Inforce 6540

Ubuntu Linux Software Release Note Release V1.2

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Preface

This document provides instructions to build and boot an Ubuntu-based Linaro Member Build that provides a terminal-like environment using Ubuntu Linux and the Gnome terminal on the Inforce 6540 board.

Intended Audience

This document is intended for Linux developers and practitioners who intend to try out Ubuntu Linux on the Inforce 6540 platform.

Intended Use

All Inforce boards are evaluated as Information Technology Equipment (I.T.E.) for use in personal computers (PC) for installation in homes, offices, schools, computer rooms, and similar locations. The suitability of this product for other PC or embedded non-PC applications or other environments, such as medical, industrial, alarm systems, test equipment, etc. may not be supported without further evaluation by Inforce Computing.

Conventions

The following conventions are used in this document:

⚠️**CAUTION**

Cautions warn the user about how to prevent damage to hardware or loss of data.

📝 **NOTE**

Notes call attention to important information.

Note

This document is subject to change without notice.

Support Information

Every effort has been made to ensure the accuracy of Release Note. If you have any comments, questions, or ideas regarding this document, contact Inforce's technical support at: **techsupport@inforcecomputing.com**

Table of Contents

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1. INTRODUCTION

The Inforce 6540 is a low-cost, full-featured Pico-ITX Single Board Computer that is powered by Qualcomm® Snapdragon™ 805 APQ8084 SoC.

The Inforce 6540 kit comes bundled with the proper power supply (12V) and it is recommended to use it.

The boot process is complex, but from a high-level perspective, it can be described as follows: The krait core jumps to the main bootloader after the booting process. SBL1 and the APPSBL are binary files which are loaded from eMMC partitions. While it would be possible to load these files from SD card, it is currently not supported. There are dedicated partitions in the on-board eMMC for each of these files:

Partition	Size (kb)	Label
mmcblk0p2	512	sbl1
mmcblk0p7	1024	aboot

It is not recommended to erase or modify any of these partitions. Modifying may cause the board to no longer boot. If the eMMC partitions have been erased or partition table has been corrupted, the board would have to be sent back through RMA.

The board comes with fastboot support, which means that the APPSBL implements the fastboot protocol. Fastboot is a special bootloader protocol that allows eMMC partition to be flashed with new images. By default, the APPSBL will load and execute the boot image from the 'boot' partition.

To go to fastboot mode, press the Fastboot button (Vol– button) before powering on the board.

This release supports the following versions:

Linux Kernel: 3.10.40

Ubuntu Linux: 14.10 aka Utopic

2. UBUNTU LINUX ON INFORCE 6540

The following instructions assume that you are working from an Ubuntu 12.04 (or later) host system for development. The steps for other systems will be similar, and should be easily discerned from what follows.

2.1 BUILD AND RUN IMAGES

A. Package Description

The binaries and build-related files are packaged into the tarball, which can be extracted to the release folder "IFC6540_Ubuntu_Linux_BSP_880395_V1.2". This package contains binaries and source folders.

- The binaries folder contains:

  □ Boot image that includes prebuilt kernel with Inforce patches applied (zImage+dts+initrd)

  □ Root FS image that includes a minimal Gnome Shell environment

  □ Firmware image that includes proprietary firmwares from Qualcomm

  □ Debian packages for Snapdragon 8084 CSI camera feature

The binaries provided can be flashed directly onto your Inforce 6540 platform using the commands in the next section.

- The source folder contains:

  □ GCC compiler tarball

  □ Boot image configuration file

  □ Initrd image

  □ Kernel source bundle in repo-ifc6540-r1.2.bundle

  □ Kernel patches

  □ Camera-HAL patches

  □ Source code for gstreamer video source plug-in for Snapdragon 8084 CSI camera

These files are useful to build kernel image and camera packages.

B. Flashing the Images

Change the directory to binaries folder within the release folder. From fastboot mode, enter the following commands:

```
#fastboot flash boot boot_ifc6540_v1.2.img

#fastboot flash cache firmware-ifc6540-4.4.4_27032015.img

#fastboot flash userdata ubuntu-utopic-gnome-qcom-snapdragon-v1.2.img

#fastboot reboot
```

The platform shall boot into Ubuntu utopic. Once the board boots, enter the login password "**linaro**". The Gnome-based image is expected to provide a *terminal-like* experience and it is thus recommended to use an USB Keyboard.

Note: Flashing userdata takes around 22 minutes.

C. Resizing Root FS Partition

Open a terminal and enter the command below:

```
$ df -ah
```

The above command will list the available partitions and sizes. To increase the partition size, issue the following commands:

```
$ sudo resize2fs /dev/mmcblk0p25

$df -ah
```

Note that the partition size is increased to 10GB.

Now if you want to build the kernel images and create a boot image, follow the steps in the subsequent sections.

D. Fetch Kernel Sources

To build the kernel image, follow the steps listed below from your Ubuntu host machine. To get kernel sources, the user can follow any of the following methods:

■ **Getting kernel source from the release package**

  □ The kernel sources are available within the source folder of the IFC6540_Ubuntu_Linux_BSP_880395_V1.2 package as repo-ifc6540-r1.2.bundle.

```
$mkdir Ubuntu_Linux

$cd Ubuntu_Linux
```

  □ Copy the repo-ifc6540-r1.2.bundle file to the current folder from the source package IFC6540_Ubuntu_Linux_BSP_880395_V1.2 using the commands below:

```
$cp/IFC6540_Ubuntu_Linux_BSP_880395_V1.2/source/ repo-ifc6540-
r1.2.bundle .

$git clone repo-ifc6540-r1.2.bundle ifc6540-r1.2 -b ifc6540-
r1.2

$cd ifc6540-r1.2
```

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- **Getting kernel source through GIT repository**
  - The current Ubuntu-Linux release is based on Android 4.4.4 MSM kernel with the release tag LNX.LA.3.6_rb1.27. The kernel sources are available on **codeaurora.org**.

    ```
    $mkdir Ubuntu_Linux

    $cd Ubuntu_Linux

    $git clone git://codeaurora.org/kernel/msm-3.10.git ifc6540-
    r1.2 -b LNX.LA.3.6_rb1.27

    $cd ifc6540-r1.2
    ```

  - Extract the patches from 3.10.40-ifc6540-v1.2-patches.tar.gz file in the source folder.

    ```
    $tar xvf ../../source/3.10.40-ifc6540-v1.2-patches.tar.gz
    ```

  - Apply the patches to the kernel.

    ```
    $git am  3.10.40-ifc6540-v1.2-patches/*.patch
    ```

E. Build Kernel Sources

Use the toolchain available in Inforce package IFC6540_Ubuntu_Linux_BSP_880395_V1.2 (the toolchain can also be downloaded from **https://releases.linaro.org/14.09/components/toolchain/binaries/gcc-linaro-arm-linux-gnueabihf-4.9-2014.09_linux.tar.bz2**.

- Change the directory to IFC6540_Ubuntu_Linux_BSP_880395_V1.2/source.

  ```
  $tar xvf gcc-linaro-arm-linux-gnueabihf-4.9-2014.09_linux.tar.bz
  ```

- Change the directory to IFC6540_Ubuntu_Linux_BSP_880395_V1.2/Ubuntu_Linux/ifc6540-r1.2.

  ```
  $TC={path to release folder}/source/gcc-linaro-arm-linux-gnueabihf-
  4.9-2014.09_linux/bin/arm-linux-gnueabihf-

  $alias kmake='make CROSS_COMPILE=$TC ARCH=arm -j16'

  $kmake ifc6540_freedreno_defconfig

  $kmake qcom/apq8084-v1.1-sbc.dtb

  $kmake zImage

  $cat arch/arm/boot/zImage arch/arm/boot/dts/qcom/apq8084-v1.1-
  sbc.dtb > zImage-dtb
  ```

`abootimg` is a tool to read/write/update Android boot partition, and is available in most standard Linux distribution. From your Ubuntu host machine, run the following commands:

```
$sudo apt-get install abootimg

$abootimg --create boot_ifc6540_v1.2.img -k zImage-dtb -f
../../source/bootimg_6540.cfg -r ../../source/initrd.img

#fastboot flash boot boot_ifc6540_v1.2.img
```

Assuming that firmware and user data are flashed earlier as in Section B,

```
#fastboot reboot
```

Once the board boots, enter the login password "linaro".

F. Wi-Fi Module Build

Wi-Fi feature is supported in the default release binaries. Follow the steps below to build wlan kernel module if the user wants to build it from the sources.

- ■ Change the directory to IFC6540_Ubuntu_Linux_BSP_880395_V1.2/Ubuntu_Linux folder, and follow the steps below:

  ```
  $git clone git://codeaurora.org/platform/vendor/qcom-
  opensource/wlan/qcacld-2.0.git -b LNX.LA.3.6_rb1.27

  $cd qcacld-2.0

  $TC={path to release folder}/source/gcc-linaro-arm-linux-gnueabihf-
  4.9-2014.09_linux/bin/arm-linux-gnueabihf-

  $alias kmake='make CROSS_COMPILE=$TC ARCH=arm -j16'
  ```

  - ☐ Make the following changes to Makefile:

    ```
    KERNEL_SRC ?= <kernel source path>

    $kmake
    ```

  - ☐ Copy the wlan.ko to /lib/modules/3.10.40-ifc6540-v1.2+/extra/ directory on target.

  - ☐ Run "`sudo depmod -a`" command on target.

  - ☐ Reboot the target.

G. Customizing the rootfs

The user can add/delete/modify contents in rootfs provided by Inforce, if required. The tools (android-tools-fsutils in Debian/Ubuntu) are typically packaged in desktop distributions of Ubuntu Utopic.

- ■ Use the following commands to customize the rootfs:

  ```
  $simg2img ubuntu-utopic-gnome-qcom-snapdragon.img rootfs.img.raw

  $mkdir mnt-point

  $sudo mount -t ext4 -o loop rootfs.img.raw mnt-point/
  ```

- ■ Make the required changes to rootfs:

  ```
  $img2simg rootfs.img.raw ubuntu-utopic-gnome-qcom-snapdragon-
  modified.img

  $sudo umount mnt-point/
  ```

- ■ The generated rootfs file can be directly flashed with fastboot.

2.2 PROGRAMMING THE ETHERNET MAC ADDRESS

Update the file using the command `$sudo vi /etc/network/interfaces` in Inforce 6540 by the MAC address available as a sticker on the board.

```
auto eth0

iface eth0 inet dhcp

hwaddress ether 00:a0:c6:eb:5d:7c
```

3. FEATURES OF THE RELEASE

3.1 FEATURES SUPPORTED IN THIS RELEASE

The following features are supported in this release:

1. **HDMI Display:** 1080p, 720p video playback has been validated in this release.

2. **Gigabit Ethernet:** This release supports Gigabit Ethernet.

3. **USB 2.0 and USB 3.0:** USB-based input devices (Keyboard, Mouse, Mass Storage) have been validated in this release.
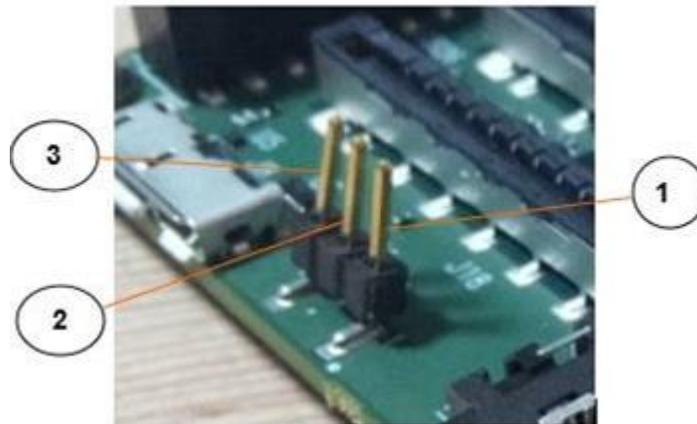
4. **Micro SD Card Interface:** Access to micro SD card interface has been validated.

   📝 **NOTE**

   Connect the micro SD card to the board. Execute the following commands:
   ```
   #fdisk –l
   #mkdir /temp2
   #mount /dev/mmcblk1p1 /temp2 (p1 partition is assumed to be
   present in the SD card)
   ```

5. **Serial UART:** This release supports serial UART. The following screenshot depicts UART connection to the board:


Pin No.	Signal Name
1	R1IN
2	T1OUT
3	GND

6. **CPU Frequency:** This release supports up to 2.7GHz.

7. **Analog Audio:** This release has support for analog audio (Tx/Rx) through external codec WCD9320.

8. **HDMI Audio:** This release was validated for HDMI audio.

9. **Wi-Fi:** This release was validated for Wi-Fi client functionality.

10. **SATA:** Access to SATA-based storage device has been validated in this release.

    Connect the SATA device to the board and then power ON the board. To power the SATA, use the **GND** and **5V** as shown in the figure below.
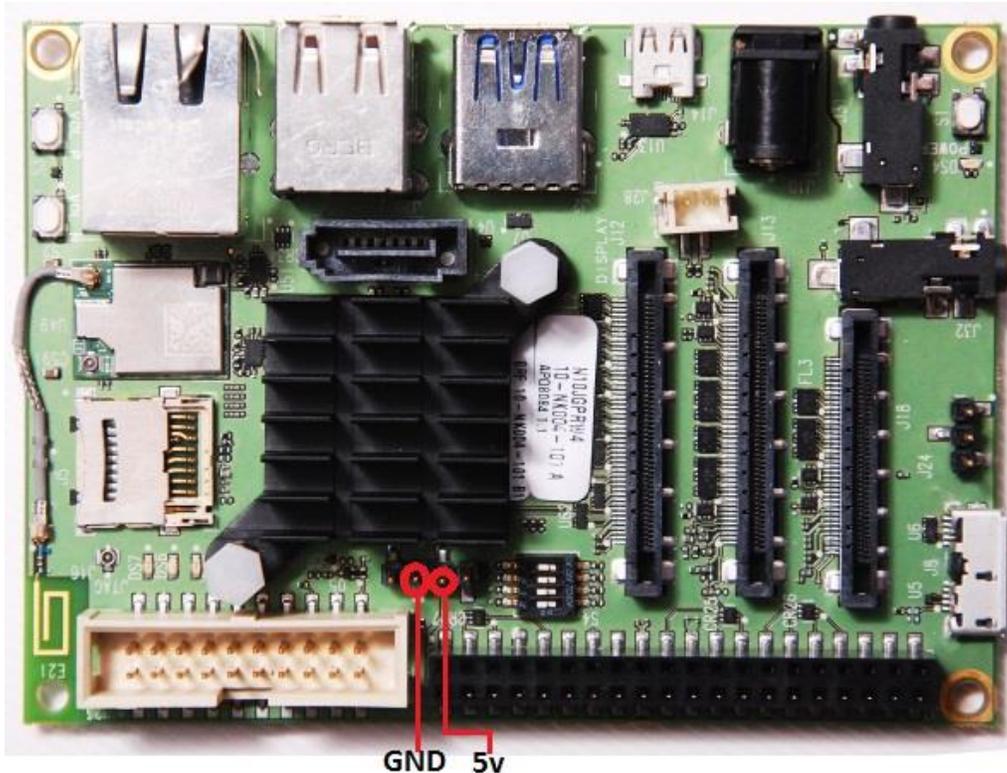
    Check the partition table using the command below:

    ```
    #fdisk –l
    ```

11. **USB Camera (Microsoft LifeCam HD 5000 is validated**
    http://www.microsoft.com/hardware/ en-in/d/lifecam-hd-5000)

    Use the following commands to test the USB camera:

    ```
    #sudo apt-get update
    #sudo apt-get install cheese
    #sudo apt-get install gstreamer1.0-tools gstreamer1.0-plugins-bad
    ```

    Connect the Microsoft HD camera to the USB port of the Inforce 6540 platform. Launch the camera using cheese application by issuing the following command and you shall see the camera-captured frames on the HDMI display:
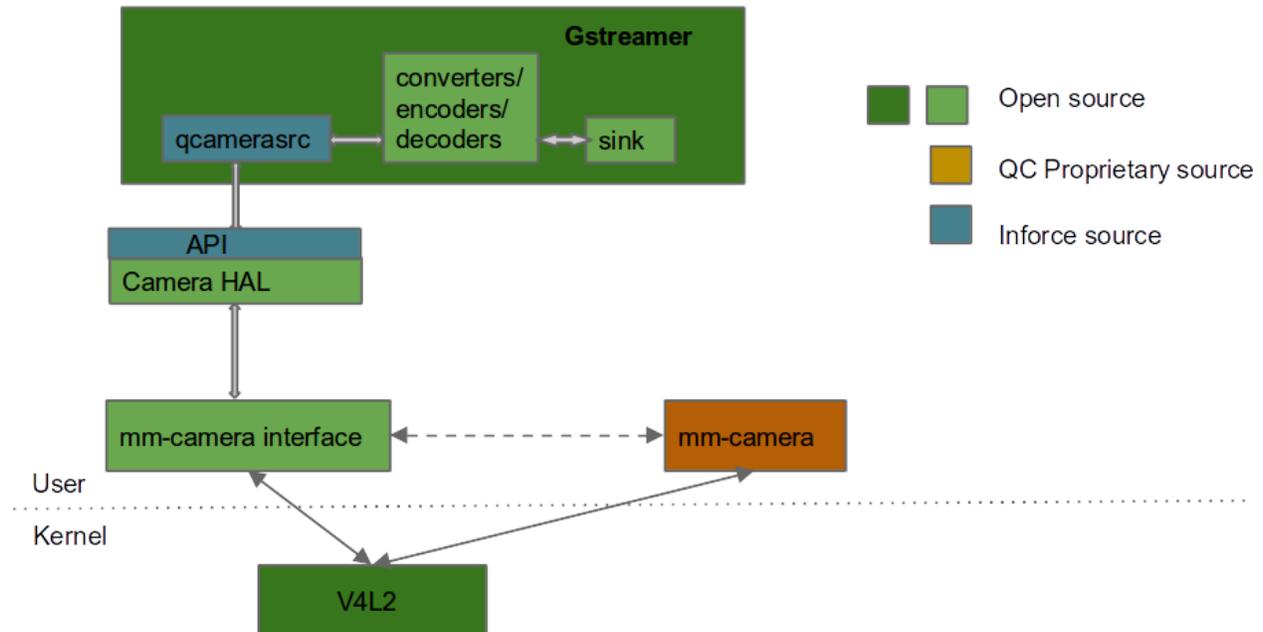
    ```
    # cheese &
    ```

3.2 NEW FEATURES OF THIS RELEASE

The following is the new feature in this release:

1. **CSI Camera:** This release supports initial version of CSI camera. It is tested using ACC-1H60 camera accessory connected to CSI1.

   ### A. CSI Camera Software Architecture Using GStreamer

Inforce has implemented the gstreamer **video source plug-in** (**qcamerasrc**) by using Camera-HAL APIs as shown in the block diagram. This plug-in can directly be used to construct pipeline (using **gst-launch-1.0**) using the commands mentioned under "**Running QCamera Video Source Plug-in**" section below.

The following software debian packages are required for the Snapdragon 8084 CSI camera to function:

- mm-camera (QC proprietary package)
- Camera-HAL (open source from CodeAurora)
- QCamera gstreamer plug-in

NOTE

Refer to Section 3.3 for Hardware reworks in the Inforce 6540 board to add support for ACC-1H60 camera accessory.

B. Installing Debian Packages for Camera Feature

- Connect the board to the Wi-Fi/Ethernet network.

- Copy the camera packages from host PC to the Inforce 6540 board using the command below:

```
$ scp deb-packages-ifc6540-v1.2.tar.gz
linaro@192.168.X.X:/home/linaro
```

- Extract the ZIP file and install the camera packages on the Inforce 6540 board using the following commands:

```
$ tar xvf deb-packages-ifc6540-v1.2.tar.gz
```

```
$ cd deb-packages-ifc6540-v1.2
```

```
$ sudo dpkg -i -R .
```

📝 **NOTE**

Observe the '.' for current directory in the above command.

```
$ sudo reboot
```

C. Installing and Testing Basic GStreamer Packages

- Issue the following commands to install the gstreamer packages:

```
$ sudo apt-get update
```

```
$ sudo apt-get install gstreamer1.0-tools gstreamer1.0-
plugins-ugly gstreamer1.0-plugins-bad
```

- Issue the following command to test the pipeline using gstreamer's video test source **"videotestsrc"**:

```
$ gst-launch-1.0 videotestsrc ! video/x-
raw,format=NV12_64Z32,width=1280,height=720 ! videoconvert !
glimagesink
```

The gstreamer documentation can be found at **http://gstreamer.freedesktop.org/documentation/**. For more information on using the gstreamer features through command-line application (gst-launch-1.0), go to **http://wiki.oz9aec.net/index.php/Gstreamer_cheat_sheet#Encoding_and_Muxing**.

📝 **NOTE**

*Use **gst-launch-1.0** instead of **gst-launch** in the gstreamer cheat sheet.*

D. Compiling QCamera Video Source Plug-in

- The following command installs the supporting packages for development environment such that the compilation can be done on the Inforce 6540 board:

```
$ sudo apt-get install build-essential git autotools-dev
autoconf libtool libgstreamer-plugins-base1.0-dev autopoint
```

- Copy and extract "gst-plugin-qcamerasrc.tar.gz" to the "/home/linaro" path on the Inforce 6540 board by issuing the commands below:

```
$ tar xvf gst-plugin-qcamerasrc.tar.gz

$ cd gst-plugin-qcamerasrc

$ ./autogen.sh

$ make

$ cp ./src/.libs/libgstqcamerasrc.so /usr/lib/arm-linux-
gnueabihf/gstreamer-1.0/
```

E. Getting Camera-HAL Source, Applying Patches, and Build the Source

- Change the directory to IFC6540_Ubuntu_Linux_BSP_880395_V1.2/Ubuntu_Linux folder, and use the commands below to fetch camera-HAL:

```
$ git clone
git://codeaurora.org/platform/hardware/qcom/camera.git camera-
hal -b LNX.LA.3.6_rb1.27

$ cd camera-hal

$ git checkout -b ifc6540-r1.2

$ tar xvf ../../source/camera-hal-patches.tar.gz

$ git am camera-hal-patches/*.patch
```

NOTE

Currently the camera-HAL build is done on an OpenEmbedded build for other platforms. The instructions to build separately will be provided later.

F. Running QCamera Video Source Plug-in

- To test the CSI camera Snapdragon 8084, issue the command below:

```
$ sudo su
```

- For camera preview, use the command below:

```
# gst-launch-1.0 qcamerasrc ! video/x-
raw,format=UYVY,width=1280,height=720 ! videoconvert !
glimagesink
```

- For camera video recording, use the command below:

```
# gst-launch-1.0 qcamerasrc ! video/x-
raw,format=UYVY,width=1280,height=720 ! videoconvert ! x264enc
! avimux ! queue! filesink location=qcamera.mp4
```

- To debug different elements in gstreamer, add "--gst-debug=qcamerasrc:<debug level>" to the command as shown below:

```
# gst-launch-1.0 --gst-debug=qcamerasrc:9,basesrc:9 qcamerasrc
! video/x-raw,format=UYVY,width=1280,height=720 ! videoconvert
! glimagesink
```

3.3 HARDWARE REWORK

1. **CSI Camera:** The following hardware rework is needed on the Inforce 6540 board to test the OV5640 camera using the ACC-1H60 camera accessory:

   - Mount R515 and R516 to enable VPH_PWR_3P3.

   - Unmount inductors E3 and E13.

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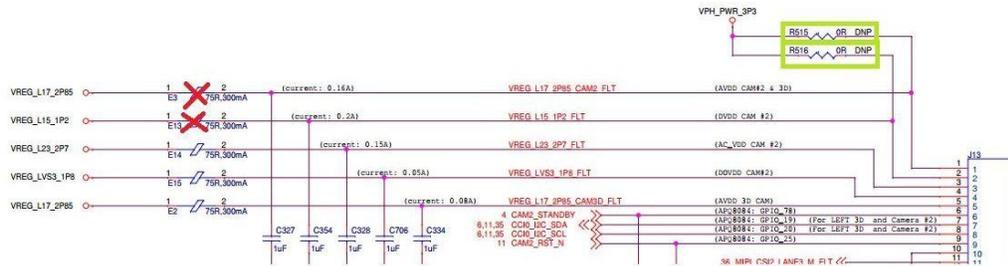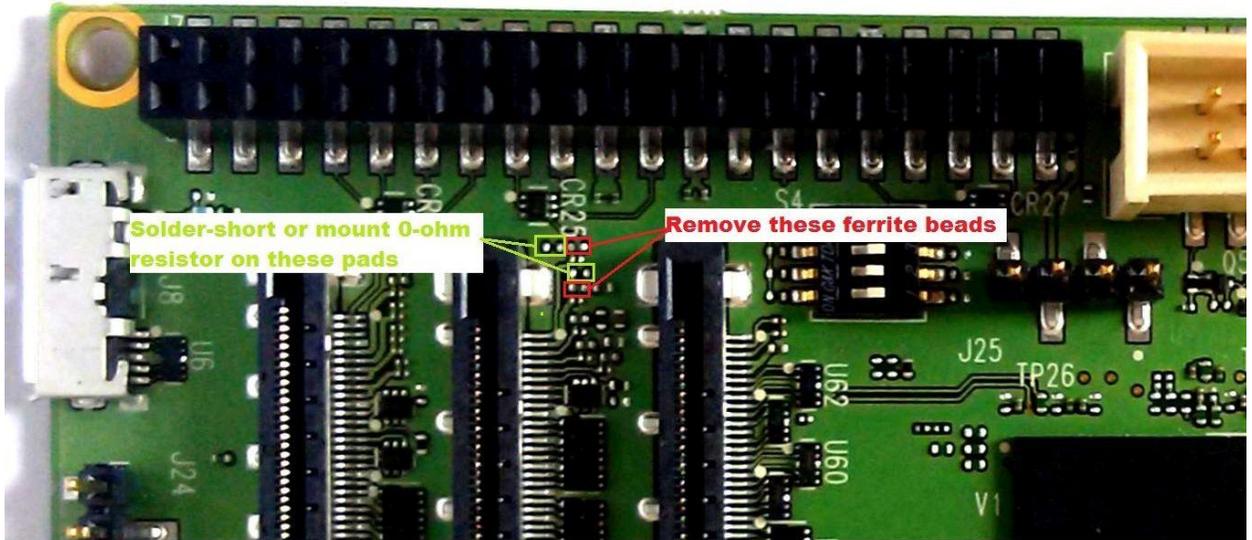
4. BUGS

4.1 KNOWN ISSUES

The following table describes the known bugs in this release. Future releases will be deployed, as these issues are resolved.

#	Description
1	Camera streaming does not start occasionally. In such scenarios, pipeline needs to be restarted by reissuing the gstreamer command after stopping "gst-launch-1.0" using CTRL+C.
2	Camera daemon logging causes the "/var/log/upstart/mm-qcamera.log" file to occupy huge space in the rootfs. Hence, frequent clean-up of this file is required.
3	Camera video recording through gstreamer stops after some time.
4	The playback of the recorded video is not proper. The behavior is similar to fast forward.
5	Audio is simultaneously heard on both the analog jack and the HDMI.

4.2 FIXED

This section is not applicable for this release.

4.3 WITHDRAWN

This section is not applicable for this release.

5. LIMITATIONS

The following features are not supported in this release:

1. GPS

2. Bluetooth

3. On-board Accelerometer and Gyroscope sensors

4. Multimedia support without video hardware acceleration

5. Hexagon DSP Support

6. MIPI-DSI feature is not supported in the default release binaries

7. Currently Camera-HAL supports resolution 1280×720 only

6. CONTACT INFORMATION

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