

# Laird Android LWB/LWB5 Software Integration Guide

Android Jellybean, KitKat, and Lollipop

*Application Note*

v1.2

## OVERVIEW

This document explains the steps required to fully integrate the LWB or LWB5 backports driver into a device running Android.

We recommend that you thoroughly analyze each step of the process. Each individual step should be integrated separately and manually tested. Attempting all of the steps at once without testing likely causes bugs that are difficult to troubleshoot as a whole. By contrast, a step-by-step approach ensures that each procedure is successful for the dependent steps that follow.

Integrating a Wi-Fi driver into specific Android platform code can be challenging and may require platform-specific changes. If the following information is confusing or does not provide the proper results, please visit <https://laird-ews-support.desk.com/> for further assistance.

This guide covers integration of Wi-Fi functionality of the LWB/LWB5 onto Android Jellybean.

## REQUIRED FILES

Laird provides the driver for the LWB and LWB5 in source form which can be found in the [software section of the LWB/LWB5 product page](#).

The driver must be compiled against the Linux kernel you are using in your Android development.

## COMPILING THE BRCMFMAC DRIVER

Follow the instructions outlined in the document [Integrating the Sterling LWB with the Freescale i.MX 6 Ultralite Evaluation Kit](#) to configure and build the backports driver for your specific Linux kernel used by Android.

---

**Note:** On some Android platforms, the SDIO bus speed is, by default, set to HS-SDIO (50 MHz) or greater. If run time issues are experienced with the SDIO interface, this may be a sign that the signal integrity of the hardware design is sub-optimal. In this case configuring a DS-SDIO (25MHz) interface will assist in isolating the issue. This must be specifically defined in the Linux kernel.

---

## COMPILING THE WPA\_SUPPLICANT

If your native AOSP does not include the wpa\_supplicant library for Broadcom (Cypress), download it at the following link:

<https://android.googlesource.com/platform/hardware/broadcom/wlan>

Add this code to your **AOSP root** directory.

### Required BoardConfiguration Values

Modify your platform's BoardConfig.mk file with the following values:

```
BOARD_WLAN_DEVICE      := bcmhdhd
WPA_SUPPLICANT_VERSION := VER_0_8_X
BOARD_WPA_SUPPLICANT_DRIVER := NL80211
BOARD_WPA_SUPPLICANT_PRIVATE_LIB := lib_driver_cmd_bcmhdhd BOARD_HOSTAPD_DRIVER
:= NL80211
BOARD_HOSTAPD_PRIVATE_LIB := lib_driver_cmd_bcmhdhd
WIFI_DRIVER_MODULE_PATH := "/system/lib/modules/brcmfmac.ko"
WIFI_DRIVER_MODULE_NAME := "brcmfmac"
```

Rebuild your AOSP. This should now generate the native Broadcom (Cypress) driver (we will remove this) and the wpa\_supplicant and support files.

### Generated Files

The following backports-generated files must be copied into the Android File System:

- brcmfmac.ko – Can be found at **/drivers/net/wireless/brcm80211/brcmfmac/**
- brcmutil.ko – Can be found at **/drivers/net/wireless/brcm80211/brcmfmac/**
- compat.ko – Can be found at **/compat/compat.ko**
- cfg80211.ko – Can be found at **/net/wireless/cfg80211.ko**

## ADDING FILES TO THE ANDROID FILE SYSTEM

### Required Files

Create a folder that contains the modules to be copied, along with an .mk file with the following entries:

### Common Files:

```
ifeq ($(BOARD_WLAN_DEVICE), bcmhdhd)
PRODUCT_COPY_FILES += \
    $(LOCAL_PATH)/compat/cfg80211.ko:system/lib/modules/cfg80211.ko \
    $(LOCAL_PATH)/compat/compat.ko:system/lib/modules/compat.ko ¥
    $(LOCAL_PATH)/compat/brcmfmac.ko:system/lib/modules/brcmfmac.ko ¥
    $(LOCAL_PATH)/compat/brcmutil.ko:system/lib/modules/brcmutil.ko ¥
    $(LOCAL_PATH)/<firmware files>:system/vendor/firmware/brcm/<firmware
    name>
endif
```

Android has its own default location to look for vendor firmware. The path is defined in **/system/core/init/devices.c**

**Note:** AOSP Jellybean source defines three locations which are version specific:

```
#define FIRMWARE_DIR1 "/etc/firmware"
#define FIRMWARE_DIR2 "/vendor/firmware"
#define FIRMWARE_DIR3 "/firmware/image"
```

The LWB/LWB5 driver expects the firmware and board calibration files in **/lib/firmware/brcm**.

For Laird's integration, FIRMWARE\_DIR2 is selected. The files are copied into the following location for both the LWB and LWB5: **/vendor/firmware/brcm**.

We selected **system/lib/modules** as a logical location for the separate kernel object files. However, any Android file system location with the correct permissions may be used. Further documentation below describes how to configure **/system/lib/modules** to have the appropriate permissions.

Note that you must select the firmware package which matches the region in which you intend to operate your end device.

- For the USA or Canada, use the *Sterling-LWB Firmware Package (480-0079)*
- For the ETSI and RCM, use the *Sterling-LWB Firmware Package (480-0080)*
- For Giteki, use the *Sterling-LWB Firmware Package (480-0116)*

## MODIFYING BOARDCONFIG.MK

**Note:** Many chip vendors provide a BoardConfig.mk file that already includes a reference to another Wi-Fi module. Duplicate definitions cause problems with Wi-Fi integration. Prior to starting, please comment out (or completely remove) unnecessary Wi-Fi card definitions.

### Required

Add the following to the end of your BoardConfig.mk file:

```
BOARD_WIFI_VENDOR := broadcom

ifeq ($(BOARD_WIFI_VENDOR), broadcom)
    BOARD_WLAN_DEVICE := brcm
endif
```

## MODIFYING INIT.RC

**init.rc** is a file that contains Android specific init language. It provides both generic and machine level initialization instructions. The following Wi-Fi specific changes are used to enable the wpa\_supplicant and allow Wi-Fi the correct sockets of communication. If done correctly, occurs automatically once Wi-Fi is turned on in Android.

**Notes:** Many chip vendors provide an init.rc file that already includes references to other Wi-Fi modules or wpa\_supplicants. Duplicate definitions cause problems with Wi-Fi integration. Ensure that these entries are not duplicated with what you already have in this file. If you have already integrated a wifi solution previously, these changes are likely already in place.

init.rc is commonly divided into the standard init.rc for non-machine level initialization and init.<platform>.rc for machine level init. Laird recommends that the wpa\_supplicant piece is added to the init.<platform>.rc file.

The following are the Wi-Fi specific sections of Laird's init.rc file for Jellybean and Kitkat respectively.

**Note:** The following is divided into sections for clarification purposes.

### File System Permissions

It is very important that the above is followed as closely as possible. Specifically make sure that the following line is added:

```
mkdir/data/Laird 0777 system
```

This directory is leveraged for storage by both LCM and the Laird supplicant.

### Init.rc file Changes and Additions - Jellybean

For Android Jellybean, make the following changes to init.rc:

```
on post-fs-data

# give system access to wpa_supplicant.conf for backup and restore
mkdir /data/misc/wifi 0770 wifi system
mkdir /data/misc/wifi/sockets 0770 wifi system
chmod 0770 /data/misc/wifi
chmod 0770 /data/misc/wifi/sockets
chmod 0660 /data/misc/wifi/wpa_supplicant.conf
chmod 0775 /data/misc/wifi/ipconfig.txt
```

```

mkdir /data/local 0751 root root

# For Use with Laird Android SDK
mkdir /data/Laird 0777 system system

mkdir /data/misc/dhcp 0770 dhcp dhcp
chown dhcp dhcp /data/misc/dhcp

...

on boot

# Define the Wi-Fi and other props
setprop wifi.interface "wlan0"
setprop wlan.interface "wlan0"
setprop wlan.driver.status "ok"

```

### Init.rc file Changes and Additions - KitKat

For Android KitKat, make the following changes to init.rc:

```

on post-fs-data

# give system access to wpa_supplicant.conf for backup and restore
mkdir /system/etc/wifi 0770 wifi wifi
chmod 0770 /system/etc/wifi
chmod 0660 /system/etc/wifi/wpa_supplicant.conf
chown wifi wifi /system/etc/wifi/wpa_supplicant.conf

#wpa_supplicant
mkdir /data/misc/wifi 0770 wifi wifi
mkdir /data/misc/wifi/sockets 0770 wifi wifi
chmod 0770 /data/misc/wifi
chmod 0660 /data/misc/wifi/wpa_supplicant.conf
chown wifi wifi /data/misc/wifi
chown wifi wifi /data/misc/wifi/wpa_supplicant.conf

mkdir /data/misc/dhcp 0770 dhcp dhcp
chown dhcp dhcp /data/misc/dhcp

...

on boot

# Define the Wi-Fi and other props
setprop wifi.interface "wlan0"
setprop wlan.interface "wlan0"
setprop wlan.driver.status "ok"

```

### Init.<platform>.rc File Changes and Additions - Jellybean

For Android Jellybean, make the following changes to init.<platform>.rc:

```

service wpa_supplicant /system/bin/wpa_supplicant -Dnl80211 -iwlan0 -
c/data/misc/wifi/wpa_supplicant.conf -e/data/misc/wifi/entropy.bin
class main
socket wpa_wlan0 dgram 660 wifi wifi
disabled
oneshot

```

```
service dhcpcd_wlan0 /system/bin/dhcpcd -ABKL
  class main
  disabled
  oneshot

service iprenew_wlan0 /system/bin/dhcpcd -n
  class main
  disabled
  oneshot
```

## Init.<platform>.rc File Changes and Additions - KitKat

For Android KitKat, make the following changes to init.<platform>.rc:

```
service wpa_supplicant /system/bin/wpa_supplicant \
  -iwlan0 -Dnl80211 -c/data/misc/wifi/wpa_supplicant.conf \
  -O/data/misc/wifi/sockets \
  -e/data/misc/wifi/entropy.bin \
  -g@android:wpa_wlan0
  class main
  socket wpa_wlan0 dgram 660 wifi wifi
  disabled
  oneshot

service dhcpcd_wlan0 /system/bin/dhcpcd -aABDKL
  class main
  disabled
  oneshot

service iprenew_wlan0 /system/bin/dhcpcd -n
  class main
  disabled
  oneshot
```

## Init.<platform>.rc File Changes and Additions - Lollipop

For Android Lollipop, make the following changes to init.<platform>.rc:

```

service wpa_supplicant /system/bin/wpa_supplicant \
  -iwlan0 -Dnl80211 -c/data/misc/wifi/wpa_supplicant.conf \
  -I/system/etc/wifi/wpa_supplicant_overlay.conf \
  -O/data/misc/wifi/sockets \
  -e/data/misc/wifi/entropy.bin -g@android:wpa_wlan0
socket wpa_wlan0 dgram 660 wifi wifi
class late_start
disabled
oneshot

service dhcpcd_wlan0 /system/bin/dhcpcd -aABDKL
class main
disabled
oneshot

service iprenew_wlan0 /system/bin/dhcpcd -n
class main
disabled
oneshot

```

## REVISION HISTORY

Version	Date	Notes	Approver
0.1	09 Dec 2016	Initial release	Eric Bentley
0.2	14 Dec 2016	Referenced different firmware info, links to other documentation	Andy Dobbing
1.0	02 Feb 2017	Release to PS	John Urban
1.1	02 Feb 2017	Added <b>Init.&lt;platform&gt;.rc File Changes and Additions - Lollipop</b> section	Eric Bentley
1.2	10 Jul 2018	Updated the description for 480-0080 and 480-0116	Eric Bentley