Overclocking Guide
for Beginners
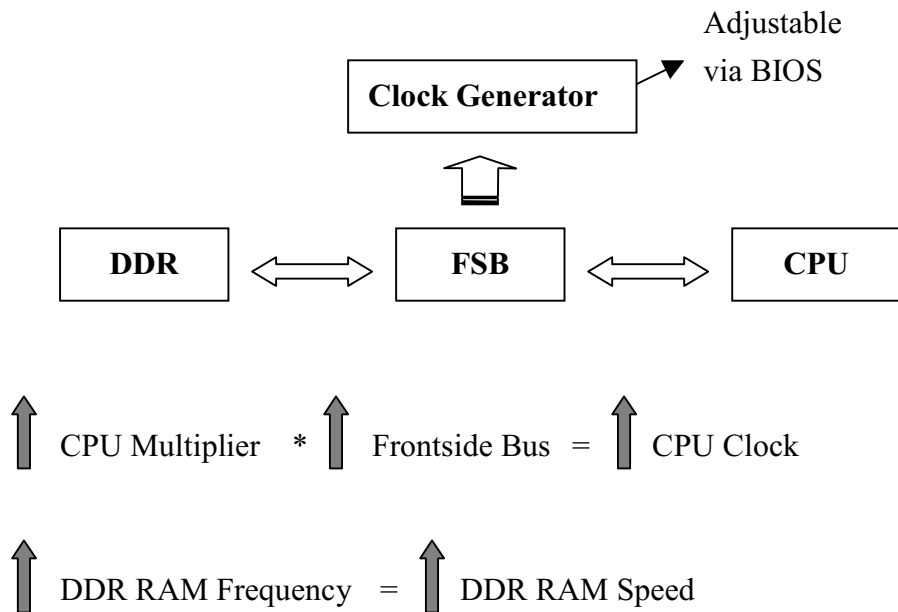
Revision 1.0

Table of Contents

Section I Introduction to Overclocking

Basic concept of overclocking:

Clock Generator → Adjustable via BIOS

DDR ⟺ FSB ⟺ CPU

↑ CPU Multiplier * ↑ Frontside Bus = ↑ CPU Clock

↑ DDR RAM Frequency = ↑ DDR RAM Speed

The main objective of overclocking is to increase the overall speed of the system in order to improve computing performance.

Normally, this is done by clocking the CPU and RAM above their rated speed in order to achieve higher benchmarks score and faster OS response. As you can see from the above, increasing CPU FSB / Multiplier / RAM Frequency,

Available Tweaking selections by *EP- 8RDA+*

CPU Clock Ratio
- Use this item to select a multiplier for the system Frontside bus (FSB) frequency.   The value of he multiplier must be set so that:

    Multiplier * Frontside Bus Frequency = CPU Clock Speed
    EX: 11 * 166MHz = 1826MHz (XP 2500+)

FSB Frequency
- Enables you to set the CPU Frontside bus speed.

Memory Frequency
- Enables you to select the memory frequency.
- Options: By SPD -> 50% all the way to 200%

VDD(V)
- The voltage level of chipset. *(Not recommend)*

Vcore(V)
- The voltage level of the CPU Vcore *(Not recommend)*

Vdimm(V)
- The voltage level of the DRAM. (*Not recommend*)

Section II Introduction to Hardware Technical terms

Technical terms:

Front Side Bus (FSB)

FSB is the central data transfer between CPU and DDR RAM, you may also treat it as the main heartbeat of the system.

Increase FSB will result in increasing computing speed and overall performance.

"*Main objective of Overclocking"*

CLK GEN(*Clock Generator*)

- Onboard chip that supplies clock for FSB / DDR RAM / CPU.   The FSB frequency is always half of the CLK GEN frequency, because of this direct relationship with FSB, it is often mistaken as FSB frequency.   This item is adjustable in BIOS.

DDR clock

For smooth operation, DDR should operate synchronously with FSB. This ensures efficient data transfer without any delay. For this the DRAM clock is derived from CLKGEN which also supplies the FSB. However in reality a clock divider is added to slow the DDR clock for better stability .

DDR memory transfers data at twice its clock rate, which means a *DDR400* memory actually clocks at *200MHz*, instead of "*400MHz*".

CPU clock

The CPU too derives its clock from the CLKGEN.   An internal multiplier increases the ratio to generate the clock for the CPU core which dictate the CPU operating frequency.

Example: *Athlon 3200+* operates at *2200MHz*, which is *200MHz* CLKGEN multiplied by *11*.

Overview

The FSB, DDR and CPU clocks are sourced from CLKGEN. Unlike DDR and CPU, the FSB has a direct relationship with CLKGEN and does not involve any clock dividers. That's why the CLKGEN is often mistaken for FSB. Increasing the CLKGEN will linearly increase the FSB, however increase in the DDR and CPU speed will depend on DDR *divider and CPU multiplier* respectively.

Example:

CLK GEN = 166		CLK GEN = *182*	
FSB	= 333	FSB	= *364*
DDR	= 333	DDR	= 333
CPU	= XP 2500+	CPU	= *XP 2800+*

Few things you may want to know before overclocking

- **Find yourself a better CPU cooler**
- **Unstable system due to overclocking?   Not always true**
- **Make sure you know what you are doing, read the instruction carefully**
- **Risks may be involved in overclocking**
- **Finding an overclockable hardware is purely good luck**
- **Quality of RAM / Motherboard / CPU will be the highest priority**
- **Overclocking may lead to system instability**

System configuration:

This manual will use the following system configuration for demonstration

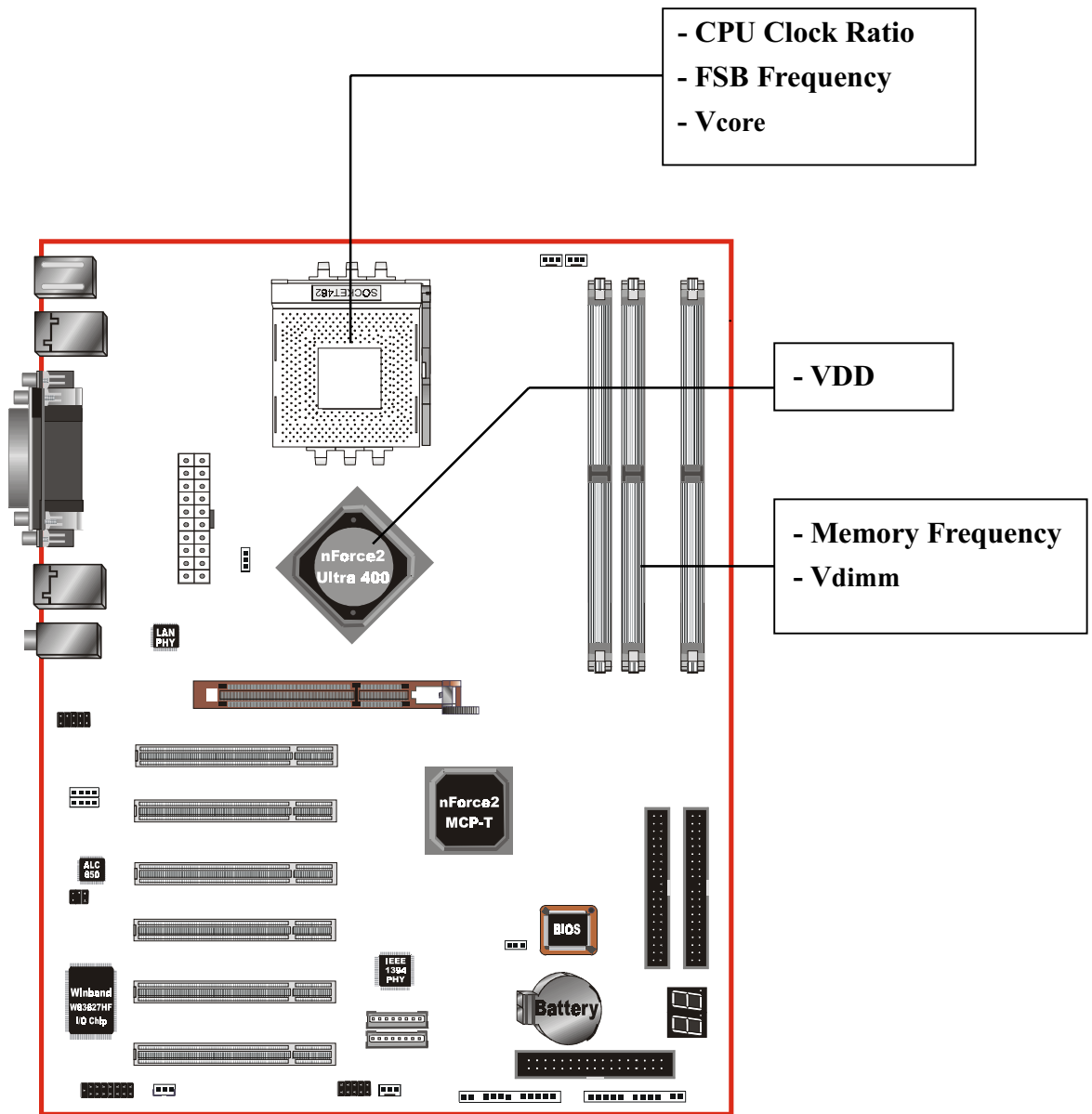> **CPU: AMD Athlon XP 2500+ (FSB 166)**
> **RAM: DDR 400 * 2**
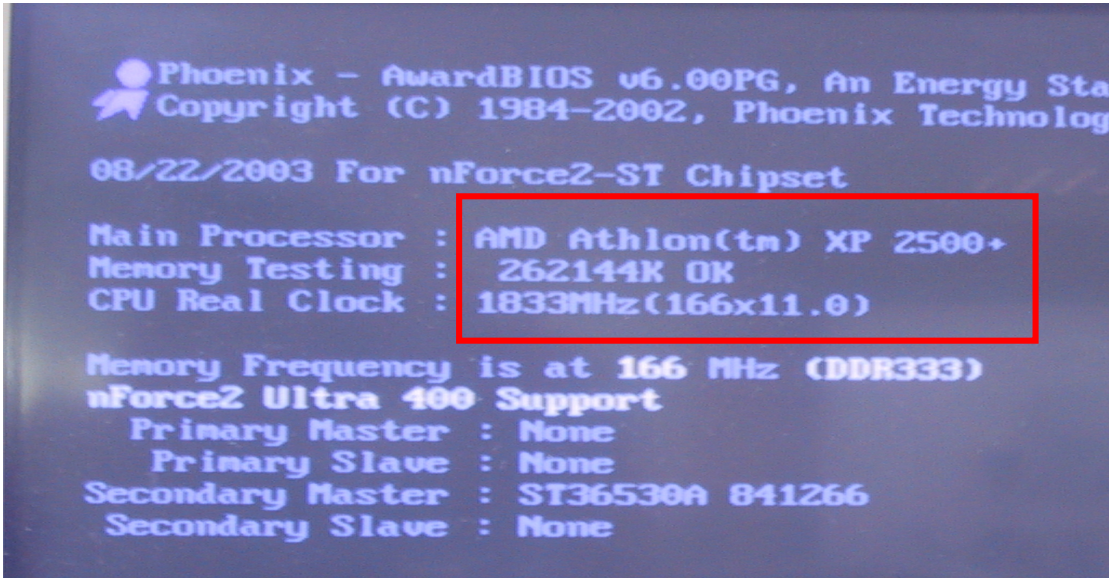> **HD: IBM 60G**
> **Mainboard: 8RDA+**
> **VGA: GeForce4 MX440**
> **OS: Windows XP SP1**

Adjustable features through BIOS

- CPU Clock Ratio
- FSB Frequency
- Vcore

- VDD

- Memory Frequency
- Vdimm

SOCKET462

nForce2 Ultra 400

LAN PHY

ALC 850

nForce2 MCP-T

BIOS

IEEE 1394 PHY

Battery

Winbond W83627HF IO Chip
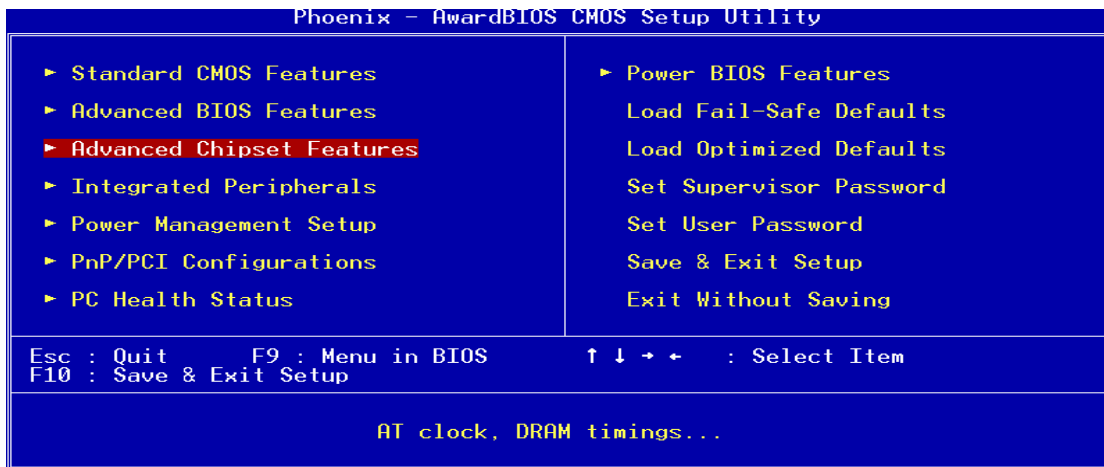
Section III Overclocking – Case Study

System running with out overclocking:

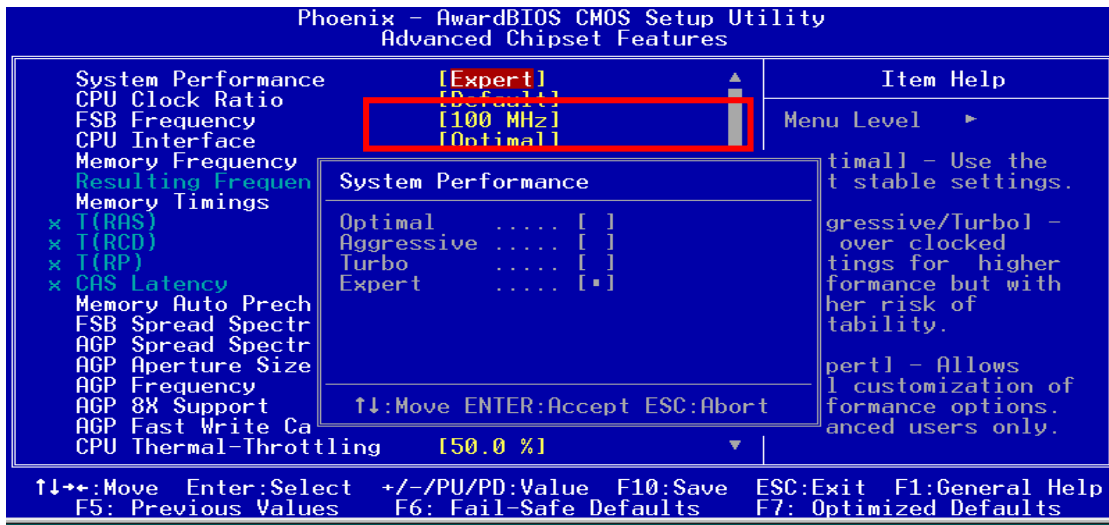## *Get ready to tweak your system now!*

Part I - Tweaking CPU Ratio

Step 1: Turn on your computer and press Delete bottom to enter the BIOS setup utility
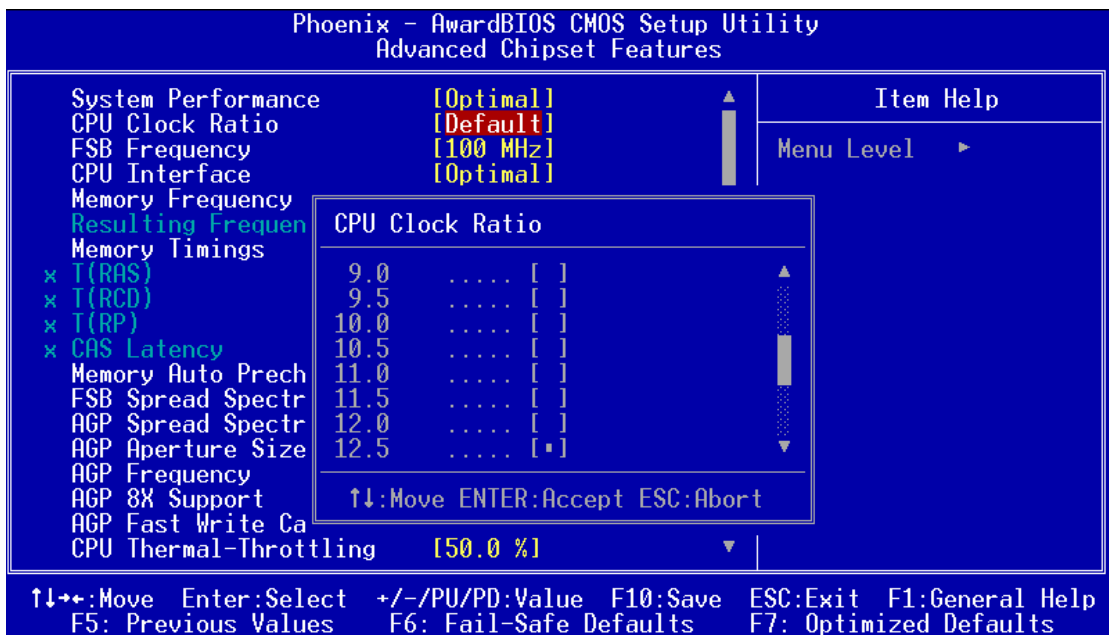
Entering Advanced Chipset Features

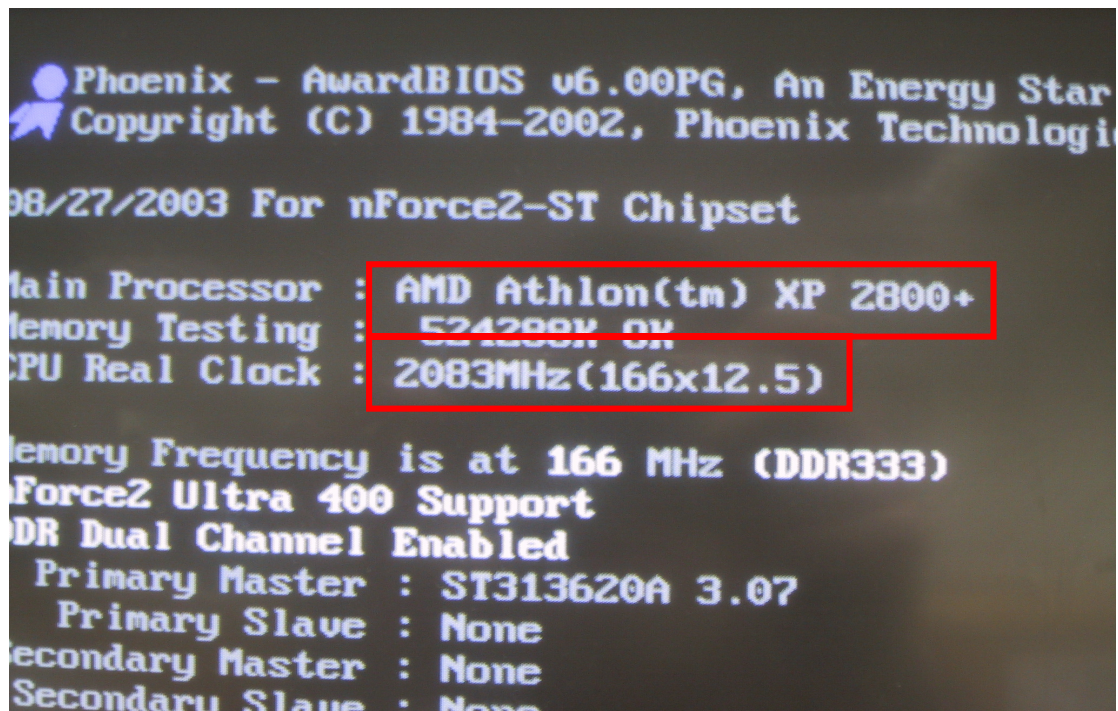**Step 2: Changing system performance setting from Optimal to expert**

Step 3: Changing CPU Clock Ratio setting from Default to 12.5

Result:

Congratulation, you have just tweaked your CPU from *Athlon XP 2500+* all the way to *Athlon XP 2800+*, simply by changing the CPU multiplier form *11x to 12.5x*

Part II - Tweaking CPU FSB

Step 1: Changing System Performance setting from Optimal to Expert
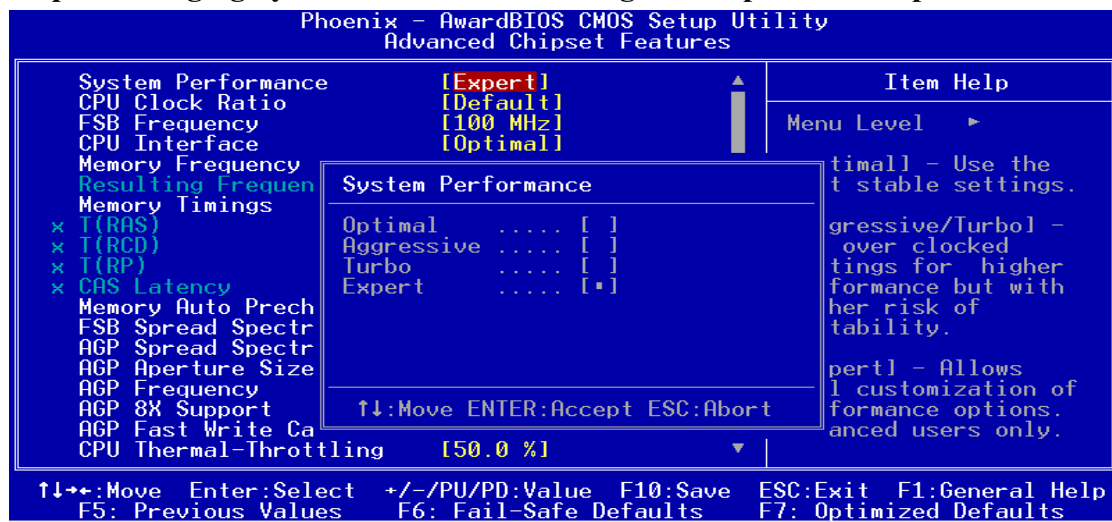
Step 2: Changing FSB Frequency from 166MHz to 182MHz
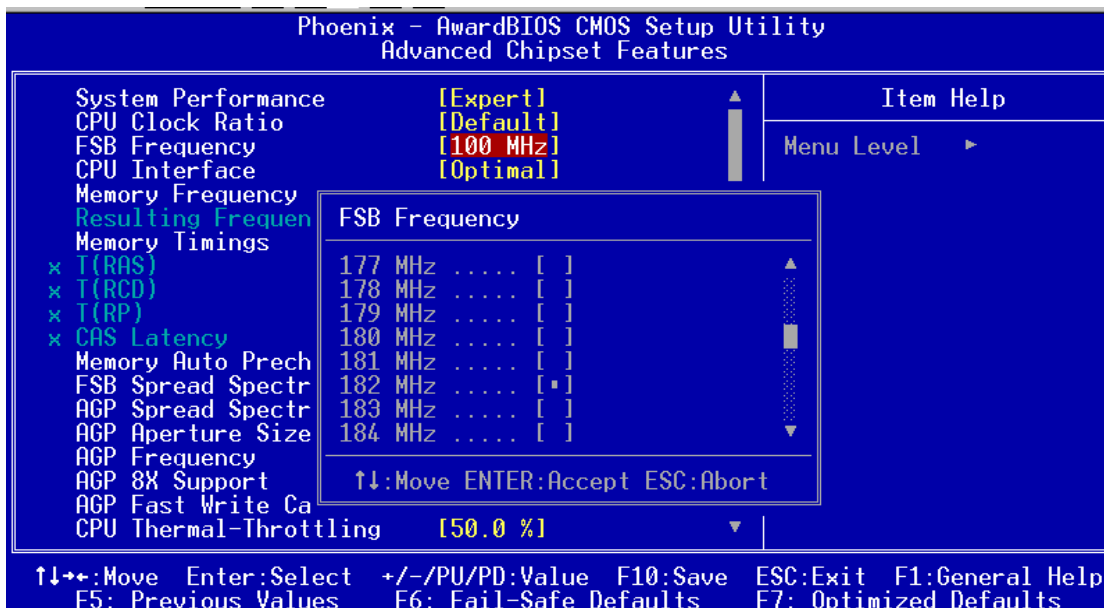
Result:

Congratulation, you have just tweaked your CPU from *Athlon XP 2500+* to *Athlon XP 2800+* again, but this time, you have done so through changing CPU FSB instead of CPU Ratio.

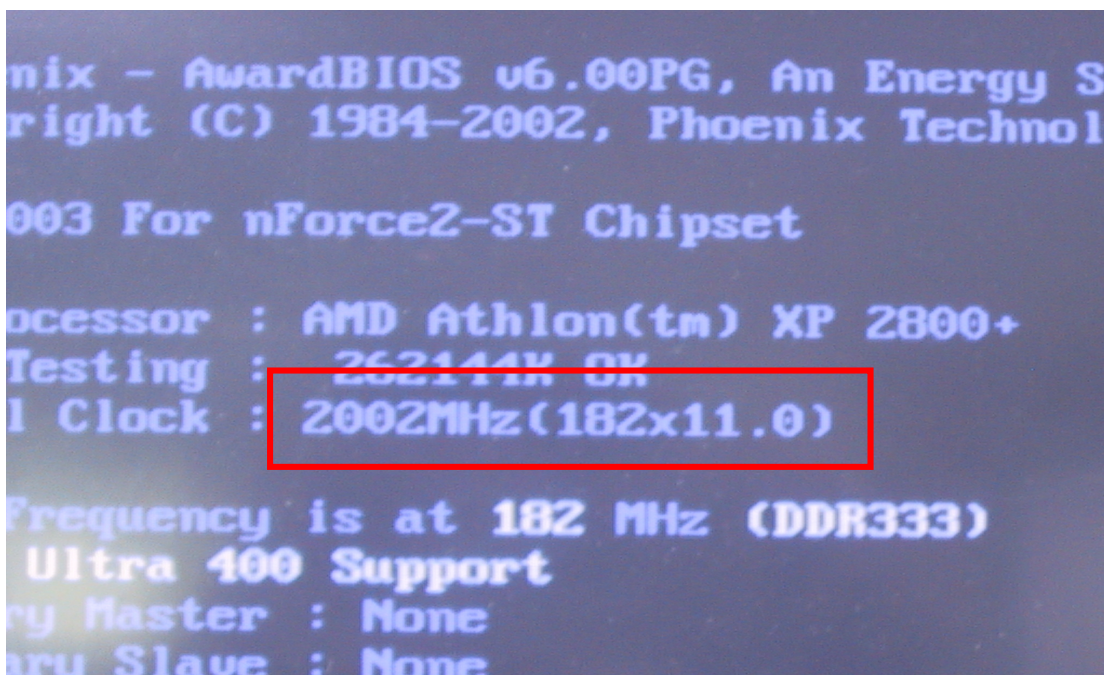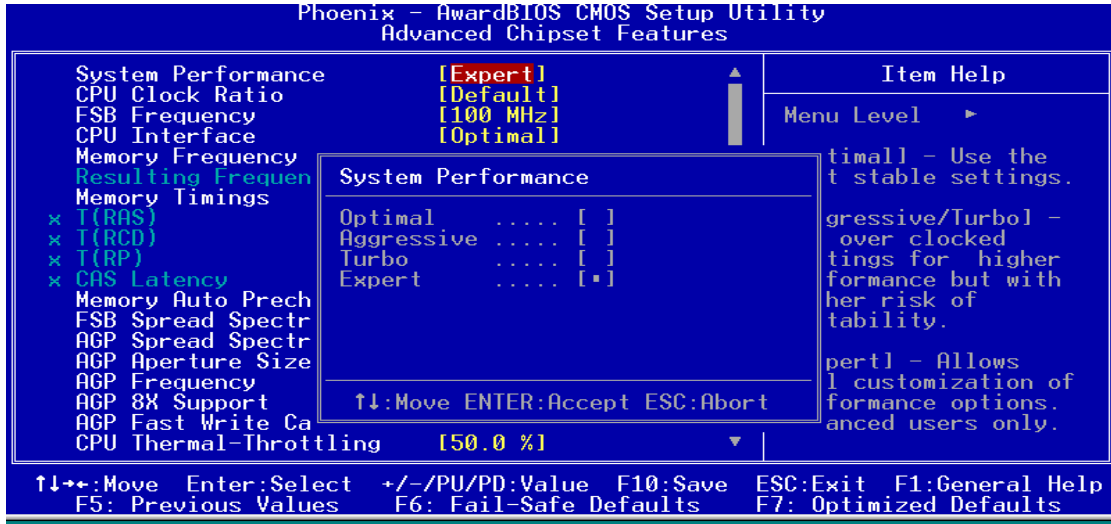# Part III - Tweaking DDR Memory Frequency

Step 1: Changing System Performance setting from Optimal to Expert

Step 2: Changing Memory Frequency from Auto to 120%
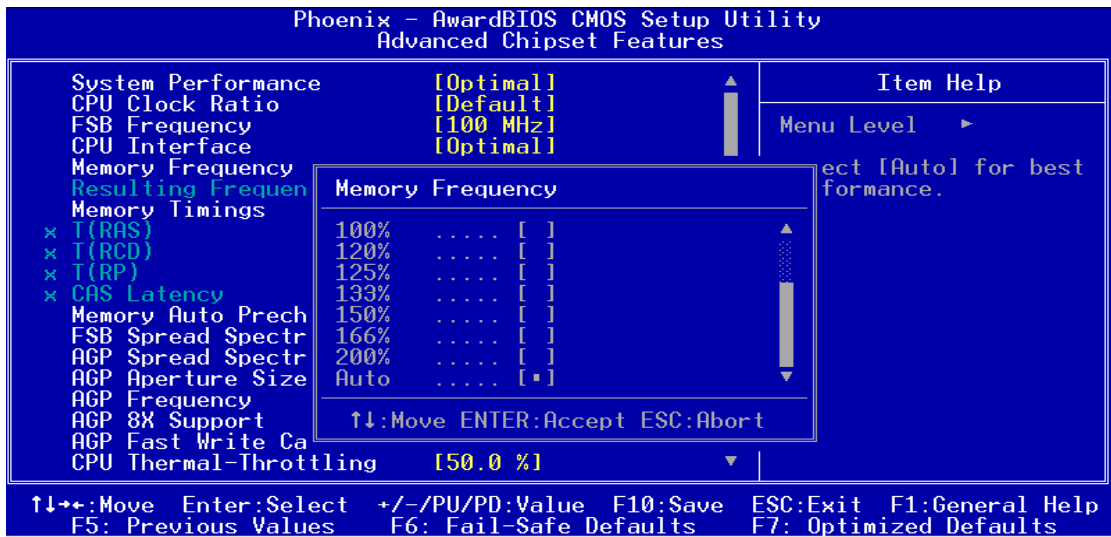
Result:
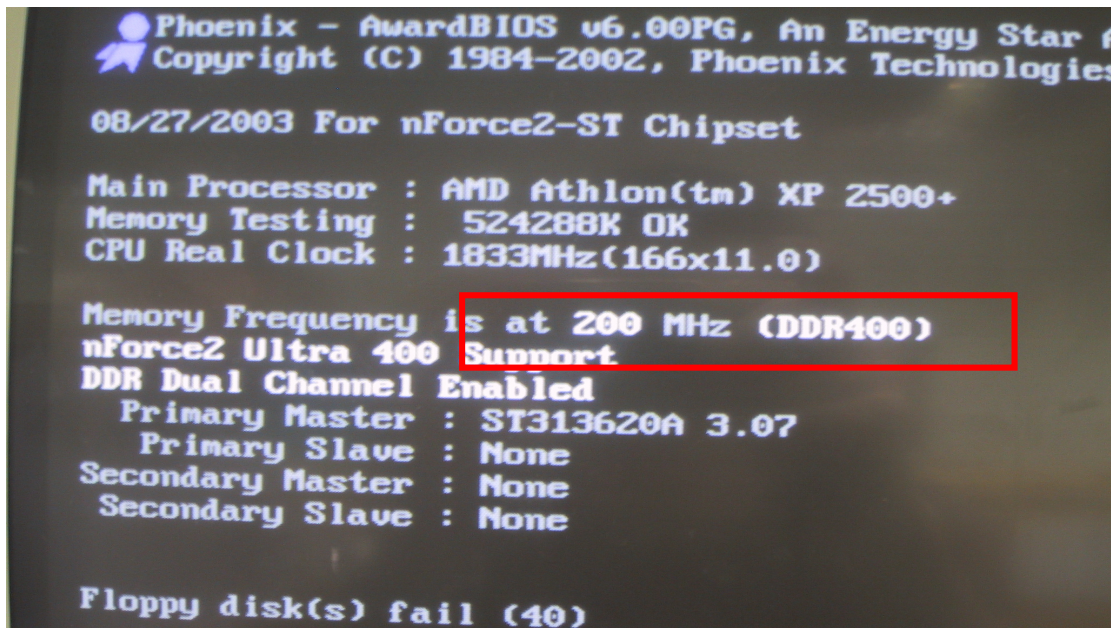
Congratulation, you have just tweaked your RAM from *DDR 333* to *DDR400*

Overclocking – Failure

What can be done if you have experience the following?

- **System boot fail**
- **Frequent system crash**
- **Could not enter the OS**

Move to part IV

Part IV – Restoring your system

Step 1: Shut down your system

Step 2: Change the CMOS jumper from 1-2 to 2-3 position for a few second

Step 3: Replace the jumper on to the 1-2 position

Step 4: Enter BIOS setup utility and select Load Optimized Defaults

Please refer the above settings to the diagram on the next page

Diagram

CMOS Clear Jumper
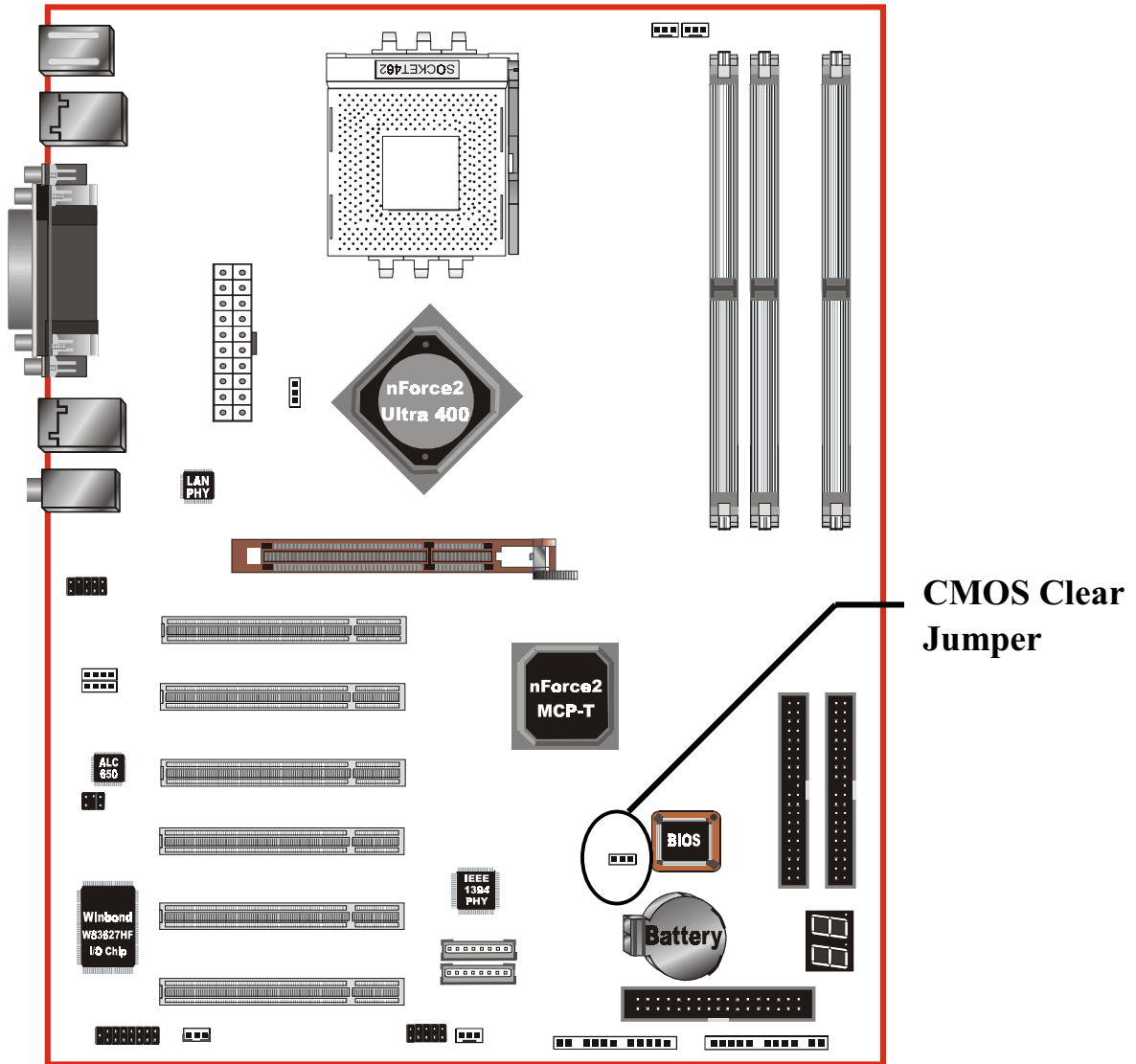
Part V – Tweaking Vcore / Vdimm / VDD

- **Changing either one of the following helps to increase system stability**
  1) **Vdimm (DDR RAM)**

     DRAM performing best at between **2.5v ~ 2.7v**

  2) **Vcore (CPU)**

     It is strongly suggest not adding more than **0.5v** on top of default setting

  3) **VDD (Chipset)**

     Not recommended to change at all

- **Changing Vcore / Vdimm / VDD generates plenty of heat, therefore must have active cooling applied**

Important

- **Changing anyone of voltage setting may cause damage to hardware(s)**
- **Any damage / fault made to hardware(s) relating to overclocking will result in void of warranty**

Summary

```
  ┌─────────────────┐
  │ Default setting │─────────────────────────────────┐
  └─────────────────┘                                  │
           │                                            │
   *Increase or Decrease*                               Optional
           ▼                                            ▼
      ┌─────────┐         ┌────────────┐         ┌────────────┐
      │  CPU    │         │   CPU      │         │  Memory    │
      │  FSB    │         │ Multiplier │         │ Frequency  │
      └─────────┘         └────────────┘         └────────────┘
       │      │            │       │              │        │
       ▼      ▼            ▼       ▼              ▼        ▼
    ┌─────┐ ┌───────┐   ┌─────┐ ┌───────┐     ┌─────┐ ┌───────┐
    │Fail │ │Success│   │Fail │ │Success│     │Fail │ │Success│
    └─────┘ └───────┘   └─────┘ └───────┘     └─────┘ └───────┘
       │                   │                     │
       ▼                   ▼                     ▼
    ┌───────┐           ┌───────┐             ┌───────┐
    │Part IV│           │Part IV│             │Part IV│
    └───────┘           └───────┘             └───────┘

                    ┌─────────────────┐
                    │ Default setting │
                    └─────────────────┘
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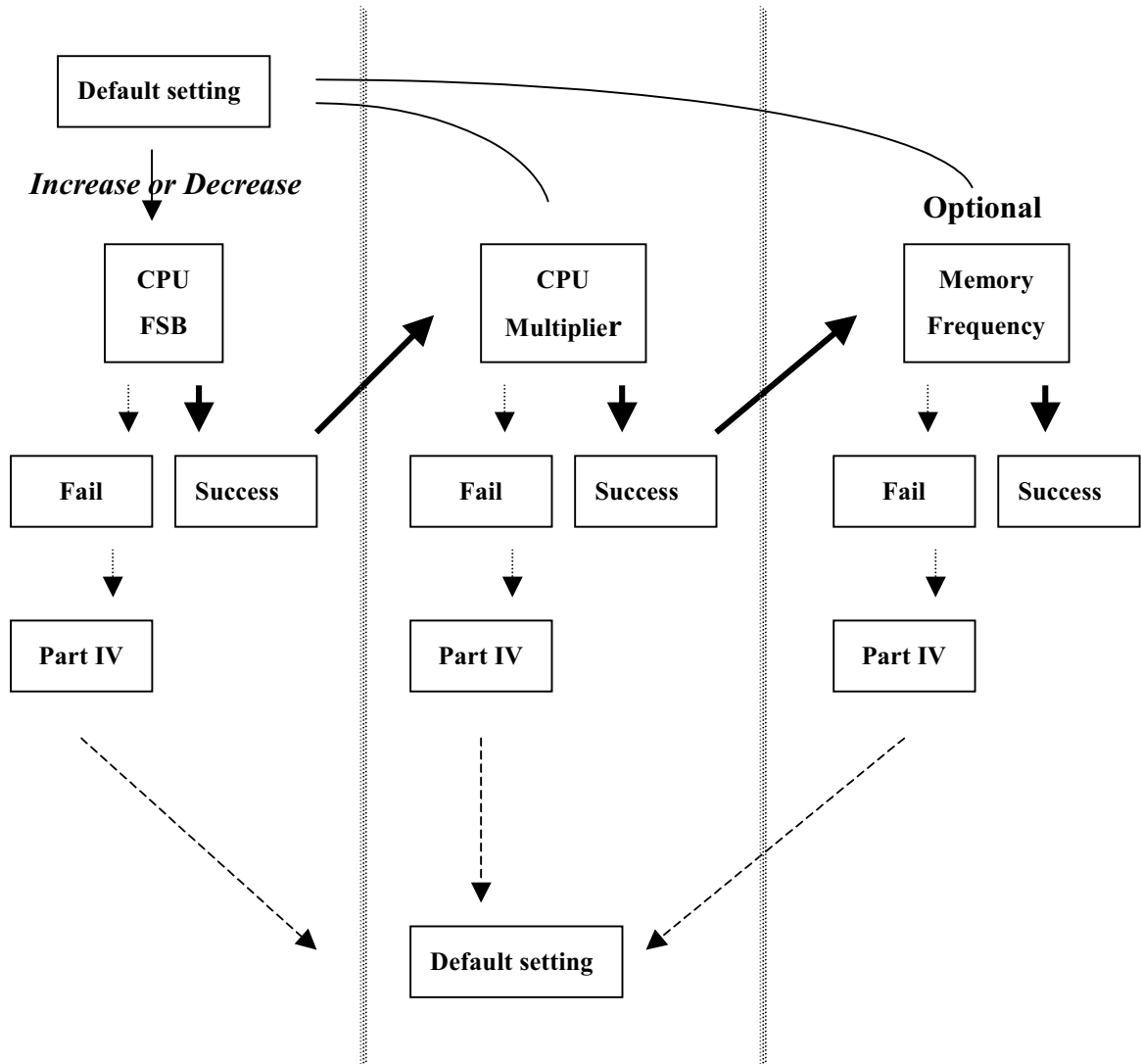
How fast can you go ?

There are few symptoms when a system has reached its limit. Typically when the FSB is stretched too far, the system will fail to boot after changing FSB in BIOS.
Even if a system boots this will result in instability.   Thus, running benchmarking for a period of time may be required to test system stability.

If a component were pushed beyond operating specs, system failure is likely to occur.
Most component will operate fairly stable above their rated speed by a small margin.
How much is the margin will depend on its quality.

Another way to increase this margin is by adjusting the component voltage higher. This helps to improve signaling strength when operating at higher frequencies, which results in better stability. **By doing so, one may risk permanent damage to system component(s).**

Note that Voltage adjustments often result in excessive heat, which brings us to the most common overclocking failure:

"Overclocking limit will depend on cooling and quality parts"