NOISE, COMPUTING and VIA

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Noise, Computing and VIA

Noise has become one of the most insidious yet underrated forms of pollution in modern society. In our machine-dominated environments, artificial noise is everywhere. Personal computers have become a significant source of noise in workplaces and homes. Many of us have come to depend on the amazing versatility and power of today's PC. But we often pay a price in our ability to concentrate and work effectively or be entertained because of the high noise levels that seem unavoidable in today's PCs.

The inverse relationship between human productivity (or enjoyment) and noise seems self evident, but the issue is not given its proper due by most PC system or component manufacturers. A recent study suggested that given trends towards greater heat leading to increased use of cooling fans, noise emissions from telecom and computer equipment would increase as much as "15-20 dB in the next 5-10 years."[1] Certainly, the last five years have seen CPU power dissipation rise from 20.6W for a Pentium II-333[2] released in Q1 1998 to 81.8W "thermal design power" for a P4-3.08[3] in Q1 2003. The rising trend does not appear to be abating, as processor clock speeds continue to rise with an attendant increase in heat dissipation and the necessary forced air cooling solutions.

At the same time, PCs are truly becoming ubiquitous. PCs have long been in every office, but now, many homes have multiple PCs. Manufacturers are pushing the PC into the living and entertainment rooms as adjuncts or integral components in the home entertainment system. Noise is certainly a hurdle to be overcome for the wide acceptance of PCs in living rooms. And as broadband Internet becomes more widespread, the practice of leaving PCs on 24/7 becomes increasingly common, putting more pressure again on reduced noise.

This white paper promotes recognition of noise pollution as a general issue of concern to all computer users, and describes VIA's energy-, environment- and noise-conscious approach to computing products.

WHAT IS SOUND? AND NOISE?

Sound is what we hear. Technically, it is defined as the human perception of airborne pressure waves caused by mechanical vibrations emanating from any source. A pure sound, such as that caused by the plucking of a single guitar string, is a tone. When picked up with a microphone and displayed on an oscilloscope, such a tone looks like a sine wave. Every tone has two components: frequency or pitch, and amplitude or volume. Hertz (Hz) is the measure of sound frequency; the decibel (dB) is the measure of sound pressure level. Most sounds that we hear are not pure tones; they are many tones in complex combinations of frequency, amplitude and timing.

Noise is difficult to define technically – it can take almost any waveform, because fundamentally, noise is any unwanted sound. Unwanted

[1] Acoustic Noise Emission and Communication Systems in the Next Century by Dan Quinlan, of Lucent Technologies published in Electronics Cooling magazine (January 1999) and reprinted as Computer Noise in the 21st Century in SilentPCReview.com (April 11, 2002)

[2] Processor Electrical Specifications © 1997-2003 by Chris Hare, who states: "All of the information contained on this page came directly from the various datasheets provided online."

[3] Processor Electrical Specifications © 1997-2003 by Chris Hare. Intel states: "The [Thermal Design Power] numbers ... reflect Intel's recommended design point and are not indicative of the maximum power the processor can dissipate under worst case conditions." As of mid 2002, Intel stopped providing Maximum Power Dissipation data for its P4 processors.

being the operative word, noise can be a dripping faucet when you're trying to sleep in a quiet room, a jackhammer being operated intermittently in the street while you try to read, or the whine of a computer's cooling fans and hard drive as you try to write a paper.

An important aspect of noise is that unlike microphones or sound level meters, people share with animals a keen ability to distinguish different kinds of sounds even when these sounds are actually quieter than the overall ambient level. You could call it focus: It is what allows us to pick out a single familiar voice in a noisy crowded restaurant. This phenomenon comes into play with noise perception as well, where an annoying sound is somehow audible even when it should be masked by other sounds. Noise is as much a psychoacoustic phenomenon as it is physical.

Some types of machine sounds can only be described as noise. The high-pitched limited bandwidth sound of small motors, such as an electric drill or a small high speed fan, is almost always perceived as unpleasant. It has high pitch and penetrating volume, much worse than the buzzing of bees or wasps, which is about the closest comparison in nature.

RELATIVE SOUND LEVELS

The decibel follows a logarithmic scale, rather than a linear one. This is a complex subject, but for our purpose, it is sufficient to note:

- 1 dB is generally the smallest difference that can be perceived by human beings
- A 3 dB difference is clearly audible for just about anyone with normal hearing
- A 10 dB difference is generally perceived as being twice or half as loud.

This means, for example, that if one source of noise is measured at point of perception at 85 dB, another source measured at 75 dB sounds half as loud. A 95 dB source sounds twice as loud as the 85 dB source, and four times louder than the 75 dB source.

Sounds are additive, but not in a simple linear way. Two 30 dB noise sources results in 33 dB. Four of the same noises makes 36 dB. Eight 30 dB noise sources makes 39 dB, and 16 makes 42 dB: Each doubling of identical noise sources results in a 3 dB increase in noise.

NOISE REFERENCE TABLE

The following table shows Sound Pressure Levels for common sounds as a frame of reference to PC noise levels.

SPL (dB)	TYPICAL ENVIRONMENT AVERAGE	DESCRIPTION
140	30 meters from military aircraft at take off	Threshold of pain
120	Boiler shop (maximum levels) Ships engine room (full speed)	Almost intolerable
100	Automatic lathe shop Platform of underground station (maximum levels) Printing press room	Very noisy
80	Curbside of busy street Office with tabulating machines	Quite noisy
60	Restaurant, Department Store; Noisiest Gamer PC35-45	Noisy
50	Conversational speech at 1 meter; Noisy workstation	Clearly audible
35-45	Quiet office or library; Typical PC	Subdued
25-30	Bedroom at night, Quiet PC	Quiet
20	Quiet whisper; Very quiet PC Background in TV and recording studios	Very quiet
10	Super quiet PC	Barely audible
0	'Normal' threshold of hearing	Not audible

HUMAN HEARING

The decibel scale gives sound of all frequencies equal weight, while human hearing does not. Our hearing sensitivity varies with frequency: It is most sensitive in the middle range (between 400~4000 Hz), but much less sensitive in the low frequencies, and less sensitive again in the high frequencies.

To compensate for the non-linear frequency response of human hearing, the "A" weighting scale was developed for sound level measurements. Such measurements are expressed as dBA instead of dB and allow sounds of different frequency balances to be fairly compared for relative loudness. For example, a reading of 90 dBA of automotive traffic measured below a bridge (mostly low frequency sound) can be said to have the same loudness as a reading of 90 dBA of massed violins holding a note at 4 octaves above middle C (high frequency sound). Sound level meters (SLM) have the "A" weighting scale built in so that dBA can be read directly off the display.

SOUND PRESSURE LEVEL (SPL) vs. SOUND POWER

Thus far, all the references to decibels have been in terms of ***sound pressure*** level. To obtain a SPL reading is relatively simple: position the meter at the specified point and measure in dBA. As long as the background noise is held at least ~6 dBA below the sound being measured, and the meter is accurate and calibrated, the result is clear. Because it is so simple to conduct, SPL measurement in decibels at 1-meter distance has become a de facto sound measurement standard, especially where a purpose-specific standard does not exist. However, this measurement is best likened to a single snapshot photograph of the object from one particular point of view. It cannot show the whole acoustic picture. The measured SPL for a device varies with angle, position and acoustical environment.

Sound power, while also a sound measurement expressed in decibels, is a more complete measurement that expresses the total amount of acoustic energy emitted by a sound source. Consider it akin to a 3-D image compiled from many photographs. It involves multiple microphone measurements from many positions around the sound source. Unlike SPL measurements, it is not dependent on environmental factors. Sound power is a more accurate measurement of noise under a wide range of environments, and correlates better with human perception, especially for comparative purposes.

To distinguish sound power from SPL, it is commonly expressed in bel (a decibel is 1/10th of a bel). The A weighting scale is also generally applied to sound power measurements. For the purposes of this paper I will use the A weighted bel scale for sound power where possible, and refer to SPL in dBA @1M where applicable.

SOUND POWER NOISE REFERENCE TABLE

The following table shows Sound Power Levels in B (bels) for common sounds as a frame of reference to PC noise levels[4].

Source	LwA
An object that emits sound	>0.0 B
Voice - very soft whisper	3.0 B
PCs in idling - design goal according to a study by Intel®	4.0 B
Dishwasher - quiet one	4.6 B
PCs in idling - accepted upper level according to TCO'99	4.8 B
Voice - conversational level	7.0 B
Dishwashers - upper range	8.0 B
Lawn mover	9.5 B
Chainsaw	11.0 B
Saturn rocket	20.0 B

The bel (B) is named after the inventor of the telephone, Alexander Graham Bell. If one sound is a bel louder than another, it is ten times louder. If a sound is two bels louder than another, it is a hundred times louder than the first. If a sound is three bels louder than another, it is a thousand times louder. Get it? A bel corresponds roughly to however many digits there are after the first digit. A sound that is perceived as 100,000 times louder than another would mean there was roughly a 5 bels difference between them. This system lets us deal with manageably small numbers that can represent very large numbers. Mathematicians call these logarithmic numbering systems[5].

4 The PC Noise page of The Silent PC website, Copyright © 1998-2003 Tomas Risberg.
5 The Biology of Hearing section of Chapter 2: The Guts of Music from Technology on The Online MP3 Book, content & layout copyright ©2002 -{ david e weekly }-

Measurement Limitations

Despite the efforts of scientists and engineers to advance the metrology of acoustics, there is still no single objective or numeric summation that tells about the quality of a sound. By the term quality, I do not mean how good it sounds, but rather, the nature of a sound. This is best illustrated with an example:

> The sound of a gas lawn mower a few houses away is measured at the point of reception as 50 dBA average SPL. The sound of the distant surf is measured at the point of reception as 50 dBA average SPL. The measurements are correct; the SPL values are the same. Do they have the same value, meaning or effect on human beings? No. Most of us perceive these sounds as fundamentally different. A sound level meter does not. It takes sophisticated frequency spectrum analysis plotted over time, and someone trained enough to interpret the data in order to identify roughly what you and I can hear and characterize in seconds.

In my work at www.silentpcreview.com, I repeatedly encounter compelling evidence that while measurements are very important, they only tell half of the acoustic story. There is simply no substitute as yet for a careful, trained listener who can describe accurately what is heard and correlate that description to an analysis of its source.

HEALTHY NOISE LEVELS

It's well known that long exposure to noise levels above ~70 dBA can cause noise-induced hearing loss. There is also considerable recent evidence that much lower levels of noise have a real impact on learning, stress, and productivity.

Cornell University researchers published a study in 2000 on the effects of what would be considered moderate levels of noise on workers in the common open-office environment. They found that there was psychological, motivational, and observational evidence of elevated stress. They concluded that chronic exposure to even low-intensity noise may have the potential to cause serious health problems such as heart disease (due to elevated levels of epinephrine, a stress hormone) and musculoskeletal problems.[6] Workplace stress is no joking matter.

The Confederation of British Industry (1992) estimates that, in the UK, 360 million working days are lost each year through illness. The Health and Safety Executive calculates that at least 50% of those lost days are due to stress.

The US Federal agency National Institute for Occupational Safety and Health (NIOSH) identifies job stress as a major cause of ailments and productivity loss, and lists noise as one of the main contributors to workplace stress.

A comprehensive 1999 study for the World Health Organization recommends:

> *"In schools and preschools, to be able to hear and understand spoken messages in class rooms, the sound pressure level should not exceed 35 dBA during teaching sessions."*[7]

[6] "Stress and Open-Office Noise", Gary W. Evans and Dana Johnson, Cornell University, Journal of Applied Psychology, 2000, Vol. 85, No. 5, 779-783, ©2000 American Psychological Association.

[7] Guidelines for Community Noise, edited by Birgitta Berglund , Thomas Lindvall, and Dietrich H Schwela ©World Health Organization 1999 (http://www.who.int/peh/noise/guidelines2.html). From Table 4.1: Guideline values for community noise in specific environments in Chapter 4: Guideline Values. The actual noise term specified was LAeq(16hrs); LAeq = Equivalent Continuous Noise Level. The noise level in dB(A) which if present for the entire measurement period would produce the same sound energy to be received as was actually received as a result of a signal which varied with time. Normally abbreviated to "Leq" or "LAeq", often followed by a specification of the time indicating the period of time to which the measured value has been normalized; for example, "LAeq(8hr)".

> The WHO study specifies the same maximum level of 35 dBA for the interior of homes, to “maintain comfortable speech intelligibility and avoid annoyance.” While no comparable recommendation was made for office environments, it is easy to see how the mentally challenging work conducted in many offices is similar to that done in classrooms, and there is no reason why a similar standard for maximum noise in the work environment shouldn’t apply.[8]

One other simple fact is that noise begets more noise. If the background noise is low, then people speak softly and communicate well whether in person or on the phone. As the ambient noise level increases, people speak louder in order to be heard. When the background noise in an open-office is high, then everyone speaks louder, and the overall noise level is far higher than in a quiet ambient.

In short, the intuitive knowledge most of us have that a quiet environment is more conducive to reduced stress, improved learning, higher productivity, and finally, better health, both mental and physical, is confirmed by the scientific authorities.

COMPUTER NOISE

Cooling fans (in the power supply, the CPU heatsink, motherboard chipset, VGA card and the case itself), hard drives and optical drives are the noise sources in typical PCs. Typical current PCs emit 3.0 to >5.0 bel sound power[9]. Even PCs at the bottom of this noise range (3.0 bel) can be heard in a classroom, office or living room because:

- In a classroom or office, it’s rarely just one PC but at least several and often dozens; in concert, even 3.0 bel PCs clearly become a source of noise.[10]
- In a living room, the ambient noise is often low enough that it does not mask that level of noise.

PCs closer to the middle of the range, say 4.0 bel, are easily heard in most class, office or home environments.

Realizing that system noise is an important issue, hard drive manufacturers have already fully embraced sound power as a noise declaration standard. Large PC makers are also becoming slowly aware of noise. Dell and HP both began in mid-2002 to include sound power and sound pressure data in the specifications for some of their PC systems, although this information still requires some digging on their web sites to find.[11] The vast majority of PC makers do not have consistent standards for noise emission declaration.

Noise Emission Declarations

The complexities of noise measurements and the importance of noise as a fundamental health, productivity and lifestyle issue leads us to the question of noise emission declaration standards. That is to say, how PC and PC component noise should be measured, and how that noise information should be reported.

Except for hard drive makers, noise

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[8] The author’s experience: I think and write faster and more effectively when the noise level is lower. A background ambient of <30 dBA is a personal requirement for high productivity. I am happiest when it is below 20 dBA (notwithstanding the clatter of the keyboard while I type).

[9] There is some debate about this range, as a majority of PCs are still sold without noise emissions ratings of any kind. These specific numbers are cited from Acoustic Overview, Version 1.0, August 2001© Intel Corporation, which can be found at the web site Desktop Form Factors,

[10] Two PCs producing 3.5 bel of noise will add up to 3.8 bel; 4 such PCs will make 4.1 bel; 8 will make 4.5 bel and 16 will make 4.8 bel. Ten identical PCs emitting 3.5 bel will add up to 4.5 bel.

[11] Dell environmental data, including noise emissions in sound power and SPL for many models: http://www.dell.com/us/en/gen/corporate/vision_datasheets_environ.htm HP’s noise data tends to be a bit less complete and embedded deeply in their very lengthy technical data sheets.

emission reporting practices in the industry are spotty and inconsistent.

- Fan makers generally provide only 1-meter (no load) SPL measurements.

- Among the few power supply makers who report noise, many incorrectly cite the SPL data provided by the makers of fans used in their products.

- Makers of mainboards, video cards and optical drives hardly ever provide noise data, despite the fact that they all make noise – mainboards and video cards by virtue of the embedded fans used for cooling, and optical drives due to their intrinsic motor-driven, spinning nature.

- Suppliers of cases often include fans, but never provide any noise information. The fans never emit the same level of noise as specified by the makers, as mounting in a case causes mechanical vibrations that usually translates to higher levels of noise.

Sound power and bel are already utilized by an important sector of the PC industry, hard drive manufacturers. It is also the primary metric used in the most applicable standards for PC noise:

- "ISO 7779… specifies operating and installation conditions in an acoustical lab in order to have reproducible and repeatable values. The two noise metrics in ISO 7779 are the A-weighted sound power level and the A-weighted sound pressure level at specified locations.

- "ISO 9296… on "declaring" noise emissions from information technology products. ISO 9296 specifies reporting statistical maximum values of the A-weighted sound power levels… based on measurements taken according to ISO 7779."[12]

With the VIA EPIA M10000 Mini-ITX mainboard, VIA has started to test acoustic emissions in accordance with the ISO 7779 standard and report the noise data as per ISO 9296 standards. VIA urges all participants in the PC industry to join together in making noise emission declaration a standard practice for all components and systems. Acoustics labs are available all over the world, and with enough demand and testing in batches, costs can be made modest. The broader goal is the creation of a saner, healthier, more productive computing world.

Noise Emissions

PC noise emissions are usually provided in various states of operation such as idle, hard drive accessing and playing a DVD. The fansink on the EPIA M10000 does not alter speed as the CPU loading changes resulting in a consistently low noise level.

Declaired Noise Emissions

	Sound Power (LWAd, bels) (1 bel=10 decibels, re 10^{-12} Watts)	Sound Pressure (LpAm, Decibels) (re $2x10^{-5}$ Pa)
VIA EPIA M10000	4.0	32 dBA @ 1 meter (SPL)

This standard noise emission practice could be extended into all industries so that all human-made products bear the same noise labeling, allowing consumers to make intelligent choices based on apples-to-apples comparisons. In a related

[12] Descriptions of both ISO 7779 and ISO 9296 are from the Noise Labels page of The Silent PC website, Copyright © 1998-2003 Tomas Risberg.

and perhaps more difficult challenge, I personally urge the industry to develop an acoustics metrology that integrates a qualitative yet objective appraisal of the noise emission.[13]

WHY SUCH NOISE LEVELS IN TYPICAL PCs?

The answer to this question was hinted at earlier. It has to do mostly with the amount of heat generated inside a PC and the forced air required to provide adequate cooling. Regardless of cooling method used, fans come into play one way or another.

A recent AMD system builder's guide suggests that the total power for a typical system based around their XP1800+ processor "needs a power supply of at least 162.47 W."[14] The same document calculates that a "High Performance" system based on their XP2100+ processor "needs a power supply of at least 241.91 watts."

The AMD XP1800+ processor has a typical power dissipation of 60.7W, is similar to the 61W rating of the Intel P4-2.5G; the AMD XP2100+ processor has a typical power dissipation of 64.3W, similar to the 66.1W rating of the Intel P4-2.67G.[15] There is little reason to doubt that these Intel CPUs in similar systems would have power supply requirements very similar to the aforementioned AMD systems. Keep in mind that none of these processors are the fastest and hottest of either line.

Whatever power is drawn by the components is dissipated as heat. The power supply mentioned above also produces heat. We can safely say that power supplies used in desktop systems have an average AC/DC conversion efficiency of about 65%. Of the AC power drawn by the PSU, 65% is delivered to the components as DC power; the remaining 35% is lost as heat within the power supply itself. The following table shows this simply:

Type of system	DC Power	Lost in PSU	Total AC Power
Typical XP1800+	162.47 W	87.55 W	249.95 W
Performance XP2100+	241.91 W	130.26 W	372.17 W

The total amount of power used by the system may or may not surprise you. What is really interesting: *Total AC Power is a good estimate of the total heat generated in PCs*. It's not a surprise that conventional PCs make as much noise as they do, given the large amount of forced air cooling required to remove all that heat!

COMPUTING POWER & HEAT

The relationship between computing power and noise is not direct, but closely related. As the central processing unit (CPU), random access memory (RAM), the hard drive (HDD) and other components run at faster speeds, they inevitably emit more heat. The most cost-effective way to cool hot electronic components is with heatsinks and fans.

The CPU is the toughest cooling challenge, because it produces so much heat in such a small area. The core die of a typical modern CPU is no bigger than one square centimeter, yet as we have seen, some are approaching 100W heat dissipation. The heat density is incredibly high! Large copper heatsinks with high-speed fans have become virtually mandatory in powerful desktops for this very reason.

In the last few years, PC makers have resorted to all kinds of extreme techniques to cool increasingly hotter components.

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13 Both concepts discussed by Tomas Risberg in the Noise Labels page of The Silent PC website, Copyright © 1998-2003
14 Builders Guide for Desktop/Tower Systems ©2000–2002 Advanced Micro Devices Inc. May 2002. (http://www.amd.com/us-en/assets/content_type/white_papers_and_tech_docs/26003.pdf)
15 Processor Electrical Specifications © 1997-2003 by Chris Hare, who states: "All of the information contained on this page came directly from the various datasheets provided online."

- Large, heavy copper heatsinks for CPUs that require special mounting and transportation techniques in order to avoid damage to the motherboard.

- Extremely noisy, high-speed fans on CPUs, video card heatsinks, and multiple high-speed fans for case cooling.

- At least one of the major CPU makers now mandates an intake opening on the case cover near the CPU for additional cooling air, which opens another direct escape path for noise.

- Water cooling — a pump circulates water through a closed loop in order to carry the heat from the CPU and other hot component parts to a radiator, often located outside the PC case and cooled by forced air with 2 or more 80~120mm fans.

- Complex heatsinks integrating heat pipes to wick heat away from the CPU to another point in the case where it can be dissipated more efficiently; it is a kind of passively pumped water-cooling system, but requires customization.

- Refrigeration technology, the ultimate liquid cooling. Complete with compressor pump, copper piping, Freon-substitute, etc.

The above cooling solutions add considerable expense, complexity, maintenance and noise. Some are so extreme as to be acceptable only for the gaming enthusiast or for highly specialized applications. All for the sake of increased clock speeds. One can't help ask: Is maximum clock speed a necessity for all computers?

The answer is no. Maximum clock speed is not a primary requirement for the vast majority of today's PC applications. Increasingly, the compelling requirements of a PC include:

- Application performance
- Ergonomic compatibility:
  - access
  - operation
  - maintenance
- Aesthetics and physical design:
  - size
  - shape
  - look
  - fit
- Low total cost of ownership
- Low noise

Maximum clock speed is not a prerequisite for any of the above. In fact, maximum clock speed makes it more difficult to reach most of the above requirements.

VIA's solution takes a radically different approach. Rather than enter the arms-race style competition for maximum clock speed, VIA offers highly optimized computing platforms that perform well in the real world. The primary focus is on extreme efficiency in:

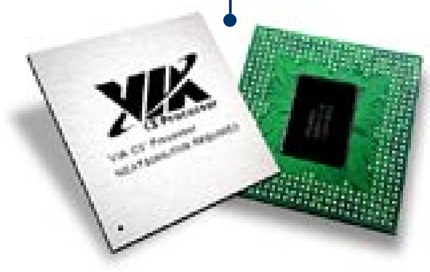
- Distributed platform application performance
- Electrical power consumption
- Heat dissipation
- Space utilization
- Cost

The result is a range of computing products and platforms that not only meet mainsteam performance requirements, but are also dramatically compact, practical and result in very quiet systems.

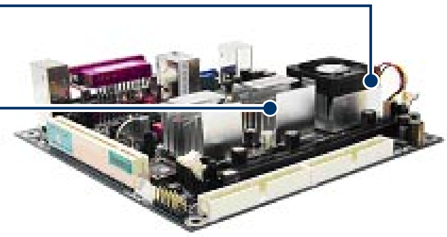
THE VIA LOW NOISE ALTERNATIVE: HIGH EFFICIENCY DISTRIBUTED PLATFORM PERFORMANCE

VIA's answer to all of the above challenges are low power products and platforms consisting of a range of energy efficient processors, chipsets and companion chip options. These low power platforms address all of the issues around heat and noise at the source by distributing the workload over the entire platform rather than concentrating it in the processor. They allow great flexibility in small footprint, low profile system designs while requiring minimal forced air-cooling in even confined and crowded environments.

THE VIA C3 PROCESSOR



THE VIA EPIA MINI-ITX MAINBOARD



The highly efficient VIA processors and VIA EPIA Mini-ITX mainboards are excellent examples of VIA's low power, low noise strategy.

The VIA EPIA M-Series, targeting the digital media entertainment market, best demonstrates the benefits of a distributed load performance over the entire Mini-ITX platform:

- Hardware MPEG 2 decoder integrated into the North Bridge for excellent DVD playback even with a fanless 600MHz VIA Eden™ processor.
- The acoustic profile for the M6000 is 0 dBA; the fan-cooled M10000 maintains extremely low noise, just 32 dBA @ 1 meter[16] or 4.0 bels Sound Power (LWAd).

The unique strengths of the VIA processors and the VIA EPIA-Series of Mini-ITX mainboards have made possible the development of a new class of low profile quiet PCs that cross the borderline between PCs and consumer electronic devices.

Essential Strengths of the VIA Approach

The Hush and Panda systems are made possible by the unique combination of distributed performance, low heat, high integration and compact size that is the VIA EPIA Mini-ITX platform. The VIA processors dissipates just a fraction of the heat produced by Intel and AMD processors.

The modest cooling needs of the CPU and the reduction in current demands on the power supply are key to the fanless operation of the Hush and Panda systems. The low power requirement has another obvious and highly desirable result: Low AC electricity consumption, with the benefits of smaller utility bills and higher environmental friendliness.

The energy consumption and associated heat dissipation benefits compared to conventional systems are dramatic, as the examples below show.

[16] Noise readings measured in the anechoic chamber at the University of British Columbia by SilentPCReview.com in dBA @ 1 meter (SPL).

DVD PLAYBACK

The table below compares a VIA EPIA M10000 (1GHz "Nehemiah" core VIA C3 processor) system's DVD playback performance to that of a system consisting of Intel® Pentium 4-1.8 GHz and 845PE chipset with Geforce 4 MX440 VGA card.[17] Both platforms achieve the requisite 30 frames per second performance for smooth DVD playback. But the VIA EPIA M10000 system delivers equivalent DVD playback performance with half the processor speed, and at a fraction of the cost, space and cooling and hence noise.

With the sleek lines and the polished finish of a high-end audio component, the Hush Mini ITX PC by Hush Technologies runs without the noise of a single fan. The Hush Mini ITX PC's excellent digital media performance makes it an ideal fit in the living room.

The Panda PC by Norhtec offers similarly quiet fanless performance in a unique, tiny package measuring just 22 x 22 x 15 cm (9 x 9 x 6"). The Panda PC is one of several fanless Mini-ITX based products offered by Norhtec that are appropriate for home and office environments.

CPU	VIA EPIA M10000 (1 GHz CPU + CLE266 chipset)		Intel P4-1.8A	
Platform			Intel D845PEBT2	
Player	Cyberlink PowerDVD4.0-(DxVA)		Cyberlink PowerDVD4.0-(DxVA)	
Performance	CPU load	Frame rate	CPU load	Frame rate
	33-44	29.8	19-33	29.9

POWER EFFICIENCY

The power consumption of the VIA EPIA M10000 Mini-ITX mainboard[18] while performing a variety of tasks was compared with the P4 1.8GHz system[19] of the previous DVD playback performance example.

Activity	EPIA M10000	P4-1.8AGHz
Power	Total AC Power for system[20]	Total AC Power for system
Play DVD	43W	63W
Play MP3	45W	66W
Run Office App	57W	81W
Idle	32W	60W

[17] Both systems running Window XP Professional, 512MB DDRAM, Seagate Barracuda IV 40G HDD; sound provided by the respective built-in sound card in each motherboard.
[18] The other components consisted of a 55W power supply, 512 MB DDRAM, Seagate Barracuda IV 40G hard drive, Windows 2000
[19] The other components consisted of an Intel-recommended 300W power supply, 512 meg DDRAM, Seagate Barracuda IV 40G hard drive, Windows 2000
[20] Isolating the EPIA M10000 & RAM gives power dissipation of approximately 55% of total system AC power.

FINAL WORDS ON POWER EFFICIENCY

The precise power dissipation of a VIA EPIA M10000-based system will be affected by choices made by the system builder regarding associated components, power supply, and configuration. However, given that the VIA EPIA M10000 mainboard and 512MB of DDR RAM rarely draw more than 25 watts, it is very easy to assemble systems that are absolutely miserly for power consumption. A stark and telling contrast to the 371W AC power draw calculated earlier for a typical recommended "performance" system from the mainstream CPU makers.

COMPUTING NOISE CONCLUSIONS

Ever-increasing noise seems an inescapable byproduct of the machines, the technologies and the infrastructure support mechanisms we employ in our work and leisure time. As computers in their various forms become more pervasive in everyone's lives, they too make their contribution to the universal din.

PC devices don't have to create the high noise levels they do and further contribute to the noise problem. Rather than employ noise reduction solutions after the fact, the best methodology is to develop computer components that are quiet from the beginning of the design cycle – for both cost and environmental reasons. VIA, as a designer of the silicon that makes up the heart and brains of PC devices, has embraced this approach to take a leading role in creating low noise processors and platforms.

Increased consumer awareness of noise pollution, and education by institutions such as the World Health Organization is already beginning to force manufacturers to address noise emission levels. Companies that wish to market effectively to noise sensitive environments, schools, offices and living rooms will be forced to face the issue of noise reduction.

Hard drive manufacturers have provided noise data as part of their product specifications for some time, and competition amongst them has helped lower the general noise level of hard drives. Cooling fans arguably create the most unnecessary system noise. VIA has taken a leadership role regarding noise emissions at the platform level, and will continue to publish noise data on VIA products to keep customers and the public informed, and to encourage other industry players to include low noise as a primary design goal wherever appropriate.

To create a level playing field for comparing products VIA recognizes that adherence to a standardized noise measurement system is imperative. As described earlier, Sound Pressure Levels measured at 1 meter in dBA are a reasonable indicator of noise, but Sound Power (bel) measurements are more accurate and better correlate with human perception of noise emitted by PC devices. Qualified sound testing laboratories with anechoic chambers that provide the most suitable testing environments for sound measurements should be used to determine official results.

Finally, in an effort to encourage greater awareness of computer noise issues, VIA is creating a brief guide on their website "An Introduction to Measuring PC Noise", freely available for companies, journalists and anyone interested in the details, requirements and process of measuring PC noise.