NEW RADIO COMMUNICATION FOR NEW ERA

NRC7292 SW PKG Release Note (v1.4.1)

Ultra-low power & Long-range Wi-Fi

Sept. 8, 2023

NEWRACOM, Inc.

NRC7292 SW PKG Release Note (v1.4.1)
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 NRC7292 chip provides two modes of operation: host mode and standalone mode. Host mode necessitates an external host device, like the Raspberry Pi3 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 NRC7292. In standalone mode, users can use the NRC7292's various peripheral interfaces to collect sensor data and transmit it to the server over the 11ah network. Furthermore, the NRC7292 offers an AT commands application in standalone mode, allowing users to utilize the 11ah Wi-Fi network.

This document outlines the NRC7292 software package for host 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.

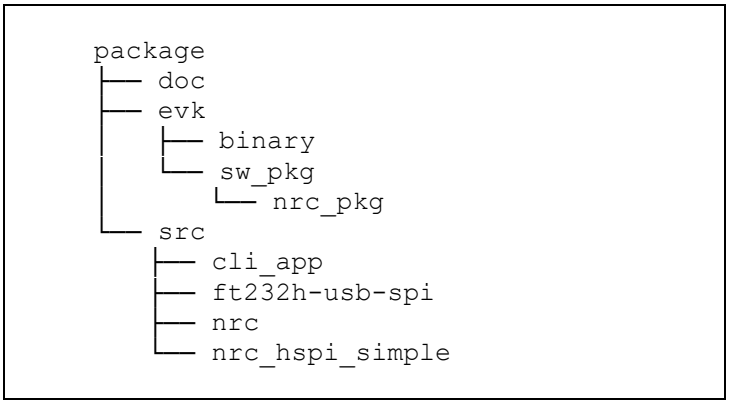

Figure 2.1 NRC7292 software release package directory

Table 2.1 Contents of NRC7292 software release package

Directory	Description
src/cli_app	The cli_app is a C-based application program. The user can use CLI commands on Raspberry PI3 by using this app. The application document and source code are included so user can build and apply it to their host platform.
src/nrc	The nrc is Linux driver for NRC7292 and its source code is included, so user can modify the source code for their own host platform.
src/ft232h-usb-spi	The FT232H USB-SPI bridge driver codes.
src/nrc_hspi_simple	The simple nrc driver codes for SPI interface testing.
evk/sw_pkg	This directory contains user guide documents and software package nrc_pkg is for 11ah. All the scripts, driver and firmware for host-mode EVK are included in the package.
evk/binary	This directory contains firmware, driver and cli_app.
doc	This directory contains document files.

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

- Firmware
  - Name : nrc7292_cspi.bin (md5sum: 4ccbc7284626bf11c6db0b747e936bb4)
  - Location : evk/binary
  - Version : 1.4.1
  - Build date : Sept. 8, 2023
- Linux driver
  - Name : nrc.ko (md5sum: d2e7fbf0e97c3328a35fba2c96984543)
  - Location : evk/binary
  - Version : 4.14.70 (Linux Kernel Version)
  - Build date : Sept. 8, 2023
- CLI application
  - Name : cli_app (md5sum: 249712d08e41fd1d1308547281888421)
  - Location : evk/binary
  - Version : 2.21.4
  - Build date : Sept. 8, 2023

3 SW Release Package

3.1 Features

The NRC7292 software release package contains the following features.

- **HaLow certification features**
  - HaLow R1 mandatory features (v1.4)
  - HaLow R1 optional features (v1.4)

    - AP optional features: BSS color, fragmentation

    - STA optional features: MCS 3-7, NDP probing, A-MPDU TX

- **11ah features**
  - 1,2,4 MHz Channel Width (v1.0.0)
  - 1MH duplicated PPDU (v1.0.0)
  - Short Guard Interval (v1.0.0)
  - NDP Control frame (v1.0.0)
  - Hierarchical TIM and TIM compression (v1.0.0)
  - S1G Beacon (v1.0.0)
  - S1G BSS Operation (v1.0.0)
  - S1G_1M, S1G_Short PPDU (v1.0.0)
  - 1SS MCS 0-7 and MCS10 (v1.0.0)
  - 2MHz duplicated PPDU (>= 4MHz) (v1.0.0)
  - Target Short Beacon Transmit Time (TSBTT) (v1.0.0)
  - TIM Operation (v1.0.0)
  - Color indication for >= 2MHz PPDU (v.1.1.0)
  - NDP Probe Request (v.1.1.0)
  - ~~PV1 MAC header (v.1.1.0) (obsolete)~~
  - Dynamic vendor IE (Information Element) (v1.2.0)
  - WPA3-OWE (v1.2.0)
  - WPA3-SAE (v1.2.0)
  - Power save (v1.3.4)
  - WDT(Watchdog Timer) Reset (v1.3.4)

- AP/STA Recovery after WDT Reset (v1.3.4)
- WPS-PBC (Push button configuration) (v1.3.4)
- CSA (Channel Switch Announcement) (v1.3.4)
- Auto BA (Block Ack) (v1.3.4)
- Max Aggregation – up to 16 (v1.3.4)
- BSS Max Idle (v1.3.4)
- Airplane Mode (v1.3.4)
- Kr00k vulnerability (v1.4)
- Dynamic fragmentation (v1.4)

- **Network stack features**
  - Concurrent mode (v.1.1.0)
  - SoftAP (v.1.1.0)
  - Tree-based mesh using concurrent mode (v1.2.0)
  - 11s mesh (v1.3.3)
  - Self-configuration on AP (v1.3.4)
  - Mesh enhancement – support MAP concurrent (v1.3.4)
  - Passive scan (v1.3.4 rev05)
  - Network bridge (v1.4)
  - RSSI-based roaming (v1.4)

- **Regulation features**
  - Duty cycle (v1.4)
- **System features**
  - Loopback Enhancement (v1.3.4)
  - Simple Driver for SPI verification (v1.3.4)

3.2 Resolved issues

Table 3.1 presents resolved issues since version 1.2.0.

Table 3.1 Resolved issues

Version	Description
v1.2.0	**Transmission failure** Wrong length calculation in the certain MCS and MPDU length combination
	Low throughput performance during the initial 10 sec after connection
	Long scan time Scan channels not in the scan list
	Fail to get IP through DHCP IAID (Identity Association Identifier) conflict during DHCP procedure
v1.2.1	**Incorrect value of "show uinfo" command – beacon_interval and short_bi**
	Target assert occurred when executing the cli_app while target is receiving response buffer allocation issue
	Target assert occurred in WPA2 protected frame destined to disassociated STA
	Wrong preamble type of "show config" command
	Wrong SNR value displayed in 1MHz BW when running "show signal"
v1.2.2	**CLI app sometimes output mismatched version information**
	Segmentation fault occurred when executing "show signal" command
	Response of "show signal" command become later than version 1.2.0
	Target firmware version mismatch between target firmware log and cli_app
v1.2.3	**"show signal start" command occur error when using interval option**
	Target firmware hung-up when execute "show uinfo" command
	Station information of "show uinfo" command was corrupted
	Station information remains even after bss_max_idle
	PING error happen when frame is particular size

	sometimes the data missing when the packet size is aligned to byte boundary
	cli_app response is late during I/F down CLI app cannot receive response from target when I/F is down
	Target firmware output error message when received many packets in short term queue for system task exhausted due to lots of frame in short time
	Support SNR/RSSI per STA on AP Mode Not considering about multiple STAs for SNR/RSSI reports
v1.2.4	**Fixed-VIF-Index-handling**
	Mapping US Full Channel
	Cli_app response is late during I/F down
	Station can't reconnect to AP when WPA3-OWE
	Remove-kernel-warning
	Display error about bss_idle_max_period of "show uinfo" Wrong information of bss_idle_max_period displayed in "show uinfo" command
	The value of twt of "show uinfo" command is always 1
	MIC failure occurred when station send multicast frames at the timing of GTK rekey
	WPA3 station can't receive broadcast frames
	BEACON-LOSS happened in STA mode Station occasionally fails to receive Beacon signal when WPA3 is enabled
	Cli_app cannot display per-station RSSI and SNR
	Target firmware output error message when execute "show mac tx|rx stats" Target firmware prints out "Unknown command" after the execution of cli_app
	Unexpected counter value in 'show mac rx' "OK frame bytes" presents a valid value even when "OK frames" is 0
	AP doesn't send deauthentication frames to non-associated station when WPA2/WPA3
	Sometimes 0 is written to the Beacon Interval field in the Beacon frame
	Sometimes wrong length information is written to the Probe Request frame

	Fail to receive broadcast frame in some case
	Target firmware crash happened while running Tree-based mesh
	Uplink/Color indication field is not set correctly
	Duplicated packet is forwarded due to error in Sequence Number Manager
	WIM_SCAN channel list stack overflow
	Sometimes Short Beacon is not transmitted
	Wrong information is written to Beacon Interval field in Probe Request frame
	Error found in callback of HSPI handller
	NDP Probe Request flooding due to retransmission
	Wrong number is written to Duration filed due to calculation error
	Wrong condition statements in some functions regarding umac stainfo
	Beacon needs to adapt S1G config on any change made.
	Wrong VIF index access on concurrent operation
v1.2.5	**Warning log are outputted when station connects and disconnects repeatedly in heavy traffic**
	Improve show signal command output
	Segmentation fault occurs in show signal command
	Can’t get transmitting opportunity equally when send very short packet continuously
	Sometimes last MCS of statistics indicates 8
	Long carrier sense time is set in some US channel
	Host warning when key is found but frame is unprotected
	Wrong value written to duration field in A-MPDU packet
	Memory leakage occurred when inserting and removing the host drive module repeatedly
	Fixed host warning when key is found but frame is unprotected
v1.2.6	**Kernel oops occurs when unload driver after changing Dynamic Vendor IE**
	Unable to disable bss_max_idle period

	Target assert happened when executing the "show uinfo 0" command in the cli_app after connection of 10th station or more
	Target assert when executed the "show signal" command
	Cipher type value was invalid in TX frame sent to target firmware from host just after station is disconnected
	Target assert happened when 400 stations (Increased up to 700 station)
v1.2.7	**Can't get transmitting opportunity equally when send very short packet continuously**
	Kernel Oops occurs when unload driver after changing Dynamic Vendor IE in Beacon
	"Tx Power" value in "cli_app show config" does not change even if the Tx_gain is changed
	cssid value in "cli_app show uinfo" is wrong
	TX_Gain is overwritten by 10 when hostapd/wpa_supplicant starts
	Noise is generated around 916MHz during loading driver
	Assert while deleting key in WPA2 on Standalone mode
	Fixed Warning log "Wrong index" is outputted when relay device sends data frames to AP
v1.2.8	**STA INFO of "show uinfo" is not displayed properly in certain situation**
	AP sends unencrypted packets at timing when station disconnected
	Indefinite value is displayed in kernel log when unloading the drive
	False detection occurs in recovery function
	Buffer of Tx queue are not freed when unloading the driver
	Buffer mismatch occurs on target firmware when receiving specific size data
	Warning log "Wrong index" is outputted when relay device sends data frames to AP
v1.2.9	**"show uinfo" command result is "FAIL" when no station connect to AP**
	nrc_recovery_wdt_clear handler is not executed
	Target assert happened when station connects and disconnects repeatedly in heavy traffic

	Lower SNR value is displayed compared with the previous version
	System fault occurs on TFW when execute cli_app "show" command in heavy traffic
	AP side memory is depleted when station sends massive multicast frames continuously
	MAC address of show uinfo command is zero before connect to AP
v1.2.10	**AP sends unencrypted packets at timing when station disconnected**
	Occurrence condition of Tx Triggered Detection
	"show signal" command result is "FAIL" when no station connect to AP
	Wireless frames are leaked at every recovery timing even if send CW
	Incorrect value in primary channel width subfield in S1G Operation element when operation bandwidth is 1MHz?
	"cli_app show uinfo 0" shows no ssid when the ssid includes '\' and its length is 32
	Fix pending skbs on wake_tx_queue() on nrc driver
v1.2.11	**Location of 1 MHz primary channel within the 2 MHz primary channel**
	Occurrence condition of Tx Triggered Detection
	Incorrect value in primary channel width subfield in S1G Operation element when operation bandwidth is 1MHz
	Incorrect bandwidth rate frames are sent after station moves to AP
v1.2.12	**"assoc_s1g_channel" of "show uinfo" command is cleared when interface down**
	"Uplink-ind" value of "show config" is different
v1.2.13	**Warning occurs in __ieee80211_scan_completed when the scan is aborted from MAC80211** duplicated ieee80211_scan_completed() call
	Improve Dynamic Vendor Specific IE function Limit length of Vendor Specific IE to 252bytes
	Warning occurs in rx_h_bss_max_idle_period when station receives association response frames of other destination Drop NDP/Ctrl frames except NDP_PREQ before Hook
v1.2.14	**Warning occurs in rx_h_bss_max_idle_period when station receives association**

	response frames of other destination NDP Probe request frame pass to host then host occurred warning condition in STA mode
v1.2.15	**Fix Spectrum Mask result log of Manufacturing tools**
v1.2.16	**“cli_app set gi long” not working**
	Assert occurred when sending NDP probe request packet
	Unable to transmit data frames permanently caused by background scanning during traffic
v1.2.17	**Fix set max TX power of each channel, bandwidth and MCS**
v1.2.18	**AP does not send probe response to NDP probe request**
	Kernel panic occurred when disconnected due to Beacon loss
v1.2.19	**Host recovery happens when scan_ssid=1**
	Segmentation Fault happens when execute cli_app by 4 MHz bandwidth
v1.3.0	**Wrong maximum number of aggregations**
	Beacon interval calculation in Beacon monitoring
	Issue on WPA2 key processing
	Wrong procedure of handling NDP frame
	Adaptation of AID in SoftAP
	Issue on STA disabled HT
	Buffer flow control issue caused by scan during in traffic
v1.3.1	**Robust Frames(ARP and DHCP) with MCS10 is not enabled while using WPA2**
	Fix backward compatibility issues for newly added sysconfig values
	Fix cli_app show recovery stats, show detection stats
v1.3.2	**Fix kernel warning occurs in _c_spi_read_regs when loading the driver after power-up**
	Treat 00:00:00:00:00:00 as invalid MAC Address when it is read from Serial Flash
	Keep Alive Packet Interval is fixed correctly based on BSS MAX Idle time
	Add HSPI Clock Recovery

	Fix Association Timeout Issue. Set Fragment Number to be 0
	Added Timeout Interval Element(TIE) support for PMF
v1.3.3	**Bugfix of NDP Probe Request**
	Fully support BSS Max Idle Period on NRC driver
	Bugfix of NDP modem sleep
	Fix 32MHz Clock Harmonic
v1.3.4	**Bugfix of RELAY throughput**
	Bugfix of updating TSF Completion Field
	Memory optimization with S1G Channel Table
	Stabilization of Modem Recovery
	Bugfix of rmmod operation
	Bugfix of addba/delba for block ack session
v1.3.4_rev01	**Fix compile time error for spi-ft232h.c for 5.7 and newer kernels**
	Fix kernel version compatibility issues
v1.3.4_rev02	**Mesh multicast packet receive bug fix**
	Fix for FTDI USB-SPI driver for designs w/out HSPI_EIRQ->GPIO0 line
	Fix out-of-tree compile of Newracom FTDI SPi module
v1.3.4_rev03	**Update exception handling of IP length mismatch for AP's bridge interface**
	Fix invalid HIF header while AP WDT reset
	Fix the starting issue at the cold boot after SW reset
	Fix the country code setting issue after WDT reset
v1.3.4_rev04	**Bug fix for the occasional AP's crash while many stations keep trying to connect and disconnect repeatably**
	Bug fix for WDT recovery failure on AP which can cause a connection failure on STAs even after AP recovery
	Bug fix for the frequent frame lost on NRC driver when large number of small-chunked (<100B) frames are transmitted
	Bug fix for the self configuration not working in the absence of hostapd

v1.3.4_rev05	**Bug fix for following issues** (1) Occasional AP crash under heavy connect and disconnect of associated STAs (2) Frames are rarely discarded on host driver when large number of small-chunked (<100B) frames are transmitted (3) Fail to set maximum aggregation number on 4M Bandwidth by using “cli_app set maxagg” command (4) Fail to turn off aggregation by using “cli_app set maxagg” command (5) Fail to set vendor IE using iw command on Linux kernel 5.10.xx
v1.3.4_rev06	**N/A**
v1.3.4_rev07	**Bug fix for following issues** (1) fail to reauth for WPA2/3-Enterprise (2) fail to deliver data after reassoc while handling large amount of traffic (3) display incorrect RSSI (4) TX power setting for response control frame
v1.3.4_rev08	**Bug fix for following issues** (1) setting invalid CH (925.5MH) of KR-MIC band while setting CH using self config (2) low Tx Power issue compared to v1.2.35 (3) setting invalid range of "set cca_thresh" (4) workaround for scan failure with log "TX buffer is not enough log"
v1.3.4_rev09	**Bug fix for following issues** (1) false warning by rx length mismatch (2) occasional TX stop issue on duty cycle setting via cli_app (3) mac80211 halt when nrc driver faces queue overflow (4) guard interval setting issue for VIF1 of concurrent mode (5) ping failure between bridge mode STA/AP using WPA2-Enterprise (6) ping delay issue on RPi4 (7) round up CS (Carrier Sense) time (8) reconnect failure issue on JP channel (9) unwanted emission for JP regulatory domain
v1.3.4_rev10	**Bug fix for following issues** (1) display error when disabling agggregation via CLI "set maxagg AC [0|1]" (2) self_config feature does not work properly for countries other than US

	(3) fail to start sniffer aperiodically triggerd by a broken frame
v1.3.4_rev11	**Bug fix for following issues** (1) improve the spurious emission performance in JP channels (2) invalid results returned by the self_config function when set 4MHz channels or dwell time to 1000ms on JP contry code (3) display config information even if corresponding vif is not activated (4) invalid results returned by the self_config function when there is a disabled channel in the BDF on US country code
v1.3.4_rev12	**Bug fix for following issues** (1) 1M center LO frequency mode triggers self_config failure on JP country code (2) fail to keep duty cycle for downlink traffic
v1.3.4_rev13	**Bug fix for following issues** (1) wrong self_config results on 2/4MHz of KR MIC SW package (2) beacon loss on relay STA (3) converged CS time after 'set tx_time' cli_app command (4) initialized duty cycle setting after target recovery
v1.3.4_rev14	**Bug fix for the failure to restore duty/LBT/CCA-threshold on AP after WDT reset**
v1.4	**Bug fix for following issues** (1) HSPI problem detection and recovery issue (2) hw_verion update error issue under frequent power on/off situation (3) Initialized aggregation/guard interval setting issue after target recovery (4) Default CCA level of 4MHz channel bandwidth (5) Fast synchronization of rx_slot count of host driver to avoid HSPI operation failure on the low-performance host platform (6) Unexpected operating channel change caused by self_config during JP 4MHz channel operation (7) Buffer mismatch triggered disconnection in the bridged node (8) Generating assert during the stop of relay node (9) Irrecoverable FW by mishandling of IP/DHCP/ARP frames in mesh and relay node (10) Long beacon_int compliance in TIM mode deep sleep (11) Imbalanced uplink/downlink performance at the repeater mode (relay) node (12) Host driver build error in the Linux kernel version 4.4 or lower (13) Incorrect 1MHz primary channel location and primary channel number

	(14) Inflexible S1G format for probe response frame (15) Inflexible 1MHz control response support (16) Fail to set output of relevant GPIO before entering the deep sleep (17) Mesh control field correction to consider 4-address usage (18) Multicast frame drop on JP channel
v1.4.1	**Bug fix for following issues** (1) Scan failures in the K2 band (2) Incorrect usage of the CTS format for RTS with RI 1 (NDP-Response) in open mode AP (3) cli_app: if duty cycle setting fails, it is now disabled, and an error is returned to the cli_app (4) Multicast frame's SN is non-sequential when duty cycle is enabled (5) rmmod failure which can occur due to target malfunctions or SPI issues (6) Beacon loss handling at the uCode (7) Kernel panic that may occur when adding a large number of vendor IEs (8) Fixed ch_switch_cnt number in the case of hidden SSID AP (9) Heap leakage during the updating of beacon frames (10) WDT reset that could occur during frequent ifconfig up/down operations on the AP (11) Kernel panic that could occur when the enable_beacon_bypass feature is enabled (12) Failure of connecting to an AP with TW country code (13) PN order mismatch for big-size packet transmission (14) iw scan meshid command failure (15) 2MHz secondary CCA operation

3.3 Changed items

Table 3.12 presents changed items since version 1.2.0.

Table 3.2 Changed items

Version	Description
v1.2.4	**Duty cycle** Set duty cycle to limit the emission of transmission time (only test purpose)
	TX power control Set different transmit power on each MCS
	WPA2 in concurrent mode To support WPA2 security in concurrent mode
	HW Timestamp on Probe Response To use more accurate timing reference
	Low TX power (1~5) To support low TX output power such as 1~5dBm Previous version only support TX power 5~30dBm even when TX gain set to 1~5
	CFL performance improvement To support low TX output power such as 1~5dBm
	Insert TIM IE when PVB is zero in Beacon frame Not clearly defined in 11ah standard but necessary for 11ah interoperability (HaLow) test
	Improve TX EVM performance Stabilize TX EVM performance by changing initial value of RF/PMS parameter
	DTIM period from configuration file DTIM period was fixed to 1 for test purpose but changed it to get from the configuration file
v1.2.5	**Redefine data structure and memory map in the external serial flash memory** Add signature & crc32 in slot header for integrity
	A-MPDU on VIF 1 To support A-MPDU packet on VIF 1 interface
	NDP probing in 4MHz BW

	To support NDP probing request in 4MHz BW
	Option to use calibration data Add CLI command in cli_app to select to or not to use calibration data
v1.2.6	**Option of 'auto' for guard interval setting** Automatically select guard interval based on the transmission success rate
	Target recovery function Recovery function triggered when a packet is scheduled but not finished within a specific time
	Remove unnecessary wait time To improve display time of the "show signal" command
	Encapsulate AID information into TX frame sent from host To resolve the issue that AP sends unencrypted packets at timing when station is disconnected
v1.2.7	**CLI command for aggregation size threshold**
	CLI command for test recovery, recovery stats, detection stats
	Target firmware recovery and Host recovery
v1.2.8	**Sort MAC address in order in umac stainfo command**
	Update "show config" command in cli_app
	Add "test assert" command in cli_app To provide a method to test the recovery function
	Enable rate control for VIF 1
v1.2.11	**Enable mesh only when CONFIG_MAC80211_MESH enabled** MAC80211 has the build option to enable mesh, CONFIG_MAC80211_MESH. This change enables mesh only when CONFIG_MAC80211_MESH enabled on Kernel.
	Add Debug on TX destined to STA in wrong state
v1.2.12	**CLI command for GPIO configuration**
	Reduce spurious level at 960MHz frequency
	Check valid MAC address stored in the memory before using it
v1.2.16	**Handle MAC address 1 for concurrent mode (VIF1)** Use two MAC addresses 0 (for VIF0) and 1 (for VIF1) when two addresses are

	available in the flash memory. If only one address is available in the memory, generate another MAC address from the one in the memory.
V1.2.17	**TX power control based on MCS, channel, bandwidth enabled by default** Previous cli_app command of “autotxgain” removed (see chapter 8)
v1.2.18	**Enhance calibration scheme to improve EVM and spectrum mask performance**
v1.3.0	**NDP blockack support**
	Support MX25V8035F flash memory
	Support MAX31875R0 temperature sensor
	Handle the macaddr1 in serial flash for VIF1
	Add PS-API module
v1.3.1	**Support KR MIC band (925.5-930.5) in host_kr_mic package**
	Delay a start of beacon monitoring
	Add API for user_config area
	Add sysconfig ‘bdf_use’ value (use the board data use or not)
	Support Hidden SSID (on AP/STA)
	Change temperature compensation value
v1.3.2	**RX gain table, RSSI offset, LNA Swithcing point, 2Mhz mode threshold value**
v1.3.3	**Support Background Scan**
	Change default CPU (from CM0 to CM3)
	Support Hidden SSID
	Support KR Wireless MIC Band
v.1.3.4	**Support Power Save (modem sleep and deep sleep)**
	Support BSS Max Idle
	Support AMPDU using block ack session (up to 16 MPDU in AMPDU)
	Support CSA (Channel Switch Announcement)
	Support Mesh MAP concurrent
	Support WPA-PBC
	Support WDT Reset

	Support Self Configuration on AP
v1.3.4_rev01	**Support duty cycle**
	Update start.py self_config related update, replace service to systemctl, ndp_preq default value change (1 to 0)
v1.3.4_rev02	**Polling mode update in FT232H-usb-spi driver**
	Add simple SPI-verification driver
	Remove MODULE_SUPPORTED_DEVICE which has been deprecated by upstream
	Add channel argument support for start.py's AP mode
v1.3.4_rev03	**Remove 'ieee80211w=2' in wpa_supplicant configuration files for AU/NZ domain**
	Update board data (BD) structure (v1.2) (1) Make BD usage as default, remove DB-related start.py script parameters (2) Add a target version in a board data field and compare the value in flash memory
	cli_app update (1) Change the configurable TX max power level from 20 to 30 dBm (2) Add a CCA threshold setting command: set cca_thresh {CCA threshold} (3) Display cssid and rx_s1gmcs_map of 'show uinfo' result in hexadecimal
	Remove triple max limit count scheme for small (<10240ms) BSS max idle period
v1.3.4_rev04	**cli_app update** (1) maximum aggregation number for AMPDU can be fixed if it is set manually by CLI (set maxagg ac max). Previously it is changed to default value (8 or 16) after reconnection (2) Setting guard interval is possible even in association state
	Module parameters update (1) Normal (Block) ACK - legacy_ack_enable: 1=enable, 0=disable(default) (2) NDP (Block) ACK - bitmap_encoding: 1=enable(default), 0=disable - reverse_scrambler: 1=enable(default), 0=disable - Parameter usage guideline

	* bitmap_encoding=0 and reverse_scrambler=0 to communicate with v1.2.x SW package device * bitmap_encoding=1 and reverse_scrambler=0 to communicate with v1.3.0 ~ v1.3.4 rev03 SW package device * bitmap_encoding=1 and reverse_scrambler=1 to communicate with HaLow certified device
	Support SAE H2E(Hash-To-Element) mechanism for PWE (Password Element) derivation The version of hostapd and wpa_supplicant should be 2.10 or higher
v1.3.4_rev05	**cli_app update** (1) “set config” is obsolete so that it is removed (2) “set ack_mode [no|ndp|normal]” is added to change ack mode (no:no ack mode, ndp: NDP ack mode, normal: normal ack mode)
	Module parameter update (1) enable/disable S1G short beacon - short_bcn_enable (default=1): if 0, only S1G full beacon is used on AP
v1.3.4_rev06	**Update AU/NZ channels according to IEEE 802.11-2020**
	Update JP channels
	Update mesh script for python 3.9
	Support MX25R1635F serial flash
v1.3.4_rev07	**N/A**
v1.3.4_rev08	**Update script to send broadcast deauth when it stops AP or STA via start.py or stop.py script**
v1.3.4_rev09	**Intuitionally display A-MPDU status via “cli_app show maxagg” command**
	Support to set TX power by iw command for OpenWRT
	Enable the 1MHz TX filter for JP channel
v1.3.4_rev10	**N/A**
v1.3.4_rev11	**Enable traveling pilot**
	Automate security option on the mesh mode
v1.3.4_rev12	**Only the BD file of version 0 is valid for the target board of flash version 65535**

v1.3.4_rev13	**Offload CQM (Connection Quality Monitor) handling onto host driver**
	Suppress overrun log for the host platform with a lower clock speed CPU
	Make "cli_app set self_config" command work only when the country code is matched to the regulatory domain
	Support half-duplex SPI
	Improve power calibration and compensation accuracy affecting the revised JP and KR-MIC channelization
	JP channel spur suppression
	Add the logging file permission check to 'show signal' cli_app command
	Initialize frame sequence number after reconnection
v1.4	**Support HaLow certification with the single firmware package**
	Regulation related updates (1) Updated JP LBT/duty cycle regulation support (2) KR channel update: K0/K1/K2 channels (3) EU channel update: remove 2MHz channel based on IEEE 802.11-2020
	Firmware/host driver refactoring
	Remove modem sleep feature
	Support faster wake-up time in deep sleep mode
	Support serial flash power down in the deep sleep mode
	Support active scanning on mesh
	Enhance duty cycle feature in terms of stability and monitoring
	Update the maximum supported STA count from 1000 to 700 due to the increased heap usage in the firmware
	Association control based on BSS max idle period and listen interval values
	cli_app update (refer to UG-7292-007-Commnad line application v2.0 document)
v1.4.1	**Enhanced dynamic vendor IE to encompass probe request/response and association request frames**
	Configuration for beacon transmission rates
	Introduction of Continuous TX mode

	Elimination of the K0 band and restoration of K1/K2 for backward compatibility
	Expanded support for up to 1000 STAs
	Support 1MHz primary channel location of 4MHz AP/STA
	Avoidance of fragmented data frames in strong/mid RF field
	Improved transmission of large-size packets
	Extended supported Linux kernel version: up to 6.1.x

3.4 Known issues in the release package

Table 3.3 presents all know issues.

Table 3.3 Known issues

Category	Description
Hostapd	Not Support 5 US channels due to hostapd channel capacity reason (Not supported channel: 100(BW_1M, 925.5MHz), 104(BW_1M, 926.5MHz), 108(BW_1M, 927.5MHz), 112(BW_2M, 927MHz), 116(BW_4M, 926MHz))
Hostapd	Due to the legacy Wi-Fi/HaLow channel mapping, "hostapd_cli chan_switch" command experiences a 60-second delay when using radar channels below: 5500(#100/925.5MHz), 5520(#104/926.5MHz), 5540(#108/927.5MHz), 5560(#112/927MHz), 5580(#116/926MHz)
Mesh	DHCP failure or delay in multi-hop MBSS (Recommend using static IP in more than 3-hop MBSS)