RN00104

NXP Wireless SoCs Linux Release Notes

Rev. 9 — 4 October 2023 **Release notes**

Document information

Information	Content
Keywords	PCIE-Wi-Fi-UART-BT-FP92-88W9098, PCIE-Wi-Fi-UART-BT-FP92-88W8997, SD-Wi-Fi-UART-BT-FP92-88W9098, SD-Wi-Fi-UART-BT-FP92-88W8997, SD-Wi-Fi-UART-BT-FP92-88W8987, SD-Wi-Fi-UART-BT-FP92-IW416, SD-Wi-Fi-UART-BT-FP99-IW612, SD-Wi-Fi-FP92-88W8801
Abstract	Linux release notes for NXP wireless SoCs

1 Revision history

Revision history

Revision	Date	Change details
v. 9	4 October 2023	Updated: • Section 4 "Feature lists" • Section 5.1 "PCIe-UART 9098" • Section 5.2 "SD-UART 8997" • Section 5.3 "PCIe-UART 8997" • Section 5.4 "SD-UART 9098" • Section 5.5 "SD-UART IW612" • Section 5.6 "SD-UART 8987" • Section 5.7 "SD-UART IW416" • Section 5.8 "SD 8801"
v. 8	29 June 2023	Updated: • Section 4 "Feature lists" • Section 5.1 "PCIe-UART 9098" • Section 5.2 "SD-UART 8997" • Section 5.3 "PCIe-UART 8997" • Section 5.4 "SD-UART 9098" • Section 5.5 "SD-UART IW612" • Section 5.6 "SD-UART 8987" • Section 5.7 "SD-UART IW416" • Section 5.8 "SD 8801"
v. 7	29 March 2023	Updated: • Section 4 "Feature lists" • Section 5.1 "PCIe-UART 9098" • Section 5.2 "SD-UART 8997" • Section 5.3 "PCIe-UART 8997" • Section 5.4 "SD-UART 9098" • Section 5.5 "SD-UART IW612" • Section 5.6 "SD-UART 8987" • Section 5.7 "SD-UART IW416" • Section 5.8 "SD 8801" • Section 6 "i.MX platforms on-board chips and external wireless solutions"
v. 6	16 December 2022	Updated: • Section 4 "Feature lists" • Section 5.1 "PCIe-UART 9098" • Section 5.2 "SD-UART 8997" • Section 5.3 "PCIe-UART 8997" • Section 5.4 "SD-UART 9098" • Section 5.6 "SD-UART 8987" • Section 5.7 "SD-UART IW416" • Section 5.8 "SD 8801" • Section 6 "i.MX platforms on-board chips and external wireless solutions" • Section 7 "Acronyms and abbreviations"

Revision history...*continued*

Revision	Date	Change details
v. 5	27 September 2022	Updated: • Section 4 "Feature lists" • Section 5.1 "PCIe-UART 9098" • Section 5.2 "SD-UART 8997" • Section 5.3 "PCIe-UART 8997" • Section 5.4 "SD-UART 9098" • Section 5.4.8 "Known issues" • Section 5.7 "SD-UART IW416" • Section 5.8 "SD 8801" • Section 7 "Acronyms and abbreviations"
v. 4	28 June 2022	Updated: • Section 4 "Feature lists" • Section 5.1 "PCIe-UART 9098" • Section 5.2 "SD-UART 8997" • Section 5.3 "PCIe-UART 8997" • Section 5.4 "SD-UART 9098" • Section 5.4.8 "Known issues" • Section 5.7 "SD-UART IW416" • Section 5.8 "SD 8801" • Section 7 "Acronyms and abbreviations"
v. 3	24 March 2022	• Added SD-UART 88W9098 Updated: • Section 5.1.4 "Wi-Fi and Bluetooth certification" • Section 5.3.4 "Wi-Fi and Bluetooth certification" • Section 5.4.4 "Wi-Fi and Bluetooth certification" • Section 5.6.4 "Wi-Fi and Bluetooth certification" • Section 5.7.4 "Wi-Fi and Bluetooth certification" • Section 5.8.4 "Wi-Fi Certification" • Bluetooth certification links
v. 2	24 January 2022	• Added the link for the WPA3-R3 support. • Section 5.8.1 "Package information": updated. • Section 5.8.2 "Version information": updated.>
v.1	14 December 2021	Initial release

2 About this document

This document includes information about the supported features, driver and firmware release versions, fixed/known issues, and the performance of the Wi-Fi, Bluetooth and coexistence.

The release has been tested for wireless SoCs mentioned in Section 2.2 with Linux BSP version v6.1.36_2.1.0.

2.1 References

Table 1. References

Reference type	Description
Application note	AN12976 – Wi-Fi Alliance Derivative Certification (link)
User manual	UM11675 - How to Download and Build NXP Wi-Fi Drivers (link)

2.2 Supported SoCs

- PCIE-Wi-Fi-UART-BT-FP92-88W9098
- PCIE-Wi-Fi-UART-BT-FP92-88W8997
- SD-Wi-Fi-UART-BT-FP92-88W9098
- SD-Wi-Fi-UART-BT-FP92-88W8997
- SD-Wi-Fi-UART-BT-FP92-88W8987
- SD-Wi-Fi-UART-BT-FP92-IW416
- SD-Wi-Fi-UART-BT-FP99-IW612
- SD-Wi-Fi-FP92-88W8801

3 Downloading wireless driver/utilities and firmware

For the latest wireless driver/utility and firmware, refer to:

- Section "Pre-compiled Wi-Fi driver and firmware"
- Section "Wi-Fi utilities (mlanutl)"
- Section "Wi-Fi driver source and firmware"
- Section "Wi-Fi patch"

3.1 Pre-compiled Wi-Fi driver and firmware

The Linux BSP image will have wireless firmware and pre-compiled drivers on following paths:

For driver modules: `/lib/modules/<kernel-version>/extra/`

For firmware binary: `/lib/firmware/nxp/`

3.2 Wi-Fi utilities (mlanutl)

The mlanutl is not part of the Linux BSP image version v.1.36_2.1.0 nor the GitHub source release tag: `lf-6.1.36_2.1.0 .`

The source is available at:

https://github.com/nxp-imx/mwifiex/tree/lf-5.15.52_2.1.0/mxm_wifiex/wlan_src/mapp/mlanutl

3.3 Wi-Fi driver source and firmware

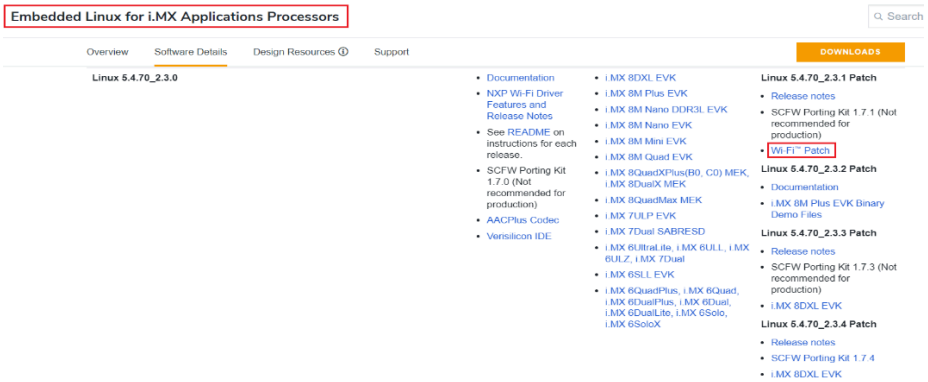
To download the Wi-Fi driver and wireless firmware releases, refer to the user manual *>How to Download and Build NXP Wi-Fi Drivers* (Section 2.1).

Note:

- *UART driver source code is open source and part of the Linux kernel source.*
- *UART driver source code used for Bluetooth is NOT part of the release package. To download the code, go to kernel.org.*

3.4 Wi-Fi patch

Intermediate fixes are posted on the website. See the example below:



https://www.nxp.com/design/software/embedded-software/i-mx-software/embedded-linux-for-i-mx-applications-processors:IMXLINUX

4 Feature lists

4.1 Wi-Fi radio

4.1.1 Client mode

Table 2. Feature list for Wi-Fi radio and client mode

Feature	Sub feature	PCIe-UART		SD-UART					SD
		9098	8997	9098	IW612	8997	8987	IW416	8801
802.11n - High Throughput	2.4 GHz band supported channel bandwidth: 20 MHz	Y	Y	Y	Y	Y	Y	Y	Y
	2.4 GHz band supported channel bandwidth: 40 MHz [1]	Y	Y	Y	Y	Y	Y	Y	N
	5 GHz band supported channel bandwidth: 20 MHz	Y	Y	Y	Y	Y	Y	Y	N
	5 GHz band supported channel bandwidth: 40 MHz	Y	Y	Y	Y	Y	Y	Y	N
	Short/long guard interval (400 ns/800 ns)	Y	Y	Y	Y	Y	Y	Y	Y
	11n data rates – Up to 72 Mbit/s (MCS 0 to MCS 7)	Y	Y	Y	Y	Y	Y	Y	Y
	11n data rates – Up to 150 Mbit/s (MCS 0 to MCS 7)	Y	Y	Y	Y	Y	Y	Y	N
	11n data rates - Up to 300 Mbit/s (MCS 0 to MCS 15)	Y	Y	Y	N	Y	N	N	N
	1 spatial stream (1x1)	Y	Y	Y	Y	Y	Y	Y	Y
	2 spatial stream (2x2)	Y	Y	Y	N	Y	N	N	N
	HT protection mechanisms	Y	Y	Y	Y	Y	Y	Y	Y
	Explicit Beamformee	Y	Y	Y	N	Y	N	N	N
	Aggregated MAC Protocol Data Unit(AMPDU) Rx support	Y	Y	Y	Y	Y	Y	Y	Y
	Aggregated MAC Service Data Unit(AMSDU) -4k Rx support	Y	Y	Y	Y	Y	Y	Y	Y
	20/40 MHz Coexistence	Y	Y	Y	Y	Y	N	N	N
	Tx MCS rate adaptation (BGN)	Y	Y	Y	Y	Y	Y	Y	Y
	RX and TX Space time block coding for 2x2 (STBC)	Y	Y	Y	N	Y	N	N	N
	Rx Low Density Parity Check (LDPC)	Y	Y	Y	Y	Y	Y	N	N

Table 2. Feature list for Wi-Fi radio and client mode*...continued*

Feature	Sub feature	PCIe-UART		SD-UART					SD
		9098	8997	9098	IW612	8997	8987	IW416	8801
802.11 ac - Very High Throughput	5 GHz band supported channel bandwidth: 20 MHz	Y	Y	Y	Y	Y	Y	N	N
	5 GHz band supported channel bandwidth: 40 MHz	Y	Y	Y	Y	Y	Y	N	N
	5 GHz band supported channel bandwidth: 80 MHz	Y	Y	Y	Y	Y	Y	N	N
	11ac data rates - Up to 433.3 Mbps (MCS0 to MCS9)	Y	Y	Y	Y	Y	Y	N	N
	11ac Data rates - Up to 866.7 Mbps(MCS0 to MCS9)	Y	Y	Y	N	Y	N	N	N
	Short/Long Guard Interval (400ns/800ns)	Y	Y	Y	Y	Y	Y	N	N
	SU-AMPDU Aggregation	Y	Y	Y	Y	Y	Y	N	N
	MU-MIMO Beamformee (Explicit and Implicit)	Y	Y	Y	Y	Y	Y	N	N
	SU-Beamformee	Y	Y	Y	Y	Y	Y	N	N
	MU-MIMO RX – Wave 2	Y	Y	Y	Y	Y	Y	N	N
	RTS/CTS with BW Signaling	Y	Y	Y	Y	Y	Y	N	N
	Operation Mode Notification	Y	Y	Y	Y	Y	Y	N	N
	Backward Compatibility with non-VHT devices	Y	Y	Y	Y	Y	Y	N	N
	Tx VHT MCS Rate Adaptation	Y	Y	Y	Y	Y	Y	N	N
802.11 ax – High Efficiency	5 GHz band supported channel bandwidth: 20 MHz	Y	N	Y	Y	N	N	N	N
	5 GHz band supported channel bandwidth: 40 MHz	Y	N	Y	Y	N	N	N	N
	5 GHz band supported channel bandwidth: 80 MHz	Y	N	Y	Y	N	N	N	N
	11ax data rates - Up to 1.2 Gbps (MCS 0 to MCS 11) - 2x2	Y	N	Y	N	N	N	N	N
	11ax data rates - Up to 600 Mbps (MCS 0 to MCS 11) - 1x1	Y	N	Y	Y	N	N	N	N
	Operating Mode Indication(OMI) Control	Y	N	Y	Y	N	N	N	N
	2x/4x HE-Long Training Field(LTF)	Y	N	Y	Y	N	N	N	N
	Triggered Wake Time	Y	N	Y	Y	N	N	N	N
	1024 QAM	Y	N	Y	Y	N	N	N	N
	Spatial reuse	N	N	N	Y	N	N	N	N
	SU beamforming	N	N	N	Y	N	N	N	N
	UL (Tx) and DL (Rx) MU-MIMO	Y	N	Y	Y	N	N	N	N
	UL (Tx) and DL (Rx) OFDMA	Y	N	Y	Y	N	N	N	N
802.11 a/b/g Features	11b/g data rates - Up to 54 Mbit/s	Y	Y	Y	Y	Y	Y	Y	Y
	11a data rates - Up to 54 Mbit/s	Y	Y	Y	Y	Y	Y	Y	N
	Tx rate adaptation (BG)	Y	Y	Y	Y	Y	Y	Y	Y
	Fragmentation/defragmentation	Y	Y	Y	Y	Y	Y	Y	Y
	ERP protection, slot time, preamble	Y	Y	Y	Y	Y	Y	Y	Y

Table 2. Feature list for Wi-Fi radio and client mode*...continued*

Feature	Sub feature	PCIe-UART		SD-UART					SD
		9098	8997	9098	IW612	8997	8987	IW416	8801
802.11d and 802.11h	802.11d - Regulatory Domain/ Operating Class/Country Info	Y	Y	Y	Y	Y	Y	Y	Y
	Per-path regulatory power table[1]	N	N	N	Y	N	Y	N	N
	802.11h – Dynamic Frequency Selection (DFS)	Y	Y	Y	Y	Y	Y	Y	N
	DFS Radar Detection in Slave Mode (Follow AP)	Y	Y	Y	Y	Y	Y	Y	N
802.11e -QoS	EDCA [Enhanced Distributed Channel Access] / WMM (Wireless Multi-Media)	Y	Y	Y	Y	Y	Y	Y	Y
802.11i - Security	Open and Shared Authentication	Y	Y	Y	Y	Y	Y	Y	Y
	WPA2-PSK Security (AES-CCMP Encryption)	Y	Y	Y	Y	Y	Y	Y	Y
	WPA + WPA2 mixed mode	Y	Y	Y	Y	Y	Y	Y	Y
	Opensource WPA supplicant	Y	Y	Y	Y	Y	Y	Y	Y
	Embedded supplicant (WPA3-R1)[1]	Y	Y	Y	Y	Y	N	Y	N
	WPA2 Enterprise Security	Y	Y	Y	Y	Y	Y	Y	Y
	WAPI support[1]	Y	N	Y	Y	N	Y	N	N
WPA3 SAE (R3) Security	Simultaneous Authentication of Equals (SAE)	Y	Y	Y	Y	Y	Y	Y	Y
	SAE Connectivity and PMK Caching	Y	Y	Y	Y	Y	Y	Y	Y
	WPA2 Personal Compatibility	Y	Y	Y	Y	Y	Y	Y	Y
	Anti-Clogging	Y	Y	Y	Y	Y	Y	Y	Y
	Wi-Fi Enhanced Open	Y	Y	Y	Y	Y	Y	Y	N
	WPA3 host-based	Y	Y	Y	Y	Y	Y	Y	N
	SAE Finite Cyclic Group - Group-19, Group 20, Group 21	Y	Y	Y	Y	Y	Y	Y	Y
	Reflection Attack	Y	Y	Y	Y	Y	Y	Y	Y
	Suite B - 192-bit Security ECC p384	Y	Y	Y	Y	Y	Y	N	N
	Suite B - 192-bit Security RSA 3K	Y	Y	Y	Y	Y	Y	N	N
802.11r- Fast BSS Transition (FT)	FT over Air and over DS (Distribution System) [Open, WPA2 security]	Y	Y	Y	Y	Y	Y	Y	Y
802.11k	802.11k	Y	Y	Y	Y	Y	Y	Y	N
802.11v	802.11v	Y	Y	Y	Y	Y	Y	Y	N
802.11z	802.11z (Host based TDLS)	Y	Y	Y	Y	Y	Y	Y	N
802.11az	New generation Wi-Fi Location	N	N	N	Y	N	N	N	N
FIPS	FIPS support	Y	Y	Y	Y	Y	Y	Y	N

Table 2. Feature list for Wi-Fi radio and client mode*...continued*

Feature	Sub feature	PCIe-UART		SD-UART					SD
		9098	8997	9098	IW612	8997	8987	IW416	8801
WPS/WSC2.0 Functionality	PIN Config Method - 8 Digit/4 Digit	Y	Y	Y	Y	Y	Y	Y	Y
	PIN Config Method - Static/Dynamic PIN	Y	Y	Y	Y	Y	Y	Y	Y
	PBC - Virtual Push Button Config Method	Y	Y	Y	Y	Y	Y	Y	Y
	PBC Session Overlap Detection	Y	Y	Y	Y	Y	Y	Y	Y
	STA as Enrollee	Y	Y	Y	Y	Y	Y	Y	Y
	Backward Compatibility with WPS1.0 Devices	Y	Y	Y	Y	Y	Y	Y	Y
	Opensource WPA supplicant	Y	Y	Y	Y	Y	Y	Y	Y
DPP Functionality	Wi-Fi Easy Connect	Y	Y	Y	Y	Y	Y	Y	N
802.11w - PMF (Protected Management Frames)	PMF require and capable	Y	Y	Y	Y	Y	Y	Y	Y
	Unicast management frames - Encryption/decryption - using CCMP	Y	Y	Y	Y	Y	Y	Y	Y
	Broadcast management frames - Encryption/decryption - using BIP	Y	Y	Y	Y	Y	Y	Y	Y
	SA query request/response	Y	Y	Y	Y	Y	Y	Y	Y
	PMF Support using Opensource WPA	Y	Y	Y	Y	Y	Y	Y	Y
Power Save Mode	Deep sleep	Y	Y	Y	Y	Y	Y	Y	Y
	IEEE power save	Y	Y	Y	Y	Y	Y	Y	Y
	U-APSD / WMM power save[1]	Y	Y	Y	Y	Y	Y	Y	N

Table 2. Feature list for Wi-Fi radio and client mode*...continued*

Feature	Sub feature	PCIe-UART		SD-UART					SD
		9098	8997	9098	IW612	8997	8987	IW416	8801
General Features	EU adaptivity support	Y	Y	Y	Y	Y	Y	Y	Y
	Wake on Wireless (WoW)	Y	Y	Y	Y	Y	Y	Y	Y
	Auto Tx[1]	Y	Y	Y	Y	Y	Y	Y	Y
	Cloud keep alive[1]	Y	Y	Y	Y	Y	Y	Y	Y
	MAC Address randomization(in Scan)	Y	Y	Y	Y	Y	Y	Y	Y
	Host-based MLME [2]	Y	Y	Y	Y	Y	Y	Y	Y
	Driver load time parameters for Manufacturing mode	Y	N	Y	N	N	N	N	N
	Extended channel switch announcement (ECSA)	Y	Y	Y	Y	Y	Y	Y	N
	Independent reset (In-band)	Y	Y	Y	Y	Y	Y	Y	N
	Wi-Fi Agile Multiband	Y	Y	Y	Y	Y	Y	Y	N
	Wireless Apple Car Play (R5)	Y	N	Y	Y	N	Y	N	N
	CSI[1]	N	Y	N	Y	Y	N	N	N
	Packet Coalescing[1]	Y	Y	Y	Y	Y	Y	Y	N
	mDNS (Bonjour) Offload	N	Y	N	Y	Y	Y	Y	N
	Mdns wake on match	N	N	N	Y	N	N	N	N
	IPv6 NS Offload	N	Y	N	Y	Y	Y	Y	N
	Extended Range [1]	Y	N	Y	Y	N	N	N	N
	Clocksync [1]	Y	Y	Y	Y	Y	Y	N	N
	DCM	Y	N	Y	Y	N	N	N	N
	DRCS [1]	Y	N	Y	N	N	N	N	N
	Auto Reconnect	Y	Y	Y	Y	Y	N	Y	N
	Monitor Mode[1]	N	Y	N	Y	Y	Y	Y	N
	Wireless Android Auto (projection mode)	N	N	N	Y	N	N	N	N
	Android Automotive OS	Y	N	Y	Y	N	Y	N	N

[1] Contact your support representative to use this feature.
[2] Feature is enabled by default in software.

4.1.2 AP mode

Feature list for Wi-Fi radio and AP mode

Features List	Sub Features List	PCIe-UART		SD-UART					SD
		9098	8997	9098	IW612	8997	8987	IW416	8801
802.11n – High Throughput	2.4 GHz band supported channel bandwidth: 20 MHz	Y	Y	Y	Y	Y	Y	Y	Y
	2.4 GHz band supported channel bandwidth: 40 MHz[1]	Y	Y	Y	Y	Y	Y	Y	N
	5 GHz band supported channel bandwidth: 20 MHz	Y	Y	Y	Y	Y	Y	Y	N
	5 GHz band supported channel bandwidth: 40 MHz	Y	Y	Y	Y	Y	Y	Y	N
	1 spatial stream (1x1)	Y	Y	Y	Y	Y	Y	Y	Y
	2 spatial stream (2x2)	Y	Y	Y	N	Y	N	N	N
	Short/long guard interval (400 ns/800 ns)	Y	Y	Y	Y	Y	Y	Y	Y
	11n data rates – Up to 72 Mbit/s (MCS0 to MCS7)	Y	Y	Y	Y	Y	Y	Y	Y
	11n data rates – Up to 150 Mbit/s (MCS0 to MCS7)	Y	Y	Y	Y	Y	Y	Y	N
	11n data rates - Up to 300 Mbit/s (MCS0 to MCS15)	Y	Y	Y	N	Y	N	N	N
	Tx MCS rate adaptation (BGN)	Y	Y	Y	Y	Y	Y	Y	Y
	Aggregated MAC Protocol Data Unit(AMPDU) Tx and Rx support	Y	Y	Y	Y	Y	Y	Y	Y
	Aggregated MAC Service Data Unit(AMSDU) - 4k Rx support	Y	Y	Y	Y	Y	Y	Y	Y
	HT protection mechanisms	Y	Y	Y	Y	Y	Y	Y	Y
	RX and TX Space time block coding (STBC)	Y	Y	Y	N	Y	N	N	N
	20/40 MHz Coexistence	Y	Y	Y	Y	Y	N	N	N
	Explicit Beamformer	Y	Y	Y	N	Y	N	N	N
	RX Low Density Parity Check(LDPC)	Y	Y	Y	Y	Y	Y	N	N
802.11 b/g Features	11 b/g data rates – Up to 54 Mbit/s	Y	Y	Y	Y	Y	Y	Y	Y
	Tx rate adaptation (BG)	Y	Y	Y	Y	Y	Y	Y	Y
	ERP protection, slot time, preamble	Y	Y	Y	Y	Y	Y	Y	Y
	Handling of associated STAs with IEEE PS - null data	Y	Y	Y	Y	Y	Y	Y	Y

Feature list for Wi-Fi radio and AP mode*...continued*

Features List	Sub Features List	PCIe-UART		SD-UART					SD
		9098	8997	9098	IW612	8997	8987	IW416	8801
802.11 ac - Very High Throughput	5 GHz band supported channel bandwidth: 20 MHz	Y	Y	Y	Y	Y	Y	N	N
	5 GHz band supported channel bandwidth: 40 MHz	Y	Y	Y	Y	Y	Y	N	N
	5 GHz band supported channel bandwidth: 80MHz	Y	Y	Y	Y	Y	Y	N	N
	Short/Long Guard Interval (400ns/800ns)	Y	Y	Y	Y	Y	Y	N	N
	11ac Data rates – Up to 433.3 Mbps (MCS 0 to MCS 9) 1SS	Y	Y	Y	Y	Y	Y	N	N
	11ac Data rates - Up to 866.7 Mbps (MCS 0 to MCS 9) 2SS	Y	Y	Y	N	Y	N	N	N
	Single User- Aggregated MAC Protocol Data Unit (SU-AMPDU) Aggregation	Y	Y	Y	Y	Y	Y	N	N
	RTS/CTS with BW Signaling	Y	Y	Y	Y	Y	Y	N	N
	Backward Compatibility with non-VHT devices	Y	Y	Y	Y	Y	Y	N	N
	Tx VHT MCS Rate Adaptation	Y	Y	Y	Y	Y	Y	N	N
	Operation Mode Notification	Y	Y	Y	Y	Y	Y	N	N
	Explicit Beamformer	Y	Y	Y	N	Y	N	N	N
	SU-Beamformee	Y	Y	Y	Y	Y	Y	N	N
802.11 ax – High Efficiency	5 GHz band supported channel bandwidth: 20MHz	Y	N	Y	Y	N	N	N	N
	5 GHz band supported channel bandwidth: 40 MHz	Y	N	Y	Y	N	N	N	N
802.11 ax – High Efficiency	5 GHz band supported channel bandwidth: 80 MHz	Y	N	Y	Y	N	N	N	N
	Operating Mode Indication (OMI) Control	Y	N	Y	Y	N	N	N	N
	2x/4x HE-Long Training Field (LTF)	Y	N	Y	N	N	N	N	N
	1024 QAM	Y	N	Y	Y	N	N	N	N
	Spatial reuse	N	N	N	Y	N	N	N	N
	SU beamforming	N	N	N	Y	N	N	N	N
802.11d	802.11d - Regulatory Domain/Operating Class/Country Info	Y	Y	Y	Y	Y	Y	Y	Y
802.11h	802.11h - Dynamic Frequency Selection (DFS)	Y	Y	Y	Y	Y	Y	Y	N
	Zero Wait DFS	Y	N	Y	N	N	N	N	N
802.11e -QoS	EDCA [Enhanced Distributed Channel Access] / WMM (Wireless Multi-Media)	Y	Y	Y	Y	Y	Y	Y	Y
802.11az	New generation Wi-Fi Location [1]	N	N	N	Y	N	N	N	N

Feature list for Wi-Fi radio and AP mode *...continued*

Features List	Sub Features List	PCIe-UART		SD-UART					SD
		9098	8997	9098	IW612	8997	8987	IW416	8801
802.11i - Security	Open security	Y	Y	Y	Y	Y	Y	Y	Y
	WPA2-PSK security (AES-CCMP encryption)	Y	Y	Y	Y	Y	Y	Y	Y
	WPA + WPA2 mixed mode	Y	Y	Y	Y	Y	Y	Y	Y
	Opensource Hostapd	Y	Y	Y	Y	Y	Y	Y	Y
	Embedded authenticator (WPA3-R1) [1]	Y	Y	Y	Y	Y	N	Y	N
	WAPI support[1]	Y	N	Y	Y	N	Y	N	N
802.11mc	Wi-Fi location[1]	Y	N	Y	Y	N	N	N	N
WPA3 SAE (R3) Security	Simultaneous Authentication of Equals (SAE)	Y	Y	Y	Y	Y	Y	Y	Y
	SAE Connectivity and PMK Caching	Y	Y	Y	Y	Y	Y	Y	Y
	WPA3 host-based	Y	Y	Y	Y	Y	Y	Y	N
	Wi-Fi Enhanced Open	Y	Y	Y	Y	Y	Y	Y	N
	WPA3 Enterprise Suite-B Host supplicant based	Y	Y	Y	Y	Y	Y	N	N
802.11w - Protected Management Frames (PMF)	PMF require and capable	Y	Y	Y	Y	Y	Y	Y	Y
	Unicast management frames - Encryption/decryption - using CCMP	Y	Y	Y	Y	Y	Y	Y	Y
	Broadcast management frames - Encryption/decryption - using BIP	Y	Y	Y	Y	Y	Y	Y	Y
	SA query request/response	Y	Y	Y	Y	Y	Y	Y	Y
	Support using Hostapd	Y	Y	Y	Y	Y	Y	Y	Y
WPS/WSC2.0 Functionality	PIN Config Method - 8 Digit/4 Digit	Y	Y	Y	Y	Y	Y	Y	Y
	PIN Config Method - Static/Dynamic PIN	Y	Y	Y	Y	Y	Y	Y	Y
	PBC - Virtual Push Button Config Method	Y	Y	Y	Y	Y	Y	Y	Y
	PBC Session Overlap Detection	Y	Y	Y	Y	Y	Y	Y	Y
	AP Setup Locked State - PIN Method	Y	Y	Y	Y	Y	Y	Y	Y
	MMH as Wireless Registrar	Y	Y	Y	Y	Y	Y	Y	Y
	MMH as Enrollee	Y	Y	Y	Y	Y	Y	Y	Y
	Opensource Hostapd	Y	Y	Y	Y	Y	Y	Y	Y
General Features	EU adaptivity support	Y	Y	Y	Y	Y	Y	Y	Y
	Automatic channel selection (ACS)	Y	Y	Y	Y	Y	Y	Y	Y
	Host-based MLME[2]	Y	Y	Y	Y	Y	Y	Y	Y
	MBSS	N	N	N	Y	N	N	N	N
	Extended channel switch announcement (ECSA)	Y	Y	Y	Y	Y	Y	Y	N
	Driver load time parameters for Manufacturing mode	Y	N	Y	N	N	N	N	N
	Max supported stations (up to 8)	N	Y	N	N	Y	Y	Y	Y
	Max supported stations (up to 64 or 16)	Y	N	Y	Y	N	N	N	N
	Independent reset (in-band)	Y	Y	Y	Y	Y	Y	Y	N

[1] Contact your support representative to use this feature.

[2] Feature is enabled by default in software.

4.1.3 Wi-Fi Direct/P2P, and AP-STA modes

Feature list for Wi-Fi radio, Wi-Fi Direct/P2P, and AP-STA modes

Mode	Features List	Sub Features List	PCIe-UART		SD-UART					SD
			9098	8997	9098	IW612	8997	8987	IW416	8801
Wi-Fi Direct/ P2P	P2P Basic Functionality	Autonomous GO Mode	Y	Y	Y	Y	Y	Y	Y	Y
		WFD Client Mode	Y	Y	Y	Y	Y	Y	Y	Y
		P2P for Miracast	Y	Y	Y	Y	Y	Y	Y	N
		P2P Device Mode	Y	Y	Y	Y	Y	Y	Y	Y
AP-STA	Simultaneous AP-STA Operation (Same Channel)	AP-STA functionality	Y	Y	Y	Y	Y	Y	Y	Y
	Software Antenna Diversity	Software Antenna Diversity[1]	N	N	N	Y	N	Y	Y	N
	Dynamic Rapid Channel Switch	DRCS[1]	Y	N	Y	Y	N	N	N	N
	Multiple Wi-Fi MAC	Multiple Wi-Fi MAC	Y	N	Y	N	N	N	N	N
	RF Test Mode	RF Test Mode functionality	Y	Y	Y	Y	Y	Y	Y	Y
	TX power config	TX power config[1]	Y	Y	Y	Y	Y	Y	Y	Y
	Deep sleep on unload	Deep sleep on unload	N	N	N	Y	N	Y	N	N
	Auto FW recovery	Auto FW recovery on fatal error	Y	Y	Y	Y	Y	Y	Y	N
	Auto ARP and Ping	Auto ARP and Ping support	N	N	N	Y	N	Y	N	N

[1] Contact your support representative to use this feature.

4.1.4 Concurrent dual Wi-Fi (CDW) mode [Dual MAC | Dual Band | Dual Channel] (88W9098)

Radio-0 always operates in 5 GHz, Radio-1 always operates in 2.4 GHz. One Wi-Fi Interface from MAC-1 operates in Radio-0 and one Wi-Fi interface from MAC-2 operates in Radio-1.

CDW mode use cases

Radio: 0 in 5G			Radio: 1 in 2.4G			
MAC:1			MAC:2			
mlan0	uap0	wfd0	mmlan0	muap0	mwfd0	Use case
—	Yes	—	—	Yes	—	AP + AP CDW Mode
Yes	—	—	Yes	—	—	STA + STA CDW Mode
Yes	—	—	—	Yes	—	AP + STA CDW Mode
—	Yes	—	Yes	—	—	AP + STA CDW Mode

4.1.5 Known limitations for simultaneous mode operation

- uAP/P2P-GO beacons are paused unconditionally whenever STA/P2P-GC performs scan and are resumed automatically once the scan is complete.
- Radio control commands, Antenna configuration commands, 802.11d – Country Info 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 another interface.
- STA can operate only in Infrastructure mode.

4.2 Bluetooth

4.2.1 Bluetooth classic

Feature list for Bluetooth radio

Features list	Sub features list	PCIe-UART		SD-UART					SD
		9098	8997	9098	IW612	8997	8987	IW416	8801
General Features	Bluetooth Class 1.5 and Class 2 support	Y	Y	Y	Y	Y	Y	Y	N
	Scatternet support	Y	Y	Y	Y	Y	Y	Y	N
	Maximum of seven simultaneous ACL connections	Y	Y	Y	Y	Y	Y	Y	N
	Automatic Packet Type Selection	Y	Y	Y	Y	Y	Y	Y	N
	Bluetooth - 2.1 to 5.0 Specification Support	Y	Y	Y	Y	Y	Y	Y	N
	Low power sniff	Y	Y	Y	Y	Y	Y	Y	N
	Independent reset (in-band and OOB [2]) [1]	Y	Y	Y	Y	N	Y	Y	N
	Wake on Bluetooth (chip to host)[2]	Y	N	Y	Y	N	Y	Y	N
	Deep Sleep (NXP UART driver)	Y	N	Y	Y	N	Y	Y	N
Bluetooth Packet Type Supported	ACL (DM1, DH1, DM3, DH3, DM5, DH5, 2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5)	Y	Y	Y	Y	Y	Y	Y	N
	SCO (HV1, HV3)	Y	Y	Y	Y	Y	Y	Y	N
	eSCO (EV3, EV4, EV5, 2EV3, 3EV3, 2EV5, 3EV5)	Y	Y	Y	Y	Y	Y	Y	N
Bluetooth Profiles Supported	A2DP Source/Sink	Y	Y	Y	Y	Y	Y	Y	N
	AVRCP Target/Controller	Y	Y	Y	Y	Y	Y	Y	N
	HFP Dev	Y	Y	Y	Y	Y	Y	Y	N
	OPP Server/Client	Y	Y	Y	Y	Y	Y	Y	N
	SPP	Y	Y	Y	Y	Y	Y	Y	N
	HID	Y	Y	Y	Y	Y	Y	Y	N
	GAP	Y	Y	Y	Y	Y	Y	Y	N
Bluetooth Dual Profiles Supported[2]	Dual A2DP (2 Source)	Y	N	Y	Y	N	Y	N	N
	DUAL A2DP (1 Source + 1 Sink)	Y	N	Y	N	N	Y	N	N
	Dual HFP (2 NBS) PCM	Y	N	Y	Y	N	Y	N	N
	Dual HFP (2 WBS) PCM	N	N	N	Y	N	N	N	N
	Dual HFP (1 WBS + 1 NBS) PCM	Y	N	Y	Y	N	Y	N	N
Bluetooth Audio Features	PCM NBS Master/Slave	Y	Y	Y	Y	Y	Y	Y	N
	PCM WBS Master/Slave	Y	Y	Y	Y	Y	Y	Y	N
	AAC and LDAC audio codec support	Y	N	Y	Y	N	N	N	N
RF Test Mode	RF Test Mode functionality	Y	Y	Y	Y	Y	Y	Y	N

[1] In-band independent reset (IR) can directly work with M.2 based modules on i.MX but OOB IR needs the external uSD muRata adaptor board with M.2 module.
[2] Contact your support representative to use this feature.

4.2.2 Bluetooth LE

Table 3. Feature list for Bluetooth LE

Features List	Sub Features List	PCIe-UART		SD-UART					SD
		9098	8997	9098	IW612	8997	8987	IW416	8801
Generic Features	Maximum 16 Bluetooth LE connections(Master role)	Y	Y	Y	Y	Y	Y	Y	N
	Independent reset (in-band and OOB) [2] [1]	Y	Y	Y	Y	N	Y	Y	N
	Wake on Bluetooth LE (chip to host)[2]	Y	N	Y	Y	N	Y	Y	N
	Deep Sleep (NXP UART driver)	N	N	N	Y	N	Y	Y	N
Bluetooth Profile Support	Bluetooth LE GATT	Y	Y	Y	Y	Y	Y	Y	N
	Bluetooth LE HOGP	Y	Y	Y	Y	Y	Y	Y	N
	Bluetooth LE GAP	Y	Y	Y	Y	Y	Y	Y	N
Bluetooth LE 4.0 Support	Low Energy Physical Layer	Y	Y	Y	Y	Y	Y	Y	N
	Low Energy Link Layer	Y	Y	Y	Y	Y	Y	Y	N
	Enhancements to HCI for Low Energy	Y	Y	Y	Y	Y	Y	Y	N
	Low Energy Direct Test Mode	Y	Y	Y	Y	Y	Y	Y	N
	Bluetooth LE - 1Mbit/s support	Y	Y	Y	Y	Y	Y	Y	N
Bluetooth 4.1 support	Low duty Cycle Directed Advertising	Y	Y	Y	Y	Y	Y	Y	N
	Bluetooth LE Dual Mode Topology	Y	Y	Y	Y	Y	Y	Y	N
	Bluetooth LE Privacy v1.1	Y	Y	Y	Y	Y	Y	Y	N
	Bluetooth LE Link Layer Topology	Y	Y	Y	Y	Y	Y	Y	N
Bluetooth 4.1 support	Bluetooth LE secure connection	Y	Y	Y	Y	Y	Y	Y	N
	Bluetooth LE Link Layer Privacy v1.2	Y	Y	Y	Y	Y	Y	Y	N
	Bluetooth LE Data Length Extension	Y	Y	Y	Y	Y	Y	Y	N
	Link Layer Extended Scanner Filter Policies	Y	Y	Y	Y	Y	Y	Y	N
Bluetooth 5.0 Support	Bluetooth LE 2 Mbps Support	Y	Y	Y	Y	Y	Y	Y	N
	High Duty Cycle Directed Advertising	Y	Y	Y	Y	Y	Y	Y	N
	Bluetooth LE Multiple Advertisement (4 or 5*) Sets	Y	Y	Y	N	Y	Y*	Y	N
	Bluetooth LE Extended Advertisement	N	N	N	Y	N	N	Y	N
	Bluetooth LE channel selection #2	N	N	N	Y	N	N	Y	N
	Bluetooth LE long range	N	N	N	Y	N	N	Y	N
	Bluetooth LE Periodic Advertisement	N	N	N	Y	N	N	Y	N
RF Test Mode	RF Test Mode functionality	Y	Y	Y	Y	Y	Y	Y	N

[1] In-band independent reset (IR) can directly work with M.2 based modules on i.MX but OOB IR needs the external uSD muRata adaptor board with M.2 module.
[2] Contact your support representative to use this feature.

4.3 Thread

Table 4. Feature list for Thread

IW612 features are tested on the i.MX 8M Mini host platform with NXP reference board.

Features	Sub features	PCIe-UART		SD-UART					SD
		9098	8997	9098	IW612	8997	8987	IW416	8801
Thread Features	Thread 1.2.1 (OpenThread RCP)	N	N	N	Y	N	N	N	N
	Thread 1.3.0 (OpenThread RCP)	N	N	N	Y	N	N	N	N
Tools & validation	ESMAC	N	N	N	Y	N	N	N	N
	Auto DUT (THCI) for test harness	N	N	N	Y	N	N	N	N
Miscellaneous Features	Tx overall target power back off control (dB) per step	N	N	N	Y	N	N	N	N
	15.4 Independent Reset	N	N	N	Y	N	N	N	N
	Secure Boot	N	N	N	Y	N	N	N	N
	15.4 RF test Mode	N	N	N	Y	N	N	N	N
Thread Device Roles	Border Router	N	N	N	Y	N	N	N	N
	Router	N	N	N	Y	N	N	N	N
	Router Eligible End Device (REED)	N	N	N	Y	N	N	N	N

4.4 Coexistence

4.4.1 Wi-Fi and Bluetooth coexistence

Table 5. Feature list for Wi-Fi and Bluetooth coexistence

Features	Sub features	PCIe-UART		SD-UART					SD
		9098	8997	9098	IW612	8997	8987	IW416	8801
BCA-TDM Mode (Shared Antenna)	STA + Bluetooth Coex	N	Y	N	Y	Y	Y	Y	N
	STA + Bluetooth LE Coex	N	Y	N	Y	Y	Y	Y	N
	STA + Bluetooth + Bluetooth LE Coex	N	Y	N	Y	Y	Y	Y	N
	AP + Bluetooth Coex	N	Y	N	Y	Y	Y	Y	N
	AP + Bluetooth LE Coex	N	Y	N	Y	Y	Y	Y	N
	AP + Bluetooth + Bluetooth LE Coex	N	Y	N	Y	Y	Y	Y	N
	P2P + Bluetooth Coex	N	Y	N	Y	Y	Y	Y	N
	P2P + Bluetooth LE Coex	N	Y	N	Y	Y	Y	Y	N
	P2P + Bluetooth + Bluetooth LE Coex	N	Y	N	Y	Y	Y	Y	N
	AP(5GHz) + AP(5GHz) + Bluetooth Coex	N	Y	N	Y	Y	N	N	N
	AP(5GHz) + AP(5GHz) + Bluetooth LE Coex	N	Y	N	Y	Y	N	N	N
BCA-TDM Mode (Separate Antenna) [1]	STA + Bluetooth Coex	Y	N	Y	Y	N	N	N	N
	STA + Bluetooth LE Coex	Y	N	Y	Y	N	N	N	N
	STA + Bluetooth + Bluetooth LE Coex	Y	N	Y	Y	N	N	N	N
	AP + Bluetooth Coex	Y	N	Y	Y	N	N	N	N
	AP + Bluetooth LE Coex	Y	N	Y	Y	N	N	N	N
	AP + Bluetooth + Bluetooth LE Coex	Y	N	Y	Y	N	N	N	N
	P2P + Bluetooth Coex	Y	N	Y	Y	N	N	N	N
	P2P + Bluetooth LE Coex	Y	N	Y	Y	N	N	N	N
BCA-TDM Mode (Separate Antenna)[1]	P2P + Bluetooth + Bluetooth LE Coex	Y	N	Y	Y	N	N	N	N
	AP(5GHz) + AP(5GHz) + Bluetooth Coex	Y	N	Y	Y	N	N	N	N
	AP(5GHz) + AP(5GHz) + Bluetooth LE Coex	Y	N	Y	Y	N	N	N	N
External coex	External Coex (Hardware interface)[1]	Y	N	Y	N	N	N	Y	N

[1] IW612 chipset features are tested on the i.MX 8M Mini host platform with NXP reference board.

4.4.2 Wi-Fi and Bluetooth/802.15.4 coexistence

Feature list for Wi-Fi and Bluetooth/802.15.4 radio coexistence

Type	Features List	Sub Features List	PCIe-UART			SD-UART				SD
			9098	8997	9098	IW612	8997	8987	IW416	8801
Bluetooth + Wi-Fi + 15.4 Coexistence	BCA-TDM Mode (Separate Antenna)[1]	STA + Bluetooth + 802.15.4 Coex	N	N	N	Y	N	N	N	N
		STA + Bluetooth LE + 802.15.4 Coex	N	N	N	Y	N	N	N	N
		STA + Bluetooth + Bluetooth LE + 802.15.4 Coex	N	N	N	Y	N	N	N	N
		AP + Bluetooth + 802.15.4 Coex	N	N	N	Y	N	N	N	N
		AP + Bluetooth LE + 802.15.4 Coex	N	N	N	Y	N	N	N	N
		AP + Bluetooth + Bluetooth LE + 802.15.4 Coex	N	N	N	Y	N	N	N	N
		P2P + Bluetooth + 802.15.4 Coex	N	N	N	Y	N	N	N	N
		P2P + Bluetooth LE + 802.15.4 Coex	N	N	N	Y	N	N	N	N
		P2P + Bluetooth + Bluetooth LE + 802.15.4 Coex	N	N	N	Y	N	N	N	N
		AP(5GHz) + AP(5GHz) + Bluetooth + 802.15.4 Coex	N	N	N	Y	N	N	N	N
		AP(5GHz) + AP(5GHz) + Bluetooth LE + 802.15.4 Coex	N	N	N	Y	N	N	N	N
Any	Security	Secure Boot	N	N	N	Y	N	N	N	N

[1] IW612 chipset features are tested on the i.MX 8M Mini host platform with NXP reference board.

Note: *When the dual A2DP (A2DP SRC+SRC & SRC+SNK) feature is enabled on firmware using vendor-specific commands then it will affect the Wi-Fi throughput until it gets disabled.*

5 Release notes for the supported SoCs

5.1 PCIe-UART 9098

5.1.1 Package information

- BSP version: Linux 6.1.36-2.1.0
- Wi-Fi and Bluetooth/Bluetooth LE Firmware version: 17.92.1.p136.131
- Driver version: MM6X17408.p2-GPL

5.1.2 Version information

- Wireless SoC: 88W9098
- Wi-Fi and Bluetooth/Bluetooth LE Firmware Version: 17.92.1.p136.131
  - 17 - Major revision
  - 92 - Feature pack
  - 1 - Release version
  - p136.131 - Patch number
- Driver Version: MM6X17408.p2-GPL
  - 6X - Linux 6.x Kernel
  - 17408 - Release version
  - p2 - Patch Number
  - GPL - General Public License V2 v2

5.1.3 Host platform

- MCIMX8M-EVK platform running Linux
- Supported Linux kernel versions: From 2.6.32 to 6.3.0
- Interface used
  - Wi-Fi over PCIe Interface
  - Bluetooth/Bluetooth LE over UART Interface
- Test Tools
  - iPerf (version 2.0.13)
  - wpa_supplicant (version 2.10)
  - hostapd (version 2.10)

5.1.4 Wi-Fi and Bluetooth certification

The Wi-Fi and Bluetooth certification is obtained with the following combinations.

5.1.4.1 Wi-Fi pre-certification

- STA | WiFi6 11ax
- STA | Wi-Fi CERTIFIED ac
- STA | Wi-Fi CERTIFIED n
- STA | PMF
- STA | VU
- STA | FFD
- STA | Security Improvement
- STA | WPA-SAE R3
- STA | Agile Multiband (MBO)

Note:

- *Download Labtool application for RF test mode, refer to the URL: 9098_BridgeLabtool_MFG_FW_p227*
- *Download Sigma tool, refer to the URL: NXP_WTS_DUT_AGENT Release R2.0*

5.1.4.2 Bluetooth controller certification

Refer to the URL: https://launchstudio.bluetooth.com/ListingDetails/134477

5.1.5 Wi-Fi throughput

5.1.5.1 Throughput Test Setup

- Environment: Shield Room - Over the Air
- External Access Point: Asus RT-AX88U (FW-3.0.0.4.386_49674)
- DUT: Murata 88Q9098 M.2 (Module: LBEE6ZZ1) with MCIMX8M-EVK platform
  - Driver Load Parameters:
    fw_name=nxp/pcieuart9098_combo_v1.bin, cal_data_cfg=none, cfg80211_wext=0xf, host_mlme=1, amsdu_deaggr=1, net_rx=1, tx_skb_clone=1, tx_work=1
  - iPerf commands:
    TCP server: # iperf -s -i1 -fm -w 2M
    TCP client: # iperf -c <ip_address> -i1 -fm -w 2M -t60 -P5
    UDP server: # iperf -s -u -i1 -fm -w 2M
    UDP client: # iperf -c <ip_address> -i1 -fm -w 2M -t60 -b 800 -P5
    Note: *You can add iPerf parameters like TCP window size, parallel streams, etc. to achieve the best throughput. The above-described iPerf parameters are an example.*
- External Client: NXP 88W9098 PCIe-UART
- Channel: 6 | 36

5.1.5.2 STA Throughput

External Access Point: Asus RT-AX88U

STA Mode Throughput - BGN Mode | MAC2 | 2.4 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	116	113	126	120
WPA2-AES	114	111	125	122
WPA3-SAE	115	111	125	122

STA Mode Throughput - AN Mode | MAC1 | 5 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	116	115	128	125
WPA2-AES	114	114	127	124
WPA3-SAE	114	114	128	125

STA Mode Throughput - AN Mode | MAC1 | 5 GHz Band | 40 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	223	240	254	259
WPA2-AES	221	238	254	256
WPA3-SAE	221	237	254	257

STA Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 20 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	141	144	152	154
WPA2-AES	140	143	152	153
WPA3-SAE	140	143	152	153

STA Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 40 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	301	315	360	347
WPA2-AES	297	315	358	340
WPA3-SAE	297	310	358	346

STA Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 80 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	658	621	748	733
WPA2-AES	656	624	744	683
WPA3-SAE	656	623	744	727

STA Mode Throughput - AX Mode | MAC2 | 2.4 GHz Band | 20 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	172	167	192	187
WPA2-AES	172	167	191	186
WPA3-SAE	172	167	191	186

STA Mode Throughput - AX Mode | MAC1 | 5 GHz Band | 20 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	223	227	255	253
WPA2-AES	220	225	255	251
WPA3-SAE	220	226	255	251

STA Mode Throughput - AX Mode | MAC1 | 5 GHz Band | 40 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	438	418	500	491
WPA2-AES	422	414	498	488
WPA3-SAE	433	414	498	489

STA Mode Throughput - AX Mode | MAC1 | 5 GHz Band | 80 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	818	752	811	873
WPA2-AES	806	702	881	807
WPA3-SAE	808	710	882	804

5.1.5.3 P2P-GO Throughput

P2P - GO Mode Throughput - BGN Mode | MAC2 | 2.4 GHz Band | 20MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	121	117	126	126

P2P - GO Mode Throughput - AN Mode | MAC1 | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	244	245	258	261

P2P - GO Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	618	686	735	745

5.1.5.4 P2P-GC Throughput

P2P - GC Mode Throughput - BGN Mode | MAC2 | 2.4 GHz Band | 20MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	121	118	126	127

P2P - GC Mode Throughput - AN Mode | MAC1 | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	248	245	258	261

P2P - GC Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	619	678	735	728

5.1.5.5 Mobile AP Throughput

External client: NXP 88W9098 PCIe-UART

Mobile AP Mode Throughput - BGN Mode| MAC2 | 2.4 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	118	115	123	124
WPA2-AES	116	115	120	124
WPA3-SAE	116	115	120	124

Mobile AP Mode Throughput - AN Mode | MAC1 | 5 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	125	121	129	129
WPA2-AES	124	120	129	129
WPA3-SAE	124	120	129	129

Mobile AP Mode Throughput - AN Mode | MAC1 | 5 GHz Band | 40 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	247	245	259	261
WPA2-AES	248	244	258	261
WPA3-SAE	245	245	259	261

Mobile AP Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 20 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	147	143	151	152
WPA2-AES	146	143	151	151
WPA3-SAE	146	142	151	151

Mobile AP Mode Throughput - AC Mode| MAC1 | 5 GHz Band | 40 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	334	332	354	358
WPA2-AES	333	332	354	356
WPA3-SAE	332	332	353	356

Mobile AP Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 80 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	652	685	736	738
WPA2-AES	630	662	733	739
WPA3-SAE	626	662	730	738

Mobile AP Mode Throughput - AX Mode | MAC2 | 2.4 GHz Band | 20 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	179	179	187	190
WPA2-AES	179	178	187	189
WPA3-SAE	178	178	188	189

Mobile AP Mode Throughput - AX Mode | MAC1 | 5 GHz Band | 20 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	238	244	253	255
WPA2-AES	238	244	253	255
WPA3-SAE	238	243	253	254

Mobile AP Mode Throughput - AX Mode | MAC1 | 5 GHz Band | 40 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	460	477	420	420
WPA2-AES	464	476	420	420
WPA3-SAE	458	474	419	400

Mobile AP Mode Throughput - AX Mode | MAC1 | 5 GHz Band | 80 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	872	762	910	801
WPA2-AES	837	706	858	740
WPA3-SAE	855	712	857	750

5.1.6 EU conformance tests

- EU Adaptivity test - EN 300 328 v2.1.1 (for 2.4 GHz)
- EU Adaptivity test - EN 301 893 v2.1.1 (for 5 GHz)

5.1.7 Bug fixes/feature enhancements

5.1.7.1 FW version: From 17.92.5.p3 to 17.92.5.p9

Component	Description
Wi-Fi	• Wake On Wireless Feature

5.1.7.2 FW version: From 17.92.5.p9 to 17.92.5.p11

Component	Description
Wi-Fi	• In RF Test Mode Tx tests, the device is unable to transmit Tx Frame and Tx Continuous Wave modes. Manufacturing software can be used for validation.

5.1.7.3 FW version: From 17.92.5.p11 to 17.92.1.p116.1

Component	Description
Wi-Fi	• Low TCP/UDP Tx (by ~80%) and TCP/UDP Rx (by ~70%) throughput is observed for Internal STA mode on MAC2 interface in BGN20 mode with Netgear R6200 AP. • Low UDP Tx (20-25%) throughput observed on HE-80 MHz Band For All Securities. • Internal-AP mode the data-rate drops to 0 Mbps and does not recover when TCP Bidirectional test is run in HE80/WPA2 mode after ~2 hours. • P2P GO on/off stress test fails and DUT stops responding after ~1 hour.

5.1.7.4 FW version: From 17.92.1.p116.1 to 17.92.1.p136.13

Component	Description
--	NA

5.1.7.5 FW version: From 17.92.1.p136.13 to 17.92.1.p136.24

Component	Description
Coex	• OPP file transfer gets failed while OPP file transfer is ongoing and Wi-Fi traffic initiated with 2.4GHz external AP.

5.1.7.6 FW version: From 17.92.1.p136.24 to 17.92.1.p136.131

Component	Description
Wi-Fi	• Wake-up card timeout is seen when performing suspend and resume stress test with i.MX 8 host. • Command timeout is seen when performing connection and disconnection test in a loop with external AP during addition of block ack requests.
Bluetooth	• A2DP audio glitches heard while audio streaming and OPP file transfer to another ref device at the same time

5.1.8 Known issues

Component	Description
BT	• After disconnecting LE link, sometime disconnect complete event is delayed by 30 seconds, so next re-connection possible only after 30 seconds.

5.2 SD-UART 8997

5.2.1 Package information

- BSP version: Linux 6.1.36-2.1.0
- Wi-Fi and Bluetooth/Bluetooth LE Firmware version: 16.92.21.p84.4
- Driver version: MM6X16408.p2-GPL

5.2.2 Version information

- Wireless SoC: 88W8997
- Wi-Fi and Bluetooth/Bluetooth LE Firmware Version: 16.92.21.p84.4
  - 16 - Major revision
  - 92 - Feature pack
  - 21 - Release version
  - p84.4 - Patch number
- Driver Version: MM6X16408.p2-GPL
  - 6X - Linux 6.x Kernel
  - 16408 - Release version
  - p2 - Patch Number
  - GPL - General Public License v2

5.2.3 Host platform

- MCIMX8M-EVK platform running Linux
- Supported Linux kernel versions: from 2.6.32 to 6.3.0
- Interface used
  - Wi-Fi over SDIO 3.0
  - Bluetooth/Bluetooth LE over UART
- Test Tools
  - iPerf (version 2.0.13)
  - wpa_supplicant (version 2.10)
  - hostapd (version 2.10)

5.2.4 Wi-Fi and Bluetooth certification

The Wi-Fi and Bluetooth certification is obtained with the following combinations.

5.2.4.1 Wi-Fi pre-certifications

- STA | 802.11n
- STA | 802.11ac
- STA | PMF
- STA | VU
- STA | FFD
- STA | Security Improvement
- STA | WPA-SAE R3

Note:

- *Download Labtool application for RF test mode, refer to the URL: 88W8997-MANUFACTURING-RELEASE-P208*
- *Download Sigma tool, refer to the URL: NXP_WTS_DUT_AGENT Release R2.0*

5.2.4.2 Bluetooth controller certification

Refer to the URL: https://launchstudio.bluetooth.com/ListingDetails/135509

5.2.5 Wi-Fi throughput

5.2.5.1 Throughput Test Setup

- Environment: Shield Room - Over the Air
- DUT: 88W8997-Murata M.2 (Module: LBEE5XV1YM) with MCIMX8M-EVK platform
  - Driver Load Parameters:
    fw_name=nxp/sdiouart8997_combo_v4.bin, cal_data_cfg=none, cfg80211_wext=0xf, host_mlme=1, amsdu_deaggr=1, net_rx=1, tx_skb_clone=1, tx_work=1
  - iPerf commands:
    TCP server: # iperf -s -i1 -fm -w 2M
    TCP client: # iperf -c <ip_address> -i1 -fm -w 2M -t60 -P5
    UDP server: # iperf -s -u -i1 -fm -w 2M
    UDP client: # iperf -c <ip_address> -i1 -fm -w 2M -t60 -b 800 -P5
    Note: *You can add iPerf parameters like TCP window size, parallel streams, etc. to achieve the best throughput. The above-described iPerf parameters are an example.*
- External Access Point: Asus RT-AX88U (FW-3.0.0.4.386_49674)
- External Client: NXP IW620 PCIe-UART
- Channel: 6 | 36

5.2.5.2 STA Throughput

External AP: Asus RT-AX88U

STA Mode Throughput - BGN Mode | 2.4 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	116	113	125	124
WPA2-AES	114	112	124	123
WPA3-SAE	112	111	124	122

STA Mode Throughput - AN Mode | 5 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	111	114	122	123
WPA2-AES	110	113	123	122
WPA3-SAE	101	113	123	121

STA Mode Throughput - AN Mode | 5 GHz Band | 40 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	201	231	233	254
WPA2-AES	200	229	233	251
WPA3-SAE	203	238	233	253

STA Mode Throughput - AC Mode | 5 GHz Band | 20 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	132	138	146	151
WPA2-AES	124	137	146	150
WPA3-SAE	130	137	146	150

STA Mode Throughput - AC Mode | 5 GHz Band | 40 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	313	318	339	345
WPA2-AES	304	316	339	343
WPA3-SAE	301	320	339	342

STA Mode Throughput - AC Mode | 5 GHz Band | 80 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	450	449	482	522
WPA2-AES	437	446	480	520
WPA3-SAE	447	443	481	521

5.2.5.3 P2P-GO Throughput

P2P - GO Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz | 1SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	116	118	123	129

P2P - GO Mode Throughput - AN Mode | 5 GHz Band | 40 MHz | 2SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	241	247	259	262

P2P - GO Mode Throughput - AC Mode | 5 GHz Band | 80 MHz | 2SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	456	460	484	511

5.2.5.4 P2P-GC Throughput

P2P - GC Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz | 1SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	112	117	127	129

P2P - GC Mode Throughput - AN Mode | 5 GHz Band | 40 MHz | 2SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	247	247	259	262

P2P - GC Mode Throughput - AC Mode | 5 GHz Band | 80 MHz | 2SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	457	458	482	508

5.2.5.5 Mobile AP Throughput

External Client: NXP IW620 PCIe-UART

Mobile AP Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	116	115	122	127
WPA2-AES	114	114	121	127
WPA3-SAE	114	115	121	127

Mobile AP Mode Throughput - BGN Mode | 2.4 GHz Band | 40MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	214	242	233	255
WPA2-AES	213	241	233	255
WPA3-SAE	205	238	225	250

Mobile AP Mode Throughput - AN Mode | 5 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	113	119	125	130
WPA2-AES	118	119	125	130
WPA3-SAE	118	119	125	130

Mobile AP Mode Throughput - AN Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	220	248	240	262
WPA2-AES	219	248	240	262
WPA3-SAE	217	248	240	262

Mobile AP Mode Throughput - AC Mode | 5 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	139	141	147	153
WPA2-AES	139	141	147	153
WPA3-SAE	139	141	147	153

Mobile AP Mode Throughput - AC Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	318	339	331	362
WPA2-AES	315	339	331	360
WPA3-SAE	315	339	331	360

Mobile AP Mode Throughput - AC Mode | 5 GHz Band | 80 MHz				
Protocol	TCP (Mbit/s)		UDP (Mbit/s)	
Direction	Tx	Rx	Tx	Rx
Open Security	456	458	402	455
WPA2-AES	457	458	405	470
WPA3-SAE	457	459	408	471

5.2.6 EU conformance tests

- EU Adaptivity test - EN 300 328 v2.1.1 (for 2.4 GHz)
- EU Adaptivity test - EN 301 893 v2.1.1 (for 5 GHz)

5.2.7 Bug fixes/feature enhancements

5.2.7.1 FW version: From 16.92.10.p218 to 16.92.10.p219.3

Component	Description
Wi-Fi	• Added support for 40 MHz band in 2.4 GHz BGN mode for AP and STA

5.2.7.2 FW version: From 16.92.10.p219.3 to 16.92.10.p219.5

Component	Description
--	NA

5.2.7.3 FW version: From 16.92.10.p219.5 to 16.92.21.p41

Component	Description
--	NA

5.2.7.4 FW version: From 16.92.21.p41 to 16.92.21.p55.3

Component	Description
Wi-Fi	• P2P-client fails to re-connect to DUT-P2P-GO mode after internal-STA connects to external-AP on different channel. • Internal-STA disconnects from external-AP shortly after starting DUT-P2P-GO mode. • DUT in STA only mode fails to connect with specific hotspot.

5.2.7.5 FW version: From 16.92.p55.3 to 16.92.21.p76.2

Component	Description
Bluetooth	• DUT SPP link gets disconnected with Remote, when DUT creates A2DP SINK profile connection with Remote device.

5.2.7.6 FW version: From 16.92.21.p76.2 to 16.92.21.p84.4

Component	Description
Bluetooth	• DUT HFP link gets disconnected with Remote phone, when it starts OPP file transfer to Remote device.
Coex	• DUT A2DP sink audio glitches observed when it starts Wi-Fi data traffic with Station device on BGN 20MHz. • DUT is not able to connect with Bluetooth device and not able to sustain LE connection, when it starts receiving the Wi-Fi data traffic with Station/Access Point on BGN 20MHz.

5.2.8 Known issues

Component	Description
Bluetooth	• After disconnecting LE link, sometime disconnect complete event is delayed by 30 seconds, so next re-connection possible only after 30 second • DUT role switch request is failing sometimes to the first remote device when DUT is streaming A2DP data to another remote device.

5.3 PCIe-UART 8997

5.3.1 Package information

- BSP version: Linux 6.1.36-2.1.0
- Wi-Fi and Bluetooth/Bluetooth LE Firmware version: 16.92.21.p84.4
- Driver version: MM6X16408.p2-GPL

5.3.2 Version information

- Wireless SoC: 88W8997
- Wi-Fi and Bluetooth/Bluetooth LE Firmware Version: 16.92.21.p84.4
  - 16 - Major revision
  - 92 - Feature pack
  - 21 - Release version
  - p84.4 - Patch number
- Driver Version: MM6X16408.p2-GPL
  - 6X - Linux 6.x Kernel
  - 16408 - Release version
  - p2 - Patch Number
  - GPL - General Public License v2

5.3.3 Host platform

- MCIMX8M-EVK platform running Linux
- Supported Linux kernel versions: From 2.6.32 to 6.3.0
- Interface used
  - Wi-Fi over PCIE
  - Bluetooth/Bluetooth LE over UART
- Test Tools
  - iPerf (version 2.0.13)
  - wpa_supplicant (version 2.10)
  - hostapd (version 2.10)

5.3.4 Wi-Fi and Bluetooth certification

The Wi-Fi and Bluetooth certification is obtained with the following combinations.

5.3.4.1 Wi-Fi pre-certifications

- STA | 802.11n
- STA | 802.11ac
- STA | PMF
- STA | VU
- STA | FFD
- STA | Security Improvement
- STA | WPA-SAE R3

Note:

- *Download Labtool application for RF test mode, refer to the URL: 88W8997-MANUFACTURING-RELEASE-P208*
- *Download Sigma tool, refer to the URL: NXP_WTS_DUT_AGENT Release R2.0*

5.3.4.2 Bluetooth controller certification

Refer to the URL: https://launchstudio.bluetooth.com/ListingDetails/135509

5.3.5 Wi-Fi throughput

5.3.5.1 Throughput Test Setup

- Environment: Shield Room - Over the Air
- External Access Point: Asus RT-AX88U (FW-3.0.0.4.386_49674)
- DUT: 88W8997- Murata M.2 (Module: LBEE5XV1YM) with MCIMX8M-EVK platform
  - Driver Load Parameters:
    fw_name=nxp/pcieuart8997_combo_v4.bin, cal_data_cfg=none, cfg80211_wext=0xf, host_mlme=1, amsdu_deaggr=1, net_rx=1, tx_skb_clone=1, tx_work=1
  - iPerf commands:
    TCP server: # iperf -s -i1 -fm -w 2M
    TCP client: # iperf -c <ip_address> -i1 -fm -w 2M -t60 -P5
    UDP server: # iperf -s -u -i1 -fm -w 2M
    UDP client: # iperf -c <ip_address> -i1 -fm -w 2M -t60 -b 800 -P5
    Note: *You can add iPerf parameters like TCP window size, parallel streams, etc. to achieve the best throughput. The above-described iPerf parameters are an example.*
- External Client: NXP IW620 PCIe-UART
- Channel: 6 | 36

5.3.5.2 STA Throughput

External AP: Asus RT-AX88U

STA Mode Throughput - BGN Mode | 2.4 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	114	112	124	123
WPA2-AES	112	111	123	121
WPA3-SAE	112	111	124	121

STA Mode Throughput - AN Mode | 5 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	112	117	123	126
WPA2-AES	111	116	123	125
WPA3-SAE	111	116	123	125

STA Mode Throughput - AN Mode | 5 GHz Band | 40 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	228	241	254	259
WPA2-AES	224	240	254	256
WPA3-SAE	224	241	253	256

STA Mode Throughput - AC Mode | 5 GHz Band | 20 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	132	145	147	154
WPA2-AES	131	144	147	153
WPA3-SAE	132	144	147	153

STA Mode Throughput - AC Mode | 5 GHz Band | 40 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	299	312	342	347
WPA2-AES	293	311	342	345
WPA3-SAE	294	319	341	345

STA Mode Throughput - AC Mode | 5 GHz Band | 80 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	688	665	738	736
WPA2-AES	686	665	732	732
WPA3-SAE	678	665	738	732

5.3.5.3 P2P-GO Throughput

P2P - GO Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz | 1SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	117	102	124	121

P2P - GO Mode Throughput - AN Mode | 5 GHz Band | 40 MHz | 2SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	226	245	256	260

P2P - GO Mode Throughput - AC Mode | 5 GHz Band | 80 MHz | 2SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	595	640	664	736

5.3.5.4 P2P-GC Throughput

P2P - GC Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz | 1SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	123	102	128	123

P2P - GC Mode Throughput - AN Mode | 5 GHz Band | 40 MHz | 2SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	224	244	254	260

P2P - GC Mode Throughput - AC Mode | 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	584	641	660	740

5.3.5.5 Mobile AP Throughput

External client: NXP IW620 PCIe-UART

Mobile AP Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	115	117	123	128
WPA2-AES	115	117	123	123
WPA3-SAE	115	116	122	128

Mobile AP Mode Throughput - AN Mode | 5 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	118	119	125	130
WPA2-AES	118	119	125	130
WPA3-SAE	118	119	125	130

Mobile AP Mode Throughput - AN Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	219	248	240	262
WPA2-AES	217	247	240	262
WPA3-SAE	218	248	240	262

Mobile AP Mode Throughput - AC Mode | 5 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	139	142	147	153
WPA2-AES	139	142	147	153
WPA3-SAE	139	142	147	153

Mobile AP Mode Throughput - AC Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	319	337	341	362
WPA2-AES	314	333	341	359
WPA3-SAE	315	334	341	359

Mobile AP Mode Throughput - AC Mode | 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	675	697	730	754
WPA2-AES	671	660	729	749
WPA3-SAE	673	660	731	748

5.3.6 EU conformance tests

- EU Adaptivity test - EN 300 328 v2.1.1 (for 2.4 GHz)
- EU Adaptivity test - EN 301 893 v2.1.1 (for 5 GHz)

5.3.7 Bug fixes/feature enhancements

5.3.7.1 FW version: From 16.92.10.p208 to 16.92.10.p211

Component	Description
Wi-Fi	• Fixed Mobile AP start issue on switching bands
Bluetooth	• Fix for Sniff Subrate command processing which resulted in command queue that caused Bluetooth to restart. • Fix for ACL link disconnection due to DUT not responding to LMP_switch_req.
Coex	• Fix Wi-Fi Link loss during UDP Rx + Bluetooth Inquiry and Wi-Fi deauth during Bluetooth HFP coexistence scenarios

5.3.7.2 FW version: From 16.92.10.p211 to 16.92.10.p213

Component	Description
Wi-Fi	• Fix for Wi-Fi Fragment and Forge Vulnerabilities (EB - NXP Security Advisory - Wi-Fi Vulnerability - USIRP02-2020)
Bluetooth	• Fix for ANSSI Vulnerabilities (**EB - NXP Security Advisory - Bluetooth Vulnerability - ANSSI**)

5.3.7.3 FW version: From 16.92.10.p213 to 16.92.10.p213.2

Component	Description
Wi-Fi	• Added support for 40 MHz band in 2.4 GHz BGN mode for AP and STA

5.3.7.4 FW version: From 16.92.10.p213.2 to 16.92.10.p213.4

Component	Description
--	NA

5.3.7.5 FW version: From 16.92.10.p213.4 to 16.92.21.p26.1

Component	Description
--	NA

5.3.7.6 FW version: From 16.92.21.p26.1 to 16.92.21.p55.3

Component	Description
--	NA

5.3.7.7 FW version: From 16.92.21.p55.3 to 16.92.21.p76.2

Component	Description
Bluetooth	• DUT SPP link gets disconnected with Remote, when DUT creates A2DP SINK profile connection with Remote device.

5.3.7.8 FW version: From 16.92.21.p76.2 to 16.92.21.p84.4

Component	Description
Bluetooth	• DUT HFP link gets disconnected with Remote phone, when it starts OPP file transfer to Remote device.
Coex	• DUT A2DP sink audio glitches observed when it starts Wi-Fi data traffic with Station device on BGN 20MHz. • DUT is not able to connect with Bluetooth device and not able to sustain LE connection, when it starts receiving the Wi-Fi data traffic with Station/Access Point on BGN 20MHz.

5.3.8 Known issues

Component	Description
Wi-Fi	• DUT firmware hang is seen when connected Intel AX210 client sends UDP traffic with power management enabled in noisy environment.
Bluetooth	• After disconnecting LE link, sometime disconnect complete event is delayed by 30 seconds, so next re-connection possible only after 30 second. • DUT role switch request is failing sometimes to the first remote device when DUT is streaming A2DP data to another remote device. • Bluetooth-only firmware initialization is failing when it is downloaded & initialized after Wi-Fi-only firmware initialization.

5.4 SD-UART 9098

5.4.1 Package information

- BSP version: Linux 6.1.36-2.1.0
- Wi-Fi and Bluetooth/Bluetooth LE Firmware version: 17.92.1.p136.131
- Driver version: MM6X17408.p2-GPL

5.4.2 Version information

- Wireless SoC: 88W9098
- Wi-Fi and Bluetooth/Bluetooth LE Firmware Version: 17.92.1.p136.131
  - 17 - Major revision
  - 92 - Feature pack
  - 1 - Release version
  - p136.131 - Patch number
- Driver Version: MM5X17391.p3-GPL
  - 6X - Linux 6.x Kernel
  - 17408 - Release version
  - p2 - Patch Number
  - GPL - General Public License v2

5.4.3 Host platform

- MCIMX8M-EVK platform running Linux
- Supported Linux kernel versions: From 2.6.32 to 6.3.0
- Interface used
  - Wi-Fi over SDIO (SDIO 3.0 support, Clock speed: 200 MHz)
  - Bluetooth/Bluetooth LE over UART
- Test Tools
  - iPerf (version 2.0.13)
  - wpa_supplicant (version 2.10)
  - hostapd (version 2.10)

5.4.4 Wi-Fi and Bluetooth certification

The Wi-Fi and Bluetooth certification is obtained with the following combinations.

5.4.4.1 Wi-Fi pre-certification

- STA | WiFi6 11ax
- STA | Wi-Fi CERTIFIED ac
- STA | Wi-Fi CERTIFIED n
- STA | PMF
- STA | VU
- STA | FFD
- STA | Security Improvement
- STA | WPA-SAE R3
- STA | Agile Multiband (MBO)

Note:

- *Download Labtool application for RF test mode, refer to the URL: 9098_BridgeLabtool_MFG_FW_p227*
- *Download Sigma tool, refer to the URL: NXP_WTS_DUT_AGENT Release R2.0*

5.4.4.2 Bluetooth controller certification

Refer to the URL: https://launchstudio.bluetooth.com/ListingDetails/134477

5.4.5 Wi-Fi throughput

5.4.5.1 Throughput Test Setup

- Environment: Shield Room - Over the Air
- External Access Point: Asus RT-AX88U (FW-3.0.0.4.386_49674)
- DUT: Murata 88Q9098 M.2 (Module: LBEE5ZZ1XL) with MCIMX8M-EVK platform
  - Driver Load Parameters:
    fw_name=nxp/sduart9098_combo_v1.bin, cal_data_cfg=none, cfg80211_wext=0xf, host_mlme=1, amsdu_deaggr=1, net_rx=1, tx_skb_clone=1, tx_work=1
  - iPerf commands:
    TCP server:# iperf -s -i1 -fm -w 2M
    TCP client:# iperf -c <ip_address> -i1 -fm -w 2M -t60 -P5
    UDP server:# iperf -s -u -i1 -fm -w 2M
    UDP client:# iperf -c <ip_address> -i1 -fm -w 2M -t60 -b 800 -P5
    Note: *You can add iPerf parameters like TCP window size, parallel streams, etc. to achieve the best throughput. The above-described iPerf parameters are an example.*
- External Client: NXP 88W9098 PCIe-UART
- Channel: 6 | 36

5.4.5.2 STA Throughput

External Access Point: Asus RT-AX88U

STA Mode Throughput - BGN Mode | MAC2 | 2.4 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	116	113	126	120
WPA2-AES	114	111	125	122
WPA3-SAE	115	111	125	122

STA Mode Throughput - AN Mode | MAC1 | 5 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	116	115	128	125
WPA2-AES	114	114	127	124
WPA3-SAE	114	114	128	125

STA Mode Throughput - AN Mode | MAC1 | 5 GHz Band | 40 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	223	240	254	259
WPA2-AES	221	238	254	256
WPA3-SAE	221	237	254	257

STA Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 20 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	141	144	152	154
WPA2-AES	140	143	152	153
WPA3-SAE	140	143	152	153

STA Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 40 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	301	315	360	247
WPA2-AES	297	315	358	340
WPA3-SAE	297	310	358	346

STA Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 80 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	658	6210	748	733
WPA2-AES	656	624	744	683
WPA3-SAE	655	653	744	727

STA Mode Throughput - AX Mode | MAC2 | 2.4 GHz Band | 20 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	172	167	192	187
WPA2-AES	172	167	191	186
WPA3-SAE	172	167	191	186

STA Mode Throughput - AX Mode | MAC1 | 5 GHz Band | 20 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	223	227	255	253
WPA2-AES	220	225	255	251
WPA3-SAE	220	226	255	251

STA Mode Throughput - AX Mode | MAC1 | 5 GHz Band | 40 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	438	418	500	491
WPA2-AES	422	414	498	488
WPA3-SAE	433	414	498	489

STA Mode Throughput - AX Mode | MAC1 | 5 GHz Band | 80 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	818	752	811	873
WPA2-AES	806	702	881	807
WPA3-SAE	808	710	882	804

5.4.5.3 P2P-GO Throughput

P2P - GO Mode Throughput - BGN Mode | MAC2 | 2.4 GHz Band | 20MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	121	117	126	126

P2P - GO Mode Throughput - AN Mode | MAC1 | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	244	245	258	261

P2P - GO Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	618	686	735	745

5.4.5.4 P2P-GC Throughput

P2P - GC Mode Throughput - BGN Mode | MAC2 | 2.4 GHz Band | 20MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	121	118	126	127

P2P - GC Mode Throughput - AN Mode | MAC1 | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	248	245	258	261

P2P - GC Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	619	678	735	728

5.4.5.5 Mobile AP Throughput

External client: NXP 88W9098 PCIe-UART

Mobile AP Mode Throughput - BGN Mode| MAC2 | 2.4 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	118	115	123	124
WPA2-AES	116	115	120	124
WPA3-SAE	116	115	120	124

Mobile AP Mode Throughput - AN Mode | MAC1 | 5 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	125	121	129	129
WPA2-AES	124	120	129	129
WPA3-SAE	124	120	129	129

Mobile AP Mode Throughput - AN Mode | MAC1 | 5 GHz Band | 40 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	247	245	259	261
WPA2-AES	248	244	258	261
WPA3-SAE	245	245	259	261

Mobile AP Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 20 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	147	143	151	152
WPA2-AES	146	142	151	151
WPA3-SAE	146	142	151	151

Mobile AP Mode Throughput - AC Mode| MAC1 | 5 GHz Band | 40 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	334	332	354	358
WPA2-AES	333	332	354	356
WPA3-SAE	332	332	353	356

Mobile AP Mode Throughput - AC Mode | MAC1 | 5 GHz Band | 80 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	652	685	736	738
WPA2-AES	630	662	733	739
WPA3-SAE	626	662	730	738

Mobile AP Mode Throughput - AX Mode | MAC2 | 2.4 GHz Band | 20 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	179	179	187	190
WPA2-AES	179	178	187	189
WPA3-SAE	178	178	188	189

Mobile AP Mode Throughput - AX Mode | MAC1 | 5 GHz Band | 20 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	238	244	253	255
WPA2-AES	238	244	253	255
WPA3-SAE	238	243	253	254

Mobile AP Mode Throughput - AX Mode | MAC1 | 5 GHz Band | 40 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	460	477	420	420
WPA2-AES	464	476	420	420
WPA3-SAE	458	474	419	400

Mobile AP Mode Throughput - AX Mode | MAC1 | 5 GHz Band | 80 MHz (HE)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	872	762	910	801
WPA2-AES	837	706	858	740
WPA3-SAE	855	712	857	750

5.4.6 EU conformance tests

- EU Adaptivity test - EN 300 328 v2.1.1 (for 2.4 GHz)
- EU Adaptivity test - EN 301 893 v2.1.1 (for 5 GHz)

5.4.7 Bug fixes/feature enhancements

5.4.7.1 FW version: From 17.92.1.p98.1 to 17.92.1.p116.1

Component	Description
-	NA

5.4.7.2 FW version: From 17.92.1.p116.1 to 17.92.1.p136.13

Component	Description
--	NA

5.4.7.3 FW version: From 17.92.1.p136.13 to 17.92.1.p136.24

Component	Description
Coex	• OPP file transfer gets failed while OPP file transfer is ongoing and Wi-Fi traffic initiated with 2.4GHz external AP.

5.4.7.4 FW version: From 17.92.1.p136.24 to 17.92.1.p136.131

Component	Description
Wi-Fi	• Low throughput is observed in VHT/HE mode.
Bluetooth	• A2DP Audio glitches heard while audio streaming and OPP file transfer to another ref device at the same time.

5.4.8 Known issues

Component	Description
Bluetooth	• When A2DP steaming is initiated during an ongoing HFP call, A2DP link lose observed due to LMP response timeout (Frequency of occurrence 4/5 times). • Link Stability in presence of multiple Bluetooth links under optimization
Wi-Fi, Bluetooth and 802.15.4 (Open Thread) Coex	• Wi-Fi throughput in presence of OT peak throughput is under optimization

5.5 SD-UART IW612

5.5.1 Package information

- BSP version: Linux 6.1.36-2.1.0
- Wi-Fi and Bluetooth/Bluetooth LE Firmware version: 18.99.1.p154.40
- Driver version: MM6X18408.p2-GPL

5.5.2 Version information

- Wireless SoC: IW612
- Wi-Fi and Bluetooth/Bluetooth LE Firmware Version: 18.99.2.p19.13
  - 18 - Major revision
  - 99 - Feature pack
  - 2 - Release version
  - p10.13 - Patch number
- Driver Version: MM6X18408.p2-GPL
  - 6X - Linux 6.x Kernel
  - 18408 - Release version
  - p2 - Patch Number
  - GPL - General Public License v2

5.5.3 Host Platform

- MCIMX8M-EVK platform running Linux
- Supported Linux kernel versions: From 2.6.32 to 6.3.0
- Interface used
  - Wi-Fi over SDIO (SDIO 3.0 support, Clock speed: 200 MHz)
  - Bluetooth/Bluetooth LE over UART
- Test Tools
  - iPerf (version 2.0.13)
  - wpa_supplicant (version 2.10)
  - hostapd (version 2.10)

5.5.4 Wi-Fi and Bluetooth certification

The Wi-Fi and Bluetooth certification is obtained with the following combinations.

5.5.4.1 Wi-Fi pre-certification

1. **Wi-Fi pre-certification**

- STA | WiFi6 11ax
- STA | Wi-Fi CERTIFIED ac
- STA | Wi-Fi CERTIFIED n
- STA | PMF
- STA | VU
- STA | FFD
- STA | Security Improvement
- STA | WPA-SAE R3
- STA | Agile Multiband (MBO)

Note:

- *Download Labtool application for RF test mode, refer to the URL: MFG-AW-IW61X-MF-LABTOOL_Native_BRG-WIN-X86-1.0.0.45.6-18.99.2.p19.13*
- *Download Sigma tool, refer to the URL: NXP_WTS_DUT_AGENT Release R2.0*

5.5.4.2 Bluetooth controller certification

Refer to the URL: https://launchstudio.bluetooth.com/ListingDetails/155070

5.5.5 Wi-Fi throughput

5.5.5.1 Throughput Test Setup

- Environment: Shield Room - Over the Air
- External Access Point: Asus RT-AX88U (FW-3.0.0.4.386_49674)
- DUT: Murata M.2 Module LBES5PL2EL with MCIMX8M-EVK platform
  - Driver Load Parameters:
    fw_name=nxp/sduart_nw61x_v1.bin.se, cal_data_cfg=none, cfg80211_wext=0xf, host_mlme=1, amsdu_deaggr=1, net_rx=1, tx_skb_clone=1, tx_work=1
  - iPerf commands:
    TCP server:# iperf -s -i1 -fm -w 2M
    TCP client:# iperf -c <ip_address> -i1 -fm -w 2M -t60 -P5
    UDP server:# iperf -s -u -i1 -fm -w 2M
    UDP client:# iperf -c <ip_address> -i1 -fm -w 2M -t60 -b 800 -P5
    Note: *You can add iPerf parameters like TCP window size, parallel streams, etc. to achieve the best throughput. The above-described iPerf parameters are an example.*
- External Client: NXP IW620 PCIe-UART
- Channel: 6 | 36

5.5.5.2 STA Throughput

External Access Point: Asus RT-AX88U

STA Mode Throughput - BGN Mode | 2.4 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	49	52	56	55
WPA2-AES	48	51	56	54
WPA3-SAE	42	53	58	56

STA Mode Throughput - AN Mode | 5 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	57	59	62	62
WPA2-AES	57	59	62	62
WPA3-SAE	52	56	61	58

STA Mode Throughput - AN Mode | 5 GHz Band | 40 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	118	121	132	130
WPA2-AES	118	121	133	129
WPA3-SAE	118	121	133	130

STA Mode Throughput - AC Mode | 5 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	60	70	75	74
WPA2-AES	61	70	75	74
WPA3-SAE	60	70	75	74

STA Mode Throughput - AC Mode | 5 GHz Band | 40 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	142	164	175	174
WPA2-AES	144	163	179	173
WPA3-SAE	137	162	179	173

STA Mode Throughput - AC Mode | 5 GHz Band | 80 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	284	341	387	374
WPA2-AES	274	337	381	369
WPA3-SAE	273	338	384	372

STA Mode Throughput - AX Mode | 2.4 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	77	102	119	111
WPA2-AES	73	102	121	108
WPA3-SAE	73	100	119	109

STA Mode Throughput - AX Mode | 5 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	78	112	129	123
WPA2-AES	75	112	129	123
WPA3-SAE	76	113	129	122

STA Mode Throughput - AX Mode | 5 GHz Band | 40 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	180	219	257	246
WPA2-AES	172	218	256	245
WPA3-SAE	172	218	256	244

STA Mode Throughput - AX Mode | 5 GHz Band | 80 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	286	399	478	504
WPA2-AES	275	396	476	501
WPA3-SAE	275	395	474	502

5.5.5.3 P2P-GO Throughput

P2P - GO Mode Throughput - BGN Mode | 2.4 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	37	54	38	58

P2P - GO Mode Throughput - AN Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	118	123	133	133

P2P - GO Mode Throughput - AC Mode | 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	224	337	380	345

5.5.5.4 P2P-GC Throughput

P2P - GC Mode Throughput - BGN Mode | 2.4 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	29	55	37	60

P2P - GC Mode Throughput - AN Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	121	123	133	133

P2P - GC Mode Throughput - AC Mode | 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	277	341	373	381

5.5.5.5 Mobile AP Throughput

External client: NXP IW620 PCIe-UART

Mobile AP Mode Throughput - BGN Mode| 2.4 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	36	53	36	58
WPA2-AES	36	52	38	58
WPA3-SAE	37	53	35	58

Mobile AP Mode Throughput - AN Mode| 5 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	58	52	62	63
WPA2-AES	58	58	62	63
WPA3-SAE	58	58	62	63

Mobile AP Mode Throughput - AN Mode| 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	122	124	135	134
WPA2-AES	119	124	135	134
WPA3-SAE	119	124	135	134

Mobile AP Mode Throughput - AC Mode| 5 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	69	70	75	73
WPA2-AES	69	70	75	73
WPA3-SAE	69	70	75	73

Mobile AP Mode Throughput - AC Mode| 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	155	166	178	176
WPA2-AES	152	163	175	176
WPA3-SAE	151	163	178	175

Mobile AP Mode Throughput - AC Mode| 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	242	349	385	355
WPA2-AES	235	341	380	329
WPA3-SAE	236	344	383	347

Mobile AP Mode Throughput - AX Mode| 2.4 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	84	85	111	115
WPA2-AES	82	86	109	114
WPA3-SAE	76	87	108	119

Mobile AP Mode Throughput - AX Mode| 5 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	86	89	128	120
WPA2-AES	81	93	128	118
WPA3-SAE	80	91	127	120

Mobile AP Mode Throughput - AX Mode| 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	161	205	259	220
WPA2-AES	157	202	257	220
WPA3-SAE	157	198	257	223

Mobile AP Mode Throughput - AX Mode| 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	241	368	473	392
WPA2-AES	235	354	472	393
WPA3-SAE	236	356	471	359

5.5.6 Bug fixes/feature enhancements

5.5.6.1 FW version: From 16.92.21.p76.5 to 16.92.21.p99.2

Component	Description
Bluetooth	• LMP/LL response timeout occurs when connecting with nRF connect app on iOS15+ mobile device.
Coex	• Audio glitches observed on DUT as Master A2DP Source/Sink streaming with remote device when DUT Wi-Fi station is connected with external AP on 2.4 GHz.

5.5.7 EU conformance tests

- EU Adaptivity test - EN 300 328 v2.2.2 (for 2.4 GHz)
- EU Adaptivity test - EN 301 893 v2.1.1 (for 5 GHz)

5.5.8 Known issues

Component	Description
Bluetooth	• When A2DP steaming is initiated during an ongoing HFP call, A2DP link lose observed due to LMP response timeout (Frequency of occurrence 4/5 times) • Link Stability in presence of multiple Bluetooth links under optimization
Wi-Fi, Bluetooth and 802.15.4 (Open Thread) Coex	• Wi-Fi throughput in presence of OT peak throughput is under optimization

Note: *Before loading Bluetooth-only firmware, the Wi-Fi SDIO driver and firmware loading must be required with the calibration data file.*

5.6 SD-UART 8987

5.6.1 Package information

- BSP version: Linux 6.1.36-2.1.0
- Wi-Fi and Bluetooth/Bluetooth LE Firmware version: 16.92.21.p99.2
- Driver version: MM6X16408.p2-GPL

5.6.2 Version information

- Wireless SoC: 88W8987
- Wi-Fi and Bluetooth/Bluetooth LE Firmware Version: 16.92.21.p99.2
  - 16 - Major revision
  - 92 - Feature pack
  - 21 - Release version
  - p99.2 - Patch number
- Driver Version: MM5X16391.p3-GPL
  - 6X - Linux 6.x Kernel
  - 16408 - Release version
  - p2 - Patch Number
  - GPL - General Public License v2

5.6.3 Host platform

- MCIMX8M-EVK platform running Linux
- Supported Linux kernel versions: From 2.6.32 to 6.3.0
- Interface used
  - Wi-Fi over SDIO (SDIO 3.0 support, Clock speed: 200 MHz)
  - Bluetooth/Bluetooth LE over UART
- Test Tools
  - iPerf (version 2.0.13)
  - wpa_supplicant (version 2.10)
  - hostapd (version 2.10)

5.6.4 Wi-Fi and Bluetooth certification

The Wi-Fi and Bluetooth certification is obtained with the following combinations.

5.6.4.1 WFA certifications

- STA | 802.11n
- STA | 802.11ac
- STA | PMF
- STA | FFD
- STA | Security Improvement
- STA | WPA3-R3
- STA | VU

Refer to the application note *Wi-Fi Alliance Derivative Certification* (Section 2.1).

Note:

- *Download Labtool application for RF test mode, refer to the URL: MFG-W8987-MF-WIFI-BT-BRG-FC-VS2013-1.1.0.191-16.80.205.p211*
- *Download Sigma tool, refer to the URL:NXP_WTS_DUT_AGENT Release R2.0*

5.6.4.2 Bluetooth controller certification

Refer to the URL: https://launchstudio.bluetooth.com/ListingDetails/115533

5.6.5 Wi-Fi throughput

5.6.5.1 Throughput Test Setup

- Environment: Shield Room - Over the Air
- Access Point: Asus RT-AX88U (FW-3.0.0.4.386_49674)
- DUT: 88W8987-Murata M.2 (Module: LBEE5QD1ZM) with MCIMX8M-EVK platform
  - Driver Load Parameters:
    fw_name=nxp/sdiouart8987_combo_v0.bin, cal_data_cfg=none, cfg80211_wext=0xf, host_mlme=1, amsdu_deaggr=1, net_rx=1, tx_skb_clone=1, tx_work=1
  - iPerf commands:
    TCP server: # iperf -s -i1 -fm -w 2M
    TCP client: # iperf -c <ip_address> -i1 -fm -w 2M -t60 -P5
    UDP server: # iperf -s -u -i1 -fm -w 2M
    UDP client: # iperf -c <ip_address> -i1 -fm -w 2M -t60 -b 800 -P5
    Note: *You can add iPerf parameters like TCP window size, parallel streams, etc. to achieve the best throughput. The above-described iPerf parameters are an example.*
- External Client: NXP 88W8997 PCIe-UART
- Channel: 6 | 36

5.6.5.2 STA Throughput

External AP: Asus RT-AX88U

STA Mode Throughput - BGN Mode | 2.4 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	56	58	60	63
WPA2-AES	55	57	60	62
WPA3-SAE	54	57	60	61

STA Mode Throughput - AN Mode | 5 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	55	60	61	64
WPA2-AES	55	59	60	63
WPA3-SAE	55	60	61	63

STA Mode Throughput - AN Mode | 5 GHz Band | 40 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	110	122	124	131
WPA2-AES	107	114	123	116
WPA3-SAE	107	101	122	118

STA Mode Throughput - AC Mode | 5 GHz Band | 20 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	56	55	61	57
WPA2-AES	55	54	61	57
WPA3-SAE	55	54	61	57

STA Mode Throughput - AC Mode | 5 GHz Band | 40 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	157	166	174	177
WPA2-AES	149	165	172	151
WPA3-SAE	149	154	172	149

STA Mode Throughput - AC Mode | 5 GHz Band | 80 MHz (VHT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	232	346	265	376
WPA2-AES	214	342	251	374
WPA3-SAE	214	341	250	374

5.6.5.3 P2P-GO Throughput

P2P - GO Mode Throughput - BGN Mode | 2.4 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	56	54	60	59

P2P - GO Mode Throughput - AN Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	116	126	123	135

P2P - GO Mode Throughput - AC Mode | 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	249	361	256	389

5.6.5.4 P2P-GC Throughput

P2P - GC Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	57	54	60	59

P2P - GC Mode Throughput - AN Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	116	126	124	135

P2P - GC Mode Throughput - AC Mode | 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	256	365	256	386

5.6.5.5 Mobile AP Throughput

External client: NXP 88W8997 PCIe-UART

Mobile AP Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	55	53	59	58
WPA2-AES	55	53	58	58
WPA3-SAE	55	53	58	58

Mobile AP Mode Throughput - AN Mode | 5 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	58	55	61	60
WPA2-AES	58	56	61	60
WPA3-SAE	58	55	61	60

Mobile AP Mode Throughput - AN Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	116	78	125	118
WPA2-AES	115	76	124	117
WPA3-SAE	115	75	124	115

Mobile AP Mode Throughput - AC Mode | 5 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	69	69	73	77
WPA2-AES	69	69	74	77
WPA3-SAE	69	69	74	77

Mobile AP Mode Throughput - AC Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	147	101	160	107
WPA2-AES	146	101	158	108
WPA3-SAE	144	101	158	107

Mobile AP Mode Throughput - AC Mode | 5 GHz Band | 80 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	236	368	270	382
WPA2-AES	225	362	254	390
WPA3-SAE	223	362	253	388

5.6.6 EU conformance tests

- EU Adaptivity test - EN 300 328 v2.1.1 (for 2.4 GHz)
- EU Adaptivity test - EN 301 893 v2.2.2 (for 5 GHz)

5.6.7 Bug fixes/feature enhancements

5.6.7.1 FW version: From 16.92.10.p208 to 16.92.10.p210

Component	Description
Wi-Fi	• Fix for Wi-Fi Fragment and Forge Vulnerabilities (**EB - NXP Secuirty Advisory - Wi-Fi Vulnerability - USIRP02-2020**)
Bluetooth	• Fix for ANSSI Vulnerabilities (**EB - NXP Security Advisory - Bluetooth Vulnerability - ANSSI**)

5.6.7.2 FW version: From 16.92.10.p210 to 16.92.10.p210.1

Component	Description
Wi-Fi	• Added support for 40 MHz band in 2.4 GHz BGN mode for AP and STA

5.6.7.3 FW version: From 16.92.10.p210.1 to 16.92.21.p11.1

Component	Description
-	NA

5.6.7.4 FW version: From 16.92.21.p11.1 to 16.92.21.p26

Component	Description
Bluetooth	• When host read batch scan parameters then DUT gets unresponsive.

5.6.7.5 FW version: From 16.92.21.p26 to 16.92.21.p41.3

Component	Description
-	NA

5.6.7.6 FW version: From 16.92.21.p41.3 to 16.92.21.p41.4

Component	Description
Bluetooth	• DUT as peripheral and DUT as central starts connection for LE link simultaneously, if link with DUT as peripheral gets connected before link with DUT as central then link with DUT as central gets disconnected.

5.6.7.7 FW version: From 16.92.21.p41.4 to 16.92.21.p69.3

Component	Description
Bluetooth	• DUT pairing with LE HoGP remote device fails with authentication failure error. • DUT is connected for OPP profile with remote device and when transfer file to remote device then Bluetooth link gets disconnected. • When Bluetooth A2DP streaming is ongoing with first remote device then DUT failed for encryption with another LE remote device. • When DUT connected for HFP call and perform stress test for Bluetooth link connect disconnect then DUT firmware becomes unresponsive.
Coex	• Sometimes in dual A2DP mode, glitches are observed and Wi-Fi Rx throughput drops.

5.6.7.8 FW version: From 16.92.21.p69.3 to 16.92.21.p76.2

Component	Description
Wi-Fi	• The current consumption is higher than expected on chipset when loading the Wi-Fi only firmware.
Bluetooth	• When DUT A2DP streaming is ongoing and another LE device is connected with DUT and DUT is performing LE scan makes DUT firmware in bad condition for stress test.
Coex	• LE peripheral pairing gets failed with Mobile device when Wi-Fi is enabled on a single antenna device.

5.6.7.9 FW version: From 16.92.21.p76.2 to 16.92.21.p76.5

Component	Description
-	NA

5.6.7.10 FW version: From 16.92.21.p76.5 to 16.92.21.p99.2

Component	Description
Bluetooth	• LMP/LL response timeout occurs when connecting with nRF connect app on iOS15+ mobile device.
Coex	• Audio glitches observed on DUT as Master A2DP Source/Sink streaming with remote device when DUT Wi-Fi station is connected with external AP on 2.4 GHz.

5.6.8 Known issues

Component	Description
Bluetooth	• After disconnecting LE link, sometime disconnect complete event is delayed by 30 seconds, so next re-connection possible only after 30 second.

5.7 SD-UART IW416

5.7.1 Package information

- BSP version: Linux 6.1.36-2.1.0
- Wi-Fi and Bluetooth/Bluetooth LE Firmware version: 16.92.21.p84.3
- Driver version: MM5X16408.p2-GPL

5.7.2 Version information

- Wireless SoC: IW416
- Wi-Fi and Bluetooth/Bluetooth LE Firmware Version: 16.92.21.p84.3
  - 16 - Major revision
  - 92 - Feature pack
  - 21 - Release version
  - p84.3 - Patch number
- Driver Version: MM6X16408.p2-GPL
  - 6X - Linux 6.x Kernel
  - 16408 - Release version
  - p2 - Patch Number
  - GPL - General Public License v2

5.7.3 Host Platform

- MCIMX8M-EVK platform running Linux
- Supported Linux kernel versions: From 2.6.32 to 6.3.0
- Interface used
  - Wi-Fi over SDIO (SDIO 3.0 support, Clock speed: 200 MHz)
  - Bluetooth/Bluetooth LE over UART
- Test Tools
  - iPerf (version 2.0.13)
  - wpa_supplicant (version 2.10)
  - hostapd (version 2.10)

5.7.4 Wi-Fi and Bluetooth certification

The Wi-Fi and Bluetooth certification is obtained with the following combinations.

5.7.4.1 WFA Certifications

- STA | 802.11n
- STA | PMF
- STA | FFD
- STA | Security Improvement
- STA | WPA3-R3
- STA | VU

Refer to *AN12976 – Wi-Fi Alliance Derivative Certification* available on NXP website.

Note:

- *Download Labtool application for RF test mode, refer to the URL: MFG-IW416-MF-WIFI-BT-BRG-FC-VS2013-1.0.0.15.0-16.80.21.p72*
- *Download Sigma tool, refer to the URL: NXP_WTS_DUT_AGENT Release R2.0*

5.7.4.2 Bluetooth controller certification

Refer to the URL: https://launchstudio.bluetooth.com/ListingDetails/108035

5.7.5 Wi-Fi throughput

5.7.5.1 Throughput Test Setup

- Environment: Shield Room - Over the Air
- Access Point: Asus RT-AX88U (FW-3.0.0.4.386_49674)
- DUT: IW416-Murata (Module: LBEE5CJ1XK) with MCIMX8M-EVK platform
  - Driver Load Parameters:
    fw_name=nxp/sdiouartiw416_combo_v0.bin, cal_data_cfg=none, cfg80211_wext=0xf, host_mlme=1, amsdu_deaggr=1, net_rx=1, tx_skb_clone=1, tx_work=1
  - iPerf commands:
    TCP server: # iperf -s -i1 -fm -w 2M
    TCP client: # iperf -c <ip_address> -i1 -fm -w 2M -t60 -P5
    UDP server: # iperf -s -u -i1 -fm -w 2M
    UDP client: # iperf -c <ip_address> -i1 -fm -w 2M -t60 -b 800 -P5
    Note: *You can add iPerf parameters like TCP window size, parallel streams, etc. to achieve the best throughput. The above-described iPerf parameters are an example.*
- External Client: NXP IW620 PCIe-UART
- Channel: 6 | 36

5.7.5.2 STA Throughput

External AP: Asus RT-AX88U

STA Mode Throughput - BGN Mode | 2.4 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	54	55	61	61
WPA2-AES	51	51	61	56
WPA3-SAE	51	38	61	57

STA Mode Throughput - BGN Mode | 2.4 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	97	111	124	114
WPA2-AES	82	96	124	102
WPA3-SAE	87	60	124	64

STA Mode Throughput - AN Mode | 5 GHz Band | 20 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	53	59	60	63
WPA2-AES	53	58	60	62
WPA3-SAE	53	58	60	62

STA Mode Throughput - AN Mode | 5 GHz Band | 40 MHz (HT)				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	100	119	123	129
WPA2-AES	87	97	121	102
WPA3-SAE	87	98	121	103

5.7.5.3 P2P-GO Throughput

P2P - GO Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	56	55	60	58

P2P - GO Mode Throughput - AN Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	108	116	117	125

5.7.5.4 P2P-GC Throughput

P2P - GC Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	57	55	60	58

P2P - GC Mode Throughput - AN Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	113	116	122	125

5.7.5.5 Mobile AP Throughput

External client: NXP IW620 PCIe-UART

Mobile AP Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	55	54	59	58
WPA2-AES	55	54	58	57
WPA3-SAE	55	54	58	61

Mobile AP Mode Throughput - BGN Mode | 2.4 GHz Band | 40MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	109	102	120	100
WPA2-AES	107	104	118	86
WPA3-SAE	107	105	118	87

Mobile AP Mode Throughput - AN Mode | 5 GHz Band | 20 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	57	56	60	59
WPA2-AES	57	56	60	59
WPA3-SAE	57	56	60	59

Mobile AP Mode Throughput - AN Mode | 5 GHz Band | 40 MHz				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	116	108	124	116
WPA2-AES	114	108	122	116
WPA3-SAE	114	124	122	134

5.7.6 EU conformance tests

- EU Adaptivity test - EN 300 328 v2.1.1 (for 2.4 GHz)
- EU Adaptivity test - EN 301 893 v2.2.2 (for 5 GHz)

5.7.7 Bug fixes/feature enhancements

5.7.7.1 FW version: From 16.92.10.p233.2 to 16.92.21.p11.2

Component	Description
Bluetooth	• The ACL link with iPhone is disconnected due to error code “REMOTE DEVICE TERMINATED CONNECTION DUE TO LOW RESOURCES.

5.7.7.2 FW version: From 16.92.21.p11.2 to 16.92.21.p41.1

Component	Description
Wi-Fi	• Fix Channel Occupancy Time (COT) for HT20/MCS0 within 6 msec.

5.7.7.3 FW version: From 16.92.21.p41.1 to 16.92.21.p55.3

Component	Description
Wi-Fi	• Once DUT PAN profile gets disconnection with remote device, then DUT reconnection fails for successive connection trials. • DUT Bluetooth Classic & BLE RX test mode fails to receive the packets and host is failing to derive the various parameters.

5.7.7.4 FW version: From 16.92.21.p55.3 to 16.92.21.p76.3

Component	Description
Bluetooth	• DUT Bluetooth & BLE TX test mode fails to set the power continuously and there is a difference between configured and measured power.

5.7.7.5 FW version: From 16.92.21.p76.3 to 16.92.21.p84.3

Component	Description
Bluetooth	• DUT HFP link gets disconnected with Remote phone, when it starts OPP file transfer to Remote device.

5.7.8 Known issues

Component	Description
Wi-Fi	• When ed-mac is enabled, probe responses are transmitted during interference signal.
Bluetooth	• After disconnecting LE link, sometime disconnect complete event is delayed by 30 seconds, so next re-connection possible only after 30 second • Random Bluetooth security link loss in concurrent Bluetooth classic and Bluetooth LE modes with AES • When Bluetooth A2DP streaming is ongoing with first remote device then DUT shows low transmit throughput with second remote device.

5.8 SD 8801

5.8.1 Package information

- BSP version: Linux 6.1.36-2.1.0
- Wi-Fi Firmware version: 14.92.36.p182
- Driver version: MM6X14408.p2-GPL

5.8.2 Version information

- Wireless SoC: SD8801
- Wi-Fi Firmware Version: 14.92.36.p182
  - 14 - Major revision
  - 92 - Feature pack
  - 36 - Release version
  - p182 - Patch number
- Driver Version: MM6X14408.p2-GPL
  - 6X - Linux 6.x Kernel
  - 14408 - Release version
  - p2 - Patch Number
  - GPL - General Public License v2

5.8.3 Host Platform

- MCIMX8M-EVK platform running Linux
- Supported Linux kernel versions: From 2.6.32 to 6.3.0
- Interface used
  - Wi-Fi over SDIO (SDIO 2.0 support, Clock speed: 50 MHz)
- Test Tools
  - iPerf (version 2.0.13)
  - wpa_supplicant (version 2.10)
  - hostapd (version 2.10)

5.8.4 Wi-Fi Certification

The Wi-Fi certification is obtained with the following combinations.

5.8.4.1 WFA Certifications

- STA | 802.11n
- STA | PMF
- STA | Security Improvement
- STA | SAE-R3
- STA | FFD
- STA | VU

Refer to *AN12976 – Wi-Fi Alliance Derivative Certification* available on NXP website.

Note:

- *Download Labtool application for RF test mode, refer to the URL: MFG-W8801- MF-WIFI- BRG-FC13- WIN-X86*
- *Download Sigma tool, refer to the URL: NXP_WTS_DUT_AGENT Release R2.0*

5.8.5 Wi-Fi throughput

5.8.5.1 Throughput Test Setup

- Environment: Shield Room - Over the Air
- Access Point: Asus RT-AX88U (FW-3.0.0.4.386_49674)
- DUT: W8801-Murata M.2 (Module LBWA0ZZ2DS) with MCIMX8M-EVK platform
  - Driver Load Parameters:
    fw_name=nxp/sd8801_uapsta.bin cal_data_cfg=none cfg80211_wext=0xf host_mlme=1, amsdu_deaggr=1, net_rx=1, tx_skb_clone=1, tx_work=1
  - iPerf commands:
    TCP server: # iperf -s -i1 -fm -w 2M
    TCP client: # iperf -c <ip_address> -i1 -fm -w 2M -t60 -P5
    UDP server: # iperf -s -u -i1 -fm -w 2M
    UDP client: # iperf -c <ip_address> -i1 -fm -w 2M -t60 -b 800 -P5
    Note: *You can add iPerf parameters like TCP window size, parallel streams, etc. to achieve the best throughput. The above-described iPerf parameters are an example.*
- External Client: NXP 88W8997 PCIe-UART
- Channel: 6

5.8.5.2 STA Throughput

External AP: Asus RT-AX88U

STA Mode Throughput - BGN Mode | 2.4 GHz Band | 20 MHz | 1SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	40	55	46	59
WPA2-AES	42	55	45	59
WPA3-SAE	42	55	47	60

5.8.5.3 P2P-GO Throughput

P2P - GO Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz | 1SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	40	55	44	60

5.8.5.4 P2P-GC Throughput

P2P - GC Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz | 1SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
WPA2-AES	42	55	49	60

5.8.5.5 Mobile AP Throughput

External client: NXP 88W8997 PCIe-UART

Mobile AP Mode Throughput - BGN Mode | 2.4 GHz Band | 20MHz | 1SS				
Protocol	**TCP (Mbit/s)**		**UDP (Mbit/s)**	
Direction	**Tx**	**Rx**	**Tx**	**Rx**
Open Security	42	52	44	58
WPA2-AES	40	55	43	60
WPA3-SAE	42	53	47	60

5.8.6 EU conformance tests

- EU Adaptivity test - EN 300 328 v2.1.1 (for 2.4 GHz)

5.8.7 Bug fixes/feature enhancements

Component	Description
--	NA

5.8.8 Known issues

Component	Description
--	NA

6 i.MX platforms on-board chips and external wireless solutions

Table 6. On-board chips and external support for Bluetooth and Wi-Fi support

SoC	On-board chip	PCIe M.2 card	uSD card or SDIO M.2 card
8 QM/QXP/DX/DXL	-	NXP 88W8997 (Murata LBEE5XV1YM[1]) NXP 88W9098 (Murata LBEE5ZZ1XL[1])	-
8 ULP	-	-	NXP IW416 (Murata LBEE5CJ1 XK[1])
8M Nano	NXP 88W8987 (AzureWave AW-CM358 SM/MA[1])	-	NXP 88W8987 (Murata M.2 LBEE5QD1ZM)
8M Mini	NXP 88W8987 (AzureWave AW-CM358 SM/MA[1])	-	NXP 88W8987 (Murata M.2 LBEE5QD1ZM)
8M Plus	-	NXP 88W8997 (AzureWave AW-CM276 SM/MA[1]) NXP 88Q9098 (Murata LBEE6ZZ-1TA[1])	NXP 88W8997 (Murata LBEE5 XV1YM[1]) NXP 88Q9098 (Murata LBEE5 ZZ1XL[1])
8M Quad	-	NXP 88W8997 (Murata LBEE5XV1YM[1]) NXP 88Q9098 (Murata LBEE6ZZ-1TA[1])	NXP 88W8997 (Murata LBEE5 XV1YM[1]) NXP IW416 (Murata LBEE5CJ1 XK[1]) NXP 88W8801 (Murata LBWA0 ZZ2DS[1]) NXP 88Q9098 (Murata LBEE5 ZZ1XL[1])
7ULP	-	-	NXP 88W8987(Azurewave AW-CM358-SM/MA[1])(WLAN only)
7D	-	-	NXP 88W8987(Azurewave AW-CM358-SM/MA[1])(WLAN only)
6Q/6DL/6QP/6SX/ 6 SLL/6UL/6ULL/ 6ULZ	-	-	NXP IW416 (Murata LBEE5CJ1 XK)[2][1] #NXP 88W8801 (Murata LBWA0 ZZ2DS[2][1]) NXP 88W8987(Murata LBEE5 QD1ZM[1])

[1] Tested modules with mentioned i.MX EVK.
[2] M.2 + M.2-to-usd adapter (only imx6ull support)

7 Acronyms and abbreviations

Table 7. List of acronyms and abbreviations

Acronym	Definition
A2DP	Advanced audio distribution profile
AP	Access point
BCA-TDM	Bluetooth coexistence arbiter - Time division multiplexing
BW	Bandwidth
CCMP	Counter mode CBC-MAC protocol
CTS	clear to send
DCM	Dual carrier modulation
DRCS	Dynamic rapid channel switching
ERP	Extended rate physical
GATT	Generic attribute profile
HFP	Hands free profile
HID	Human interface device
HT	High throughput
MCS	Modulation and coding scheme
MLME	Mac layer management entity
RTS	Request To Send
SAE	Simultaneous authentication of equals
STA	Station
VHT	Very high throughput
WFD	Wi-Fi direct
WPA	Wi-Fi protected access
WPS	Wi-Fi protected setup
WSC	Wi-Fi simple configuration

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