WINC1500 Software

Release Notes

VERSION : **19.7.6**

DATE : **NOV, 2021**

Abstract

This document presents an overview of the WINC15x0 firmware release version 19.7.6, and corresponding driver.

1 Introduction

This document describes the WINC15x0 version 19.7.6 release package.

The release package contains all the necessary components (binaries and tools) required to make use of the latest features including tools, driver code and firmware binaries.

1.1 Firmware readiness

Microchip Technology Inc. considers version 19.7.6 firmware to be suitable for production release.

2 Release summary

2.1 Auditing information

Master Development Ticket	:	https://jira.microchip.com/projects/W1500/versions/69213
Release Repository	:	Wifi_M2M
Source Branch	:	/branches/rel_1500_19.7.6
Subversion Revision	:	r19393

2.2 Version information

WINC Firmware version	:	19.7.6
Host Driver version	:	19.7.5
Minimum driver version	:	19.3.0

Please note that the SVN revision advertised in the firmware serial trace will be **19389**.

```
(10)NMI M2M SW  VER 19.7.6 REV 19389
(10)NMI MIN DRV VER 19.3.0
(10)FW URL branches/rel_1500_19.7.6
(10)Built Oct 29 2021   11:07:37
```

2.3 Released components

The release contains documentation, sources and binaries.

2.3.1 Documentation overview

The Application manuals, Release notes and Software API guides can be found in the `doc/` folder of the release package.

Release Notes:

This document

Software APIs:

WINC1500_IoT_SW_APIs.chm

2.3.2 Binaries and programming scripts

The main WINC15x0 firmware binary is located in the `firmware` directory and named `m2m_aio_3a0.bin`. This can be flashed to a WINC device using, for example, a serial bridge application available from ASF.

An OTA image is provided in the `ota_firmware` directory named `m2m_ota_3a0.bin`.

2.3.3 Sources

Source code for the host driver can be found under the `src/host_drv` directory.

Source code for the tools, including crypto_lib, can be found under the `src/Tools` directory.

2.4 Release Comparison

Features in 19.7.4	Changes in 19.7.6
Wi-Fi STA	
• IEEE 802.11 b/g/n. • OPEN, WEP security. • WPA Personal Security (WPA1/WPA2). • WPA Enterprise Security (WPA1/WPA2) supporting: EAP-TTLSv0/MS-Chapv2.0 EAP-PEAPv0/MS-Chapv2.0 EAP-PEAPv1/MS-Chapv2.0 EAP-TLS EAP-PEAPv0/TLS EAP-PEAPv1/TLS	• Support for the WEP protocol is deprecated in 19.7.5. Attempts to configure it will result in error. • Countermeasures for 'Fragattack' vulnerabilities
Wi-Fi Hotspot	
• Only ONE associated station is supported. After a connection is established with a station, further connections are rejected. • OPEN, WEP and WPA/WPA2 security modes. • The device cannot work as a station in this mode (STA/AP Concurrency is not supported).	• Support for the WEP protocol is deprecated in 19.7.5. Attempts to configure it will result in error. • Countermeasures for 'Fragattack' vulnerabilities
Wi-fi Direct/P2P	
• Wi-Fi direct client is not supported.	No change
WPS	
The WINC1500 supports the WPS protocol v2.0 for PBC (Push button configuration) and PIN methods.	No change
TCP/IP Stack	
The WINC1500 has a TCP/IP Stack running in firmware side. It supports TCP and UDP full socket operations (client/server). The maximum number of supported sockets is currently configured to 11 divided as: • 7 TCP sockets (client or server). • 4 UDP sockets (client or server).	• No change
TLS	
• Support TLS v1.2. • Client and server modes.	• No change

Features in 19.7.4	Changes in 19.7.6
• Mutual authentication in client mode. • X509 certificate revocation scheme. • SHA384 and SHA512 support in X509 certificates processing. • Integration with ATECC508 (ECDSA and ECDHE support). • Supported cipher suites are: TLS_RSA_WITH_AES_128_CBC_SHA TLS_RSA_WITH_AES_128_CBC_SHA256 TLS_RSA_WITH_AES_256_CBC_SHA TLS_RSA_WITH_AES_256_CBC_SHA256 TLS_DHE_RSA_WITH_AES_128_CBC_SHA TLS_DHE_RSA_WITH_AES_128_CBC_SHA256 TLS_DHE_RSA_WITH_AES_256_CBC_SHA TLS_DHE_RSA_WITH_AES_256_CBC_SHA256 TLS_RSA_WITH_AES_128_GCM_SHA256 TLS_DHE_RSA_WITH_AES_128_GCM_SHA256 TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (requires ECC508) TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 (requires ATECC508)	• Fix to TLS ALERT handling
Networking Protocols	
DHCPv4 (client/server) DNS Resolver IGMPv1, v2. SNTP	No change
Power saving Modes	
• M2M_PS_MANUAL • M2M_PS_DEEP_AUTOMATIC	No change
Device Over-The-Air (OTA) upgrade	
• Built-in OTA upgrade available. • Backwards compatible as far as 19.4.4, with the exception of: - Wi-Fi Direct (removed in 19.5.3) - Monitor mode (removed in 19.5.2)	No change
Wi-Fi credentials provisioning via built-in HTTP server	
Built-in HTTP/HTTPS (TLS server mode) provisioning using AP mode (Open, WEP or WPA/WPA2 secured).	No change

Features in 19.7.4	Changes in 19.7.6
Ethernet Mode (TCP/IP Bypass)	
Allow WINC1500 to operate in WLAN MAC only mode and let the host send/receive Ethernet frames.	No change
ATE Test Mode	
Embedded ATE test mode for production line testing driven from the host MCU.	No change
Miscellaneous features	
	Improved gain tables for module antenna Transmit DC offset correction adjusted to optimal value

3 Test Information

Please refer to ticket W1500-802 for full details.

Testing was performed against the release candidate 19.7.6 against the following configuration(s):

H/W Version : WINC1510 Xplained module

Host MCU : ATSAMD21-Xplained

The following testing was performed in both open air and shielded environments;

1. General functionality including:
    1. HTTP Provisioning
    2. Station Mode
    3. AP Mode
    4. IP (TCP and UDP client and server)
    5. HTTP POST/GET
    6. WPS (PIN and PushButton methods)
    7. Over-The-Air (OTA) update functionality and robustness (with and without TLS)
2. TLS functionality including:
    1. RSA cipher-suites:
        i. TLS_RSA_WITH_AES_128_CBC_SHA
        ii. TLS_RSA_WITH_AES_128_CBC_SHA256
        iii. TLS_RSA_WITH_AES_128_GCM_SHA256
        iv. TLS_DHE_RSA_WITH_AES_128_CBC_SHA
        v. TLS_DHE_RSA_WITH_AES_128_CBC_SHA256
        vi. TLS_DHE_RSA_WITH_AES_128_GCM_SHA256

        Testing uses 1024-bit, 2048-bit and 4096-bit server certificates, with a chain of 7 certificates of varying key lengths (1024,2048 and 4096 bit) leading to a 2048-bit root certificate.
    2. ECDSA ciphersuites:
        i. TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256
        ii. TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256

        Testing uses a NIST standard ECC P256 prime curve server certificate with two chains, one leading back to an ECDSA root certificate and the other leading to an RSA root certificate.
    3. Client authentication
3. Performance under interference
4. TCP/IP stack robustness testing
    1. Using an internal implementation of IPerf.
    2. Verification of multi socket functionality

4 Known issues

ID	Description
W1500-63	Occasionally WINC15x0 fails to receive an individual UDP broadcast frame when in M2M_PS_DEEP_AUTOMATIC powersave mode. Recommended workaround: **Use M2M_NO_PS powersave mode if reliability is preferred for UDP broadcast frames. Otherwise ensure the overlying protocol can handle the odd missing frame.**
W1500-108	The WINC15x0 cannot handle two simultaneous TLS handshakes, due to memory constraints. Recommended workaround: **When attempting to open two secure sockets in STA mode, the application should wait to be notified of the first one completing (succeeding or failing) before attempting the second one.**
W1500-325	1% of Enterprise conversations fail due to the WINC15x0 not sending an EAP response. The response is prepared and ready to send but does not appear on the air. After 10 seconds the firmware times-out the connection attempt and the application is notified of the failure to connect. Recommended workaround: Configure the authentication server to retry EAP requests (with interval < 10 seconds). **The application should retry the connection request when it is notified of the failure.**
W1500-369	When connected to certain access points, the WINC15x0 sometimes fails to roam when the access point changes channel. The issue is seen with these access points: Linksys E2500, Linksys E4200, Linksys 6500. The failures to roam are due to two issues: 1. Sometimes the access point takes a long time to start sending beacons or probe responses on the new channel, so it is not discoverable. 2. Sometimes the access point does not initiate the 4-way handshake (for WPA/WPA2 PSK reconnections). Recommended workaround: **On reception of M2M_WIFI_DISCONNECTED event, the application should attempt to discover the access point using `m2m_wifi_request_scan()` API.**

W1500-387	If an AP uses an 802.11 ACK policy of "No Ack", then the WINC15x0 sometimes fails to receive 802.11b frames. Recommended workaround: **Avoid using an ACK policy of "No Ack". If "No Ack" is used, ensure frames are sent at 802.11g or higher rates.**
W1500-397	70% of Enterprise connection requests fail with a TP Link Archer D2 access point (TPLink-AC750-D2). The access point does not forward the initial EAP Identity Response to the authentication server. The issue is bypassed by PMKSA caching (WPA2 only), so reconnection attempts will succeed. Recommended workaround: **The application should retry the connection request when it is notified of the failure.**
W1500-402	Occasionally during AP provisioning, after entering the credentials of the AP to connect to and pressing "connect", an error will be returned even though provisioning was successful and the connection proceeds. Recommended workaround: **Add a delay in the application between receiving the provisioning info and connecting to the AP. Ignore the "Request Failed" message.**
W1500-510	Using TLS Server mode with a server certificate that is signed with a key size which differs from the key size contained within the certificate can cause the WINC to crash. Recommended workaround: **Only use a TLS Server certificate that is signed using the same key size as the key contained within the certificate.**
W1500-699	When using a driver pre – 19.6.0 with this firmware, upon failure to obtain a DHCP address the WINC will not trigger a WiFi Disconnection and notify the driver of the failure. Recommended workaround: **In this case of an older driver running with later firmware, the application should monitor the time taken to obtain a DHCP address, if it takes too long then it can decide whether to disconnect and try again.**

5 New Features

There are no new features in this release.

6 Fixes and enhancements

These are the major fixes and enhancements since the previous released version (19.7.4).

6.1 Issues fixed

ID	Description
W1500-645	**Sequence numbers from QoS NULL frames affect Block Ack operation** When a QoS NULL frame was received during a Block Ack session, the sequence number from the frame was incorrectly removed from the Block Ack scoreboard which could eventually result in the data transfer becoming stuck. Fixed: Ensure the Block Ack scoreboard is not updated on receipt of a QoS NULL frame.
W1500-762	**Plaintext data frames accepted in protected network (CVE-2020-26140, CVE-2020-26143, CVE-2020-26144)** Part of the 'Fragattack' vulnerabilities – plaintext QoS data frames received in a protected network were being processed and passed to the upper layers. Fixed: When in a protected network, drop plaintext non-EAPOL data frames
W1500-765	**Processes spoofed A-MSDU (CVE-2020-24588)** Receipt of a non-AMSDU frame that has been manipulated to look like an A-MSDU frame can establish an attack vector into the upper layers. Fixed: Check for a specifically crafted packet and discard if it is detected (fixed as per WFA security considerations 11/05/2021)
W1500-768	**Processes fragmented frame if 2nd fragment is plaintext (CVE-2020-26147)** In the case of CCMP, WINC would allow a plaintext fragment in a fragmented frame if the first fragment was CCMP encrypted. Fixed: Processing of fragmented frames is now performed in firmware, allowing a fix to be implemented.
W1500-769	**Processes fragmented frame if CCMP PN is not consecutive (CVE-2020-26146)** Fragments that have non-consecutive PN values were being accepted and processed. Fixed: Processing of fragmented frames is now performed in firmware, allowing a fix to be implemented.
W1500-771	**Incorrect return value from m2m_wifi_1x_get_option()** Driver function m2m_wifi_1x_get_option() returns the wrong status code in a particular code path. Fixed: Missing 'break' added.
W1500-780	**Received frames can get trapped in block ack reorder queue**

	When a non-AMPDU frame is received for a TID that has an active Block Ack session, the sender will not receive info on the WINCs Block Ack reorder queue, and previously missed frames may never be re-sent. Fixed: Drain the re-order queue whenever a non-AMPDU frame is received for a TID with an active Block Ack session.
W1500-803	802.11b RF Carrier Suppression testing shows sub-optimal results Fixed: The TX I/Q DC offset value has been set from (-7/-7Mv) to (-4/-4Mv) which gives the best 802.11b RF carrier suppression results in testing.

6.2 Enhancements

W1500-753	**Increase TLS Rx throughput.** TCP Rx windowing reworked to increase single stream and two-stream throughput with large TLS records.

7 Appendix A – TLS Root certificates

The WINC1500 19.7.6 module comes with a preselected selection of TLS root certificates that will allow a TLS connection to be established with a range of internet TLS servers out of the box.

These preselected certificates are described in 7.1

7.1 TLS root certificates

Issuer	Filename	Expiry	Public Key	Signature Alg.	Notes
Amazon Root CA 1	AmazonRootCA1.cer	17 January 2038 01:00:00	RSA (2048 bits)	SHA256RSA	AWS Cloud
Baltimore CyberTrust Root	BaltimoreCyber-TrustRoot.cer	13 May 2025 00:59:00	RSA (2048 bits)	SHA1RSA	Azure Cloud
DigiCert High Assurance EV Root CA	DigiCert.cer	10 November 2031 01:00:00	RSA (2048 bits)	SHA1RSA	
DigiCert High Assurance EV Root CA	DigiCertSHA2.cer	22 October 2028 13:00:00	RSA (2048 bits)	SHA256RSA	
Entrust Root Certification Authority	EnTrust.cer	27 November 2026 21:53:42	RSA (2048 bits)	SHA1RSA	
GlobalSign Root CA	GlobalSignRoot.cer	28 January 2028 13:00:00	RSA (2048 bits)	SHA1RSA	
Internet Security Research Group Root X1	isrgrootx1.cer	04 June 2035 12:04:38	RSA (4096 bits)	SHA256RSA	LetsEncrypt
QuoVadis Root CA 2	QuoVadis_Root.cer	24 November 2031 19:23:33	RSA (4096 bits)	SHA1RSA	
VeriSign Class 3 Primary Certification Authority	VeriSign.cer	17 July 2036 00:59:59	RSA (2048 bits)	SHA1RSA	

8 Terms and Definitions

Term	Definition
AES	Advanced Encryption Standard
AJAX	Asynchronous JavaScript and XML
AKM	Authentication and Key Management
ARP	Address Resolution Protocol
ATE	Automated Test Equipment
BSS	Basic Service Set
CBC	Cyclic Block Chaining
DHCP	Dynamic Host Control Protocol
DHE	Diffie-Hellman Ephemeral
DNS	Domain Name Server
DTIM	Directed Traffic Indication Map
EAP	Extensible Authentication Protocol
EAPOL	EAP Over LAN
ECC	Elliptic Curve Cryptography
ECDHE	Elliptic Curve Diffie-Hellman Ephemeral
ECDSA	Elliptic Curve Digital Signature Algorithm
EEPROM	Electrically Erasable Programmable Read Only Memory
ESD	Electrostatic Discharge
EVM	Error Vector Magnitude
HIF	Host Interface
HTTP	Hypertext Transfer Protocol
IEEE	Institute of Electronic and Electrical Engineers
MAC	Media Access Control
OTA	Over The Air update
PEAP	Protected Extensible Authentication Protocol
PLL	Phase Locked Loop
PMK	Pair-wise Master Key
PSK	Pre-shared Key
QAM	Quadrature Amplitude Modulation
RSA	Rivest-Shamir-Adleman (public key cryptosystem)
RSN	Robust Security Network
RSSI	Receive Strength Signal Indicator
SHA	Secure Hash Algorithm
SNTP	Simple Network Time Protocol
SPI	Serial Peripheral Interface
SSID	Service Set Identifier
SSL	Secure Sockets Layer
TCP	Transmission Control Protocol
TIM	Traffic Indication Map
TLS	Transport Layer Security

Term	Definition
WEP	Wired Equivalent Privacy
WINC	Wireless Network Controller
WLAN	Wireless Local Area Network
WMM™	Wi-Fi Multimedia
WMM-PS™	Wi-Fi Multimedia Power Save
WPA™	Wi-Fi Protected Access
WPA2™	Wi-Fi Protected Access 2 (same as IEEE 802.11i)