SD-SD 8897 Driver/Firmware Release Note

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December 23, 2015

1. Package Information

- Version: **15.68.7.p63-15.28.7.p63–C3X15125_B0B1-MGPL-(FP68)**

  SD-SD Software Release

2. Version info

- SOC Version 88W8897 (SD_SD)
- Firmware
  - sd8897_wlan.bin (WLAN firmware) 15.68.7.p63
  - sd8897_bt.bin (BT firmware) 15.28.7.p63
- Driver Package C3X15125
  - Wlan Driver (mlan.ko , sd8897.ko)
  - BT Driver
    - ➔ bt8897.ko ← sd driver with bluez support
- WPA supplicant (STA/P2P) wpa_supplicant-2.3-M003
- Hostapd (MMH) hostapd- 2.3-M003
- WAPI (MMH) 1.1.0-M034
- Android Version KK 4.4

Driver version:

- C : Indicated Marvell combo driver
- 3.X : indicated support for kernel version 3.x
- **Release Number:** this number tracks the incremental changes in the consequent driver releases given to QA or customers.
- **Patch Number:** Customers may want to receive a driver build based on a previous release plus

specific bug fixes, or patches. It is not unusual for customers to request this when they are close to production. The patch number starts at zero (no patch), and increments as we release subsequent builds with more bug fixes.

Firmware version:

- Following is an explanation of each digit in the versioning scheme designed for the firmware:
  - **Major Revision (first number from the left):** Tracks the main FW version.
  - **Minor Revision (second number from the left):** Tracks the chip family, firmware branch, custom projects. etc.
  - **Release Number (third number from the left):** this number tracks the incremental changes in the consequent firmware releases given to QA or customers.
  - **Patch Number (fourth number from the left):** Customers may want to receive a firmware build based on a previous release plus specific bug fixes, or patches. It is not unusual for customers to request this when they are close to production. The patch number starts at zero (no patch), and increments as we release subsequent builds with more bug fixes.

Bluetooth Host Software version:

- BlueZ - HCI Tool version 4.101 on FC18

3. Host Platform

- SD-SD 8897 on T50 Android Platform
- Interfaces used
  1. WLAN over SD
  2. BT over SD
  3. NFC over SD (shared with BT through vendor-specific HCI packets)

4. Tested HW

- WLAN SOC/RF chipset: 88W8897

5. Features

5.1 Wireless Client Features

1. 802.11 a/b/g Features

    - Data Rates (Up to 54 Mbps)
    - Tx Rate Adaptation (ABG)
    - Tx of RTS/CTS based upon RTS Threshold
    - Fragmentation/Defragmentation
    - ERP protection, Slot time, Preamble
    - ERP Protection using macctrl command (RTS-CTS/Self-CTS)

2. 802.11d & 802.11h
    - 802.11d - Regulatory Domain/Operating Class/Country Info
    - 802.11h - DFS - Radar Detection and CSA
    - DFS Radar Detection Tests for FCC/FCC1/ETSI/JP for W53/W56 channels

3. 802.11e -QoS
    - EDCA[Enhanced Distributed Channel Access] / WMM (Wireless Multi-Media)
    - U-APSD[Unscheduled Automatic Power save and Delivery]/ WMM-Power save

4. 802.11i - Security
    - Open and Shared Authentication
    - Auto Auth
    - WEP Security (64/128 bit)
    - WPA-PSK, WPA2-PSK Security (TKIP and AES-CCMP Encryption)
    - 802.1x EAP Authentication methods
      (TLS, TTLS, PEAP, SIM, AKA, AKA-PRIME, FAST, LEAP)
    - Opensource WPA Supplicant Support
    - Embedded Supplicant Support

5. 802.11w - Protected Management Frames (PMF)
    - PMF Require and Capable
    - Unicast Management Frames - Encrypt/Decryption -using CCMP
    - Broadcast Management Frames - Encrypt/Decryption - using BIP
    - SA Query Request/Response
    - PMF Support (Opensource WPA Supplicant)
    - PMF Support (Embedded Supplicant)

6. Security WAPI
    - WAPI-PSK
    - WAPI-CERT
    - WAPI-PKCS12

7. 802.11n - High Throughput (HT Mode)
    - 2.4GHz Band Operation
    - 5GHz Band Operation

- 20MHz and 40MHz channel Bandwidth
- Short/Long Guard Interval (400ns/800ns)
- Green Field Operation
- 2 Spatial stream (2x2)
- 11n Data rates – Up to 300 Mbps (MCS 0 to MCS 15)
- HT Duplicate mode (MCS32)
- Tx MCS Rate Adaptation (ABGN)
- AMPDU Tx and Rx Support
- AMSDU-4k Tx and Rx Support
- Explicit Beam forming
- HT Protection Mechanisms
- 20/40 MHz Coexistence Support
- STBC Rx
- LDPC Parity

8. 802.11 ac - Very High Throughput (VHT Mode) *

(*Note: In addition to above 802.11n features)

- 20/40/80 MHz Channel Bandwidth
- 11ac Data rates – Up to 866.7 Mbps (MCS 0 to MCS 9)
- 256 QAM Modulation - MCS8 and MCS9
- Explicit Beam forming
- RTS/CTS with BW Signaling
- CCA on Secondary Channel
- Backward Compatibility with non-VHT devices
- VHT Tx Rate Adaptation(802.11ac)

9. General Features
   - Auto Deep Sleep
   - Host Sleep (hscfg)
   - Background Scan
   - User Defined Scan (setuserscan)
   - Specific scan (scancfg)
   - Network Scan (iwlist scan)
   - Extended Scan
   - ARP Filter
   - Inactivity time out
   - Subscriber Event
   - Auto Response (MEF)
   - Auto Tx
   - Vendor Specific IE (Custom IE)
   - Broadcast/Multicast data Tx/Rx Support
   - Antenna Config Command Tests
   - Signal Commands Tests (RSSI/SNR)

10. Power Save Modes
    - IEEE PS (Infrastructure Mode)
    - PPS
    - Inactivity Timeout
    - Listen Interval

11. WPS/WSC2.0 Functionality (Using mwu app)
    - PIN Config Method - 8 Digit/4 Digit
    - PIN Config Method - Static/Dynamic PIN
    - PBC - Virtual Push Button Config Method
    - STA as Enrollee
    - STA as Registrar
    - Auto PIN
    - Auto PBC
    - Backward Compatibility with WPS1.0 Devices
    - Using mwu_cli app with Embedded Supplicant
    - Using mwu_cli app with Opensource WPA Supplicant
    - Using wpa_supplicant

12. 802.11k – Radio Resource Measurement
    - Beacon Report
    - Link Measurement
    - Power Measurement
    - Neighbor Report
    - Traffic Stream/Category Measurement

13. 802.11v – Wireless Network Management
    - Transition Management

14. 802.11r – Fast BSS Transition (FT)
    - FT over Air
    - FT over DS (Distribution System)

15. 802.11z – Tunneled Direct Link Setup (TDLS)
    - Host Based TDLS Support using wpa_supplicant
    - TDLS Discovery
    - TDLS Link Setup
    - TDLS Link Teardown
    - TDLS Security (TDLS Link possible with Peers using WPA2-AES Security)
    - TDLS Channel Switching
    - Concurrent operation of STA-Infra Link and TDLS Link.

16. 802.11u – Hotspot 2.0 / Passpoint R2 (Release 2)
    - GAS/ANQP Query
    - NAI Home Realm Query
    - Operating Class Indication
    - EAP SIM and EAP- AKA Methods
    - User Preference – (Re)Association using Stored/preferred Credentials
    - Proxy ARP Service – Discards Gratuitous ARP/ Unsolicited Neighbor Advertisement
    - Home Service Provider and Visited Service Provider
    - Subscription Remediation – SOAP-XML/OMA-DM
    - Policy Update – password/renewal
    - Network Selection and Access

- Online Sign-up
- WNM Notification Request (De-authentication Imminent)
- Failed Authentication Attempts - Blacklist Credentials
- (Re) Authentication delay for De-authentication Imminent Notice
- SP Multi Credentials Priority/Policy
- Minimum Backhaul Threshold Policy
- Roaming Network
- Required Proto Port Tuple Policy Evaluation
- Maximum BSS Load Value Policy Compliance

5.2 Access Point Features

1. 802.11 a/b/g Features
   - Data Rates (Up to 54 Mbps)
   - Tx Rate Adaptation (ABG)
   - Tx of RTS/CTS based upon RTS Threshold
   - Fragmentation/Defragmentation
   - ERP protection, Slot time, Preamble
   - Handling Associated STAs with IEEE PS - PS-Poll and Null Data

2. 802.11d & 802.11h
   - 802.11d - Regulatory Domain/Operating Class/Country Info
   - 802.11h - DFS - Radar Detection and CSA
   - DFS Radar Detection Tests for FCC/FCC1/ETSI/JP for W53/W56 channels

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   - EDCA[Enhanced Distributed Channel Access] / WMM (Wireless Multi-Media)
   - U-APSD[Unscheduled Automatic Power save and Delivery]/ WMM-Power save

4. 802.11i - Security
   - Open and Shared Authentication
   - Auto Auth
   - WEP Security (64/128 bit)
   - WPA-PSK, WPA2-PSK Security (TKIP and AES-CCMP Encryption)
   - 802.1x EAP Authentication methods (using Hostapd only)
     (TLS, TTLS, PEAP, SIM, AKA, AKA-PRIME, FAST, LEAP)
   - Opensource Host based Authenticator Support (Hostapd)
   - Embedded Authenticator Support
   - Group Key Refresh (Rekeying GTK)

5. 802.11w - Protected Management Frames (PMF) - using Hostapd only
   - PMF Require and Capable
   - Unicast Management Frames - Encrypt/Decryption -using CCMP
   - Broadcast Management Frames - Encrypt/Decryption - using BIP
   - SA Query Request/Response
   - PMF Support (using Hostapd only)

6. Security - WAPI
    - WAPI-PSK
    - WAPI-CERT
    - WAPI-PKCS12

7. 802.11n - High Throughput
    - 2.4GHz Band Operation
    - 5GHz Band Operation
    - 20/40 MHz channel Bandwidth
    - Short/Long Guard Interval (400ns/800ns)
    - Green Field Operation
    - 2 Spatial stream (2x2)
    - 11n Data rates – Up to 300 Mbps (MCS 0 to MCS 15)
    - HT Duplicate mode (MCS32)
    - Tx MCS Rate Adaptation (802.11n)
    - Aggregation - AMPDU and AMSDU4K Support
    - AMSDU 4K Over AMPDU Support
    - HT Protection Mechanisms
    - 20/40 MHz Coexistence Support
    - Explicit Beam forming
    - SM Power save (MIMO Power save)
    - LDPC Parity

8. 802.11 ac - Very High Throughput*
   (*Note: In addition to above 802.11n features)
    - 2.4GHz Band Operation
    - 5GHz Band Operation
    - 20/40/80 MHz channel Bandwidth
    - Short/Long Guard Interval (400ns/800ns)
    - 11ac Data rates – Up to 866.7 Mbps (MCS 0 to MCS 9)
    - 256 QAM Modulation - MCS8 and MCS9
    - SU-AMPDU Tx/Rx Support
    - AMSDU - 4K Tx/Rx Support
    - Explicit Beam forming
    - Backward Compatibility with non-VHT devices
    - VHT Tx Rate Adaptation

9. General Features
    - Auto Deep Sleep
    - Host Sleep (hscfg)
    - Automatic Channel Selection (ACS)
    - Hidden SSID (Broadcast SSID Disabled)
    - MAC Address Filter (Allowed/Denied List)
    - Vendor Specific IE (Custom IE)
    - STA Age out Feature for non-PS clients
    - STA Age out Feature for Power save clients
    - Configurable MAX Supported Stations (Up to 10)
    - Configurable Retry Limit
    - Configurable Unicast Data Rate
    - Configurable Broadcast/Multicast Data Rate

- Broadcast/Multicast data Tx/Rx Support
- Antenna Config Command Tests
- MMH Events
- BSS Privacy Control (Packet forward Control) or AP Isolation
- Sticky TIM
- Restrict Client Associations based on Phy mode (a/b/bg/n/ac)

10. MMH Power Save Modes
    - Inactivity based Power save

11. Multi-BSS support
    - MAX MMH BSS = 2
    - MMH power save in MBSS scenario
    - Independent security configurations on different interfaces (All Security Methods)

12. WPS/WSC2.0 Functionality (using mwu app)
    - PIN Config Method - 8 Digit/4 Digit
    - PIN Config Method - Static/Dynamic PIN
    - PBC - Virtual Push Button Config Method
    - AP Setup Locked State - PIN Method
    - MMH as Enrollee
    - MMH as Wireless Registrar
    - Using mwu_cli app

5.3 Wi-Fi Direct / P2P Features

1. P2P Basic Functionality
    - Protocol conformance tests
    - Autonomous GO Mode
    - WFD Client Mode

2. P2P Backward Compatibility
    - Non P2P Client Association with GO

3. P2P Client Power save
    - P2P Client with IEEE Power save enabled
    - P2P Client with WMM PS enabled
    - P2P Client with NoA PS enabled on GO
    - P2P Client with Opportunistic PS enabled on GO

4. P2P GO Power save
    - GO Operating with IEEE PS Clients(PS-Poll and non_PS-Poll)
    - GO Operating with WMM PS Clients
    - GO power save

5. Other P2P Features
    - Max Client Support (Up to 8 Devices)
    - Provision Discovery
    - Persistent Group
    - P2P Invitation

5.4 Wi-Fi Display / Miracast Features

- Miracast over P2P Support using Marvell Wireless Utility(MWU APP)
- WiFi Display Source under Test (SoUT)
- WiFi Display Primary Sink under Test (P-SnUT)
- WiFi Display over P2P Link
- Provision Discovery

1. SoUT and P-SnUT Support for
   - UIBC with Generic User Input
   - UIBC with HID
   - HDCP Encryption of audio and video Content
   - Frame Skipping
   - Explicit AV Format Change
   - Standby Capabilities
   - Remote I2C Read/Write Capabilities
   - Concurrent WLAN Operation
   - Persistent P2P Group
2. P-SnUT Support for
   - Video Recovery
   - Extended Display Identification Data (EDID)

5.5 Wi-Fi Aware / Neighbor Awareness Network (NAN) Features

- NAN Discovery
- Timing synchronization
- Operating in Discovery Windows

1. NAN Device Role Selection and State Transition
   - Anchor Master
   - Non-Master and Sync
   - Non-Master and non-Sync
2. NAN Cluster
   - Initiation
   - Selection
   - Merging
3. NAN Service Discovery Methods
   - Publish
   - Cancel Publish
   - Subscribe
   - Follow-up Transmit
4. NAN Service Discovery Events (Discovery Result, Replied, Publish Terminated, Subscribe Terminated, Follow-up Receive)
5. NAN Control and Filtering Function (Matching, Service Response Filter, Bloom Filter)

5.6 Simultaneous AP-STA Operation

- AP-STA Simultaneous functionality.
- Independent security configurations on different interfaces.
- Enhanced Power Save (AP-STA simultaneous power save)

5.7 DRCS (Dynamic Rapid Channel Selection) Operation

- DRCS in AP-STA scenario
  - MMH and STA can operate in two different channels in same/different band.
  - Applicable Cases:
    a) MMH and STA (uap0 + mlan0)
    b) P2P-GO and STA (wfd0+mlan0)
    c) P2P-GC and MMH (wfd0+uap0)
    d) P2P-GO and P2P-GC (wfd0 + wfd1)

- DRCS in AP-AP scenario
  - MBSS can operate in two different channels in same/different band.
  - Applicable Cases:
    a) MMH MBSS (uap0+uap1)
    b) P2P-GO and MMH (wfd0+uap0)

- DRCS in STA-STA scenario
  - STA-STA can operate in two different channels in same/different band.
    a) P2P-Client + STA (wfd0+mlan0)

- DRCS in 3 WLAN Interfaces Active
  - Can operate in two different channels in same/different band
  - Applicable Cases:
    a) Channel X (uap0 , mlan0) + Channel Y (uap1)
    b) Channel X (uap0 , uap1) + Channel Y (mlan0)
    c) Channel X (uap0 , mlan0) + Channel Y (wfd0)
    d) Channel X (wfd0 , uap0) + Channel Y (mlan0)
    e) Channel X (wfd0 , mlan0) + Channel Y (uap0)

5.8 Bluetooth Features

- BT 4.2
- BT Class 1.5 and Class 2 support
- Automatic Packet Type Selection
- 2.5 scatternet support
- Maximum of seven simultaneous ACL connections
- Maximum of three SCO/eSCO links
- ACL (DM1, DH1, DM3, DH3, DM5, DH5, 2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5)
- SCO (HV1, HV3)
- eSCO (EV3, EV4, EV5, 2EV3, 3EV3, 2EV5, 3EV5)
- Deep Sleep
- BT A2DP/PAN traffic distinction
- Wake on BT
- BR/EDR secure connections
- LE 4.2 features – LE secure connection, LE Privacy 1.2
- Spatial / Time shared Coexistence support
- BLE (7 Active links support)

5.9 NFC Features

- NCI 1.0 support according to NFC Forum specification
- Full protocol support for NFC Forum, ISO 14443A/B, ISO 18092, ISO 15693, NFCIP-2, EMV contactless targets
- Reader/Writer, Card Emulation and Peer-to-peer modes
- Data rates up to 848 kbps
- Deep Sleep
- Proprietary Low-Power Target Detection mode to reduce standby current consumption
- NFCC card emulation fully handled by NFC chip (no host required), for standard NDEF tag types over ISO14443-4 A/B protocols.
- On-Host card emulation: supported in NFC A, B, F and V technologies.
- Off-Host card emulation with UICCs and Embedded SEs:
    - ETSI TS 102 613: SWP/CLT ISO14443 Type A (Mifare) and ISO18093 212/424 kbps passive mode (FeliCa).
    - ETSI TS 102 622: SWP/HCI ISO14443A/B and ISO18092 212/424 kbps passive mode
    - DCLB
- Compliant with EMVCo book D (Contactless Communication Protocol)

6. Testing

6.1 Test Tools:

- OmniPeek Wireless Sniffer
- iperf (Version 2.0.5)
- Frontline BT Sniffer
- Keysight- T3111S NFC Conformance Test System
- Comprion CLT Move / Move 2 (NFC)
- Keolabs ProxiSPY / ContactLAB (NFC)
- Frontline ComProbe NFC Protocol Analyzer

7. WLAN Throughput

7.1 STA Throughput

Ref. AP	Linksys WRT1900AC | with Linux Backend
Environment	Shielded Environment (Non Cabled up Setup)
Default Channel	6 for 2.4GHz (Short GI) | 36 for 5GHz (Short GI)

STA Infra Mode Throughput - BGN Mode | 2.4GHz Band								
Security	20MHz				40MHz			
	TCP		UDP		TCP		UDP	
	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx
OPEN	100.00	104.00	119.30	113.00	202.80	215.40	239.70	239.60
WPA2	89.00	98.00	104.20	112.00	198.90	215.40	239.10	239.50

STA Infra Mode Throughput - AC Mode | 5GHz Band												
Security	20MHz				40MHz				80MHz			
	TCP		UDP		TCP		UDP		TCP		UDP	
	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx
OPEN	120.00	133.20	138.00	142.30	274.40	304.30	338.60	337.00	460.20	456.00	507.00	542.10
WPA2	118.80	132.80	138.00	141.90	260.80	303.80	323.10	336.60	424.10	456.00	505.00	538.00

7.2 MMH Throughput

Ref. STA Details	PCIe-UART 8897 – 15.68.7.p35-C2615C099-GPL-(FP68)
Environment	Over the Air in Shield Box
Default Channel	6 for 2.4GHz (Short GI) | 36 for 5GHz (Short GI)

MMH Mode Throughput - BGN Mode | 2.4GHz Band								
Security	20MHz				40MHz			
	TCP		UDP		TCP		UDP	
	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx
OPEN	97.50	104.00	107.00	117.00	199.00	208.00	219.00	245.00
WPA2	85.60	93.90	101.00	110.00	193.00	205.00	216.00	243.00

MMH Mode Throughput - AC Mode | 5GHz Band												
Security	20MHz				40MHz				80MHz			
	TCP		UDP		TCP		UDP		TCP		UDP	
	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx
OPEN	110.00	123.70	128.00	138.90	291.50	281.10	319.10	339.90	435.00	452.90	491.20	541.00
WPA2	109.00	120.90	125.00	138.80	280.40	266.10	305.00	326.10	418.00	411.20	489.00	541.00

8. Bug Fixes

Component	Description
BT	Enhancements in WBS TX path
MMH	Low throughput observed in Rx VHT80-WPA2 security configuration.

9. Known issues

Component	Description
P2P	WFA P2P certification in progress
HS2.0	WFA HS2.0 certification in progress
STA	WFA Voice-Personal certification in progress

10. Serial and Parallel Download

To set Board to Serial or Parallel FW download mode the H/W strap setting needs to be done using pull up register. Please refer Section 1.5 from data sheet for 8897

Parallel download: The WLAN and BT FW are downloaded independently. WLAN driver will download WLAN-only firmware and BT driver will download BT-only firmware. The Separate WLAN and BT FW binaries should be used when using parallel download and are provided in the release package “FwImage” folder.

WLAN only Firmware: sd8897_wlan.bin

BT Only Firmware: sd8897_bt.bin

i.e.

1. Download WLAN only firmware: (Copy FW image in /lib/firmware/mrvl)

i. insmod mlan.ko

ii. insmod sd8897.ko fw_name=mrvl/sd8897_wlan.bin

2. Download BT Only Firmware:

i. insmod bt8897.ko fw_name=mrvl/sd8897_bt.bin

Serial Download: Serial downloading is for WLAN and BT driver download WLAN/BT combo firmware, when one of them has already downloaded combo firmware, the other one will skip firmware downloading. The WLAN/BT combo firmware should be used when using serial download.

WLAN/BT Combo Firmware: sd8897_uapsta.bin

i.e. insmod sd8897.ko fw_name=mrvl/ sd8897_uapsta.bin

11. Simultaneous Mode use cases

Single Channel Simultaneous Mode Use Cases								
mlan 0	uap 0	uap 1	wfd0	mlan0	uap 0	uap 1	wfd0	Use case
Channel X				Channel Y				
								Standalone Modes - Single State
Y								STA only Mode
	Y							MMH(Single -BSS) only Mode
			Y					P2P only mode - P2P_GO | P2P_Client
								Simultaneous Modes - Dual State involving MMH and STA
	Y	Y						MMH (Multiple-BSS - max_uAP_BSS =2) Mode
Y	Y							Simultaneous STA + MMH(Single -BSS) Mode
Y	Y	Y						Simultaneous STA + MMH (Multiple-BSS - max_uAP_BSS =2) Mode
								Simultaneous Modes - Dual State involving P2P and STA
Y			Y					Simultaneous STA + P2P-GO Mode
Y			Y					Simultaneous STA + P2P-Client Mode
								Simultaneous Modes - Dual State involving P2P and MMH
	Y		Y					Simultaneous MMH (Single-BSS) + P2P-GO Mode
	Y		Y					Simultaneous MMH (Single-BSS) + P2P-Client Mode
								Simultaneous Modes - Multi-State involving P2P + MMH + STA
Y	Y		Y					Simultaneous STA + MMH (Single-BSS) + P2P-GO Mode
Y	Y		Y					Simultaneous STA + MMH (Single-BSS) + P2P-Client Mode

Dual Channel Simultaneous Mode Use Cases								
mlan 0	uap 0	uap 1	wfd 0	mlan 0	uap 0	uap 1	wfd0	Use case
Channel X				Channel Y				DRCS Mode Use Cases
								DRCS Modes - Dual State involving MMH
	Y					Y		MMH (Multiple-BSS - max_uAP_BSS =2) Mode
								DRCS Modes - Dual State involving MMH and STA
Y					Y			Simultaneous STA + MMH Mode
Y	Y					Y		Simultaneous STA + MMH (Multiple-BSS - max_uAP_BSS =2) Mode
	Y	Y		Y				Simultaneous STA + MMH (Multiple-BSS - max_uAP_BSS =2) Mode
								DRCS Modes - Dual State involving P2P and STA
Y							Y	Simultaneous STA + P2P-GO Mode

Y							Y	Simultaneous STA + P2P-Client Mode
								DRCS Modes - Dual State involving P2P and MMH
	Y						Y	Simultaneous MMH (Single-BSS) + P2P-GO Mode
	Y						Y	Simultaneous MMH (Single-BSS) + P2P-Client Mode
								Simultaneous Modes - Multi-State involving P2P + MMH + STA
Y	Y						Y	Simultaneous STA + MMH (Single-BSS) + P2P-GO Mode
	Y			Y			Y	Simultaneous STA + MMH (Single-BSS) + P2P-GO Mode
	Y		Y	Y				Simultaneous STA + MMH (Single-BSS) + P2P-GO Mode

12. Notes

12.1 Simultaneous AP-STA Limitations:

- MMH BSS beacons are paused unconditionally whenever In-STA Performs scan and are resumed automatically once the scan is complete.
- TX power settings, Radio control commands, Antenna config commands, Wireless slot, 802.11d are not unified across MMH and In-STA interfaces.
- Custom IE Buffers are shared between two interfaces (uap0 and mlan0). IE_Buffer Index used by one interface cannot be used by other interface.
- Notes:
  - Ex-AP - External AP (AP to which mlan0 interface is associated)
  - In-STA - Internal Station (mlan0 interface)
  - Ex-STA - External Stations associates to MMH.
  - uAP - Micro AP/ MMH – (Marvell Mobile Hotspot)

12.2 Multi-BSS (MBSS) Limitations:

- TX power settings, Radio control commands, Antenna config commands, wireless slot, 802.11d are not unified across two interfaces.
- Custom IE Buffers are shared between two interfaces. IE_Buffer Index used by one interface cannot be used by other interface.

12.3 DRCS IOT/performance limitations:

- The Beacon Interval of MMH/Ex-AP/P2P-GO has to be 100 TU (102.4ms).
- Device power saves with DRCS is not supported.
- Using Null packets with NAV will have an adverse impact on neighboring BSS present on same channel
- Performance cannot be guaranteed across different clients & environment. Limitations are protocol and eco system related and not Marvell specific.

- STA can operate only in Infrastructure mode in DRCS Scenarios. Adhoc/IBSS and TDLS Connections are not supported.
- NAN/WiFi Aware is supported in Standalone Mode Only.

12.4 TDM Support for Coex:

- Default Coex mode for 8897 is Spatial, therefore to enable TDM mode please use following commands.

  - Command to check current mode:
  #./mlanutil mlan0 hostcmd config/robust_btc.conf mode_get

  - Command to change the Coex mode to TDM mode:
  #./mlanutil mlan0 hostcmd config/robust_btc.conf mode_timeshare