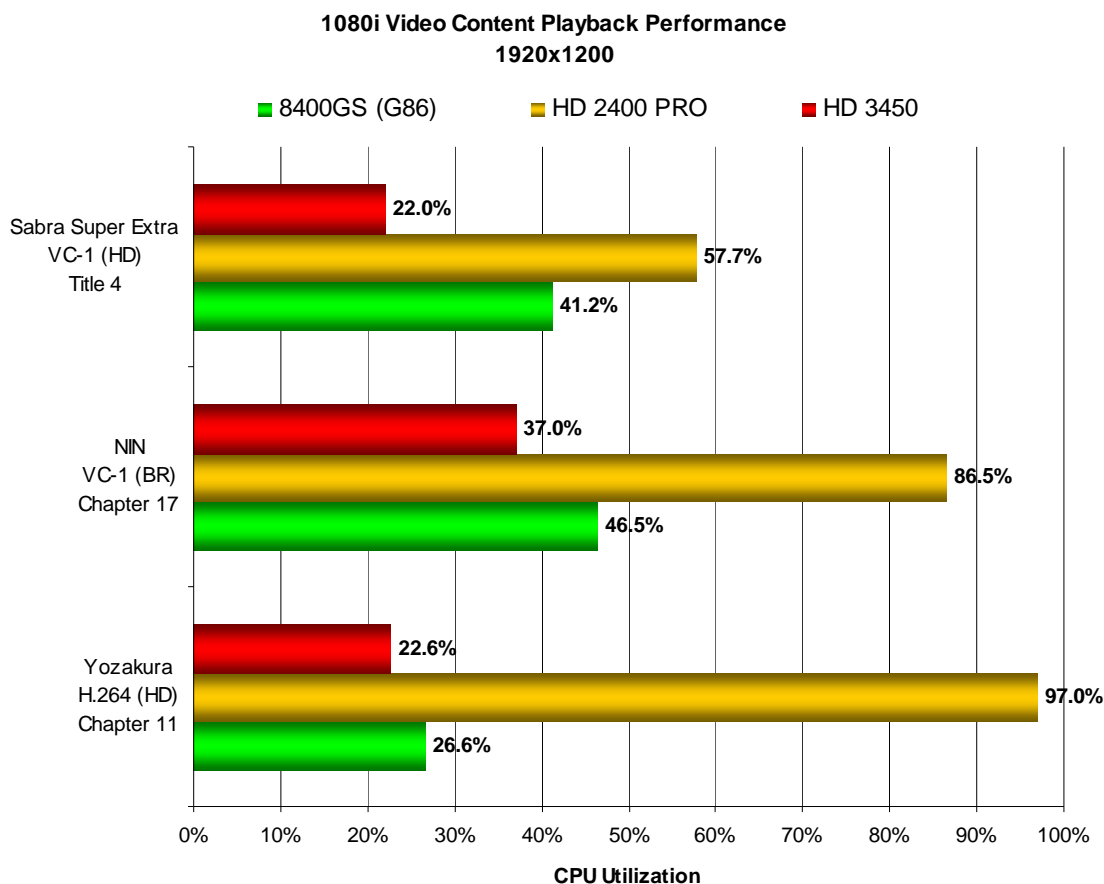
* Lower is Better ** BR = Blu-Ray *** HD = HD-DVD

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Appendix A: ATI Radeon™ HD 3450 based HTPC

This is an overview of the cost of a home theater PC (HTPC) based on ATI Radeon™ HD 3450, enabling both Blu-ray Disc and HD DVD formats.

	PRDOUCT	MSRP	Retail URL
GPU	ATI Radeon™ HD 3450	$59.00 *	
CPU	AMD Athlon™ X2 BE-2400 Brisbane 2.3GHz	$99.99	Newegg
Memory	CORSAIR 2GB DDR2 SDRAM 800MHz	$67.00	Newegg
Motherboard	GIGABYTE GA-MA69GM-S2H	$79.99	Newegg
PC Case	Antec Minuet 300	$79.99	Newegg
Hard drive	Seagate Barracuda 7200.10 160GB	$70.87	NCIX
Optical Drive	LG BD/HD DVD GGC-H20L	$279.99	NCIX
		TOTAL	**$736.83**

Retail prices (URLs) as of December 18th 2007
* Suggested retail price. Product available in retail on January 23rd 2008

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