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How to Enable the NPU on the Radxa Zero 3

Most operating systems for the Radxa Zero 3W or 3E do not have the NPU enabled by default.
This guide explains how to enable the NPU by adding an overlay to the device tree.

We cover the three most popular operating systems.

Ubuntu 22.04 / 24.04

Joshua Riek's Ubuntu image for the Radxa Zero 3W and 3E does not include NPU acceleration by default.
To enable the NPU, you need to install the appropriate overlay and modify the boot configuration.

Step 1: Locate the Kernel Device Tree Overlays

Navigate to the overlay directory:

```
cd /lib/firmware/$(uname -r)/device-tree/rockchip/overlay
```

Look for the NPU-related overlay files:

```
ls | grep npu
```

You should see files similar to these:

```
rk3568-npu-disable.dtbo
rk3568-npu-enable.dtbo
```

> Note: The **RK3568 NPU overlay** is used because the RK3566 NPU in the Radxa Zero 3 is identical to the RK3568 NPU.

If you cannot find these files, search your system with:

```
sudo find / -name 'rk3568-npu*'
```

We need the `rk3568-npu-enable.dtbo` file.

Step 2: Modify the Boot Configuration

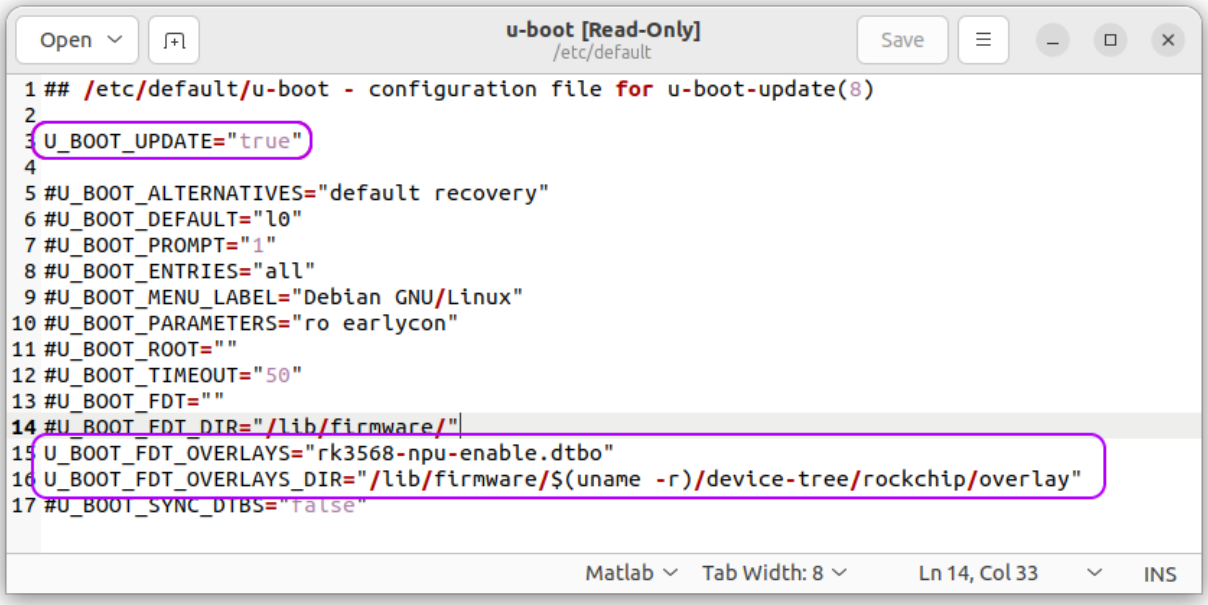
Now that we know the location of the overlay, let's add it to the boot configuration.

Edit the **u-boot** configuration file:

```
cd /etc/default
sudo nano u-boot
```

Uncomment or add the following lines (make sure **U_BOOT_UPDATE** is set to `"true"`):

```
U_BOOT_UPDATE="true"
U_BOOT_FDT_OVERLAYS="rk3568-npu-enable.dtbo"
U_BOOT_FDT_OVERLAYS_DIR="/lib/firmware/$(uname -r)/device-tree/rockchip/over
```



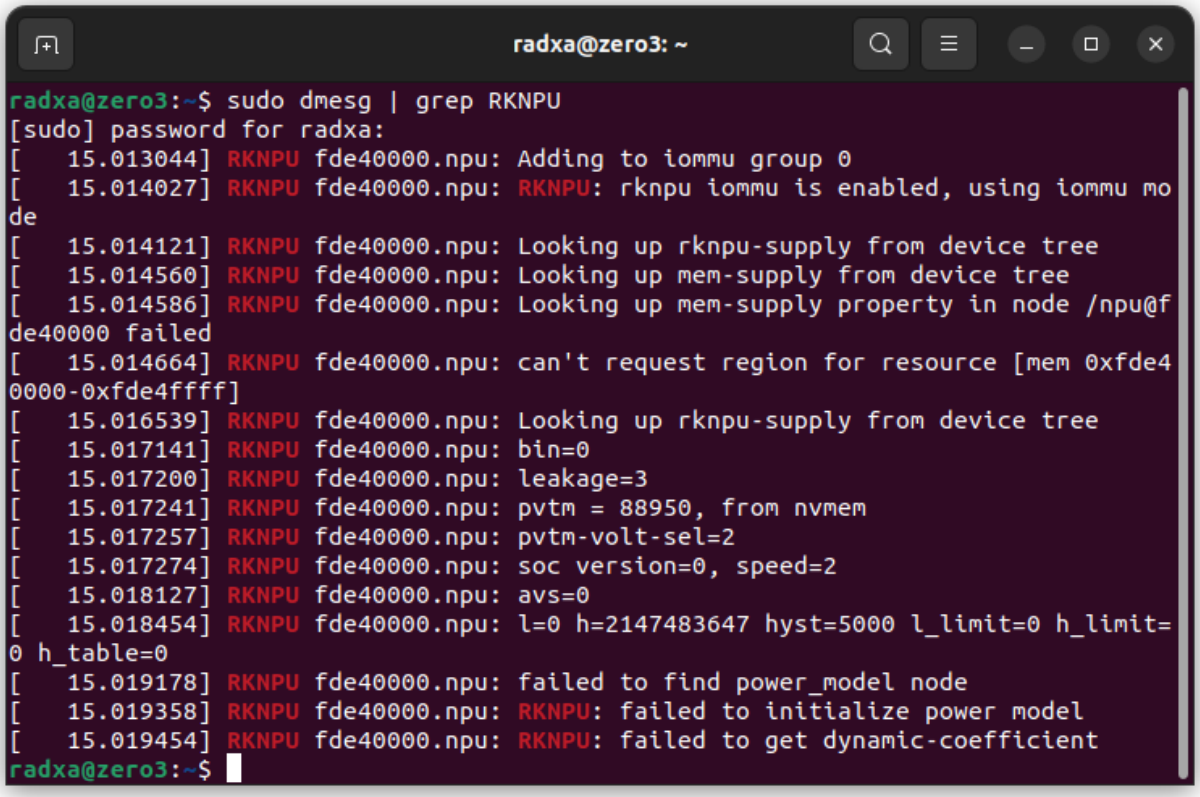
Step 3: Apply the Changes

Update U-Boot to apply the configuration:

```
sudo u-boot-update
```

Reboot your system to activate the NPU:

```
sudo reboot
```



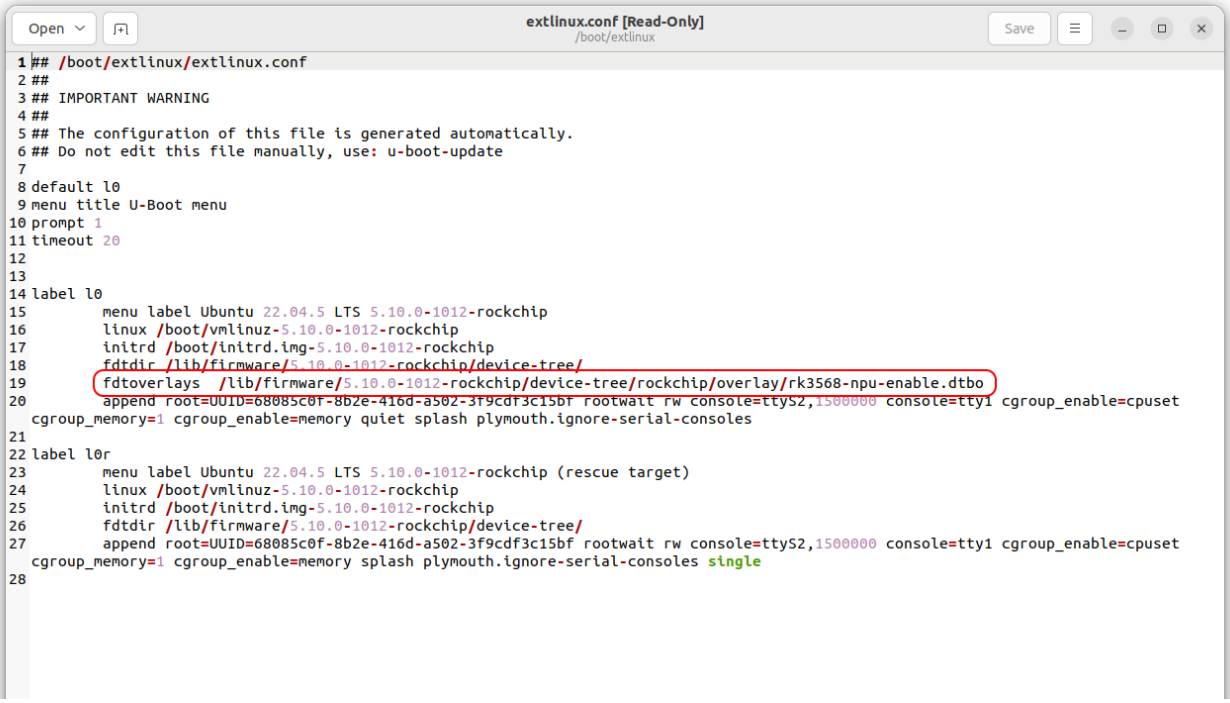
Troubleshooting: NPU Not Working?

If your NPU isn't working, check the following:

1. Open the `extlinux.conf` file:

```
sudo nano /boot/extlinux/extlinux.conf
```

2. Look for the following line, which should have been added by the `u-boot` tool:



In rare cases, the `u-boot` tool might fail to update this file automatically.
If that happens, add it manually, ensuring the correct folder path and filename.
It should resolve the issue.

Armbian

Like Ubuntu, the Armbian image for the Radxa Zero 3W and 3E enables NPU acceleration neither.
To enable the NPU, you need to download the appropriate overlay and modify the boot configuration.

Step 1: Download the NPU Overlay

Since the Armbian OS lacks additional overlays, you must first download the NPU overlay.
You can find the link to download the rk3568-npu-enable.dtbo here.

Step 2: Add the NPU Overlay

Next, create a directory for user overlays:

```
sudo mkdir /boot/overlay-user
```

Move the NPU overlay file to the newly created directory:

```
sudo mv ~/Downloads/rk3568-npu-enable.dtbo /boot/overlay-user
```

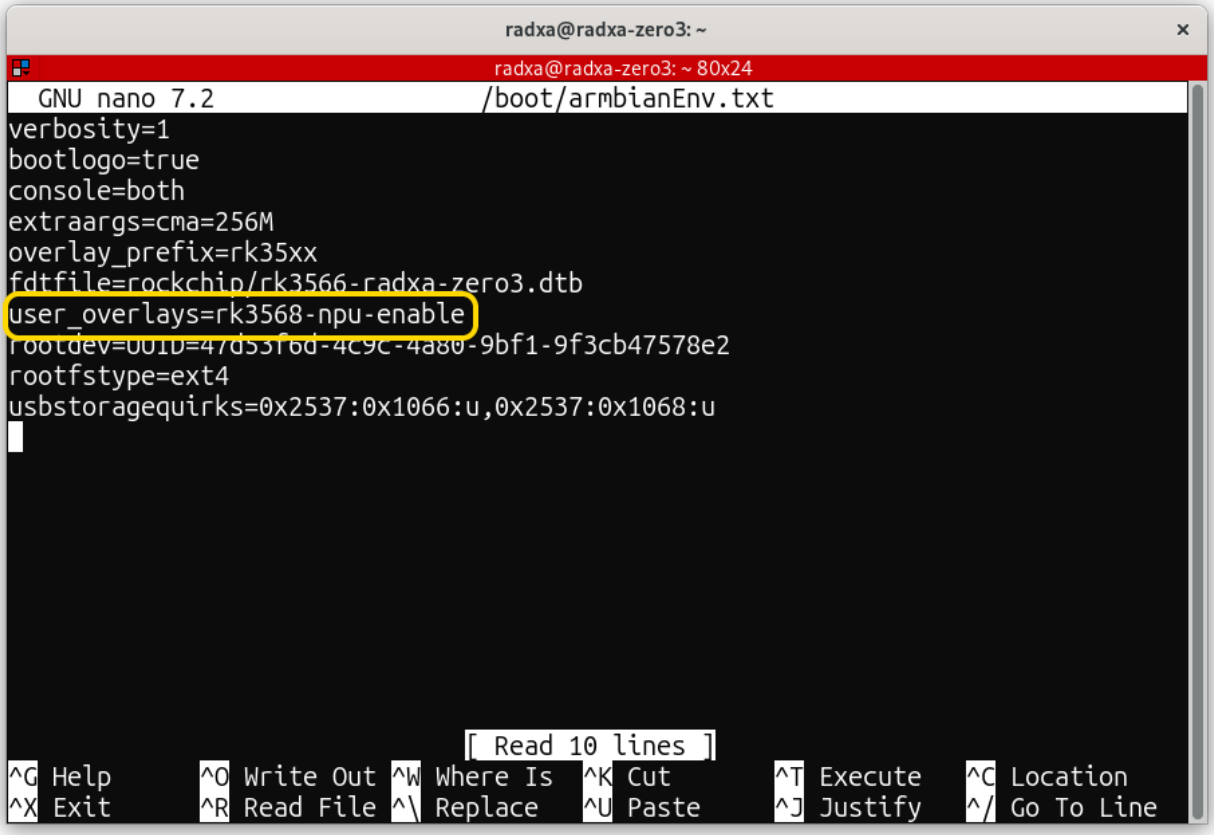
Step 3: Modify the Boot Configuration

Edit the **armbianEnv.txt** file:

```
sudo nano /boot/armbianEnv.txt
```

Look for a line that starts with user_overlays=. If it doesn't exist, add it to the file.
Add the name of your overlay (without the .dtbo extension) to the user_overlays line.
If there are already other overlays listed, separate them with spaces. For example:

```
user_overlays=rk3568-npu-enable
```



Save and exit by pressing `<Ctrl>+<X>` , then `<Y>` , and `<Enter>` .

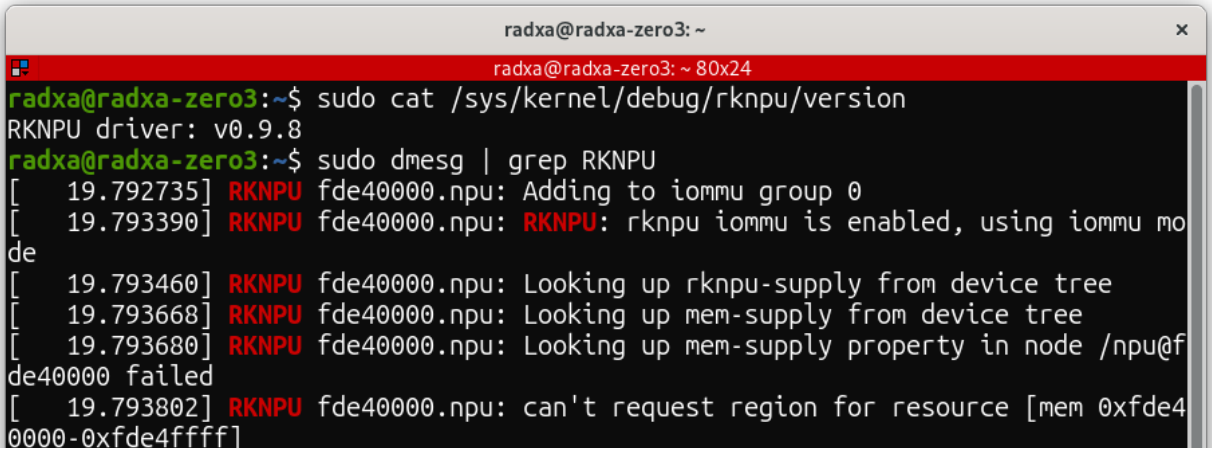
Step 4: Apply the Changes

Reboot your system to activate the NPU:

```
sudo reboot
```

Step 5: Verify NPU Activation

After rebooting, check if the NPU is recognized by running:



```
[   19.793860] RKNPU fde40000.npu: error -ENXIO: IRQ npu_irq not found
[   19.798050] RKNPU fde40000.npu: Failed to get specification_serial_number
[   19.798098] RKNPU fde40000.npu: Failed to get leakage
[   19.798134] RKNPU fde40000.npu: Looking up rknpu-supply from device tree
[   19.798270] RKNPU fde40000.npu: soc version=0, speed=0
[   19.798403] RKNPU fde40000.npu: Looking up rknpu-supply from device tree
[   19.799649] RKNPU fde40000.npu: avs=0
[   19.799956] RKNPU fde40000.npu: l=0 h=2147483647 hyst=5000 l_limit=800000000
h_limit=0 h_table=0
radxa@radxa-zero3:~$
```

Here's the improved version of your **Radxa Debian OS** section with clearer instructions and formatting:

Enabling the NPU on Radxa Debian OS

The Radxa Debian OS does not enable NPU acceleration by default.
To activate the NPU, you need to use the `rsetup` tool to modify the overlay tree.

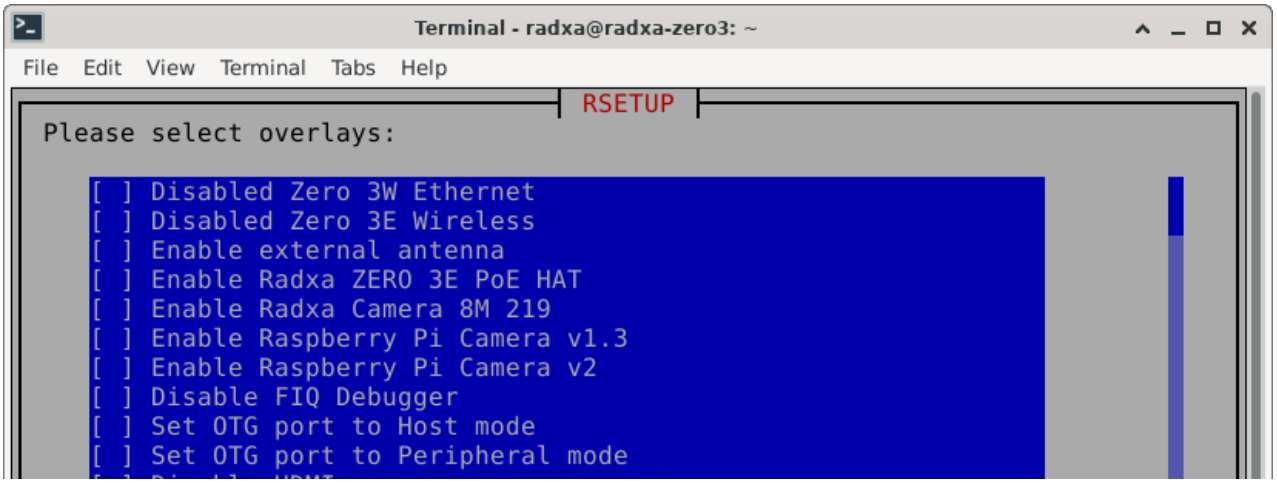
Step 1: Open `rsetup`

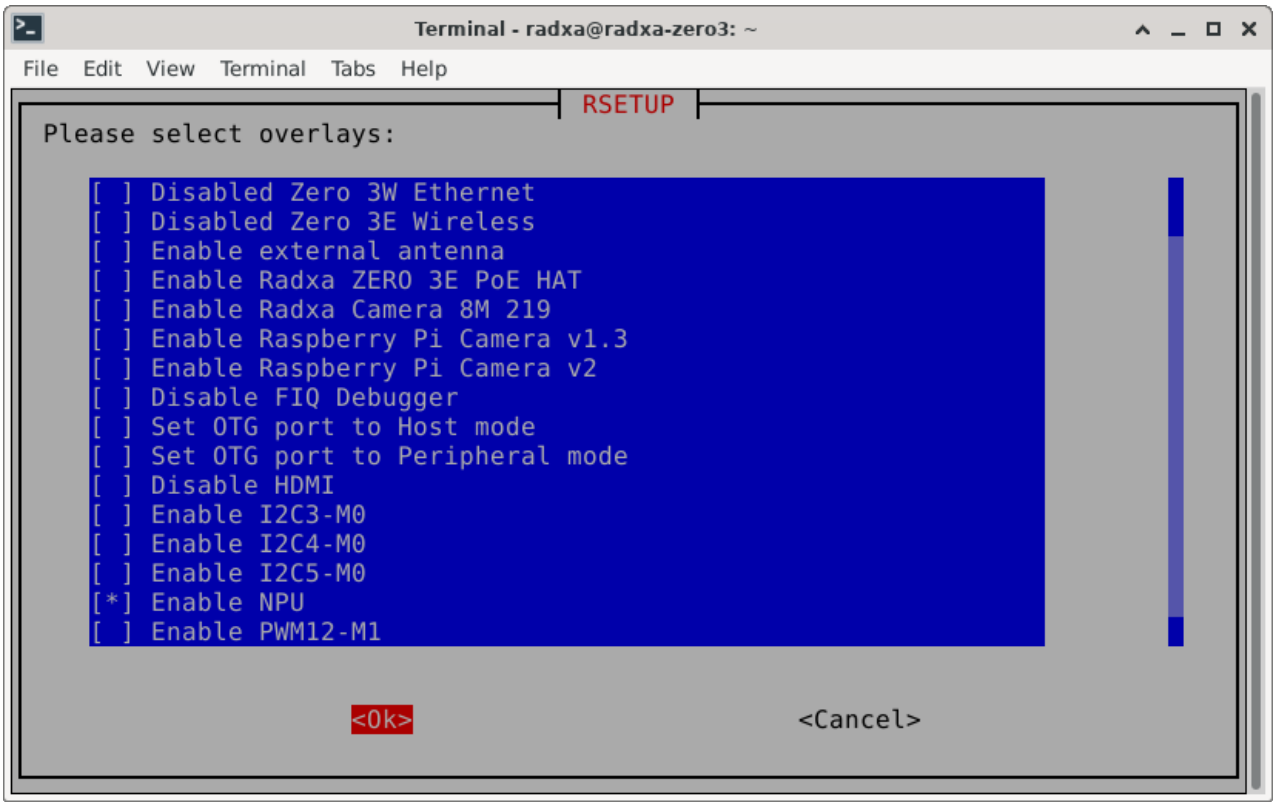
Launch the `rsetup` utility with:

```
sudo rsetup
```

Step 2: Enable the NPU

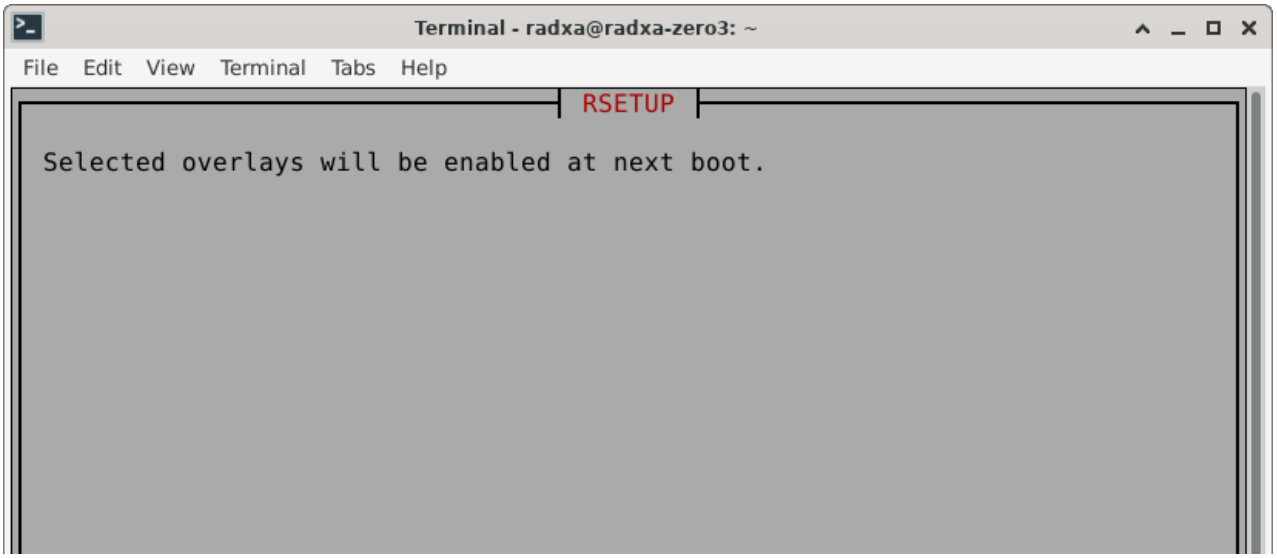
Navigate through the menu and select the **NPU** option:

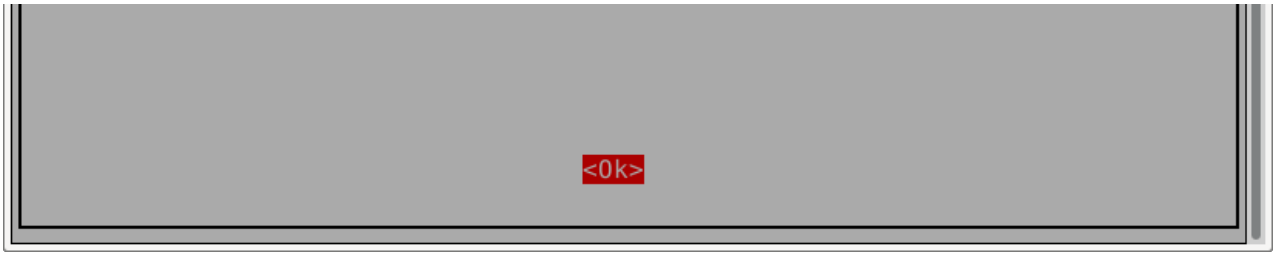




Step 3: Reboot the System

After enabling the NPU overlay, reboot the system for the changes to take effect:

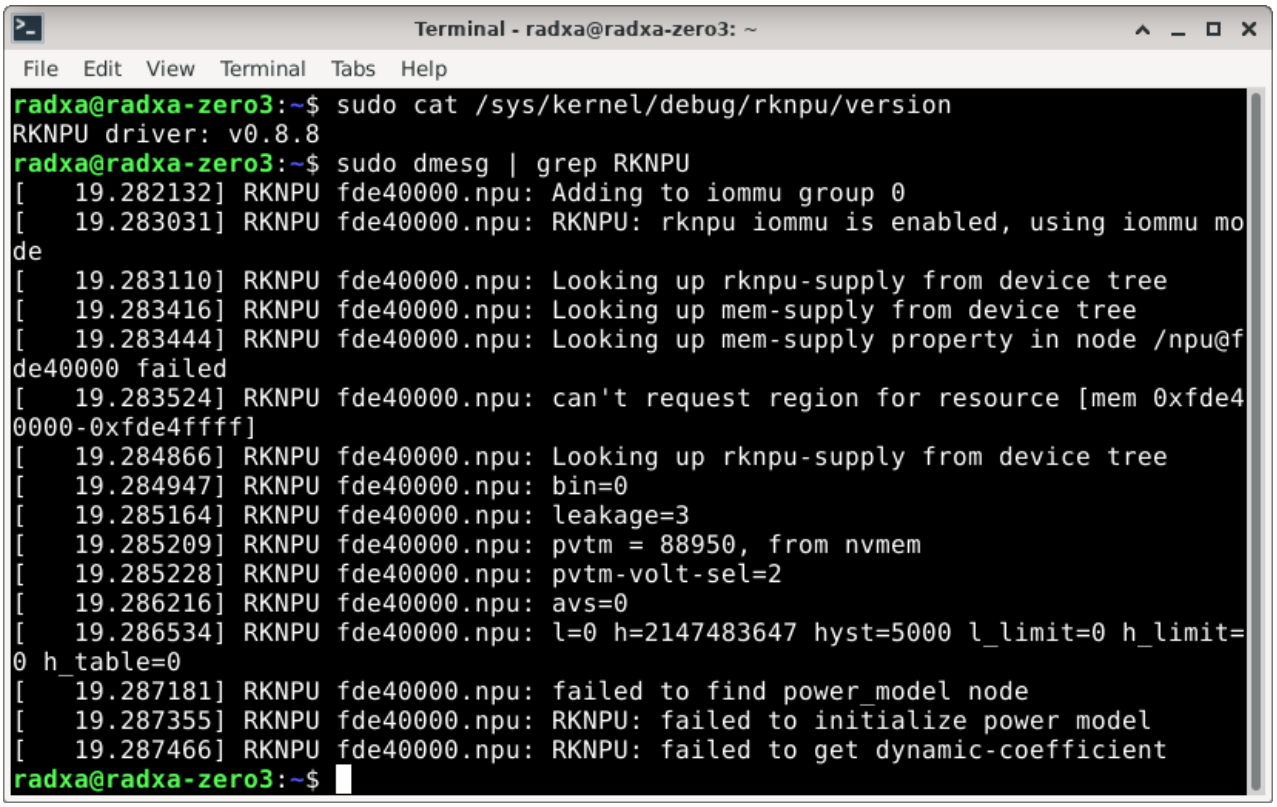




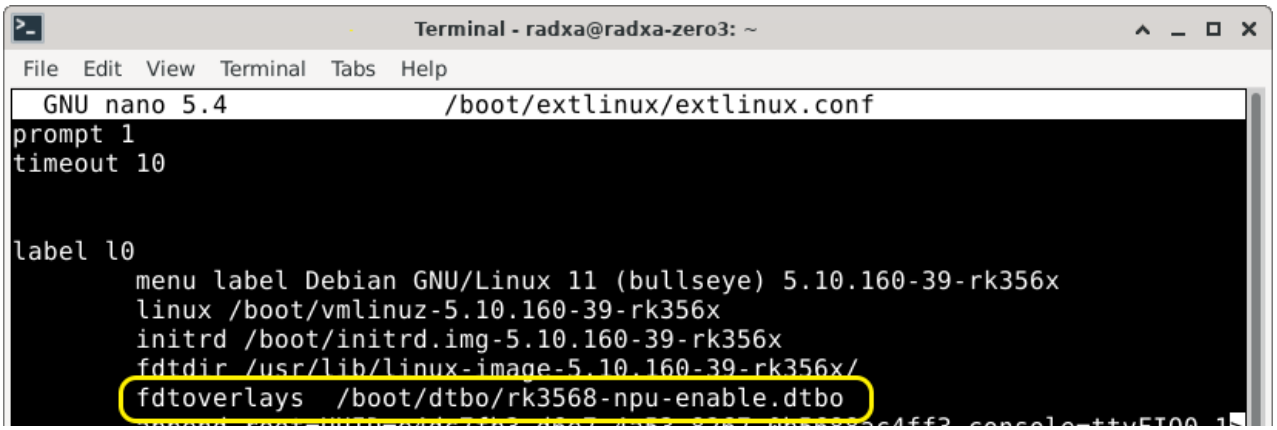

```
sudo reboot
```

Step 4: Verify NPU Activation

After rebooting, check if the NPU is recognized:



You may also want to inspect the `/boot/extlinux/extlinux.conf` file to confirm that `rsetup` has correctly applied the overlay:

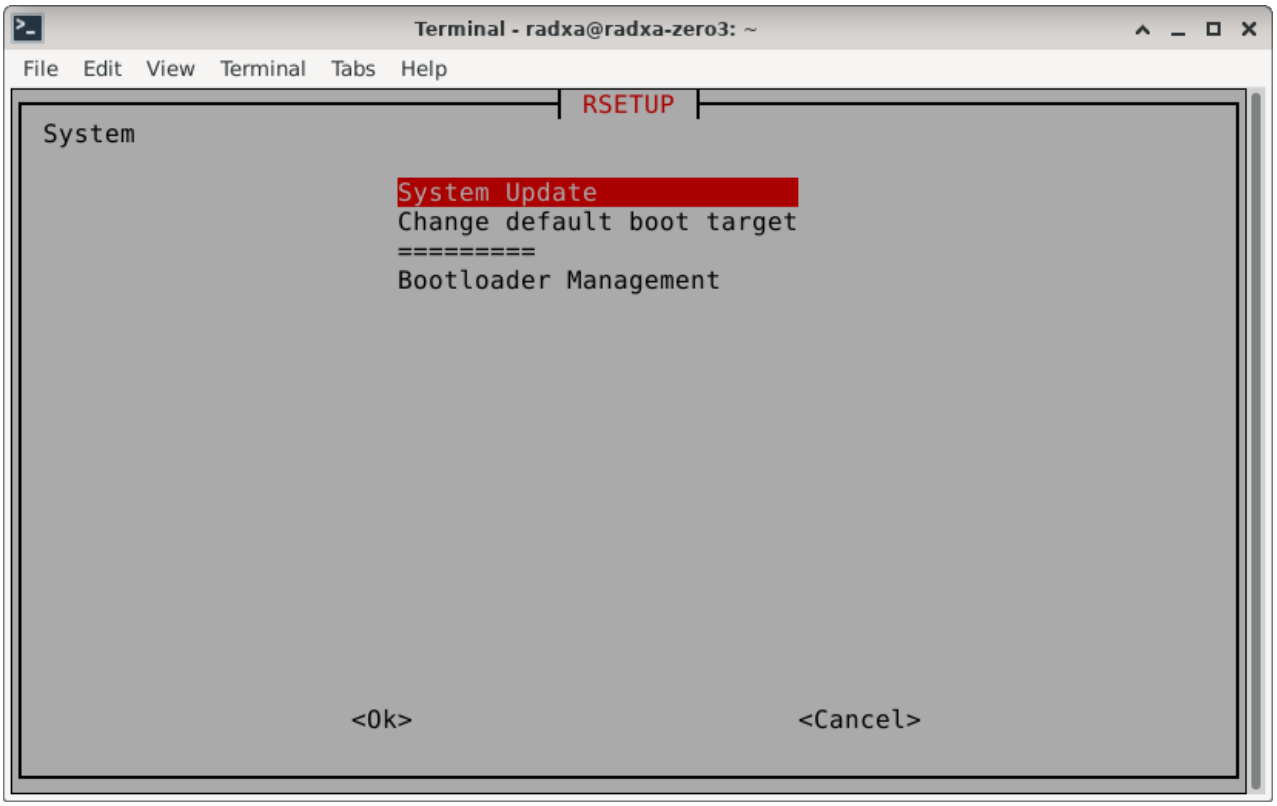


```
label l0r
        menu label Debian GNU/Linux 11 (bullseye) 5.10.160-39-rk356x (rescue ta>
        linux /boot/vmlinuz-5.10.160-39-rk356x
        initrd /boot/initrd.img-5.10.160-39-rk356x
        fdtdir /usr/lib/linux-image-5.10.160-39-rk356x/
        append root=UUID=e4dc7fb3-d6e7-4a53-8267-0b5688ac4ff3 console=ttyFIQ0,1>

^G Help      ^O Write Out ^W Where Is  ^K Cut       ^T Execute   ^C Location
^X Exit      ^R Read File ^\ Replace   ^U Paste     ^J Justify   ^_ Go To Line
```

Troubleshooting: NPU Not in the List?

If the NPU option is missing from `rsetup`, you may need to perform a **full system update**:



After updating, try running `rsetup` again and check if the NPU option is available.

Clone this wiki locally

```
https://github.com/Qengineering/Radxa-Zero-3-NPU-Ubuntu22.wiki.git
```