Morse Micro



MM8108 Linux Software Release Notes

Linux Firmware and Driver Package

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1 Overview

The purpose of this document is to provide a summary of new software features and improvements implemented in the latest Linux firmware and driver.

2 Software Change Summary

2.1 Release 2.2.3

This section summarizes software changes made since release 2.1.0.

Long-Term Support (LTS) Linux Kernels supported in this release
6.18.34, 6.12.21, 6.6.31, 6.1.21, 5.15.61, 5.10.11, 5.4.83, 4.19.66, 4.14.98, 4.9.80

2.1.1 New Features

- Added support for GPIO board configuration (eval only): The feature adds more flexibility to GPIO pin configuration. It allows users to map pins to pre-defined functions as well as set GPIO states while in active and snooze states.
- Added support for 70+ countries that do not require new 5G mappings
    - These countries have not been regulatory-certified by Morse Micro. This support enables customers to take their devices to these countries for local regulatory certification.
    - The list of newly added countries in this release: Albania, Andorra, Austria, Bahamas, Barbados, Belgium, Belize, Bosnia and Herzegovina, Bulgaria, Costa Rica, Croatia, Cyprus, Czech Republic, Denmark, Ecuador, El Salvador, Estonia, Finland, France, French Guiana, Georgia, Germany, Greece, Guyana, Haiti, Honduras, Hungary, Iceland, Ireland, Italy, Jamaica, Kenya, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Netherlands, Nicaragua, North Macedonia, Norway, Panama, Poland, Portugal, Romania, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Uganda, Ukraine, Uruguay, Vatican City
- Added Japan 850 MHz channel support
- Added support for individual EU countries that follow ETSI EN 304 220
- Removed the dot11ah.ko kernel module (merged with morse.ko)
- Added support for LTS kernel 6.18 (early access, limited testing)
- YAPS host-interface benchmark: A YAPS benchmark has been added to make it easier to port the YAPS host interface to new platforms. YAPS is the transport the driver uses to carry commands and frames between the host and the chip. The benchmark measures the raw throughput of this link on its own, without the radio. This lets developers check that the host bus works and performs as expected during board bring-up, before moving on to RF testing.

The benchmark is available through debugfs. For more information, refer to the Morse Micro SoftMAC Linux driver User Guide

2.1.2 Resolved Issues and Improvements

- Improved GPIO initialization across snooze: GPIO settings now stay the same when the chip goes into and wakes from snooze. Host-facing signals stay stable, no glitches or power leaks on connected peripherals.
- More stable multi-STA over-the-air operation: The PHY firmware is now more robust under sustained multi-station traffic. Multi-STA deployments can run for longer without interruption (see Known Issues below).
- Improved interference handling for: NBI, ACI, AACI, and OOB
- Improved DPP Push Button robustness
- Improved subband reception for MM8108-M20-US modules

2.1.3 Known Issues

SoftMAC

- Performance Regression under high power ACI. The issue will be fixed in later versions.
    - Impact: Lower throughput when the ACI source is very close
    - Mitigation: Move away from the interferer
- Association failures may be observed at very weak signal levels (around -97 dBm)
    - Impact: Up to 5% higher failure rate in DPP and association testing in higher attenuation
    - Mitigation: Move closer to AP if applicable
- A lower association success rate was observed when interoperating with older (i.e., versions < 2.0.0) MM8108 software releases in high-noise environments.
    - This behavior can be attributed to the increased collision rate when a 1.17-based DUT occupies the medium while a 2.x-based DUT backs off more.
    - Workaround: Upgrade all devices to release 2.x whenever possible, or allow for a longer association time in noisy environments.
- Multi-STA unrecoverable drop to zero throughput. The issue is caused by the station going to 0 throughput for a few seconds due to medium contention, then iPerf gives up and drops the stream/connection.
    - The issue is only observable in large setups (7 or 8 stations), with unthrottled traffic.
    - Workaround: Limit the bitrate through -b if using iPerf
- Multi-STA camera performance for mixed RSSI STAs is not optimal.
    - Impact: Can affect multi-camera setups, where a lower throughput camera can affect better performing ones. Minimal impact on general multi-sta setups
    - Mitigation: For best performance, when applicable avoid streaming weaker signal cameras simultaneously with stronger signal ones

- Adaptive RAW low throughput in a multi-STA network
    - Workaround: Under Investigation

2.1.4 Unsupported, Limited, and Deprecated Features

- SoftMAC:
    - AP power save mode is not supported
    - Support for PV1 frames has been deprecated
    - Pre-association power save is disabled by default, but can be enabled via a module parameter.
- FullMAC is deprecated and won't be supported in future versions.

2.2 Release 2.1.0

This section summarizes software changes made since release 2.0.0.

Long-Term Support (LTS) Linux Kernels supported in this release
6.12.21, 6.6.31, 6.1.21, 5.15.61, 5.10.11, 5.4.83, 4.19.66, 4.14.98, 4.9.80

2.2.1 New Features

- Support for Standby mode
    - Standby is a power management state in which the host application processor is powered down while the Wi-Fi HaLow firmware continues to run autonomously, maintaining network connectivity.
- Support for Argentina, Chile, Colombia, and Mexico regulatory domains.
- Support for EN 304 220
- Support for bus-test mode
    - The Morse driver test mode brings the driver up only to a selected stage, rather than performing a full interface bring-up. This is useful during driver porting. The new bus-test mode skips the firmware boot and verifies only that the host bus is functional and that data can be read from and written to the device correctly.
- Support for FullMAC (Beta)
    - MM8108 firmware and driver can be configured to operate in FullMAC architecture. A FullMAC driver is a Linux Wi-Fi HaLow driver architecture in which most of the 802.11 MAC-layer processing occurs on the device rather than in the host kernel.
    - MM8108 FullMAC can only operate in STA mode.
    - FullMAC is currently in beta support. For configuration and limitations, refer to the "FullMAC Linux Driver User Guide".
    - FullMAC supports UDP keep-alive. The firmware maintains periodic UDP keep-alive packets to a cloud server on the host's behalf, allowing the host to enter deep power-down states, including full power-off.

    - Opportunistic Wireless Encryption (OWE) is supported on kernels older than 6.7. OWE is a Wi-Fi Alliance Enhanced Open mechanism that encrypts traffic on open networks without a passphrase.
    - Human Machine Interface (HMI) (Beta). A new framework for triggering user-defined actions in response to driver or firmware events.
- Support for the MM8108-M20-US module
    - MM8108-M20 combines Morse Micro's Wi-Fi HaLow silicon with an external high-power amplifier, alongside a surface acoustic wave (SAW) filter tuned for the 902-928 MHz band in North America. For more details, see MM8108 M20 High Power Wi-Fi HaLow Module.
- BCF-based Thermal Protection Thresholds (beta): Thermal Mitigation ensures the device operates within safe limits. The firmware continuously monitors chip temperature and suspends transmission once it reaches the mitigation threshold, resuming once the chip cools down. BCF parameterization, introduced as alpha in 2.0.0, is now available as beta for customer evaluation. See APPNOTE-56, MM8108 Thermal Protection Mechanism, for more information.

2.2.2 Resolved Issues and Improvements

- Throughput degradation for multi-STA if WDS is enabled.
- An intermittent crash can be observed if running on the SPI bus with A-MSDU enabled and traffic flowing bidirectionally.
- Intermittent firmware assert/crash during calibration. The issue is intermittent and uncommon.
- Intermittent chip hangs during packet offloading transmission: Caused by incorrect packet size calculations.
- Health-check can fail/timeout while the chip is busy handling scan requests.
- The TX power setting is not obeyed for the sub-band. The feature doesn't affect data packets but only management packets (e.g., beacons, Probe request/response)

2.2.3 Known Issues

SoftMAC

- A lower association success rate was observed when interoperating with older (i.e., versions < 2.0.0) MM8108 software releases in high-noise environments.
    - This behavior can be attributed to the increased collision rate when a 1.17-based DUT occupies the medium while a 2.0 (and later) devices backs off more.
    - Workaround: Upgrade all devices to release 2.x whenever possible, or allow for a longer association time in noisy environments.
    - The issue won't be further reported in later releases.
- 5dB range degradation can be seen in the presence of strong Adjacent Channel Interference

(ACI) in 8 MHz channels.
    - Workaround: When possible, devices should be put further away from strong interferer signals
    - The issue will be resolved in later releases.
- MM8108-M20 based modules may exhibit degraded subband reception at specific attenuation levels, which may occasionally cause association failures
    - Workaround: consider adding a 10 dB attenuation if devices are less than 10 m apart
    - The issue will be resolved in later releases.
- Multi-STA unrecoverable drop to zero throughput. The issue is caused by the station going to 0 throughput for a few seconds due to medium contention, then iPerf gives up and drops the stream/connection.
    - The issue is only observable in large setups (7 or 8 stations), with unthrottled traffic.
    - Workaround: Limit the bitrate through -b if using iPerf
- Adaptive RAW low throughput in a multi-STA network
    - Workaround: None

FullMAC

- FullMAC STA doesn't yet support interoperability with Newracom APs
- Firmware crashes if burst exhaust duty cycle restrictions are exceeded
    - Workaround: Avoid overloading burst mode duty cycle packets
- Firmware crashes in bi-directional high TCP throughput. The issue is intermittent and uncommon to occur
    - Recoverable through watchdog timer
    - Workaround: None
- In a noisy environment, wpa_supplicant can time out before the FullMAC association is complete.
    - Workaround: Use the `iw connect` command instead of wpa_supplicant

2.2.4 Unsupported, Limited, and Deprecated Features

- SoftMAC:
    - AP power save mode is not supported
    - Support for PV1 frames has been deprecated
    - Pre-association power save is disabled by default, but can be enabled via a module parameter.
- FullMAC:
    - STA only, single interface (IBSS, MBSS, mesh Soft AP are not supported)
    - Some advanced Wi-Fi HaLow features are not yet supported (WPA3 Enterprise, U-APSD, DPP, NDP probes)

2.3 Release 2.0.0

This section summarizes software changes made since release 1.17.9.

2.3.1 New Features

- Airtime fairness support
    - Airtime fairness (ATF) in the Linux wireless stack ensures that each station on an AP receives a fair share of channel *time*, not a fair share of *throughput*. It solves the "performance anomaly" in 802.11: without it, slow clients (distant, low-data-rate, or 802.11b/g legacy devices) monopolize the medium because transmitting the same amount of data takes them longer. Airtime primarily governs the download (i.e., AP to STAs). This is enabled by default for any Linux kernel > 6.2, and can be enabled through a module parameter for older kernels (unsupported for kernels < 5.10)
- A-MSDU Support
    - A-MSDU (Aggregate MAC Service Data Unit) is an 802.11 frame aggregation technique introduced in 802.11n to improve efficiency by packing multiple payloads into a single transmission. This feature is dependent on ATF being enabled. Default for Linux kernel > 6.2, and can be enabled once ATF is enabled for earlier kernels (unsupported for kernels < 5.10)
- FullMAC Support (Beta)
    - MM8108 firmware and driver can be configured to operate in FullMAC architecture. A FullMAC driver is a Linux WiFi driver architecture in which most of the 802.11 MAC-layer processing occurs on the device rather than in the host kernel. MM8108 FullMAC can only operate in STA mode. FullMAC is currently in beta support. For configuration and limitations, refer to “FullMAC Linux Driver User Guide”.
    - FullMAC supports configurable channelization for AU.
- MM8108-M20-US Module Support (engineering sampling)
    - MM8108-M20 combines Morse Micro’s Wi-Fi HaLow silicon with an external high-power amplifier delivering high transmit output power, alongside a surface acoustic wave (SAW) filter tuned for the 902-928 MHz band in North America. For more details, see MM8108 M20 High Power Wi-Fi HaLow Module.
- Firmware failsafe boot error mode
    - Allows the firmware to enter a failsafe mode and report boot errors to quickly identify the failure reason

2.3.2 Resolved Issues and Improvements

- Thin LMAC support: Multiple improvements have been added to improve Thin LMAC, including bug fixes and throughput improvements
- PHY interference performance improvements, including:
    - Improved Out-Of-Band (OOB) detection and desensing

    - Improved DC calibration in the presence of interference
    - Optimized packet detection desensing under interference, improving the overall range
- Improved initial PHY calibration timing, which reduces boot-up time by up to 30%
- WiFi feature improvements, including improved DPP performance and DCS (Dynamic Channel Selection) bug fixes

2.3.3 Known Issues

SoftMAC

- A lower association success rate is observed when interoperating with older MM8108 software releases in high-noise environments.
    - The behavior can be attributed to the increased collision rate when a 1.17-based DUT is occupying the medium, while a 2.-based DUT is backing off more.
    - Workaround: Upgrade all devices to release 2.0 whenever possible, or allow for a longer association time in noisy environments.
- Throughput degradation for multi-STA if WDS is enabled. This is due to disabling the `max_txq_len` modparam (i.e., set to 0)
    - Workaround: Update the driver to remove the disabling of `max_txq_len` and enable airtime fairness.
    - For more information, customers can review OpenWRT 3.1.0 driver patches.
- An intermittent crash can occur when running on the SPI bus with A-MSDU enabled and traffic flowing bidirectionally.
    - Recoverable through watchdog timer
    - Workaround: Disable A-MSDU when using the SPI bus
- Intermittent firmware assert/crash during calibration. The issue is intermittent and uncommon.
    - Recoverable through watchdog timer
    - No workaround.
- Intermittent chip hangs during packet offloading transmission: Caused by incorrect packet size calculations. The issue is intermittent and uncommon.
    - Recoverable through watchdog timer
    - Workaround: Disable packet offloading
- Health-check can fail/timeout while the chip is busy handling scan requests. The issue is intermittent, and occurs only when both commands trigger at the same time.
    - The issue is not watchdog-recoverable and will require a full chip reset
- The TX power setting is not obeyed for the sub-band. The feature doesn't affect data packets but only management packets (e.g., beacons, Probe request/response)
    - Workaround: None
- Multi-STA unrecoverable drop to zero throughput. The issue is caused by the station going to 0 throughput for a few seconds due to medium contention, then iPerf gives up and drops the

stream/connection.
    - The issue is only observable in large setups (7 or 8 stations), with unthrottled traffic.
    - Workaround: Limit the bitrate through -b if using iPerf
- Adaptive RAW low throughput in a multi-STA network
    - Workaround: None

FullMAC

- FullMAC STA doesn't support interoperability with Newracom APs
- Firmware crashes if burst exhaust duty cycle restrictions are exceeded
    - Workaround: Avoid overloading burst mode duty cycle packets
- Firmware crashes in bi-directional high TCP throughput. The issue is intermittent and uncommon to occur
    - Recoverable through watchdog timer
    - Workaround: None
- In a noisy environment, wpa_supplicant can time out before the FullMAC association is complete.
    - Workaround: Use the `iw connect` command

2.3.4 Unsupported, Limited, and Deprecated Features

- SoftMAC:
    - AP power save mode is not supported
    - Support for PV1 frames has been deprecated
    - Standby power save mode is not supported in SoftMAC.
    - Pre-association power save is disabled by default, but can be enabled via a module parameter.
- FullMAC:
    - STA only, single interface (IBSS, MBSS, mesh Soft AP are not supported)
    - Some advanced Wi-Fi features are not supported (WPA3 Enterprise, U-APSD, DPP, NDP probes)

2.4 Release 1.17.9

This section summarizes software changes made since release 1.17.8.

Long-Term Support (LTS) Linux Kernels supported in this release
6.12.21, 6.6.31, 6.1.21, 5.15.61, 5.10.11, 5.4.83, 4.9.80, 4.19.66

2.4.1 New Features

No new features since release 1.17.8

2.4.2 Resolved Issues and Improvements

Various security vulnerabilities have been addressed:

- Out-of-bounds memory access when processing compatibility IE in beacons and probe responses
- Out-of-bounds memory access when processing TIM IE in beacons
- Out-of-bounds memory access when processing vendor IE in beacons.

2.4.3 Known Issues

No new known issues since release 1.17.8

2.5 Release 1.17.8

This section summarizes software changes made since release 1.16.4.

Long-Term Support (LTS) Linux Kernels supported in this release
6.12.21, 6.6.31, 6.1.21, 5.15.61, 5.10.11, 5.4.83, 4.9.80, 4.19.66

2.5.1 New Features

- 802.11s Mesh (Beta)
    - 802.11s Mesh is a Wi-Fi feature that allows multiple wireless devices to interconnect to create a wireless LAN mesh network. This can extend network coverage by creating wireless links that manage multiple paths between nodes. It can automatically recover connectivity and dynamically adjust routes in response to environmental changes. For more details on 802.11s, please refer to Morse Micro's Application Note 32: How to Configure 802.11s Mesh.
- WNM Sleep
    - WNM Sleep is a power-saving mechanism that allows Stations to explicitly negotiate sleep schedules with the Access Point, reducing power consumption during idle periods. For more information about WNM sleep, please refer to Morse Micro's Application Note 34: Measuring Low Power Wi-Fi HaLow.
- Centralized Authentication Control (CAC)
    - Centralized Authentication Control (CAC) can reduce the time required for a large number of Stations to associate by throttling the number of Stations that attempt to associate simultaneously, thereby minimizing contention for time-sensitive association.
- Periodic Restricted Access Window (PRAW)
    - PRAW is a specific type of RAW where an Access Point reserves time slots at regular, recurring intervals for scheduled transmissions. This is crucial for sensors or devices

that generate data on a regular schedule, as it mitigates contention on the medium and enables better power savings.

- IEEE802.11-2024 AU channelization
    - The channelization for Australia was updated in IEEE802.11-2024
- Dynamic Target Wake Time (TWT):
    - Dynamic TWT allows Stations to renegotiate TWT service periods after connecting to the Access Point (rather than before). For more details on TWT configuration, please refer to Morse Micro's Application Note 3: Target Wake Time.
- 802.11r Fast BSS Transition
    - This mode allows a Station to transition between Access Points without redoing key exchange, minimizing switching time for time-sensitive applications.

2.5.2 Resolved Issues and Improvements

- Multi-STA performance has been improved for up to 8 Stations
- Improved interference performance
- During power save, the SDIO_CLK pin is no longer driven low but is put into high impedance. System developers should ensure they do not drive a clock on the pin during these periods to avoid increased power consumption.

2.5.3 Known Issues

- In Multi-STA setups, an unbalanced downlink can be seen if WDS is enabled. The issue can be mitigated by setting the `max_txq_len` module param to 0 (i.e., unlimited queue length)
- Some receive degradation is seen at 2 MHz, at approximately -73dBm RSSI
    - Workaround: Increase or decrease the RSSI by 2 dB to resolve this issue
- Some receive degradation is seen at 1 MHz at strong signals
    - Workaround: Move devices further apart to lower signal strength.
- The maximum TCP throughput between MM6108 and MM8108 is approximately 10% lower than expected. This issue is expected to be resolved in a future release.
- In environments with very strong interference signals (greater than –40 dBm), wireless performance may be reduced. Improvements are planned for a future release.
- In rare cases, an assert may occur if STAs remain idle for several hours. When this happens, the watchdog timer automatically restores the chip to its original associated state. Recovery is seamless at the link level; however, upper-layer connections (e.g., TCP/UDP) may need to be reestablished.
- When using the 1 MHz MCS 9 rate in the 868 MHz channel band, you may observe a lower EVM. In practice, the rate control algorithm automatically steps down to MCS8 to maintain reliable performance. An improvement is planned for a future release.
- In multi-STA setups on devices running Linux kernel > 6.2, airtime fairness is not enabled by default, which may result in suboptimal wireless performance.

    - Workaround: Set the `enable_airtime_fairness` module parameter to `true`. Additional patches for improved airtime fairness are available in the Morse Micro OpenWrt feed packages.
- When pairing two devices at very close range, the STA may intermittently fail to join the AP due to excessively strong received signal levels (greater than -10 dBm).
    - Workaround: Ensure at least 2 meters of separation between the AP and STA before initiating the pairing sequence to maintain reliable association. An improvement is planned for the next firmware release.
- The MM810x driver's vendor Information Element (IE) handling contains an out-of-bounds memory access vulnerability. This issue will be resolved in future releases.
    - Workaround**:** Customers with security concerns regarding this vulnerability may apply a patch to mitigate the issue. For details, refer to the Morse Micro OpenWrt patch sets available on GitHub.

2.5.4 Unsupported, Limited, and Deprecated Features

- This release supports SoftMAC only. FullMAC and Thin LMAC modes are available for beta evaluation only.
- Standby power-save mode is not supported in SoftMAC.
- Support for PV1 frames has been deprecated in 1.17.8.
- Support for software scan in the Linux Driver has been deprecated in 1.17.8.

2.6 Release 1.16.4

This section summarizes software changes made since release 1.15.3.

Long-Term Support (LTS) Linux Kernels supported in this release
6.6.31, 5.15.61, 5.4.83, 4.19.66

2.6.1 New Features

- Dynamic Channel Selection (DCS) support and Extended Channel Switch Announcement (ECSA) support
    - The system can now automatically switch to a better Wi-Fi HaLow channel to reduce interference (Dynamic Channel Selection) and seamlessly notify connected devices to follow (Extended Channel Switch Announcement), improving reliability and performance.
- Support for 100% duty cycle in Europe with DCS enabled
- Device Provisioning Protocol (DPP) support
    - Wi-Fi HaLow devices can be added securely without needing to share or type passwords, making setup faster and safer.

- EasyMesh support
    - Multiple access points can work together in a single, self-organizing wide-area mesh network to provide extended coverage and reliability.
- FullMAC support (beta - not for production)
    - Early support for FullMAC operation, simplifying Wi-Fi HaLow integration and development by handling more functions in the firmware
    - Please note that this feature is currently in beta testing for integration and development purposes. It is not considered suitable for mass production

2.6.2 Known Issues

- When the Access Point (AP) bandwidth is fully saturated with more than four stations (STAs), aggregated throughput through the AP degrades.
    - Workaround: For use cases requiring multiple stations running continuous, high-bandwidth data streams, limit the number of stations to 4 to ensure optimal overall performance
- Dynamic Target Wake Time (TWT) is not supported in this release
- When using the SDIO host interface, if the SDIO clock pin continues to be driven by the host while the device is in power-save mode, it may result in additional VDDIO leakage
    - Workaround: Ensure the SDIO clock is idle when the device is in power-save mode
- The maximum TCP throughput between MM6108 and MM8108 is approximately 10% lower than expected. This issue is expected to be resolved in a future release.
- In environments with very strong interference signals (greater than –40 dBm), wireless performance may be reduced. This is a known limitation, and improvements are planned for a future release.
- In rare cases, an assert may occur if STAs remain idle for several hours. When this happens, the watchdog timer automatically restores the chip to its original associated state. Recovery is seamless at the link level; however, upper-layer connections (e.g., TCP/UDP) may need to be reestablished.
- In uncommon scenarios with intermittent traffic (e.g., a single packet every few seconds), a race condition may cause occasional packet loss if power-save mode is enabled exactly when a packet is queued for transmission. The overall impact is minimal, with expected loss rates of less than 5%. A fix is planned for the next release.
- Some receive degradation is seen at 2 MHz, at approximately -73dBm RSSI
    - Workaround: Increase or decrease the RSSI by 2 dB to resolve this issue
- When using the 1 MHz MCS 9 rate in the 868 MHz channel band, a lower EVM may be observed. In practice, the rate control algorithm automatically steps down to MCS8 to maintain reliable performance. An improvement is planned for the next firmware release.

3 Revision History

Version Number	Release Date	Release Notes
1	22 Sep 2025	Release FW 1.16.4
2	20 Apr 2026	Release FW 1.17.8
3	01 May 2026	Release FW 1.17.9
4	29 Jun 2026	Release FW 2.0.0
5	03 Sep 2026	Release FW 2.1.0
6	22 Oct 2026	Release FW 2.2.3

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