Digi XBee3 Zigbee Migration Guide

Migration from XBee/XBee-PRO ZB (S2C) to
Digi XBee3 Zigbee 3.0

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Contents

1   Introduction

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

This guide will assist 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.

2   What's new

The Digi XBee3 Zigbee 3.0 introduces some new features such as:

- Addition of the "Micro" form factor

- Introduction of Zigbee 3.0 support

- New, more reliable and secure, over-the-air (OTA) firmware update process with image signature and verification support

- Capable of firmware migration to DigiMesh™, Digi 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

3   Specification considerations

XBee/XBee-PRO ZB (S2C) to Digi XBee3 Zigbee 3.0 (Micro)

XBee ZB (S2C)			
Considerations	Legacy XBee ZB (S2C)	New Digi XBee3 Zigbee 3.0	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

XBee ZB (S2C)

Considerations	Legacy XBee ZB (S2C)	New Digi XBee3 Zigbee 3.0	Comments
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
FCC ID	MCQ-S2C	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 ZB (S2C)

Considerations	Legacy XBee-PRO ZB (S2C)	New Digi XBee3 Zigbee 3.0	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	

4 Part number migration guide

The following table shows which Digi XBee3 Zigbee 3.0 to migrate to depending on which XBee/XBee-PRO ZB (S2C) module you are currently using.

Legacy part number	Description	Migrate to
XB24CZ7SIT-004	XBee3, 2.4 GHz ZB 3.0, SMA Ant, TH MT(coming soon)	XB3-24Z8ST-J
XB24CZ7UIT-004	XBee3, 2.4 GHz ZB 3.0, U.FL Ant, TH MT (coming soon)	XB3-24Z8UT-J
XB24CZ7PIT-004	XBee3, 2.4 GHz ZB 3.0, PCB Ant, TH MT (coming soon)	XB3-24Z8PT-J
XBP24CZ7SIT-004	XBee3 PRO, 2.4 GHz ZB 3.0, SMA Ant, TH MT (coming soon)	XB3-24Z8ST
XBP24CZ7UIT-004	XBee3 PRO, 2.4 GHz ZB 3.0, U.FL Ant, TH MT (coming soon)	XB3-24Z8UT
XBP24CZ7PIT-004	XBee3 PRO, 2.4 GHz ZB 3.0, PCB Ant, TH MT (coming soon)	XB3-24Z8PT
XB24CZ7RIS-004	XBee3, 2.4 GHz ZB 3.0, RF Pad Ant, SMT	XB3-24Z8RS-J
XB24CZ7UIS-004	XBee3, 2.4 GHz ZB 3.0, U.FL Ant, SMT	XB3-24Z8US-J
XB24CZ7PIS-004	XBee3, 2.4 GHz ZB 3.0, PCB Ant, SMT	XB3-24Z8PS-J
XBP24CZ7RIS-004	XBee3 PRO, 2.4 GHz ZB 3.0, RF Pad Ant, SMT	XB3-24Z8RS
XBP24CZ7UIS-004	XBee3 PRO, 2.4 GHz ZB 3.0, U.FL Ant, SMT	XB3-24Z8US
XBP24CZ7PIS-004	XBee3 PRO, 2.4 GHz ZB 3.0, PCB Ant, SMT	XB3-24Z8PS

5 Micro options - new to Digi XBee3 Zigbee 3.0

Legacy part number	Description
XB3-24Z8RM-J	XBee3, 2.4 GHz ZB 3.0, RF Pad Ant, MMT
XB3-24Z8UM-J	XBee3, 2.4 GHz ZB 3.0, U.FL Ant, MMT
XB3-24Z8CM-J	XBee3, 2.4 GHz ZB 3.0, Chip Ant, MMT
XB3-24Z8RM	XBee3 PRO, 2.4 GHz ZB 3.0, RF Pad Ant, MMT
XB3-24Z8UM	XBee3 PRO, 2.4 GHz ZB 3.0, U.FL Ant, MMT
XB3-24Z8CM	XBee3 PRO, 2.4 GHz ZB 3.0, Chip Ant, MMT

6 Pin signals

The Digi XBee3 Zigbee 3.0 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 ZB (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.

7 Configuration

The Digi XBee3 Zigbee 3.0 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 the IEEE 802.15.4 protocol, DigiMesh 2.4, and 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 Zigbee User Guide* for more information.

8 Digi XBee3 Zigbee 3.0 functional migration considerations

The Digi XBee3 Zigbee 3.0 module was designed to provide support for the Zigbee 3.0 specification. Some of the default configurations have changed to comply with Zigbee 3.0 requirements. See the *XBee3 Zigbee User Guide* for details. Some of these changes include:

- Over-the-air firmware updates now use ZCL frames. The firmware image will store and only boot to the new image, if it is complete. Firmware images will only boot if they are authentic, signed images from Digi. Firmware updates are no longer handled exclusively in the bootloader. There is no requirement for neighbor nodes in order to perform the update.

- The **ATEO** command now defaults to 2 to act as a Centralized Trust Center network. For increased security, when encryption is enabled (ATEE=1), the module will default to Centralized Trust Center.

- The **ATNJ** command now defaults to 0xFE. This will limit the module's ability to allow other devices to join to 254s. The Zigbee 3.0 standard does not allow for an open network. To always allow joining, you must set ATNJ=FF explicitly.

- The **ATDO** command now defaults to 0x40 to enable a high RAM concentrator. This effectively does what the XBee/XBee-PRO ZB (S2C) was already doing for small networks. Use this setting for networks of 40 nodes or less. When using Source routing, routes will be stored on the module instead of requiring the use of an external micro to store route records.

- In Zigbee 3.0, NULL Transport keys are no longer allowed. As such, **ATDO** bit 3 is deprecated.

- The Enable Best Response Joining option moved from **ATDO** bit 2 to **ATDC** bit 3.

- Coordinator operation is no longer supported in a Distributed Trust Center (ATEE=1, ATEO=0) security model. This means that the 64-bit default address of 0x0000000000000000 should not be used to communicate to the "Coordinator". Use the full EUI64 bit address instead.

- A new **ATKT** command lets you set the Trust Center link key registration timeout.

- A new **ATI?** command provides a random install code for the device to use during Trust Center registration to generate a link key.

- Enable Joiner Global Link Key (**ATDC** bit 0) has been removed for Zigbee 3.0 security, and this bit now enables using the install code as link key.

- The ADC voltage reference changed from 1.2 V to 1.25 V.

- Mark Parity UART support has been removed.

- Some parameters have changed position in XCTU for usability.

- The SPI operation is not currently supported.

- Please see the firmware release notes for additional details.

9 Examples

9.1 OTA firmware update

The firmware update process has changed on the Digi XBee3 Zigbee 3.0. 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.
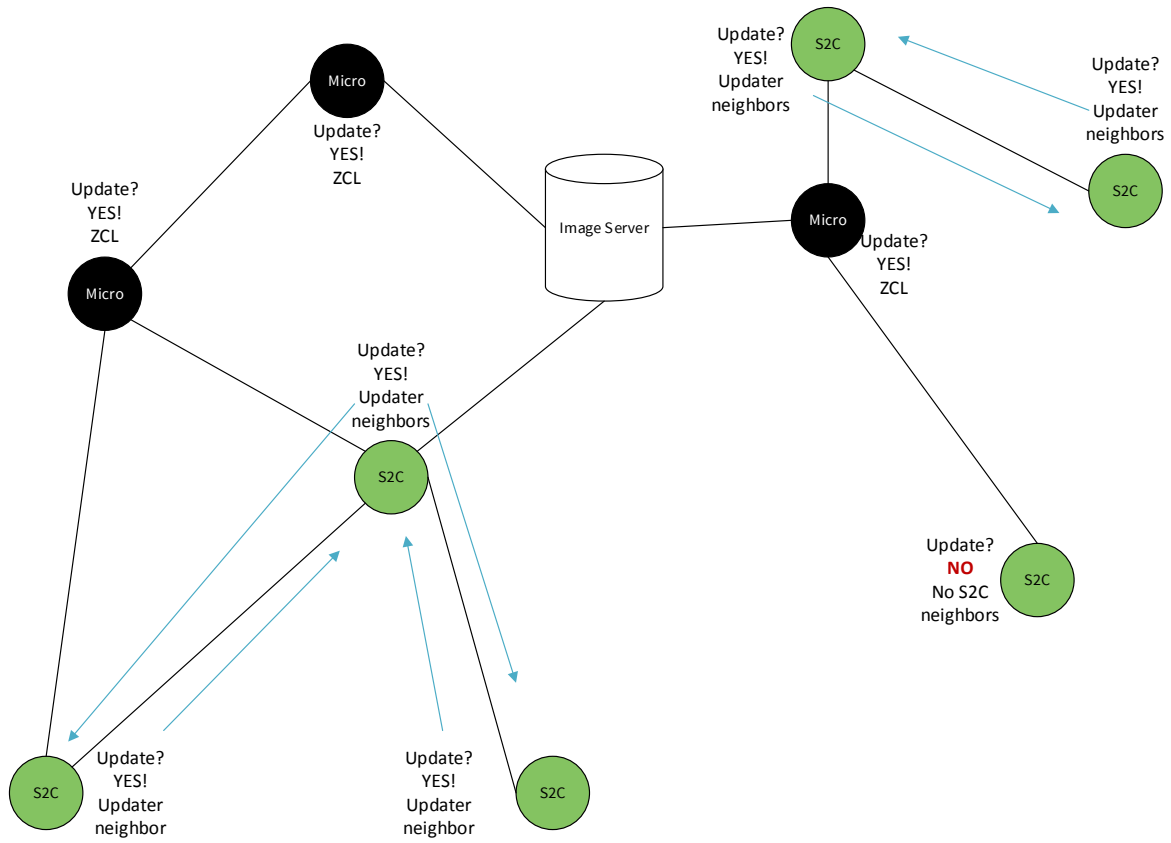
The OTA firmware update process has been improved on the Digi XBee3 Zigbee 3.0 module. First, the firmware update requires only the use of a server (node sending the firmware file), and a client node (node receiving the firmware file).

The firmware image is sent in blocks using standard Zigbee Cluster Library (ZCL) frames. These frames are supported 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 Zigbee 3.0 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 Zigbee 3.0 or XBee/XBee-PRO ZB (S2C). S2C modules must be within range of another S2C module to be updated.

Micro

Update?
YES!
ZCL

Update?
YES!
ZCL

Micro

Image Server

Update?
YES!
Updater
neighbors

S2C

Update?
YES!
Updater
neighbors

S2C

Micro

Update?
YES!
ZCL

S2C

Update?
YES!
Updater
neighbors

S2C

S2C

Update?
NO
No S2C
neighbors

S2C

Update?
YES!
Updater
neighbor

S2C

Update?
YES!
Updater
neighbor

S2C

9.2 Security

Digi makes it easy to find the right level of security for your specific application, ranging from a completely open and unencrypted network, to a high security model with out-of-band commissioning. The Zigbee 3.0 standard default requires a higher security model than what is currently default on the XBee/XBee-PRO ZB (S2C). In order to better support Zigbee 3.0, the default configurations have changed.

An open network is one in which other Zigbee devices are allowed to join. Joining is enabled using the **ATNJ** command. The XBee/XBee-PRO ZB (S2C) for the **ATNJ** command is NJ=0xFF. This setting indefinitely enables joining to other nodes which pass the security model settings used. However, Zigbee 3.0 does not support an open joining model. To meet this requirement, the **ATNJ** command has a new default setting of NJ=0xFE. This generous joining window still allows other devices to join to the network through that node, while closing the window after 254s. The join window can be reopened again at any time with an **ATCB2**. If the joining window must be opened indefinitely, **ATNJ** can be configured to the old default, but this is not recommended.

The **ATEE** command controls enabling encryption on a network. In a completely open network, ATEE is not enabled, and no security is employed. The **ATNJ** command restricts the join time to this type of network, but no other changes will affect a Digi XBee3 Zigbee 3.0 joining and communicating in this type of network.

Once encryption is enabled via the **ATEE=1** command, the level of security employed will primarily depend on the ATEO setting. The Digi XBee3 Zigbee 3.0 default for ATEO has changed to 2, which enables a Centralized Trust Center for key management.

The default for XBee/XBee-PRO ZB (S2C) is **ATEO=0**, which is a Distributed Trust Center model. If no ATEO option was used in XBee/XBee-PRO ZB (S2C), then ATEO must be explicitly set to match the XBee/XBee-PRO ZB (S2C) default.

With the XBee 3, in a "Distributed Trust Center" model, the network forms on the device that has ATCE=1, and there is no coordinator on the network. (The device forms the network as a router.) This means any traffic should be directed to the actual EUI64 address.