



Wi-Fi Link Controller Linux Release Notes

Introduction

This release notes describes the software deliveries of the ATWILC1000 and ATWILC3000. The ATWILC1000 supports only Wi-Fi, whereas, the ATWILC3000 supports Wi-Fi and Bluetooth.

The ATWILC software releases are available on github: github.com/linux4sam

The Firmware, Demo, Tools and pre-built binaries are available on github.com/linux4wilc

The deliveries are tested against the SAMA5D4 Xplained board running on Linux Kernel 5.10 only, and may be compatible with any other Linux kernel and platform that runs Linux

Notes: All references to the ATWILC module includes all the devices listed below, unless otherwise noted:

- ATWILC1000
- ATWILC3000

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1. ATWILC Software Architecture

The following figures illustrate the ATWILC architecture of the Wi-Fi and Bluetooth software.

Figure 1-1. ATWILC Wi-Fi Software Architecture

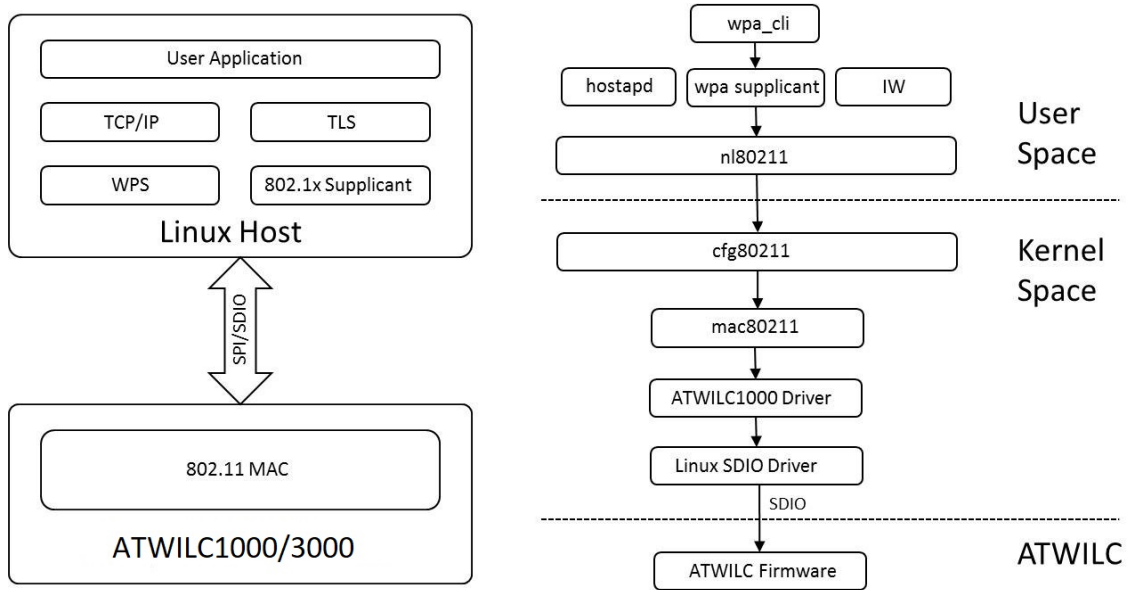
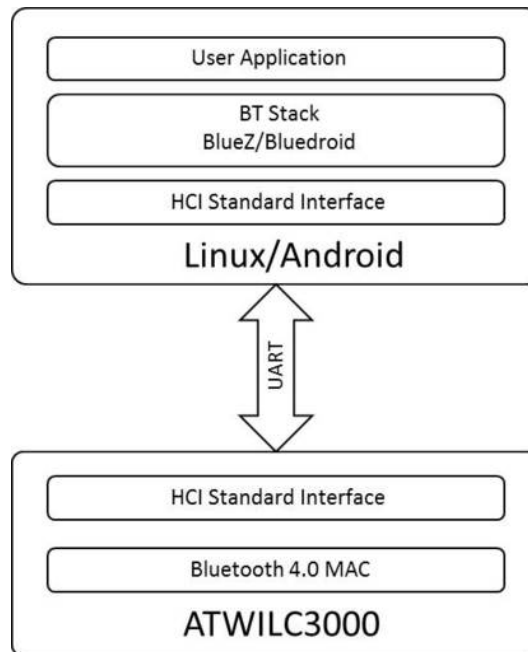


Figure 1-2. ATWILC Bluetooth Software Architecture



2. ATWILC Release Contents

The release ATWILC Linux v15.5 includes the following Binary and Source files

Folder Name	Description
Binary	<p>This folder contains the following files:</p> <ul style="list-style-type: none"> • <code>wilc1000_wifi_firmware.bin</code>: Wi-Fi station-P2P-AP concurrency firmware for ATWILC1000. • <code>wilc3000_wifi_firmware.bin</code>: Wi-Fi station-P2P-AP concurrency firmware for ATWILC3000. • <code>wilc3000_wifi_firmware_ua.bin</code>: Wi-Fi station-P2P-AP concurrency firmware for ATWILC3000 for the UA module. • <code>wilc3000_ble_firmware.bin</code>: BTDM firmware for ATWILC3000. • <code>wilc3000_ble_firmware_no_rtc.bin</code>: BTDM firmware for ATWILC3000 boards that does not have RTC. • <code>wilc-sdio.ko</code>: Linux 5.10 pre-built SDIO driver for ATWILC. • <code>wilc-spi.ko</code>: Linux 5.10 pre-built SPI driver for ATWILC. • <code>linux_kernel_5.10_images</code>: Pre-built Linux 5.10 image for SAMA5D4.
src	Linux driver examples for ATWILC1000 and ATWILC3000 for SAMA5D4 Xplained running Linux kernel 5.10.

3. ATWILC Release Features

The ATWILC module supports the following features.

1. Wi-Fi Station (STA)
 - IEEE 802.11 b/g/n
 - Open, Wired Equivalent Privacy (WEP), Wi-Fi Protected Access (WPA)/WPA2 personal and WPA/WPA2 enterprise security
2. Wi-Fi Access Point (AP)
 - IEEE 802.11 b/g/n
 - Open, WEP, WPA/WPA2 personal and WPA/WPA2 enterprise security
 - Supports eight stations
3. Wi-Fi Protected Setup (WPS)
 - PBC
 - PIN code
4. Wi-Fi direct
 - P2P Client
 - P2P GO
5. Concurrent modes
 - STA-STA
 - STA-AP
 - STA-P2P Client
 - STA-P2P GO
 - AP-P2P Client
6. Antenna diversity control for Wi-Fi
7. Bluetooth (ATWILC3000 only)
 - Bluetooth Low Energy (BLE) 4.0 support
 - Modes of operation: Central and peripheral support
 - Number of Connections: Supports seven clients
 - Adaptive frequency hopping
 - Coexistence with Wi-Fi
8. Power save
 - Beacon monitoring mode
 - Low-power mode when disconnected
 - Host suspend support
 - Wake-up host on wireless LAN events
9. RF version number 01.1

Note: RF version number format is xx.y, where xx: "Major" and y: "Minor". Changes in Major number requires re-tests and possibly re-certification.

4. Throughput

This section provides the results of throughput test for Wi-Fi standalone and Wi-Fi/BT coexistence feature.

4.1 Wi-Fi Standalone

- **ATWILC1000**

Throughput test is performed for ATWILC1000 using iPerf application on SAMA5D4 on a radiated setup.

Protocol	SDIO		SPI	
	Downlink (Mbps)	Uplink (Mbps)	Downlink (Mbps)	Uplink (Mbps)
UDP	45.6	15.2	17.5	13.5
TCP	36.1	15.4	11.9	3.31

- **ATWILC3000**

Throughput test is performed for ATWILC3000 using iPerf application on SAMA5D4 on a radiated setup.

Protocol	SDIO		SPI	
	Downlink (Mbps)	Uplink (Mbps)	Downlink (Mbps)	Uplink (Mbps)
UDP	47.8	20.1	17.7	11.2
TCP	38.7	21.3	12.5	5.05

4.2 ATWILC3000 Wi-Fi/BLE Coexistence

Throughput test is performed using iPerf application on SAMA5D4 using SDIO shield board radiated setup while BLE interface advertises the packets with default payload and interval.

Protocol	Downlink (Mbps)	Uplink (Mbps)
UDP	45.8	18.6
TCP	39.7	20.4

5. Release Revision History

5.1 ATWILC Linux Release v15.5

The following are the bug fixes for ATWILC Linux Release v15.5

1. Fix Command(crc7) and Data(crc16) CRC check enabling on WILC SPI bus
2. Fix WILC AP mode hang up issue
3. Fix WILC1000 - Specific AP's are not getting detected during scan
4. Fix WILC3000 SPI: Sometimes bus communication error observed during PS mode
5. Fix WILC 3000 BLE fails to start advertising under some application command sequence
6. Fix WILC1000 SPI: Fix TXQ starvation issue
7. Fix Default GPIO's values are not getting populated
8. Fix WILC SPI failure recovery mechanism issue
9. Fix Gain table settings for WILC1000 and WILC3000 UA

5.2 ATWILC Linux Release 15.4.1

The following are the bug fixes for ATWILC Linux Release v15.4.1

1. Fix network packet flow in WILC 1000/3000 WiFi Driver
2. Fix HIF instability issues in WILC 3000 - In PSM mode due to DC-DC trim values
3. Fix HIF instability issues in WILC 3000 - In WiFi-BLE co-existence
4. Fix Memory leak in WILC driver scan while connect/disconnect AP
5. Fix WiFi Driver for SDIO suspend/resume
6. Fix WILC 1000 SPI communication stall issues
7. Fix WILC 1000 SDIO failures when power save mode is enabled

5.3 ATWILC Linux Release v15.4

The following are the new features in ATWILC Linux Release v15.4

1. WILC3000: Change Gain with Temperature to avoid in-band spurs
2. Migration to Linux4SAM git

The following are the bug fixes for ATWILC Linux release v15.4

1. Fix BLE Sweyntooth Vulnerability
2. Fix SDIO OOB Interrupt
3. Update WILC1000UB Gain Table

5.4 ATWILC Linux Release v15.3.1

The following are the bug fixes for ATWILC Linux release 15.3.1:

1. Failure to wake some parts through SPI .
2. iperf stalls during longevity tests.

5.5 ATWILC Linux Release v15.3

The following are the new features in ATWILC Linux Release v15.3:

1. Reed IQ imbalance calibration data from Efuse.
2. Dynamically add network interfaces for ATWILC driver.
3. Add optional `rtc_clk` property to dts and use it in the driver.

The following are the bug fixes for ATWILC Linux release v15.3

1. Apply feedback comments from staging community to the driver.
2. Fix for CF-End packets on air when multiple WILC stations are connected to the same AP.
3. Fix crack Attack failure – Upgrade `wpa_supplicant` on buildroot to 2.7 and latest security fixes.
4. Fix memory leak when connecting/disconnecting to AP continuously.
5. Fix for Passive scanning feature.
6. Avoid controlling power save state from the driver while obtaining IP and scanning.
7. FW crash when switching between AP via link loss.
8. Fix for low Tx power when using CW Tone in the Ch/C GUI tool.
9. Clear pending interrupts while initializing/de-initializing the device.
10. WILC3000 Low Rx performance with 11n rates.

5.6 ATWILC Linux Release v15.2

The following are the bug fixes for ATWILC Linux release v15.2.

1. Regression in v15.1 while connecting to WPA AP.
2. Fix for corrupted packets reported on the Monitor mode.
3. Better consistency to find ATWILC softAP's in stations' scan results.
4. Consistent assignment of printed MAC address to `wlan0`.
5. Better TX performance with significant temperature changes.
6. SoftAP fails to operate correctly when its MAC address is assigned from the host.
7. Staging review fixes.
8. GPIO descriptor related changes. Requires changes on the host's Device Tree file.
9. Fix for crash from v15.1 when switching between AP and station interface.
10. Enable Antenna diversity using GPIO3 for ATWILC3000.
11. SoftAP fails to associate eighth station.
12. Improve transmission performance in noisy environment.
13. Fix regression causing degradation in BLE RX Sensitivity.
14. Fix for ATWILC firmware overwriting MAC address in received broadcast packets.
15. Incorrect pointer passed while getting `IF handler`.
16. Refactor `coreconfigurator.c` file to use API's provided in kernel framework.
17. High latency on receiving firmware start interrupt and intermittent lower throughput on SAMA5D4 board.
18. iPhone intermittently fails to connect to ATWILC SoftAP.

5.7 ATWILC Linux Release v15.1

The following are the new features in ATWILC Linux Release v15.1:

1. Use mainline buildroot git.buildroot.net/buildroot/ tag 2017_08.
2. Idle (Disconnected) power save mode.
3. Ability to change WILC mac address dynamically from Linux host.
4. Support for sam-ba 3.2 to flash prebuilt images.
5. CAPI Agent code added to Buildroot.
6. Support compilation against Linux 3.10 and 4.14.
7. Single kernel module is now used; either `wilc-sdio.ko` or `wilc-spi.ko` depending to the used bus.
8. Firmware binaries are now compiled as part of the Linux kernel's image, instead of the file system image. The firmware should be located on the target under `/lib/firmware/mchp`.

9. Chip_en and Reset_n GPIOs' numbers are now retrieved from the platform's device tree file (dts).
10. BLE example application (btgatt-server) for BlueZ 5.46.
11. Use Linux Style Tracing System.
12. Implement Linux community recommendations and notes.
13. Ability to change Antenna diversity GPIOs dynamically.

The following are the bug fixes for RTP:

1. Wi-Fi/BLE Power save mode.
2. Host power save (Suspend/Resume).
3. Antenna diversity.
4. Scan results should not include APs from adjacent channels.
5. Fixed concurrency regression.
6. Fixed spurious emissions issue in Wi-Fi/BLE coexistence mode.
7. Replayed packets are not discarded in the firmware.
8. Second Wi-Fi interface failure.
9. Concurrency failure.

5.8 ATWILC Linux Release v15.0

The following are new features in ATWILC Linux Release v15.0:

1. Used staging ATWILC driver
2. ATWILC3000 WFA certification.

The following are the bug fixes for RTP:

1. DUT disconnects from the AP when AP is in mixed mode.
2. Updated ATWILC1000 and ATWILC3000 gain tables
3. Autorate Algorithm enhancements

5.9 ATWILC Linux Release v14.4

The following are key enhancements and bug fixes in ATWILC Linux Release v14.4:

1. Fixed ATWILC1000 loading error.

5.10 ATWILC Linux Release v14.3

The following are key enhancements and bug fixes in ATWILC Linux Release v14.3:

1. European Telecommunications Standards Institute (ETSI) certification support to implement per channel Rx Received Signal Strength Indicator (RSSI) offset.
2. Increased BLE transmit power granularity to 7 levels.
3. Eliminate spurious emissions for BLE.
4. Avoid user setting BLE power to the level exceeding Federal Communications Commission (FCC) recommendations.
5. Fixed for low-side injection for higher channels on Bluetooth.
6. Adding support on linux to change regulatory domains.
7. Fixed to enable BT test mode from characterization GUI.
8. Added new feature to the characterization GUI to send Host Controller Interface (HCI) commands, dynamically.
9. Support for SPI on ATWILC3000 Shield board.
10. Updated porting guide and linux user guide.
11. Suspend/Resume support tested overnight.

12. Phased out ATWILC1000 RevA (ATWILC10002xx).
13. Eliminated Lint error in Wi-Fi firmware.
14. Eliminated GCC warning in Wi-Fi driver.

5.11 ATWILC Linux Release v14.2

The following are key enhancements and bug fixes in ATWILC Linux Release v14.2:

1. Fixed WEP40 and WEP104 shared authentication.
2. Antenna diversity for ATWILC3000.
3. Using latest tool chain to compile Wi-Fi firmwares.
4. [ATWILC3000] Support for WILC3000D2.
5. [ATWILC3000] Using PMU code 0x1 as recommended to pass FCC tests, and lowering sleep LDO voltage to code 0xe to minimize sleep current.

6. Limitations

1. Concurrency:
 - Multichannel concurrency is not supported. Concurrent modes have to run on the same channel.
2. P2P Client:
 - By default, the driver acts as a P2P GO to be able to select the channel to overcome the multichannel concurrency limitation.
To use the P2P client mode, the required mode has to be set in `/sys/wilc/p2p_mode`.

```
echo <mode> > /sys/wilc/p2p_mode
```

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