XCTU

Configuration and Test Utility Software

User Guide

Revision history—90001458-13

Revision	Date	Description
H	November 2017	Added support for XBee Cellular modem update.
J	April 2018	Added support for all XBee3 variants.
K	June 2018	Added support for File System Manager. Updated with XCTU 6.4.0.X information.
L	September 2018	6.4.1.X release.
M	November 2018	6.4.2.X release.

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Product name and model

Product serial number (s)

Firmware version

Operating system/browser (if applicable)

Logs (from time of reported issue)

Trace (if possible)

Description of issue

Steps to reproduce

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Download and install XCTU

This section contains download and install instructions based on operating system. XCTU is compatible with Linux, OSX, and Windows. It may be necessary to configure your system prior to installing XCTU for the first time.

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XCTU requirements

Operating systems

XCTU is compatible with the following operating systems:

- Windows Vista/7/8/10 (32-bit or 64-bit versions)
- Mac OS X v10.6 and higher versions (64-bit only)
- Linux with KDE or GNOME window managers (32-bit or 64-bit versions)

System requirements

Property	Minimum	Recommended
HDD space	500 MB	1 GB
RAM memory	2 GB	4 GB
CPU	Dual-core processor	Quad-core processor

Supported RF modules

XCTU supports configuration and communication for most Digi RF modules. XCTU uses a serial link to interact with these radio modules, providing an easy-to-use and intuitive graphical interface. The following is a complete list of XCTU-compatible RF modules:

- XBee®/XBee-PRO® RF Module Family
  - XBee SX
  - XBee-PRO SX
  - XBee 802.15.4
  - XBee-PRO 802.15.4
  - XBee ZB
  - XBee-PRO ZB
  - Programmable XBee-PRO ZB
  - XBee ZB SMT
  - XBee-PRO ZB SMT
  - Programmable XBee-PRO ZB SMT
  - XBee-PRO 900HP
  - Programmable XBee-PRO 900HP
  - XBee-PRO XSC
  - XBee-PRO 900
  - XBee-PRO DigiMesh 900
  - XBee DigiMesh 2.4
  - XBee-PRO DigiMesh 2.4
  - XBee-PRO 868

- XBee Wi-Fi
- XBee 865LP
- Programmable XBee 865LP
- XBee Cellular
- XBee 868LP SX
- XBee Thread
- XBee3 (Zigbee, DigiMesh 2.4, 802.15.4 and Cellular)

- XTend® RF Module family
- XLR PRO radio solution
- XLR Module

Install XCTU - Windows

Follow the steps below to download and install XCTU on your computer.

1. Visit www.digi.com/xctu.
2. Click **Download XCTU**.
3. Under **Utilities**, click the Windows installer link.
4. When the file has finished downloading, run the executable file and follow the steps in the XCTU Setup Wizard.

   A "What's new" dialog appears when XCTU opens the first time after the installation.

XCTU updates

You may be notified about XCTU software updates once XCTU has loaded. You should always update XCTU to the latest available version. See Install XCTU updates.

Install XCTU - Linux

By default, access to the serial and USB ports in Linux is restricted to root and dialout group users. To access your XBee devices and use XCTU to communicate with them, your Linux user must belong to this group.

To add your Linux user to the dialout group:

1. Open a terminal console.
2. Execute this command:

   ```
   sudo usermod -a -G dialout <user>
   ```

   where <user> is the user you want to add to the dialout group.
3. Log out and log in again with your user in the system.

Then download and install XCTU:

4. Visit www.digi.com/xctu.
5. Click **Download XCTU**.
6. Under **Utilities**, click the Linux installer link.
7. When the file has finished downloading, run the executable file and follow the steps in the XCTU Setup Wizard.

   A “What’s new” dialog appears when XCTU opens the first time after the installation.

XCTU updates

You may be notified about XCTU software updates once XCTU has loaded. You should always update XCTU to the latest available version. See Install XCTU updates.

Install XCTU - OSX

OSX version 10.8 (Mountain Lion) and greater only allows you to install applications downloaded from the Apple Store. To install XCTU, you must temporarily disable this setting.

Follow these steps to enable installation of "unsigned" software:

1. Click the **Apple** icon in the top-left corner of your screen and choose **System Preferences**.
2. Click the **Security & Privacy** icon.
3. To edit security settings, click the **padlock** icon in the bottom left of the window.
4. Enter your Mac credentials and click **Unlock**. The **Allow applications downloaded from** dialog appears.
5. Click the **Anywhere** radio button and, in the confirmation window, click **Allow From Anywhere**.

Note We recommend you set this option back to **Mac App Store** or **Mac App Store and identified developers** once you have finished installing XCTU.

Then download and install XCTU:

6. Visit www.digi.com/xctu.
7. Click **Download XCTU**.
8. Under **Utilities**, click the OSX installer link.
9. When the file has finished downloading, unzip and run the executable file and follow the steps in the XCTU Setup Wizard.

   A “What’s new” dialog appears when XCTU opens the first time after the installation.

XCTU updates

You may be notified about XCTU software updates once XCTU has loaded. You should always update XCTU to the latest available version. See Install XCTU updates.

Optional: Manually install USB drivers

When you connect the XBee board to your computer for the first time, USB drivers are installed automatically. There are times when this does not occur, and you need to install device drivers

manually:

1. Find the appropriate USB drivers on the Digi support site.
2. Choose your operating system.
3. Download and run the file.
4. Follow the steps in the installation wizard.

RF concepts and terminology

This section contains concepts regarding radio frequency modules and the XCTU application itself. Understanding these concepts will help you work most effectively with XCTU.

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RF modules

A radio frequency (RF) module is a small electronic circuit used to transmit and receive radio signals on different frequencies. Digi produces a wide variety of RF modules to meet the requirements of almost any wireless solution, such as long-range, low-cost, and low-power modules. The most popular wireless products are the XBee RF modules.

XCTU is compatible with Digi's XBee and XTend RF modules and XLR PRO. For a complete list of XCTU-compatible modules, see XCTU requirements.

XBee RF modules

XBee is the brand name of a family of RF modules produced by Digi. They are modular products that make deploying wireless technology easy and cost-effective. Digi has made multiple protocols and RF features available in the popular XBee footprint, giving customers enormous flexibility to choose the best technology for their needs.

XBee RF modules are available in two form-factors, Through-Hole and Surface Mount, with different antenna options. One of the most popular features of these modules is that almost all of them are available in the Through-Hole form factor and share the same footprint.

XTend RF modules

XTend family devices are long-range RF modules produced by Digi that provide unprecedented range in a low-cost wireless data solution. They were engineered to provide customers with an easy-to-use RF solution that provides reliable delivery of critical data between remote devices. These modules transfer standard asynchronous serial data streams, operate within the ISM 900 MHz frequency band, and sustain up to 115.2 Kbps data throughput.

XLR PRO radio solutions

The XLR PRO is an ultra long-range, rugged 900MHz radio solution designed for optimal performance even in the most challenging RF environments. Leveraging Digi's patent-pending Chirp Spread Spectrum technology, the XLR PRO provides industry-leading receive sensitivity and interference immunity, making it ideal for deployments in noisy RF environments like oil fields. The XLR PRO includes 2 Ethernet ports and 1 serial port, enabling wireless data communications between Ethernet and/or serial devices up to distances of over 90 miles.

Radio firmware

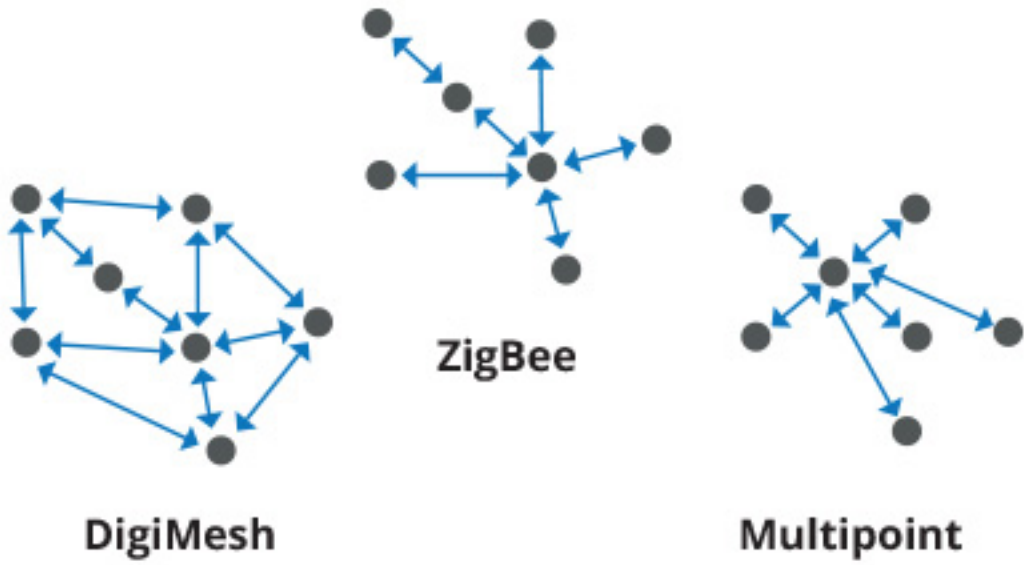
Radio firmware is program code stored in a radio module's persistent memory that provides the control program for the device. Digi periodically releases new radio firmware versions to fix bugs or improve functionality. You may need to add these firmware files to XCTU's radio firmware library. You can use XCTU to update or change the firmware of a module if, for example, you want to change the role of a device or you want to use the latest firmware version.

Radio communication protocols

A radio communication protocol is a set of rules for data exchange between radio devices. An RF module supports a specific radio communication protocol depending on the module and its radio firmware.

The following is the complete list of protocols supported by the XBee radio modules:

- IEEE 802.15.4
- ZigBee
- ZigBee Smart Energy
- DigiMesh (Digi proprietary)
- ZNet
- IEEE 802.11 (Wi-Fi)
- Point-to-multipoint (Digi proprietary)
- XSC (XStream-compatible)



Not all XBee devices can run all listed communication protocols. The combination of XBee hardware and radio firmware determines the protocol that an XBee device can execute. For more information about the available XBee RF modules and the protocols they support, see XBee RF Family Comparison Matrix.

Radio module operating modes

The operating mode of an XBee radio module establishes the way a user or any microcontroller attached to the XBee communicates with the module through the Universal Asynchronous Receiver/Transmitter (UART) or serial interface.

Depending on the firmware and its configuration, radio modules can work in three different operating modes:

- Application Transparent (AT) operating mode
- API operating mode
- API escaped operating mode

In some cases, the operating mode of a radio module is established by the firmware version, which determines whether the operating mode is AT or API, and the AP setting of the firmware, which determines if the API mode is escaped (2) or not (1). In other cases, the operating mode is only determined by the AP setting, which allows you to configure the mode to be AT (AP=0), API (AP=1), or API escaped (AP=2).

AT operating mode

In AT (Application Transparent) or transparent operating mode, all serial data received by the radio module is queued up for RF transmission. When RF data is received by the module, the data is sent out through the serial interface.

To configure an XBee module operating in AT, you must put it in command mode to send the configuration commands.

AT Command mode

When the radio module is working in AT operating mode, you must use the command mode interface to configure settings.

To enter AT command mode, send the three-character command sequence (usually "+++") within one second. Once AT command mode has been instigated, the module sends an "OK\r", the command mode timer is started, and the radio module is able to receive AT commands.

AT command structure

The structure of an AT command is:

```
AT[ASCII command][Space (optional)][Parameter (optional)][Carriage return]
```

For example:

```
ATNI MyDevice\r
```

If no valid AT commands are received within the command mode timeout, the radio module automatically exits AT command mode. You can also exit command mode by issuing the CN command:

```
(ATCN\r)
```

API operating mode

API (Application Programming Interface) operating mode is an alternative to AT mode. API operating mode requires that communication with the module be done through a structured interface. In other words, data is communicated via API frames.

The API specifies how commands, command responses, and module status messages are sent and received from the module using the serial interface. With API operating mode, you can:

- Configure the XBee module itself.
- Configure remote modules in the network.
- Manage data transmission to multiple destinations.

- Receive success/failure status of each transmitted RF packet.
- Identify the source address of each received packet.

Depending on the AP parameter value, the radio module can operate in one of two modes: API (AP=1) or API escaped (AP=2) operating mode.

API escaped operating mode

API escaped operating mode (AP=2) is similar to API mode except that when working in API escaped mode, some bytes of the API frame specific data must be escaped. Since XCTU is compatible with both API and API escaped operating modes, you do not need to manually escape characters.

API escaped operating mode increases the reliability of RF transmission by preventing conflicts with special characters such as the start-of-frame byte (0x7E). API non-escaped (API=1) operation relies solely on the start delimiter and length bytes to differentiate API frames. In API escaped mode, on the other hand, those special bytes are escaped. Since 0x7E can only appear at the start of an API packet, a module can always "assume" that a new packet has started if 0x7E is received at any time while in API escaped mode.

Escape characters

When sending or receiving an API frame in API escaped mode, specific data values must be escaped (flagged) so they do not interfere with the data frame sequence.

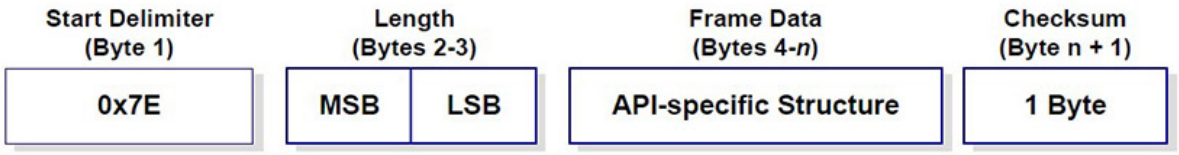
To escape a data byte, insert 0x7D and follow it with the byte to be escaped XOR'd with 0x20. The data bytes that need to be escaped are as follows:

- 0x7E: Frame delimiter
- 0x7D: Escape
- 0x11: XON
- 0x13: XOFF

Note XCTU automatically escapes the appropriate characters when interacting with API escaped radio modules.

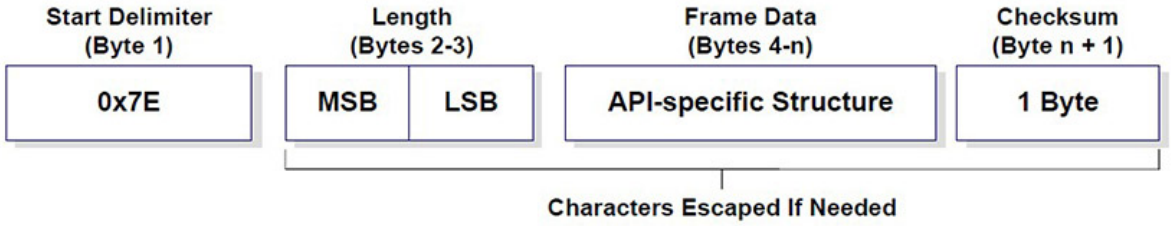
API frames

An API frame is the structured data sent and received through the serial interface of the radio module when it is configured in API or API escaped operating modes. API frames are used to communicate with the module or with other modules in the network. An API frame has the following structure:



Field	Description
Start delimeter	The first byte of a frame consisting of a special sequence of bits which indicate the beginning of a data frame. Its value is always 0x7E. This allows for easy detection of a new incoming frame.
Length	Specifies the total number of bytes included in the frame data field. Its two-byte value excludes the start delimiter, the length, and the checksum.
Frame data	Composed by the API identifier and the API identifier-specific data. The content of the specific data depends on the API identifier (also called API frame type).
Checksum	The last byte of the frame. It helps test data integrity and is calculated by taking the hash sum of all the API frame bytes that came before it, excluding the first three bytes (start delimiter and length).

If your module is operating in API escaped operating mode, some bytes in the Length, Frame data, and Checksum frame fields may need to be escaped. XCTU automatically performs this step and escapes the appropriate characters. See API escaped operating mode.



Note There are many different types of API frames. You can use the Frames generator tool to learn the specific data contained within a determined API frame as well as to build and fill any type of API frame. See Frames generator tool.

AT settings or commands

The firmware running in RF modules contains a set of settings and commands that can be configured to change the behavior of the module or to perform any action related to it. Depending on the protocol, the number of settings and their meanings varies, but all XBee RF modules can be configured with AT commands.

All firmware settings or commands are identified with two ASCII characters. Applications and documents refer to them as either AT settings or AT commands.

The configuration process of these AT settings varies depending on the operating mode of the RF module.

Configuring in AT mode

In AT operating mode, you must put the module in a special mode called command mode so it can receive AT commands. For more information about configuring RF modules working in AT operating mode, see AT operating mode.

Configuring in API mode

To configure or execute AT commands when the RF module is in API operating mode, you must generate an AT command API frame containing the AT setting identifier and the value of that setting, and send it to the RF module. See API frames.

Local radio modules

A local radio module is any module added to the device list using the Add a radio module or Discover radio modules buttons.

XCTU communicates directly with local modules, and they are physically attached to the PC through a serial or USB port. A local radio module can discover remote modules in the same network if their protocol is ZigBee or DigiMesh. A local module is configurable if Configuration working mode is active, and you can communicate with a local module through its console when Consoles working mode is active.

Remote radio modules

You can locate remote radio modules in the same network as a local module. A remote module is not physically attached to your computer. Remote modules are displayed in a sub-list under the local module, and that local module functions as an interpreter; without it, XCTU is unable to communicate with the remote module. See Discover remote radio modules.

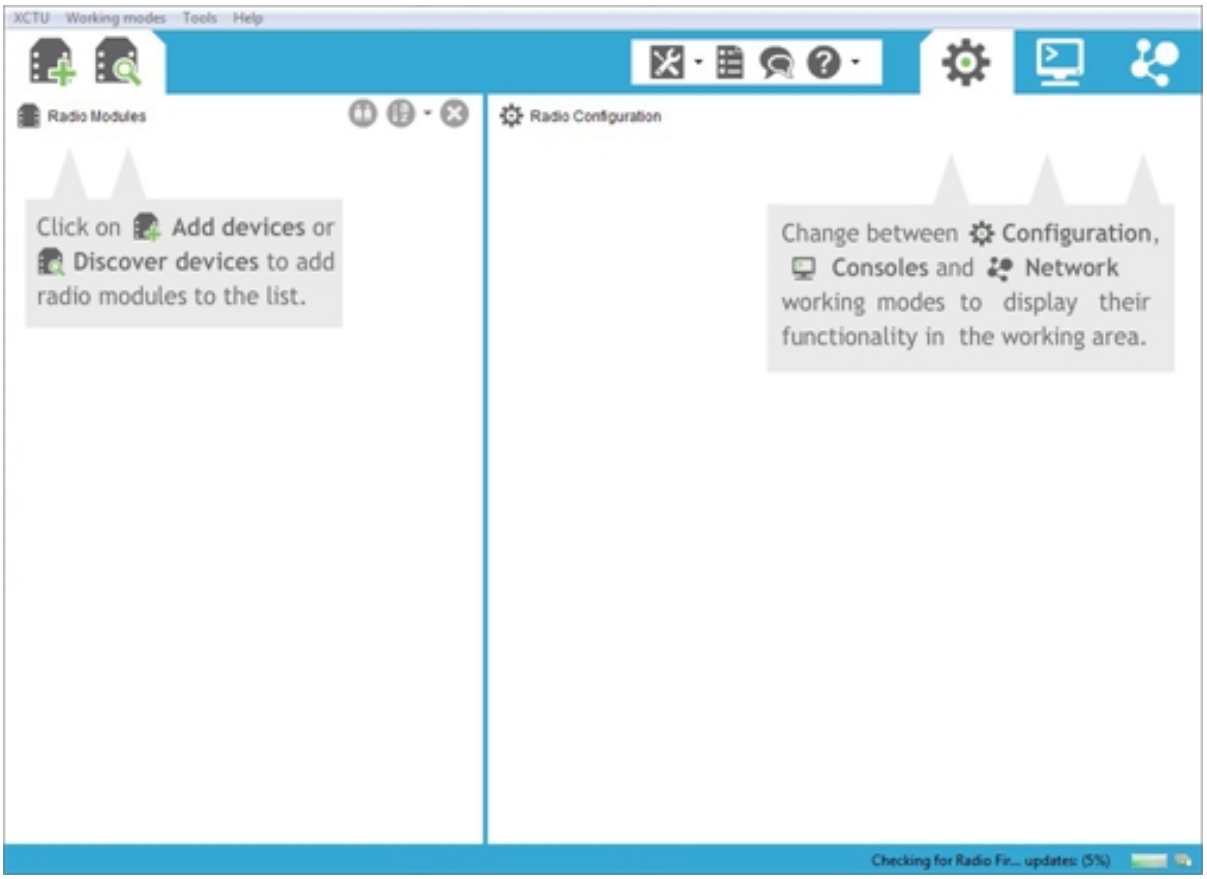
Communication between XCTU and a remote module takes place in two stages: serial communication from XCTU to the local module, and wireless communication between the local module and the remote module. XCTU uses the serial port to send a message intended for the remote module, along with delivery specifics, to the local module. The local module then transmits the message wirelessly to the remote module.

If the local device containing remote modules is configured in AT (transparent) operating mode, you cannot configure its remote radio modules due to a protocol limitation. If the local radio module is configured in API operating mode, you can configure its remote radio modules like any local module.

Since a remote radio module is not physically connected to the PC, it does not have a communication console in Consoles working mode. For the same reason, you also cannot obtain a remote radio module's network topology in Network working mode. See Consoles working mode and Network working mode.

XCTU overview

XCTU is divided into five main sections: the menu bar, main toolbar, devices list, working area, and status bar.



Menu bar

The menu bar is located at the top of the application. You can use the menu bar to access all XCTU features, tools, and working modes.

Main toolbar

The main toolbar is located at the top of the application and is divided into three sections.

- The first section contains two icons used to add radio modules to the radio modules list. See Add radio modules to XCTU.

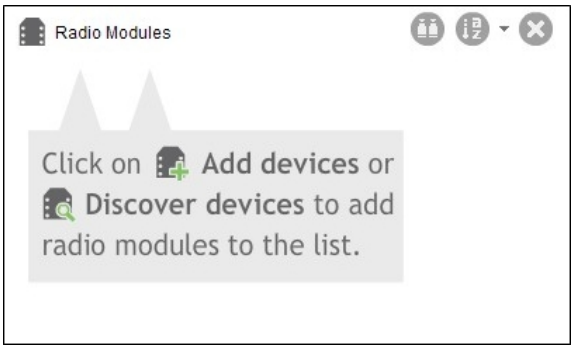
- The second section contains the static XCTU functionality that does not require a radio module. This section includes the XCTU tools, the XCTU configuration, the feedback form, and the help and updates functions. See XCTU tools and Configure XCTU.

- The third section contains tabs corresponding to the three XCTU working modes. To use this functionality, you must have added one or more radio modules to the list. See XCTU working modes.

Devices list

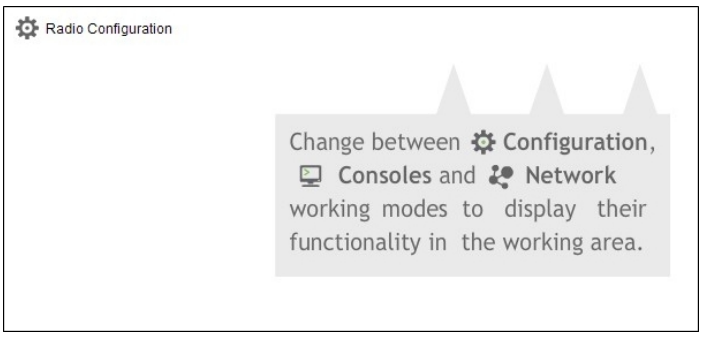
The radio modules list, or devices list, is located on the left side of the tool and displays the radio modules that are connected to your computer. If you know the serial port configuration of a radio module, you can add it to the list directly. You can also use the discovery feature of XCTU to find radio modules connected to your PC and add them to the list. See Add radio modules to XCTU.

Depending on the protocol of the local radio modules added, you can also add remote radio modules to the list using the module's search feature.



Working area

The working area is the largest section and is located at the right side of the application. The contents of the working area depend on the working mode selected in the toolbar. To interact with the controls displayed in the working area, you must have added one or more radio modules to the list and one of the modules must be selected.



Status bar

The status bar is located at the bottom of the application and displays the status of specific tasks, such as the firmware download process.

XCTU preferences

To configure XCTU settings, click the **Preferences** button on the XCTU toolbar.

Configuration preferences are grouped into categories listed on the left-hand side of the preferences dialog box. You can configure settings in the following XCTU categories:

Appearance

You can configure some graphic aspects of the tool and how some elements are displayed.

Field	Description
Font size	Change all the XCTU texts size in percentage, from 50 to 120%.
Show top bar menu	Displays an application top bar menu with texts.
Show text on toolbar actions	Displays the name of the action below each toolbar element for a better understanding of the meaning of each action.
Use reduced toolbars size	Changes the size of the application toolbars reducing them.

Automatic updates

Field	Description
Automatically find new updates and notify me	Enables or disables automatic XCTU updates. Uncheck if you do not want XCTU to update automatically.
Update schedule	Sets a schedule to search for updates or to update when XCTU is started. If you select **Look for updates on the following schedule**, you must also specify the search interval and hour.
Download options	Establishes when new updates should download and sets permissions for whether updates are automatically downloaded.
When updates are found	Sets the frequency of update notification.

Consoles

Field	Description
API console	Configures the maximum number of API frames that can be displayed in the frames log during a session. When the maximum limit is reached, the session starts overwriting frames.
AT console	Configures the maximum number of bytes that can be displayed during a session. When the maximum limit is reached, the session starts overwriting bytes.

MadCap:autonum="Note ">If you set high values for maximum API frames and/or AT bytes, you may notice performance issues in the consoles.

Firmware updates

Field	Description
Remote firmware update timeout	Configures the remote firmware update timeout in milliseconds. This value is the maximum time the application will wait for answers sent by the remote node during remote firmware update before concluding that there was an error during the process.

Network

You can configure Network view in the **Network preferences** dialog. The first four options are common to all networks:

Field	Description
Always clear the Network view before starting	Clears Network view before each new network scan.
Remove nodes if they were not discovered in the last performed scan	Removes any nodes not discovered in the last scan.
Stop after scan	Sets the number of scans to perform before stopping the discovery process. A value of '0' means the process will not stop automatically.
Time between scans	Sets the duration of time XCTU waits before starting a new network scan. The value must be between 0 and 300 seconds.

The remainder of the options are specific to 802.15.4, DigiMesh, and ZigBee network types:

Field	Description
Discovery mode	Sets the method used by the network discovery process. ■ Flood: The neighbor discovery process is performed for every node at the moment it is found. Several discovery processes may be running at the same time. This method may be faster, but it may also generate a lot of traffic and saturate the network. ■ Cascade: The neighbor discovery process is performed for every node as soon as the discovery process finishes. Only one discovery process runs at a time. This method may be slower, but it is likely to generate less traffic.
Neighbor discovery timeout	Sets the maximum duration, in seconds, the discovery process should spend finding neighbors of a module. Value must be between 5 and 1800 seconds (30 minutes). This timeout is highly dependent on the nature of the network. For DigiMesh, the value should be greater than the highest NT (Node Discover Timeout) and include enough time to let the message propagate, depending on the sleep cycle of your devices.
Time between requests	Sets the wait time between node neighbor requests. The value must be between 0 and 300 seconds (5 minutes). For the Cascade method, this is the number of seconds to wait after completion of the neighbor discovery process of the previous node. For the Flood method, this is the minimum time to wait between each radio module's neighbor requests.

Note The Cascade discovery method is recommended for large networks.

Network appearance

You can configure how node links are represented in Network graphic view.

Field	Description
Connection default color	Defines the default color of the node's connection lines.
Show colored connections based on their quality	Enables or disables the coloring of node connection lines based on their link quality.
DigiMesh / ZigBee network	Enables you to modify the maximum and minimum values and RGB colors for each quality range. Click in the cell, type the value, and click **Enter** to change a value. Ranges include minimum values but not maximum values. When you change the minimum value of a quality range, the maximum value of the next range adopts a corresponding value.

Radio firmware library

You can instruct XCTU to look for new radio firmware when it starts up by checking **Automatically update the XBee Firmware Library each time XCTU is started**. If this option is disabled, you can only check for firmware updates manually.

XCTU working modes

XCTU operations are grouped into three working modes—Configuration, Consoles, and Network. The selected working mode determines which specific operations you can perform with a radio module or modules in your device list. You can only select one working mode at a time. By default, XCTU launches in Configuration mode.

Configuration working mode

Use configuration working mode to configure a radio module selected from your device list. See Configure your modules.

Consoles working mode

Use consoles working mode to interact or communicate with the selected radio module. See Communicate with your modules.

Network working mode

Use network working mode to discover and visualize the topology and interconnections of your network. See View your radio network.

Add radio modules to XCTU

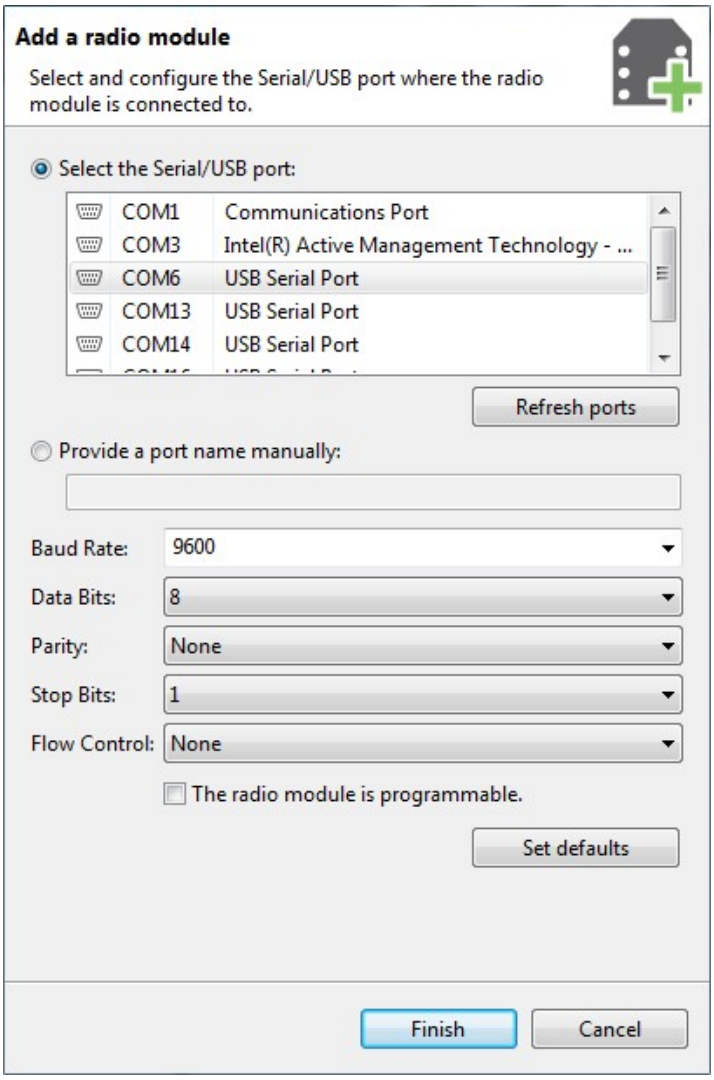
This section describes how to add, discover and organize your radio modules in XCTU.

Add a radio module manually 29
Add a programmable radio module 30
Discover local radio modules 32
Radio module information panel 34
Organize your modules 39
Discover remote radio modules 39
Find radio modules 41

Add a radio module manually

If you know the serial configuration of your radio module, you can add it to the list manually.

1. Click the **Add a radio module** button from the toolbar. The **Add a radio module** dialog opens.

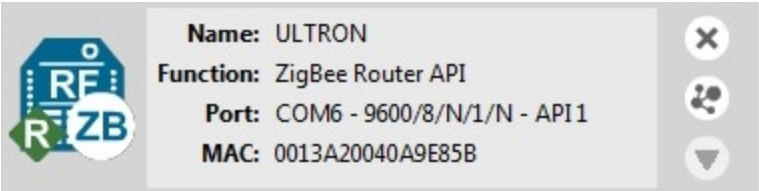


2. Select the serial port where the radio module is connected (or enter its name manually) and configure the serial settings of the port.

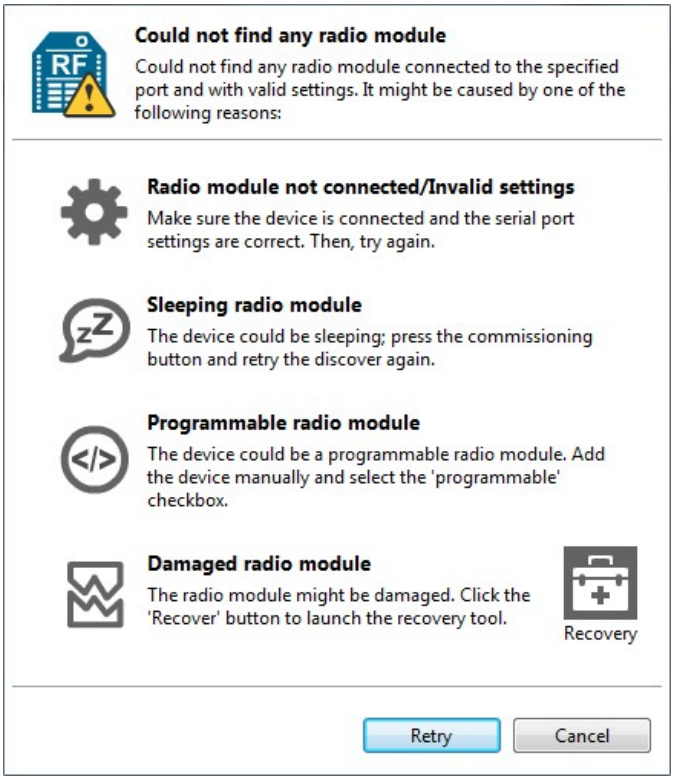
   Note Custom baud rates can only be typed under Windows OS.

3. Click **Finish** to add the radio module to the list of radio modules.

4. If the settings were configured correctly and the radio module was connected to the selected port, the module is displayed in the device list. For more information about the device list, see Radio module information panel.



5. If the settings were configured incorrectly, an **Action Required** dialog asks you to reset the module. Reset the module. The action required dialog should close and your module should be added to the list.
6. If your module could not be found, XCTU displays the **Could not find any radio module** dialog providing possible reasons why the module could not be added. To resolve the issue, see Troubleshooting for XCTU.



Note You can also use the Add a radio module dialog to add programmable radio modules. See Add a programmable radio module.

For more information, see Local radio modules and Radio module information panel.

Add a programmable radio module

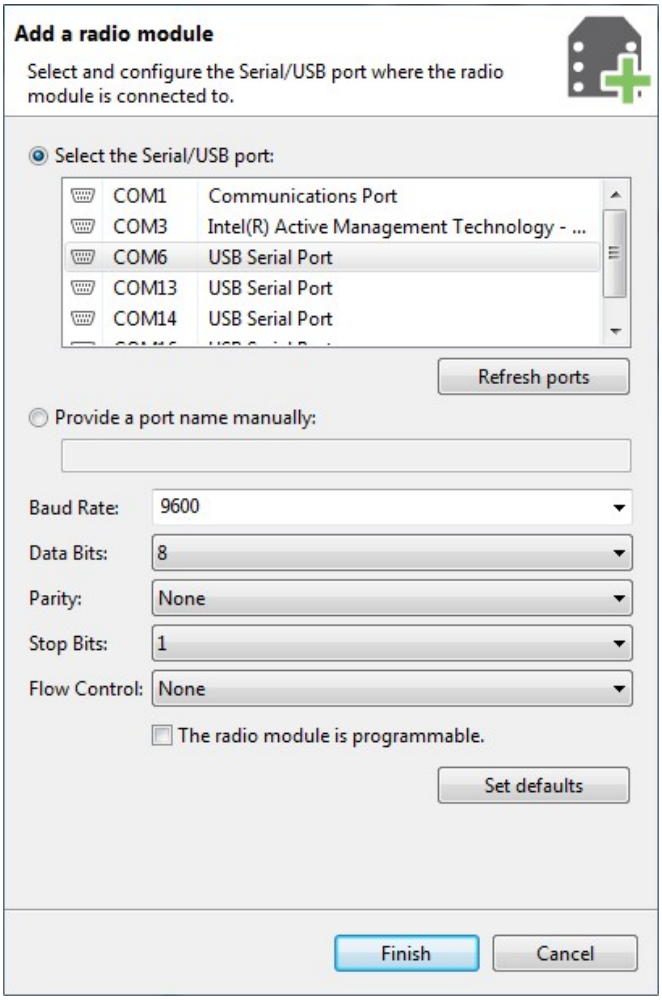
Some radio module variants are programmable, which means they are able to run applications written in C. Normally, they are known as Programmable XBee modules and can be identified by a

part number ending in B on the back label.

XBee-PRO modules are often confused with Programmable XBee modules. The -PRO suffix does not mean that the module is programmable.

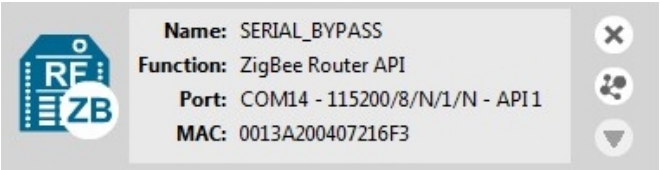
To add a programmable radio module:

1. Click the **Add a radio module** button from the toolbar. The **Add a radio module** dialog opens.



2. Select the serial port to which the radio module is connected (or enter its name manually) and configure the serial settings of the port.
3. Check the **My radio module is programmable** setting.
4. Click **Finish**.

5. Reset your radio module when prompted. The module appears in the device list.

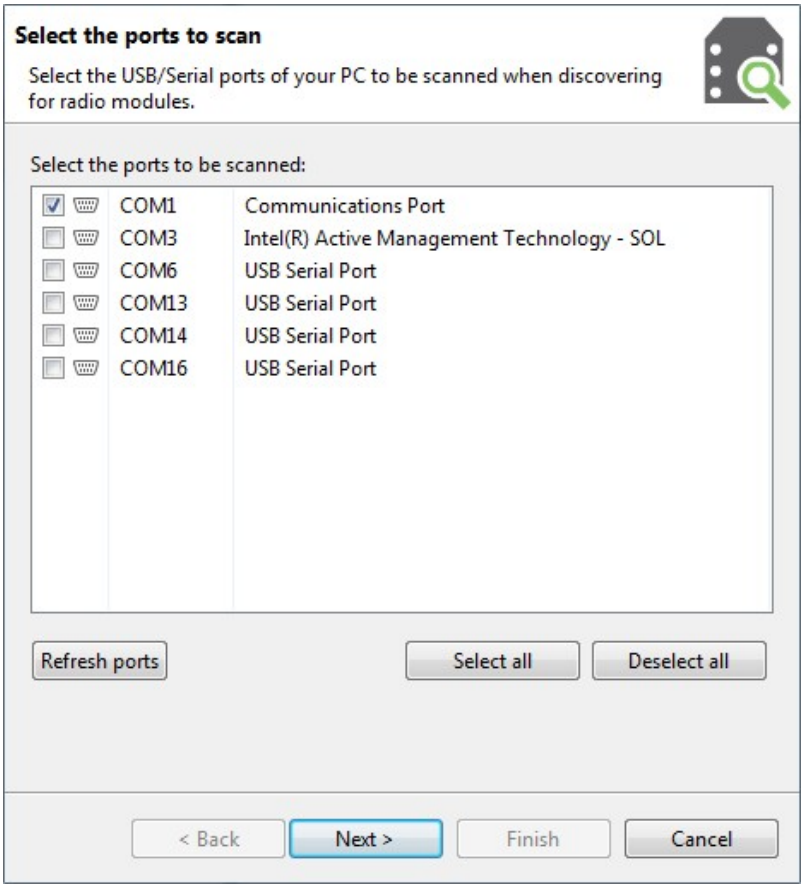


For more information, see Local radio modules and Radio module information panel.

Discover local radio modules

XCTU can discover radio modules that are connected directly to your computer. You can use the discovery tool if you don't know the serial configuration of your radio module, don't know the port it is connected to, or want to add multiple modules at once.

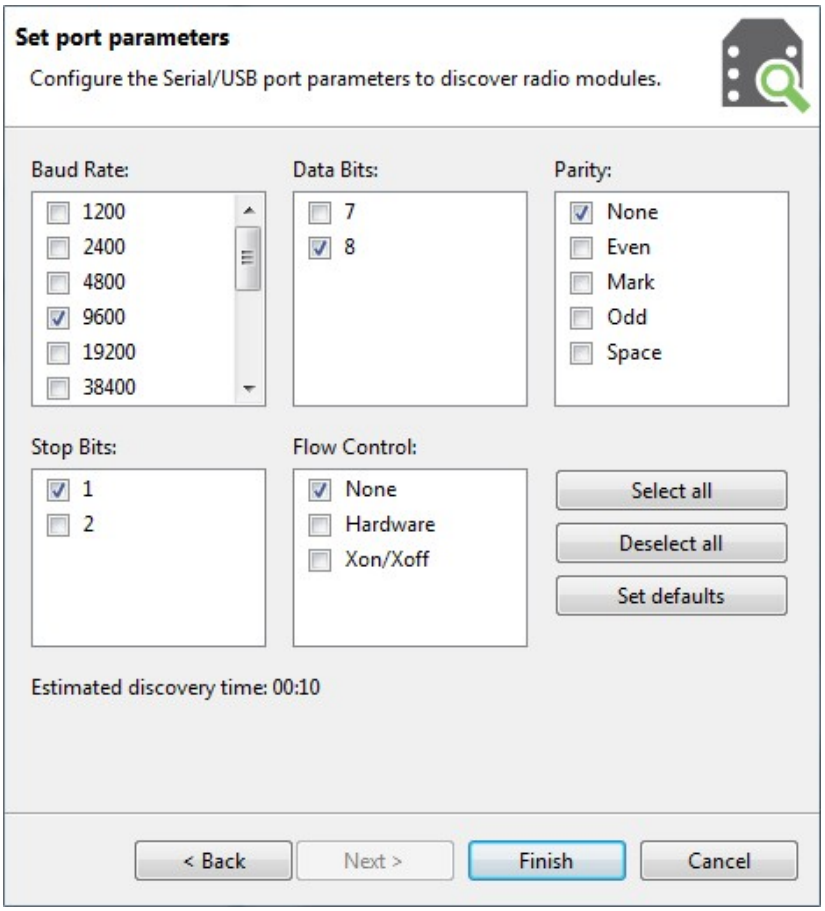
1. Click the **Discover radio modules** button on the XCTU toolbar. The **Discover radio modules** dialog box opens.



2. Select the serial ports you would like to scan for radio modules. Click **Next**.

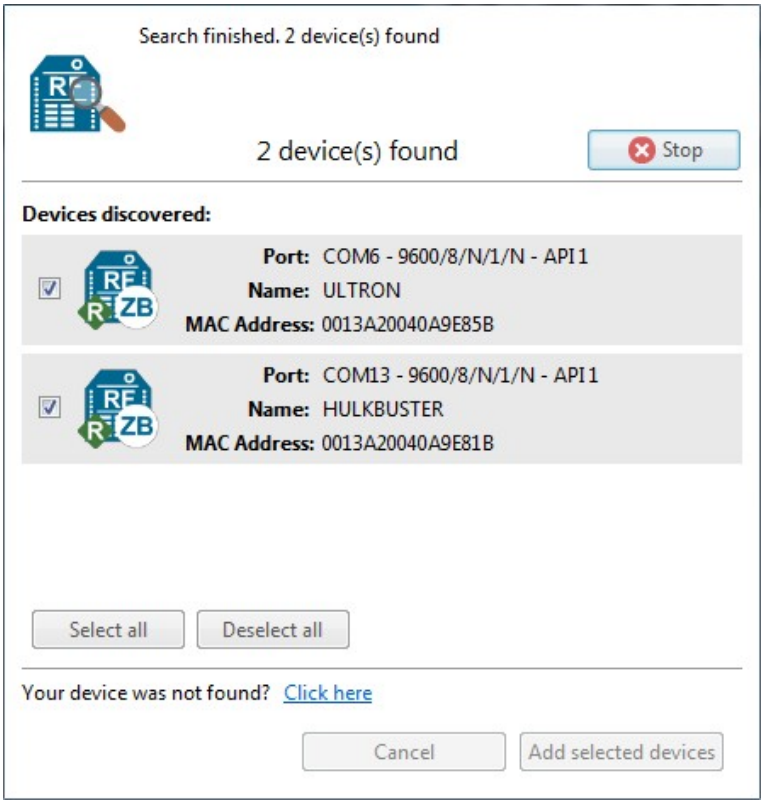
3. Select any port parameters you would like to include in the search process.

Note XCTU displays estimated discovery time in the **Set port parameters** dialog. Adding more port parameters to the search increases discovery time.

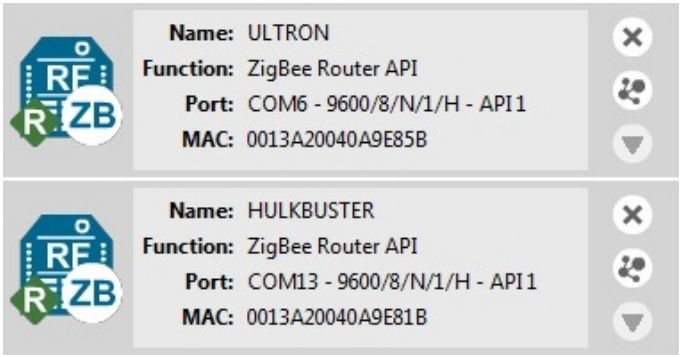


4. Click **Finish** to initiate the discovery scan.

   A new dialog opens, displaying devices found and estimated time remaining. You can click **Stop** to halt the discovery process at any time. For example, you can stop the process if the modules you were looking for are already found.



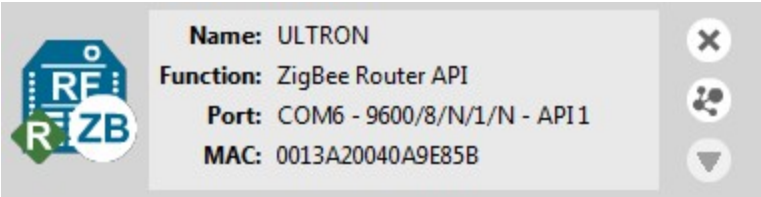
5. Select the box next to the module(s) you want to add to your device list and click **Add selected devices**. The modules appear in the device list.



For more information, see Local radio modules and Radio module information panel.

Radio module information panel

Local radio modules appear as big buttons in the modules list. Each module displays identifying information about itself.



To work with a radio module, you must select it from the list of devices. When you hover over a module, the background color changes to yellow.

Selecting a radio module refreshes the contents of the working area, displaying the information or actions you can perform on the selected module. The contents of the working area depend on the active working mode.

Module Icon

An icon on the left side of the information panel identifies the module type and protocol.

Icon	Module type	Protocol
	XBee	ZigBee
	XBee	DigiMesh (Digi's proprietary protocol)
	XBee	802.15.4
	XBee	Point-to-multipoint
	XBee	Smart Energy

Icon	Module type	Protocol
	XBee	ZNet
	XBee	Wi-Fi
	XBee	XStream Compatibility
	XTend	XTend native
	XTend	DigiMesh (Digi's proprietary protocol)
	XLR	XLR-PRO native
	XLR Module	XLR Module
	XBee	SX

Icon	Module type	Protocol
	XBee	Cellular
	XBee	Thread

Each icon may contain a small image in the lower-right corner that identifies the role of that module within its network:

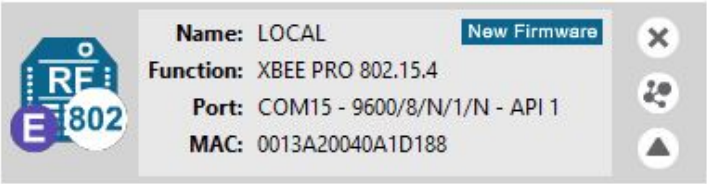
Icon	Description
	Coordinator
	Router
	End device

Buttons along the right-hand side of the module information panel perform actions on the selected module:

Button	Name	Description
	Remove	Removes the radio module from the list of devices. Also removes the associated communication console and network view of that module. Removes the local module and any associated remote modules.
	Search	Discovers remote radio modules in the same network. Dependent on radio module protocol. Performs an SSID discovery for Wi-Fi modules, and for any other protocol performs a discovery of remote radio modules. See Discover remote radio modules and Active scan.
	Expand/collapse	Expands and collapses the remote radio modules list.

New firmware indicator

When a radio module is not running the latest firmware version it is able to run, the **New Firmware** control displays next to the name label for the information panel.



This control indicates that there is a newer firmware version that can be flashed in the radio module. If you click **New Firmware**, the **Update firmware** dialog is automatically opened for that radio module. All of the available firmware versions for the radio module are listed in the dialog.

Remove a radio module

Click **Remove** to remove a selected radio module from the list of devices. Removing a module from the list also disables the associated communication console and network view of the module.

Note Clicking the **Remove** button of a remote module removes only that radio module from the sub-list of remote modules. Click the **Remove** button of a local module with a sub-list of remote modules removes the local module as well as all of its remote modules.

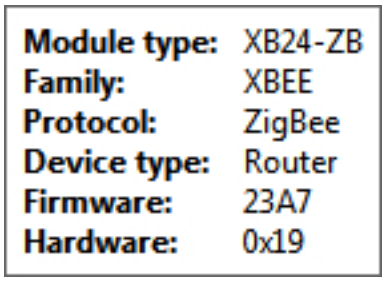
Expand/Collapse radio modules list

If the protocol of the radio module is ZigBee or DigiMesh and you have found remote modules in the same network, you can use the **expand/collapse** button to expand or collapse the list of remote modules under the local device.

Note This button is only enabled for local radio modules.

Module information box

When you hover over the icon, XCTU displays additional information about the selected module, including module type, family, protocol, device type, firmware, and hardware.



Organize your modules

The Radio Modules view contains a toolbar with options to manage radio modules in the list. These options are only enabled when the list contains at least one radio module.

Find radio modules

Click the **Find radio modules** button to find local and remote radio modules in your list. For details, see Find radio modules.

Sort radio modules

Radio modules are displayed in the order in which you added them to XCTU. Click the **Sort radio modules list** button to sort radio modules by name, function, serial port, or MAC address. Or you can select a specific device and move it up/down in the list.

Note The sorting feature affects both local and remote radio modules.

Clear radio modules

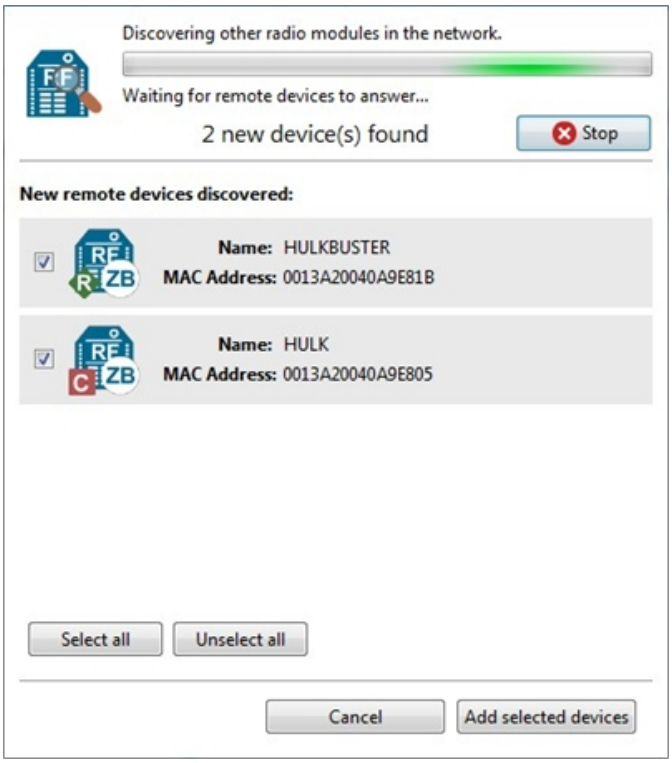
Click **Clear radio modules list** to remove all discovered modules from the radio modules list. For more information, see Local radio modules and Remote radio modules.

Discover remote radio modules

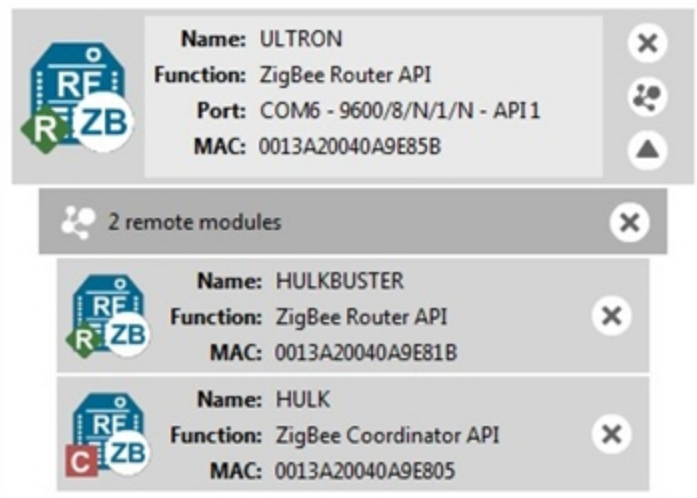
You can execute a discovery process to locate remote radio modules in the same network as the local (selected) module. To discover remote modules:

1. Select a module from your device list. If you do not have any modules in the list, see Add a radio module manually or Discover local radio modules.

2. Click the **Discover radio nodes in the same network** button . As XCTU discovers new remote radio modules, they appear in the discovery process dialog box.



3. Click **Stop** to halt the discovery process at any time.
4. Check the box next to the module(s) you want to add to your device list and click **Add selected devices**. The discovered remote modules appear in the list of remote modules.



Note XBee Wi-Fi modules do not support the remote radio modules discovery feature. Instead, they can look for access points.

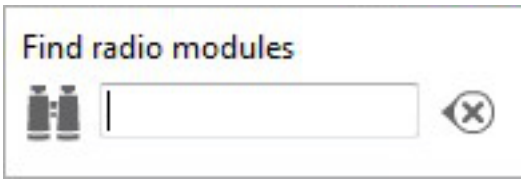
For more information, see Remote radio modules.

Find radio modules

To find local or remote radio modules, you must have already discovered the network they are on. You can then use the Find radio modules search box to find radio modules by MAC address, name, network address, and other search expressions.

1. On the Radio Modules toolbar, click the **Find radio modules** button.

   The **Find radio modules** search box appears.

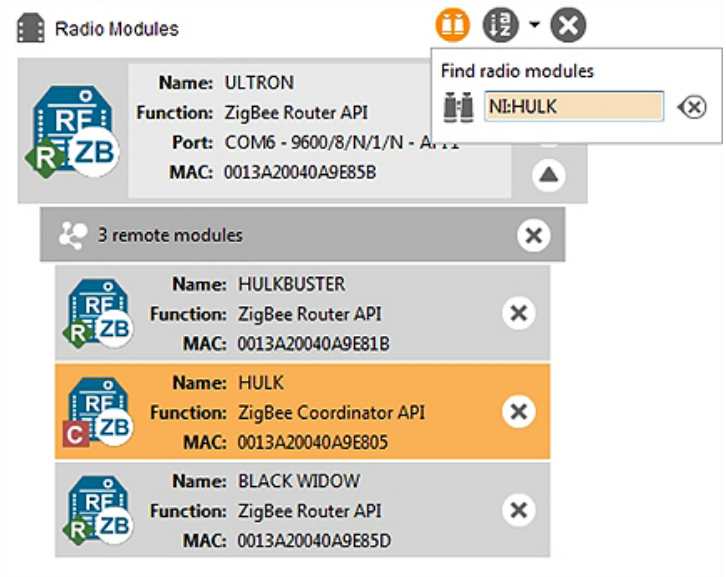


2. Enter your search expression to find one or more modules.

   For a list of search prefixes and wildcards, as well as sample searches, see Search expressions.

3. Press **Enter**.

   The background color of the search box and search icon indicates status. Yellow indicates matches found by XCTU, and red indicates no matches. Modules found along the list are also highlighted in yellow.



Search expressions

You can enter the following search prefixes in the Find radio modules dialog box.

Search prefix	Search by
MAC: (or no prefix)	MAC address

Search prefix	Search by
SH:	Serial Number High
SL:	Serial Number Low
NI:	Node Identifier (only available in 802.15.4 and DigiMesh)
MY:	16-bit Network Address (only available in 802.15.4 and ZigBee)

You can also use a wildcard if you do not want to specify the entire parameter or if you want to find more than one node.

Wildcard	Equals
*	any string
?	any character
\	escape for literals (i.e. *, ?, or \)

Sample searches:

- To search for a module with node identifier (NI) "NODE1" and network address (MY) 0831, enter

```
NI:NODE1, or MY:0831
```

- To find all nodes whose MAC starts with 00 and ends with B, enter

```
MAC:00*B
```

Configure your modules

This section describes how to use Configuration working mode to configure your modules and change application settings once you have added a radio module or modules to your list of devices.

Configuration working mode 44
Read radio module configuration 51
Write module settings 51
Load default firmware settings 51
Update firmware 52
Save a configuration profile 54
Load a configuration profile 55
Search for a firmware setting 57
Configure remote modules securely 57
Configure a Wi-Fi access point 58
Enable and configure Bluetooth 60
View firmware release notes 61

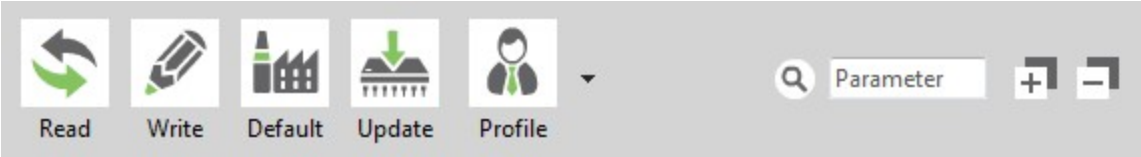
Configuration working mode

When you launch XCTU, Configuration working mode opens as the default operating mode.

The Configuration working mode allows you to configure any radio module that has been added to your device list. When you select a module from the list, XCTU loads the firmware information of the selected radio module and displays the firmware settings in the working area. It automatically reads the values and fills in the fields.

Configuration toolbar

The Configuration toolbar presents the configuration actions you can perform with the selected radio module and firmware settings.



Button	Name	Description
	Read module settings	Reads the firmware settings for the selected radio module.
	Write module settings	Writes new firmware values to the selected radio module.
	Load default firmware settings	Loads the default firmware values on to the selected radio module but does not write them.
	Update firmware	Opens the **Update the radio module firmware** dialog, displaying available compatible firmware for the selected radio module.
	Load/save configuration profile	Opens the **Load configuration profile** or **Save configuration profile** dialog.
	Search	Enables you to search firmware settings by AT parameter.

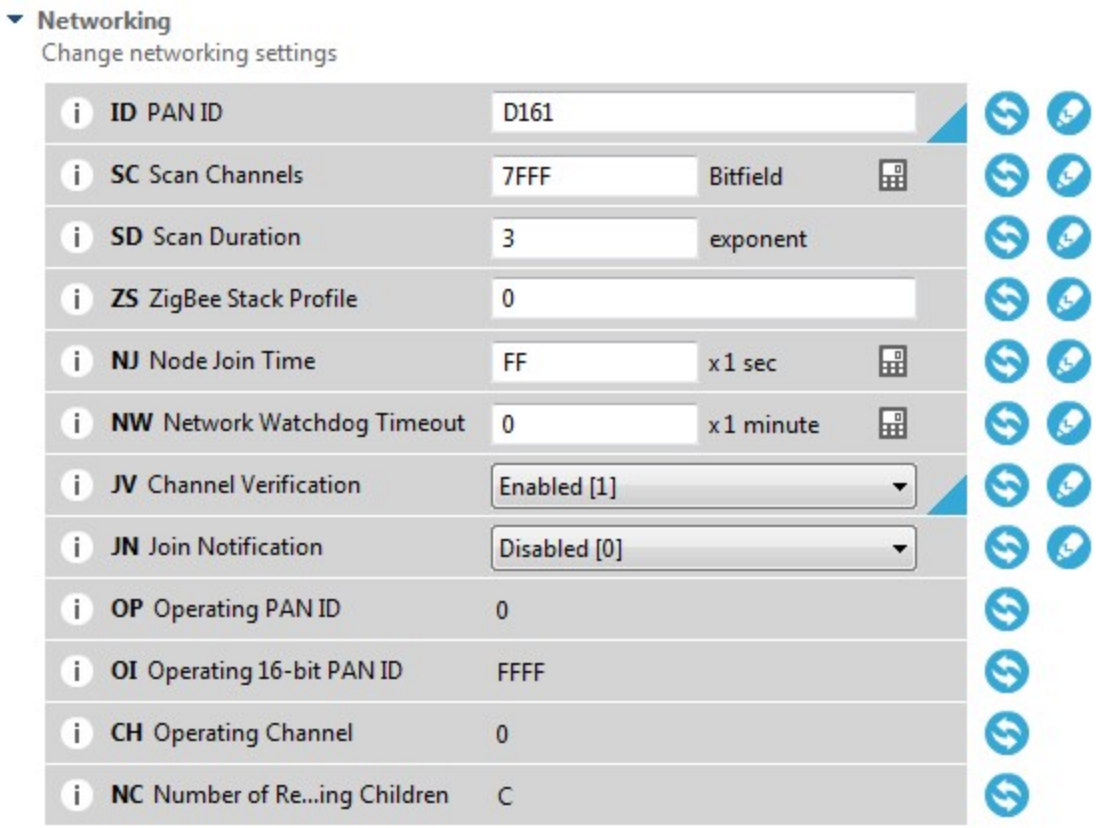
Button	Name	Description
	Expand/collapse settings	Expands or collapses all firmware settings sections.

Firmware information panel

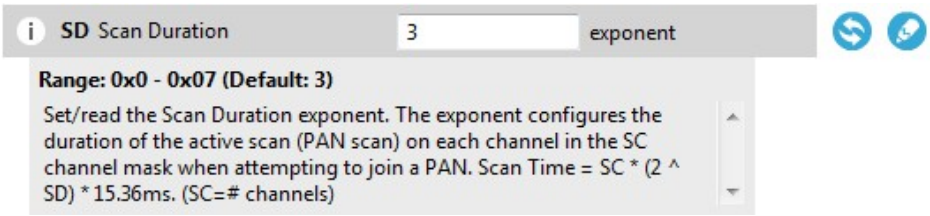
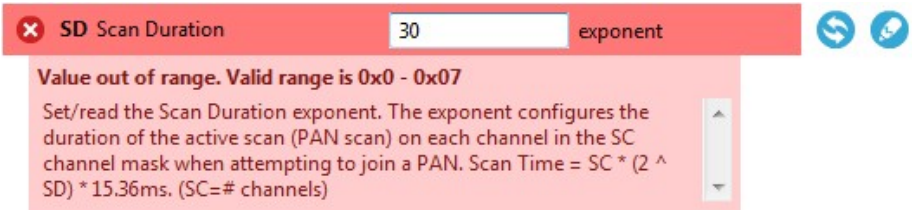
The firmware information panel is located below the Configuration toolbar and displays information about the firmware running in the selected radio module.

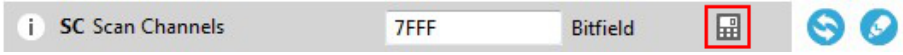
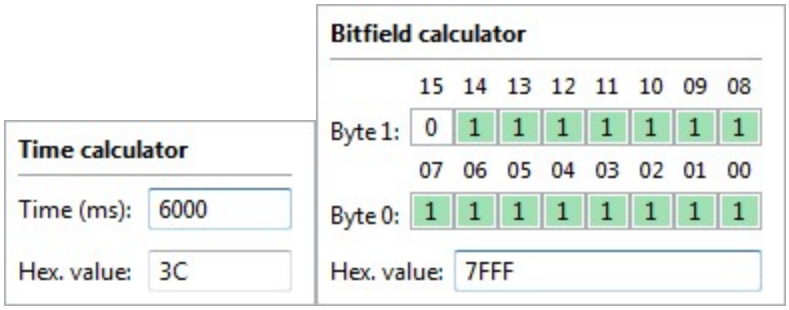
Firmware settings

XCTU displays firmware settings of the radio module below the firmware information panel. They are divided into sections or categories with a short description in each. Read-only settings are displayed with a gray label.



The following table provides descriptions for the setting controls.

Field	Description
Information button	 Clicking the information button displays a short description of the setting, including the default value and the valid range, if the setting is numeric. 
AT parameter	Displays the associated AT parameter of the setting. Some settings, such as actions, may not have an associated AT parameter. In the example above, the AT parameter is **SD**.
Setting name	Displays the name of the setting. In the example above, the setting name is **Scan Duration**.
Setting configuration control	Contains the text box or combo box where the setting value must be entered or configured. You can hover over the text box of a numeric setting to display the valid range for that setting. Always enter numeric values in hexadecimal format (without the '0x' prefix), unless the hover text indicates that an ASCII value is required. If the setting is configured with an invalid value, an explanation for the error appears. 
Units label	Displays the units of measure for that setting. Not all settings have a units label. In the example above, the unit is **exponent**.

Field	Description
Value calculator icon	 Clicking the value calculator icon launches a time or bitfield calculator for numeric settings that are difficult to compute. The content of the calculator panel depends on the setting. 
Refresh and write buttons	Clicking the refresh button or write button allows you to read or write the value of the setting. Some settings, such as the read-only settings, do not have a write button.

Setting status

XCTU delineates the status of each setting with background color and/or the color of a triangle located next to the setting value. These are the possible statuses of a setting:

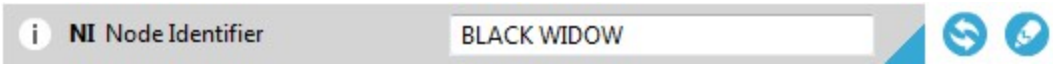
	Green triangle	The value of the setting has changed but it has not been written in the radio module yet.
	Blue triangle	The value of the setting is written in the radio module but is different from the default value.
	Gray background	The value of the setting is written in the radio module and matches the default value.
	Yellow background	Indicates that the setting is highlighted because it has been found using the **Search** parameter control.
	Red background	The value of the setting is not valid.

Setting types

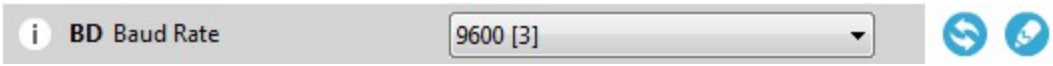
There are different kind of settings that you can configure in a radio firmware. Depending on the setting type they display different controls and options.

- **Numeric settings**: These settings must always be configured with a numeric value in hexadecimal format (without the '0x' prefix). Hovering over the text box of a numeric setting displays the valid range for the setting. There are several types of settings:

- **Text settings**: Text settings are very similar to the numeric settings, but they can be configured with hexadecimal or ASCII characters. If you hover over the text box of a text setting, a dialog displays the minimum and maximum characters and whether they must be an ASCII or hexadecimal value.



- **Combo settings**: A combo box displays all the possible values of the setting with symbolic text, to help you to choose the correct option.



- **Read-only settings**: These settings cannot be modified. They can only be read from the radio module and their values are displayed in a label.

- **Action settings**: These settings can be neither read nor written. The main purpose of the action settings is to execute a task or process in XCTU that implies some interaction with the radio module. To learn more about the Action settings see the Special functions topic.

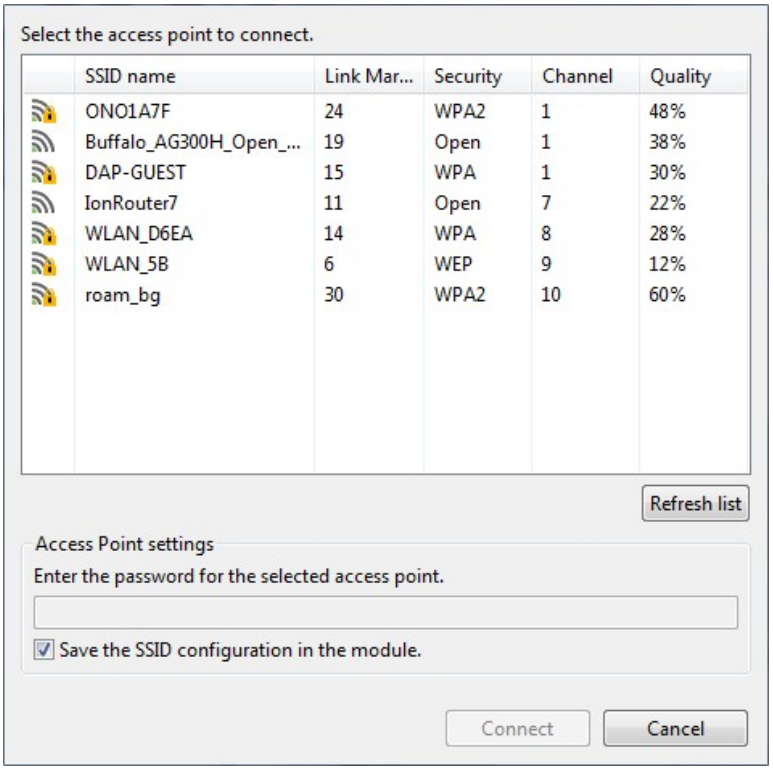
Special functions

Some settings within XCTU cannot be read or written. Instead, they execute tasks or processes in XCTU related to interaction with the radio module. The processes that these settings execute are called special functions. At this time, XCTU has two special functions: **Active scan** and **Bluetooth Authentication**.

Active Scan

The **Active Scan** function discovers and configures the access point for an XBee Wi-Fi module.

When you click the **Active Scan** button, XCTU reads the SSID configuration of the Wi-Fi module. If the module has an SSID already configured, you need to clear the configuration and perform a new SSID discovery. If the SSID configuration is empty, the nearby SSIDs are displayed in a new dialog.



The dialog displays all the nearby access points as well as their security protocols and signal quality. Select the Access Point you want the Wi-Fi module to connect to and, if necessary, configure the password of the Access Point. The Access Point settings also have a check box that allows you to permanently save the SSID configuration in the Wi-Fi module. If you uncheck this option, the next time you reset the module the SSID configuration is cleared.

Click **Connect** to connect the Wi-Fi module to that Access Point and refresh the settings of the radio module.

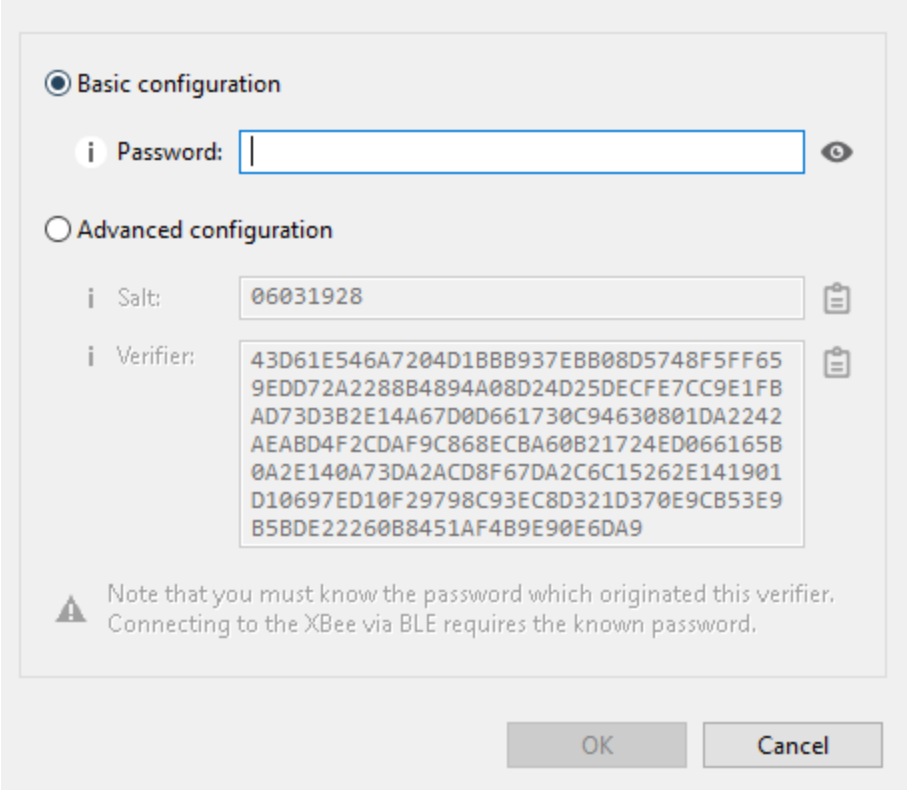
Enable BLE and configure the BLE password

The Bluetooth Authentication function allows you to configure the security parameters of your XBee device with Bluetooth Low Energy (BLE) support. This step is mandatory if you want to enable Bluetooth on the module.

XBee BLE security is based on the Secure Remote Password protocol. When you click the **Configure** button, XCTU displays a dialog asking you to either:

1. Type a password, which you are asked for when you connect to the XBee via Bluetooth Low Energy.
2. Enter a random salt and a password verifier generated from a password and that salt (as specified in the SRP protocol).

CAUTION! Only use the advanced configuration if you are familiar with the SRP protocol. You must know the password which originated the verifier since you will be asked for it when you connect to the XBee via BLE.



When you enter the password or the salt/verifier combination, click **OK** to save the settings to the module.

For more information about Bluetooth security, see the user guide for your XBee device.

Read radio module configuration

You can refresh a radio module's firmware settings once you have added the module to your device list. To read a module's configuration settings:

1. Switch to Configuration working mode .
2. Select a radio module from the device list. XCTU displays the current firmware settings for that module.

   Note If the selected module is remote and the Remote AT Command password (**KZ**) is set, you may be asked to enter that password in order to access the module configuration.

3. From the configuration toolbar, click the **Read module settings** button to refresh the selected radio module's firmware settings.

Write module settings

You can configure a radio module's firmware settings once you have the module to your device list. To configure a radio module:

1. Switch to Configuration working mode .
2. Select a radio module from the device list. XCTU displays the current firmware settings for that module.

   Tip To refresh the selected radio module's firmware settings, click the **Read module settings** button on the configuration toolbar.

   Note If the selected module is remote and the Remote AT Command password (**KZ**) is set, you may be asked to enter that password in order to access the module configuration.

3. Change the value of the setting or settings to be configured.
4. Click the **Write module settings** button to write any newly configured firmware values to the module.

Load default firmware settings

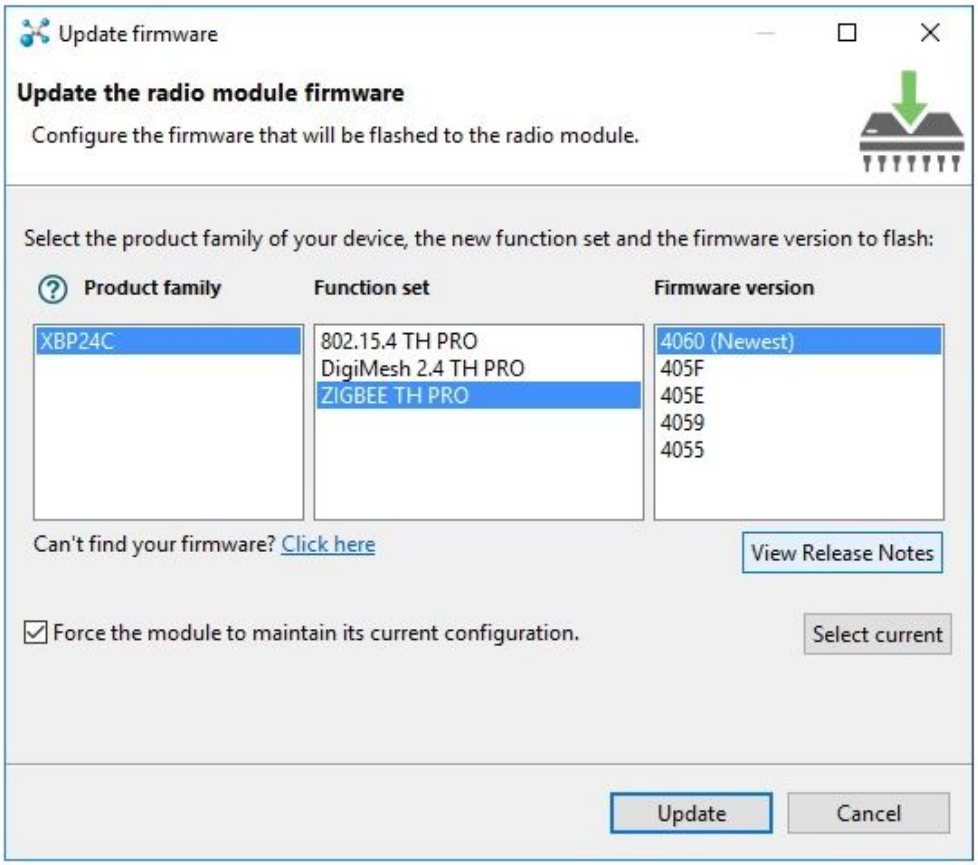
You can load default radio firmware settings in a module in your device list.

1. Switch to Configuration working mode .
2. Select a radio module from the device list. XCTU displays the current firmware settings for that module.
3. On the Configuration toolbar, click the **Load default firmware settings** button to load the default values established by the firmware.
4. Firmware settings are loaded but not written to the radio module. In order to write them in the module, click the **Write module settings** button on the toolbar.

Update firmware

You can use XCTU to update a module's radio firmware.

1. Switch to Configuration working mode .
2. Select a radio module from the device list.
3. Click the **Update firmware** button . A dialog box appears displaying the available and compatible firmware for the selected module.



4. Choose the firmware family, function, and version.

   Note If you do not remember the firmware version that is currently installed in your radio module, click **Select current** to automatically select it.

5. Click **Update**. A dialog box displays update progress. You can click the **Show details** button to view a detailed progress log, and **Hide details** to hide it.

   Note During the firmware update process, XCTU attempts to obtain the module information again, as some critical settings such as the operating mode could have changed. If the **Maintain current module configuration** setting is checked, XCTU writes the old configuration to the module and then reads the setting's values.

Cellular modem firmware updates

When you update the firmware of an XBee Cellular module, XCTU may need to update the modem firmware. This process is completely transparent, but note that XCTU requires an Internet connection to download the modem firmware.

Note The system prompts you for confirmation when the module requires a modem firmware update, as this process may take up to 30 minutes.

Remote firmware updates

You can use XCTU to perform firmware updates on remote modules because once you add a remote module to XCTU's device list, the update process is exactly the same whether you are updating a local module or a remote module. To perform a remote firmware update, the local module must be working in API or API escaped operating mode.

Remote firmware updates can be performed on the following radio modules:

- XBee/XBee PRO SX
- XLR Module
- XBee/XBee PRO 802.15.4 (S2C module versions only)
- XBee/XBee-PRO DigiMesh 2.4 (S2C module versions only)
- XTend RF Module Family (SX module versions only)
- XLR PRO Radio Solution
- XBee/XBee-PRO ZB and Programmable XBee-PRO ZB
- XBee/XBee-PRO ZB SMT and Programmable XBee-PRO ZB SMT
- XBee-PRO 900HP and Programmable XBee-PRO 900HP
- XBee 865LP and Programmable XBee 865LP
- XBee 868LP SX
- XBee3 (Zigbee, DigiMesh 2.4, and 802.15.4)

Note If something goes wrong during an over-the-air firmware update on a remote module—for example, communication is lost because the remote device is disconnected—you must perform a manual recovery. See Recover a radio module.

Bootloader updates

Some firmware versions require a specific bootloader version in order to work properly. The bootloader is the software running in the module that, among other things, launches the firmware as soon as the module boots.

The bootloader update takes place during the firmware update process. If the firmware to be flashed requires a bootloader update, XCTU updates the bootloader first and then the module's firmware.

Note The system prompts you for confirmation when the firmware requires a bootloader update, as this process erases the configuration of the module. You must accept it in order to continue with the firmware update process. If you decline the bootloader update, the overall firmware update process is canceled.

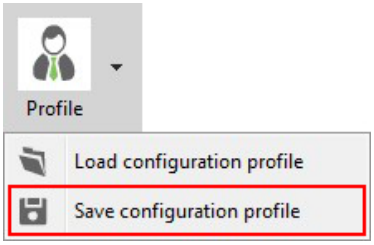
Save a configuration profile

A configuration profile is a snapshot of a specific radio firmware configuration, including settings values and other configuration information. XCTU allows you to save and write configuration profiles to the radio module. This feature is useful in a production environment when you need to set the same parameters on multiple radios.

You must first create a representative model upon which to base the configuration profile and then save the profile. Note that you only need to configure the values; it is not necessary to write the settings to the module.

To save a configuration profile:

1. Switch to Configuration working mode .
2. Select a radio module from the device list.
3. Configure the radio module with your desired values.
4. Click the **Configuration profiles** drop-down menu on the Configuration toolbar and select **Save configuration profile**.



5. The **Profile configuration** dialog displays asking you to configure other profile settings:
   - The **Description** field is optional and you can use it to enter any information that helps to identify the profile and its purpose.
   - In the **Radio firmware** group you can set the action to perform with the radio firmware of the profile. This action is used later by XCTU and other applications when loading the profile.
     - **Flash always**. Radio firmware configured in the profile is always flashed in the radio module, it does not matter if the module already has the same radio firmware version flashed.
     - **Flash if firmware is different**. Radio firmware configured in the profile is flashed in the radio module only if the radio firmware version of the module is different than the one configured in the profile.
     - **Do not flash firmware**. Only settings configured in the profile are written in the radio module.
   - Whether you want to reset all XBee device settings to defaults before applying those specified in the profile you are saving. Select this option if you want to ensure that the XBee device where you apply this profile will only have the settings you have specified; all other devices will have the default values. If you want to keep the state of the device and only change some settings, clear this option.

- If the selected firmware version corresponds to the Cellular protocol and it has a specific modem firmware version associated, the profile configuration dialog displays a new option. Check the **Attach Cellular modem firmware** option if you want to include the modem firmware in the profile.

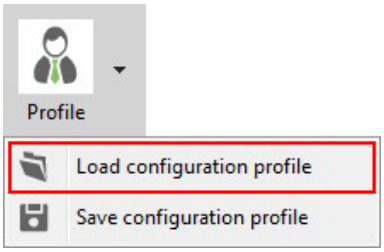
6. Enter your configuration preferences and click OK.
7. A **Save file** dialog box appears. Choose a name and path and click **Save**.

Note You can also use the Firmware explorer tool to save a configuration profile. See Firmware explorer tool.

Load a configuration profile

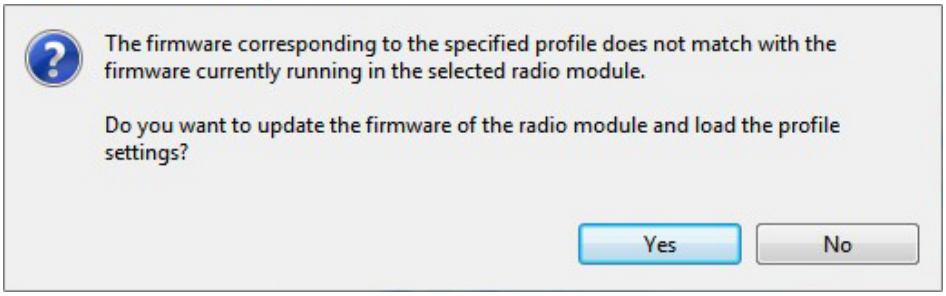
A configuration profile is a snapshot of a specific radio firmware configuration, including settings values and other configuration information. XCTU allows you to save and write configuration profiles to the radio module. This feature is useful in a production environment when you need to set the same parameters on multiple radios. To load a configuration profile:

1. Switch to the Configuration working mode .
2. Select a radio module.
3. Click the **Configuration profiles** drop-down menu on the Configuration toolbar and select **Load configuration profile**.

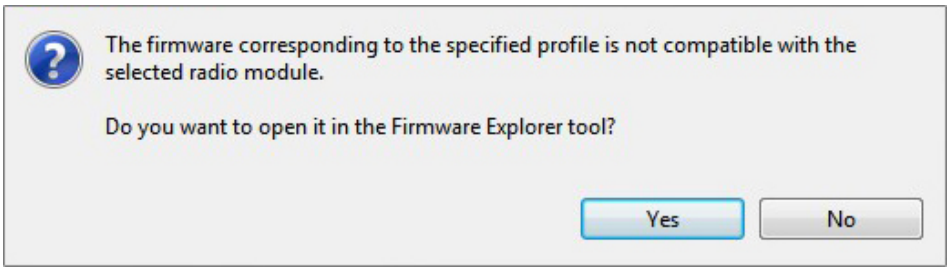


An **Open file** dialog appears, asking for the configuration profile file to load.

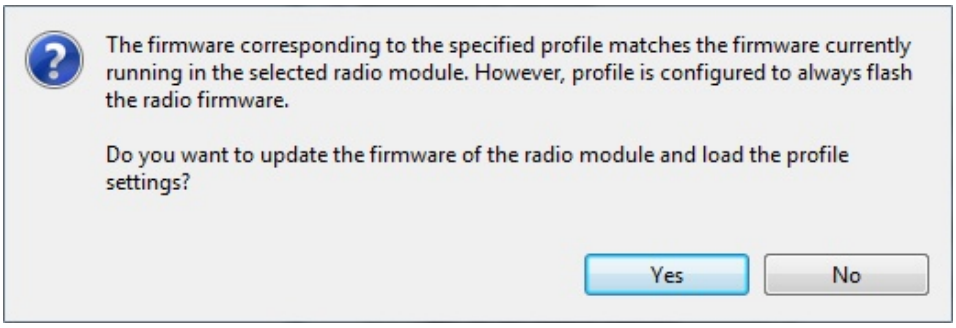
4. Locate the configuration profile (a ZIP file) and click **Open**. Depending on the firmware compatibility with your radio module and the firmware flash action configured in the profile, a dialog box may appear:
   - If the firmware of the configuration profile does not match the firmware running in the radio module but is compatible with the module and the profile is configured to always flash the firmware or flash when it is different, click **Yes** to update the module's firmware so the profile will load correctly.



   - If the firmware of the configuration profile is not compatible with the radio module, click **Yes** to open the firmware file in the **Firmware explorer** tool.



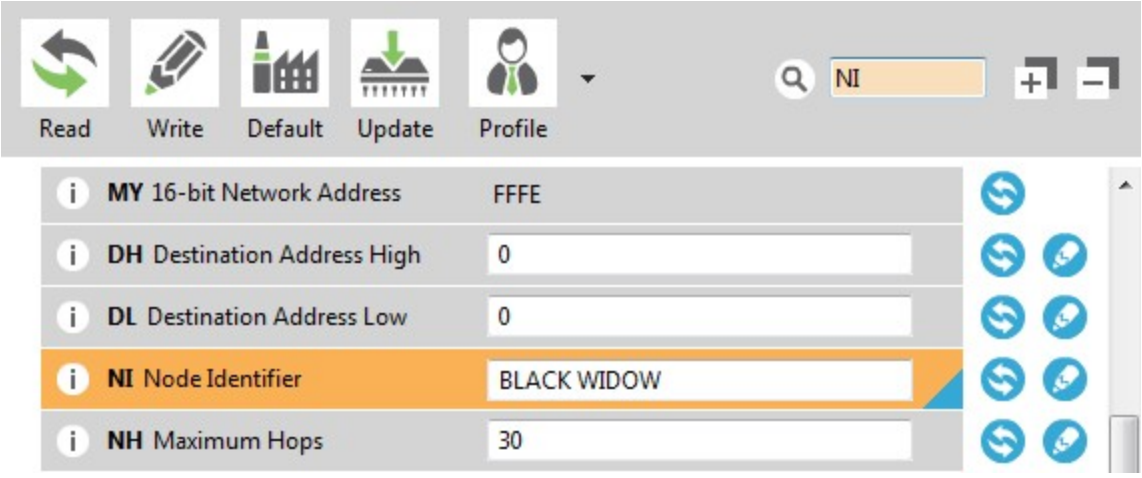
   - If the firmware of the configuration profile matches the firmware running in the radio module but the profile is configured to always flash the firmware, click **Yes** to update the module's firmware so the profile will load correctly.



   - If the firmware of the profile you are loading and the firmware running in the radio module match or the profile is configured to don't flash the radio firmware, XCTU loads the settings saved in the profile but does not write them to the radio module.
5. Locate the configuration profile (an XPRO document) and click **Open**. A dialog box may appear based on firmware compatibility with the module.

Search for a firmware setting

The configuration toolbar includes a search box. To search for a firmware setting in the list of settings, search for the AT parameter associated with the setting. If the setting is found, it is highlighted in yellow.



Configure remote modules securely

Some new firmware versions allow you to add an extra protection layer to encrypted networks in order to prevent an intruder from hijacking a module and making changes in the network. This feature requires you to enter a pre-configured password every time you want to configure a remote module.

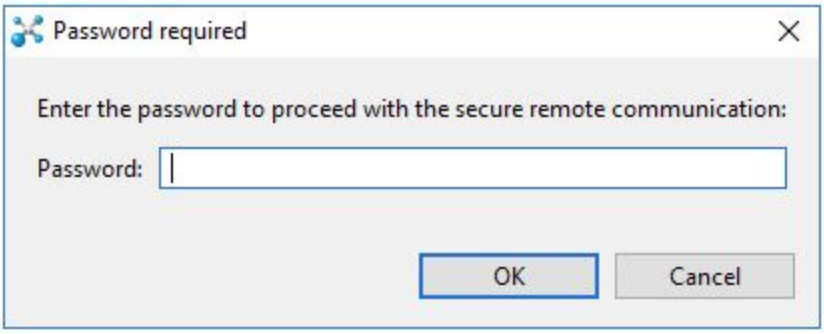
Note To learn more about this feature and how it works, refer to the user guide for your XBee module.

To enable the secured remote configuration, set a password with the **KZ** parameter. To do so, enter the old password ('0' by default), followed by a blank space and the new password. For example, if your password is "1234" and you want to change it to "7a$b3l1", you should enter:

```
1234 7a$b3l1
```

After the password has been set, **Password required** dialog appears when you try to configure a remote module and the password is set on your local one (**KZ** is not set to '0'). The same dialog appears if you perform a range or throughput test with a remote module.

You must enter the password and click **OK** before you can configure the module.



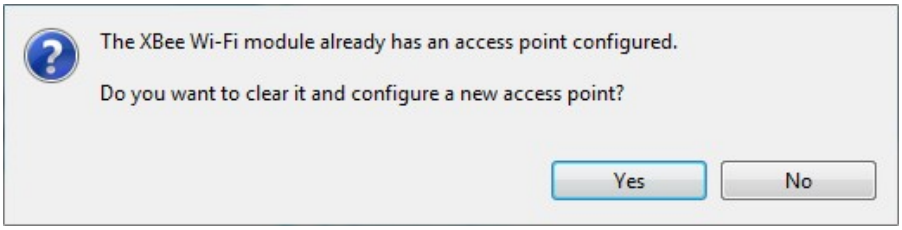
Configure a Wi-Fi access point

The Active scan special function discovers and configures the access point for the XBee Wi-Fi module. The feature is only enabled for Wi-Fi modules.

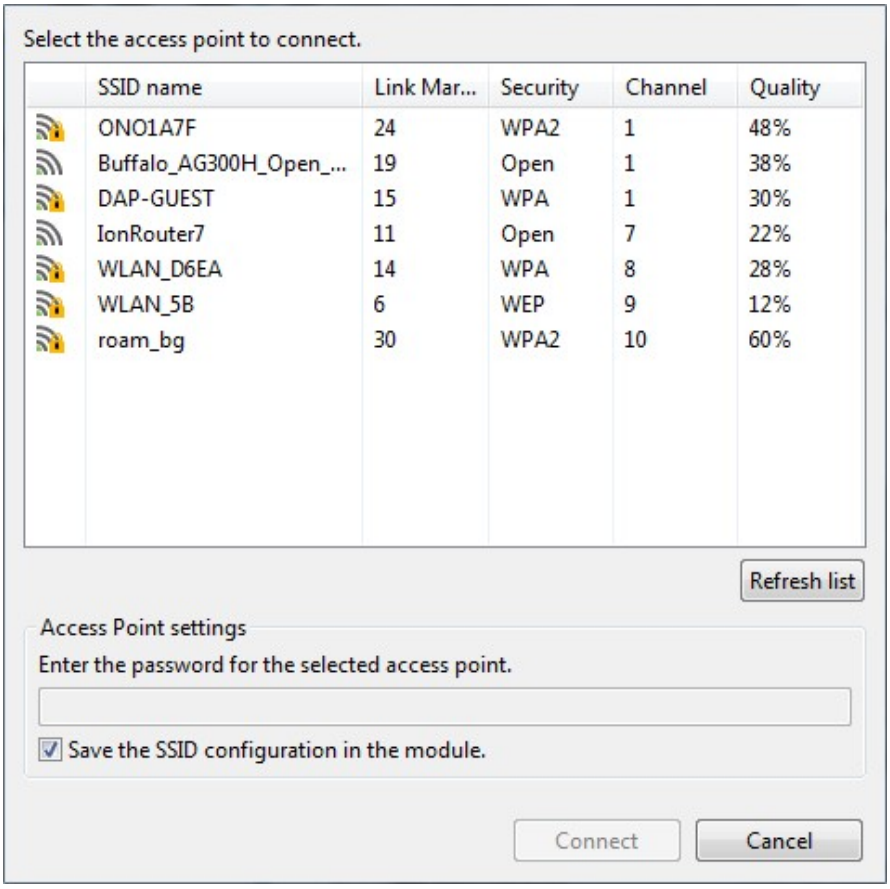
1. Switch to Configuration working mode .
2. Select a Wi-Fi-enabled radio module from the device list.

3. Click the **Active scan** button. XCTU reads the SSID configuration of the Wi-Fi module.

- If the module already has an SSID configured, click **Yes** to clear the configuration and perform a new SSID discovery.



- If the SSID configuration is empty, XCTU displays all nearby access points as well as their security protocols and signal quality.



4. Select the SSID you want the Wi-Fi module to connect to.

   For S6 Wi-Fi modules, the table displays the following fields:

Field	Description
SSID name	Name of the access point
RSSI (dBm)	RSSI of the access point (negated hex value)
Security	Security type of the access point
Quality	Link quality (based on the RSSI) with the access point

   For S6B Wi-Fi modules, the table displays the following fields

Field	Description
SSID name	Name of the access point
Link margin (dBm)	Signal strength in dBm above sensitivity
Security	Security type of the access point
Channel	Channel number in use by the access point
Quality	Link quality (based on the link margin) of the access point

5. If necessary, enter the password of the access point.
6. If you would like to retain the SSID configuration for future use, check **Save the SSID configuration in the module**.
7. Click **Connect** to connect the Wi-Fi module to that access point and refresh the settings of the radio module.

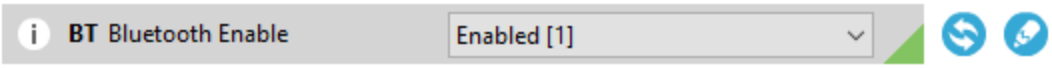
Enable and configure Bluetooth

Some of the latest XBee3 modules support Bluetooth Low Energy (BLE) as an extra interface for configuration. If you want to use this feature, you have to enable BLE. You must also enable security by setting a password on the XBee device in order to connect, configure, or send data over BLE.

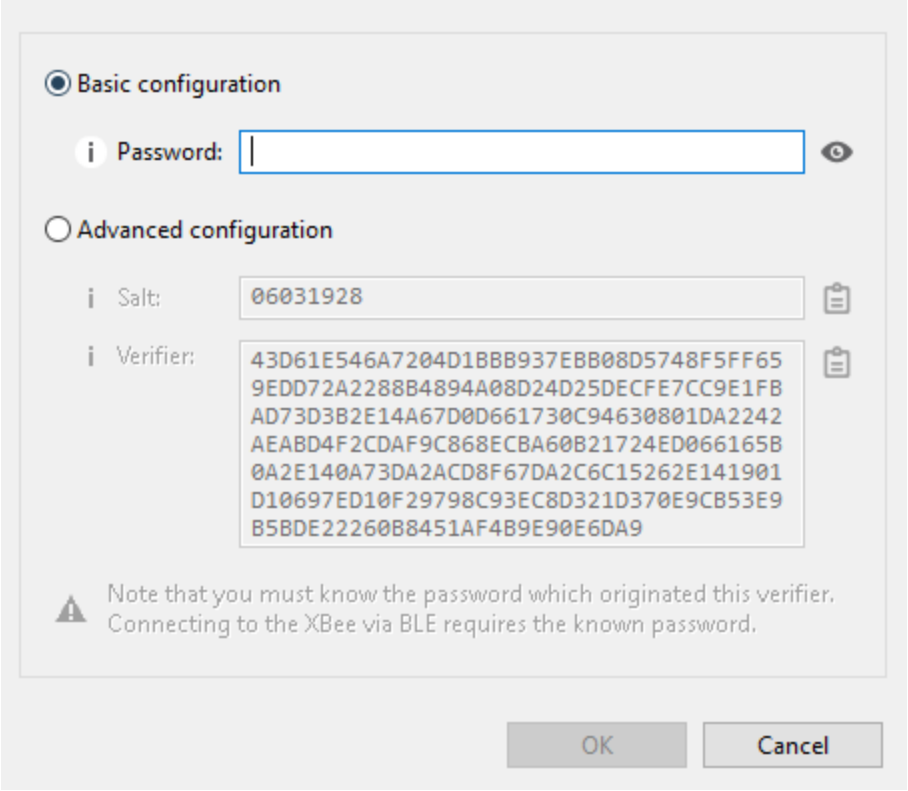
Before you begin, you should determine the password you want to use for BLE on the XBee device and store it in a secure place. Digi recommends a secure password of at least 8 characters and a random combination of letters, numbers, and special characters. Digi recommends using a security management tool such as LastPass or Keepass for generating and storing passwords for many devices.

The salt and verifier values are calculated when you set your password.

1. Switch to Configuration working mode .
2. Select a BLE compatible radio module from the device list.
3. Select **Enabled[1]** from the **BT Bluetooth Enable** command drop-down.



4. Click the **Write setting** button . The **Bluetooth authentication not set** dialog appears.
5. Click **Configure** in the dialog. The **Configure Bluetooth Authentication** dialog appears.
6. Type a password or a salt/verifier combination (as specified by the Secure Remote Password protocol—only for advanced users). When you connect the XBee device via BLE, it asks for this password (or the one that generated the verifier).



7. In the **Password** field, type the password for the device. As you type, the **Salt** and **Verifier** fields are automatically calculated and populated in the dialog as shown above. This password is used when you connect to this XBee device via BLE using the XBee Configurator app.

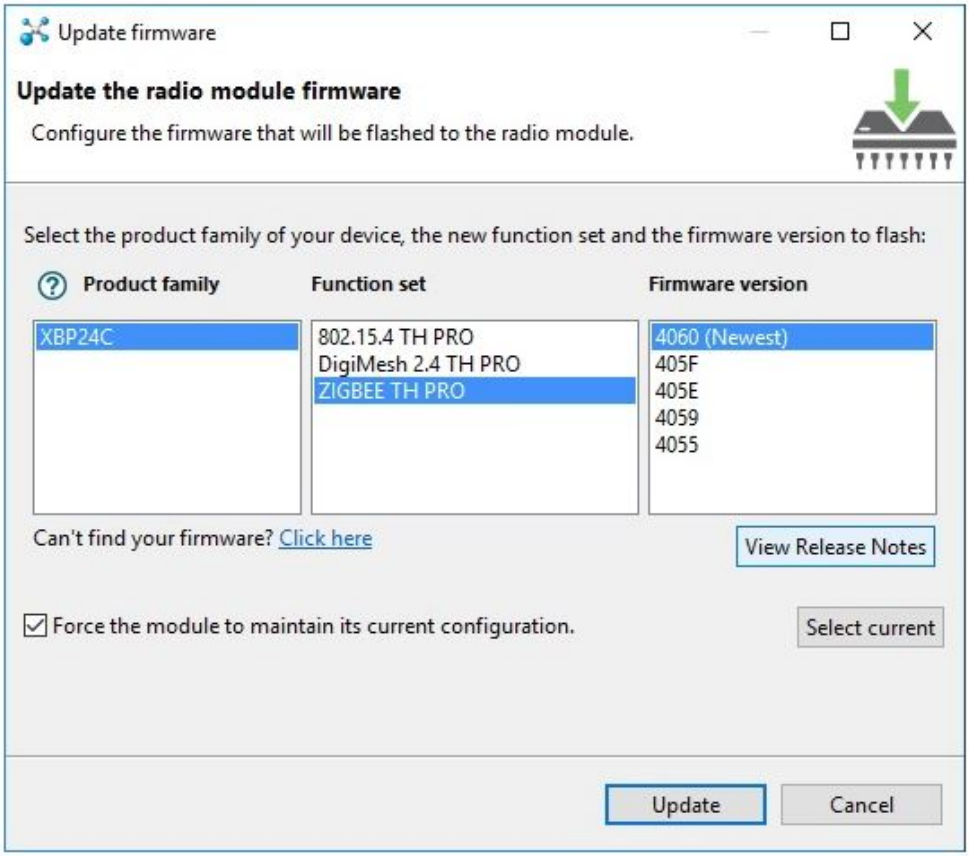
For more information about Bluetooth, see the user guide for your XBee device.

View firmware release notes

XCTU allows you to review the release notes of some of the firmware it hosts.

1. Switch to Configuration working mode .
2. Select a radio module from the device list.

3. Click the **Update firmware** button . The **Update firmware** dialog appears, displaying the available compatible firmware for that module.



4. Select the firmware family, the firmware function, and the firmware version. If the selected firmware has release notes, the **View Release Notes** button View Release Notes below the firmware list is enabled.
5. Click **View Release Notes**. A new window displays the release notes for the selected firmware.

Note You can also access the release notes of firmware via the XBee recovery tool and the Firmware explorer tool.

Communicate with your modules

This section describes how to use Consoles working mode to communicate with your modules once you have added a radio module or modules to your list of devices.

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Record a console session 66
Attach and detach the console 67
Communicate with modules running in API or API escaped mode 68
Communicate with modules running in AT mode 83
Console log files 91

Consoles working mode

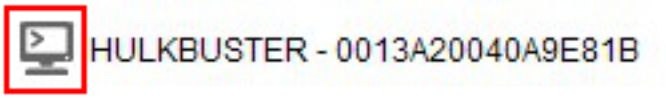
The Consoles working mode allows you to communicate with radio modules in the device list. When you click the **Consoles working mode** button on the toolbar, XCTU displays a tabbed list of consoles with one entry for each module of the devices list. Each tab is labeled with the name of the radio module and its physical address (MAC).

If you select a module from the device list, the associated console activates and moves to the front of the display. Conversely, selecting a console from the working area highlights the associated module in the device list.

The console type depends on the operating mode of the selected radio module.

- The API Console is used for radio modules working in API or API escaped operating mode. See API console.
- The AT Console is used for radio modules working in AT (transparent) operating mode. See AT console.

Console status



The icon in the left corner of the console tab displays the following states:

Icon	Status
	The console is disconnected.
	The console is connected.
	The console is receiving data.
	The console is sending data.

The text of each tab contains the name of the radio module and its physical address (MAC). This makes it easy to identify the console corresponding to each radio module.

Consoles toolbar

All consoles have a common toolbar that allows you to connect or disconnect the console and to attach or detach it from the working area.

Button	Name	Description
	Open	Establishes communication with the radio module corresponding to the console. When the console is connected, the background color of the button changes to green and the text changes to "Close" See Connect and disconnect the console.
	Close	The console is connected. Clicking this button disconnects the module from the console. See Connect and disconnect the console.
	Start recording	Records all incoming and outgoing console data as it is sent or received and saves to a console log file. The console must be connected to start or stop recording. See Record a console session.
	Stop recording	Stops the process of saving any sent or received data. The console must be connected to start or stop recording. See Record a console session.
	Detach	Detaches the console from the tabbed working area and displays it in a new floating dialog.
	Attach	Reattaches the console to the tabbed working area.

Line status indicator

The line status indicator displays the status of the RS-232 hardware flow control lines. Dark gray indicates that the line is asserted, while white indicates that it is de-asserted. You must open the console connection to display line status and enable line status control.

CTS CD DSR DTR RTS BRK	Connection open
CTS CD DSR DTR RTS BRK	Connection closed

You can view and manage the following lines from the line status indicator:

CTS	Clear to send	Indicates that the connected device is ready to accept data.
CD	Carrier Detect	Detects the presence of connection.
DSR	Data Set Ready	Indicates that the connected device is ready for communication.
DTR	Data Terminal Ready	Indicates that the terminal is ready for communication.
RTS	Ready to send	Requests that the connected device prepare to receive data.
BRK	Break	Engages the serial line break. Asserting this line places the DI line high, preventing data from being sent to the radio.

Console overview

The console overview panel, located on the right side of the toolbar, displays the number of sent and received frames or bytes.

Tx Frames: 0
Rx Frames: 0

Connect and disconnect the console

The first time you open a console, it is disconnected by default.

1. Switch to Consoles working mode.

2. Select a radio module from the list.
3. Click the **Open** button to establish communication with the radio module corresponding to the console. The background color of the **Open** button changes to green and its text changes to **Close**.

   When the console is connected, all the data traffic of the radio module is captured by the console and displayed in the corresponding controls.
4. To disconnect the console from the module, click the **Close** button. The background color of the button changes to white and its text changes to **Open**.

Record a console session

In the Consoles working mode, you can record all incoming and outgoing console data as it is sent or received. XCTU saves this data in a Console log file. The console must be connected to start or stop recording.

Note You can also use the Serial console tool to record console sessions. See Serial console tool.

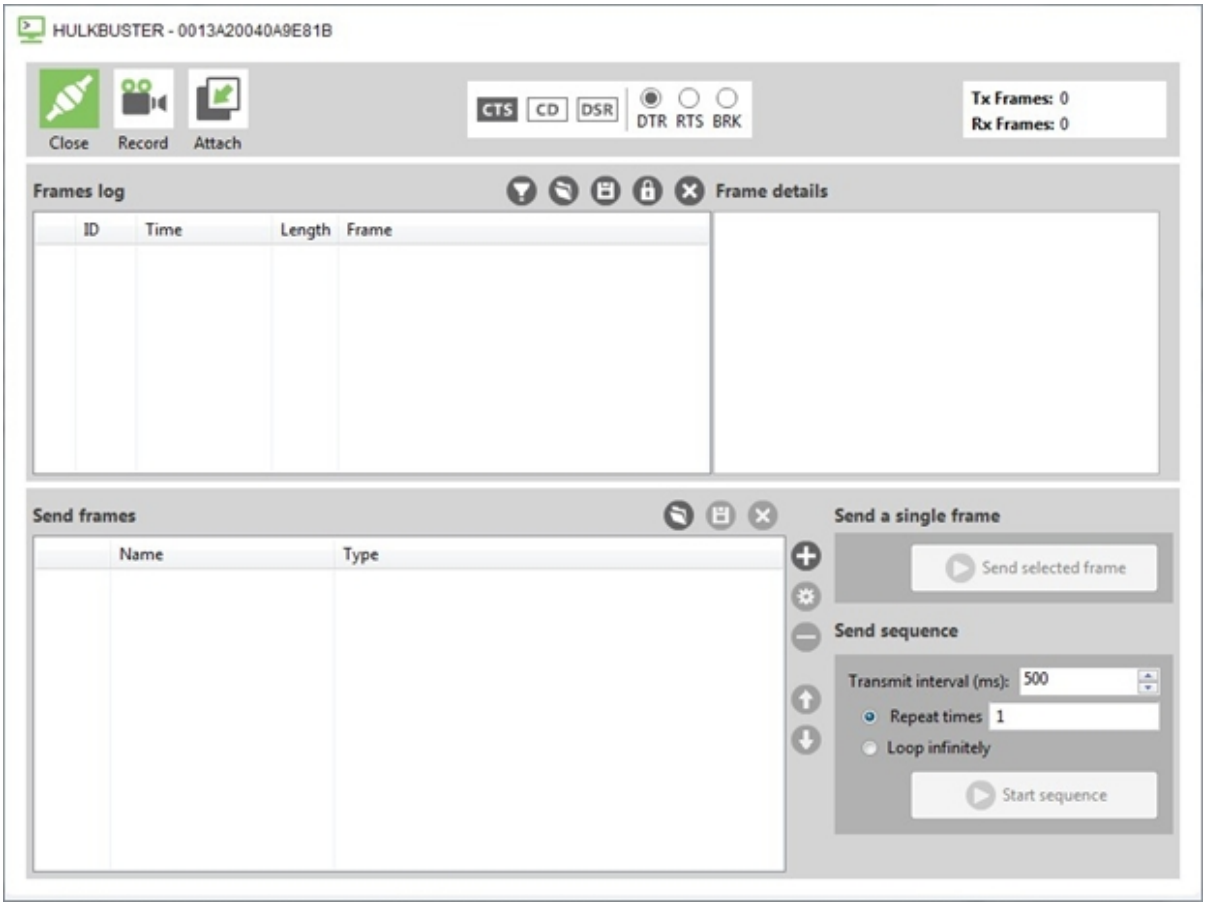
1. Switch to Consoles working mode .
2. Select a radio module from the list.
3. Click the **Open** button to establish communication. The background color of the button changes to green.
4. Click the **Start Recording** button . A **Save file** dialog appears.
5. Specify a destination for the console log file. Data is periodically written to this log file in comma separated values (CSV) format. See Console log files.
6. Click the **Stop Recording** button to stop the process of saving sent or received data.

Note You can use the Load console session tool to load a saved console session at a later time. For details, see Load console session tool.

Attach and detach the console

You can attach or detach the console from the working area by clicking the Attach and Detach buttons on the Console toolbar. By default, all the consoles are attached and sorted in tabs.

1. To detach a console from the working area, click the **Detach** button . The console is displayed in a floating dialog.



You can detach all the consoles to display them in multiple dialogs. This is useful if you need to see the traffic for different radio modules simultaneously.

2. To reattach the console view, click the **Attach** button or close the floating dialog containing that console.

Communicate with modules running in API or API escaped mode

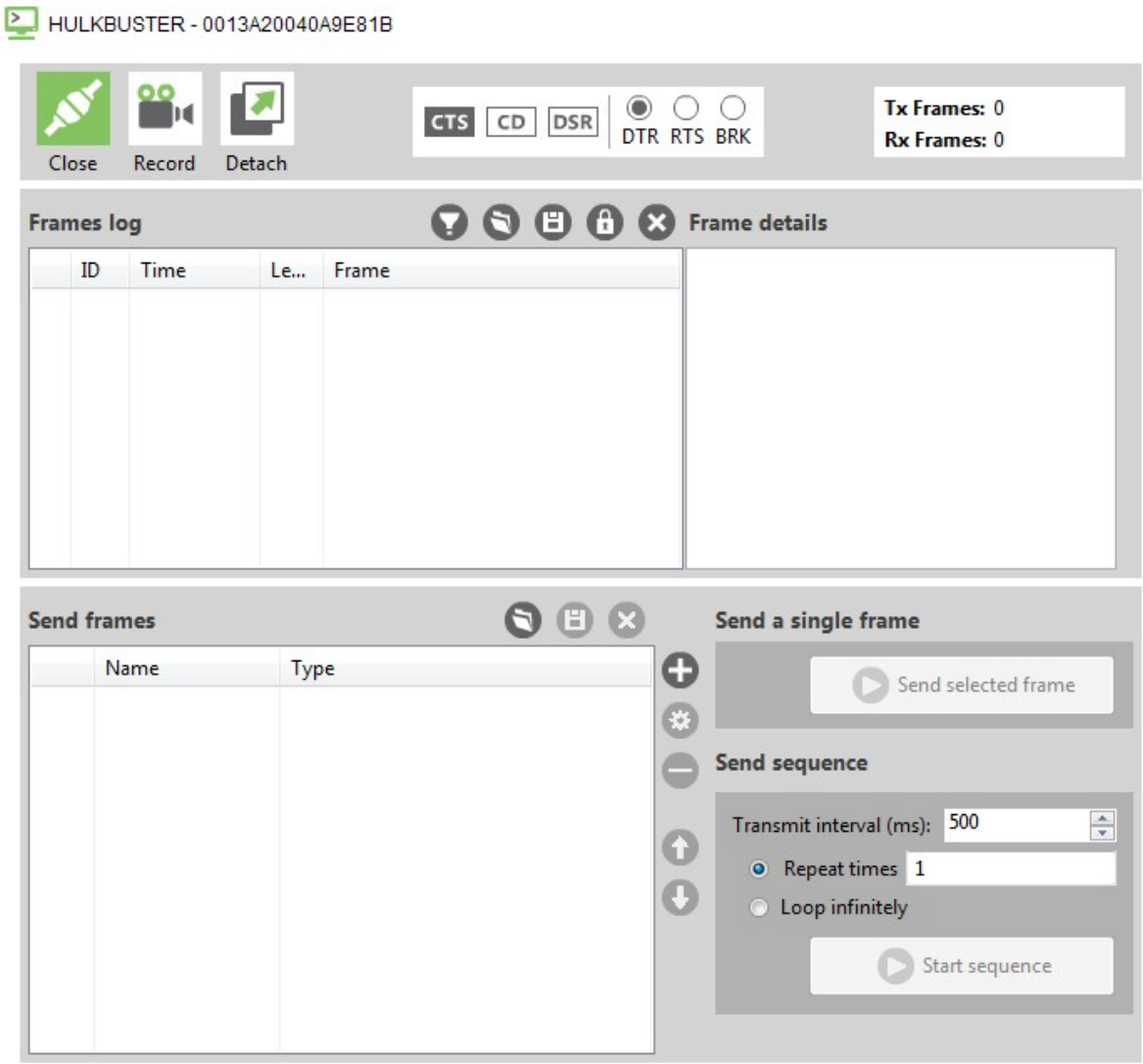
XCTU uses API frames to communicate with radio modules running in API or API escaped mode. You can use XCTU's API console to communicate with radio modules running in API or API escaped operating mode. XCTU automatically creates an API console for these modules when you switch to Consoles working mode.

API console

The API console allows you to communicate with radio modules running in API or API escaped operating mode. To display the API console, switch to Consoles working mode and select a radio module configured with either API or API escaped operating mode. For more information, see API operating mode and API escaped operating mode.

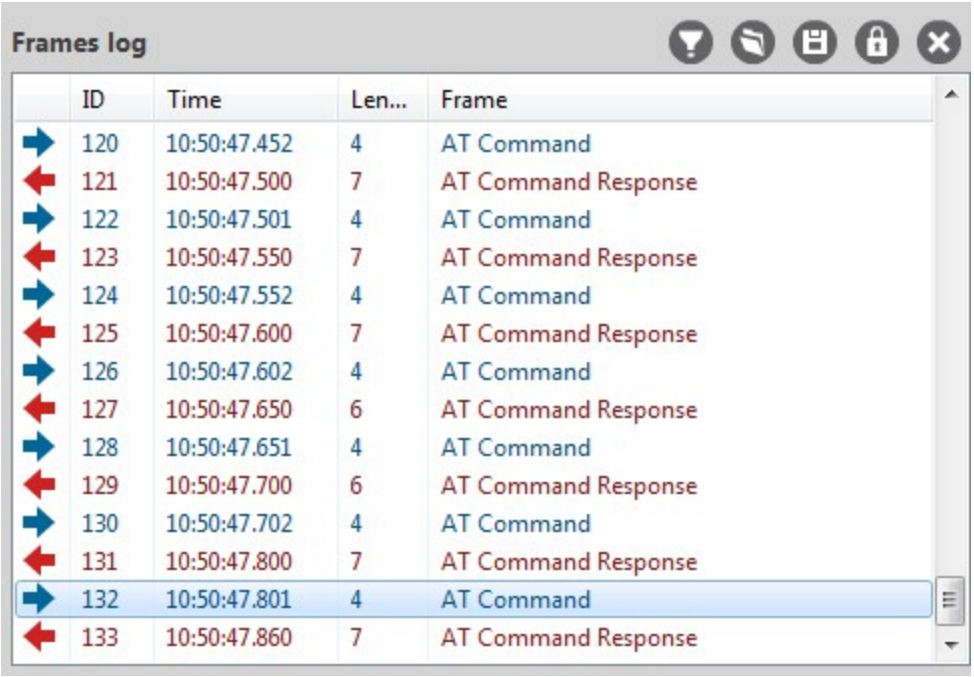
XCTU uses API frames to communicate with radio modules running in API mode. An API frame is an array of bytes with a specific structure defined by the API Frame Specifications. For more information, see API frames.

API console view



Frames log

The **Frames log** is XCTU's API frames traffic monitor. When API frames are sent or received by the module, they are added to the **Frames log**. Depending on whether the frame is sent or received, the color of the frame fields is blue or red, respectively.



Button	Name	Description
	Configure filters	Opens the **Frames filtering configuration** dialog.
	Load console session	Opens the embedded **Load console session** tool. For details, see Load console session tool.
	Save console session	Saves the active console session in a Console log files.
	Lock scroll	Toggles the scroll behavior of the data box. If **Lock scroll** is enabled, the Frames log will not automatically scroll when a new frame is sent or received.
	Clear data	Clears the list of sent and received API frames.

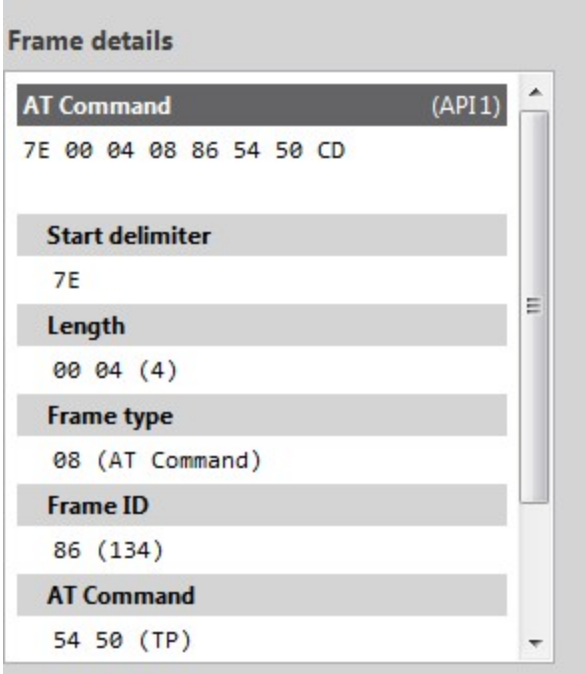
The **Frames log** displays the following properties of the transmitted and received API frames:

Field	Description
Icon	Displays as a right blue arrow if the API frame is sent, and as a left red arrow if it is received.
ID	Lists a numeric value given by XCTU to identify the API frame. When the list of frames is cleared, this value is reset to 0.

Field	Description
Time	Displays the time at which the API frame was sent or received.
Length	Contains the number of bytes of the API frame.
Frame	Displays the API frame type.

Frame details

Frame details appear next to the API frames table and display the decoded contents of the selected API frame.



Send frames

The **Send frames** section of the **API Console** allows you to add, manage, and send an API frame or sequence of frames.

Button	Name	Description
	Add new frame	Adds a new API frame to the list of frames to send
	Edit selected frame	Changes the name or contents of a frame
	Remove selected frame	Removes a frame from the list

Button	Name	Description
	Move up / move down	Changes the order of frames in the list
	Save frames list	Saves the list of frames to be used in future sessions or on another computer
	Load frames list	Loads a saved list of frames
	Clear the list of frames	Clears the entire frames list

The **Send sequence** dialog contains the following fields:

Field	Description
Transmit interval	Amount of time, in milliseconds, to pause between frames. The minimum value is 0 ms and the maximum value is 60000 ms (1 minute).
Repeat times	Number of times the sequence should be repeated or sent. By default, this value is 1.
Loop infinitely	Sends the sequence of frames in an infinite loop.

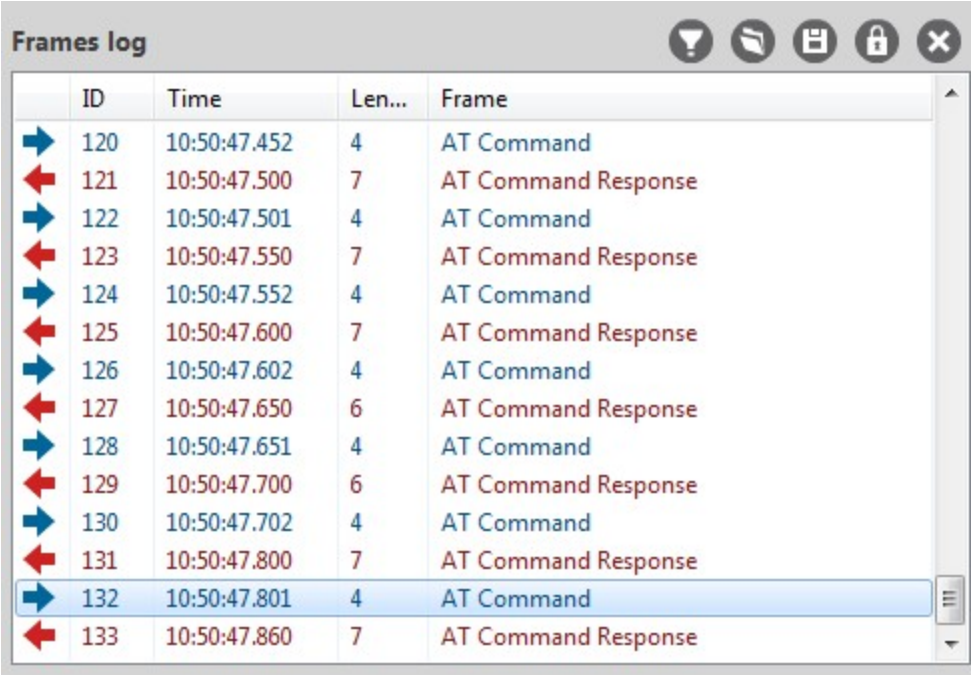
Note You can send a single frame (**Send selected frame**) or the configured sequence of frames (**Start sequence**).

Filter sent and received frames

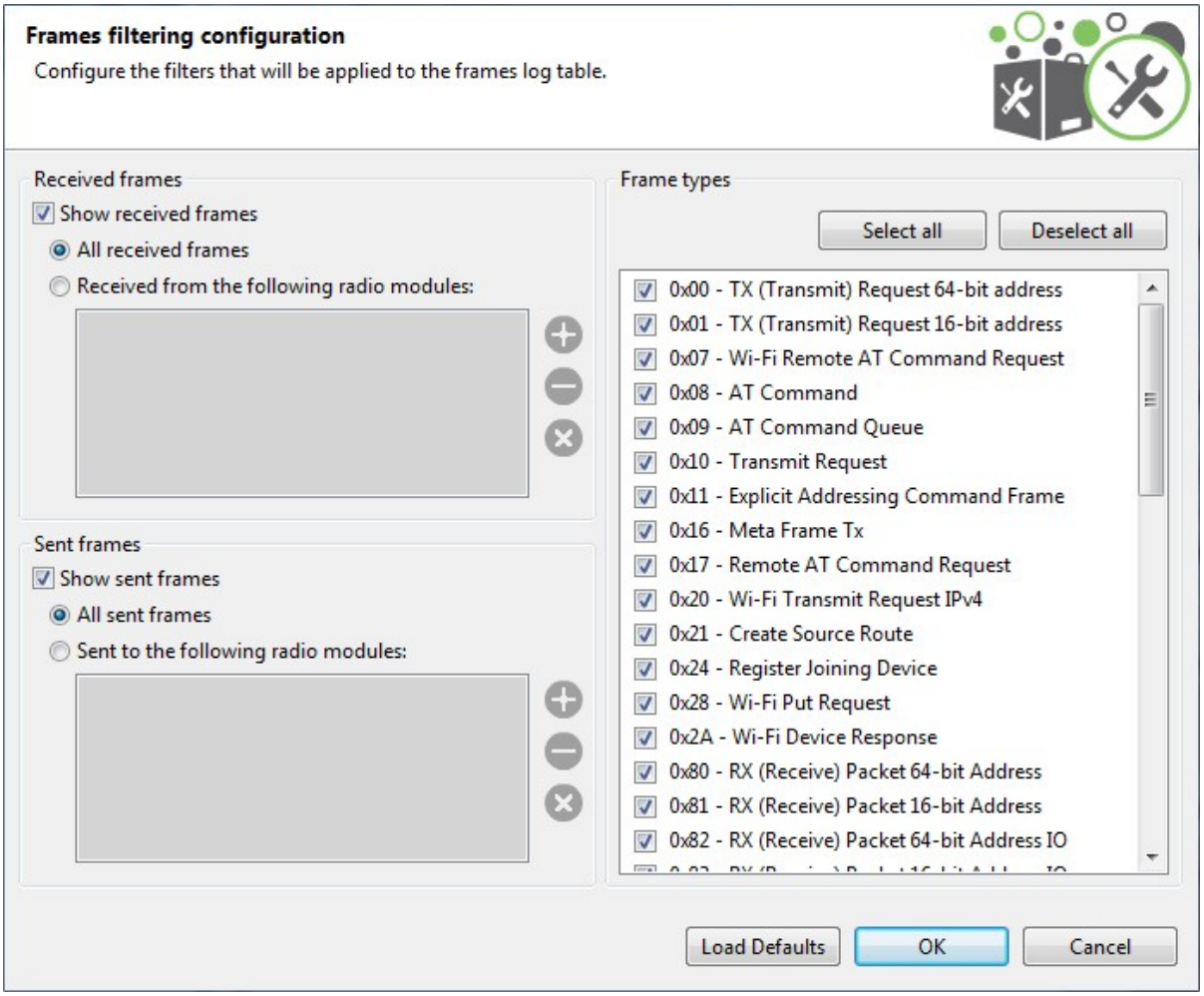
You can filter by sent and received frames in the API console to focus only on specific frames. For both sent and received frames, you can show any, show all, filter by sender MAC, and filter by frame type.

1. Switch to Consoles working mode .
2. Select a radio module configured in API or API escaped operating mode.

3. Click the **Configure filters** button in the **Frames log** area.



The **Frames filtering configuration** dialog appears.



4. Configure the filtering options for one or more of the following: received frames, sent frames, and frame types.

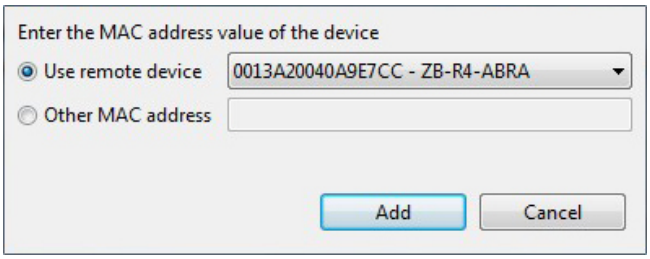
Received frames

When filtering the received frames, you have the following options:

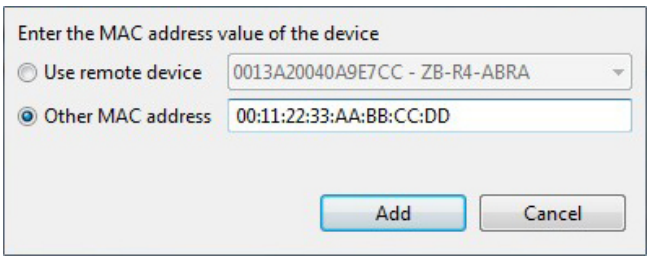
Option	Description
Show received frames	Shows/hides received frames
All received frames	Shows all the received frames
Received from the following radio modules	Shows the received frames by source address and lists the source MAC addresses that can be filtered. You can add and remove addresses from this list at any time.

To add a new MAC address:

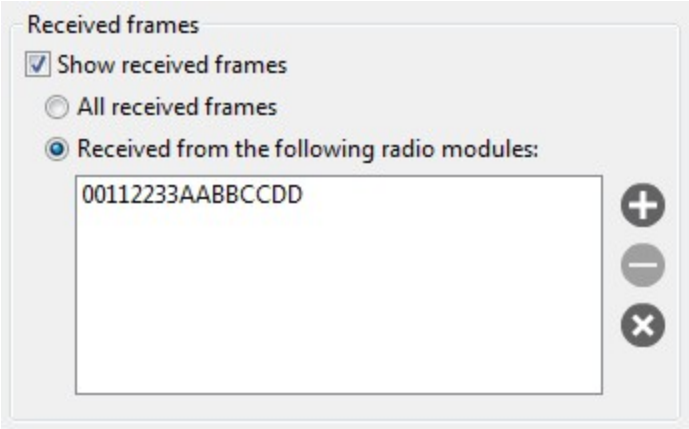
1. Select the **Received from the following radio modules** option.
2. Click the **Add new item** button. A new dialog appears.
3. If any remote devices have been discovered for your local device, you can select the specific device from the combo box:



If no remote devices are discovered for the local device, you can enter the MAC address manually:



4. Click the **Add** button to add the MAC address to the list:



Sent frames

When filtering the sent frames, you have the following options:

Option	Description
Show sent frames	Shows/hides sent frames
All sent frames	Shows all the sent frames

Option	Description
Sent to the following radio modules	Shows the sent frames by destination addresses and lists the source MAC addresses that can be filtered.

Note You can add a MAC address to the list by following the steps in Received frames.

Frame types

When filtering frames by type, you can select or deselect the desired frame types. By default all frame types but the Invalid frame are selected. You can also use the following buttons:

Option	Description
Select all	Checks all the frame types
Deselect all	Unchecks all the frame types

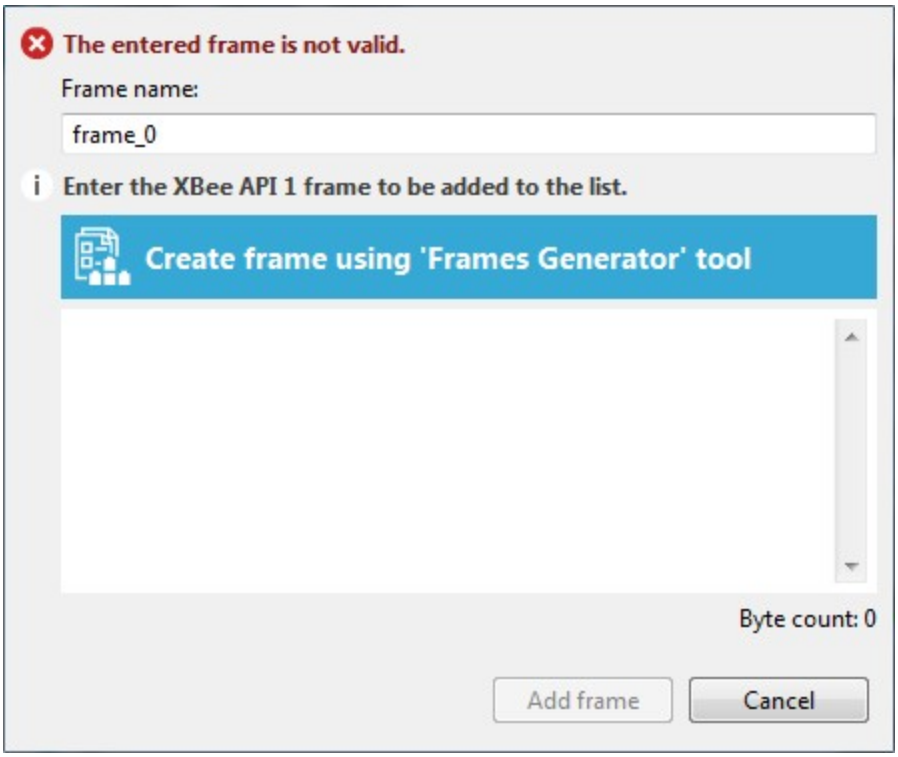
Add an API frame

An API frame is the structured data sent and received through the serial interface of the radio module when it is configured in API or API escaped operating modes. API frames are used to communicate with the module or with other modules in the network. For more information, see API frame.

If you want to send an API frame either individually or as part of a series, you first need to create the API frame:

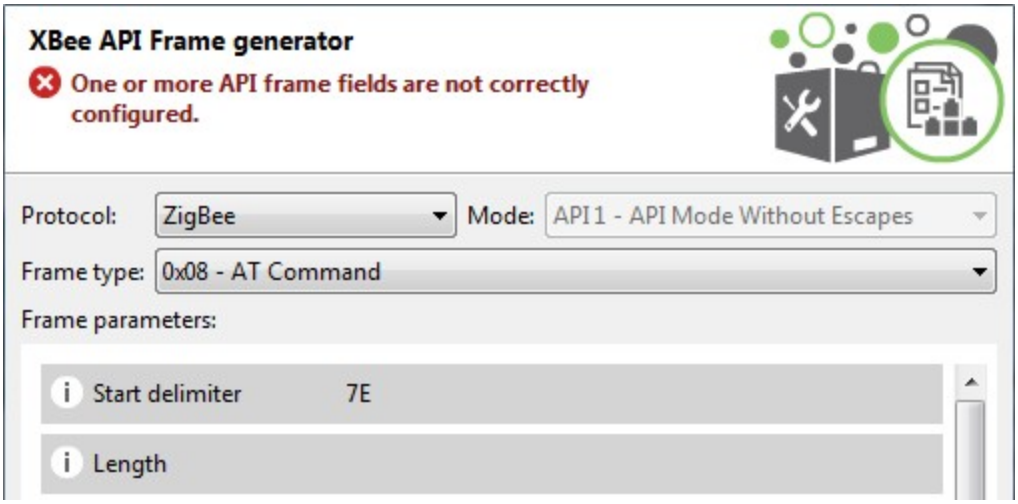
1. Switch to Consoles working mode .
2. Select a radio module from the list.

3. In the **Send frames** area, click the **Add new frame to the list** button .
   The **Add API frame to the list** dialog appears.

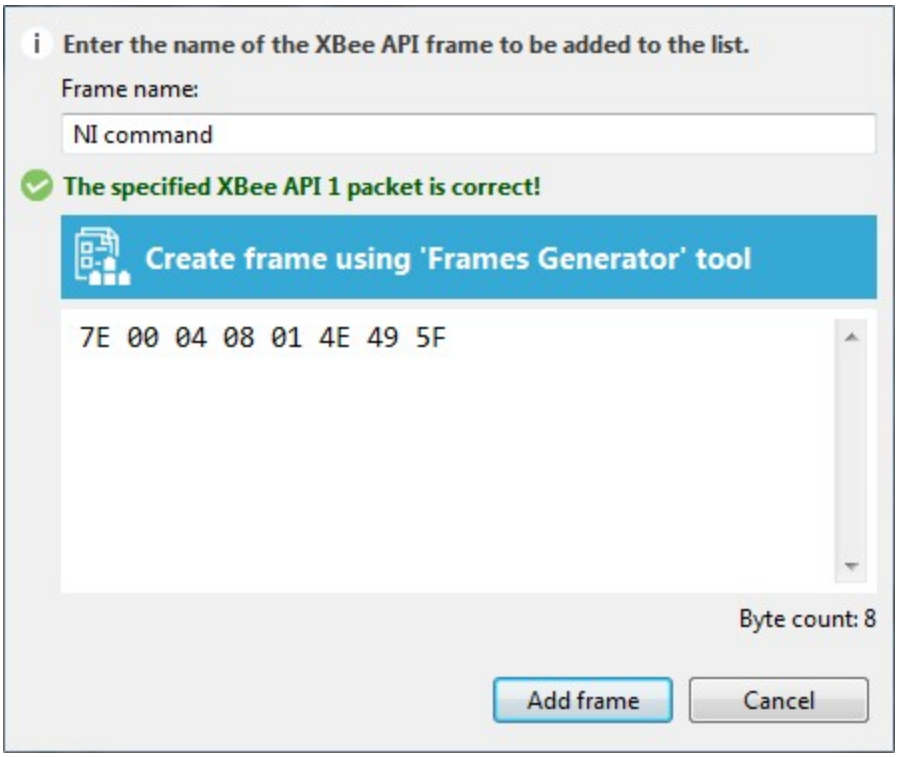


4. Enter a name for the frame.

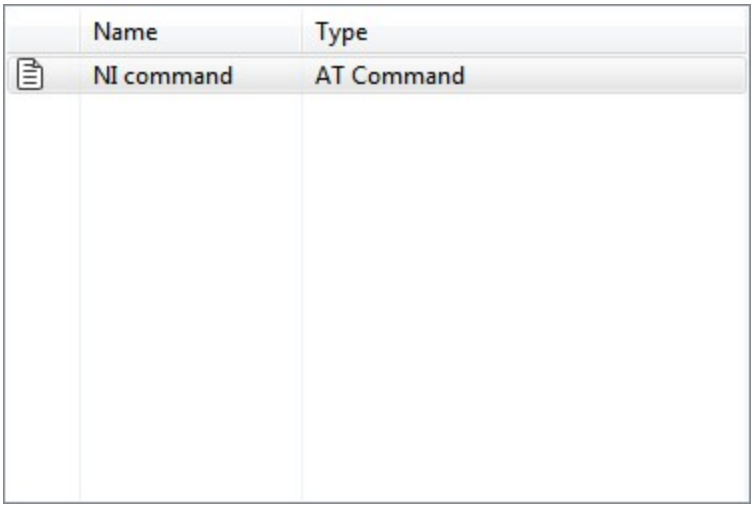
5. Create the frame by doing one of the following:
   - Enter the byte array of the API frame.
   - Click the **Create frame using 'Frames Generator' tool** button to open the Frames Generator tool. Then, configure the frame and click **OK**. For more information, see Frames generator tool.



Your generated frame appears in the API frame.



6. Click the **Add frame** button to add the API frame to the list of frames to send.

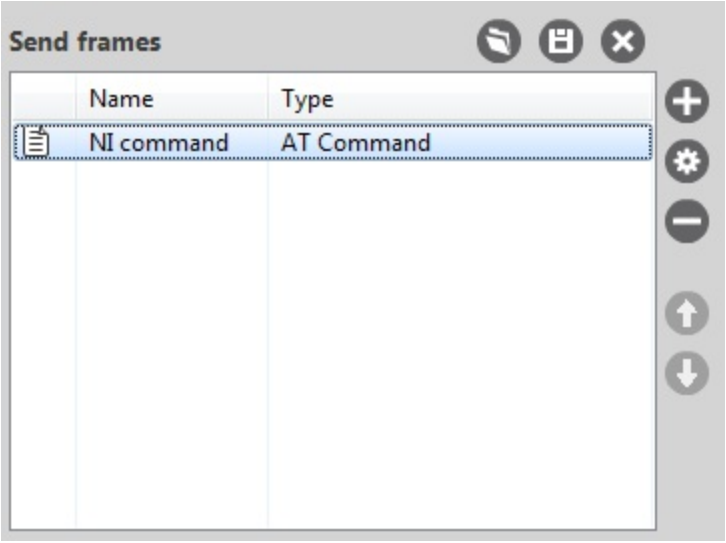


7. Repeat the steps to add additional API frames.

When finished, you can Send a single API frame and Send a sequence of API frames.

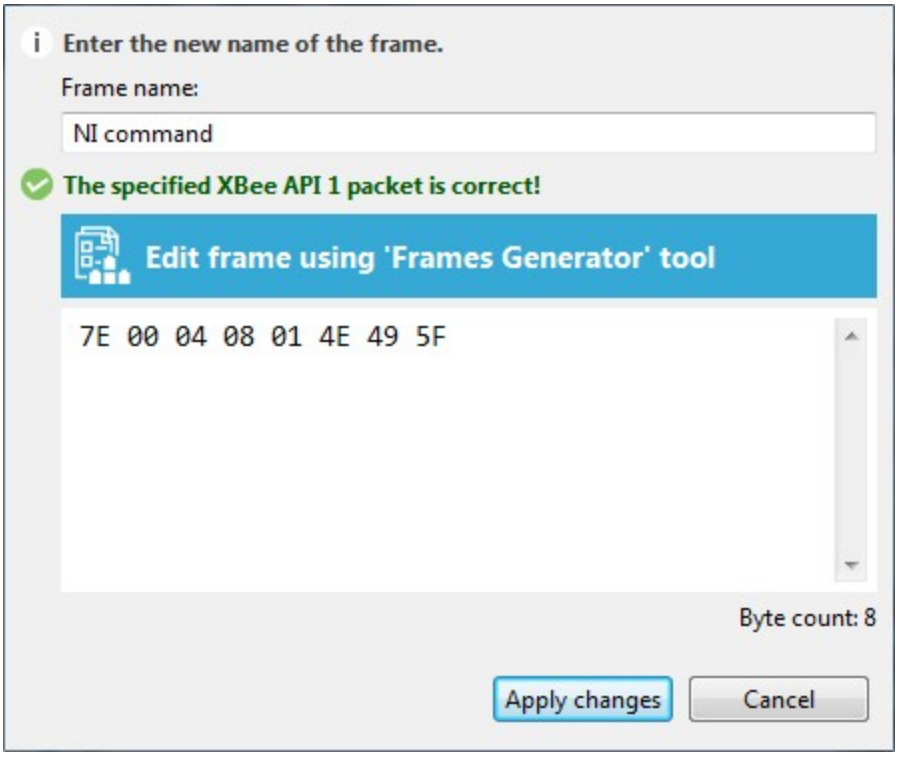
Manage API frames

Once you add an API frame to the list, you can perform the following actions. For instructions on adding a frame, see Add an API frame.



Edit a frame

1. Select the frame and click the **Edit selected frame** button .



2. Do one of the following:
   - Manually edit the frame name and content.
   - Click **Edit frame using 'Frames Generator' tool** to edit the content of the frame within the tool.
3. Click **Apply changes**.

Remove a frame

To remove a frame from the frames list, select the frame and click the **Remove selected frame** button .

Change the order of the frames list

If your list of API frames contains more than one frame, you can change the order of the frames.

Select an API frame and then click **Move up** or **Move down** to change the position of the frame in the list.

Save a list of frames

You can save a list of frames for use in future XCTU sessions.

1. Click the **Save frames list** button . A **Save file** dialog box appears.
2. Specify a name and path for the API frames list XML file, and click **Save**.

Note XCTU also saves the sending configuration.

Load a saved list of frames

You can load a previously saved list of API frames.

1. Click the **Load frames list** button . A **Load file** dialog box appears.
2. Select the saved API frame list XML file and click **Open**.

Note XCTU also loads the sending configuration.

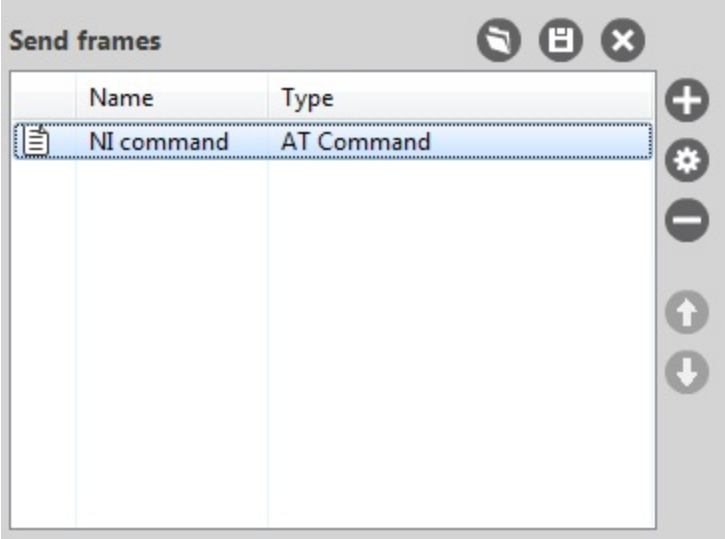
Clear the frames list

To clear the list of API frames, click the **Clear list** button .

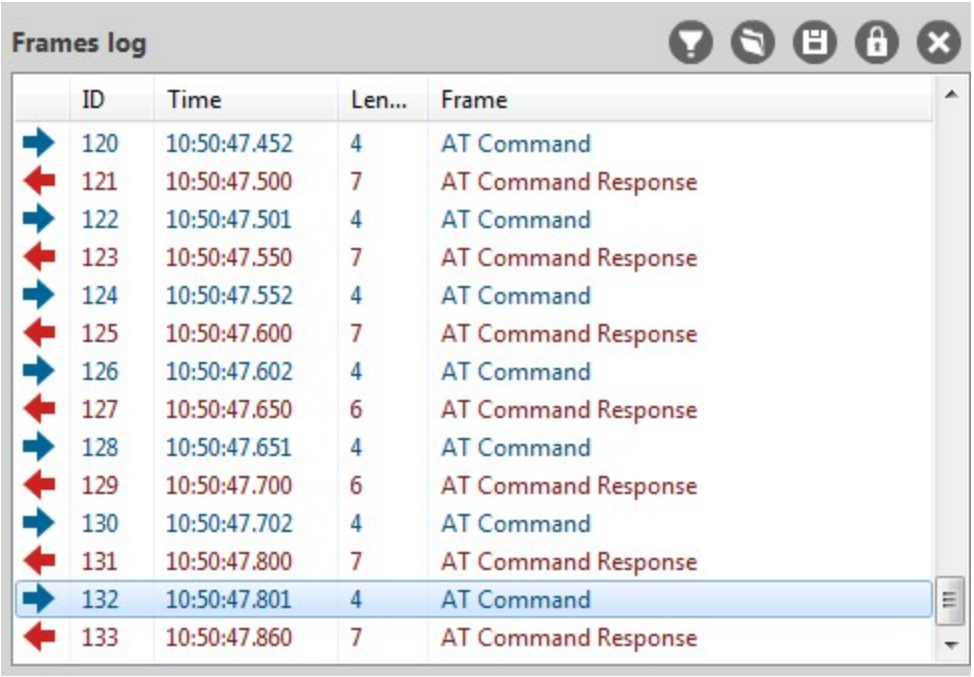
Send a single API frame

After you have added at least one frame to the Send frames area, you can send a single API frame to the console's corresponding radio module. For instructions on adding a frame, see Add an API frame.

1. In the API Console, select a frame in the **Send frames** area.



2. Click **Send selected frame**. The sent frame appears in the **Frames log** area.



For more information, see Send a sequence of API frames.

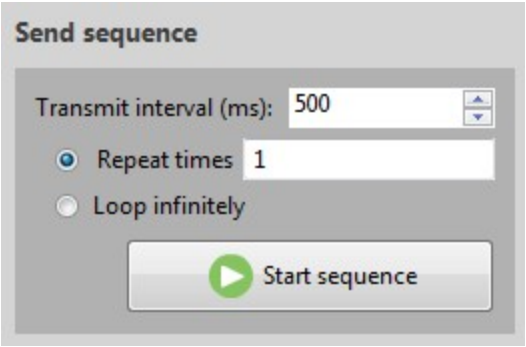
Send a sequence of API frames

After you have added at least two API frames to the Send frames area, you can send a sequence of API frames to a radio module running in API mode. For instructions on adding a frame, see Add an API frame.

An API frame sequence contains the list of frames to send as well as configured information about the way the frames will be sent.

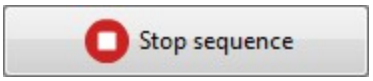
1. In the **Send sequence** area of the API console, configure the following options:
   - **Transmit interval**: Specify the amount of time, in milliseconds, to pause between frames. The minimum value is 0ms and the maximum value is 60000ms (1 minute).
   - **Repeat times**: Select this option to specify the number of times the sequence should be repeated or sent. By default, this value is 1.

- **Loop infinitely**: Select this option to send the sequence of frames in an infinite loop.



2. Click **Start sequence**. XCTU sends all frames in the **Send frames** list. Sent and received frames appear in the **Frame logs** area.

3. The process could end by itself, but you can click **Stop sequence** at any time to halt transmission.



For more information, see Send a single API frame.

Save an API console session

You can save the API console session, containing the list of sent and received API frames, by clicking the Save console session button.

1. Switch to Consoles working mode .
2. Select a radio module running in API or API escaped operating mode from the list.
3. Connect the console.
4. Generate some traffic.
5. Click the **Save console session** button in the **Frames log** view. The **Save file** dialog appears.
6. Designate a filename and path for the console session file.
7. Click **Save**.

Note You can load an API console session using the Load console session tool. See Load console session tool.

Communicate with modules running in AT mode

In AT (Application Transparent) or transparent operating mode, all serial data received by the radio module is queued up for RF transmission. When RF data is received by the module, the data is sent out through the serial interface.

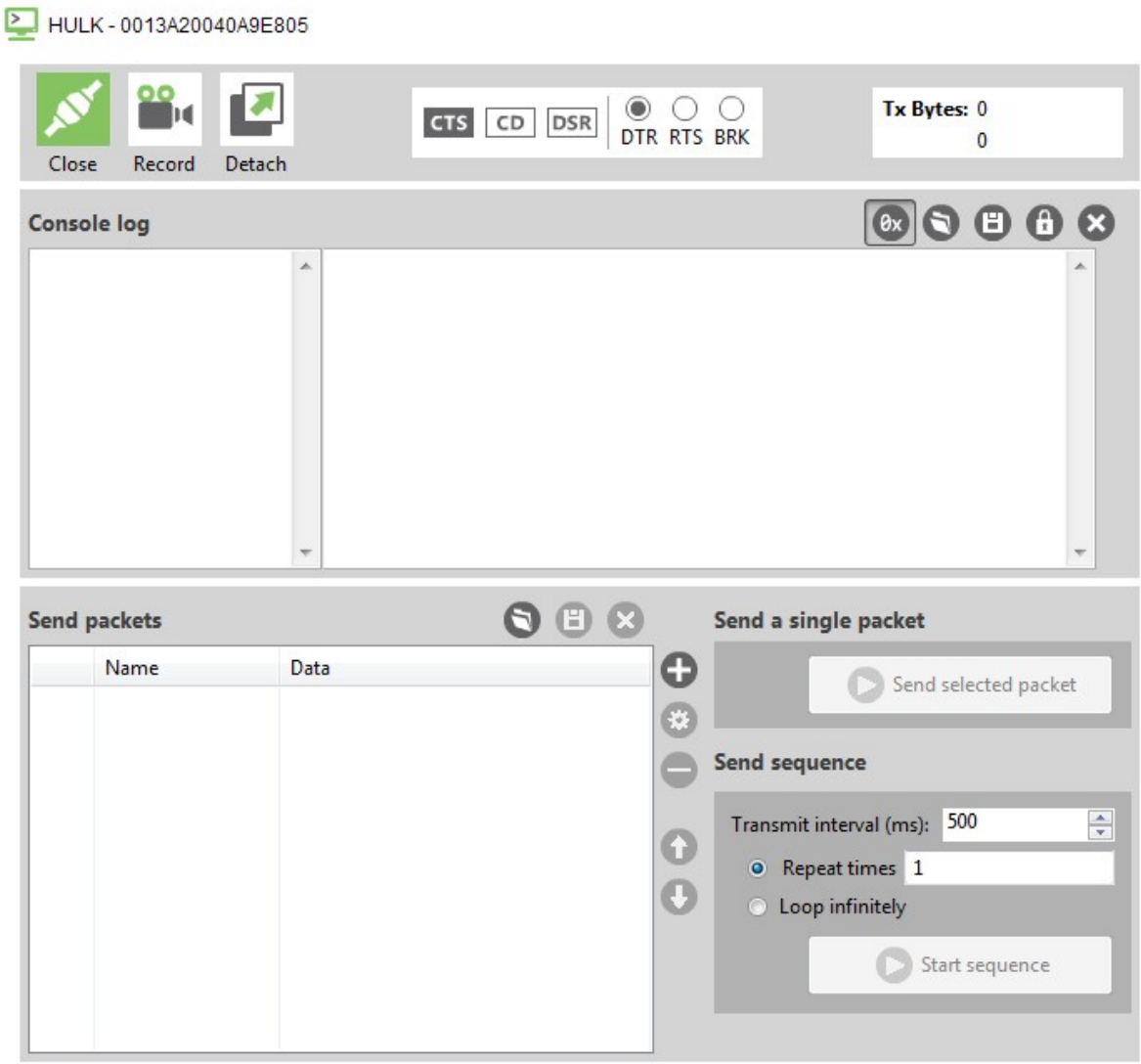
You can use XCTU's AT console to communicate with radio modules running in AT operating mode. XCTU automatically creates an AT console for these modules when you switch to Consoles working mode.

AT console

The AT console allows you to communicate with radio modules running in AT (transparent) operating mode. To display the AT console, switch to Consoles working mode and select a radio module configured with AT operating mode.

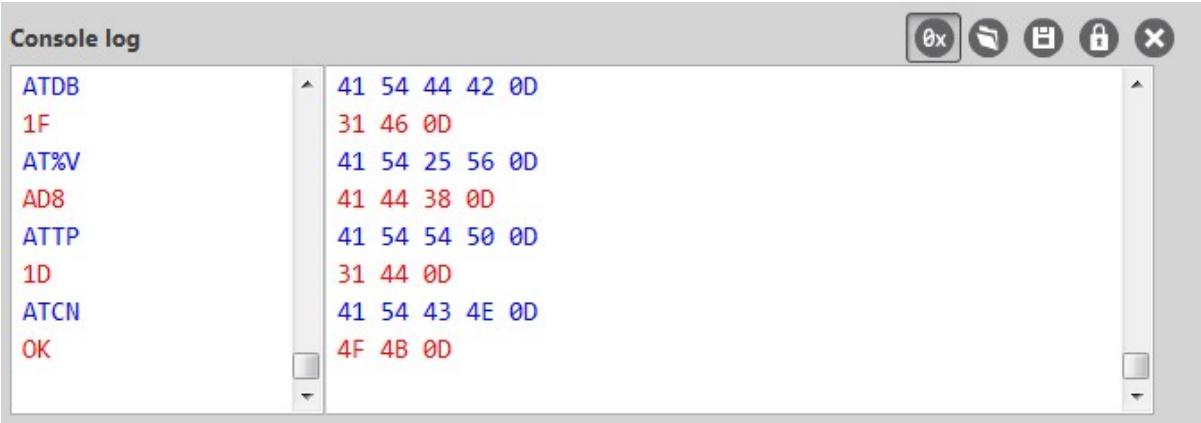
In the AT console, communication with the device is direct. All the data you send through the serial interface is queued for transmission by the module, and all data received by the module is sent through the serial interface.

AT console view



Console log

The Console log operates as a data traffic monitor. It displays all sent (blue) and received (red) data characters. Sent and received data is appended at the bottom of the data box. The right-hand side of the Console log displays corresponding hexadecimal values for all sent and received data characters.



Button	Name	Description
	Show/hide hexadecimal	Toggles hexadecimal view.
	Load console session	Opens the embedded Load console sessions tool. See Load console session tool.
	Save console session	Saves the active console session in a Console log files.
	Lock scroll	Toggles the scroll behavior of the data box. If Lock scroll is enabled, the data box will not automatically scroll when a new data character is sent or received.
	Clear data	Clears all data characters, as well as their hexadecimal representation, from the data box.

When operating in AT operating mode, XCTU does not require that you use structured data to communicate with a radio module. Communication with the device is direct. Type directly in the data box and the characters you enter are automatically sent to the radio module.

Note To insert CR/LF, CR or LF characters, right click on the ASCII panel of the Console log and select the appropriate option from the context menu. It is also possible to configure the default behavior when you press the ENTER key. For more information about configuring default behavior, see Set console preferences.

Send packets

The **Send packets** section of the **AT Console** allows you to add and manage data packets. You can send a data packet—one or more groups of characters—to a radio module in your device list. When

you type in the data box, XCTU sends the data as individual characters. Sending a data packet sends all of the characters in a single operation.

Button	Name	Description
	Add new packet	Adds a packet to the list of packets to send
	Edit selected packet	Changes the name or contents of a data packet
	Remove selected packet	Removes a data packet from the list
	Move up / move down	Changes the order of packets in the list
	Save packets list	Saves the list of packets to be used in future sessions or on another computer
	Load packets list	Loads a saved list of data packets
	Clear the list of packets	Clears the entire packet list

The **Send sequence** dialog contains the following fields:

Field	Description
Transmit interval	Amount of time, in milliseconds, to pause between data packets. The minimum value is 0ms and the maximum value is 60000ms (1 minute).
Repeat times	Number of times the sequence should be repeated or sent. By default, this value is 1.
Loop infinitely	Sends the sequence of data packets in an infinite loop.

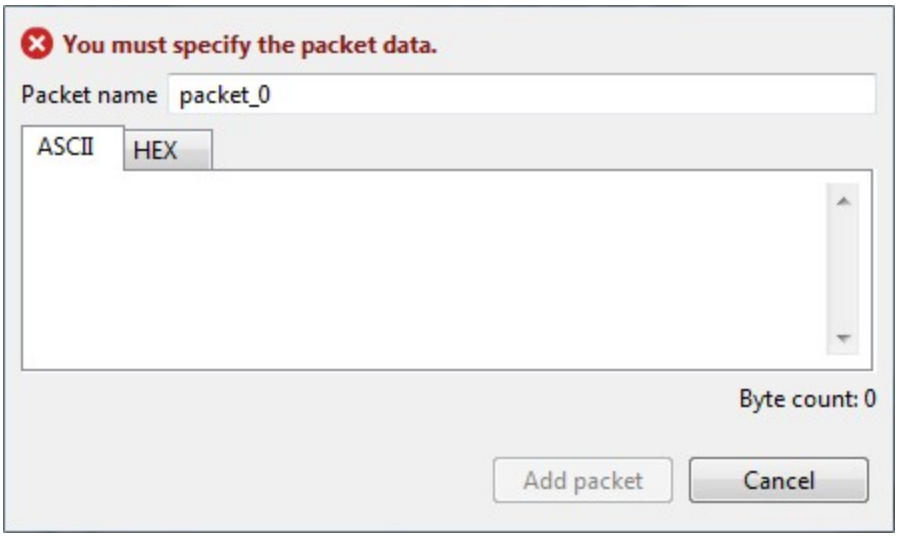
Note You can send a single packet (**Send selected packet**) or the configured sequence of packets (**Start sequence**).

For more information, see Consoles working mode and AT operating mode.

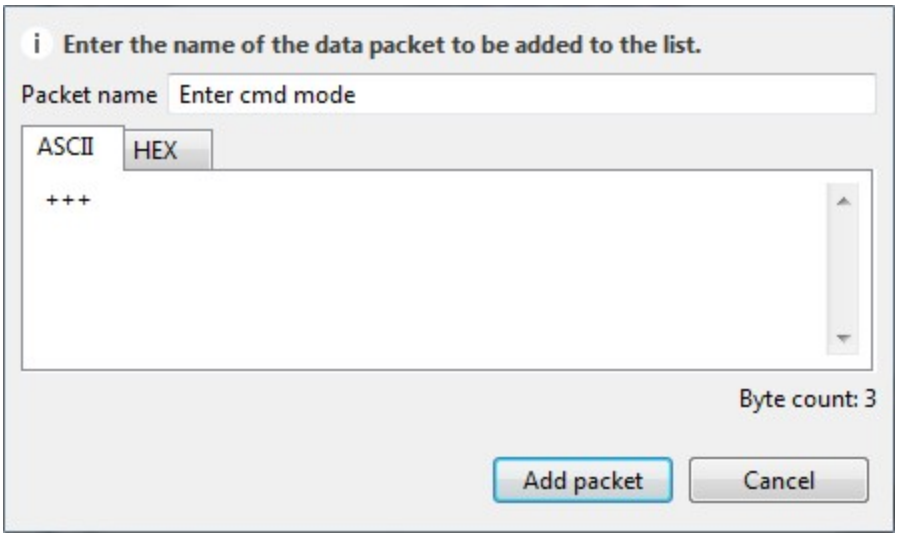
Add a data packet

When a module is operating in AT mode, you can send data byte by byte, or you can send a set of bytes—a data packet. To send a data packet, you must first create one. By default, the data packets list is empty.

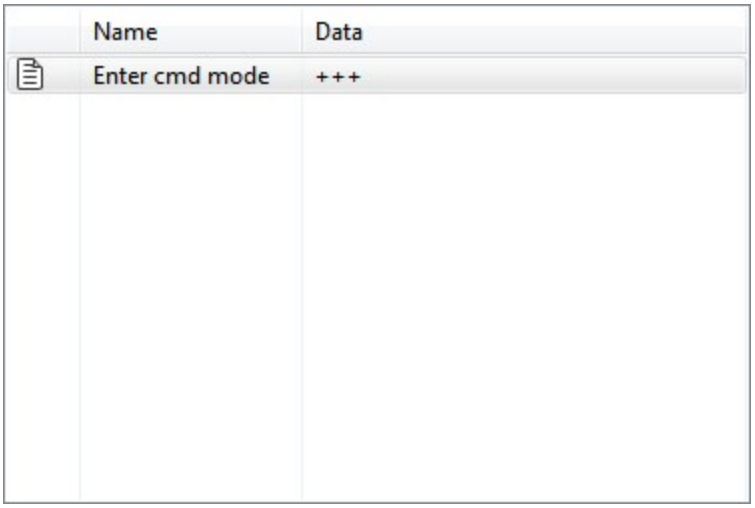
1. From the AT console, click the **Add new packet** button in the **Send packets** dialog. The **Add new packet** dialog appears.



2. Enter the name of the data packet to be added to the list.
3. Type in your data. You can use the tabs to toggle between ASCII and HEX input views.



4. Click **Add packet**. The data packet appears in the list of packets. Repeat the operation to add additional packets to the list.



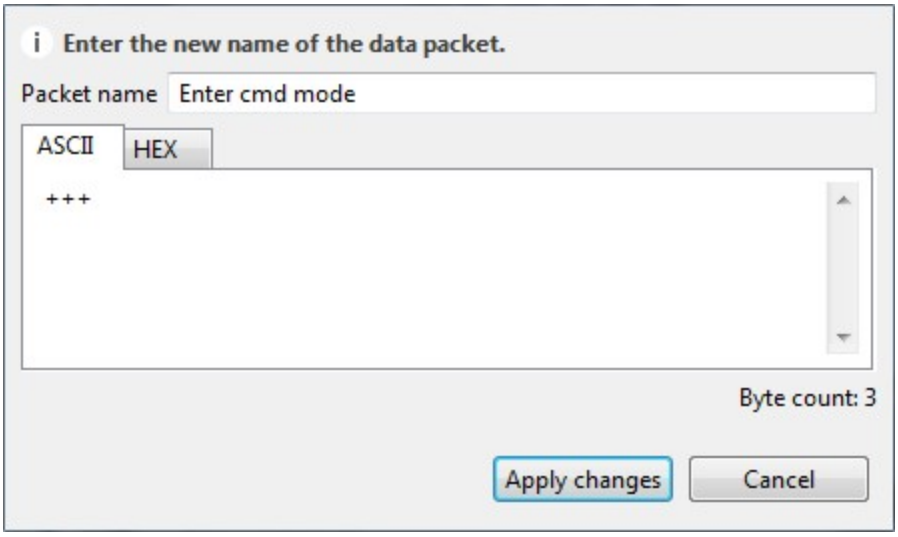
When finished, you can send a single packet or a sequence of packets. See Send a single packet and Send a sequence of packets.

Manage data packets

Once you create a data packet, you can perform the following actions. For instructions on adding a packet, see Add a data packet.

Edit a data packet

1. Select the packet and click the **Edit selected packet** button .
2. Manually edit the packet name and content.



3. Click **Apply changes**.

Remove a data packet

To remove a data packet from the list, select the packet and click the **Remove selected packet** button .

Change the order of the data packets list

If your list of data packets contains more than one packet, you can select a packet and then click **Move up** or **Move down** to change the position of the packet in the list.

Save a list of packets

You can save a list of packets for use in future XCTU sessions.

1. Click the **Save packets list** button . A Save file dialog box appears.
2. Specify a name and path for the XML file and click **Save**.

Note XCTU also saves the sending configuration.

Load a saved list of packets

You can load a previously saved list of data packets.

1. Click the **Load packets list** button . The Load file dialog box appears.
2. Select the saved XML file and click **Open**.

Note XCTU also loads the sending configuration.

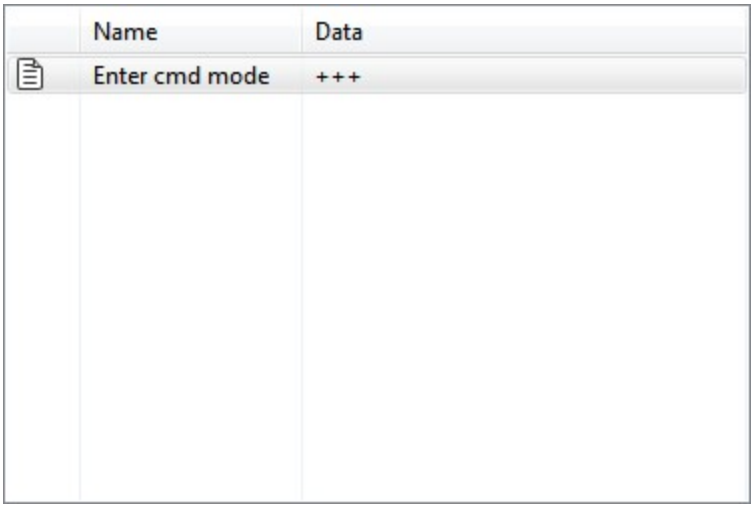
Clear the packet list

To clear the list of data packets, click the **Clear list** button .

Send a single packet

After you have added at least one data packet to the Send packets area, you can send a single packet to the console's corresponding radio module. For instructions on adding a packet, see Add a data packet.

1. In the Consoles working mode, select a packet in the **Send packets** area.



2. Click **Send selected packet**.

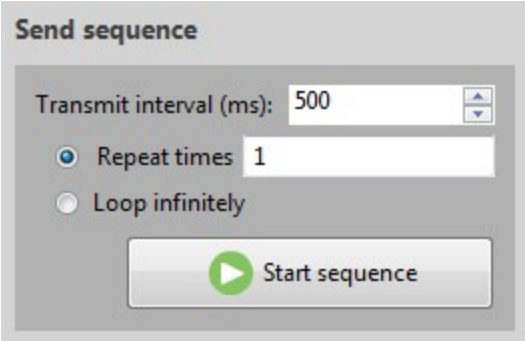
The sent data appears in the Data traffic section.

For more information, see Send a sequence of packets.

Send a sequence of packets

After you have added at least two data packets to the Send packets area, you can send a sequence of data packets to a radio module running in AT mode. The sequence is defined by the list of packets to send and the send sequence options located next to the list. For instructions on adding packets, see Add a data packet.

1. In the **Send sequence** dialog of the AT Console, configure the following options:
   - **Transmit interval**: Specify the amount of time, in milliseconds, to pause between frames. The minimum value is 0ms and the maximum value is 60000ms (1 minute).
   - **Repeat times**: Select this option to specify the number of times the sequence should be repeated or sent. By default, this value is 1.
   - **Loop infinitely**: Select this option to send the sequence of frames in an infinite loop.



2. Click **Start sequence**. The sent and received data appear in the **Data traffic monitor**.

3. The process can end by itself. You can also click **Stop sequence** at any time to halt transmission.

For more information, see Send a single packet.

Save an AT console session

A saved AT console session contains sent and received data. You can use the AT console and Serial console tool to save a console session. XCTU saves this data in a Console log file.

1. Switch to Consoles working mode .
2. Select a radio module running in AT (transparent) operating mode.
3. Connect the console.
4. Generate some traffic. (The save feature doesn't work if there is no data to save.)
5. Click the **Save console session** button. The **Save file** dialog appears.
6. Designate a filename and path for the console session file.
7. Click **Save**.

Note You can load an AT console session using the Load console session tool. For more information, see Load console session tool.

Console log files

A console log file is the file generated when saving or recording a console session. It consists of a record containing console session information followed by multiple data records with sent and received data. XCTU writes data in a console log file using Comma Separated Value (CSV) format.

Console session records

A console session record contains the following fields:

Field	Description
Date	Date and time when the session record started
ID	Not used in this record; this field contains a "-" character
Type	API, API2, AT, or Serial
Description	Comma-separated console session information such as the module node identifier, MAC address, function set, firmware version, and COM port

Console session records look like this:

```
     02-05-2015 11:44:56.017,-,API,"A,0013A2004031A8D7,ZigBee Router
API,23A7,COM4 - 9600/8/N/1/N,0"
```

Data records

Data records contain the following fields:

Field	Description
Date	Date and time when the data was sent or received
ID	ID number of the packet or API frame
Type	SENT or RECV
Data	Data sent or received in Hexadecimal string format

Data records look like this:

```
     02-05-2015 11:44:58.857,0,SENT,7E000408764944F4
```

View your radio network

This section describes how to use Network working mode to view your radio network once you have added a radio module or modules to your list of devices.

Modules in AT (transparent) operating mode do not support the network discovery process.

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Network working mode

The Network working mode allows you to discover and see the topology of your network.

The Network perspective only works in API operating mode. Radio modules in AT (transparent) mode do not support the network discovery process.

Network toolbar

The Network toolbar presents the network actions you can perform.

Button	Name	Description
	Start scan	Scans the radio module's network and displays a list of available modules.
	Stop scan	When scans specified in scan preferences are finished, the discovery process stops automatically. You can also click the **Stop scan** button at any time.
	Graph view	Displays the modules as nodes in a graph.
	Table view	Displays the modules as rows in a table.
	Screenshot	Saves an image of the network to your computer.
	Export table	Exports network information in a tabular file format.
	Settings	Configures network-related parameters.
	Layout	Changes the network layout to one of six types: composite, spring, vertical tree, horizontal tree, grid (default), and radial.
	Filter links	Hides or displays connections between RF modules based on their quality. Enables/disables quality ranges via radio buttons. All filters are enabled by default so all connections are visible. You can establish connection quality colors and ranges in **Preferences > Network > Appearance** or by clicking **Configure quality ranges** link in the **Filter links** dialog. See Set network discovery preferences.

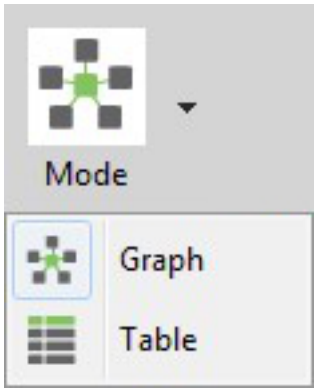
Button	Name	Description
	Zoom	Changes the zoom level of the network.
	Find box	Searches for a particular module in the network.

Network scan status

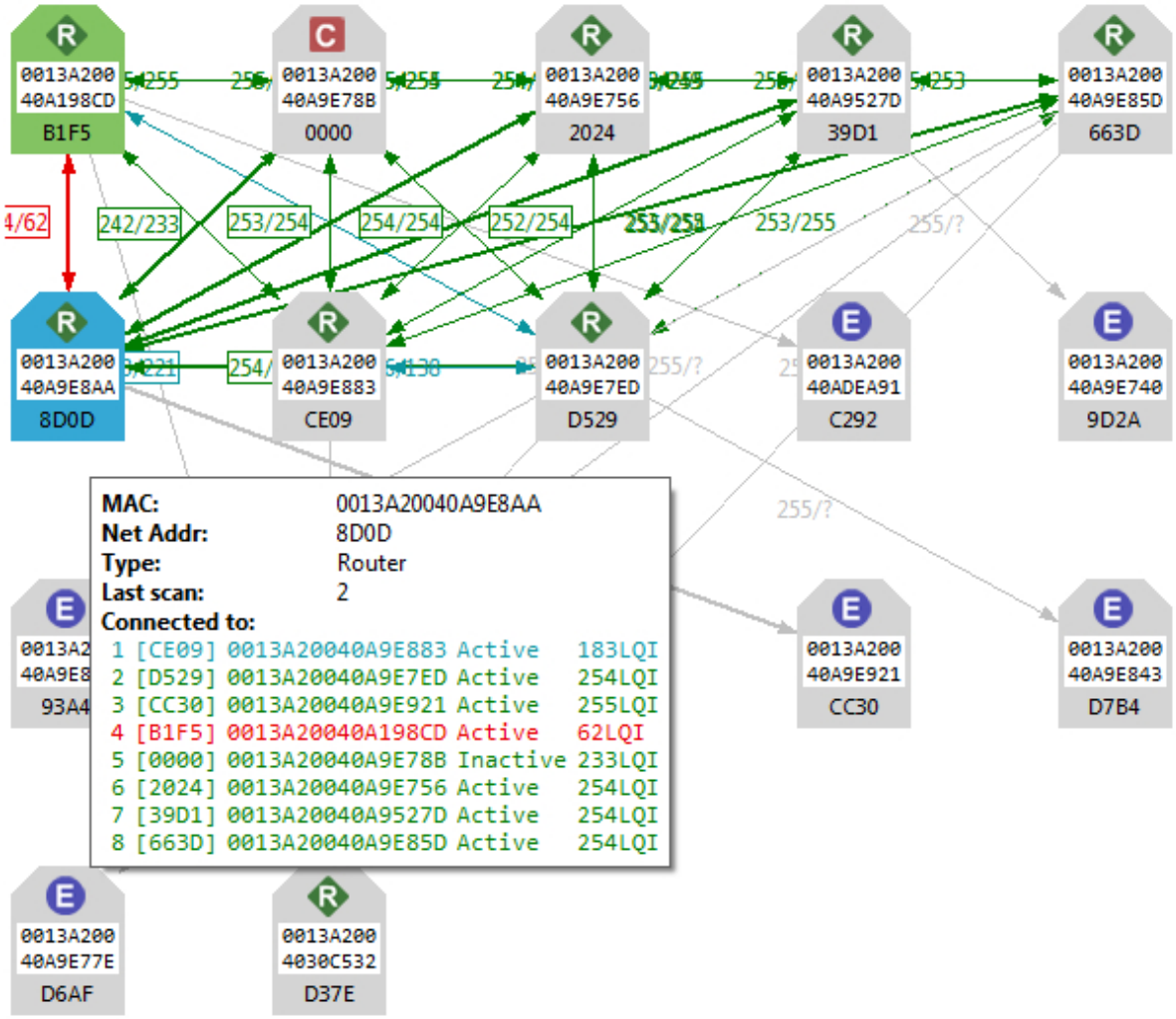
When you scan a radio module's network to find available modules, XCTU displays the status of the scan along the bottom edge of the Network working mode display.

Field	Description
17 nodes	Number of nodes in the network
[PAN ID: BAB05A]	PAN ID
[CH: 11]	Channel
<Scanning>	Status: Getting information, Initializing scan, Scanning, Waiting for next scan, or Stopped
Scan 2	Current scan number
Remaining: 00:00:21	Estimated time remaining to finish current scan
Total: 00:00:39	Total elapsed time of scan

Graph view



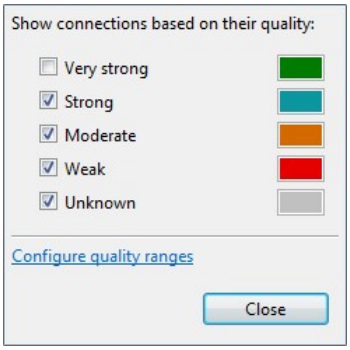
In Graph view, XCTU displays the modules as nodes in a graph. A green background denotes the local radio module and a blue background denotes the selected module. Each module is labeled with its role (coordinator, router, or end device) and MAC address as well as the 16-bit network address for ZigBee networks and node identifier for other protocols. You can click any node to inspect its connections.

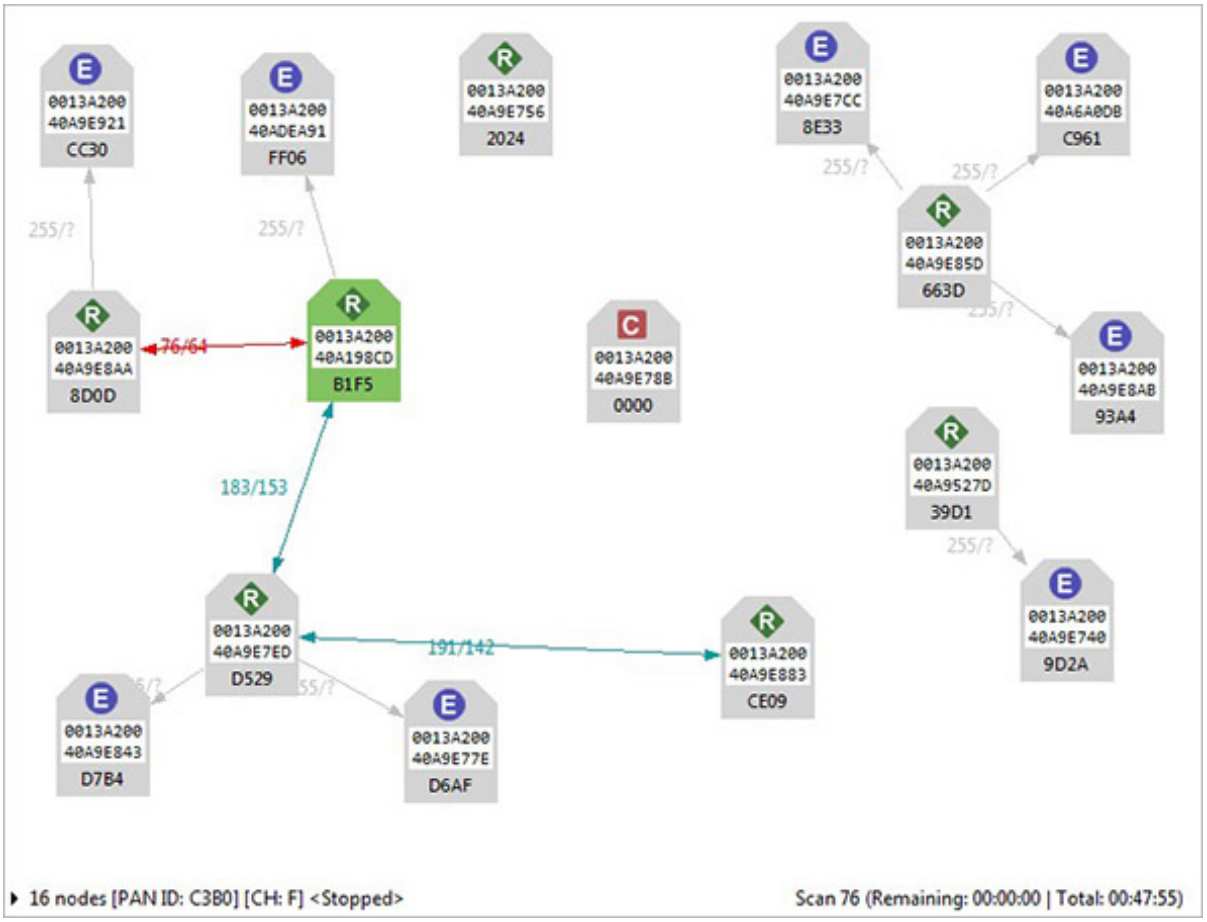


- Each node is connected to its neighbors with solid lines (active connections) or dotted lines (undiscovered connections), with arrows indicating the direction of communication. Selected nodes are blue, and connections are black. Nodes discovered in previous scans that have not been found in the current scan are delineated via lighter-colored lines; they will "turn on" as they are discovered.
- When a radio module leaves the network, some devices continue to store information about their relationship. When you perform a new discovery, the module appears because of the preserved information but the device is unreachable if you attempt to verify the connection. These modules are shown in red.
- When you double click a node, XCTU switches to Configuration mode and displays the node's settings. If the node was not previously discovered, XCTU will add it to the device list as a remote node before displaying its settings.

Connection quality filters

You can filter connections by quality in Graph view to show/hide connections between modules according to configurable quality ranges.





Connections in 802.15.4, DigiMesh, and ZigBee

When viewing 802.15.4, DigiMesh, and ZigBee modules in Graph view, consider the following differences in node display:

Protocol	Description and Node Display
802.15.4	XCTU does not display the quality of the connection between two nodes. The nodes displayed are in the RF range of the local radio module.

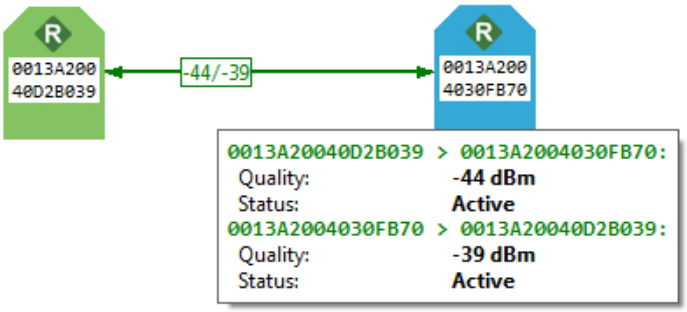
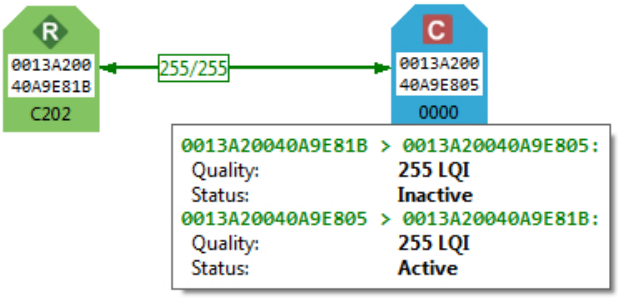
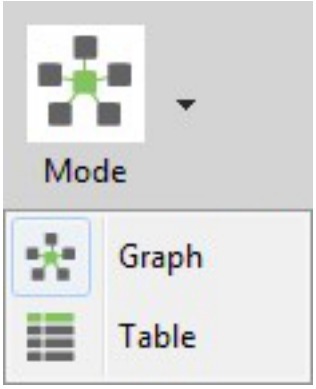
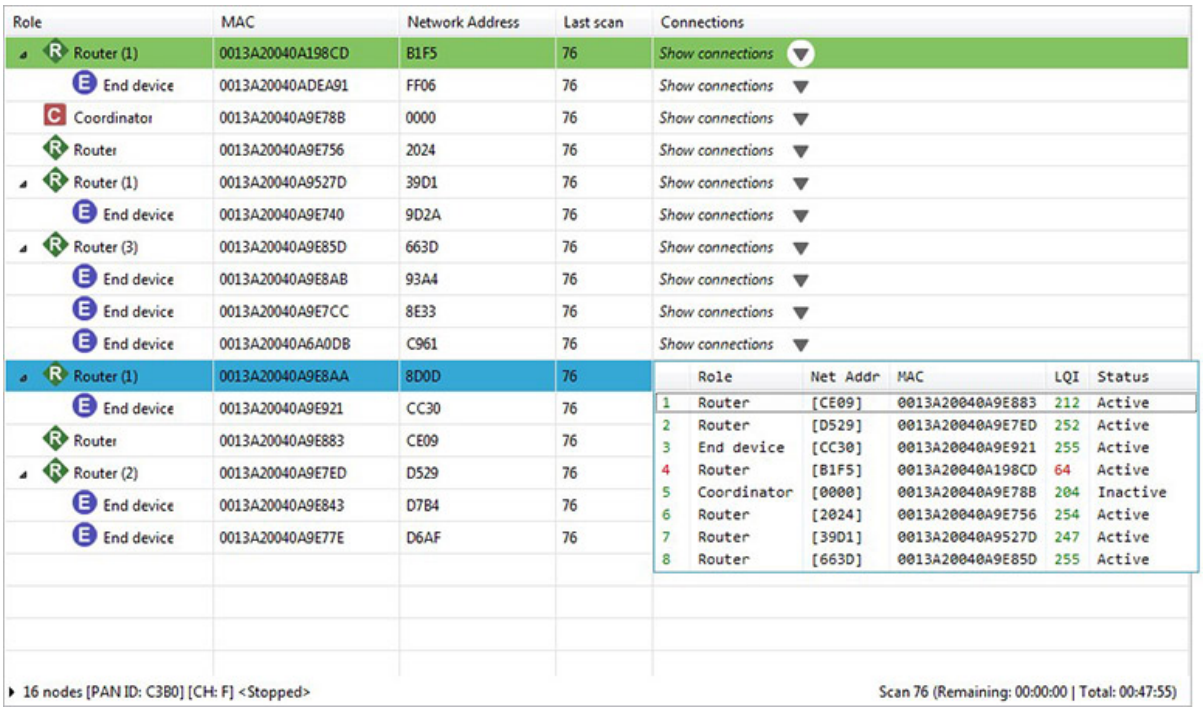
Protocol	Description and Node Display
DigiMesh	The quality of the connection between two nodes is displayed next to the line that connects them. Hover over the line joining the nodes to see bidirectional quality (in dB) and status of the connection, respectively. 
ZigBee	The quality of the connection between two nodes is displayed next to the line that connects them. Hover over the line joining the nodes to see bidirectional quality and status of the connection, respectively. Link quality is represented by Link Quality Indication, or LQI, a number between 0 and 255 where 0 is the weakest and 255 is the strongest. 

Table view



In Table view, network radio modules are displayed as rows in a table. ZigBee devices display end devices as children of their coordinators or routers. Other protocols display all nodes at the same level.

Nodes discovered in previous scans that have not been found in the current scan are delineated via italicized grey text. Connections not yet discovered are also displayed with grey text. A green background denotes the local radio module and a blue background denotes the selected module. When a radio module leaves the network, some devices continue to store information about their relationship. When you perform a new discovery, the module appears because of the preserved information but the device is unreachable if you attempt to verify the connection. These modules are shown in red.



Role	MAC	Network Address	Last scan	Connections
Router (1)	0013A20040A198CD	B1F5	76	Show connections
End device	0013A20040ADEA91	FF06	76	Show connections
Coordinator	0013A20040A9E78B	0000	76	Show connections
Router	0013A20040A9E756	2024	76	Show connections
Router (1)	0013A20040A9527D	39D1	76	Show connections
End device	0013A20040A9E740	9D2A	76	Show connections
Router (3)	0013A20040A9E85D	663D	76	Show connections
End device	0013A20040A9E8AB	93A4	76	Show connections
End device	0013A20040A9E7CC	8E33	76	Show connections
End device	0013A20040A6A0DB	C961	76	Show connections
Router (1)	0013A20040A9E8AA	8D0D	76	
End device	0013A20040A9E921	CC30	76	
Router	0013A20040A9E883	CE09	76	
Router (2)	0013A20040A9E7ED	D529	76	
End device	0013A20040A9E843	D7B4	76	
End device	0013A20040A9E77E	D6AF	76	

	Role	Net Addr	MAC	LQI	Status
1	Router	[CE09]	0013A20040A9E883	212	Active
2	Router	[D529]	0013A20040A9E7ED	252	Active
3	End device	[CC30]	0013A20040A9E921	255	Active
4	Router	[B1F5]	0013A20040A198CD	64	Active
5	Coordinator	[0000]	0013A20040A9E78B	204	Inactive
6	Router	[2024]	0013A20040A9E756	254	Active
7	Router	[39D1]	0013A20040A9527D	247	Active
8	Router	[663D]	0013A20040A9E85D	255	Active

16 nodes [PAN ID: C3B0] [CH: F] <Stopped>

Scan 76 (Remaining: 00:00:00 | Total: 00:47:55)

Field	Description
Role	Coordinator, router, or end device
MAC	64-bit address of the module
Network address	Network address (ZigBee) / Node identifier (other protocols)
Last scan	Scan number when the device was last discovered
Connections	Description of current module connections. Click **Show connections** to view a table with additional information about the module's connections.

Scan the network for available modules

You can scan a radio module's network to find available modules. Note that the search may take some time. To scan the network:

1. Switch to the Network mode .
2. Select a radio module running in API mode.

   Note Modules in AT (transparent) operating mode do not support the network discovery process.

3. Click the **Scan the radio module network** button to begin the network discovery process. Radio modules are dynamically added to the working area as they are found, showing connections and link quality.
4. The scan process automatically stops according to the network preferences configured in the **Network Preferences** dialog. For details, see Set network discovery preferences. You can also click the **Stop scanning the network button** at any time.

   XCTU displays the network scan status along the bottom edge of the **Network working mode** display. For a description of the status fields, see Network working mode.

   17 nodes [PAN ID: BAB05A] [CH: 11] <Scanning> Scan 2 (Remaining: 00:00:21 | Total: 00:00:39)

Note You may need to perform multiple scans to discover the entire network if, for example, modules are sleeping or the network is very large.

Search for network nodes

If a network scan is active, you can use search expressions to find particular nodes in the network:

1. In the search box, type in a search expression to search for particular nodes in the network. For more information on available search prefixes and parameters, see Find radio modules.

   Find...

2. The background color of the search box changes based on search status: yellow indicates matches found, and red indicates no matches found.

Change network perspective

The Network working mode has two different view perspectives: graph view and table view. The Network perspective button allows you to switch between them.

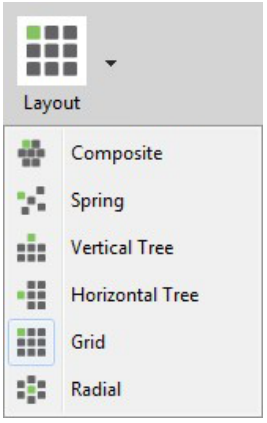
1. Switch to Network working mode .
2. Select a radio module running in API mode from the list.
3. Click the **Network perspective** button and select either **Graph view** or **Table view**.

For a description of each view, see Network working mode.

Set network layout

If a network scan is active, you can change the network layout:

1. Change the network perspective to Graph view. For details, see Change network perspective.
2. Click the **Set layout** drop-down menu.



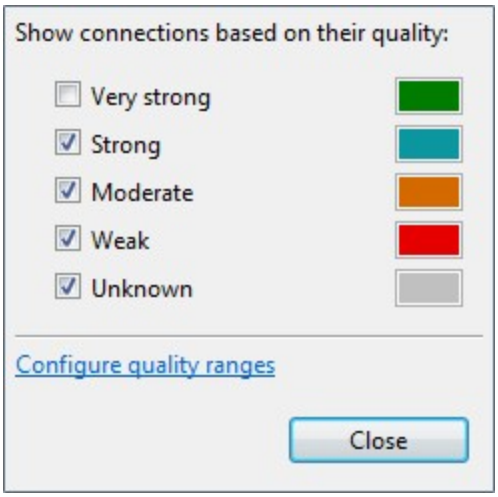
3. Select one of the six layout options.

Filter network connections by quality

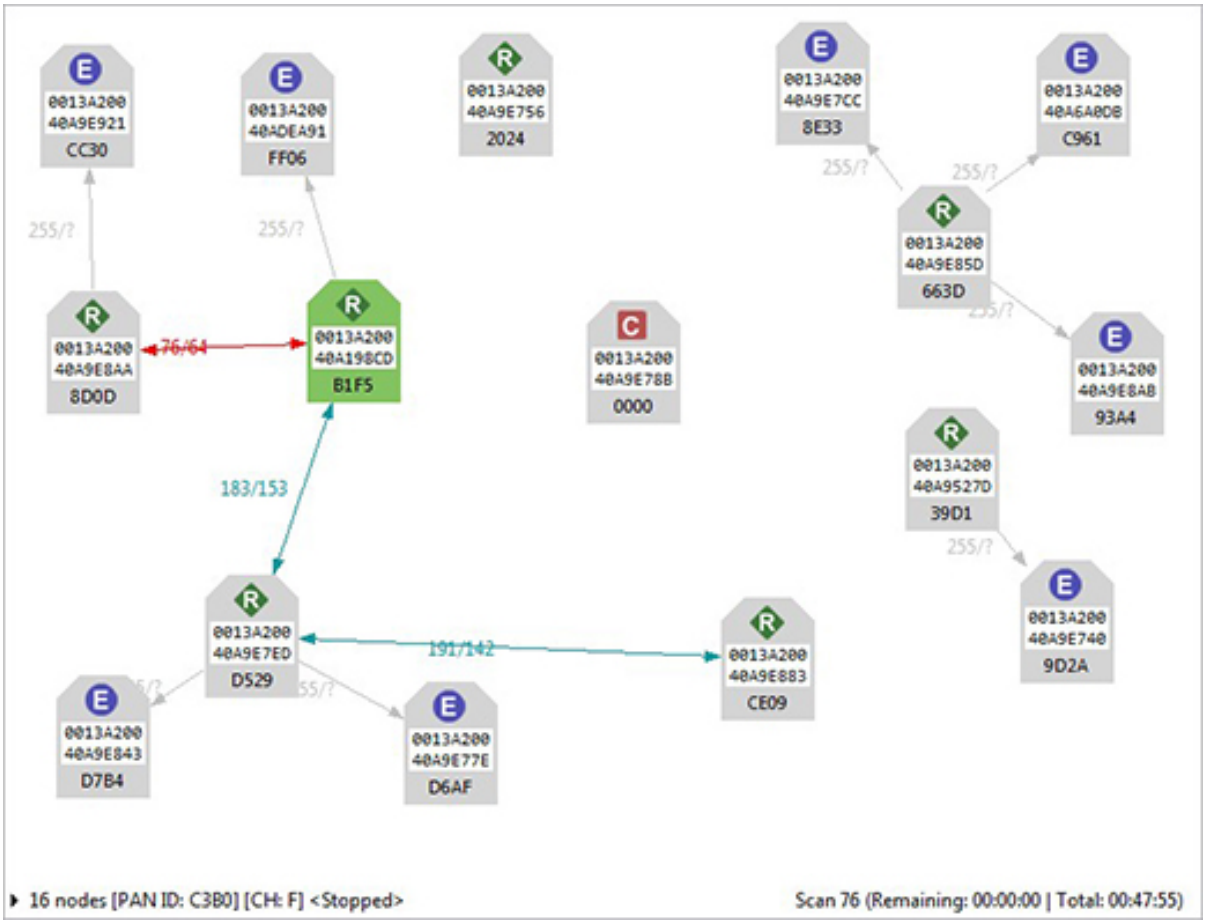
If a network scan is active, you can hide and show connections between RF modules depending on their quality. All filters are enabled by default, so all connections are initially visible.

1. Click the **Filter connections** button . A dialog appears with all of the filters enabled.
2. Check or uncheck quality connection filters. Unchecking a box hides all connections associated with that quality filter, and checking a box displays all connections associated with that quality filter.

   In this example, we unchecked the **Very strong** filter.



3. Click **Close**. XCTU displays network connections based on the filters you selected.
   In this example, we can see all of the connections except for those that are very strong.

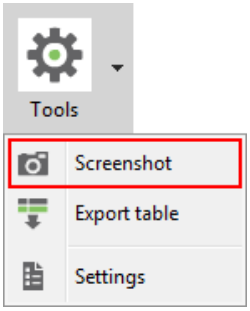


Note Click **Configure quality ranges** to configure quality range values and display colors. You can also access quality range configuration options from **Tools > Settings** on the Network view toolbar.

Take a screenshot of the network

If a network scan is active, you can save a Graph view or Table view screenshot.

1. Click the **Options** drop-down menu and select **Screenshot**. A **Save file** dialog appears.



2. Specify the name and location of the image and click **Save**. A screenshot is saved to your clipboard.

Set zoom level in Graph view

If a network scan is active, you can use the zoom control in Graph view to change the zoom level of the view:

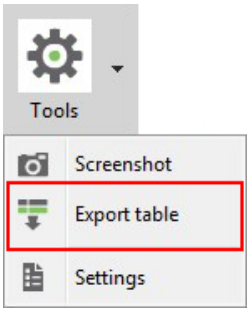
1. Change the network perspective to Graph view. For details, see Change network perspective.
2. In the Zoom level dialog, use the up/down arrows to change the zoom level or enter a percentage between 10 and 400.

Note You can also zoom in and out by pressing the **Control** key while scrolling the mouse wheel.

Export a network table

If a network scan is active, you can save network information from either graph view in CSV (comma separated value) file format. To export a network table when a network scan is active:

1. Click the **Options** drop-down menu and select **Export table**.



A **Save file** dialog appears.

2. Designate a filename and location and click **Save**.

Configure XCTU

This section describes how to configure several XCTU settings such as firmware updates, display settings, and network connectivity. To open the Preferences dialog box, click the Preferences button on the XCTU toolbar.

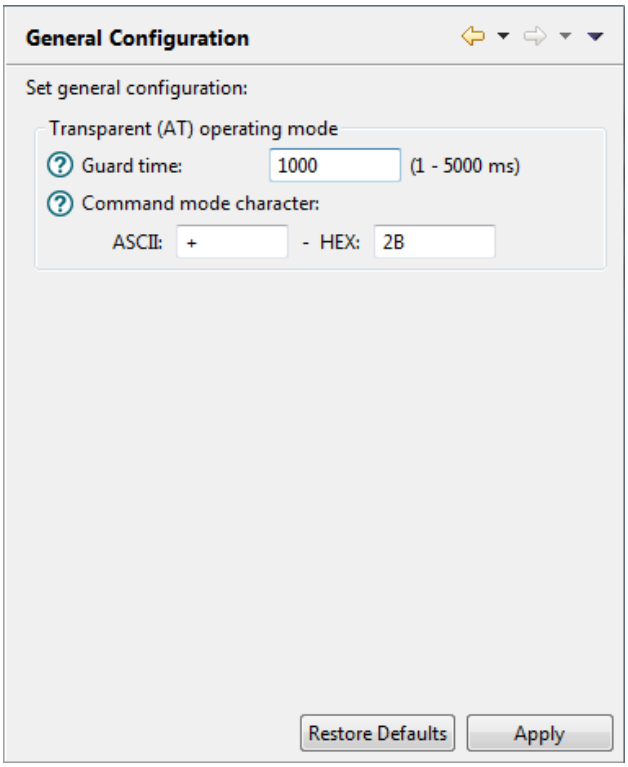
The preference categories are listed on the left side of the Preferences dialog box. You can configure settings for the following categories:

Set general preferences 106
Set appearance preferences 106
Set automatic software update preferences 107
Set console preferences 109
Set firmware update preferences 110
Set network discovery preferences 111
Set network appearance preferences 114
Set radio firmware library preferences 116
Set MicroPython Terminal preferences 117

Set general preferences

You can configure some general settings related with the transparent operating mode.

1. On the XCTU toolbar, click the **Preferences** button . The Preferences dialog appears.
2. On the left side of the Preferences dialog, select **General Preferences**.



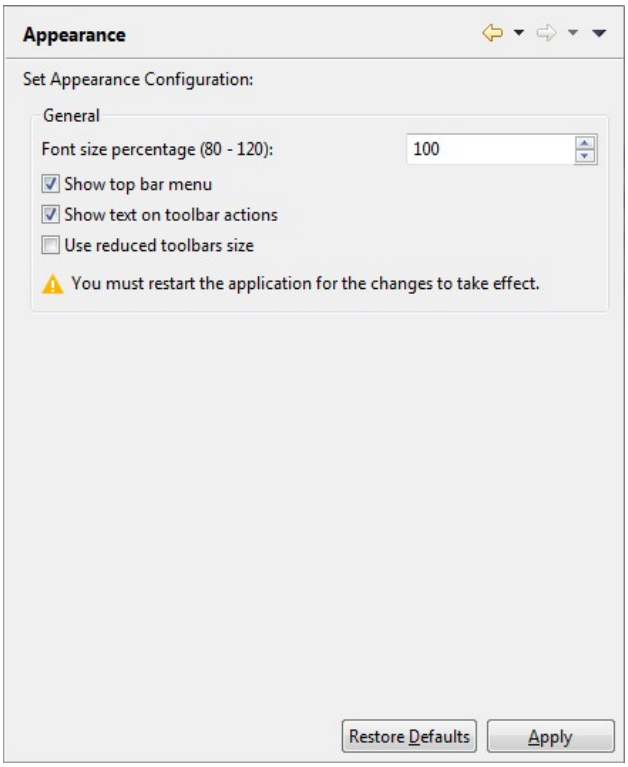
3. Configure your preferred settings and click **Apply**.

Settings	Description
Guard time	Sets the period of silence XCTU waits before and after entering command mode when the radio module operates in transparent (AT) mode. This value must match the **GT** value of the radio modules.
Command mode character	Sets the character value to be used to enter command mode when the radio module operates in transparent (AT) mode. The command mode character can be specified either in ASCII or hexadecimal format. This value must match the **CC** value of the radio modules.

Set appearance preferences

You can configure some graphic aspects of the tool and how some elements are displayed.

1. On the XCTU toolbar, click the **Preferences** button . The **Preferences** dialog appears.
2. On the left side of the Preferences dialog, select **Appearance**.



3. Configure your preferred settings and click **Apply**.

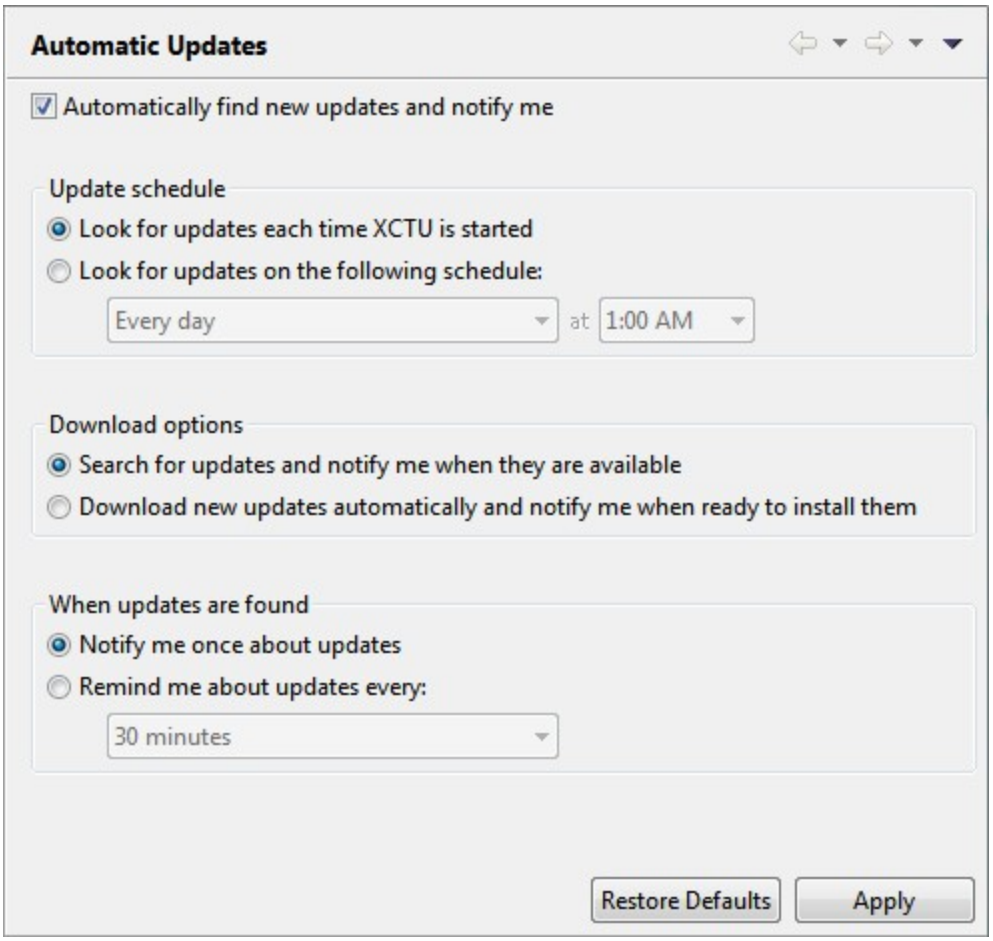
Field	Description
Font size	Changes all the XCTU texts size in percentage, from 50 to 120%.
Show top bar menu	Displays an application top bar menu with texts.
Show text on toolbar actions	Displays the name of the action below each toolbar element for a better understanding of the meaning of each action.
Use reduced toolbars size	Changes the size of the application toolbars reducing them.

Note You must restart XCTU for the changes to take effect.

Set automatic software update preferences

You can configure when and how new updates for XCTU are downloaded and installed.

1. On the XCTU toolbar, click the **Preferences** button . The configuration dialog appears.
2. On the left side of the configuration dialog, select **Automatic Updates**.



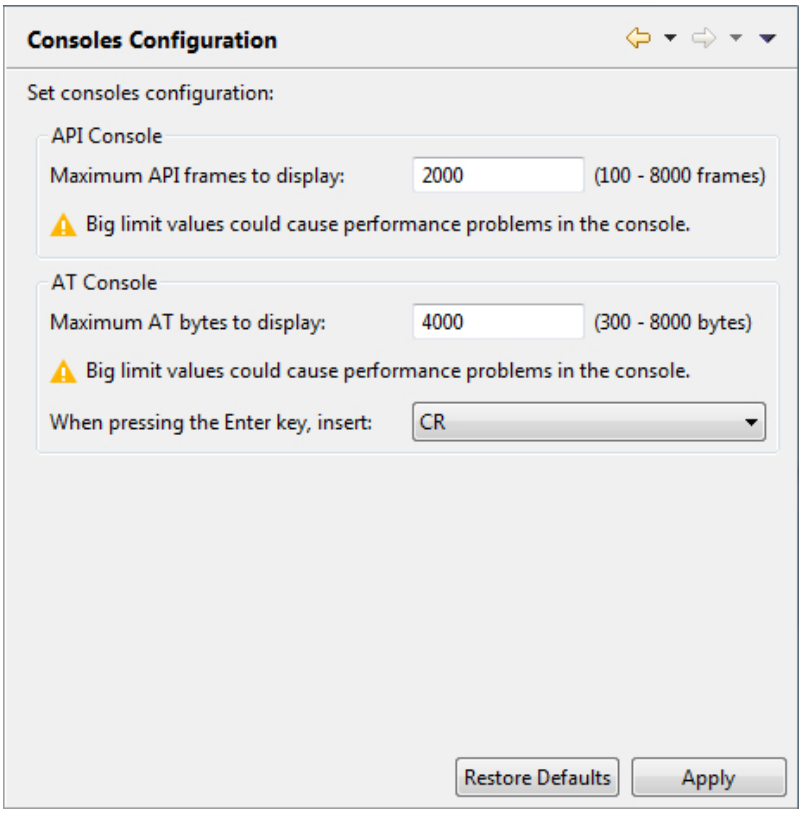
3. Check **Automatically find new updates and notify me** to enable the automatic updates feature.
4. Configure your preferred settings and click **Apply**.

Field	Description
Update schedule	Sets a schedule to search for updates or to update when XCTU is started. If you select **Look for updates on the following schedule**, you must also specify the search interval and hour.
Download options	Establishes when new updates should download and sets permissions for whether updates are automatically downloaded.
When updates are found	Sets the frequency of update notification.

Set console preferences

You can configure the number of frames to display in an API console and/or the number of bytes to display in an AT console.

1. On the XCTU toolbar, click the **Preferences** button to open the **Preferences** dialog.
2. On the left side of the **Preferences** dialog, select **Consoles preferences**.



3. Configure your preferred settings and click **Apply**.

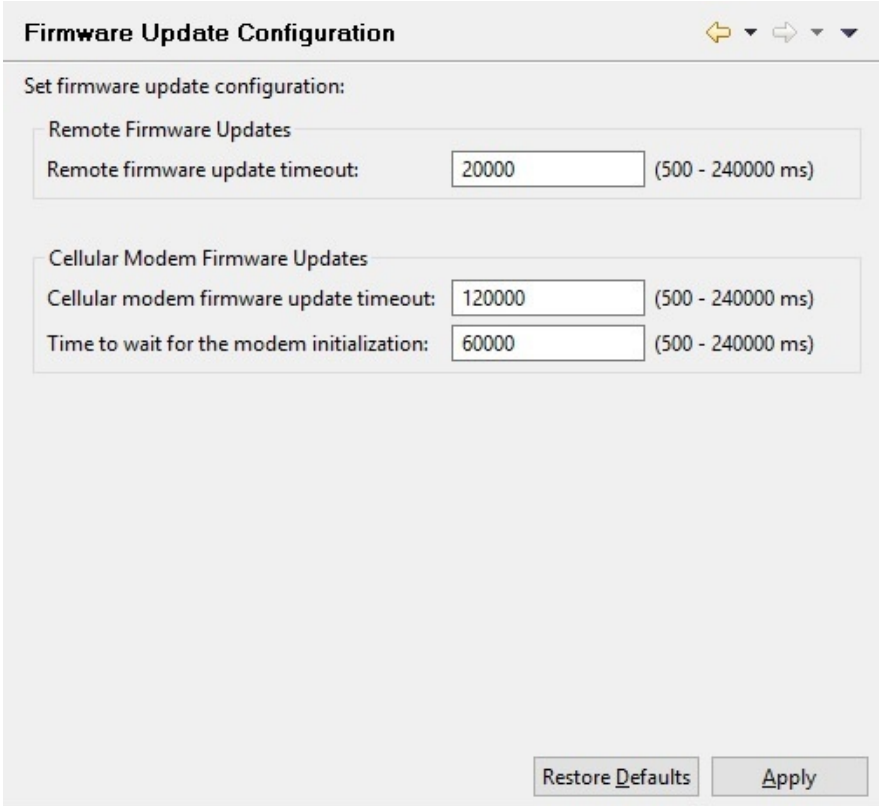
Settings	Description
API console	Configures the maximum number of API frames that can be displayed in the frames log during a session. When the maximum limit is reached, the session starts overwriting frames.
AT console	Configures the maximum number of bytes that can be displayed during a session. When the maximum limit is reached, the session starts overwriting bytes. It also establishes the default behavior when you press the ENTER key in the AT Console to insert CR/LF, CR or LF characters.

Note If you set high values for maximum API frames and/or AT bytes, you may notice performance issues in the consoles.

Set firmware update preferences

You can configure some preferences related to the firmware update process.

1. On the XCTU toolbar, click the **Preferences** button . to open the **Preferences** dialog.
2. On the left side of the **Preferences** dialog, select **Firmware Update preferences**.



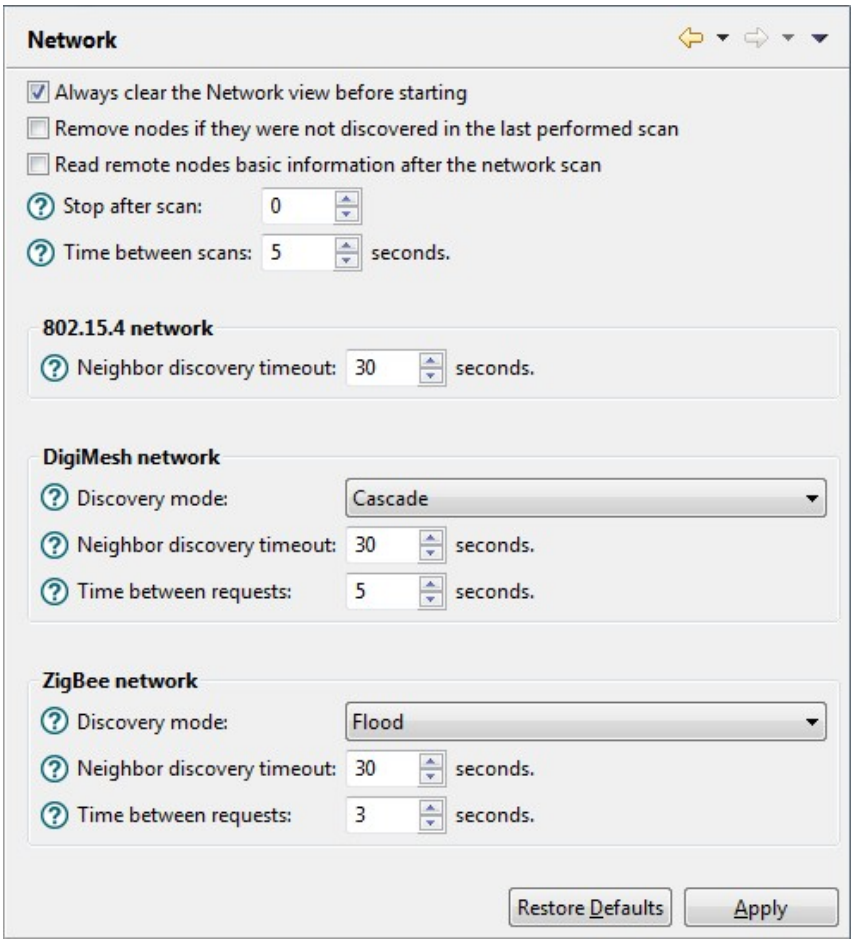
3. Configure your preferred settings and click **Apply**.

Field	Description
Remote firmware update timeout	Configures the remote firmware update timeout in milliseconds. This is the maximum time that XCTU waits for a response sent by the remote node during the remote firmware update before determining if there was an error during the process.
Cellular modem firmware update timeout	Configures the cellular modem firmware update timeout in milliseconds. This is the maximum time that XCTU waits for a response sent by the modem of a Cellular device during a local firmware update before determining if there was an error during the process.
Time to wait for the modem initialization	Configures the time to wait for the modem initialization in milliseconds. This is the maximum time that XCTU waits for the Cellular modem initialization. If this time expires and the modem version cannot be read, XCTU forces the modem firmware update.

Set network discovery preferences

You can configure network discovery parameters in the **Network preferences** panel.

1. On the XCTU toolbar, click the **Preferences** button to open the **Preferences** dialog.
2. On the left side of the **Preferences** dialog, select **Network**.



3. Configure your preferred settings and click **Apply**.

   The first set of options are common to all networks:

Settings	Description
Always clear the Network view before starting	Clears Network view before each new network scan.
Remove nodes if they were not discovered in the last performed scan	Removes any nodes not discovered in the last scan.
Read remote nodes basic information after the network scan	Reads the following information from the remote nodes after each network scan: Node identifier, hardware version, firmware version, network address and device type.
Stop after scan	Sets the number of scans to perform before stopping the discovery process. A value of '0' means the process will not stop automatically.
Time between scans	Sets the duration of time XCTU waits before starting a new network scan. The value must be between 0 and 300 seconds.

The remainder of the options are specific to 802.15.4, DigiMesh, and ZigBee network types:

Settings	Description
Discovery mode	Sets the method used by the network discovery process. ■ Flood: The neighbor discovery process is performed for every node at the moment it is found. Several discovery processes may be running at the same time. This method may be faster, but it may also generate a lot of traffic and saturate the network. ■ Cascade: The neighbor discovery process is performed for every node as soon as the discovery process finishes. Only one discovery process runs at a time. This method may be slower, but it is likely to generate less traffic.
Neighbor discovery timeout	Sets the maximum duration, in seconds, the discovery process should spend finding neighbors of a module. Value must be between 5 and 1800 seconds (30 minutes). This timeout is highly dependent on the nature of the network. For DigiMesh, the value should be greater than the highest NT (Node Discover Timeout) and include enough time to let the message propagate, depending on the sleep cycle of your devices.

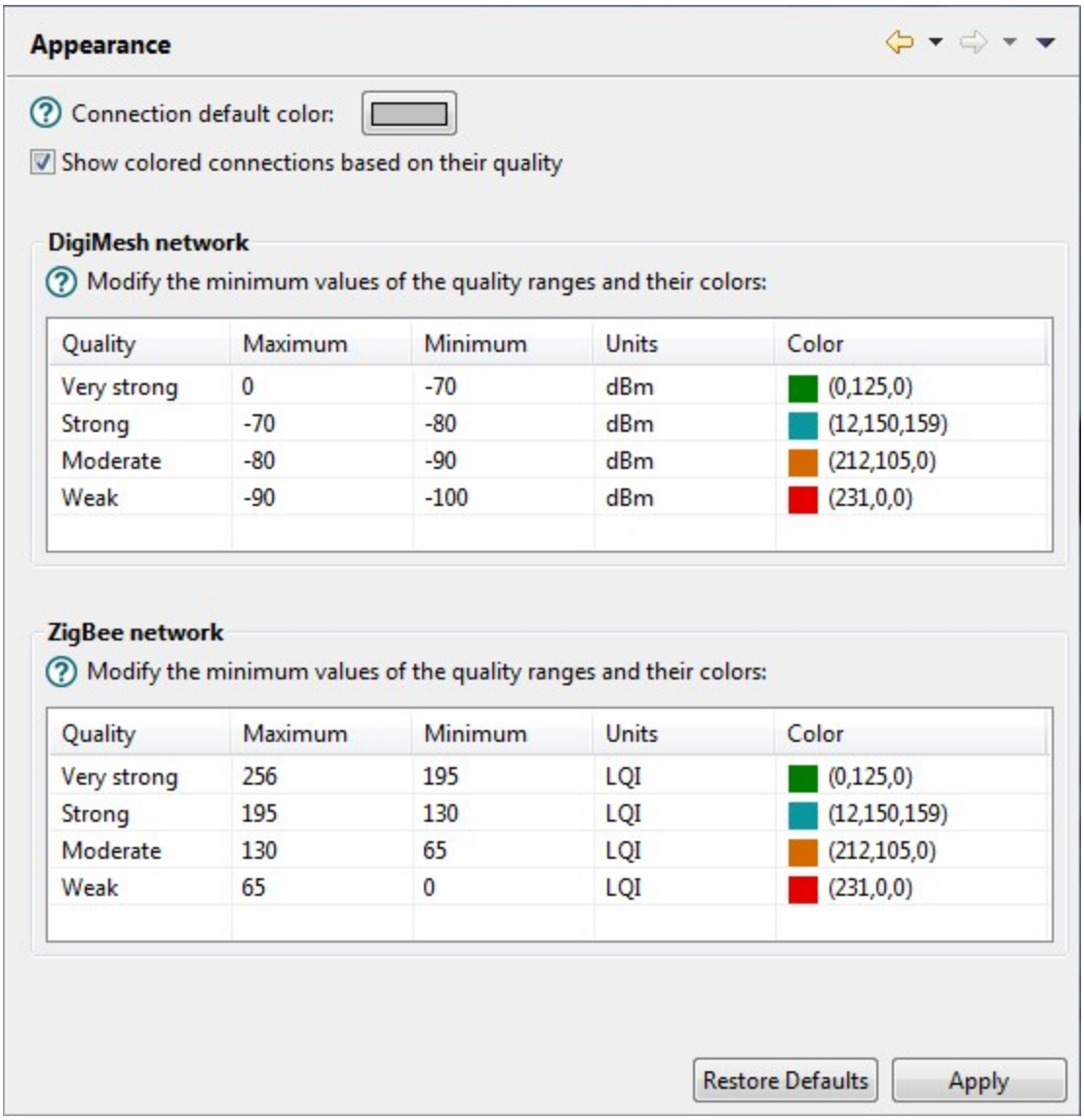
Settings	Description
Time between requests	Sets the wait time between node neighbor requests. The value must be between 0 and 300 seconds (5 minutes). For the Cascade method, this is the number of seconds to wait after completion of the neighbor discovery process of the previous node. For the Flood method, this is the minimum time to wait between each radio module's neighbor requests.

Note The Cascade discovery method is recommended for large networks.

Set network appearance preferences

The Network preferences has a sub-category named Appearance where you can customize the appearance of node links in Network view.

1. On the XCTU toolbar, click the **Preferences** button to open the **Preferences** dialog.
2. On the left side of the **Preferences** dialog, select **Network** and then select **Appearance**.



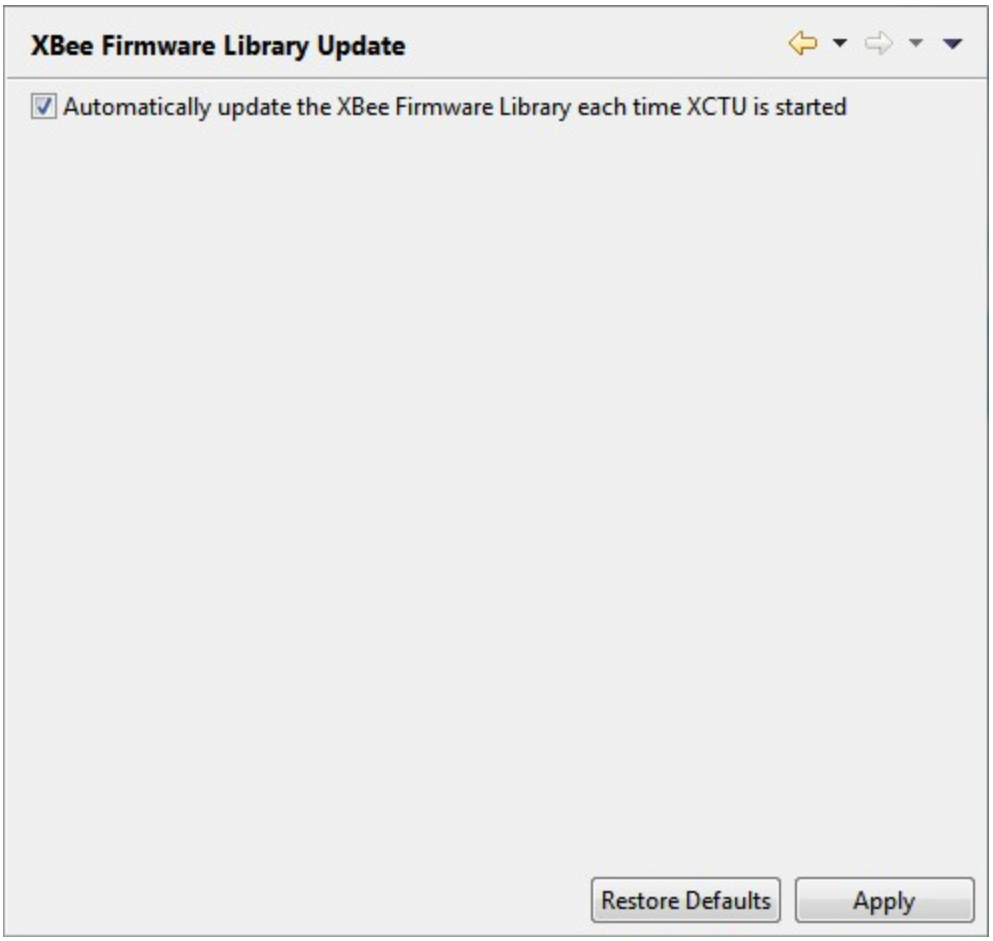
3. Configure your preferred settings and click **Apply**.

Settings	Description
Connection default color	Defines the default color of the node's connection lines.
Show colored connections based on their quality	Enables or disables the coloring of node connection lines based on their link quality.
DigiMesh / ZigBee network	Enables you to modify the maximum and minimum values and RGB colors for each quality range. Click in the cell, type the value, and click **Enter** to change a value. Ranges include minimum values but not maximum values. When you change the minimum value of a quality range, the maximum value of the next range adopts a corresponding value.

Set radio firmware library preferences

You can configure XCTU to look for new radio firmware at startup.

1. On the XCTU toolbar, click the **Preferences** button . The **Preferences** dialog appears.
2. On the left side of the Preferences dialog, select **Radio Firmware Library Update**.



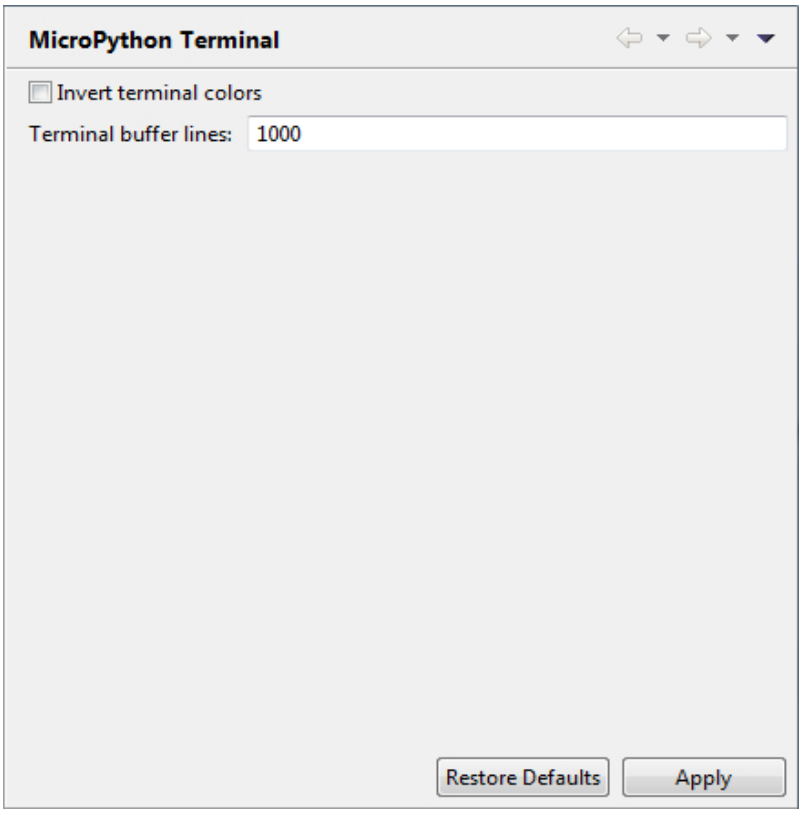
3. Check **Automatically update the Radio Firmware Library each time XCTU is started**. If you do not select this option, you can only check for firmware updates manually.
4. Click **Apply**.

For more information, see Update radio firmware library.

Set MicroPython Terminal preferences

You can configure some terminal related preferences of the MicroPython terminal tool.

1. On the XCTU toolbar, click the **Preferences** button . The Preferences dialog appears.
2. On the left side of the Preferences dialog, select **MicroPython Terminal**.



3. Configure your preferred settings and click **Apply**.

Field	Description
Invert terminal colors	Inverts the colors of the terminal. By default, this sets the background from white to black and the font color from black to white.
Terminal buffer lines	Sets the maximum number of lines that are displayed in the terminal.

Update software

XCTU allows you to automatically update the radio firmware library and the XCTU application itself without downloading any extra files. These processes can be configured to execute automatically, but you can also execute them manually at any time. For more information about configuring automatic XCTU and radio firmware library updates, see Configure XCTU.

Update radio firmware library 120
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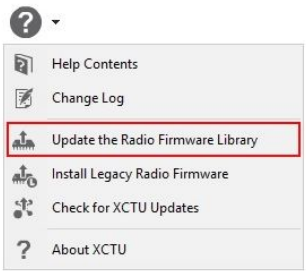
Update radio firmware library

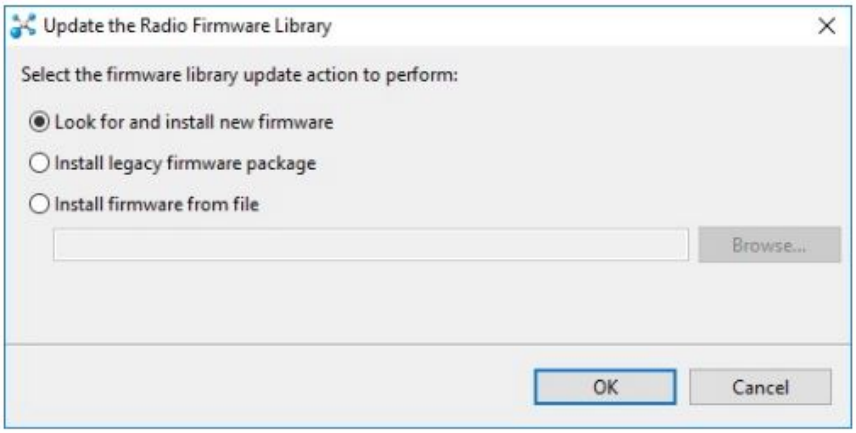
Digi periodically releases new versions of the radio firmware to fix issues, improve functionality, or add new features. These firmware files might not be included with XCTU and need to be added to the radio firmware library. Also, new RF products may be launched in the market that require new radio firmware to be configured with XCTU. For this reason, XCTU can update the radio firmware library from the application itself.

You can configure XCTU so the firmware is automatically updated. For more information, see XCTU preferences. To manually update the radio firmware library:

1. Select **Help** > **Update Radio Firmware Library** option.



2. Do one of the following:
   - To look for new radio firmware inside Digi's update site, select **Look for and install new firmware**.
   - To install legacy radio firmware, select **Install legacy firmware package**.
   - To install a local radio firmware file, select **Install firmware from file** and specify the path where the file is located.



3. Click **OK** to start. A dialog displays the status of the download process.
4. You can click the **Run in background** button of the progress dialog to execute this process in the background. This allows you to keep working with XCTU while the new firmware is downloaded. The status bar displays the update process.

   When the process finishes, a dialog displays the list of downloaded firmware.

Note Downloading the firmware does not automatically update attached modules.

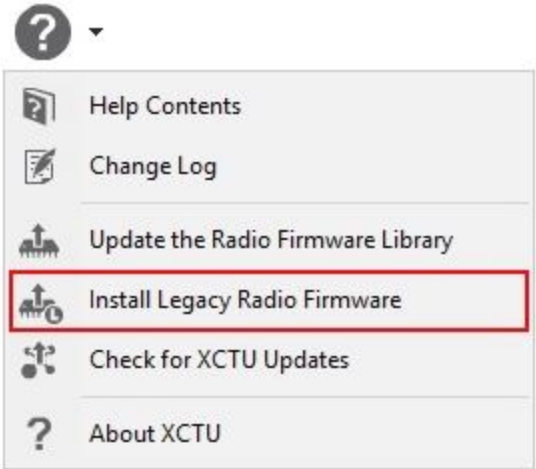
Install legacy radio firmware

The latest versions of XCTU provide only the latest firmware versions of the currently supported products and families. In the past, the current version of XCTU installed all of the existing radio firmware versions.

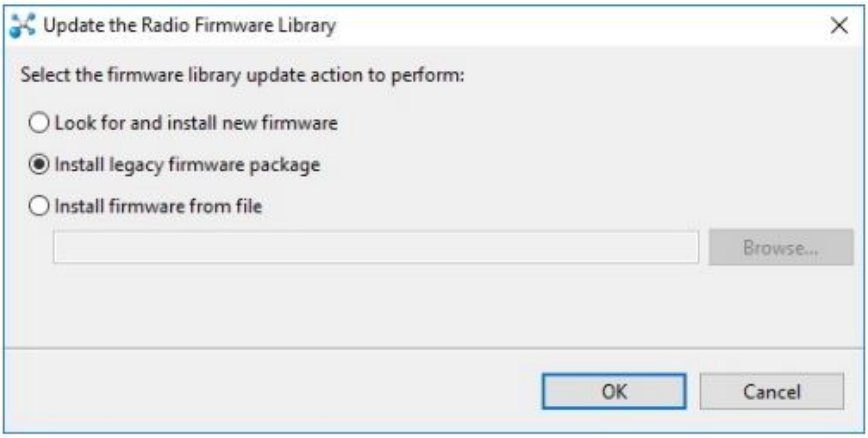
However, if you have a legacy product or an old firmware version that cannot be found in XCTU, you can install the legacy radio firmware package.

To install the legacy radio firmware package:

1. Select **Help** > **Install Legacy Radio Firmware** option. The **Update the Radio Firmware Library** dialog appears.



2. In the **Update the Radio Firmware Library** dialog, select the **Install legacy firmware package** option. This option should be selected by default.



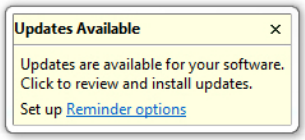
3. Click **OK** to start. A dialog displays the status of the download process.
4. Click the **Run in background** button in the progress dialog to run the download process in the background. This allows you to keep working with XCTU while the legacy firmware is downloaded. The status bar displays the update process.

   When the process finishes, a dialog displays the list of installed firmware.

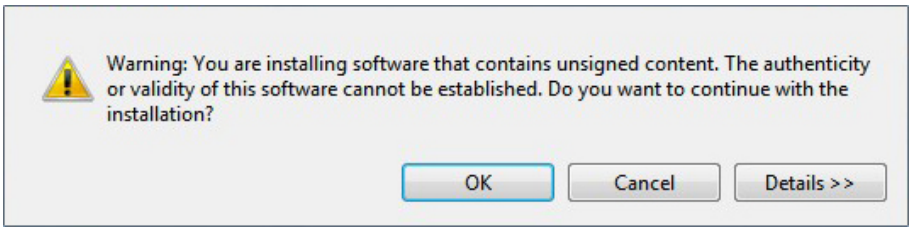
Install XCTU updates

When you start XCTU, you may be notified about software updates. You should always run the latest version of XCTU.

1. When a new version is available, a pop-up window appears in the bottom-right corner of XCTU.



2. Click anywhere in that window and follow the prompts to proceed with the update.
3. During installation, you may be asked if you want to proceed with installing unsigned software.

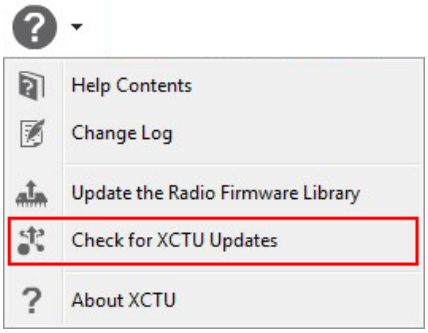


Click **OK** to continue.

4. When the installation process is finished, you must reset XCTU so new changes can be applied. When prompted, click **Yes** to restart XCTU.

Note You can click the **Run in background** button of the progress dialog to execute this process in the background. The status bar displays the update process.

5. Once restarted, XCTU displays a change log. You can manually open the change log at any time by clicking **Help** > **Change Log**.
6. You can also check for updates and manually update the tool by clicking **Help** > **Check for XCTU Updates**.

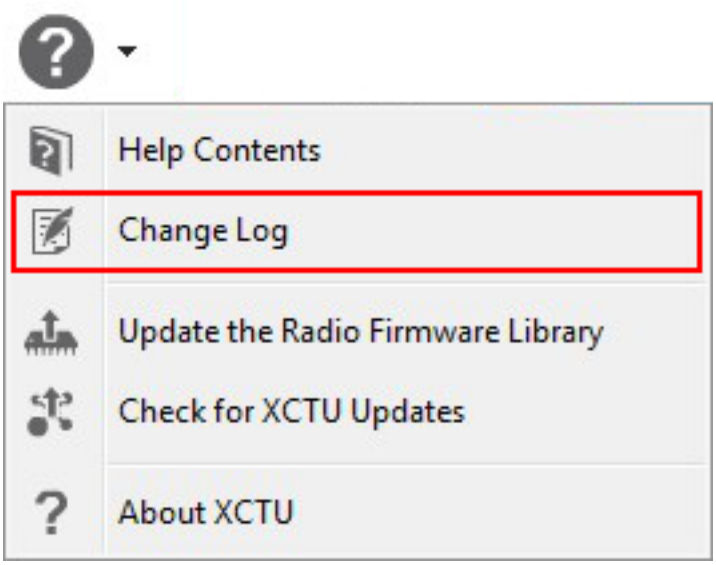


If an update for the application is found, a dialog box displays the update. Click **Finish** to start the update process.

Open change log

XCTU includes a change log with historical changes and additions between versions. You can view the change log at any time. To open the change log:

Select **Help** > **Change Log**.



A new dialog opens listing all the XCTU versions with their corresponding dates and changes.

Use the XCTU command line

This section describes how to automate tasks using the XCTU command line interface.

Understanding the XCTU command line interface 125
List ports via command line 125
Load profile via command line 126
Update firmware via command line 127

Understanding the XCTU command line interface

The XCTU Command-Line Interface (CLI) enables you to manage and automate certain tasks without launching the graphic user interface.

The CLI uses a multipart structure on the command line:

```
XCTUcmd <command> <required parameters> [optional parameters]
```

The first portion of the syntax is the base call to XCTUcmd executable. The location of this file depends on your operating system:

OS	File location
Windows	<installation_directory>/XCTUcmd.exe
MacOS X	<installation_directory>/XCTU.app/Contents/MacOS/XCTUcmd
Linux	<installation_directory>/XCTUcmd

The next part specifies a top-level command, which often represents an XCTU management action supported in the CLI. You can specify additional parameters or options for each command in any order on the command line. If an exclusive parameter is specified multiple times, then only the last value applies.

List all commands

You can run **XCTUcmd** by itself to display a list of all available commands. This is the complete list:

- **update_firmware** updates the firmware of the specified device.
- **load_profile** loads a profile to the specified device.
- **list_ports** lists all the available serial and USB ports on your computer.

Program arguments

You can also run **XCTUcmd** with specific program arguments to display information about the tool:

Display the tool usage information

```
XCTUcmd --help
```

Display the tool version

```
XCTUcmd --version
```

Print the tool error codes table

```
XCTUcmd --errorlist
```

List ports via command line

The **list_ports** command allows you to list all available serial and USB ports on your computer. To list the ports on your computer using the XCTU CLI:

1. Enter the following command syntax.

```
XCTUcmd list_ports
```

   The location of the base call to XCTUcmd executable depends on your operating system:
   - Windows: <installation_directory>/XCTUcmd.exe
   - MacOS X: <installation_directory>/XCTU.app/Contents/MacOS/XCTUcmd
   - Linux: <installation_directory>/XCTUcmd

2. If the command is executed successfully, the command line prompt returns an error code 0. A return code different than 0 is represented by the error ID. Enter the following command for a list of possible errors:

```
XCTUcmd --errorlist
```

Options

Some commands have multiple options. There are no options for the **list_ports** command.

Load profile via command line

The **load_profile** command allows you to load a previously saved profile to the specified device. To load a profile using the XCTU CLI:

1. Enter the following command syntax. Both -f <file> and -p <port> are required parameters. The rest are optional. The file option must point to an existing XPRO profile. These files are generated from the XCTU graphic application and can be stored anywhere in your computer.

```
XCTUcmd load_profile -f <file> -p <port> [-b <baud_rate>] [-e] [-o] [-h] [-
F] [-R] [-P] [-v]
```

   The location of the base call to XCTUcmd executable depends on your operating system:
   - Windows: <installation_directory>/XCTUcmd.exe
   - MacOS X: <installation_directory>/XCTU.app/Contents/MacOS/XCTUcmd
   - Linux: <installation_directory>/XCTUcmd

2. If the command is executed successfully, the command line prompt returns an error code 0. A return code different than 0 is represented by the error ID. Enter the following command for a list of possible errors:

```
XCTUcmd --errorlist
```

Note Legacy XCTU *.PRO profile files are not supported by this command. If you have a legacy *.pro file, you must first load the profile in the XCTU graphic application and save it in the new XPRO format.

Options

Use the following options with the **load_profile** command:

-f <file>	Required *	Specify the profile file location path.
-p <port>	Required	Specify the serial port name to be used.
-b <baud_rate>	Optional	Specify serial connection baud rate to use. [Default 9600]
-e	Optional	Set parity to even for the serial connection. [Default NONE]
-o	Optional	Set parity to odd for the serial connection. [Default NONE]
-h	Optional	Set hardware flow control for the serial connection. [Default NONE]
-F	Optional	Force firmware update if profile firmware does not match with firmware of device.
-R	Optional **	Force a device recovery if device cannot be discovered.
-P	Optional **	Indicate that the device is a programmable radio. These radios have a baud rate of 115200 by default.
-v	Optional	Show details about the process being executed.

* File paths containing blank spaces must be quoted.

** These options may trigger an action request event where users will be asked to reset the device.

Examples

For additional guidance, see the following usage examples for the **load_profile** command:

Load profile ZB1_profile to the device connected to COM7 at 115200 bps, updating the firmware if required and displaying process details

```
XCTUcmd load_profile -f "C:\profiles\ZB1_profile.xpro"  -p COM7 -b 115200  -F -v
```

Load profile ZB2_profile to the programmable device connected to COM1 using parity even and displaying process details

```
XCTUcmd  load_profile  -f "C:\profiles\ZB2_profile.xpro"  -p COM1 -e -P -v
```

Load profile ZB3_profile to the device connected to COM4 and perform a device recovery if required

```
XCTUcmd  load_profile  -f "C:\profiles\ZB3_profile.xpro" -p COM4  -R
```

Update firmware via command line

The **update_firmware** command allows you to update the firmware of the specified device. To update firmware using the XCTU CLI:

1. Enter the following command syntax. Both -f <file> and -p <port> are required parameters. The rest are optional. The file option must point to an existing firmware description XML file. These files are stored within the XCTU installation path under a folder named radio_firmwares, sorted by protocols or hardware models.

   ```
   XCTUcmd update_firmware -f <file> -p <port> [-b <baud_rate>] [-e] [-o] [-h]
   [-R] [-P] [-v]
   ```

The location of the base call to XCTUcmd executable depends on your operating system:

- Windows: <installation_directory>/XCTUcmd.exe
- MacOS X: <installation_directory>/XCTU.app/Contents/MacOS/XCTUcmd
- Linux: <installation_directory>/XCTUcmd

2. If the command is executed successfully, the command line prompt returns an error code 0. A return code different than 0 is represented by the error ID. Enter the following command for a list of possible errors:

```
XCTUcmd --errorlist
```

Set options

Use the following options with the **update_firmware** command:

Option	Required/optional	Action
-f <file>	Required *	Specify the firmware file location path.
-p <port>	Required	Specify the serial port name to be used.
-b <baud_rate>	Optional	Specify serial connection baud rate to use. [Default 9600]
-e	Optional	Set parity to even for the serial connection. [Default NONE]
-o	Optional	Set parity to odd for the serial connection. [Default NONE]
-h	Optional	Set hardware flow control for the serial connection. [Default NONE]
-R	Optional **	Force a device recovery if device cannot be discovered.
-P	Optional **	Indicate that the device is a programmable radio. These radios have a baud rate of 115200 by default.
-v	Optional	Show details about the process being executed.

* File paths containing blank spaces must be quoted.

** These options may trigger an action request event where users will be asked to reset the device.

Examples

For additional guidance, see the following usage examples for the **update_firmware** command:

Flash XBP24-ZB_23A7_S2B firmware to the device connected to COM7 at 115200 bps and display process details:

```
XCTUcmd update_firmware -f "C:\Program Files (x86)\Digi\XCTU-NG\radio_
firmwares\xbee_zb\XBP24-ZB_23A7_S2B.xml" -p COM7 -b 115200 -v
```

Flash XBP24-ZB_23A7_S2B firmware to the programmable device connected to COM1 using HW flow control and display process details:

```
XCTUcmd update_firmware -f "C:\Program Files (x86)\Digi\XCTU-NG\radio_
firmwares\xbee_zb\XBP24-ZB_23A7_S2B.xml" -p COM1 -h -P -v
```

Flash XBP24-ZB_23A7_S2B firmware to the device connected to COM4 and perform a recovery if required:

```
XCTUcmd update_firmware -f "C:\Program Files (x86)\Digi\XCTU-NG\radio_
firmwares\xbee_zb\XBP24-ZB_23A7_S2B.xml" -p COM4 -R
```

XCTU tools

XCTU includes a set of embedded tools that you can execute at any time, regardless of the active working mode.

Access the following XCTU tools from the **Tools** drop-down menu of the main toolbar:

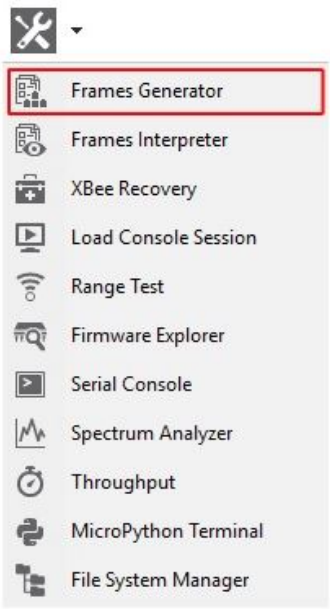
Icon	Tool	Description
	Frames generator tool	Generate an API frame.
	Frames interpreter tool	Decode any API frame and get the value of any field.
	XBee recovery tool	Recover a radio module that is out of communication.
	Load console session tool	Load and navigate previously saved console sessions.
	Range test tool	Perform a range test between two radio modules in your network.
	Firmware explorer tool	Navigate and investigate any XCTU-hosted radio firmware.

Icon	Tool	Description
	Serial console tool	Open a serial communication with a radio module without adding it to your device list.
	Spectrum analyzer tool	Test and measure the spectrum of a radio band.
	Throughput tool	Measure the transfer ratio between two radio modules in the same network.
	MicroPython Terminal tool	Communicate with the XBee Cellular Modem when it is in MicroPython mode.
	File system manger tool	Access and interact with the file system of your XBee module.

Frames generator tool

The Frames generator tool generates any type of API frame (output or input), automatically generating the byte array from a series of inputs in the tool. You do not have to add a radio module to your device list to use the Frames generator tool. Frame parameters are dependent on the protocol, mode, and frame type you choose from the drop-down boxes. For more information, see API frames.

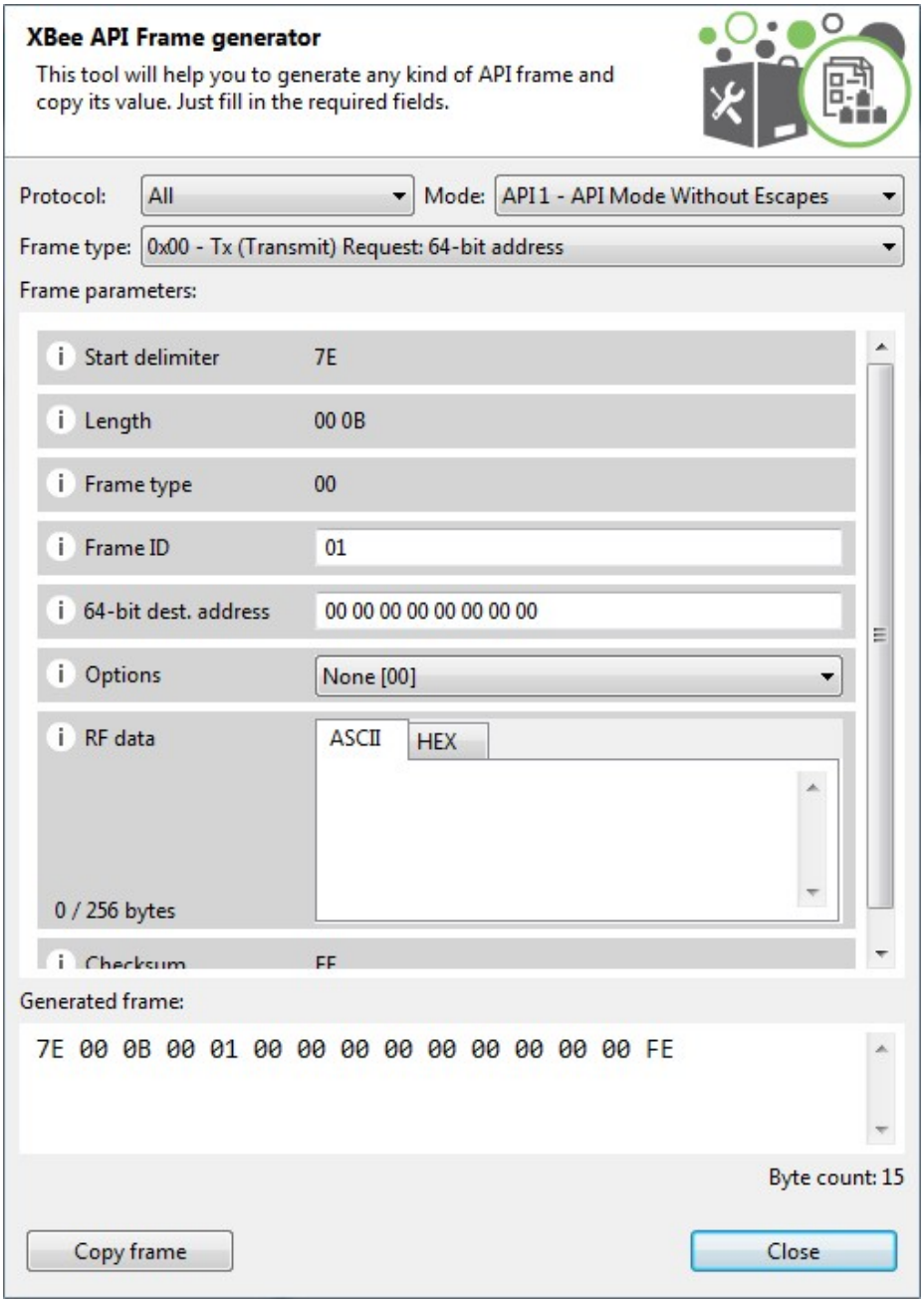
To open the **Frames generator** tool, select **Frames generator** from the **Tools** drop-down menu on the main XCTU toolbar.



Note You can also access the Frames generator tool from the API console when you add a new API frame to the list of frames to send. Use the **OK** button to automatically copy the generated byte array to the content of the frame to be added.

XBee API Frame generator dialog

Use the Frame generator dialog to generate an API frame. For instructions, see Generate an API frame.



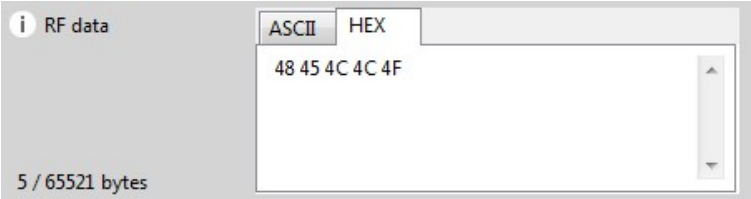
The following table provides descriptions of the fields in the XBee API Frame generator dialog.

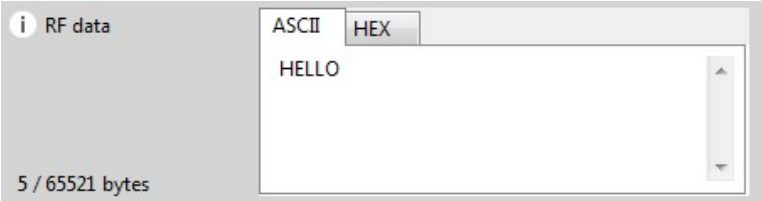
Field	Description
Protocol	Radio protocol of the frame to be generated. Select **All** to display all frame types.
Mode	API mode (API or API escaped) of the frame to be generated.
Frame type	API frame type of the frame to be generated.

Field	Description
Frame parameters	Options are dependent upon the selected API frame. Hover over the information icon next to each setting to view a short description of the setting and its parameters.
Generated frame	Byte array result of API frame generation. You can select and copy the text or use the **Copy frame** button.

ASCII/HEX conversion

Settings with text boxes have a tab control with two tabs, HEX and ASCII, that allow you to fill the setting with ASCII or HEX values. If you enter a value in HEX, the same value is represented in the ASCII tab, and vice versa.





Generate an API frame

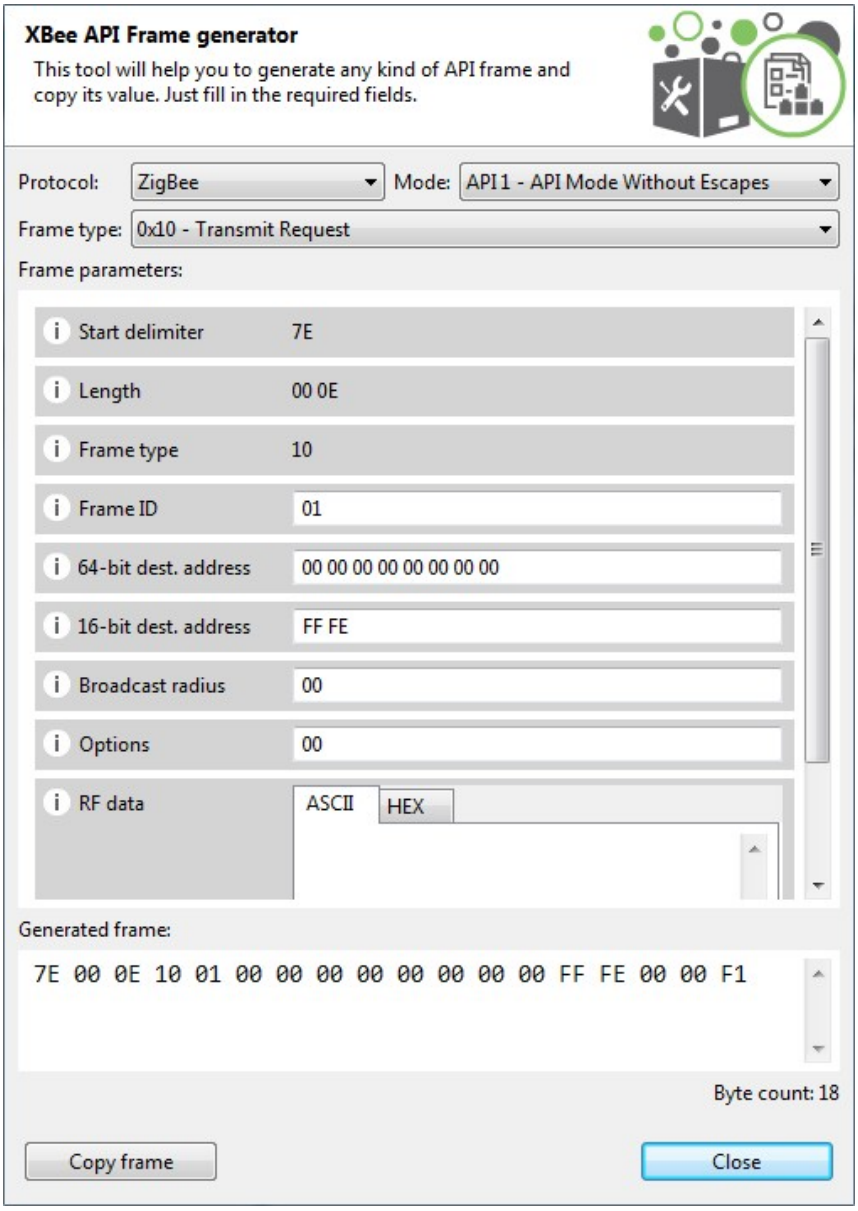
Follow these instructions to generate an API frame (output or input). For more information, see the Frames generator tool.

1. Launch the XBee API Frame generator tool by selecting **Frames generator** from the **Tools** drop-down menu on the main toolbar. The **XBee API Frame generator** dialog appears.
2. For **Protocol**, select a radio protocol to display its corresponding API frames. If you select **All**, all the frame types are displayed.
3. For **Mode**, select the API mode (API or API Escaped) of the frame to generate.

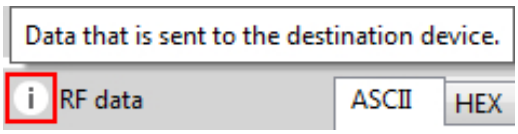
   Tip To learn more about these modes, see API operating mode and API escaped operating mode.

4. For **Frame type**, select the API frame type you want to generate.

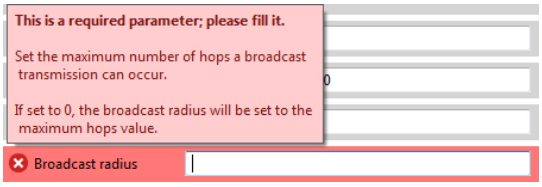
   The selected frame's settings appear in the **Frame parameters** area. In this example, we selected the **ZigBee** protocol and the **ZigBee Transmit Request** API frame type.



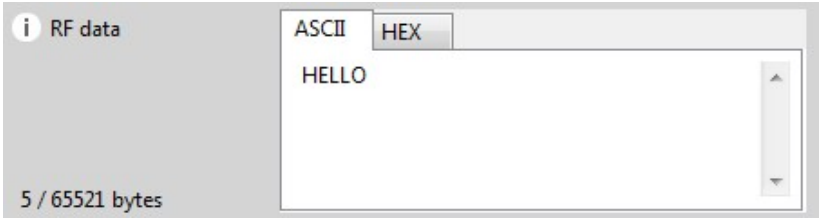
5. Hover over a setting's information icon to see a short description of the setting and its parameters.

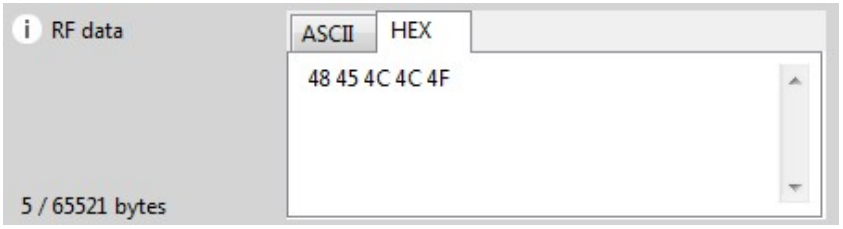


6. If any setting is not configured correctly, its background color changes to red and the information icon is replaced by a red cross. Hover over the icon to display the error message.

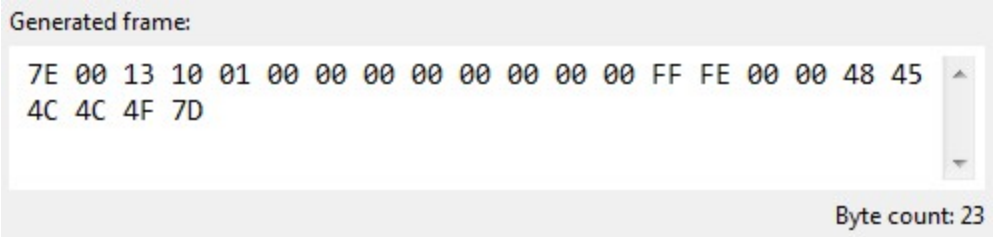


7. For **RF data**, you can enter a value in ASCII or HEX. If you enter a value in HEX, the same value is represented in the ASCII tab, and vice versa.





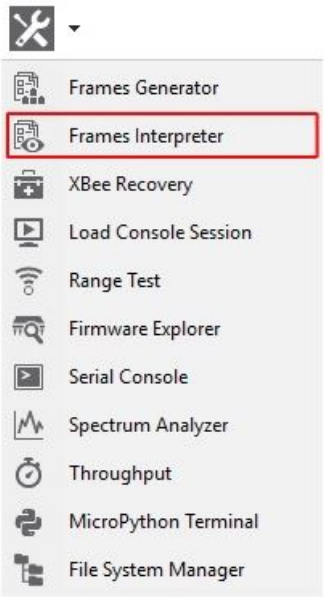
8. After you fill in all of the settings correctly, the frame is generated automatically and the byte array of the frame is displayed in the **Generated frame** box. You can copy it from here or click the **Copy frame** button.



Frames interpreter tool

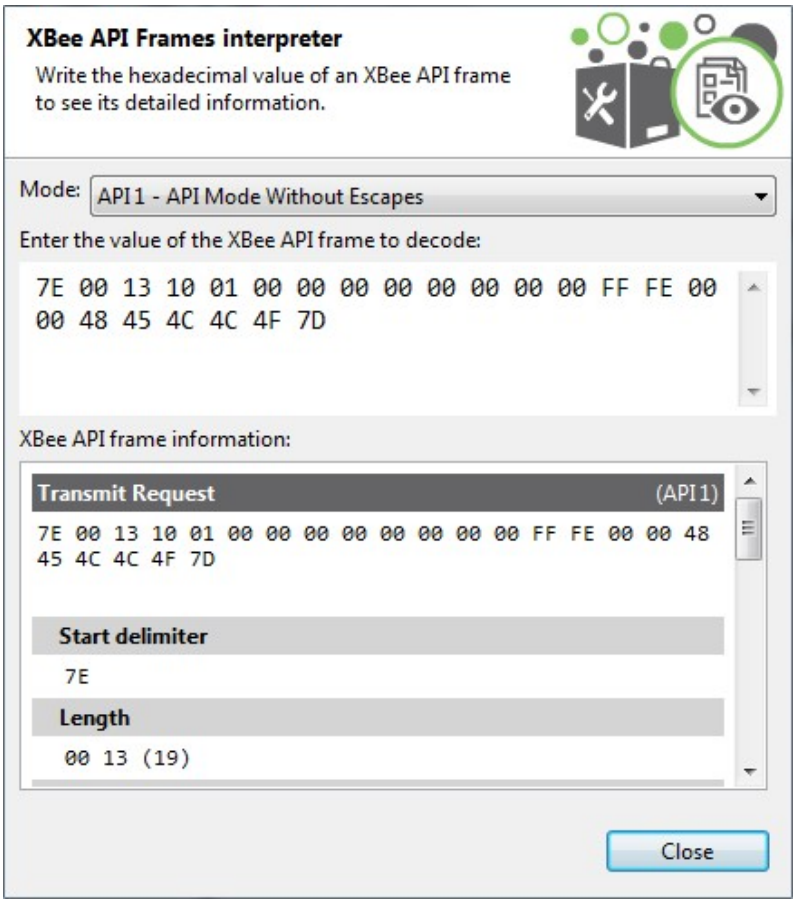
The **Frames interpreter** tool decodes the byte array of an API frame and displays it in a set of fields with corresponding values. The number of frame fields depends on the API frame type.

To open the **Frames interpreter** tool, select **Frames interpreter** from the **Tools** drop-down menu on the main XCTU toolbar.

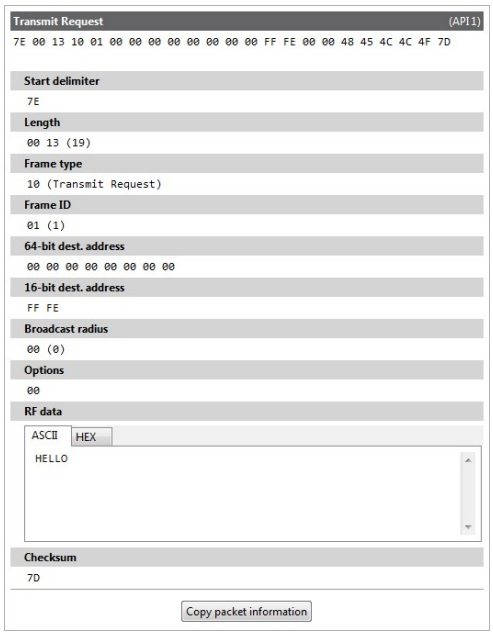


XBee API Frames interpreter dialog

Use the Frames interpreter dialog to decode the byte array of an API frame.



The following table provides descriptions of the fields in the XBee API Frames interpreter dialog.

Field	Description
Mode	API mode or API escaped mode
API frame value	Byte array of the API frame to decode. The value of each byte must be hexadecimal without the "0x" prefix.
API frame information	Includes the type of API frame with all specific frame fields as well as the start delimiter, length, and checksum of the frame. Frames with an RF data field display the data in both Hexadecimal and ASCII formats. 
Copy packet information	Copies the decoded API frame information to the clipboard in plain text.

Decode a frame

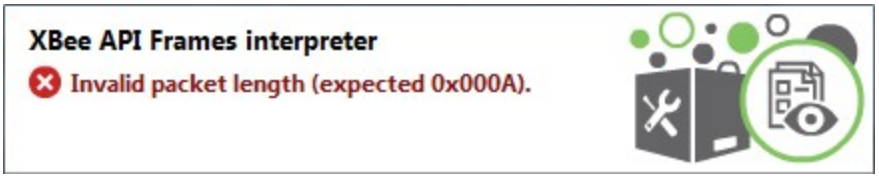
Follow these steps to decode a frame. For more information, see the Frames interpreter tool.

1. Launch the Frames interpreter tool by selecting **Frames interpreter** from the **Tools** drop-down menu on the main toolbar. The **XBee API Frame interpreter** dialog appears.
2. For **Mode**, select the API mode (API or API Escaped) of the frame to generate.

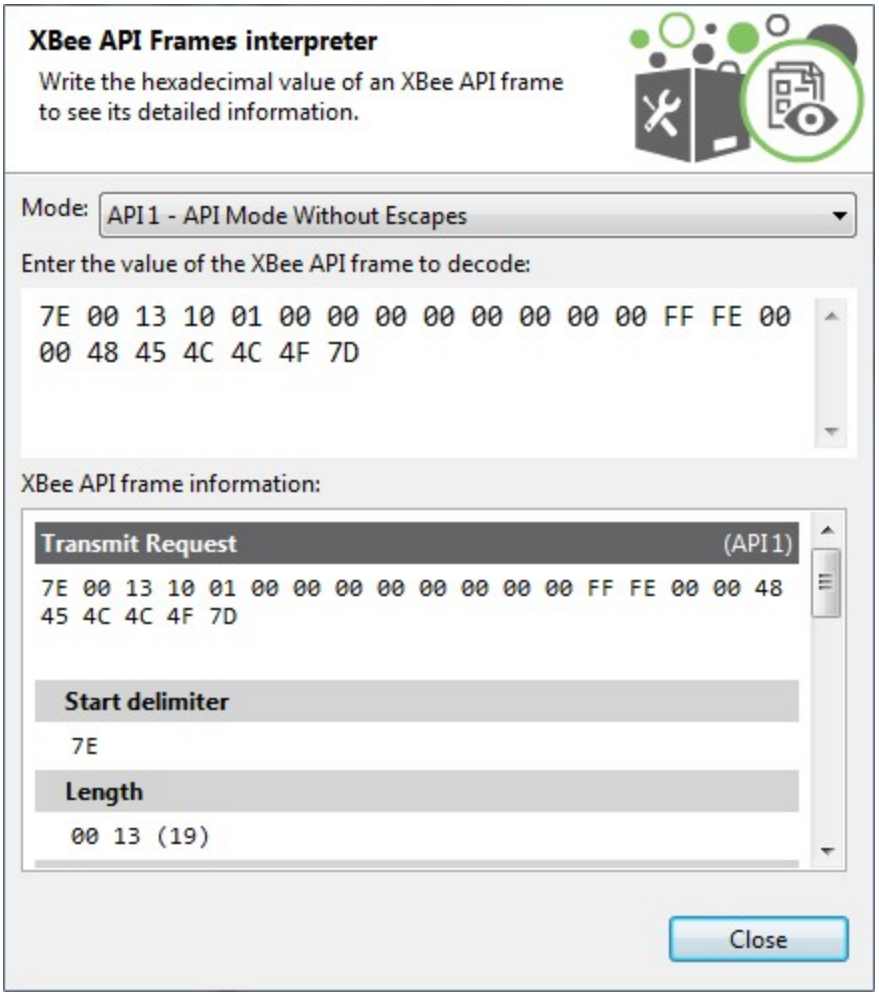
   Tip To learn more about these modes, see API operating mode and API escaped operating mode.

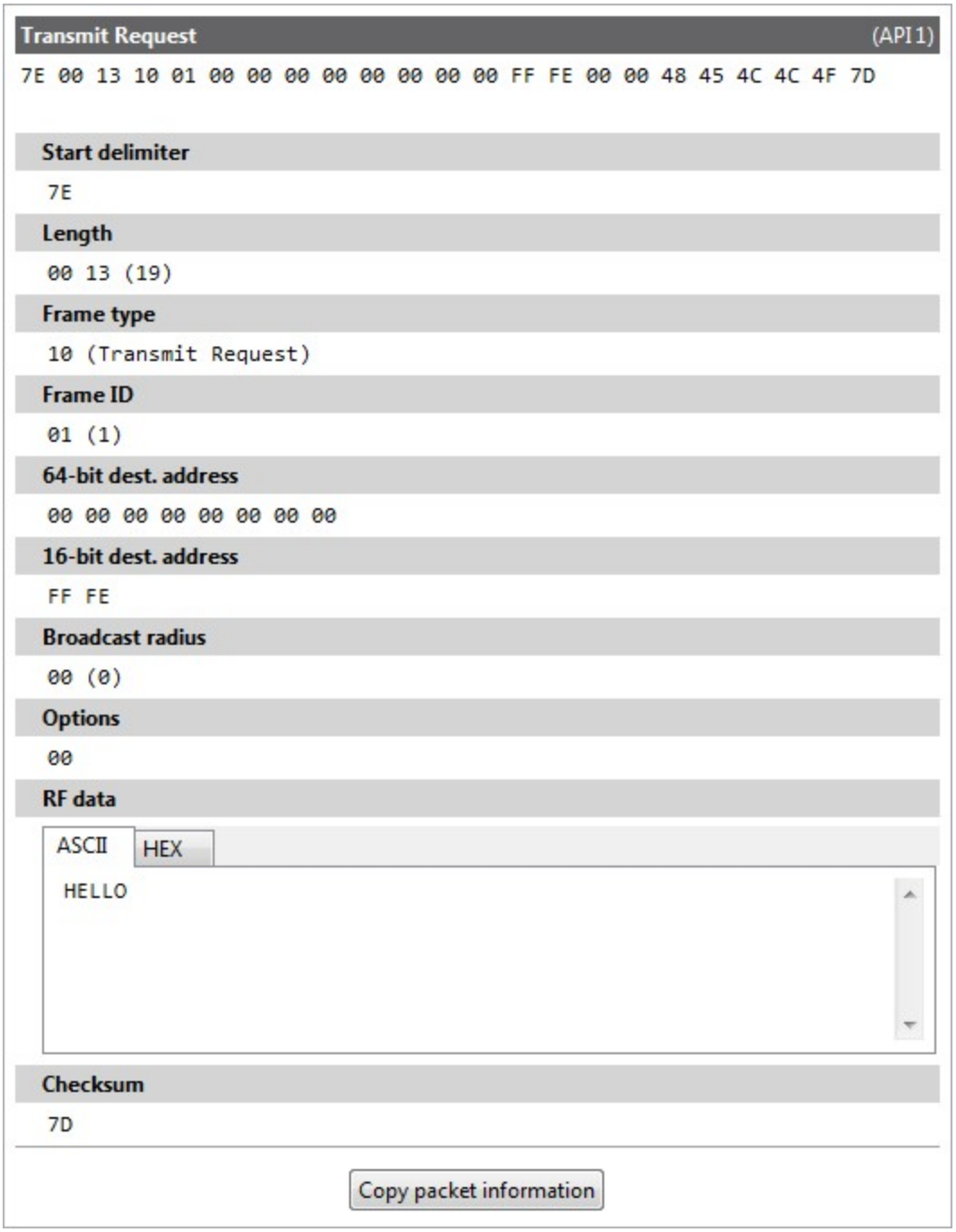
3. Below the API mode selection there are two text boxes. Enter the byte array of the API frame to decode in the top text box. The value of each byte must be hexadecimal and without the "0x" prefix.

   If the byte array is not valid, the tool displays the corresponding error at the top.



   If the byte array is valid, the bottom text box displays information about the API frame.

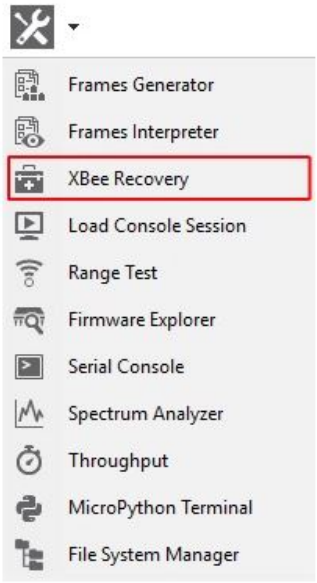




XBee recovery tool

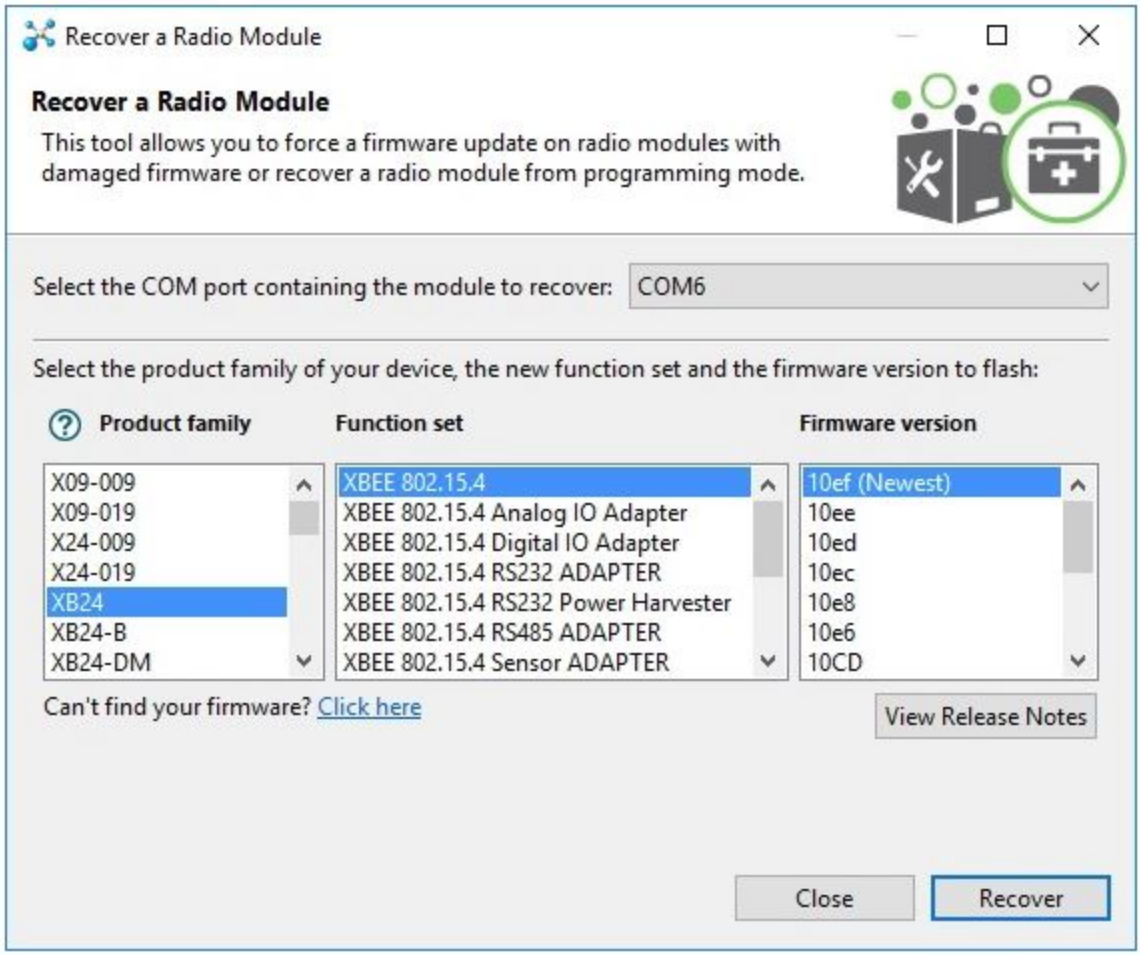
The **XBee recovery** tool is an embedded tool that you can use to force a firmware update on radio modules with damaged firmware. You can also use this tool to recover a radio module from programming mode.

To open the **XBee recovery** tool, select **XBee recovery** from the **Tools** drop-down menu on the main XCTU toolbar.



Recover a radio module dialog

Use the Recover a radio module dialog to force a firmware update on radio modules or recover radio modules. For instructions, see Recover a radio module.



The following table provides descriptions of the fields in the Recover a radio module dialog.

Field	Description
COM port	Serial port where the module to be recovered is connected
Product family	Product family of the module to be recovered. If you do not know the product family, check the label on the back of the device.
Function set	Determines the available functionality such as mode of operation; end device, router, or coordinator designation; special sensor and adapter settings; etc. Available options depend on the module selected.

Field	Description
Firmware version	Firmware version to flash to the module to be recovered. The most recent firmware version appears at the top of the list.
View release notes	Enabled if the selected firmware has release notes available. Click to open a new dialog containing release notes for the selected firmware.

Programmable XBee radio modules and the XLR PRO cannot be recovered using the **XCTU recovery** tool.

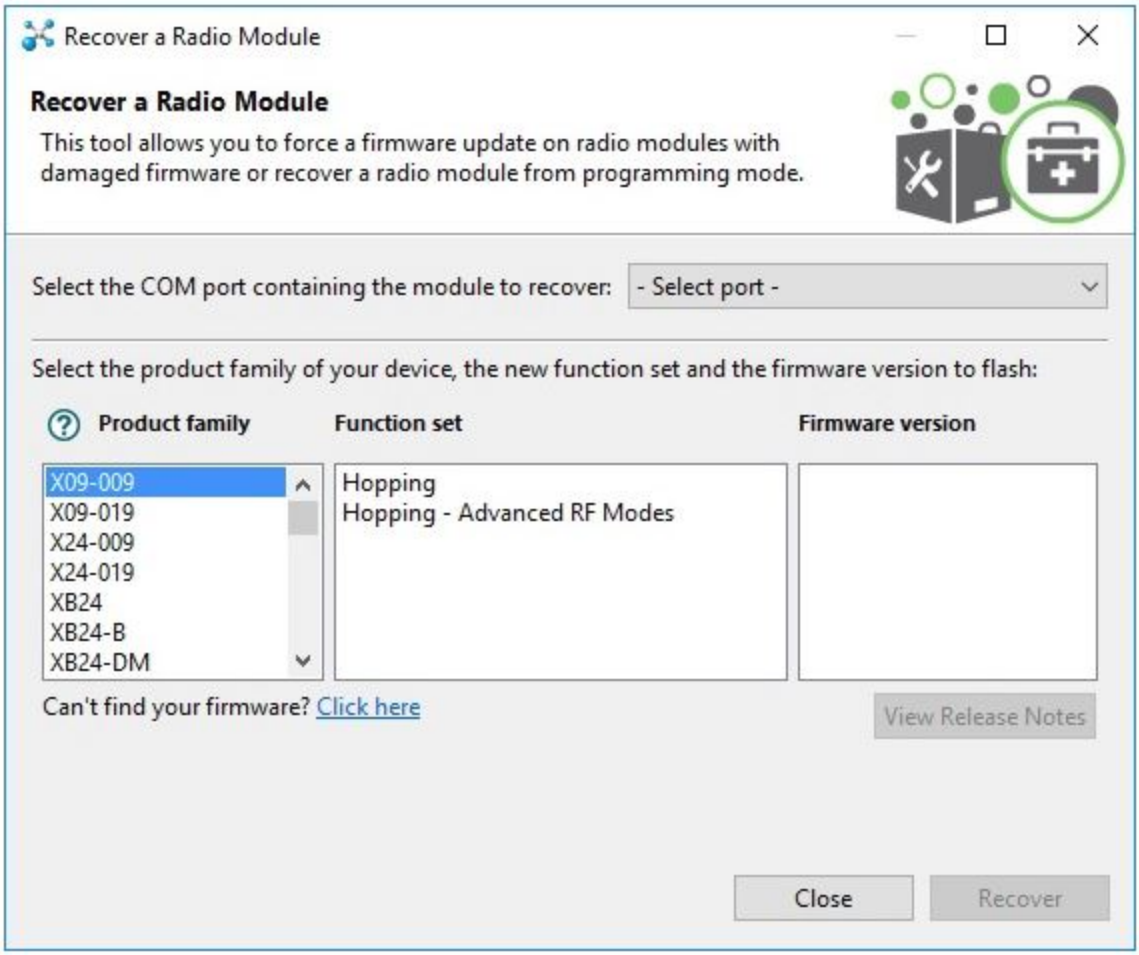
Note The recovery process may require you to reset the radio module. Reset the module and wait for the dialog to close; the recovery process will continue after the module is reset.

Recover a radio module

Follow these steps to recover radio modules that have damaged firmware or are in programming mode. For more information, see the XBee recovery tool.

Note You cannot use the recovery tool to recover programmable radio modules or the XLR-PRO.

1. Launch the XBee recovery tool by selecting **XBee recovery** from the **Tools** drop-down menu on the main toolbar. The **Recover a radio module** dialog appears.



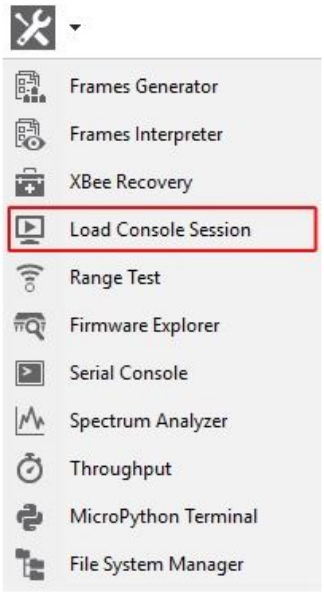
2. Select the serial port where the damaged radio module is attached.
3. Select the firmware you want to use for recovery. Specify the product family, function set, and version.
4. Click **Recover** to program the new firmware in the radio module. Click **Show Details** from the progress box to view a detailed progress log.
5. If XCTU displays a dialog asking you to reset your radio module, reset the module and wait for the dialog to close.
6. If the recovery is successful, click **OK** to close the validation message. Errors are displayed as separate error messages and are also logged in the progress log.

Note You can click **View Release Notes** if the selected firmware has available release notes.

Load console session tool

The **Load console session** tool allows you to load a saved API or AT console session to review the recorded API frames or data. You can load a session saved directly from the frames/packets log of the console or a session generated using the recording feature.

To open the **Load console session** tool, select **Load console session** from the **Tools** drop-down menu on the main XCTU toolbar.

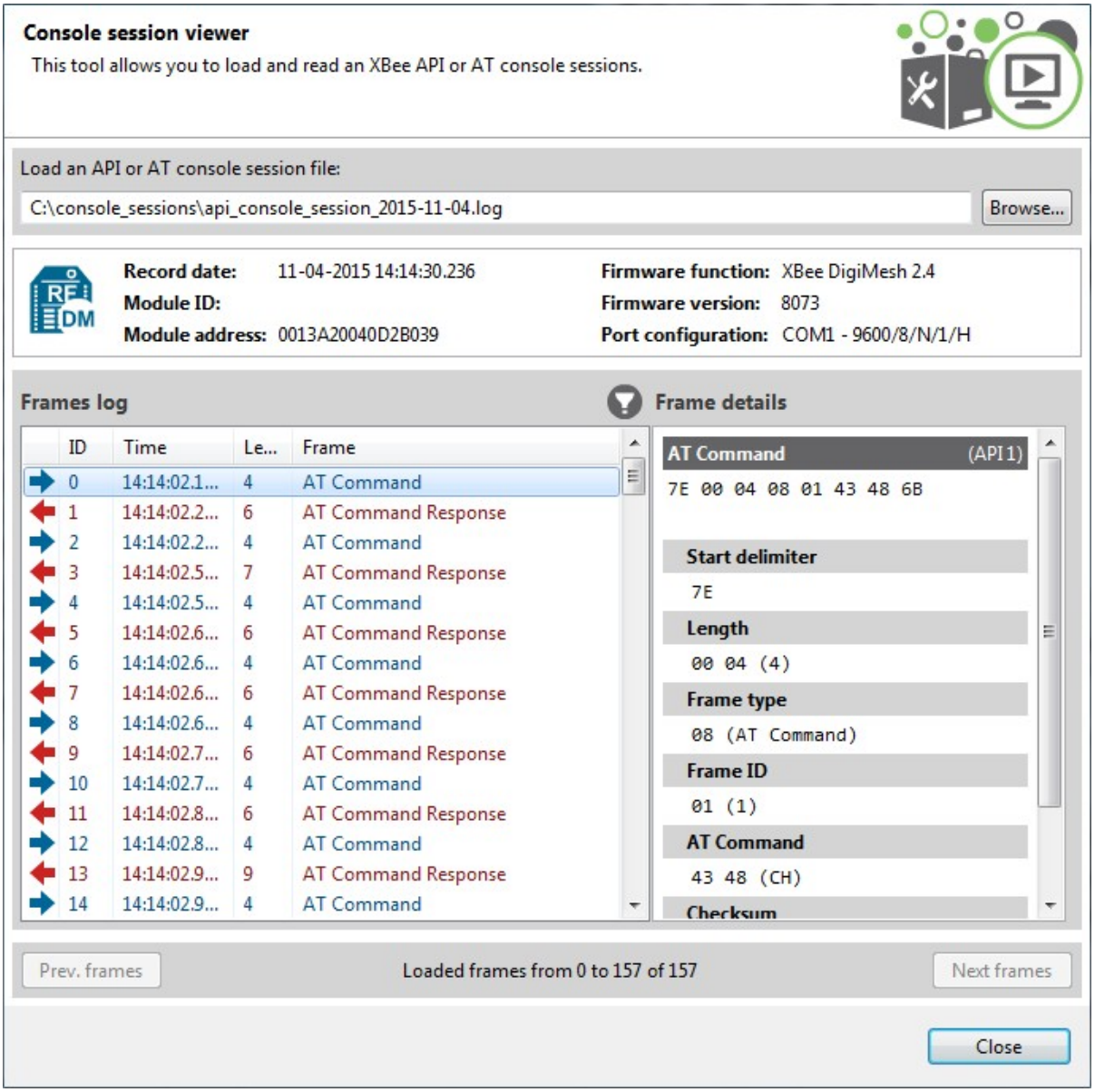


Console session viewer dialog

The Console session viewer dialog is where you can load a saved API or AT console session. For instructions, see Load a console session.

If the console session file successfully loads, the tool displays three new controls inside the Console session viewer:

- Radio module information box
- Console session control
- Session data splitting



Radio module information box

The radio module information box displays information about the radio module used in the session.

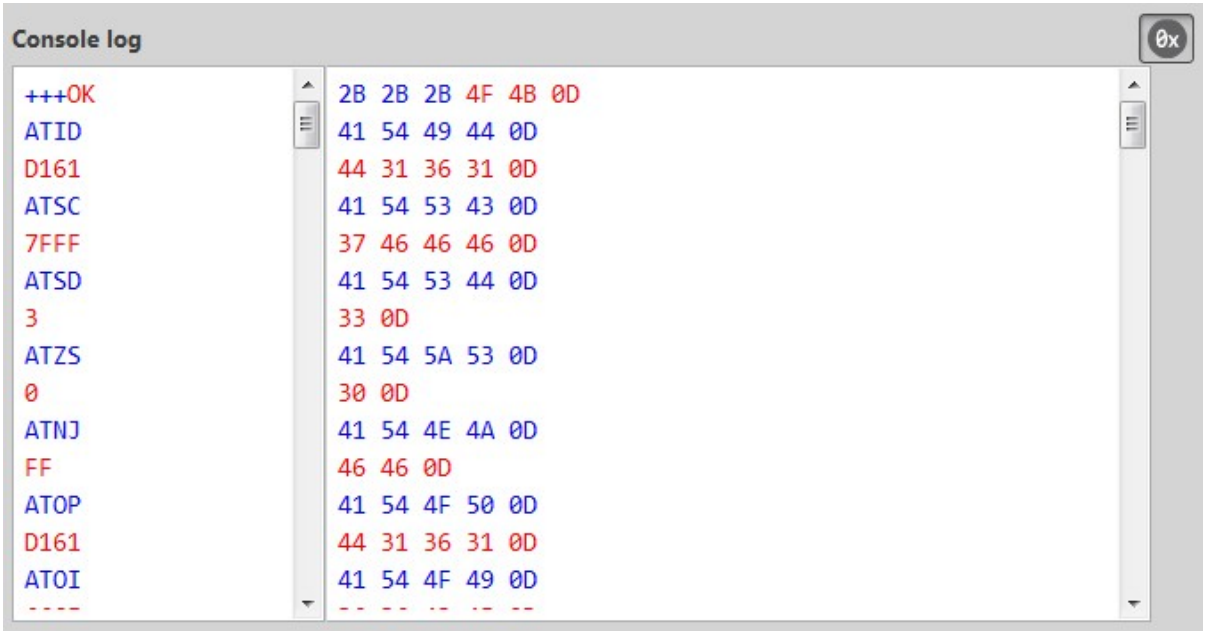
Field	Description
Icon	Represents the protocol of the radio module

Field	Description
Record date	The date the console session was saved
Module ID	The name or identifier of the radio module
Module address	The physical (MAC) address of the device
Firmware function	The function of the firmware running in the radio module
Firmware version	The version of the firmware running in the radio module
Port configuration	The radio module port statistics from the session

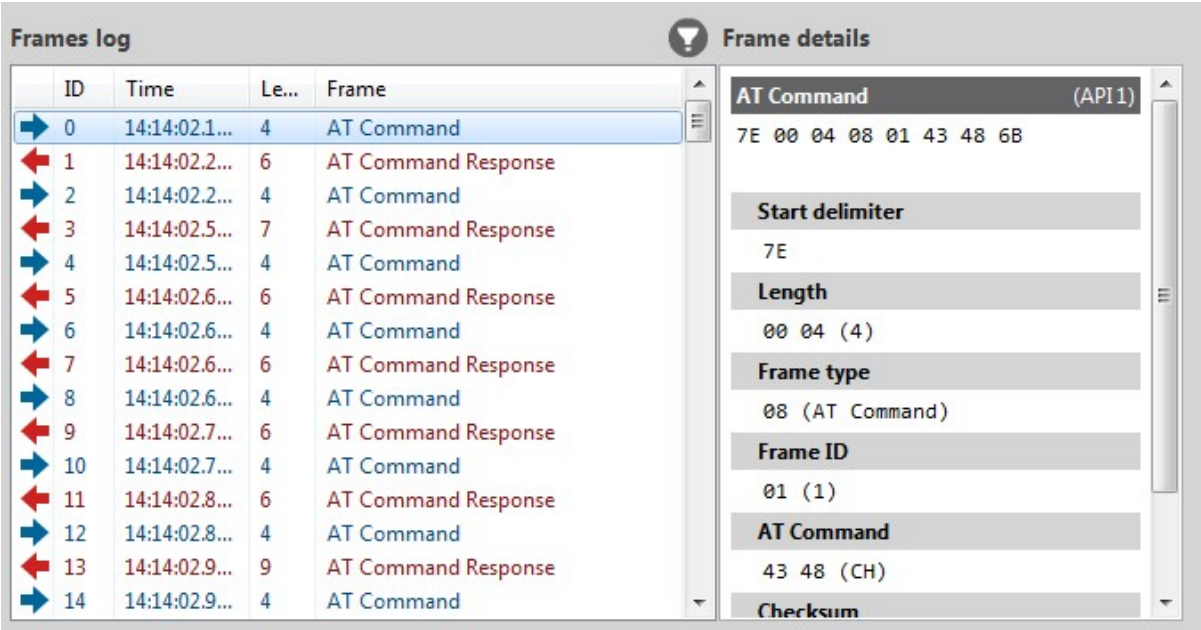
Note If the session you attempt to load corresponds to a Serial console session, the Radio module information box displays only the Record date and Port configuration fields.

Console session control

The console session control varies depending on the type of console session. If the saved console session is an AT (transparent) or Serial session, the control is the same as the one in the Data traffic monitoring section of the AT or Serial consoles. In other words, it is a data text box with the hexadecimal representation of the data.



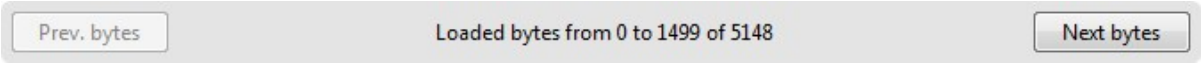
If the saved console session is an API session, XCTU displays an API frames table with an API frame details view attached on the right side. This is the same control as the one in the API frames traffic monitoring section of the API Console.

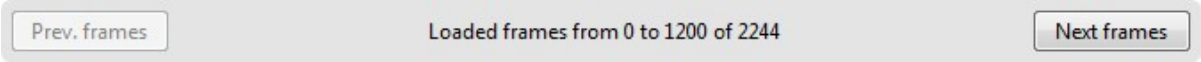


Regardless of the control displayed, you can only review the session data; any other functionality with the controls is disabled in this tool.

Session data splitting

If the data to be loaded is too long for XCTU to display all at once, the data is split into blocks of bytes (when the session is an AT or Serial session) or blocks of frames (when the session is an API session). Depending on which console you used to save the session, XCTU displays a **Frames log viewer** (API) or a **Console log viewer** (AT and Serial Console).





Note You can also use the console session scroll bar to load the next and previous blocks of data. The next block of data loads automatically when you scroll to the bottom of the control and scroll down again.

Load a console session

Follow these steps to load a saved API or AT console session. For more information, see the Load console session tool.

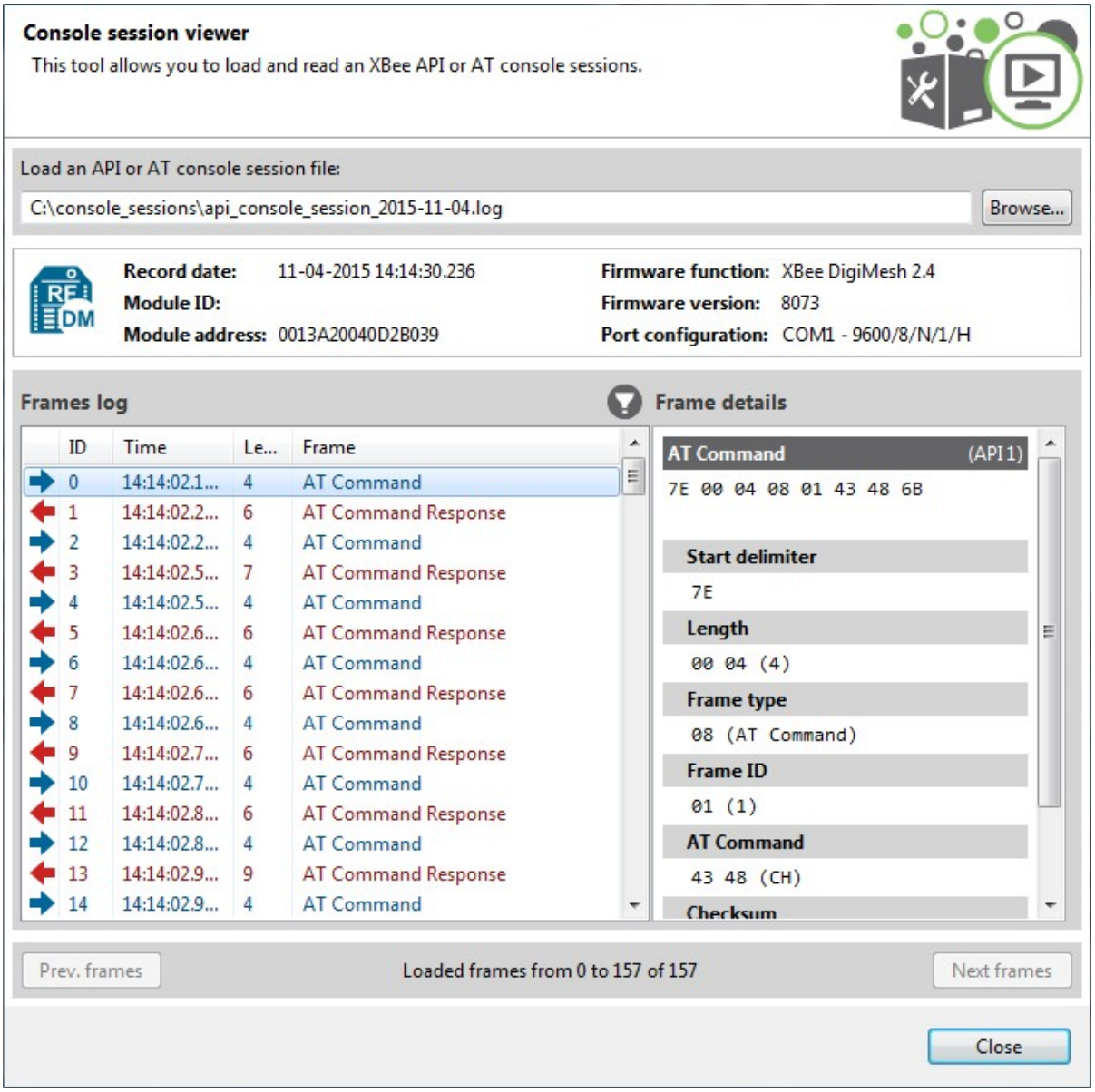
1. Launch the Load console session tool by selecting **Load console session** from the **Tools** drop-down menu on the main toolbar. The **Console session viewer** dialog opens.
2. Click **Browse**. An **Open file** dialog box asks you for a saved XML console session file.

3. Navigate to your saved console session file and click **Open**.

Note You can open log sessions in XML format that were generated with previous versions of XCTU. Although saving sessions in XML is no longer supported, XCTU maintains backward compatibility.

If the tool is not able to load the selected file, an error states the cause of the problem.

The **Console session viewer** displays a loaded console session.

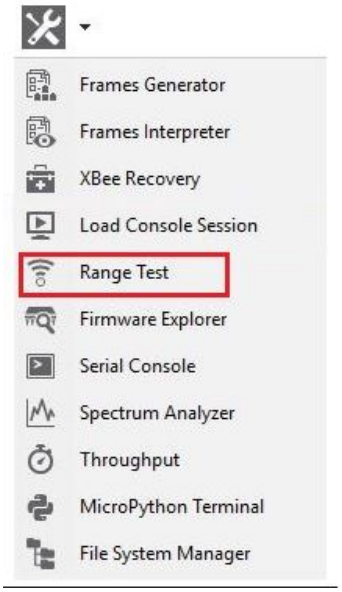


Range test tool

The Range test tool is an embedded tool that tests the real RF range and link quality between two radio modules in the same network. To perform a range test, you must have at least one local radio

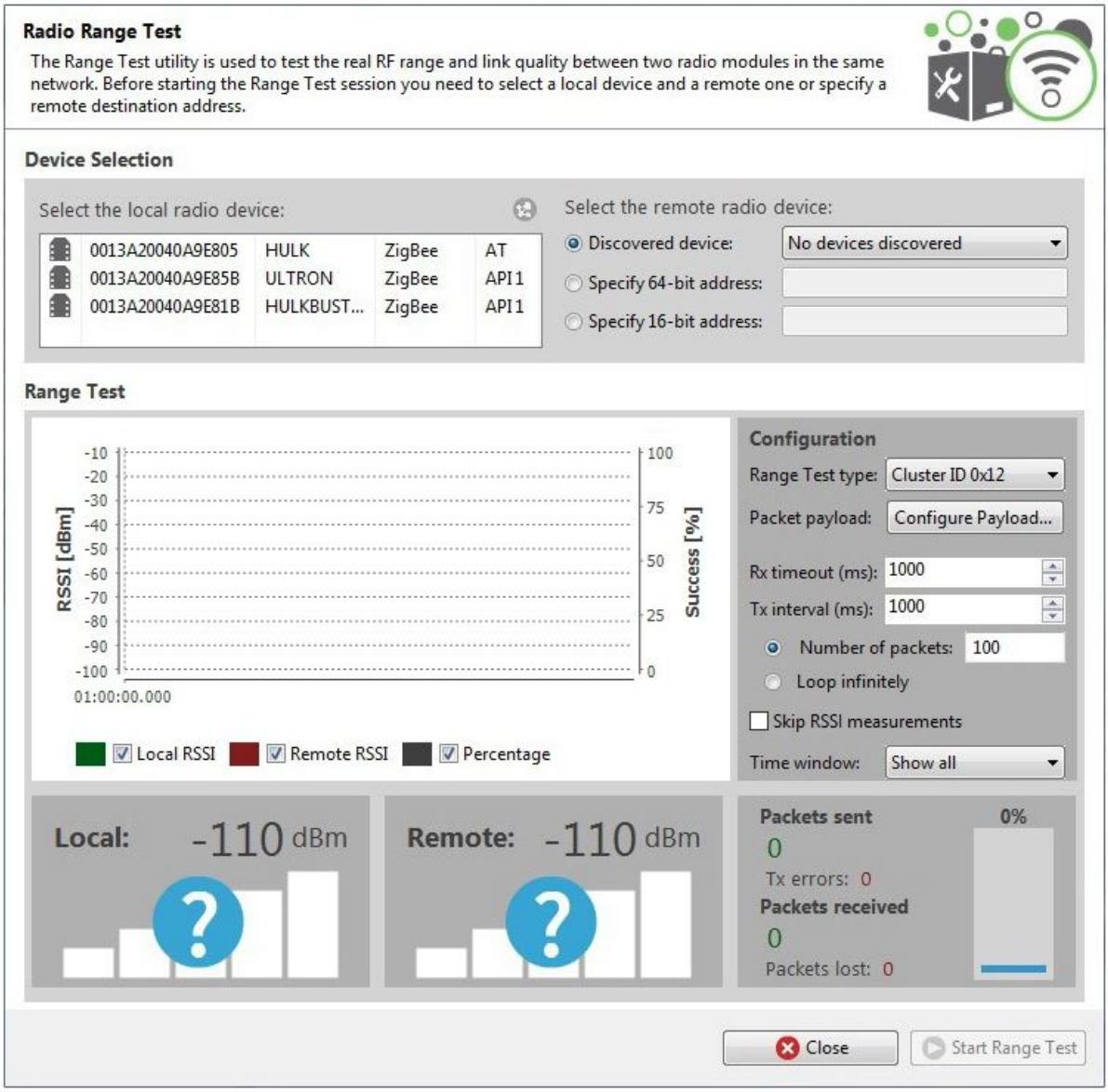
module connected to your computer and added to XCTU, and a remote device in the same network configured as the local device. See Range test.

To open the Range test tool, select **Range test** from the **Tools** drop-down menu on the main XCTU toolbar.



Radio range test dialog

Use the Radio range test dialog to perform a range test. For instructions, see Perform a range test.



The following sections provide descriptions of the controls and fields in the Radio Range Test dialog.

Device Selection

Use the **Device Selection** section to designate the local device that will perform the range test and the remote device the range test will be performed upon.

Select the local radio device:

Field/button	Description
Local device list	Populates with devices currently added to XCTU. The list provides the following information about each local device: ■ MAC address ■ Device name ■ Protocol ■ Operating mode
	Discovers remote devices for the selected local device.

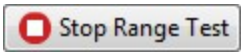
Select the remote radio device:

Field	Description
Discovered device	Displays a list of any remote devices discovered for the selected local device. Only devices whose protocols support node discovery list remote devices.
Specify 64-bit address	Allows a user to manually enter the 64-bit address of the destination device.
Specify 16-bit address	Allows a user to manually enter the 16-bit address of the destination device.

Note Not all protocols support 64- and 16-bit addressing.

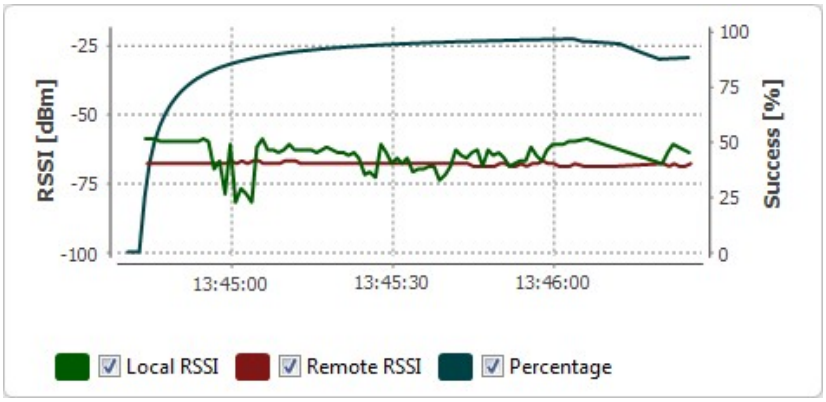
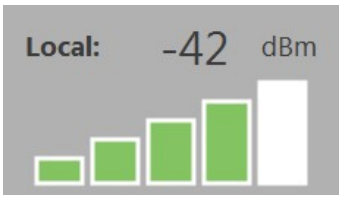
Range Test Configuration

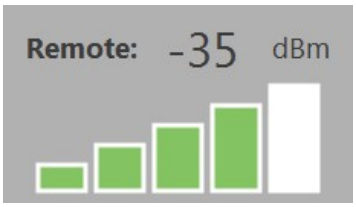
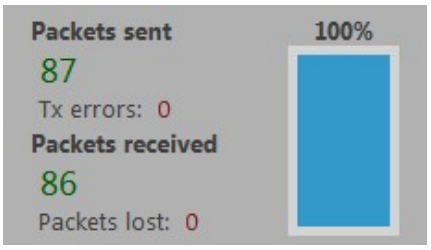
You can configure the following range test options from within the Range test tool:

Field	Description
Range Test type	■ **Cluster ID 0x12:** Performed using explicit addressing frames/packets directed to the Cluster ID 0x12 on the data endpoint (0xE8), which returns the received data to the sender. Not all protocols and operating modes support the Cluster ID 0x12 range test. XCTU displays an error message for unsupported devices. ■ **Loopback:** Performed using the serial port/USB hardware loopback capabilities. Before initiating this range test, you must configure the remote module to work in transparent mode and close the loopback jumper. Works only with remote devices in AT operating mode.
Packet payload	Allows you to configure the packet payload that will be sent to the remote device during range test. Opens a new window for ASCII/HEX input.
Rx Timeout (ms)	Sets the maximum time in milliseconds to wait for response from the remote device before considering a packet to be lost.
Tx interval (ms)	Sets the minimum time in milliseconds to wait before sending a new packet to the remote device.
Number of packets	Configures the number of packets to send in a single range test session.
Loop infinitely	When checked, configures the **Range test** tool to send packets infinitely until the session is stopped manually.
Skip RSSI measurements	When checked, the test skips the RSSI measurements. Note that you can only skip them when your local module works in **AT** (transparent) mode.
Time window	Configures the visible time window of the RSSI data measured by the range test.
	When you have configured all the options, click **Start Range Test** to start sending packets and measure the signal strength.
	You can stop the process any time by pressing the same button, now showing the text **Stop Range Test**.

Data representation

XCTU represents range test data in three ways:

	Field	Description
	RSSI chart	Represents the RSSI values of the local and remote devices during the range test session. The line graph also contains the percentage of success for the total packets sent. You can hide/show chart data by checking or unchecking **Local RSSI**, **Remote RSSI**, and **Percentage**.
	Local RSSI value	Displays instant RSSI value of a local device, in dBm, for the last packet transmitted.

	Field	Description
	Remote RSSI value	Displays instant RSSI value of a remote device in dBm, for the last packet transmitted. When the local module is working in AT (transparent) mode, XCTU cannot read the remote device RSSI value.
	Packet summary	Displays total number of packets sent and received, transmission errors, and packets lost. It also displays the percentage of success sending and receiving packets during the range test session.

Supported products

Range test is only supported in the following:

- SX
- XLR Pro Module
- ZigBee
- DigiMesh
- XTend
- XTend - DigiMesh
- XC/XSC

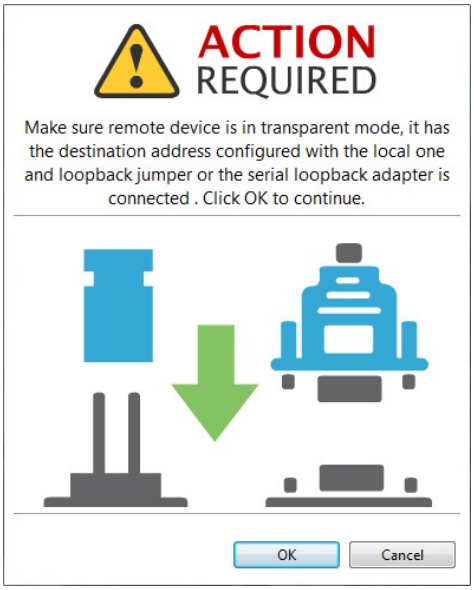
- 802.15.4
- DigiPoint

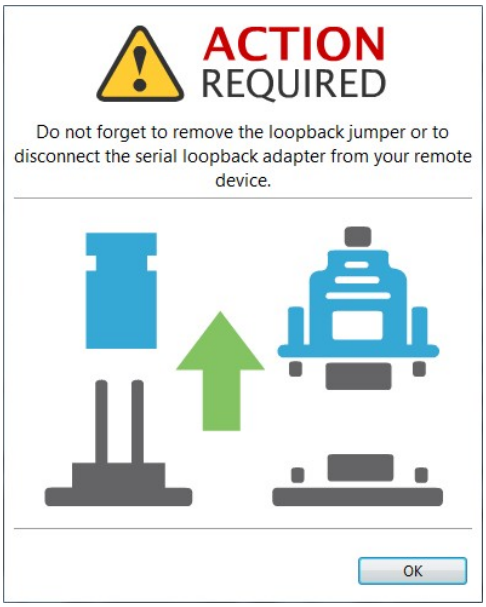
Special considerations

There are some special considerations to be aware of while working with the Range test tool:

- When the local module is working in AT (transparent) mode, the tool automatically performs configuration steps in the module before starting the range test, and after finishing or stopping it. A progress bar shows the level of completion for this process.
- When the local module is working in AT (transparent) mode, it is not possible to read the remote device RSSI value.
- The Loopback range test type only works with remote devices in AT (transparent) operating mode.

- When performing a Loopback range test, you need to connect the loopback jumper or the loopback adapter in the remote device before starting and disconnect it after finishing. A dialog box notifies you of the action required:





Range test

Since communication between XBee RF modules takes place over the air, the quality of the wireless signal can be affected by many factors: absorption, reflection of waves, line-of-sight issues, antenna style and location, etc. A range test demonstrates the real-world RF range and link quality between two XBee modules in the same network. During a range test, XCTU send data packets from the local XBee module to the remote module and waits for the echo to be returned from the remote module to the local module. XCTU counts the number of packets sent and received by the local module and

measures the signal strength of both sides as an RSSI (Received Signal Strength Indicator) value. Every sent packet from the local XBee should be received again as an echo by the same local XBee.

The following products support range testing:

- ZigBee
- DigiMesh
- XTend
- XTend - DigiMesh
- XC/XSC
- XLR PRO
- 802.15.4
- DigiPoint
- SX

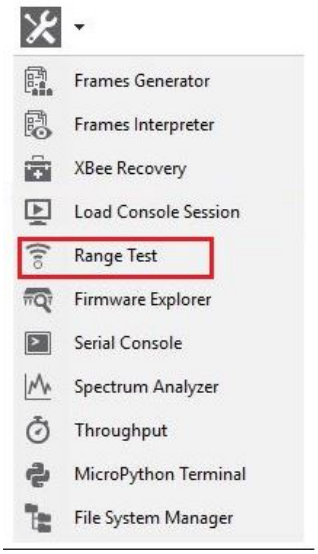
Note When deploying an actual network, perform multiple range tests to analyze varying conditions in your application.

Perform a range test

Follow these steps to perform a a range test. For more information, see the Range test tool. When the local module is working in AT (transparent) mode, the Range test tool automatically pre-configures the module before starting the range test, as well as after the range test is completed or manually stopped. A progress bar displays the level of completion for this process.

To perform a range test, you must have at least one local radio module connected to your computer and added to XCTU, and a remote device in the same network as the local device.

1. Launch the Range test tool by selecting **Range test** from the **Tools** drop-down menu on the main toolbar.



2. Select the local device that will perform the range test and the remote device against which the range test will be performed.

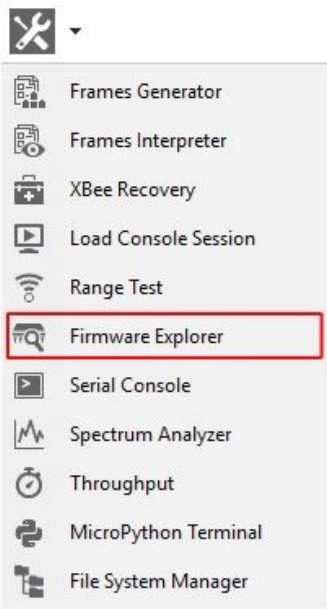
3. Configure the following range test parameters:
   - Range Test type
   - Packet payload
   - Rx timeout
   - Tx interval
   - Number of packets
   - Loop infinitely
   - Skip RSSI measurements
   - Time window
4. Click **Start range test** to begin sending packets and measuring signal strength. You can stop the range test at any time by clicking the **Stop range test** button.

Note If the Loopback range test type is configured, you must connect the loopback jumper in the remote module before starting the range test and remove it when the range test has finished.

Firmware explorer tool

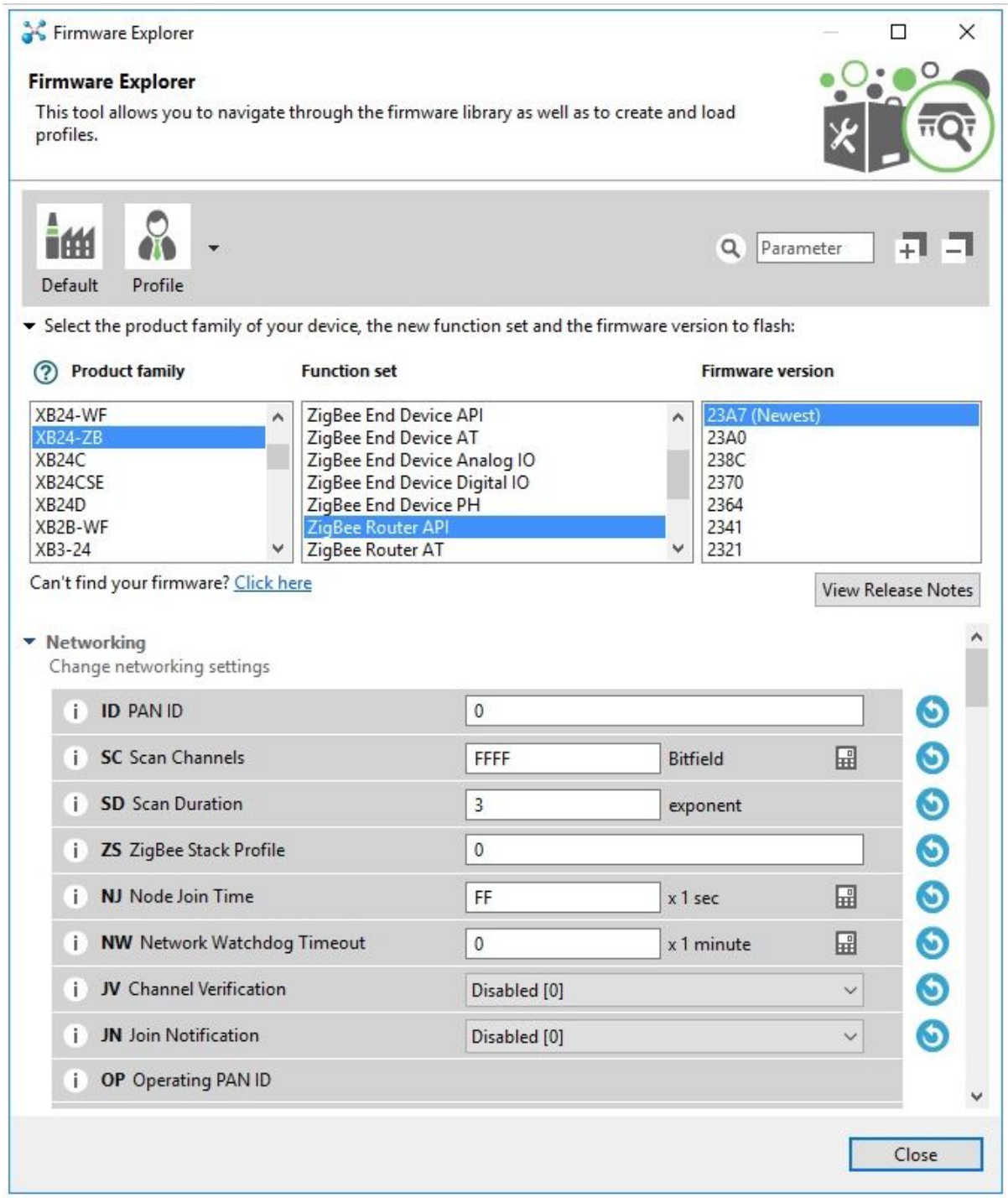
The **Firmware explorer** tool allows you to navigate through XCTU's firmware library to review available firmware versions and their settings, without having a radio module attached to your computer. It also lets you save and load firmware profiles.

To open the **Firmware explorer** tool, select **Firmware explorer** from the **Tools** drop-down menu on the main XCTU toolbar.



Firmware explorer dialog

Use the Firmware explorer dialog to review available firmware versions and their settings. For instructions, see Inspect a firmware version.



Firmware toolbar

The toolbar displays all the actions you can perform on the selected firmware:

Field	Description
Load default firmware settings	Loads the default firmware values.
Load/save configuration profile	Opens the **Load configuration profile** or **Save configuration profile** dialog.
Search	Enables you to search firmware settings by AT parameter.
Expand/collapse settings	Expands or collapses all firmware settings sections.

Firmware selection panel

The firmware selection panel allows you to specify the firmware to be loaded. To display the settings of a specific radio firmware, specify the firmware family, function, and version from the corresponding lists.

Note The firmware selection panel does not flash the firmware on a module. It loads the firmware in the dialog so you can view its settings.

Field	Description
Product family	Product family of the firmware to load. If you do not know the product family, check the label on the back.
Function set	Determines the available functionality such as mode of operation; end device, router, or coordinator designation; special sensor and adapter settings; etc. Available options depend on the module selected.
Firmware version	Firmware version to be loaded. The most recent firmware version appears at the top of the list.
View release notes	Displays the release notes of the selected firmware, if available.

Firmware settings panel

The firmware settings panel is located below the firmware selection panel and contains all the settings that make up the firmware, in categories.

You can see the default value of each setting, and also change them to edit configuration profiles.

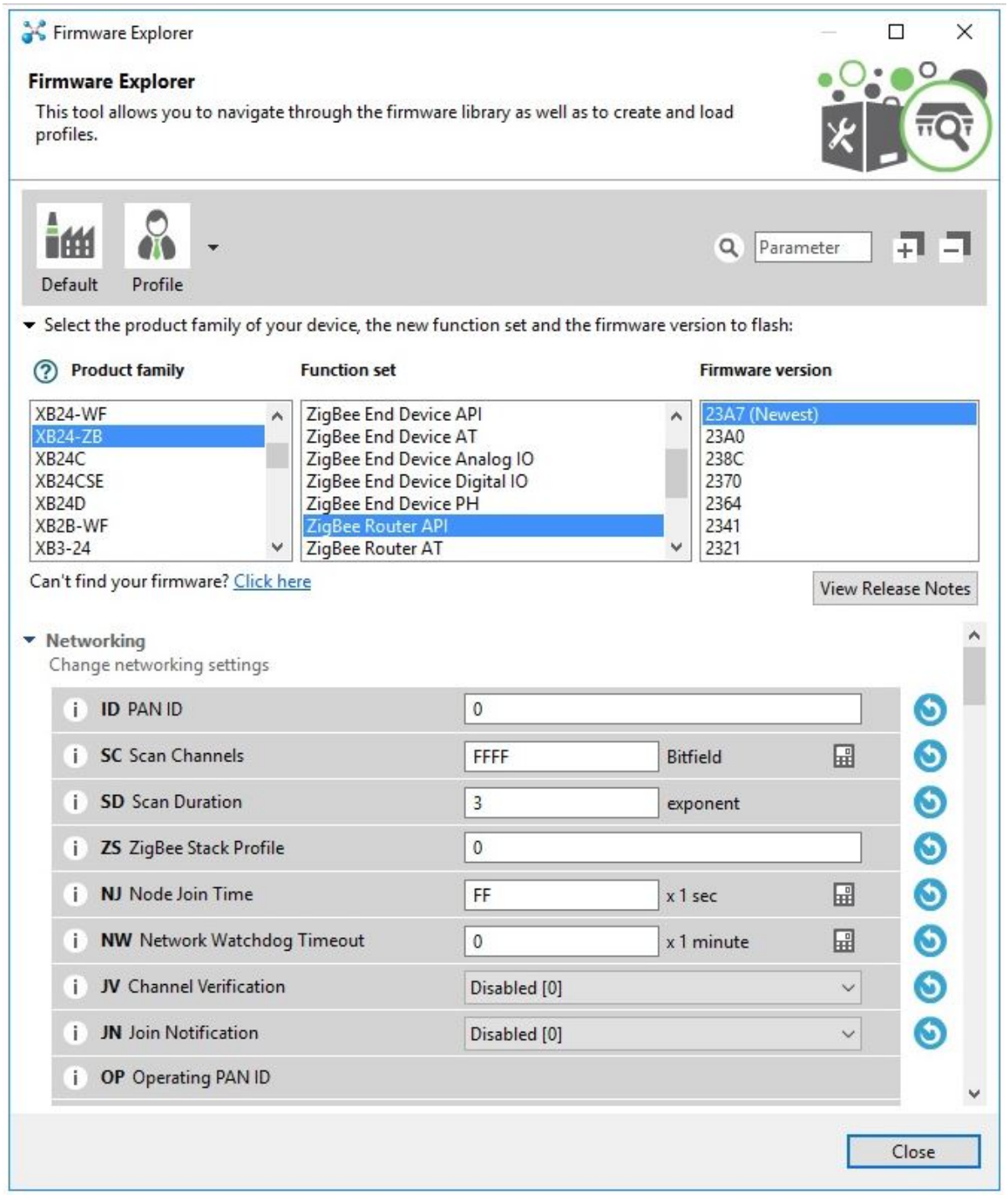
Click the blue arrow button next to a setting to load the default value of that setting.
The settings are displayed and managed the same way as they are in the Radio configuration section. For more information, see Configure your modules.

Inspect a firmware version

Follow these steps to inspect a firmware version. For more information, see the Firmware explorer tool.

1. Launch the Firmware explorer tool by selecting **Firmware explorer** from the **Tools** drop-down menu on the main toolbar. The **Firmware Explorer** dialog displays all the available firmware hosted in XCTU.
2. Select the product family of the firmware, the function set, and the desired firmware version.

3. You can inspect available settings for the selected firmware version.

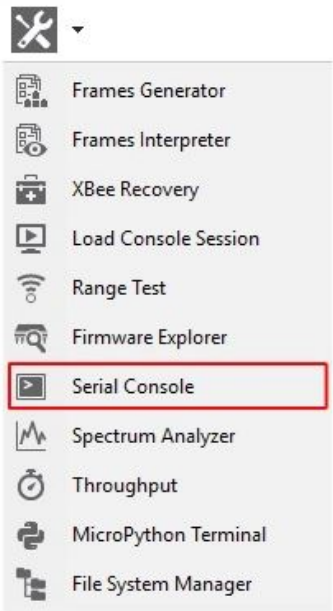


Serial console tool

The **Serial console** tool allows you to interact with your radio modules without having to first discover them and add them to the list of radio modules. It is essentially an AT console, but instead of

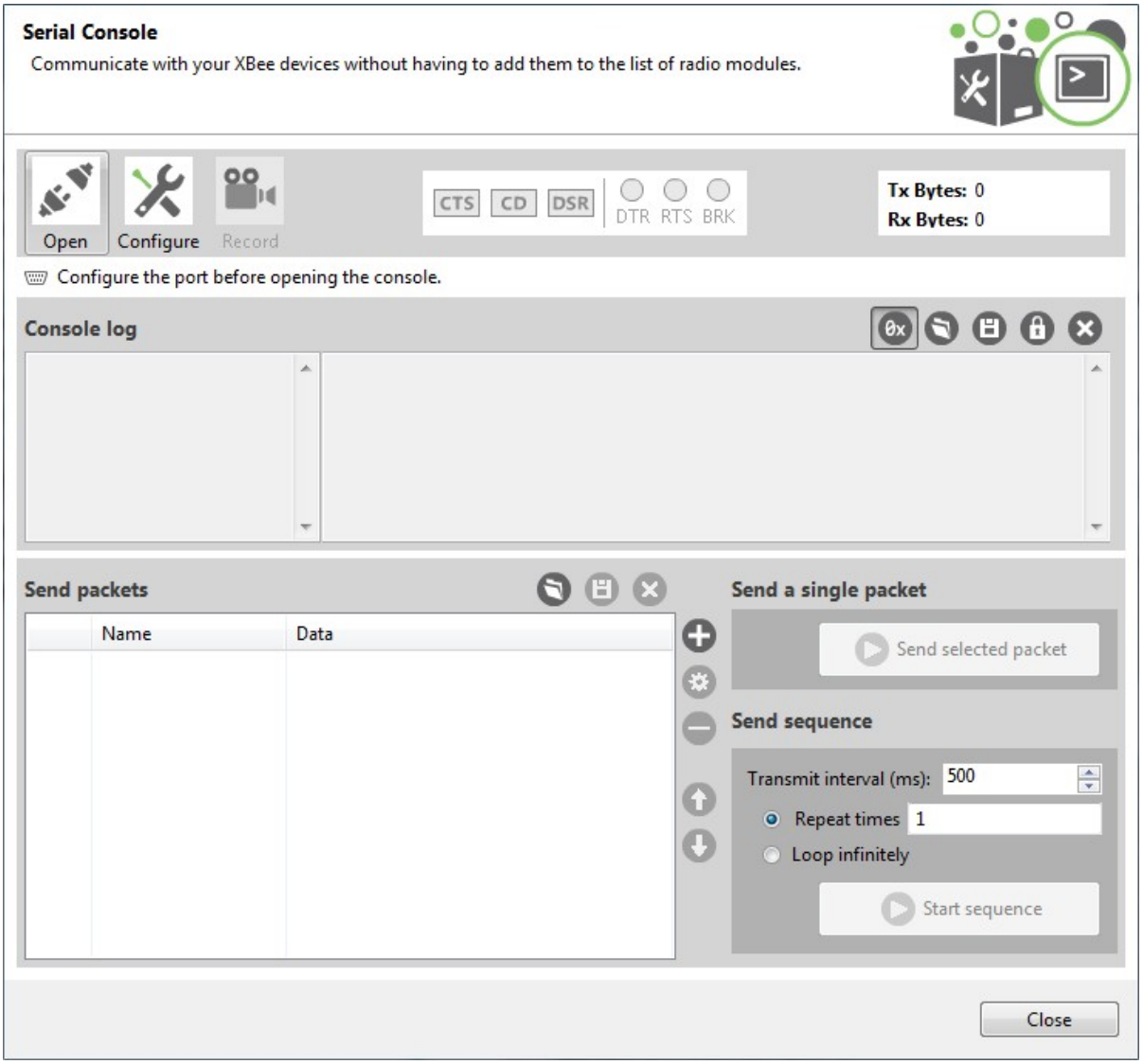
associating directly with a module it communicates with the port attached to the module you want to communicate with.

To open the **Serial console** tool, select **Serial console** from the **Tools** drop-down menu on the main XCTU toolbar.



Serial console dialog

The workflow and components of the serial console are similar to those of the AT console. However, since the serial console is not associated with a radio module, you must configure the serial port the console will open a connection with. For instructions, see Configure the serial port settings.



For more information on the console toolbar, see Consoles working mode. For a description of **Console log** and **Send packets** dialogs, see AT console.

Open a serial console session

The first time you open a console, it is disconnected by default. This is indicated by the gray background of the toolbar and the status text reading "Closed."

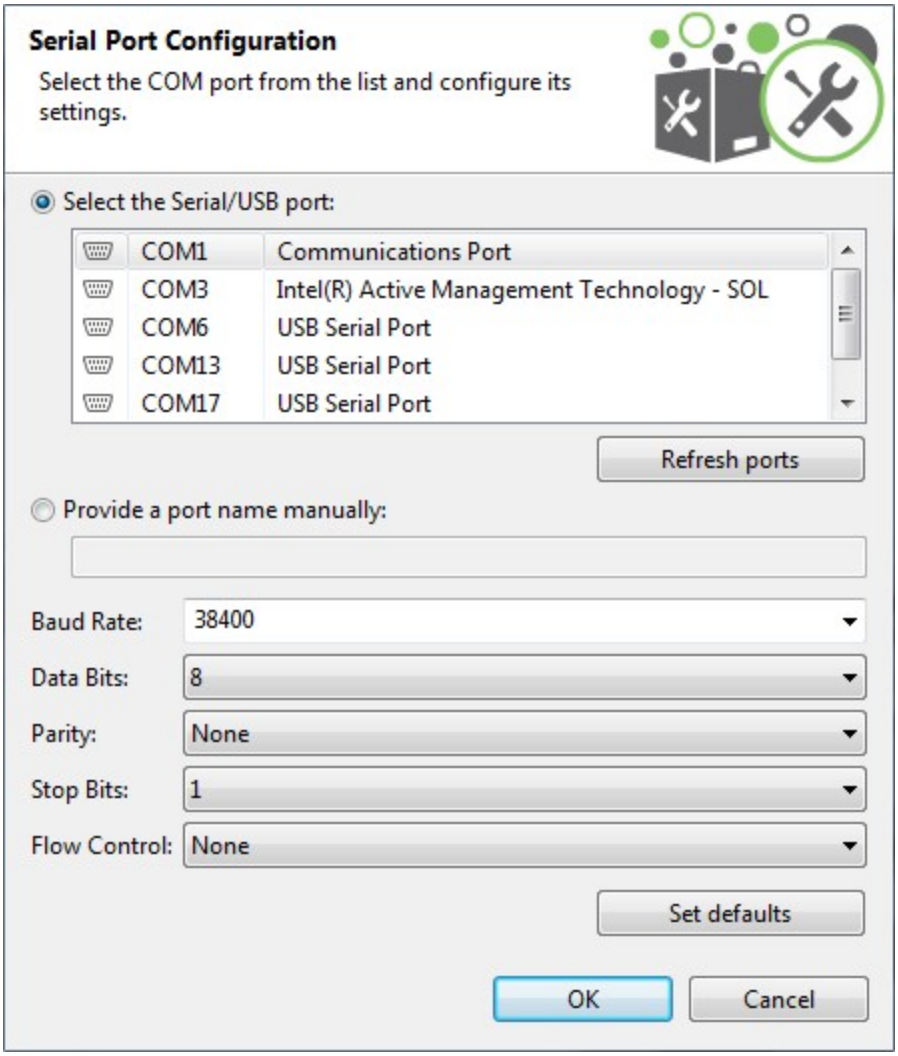
Buttons	Description
	Click the **Open** button to establish communication with the radio module corresponding to the console. If it is the first time you connect the console, you are prompted to configure the serial connection. The background color of the Open button changes to green and its text changes to Close. When the console is connected, all the data traffic of the radio module is captured by the console and displayed in the corresponding controls.
	Click the **Close**button if you want to disconnect the console from the module.

Configure the serial port settings

Follow these steps to configure the serial port settings of an instance of the Serial console tool. For more information, see Serial console tool.

1. Click the **Configure** button on the Serial Console toolbar. If the console is not yet connected, click the **Open** button .

The **Serial Port Configuration** dialog list all of the serial connection parameters to be configured.



2. Select the device's serial port, or provide it manually. The rest of the parameters are loaded with their default values.
3. Change the configuration if needed. The most common serial configuration is:

   Baud rate: 9600 or 115200

   Data bits: 8

   Stop bits: 1

   Parity: None

   Flow control: None

Note Custom baud rates can only be typed under Windows OS.

Open a serial console session

The first time you open a console, it is disconnected by default. To open a serial console session:

1. Select **Serial console** from the **Tools** drop-down menu on the main XCTU toolbar. The **Serial console** dialog appears.

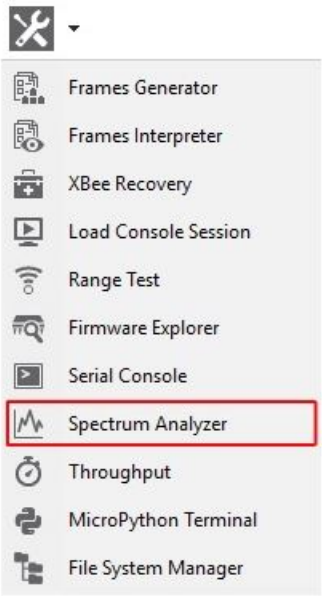
2. Click the **Configure** button from the toolbar and configure the serial port where the radio module is attached. See Configure the serial port settings for details.
3. Click the **Open** button to establish communication with the radio module.

Note The serial console tool operates just like an AT console. For more information, see Consoles working mode, AT console, and Serial console tool.

Spectrum analyzer tool

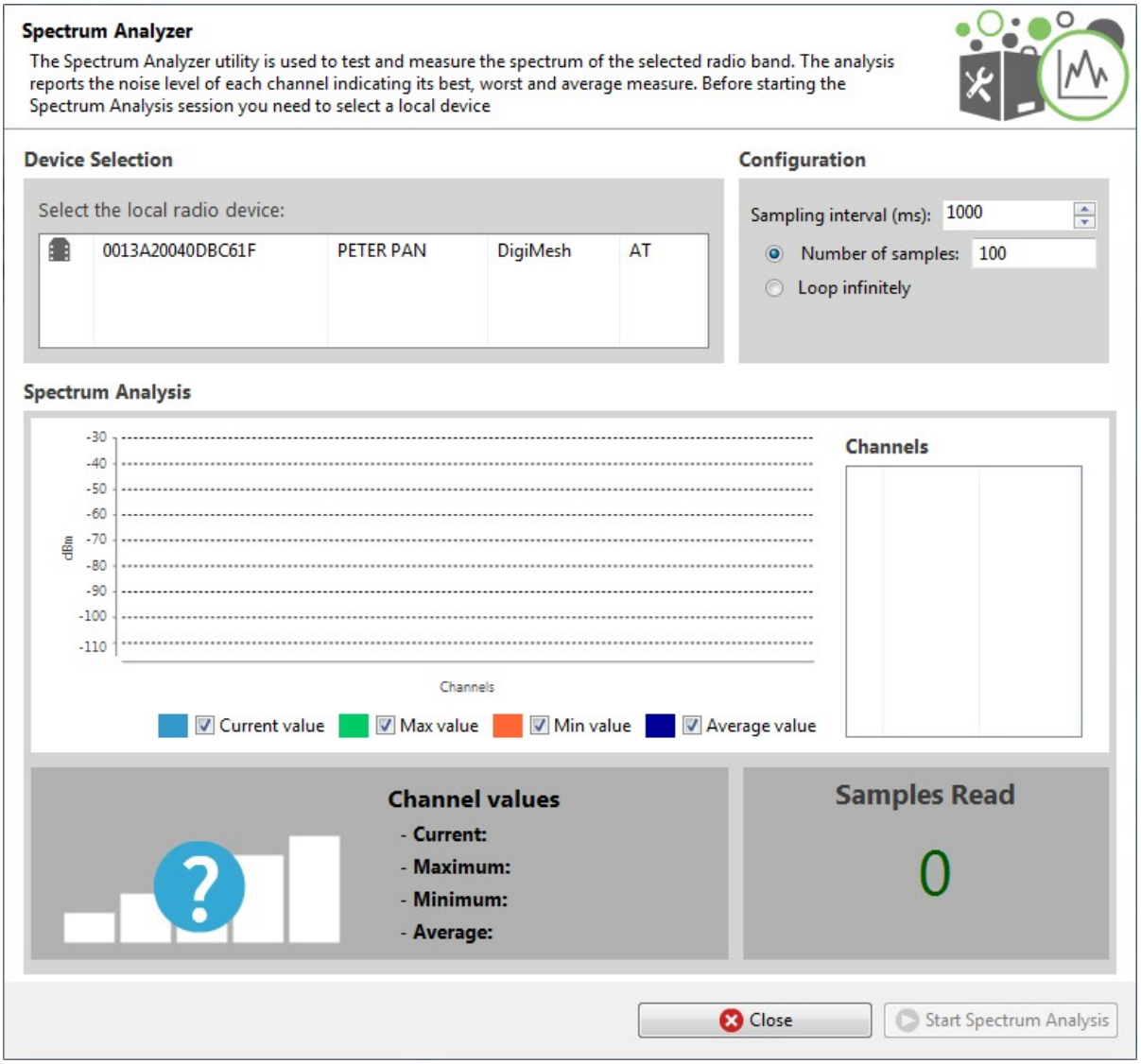
The Spectrum analyzer tool allows you to test and measure the spectrum of the selected radio band. The tool reports the noise level of each channel indicating its best, worst and average measures.

To open the Spectrum Analyzer tool, select **Spectrum analyzer** from the **Tools** drop-down menu on the main XCTU toolbar.



Spectrum analyzer dialog

Use the Spectrum analyzer dialog to analyze the spectrum of a radio band. For instructions, see Analyze the spectrum of a radio band.



Device selection

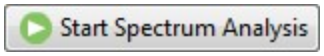
The Device selection area lists the devices that you have added to XCTU. Select the radio module you want to use to perform the analysis.

Analysis configuration

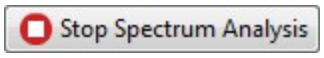
The Configuration area allows you to configure the spectrum analysis process.

Field	Description
Sampling interval (ms)	Determines the time to wait in milliseconds before reading a new noise level sample of the RF channels.

Field	Description
Number of samples	Select this option to configure the number of samples to read in the spectrum analysis session.
Loop infinitely	Select this option to read samples infinitely until the spectrum analysis session is stopped manually.



When you have configured all the options, click the **Start Spectrum Analysis** button to start reading samples and measure the noise level of each RF channel.

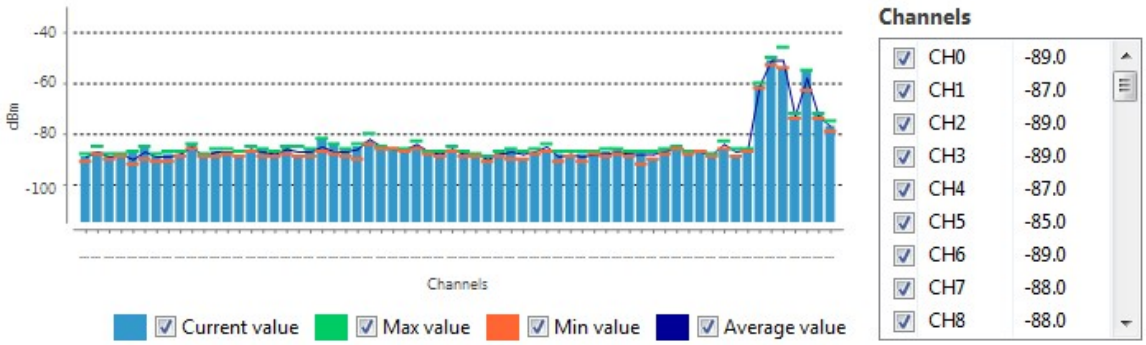


You can manually stop the analysis at any time by clicking the same button, which changes to **Stop Spectrum Analysis**.

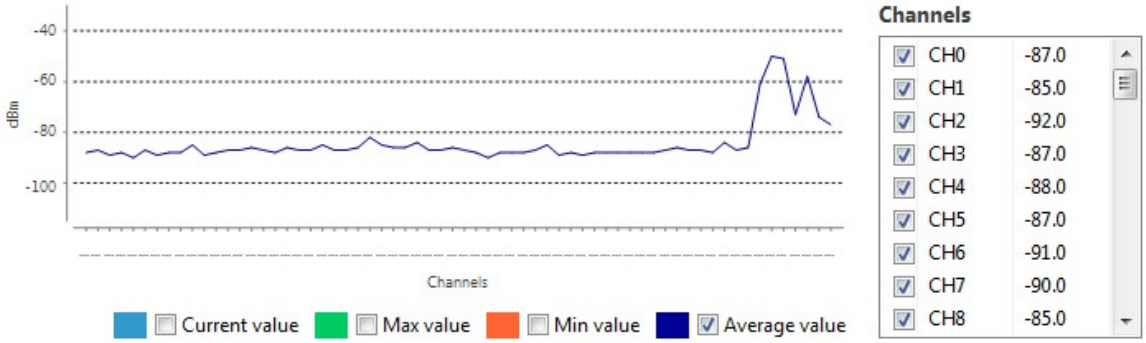
Channels Chart

The Channels chart represents the noise level of all the RF channels. Each channel displays one bar with the current noise level and two little marks representing the highest noise level (green) and the lowest noise level (red). A blue line indicates the average noise level of all the channels. The spectrum analysis refreshes the noise levels of each channel continuously until the analysis ends or is stopped.

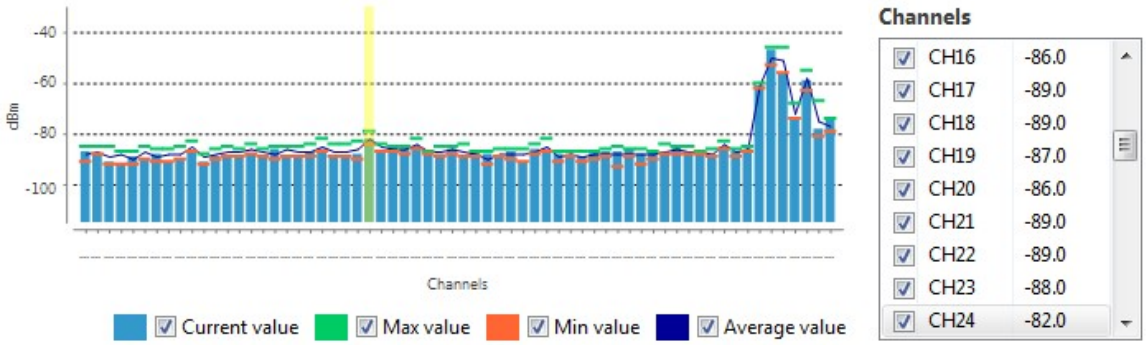
Note The list of supported channels may vary depending on the device type and device region.



You can use chart filters to hide or display the bars, the best and worst noise level values and the average noise level line.



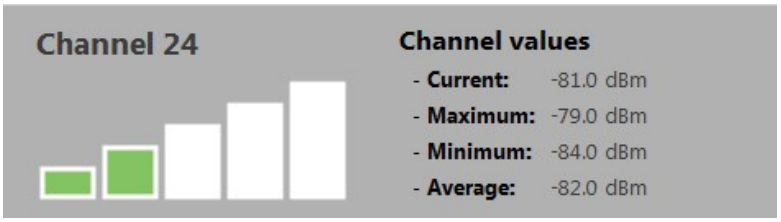
If you click a channel from the list of channels, it is highlighted in the chart. Likewise, you can select a channel in the chart to highlight it in the list of channels.



Selecting or clearing the check box of each channel within the list of channels shows and displays it in the chart.

Channel summary values

The Channel area displays the instant noise level of a channel as well as its average, best and worst noise level. To display channel values, select a channel in the chart or highlight a channel in the list of channels on the right.



Number of samples

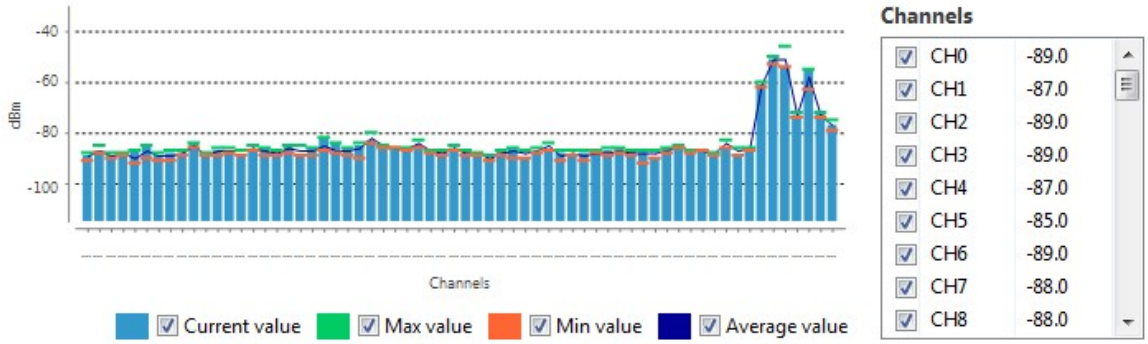
The Samples Read area displays the number of noise level samples read by the selected radio module. Note that you can specify the number of samples to read in the Configuration area.

Analyze the spectrum of a radio band

Follow these steps to analyze the spectrum of a radio band. For more information, see Spectrum analyzer tool.

1. Launch the Spectrum analyzer tool by selecting **Spectrum analyzer** from the **Tools** drop-down menu on the main toolbar. The **Spectrum Analyzer** dialog appears.
2. Under **Device Selection**, select the local radio device you want to analyze.
3. Under **Configuration**, specify the sampling interval and a configuration method.
4. Click the **Start Spectrum Analysis** button to start reading samples and measure the noise level of each RF channel. You can manually stop the analysis at any time by clicking the **Stop Spectrum Analysis** button.

   When an analysis begins, the chart and channels list display the RF channels supported by the selected device.

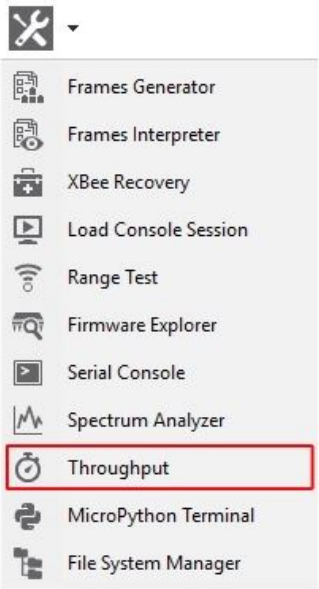


5. Use chart filters to hide or display channels, the best and worst noise level values and the average noise level line. You can also display channel values and samples read. For details, see Spectrum analyzer tool.

Throughput tool

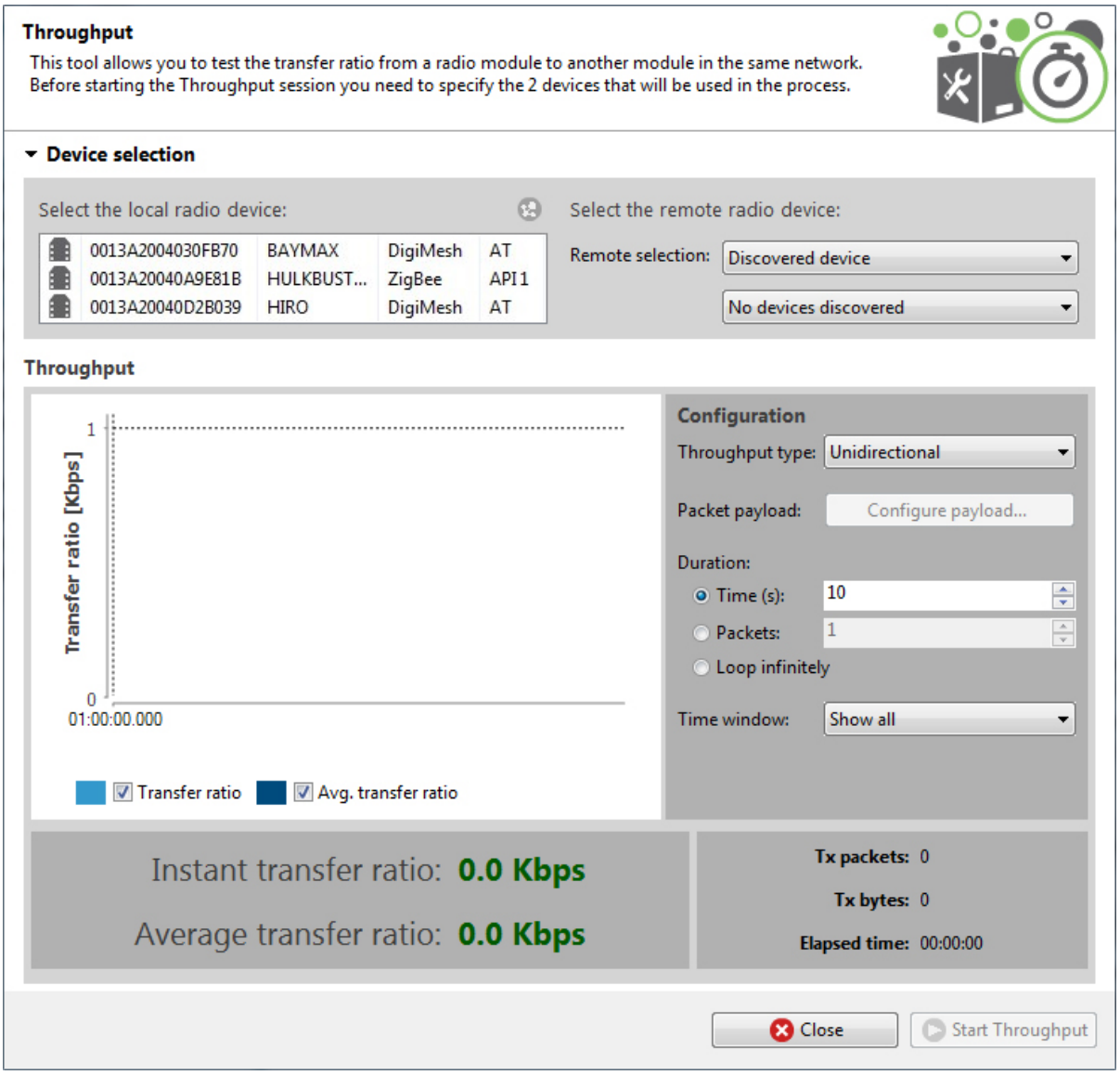
The Throughput tool allows you to measure the transfer ratio between two radio modules in the same network. To perform a throughput measure, you need to have a local radio module added to XCTU and a remote device in the same network as the local one.

To open the Throughput tool, select **Throughput** from the **Tools** drop-down menu on the main XCTU toolbar.


Frames Generator
Frames Interpreter
XBee Recovery
Load Console Session
Range Test
Firmware Explorer
Serial Console
Spectrum Analyzer
Throughput
MicroPython Terminal
File System Manager

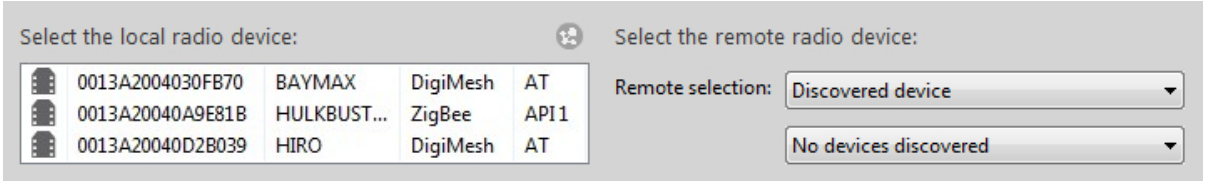
Throughput dialog

Use the Throughput dialog to measure the transfer ratio between two radio modules in the same network. For instructions, see Measure the transfer ratio between two radio modules.



Device selection

Use the **Device selection** section to designate the local device that will perform the throughput and the remote device that receives the data:



Select the local radio device

Field/button	Description
Local device list	Populates with devices currently added to XCTU. Select the device you want to use in the throughput session. The list provides the following information about each local device: ■ MAC address ■ Device name ■ Protocol ■ Operating mode
	Discovers remote devices for the selected local device.

Select the remote radio device

The remote device selection can be performed in four ways:

Field	Description
Discovered device	Displays a list of any remote devices discovered for the selected local device. Only devices whose protocols support node discovery list remote devices.
Specify 64-bit address	Allows a user to manually enter the 64-bit address of the destination device.
Specify 16-bit address	Allows a user to manually enter the 16-bit address of the destination device.
Specify IPv6 address	Allows a user to manually enter the IPv6 address of the destination device. Only supported by Thread modules.

Note Not all protocols support node discovery. Only devices that support node discovery list remote devices.

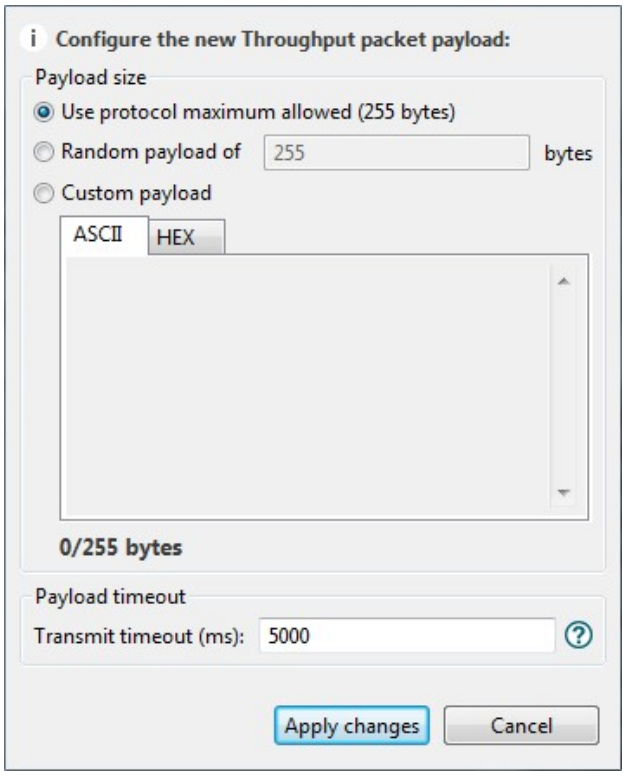
Note Not all protocols support IPv6, 64 and 16-bit addressing. Devices that do not support any of these mechanisms display an error at the top of the page.

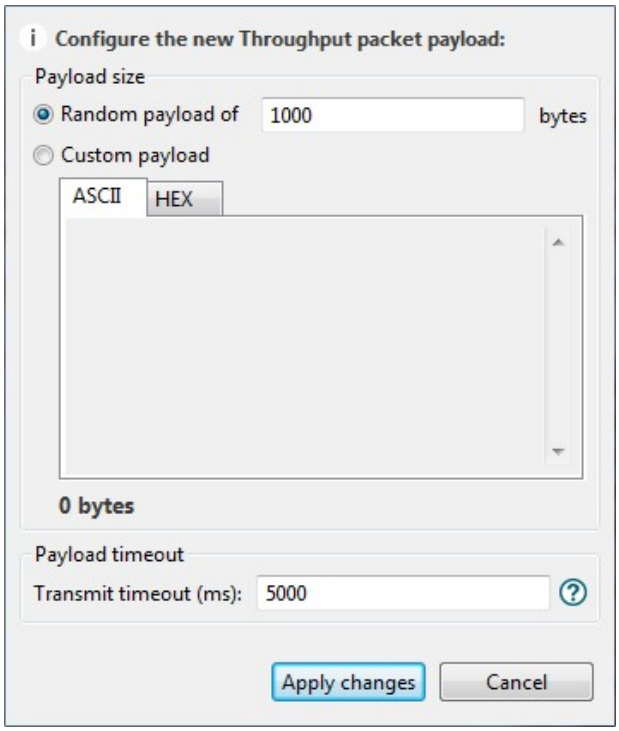
Throughput session configuration

You can configure the following throughput session options from within the Throughput tool:

Field	Description
Throughput type	Determines the type of throughput process to perform. Available options include: ■ **Unidirectional**: Sends data from the local device to the remote device. Before sending the next packet of data, it waits for the transmission status of the previous one. ■ **Unidirectional (UDP)**: Sends data from the local device to the remote device using UDP protocol. Before sending the next packet of data, it waits for the transmission status of the previous one. Only supported by Thread modules. ■ **Unidirectional CoAP**: Sends data from the local device to the remote device using CoAP protocol. Before sending the next packet of data, it waits for the CoAP transmission status of the previous one. Only supported by Thread modules. ■ **Bidi - Cluster ID 0x12**: Sends data from the local device to the remote one and waits for the data receipt from the remote device. The transmission is performed using explicit addressing frames/packets directed to the Cluster ID 0x12 which returns the sent message. **Note** Not all protocols and operating modes support **Bidi - Cluster ID 0x12 Throughput** type. Devices that do not support it display an error at the top of the page. ■ **Bidi - Loopback**: Same as previous bidirectional mode, this one also waits for the data back from the remote device before sending the next block of data. The data back is performed using the serial port/USB hardware loopback capabilities. Specific user actions are required to use this mechanism. See Special considerations. This method is valid for local modules working in both AT and API operating modes. ■ **Bidi - Loopback (UDP)**: Bidirectional mode. Sends data from the local device to the remote one using UDP protocol and waits for the data receipt from the remote device before sending the next block of data. The data back is performed using the serial port/USB hardware loopback capabilities. Specific user actions are required to use this mechanism. See Special considerations. This method is valid only for Thread modules working either in AT or API operating modes.

Field	Description
	■ **Bidi - Loopback (CoAP)**: Same as Bidi - Loopback (UDP) but using CoAP protocol. Specific user actions are required to use this mechanism. See Special considerations. See Special considerations. This method is valid only for Thread modules working either in AT or API operating modes **Note** Loopback throughput sessions require the remote device to be in AT (transparent) mode.

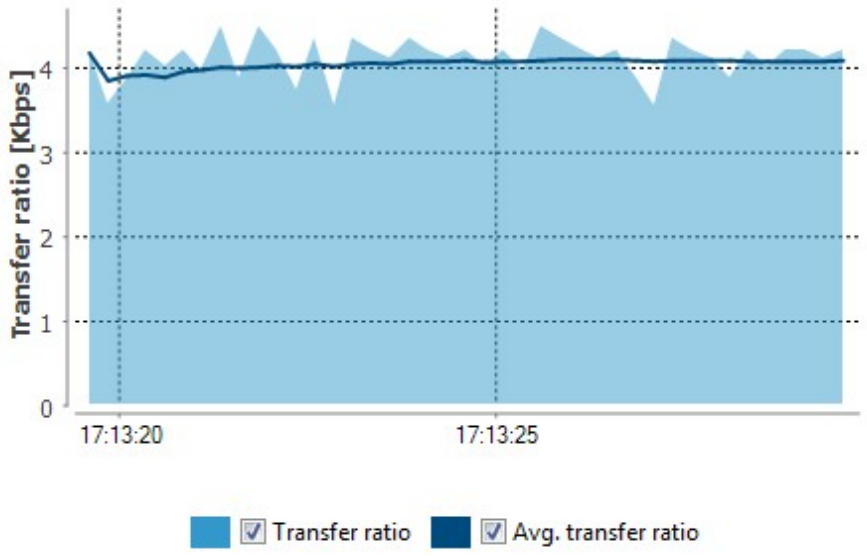
Field	Description
Packet payload	Allows you to configure the packet payload that will be sent to the remote device. Opens a new window where you can configure different payload values by operating mode of the local radio module (AT or API): Local module working in API mode: 

Field	Description
	Local module working in AT mode:  **Note** In API mode the payload length is limited by the protocol. In AT mode the payload length is unlimited. ■ **Payload timeout**: This is the time that the Throughput session waits to receive the transmit status packet (when the throughput type is unidirectional) or the data back from the module (when the throughput type is bidirectional). The bigger the payload is the greater this time should be.
Duration	Determines the duration of the Throughput session. Available options include: ■ **Time (s)**: Establishes the minimum duration of the session in seconds. The process sends data packets to the remote device until this time is reached. ■ **Packets**: The duration of the session is established by the number of packets configured in this field. Bear in mind that depending on the packet payload, a packet can take several seconds to be sent. ■ **Loop infinitely**: The process sends packets infinitely until the throughput session is stopped manually.

Field	Description
Time window	Configures the visible time window of the transfer ration measured by the throughput session.
Start Throughput	When you have configured all the options, click the **Start Throughput** button to start measuring the transfer ratio of your radio module.
Stop Throughput	You can stop the process at any time by pressing the same button, now showing the text **Stop Throughput**.

Data representation

The chart in the tool represents the instant transfer ratio and the average transfer ratio.

Field	Description
Transfer ratio chart	Displays the instant transfer ratio with a light blue area and the average transfer ratio as a dark blue line. The instant transfer ratio is calculated every 250ms or every time a packet is sent if sending takes longer than 250ms. You can hide and show chart data by checking or unchecking **Transfer ratio** and **Avg. transfer ratio**. 

Field	Description
Transfer ratio values	Displays the instant and average transfer ratio as packets are sent to the remote module during the session. Instant transfer ratio: **4.2 Kbps** Average transfer ratio: **4.08 Kbps**
Session statistics	Displays session statistics such as the number of packets sent to the remote device, the number of transferred bytes, and the duration of the session. **Tx packets:** 61 **Tx bytes:** 5124 **Elapsed time:** 00:00:09

Supported products

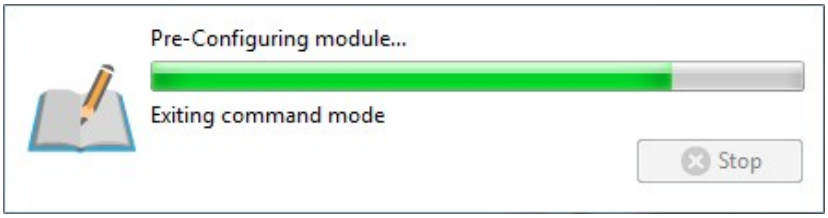
Throughput is only supported in these protocols:

- SX
- XLR Module
- ZigBee
- DigiMesh
- XTend
- XTend - DigiMesh
- XC/XSC
- XLR PRO
- 802.15.4
- Digi Point
- Thread

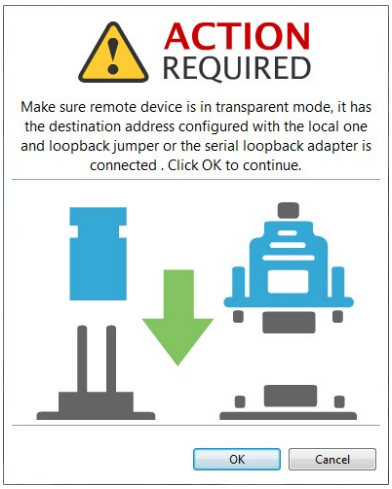
Special considerations

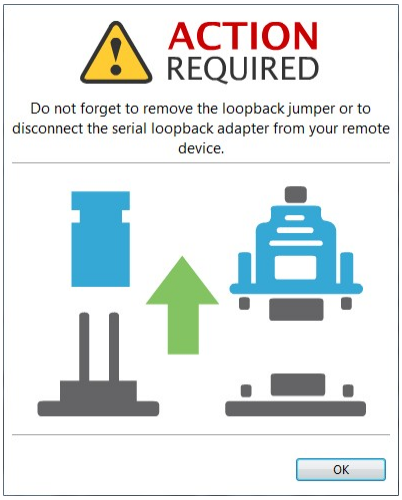
There are some special considerations to be aware of while working with the Throughput tool.

When the local module is working in **AT (transparent) mode**, the tool automatically performs configuration steps in the module before starting the throughput session, and after finishing or stopping it. A progress bar shows the level of completion for this process:



- The **bidirectional loopback** throughput types only work with remote devices in AT (transparent) operating mode.
- When performing any **bidirectional loopback** throughput, you need to connect the loopback jumper or the loopback adapter in the remote device before starting and disconnect it after finishing. A dialog box notifies you of the action required:





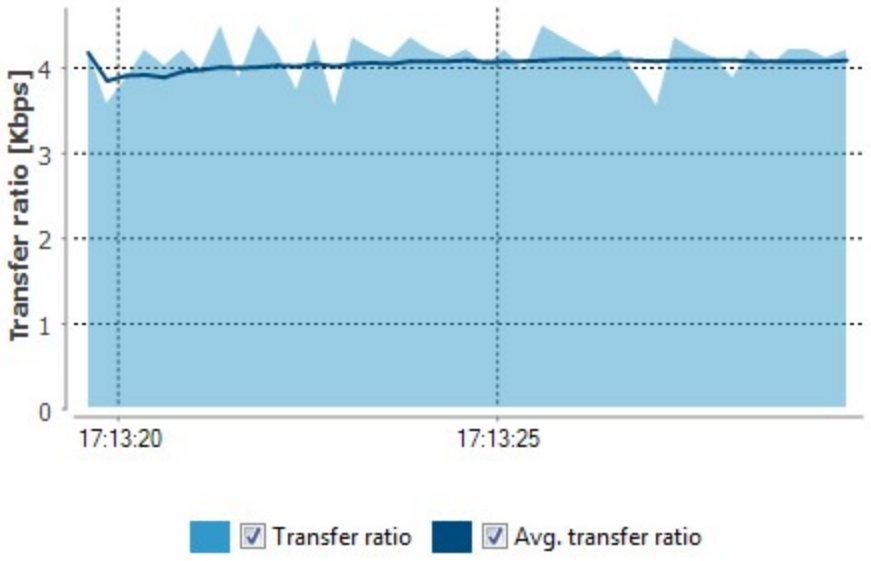
Measure the transfer ratio between two radio modules

Follow these steps to measure the transfer ratio between two radio modules in the same network. For more information, see Throughput tool.

1. Launch the Throughput tool by selecting **Throughput** from the **Tools** drop-down menu on the main toolbar. The **Throughput** dialog appears.
2. Under **Device selection**, select a local device to perform the throughput and a remote device to receive the data.
3. Under **Configuration**, configure the throughput type, packet payload, duration, and time window.

4. Once you have configured all the options, click the **Start Throughput** button to start measuring the transfer ratio of your radio module. You can stop the process at any time by pressing the same button, which has changed to **Stop Throughput**.

   The Throughput chart represents the instant transfer ratio and the average transfer ratio.



5. You can hide and show any of the chart data by selecting or clearing the transfer ratio check boxes.

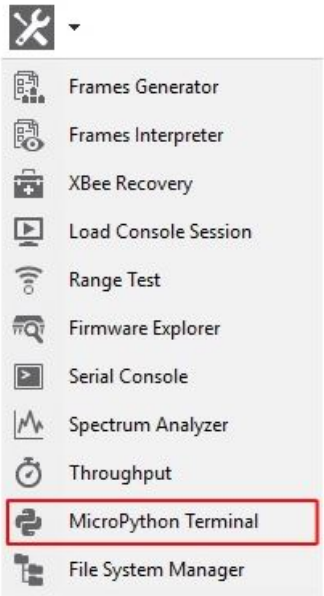
Note There are special considerations to be aware of while working with the Throughput tool. For details, see Throughput tool.

MicroPython Terminal tool

The MicroPython Terminal tool allows you to communicate with the MicroPython stack of your radio module through the serial interface.

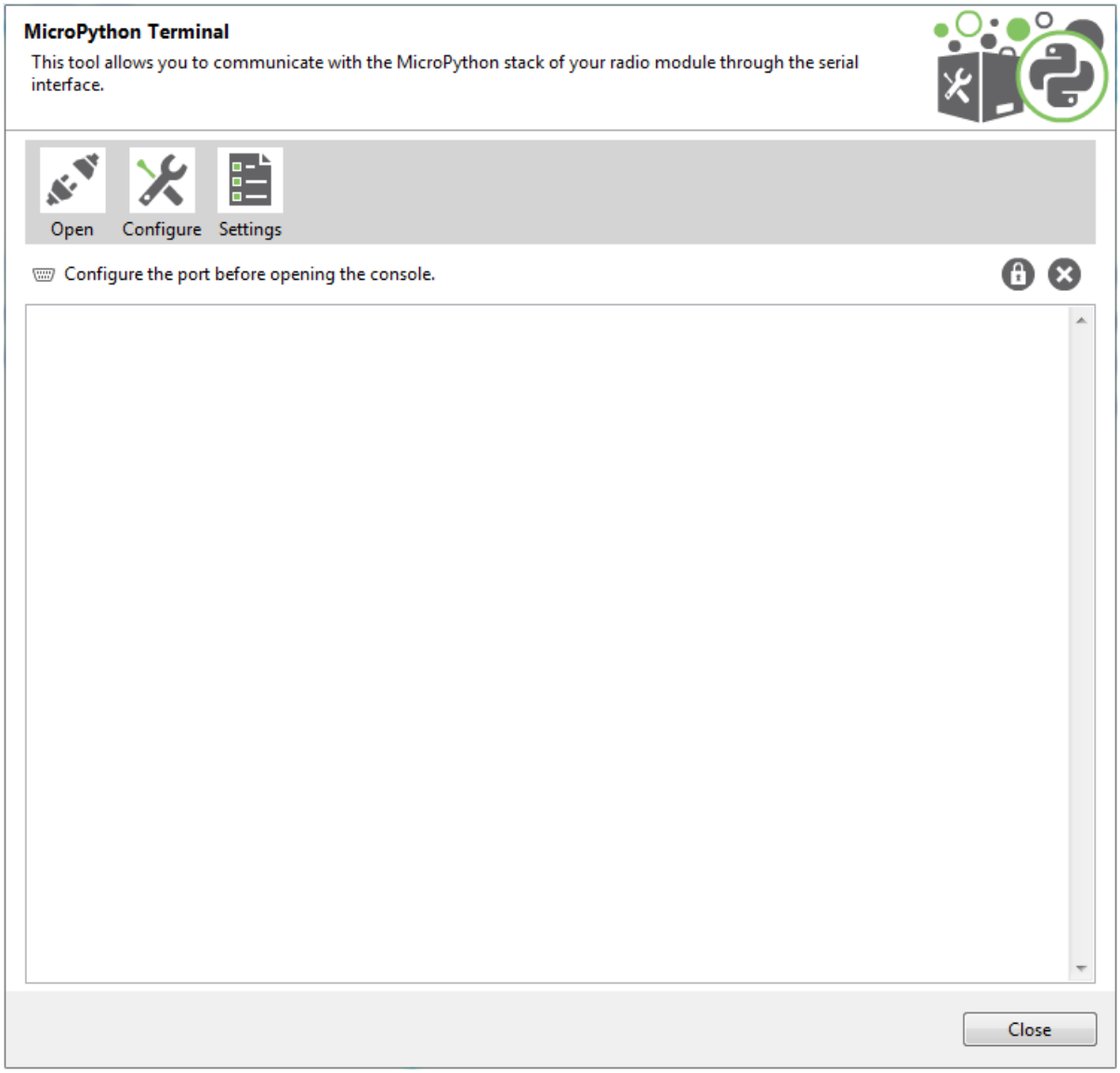
Note Make sure your radio module supports MicroPython and is configured in that mode.

To open the MicroPython Terminal tool, select **MicroPython Terminal** from the **Tools** drop-down menu on the main XCTU toolbar.



MicroPython Terminal dialog

The workflow and components of the MicroPython Terminal tool are similar to those of the Serial console one. Because the MicroPython Terminal is not associated with a radio module, you must configure the serial port the console will open a connection with. For more information, see Configure the serial port settings - MicroPython Terminal tool.



Open a terminal session

By default, the first time you open the terminal it is disconnected, as is indicated by the gray background of the toolbar.

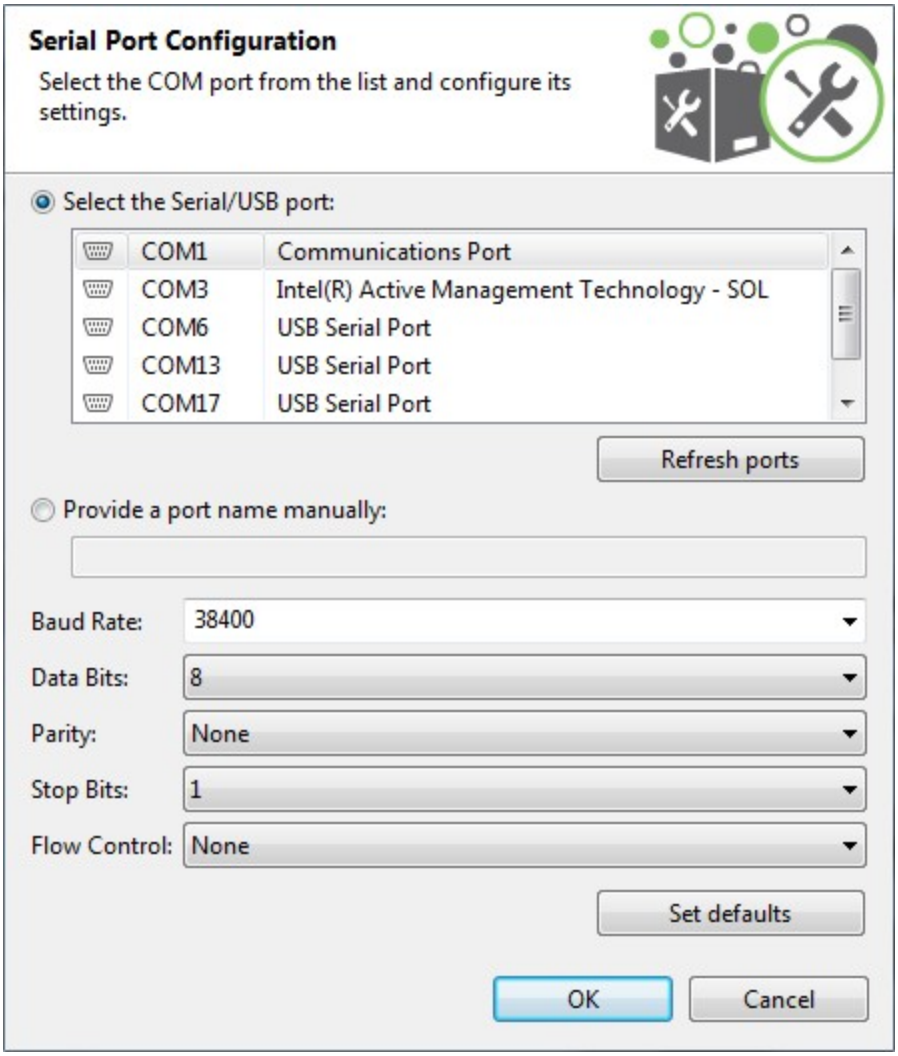
Buttons	Description
	Click the **Open** button to establish communication with the radio module corresponding to the terminal. If it is the first time you are connecting the console, you are prompted to configure the serial connection. The background color of the Open button changes to green and its text changes to Close. When the terminal is connected, all data traffic of the radio module is captured by the console and displayed in the corresponding controls.
	Click the **Close** button to disconnect the terminal from the module.

Configure the serial port settings - MicroPython Terminal tool

Follow these steps to configure the serial port settings of an instance of the MicroPython Terminal tool. For more information, see MicroPython Terminal tool.

1. Click the **Configure** button on the MicroPython Terminal. If the console is not yet connected, click the **Open** button .

The **Serial Port Configuration** dialog lists all of the serial connection parameters to be configured.



2. Select the device's serial port, or provide it manually. The rest of the parameters are loaded with their default values.
3. Change the configuration if needed. The most common serial configuration is:

   Baud rate: 9600 or 115200

   Data bits: 8

   Stop bits: 1

   Parity: None

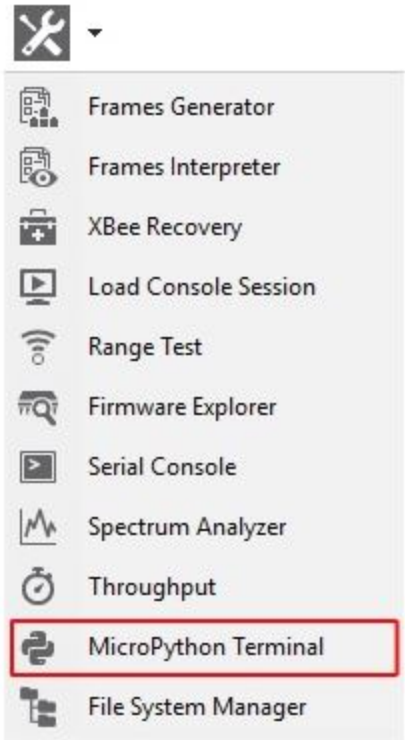
   Flow control: None

Note Custom baud rates can only be typed under Windows OS.

Open a MicroPython Terminal session

The first time you open a console, it is disconnected by default. To open a MicroPython Terminal session:

1. Select **MicroPython Terminal** from the **Tools** drop-down menu on the main XCTU toolbar. The **MicroPython Terminal** dialog appears.



2. Click the **Configure** button from the toolbar and configure the serial port where the radio module is attached. See Configure the serial port settings - MicroPython Terminal tool for details.
3. Click the **Open** button to establish communication with the radio module.

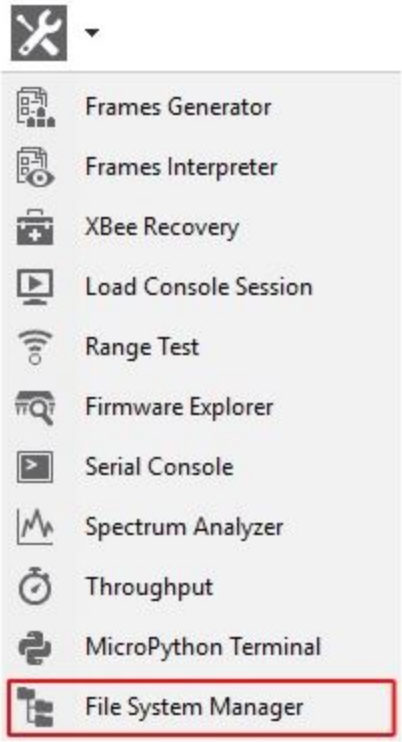
Note The MicroPython Terminal tool operates the same as any other VT100 terminal emulator.

File system manger tool

The **File system manger** tool allows you to access and interact with the file system of your XBee module.

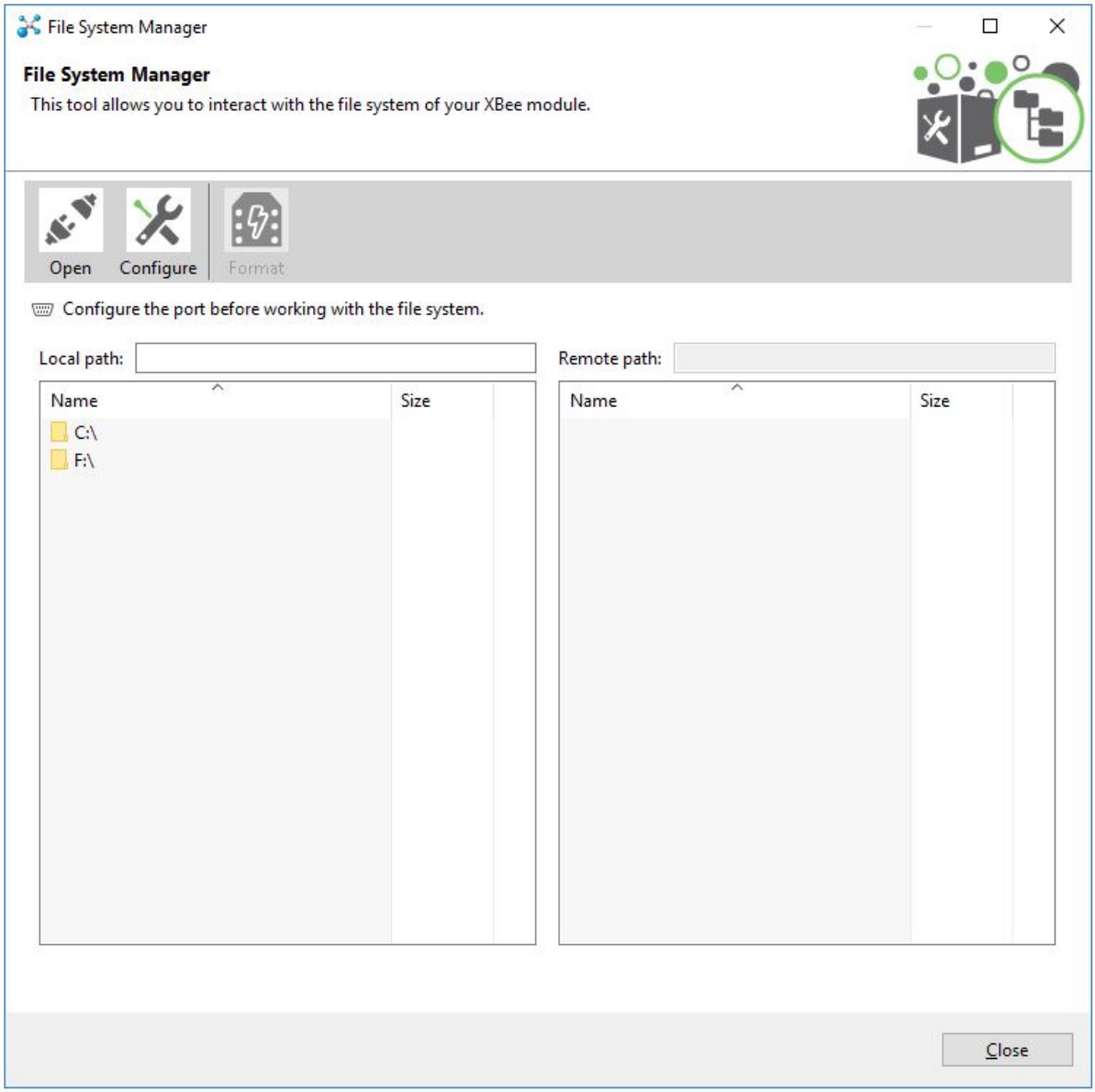
Note Make sure your radio module supports the file system feature.

To open the **File System Manager** tool, select **File System Manager** from the **Tools** drop-down menu on the main XCTU toolbar.



File system manager dialog

Use the **File System Manager** dialog to interact with the file system of your XBee module. For instructions, see Interact with XBee file system.



File System Manager sections

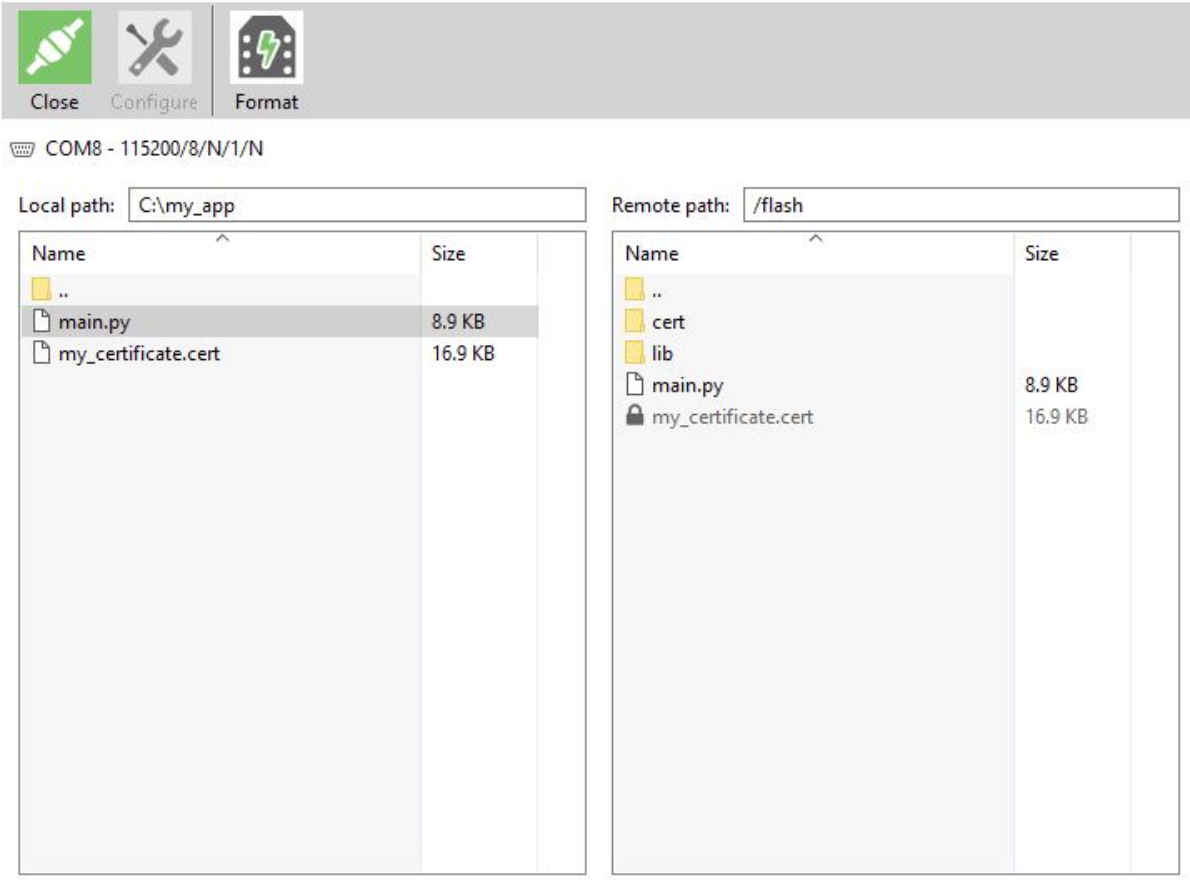
The **File System Manager** dialog is divided into three parts:

- **Toolbar**: Allows opening/closing the connection with the XBee module, configuring the serial port parameters, and formatting the XBee file system.
- **Local file system view**: Shows the current path of your computer and its contents.
- **Remote file system view**: Shows the current path of the XBee module and its contents.

Interact with XBee file system

Follow these steps to interact with the file system of your XBee module. For more information, see File system manger tool.

1. Launch the File System Mangager tool by selecting **File System Manager** from the **Tools** drop-down menu on the main toolbar. The **File System Manager** dialog appears.
2. Click **Open**.
3. If you did not add your XBee module to XCTU before, select its serial port configuration. Click **OK** to open the connection with the module.
4. If the serial configuration is correct and your XBee module supports file system, the contents of the default path are listed in the remote file system view.



Operations with the file system

You can perform the following operations in the XBee file system:

Operation	Description
Navigate	Navigate through the different directories by double clicking on them. To go back, double click on the parent directory (..) or press the backspace key. You can also go directly to a specific path by typing it on the local/remote path text box and pressing enter.

Operation	Description
Upload	Upload a file or directory to the XBee module. Drag-and-drop or right-click on a file or directory and then click **Upload**. If you want to upload several files or directories, select and drag them to the XBee file system view.
Upload a secure file	Upload special files, such as certificates or keys, as write-only. Once the files are uploaded to the XBee, they cannot be downloaded, renamed or moved; only deleted. These secure files are displayed in the XBee file system with a lock and are grayed out.
Download	Download a file or directory from the XBee module. Drag-and-drop or right-click a file or directory and then click **Download**. If you want to download several files or directories, select and drag them to the local file system view.
Create directory	Create a directory. Right-click on either the local or remote file system view and click **Create directory**. You are asked to enter the name of the new directory.
Delete	Delete any file or directory. Right-click a file or directory and click **Delete**. You are asked to confirm the operation.
Rename	Rename any file or directory. Right-click a file or directory and click **Rename**.
Get and compare hash	Get the SHA256 hash of any secure file that is on the XBee file system and compare it with the hash of a local file. Since secure files cannot be downloaded, this operation allows you to verify that the secure file is actually equal to other located on your computer. Right-click on a secure file and click**Get hash** or **Compare hash**.
Format	Re-format the entire XBee file system by clicking the **Format** button located in the toolbar. **Note** This process erases all your files on the XBee module and cannot be undone.

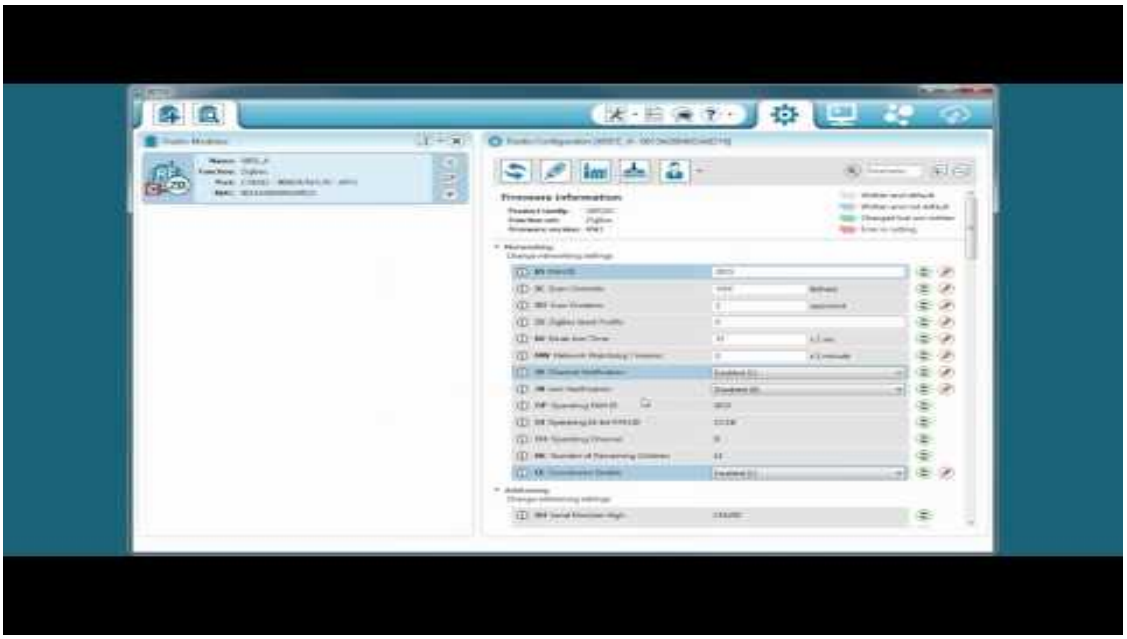
How-to articles and videos

See how to get things done with XCTU. Check back for additional how-to articles describing the most common XCTU procedures.

How to update the firmware of your modules 195
How to visualize your network 197

How to update the firmware of your modules

Watch the video to learn how to perform local and remote firmware updates.

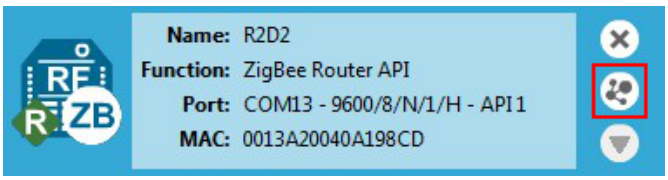


You can use XCTU to update firmware in both local and remote modules. For more information, see Update firmware.

Step 1: Add the module to XCTU

You must have a local module connected to your computer in order to perform firmware updates, either to update local firmware through the serial connection or to use the local device to remotely upgrade another module in the same network. With a local module properly attached to your computer, follow these steps:

1. Add the local module attached to your computer to XCTU so it is displayed in the radio modules list.
2. Add your remote module in the network to XCTU:
    a. Configure the local module you have just added to work in API mode.
    b. Click **Discover radio nodes in the same network** to start a search of the remote module.



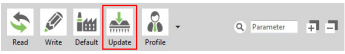
    c. When a remote module is found, it is listed in the **Discovering remote devices** dialog. Select the device and click **Add selected devices.** The remote module is added to the radio modules list as a subordinate to the local module.

Note Once you add your module to the radio modules list in XCTU, the update process is exactly the

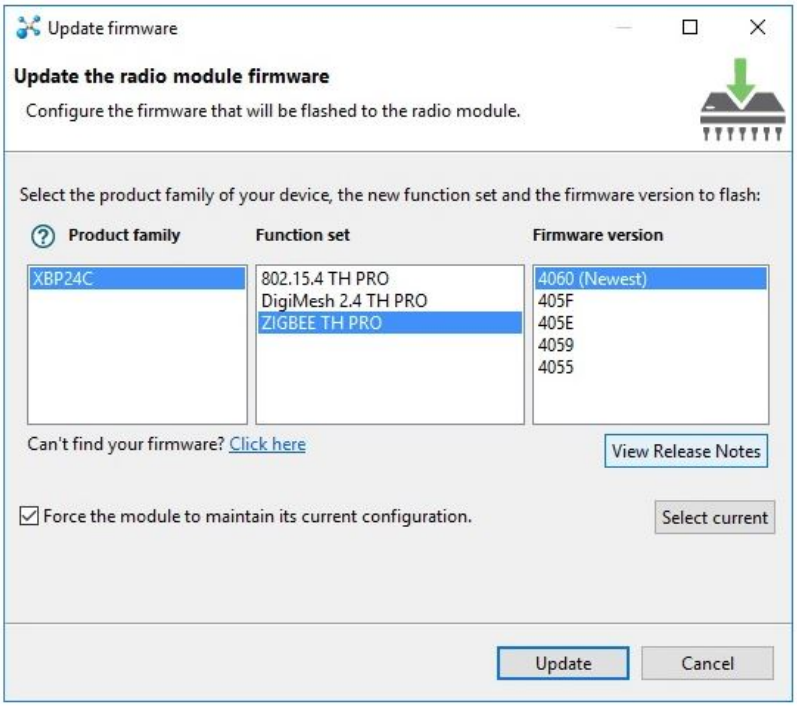
same whether it is a local or remote module.

Step 2: Update the firmware

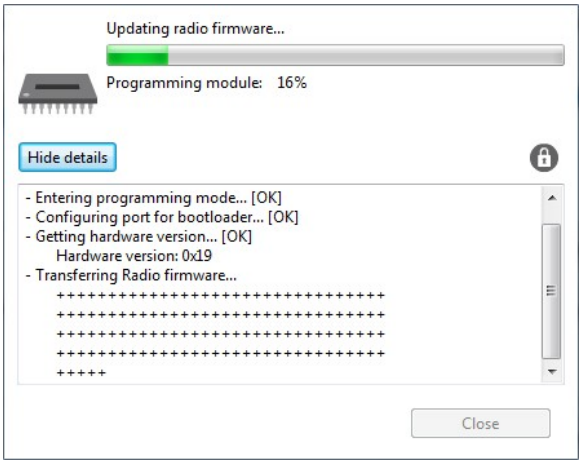
1. Select a local or remote module from the radio modules list. Click **Update firmware**. The **Update the radio module firmware** dialog is displayed.



2. Select the product family, function set, and firmware version.



3. Click **Update**. A progress dialog displays the status of the update. Click **Show details** to review the steps of the firmware update process.

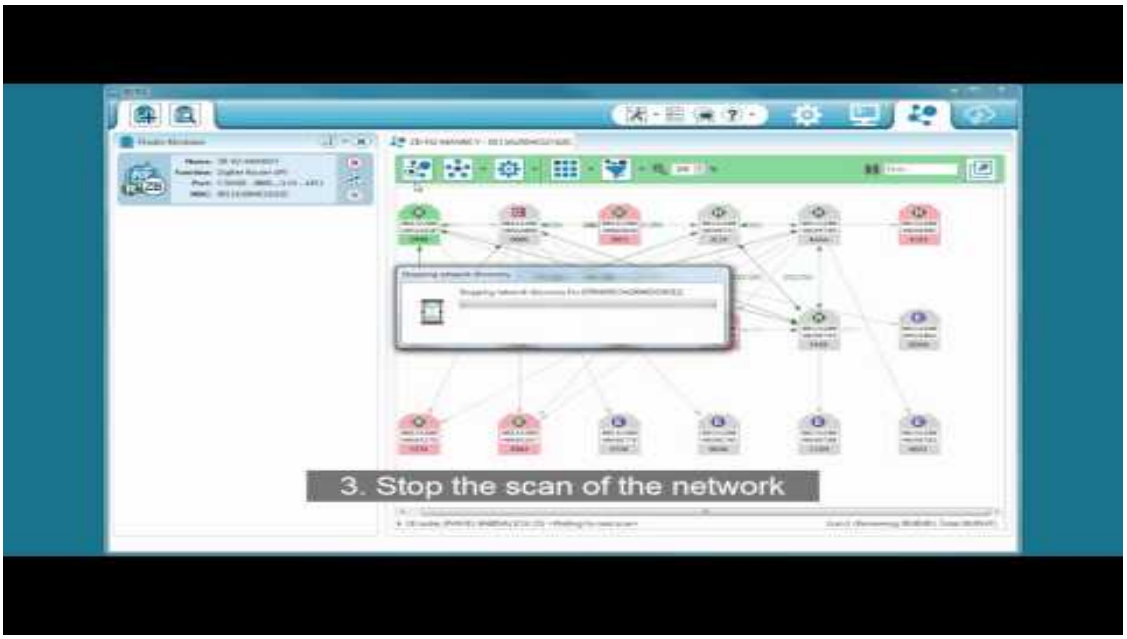


Over-the-air firmware update considerations

1. To perform a firmware update of a remote XBee in the same network, you must configure the local module to work in API mode.
2. Remote firmware update functionality is limited to the following radio modules:
   - XBee/XBee PRO SX
   - XLR Pro Module
   - XBee/XBee PRO 802.15.4 (S2C module versions only)
   - XBee/XBee-PRO DigiMesh 2.4 (S2C module versions only)
   - XTend RF Module Family (SX module versions only)
   - XBee/XBee-PRO ZB and Programmable XBee-PRO ZB
   - XBee/XBee-PRO ZB SMT and Programmable XBee-PRO ZB SMT
   - XBee-PRO 900HP and Programmable XBee-PRO 900HP
   - XBee 865LP and Programmable XBee 865LP
   - XBee3 (Zigbee, DigiMesh 2.4, and 802.15.4)
3. If something goes wrong during the over-the-air firmware update of a remote node—for example, the communication is lost because the remote device is disconnected—you must perform a manual recovery. See XBee recovery tool.

How to visualize your network

Watch the video to learn how to explore your network with Network view.



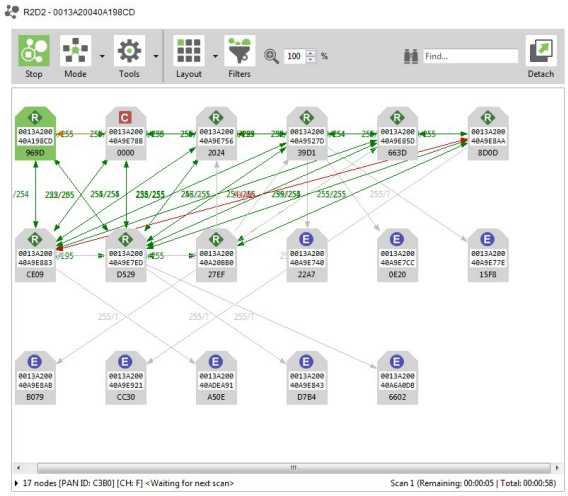
Network working mode allows you to discover and visualize the topology and interconnections of your network. For more information, see View your radio network.

Step 1: Scan the network

To discover the network, follow these steps:

1. Once you have added a module to XCTU, switch to Network working mode.

2. Click **Scan the radio module network** to start the network discovery process. Modules are dynamically added as they are discovered, showing their connections and link quality.



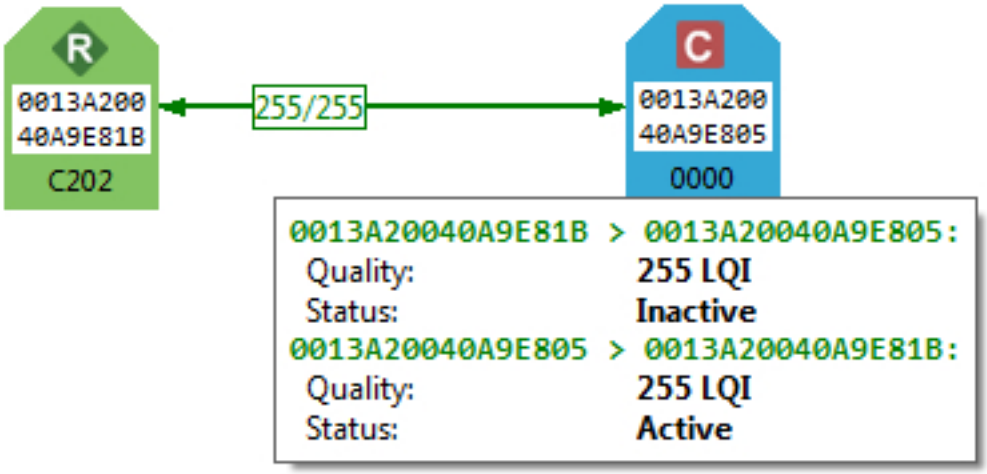
3. The scan process automatically stops according to the network preferences configured in Set network discovery preferences. You can also click **Stop scanning the network** at any time.

Note You may need to perform multiple scans to discover the entire network if, for example, modules are sleeping or the network is very large.

Step 2: Explore the network

Each module displays information about itself such as its role or its address. Hover the cursor over a module to view more detail.

The modules are connected by lines indicating connections with neighboring modules. The arrows indicate the direction of communication. When you are using protocols such as ZigBee or DigiMesh, click on a connection to view additional information about link quality and status.



Network working mode features can help you examine your network:

Button	Name	Description
	Start scan	Scans the radio module's network and displays a list of available modules.
	Stop scan	When scans specified in scan preferences are finished, the discovery process stops automatically. You can also click the **Stop scan** button at any time.
	Graph view	Displays the modules as nodes in a graph.
	Table view	Displays the modules as rows in a table.

Button	Name	Description
	Screenshot	Saves an image of the network to your computer.
	Export table	Exports network information in a tabular file format.
	Settings	Configures network-related parameters.
	Layout	Changes the network layout to one of six types: composite, spring, vertical tree, horizontal tree, grid (default), and radial.
	Filter links	Hides or displays connections between RF modules based on their quality. Enables/disables quality ranges via radio buttons. All filters are enabled by default so all connections are visible. You can establish connection quality colors and ranges in **Preferences > Network > Appearance** or by clicking **Configure quality ranges** link in the **Filter links** dialog. See Set network discovery preferences.
	Zoom	Changes the zoom level of the network.
	Find box	Searches for a particular module in the network.

Troubleshooting for XCTU

Check here for answers to common questions about working with XCTU.

Troubleshooting: General

After adding a local device to the list of devices, the icon corresponding to the module does not display the role of the module within its network.

The local radio module might not be joined to any network. In some cases (mostly in ZigBee protocols), the device must be joined to a network in order to determine its configured role.
After a local DigiMesh radio module executes a remote node discovery process, the device becomes unresponsive.

In the DigiMesh protocol, when you perform a Node Discovery (ND) or a Find Neighbors (FN) operation, the module will not process any AT command until its configured NT time expires. If you want to talk with the device immediately, you must restart it by pressing its reset button.
I have an end device radio module configured to sleep. It works in API operation mode with an ST value less than one second, but XCTU is not able to find it or read its settings.

You may need to press the commissioning button of the device before performing any action with that module in XCTU. Pressing the commissioning button will wake the module for 30 seconds so XCTU can communicate with it.
I get a "Permission denied" error while trying to add or discover modules in Linux.

By default, access to the serial and USB ports in Linux is restricted to root and dialout group users. To access your devices and communicate with them using XCTU, it is mandatory that your Linux user belongs to this group. Follow these steps to add your Linux user to the dialout group:

1. Open a terminal console
2. Execute this command:

   ```
   sudo usermod -a -G dialout <user>
   ```

   Where <user> is the user you want to add to the dialout group.

3. Log out and log in again with that user in the system.

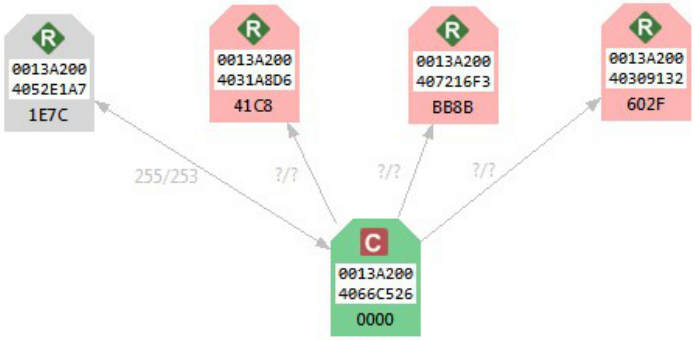
Troubleshooting: Networking

Not all remote devices are found after clicking the search button of a local radio module in a relatively big network.

In big networks, some devices may not answer the ND command in time. If not all devices are found after executing the remote discovery process, do the following:

1. Add those that have been found.
2. Click the search button of the local device again.
3. When asked whether to clear the list of remote modules, click **NO**.
4. Wait for new modules to be discovered.

Repeat this process until all the modules on your network are found.
When discovering a network, some of the nodes are displayed in light red color. What does it mean?

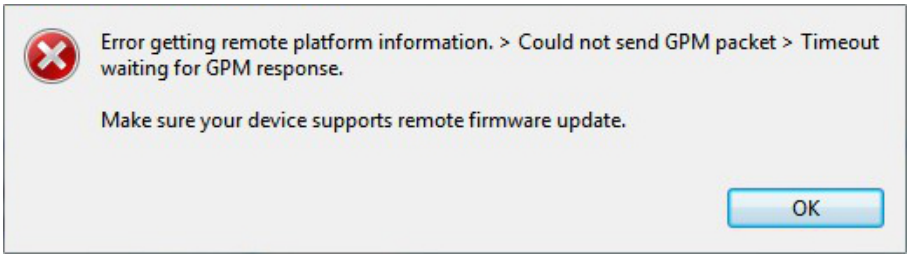


Red radio modules represent devices that were in the network at any time in the past but are unreachable now. When a radio module leaves the network, some devices may still contain information about it. When a new discovery is performed, the module appears to be there but does not answer or is unreachable when XCTU tries to verify the connection.

Troubleshooting: Firmware update

When XCTU is attempting to update the firmware of a local radio module, an error appears indicating that the firmware binary does not exist.

You probably tried to install a firmware using an old firmware. Old firmware packets are not compatible with this new version of XCTU. To obtain an updated firmware version, contact Digi support.
When XCTU is attempting to update the firmware of a remote radio module, an error appears indicating XCTU could not retrieve remote platform information.



Your remote radio module probably does not support remote firmware update. The following radio modules support the remote firmware update feature:

- XBee/XBee-PRO SX
- XLR Pro Module
- XLR PRO Radio Solution
- XBee/XBee-PRO 802.15.4 (S2C module versions only)
- XBee/XBee-PRO DigiMesh 2.4 (S2C module versions only)
- XTend RF Module Family (SX module versions only)
- XBee/XBee-PRO ZB and Programmable XBee-PRO ZB
- XBee/XBee-PRO ZB SMTand Programmable XBee-PRO ZB SMT
- XBee-PRO 900HP and Programmable XBee-PRO 900HP
- XBee 868LP and Programmable XBee 868LP
- XBee3 (Zigbee, DigiMesh 2.4, and 802.15.4)

Troubleshooting: Add radio module

I can't find my module when trying to add it to the list of devices.

Investigate the following possible reasons that XCTU isn't finding your module:

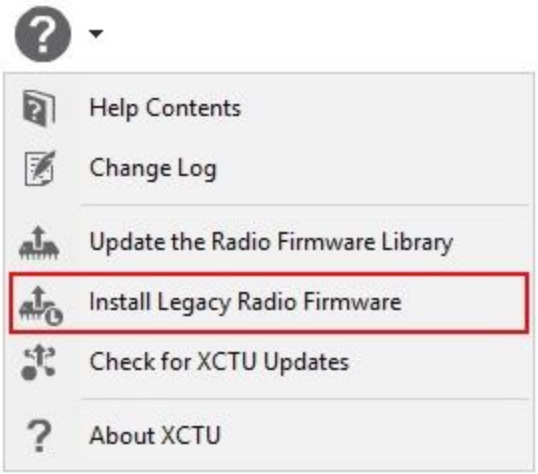
- **Radio module not connected/Invalid settings.** The selected port or the serial port settings where the radio module is connected are not valid. Make sure you have selected the correct port and settings. The most common serial configuration is:
  - Baud rate: 9600 or 115200
  - Data bits: 8
  - Stop bits: 1
  - Parity: None
  - Flow control: None
- **Sleeping radio module.** The radio module may be a sleeping node. If the module is sleeping at the time XCTU tries to communicate with it, XCTU cannot add it to the device list. If you believe your module could be sleeping, try to wake it up by pressing the Commissioning button of the board the module is connected to. Immediately click **Retry** to attempt to add the radio module again.
- **Programmable radio module.** The radio module you are trying to add may be a programmable variant. You must check the box next to **The radio module is programmable** in the **Add a radio module** dialog. Then, try to add it again and reset your module when prompted. For more information, see Add a programmable radio module.

- **Damaged radio module.** The firmware of the module may be damaged or the module may be in programming mode. Click **Recovery** from the dialog to open XCTU's XBee recovery tool. For more information, see XBee recovery tool.

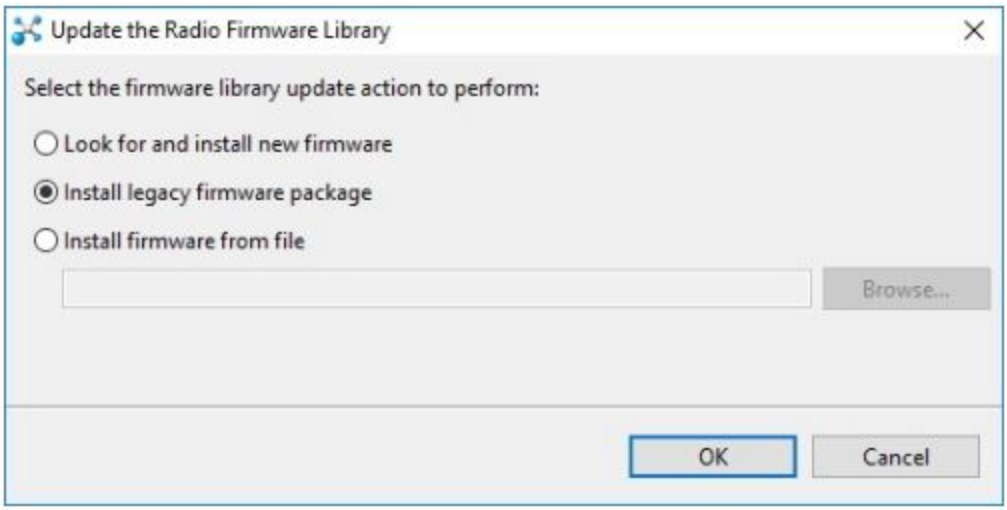
After adding a device to the list of devices, the **Function** field states "XXX - Not found in XCTU".

The firmware version of the radio module is not installed in XCTU. The radio module firmware may be legacy firmware, and you need to install the legacy radio firmware package on XCTU. Follow these steps to do so:

1. Select **Help > Install Legacy Radio Firmware** option.



2. The **Install legacy firmware package** option should be already selected in the **Update the Radio Firmware Library** dialog. If not, select it.



3. Click **OK** to start. A dialog displays the status of the download process.
    - If it does not fix the problem, try the same steps but choose the **Look for and install** new firmware option in the **Update the Radio Firmware Library** dialog.
    - If the problem persists, contact with support so they can provide you the proper firmware for your module. Then, follow previous steps but the **Install firmware from file** option in the **Update the Radio Firmware Library** dialog and select the firmware file you were provided with.

Known issues

XCTU currently has the following known issues and limitations:

- XCTU is not compatible with the following Digi RF devices:
  - XTream OEM RF modules family
  - XCite OEM RF modules family
- XCTU includes a mechanism to prevent the computer from going to sleep automatically in Windows and MacOS systems when it is performing long-duration tasks such as network discovery and range testing. Note that if you force the computer to sleep while XCTU is performing such tasks, the USB ports that XCTU was communicating with may become unresponsive after the system wakes from sleep. Furthermore, if you try to close the communication with them they could hang and they won't recover even if you close XCTU. If your experience this issue, you must unplug the USB cable and plug it in again to restore the communication with the port. You can do this even while XCTU is running.
- ZigBee local modules configured as end devices cannot perform network discovery in network working mode.
- The XLR PRO Radio Solution and programmable XBee radio modules do not support the XCTU recovery feature.
- UNIX-based operating systems allow you to open multiple instances of the same port. This scenario can produce unexpected behavior if you have the same port open simultaneously by different Linux apps.