

Wrath of the Wind God

AOpen Aeolus 6600GT 128MB GDDR3 Unleashed

Foreword

The AOpen name requires no introduction to the DIY crowd thanks to the company's rich product lines covering motherboards, video cards, optical storage, TV tuner cards, sounds cards, display devices, pointing devices, network gear, barebone systems, notebooks, and speaker systems.

A PC system must consist of the CPU, hard drive, and memory; which, as we all know, are components produced by only a select few manufacturers. For everything else - the other components needed to build a complete PC system – they can be found readily available from the AOpen product range.

In the video card realm, AOpen maintains a close working relationship with NVIDIA. The company produces a complete line of NVIDIA video card products, ranging from the GeForce FX 5200 to the newest and strongest GeForce 7800 GTX. With this, AOpen has a video card product for just about any type of application. Now with the GeForce 6 series era fully upon us, AOpen has done its homework and has successfully delivered a full compliment of GeForce 6 series products, including the Aeolus 6600GT 128MB GDDR3 (based on the GeForce 6600 GT, a key NVIDIA GPU offering) covered here.



“Aeolus” is the Greek word for the God of the Winds. AOpen has taken the word Aeolus and has expanded on it; using it as the acronym for Absolute, Extreme, Optimize, Luxury, Ultimate, and Satisfied. These represent AOpen's ideals when creating the video card –ideals the manufacturer believes will provide total user satisfaction. And how does the Aeolus perform? Let's find out!

The GeForce 6600 GT is a mega-popular choice in the mid-range market. The GPU represents NVIDIA's earliest PCI Express effort and is fabbed using the 110nm process. Internally, there are 8 pixel pipelines 3 vertex shaders, and 146million transistors. Compared to the 130nm process, 16 pixel pipeline, 6

vertex shader, and 222million transistor GeForce 6800 Ultra, the reduced transistor count and process technology significantly decreases power consumption and improves thermal performance to allow core frequency to breach the 500MHz mark, which is far higher than the 400MHz core frequency of the GeForce 6800 Ultra. This improved thermal performance allows the GeForce 6600 GT to sport a smaller cooling system with reduced operating noise and therefore increased user enjoyment.

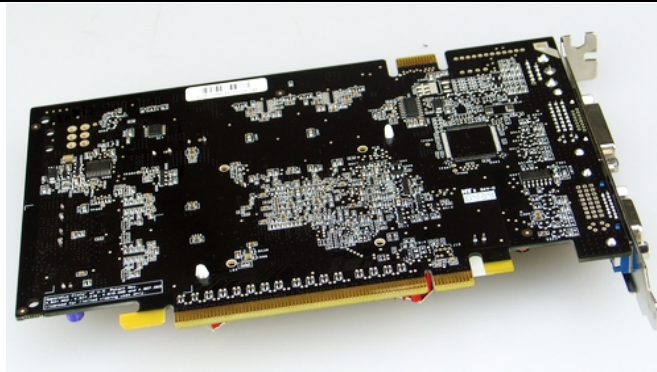
In terms of video memory, this card is equipped with GDDR3 modules good for a theoretical maximum of 1GHz. It will also be sufficiently powered by the PCI Express graphics interface and has no requirement for an auxiliary power connection.

AOpen Aeolus 6600GT Intro

The AOpen Aeolus 6600GT 128MB GDDR3 adopts a cool black NVIDIA P216 PCB. In terms of quality, it is completely rulebook. What makes it special is the custom cooler design; the cover of which sports the Aeolus logo. And although the FBGA packaged GDDR3 modules do not require cooling for stable operation, AOpen has added 4 bronze-colored aluminum alloy (same material as the core cooler) heatspreaders just in case. This no doubt will improve the stability and safety of the video card further.



AOpen Aeolus 6600GT



Rear of the AOpen Aeolus 6600GT

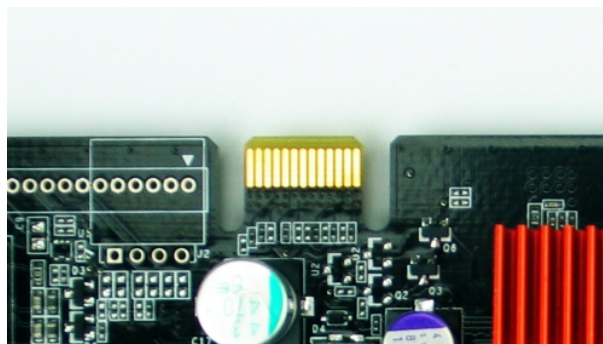
2.0ns Samsung GDDR3 memory is commonly found on GeForce 6600GT video cards. There are 4 for 128MB total memory capacity and a 128-bit memory interface.



Samsung K4J55323QF-GC20 memory module

Most of the capacitors installed along the power supply area come from popular Japanese manufacturer Sanyo. Quality is very good.

The PCIe version GeForce 6600 GT card features SLI support made possible by a set of gold finger connectors. This allows two identical GeForce 6600 GT cards to operate in SLI mode for performance that is substantially superior to the single card setup.



SLI gold finger connectors

In terms of connectivity the AOpen Aeolus 6600GT 128MB GDDR3 provides the mainstream combination of 1 analog D-Sub port, an S-Video out port (9-pin, supports component output), and a digital DVI-I port.



L to R: S-Video out, DVI-I, and D-Sub ports

Package and Accessories

The medium-sized package sports the Aeolus logo. HDTV support is stated right on the box.



Aeolus 6600GT package

A rich set of accessories come in the box, including a user manual, warrantee card, quick installation guide, full versions of Spell Force (2 CDs) and ARX Fatal (1 CD) games, a 5-in-1 combo game disc, driver disc, DVI to D-Sub adapter, and a modular block connector supporting RCA, S-Video, and component output (supports HDTV) .



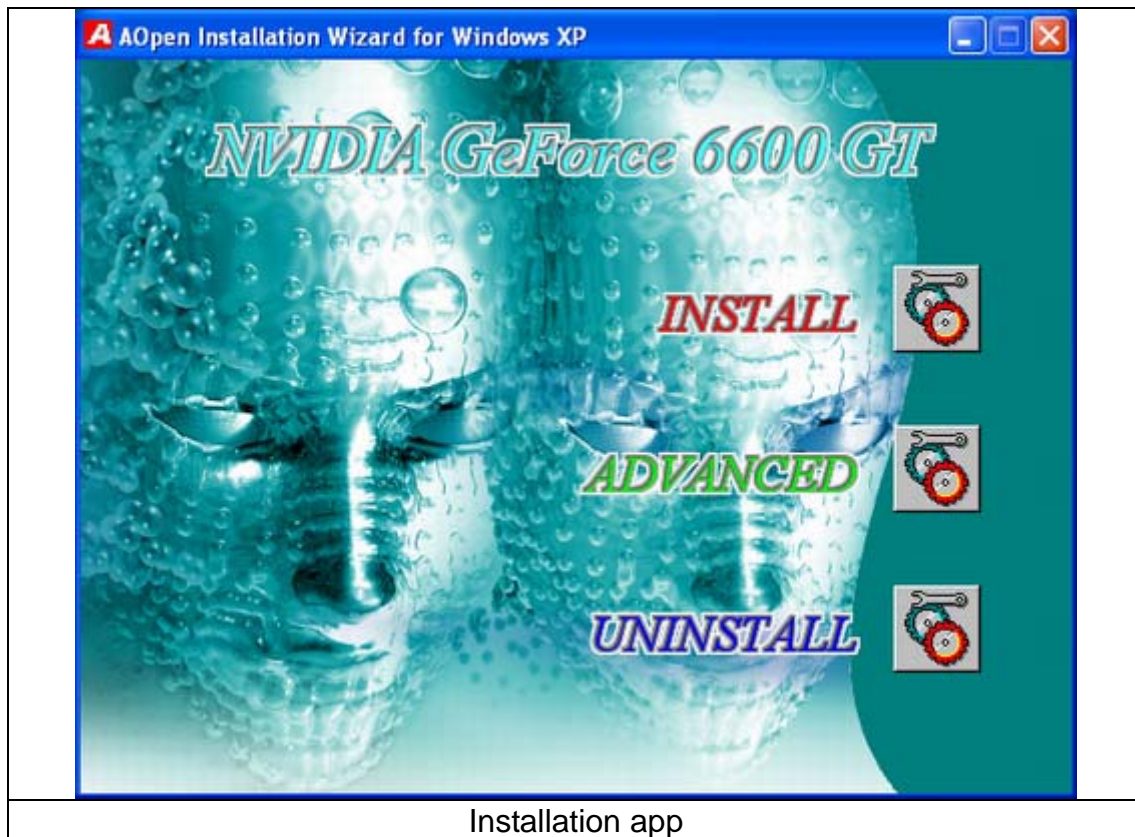
User manual (left), warrantee card (right upper), quick installation guide (right lower)



Top: Game and installation discs
Below: DVI to D-Sub adapter, HDTV-supporting modular block connector

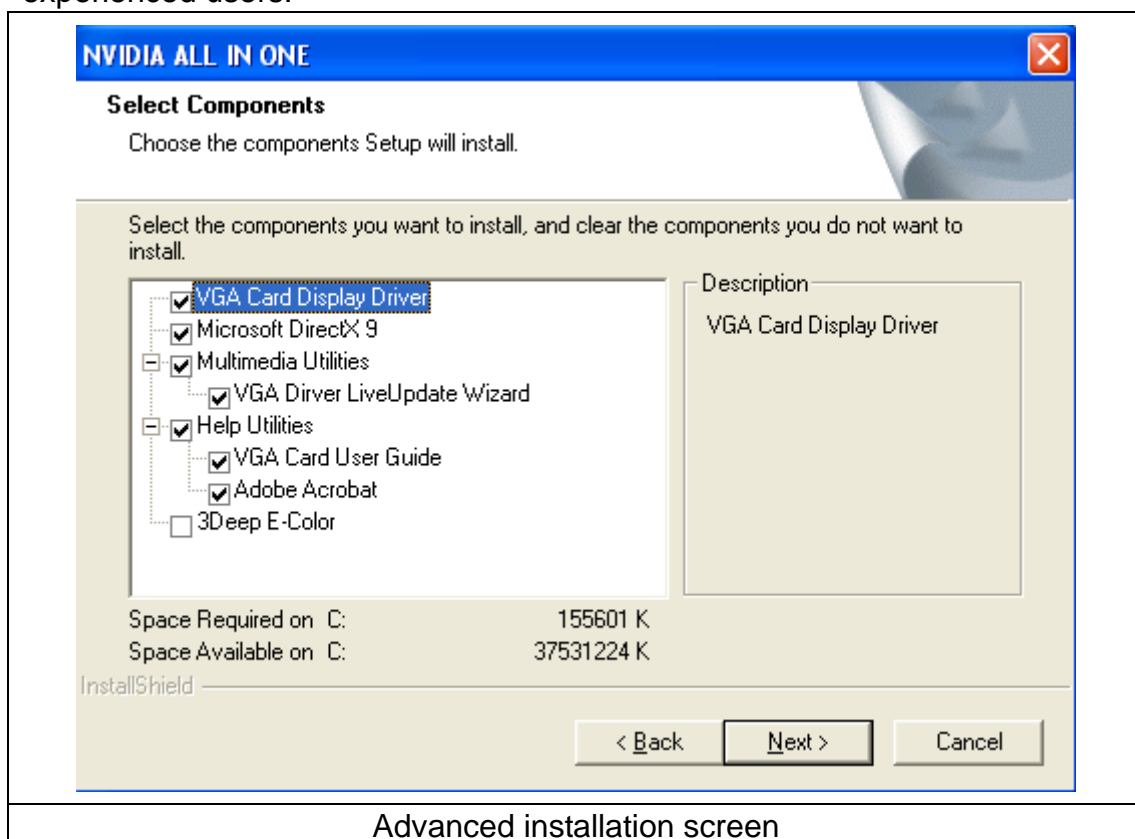
Installation and Specifications

The AOpen Aeolus 6600 GT installation app is quite simple and easy to use with options only for installation, advanced installation, and uninstall. The first option is for quick installation of the required drivers and software and is perfect for beginners.



Installation app

The advanced option allows the user to see the list of software components to be installed, and to select them as the user sees fit. This is more suited for experienced users.



Advanced installation screen

Test Configuration

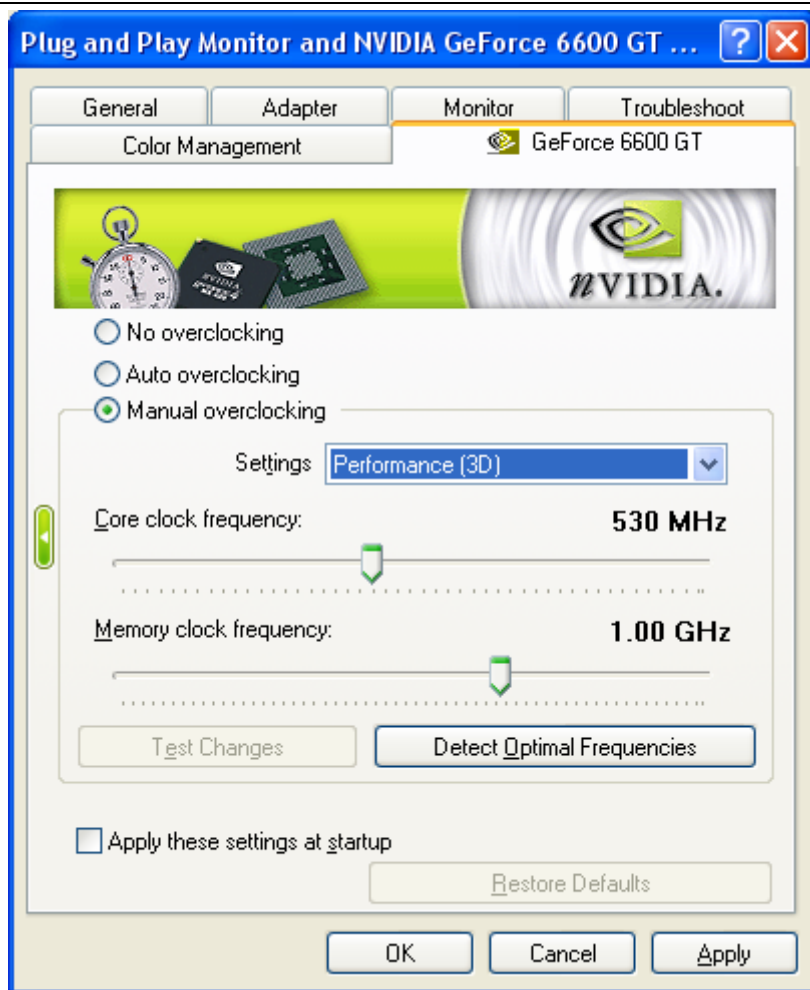
Hardware	
CPU	Intel Pentium4 560 (LGA775,3.6GHz,1MB L2 Cache,800MHz FSB)
Motherboard	Gigabyte GA-8I915P Duo Pro-A (i915P)
Memory	A-Data DDR2 533 512MB x2 (Run@533,CL 4-4-4-11)
HDD	WD2000JB 200GB,PATA,7200rpm,8MB Cache
Display	Viewsonic P95f+
PSU	Century Star 500W
Optical drive	Liteon 52X CDROM
Software and Drivers	
OS	Windows XP Pro + SP2
DirectX	9.0c
Intel INF	6.3.0
Graphics driver	Forceware 66.93
Benchmarking applications	Windows Media Player 10
	Windows Media Classic
	3DMark01 Build 330
	3DMark03 Build 350
	3DMark05 Build 110
	AquaMark3 Commercial Edition Detail: Very High
	X2 Rolling Demo Shadows: Enabled
	Far Cry v1.3 + FarCry benchmark v1.4 Demo HardwareOC Volcano Detail: Maximum
	Counter Strike: Source Video Stress Test Advanced configuration: Model detail: High Texture detail: High Water detail: Reflect world Shader detail: High Shadow detail: High Vsync: Disabled

	Half Life 2 TimeDemo: Custom Demo Advanced configuration: Model detail: High Texture detail: High Water detail: Reflect world Shader detail: High Shadow detail: High Vsync: Disabled
	Quake III Timedemo: Demo1 Quality: Custom (Highest Quality)
	Doom3 Timedemo: demo1 Quality: High

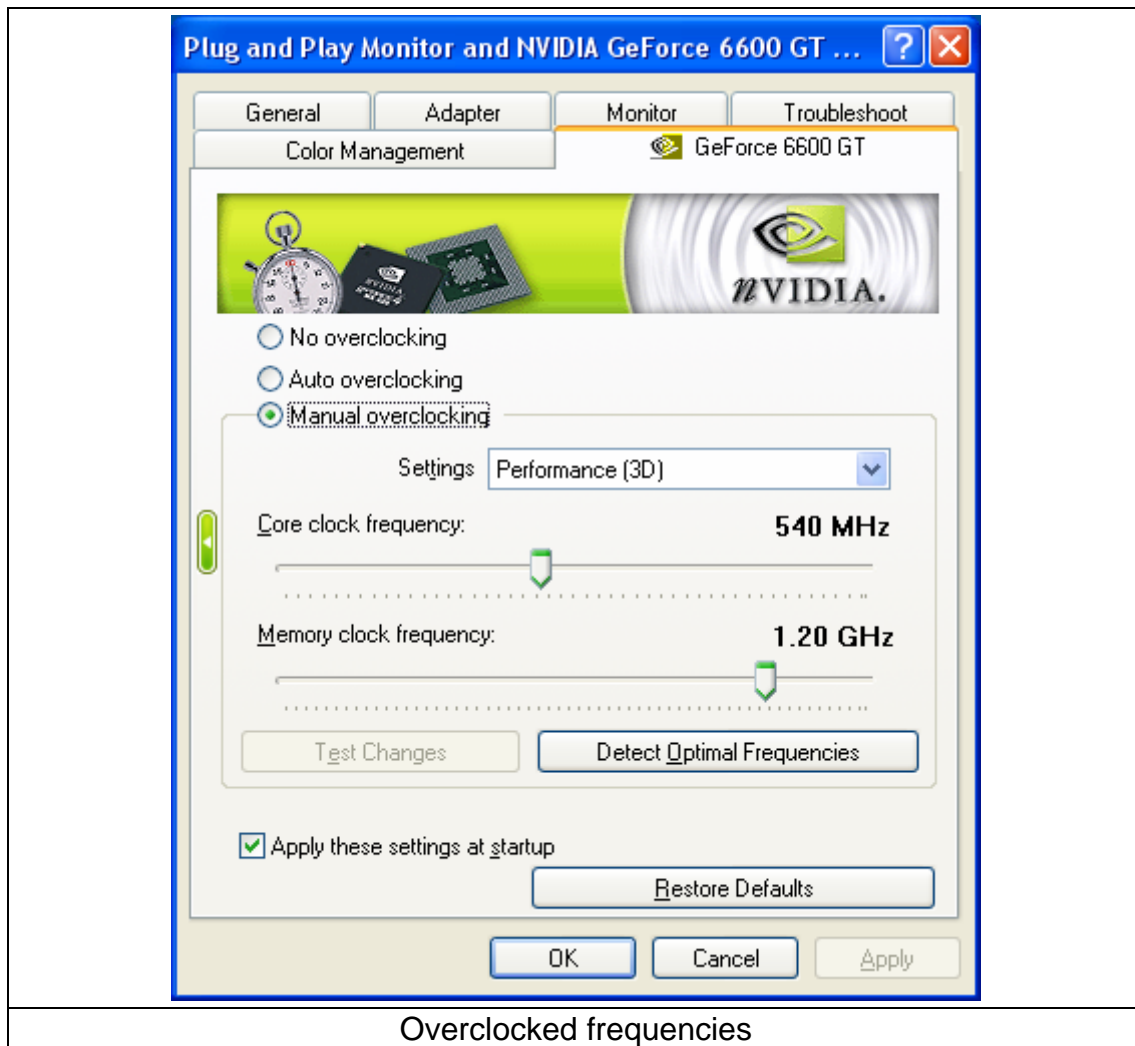
Overclocking Test

This card is factory overclocked to higher operating frequencies leaving little performance for the user to unlock on his or her own. At the end of testing we found the stable limit at 540MHz. While the card could be overclocked to 580MHz, flawed images would appear at any frequency operating point above 540MHz. We find out in more detail later in the temperature testing section that this is caused by the overheating of the 6600 GT at those frequencies.

Memory overclocking is excellent, the video card operating stably at 1.2GHz (1.6ns territory) with flawless display output. The contribution of the memory heatspreaders towards this result is no doubt significant.

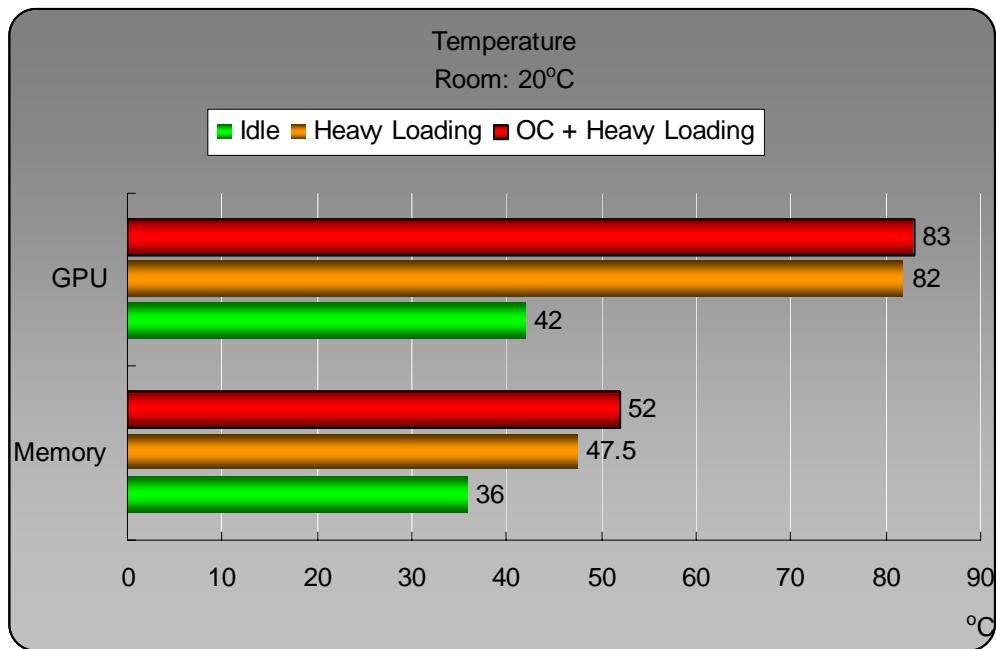


Default frequencies



Temperature Testing

Testing is performed for idle, heavy loading and heavy loading + overclocking conditions, with the driver utility used to detect GPU temperatures and the Thermaltake HARDCANO 12 tool to detect memory temperatures. Heavy loading is simulated by running the 3DMark03 GT4 test for 30 minutes. Room temperature during the test was 20°C.

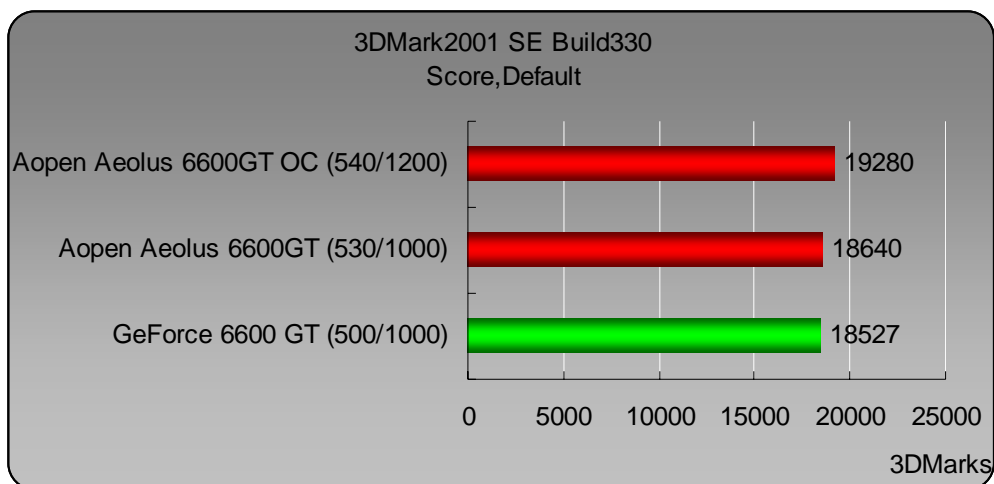
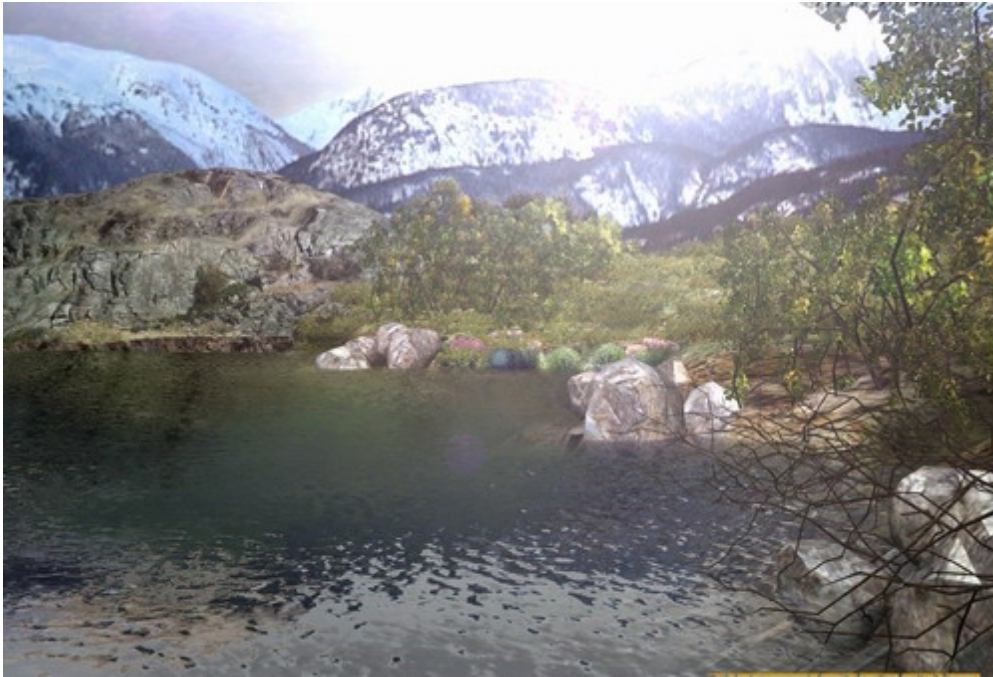


Our experience tells us that the reference NVIDIA cooler should have a default non-overclocked GeForce 6600 GT operating at an idle temperature of 48°C and a heavy loading temperature of 82°C. The Aeolus cooler is thus clearly superior because the core operates at a 30MHz-higher frequency. The memory modules are at very agreeable temperature thanks to the addition of the heatsinks.

3D Benchmarking Performance

3DMark2001 SE

Most tests in the 3DMark2001 SE are DirectX 7 based – these include Game Tests 1 through 3, but not Game Test 4, which is a DirectX 8.1 test. This is an older benchmarking title, but its value as a 3D performance test tool is unquestionable to this day. Many DIYers continue to use the 3DMark2001 SE benchmark to this day to achieve the highest score possible. As the benchmark is hardly a challenge for contemporary video cards, the system performance bottleneck becomes the CPU instead.



3DMark2001 SE is an older benchmarking application where a video card using the same core but operating at higher frequencies is not really able to show increased performance under default image settings. For improved performance, a higher CPU frequency would actually be more beneficial. The 30MHz default frequency advantage of the Aeolus 6600GT yields a less than 1% performance increase, while the overclocking yields a 3% approximate increase.

3DMark03

Released in 2003 by the FutureMark Corporation, 3DMark03 is a professional video card performance benchmark application and the first of its kind to support DirectX 9 performance testing.

According to FutureMark, "There are 4 game tests - each one is designed to represent a certain type of 3D game, and thereby offer a wider range of 3D game workloads. 3DMark03 records the total number of frames rendered. Using the length of time for the test, an average frame rate is produced. A higher average framerate is better. The results from the four game tests are then collated to produce the total 3DMark score".

"The 3DMark total score is calculated using the following formula:

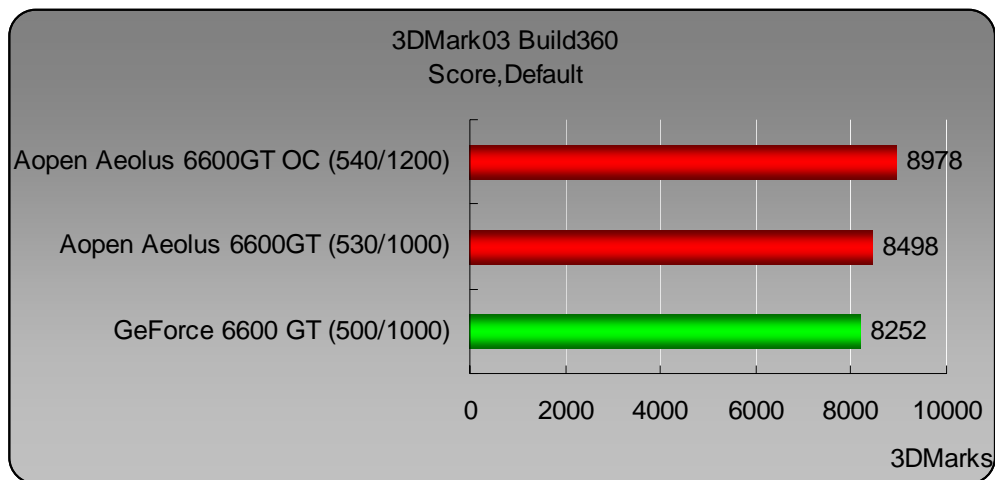
3DMark score = (GT1fps * 7.3) + (GT2fps * 37) + (GT3fps * 47.1) + (GT4fps * 38.7)

GT1fps refers to the average frame rate measured in game test 1".

In essence, the higher the score, the higher performance of the tested video card. Should a card not support DirectX 9, it will be unable to run GT4, and its total score significantly lower compared to cards supporting DirectX 9.

3DMark03 also features other benchmarks such as the CPU Test, Fill Rate test, and Pixel Shader & Vertex Shader tests, all of which can help the user to better understand the various performance aspects of his/her video card.





In 3DMark03, the Aeolus 6600GT achieves a 3% better score than the standard GeForce 6600 GT. Compared to 3DMark2001 SE, results in the 3DMark03 benchmark rely less on the CPU and more on a video card's own abilities. Overclocking results in a satisfying 5.6% performance increase.

3DMark05

Released as the successor to 3DMark03, 3DMark05 is a professional video card performance benchmark application. 3DMark05 completely forgoes support for DirectX 7 and DirectX 8 and focuses solely on the DirectX 9 API. As such, only video card that support (as supposed to being compatible with) DirectX 9 will be able to run and complete the benchmark.

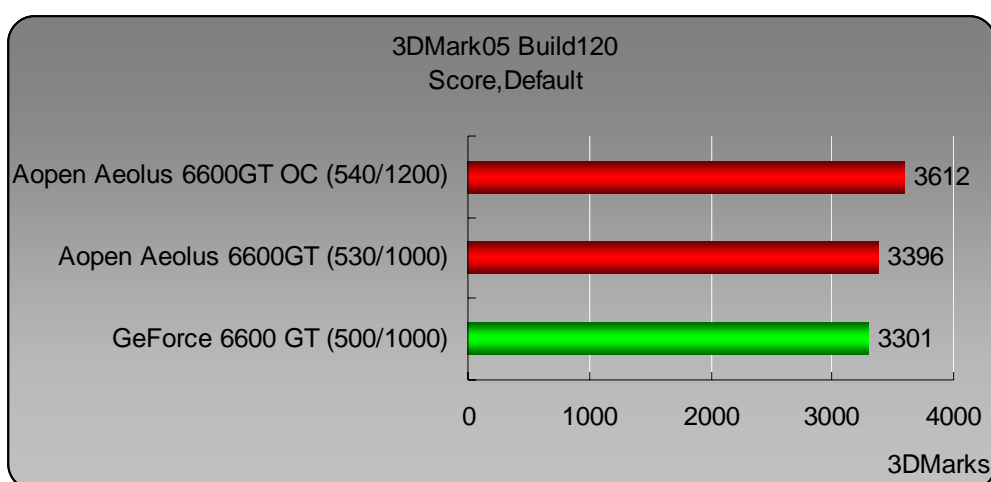
According to FutureMark, "There are 3 game tests - each one is designed to represent a certain type of 3D game, and thereby offering a variety of 3D game workloads. 3DMark05 records the total number of frames rendered. Using the length of time for the test, an average frame rate is calculated. A higher average framerate is better. The results from the three game tests are then collated to produce the total 3DMark score by taking a geometric mean of the game tests' average framerates."

"The 3DMark total score is calculated using the following formula:

$$\text{3DMark score} = (\text{GT1fps} * \text{GT2fps} * \text{GT3fps})^{1/3} * 250$$

GT1fps refers to the average frame rate measured in game test 1."

In essence, the higher the score, the higher performance of the tested video card. 3DMark03 also features other benchmarks such as the CPU Test, Fill Rate test, and Pixel Shader & Vertex Shader tests, all of which can help the user to better understand the various performance aspects of his/her video card.



As was the case in 3DMark03, the Aeolus 6600GT achieves a 3% better score under default frequencies, but here in 3DMark05, the overclocked score is 6.4% better instead. 3DMark05 requires a lot in terms of graphics memory capacity and bandwidth, so the video card's increased memory frequency under overclocked mode is bringing a definite positive effect.

AquaMark3

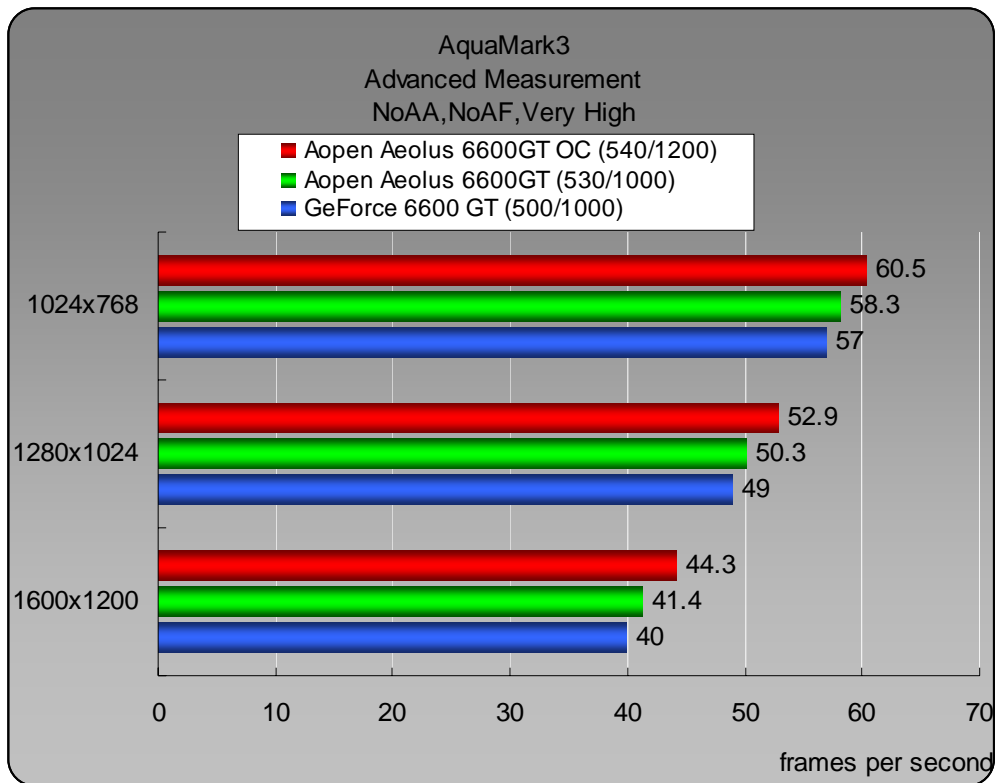
From the Massive Development Team comes the AquaMark3 3D "Reality Benchmark" application which makes full use of the hardware-accelerated effects supported by the DirectX 9 API. The Krass game engine in AquaMark3 is a real game engine used to generate the 3D scenes seen during benchmarking - results are therefore indicative of a video card's true in-game performance.

The AquaMark3 Score Measurement benchmark (and the resultant Triscore) employs methodology similar to the 3DMark series, but here the resolution is fixed at 1024x768, with anti-aliasing disabled and 4X anisotropic filtering enabled, and textures set to Very High. Users are unable to reconfigure these settings.

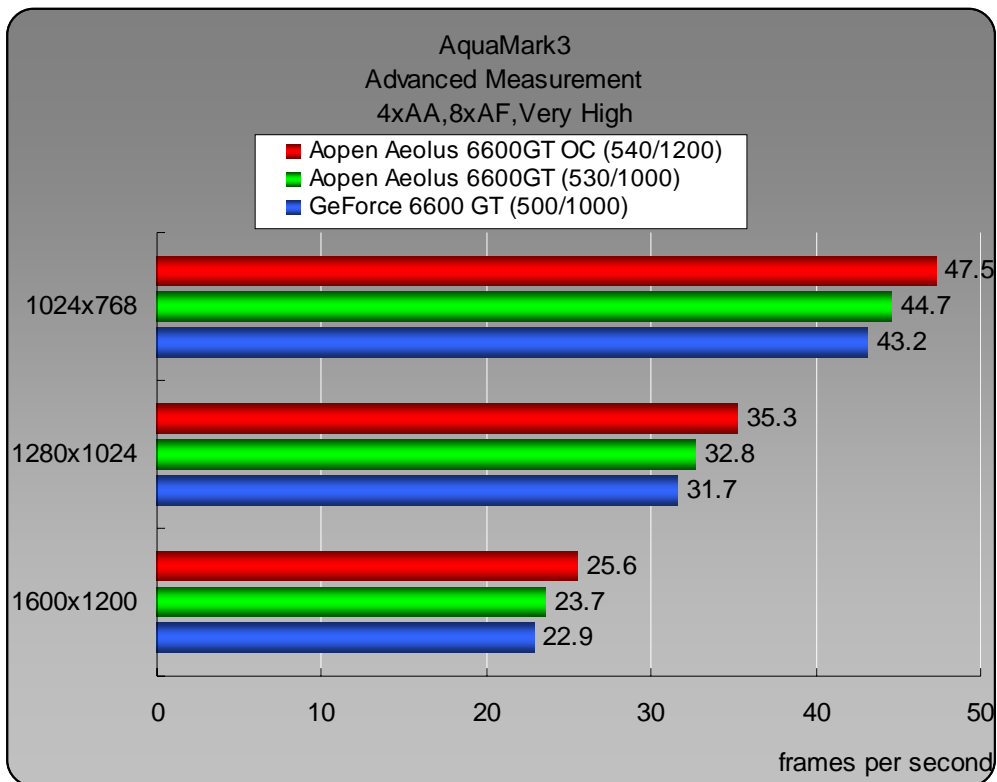
The Advanced Measurement system is a calculation of the average framerate performance in the various test scenes. Here users can make changes to resolution, anti-aliasing, and anisotropic filtering settings in order to achieve the clearest picture possible regarding the performance of their video cards.



Pure Speed Mode



Eye Candy Mode



In most of these tests, the AOpen produces a 3.5% better frame rate than the

standard 6600 GT. As AquaMark3 uses the Krass real gaming engine, we can expect similar results in games such as Aquanox, Aquanox2, and SpellForce. An impressive 8% gain is achieved by the Aeolus under eye candy mode at resolution of 1600x1200.

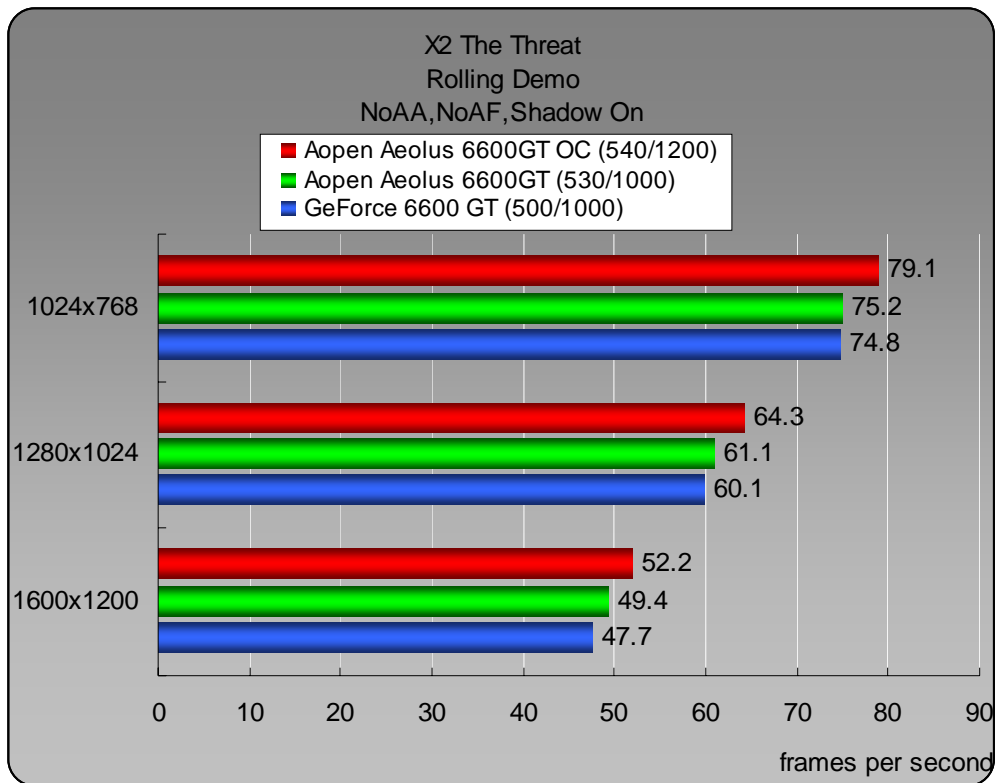
X2 the Threat

X2 the Threat is a 3D Space Simulator from Enlight which wraps space combat, commerce, architecture and an involving storyline into one mind-blowing game of epic graphical proportions. At the time of its launch in 2003, the game made very heavy demands on graphics hardware (DirectX8 video card e.g. GeForce 4 Ti series or RADEON 8500 series) with the recommended basic configuration of a 2GHz+ CPU and 512MB of system memory. Enabling Shadows requires a DirectX 9 video card instead. In fact, the game is one of the earliest to support DirectX 9.

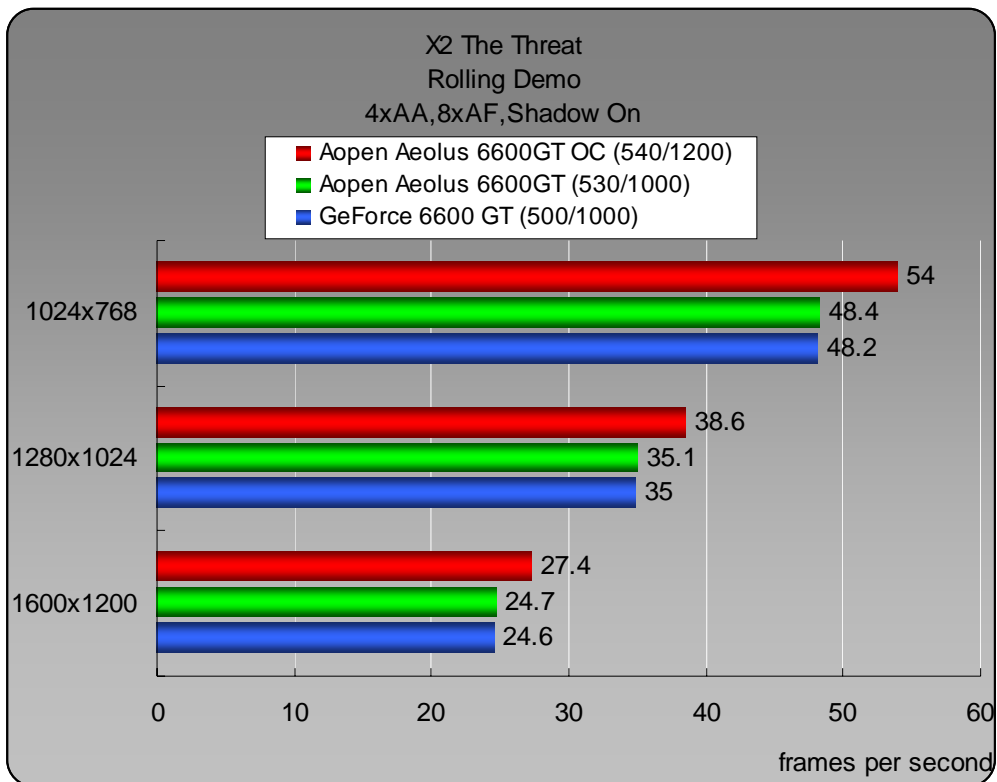
For our test we use the Benchmarking function found in the officially provided Rolling Demo with Shadows enabled. Results are shown in frames per second; the higher the better.



Pure Speed Mode



Eye Candy Mode



Here the frequency advantage of the Aeolus is not manifesting itself clearly.

We do see a 3.6% increase under pure speed mode at resolution of 1600x1200, however. When overclocked there is an impressive 10% average increase across the board and showing the importance of increased memory bandwidth in X2 The Threat.

Far Cry

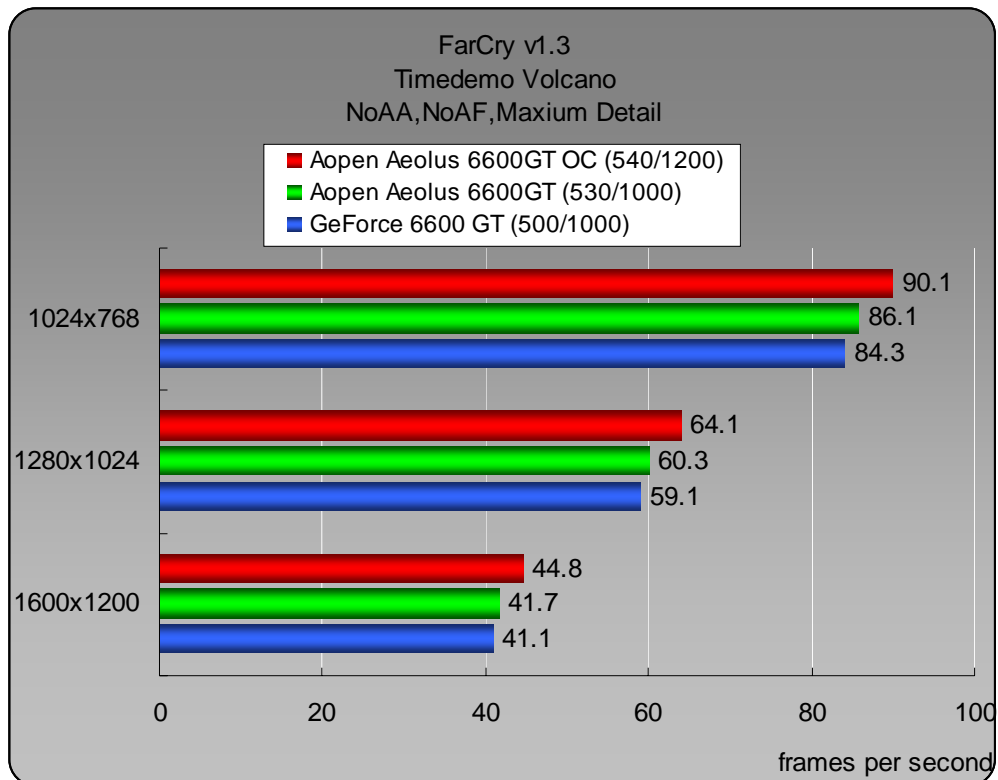
Released in early 2004, Far Cry features exceptionally lush and vivid environments, realistic enemy AI and explosive gun fights so stunning that it captured the top prize in that year's E3 convention. Behind this success is the CryEngine, which requires a very high-level DirectX 9 video card to push frame rates into playable territory.

Far Cry also supports HDR (High Dynamic Range) technology beginning with patch 1.3. What HDR does is increase the dynamic range (the ratio between brightest and darkest details in an image) to better approximate/simulate the dynamic range of the human eye. Developer UbiSoft has also provided a 64-bit patch in order to provide support 64-bit operating systems.

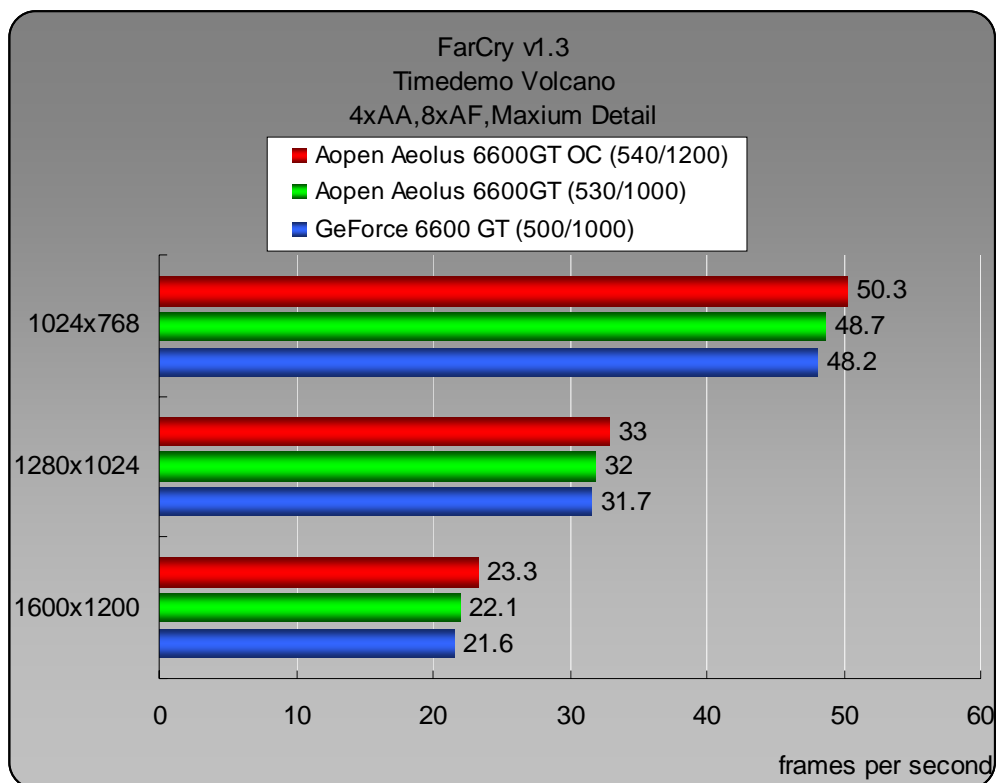
For our test we will use the Far Cry Benchmark utility provided by Hardware OC, and run the HardwareOC Volcano demo. The higher the average framerate achieved, the better the result.



Pure Speed Mode



Eye Candy Mode



On average the Aeolus is about 2% up on the standard 6600 GT, so the effect of increased core frequency is again quite limited. Overclocking is good for a

maximum 7% increase (1600x1200, pure speed mode). Far Cry is significant test of not only the core performance, but memory bandwidth as well.

Half Life 2

In what seems to be a lifetime ago, in November 1998, Valve unleashed Half Life, a game whose beautiful storyline and graphics plus creative combat weaponry took the FPS gaming world by storm. The number of awards bestowed upon this title has been countless.

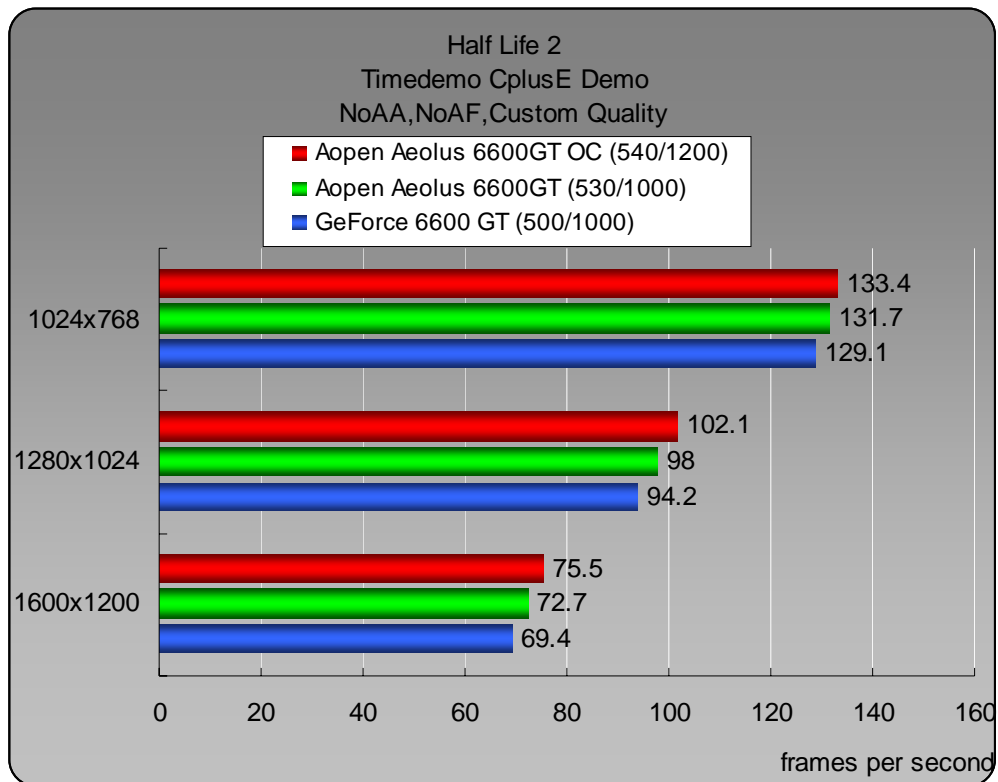
In 2004 Half Life 2 made its debut. This epic uses the Source Engine and emphasizes natural environments with special effects such as water reflection taking in-game images ever closer to reality. Worth even higher praise is the physics engine which has been taken to a hitherto unseen level of realism – the shattering effect of bullets flying into brick walls, boats rocking violently after a character jumps on – everything reacts as you expect them to in real life, making every part of the gaming process a mighty visual feast.

To make all this possible requires a strong DirectX 9 video card - anything less will result in a slow-speed slideshow. ATI's close working relationship with Valve means that an ATI video card is likely to perform better than video cards of the same class from rival manufacturers. Of note, while the GeForce FX series support DirectX 9, they operate in DirectX 8.1 mode while running Half Life2.

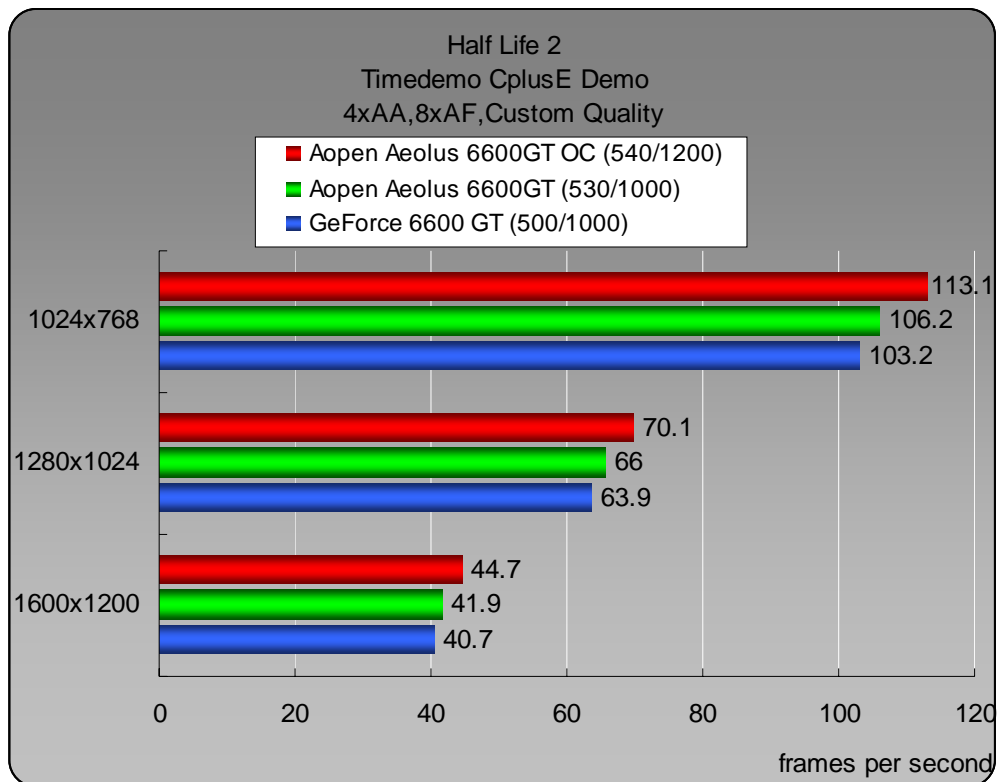
Using the in-game record command, we record a clip and use the Timedemo replay function to check the average framerate. A higher framerate indicates better performance.



Pure Speed Mode



Eye Candy Mode



Half Life 2 allows the Aeolus to shine by slightly outpacing the standard 6600 GT. In pure speed mode at 1600x1200 it really hits its stride with a 4.8% frame rate advantage. Overclocking the card boosts that advantage by another 6%. Half Life 2 seems to benefit nicely from the increased memory bandwidth.

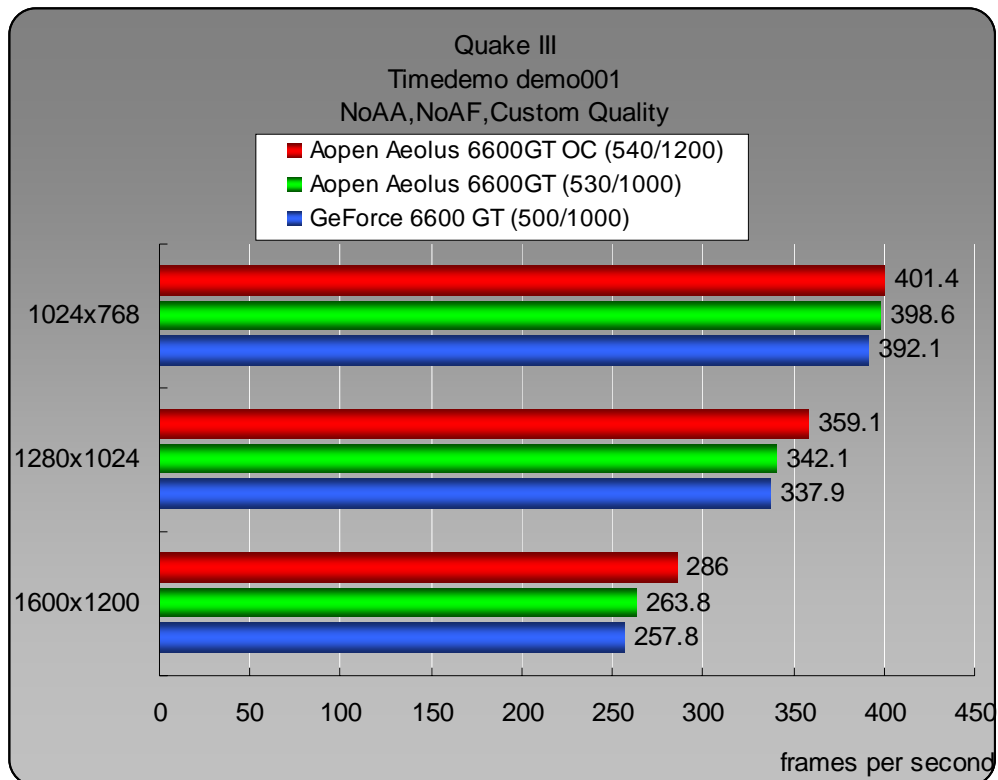
Quake III

This classic OpenGL 3D game comes from ID Software. Although it has been around for quite some time, it enjoys a tremendous following even in this modern day and age. NVIDIA's strength in OpenGL games is well documented. We can thus usually expect the NVIDIA video card to come out ahead of rival video cards of the same level.

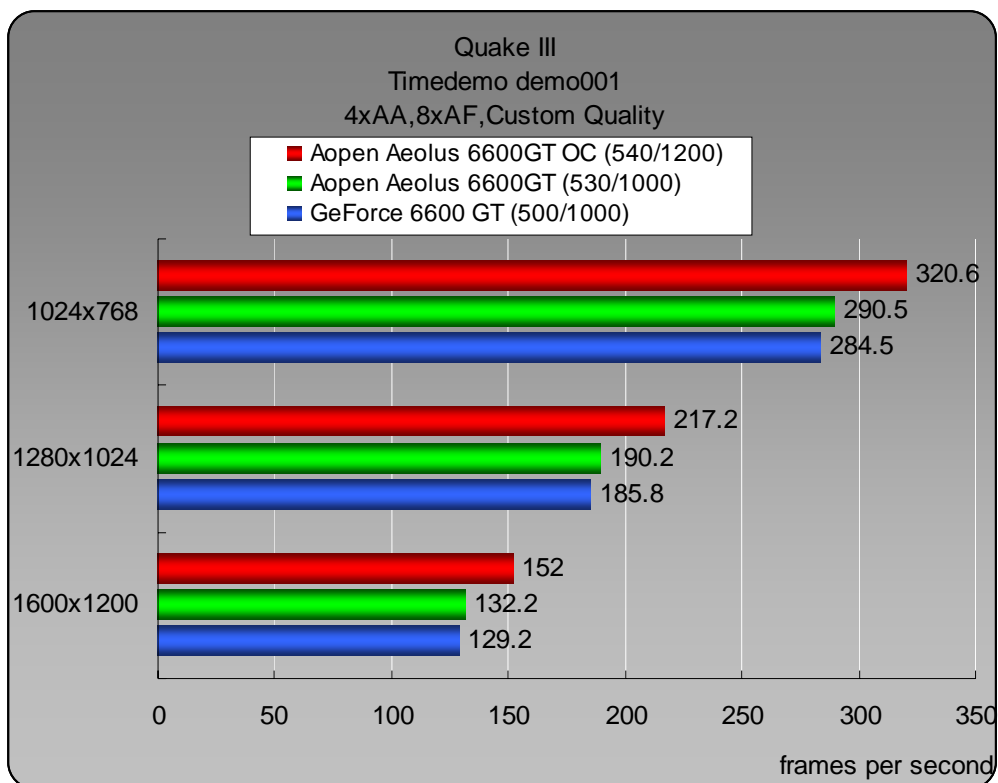
This test uses the built-in Timedemo function running demo001. The higher the framerate achieved, the higher the performance of the video card.



Pure Speed Mode



Eye Candy Mode



Yesterday's video card killer is nothing more than a minor task for today's video cards. In Quake III it is the CPU that contributes most to performance at low

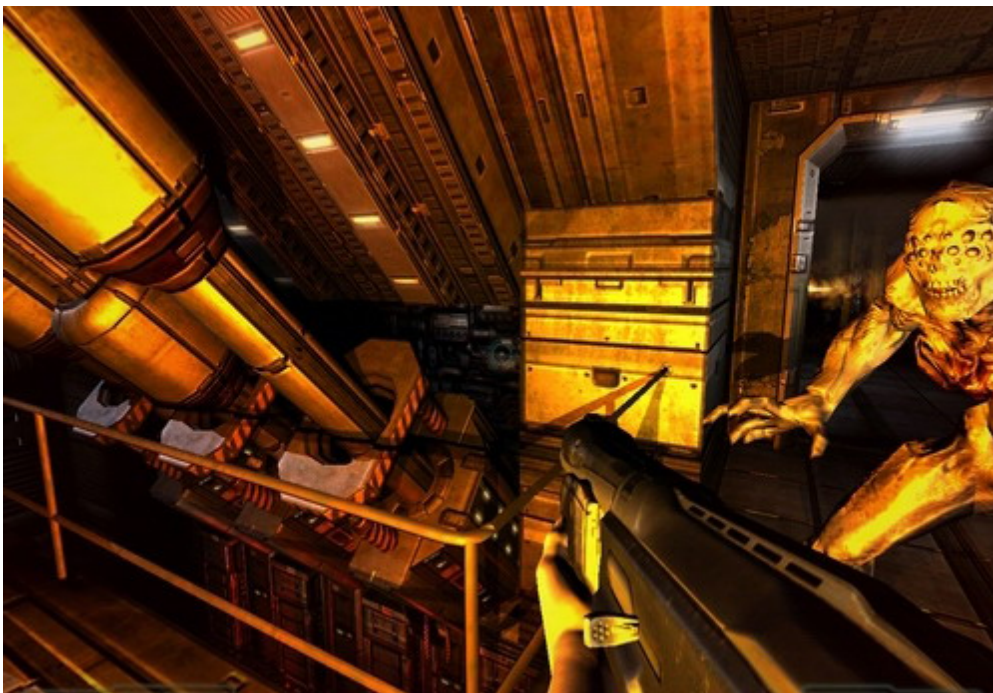
resolution, which is why in pure speed mode, at the resolution of 1024x768, the Aeolus 6600GT is unable to show a serious advantage. That advantage is extended at high image quality, however. While the AOpen Aeolus exhibits a 2% advantage over the standard 6600 GT, in overlocked mode, that advantage stretches to 15% (1600x1200)!

Doom3

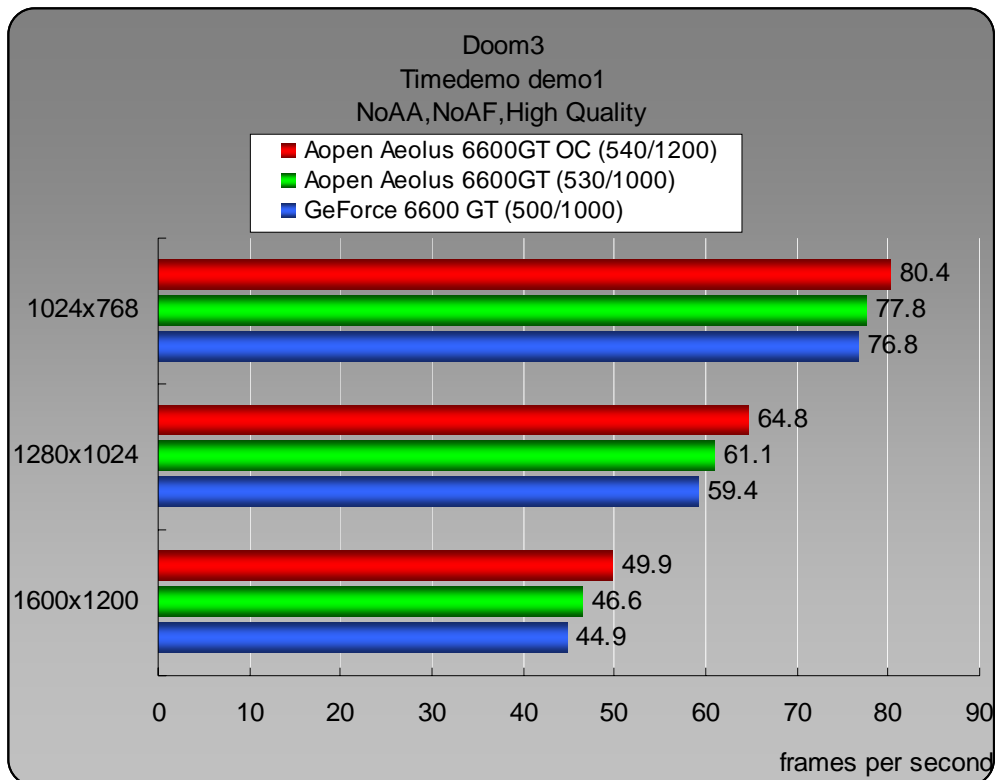
This OpenGL first person shooter master works arrived in 2004 from ID Software, a company that has always been at the forefront of 3D graphics technology. Using the latest in special effects, Doom3 is demanding on the graphics hardware to say the very least. NVIDIA video cards have traditionally held the upper hand with OpenGL games, allowing them users a smoother gaming experience over rival video cards of the same class. The current GeForce FX and GeForce 6 series cards also support UltraShadow/UltraShadow II technology for significant load reduction during shadow processing. Naturally, this translates into improved overall performance.

Not willing to go down without a fight, ATI offers optimized Doom3 performance with its CATALYST driver (there is optimization for some other predefined games as well) to allow their video cards to produce higher framerates with no impact to image quality.

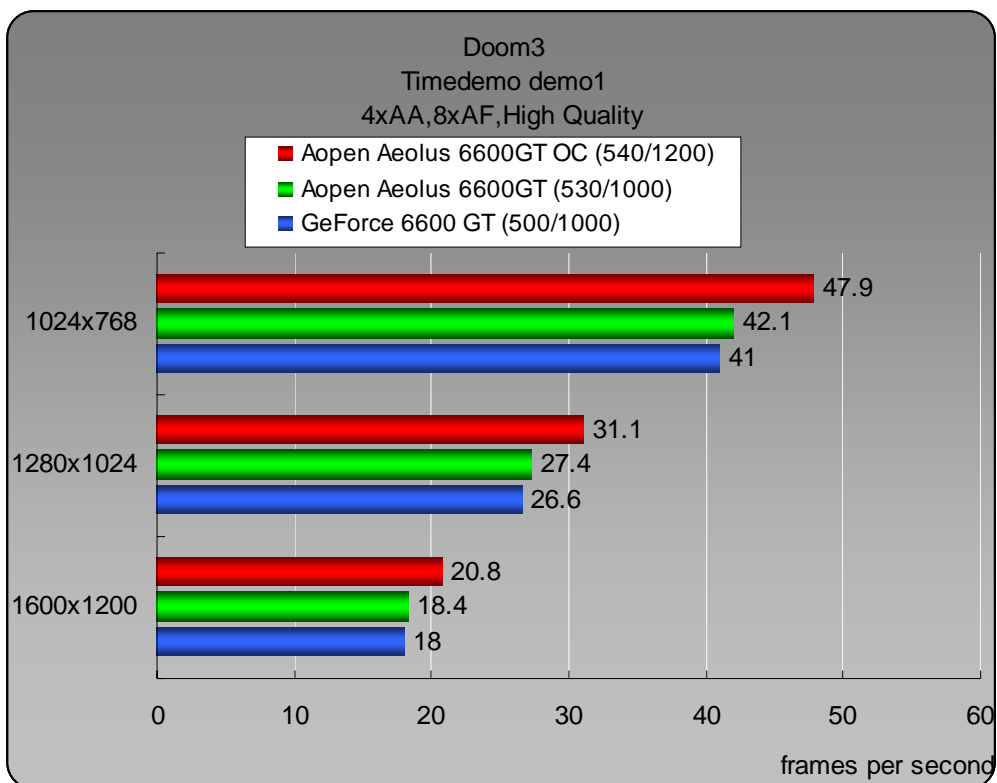
This test uses the built-in Timedemo function running Demo1. The higher the framerate achieved, the higher the performance of the video card.



Pure Speed Mode



Eye Candy Mode



The overclocked Aeolus performs very well in Doom3, achieving a 5fps better frame rate over its non-overclocked form, or a 13% frame rate increase in eye

candy mode at 1024x768. At higher resolutions that percentage increase is maintained while frame rates drop.

Summary

While the AOpen Aeolus 6600GT 128MB GDDR3 adopts a reference P216 PCB, it does something special in the process too, by adopting its own designs, which are a black PCB, custom bronze colored aluminum alloy cooler, memory heatspreaders, and factory overclocked frequencies.

AOpen has prepared a rich array of accessories as well; they include the component output cable and several full version games which aim to increase product value and user enjoyment. Worth mentioning is the extra effort that AOpen has put in to facilitate usage by beginners with the manual and installation poster. This is the kind of preparation and considerateness one would expect from a major brand.