

# RZ/G Verified Linux Package

## Version 3.0.3

R01US0553EJ0107

Rev. 1.07

### Release Note

Apr 21, 2023

## 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 .....	2
2. Build environment.....	6
3. Build Instructions.....	7
3.1 Building images to run on the board .....	7
3.2 Building SDK .....	14
4. Components .....	15
5. Restrictions .....	16
6. Notes .....	17
6.1 Notes for RZ/G2L, RZ/G2LC, and RZ/G2UL .....	17
6.2 Notes for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E.....	17
6.3 Common Notes for all RZ Platforms .....	20
6.4 Build with the same procedure as before.....	23
7. Revision History .....	26

## 1. Release Items

- **Name and version**

RZ/G Verified Linux Package

Version 3.0.3 (hereinafter referred to as “VLP/G v3.0.3”)

- **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 v3.0.3 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 v3.0.3 which are listed in Table 1 from the site below.

RZ/G Marketplace:

<https://www.renesas.com/us/en/products/microcontrollers-microprocessors/rz-mpus/rzg-linux-platform/rzg-marketplace/verified-linux-package/rzg-verified-linux-package>

- **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 E

RZ/G2L Evaluation Board Kit PMIC version (\*2):

- RZ/G2L SMARC Module Board v2.1
- RZ SMARC Series Carrier Board v4.0

RZ/G2LC Evaluation Board Kit (\*3):

- RZ/G2LC SMARC Module Board v1.0
- RZ SMARC Series Carrier Board v4.0

RZ/G2UL Evaluation Board Kit (\*4):

- RZ/G2UL SMARC Module Board v1.0
- 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 files of VLP/G v3.0.3**

File	Description
RTK0EF0045Z0021AZJ-v3.0.3.zip (*1)	Verified Linux Package. This file includes the <b>Yocto recipe packages</b> and the necessary documents.
rzg_bsp_v3.0.3.tar.gz	<b>Yocto recipe packages</b>
oss_pkg_rzg_v3.0.3.7z (*1)	Open source software packages  <b>See the Note below before download</b>
r01us0553ej0107-rz-g(Release Note).pdf	This document
r01us0554ej0105-rz-g(Component List).pdf	Component List
r01us0555ej0100-rz-g(Board_StartUp_Guide_RZG2H,M,N,E).pdf	Documents describing booting method and the required settings of bootloader for <b>RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E</b> .
r01us0556ej0101-rz-g(Board_StartUp_Guide_smarcEVK).pdf	Documents describing booting method and the required settings of bootloader for <b>RZ/G2L, RZ/G2LC, and RZ/G2UL</b> .

(\*1) These packages are provided “AS IS” with no warranty and the license which is described in the source code. Please check the contents of the license, then consider the applicability to the product carefully.

Note) The open source software (OSS) packages contain all the relevant source code files. These are the same versions of OSS that was used when VLP/G was verified. Downloading a using this large OSS package file (oss\_pkg\_rzg\_XXX.7z) is not mandatory if your build PC is connected to the Internet and can directly download the individual source code packages listed in the Yocto recipes. However, if your build PC is not connected to the Internet, this OSS package file contains all the source packages required by the Yocto build.

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)**

	File (“XX” is replaced by “EN” or “JP”.)	Description
RZ MPU Graphics Library	RTK0EF0045Z13001ZJ-v1.0.5_XX.zip (Evaluation version) RTK0EF0045Z14001ZJ-v1.0.5_rzg_XX.zip (Unrestricted version)	For <b>RZ/G2L</b> and <b>RZ/G2LC</b> . This provides graphics function compliant with the OpenGL ES standard.
RZ MPU Video Codec Library	RTK0EF0045Z15001ZJ-v1.1.0_XX.zip (Evaluation version) RTK0EF0045Z16001ZJ-v1.1.0_rzg_XX.zip (Unrestricted version)	RZ MPU Video Codec Library for <b>RZ/G2L</b> .
Multimedia Packages	RTK0EF0045Z0022AZJ-v1.0.2_XX.zip (Evaluation version) RTK0EF0045Z0023AZJ-v1.0.2_XX.zip (Unrestricted version)	Multimedia Packages for <b>RZ/G2H,M,N,E</b> . This includes the graphics library and the video codec library.

**(\*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.

**Additional packages**

File	Description
RTK0EF0045Z9006AZJ-v3.0.3.zip	BSP Manual Set for RZ/G2L, RZ/G2LC, and RZ/G2UL.
RTK0EF0045Z9002AZJ-v3.0.3.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/G 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 the below table. Please refer to the below documents for details about setting up the environment:

SMARC EVK of RZ/G2L, RZ/G2LC, RZ/G2UL, RZ/V2L, and RZ/Five 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 2. Equipment and Software Necessary for Developing Environments of RZ/G Linux Platform**

Equipment	Description
Linux Host PC	Used as build/debug environment 100GB free space on HDD is necessary
OS	<b>Ubuntu 20.04 LTS</b> 64 bit OS must be used.
Windows Host PC	Used as debug environment, controlling with terminal software
OS	Windows 10
Terminal software	Used for controlling serial console of the target board Tera Term (latest version) is recommended Available at <a href="https://tssh2.osdn.jp/index.html.en">https://tssh2.osdn.jp/index.html.en</a>
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: <ul style="list-style-type: none"> <li><a href="http://www.ftdichip.com/Drivers/VCP.htm">http://www.ftdichip.com/Drivers/VCP.htm</a> (for ek874, Evaluation Board Kit of RZ/G2L, RZ/G2LC, and RZ/G2UL)</li> <li><a href="https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers">https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers</a> (for hihope-rzg2h, hihope-rzg2m, and hihope-rzg2n)</li> </ul> <b>Please install the VCP Driver corresponding to the target board.</b>

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, 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)

Note) Please note that the network access is required when you prepare a Linux Host PC.

### 3. Build Instructions

#### 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 libyaml-dev \
libssl-dev
```

Please refer to the URL below for detailed information:

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

Run the commands 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 Linux Host PC prior to the steps below. The directory which you put the files in is described as <package download directory> in the build instructions.**

##### (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_vlp_v3.0.3
$ cd ~/rzg_vlp_v3.0.3
$ cp ../<package download directory>/*.zip .
$ unzip ./RTK0EF0045Z0021AZJ-v3.0.3.zip
$ tar zxvf ./RTK0EF0045Z0021AZJ-v3.0.3/rzg_bsp_v3.0.3.tar.gz
```

Note) Please note that your build environment must have 100GB of free hard drive space in order to complete the minimum 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.

## (2) Enable Graphics and Video Codec

### For RZ/G2L and RZ/G2LC

The graphics package and the video codec package can be used at the same time. And also, one of the packages can be used.

If you want to enable the Graphics on RZ/G2L and RZ/G2LC when building **core-image-weston**, please copy the Graphics package (RTK0EF0045Z13001ZJ-v1.0.5\_EN.zip or RTK0EF0045Z13001ZJ-v1.0.5\_JP.zip) to [working directory](#) and run the commands below. If you build core-image-minimal, please ignore this step.

```
$ unzip ./RTK0EF0045Z13001ZJ-v1.0.5_EN.zip
$ tar zxvf ./RTK0EF0045Z13001ZJ-v1.0.5_EN/meta-rz-features_graphics_v1.0.5.tar.gz
```

### For RZ/G2L

If you want to enable the video codec on RZ/G2L when building **core-image-weston** or **core-image-bsp**, please copy the video codec package (RTK0EF0045Z15001ZJ-v1.1.0\_EN.zip or RTK0EF0045Z15001ZJ-v1.1.0\_JP.zip) to [working directory](#) and run the commands below.

```
$ unzip ./RTK0EF0045Z15001ZJ-v1.1.0_EN.zip
$ tar zxvf ./RTK0EF0045Z15001ZJ-v1.1.0_EN/meta-rz-features_codec_v1.1.0.tar.gz
```

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

If you want to enable the Graphics and the video codec on RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E when building **core-image-weston**, please copy the Multimedia package (RTK0EF0045Z0022AZJ-v1.0.2\_EN.zip or RTK0EF0045Z0022AZJ-v1.0.2\_JP.zip) to [working directory](#) and run the commands below. If you build core-image-minimal, please ignore this step.

```
$ unzip ./RTK0EF0045Z0022AZJ-v1.0.2_EN.zip
$ tar zxvf ./RTK0EF0045Z0022AZJ-v1.0.2_EN/meta-rz-features.tar.gz
```

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

After applying above patch, please note the limitations for Audio, Bluetooth and SATA in section 6.2



**(3) Build Initialize**

Initialize a build using the 'oe-init-build-env' script in Poky and point TEMPLATECONF to platform conf path.

```
$ TEMPLATECONF=$PWD/meta-renesas/meta-<platform>/docs/template/conf/ source \
poky/oe-init-build-env build
```

[<platform>](#) and [<board>](#) can be selected in the below table.

**Table 3. List of the platforms and the boards**

<b>Renesas MPU</b>	<b>Platform</b>	<b>Board</b>
RZ/G2H	rzg2h	hihope-rzg2h
RZ/G2M	rzg2h	hihope-rzg2m
RZ/G2N	rzg2h	hihope-rzg2n
RZ/G2E	rzg2h	ek874
RZ/G2L	rzg2l	smarc-rzg2l, rzg2l-dev
RZ/G2LC	rzg2l	smarc-rzg2lc, rzg2lc-dev
RZ/G2UL	rzg2l	smarc-rzg2ul, rzg2ul-dev

**(4) Add layers**

Please follow the below steps to add the layers you need. The steps add the settings to bblayers.conf.

- **Graphics:** Please run the below command if you need the Graphics library.

```
$ bitbake-layers add-layer ../meta-rz-features/meta-rz-graphics
```

- **Video Codec:** Please run the below command if you need the video codec library.

```
$ bitbake-layers add-layer ../meta-rz-features/meta-rz-codecs
```

- **Qt:** Please run the below commands if you want to include Qt.

```
$ bitbake-layers add-layer ../meta-qt5
$ bitbake-layers add-layer ../meta-rz-features/meta-rz-graphics
$ bitbake-layers add-layer ../meta-rz-features/meta-rz-codecs
```

- **Docker:** Please run the below commands if you want to include Docker. This means running Docker on the RZ board, not as using Docker as part of your build environment.

```
$ bitbake-layers add-layer ../meta-openembedded/meta-filesystems
$ bitbake-layers add-layer ../meta-openembedded/meta-networking
$ bitbake-layers add-layer ../meta-virtualization
$ cd ../meta-renesas
$ patch -p1 < ../extra/0001-dynamic-layers-virtualization-layer-add-WA-to-\
remove.patch
$ cd ../build
```

**(5) Decompress OSS files to “build” directory (Optional)**

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.

```
$ cp ../../<package download directory>/*.7z .
$ 7z x oss_pkg_rzg_v3.0.3.7z
```

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\_vlp\_v3.0.3/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.

Build the target file system image using bitbake

```
$ MACHINE=<board> bitbake core-image-<target>
```

<board> can be selected by referring to the [Table 3](#). Example: MACHINE=smarc-rg2l

<target> can be selected in below. Please refer to the Table 4 for supported image details.

- core-image-minimal
- core-image-bsp
- core-image-weston
- core-image-qt

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 all 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/dep/** 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.

For the booting method and the required settings, please refer to the below documents.

- [SMARC EVK of RZ/G2L, RZ/G2LC, RZ/G2UL, RZ/V2L, and RZ/Five Start-up Guide](#)
- [Reference Boards of RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E Start-up Guide](#)

Table 4. Supported images of VLP/G

Image name	Target devices (*1)	Dependency (*2)	Notes
core-image-minimal	RZ/G2L, RZ/G2LC, RZ/G2UL RZ/G2H, M, N, E	-	Minimal set of components
core-image-bsp	RZ/G2L, RZ/G2LC, RZ/G2UL RZ/G2H, M, N, E	-	Minimal set of components plus audio support and some useful tools
core-image-weston	RZ/G2L,	Graphics and Video Codec	Standard image with graphics support.
	RZ/G2LC	Graphics	
	RZ/G2H, M, N, E	Multimedia Packages	
core-image-qt	RZ/G2L,	Graphics and Video Codec	Enable Qt LGPL version.
	RZ/G2LC	Graphics	
	RZ/G2H, M, N, E	Multimedia Packages	

(\*1) “RZ/G2H, M, N, E” means the devices of RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E.

(\*2) Some images require the Multimedia package and the library of the Graphics and the video codec.

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

<b>RZ/G2L PMIC ver</b>	<b>Linux kernel</b>	Image-smarc-rzg2l.bin
	<b>Device tree file</b>	Image-r9a07g044l2-smarc.dtb
	<b>root filesystem</b>	<image name>-smarc-rzg2l.tar.bz2
	<b>Boot loader</b>	<ul style="list-style-type: none"> <li>• bl2_bp-smarc-rzg2l_pmic.srec</li> <li>• fip-smarc-rzg2l_pmic.srec</li> </ul>
	<b>Flash Writer</b>	Flash_Writer_SCIF_RZG2L_SMARC_PMIC_DDR4_2GB_1PCS.mot
<b>RZ/G2LC</b>	<b>Linux kernel</b>	Image-smarc-rzg2lc.bin
	<b>Device tree file</b>	Image-r9a07g044c2-smarc.dtb
	<b>root filesystem</b>	<image name>-smarc-rzg2lc.tar.bz2
	<b>Boot loader</b>	<ul style="list-style-type: none"> <li>• bl2_bp-smarc-rzg2lc.srec</li> <li>• fip-smarc-rzg2lc.srec</li> </ul>
	<b>Flash Writer</b>	• Flash_Writer_SCIF_RZG2LC_SMARC_DDR4_1GB_1PCS.mot
<b>RZ/G2UL</b>	<b>Linux kernel</b>	Image-smarc-rzg2ul.bin
	<b>Device tree file</b>	Image-r9a07g043u11-smarc.dtb
	<b>root filesystem</b>	<image name>-smarc-rzg2ul.tar.bz2
	<b>Boot loader</b>	<ul style="list-style-type: none"> <li>• bl2_bp-smarc-rzg2ul.srec</li> <li>• fip-smarc-rzg2ul.srec</li> </ul>
	<b>Flash Writer</b>	• 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
<b>RZ/G2H</b>	Image-hihopec-rzg2h.bin	<image name>-hihopec-rzg2h.tar.bz2	u-boot-elf-hihopec-rzg2h.srec bootparam_sa0.srec bl2-hihopec-rzg2h.srec bl31-hihopec-rzg2h.srec tee-hihopec-rzg2h.srec cert_header_sa6.srec
<b>RZ/G2M v3.0 (*) v1.3 (*)</b>	Image-hihopec-rzg2m.bin	<image name>-hihopec-rzg2m.tar.bz2	u-boot-elf-hihopec-rzg2m.srec bootparam_sa0.srec bl2-hihopec-rzg2m.srec bl31-hihopec-rzg2m.srec tee-hihopec-rzg2m.srec cert_header_sa6.srec
<b>RZ/G2N</b>	Image-hihopec-rzg2n.bin	<image name>-hihopec-rzg2n.tar.bz2	u-boot-elf-hihopec-rzg2n.srec bootparam_sa0.srec bl2-hihopec-rzg2n.srec bl31-hihopec-rzg2n.srec tee-hihopec-rzg2n.srec cert_header_sa6.srec
<b>RZ/G2E</b>	Image-ek874.bin	<image name>-ek874.tar.bz2	u-boot-elf-ek874.srec bootparam_sa0.srec bl2-ek874.srec bl31-ek874.srec tee-ek874.srec cert_header_sa6.srec

<image name> will be the name used in the step (6).

#### Device tree files

	Type 1	Type 2	Type 3	Type 4
<b>RZ/G2H</b>	Image-r8a774e1-hihopec-rzg2h.dtb	Image-r8a774e1-hihopec-rzg2h-ex.dtb	Image-r8a774e1-hihopec-rzg2h-ex-idk-1110wr.dtb	Image-r8a774e1-hihopec-rzg2h-ex-mipi-2.1.dtb
<b>RZ/G2M v1.3 (*1)</b>	Image-r8a774a1-hihopec-rzg2m.dtb	Image-r8a774a1-hihopec-rzg2m-ex.dtb	Image-r8a774a1-hihopec-rzg2m-ex-idk-1110wr.dtb	Image-r8a774a1-hihopec-rzg2m-ex-mipi-2.1.dtb
<b>RZ/G2M v3.0 (*1)</b>	Image-r8a774a3-hihopec-rzg2m.dtb	Image-r8a774a3-hihopec-rzg2m-ex.dtb	Image-r8a774a3-hihopec-rzg2m-ex-idk-1110wr.dtb	Image-r8a774a3-hihopec-rzg2m-ex-mipi-2.1.dtb
<b>RZ/G2N</b>	Image-r8a774b1-hihopec-rzg2n.dtb	Image-r8a774b1-hihopec-rzg2n-ex.dtb	Image-r8a774b1-hihopec-rzg2n-ex-idk-1110wr.dtb	Image-r8a774b1-hihopec-rzg2n-ex-mipi-2.1.dtb
<b>RZ/G2E EK874 Rev E (*2)</b>	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.**

(\*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) In case you use the RZ/G2E EK874 revision C board, please see the section 6.2 (1).

### 3.2 Building SDK

To build Software Development Kit (SDK), run the commands below after the steps (1) – (3) 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_vlp_v3.0.3/build
$ MACHINE=<board> bitbake core-image-weston -c populate_sdk
```

For building Qt applications:

```
$ cd ~/rzg_vlp_v3.0.3/build
$ MACHINE=<board> 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-3.1.17.sh
```

Or

```
$ sudo sh poky-glibc-x86_64-core-image-qt-aarch64-<board>-toolchain-3.1.17.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

This section describes the components of VLP/G. Please also refer to the “Component list” for details.

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

Components	VLP/G v3.0.1	VLP/G v3.0.3
	For RZ/G2 Group	For RZ/G2 Group
Linux kernel	5.10.131-cip13	5.10.158-cip22
GCC	8.3.0 (Arm GCC 8.3-2019.03)	8.3.0 (Arm GCC 8.3-2019.03)
glibc	2.28	2.28
busybox	1.31.1	1.31.1
openssl	1.1.1n	1.1.1n
gstreamer1.0	1.16.3	1.16.3
wayland	1.18.0	1.18.0
weston	8.0.0	8.0.0
Python3	3.8.14	3.8.14
Qt (LGPL version)*1	5.6.3	5.6.3
Docker	19.03.8-ce	19.03.8-ce

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

\*1) New versions such as Qt6.2.4 are also known to work. Please contact The Qt Company for instructions and support.

## 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 groups of notes in this section. They are listed 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_vlp_v3.0.3/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) Device tree for RZ/G2M, RZ/G2N and RZ/G2E

The dtb files listed in the Table 6 cannot be used for the early revision of Hoperun and Silicon Linux boards. If you are using revision 2 of Hoperun and revision C of Silicon Linux 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-hihopec-rzg2m-**rev2**.dtb (main board only)
- Image-r8a774a1-hihopec-rzg2m-**rev2**-ex.dtb (main + sub board)
- Image-r8a774a1-hihopec-rzg2m-**rev2**-ex-idk-1110wr.dtb (main + sub board + LVDS-IF)
- Image-r8a774a1-hihopec-rzg2m-**rev2**-ex-mipi-2.1.dtb (main + sub board + MIPI/CSI2 cameras)

##### HiHope RZ/G2N board:

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

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

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

Note) Board revision is printed on boards. It is printed below the Hoperun logo on boards and directly printed on the Silicon Linux 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_vlp_v3.0.3/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) SDHI

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

## (5) 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.

**(6) 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>
    <input 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 Graphics and Video Codec

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

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

```
DISTRO_FEATURES_remove = " opengles"
```

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

```
DISTRO_FEATURES_remove = " openc1"
```

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

```
DISTRO_FEATURES_remove = " hwh264dec hwh265dec"
```

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

```
DISTRO_FEATURES_remove = " hwh264enc"
```

(\*1) This library is included in RTK0EF0045Z13001ZJ-v1.0.5\_EN.zip and RTK0EF0045Z13001ZJ-v1.0.5\_JP.zip

(\*2) This library is included in RTK0EF0045Z15001ZJ-v1.1.0\_EN.zip and RTK0EF0045Z15001ZJ-v1.1.0\_JP.zip

### (3) Real time performance

If you want to use the kernel which improves the real-time performance, please add the line below to the file "*~/rzg\_vlp\_v3.0.x/build/conf/local.conf*".

```
IS_RT_BSP="1"
```

### (4) USB Video Class

USB Video Class (UVC) driver is not installed with the default settings of VLP/G due to its large 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 "
```

### (5) CIP Core Packages

VLP/G includes Debian 10 (Buster) and Debian 11 (Bullseye) based CIP Core Packages and Buster 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 (or Bullseye) 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 by switching between Buster and Bullseye.
# - Buster (default) : build all supported Debian 10 Buster recipes
# - Bullseye : build all supported Debian 11 Bullseye recipes
# - Not set (or different with above): not use CIP Core, use default packages version
in Yocto

CIP_MODE = "Buster"
```

#### 2. Bullseye:

Please change "CIP\_MODE" in the `local.conf` to change from Buster to Bullseye:

```
# Select CIP Core packages by switching between Buster and Bullseye.
# - Buster (default) : build all supported Debian 10 Buster recipes
# - Bullseye : build all supported Debian 11 Bullseye recipes
# - Not set (or different with above): not use CIP Core, use default packages version
in Yocto

CIP_MODE = "Bullseye"
```

#### 3. No CIP Core Packages:

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

```
# Select CIP Core packages by switching between Buster and Bullseye.
# - Buster (default) : build all supported Debian 10 Buster recipes
# - Bullseye : build all supported Debian 11 Bullseye recipes
# - Not set (or different with above): not use CIP Core, use default packages version
in Yocto

#CIP_MODE = "Buster"
```

Note) The above 3 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 and Bullseye Debian packages**

<b>Package</b>	<b>Buster Debian</b>	<b>Bullseye Debian</b>
attr	2.4.48	2.4.48
busybox	1.30.1	1.30.1
coreutils	6.9	-
gcc	8.3.0	-
glib-2.0	2.58.3	-
glibc	2.28	2.31
gnupg	1.4.7	-
kbd	2.0.4	-
libassuan0	2.5.2	2.5.3
libgcrypt	1.8.4	-
libunistring	0.9.10	0.9.10
libnss	0.14.1	-
openssh	7.9p1	-
perl	5.30.1	-
pkgconfig	0.29	-
quilt	0.65	-

Note)

(-) These packages are not supported with Bullseye Debian version, so they used No CIP CORE version.

## 6.4 Build with the same procedure as before

The instruction to build BSP is updated and deprecated from this release and the new build instruction in section 3 is **strongly recommended**. However, if you want to build in the same way as before, please refer to the following procedure.

### (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_vlp_v3.0.3
$ cd ~/rzg_vlp_v3.0.3
$ cp ../<package download directory>/*.zip .
$ unzip ./RTK0EF0045Z0021AZJ-v3.0.3.zip
$ tar zxvf ./RTK0EF0045Z0021AZJ-v3.0.3/rzg_bsp_v3.0.3.tar.gz
```

### (2) Enable Graphics and Video Codec

#### For RZ/G2L and RZ/G2LC

The graphics package and the video codec package can be used at the same time. And also, one of the packages can be used.

If you want to enable the Graphics on RZ/G2L and RZ/G2LC when building **core-image-weston**, please copy the Graphics package (RTK0EF0045Z13001ZJ-v1.0.5\_EN.zip or RTK0EF0045Z13001ZJ-v1.0.5\_JP.zip) to [working directory](#) and run the commands below. If you build **core-image-minimal**, please ignore this step.

```
$ unzip ./RTK0EF0045Z13001ZJ-v1.0.5_EN.zip
$ tar zxvf ./RTK0EF0045Z13001ZJ-v1.0.5_EN/meta-rz-features_graphics_v1.0.5.tar.gz
```

#### For RZ/G2L

If you want to enable the video codec on RZ/G2L when building **core-image-weston** or **core-image-bsp**, please copy the video codec package (RTK0EF0045Z15001ZJ-v1.1.0\_EN.zip or RTK0EF0045Z15001ZJ-v1.1.0\_JP.zip) to [working directory](#) and run the commands below.

```
$ unzip ./RTK0EF0045Z15001ZJ-v1.1.0_EN.zip
$ tar zxvf ./RTK0EF0045Z15001ZJ-v1.1.0_EN/meta-rz-features_codec_v1.1.0.tar.gz
```

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

If you want to enable the Graphics and the video codec on RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E when building **core-image-weston**, please copy the Multimedia package (RTK0EF0045Z0022AZJ-v1.0.2\_EN.zip or RTK0EF0045Z0022AZJ-v1.0.2\_JP.zip) to [working directory](#) and run the commands below. If you build **core-image-minimal**, please ignore this step.

```
$ unzip ./RTK0EF0045Z0022AZJ-v1.0.2_EN.zip
$ tar zxvf ./RTK0EF0045Z0022AZJ-v1.0.2_EN/meta-rz-features.tar.gz
```

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

### (3) Setup a build environment

Run the commands below in [working directory](#). The environment to build is set by the source command.

```
$ source poky/oe-init-build-env
```

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

Run the commands below in [build directory](#) [insider working directory](#). 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

```
$ cp ../meta-renesas/docs/template/conf/board/*.conf ./conf/
```

### (5) Decompress OSS files to “build” directory (Optional)

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.

```
$ cp ../../<package download directory>/*.7z .
$ 7z x oss_pkg_rzg_v3.0.3.7z
```

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\_vlp\_v3.0.3/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
```



**(7) Notes for the old procedure (Optional Step)**

This step is not necessary. Please check and follow the instruction.

- **ECC for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E**

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.

- **Docker for all RZ Platforms**

Docker is disabled in the default settings of VLP/G. To enable Docker, please comment out the below line inside the file "`~/rzg_vlp_v3.0.x/build/conf/local.conf`" before building images.

```
#DISTRO_FEATURES_remove = " docker"
```

Then please run the commands below.

```
$ cd ~/rzg_vlp_v3.0.3/meta-renesas
$ patch -p1 < ../extra/0001-dynamic-layers-virtualization-layer-add-WA-to-\
remove.patch
```

## 7. Revision History

Rev.	Date	Description	
		Page	Summary
1.01	Jul. 13, 2022	-	First edition for VLP/G v3.0.0-update1.
1.02	Jun. 24, 2022	11	Add the "Target devices" column to the Table 4.
		23	Fix the patch file name and the commands.
1.03	Jul. 8, 2022	5	Update the Graphics and Video codec libraries for RZ/G2L and RZ/G2L.
		15	Add the additional information to the table 7.
1.04	Aug. 9, 2022	-	Change some introduction about VLP/G v3.0.0-update1 to VLP/G v3.0.0-update 2.
		4	Update the Release Note and Component List. Add the additional information to OSS files.
		5	Update Optional packages.
		23	Add the update points of VLP/G v3.0.0-update2.
1.05	Sep. 30, 2022	-	First edition for VLP/G v3.0.1.
1.06	Mar. 30, 2023	-	First edition for VLP/G v3.0.3.
1.07	Apr. 21, 2023	4, 8	Update the Multimedia Package revision for RZ/G2H, RZ/G2M, RZ/G2N and RZ/G2E.

## Website and Support

Renesas Electronics Website

<http://www.renesas.com/>

Inquiries

<http://www.renesas.com/contact/>

All trademarks and registered trademarks are the property of their respective owners.