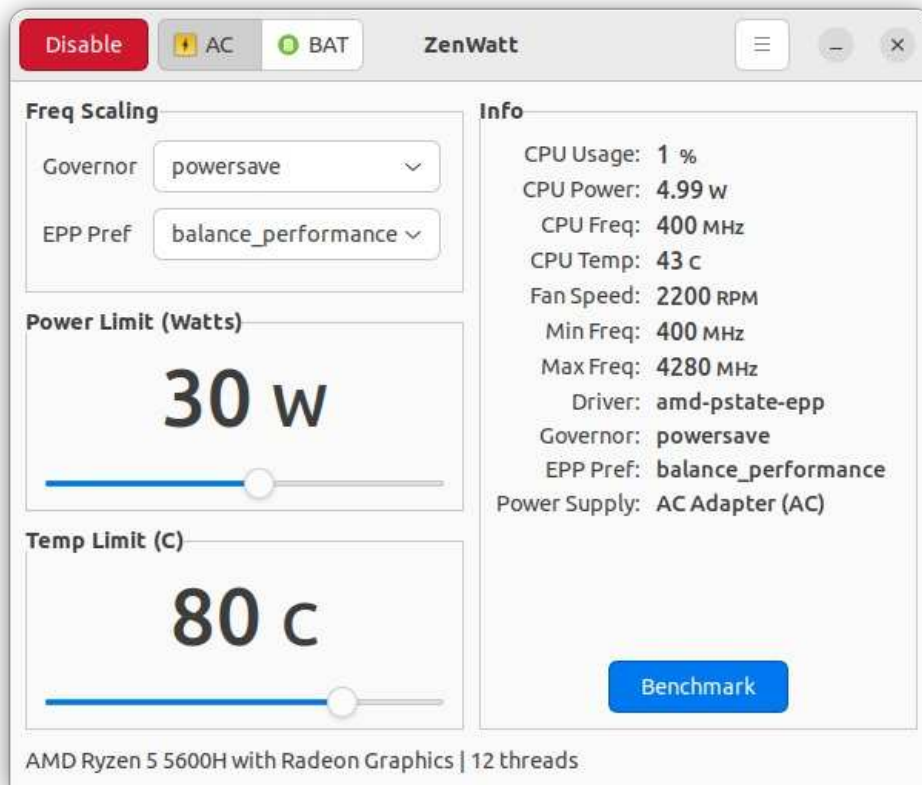# 1. Introduction

1.1. Overview

ZenWatt is an app for changing the power limit of Ryzen mobile CPUs in laptops and Mini-PCs. It is powered by the RyzenAdj⬏ utility.

1.2. Features

- Change the power limits for mobile Ryzen CPUs between 1 to 55 watts.
- Change the thermal limits for mobile Ryzen CPUs between 50 to 90 degrees celcius.
- Change the CPU governor, scaling frequency, and EPP profile.
- Benchmark the CPU using Sysbench and Passmark PerformanceTest.
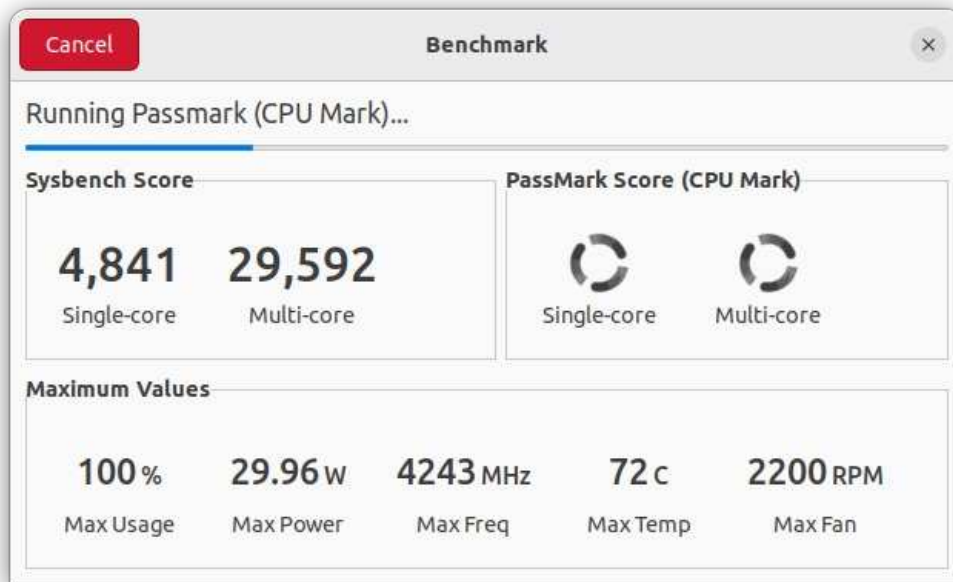
1.3. Limitations

- Only Ryzen mobile CPUs are supported. Desktop CPUs are NOT supported.
- Your laptop or Mini-PC may have limitations in the BIOS that may prevent power limits from being changed by the RyzenAdj utility.
- Refer to the RyzenAdj FAQ⬚ for more information.

1.4. Use-Case

- Reduce CPU power limit to improve battery life
- Increase CPU power limit for higher performance
- Reduce CPU temperature limit to reduce heat
- Benchmark CPU performance

1.5. Supported CPUs

The following Ryzen Mobile CPUs are supported.

- Ryzen 2000 (Raven Ridge) - 2300U, 2500U, 2700U
- Ryzen 3000 (Picasso) - 3500U
- Ryzen 4000 (Renoir) - 4750U, 4800U
- Ryzen 5000 (Lucienne) - 5500U
- Ryzen 5000 (Cezanne) - 5600U, 5600H, 5800HS
- Ryzen 6000 (Rembrandt) - 6800U

CPU models supported by RyzenAdj⬚

1.6. Supported Distributions

This app is meant for Linux distributions based on Debian and Ubuntu.

- **Debian**
  - **Debian 12 (Bookworm)** and derivatives
  - **Debian 11 (Bullseye)** and derivatives
  - MX Linux 20, 21
  - Linux Mint Debian Edition (LMDE) 5, 6

- ◦ Older releases of Debian are not supported
- **Ubuntu**
  - ◦ **Ubuntu 22.04 (Jammy)** and derivatives
  - ◦ **Ubuntu 20.04 (Focal)** and derivatives
  - ◦ Ubuntu's current Non-LTS release, and derivatives
  - ◦ **Xubuntu**, **Kubuntu**, **Ubuntu MATE**, and others
  - ◦ **Linux Mint** 20, 21, and later releases. Mint 19 and older releases are not supported.
  - ◦ Solus and KDE Neon are not supported.
  - ◦ Older releases of Ubuntu are not supported
- **Not Supported**
  - ◦ Fedora, Arch Linux, Manjaro, SUSE, Gentoo, Solus, and other distributions are not supported.

1.7. Installation

ZenWatt can be purchased from the store⤤.

Installation steps and license keys will be sent to the email address provided at the time of purchase. Installation is as simple as running a one-line command.

Native packages and repositories (for apt) are available for all supported Linux distributions.

1.8. Uninstall

Run the following command in a terminal window:

```
sudo apt-get purge -y zenwatt-gtk
sudo rm -fv /etc/apt/sources.list.d/*zenwatt*
```

This will remove installed packages and also remove the repository.

1.9. Purchase

The full version of ZenWatt is available for purchase from the store⤤.

1.10. Trial & Refunds

There is a no trial version available but there is a 14-day refund policy. If the app does not meet your requirements, please send an email to support@teejeetech.com⤤ within 14 days of purchase to get a refund.

2. AMD CPU Driver

Following CPU drivers are used by the Linux kernel for frequency scaling for AMD CPUs.

2.1. acpi-cpufreq

- Supports all AMD CPUs.
- This is the default driver that is used if newer drivers are not supported.
- This driver exposes only 3 P-states for moderate power savings.

2.2. amd-pstate

- For AMD Zen 2 and newer CPUs.
- This driver exposes more P-states than `acpi_cpufreq` for better power savings.
- This driver has 3 modes - `active`, `passive`, and `guided`.
- `active` mode is same as `amd-pstate-epp` mentioned below.

2.3. amd-pstate-epp

- Requires Linux kernel 6.3 or newer.
- This driver is used by default by Linux kernel 6.5 or newer on supported hardware.
- This driver allows the CPU to select the operating frequencies autonomously within the hardware limits. This is a fully-autonomous mode that requires manual configuration and CPPC support in both the CPU and BIOS.
- Only 2 governors are available - `powersave` and `performance`. These are translated to a *Energy Performance Preference (EPP)* hint for the CPU's internal governor.

> ❗ **Note**
>
> For kernels older than 6.5 amd-pstate must be activated via a kernel boot option

References:

1. https://linrunner.de/tlp/settings/processor.html⬈
2. https://wiki.archlinux.org/title/CPU_frequency_scaling⬈
3. https://www.kernel.org/doc/html/latest/admin-guide/pm/amd-pstate.html⬈

3. Systemd Service

A systemd service and timer is installed by ZenWatt to apply the power limits again after a system reboot. Clicking the *Enable* button in GUI will enable the timer.

To avoid conflict with other power management tools, following services will be disabled if they are found on the system.

- GNOME power-profiles-daemon⧉ - `power-profiles-daemon.service`
- CPUPower⧉ - `cpupower.service`

Disable the ZenWatt service from the GUI to re-enable the GNOME power-profiles-daemon.

3.1. TLP

ZenWatt is compatible with TLP⧉. Settings selected from ZenWatt's GUI will also be applied to TLP.

> **❶ Tip**
>
> If you don't wish to control the CPU governor or EPP profile using ZenWatt, set the option to 'auto' from the GUI.

Read the following article⧉ on how to prevent conflict between TLP and other power management tools.

4. FAQ

4.1. Can this be used on Ryzen desktops?

Ryzen desktop CPUs are not supported by [RyzenAdj](#)⬈. Options for changing the power limit and thermal limit will be disabled. Options for changing CPU Governor and EPP profile will be available.

4.2. Can this be used with TLP?

Yes. ZenWatt can be used along with TLP. Settings selected from ZenWatt's GUI will also be applied to TLP. If you don't wish to control the CPU governor or EPP profile using ZenWatt, set the option to `auto` from the GUI.

4.3. I don't see an option to change EPP profile?

Check if CPU driver is diplayed as `amd-pstate-epp`. This CPU driver requires Linux kernel 6.3 and a CPU with Zen 2 or Zen 3 cores.

- Zen 1 and older CPUs are not supported.
- Linux kernels older than v6.3 are not supported.
- Driver may need to be loaded by editing the GRUB cmdline options.

Read the [ArchWiki article](#)⬈ for more details.