



Digi XBee3[®] DigiMesh

RF Module

Contents

Introduction	3
What's new	3
Specification considerations	3
XBee3 Micro options - new to Digi XBee3 DigiMesh	4
Part number migration guide	5
Pin signals.....	6
Configuration	6
Digi XBee3 DigiMesh functional migration considerations	6
New AT commands	6
Enhanced security.....	6
XCTU support	7
Expanded channel selection.....	7
Clear channel assessment	7
Display output power.....	7
Reduced Energy Detection parameter range.....	7
Voltage reference	8
UART Parity and baud rate changes.....	8
Other AT command considerations.....	8
Expanded I/O capabilities.....	8
Bootloader update support.....	8
Asynchronous sleep with pin wake	9
Future updates.....	10

Introduction

Digi has updated and ported its XBee DigiMesh firmware from the XBee/XBee-PRO DigiMesh (S2C) hardware based on the SiLabs EM357 SoC, to the Digi XBee3 (Micro) hardware based on the SiLabs EFR32 SoC.

This guide assists you with migration to the new platform. While basic functionality and communication are similar and compatible, there are some differences to consider. This newer platform provides several major advantages over the existing platform, which we describe in this guide, along with other migration considerations.

What's new

The Digi XBee3 DigiMesh RF Module introduces some new features such as:

- Addition of the Micro form factor
- Capable of firmware migration to Zigbee 3.0, 802.15.4, and Thread protocols, when available
- Lower operating receive current
- Power on channel 26 is increased on the PRO and power cap on channel 26 is removed for non-PRO
- Expanded channel selection
- Synchronous Sleep support: Available on XBee S1 but not available on XBee S2C. Re-introduced for XBee3.

Specification considerations

XBee/XBee-PRO DigiMesh (S2C) to Digi XBee3 DigiMesh (Micro).

XBee DigiMesh (S2C)			
Considerations	Legacy XBee S2C	New Digi XBee3	Comments
Indoor/urban range	Up to 60 m (200 ft)	Up to 60 m (200 ft)	Same
Outdoor RF line-of-sight	Up to 1200 m (4000 ft)	Up to 1200 m (4000 ft)	Same
Transmit power output	6.3 mW (+8 dBm), boost mode 3.1 mW (+5 dBm), normal mode Channel 26 max power is +3 dBm	6.3 mW (+8 dBm)	No power cap on channel 26
Receive sensitivity	-102 dBm, boost mode -100 dBm, normal mode	-103 dBm	Comparable to boost mode
Operating current (transmit)	45 mA (+8 dBm, boost mode) 33 mA (+5 dBm, normal mode)	40 mA @ +3.3V, +8dBm	Lower operating current vs boost mode
Operating current (receive)	31 mA (boost mode) 28 mA (normal mode)	15 mA	Improved
Supply voltage	2.7 – 3.6 V	2.1 - 3.6 V	Larger voltage range

XBee DigiMesh (S2C)			
Considerations	Legacy XBee S2C	New Digi XBee3	Comments
FCC ID	MCQ-PS2C	MCQ-XBEE3	Customer will need to change the label on the end product to show the appropriate regulatory ID for the XBee3
Industry Canada (IC) ID	1846A-XBS2C	1846A-XBEE3	

XBee-PRO DigiMesh (S2C)			
Considerations	Legacy XBee-PRO S2C	New XBee3	Comments
Indoor/urban range	Up to 90 m (300 ft)	Up to 90 m (300 ft)	Same
Outdoor RF line-of sight	Up to 3200 m (2 mi)	Up to 3200 m (2 mi)	Same
Transmit power output	63 mW (+18 dBm) Channel 26 max power is +1 dBm	79 mW (+19 dBm) Channel 26 max power is +8 dBm	Power on channel 26 is increased
Receive sensitivity	-101 dBm	-103 dBm	Better sensitivity
Operating current (transmit)	120 mA @ 3.3 V, +18 dBm	135 mA @ +3.3 V, +19 dBm	Comparable
Operating current (receive)	31 mA (Boost mode) 28 mA (Normal mode)	15 mA	Improved
Supply voltage	2.7 - 3.6 V	2.1 - 3.6 V	Larger voltage range
FCC ID	MCQ-PS2C	MCQ-XBEE3	Customer will need to change the label on the end product to show the appropriate regulatory ID for the XBee3
Industry Canada (IC) ID	1846A-PS2CSM	1846A-XBEE3	

XBee3 Micro options - new to Digi XBee3 DigiMesh

New part number	Description
XB3-24DMRM-J	Digi XBee3, 2.4 Ghz, DigiMesh, Micro, RF Pad Ant, MMT
XB3-24DMUM-J	Digi XBee3, 2.4 Ghz, DigiMesh, Micro, U.FL Ant, MMT
XB3-24DMCM-J	Digi XBee3, 2.4 Ghz, DigiMesh, Micro, Chip Ant, MMT
XB3-24DMRM	Digi XBee3 PRO, 2.4 Ghz, DigiMesh, Micro, RF Pad Ant, MMT
XB3-24DMUM	Digi XBee3 PRO, 2.4 Ghz, DigiMesh, Micro, U.FL Ant, MMT
XB3-24DMCM	Digi XBee3 PRO, 2.4 Ghz, DigiMesh, Micro, Chip Ant, MMT

Part number migration guide

The following table shows which Digi XBee3 DigiMesh to migrate to depending on which XBee/XBee-PRO DigiMesh (S2C) module you are currently using.

DigiMesh is initially only available in the Micro form factor, however the XBee3 with Zigbee firmware is available in a wide variety of form factors. The software can be updated to DigiMesh using a variety of options (contact sales or support for more information).

For the latest list of available XBee3 DigiMesh modules, see the [XBee3 DigiMesh Part Numbers & Accessories](#) page.

S1 part number	S2C part number	Description	Migrate to
XB24-DMPIT-250	XB24CDMPIT-001	Digi XBee3, 2.4 Ghz ZB 3.0, PCB Ant, TH MT	XB3-24Z8PT-J
XBP24-DMPIT-250	XBP24CDMPIT-001	Digi XBee3 PRO, 2.4 Ghz ZB 3.0, PCB Ant, TH MT	XB3-24Z8PT
XB24-DMSIT-250	XBP24CDMPIT-001	Digi XBee3, 2.4 Ghz ZB 3.0, SMA Ant, TH MT	XB3-24Z8ST-J
XBP24-DMSIT-250	XBP24CDMSIT-001	Digi XBee3 PRO, 2.4 Ghz ZB 3.0, SMA Ant, TH MT	XB3-24Z8ST
XB24-DMUIT-250	XB24CDMUIT-001	Digi XBee3, 2.4 Ghz ZB 3.0, U.FL Ant, TH MT	XB3-24Z8UT-J
XB24-DMUIT-250	XBP24CDMUIT-001	Digi XBee3 PRO, 2.4 Ghz ZB 3.0, U.FL Ant, TH MT	XB3-24Z8UT
XB24-DMWIT-250	XB24CDMWIT-001	XBee DigiMesh Wire whip	N/A
XBP24-DMWIT-250	XBP24CDMWIT-001	XBee-Pro DigiMesh wire whip	N/A
	XB24CDMRIS-001	Digi XBee3, 2.4 Ghz ZB 3.0, RF Pad Ant, SMT	XB3-24Z8RS-J
	XBP24CDMRIS-001	Digi XBee3 PRO, 2.4 Ghz ZB 3.0, RF Pad Ant, SMT	XB3-24Z8RS
	XB24CDMPIS-001	Digi XBee3, 2.4 Ghz ZB 3.0, PCB Ant, SMT	XB3-24Z8PS-J
	XBP24CDMPIS-001	Digi XBee3 PRO, 2.4 Ghz ZB 3.0, PCB Ant, SMT	XB3-24Z8PS
	XB24CDMUIS-001	Digi XBee3, 2.4 Ghz ZB 3.0, U.FL Ant, SMT	XB3-24Z8US-J
	XBP24CDMUIS-001	Digi XBee3 PRO, 2.4 Ghz ZB 3.0, U.FL Ant, SMT	XB3-24Z8US

Pin signals

The Digi XBee3 DigiMesh will be released initially in two different form factors, Surface Mount (SMT) and the newly introduced XBee3 Micro (MMT). The SMT version is pin compatible with existing XBee/XBee-PRO DigiMesh (S2C) SMT hardware.

This hardware is drop-in replaceable. In order to fit all necessary pin connections on the XBee3 Micro, three pins on the SMT were removed and the remaining pins were shifted. These pins were unused on the SMT module. See the [XBee3 Hardware Reference Manual](#) for more information.

Configuration

The Digi XBee3 DigiMesh family of modules will enable the user to reconfigure the firmware as new protocol support is released. Future protocols supported on the XBee3 hardware may include Digi's proprietary implementation of Thread. Using XCTU, you can load the appropriate firmware to fit your current needs within the regulatory guidance of the region of deployment. See the [XBee3 DigiMesh User Guide](#) for more information.

Digi XBee3 DigiMesh functional migration considerations

The following enhancements have been made to the DigiMesh XBee firmware for the XBee3 platform:

New AT commands

- **PP** - Output power level in dBm
- **C8** - Compatibility Options bitfield
 - *Bit 0* - Reserved
 - *Bit 1* - Reserved
 - *Bit 2* - Enable 128bit AES Encryption (OTA compatible with existing S1 and S2C DM devices when using encryption)
 - *Bit 3* - Enable XBee S1 compatible synchronous sleep messages. This bit **must** be set if there are **any** Xbee S1 modules in a network using Synchronous Sleep. Otherwise, the bit should be off for greater accuracy of synchronous sleeping network.
- **!C** - Clear custom defaults
- **%F** - Set custom default
- **R1** - Restore factory defaults
- **AZ** - Expanded API Output options

Enhanced security

On the previous XBee S1 DigiMesh and XBee S2C DigiMesh modules, 128-bit AES encryption was used to secure RF traffic. The default security on the XBee3, when enabled, is 256-bit AES with counter mode to protect against replay attacks. As a result, the **KY** parameter has been increased to a 256-bit value (64 ASCII characters) on the XBee3.

In order to provide compatibility with legacy DigiMesh networks, a new **C8** command has been created. *Bit 2* of the **C8** bitfield, when set, reduces the security mode of the XBee3 to 128-bit AES; this is over-the-air compatible with legacy 2.4 GHz DigiMesh devices.

When this compatibility mode is enabled, only the last 32 ASCII chars (128 least significant bits) of the 256-bit **KY** parameter will be used. **KY** cannot be read and is write-only. i.e.

Examples:

- If **EE** = 1 and **C8** = 0, then **KY** is a 256-bit Link key and will only communicate with other XBee3 DM devices with the same **C8** and **KY** values.
- If **EE** = 1 and **C8** = 4, then **KY** is a 128-bit Link key that is compatible with S1, S2C, and XB3 DigiMesh using with the same 128-bit **KY** value.

If **KY** = 11112222333344445555666677778888ZZZZYYYYXXXWWWWVVUUUUTTTSSSS, the underlined portion would be the 128-bit link key.

XCTU support

To improve usability within XCTU, AT commands have been rearranged and additional categories have been created.

Legacy X-CTU (5.2.8.10 and older) can be used for serial firmware updates only; no module configuration is available.

Expanded channel selection

The IEEE 802.15.4 standard allows for 16 channels to be used for communication: from 2.405 GHz (Channel 11) through 2.480 GHz (Channel 26).

On the previous XBee-PRO S1 DigiMesh and XBee-PRO S2C DigiMesh modules, the range of available channels (via the **CH** command) was restricted on the PRO variant. This restriction is alleviated on the XBee3 and all 16 channels are available for use regardless of the variant.

If you are designing an application that will be interoperating with legacy S1 and/or S2C PRO modules, the **CH** parameter on the XBee3 should be within 0x0C and 0x17 to guarantee communication.

Clear channel assessment

Clear channel assessment (CCA) can be disabled by setting the **CA** parameter to 0. Doing so may reduce latency in noisy environments at a risk of data loss and causing interference.

The maximum value for **CA** has been increased to 0x64 (-100dBm).

The CCA threshold is set upon device initialization. Any change made to the **CA** parameter value must be written to flash using the **WR** command and will be used upon the next power cycle. Disabling CCA (**CA** = 0) can be done at runtime and does not require a reboot to take effect.

Display output power

The **PP** AT Command will return the operating power level of the device in dBm based on the current operating configuration. Boost Mode (**PM**) from the XBee S2C is no longer available, as both the Pro and Non-PRO variants of the XBee3 hardware have enhanced receive sensitivity.

Reduced Energy Detection parameter range

The ED command, used to perform an energy detect scan, accepts a parameter value from 0 to 0x80 (1280 ms) which determines how long to perform the scan for. On the S1 and S2C, you could perform an energy detection up to 15 seconds in length (0x3A98).

Voltage reference

The ADC voltage reference changed from 1.2 V to 1.25 V. The VREF pin from the XBee Series 1 is not supported by the XBee3 hardware and has been removed from the Micro (MMT) form factor.

In-addition the module now supports ATAV command to provide additional ADC VREF options.

- **AV**
 - 0 = 1.25v
 - 1 = 2.5v
 - 2 = VDD

Default = 0

UART Parity and baud rate changes

The XBee3 802.15.4 supports the following serial communication parity bit modes:

- No parity bit (**NB** = 0)
- Even parity bit (**NB** = 1)
- Odd parity bit (**NB** = 2)

Support for space and mark parity has been removed.

Support for standard UART baud rates 460800 and 921600 has been added to the **BD** command. When setting a custom baud rate, **BD** now accepts a value up to 0x0EC400.

Other AT command considerations

- **GT** maximum guard time changed from 0xCE4 (3.3 seconds) on S2C to 0x6D3 (1.747 seconds) on XBee3 platform. The default guard time of 0x3e8 (1 second) did not change.

Expanded I/O capabilities

- **IC - Added Support for DIO13 and DIO14**
- **P3 - P4 Supports I/O**
 - 3 = Digital input
 - 4 = Digital output, low
 - 5 = Digital output, high
- **P5 - P9 Supports Digital output**
 - 4 = Digital output, low
 - 5 = Digital output, high

Bootloader update support

The bootloader of the XBee3 can be updated in addition to the XBee application. The bootloader update can be performed serially or over the air. When the bootloader is updated serially, the XBee application is erased and must be reinstalled.

The bootloader can also be updated over the air. This is done by updating the XBee application and bootloader as a single image.

Asynchronous sleep with pin wake

The behavior of asynchronous sleep with pin wake (SM = 5) has changed on the XBee3 starting with version 3002. While sleeping, the XBee/XBee-PRO ZB (S2C) module would respond to a falling edge on $\overline{DTR}/SLEEP_RQ$ by waking and would return to sleep immediately when $\overline{DTR}/SLEEP_RQ$ again transitioned high. The XBee3 will respond to a falling edge on $\overline{DTR}/SLEEP_RQ$ by waking for a minimum of ST (sleep wake) time. If $\overline{DTR}/SLEEP_RQ$ again transitions high prior to a ST time period, the XBee3 will remain awake for ST time then return to sleep. OTA firmware update process

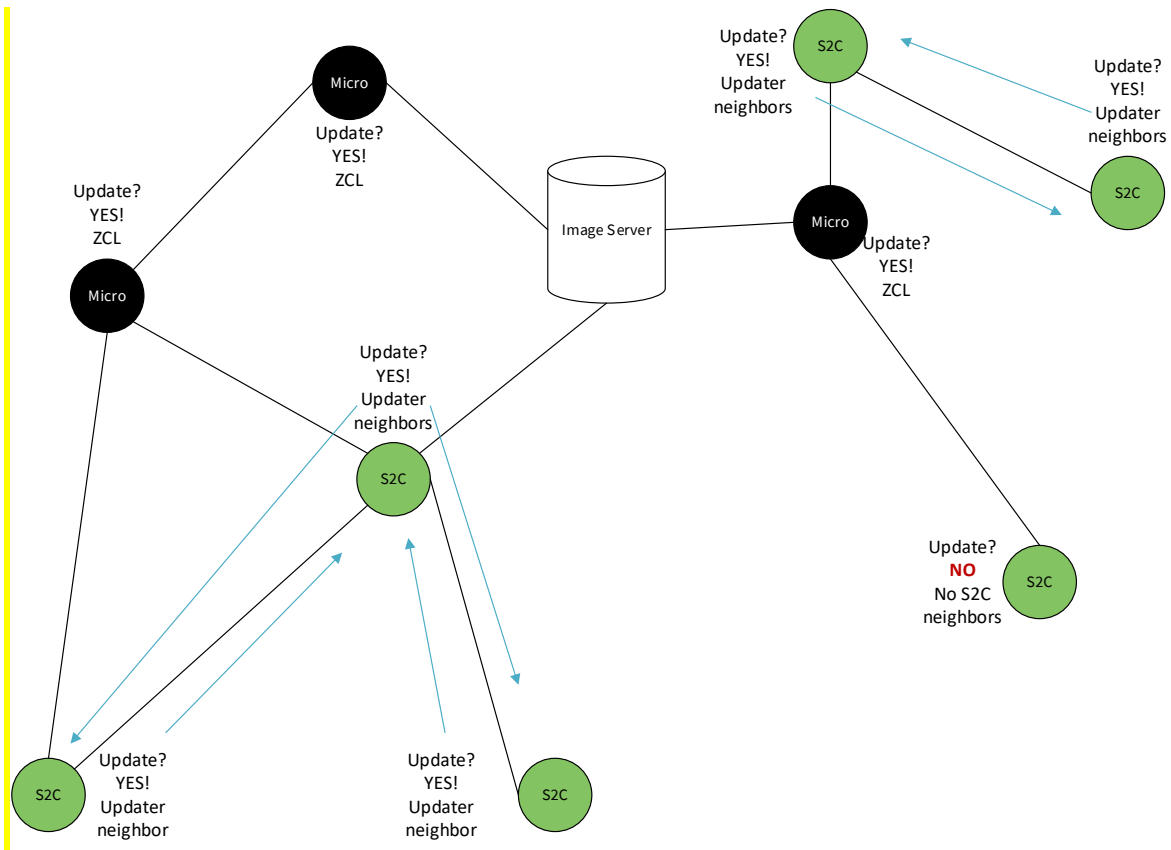
The firmware update process has changed on the Digi XBee3. The XBee/XBee-PRO ZB (S2C) module required a source, updater, and target node. Under certain circumstances, nodes could be put in bootloader mode, and were therefore unavailable on the network. Additionally, if the firmware upload was interrupted at any point in the update process, the target module would then need to be “recovered”. This can be very taxing on a network, especially across multiple hops.

The OTA firmware update process has been improved on the Digi XBee3 module. First, the firmware update requires only the use of a server (node sending the firmware file), and a client node (node receiving the firmware file).

The firmware image is sent in blocks using standard Zigbee Cluster Library (ZCL) frames. These frames are supported on DigiMesh using the 0x11 Explicit Transmit Frame. The client device never goes offline. The image is simply stored in an internal flash slot of the module’s memory. Once the entire firmware file has been uploaded, the client can switch to the new firmware image. If at any point in the process the transfer was interrupted, the image will simply not pass a security check and the module will not boot into the new image.

The radio serving up the firmware image can be either a Digi XBee3 or XBee/XBee-PRO ZB (S2C). However, since the XBee/XBee-PRO ZB (S2C) requires that another XBee/XBee-PRO ZB (S2C) be a nearest neighbor to act as the updater node, there is some limitation as to how nodes can be updated in a mixed network.

The image below describes how it is determined whether nodes in a mixed network arrangement can be updated from a single firmware image server. The image server can be either Digi XBee3 or XBee/XBee-PRO ZB (S2C). S2C modules must be within range of another S2C module to be updated.



Future updates

For the most up-to-date information on what features and enhancements have been added in the XBee software, refer to the release notes that are included with each software update.