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NRC7394 Standalone SDK Release Note (v1.1)

Ultra-low power & Long-range Wi-Fi

Ver 1.1
Aug. 17, 2023

NEWRACOM, Inc.

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Ultra-low power & Long-range Wi-Fi

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1 Overview

The IEEE 802.11ah is a new Wi-Fi standard created to fulfill the requirements of a variety of IoT applications. Newracom's NRC7394 chip provides two modes of operation: host mode and standalone mode. Host mode necessitates an external host device, like the Raspberry Pi4 included in Newracom's EVK, to supply 11ah Wi-Fi connectivity. On the other hand, standalone mode enables users to develop their own applications using the APIs provided in the standalone package, compile binaries with the SDK, and execute them on the NRC7394. In standalone mode, users can use the NRC7394's various peripheral interfaces to collect sensor data and transmit it to the server over the 11ah network. Furthermore, the NRC7394 offers an AT commands application in standalone mode, allowing users to utilize the 11ah Wi-Fi network.

This document outlines the NRC7394 software package for standalone mode.

2 Contents of software release package

The software release package encompasses all the necessary components for utilizing the most recent features, including firmware libraries, header files, APIs, sample codes, downloader tool, makefile, and documentation. Figure 2.1 illustrates the directory structure of the package, while Table 2.1 presents a summary of its contents.

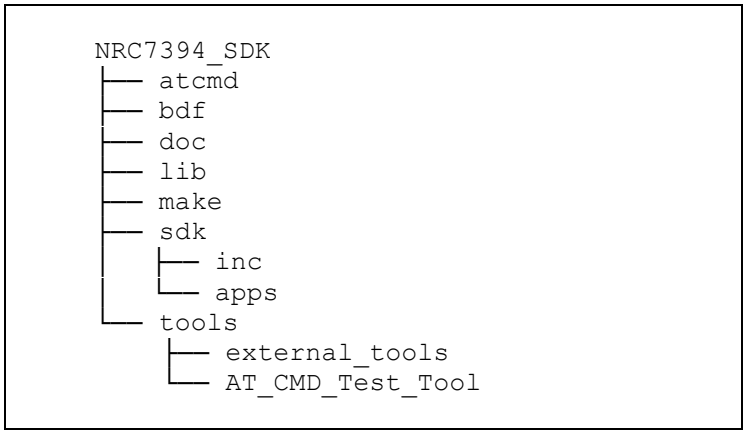

Figure 2.1 NRC7394 standalone SDK package directory

Table 2.1 Contents of NRC7394 standalone SDK package

Directory	Description
doc	Documents for standalone guide document and SDK API lists
lib	NRC7394 modem library and 3rd party libraries.
make	makefiles and configuration files
sdk/inc	SDK API header files and SDK common header files.
sdk/apps	Several kinds of reference sample applications.
atcmd	ATCMD binaries and reference codes for the host platform
bdf	A Board Data File (BDF) contains power tables based on a country, channel, target hardware version, MCS (Modulation Coding Scheme).
tools/AT_CMD_Test_Tool	AT command test tool for UART interface
tools/external_tools	The FirmwareFlashTool is a firmware uploader.

The information of the library released in this package is as follows.

- Library (including 3rd party)
  - Name : libModem.a (MD5: 3f3d1c8528bc45684636fb28619552cf)
  - Location : lib/modem
  - Version : 1.1
  - Build date : Aug. 17, 2023

3 Standalone SDK Package

3.1 General guide

To gain a broad understanding of the software package, developers can refer to the 'UG-7394-004-Standalone SDK.pdf' document. This resource offers instructions on configuring the software build environment, compiling standalone binaries, and downloading binary and sample applications. Furthermore, developers can utilize the 'UG-7394-005-Standalone SDK API.docx' document, which provides a list of supported APIs that can be used in conjunction with the NRC7394. These APIs enable users to implement services connected to Wi-Fi connections and peripherals. For additional assistance, the 'UG-7394-006-AT_Command.pdf' document offers a guide to AT commands.

3.2 Supported 3rd party libraries

The standalone SDK package for the NRC7394 contains numerous third-party libraries, which are detailed in the 'UG-7394-005-Standalone SDK API.docx' document along with their corresponding URLs. FreeRTOS, LwIP, and Mbed TLS are among these libraries, and they are essential for the standalone SDK to function properly.

- **FreeRTOS**
- **LwIP**
- **Mbed TLS**
- **MQTT**
- **cJSON**
- **Mini-XML**
- **AWS (Amazon web service)**
- **NVS (Non-volatile storage)**
- **Device libraries**
    - **BME680 (Gas, humidity, pressure, and temperature sensor)**
    - **SSD1306 (OLED/PLED controller)**
    - **SGP30 (Air quality sensor)**
    - **SHT30 (Temperature and humidity sensor)**
    - **w5500 (Ethernet controller)**

4 SW Release Package

4.1 Features

The NRC7394 software release package contains the following features.

- **AT-CMD features**
  - WPA3-SAE (v1.0)
  - OWE (v1.0)
  - FOTA (v1.0)
  - SoftAP (v1.0)
  - Power save TIM mode (v1.0)
  - Power save non-TIM mode (v1.0)
  - Continuous TX (v1.1)
- **Regulation features**
  - Duty cycle (v1.0)
- **System features**
  - Power save – deep sleep (v1.0)
  - WDT/Recovery (v1.0)
  - UART/UART-HFC/HSPI interface (v1.0)
- **Sample applications**
  - Refer to UG-7394-004-Standalone SDK document (v1.0)
    - Wi-Fi: Wi-Fi state, WPS-PBC, Ethernet bridge, SoftAP, FOTA
    - Protocol: TCP/UDP
    - Power save
    - Peripheral: GPIO, UART, ADC, NVS, PWM, sensors, etc.
    - Middleware: XML, JSON, AWS, MQTT, HTTP
    - Scenario: PS schedule, UART data handling

4.2 Resolved issues

Table 4.1 Resolved issues

Version	Description
v1.1	**Bug fix for following issues** (1) Intermittent scan failure on TW channel (2) AP's association grant for STA with listen interval exceeding BSS max idle period (3) CCA type of JP 2/4MHz channels (4) Inability to return to doze state in deep sleep mode for STA with static IP address (5) Scan failure on K2 channel (6) Incorrect peer MAC address copy at 4-address enabled W5500 device

4.3 Changed items

Table 4.2 Changed items

Version	Description
v1.1	**Enhanced RSSI accuracy of system_api_get_rssi()**

4.4 Known issues

Table 4.3 Known issues

Category	Description
Security	The initial connection time for WPA3-SAE/OWE can be quite lengthy (> 15 seconds) due to the substantial computational load required by software for large number operations.
SoftAP	The SoftAP disable/enable sequence on the standalone mode is not supported.
PMF	The issue of deauthentication frame delivery failure can occur between PMF-enabled NRC7394 and PMF-enabled NRC7292 devices.
TCP/IP	During deep sleep, TCP connections are not maintained. Upon waking up, a new TCP connection must be established.
AT-CMD	The AT-CMD throughput over HSPI interface is slightly lower than NRC7292 device due to CPU clock speed variation.