# RZ/G Verified Linux Package
## Version 3.0.0

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## Release Note

### Introduction

This release note describes the contents, building procedures and important points of the RZ/G Verified Linux Package (hereinafter referred to as "VLP/G").

### Contents

# 1. Release Items

- **Name and version**
  RZ/G Verified Linux Package
  Version 3.0.0 (hereinafter referred to as "VLP/G v3.0.0")

- **Distribution method**
  Please visit the site below and create an account to download the packages. This site is for the entire RZ Family which includes the RZ/G series. Basic packages of VLP/G v3.0.0 which are listed in **Table 1** can be downloaded.

  RZ Family:
  https://www.renesas.com/products/microcontrollers-microprocessors/rz-arm-based-high-end-32-64-bit-mpus

  You can also download the basic packages of VLP/G v3.0.0 which are listed in **Table 1** from the site below.

  RZ/G Marketplace:
  https://www.renesas.com/products/microcontrollers-microprocessors/rz-cortex-a-mpus/rzg-linux-platform

- **Target board**
  Hoperun Technology HiHope RZ/G2H platform (hihope-rzg2h) Rev 4.0
  Hoperun Technology HiHope RZ/G2M platform (hihope-rzg2m) Rev 4.0 (*1)
  Hoperun Technology HiHope RZ/G2N platform (hihope-rzg2n) Rev 4.0
  Silicon Linux RZ/G2E evaluation kit (ek874) Rev C
  Silicon Linux RZ/G2E evaluation kit (ek874) Rev E

  RZ/G2L Evaluation Board Kit PMIC version (*2):
  o   RZ/G2L SMARC Module Board v2.1
  o   RZ SMARC Series Carrier Board v4.0

  RZ/G2LC Evaluation Board Kit (*3):
  o   RZ/G2LC SMARC Module Board v1.0
  o   RZ SMARC Series Carrier Board v4.0

  RZ/G2UL Evaluation Board Kit (*4):
  o   RZ/G2UL SMARC Module Board v1.0
  o   RZ SMARC Series Carrier Board v4.0

(*1)　There are 2 versions of RZ/G2M LSI devices. There are version 3.0 and 1.3 (hereinafter referred to as "RZ/G2M v3.0" and "RZ/G2M v1.3").
(*2)　"RZ/G2L Evaluation Board Kit" and "RZG2L Evaluation Board Kit PMIC version" includes the  RZ/G2L SMARC Module Board and the RZ SMARC Series Carrier Board.
(*3)　"RZG2LC Evaluation Board Kit" includes the RZ/G2LC SMARC Module Board and the RZ SMARC Series Carrier Board.
(*4)　"RZ/G2UL Evaluation board Kit" includes the RZ/G2UL SMARC Module Board and the RZ SMARC Series Carrier Board.

- **Verified functions**

  Linux BSP
    - Linux Kernel
    - Linux Drivers
    - Graphics Libraries
    - Codec Libraries

  GUI Framework
    - Qt (LGPL version)

- **File contents**

  VLP/G is delivered by the files listed in **Table 1**.

**Table 1. RZ/G Verified Linux Package**

**Basic packages**

| File | Description |
|---|---|
| RTK0EF0045Z0021AZJ-v3.0.0.zip | Verified Linux Package. This file includes the **Yocto recipe packages** and the necessary documents. |
| rzg_bsp_v300.tar.gz | **Yocto recipe packages** |
| oss_pkg_v3.0.0.7z (2.2GB) | Open source software packages<br><br>See the Note below before download |
| r01us0553ej0100-rz-g.pdf | This document |
| r01us0554ej0100-rz-g.pdf | Component list |
| r01us0555ej0100-rz-g.pdf | Documents describing booting method and the required settings of bootloader for **RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E**. |
| r01us0556ej0100-rz-g.pdf | Documents describing booting method and the required settings of bootloader for **RZ/G2L, RZ/G2LC, and RZ/G2UL**. |

Note)   Open source software packages contain all source codes of OSSs except for Linux kernel. These are the same versions of OSSs used when VLP/G was verified.
<u>If you are just evaluating VLP/G and RZ/G series, open source software packages are not mandatory to use.</u>
Usually, all the software can be built without using these files if your build machine is connected to the Internet.

Open source software packages are required for an "offline" environment. The word "offline" means an isolated environment which does not connect to any network. VLP/G can always build images in this "offline" environment by using these packages without affected from changes of original repositories of OSSs. Also, this "offline" environment always reproduces the same images as the images which were verified by Renesas. Note that if you build without using open source software packages, there are possibilities to use different source codes than Renesas used due to the implicit changes of the repositories of OSSs.
Most bootable images that VLP/G supports can be built on an "offline" environment. Please refer to **2. Build environment**.

**Optional packages** (*1, 2)

| File | Description |
|---|---|
| RTK0EF0045Z13001ZJ-v1.0_EN.zip (Evaluation version)<br>RTK0EF0045Z13001ZJ-v1.0_JP.zip (Evaluation version)<br><br>RTK0EF0045Z14001ZJ-v1.0_EN.zip (Unrestricted version)<br>RTK0EF0045Z14001ZJ-v1.0_JP.zip (Unrestricted version) | RZ MPU Graphic Library for **RZ/G2L, LC**. This provides graphics function compliant with the OpenGL ES standard. |
| RTK0EF0045Z15001ZJ-v1.0_EN.zip (Evaluation version)<br>RTK0EF0045Z15001ZJ-v1.0_JP.zip (Evaluation version)<br><br>RTK0EF0045Z16001ZJ-v1.0_EN.zip (Unrestricted version)<br>RTK0EF0045Z16001ZJ-v1.0_JP.zip (Unrestricted version) | RZ MPU Video Codec Library for **RZ/G2L**. |
| RTK0EF0045Z0022AZJ-v1.0_EN.zip (Evaluation version)<br>RTK0EF0045Z0022AZJ-v1.0_JP.zip (Evaluation version)<br><br>RTK0EF0045Z0023AZJ-v1.0_EN.zip (Unrestricted version)<br>RTK0EF0045Z0023AZJ-v1.0_JP.zip (Unrestricted version) | Multimedia Packages for **RZ/G2H,M,N,E**. This includes the graphics library and the video codec library. |

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(*1)    **Evaluation vs Unrestricted Version**
        There are two release versions: Evaluation and Unrestricted. Please note that both of these packages have the same exact functionality. The only difference is that when you execute an application that uses the evaluation version of the libraries, operation will automatically be stopped after a few hours. The unrestricted version does not have this time limitation. To acquire the unrestricted version, please contact Renesas to start the formal process of acquiring those releases.

(*2)    Please refer to the Table 2 to check which LSI has GPU and Video Codec. "O" means "Exist" and "－" also means "Doesn't Exist".

**Table 2.  List of GPU/Codec on LSIs**

| LSI | GPU | Video Codec | Note |
|---|---|---|---|
| RZ/G2H, RZ/G2M, RZ/G2N, RZ/G2E | O | O | These LSIs can use Multimedia Packages. |
| RZ/G2L | O | O | This LSI can use both of the graphics library and the video codec. |
| RZ/G2LC | O | － | This LSI can use the graphics library. |
| RZ/G2UL | － | － | This LSI cannot use the graphics library and the video codec. |

O : Exist  /  － : Doesn't Exist

**Additional packages**

| File | Description |
|---|---|
| RTK0EF0045Z9006AZJ-v3.0.0.zip | BSP Manual Set for RZ/G2L, RZ/G2LC, and RZ/G2UL. |
| RTK0EF0045Z9002AZJ-v3.0.0.zip | BSP Manual Set for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E. |

Note)    Detailed information regarding the configuration (Device tree) and usage of the device drivers contained in this VLP can be downloaded from Renesas.com. Please download the "BSP Manual Set".

For RZ/G2L, LC, UL

https://www.renesas.com/document/oth/rzg2l-group-bsp-manual-set

For RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E

https://www.renesas.com/document/rzg2-group-bsp-manual-set

## 2.  Build environment

The environment for building the Board Support Package (hereinafter referred to as "BSP") is listed in Table 3. Please refer to the below documents for details about setting up the environment:

RZ/G2L Group, RZ/V2L, and RZ/Five SMARC EVK Start-up Guide

Reference Boards of RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E Start-up Guide

A Linux PC is required for building the software.

A Windows PC can be used as the serial terminal interface with software such as TeraTerm.

**Table 3. Equipment and Software Necessary for Developing Environments of RZ/G Linux Platform**

| Equipment | | Description |
|---|---|---|
| Linux Host PC | | Used as build/debug environment<br>100GB free space on HDD is necessary |
| | OS | Ubuntu 20.04 LTS<br>64 bit OS must be used. |
| | TFTP server | Used for downloading the Linux kernel to the board |
| | NFS server | Used for mounting rootfs via NFS |
| Windows Host PC | | Used as debug environment, controlling with terminal software |
| | OS | Windows 10 |
| | Terminal software | Used for controling serial console of the target board<br>Tera Term (latest version) is recommended<br>Available at https://ttssh2.osdn.jp/index.html.en |
| | VCP Driver | Virtual COM Port driver which enables to communicate Windows Host PC and the target board via USB which is virtually used as serial port. Available at:<br>• http://www.ftdichip.com/Drivers/VCP.htm (for ek874, Evaluation Board Kit of RZ/G2L, RZ/G2LC, and RZ/G2UL)<br>• https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers (for hihope-rzg2h, hihope-rzg2m, and hihope-rzg2n)<br>Please install VCP Driver corresponding to the target board. |

Most bootable images VLP/G supports can be built on an "offline" environment.
The word "offline" means an isolated environment which does not connect to any network. Since VLP/G includes all necessary source codes of OSS except for the Linux kernel, VLP/G can always build images in this "offline" environment without affected from changes of repositories of OSS. Also, this "offline" environment reproduces the same images as the images which were verified by Renesas.

Below images can be built "offline".
- core-image-minimal
- core-image-bsp
- core-image-weston (including the SDK build)
- core-image-qt (including the SDK build)

Below are not available in the "offline" environment. Please connect your Linux Host PC to the internet.
- Preparing a Linux Host PC

## 3. Building Instructions of a BSP

### 3.1 Building images to run on the board

This section describes the instructions to build the Board Support Package.
Before starting the build, run the command below on the Linux Host PC to install packages used for building the BSP.

```
$ sudo apt-get update
$ sudo apt-get install gawk wget git-core diffstat unzip texinfo gcc-multilib \
build-essential chrpath socat cpio python python3 python3-pip python3-pexpect \
xz-utils debianutils iputils-ping libsdl1.2-dev xterm p7zip-full
```

Please refer to the URL below for detailed information:

- https://docs.yoctoproject.org/3.1.5/brief-yoctoprojectqs/brief-yoctoprojectqs.html

Run the command**s** below and set the user name and email address before starting the build procedure. **Without this setting, an error occurs when building procedure runs git command to apply patches.**

```
$ git config --global user.email "you@example.com"
$ git config --global user.name "Your Name"
```

**Copy all files obtained from Renesas into your home directory prior to the steps below.**

**(1)    Create a working directory at your home directory, and decompress Yocto recipe package**

Run the commands below. The name and the place of the working directory can be changed as necessary.

```
$ mkdir ~/rzg_bsp_v3.0.0
$ cd ~/rzg_bsp_v3.0.0
$ tar zxvf ~/rzg_bsp_v3.0.0.tar.gz
```

Note)   Please note that your build environment must have 100GB of free hard drive space in order to complete the build. The Yocto BSP build environment is very large. Especially in case you are using a Virtual Machine, please check how much disk space you have allocated for your virtual environment.

Note) If you have a board with the early silicon version, please refer to the **Section 6.1 - (1) Early version of RZ/G2L Evaluation Board Kit** and apply the patch files during this step.  Please also confirm how to check which version you use.

Note)   VLP/G is set video output to LVDS as default setting. In case using HDMI, please refer to the **Section 6.2 - (2) Video output**.

**(2)   Enable GPU and Video Codec**

### For RZ/G2L and RZ/G2LC

If you enable the GPU on RZ/G2L and RZ/G2LC with **core-image-weston**, please copy the Graphic package (RTK0EF0045Z13001ZJ-v1.0_EN.zip or RTK0EF0045Z13001ZJ-v1.0_JP.zip) to working directory and run the commands below. If you build core-image-minimal, please ignore this step.

```
$ cd ~/rzg_bsp_v3.0.0
$ unzip RTK0EF0045Z13001ZJ-v1.0_EN.zip
$ tar zxvf RTK0EF0045Z13001ZJ-v1.0_EN/meta-rz-features.tar.gz
```

If you enable the video codec on RZ/G2L with **core-image-weston** or **core-image-bsp**, please copy the video codec package (RTK0EF0045Z15001ZJ-v0.56_EN.zip or RTK0EF0045Z15001ZJ-v0.56_JP.zip) to working directory and run the commands below.

```
$ cd ~/rzg_bsp_v3.0.0
$ unzip RTK0EF0045Z15001ZJ-v0.56_EN.zip
$ tar zxvf RTK0EF0045Z15001ZJ-v0.56_EN/meta-rz-features.tar.gz
```

Note) The Graphic package and the video codec package can be used at the same time for RZ/G2L.

Note) The video codec package is under development. These are released ASIS with no warranty.

### For RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E

If you enable the GPU and the video codec on RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E with **core-image-weston**, please copy the Multimedia package (RTK0EF0045Z0022AZJ-v1.0_EN.zip or RTK0EF0045Z0022AZJ-v1.0_JP.zip) to working directory and run the commands below. If you build core-image-minimal, please ignore this step.

```
$ cd ~/rzg_bsp_v3.0.0
$ unzip RTK0EF0045Z0022AZJ-v1.0_EN.zip
$ tar zxvf RTK0EF0045Z0022AZJ-v1.0_EN/meta-rz-features.tar.gz
```

**(3)   Setup a build environment**

Run the commands below. The environment to build is set by the source command.

```
$ cd ~/rzg_bsp_v3.0.0
$ source poky/oe-init-build-env
```

**(4)    Prepare the default configuration files for the target board**

Run the commands below. Please replace "*board*" by the name below:

|                                              |                 |
|----------------------------------------------|-----------------|
| HiHope RZ/G2H board:                         | hihope-rzg2h    |
| HiHope RZ/G2M board:                         | hihope-rzg2m    |
| HiHope RZ/G2N board:                         | hihope-rzg2n    |
| EK874 RZ/G2E board:                          | ek874           |
| RZ/G2L Evaluation Board Kit PMIC version:    | smarc-rzg2l     |
| RZ/G2LC Evaluation Board Kit:                | smarc-rzg2lc    |
| RZ/G2UL Evaluation Board Kit:                | smarc-rzg2ul    |

```
$ cd ~/rzg_bsp_v3.0.0/build
$ cp ../meta-renesas/docs/template/conf/board/*.conf  ./conf/
```

**(5)    Decompress OSS files to "build" directory**

Run the commands below. This step is not mandatory and able to go to the step (6) in case the "offline" environment is not required. All OSS packages will be decompressed with this '7z' command.

```
$ cd ~/rzg_bsp_v3.0.0/build
$ 7z x ~/oss_pkg_v3.0.0.7z
```

Note)   If this step is omitted and BB_NO_NETWORK is set to "0" in next step, all source codes will be downloaded from the repositories of each OSS via the internet when running bitbake command. Please note that if you do not use an "offline" environment, a build may fail due to the implicit changes of the repositories of OSS.

After the above procedure is finished, the "offline" environment is ready. If you want to prevent network access, please change the line in the "~/rzg_bsp_v3.0.x/build/conf/local.conf" as below:

```
BB_NO_NETWORK = "1"
```

To change BB_NO_NETWORK from "0" to "1".

**(6) Start a build**

Run the commands below to start a build. Building an image can take up to a few hours depending on the user's host system performance.

```
$ bitbake core-image-weston
```

After the build is successfully completed, a similar output will be seen, and the command prompt will return.

```
NOTE: Tasks Summary: Attempted 7427 tasks of which 16 didn't need to be rerun and al
l succeeded.
```

All necessary files listed in **Table 5** and **Table 6** will be generated by the bitbake command and will be located in the **build/tmp/deploy/images** directory.
Table 5 is for RZ/G2L, RZ/G2LC, and RZ/G2UL.
Table 6 is for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E.

VLP/G can build a few types of images listed in **Table 4**. Please refer to the "Component list" for details about components of each image.

**Table 4. Supported images of VLP/G**

| Image name | Purpose |
|---|---|
| core-image-minimal | Minimal set of components |
| core-image-bsp | Minimal set of components plus audio support and some useful tools |
| core-image-weston | Standard image with graphics support |
| core-image-qt | Enable Qt LGPL version |

**Table 5 Image files for RZ/G2L, RZ/G2LC, and RZ/G2UL**

| RZ/G2L PMIC ver | Linux kernel | Image-smarc-rzg2l.bin |
|---|---|---|
| | Device tree file | Image-r9a07g044l2-smarc.dtb |
| | root filesystem | *<image name>*-smarc-rzg2l.tar.bz2 |
| | Boot loader | ・bl2_bp-smarc-rzg2l_pmic.srec |
| | | ・fip-smarc-rzg2l_pmic.srec |
| | Flash Writer | Flash_Writer_SCIF_RZG2L_SMARC_PMIC_DDR4_2GB_1PCS.mot |
| | | |
| RZ/G2LC | Linux kernel | Image-smarc-rzg2lc.bin |
| | Device tree file | Image-r9a07g044c2-smarc.dtb |
| | root filesystem | *<image name>*-smarc-rzg2lc.tar.bz2 |
| | Boot loader | ・bl2_bp-smarc-rzg2lc.srec |
| | | ・fip-smarc-rzg2lc.srec |
| | Flash Writer | ・Flash_Writer_SCIF_RZG2LC_SMARC_DDR4_1GB_1PCS.mot |
| | | |
| RZ/G2UL | Linux kernel | Image-smarc-rzg2ul.bin |
| | Device tree file | Image-r9a07g043u11-smarc.dtb |
| | root filesystem | *<image name>*-smarc-rzg2ul.tar.bz2 |
| | Boot loader | ・bl2_bp-smarc-rzg2ul.srec |
| | | ・fip-smarc-rzg2ul.srec |
| | Flash Writer | ・Flash_Writer_SCIF_RZG2UL_SMARC_DDR4_1GB_1PCS.mot |

**Table 6. Image files for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E**

|  | Linux kernel | root filesystem | Boot loader |
|---|---|---|---|
| RZ/G2H | Image-hihope-rzg2h.bin | *<image name>*-hihope-rzg2h.tar.bz2 | u-boot-elf-hihope-rzg2h.srec<br>bootparam_sa0.srec<br>bl2-hihope-rzg2h.srec<br>bl31-hihope-rzg2h.srec<br>tee-hihope-rzg2h.srec<br>cert_header_sa6.srec |
| RZ/G2M<br>v3.0 (*)<br>v1.3 (*) | Image-hihope-rzg2m.bin | *<image name>*-hihope-rzg2m.tar.bz2 | u-boot-elf-hihope-rzg2m.srec<br>bootparam_sa0.srec<br>bl2-hihope-rzg2m.srec<br>bl31-hihope-rzg2m.srec<br>tee-hihope-rzg2m.srec<br>cert_header_sa6.srec |
| RZ/G2N | Image-hihope-rzg2n.bin | *<image name>*-hihope-rzg2n.tar.bz2 | u-boot-elf-hihope-rzg2n.srec<br>bootparam_sa0.srec<br>bl2-hihope-rzg2n.srec<br>bl31-hihope-rzg2n.srec<br>tee-hihope-rzg2n.srec<br>cert_header_sa6.srec |
| RZ/G2E | Image-ek874.bin | *<image name>*-ek874.tar.bz2 | u-boot-elf-ek874.srec<br>bootparam_sa0.srec<br>bl2-ek874.srec<br>bl31-ek874.srec<br>tee-ek874.srec<br>cert_header_sa6.srec |

*<image name>* will be the name used in the step (8).

**Device tree files**

|  | Type 1 | Type 2 | Type 3 | Type 4 |
|---|---|---|---|---|
| RZ/G2H | Image-r8a774e1-hihope-rzg2h.dtb | Image-r8a774e1-hihope-rzg2h-ex.dtb | Image-r8a774e1-hihope-rzg2h-ex-idk-1110wr.dtb | Image-r8a774e1-hihope-rzg2h-ex-mipi-2.1.dtb |
| RZ/G2M<br>v1.3 (*1) | Image-r8a774a1-hihope-rzg2m.dtb | Image-r8a774a1-hihope-rzg2m-ex.dtb | Image-r8a774a1-hihope-rzg2m-ex-idk-1110wr.dtb | Image-r8a774a1-hihope-rzg2m-ex-mipi-2.1.dtb |
| RZ/G2M<br>v3.0 (*1) | Image-r8a774a3-hihope-rzg2m.dtb | Image-r8a774a3-hihope-rzg2m-ex.dtb | Image-r8a774a3-hihope-rzg2m-ex-idk-1110wr.dtb | Image-r8a774a3-hihope-rzg2m-ex-mipi-2.1.dtb |
| RZ/G2N | Image-r8a774b1-hihope-rzg2n.dtb | Image-r8a774b1-hihope-rzg2n-ex.dtb | Image-r8a774b1-hihope-rzg2n-ex-idk-1110wr.dtb | Image-r8a774b1-hihope-rzg2n-ex-mipi-2.1.dtb |
| RZ/G2E<br>EK874<br>Rev C (*2) | Image-r8a774c0-cat874-revc.dtb | Image-r8a774c0-ek874-revc.dtb | Image-r8a774c0-ek874-revc-idk-2121wr.dtb | Image-r8a774c0-ek874-revc-mipi-2.1.dtb |
| RZ/G2E<br>EK874<br>Rev E (*2) | Image-r8a774c0-cat874.dtb | Image-r8a774c0-ek874.dtb | Image-r8a774c0-ek874-idk-2121wr.dtb | Image-r8a774c0-ek874-mipi-2.1.dtb |

There are 4 types of the device tree files. Available devices are different depending on them. Please refer to the following description:

- **Type1**: Main board only
- **Type2**: Main board + Sub board
- **Type3**: Main board + Sub board + LVDS panel
- **Type4**: Main board + Sub board + MIPI/CSI2 cameras

Please note that users who use the combination of main and sub boards need to use type2-4 as a device tree file. **If the dtb files of type1 are used, interfaces on the sub board such as Ethernet are not able to be used.** For the booting method and the required settings, please refer to the "Reference Boards of RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E Start-up Guide".

(\*1) There are 2 types of RZ/G2M LSI ("RZ/G2M v3.0" and "RZ/G2M v1.3"). In case you use the hihope-rzg2m board which has one of them, the same image files can be used, but the same device tree files cannot be used. Please refer to the above table. If the board prints the messages below when turn on the power, RZ/G2M v3.0 is used on your board. In case of RZ/G2M v1.3, "R8A774A1" will be displayed.

```
CPU: Renesas Electronics R8A774A3
```

(\*2) There are 2 revisions of the ek874 board (Rev C, E). In case you use the ek874 board, the same image files can be used, but the same device tree files cannot be used. Please refer to the above table. You can check the board revision with the silk printed on the board.

Note) The dtb files listed in the Table 6 cannot be used for the early version of boards. See the section **0.**

Notes - **(1)**. In case you use the hihope-rzg2m board which has RZ/G2M v3.0 LSI, the dtb files listed in the Table 6 can be used because the board is the latest version.

## 3.2 Building SDK

To build Software Development Kit (SDK), run the commands below after the steps (1) – (6) of section **3.1** are finished.

The SDK allows you to build custom applications outside of the Yocto environment, even on a completely different PC. The results of the commands below are 'installer' that you will use to install the SDK on the same PC, or a completely different PC.

For building general applications:

```
$ cd ~/rzg_bsp_v3.0.0/build
$ bitbake core-image-weston -c populate_sdk
```

For building Qt applications:

```
$ cd ~/rzg_bsp_v3.0.0/build
$ bitbake core-image-qt -c populate_sdk
```

The resulting SDK installer will be located in **build/tmp/deploy/sdk/**

The SDK installer will have the extension .sh
To run the installer, you would execute the following command:

```
$ sudo sh poky-glibc-x86_64-core-image-weston-aarch64-<board>-toolchain-3.1.14.sh
```

Or

```
$ sudo sh poky-glibc-x86_64-core-image-qt-aarch64-<board>-toolchain-3.1.14.sh
```

Please replace *<board>* by the name below:

HiHope RZ/G2H board:     hihope-rzg2h

HiHope RZ/G2M board:     hihope-rzg2m

HiHope RZ/G2N board:     hihope-rzg2n

EK874 RZ/G2E board:      ek874

RZ/G2L Evaluation Board Kit PMIC version:        smarc-rzg2l

RZ/G2LC Evaluation Board Kit:        smarc-rzg2lc

RZ/G2UL Evaluation Board Kit:        smarc-rzg2ul

## 4. Components

Compared to the RZ/G Verified Linux Package (hereinafter referred to as "VLP") for 64bit kernel and RZ/G2L Group Boar Support Package, this version uses different version of Linux kernel. Please also refer to the "Component list" for details.

**Table 7. Versions of commonly used components**

| Components | VLP for 64bit kernel v1.0.10<br><br>For RZ/G2H,RZ/G2M, RZ/G2N, RZ/G2E | RZ/G2L Group Board Support Package v1.4<br><br>For RZ/G2L,RZ/G2LC, RZ/G2UL | VLP/G v3.0.0<br><br>For RZ/G2 Group |
|---|---|---|---|
| Linux kernel | 4.19.198-cip54 | 4.19.140-cip54 | 5.10.83-cip1 |
| GCC | 7.2.1<br>(Linaro GCC 7.2-2017.11) | 8.3.0<br>(Arm GCC 8.3-2019.03) | 8.3.0<br>(Arm GCC 8.3-2019.03) |
| glibc | 2.28 | 2.28 | 2.28 |
| busybox | 1.30.1 | 1.31.1 | 1.31.1 |
| openssl | 1.1.1d | 1.1.1d | 1.1.1d |

Note)    RZ/G2 Group includes RZ/G2H, RZ/G2M, RZ/G2N, RZ/G2E, RZ/G2L, RZ/G2LC, and RZ/G2UL.

## 5. Restrictions

**(1)　USB camera 3.0**

RZ/G2E cannot stream with higher resolution than Full HD when you use a camera with USB 3.0.

**(2)　CSI40**

Disable CSI40 in RZ/G2H, N and G2M v3.0 by default due to SW limitation.

**(3)　Wifi and Bluetooth**

Low performance while using 2.4GHz Wifi/Bluetooth and USB 3.0 device in Hihope RZ/G2H, M, and N at the same time due to noise. If using USB3.0 device, should connect to 5GHz Wifi network.

## 6. Notes

There are 3 types of notes like as below. Please refer to them according to your boards.

- Notes for RZ/G2L, RZ/G2LC, and RZ/G2UL
- Notes for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E
- Common Notes for all RZ Platforms

### 6.1  Notes for RZ/G2L, RZ/G2LC, and RZ/G2UL

**(1) Early version of RZ/G2L Evaluation Board Kit**

When you use the **early** version of the RZ/G2L LSI, please run the commands below to apply the patch files after step (1) in the section 3.1.

```
$ cd ~/rzg_bsp_v3.0.0/meta-renesas
$ patch -p1 < ../extra/0002-trusted-firmware-a-add-rd-wr-64-bit-reg-workaround.patch
$ patch -p1 < ../extra/0003-recipes-rzg2l-linux-renesas-add-WA-GIC-access-64bit\
.patch
```

Note)  If you want to know which version of the RZ/G2L LSI you use, please check the LSI on the board. When "2050KC002" is printed on the LSI, you use the early version.

### 6.2  Notes for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E

**(1)  Bootloader/Linux kernel**

The dtb files listed in the **Table 4** cannot be used for the early revision of Hoperun boards. If you are using revision 2 boards, please use below files. These are automatically generated at the same place as the other image files when building a BSP.

**HiHope RZ/G2M board:**

- Image-r8a774a1-hihope-rzg2m-**rev2**.dtb (main board only)
- Image-r8a774a1-hihope-rzg2m-**rev2**-ex.dtb (main + sub board)
- Image- r8a774a1-hihope-rzg2m-**rev2**-ex-idk-1110wr.dtb (main + sub board + LVDS-IF)
- Image-r8a774a1-hihope-rzg2m-**rev2**-ex-mipi-2.1.dtb (main + sub board + MIPI/CSI2 cameras)

**HiHope RZ/G2N board:**

- Image-r8a774b1-hihope-rzg2n-**rev2**.dtb (main board only)
- Image-r8a774b1-hihope-rzg2n-**rev2**-ex.dtb (main + sub board)
- Image- r8a774b1-hihope-rzg2n-**rev2**-ex-idk-1110wr.dtb (main + sub board + LVDS-IF)
- Image-r8a774b1-hihope-rzg2n-**rev2**-ex-mipi-2.1.dtb (main + sub board + MIPI/CSI2 cameras)

**Silicon Linux RZ/G2E board (EK874):**

- Please refer to **(7) GPU** in this section.

Note)  Board revision is printed below the Hoperun logo on boards.

**(2)    Video output**

VLP/G is set video output to LVDS as default setting. In case to use HDMI as a video output, please apply the patch with these commands. This step is only for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E.

```
$ cd ~/rzg_bsp_v3.0.0/meta-renesas
$ patch -p1 < ../extra/0001-Add-HDMI-support-for-RZ-G2.patch
```

After applying above patch, please note to below points.

**Audio**

In case 48kHz audio, please set SW2404 to P1 side in HiHope Rev4 Boards of RZ/G2H, M, and N.

**Bluetooth**

Firmware of Bluetooth is integrated into the kernel. Therefore, this step is not necessary.

```
hciattach /dev/ttySC1 texas 3000000
```

Instead, this step is required.

```
rfkill unblock bluetooth
```

**SATA**

SATA interface on HiHope Rev4 Boards of RZ/G2H, N is enabled by setting switches as below. (SATA cannot be supported in the RZ/G2N Rev2 board due to HW limitation).

- SW1001-7 on main board: OFF
- SW43 on sub board: ON

**(3)    Video playback**

Due to the specification of open source software (GStreamer and others) and drivers, multiple GStreamer pipelines with hardware scale cannot run.

Also, below formats of video are not supported.

- NV61
- YUV420
- YUV422
- YUV444
- H.264, 80Mbps

**(4)    ECC**

The ECC function for DRAM has two modes: 8bit data/5bit ECC mode and 64bit data/8bit ECC mode. 8bit data/5bit ECC mode can be evaluated by the following method. When applying the ECC function to products or need other details including the method to enable 64bit data/8bit ECC mode, please contact Renesas.

Enable the function by changing the lines below in the `local.conf`.

Disable:
```
# MACHINE_FEATURES_append = " ecc"
# ECC_MODE = "Partial"
```
Enable:
```
MACHINE_FEATURES_append = " ecc"
ECC_MODE = "Full"
```

This sets 8bit data/5bit ECC mode for all DRAM region. After building, please replace all images including boot loaders.

**(5) SDHI**

Early revision of EK874 boards cannot detect insertion of SD card. Please plugged in a card before turning on the power.

**(6) VIN**

One camera input is enabled in default settings. Two camera inputs can be enabled in RZ/G2H, N and M v3.0. Please refer to the Video Capture Driver User's Manual that is included in the RZ/G2 Group BSP Manual Set for more details.

VIN on early revision of HiHope RZ/G2M and N boards fails to work. Please use newer boards in case VIN is necessary.

**(7) GPU**

The dtb files listed in the Table 6 cannot be used for the early version (ES1.0) of RZ/G2E.

If the board prints the messages below when turn on the power, ES1.0 of RZ/G2E is implemented on the board.

```
[    0.000096] NOTICE:  BL2: RZ G2E Initial Program Loader(CA53)
[    0.004373] NOTICE:  BL2: Initial Program Loader(Rev.1.0.23)
[    0.009991] NOTICE:  BL2: PRR is RZG G2E Ver.1.0
```

```
CPU: Renesas Electronics R8A774C0 rev 1.0
```

In this case, please use below dtb files instead. These are built simultaneously when building normal dtb files.

- Image-r8a774c0-**es10**-cat874.dtb (main board only)
- Image-r8a774c0-**es10**-ek874.dtb (main + sub board)
- Image-r8a774c0-**es10**-ek874-idk-2121wr.dtb (main + sub board + LVDS panel)
- Image-r8a774c0-**es10**-ek874-mipi-2.1.dtb (main + sub board + MIPI/CSI2 cameras)

In case both old and new RZ/G2E LSIs are used in your laboratory at the same time, dtb files can automatically be selected using the environment variable `cut_ver` which is set by u-boot program according to the LSI's information. Please store multiple dtb files in an SD card and set `bootcmd` of u-boot like this.

```
setenv bootcmd 'fatload mmc 0:1 0x48080000 Image; if test "${cut_ver}" = "10"; then
fatload mmc 0:1 0x48000000 Image-r8a774c0-es10-ek874.dtb; else fatload mmc 0:1 0x480
00000 Image-r8a774c0-ek874.dtb ; fi ; booti 0x48080000 - 0x48000000'
```

**(8) Wifi**

Wifi is disabled in default settings but modules necessary for Wifi functions are installed into rootfs. In case Wifi is necessary, please enable it from a console as below.

```
$ rfkill list
```

If this command shows "`Soft blocked: yes`", run "`unblock`" command like this.

```
$ rfkill unblock wlan
```

Then, continue below.

```
$ connmanctl
connmanctl> scan wifi
connmanctl> services
connmanctl> agent on
connmanctl> connect <network_name>
  <imput password>
connmanctl> quit
```

You may need to retry the "connect" command few times.

Note that some settings relating about radio waves should be adjusted according to the laws of each region. Please refer to general information in books and websites about Linux networking.

## 6.3    Common Notes for all RZ Platforms

### (1)    GPLv3 packages

In this release, the GPLv3 packages are disabled as default in *build/conf/local.conf*:

```
INCOMPATIBLE_LICENSE = "GPLv3 GPLv3+"
```

If you want to use GPLv3, just hide this line:

```
#INCOMPATIBLE_LICENSE = "GPLv3 GPLv3+"
```

### (2)    Disable libraries of GPU and video codec

When you want to disable the functions of the video codec, please add lines in *build/conf/local.conf*:

- Disable OpenGL ES library in the graphics package (*1)

```
USE_RENESAS_GLES = "0"
```

- Disable OpenCL library in the graphics package (*1)

```
USE_RENESAS_OPENCL = "0"
```

- Disable OpenMAX library for decode in the video codec package (*2)

```
USE_CODEC_DEC = "0"
```

- Disable OpenMAX library for encode in the video codec package (*2)

```
USE_CODEC_ENC = "0"
```

(*1) This library is included in RTK0EF0045Z13001ZJ-v1.0_EN.zip and RTK0EF0045Z13001ZJ-v1.0_JP.zip
(*2) This library is included in RTK0EF0045Z15001ZJ-v0.56_EN.zip and RTK0EF0045Z15001ZJ-v0.56_JP.zip

### (3)    Docker

Docker is disabled in the default settings of VLP/G. To enable Docker, please uncomment the below line inside the file "~/rzg_bsp_v3.0.x/build/conf/local.conf" before building images.

```
#MACHINE_FEATURES_append = " docker"
```

**(4) LVGL Demo**

LVGL demo which is a GUI application framework for embedded devices is disabled in the default settings of VLP/G. The demo is under development, so don't change the below line inside the file "~/rzg_bsp_v3.0.x/build/conf/local.conf" before building images. When you change the value, the build fails.

```
INSTALL_RZG2_DEMOS = "0"
```

**(5) USB Video Class**

USB Video Class (UVC) driver is not installed with the default settings of VLP/G due to its big size.

In case UVC devices such as USB cameras are necessary, please install the driver by adding the line below to local.conf.

```
IMAGE_INSTALL_append = " kernel-module-uvcvideo "
```

**(6) CIP Core Packages**

VLP/G includes Debian 10 (Buster) based CIP Core Packages indicated as "(CIP Core Buster)" in the **Table 7** and is enabled by the default settings. These packages can be replaced with other versions of packages.

Note that network access is required to start the build process when you enable these packages except for Buster which is set as the default setting.

CIP Core Packages are going to be maintained by the Civil Infrastructure Platform project. For more technical information, please contact Renesas.

**1. Buster (default):**

The following lines are added as default in the local.conf:

```
# Select CIP Core packages
CIP_CORE = "1"
```

**2. No CIP Core Packages:**

If the CIP Core Packages are unnecessary, comment out and add the following lines to disable CIP Core Packages in the local.conf:

```
# Select CIP Core packages
#CIP_CORE = "1"
```

Note)    The above 2 settings disable GPLv3 packages as default. In case the GPLv3 packages are required, please comment out the following line in the local.conf.

```
# INCOMPATIBLE_LICENSE = "GPLv3 GPLv3+"
```

By building the BSP, the packages will be replaced as below in the table.

**Table 8. Versions of all Buster Debian packages**

| Package | Buster Debian |
|---------|---------------|
| attr | 2.4.48 |
| busybox | 1.31.1 |
| coreutils | 6.9 |
| gcc | 8.3.0 |
| glib-2.0 | 2.58.3 |

| glibc | 2.28 |
|---|---|
| gnupg | 1.4.7 |
| kbd | 2.0.4 |
| libassuan0 | 2.5.2 |
| libgcrypt | 1.8.4 |
| libunistring | 0.9.10 |
| libnss | 0.14.1 |
| openssh | 7.9p1 |
| perl | 5.30.1 |
| pkgconfig | 0.29 |
| quilt | 0.65 |

## Website and Support

Renesas Electronics Website
http://www.renesas.com/

Inquiries
http://www.renesas.com/contact/

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