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Product Change Notification
Software Release Notes

Dot AT Command Firmware
   Release 4.0.0
   Release 3.3.5

MultiTech xDot®
MultiTech mDot™

Date: March 30, 2021

Product Change Notification (PCN) Number
PCN 03302021-001 (Dot)

I. Overview
MultiTech announces the availability of new AT Command Firmware for use on MultiTech® Long Range LoRa® Modules:
- MultiTech xDot® (MTXDOT Series)
- MultiTech mDot™ (MTDOT Series)

New versions are currently available for download and evaluation:
- Release 4.0.0 (shipping in June 2021)
- Release 3.3.5

Release 4.0.0 will released into standard MultiTech product starting in June 2021. Currently, product ships with Release 3.2.1

II. Suggested Action Plan
Customers
- Review the information in this PCN and forward to others within your organization who are actively involved with the development of IoT applications using the MultiTech xDot and MultiTech mDot.
- Consider downloading the firmware available on MultiTech or Mbed websites to check compatibility with existing deployments.

Contents

- Review the release schedule for the upcoming firmware release and understand the effect on your manufacturing and deployment schedules.

Distributors
- Forward this announcement to others within your organization who are actively involved in the sale or support of LoRa-enabled sensors.
- Notify existing customers of this change and encourage them to evaluate the new firmware with their custom application.

III. AT Command Firmware - Release 4.0.0 Overview

Overview (Release 4.0.0)

Release 4.0.0 is a major software release built upon Release 3.3.5. The new features, feature enhancements, bug fixes, and known behaviors available in Release 3.3.5 are also available in Release 4.0.0.

More details on Release 3.3.5, are available at:

> Section IV. AT Command Firmware – Release 3.3.5 Overview
> https://os.mbed.com/teams/MultiTech/wiki/Dot-firmware-change-log#3-3-5

Release 4.0.0 also includes the following features:
1. Support for LoRaWAN 1.0.4
2. Regional Parameters 1.0.3rA
3. FUOTA - Fragmentation and Multicast Setup v1.0.0
4. Support for EU868, US915, KR920, IN865, RU864, AU915, AS923-1, AS923-2, AS923-3 and AS923-JAPAN
5. mbed-os-6.1.0 (Release 3.2.1 (currently shipping) supports mbed-os 5.11.1)

New Features (Release 4.0.0):
1. New AT Commands [MBED-396]
   - AT+BTO - Class B Timeout
   - AT+CTO - Class C Timeout
   - AT Command Reference Guides:
     - xDot: https://www.multitech.com/documents/publications/reference-guides/S000768-xDot-AT-Command-Guide.pdf
     - mDot: https://www.multitech.com/documents/publications/reference-guides/S000643-mDot-AT-Command-Guide.pdf
2. xDot - Removed some commands and options to reduce firmware size:
   - help
   - =? option
   - AT&V
   - AT&S
   - Error details have been removed, only ERROR is returned
3. Firmware Downgrade Incompatibility: Configuration Updates [MBED-179]
   - Changes to the configuration are not backwards compatible with previous versions
   - Downgrading from 4.0.0 to 3.x.x causes loss of DevEUI. A device will lose all configuration and identification if reverted to a previous firmware
   - Configuration is saved with redundancy and wear leveling to increase resiliency and allow recovery after write errors due to loss of power or reset during a write cycle

- o <u>Redundancy</u>. In case of data loss or corruption, your device stores multiple copies of the configuration and can fall back to the last good copy.
- o <u>Wear Leveling</u>. Wear leveling writes across the entire flash sector and skips bad sections on write failure. Frequently saved session parameters have more flash space available to extend the expected life of the flash system on your device.
4. mDot sleep can be interrupted by LowPowerTimer expiration when RTC_ALARM_OR_INTERRUPT is used.
5. xDot now supports FUOTA when an external SPI flash is provided
   - Block Device Requirements - For a block device to work with the xDot it must meet the following criteria:
     - o Work with Mbed OS DataFlashBlockDevice or SPIFBlockDevice classes
     - o Maximum 4KB sector erase size
     - o Maximum 512 byte page size
     - o SPIF type components must support Serial Flash Discoverable Parameters (SFDP)
6. Updated bootloader [MBED-2204]
   - Firmware Image Manifest [MBED-2205]
     - o Supports image manifest allowing full images, compressed images and differential updates
   - <u>Image Compression and Diff Images</u>. [MBED-171]
     - o BSDiff and LZ4 compression can be used to reduce the size of firmware upgrades sent over-the-air. Smaller files reduce the time required to deliver an update. Smaller FOTA sessions increase end-device battery life.
   - <u>Multicast Session Scheduling</u>. Multicast sessions are now scheduled using LowPowerTimeout instead of events. Session schedules are maintained while sleeping.
   - Firmware image utility available https://pypi.org/project/mtsmultitool/

Schedule (Release 4.0.0)
1. Downloadable versions of Release 4.0.0 are currently available at:
   - xDot AT Command Firmware: http://www.multitech.net/developer/downloads/#xdot
   - mDot AT Command Firmware: http://www.multitech.net/developer/downloads/#mdot
2. Manufacturing: xDot and mDot devices manufactured after June 2021 will be shipped with Release 4.0.0 firmware.

IV. AT Command Firmware - Release 3.3.5 Overview

Overview (Release 3.3.5)

Release 3.3.5 is built upon Release 3.2.1. The new features, feature enhancements, bug fixes, and known behaviors available in Release 3.2.1 are also available in Release 3.3.5.

More details on Release 3.2.1, are available at:

https://os.mbed.com/teams/MultiTech/wiki/Dot-firmware-change-log#3-2-1

New Features (Release 3.3.5):

1. mbed-os-5.13.4
   - mbed-os-5.13.4 (Release 3.2.1 (currently shipping) supports mbed-os 5.11.1)
2. LoRaWAN 1.0.4 (LW1.0.4)
   - MAX FCNT GAP check removed
   - Join Dev Nonce is incremented with each Join Request sent
   - Join App Nonce is validated to increment with each Join Accept received
     - Nonces are reset when AppEUI/JoinEUI is changed
3. Added unsolicited result code option AT+URC=1
   - Outputs RECV when packet is received
4. Added AT+RXO=3 option for EXTENDED_HEX output including dev_addr and fcnt for each payload
5. Added multicast setup options
   - AT+NA=(1-8),<DEV-ADDR>
   - example: AT+NA=1,00112233 - setup multicast dev address
   - AT+NSK=(1-8),<NWK-SESSION-KEY>
   - AT+DSK=(1-8),<APP-SESSION-KEY>
   - AT+DLC=(1-8),<DOWNLINK-COUNTER>
   - AT+MCRX=(1-8),(DR0-DR15),(FREQ),(-1-7:PERIOD,-1:CLASS_C)
   - AT+JN - Join Nonce counters <DEV-NONCE>,<APP-NONCE>
     - Nonces are saved to flash after each join App Nonce is validated to be incremented from the Join Server per LW1.0.4
   - AT+JNV - Enable/disable Join Nonce validation in Join Accept
   - AT+REPAIR=1 to erase flash and restore current config settings on mDot
   - AT&WP - Save Protected settings available in all firmware
   - AT+DI - Protected DeviceEUI can be changed
   - AT+NI=2,<EUI> - Set default AppEUI/JoinEUI, value if set will be used as the default AT+NI setting when AT&F is issued
   - AT+NK=2,<KEY> - Set default AppKey, value if set will be used as the default AT+NK setting when AT&F is issued
6. Pin Outputs
   - Join Status available on Associate Pin (mDot:A2, xDot:GPIO0)
   - Rx Packet pin is brought high when packet is received, the pin is reset when a new command issued. (mDot:D12, xDot:GPIO1)
     - AT+RECV can be used to retrieve the packet and reset the pin

7. FUOTA
   - Fragment and Parity indexes changed to start at 1
   - McKEKey compatible derivation to unpack multicast session keys
   - Session Start Time as GPS time supported

Bug Fixes (Release 3.3.5):
1. Fix dynamic plan (EU/AS/IN/KR) ADR option 6 to enable all defined (non-zero) channels

Known Issues (Release 3.3.5):
1. Sleep current on mDot is 10 uA higher than previous version.
   - This appears to be caused by mbed-os-5.13.4
   - Release 3.3.6 is built with mbed-os-5.15.1 is available and does not exhibit this issue

Schedule (Release 3.3.5)
1. Downloadable versions are currently available at:
   - mDot AT Command Firmware: http://www.multitech.net/developer/downloads/#mdot
   - xDot AT Command Firmware: http://www.multitech.net/developer/downloads/#xdot
2. Manufacturing: Release 3.3.5 will not be transferred to manufacturing and will not ship from MultiTech on any xDot or mDot devices.

V. Schedule
There are multiple versions of Dot AT Command Firmware available for customer evaluation and final release.
- Downloadable versions of Release 4.0.0 and Release 3.3.5 are currently available for customer evaluation:
  - mDot AT Command Firmware: http://www.multitech.net/developer/downloads/#mdot
  - xDot AT Command Firmware: http://www.multitech.net/developer/downloads/#xdot
- Manufacturing:
  - Release 4.0.0: mDot and xDot devices manufactured after June 2021 will be shipped with Release 4.0.0 firmware.
  - Release 3.3.5 will not be transferred to manufacturing and will not ship from MultiTech on any xDot or mDot devices.

VI. Flashing mDot Firmware

At any time in the upgrade process, customers can send an email to support@multitech.com or call +1(763) 717-5863.

mDots™ are shipped from the factory with AT Command Firmware. For developing your own custom firmware, refer to the mDot platform page on mbed. Information on using the developer board is in the mDot Developer Guide, available at http://www.multitech.net/developer/products/multiconnect-dot-series/multiconnect-mdot/.

Notes:
1. Due to significant changes from beta versions, upgrading from versions prior to 0.1.2 requires resetting the mDot to factory defaults.
2. FUOTA cannot be used to upgrade from release 3.X.X to release 4.0.0.
3. YMODEM upgrade from release 3.X.X to release 4.0.0 requires special firmware and extra steps.
4. When using release 4.0.0 firmware, FUOTA upgrades should use application only versions of the firmware.
5. When downgrading from release 4.0.0 to an earlier version, flash/JTAG must be used.

Instructions are available on the MultiTech Developer Portal:
http://www.multitech.net/developer/software/mdot-software/mdot-firmware-upgrade/

VII. Ordering Part Numbers Impacted

The following ordering part numbers are impacted by these updates:

Model Name	Ordering Part Numbers	
MultiTech xDot® Long Range LoRa® Modules (MTXDOT Series)		
MTXDOT-AS1-A00-1 MTXDOT-AS1-A00-100 MTXDOT-AS1-A01-100 MTXDOT-AU1-A00-1 MTXDOT-AU1-A00-100 MTXDOT-AU1-A01-100	MTXDOT-EU1-A00-1 MTXDOT-EU1-A00-100 MTXDOT-EU1-A01-100 MTXDOT-EU1-IN1-A00-1 MTXDOT-JP1-A00-1 MTXDOT-KR1-A00-1	MTXDOT-NA1-A00-1 MTXDOT-NA1-A00-100 MTXDOT-NA1-A00-1000 MTXDOT-NA1-A01-100
MultiTech mDot™ Long Range LoRa® Modules (MTDOT Series)		
MTDOT-923-AS1-M1-UFL-1 MTDOT-923-AS1-M1-UFL-100 MTDOT-923-AS1-X1P-SMA-1 MTDOT-923-AS1-X1-UFL-1 MTDOT-923-AS1-X1-UFL-50 MTDOT-915-AU-M1-TRC-1 MTDOT-915-AU-M1-UFL-1 MTDOT-915-AU-X1P-SMA-1 MTDOT-915-AU-X1-SMA-1 MTDOT-915-AU-X1-SMA-50 MTDOT-915-AU-X1-UFL-1	MTDOT-868-M1-TRC-1 MTDOT-868-M1-TRC-100 MTDOT-868-M1-UFL-1 MTDOT-868-M1-UFL-100 MTDOT-868-X1P-SMA-1 MTDOT-868-X1-SMA-1 MTDOT-868-X1-SMA-50 MTDOT-868-X1-UFL-1 MTDOT-923-JP1-X1P-SMA-1	MTDOT-915-M1-TRC-1 MTDOT-915-M1-TRC-100 MTDOT-915-M1-UFL-1 MTDOT-915-M1-UFL-100 MTDOT-915-X1P-SMA-1 MTDOT-915-X1P-SMA-50 MTDOT-915-X1-SMA-1 MTDOT-915-X1-SMA-50 MTDOT-915-X1-UFL-1 MTDOT-915-X1-UFL-50
MultiTech xDot® Micro Developer Kit: LoRa USB Dongle Developer Kit (MTMDK Series)		
MTMDK-XDOT-AS1-A00 MTMDK-XDOT-AU1-A00 MTMDK-XDOT-EU1-IN1-A00	MTMDK-XDOT-EU1-A00 MTMDK-XDOT-JP1-A00 MTMDK-XDOT-KR1-A00	MTMDK-XDOT-NA1-A00

VIII. Mbed OS Overview

Arm Mbed OS is a free, open-source embedded operating system designed specifically for the "things" in the Internet of Things. It includes all the features you need to develop a connected product based on an Arm Cortex-M microcontroller, including security, connectivity, an RTOS, and drivers for sensors and I/O devices.

- <u>Modular</u>. Necessary libraries are included automatically on your device, allowing you to concentrate on writing application code.
- <u>Secure</u>. Multilayer security helps to protect your IoT solution, from isolated security domains through to Mbed TLS for secure communications.
- <u>Connected</u>. We give you a wide range of communications options with drivers for Bluetooth Low Energy, 6LoWPAN, Mobile IoT (LPWA), Ethernet and WiFi.

For additional information on Mbed and the MultiTech/mBed partnership, visit

- https://os.mbed.com/mbed-os/
- https://os.mbed.com/teams/MultiTech/

IX. MultiTech xDot®

The MultiTech xDot® is a secure, end-certified, Arm® Mbed™ programmable, low-power RF module, that provides long-range, low bit rate M2M data connectivity to sensors, industrial equipment and remote appliances. The xDot is LoRaWAN® compliant, providing bi-directional data communication up to 10 miles / 15 km line-of-sight and 1-3 miles / 2 km into buildings, using subGHz ISM bands in North America, Europe, Australia, Asia Pacific, India and Korea.

xDots bring intelligence, reduced complexity and a lower overall bill of material cost to the very edge of the network while supporting a variety of electronic interfaces to connect just about any "Thing" for years on battery power.

For additional information on the xDot and dot firmware, visit

- http://www.multitech.net/developer/products/multiconnect-dot-series/multiconnect-xdot/
- https://os.mbed.com/platforms/MTS-xDot-L151CC/

X. MultiTech mDot™

The MultiTech mDot™ is a secure, CE/FCC/RCM/GITEKI certified, Arm® Mbed™ programmable, low-power RF module, that provides long-range, low bit rate M2M data connectivity to sensors, industrial equipment and remote appliances.

The mDot is LoRaWAN® compliant, providing bi-directional data communication up to 10 miles / 15 km line-of-sight and 1-3 miles / 2 km into buildings, using sub-GHz ISM bands in North America, Europe, Australia and Asia Pacific. mDots bring intelligence, reduced complexity and a lower overall bill of material cost to the very edge of the network while supporting a variety of electronic interfaces to connect just about any "Thing" for years on battery power.

For additional information on the mDot and dot firmware, visit

- http://www.multitech.net/developer/products/multiconnect-dot-series/multiconnect-mdot/
- https://os.mbed.com/platforms/MTS-mdot-f411/

XI. MultiTech xDot® Micro Developer Kit

The xDot® Micro Developer Kit is a USB dongle that allows a developer to plug in a MultiTech xDot and start developing their application. Its portable design makes it ideal for connecting to a laptop and doing range testing of the LoRa network. This LoRa USB dev kit includes a development board, xDot, integrated LoRa antenna and Quick Start Guide.

Developer support and resources are available at www.multitech.net.

For additional information on the xDot Micro Developer Kit and dot firmware, visit
- http://www.multitech.net/developer/products/multiconnect-dot-series/multiconnect-xdot/
- https://os.mbed.com/platforms/MTS-xDot-L151CC/

XII. Additional Information

If you have any questions regarding this Product Change Notification/Software Release Notes, please contact your MultiTech sales representative or visit the technical resources listed below:

World Headquarters – USA
+1 (763) 785-3500 | sales@multitech.com

EMEA Headquarters – UK
+(44) 118 959 7774 | sales@multitech.co.uk

MultiTech Developer Resources:
www.multitech.net
An open environment where you can ask development related questions and hear back from MultiTech engineering or a member of this community.

Knowledge Base:
http://www.multitech.com/kb.go
Immediate access to support information and resolutions for all MultiTech products.

MultiTech Support Portal:
https://support.multitech.com/support/login.html
Create an account and submit a support case directly to our technical support team.

MultiTech Website:
www.multitech.com

MultiTech/Mbed Partnership:
https://os.mbed.com/mbed-os/
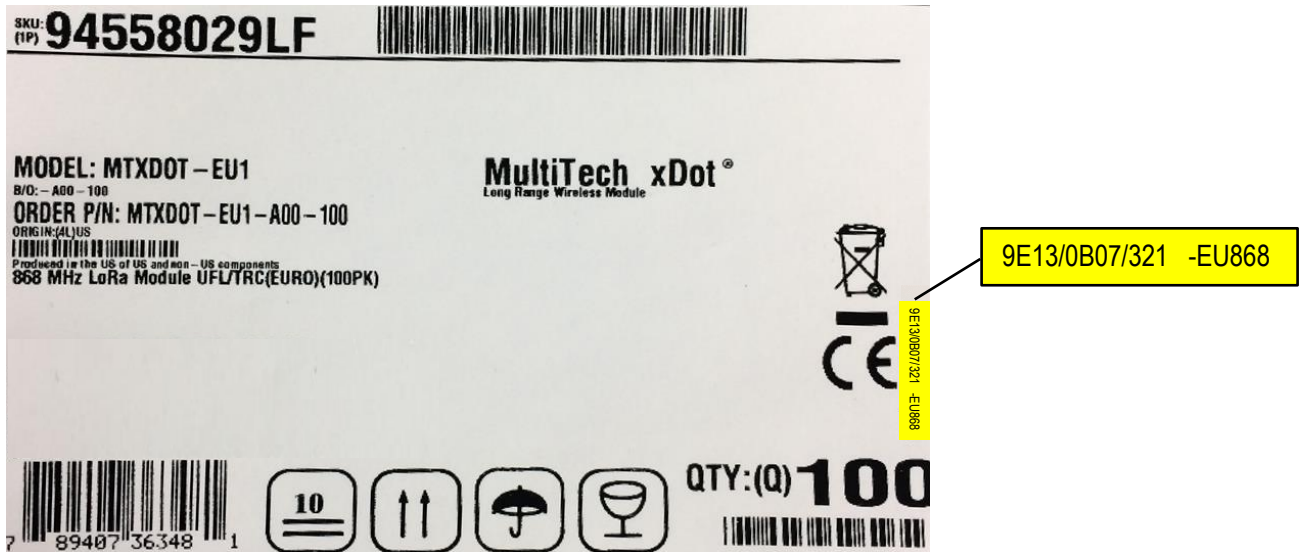https://os.mbed.com/teams/MultiTech/

ATTACHMENT 1
Identifying Dot Firmware Version

There are two ways to identify the firmware version that has been programmed into the xDot or mDot.
1. Product Packaging
- The carton label for each xDot and mDot includes an indication of the firmware version included.

9E13/0B07/**321**	Dot Firmware Version **321 = Dot Version 3.2.1**
-EU868	LoRa Channel Plan

2. AT Command
- The AT Command "ATI Request ID" returns the product and software identification information.
- Syntax Command: ATI, help ATI, ATI=?
- Parameters and Values: None
- Command with Response Examples
    - ATI
    - MultiTech mDot
      Firmware: 3.2.0-mbed51101
      Library: 3.2.0-mbed51101
      MTS-Lora: 3.2.0-mbed51101
    - OK

ATTACHMENT 2
Identifying Date of Manufacture (DOM)

Each individual product that ships from MultiTech is identified with its unique Date of Manufacture (DOM). Below are photos that demonstrate the format and placement of the DOM information.

Product: MultiTech xDot
      Model Number: MTXDOT-EU1-A00-100
      Example: DOM 2020.02.05 = February 5, 2020

Product: MultiTech mDot
      Model Number: MTDOT-868-M1-UFL-100
      Example: DOM 2017.10.12 = October 12, 2017

ATTACHMENT 3
Dot AT Command Firmware Versus mPower Software and mLinux Software

MultiTech xDot and mDot long range LoRa endpoints are most often used with MultiTech Conduit® gateways and mPower™ or mLinux embedded software. Each version of Dot firmware is compatible with different versions of mPower and mLinux embedded software.

Dot Version	mPower 5.3.X	mPower 5.2.X	mPower 5.1.X	mPower 5.0.X	mPower 1.7.X	mPower 1.6.X
Release 4.0.0	X	X	X (**)	X (**)	X (**)	X (**)
Release 3.3.5	X	X	X (**)	X (**)	X (**)	X (**)
Release 3.2.1	X	X	X	X	X (*)	X (*)
Release 3.1.0	X	X	X	X	X (*)	X (*)
Release 3.0.0	X	X	X	X	X (*)	X (*)

(*) FUOTA not available on these mPower versions
(**) Commands required for compatibility mode to be issued on startup
- AT+FOTA=0
- AT+JNV=0
- AT+JOIN

Dot Version	mLinux 5.3.X *	mLinux 5.2.X *	mLinux 5.1.X *	mLinux 5.0.X *	mLinux 1.7.X *	mLinux 1.6.X *
Release 4.0.0	X	X	X (**)	X (**)	X (**)	X (**)
Release 3.3.5	X	X	X (**)	X (**)	X (**)	X (**)
Release 3.2.1	X	X	X	X	X	X
Release 3.1.0	X	X	X	X	X	X
Release 3.0.0	X	X	X	X	X	X

(*) mLinux does not support FUOTA
(**) Commands required for compatibility mode to be issued on startup
- AT+FOTA=0
- AT+JNV=0
- AT+JOIN