Creation Start: 12/08/2024
Version: v0.0

AM5 Optimization Guide

This guide is designed to unlock the full potential of your:
- 7950X
- 7900X
- 7800X
- 7700X
- 7950X3D
- 7900X3D
- 7800X3D
- 7700X3D
- 9800X
- 9800X3D

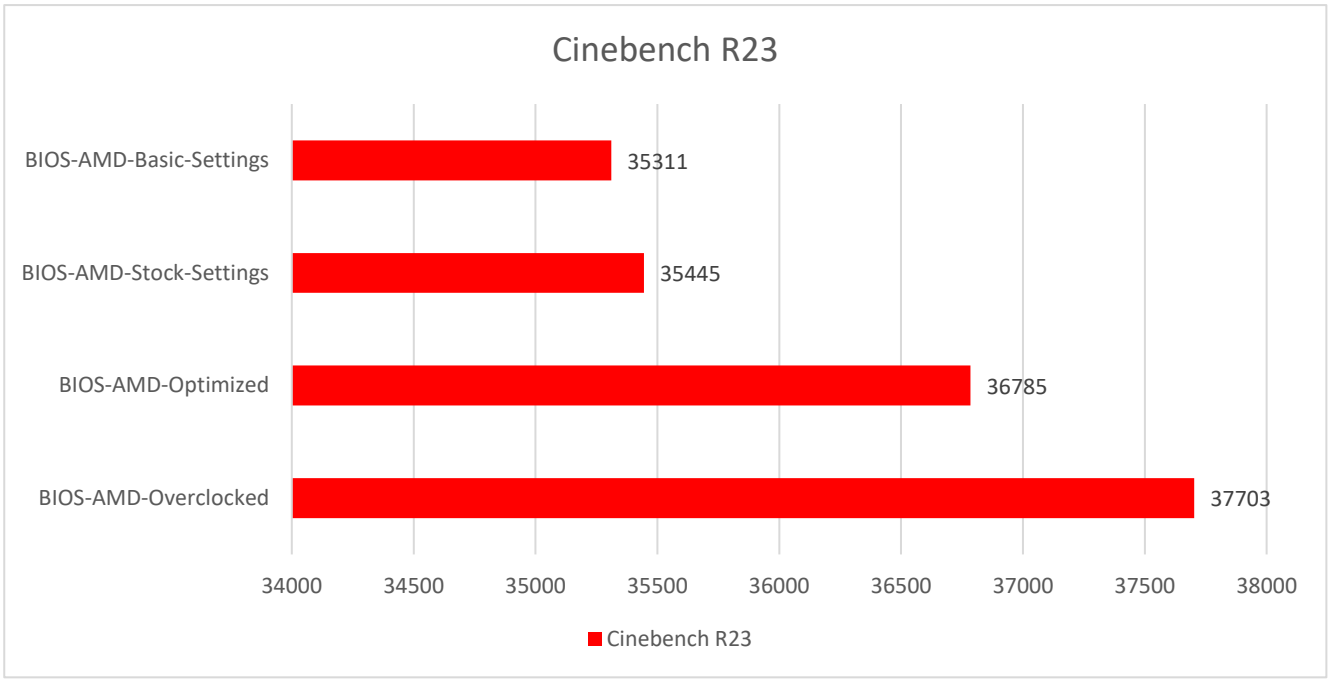
Not to forget, it also aims to optimize all other models of the AM5 platform processors that have not yet been released or are not explicitly listed at the current time.

I would like to provide you with the following benchmark results as an incentive to fight your way through this work of 31 pages!

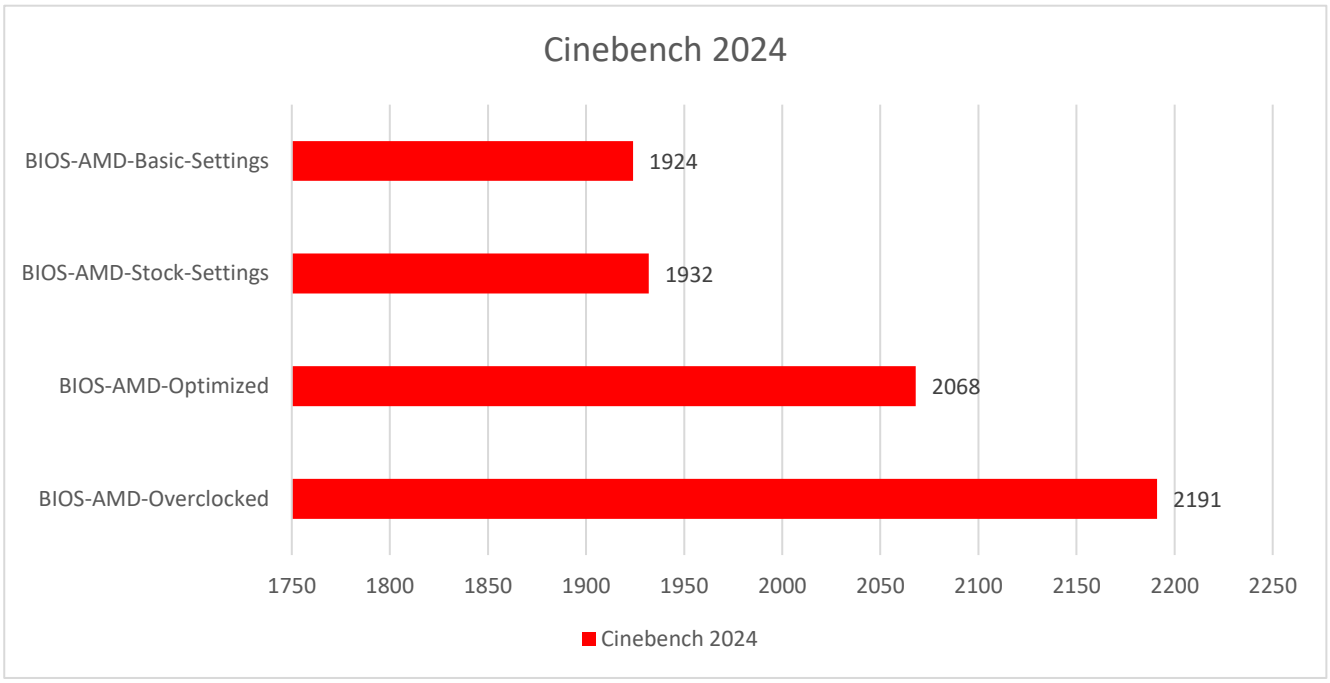
I have also listed an AMD-Overclocked profile, which I will go into more detail on, provided that the feedback from the community is positive, as the development up to this point has already cost a lot of work and effort.

From the data, it appears that optimization means more than "it can be done".

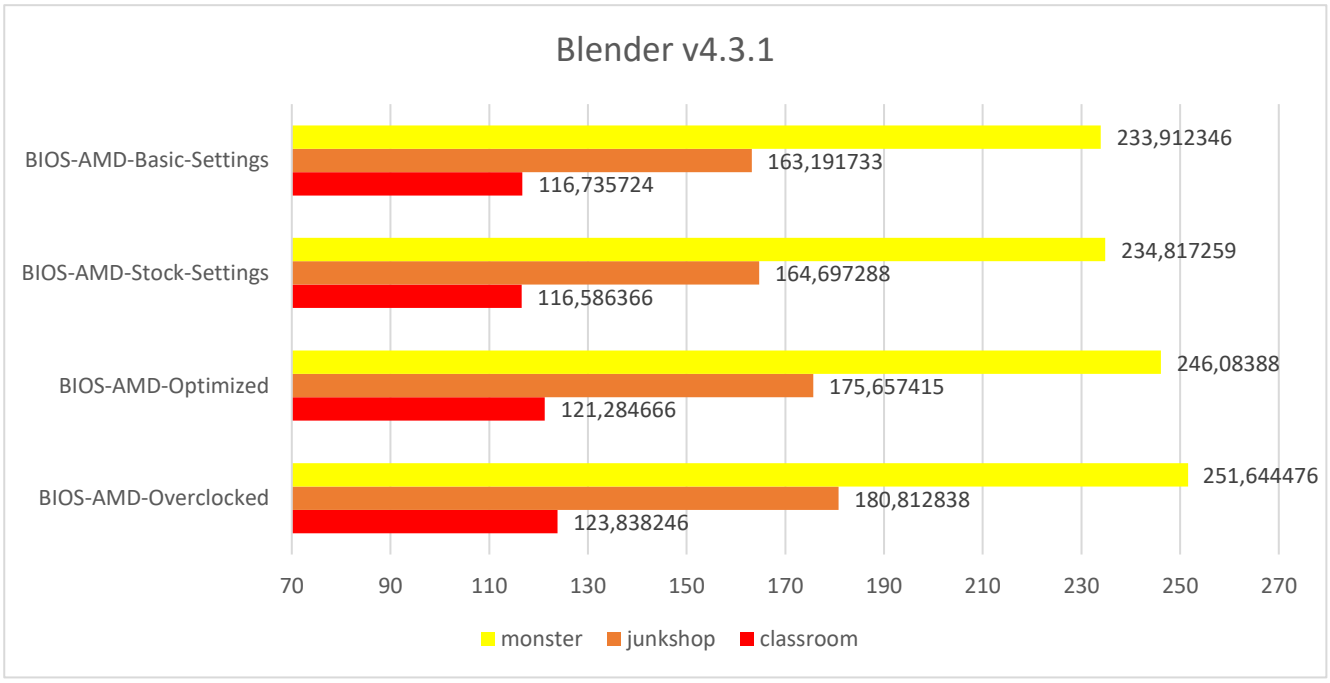
The AMD-Optimized BIOS profile already increases performance compared to the AMD-BIOS profile "AMD-Basic-Settings" by 4.17% and the BIOS profile "AMD-Overclocked" achieves a performance increase of 6.77%.



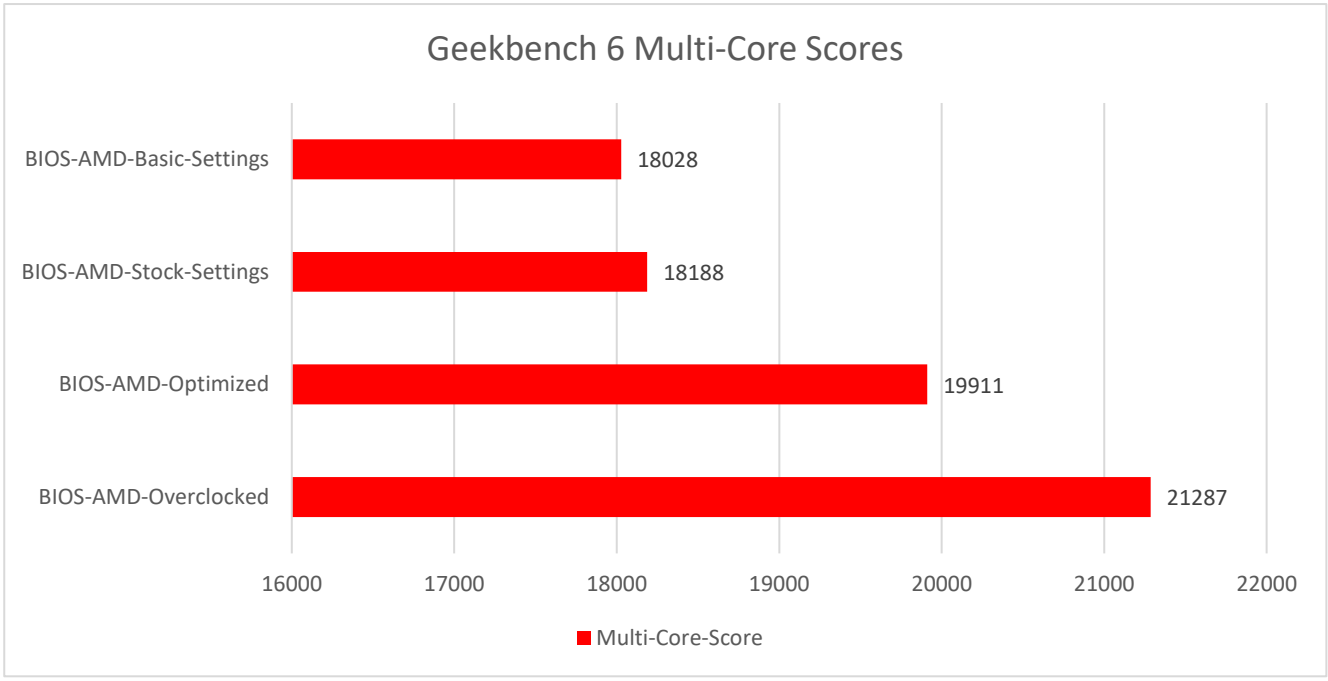
The Cinebench 2024 benchmark shows a performance increase of 7.84% with the AMD-Optimized profile and a performance increase of 13.88% with the AMD-Overclocked profile.



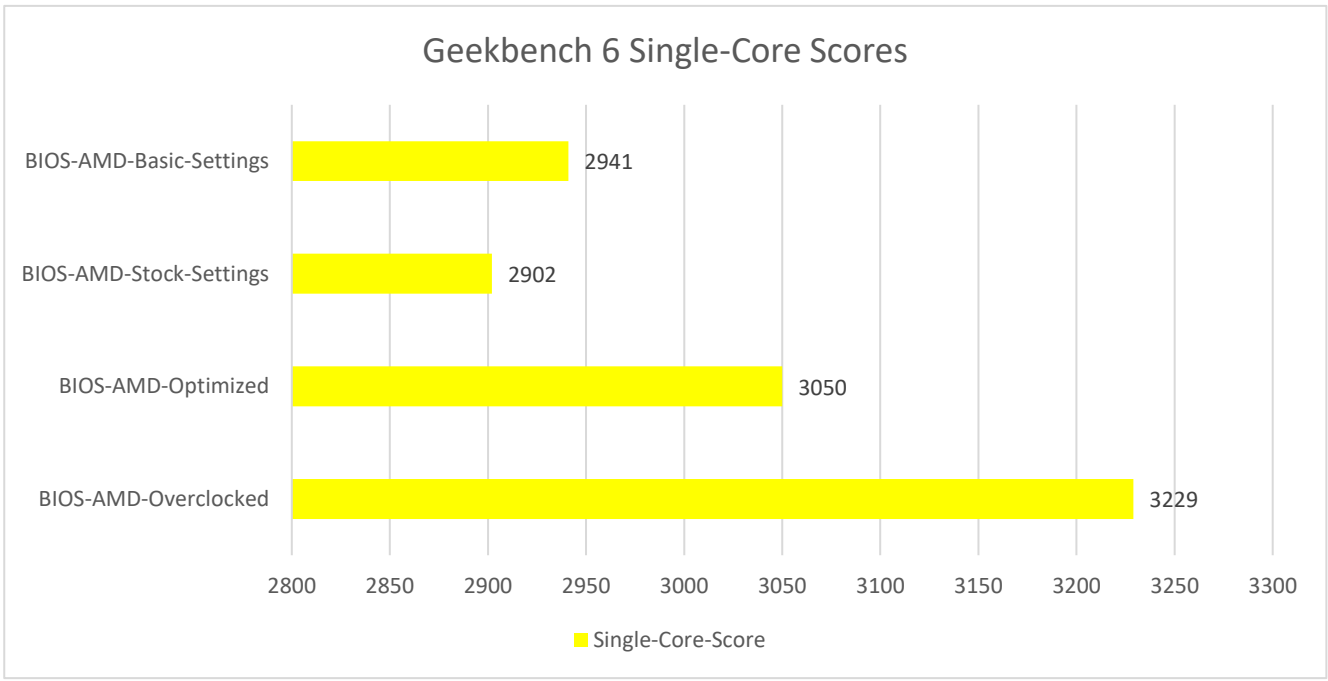
In the Blender benchmark, a similar picture emerges.
AMD-Optimized performance increase:
Monster: 5.20%
Junkshop: 7.64%
Classroom: 3.90%
AMD-Overclocked performance increase:
Monster: 7.58%
Junkshop: 10.8%
Classroom: 6.08%
Classroom: 6,08%



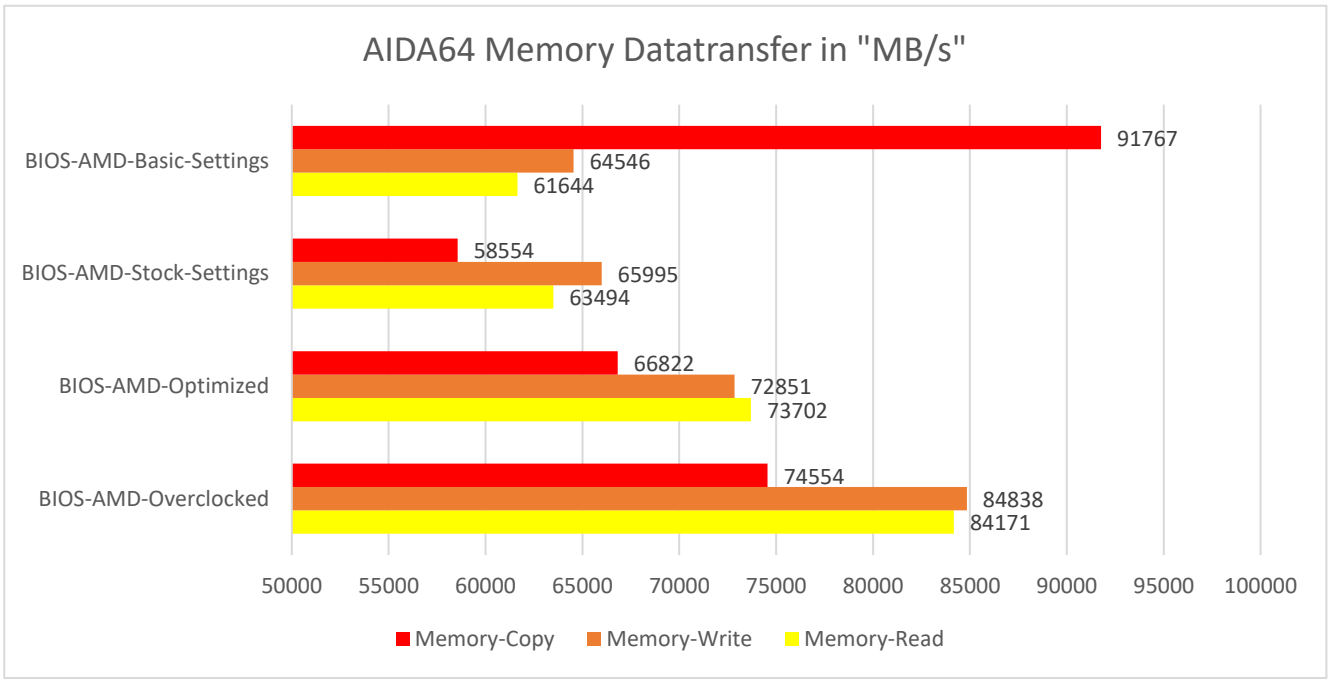
The evaluation of the Geekbench 6 benchmark shows a performance increase in the multi-core results of 10.44% with the AMD-Optimized profile and a performance increase of 18.08% with the AMD-Overclocked profile.



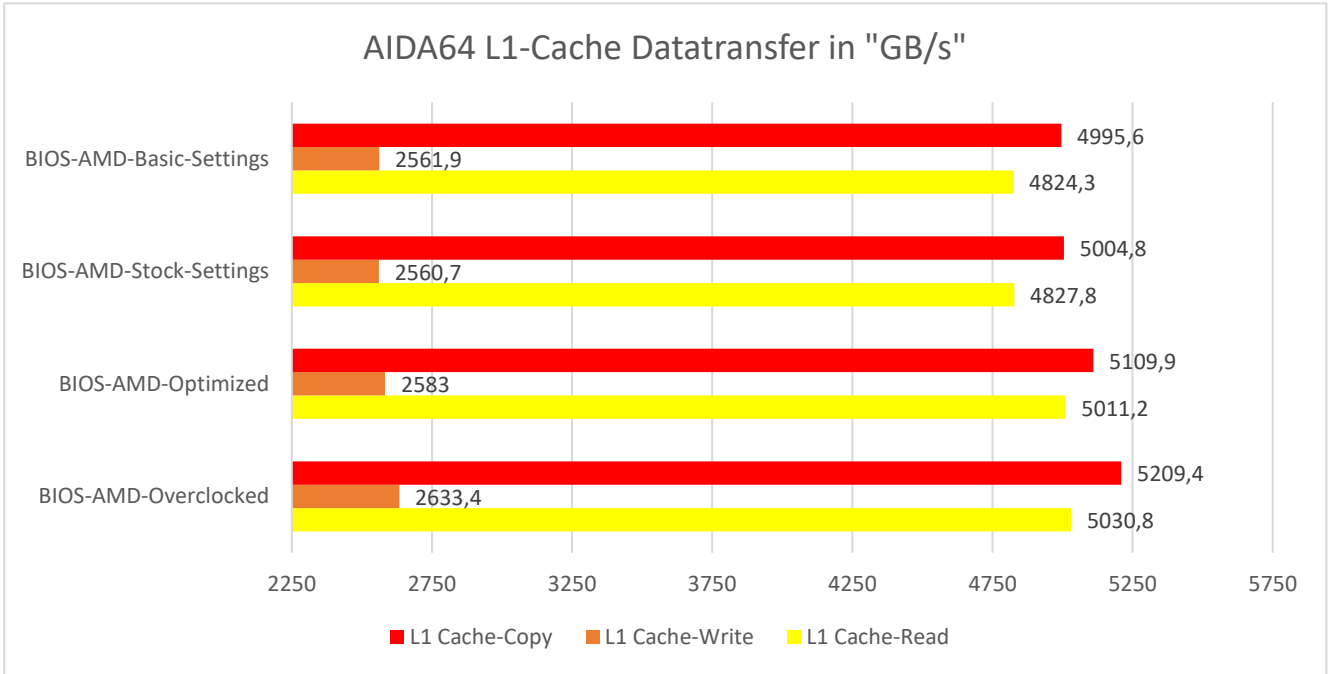
The results of the Geekbench 6 benchmark in the single-core performance area are also very interesting. The performance increase of the AMD-Optimized profile is 3.71%, and the performance increase of the AMD-Overclocked profile is again higher at 9.79%.

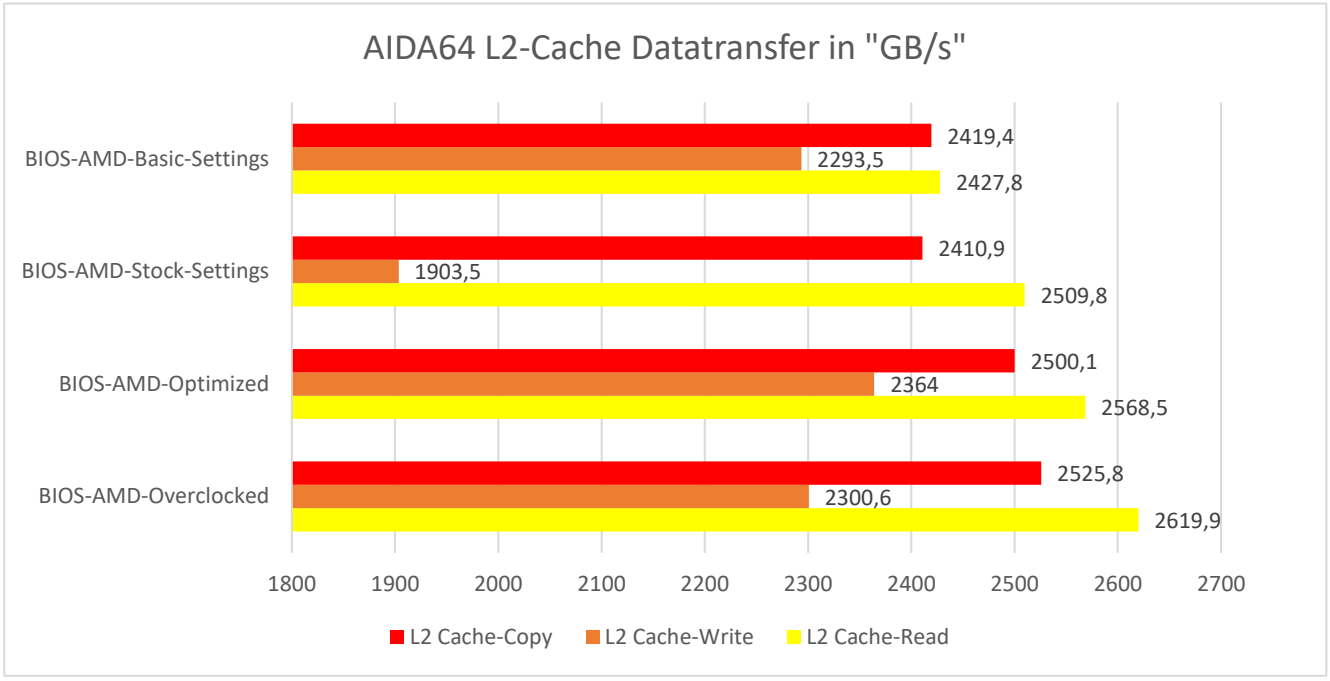


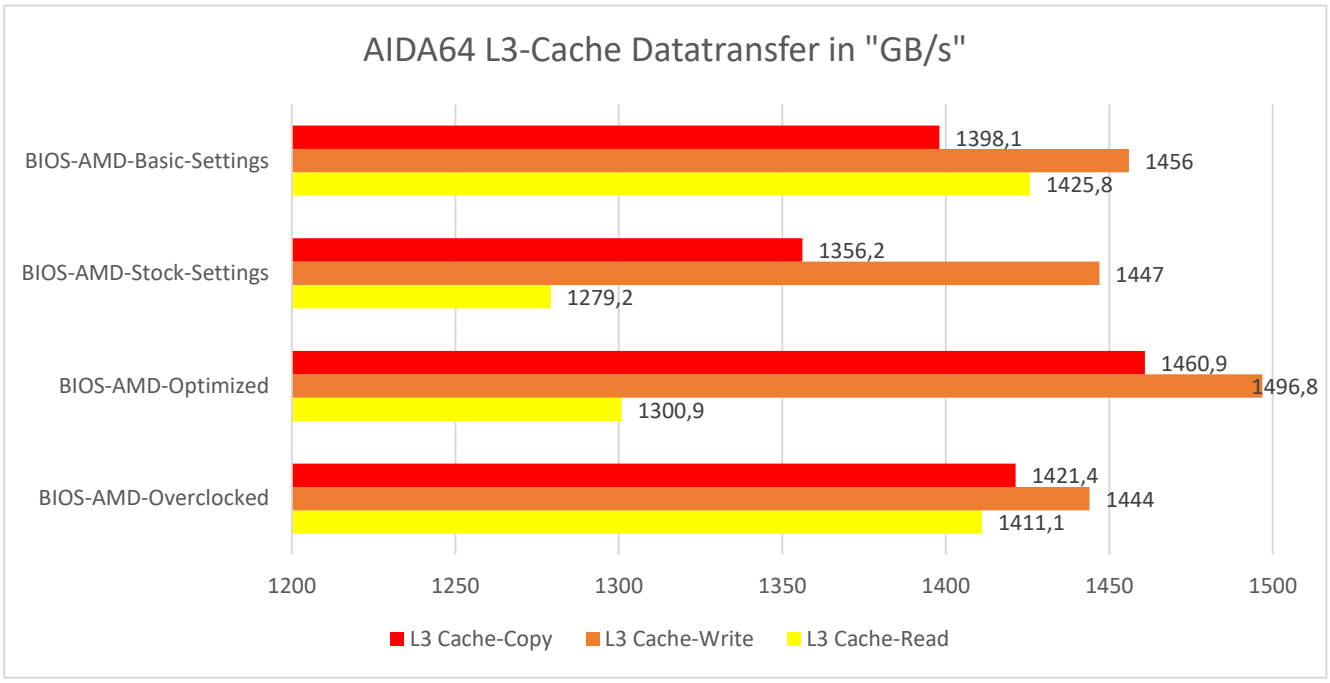
The data obtained from the AIDA64 benchmarks are also very interesting. Due to the RAM settings in combination with the different BIOS profiles, we can observe significant losses in data volume in the area of copy processing, but on the other hand, there is a considerable increase in data volume in the area of write and read processing.



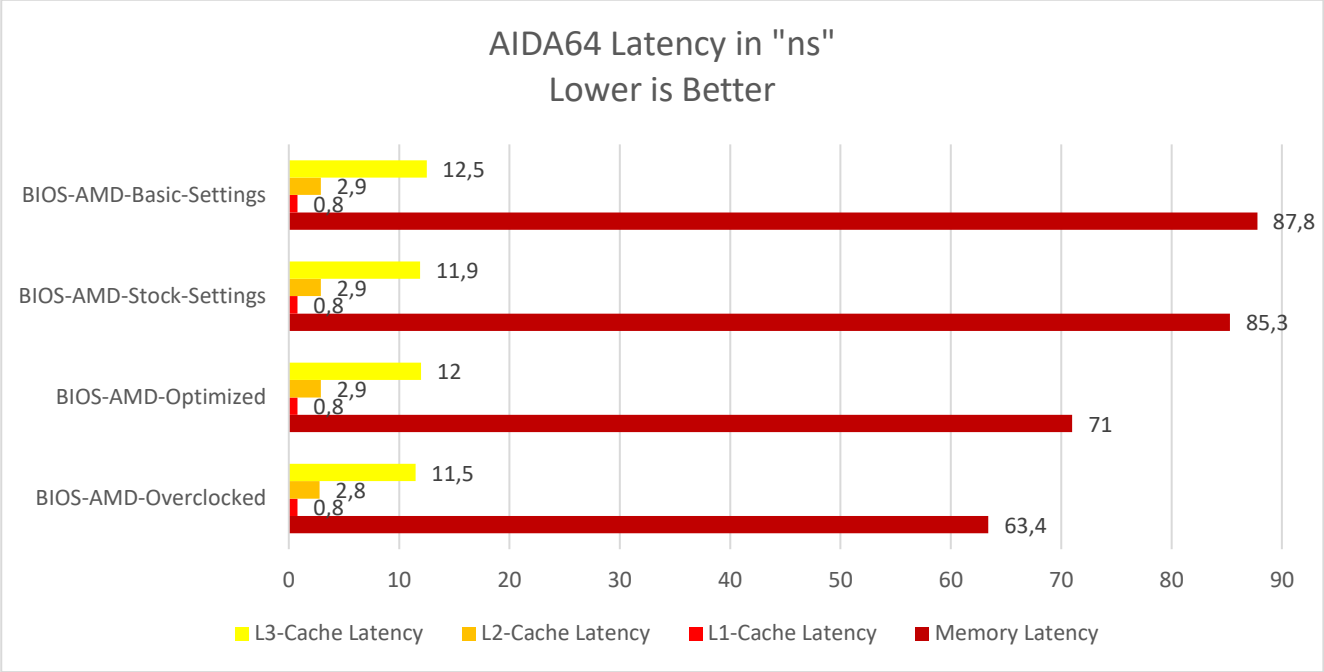
The impact on the data transfer rates of the L1 to L3 caches is also not uninteresting; however, the increases are not as pronounced.




AIDA64 L2-Cache Datatransfer in "GB/s"
BIOS-AMD-Basic-Settings
2419,4
2293,5
2427,8
BIOS-AMD-Stock-Settings
2410,9
1903,5
2509,8
BIOS-AMD-Optimized
2500,1
2364
2568,5
BIOS-AMD-Overclocked
2525,8
2300,6
2619,9
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
L2 Cache-Copy
L2 Cache-Write
L2 Cache-Read


AIDA64 L3-Cache Datatransfer in "GB/s"
BIOS-AMD-Basic-Settings
1398,1
1456
1425,8
BIOS-AMD-Stock-Settings
1356,2
1447
1279,2
BIOS-AMD-Optimized
1460,9
1496,8
1300,9
BIOS-AMD-Overclocked
1421,4
1444
1411,1
1200
1250
1300
1350
1400
1450
1500
L3 Cache-Copy
L3 Cache-Write
L3 Cache-Read

Now let's take a look at the latencies resulting from the different settings that can be read out in the AIDA64 "Cache + Memory" benchmark.



At this point, I am happy to offer you a source directory for manual data verification: [CPU Benchmarks: AIDA64, Cinebench R24, Cinebench 2024, Blender, Geekbench 6]

Foreword and Introduction

My name is Stefan André and I am 41 years young today. I have been working with computer systems since somewhere between 1990 and 1994; the exact time unfortunately eludes me. Until the release of the 7950X3D, there was only one single AMD processor in between. Please don't ask me which one it was, it's just too long ago. However, at that time, I was never satisfied with the system stability and performance. That's why Intel became my preferred processor manufacturer.
Yes! I am an Intel fanboy!

Today, with the AMD Ryzen 9 7950X3D, I have successfully broken with my principles and firmly believe that this processor represents a masterpiece of technological development. The system stability and performance are more than convincing for me.

Furthermore, I am firmly convinced that the 7950X3D is the best gaming CPU we can currently buy and my interpretation of the data suggests that the 9950X3D will successfully replace it. My opinion is based on the configuration of the processors, as the 7950X3D has higher clock rates than its smaller brother, the 7800X3D.
Currently, the 9800X3D is the winner in all benchmarks, but it will also be shown here that the larger brother, the 9950X3D, will bring higher clock rates. Now that core parking* finally works, the advantage in 3D applications does not only result from the higher clock rate on the 3D V-Cache CCD (CCD = Core Complex Dies), but is also due to the fact that the 2nd CCD takes care of the background applications, allowing the CCD with the 3D V-Cache to focus its full potential on the 3D application. Something that the 7800X3D as well as the 9800X3D are not capable of, since they only have the one CCD with 3D V-Cache, therefore they also have to handle the background applications and cannot fully concentrate on the 3D application.
As so often, the user has to decide whether the small plus in performance justifies the higher price; no one can make this decision for you. I have been using the AM5 platform since its release, including the launch of the 7950X3D processor, and I want to share my expertise here with you.

*Information: *Core Parking I will go into more detail about the function and the necessary settings for this feature. For processors with only one CCD, this feature is irrelevant. For processors with a 3D V-Cache CCD(0) and one without the cache (CCD[1]), 3D applications are only calculated by the CCD with the cache, and the other CCD takes care of background applications and partly speeds up loading cycles of cutscenes, for example.*

Basic Understanding and Disclaimer

To understand the functionality of optimizing this platform: The AM5 processors of the 7000 series are mainly limited in performance by thermal constraints. This means that we do not follow the "conventional principle" of increasing the CPU voltage to set higher multipliers and/or bus clock frequencies with adequate cooling of the unit, thus achieving higher clock frequencies. Instead, we lower the CPU voltage to gain a thermal advantage, which allows our processor to automatically clock higher and maintain this clock longer because we stay below defined thermal limitations. The 9000 series has an advantage over the 7000 series in that the 3D V-Cache has migrated under the CCD, allowing better thermal transfer. For this reason, you also have access to the VCore (or processor voltage) and can modify the multiplier.

Better cooling performance can improve this advantage to some extent, until we reach the physical limits of our processor. It is very important to understand that certain limitations are simply due to the fact that your hardware in the combination you currently have will not run stably with identical settings and values. Please, no "Copy + Paste"!

There are dependencies that also need to be understood and considered. For example, only "Golden Samples" of the 7000X3D series can achieve a memory controller clock of 3200MT/s (MEMCLK = 3200MHz), very good processors can achieve 3000MT/s (MEMCLK = 3000MHz), but this also means that the processor requires "higher" voltage to maintain these frequencies stably. This leads to a proportionality in consideration of the Curve Optimizer, as we reduce the voltage of the processor cores through it, but "higher" voltages are needed if the memory controller is to maintain a higher clock stably.

To understand:
Let’s assume the Curve Optimizer, at a memory controller clock of:
MEMCLK = 2600MT/s (2600MHz),
with a divider of:
MEMCLK = UCLK: 1:1
= 5200MT/s RAM clock,
can be set with an all-core offset of -30. Then it may be that you can only operate the offset at:
MEMCLK = 3000MT/s (3000MHz),
with a divider of:
MEMCLK = UCLK: 1:1
= 6000MT/s RAM clock,
stably with a value of -20 all-core!

Disclaimer

The use of this optimization guide is at your own risk. I accept no liability for direct or indirect damages caused by technical defects or malfunctions of the hardware. This includes, but is not limited to, data loss, operational interruptions, and physical damage. It is the user's responsibility to make regular backups of their data and take appropriate security measures.

In the event of a defect, please contact customer service or the hardware manufacturer. Warranty claims and services are subject to the respective terms and conditions and warranty provisions of the manufacturers.

The provided instructions and information have been created to the best of our knowledge and belief. However, there is no claim to their correctness, completeness, and timeliness. Changes and errors are reserved.

I would further like to point out that with careful handling and understanding of the functionality of the AM5 platform in conjunction with the optimization guide, system instabilities will and must occur, as we will gradually push the CPU to its performance limits. The goal is to achieve maximum performance and efficiency through this guide with a system stability that will not let you down on any day.
Due to manufacturer differences, it is possible that terms for options in your BIOS may differ or these options may even be entirely absent. Therefore, at certain points in the guide, an identical optimization may not be possible or may prove impossible due to missing possibilities!
The publication of this guide is only permitted if a reference to the original and my YouTube channel Stefan André Makefire: Let's Play is included. The publication must refer exclusively to the entirety of the work and excludes "partial excerpts!"
"No half measures!" is the motto here!

I can ease your concerns, as I know such disclaimers from personal experience and understand how they can affect you. My optimization guide will not, in detail: Exceed the default settings of your processor and thereby negate the manufacturer's warranty. In no case should you take steps, greetings to "Sven", that lead to an increase in CPU voltage, even if you use an appropriate cooling method and are well below the maximum allowable temperature, just because you think "Just to see what's possible!"!

System Specifications and Driver Versions

Prozessor: AMD Ryzen 9 7950X3D
RAM: 2x 16Gb G.Skill Trident Z5 (RGB) DDR5-6400 (F5-6400J3239G16GX2-TZ5RK)
Mainboard: ASUS ROG Strix X670E-E Gaming WiFi
GPU: Gigabyte nVidia RTX 3090 Ti
Link: Geizhals

Operationsystem: Windows 11 Pro x64
Build: 26100.2454
Version: 24H2
Installed on: 11/24/2024
Service-Pack: 1000.26100.36.0

BIOS-Version: v2604
Source: ASUS
Releasedate: 12/05/2024

Chipsetdriver: v6.10.22.027
Source: ASUS
Releasedate: 11/05/2024

AMD-Grafiktreiber: v32.0.12033.1030
Source: AMD
Releasedate: 12/05/2024

Nvidia Driver*: v560.94
Source: Techpowerup
Releasedate: 08/20/2024
*Information: *On my system, I noticed a continuous decline in performance in the games I run with higher driver versions, and therefore, I refrained from further updates.*

nVidia DLSS 3**: v3.8.1
Source: Techpowerup
Releasedate: 12/07/2024
**Information: *The installation of this update was manually performed in compatible games. However, it is irrelevant for the benchmarks listed here.*

Performance Tests

CPU-Performance Tests:

1) Cinebench R23
   Source: Guru3D
2) Cinebench 2024
   Source: MAXON
3) Geekbench 6
   Source: GeekBench
4) Blender v4.3.1
   Source: Blender
5) Adia 64 Extreme (Cache & Memory Benchmark)
   Source: Aida64

Gaming-Performance Tests** *:

1) Borderlands 3
2) CyberPunk 2077 (New Patch Released! New Tests Done!)
3) Deus Ex: Mankind Divided
4) Forza Horizon 5
5) Horizon Zero Dawn Complete Edition
6) Red Dead Redemption 2

** *Information: *The selected games all have an internal benchmark and will not receive any further updates or patches in the foreseeable future that could lead to performance deviations and different test results during the testing phases and the creation of this guide.*
I want to limit the influences on performance solely to the possible optimizations via BIOS settings. Therefore, it is of utmost importance to highlight that Windows updates were also disabled during the creation of this guide. In all games, the resolution is set to 1080p to exclude the GPU as a limiting factor in the tests by using the lowest possible graphics settings.
Some of the performance tests found on the Internet and YouTube channels, which focus on computer hardware, are in my opinion, not transparent enough (sometimes) and too rarely reference the current drivers and game versions. This often means that these performance tests cannot reflect the current state but rather a "possible" state.
A "standardized" or "uniform" and transparent methodology for data collection is highly desirable at this point if you allow me this criticism.

Hardware Check and Control:
1) HW-Info
Source: HWInfo

Necessary "BIOS Options" Checklist

1) (AMD Overclocking:) Core Count Control
1.1) (AMD CBS: SMU Common Options:) CPPC Dynamic Preferred Cores [2]*

2) PBO (Precision Boost Overdrive)
- (2.1) Medium Load Boostit)
- 2.2) Precision Boost Overdrive Scalar
- 2.3) Per-Core Boost Clock Limit
- 2.4) Platform Thermal Throttle Limit
- 2.5) Curve Optimizer
- 2.6) GFX Curve Optimizer
- (2.7) CPU Boost Clock Override)
- (2.8) Curve Shaper)

3) Memory Frequency
- 3.1) DRAM Timing Control
- 3.2) UCLK DIV1 MODE
- 3.3) DRAM VDD Voltage
- 3.4) DRAM VDDQ Voltage
- 3.5) Memory (DRAM) VPP Voltage
- 3.6) M Ordering

4) AI Tweaker
- 4.1) Core Flex [2]**
- 4.2) AI Overclock Tuner
- 4.3) BLCK1 + BLCK2 Frequency
- 4.4) FCLK Frequency
- 4.5) Core tunings Configuration for Gaming [2]** *
- 4.7) Core Performance Boost
- 4.8) Turbo Gaming Mode [2]** **
- 4.9) XMP/D.O.C.P./EXPO [2]** ** *

5) DIGI + VRM
- 5.1) VRM Spread Spectrum
- 5.2) CPU Current Capability
- 5.3) CPU Current Reporting Scale
- 5.4) CPU Power Phase Control
- 5.5) VDDSOC Current Capability
- 5.6) VDDSOC Current Reporting Scale

6) AMD CBS
    (6.1) Global C-State Control)
    6.2) ECC
    (6.3) SMT Control)
    6.4) DDR Options
    6.5) DDR Training Options
    6.6) DFE Read Training
    6.7) RX Burst Length
    6.8) TX Burst Length
    6.9) Memory Features
    (6.10) Memory Context Restore)
    6.11) SMU Common Options
    6.12) TDP Control

7) AMD Overclocking
    7.1) DDR and Infinity Fabric Frequency/Timings
    7.2) DDR Options
    7.3) DDR5 Nitro Mode
    7.4) Nitro RX Burst Length
    7.5) Nitro TX Burst Length

[2]*Information: *CPPC Dynamic Preferred Cores is a BIOS option that is only relevant for processors that have 2 CCDs, one of which has the 3D V-Cache.*

[2]**Information: *Core Flex is an option that is obsolete today since we can reliably regulate the load of the CPU CCDs automatically with Core Parking.*

[2]** *Information: *Core Tunings Configuration for Gaming is an entirely new feature introduced only with the latest BIOS update. The available options are:*

- *Auto – This is the default.*
- *Legacy = „Proven“ Standards*
- *Level 1 = Experimental*
- *Level 2 = Experimental*

The "Core Tuning Configuration for Gaming" feature was developed in collaboration between ASUS and AMD and is specifically designed for AM5 motherboards. It aims to reduce system latencies and improve gaming performance on AMD Ryzen CPUs. It optimizes the clock rates and CAS timings of the memory and CCDs, leading to reduced latencies. "In tests, it has shown that some games achieve up to 7% better average frames and 1% lows due to lower latencies and higher bandwidth."

Source: WCCFTech
Sounds really good, but unfortunately, a few benchmarks did not deliver convincing results, so I'm leaving this feature out.
"It's best to test!" – It probably can't hurt to play around with the options, but creating extra BIOS profiles explicitly for certain games or applications?

[2]** **Information: *Turbo Gaming Mode is a feature specifically introduced for processors that have multiple CCDs, with one of them having the 3D V-Cache. In this mode, the CCD without the 3D V-Cache (BIOS: Core Count Control) is disabled along with the SMT (BIOS: Simultaneous Multi-Threading) function. By following this guide, you can manually apply the included settings while keeping SMT active.*

[2]** ** *Information: *XMP/D.O.C.P./EXPO is a feature that can load stored profiles of the memory to save us some work. On my system, I can set the clock and RAM timings, as well as the power supply, exactly as the D.O.C.P. retrieves these data and my system starts without any problems. However, when I load the data using the D.O.C.P. of the memory, my PC does not even boot correctly.*
Let me explain this briefly.
Imagine the BIOS interface as the tip of an iceberg.
If I load the XMP profile once, or in this case the AMD compatibility mode D.O.C.P., to note the information and then manually apply these settings, my system runs or starts flawlessly because I cannot make the settings that an XMP/D.O.C.P./EXPO profile of the memory can additionally make. This can result in your PC not booting correctly or running stably with the XMP-compatible D.O.C.P. profile as well as the EXPO profile!
For this reason, I would like to ask you to retrieve the data only, note the settings that would now be made visible, but do not adopt the profile, instead, revert the changes.
Then, you manually apply the noted changes yourself.

General Information about the BIOS Options:
When listing the options, I paid some attention to ensuring that the numbering matches the menu sub-items, which is evident by the following schema:
"XY.ZV"
The digit before the point represents the "main menu", and the subsequent digits describe an "option (or a submenu) within the main menu".

BIOS-Profiles

BIOS-AMD-Basic Settings

When the BIOS has just been freshly updated or you manually load the BIOS default settings.
The specifications made for the DDR5 power supply and the RAM CL timings have been adjusted to my RAM modules accordingly.
Here is the list of options that I have changed.
All other options remain in their original state:

1) *AI Tweaker: Core Flex:*
   Algorithm 1 [Disabled]
   Algorithm 2 [Disabled]
   Algorithm 3 [Disabled]
   CCD Priority Memory Activity Threshold [0]
   CCD Priority Hysteresis [0]

2) *AI Tweaker: AI Features:*
   Cooler Efficiency Customize [User Specify]
   Cooler Score [153]
   Cooler Re-evaluation Algorithm [Least inclined to update]

3) *AI Tweaker:*
   High DRAM Voltage Mode [Disabled]
   DRAM VDD Voltage [1.42500 V]
   DRAM VDDQ Voltage [1.42500 V]

4) *AI Tweaker: Advanced Memory Features:*
   PMIC Voltages [Sync All PMICs]
   Memory VDD Voltage [1.42500 V]
   Memory VDDQ Voltage [1.42500 V]
   Memory VPP Voltage [1.80000 V]

5) *Advanced: CPU Configuration:*
   SVM Mode [Disabled]

6) *Advanced: AMD CBS: CPU Common Options:*
   SVM Lock [Disabled]
   SVM Enable [Disabled]

7) *Advanced: Onboard Devices:*
   Intel LAN Controller [Disabled]
   When system is in working state [Aura Only]
   When system is in sleep, hibernate or soft off states [Stealth Mode]

8) QFan: (Fancontrol FallBack)

HYDRANODE Fan Association [Enabled]
CPU Fan Q-Fan Control [PWM Mode]
CPU Fan Profile [Manual]
CPU Fan Q-Fan Source [CPU]
CPU Fan Step Up [Level 0]
CPU Fan Step Down [Level 0]
CPU Fan Speed Low Limit [200 RPM]
CPU Fan Point4 Temperature [85]
CPU Fan Point4 Duty Cycle (%) [100]
CPU Fan Point3 Temperature [75]
CPU Fan Point3 Duty Cycle (%) [70]
CPU Fan Point2 Temperature [60]
CPU Fan Point2 Duty Cycle (%) [40]
CPU Fan Point1 Temperature [40]
CPU Fan Point1 Duty Cycle (%) [14]

Chassis Fan 1 Q-Fan Control [PWM Mode]
Chassis Fan 1 Profile [Manual]
Chassis Fan 1 Q-Fan Source [CPU]
Chassis Fan 1 Step Up [Level 0]
Chassis Fan 1 Step Down [Level 0]
Chassis Fan 1 Speed Low Limit [200 RPM]
Chassis Fan 1 Point4 Temperature [85]
Chassis Fan 1 Point4 Duty Cycle (%) [100]
Chassis Fan 1 Point3 Temperature [75]
Chassis Fan 1 Point3 Duty Cycle (%) [70]
Chassis Fan 1 Point2 Temperature [60]
Chassis Fan 1 Point2 Duty Cycle (%) [40]
Chassis Fan 1 Point1 Temperature [40]
Chassis Fan 1 Point1 Duty Cycle (%) [31]

Chassis Fan 2 Q-Fan Control [PWM Mode]
Chassis Fan 2 Profile [Manual]
Chassis Fan 2 Q-Fan Source [CPU]
Chassis Fan 2 Step Up [Level 0]
Chassis Fan 2 Step Down [Level 0]
Chassis Fan 2 Speed Low Limit [200 RPM]
Chassis Fan 2 Point4 Temperature [85]
Chassis Fan 2 Point4 Duty Cycle (%) [100]
Chassis Fan 2 Point3 Temperature [75]
Chassis Fan 2 Point3 Duty Cycle (%) [70]
Chassis Fan 2 Point2 Temperature [60]
Chassis Fan 2 Point2 Duty Cycle (%) [40]
Chassis Fan 2 Point1 Temperature [40]
Chassis Fan 2 Point1 Duty Cycle (%) [30]

Chassis Fan 3 Q-Fan Control [PWM Mode]
Chassis Fan 3 Profile [Manual]
Chassis Fan 3 Q-Fan Source [CPU]
Chassis Fan 3 Step Up [Level 0]
Chassis Fan 3 Step Down [Level 0]
Chassis Fan 3 Speed Low Limit [200 RPM]
Chassis Fan 3 Point4 Temperature [85]
Chassis Fan 3 Point4 Duty Cycle (%) [100]
Chassis Fan 3 Point3 Temperature [75]
Chassis Fan 3 Point3 Duty Cycle (%) [70]
Chassis Fan 3 Point2 Temperature [60]
Chassis Fan 3 Point2 Duty Cycle (%) [40]
Chassis Fan 3 Point1 Temperature [40]
Chassis Fan 3 Point1 Duty Cycle (%) [28]

Chassis Fan 4 Q-Fan Control [PWM Mode]
Chassis Fan 4 Profile [Manual]
Chassis Fan 4 Q-Fan Source [CPU]
Chassis Fan 4 Step Up [Level 0]
Chassis Fan 4 Step Down [Level 0]
Chassis Fan 4 Speed Low Limit [200 RPM]
Chassis Fan 4 Point4 Temperature [85]
Chassis Fan 4 Point4 Duty Cycle (%) [100]
Chassis Fan 4 Point3 Temperature [75]
Chassis Fan 4 Point3 Duty Cycle (%) [70]
Chassis Fan 4 Point2 Temperature [60]
Chassis Fan 4 Point2 Duty Cycle (%) [40]
Chassis Fan 4 Point1 Temperature [40]
Chassis Fan 4 Point1 Duty Cycle (%) [28]

Chassis Fan 5 Q-Fan Control [PWM Mode]
Chassis Fan 5 Profile [Manual]
Chassis Fan 5 Q-Fan Source [CPU]
Chassis Fan 5 Step Up [Level 0]
Chassis Fan 5 Step Down [Level 0]
Chassis Fan 5 Speed Low Limit [200 RPM]
Chassis Fan 5 Point4 Temperature [85]
Chassis Fan 5 Point4 Duty Cycle (%) [100]
Chassis Fan 5 Point3 Temperature [75]
Chassis Fan 5 Point3 Duty Cycle (%) [70]
Chassis Fan 5 Point2 Temperature [60]
Chassis Fan 5 Point2 Duty Cycle (%) [40]
Chassis Fan 5 Point1 Temperature [40]
Chassis Fan 5 Point1 Duty Cycle (%) [28]

AIO Pump Q-Fan Control [PWM Mode]
AIO Pump Profile [Manual]
AIO Pump Q-Fan Source [CPU]
AIO Pump Step Up [Level 0]
AIO Pump Step Down [Level 0]
AIO Pump Speed Low Limit [Ignore]
AIO Pump Point4 Temperature [85]
AIO Pump Point4 Duty Cycle (%) [100]
AIO Pump Point3 Temperature [75]
AIO Pump Point3 Duty Cycle (%) [70]
AIO Pump Point2 Temperature [60]
AIO Pump Point2 Duty Cycle (%) [40]
AIO Pump Point1 Temperature [45]
AIO Pump Point1 Duty Cycle (%) [20]

9) Boot-Settings:

OS Type [Windows UEFI mode]
Secure Boot Mode [Custom]
Fast Boot [Enabled]
Next Boot after AC Power Loss [Normal Boot]
POST Delay Time [2 sec]
Setup Mode [Advanced Mode]

10) Bios-Profile:

Load from Profile [1]
Profile Name [Bas!x]

11) Tools:

Download & Install ARMOURY CRATE app [Disabled]

As can be seen from the benchmark results listed so far, I created profiles in the BIOS for comparison, which I then used for the tests. In the listing, I have already only included those options that I changed, so now the continuation follows the same schema.

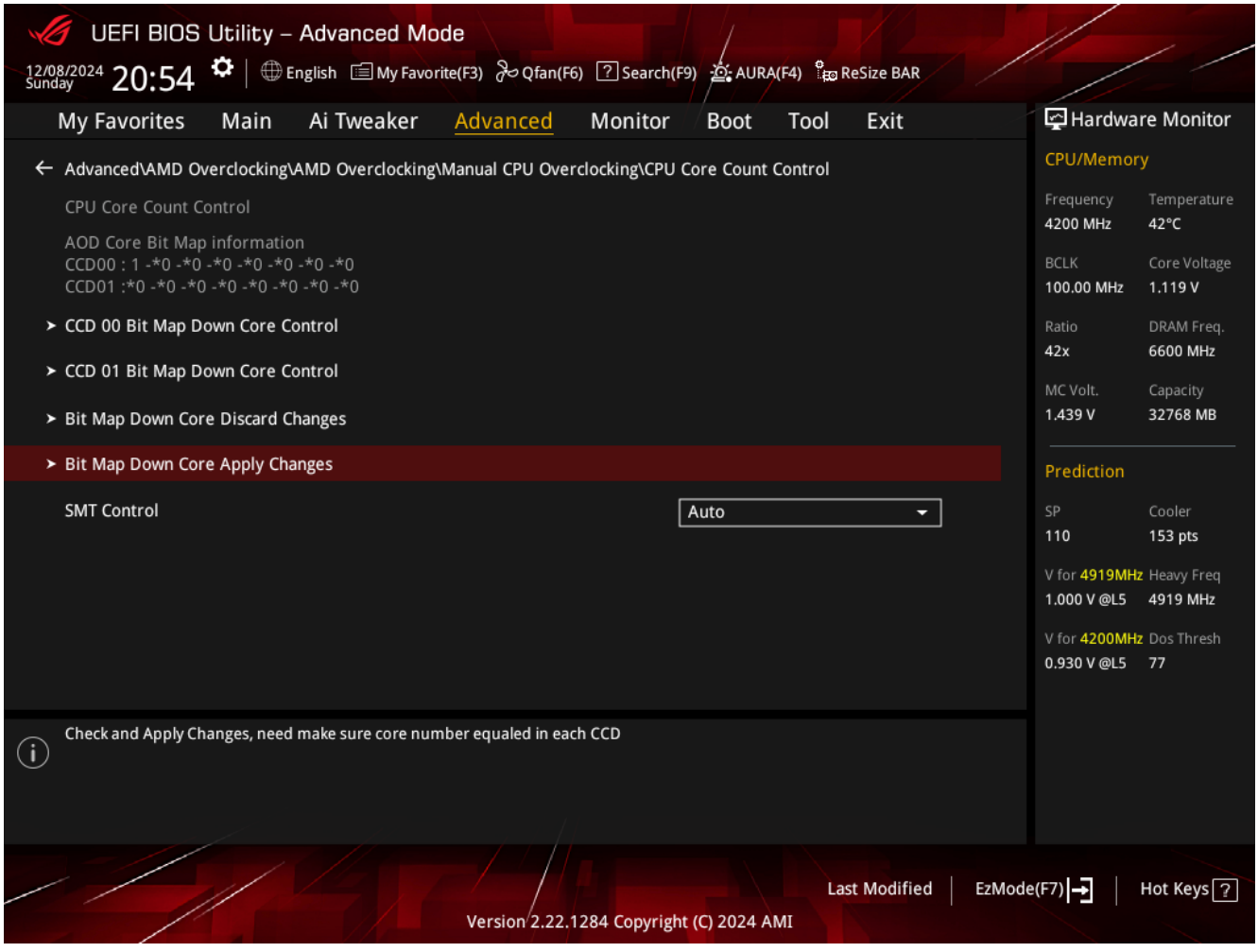
This means for you that the following listings only include the changes.

The optimization starts with the „Core Count Control“

This function allows you to selectively disable CPU cores. We need this function to test the stability and maximum negative Curve Optimizer offset value for each individual core. However, with my motherboard, I can only use this function if I have only made the BIOS basic settings. These include, for example, the fan curves or the disabling of the internal network card, as I use a more powerful network card, as well as the setting for the (RGB) LED control or the status LED.
None of these settings contribute to performance improvements in a sustainable way and are therefore irrelevant, having no impact on Core Count Control.

Well, the purpose of this procedure is to identify the maximum possible negative offset value of the Curve Optimizer for each core individually and then in a "growing" combination.

"The end justifies the means."
Isn't that how the saying goes?



I have two more remarks to make at this point:

1) The achieved maximum negative offset values are 99% **not** stable in the *long term*; they only work for a clean system start and for a few system tests.

2) Please write down these values on a piece of paper so that you can always refer back to them. I can reassure you regarding BIOS updates, as once these values are determined, you will not have to determine them again every time!

It doesn't matter if you have only one CCD on your CPU or two, and it's equally irrelevant whether one of these CCDs has the 3D V-Cache or not. In any case, the procedure for determining the values is identical.

Now to the procedure itself.
Under:
Advanced: AMD Overclocking: Manual CPU Overclocking: CPU Core Count Control:
Here we define with the option: ***CCD 00 Bitmap Down Core Control***,
in the appearing overlay, the active cores with a "1" and the deactivated cores with a "0":
1-0-0-0-0-0-0-0
Then we go to the option: ***CCD 01 Bitmap Down Core Control***,
to again in the appearing overlay, deactivate the cores:
0-0-0-0-0-0-0-0
To apply these changes now, we must select the option:
Bitmap Down Core Apply Changes – and the PC will automatically restart.

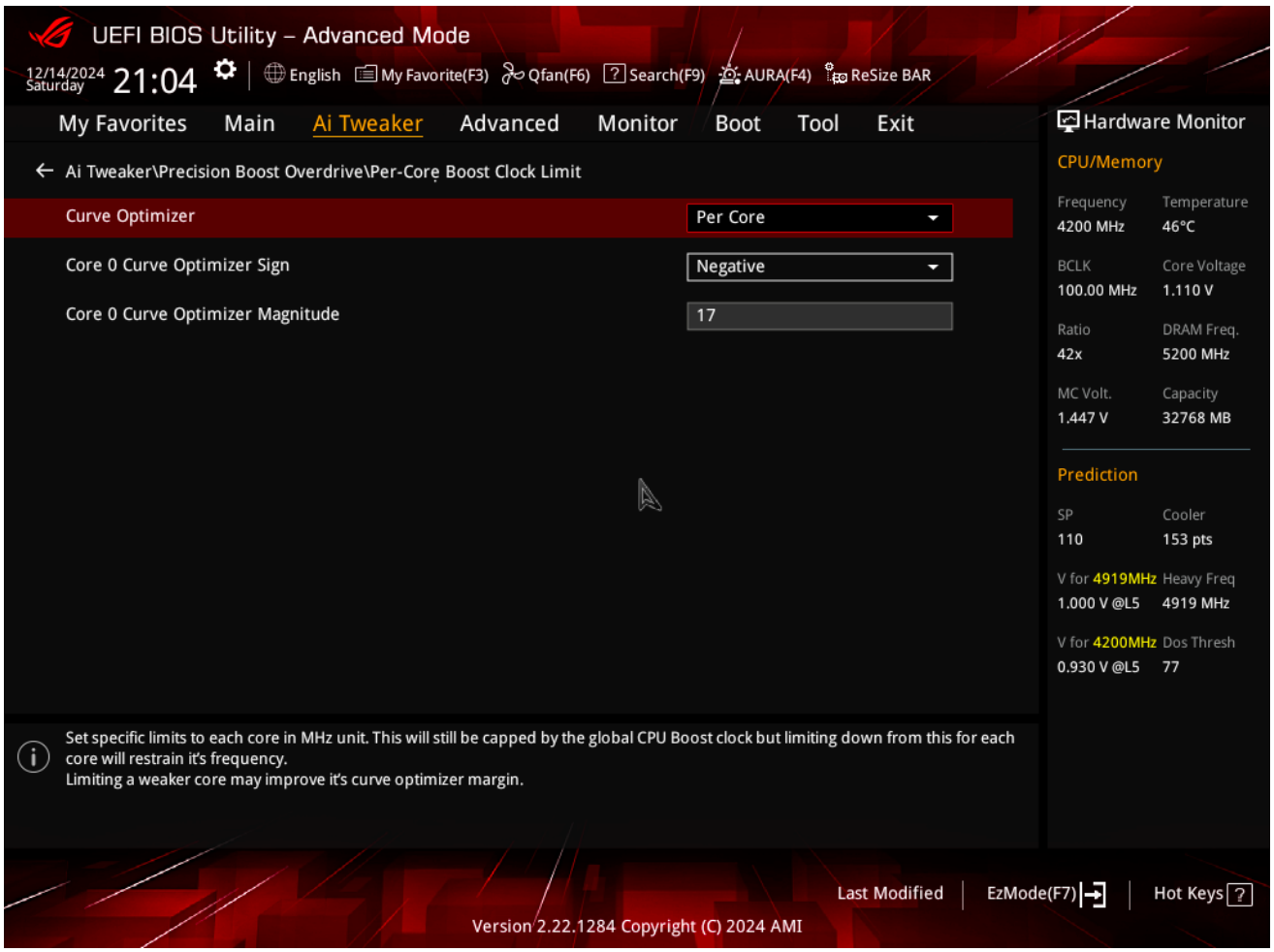
We call up the BIOS again directly to continue our work. In the further course, depending on the processor, you will need to use these options more frequently to deactivate and reactivate cores.
I have described the process here once and will not repeat it.

We start with the first core0; The maximum negative offset in the Curve Optimizer is -50 (depending on motherboard and manufacturer), so we set this value. You should notice in the Curve Optimizer that only one core can be set if the settings in Core Count Control have been adopted.

So you now set the Curve Optimizer to:

- Per Core

After that, please set the offset to "negative" and enter the value below. Always make sure that the value defines a "negative offset"!



Note: The picture is for illustration purposes only.

If your PC crashes during the tests or when starting up, you should always reduce the value by 2 points.

-50 = Crash

-48 = Test

If the tests are successful, this is not yet the end, because we want to determine the maximum, so we increase the value by one point to -49. If the system runs including the performance tests, this is the last value we note. We are then done with the first core and perform this procedure for each of the remaining cores.

Possible results of your tests might be:

Core0 = -49

Core1 = -46

Core2 = -43

Core3 = -43

Core4 = -43

Core5 = -44

Core6 = -43

Core7 = -46

This relation must always be maintained! Starting from the strongest core, this results in:
Core0 = 0
Core1 = 3 points lower
Core2 = 6 points lower
Core3 = 6 points lower
Core4 = 6 points lower
Core5 = 5 points lower
Core6 = 6 points lower
Core7 = 3 points lower
From this relation, the following, for example, would also work:
Core0 = -40
Core1 = -37
Core2 = -34
Core3 = -34
Core4 = -34
Core5 = -35
Core6 = -34
Core7 = -37
After determining the individual values for each core, we will continue by reactivating Core 0, adding Core 1, and defining the offsets in the Curve Optimizer according to our determined values.
For example:
Core0 = -49
Core1 = -46
We test again with the CPU performance tests if the system could successfully start. This may still fail in this situation, so we would reduce both values by 2 points and test again, just as before and of course in the event that the performance tests should fail.
If the startup process, including the tests, is successful, we increase the offsets by one point for safety and repeat our tests. In practice, an increase of just one point can cause the system not to start, display errors can occur, and the performance tests can crash the system.

You now add each further core individually and check the system stability. You do this until the entire CCD is reactivated.
Now, let's assume you have successfully completed the procedure with the following result (All cores of CCD0 activated together):
Core0 = -32
Core1 = -29
Core2 = -26
Core3 = -26
Core4 = -26
Core5 = -27
Core6 = -26
Core7 = -29
It is not particularly surprising if the values decrease further with each additional core that is activated.

My assumption is that even if 12 real VRMs are fast enough to work, they are still not fast enough to constantly supply 16 physical cores with power, and minor deviations can cause unstable conditions. Currently, there is no motherboard that has more than 16 real VRMs, not even with the X870E chipset. However, there is one with the X870E chipset with 15 real VRMs from AsRock, but unfortunately, I don't like the design and I'm not convinced by the manufacturer.

For those of you who have now finished with your CPU, I am very happy for you!
Based on my experience, I would ask you to finally adjust all offsets by -2 points because in my case, this could ensure really reliable daily stability. In our efforts, we only achieve a "MAX state". Of course, it is also possible to leave these values set initially and use the system normally and only make the correction if your system should crash. However, depending on the use, this can lead to valuable data being lost, even though today's operating systems have quite good mechanisms to compensate for a crash and save most of the work.

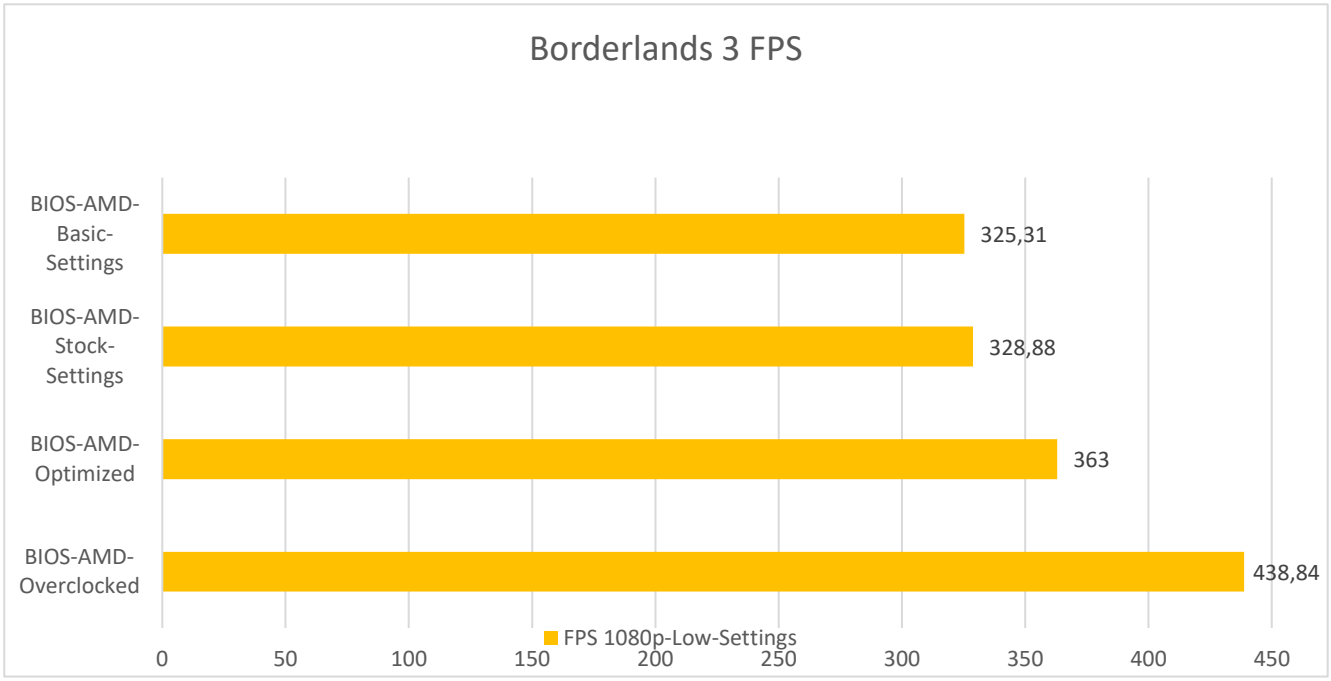
"Even as I write these lines, I absent-mindedly press CTRL+S."

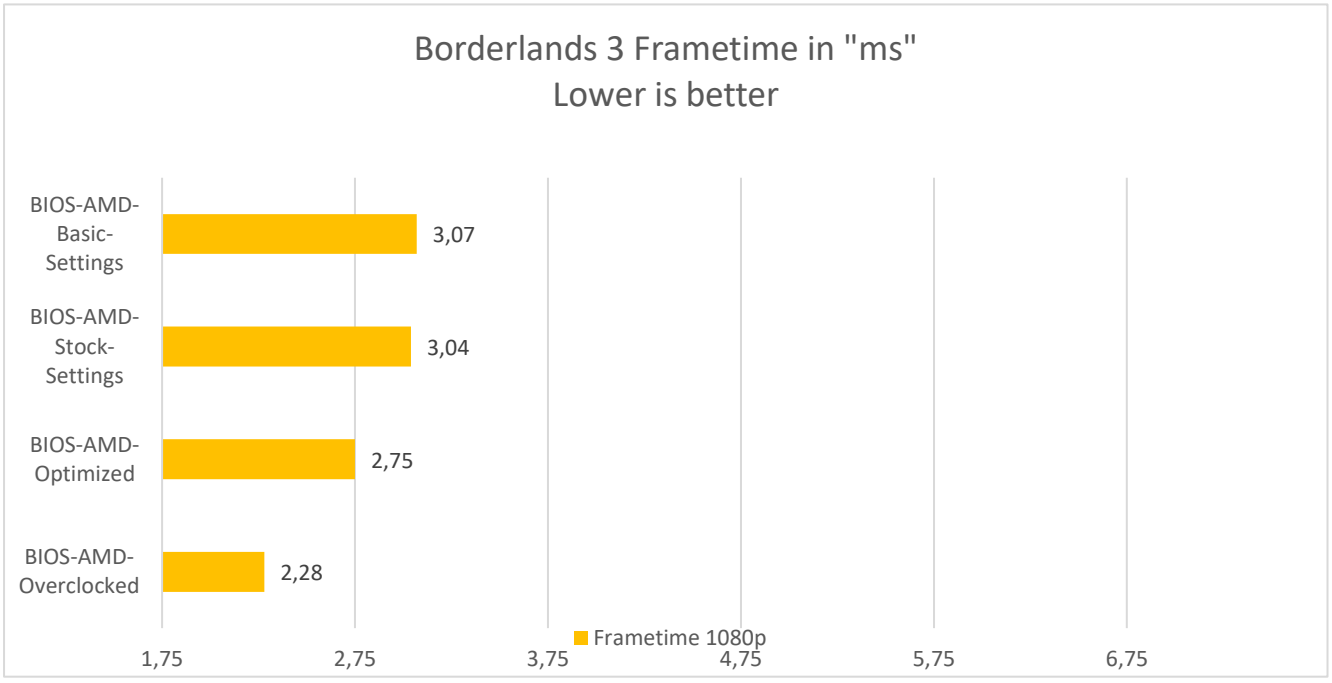
Those who have an additional CCD will now start performing the same procedure with it, but it is necessary to completely deactivate CCD0 first.
After you have completely set up CCD1, you reactivate CCD0 and test with the determined values. I already pointed out that even if only one CCD is fully active, the values can decrease. Unfortunately, this is again the case when both CCDs are activated.

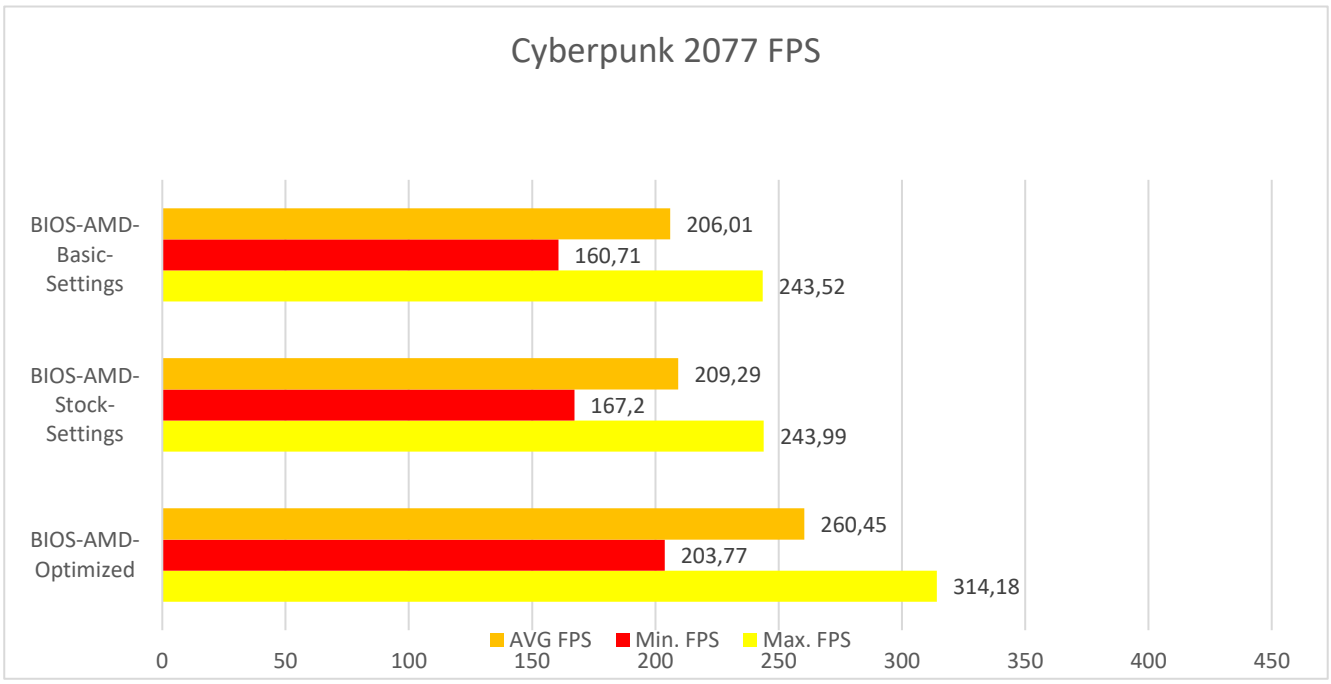
I can only repeat myself, but you only need to go through this very extensive and time-consuming procedure once, as the function of the processor does not change, and thus the relationships between the cores always remain intact!

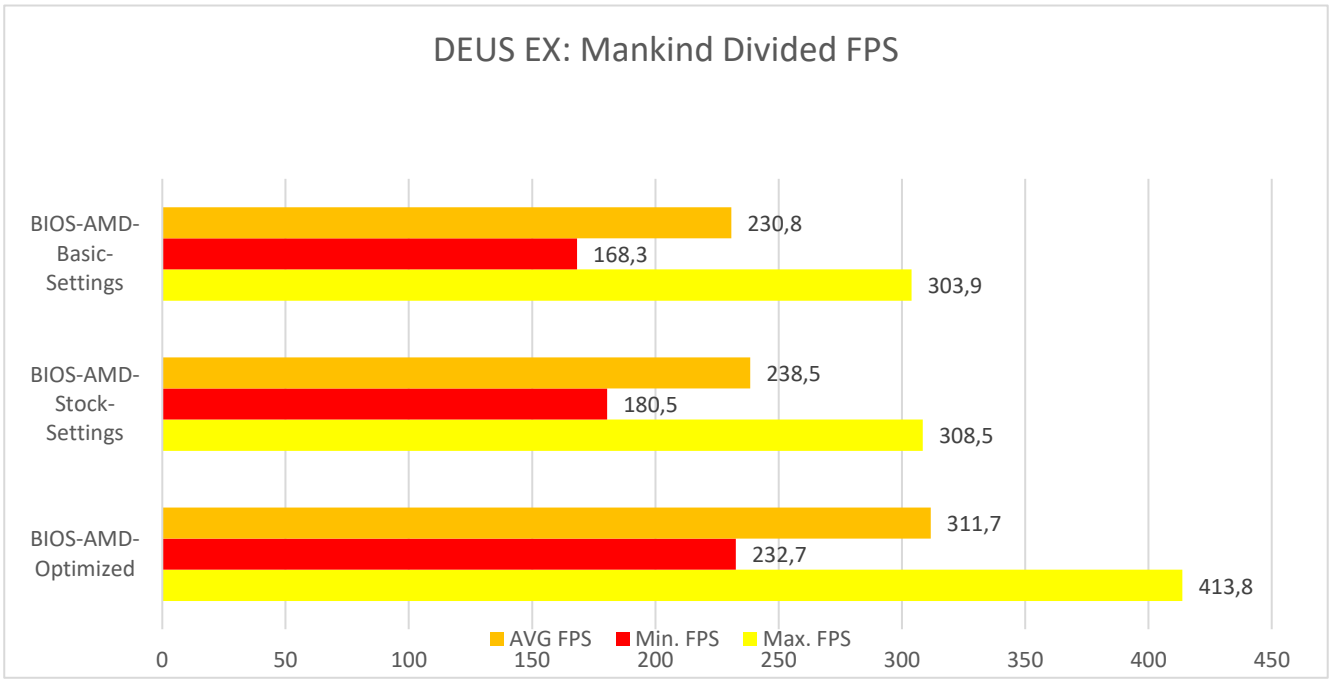
Before continuing with the further BIOS profiles, you will first receive the results from the in-game benchmarks here to give you some motivation to voluntarily tackle the rest of this "never-ending story.

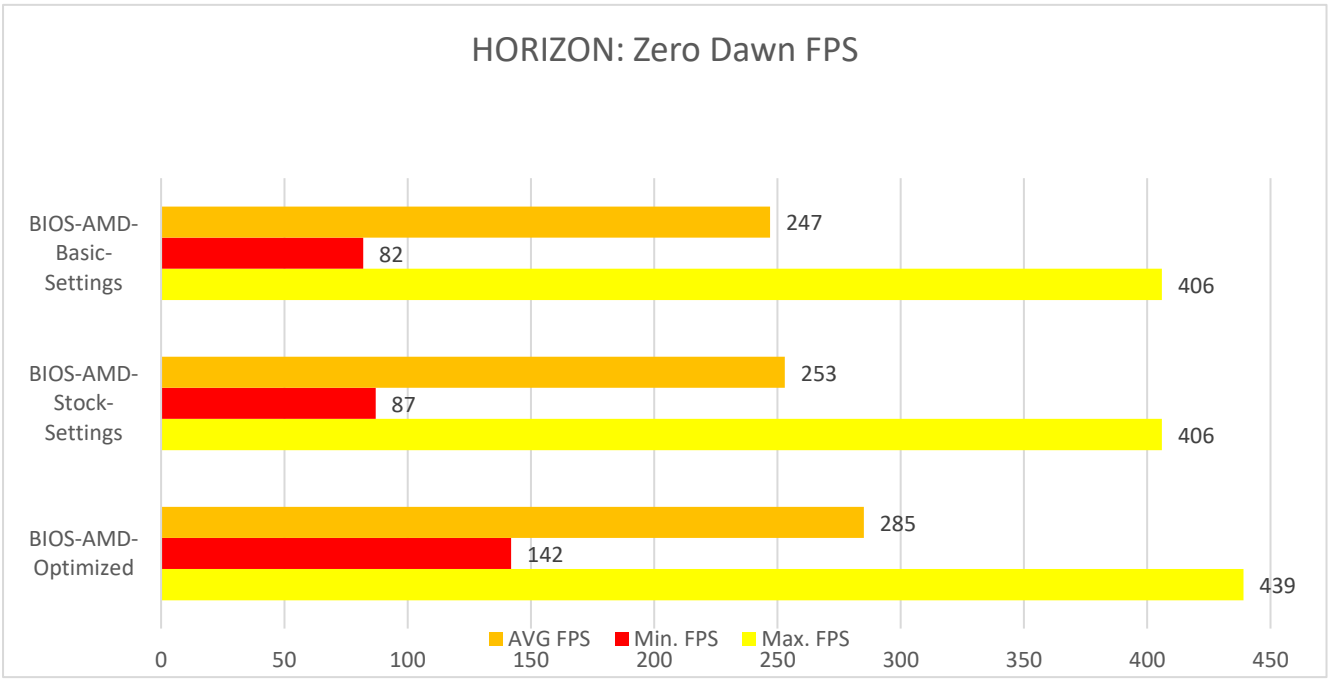
When capturing the data in these tables, it is really interesting to see how performance scales in games.

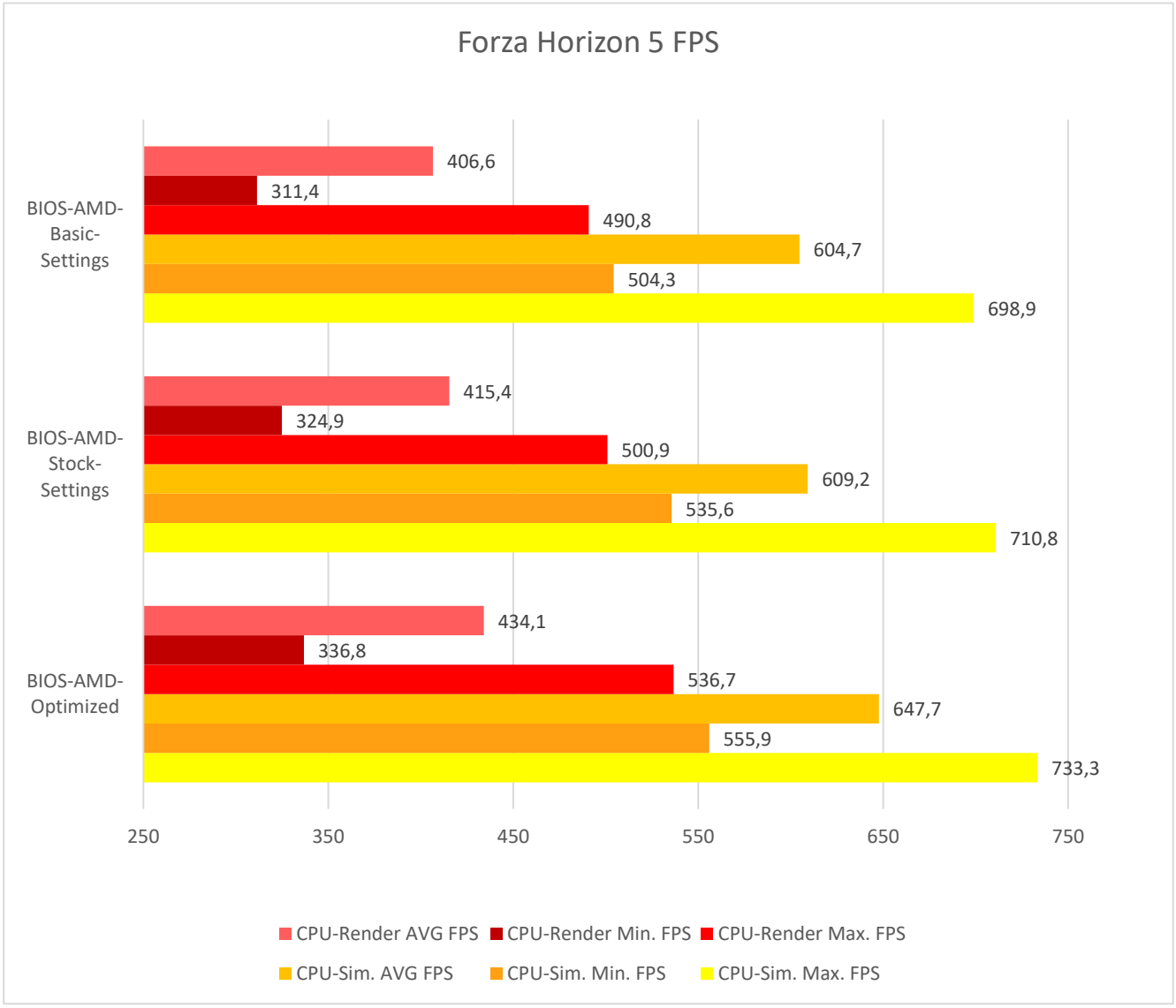


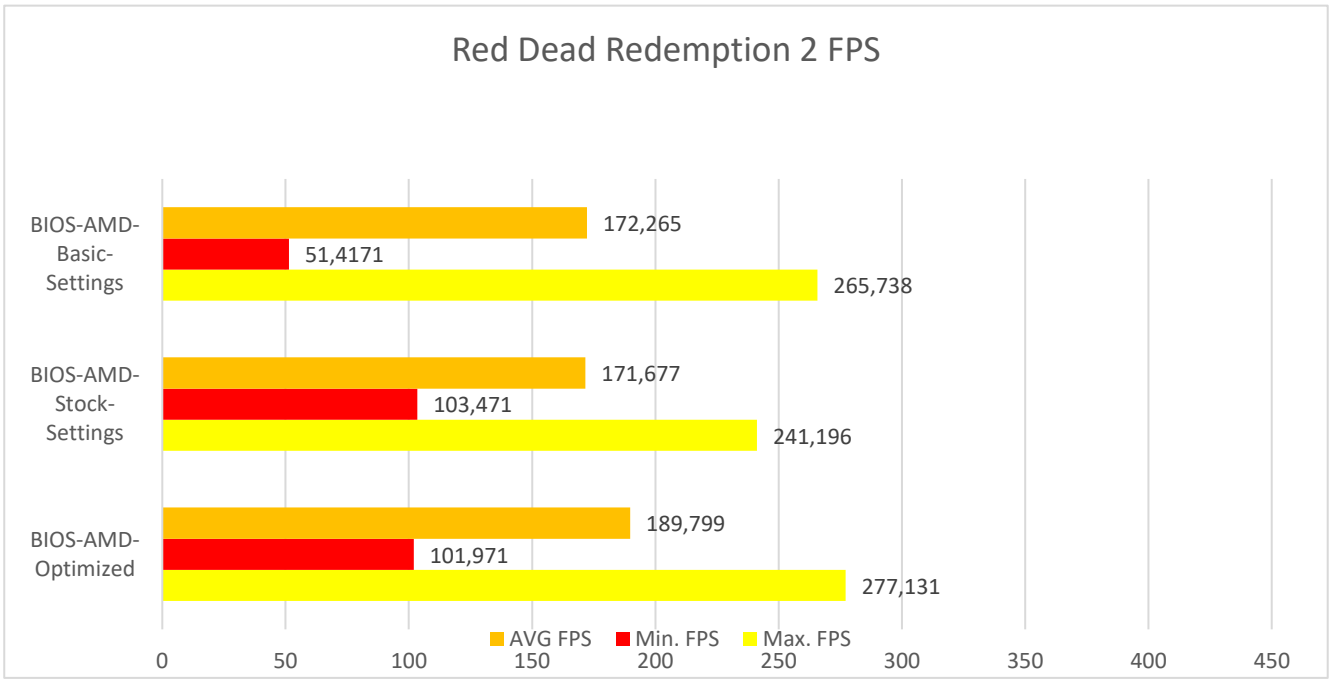



Cyberpunk 2077 FPS
BIOS-AMD-Basic-Settings
206,01
160,71
243,52
BIOS-AMD-Stock-Settings
209,29
167,2
243,99
BIOS-AMD-Optimized
260,45
203,77
314,18
AVG FPS
Min. FPS
Max. FPS
0
50
100
150
200
250
300
350
400
450


DEUS EX: Mankind Divided FPS
BIOS-AMD-Basic-Settings
230,8
168,3
303,9
BIOS-AMD-Stock-Settings
238,5
180,5
308,5
BIOS-AMD-Optimized
311,7
232,7
413,8
AVG FPS
Min. FPS
Max. FPS
0
50
100
150
200
250
300
350
400
450


HORIZON: Zero Dawn FPS
BIOS-AMD-Basic-Settings
247
82
406
BIOS-AMD-Stock-Settings
253
87
406
BIOS-AMD-Optimized
285
142
439
AVG FPS
Min. FPS
Max. FPS
0
50
100
150
200
250
300
350
400
450





Here again, I offer you the opportunity to manually verify the data:
[Gaming-Benchmark-Results]

The following BIOS profile "BIOS-AMD-Stock-Settings" includes the "safe" settings specified by AMD. These include, for example:

- TDP = 120 Watts
- (PPT = 162 Watts)
- GPU-Takt = 2.200 MHz
- FCLK (Fabric Link Speed) = 2.000 MHz
- DDR5-Clock (2 Modules) = 5.200 MT/s (MHz)
  Source: AMD RYZEN 9 7950X3D

As a result, if you are not using the 7950X3D, you will need to gather this data for your CPU to create a similar profile, ensuring that you maintain the full warranty and guarantee of your processor.

BIOS-AMD-Stock-Settings

1) *AI Tweaker:*
   Ai Overclock Tuner [Manual]
   eCLK Mode [Synchronous mode]
   BCLK1 Frequency [100.0000 MHz]
   Memory Frequency [DDR5-5200 MHz]
   FCLK Frequency [2000 MHz]
   GPU Boost [Manual Mode]
   GPU clock frequency [2200 MHz]

2) *AI Tweaker: Precision Boost Overdrive:*
   Per-Core Boost Clock Limit [Disabled]
   Platform Thermal Throttle Limit [Manual]
   Platform Thermal Throttle Limit [89°C]

3) *AI Tweaker: DIGI+VRM:*
   VRM Initialization Check [Enabled]
   CPU Load-line Calibration [Level 3]
   CPU Current Capability [100%]
   CPU Current Reporting Scale [100%]
   VRM Spread Spectrum [Disabled]
   CPU Power Phase Control [Manual]
   Power Phase Response [Ultra Fast]
   VDDSOC Current Capability [100%]
   VDDSOC Current Reporting Scale [100%]
   VDDSOC Power Phase Control [Manual]
   Power Phase Response [Ultra Fast]

4) *Advanced: AMD CBS: SMU Common Options:*
   TDP Control [Manual]
   TDP [120000 mW]

Now the long-awaited BIOS profile "BIOS-AMD-Optimized" with the advanced settings:

BIOS-AMD-Optimized

1) *AI Tweaker:*

Performance Bias [None]

2) *AI Tweaker: DRAM Timing Control:*

Tcl [30]
Trcd [38]
Trp [38]
Tras [42]
Trc [117]
Twr [96]
Refresh Interval [45000]
UCLK DIV1 MODE [UCLK=MEMCLK]

3) *AI Tweaker: Precision Boost Overdrive:*

Precision Boost Overdrive [Enhancement]
Thermal Limit [Level 1 (90°C)]

4) *AI Tweaker: Precision Boost Overdrive: Curve Optimizer:*

Core 0 Curve Optimizer Sign [Negative]
Core 0 Curve Optimizer Magnitude [17]
Core 1 Curve Optimizer Sign [Negative]
Core 1 Curve Optimizer Magnitude [21]
Core 2 Curve Optimizer Sign [Negative]
Core 2 Curve Optimizer Magnitude [21]
Core 3 Curve Optimizer Sign [Negative]
Core 3 Curve Optimizer Magnitude [21]
Core 4 Curve Optimizer Sign [Negative]
Core 4 Curve Optimizer Magnitude [21]
Core 5 Curve Optimizer Sign [Negative]
Core 5 Curve Optimizer Magnitude [21]
Core 6 Curve Optimizer Sign [Negative]
Core 6 Curve Optimizer Magnitude [21]
Core 7 Curve Optimizer Sign [Negative]
Core 7 Curve Optimizer Magnitude [21]
Core 8 Curve Optimizer Sign [Negative]
Core 8 Curve Optimizer Magnitude [22]
Core 9 Curve Optimizer Sign [Negative]
Core 9 Curve Optimizer Magnitude [22]
Core 10 Curve Optimizer Sign [Negative]
Core 10 Curve Optimizer Magnitude [22]
Core 11 Curve Optimizer Sign [Negative]
Core 11 Curve Optimizer Magnitude [22]
Core 12 Curve Optimizer Sign [Negative]
Core 12 Curve Optimizer Magnitude [22]

Core 13 Curve Optimizer Sign [Negative]
Core 13 Curve Optimizer Magnitude [22]
Core 14 Curve Optimizer Sign [Negative]
Core 14 Curve Optimizer Magnitude [22]
Core 15 Curve Optimizer Sign [Negative]
Core 15 Curve Optimizer Magnitude [22]

5) *AI Tweaker: Precision Boost Overdrive: GFX Curve Optimizer:*
GFX Curve Optimizer [GFX Curve Optimizer]
GFX Curve Optimizer Sign [Negative]
GFX Curve Optimizer Magnitude [17]

6) *Advanced: AMD CBS:*
ECC [Enabled]

7) *Advanced: AMD CBS: SMU Common Options:*
CPPC Dynamic Preferred Cores [Driver]

8) *Advanced: AMD Overclocking: DDR and Infinity Frequency:*
Timings: DDR Options:
DDR5 Nitro Mode [Enable]
DDR5 Robust Training Mode [Enable]
Nitro Rx Burst Length [8X]
Nitro Tx Burst Length [8X]

As previously mentioned, but I'd like to remind you once again, we now make a few settings in Windows (10 + 11 identical) to reliably use the Core Parking function:

The "Core-Parking" function:
Is NOT for processors with only one CCD!

Windows: Control Panel: Power Options:
"Preferred Power Plans": Select Balanced (recommended).
With the option: *"Change plan settings"*, you can then adjust the options according to your preferences.
Windows: Settings: Game Mode:
Please enable Game Mode here.

Windows: Microsoft Store: Library:
Make sure that "*Gaming Services*" and the "*Xbox App*" are up to date. You can also get the updates from here.

One of the most important drivers at this point is the current "Chipset Driver", as it adds a background process:
„*AMD 3D V-Cache Performance Optimizer Service*“

Which, in conjunction with the listed Windows settings, reliably prioritizes the CCD without 3D V-Cache for background processes.

Without the settings of the listed BIOS option, the BIOS profile:
„BIOS-AMD-Optimized“
Step „*7)*“
set to „***Driver***“
Without the settings of the listed BIOS option, the BIOS profile, the core parking will still not function reliably.

Completion of the write-up is today, 29.12.2024!
I have omitted some benchmark results of the AMD-overclocked BIOS profile from the tables, but the screenshots can still be found in the source directories. Since I am still unable to achieve 100% reliable values with the BIOS settings, combined with disturbingly poor benchmark results (at least in some games, which does not improve the situation), I have decided to exclude this section of the instructions. Whether I embark on this mammoth task again as a lone warrior really depends on my motivation.

I'm just really annoyed today by all the tests and the resulting error analyses—there's no doubt about that!
The write-up also included an Unreal Engine 5.1 game called "*Chernobylite*", but this engine always forces the GPU to high load, partly due to lack of optimization. This was also more than evident with the "*Black Myth: Wu Kong – Benchmark-Tool*", which is why I just can't take the results regarding CPU performance seriously.

Many thanks and best regards to our tech channels on YouTube:
JayzTwoCents, Gamers Nexus, Hardware Unboxed, Vex, Daniel Owen, der8auer and igorsLAB

With kind regards, until further notice,
Stefan André aka R3AP3RK1N6