



GT3-BH Technical Whitepaper “aEnthusiast Phenom II 965” Test Data on a High-End Workstation/Gaming GT3-PC System Build Document Revision 1.0

The PC configuration as detailed below, represents a high-end GT3 PC configuration optimized for workstation use and PC gaming, utilizing GTR's GT3-BH Chassis. The below data includes an exhaustive component list, necessary system settings, configuration details, including acoustic, thermal, performance, and power consumption data.

Configuration Objective

Maximize performance, thermal efficiency and system stability while minimizing acoustic emissions and power consumption.

Configuration Overview

- ✓ Quiet Operation: 40.8dB typical (silent = 38.5dB)
- ✓ Low A/C Power Consumption: 92.8 Watts typical, 326 Watts maximum
- ✓ High Performance
 - ✓ Windows Experience Index - Processor, Memory of 6.8 and 7.5, respectively.
 - ✓ 14,496 3DMark '06 Score

System Configuration Components

- [1 x GTR Tech GT3-BH](#)
- [1 x AMD Phenom II X4 965 Black Edition Deneb 3.4GHz 4 x 512KB L2 Cache 6MB L3 Cache Socket AM3 140W Quad-Core Processor - Retail](#)
- [1 x GIGABYTE GA-MA790XT-UD4P AM3 DDR3 AMD 790X ATX AMD Motherboard](#)
- [1 x G.SKILL 4GB \(2 x 2GB\) 240-Pin DDR3 SDRAM DDR3 1600 \(PC3 12800\) Dual Channel Kit Desktop Memory](#)
- [1 x SAPPHIRE Vapor-X Radeon HD 4850 512MB 256-bit GDDR3 PCI Express 2.0 x16 HDCP Ready CrossFire Supported Video Card - Retail](#)
- [1 x Western Digital Caviar Black WD1001FALS 1TB 7200 RPM 32MB Cache SATA 3.0Gb/s 3.5" Hard Drive](#)
- [1 x Sony Optiarc Black 8X DVD+R 8X DVD+RW 6X DVD+R DL 8X DVD-R 6X DVD-RW 5X DVD-RAM 8X DVD-ROM 24X CD-R 24X CD-RW 24X CD-ROM 2MB Cache SATA Slim 8X Slot Loading DVD Burner – OEM](#)
- [1 x Circuit Assembly Slimline SATA Cable SlimSATA Cable – SKU U709089-0.5M](#)
- [4 x Link Depot FAN-4020-B 40mm Case Fan - Retail](#)
- [1 x ZALMAN FAN MATE 2 Fan Controller - Retail](#)
- [4 x Link Depot 3 Pin Fan Power Y Cable Model POW-ADT-3PY - Retail](#)
- [1 x Link Depot POW-ADT-3P4 Power 4 pin adapter to 3 pin fan adapter - Retail](#)
- [1 x Link Depot 4 Pin Power Y Cable Model POW-ADT-4PY - Retail](#)
- [1 x Rosewill RCT4B-100 Black 4" Cable Tie – Retail](#)
- [1x Rosewill RCT8B-100 Black 8" Cable Tie - Retail](#)
- [Windows 7 Ultimate, Build 7100](#)

CONFIGURATION RESULTS

Environment Variables/Reference Data

Power “Off”: 1.3 Watts
Office environment in dB, as measured “quiet”: 38.5dB
(Test environment: a typical office environment, measured “silent” at 38.5dB; no appliances running, A/C, computers, etc.)
Ambient Room Temperature: 80F
Humidity: 40-50%
Windows 7 Drivers: All device drivers installed by Windows 7.
Video card drivers: Catalyst 9.9

Windows 7 Experience Index

Base Score: 5.9
Processor: 6.8
Memory: 7.5
Graphics: 6.5
Gaming Graphics: 6.5
Primary Hard Disk: 5.9

Usage Model 1 – “Typical Desktop Use”

(Web browsing, Word processing, and Spreadsheet usage)
Typical power consumption: 95.8Watts
Acoustic Emissions: 40.2 - 40.8dB
Minimum CPU core temperature: 34.5C
Maximum CPU core temperature: 49.5C
Maximum graphics core temperature: 44.0C

Usage Model 2 – “Hardware-Accelerated 3D Graphics”

(3DMark '06, Default Settings)
3DMark '06 Score – 14,494 Marks
Maximum power consumption: 241 Watts
Maximum acoustical emission: 44.1dB
Maximum CPU core temperature: 60.4C
Maximum graphics core temperature: 72.0C

Usage Model 3 - “Synthetic Test”

(The “Crusher-Tribute” Test*)
Maximum power consumption: 325Watts
Maximum acoustical emission: 46.7dB
Maximum CPU core temperature: 70.0C
Maximum graphics core temperature: 73.0C

CONCLUSIONS AND OBSERVATIONS

General Conclusions and Observations

1) The video card's fan did not “spin up” under “Usage Model 2” test, indicating the observed, relatively high, temperature is dictated by graphic's card BIOS and/or drivers and not the chassis' thermal efficiency.

2) Actual power consumption data illustrate the disparity between real world power supply requirements versus consumer's perceived needs and/or vendor's recommended power supply size, ie vendor recommendations for this system include 450 to 550 Watt power supplies([Nvidia](#), [ATI](#)). Whereas, this system uses no more than 201 “real world” and 253 “synthetic” Watts – 258 and 325 AC Watts, respectively.

3) GT3 supports all processors in the market, to date. Intel provides actual power requirement data for processor support([Reference](#)), AMD does not(4/19/09 - [AMD1](#), [AMD2](#)). Therefore, Intel processor support is explicit and AMD support is implicit, meaning AMD processors do not exceed GT3's power supply output.

Intel

GT3's power supply conforms to Intel's Core i7 Power Supply Requirements: "The Intel Core i7 processor requires a minimum of 8 Amps continuous and 13 Amps peak for 10ms on 12V2"([Reference](#)). GT3's Power Supply provides 8.5A continuous and 16.0A peak on the 12V2 rail****.

AMD

No known GT3-PC AMD based builds exceed or come close to, under “real world” or “synthetic” workloads, GT3 Power Supply's Maximum system configuration of 454Watts of A/C Outlet power consumption***.

4) GT3's Power Supply's maximum output is 370 Watts with a resulting efficiency of 78.1%**.
Resulting in a maximum system configuration of 454Watts of A/C outlet power consumption***.

5) Motherboard manufacturers, Asus and Gigabyte provide proper fan control to optimize thermal and acoustic efficiency based on system load.

5a) Gigabyte's fan control implementation, controls **one** “Sys Fan” header. Therefore, both upper and lower GT3 intake fans need to be connected to this header.

Use one [Link Depot 3 Pin Fan Power Y Cable](#) adapter to run both fans to this fan header.

5b) Asus' fan control successfully controls both upper and lower fans when connected to two different fan header connectors.

6) By implementing a system build with effective fan control, acoustics under desktop use drop from the mid to high 40dB range, to the hi 30dB range – virtually silent, ideal for office use.

7) Hard drives are a significant contributor to overall noise levels and inhibit a distraction-free computer environment. Choose your hard drive carefully if acoustics are a factor for your GT3 PC build. The hard drives used in these Technical Whitepapers consist of GTR's vendor recommendation.

OVERCLOCKING

There are several ways to overclock a system, such as this one. Either by increasing the CPU frequency multiplier or by increasing the frequency. We tested both methods and came to the following conclusions:

- 1) Manually setting the CPU frequency multiplier, though effective, disables the operating system from dynamically controlling the CPU frequency, thus CPU frequency is running at the set “maximum” frequency. This results in increased power consumption and increased noise from the additional heat being generated. Therefore, manually setting the frequency multiplier is not the preferred method of overclocking given our system build objective: “Maximize performance, thermal efficiency and system stability while minimizing acoustic emissions and power consumption.”
- 2) Increasing the bus frequency, offered the best balance between power consumption, acoustic emissions, increased performance and system stability. The system configuration outlined in this whitepaper, passed all tests with the following Phenom II 965 “overclock” settings:

<u>CPU Settings</u>	<u>Memory Settings</u>	<u>Misc. Motherboard</u>
Frequency: 3.604 GHz	Frequency: 1412(DDR)	BIOS Version: F5
Multiplier: Default Bus Frequency: 212 MHz	Multiplier: 6.66 Memory timings set to SPD	CPU Fan Control in BIOS set to “PWM”(Pulse Width Modulation)
Voltage: 1.425	Voltage: Normal(1.65)	System Fan Control in BIOS set to “Enabled”

The Phenom II 965 was not tested above a bus frequency of 212 Mhz.

SYSTEM BUILD NOTES

Rear, 4 x 40mm Fan Installation

Four(4) 40mm fans installed in the rear of the chassis create a low-pressure area, acting as “helper” fans. These fans operate at a fixed speed, allowing more air to be drawn through the chassis, with no perceived acoustic emission increase.

The four 40mm fan power headers were consolidated to one header via three(3) Link Depot 3 Pin Fan Power Y Cables outlined in the System Configuration section . The singular fan header was then connected to the Zalman Fan Mate 2. Then, the Zalman Fanmate 2 was connected to one of the power supply's four-pin molex connectors via the Link Depot POW-ADT-3P4 Power 4 pin adapter to 3 pin fan adapter.

The Zalman Fanmate 2 was set to the lowest fan speed control setting and as the data illustrates, CPU cooling is extremely effective and efficient, while minimizing overall acoustical emissions.

Without the four 40mm fans in back, a noticeable CPU Fan Speed oscillation was observed during normal desktop use. Installing the four 40mm fans eliminated the CPU fan speed oscillation and increased overall thermal efficiency.

GTR recommends **against** “T-ing” the four 40mm fans into the motherboard's fan speed control headers. Under full load, the four 40mm fans may exceed the motherboard's header circuitry.

Front Chassis Fans

Upper **and** Lower Fans connected to “Sys 1” fan header(Sys 1 header is the only header with fan control). Use one [Link Depot 3 Pin Fan Power Y Cable](#) to connect the upper and lower fan to the “Sys 1” header.

Enabling support for 9” video cards

Lower bracket on feature module and lower support bracket on chassis removed

- Remove the support bracket by removing the back side panel and unscrewing the two(2) phillips head screws which secure the support bracket.
- Snip the lower bracket on the feature module with a pair of cutters or similar.

System Configuration Settings

CPU Settings	Memory Settings	Misc. Motherboard
Frequency: 3.4Ghz	Frequency: 1333(DDR)	BIOS Version: F5
Multiplier: Default	Multiplier: 6.66 Memory timings set to SPD	CPU Fan Control in BIOS set to “PWM”(Pulse Width Modulation)
Voltage: Default	Voltage: Normal(1.65)	System Fan Control in BIOS set to “Enabled”

APPENDIX

*GTR's "Crusher-Tribute" Test

Two applications running simultaneously, executed for 60 Minutes:

- 1) Prime 95 - "In Place Large FTTs" test
- 2) 3DMark 06 - Two tests; GT2(Firefly Forest) and HDR2(Deep Freeze), executed with "Loop All Selected Tests" selected

**Maximum Power Supply Output Measured at 25C(Link)

***Power Consumption Calculation Data

	GT3's Power Supply Power Output						Total
Power Rail	+3.3v	+5v	+12v1	+12v2	-12v	+5vsby	
DC Voltage	3.3	5	12	12	12	5	
Amps	20	17	8.5	8.5	0.5	2.5	57.00
Watts	66	85	102	102	6	12.5	373.50
Efficiency							78.41%
Wall consumption							454.14

Wall Consumption = total AC power in Watts, drawn from the wall's AC plug.

***GT3 Power Supply Specification (Link)