DaintreeNetworks

Start-up commissioning and binding using the Daintree Networks Sensor Network Analyzer

Application Note AN023

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Sensor Network Analyzer Release 2.2 (2008-02-29)

About commissioning

Commissioning is the physical deployment, addressing, and logical binding of nodes to form a functional network. You commission all types of networks including those used for testing and field trials, and live deployed networks.

In its broadest sense, commissioning encompasses a wide range of tasks, including a survey of the radio and physical environment, the placement of devices, configuration of parameters, application binding, optimization of network and device parameters, and testing and verification of correct operation.

Often, non- and semi-technical issues need to be considered, including the skills and workflow practices of the installer, ease and identification and accessibility of devices, and interoperability and coexistence with other wireless or wired systems.

While consideration for commissioning is often focused on the installer, the ability to easily configure and commission ZigBee systems during development and testing, as well as field trials, can also significantly speed up the development and product delivery to market.

This application note provides instructions of how to use the Sensor Network Analyzer to perform start-up commissioning and binding to form a simple network.

About Daintree's Sensor Network Analyzer (SNA)

The SNA combines a powerful protocol analyzer with network visualization, measurements and diagnostics for IEEE 802.15.4™ and ZigBee® applications. It provides automatic display of network formation, topology changes, and router and coordinator state changes allowing rapid detection of incorrect network behavior and identification of device or network failures.

It also provides a powerful commissioning tool that helps to hide the complexity of the underlying technology, and provides straight-forward configuration, testing and troubleshooting capabilities. Its graphical representations makes if fast and easy for installers to monitor network formation and measure key parameters such as link quality and bindings.

About the 2400E Sensor Network Adapter

Daintree's 2400E Sensor Network Adapter can be used as an active device, which means that under the control of the SNA it is capable of "active analysis."

Active devices are able to join an 802.15.4 or ZigBee network, interact with other devices on it, and actively poll devices to gain information not available through passive "sniffing" alone. They can also issue commands to network devices, such as configuration settings during commissioning as described in this application note.

Visit www.daintree.net to find out more about Daintree products.

How does start-up commissioning work?

This is the initial configuration of a device that tells it which network to join and the way in which it should join that network. It typically consists of the following steps:

1. If required, load the required firmware to all devices.
2. Use the SNA to start a new Commissioning Network with a Daintree 2400E (or other active device) as coordinator.
3. Turn on the remaining devices, and then commission each device by setting all parameters required to start, and then join, the new live network.
4. Use the SNA to monitor the new live network.
5. This application note also describes how to add bindings as required.

Loading firmware to devices

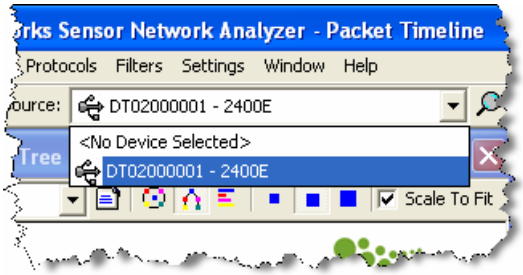
The firmware required varies depending on the type and purpose of the devices being commissioned. The SNA's commissioning and binding features rely on the following standard ZDO and ZCL clusters:

- Network Discovery
  - ZDO_IEEE_Addr_request
- Commissioning
  - ZCL Commissioning Cluster
- Permit Join
  - ZDO_Mgmt_Permit_join_request
- Leave
  - ZDO_Mgmt_Leave_req
- Service Discovery
  - ZDO_Active_EP_request
  - ZDO_Simple_Desc_request
- Binding
  - ZDO_Bind_request
- Binding Discovery
  - ZDO_Mgmt_Bind_Request
- Groups
  - ZCL Groups Cluster
- Power Levels
  - ZDO_Power_desc_request
- LQI
  - ZDO_Mgmt_LQI_request

Starting a commissioning network

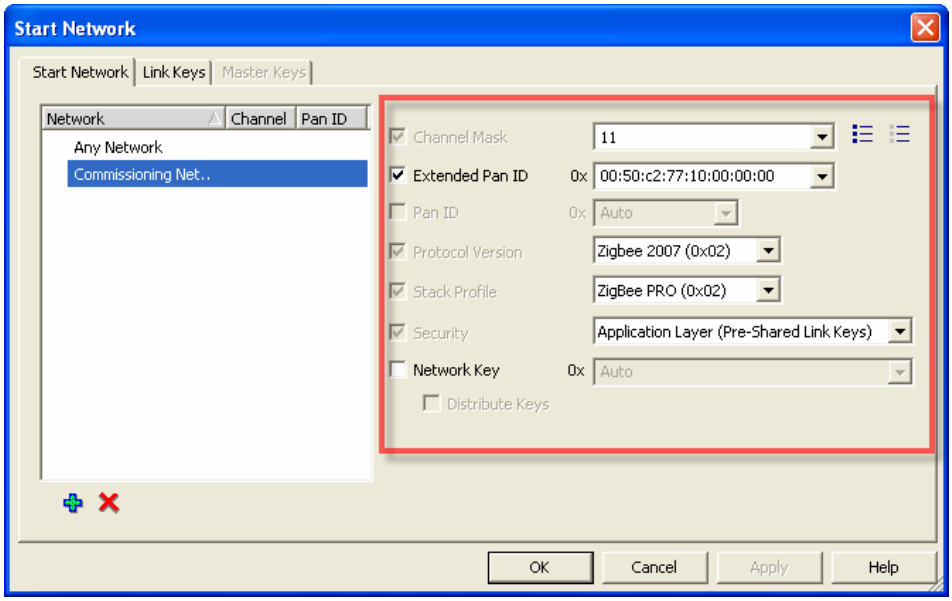
The following example uses Daintree's 2400E Sensor Network Adapter as the network coordinator. You can also use any device that supports the SNA's active analysis features such as the Integration USB Dongle or Ember EM250.

1. Start the SNA application and connect the 2400E Sensor Network Adapter to your computer via USB.
2. Select the 2400E from the **Source** list.



3. From the **Settings** menu, select **Device Manager**, or click the Device Manager icon from the main SNA toolbar. This opens the Device Manager dialog box.
4. On the Device Manager dialog box, click the **Commission** tab. Then click your active device (to select it) and click ▶ to start a new network.

5. On the Start Network dialog box **Start Network** tab, click **Commissioning Network** to select it. Then enter the settings to use for your network.



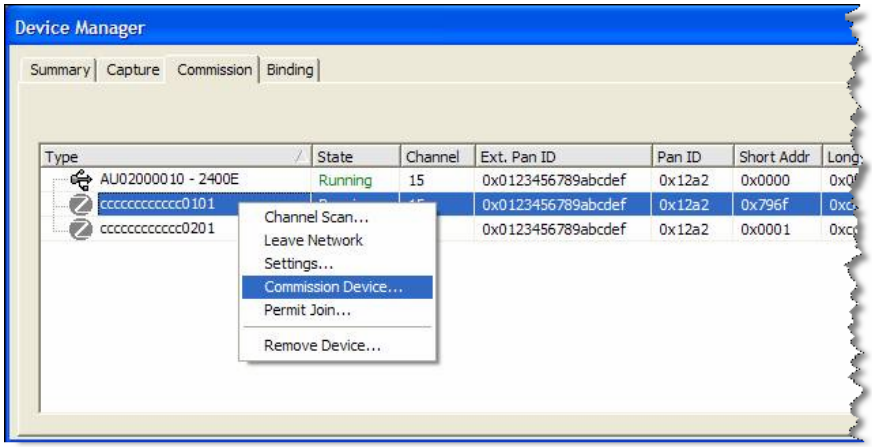
6. If you are using security, use the **Link Keys** and **Master Keys** tabs to add and manage information about your network security keys.
7. Click **OK** to start the network using the specified settings.

Commissioning devices

1. Turn on the remaining devices.

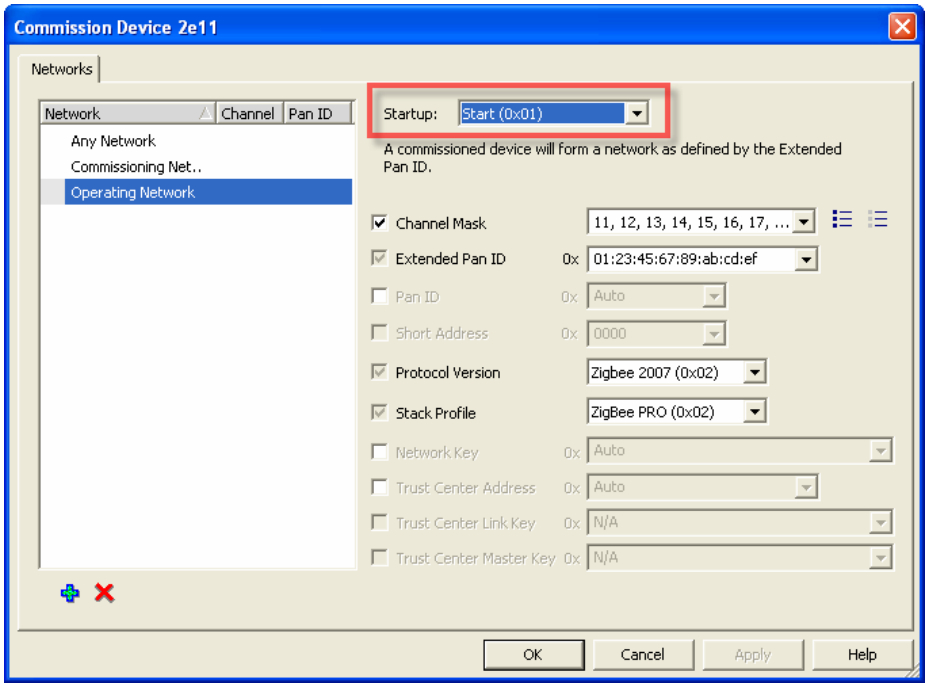
   As each device joins your commissioning network, you will see it appear on both the Visual Device Tree window and the Commission tab of the Device Manager dialog box.

2. On the Device Manager > Commission tab, right-click the device that will act as the coordinator in your new network, and then select **Commission Device**.



3. On the Commission Device dialog box, click  and enter a name under which to save the settings for the new "live" network (called Operating Network in the example below). Then enter the settings for the new coordinator:

   - **Startup** must be **Start (0x01)** to start the new network with the device as coordinator.
   - **Extended Pan ID** should be unique to ensure that subsequent devices join this new network correctly.



4. Click **OK** to save the settings.

This causes the device to leave the Commissioning Network, and go off to start the new Operating Network as coordinator. When that is complete, the device will disappear from the Visual Device Tree and Device Manager for the Commissioning Network.

5. Commission each remaining device as described in steps 2 through 4, with the following exceptions:
   - Select **Operating Network** from the list of available networks as a fast way to commission all devices with the same parameters.
   - **Startup** should be set to **Rejoin**, which causes the device to join a network using the specified channel and EPID.

Monitoring the new operating network

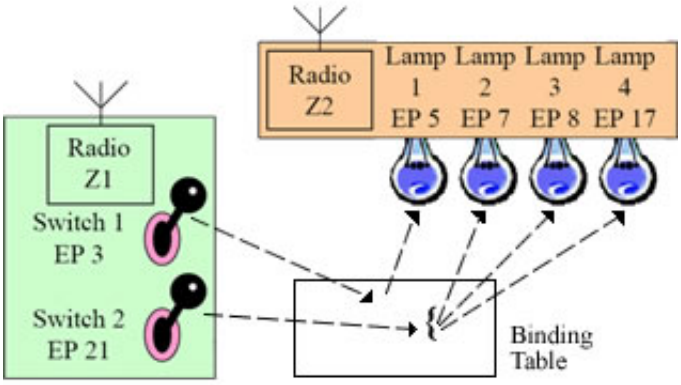
After all devices are commissioned to leave the Commissioning Network and join the new Operating Network, the Visual Device Tree and Device Manager will show only the 2400E Adapter.

1. On the Device Manager > Commission tab, right-click the 2400E, and then select **Leave Network** to leave the Commissioning Network.
2. On the Device Manager > Commission tab, right-click the 2400E, and then select **Join Network**.
3. On the Join Network dialog box, select **Operating Network** from the list of available networks to cause the 2400E to join your new live network. If the Operating Network is using security, you also need to specify the Trust Center Address and Link Key.

   When the Join is successful, the SNA will update all windows to show details for the new Operating Network.

Adding bindings

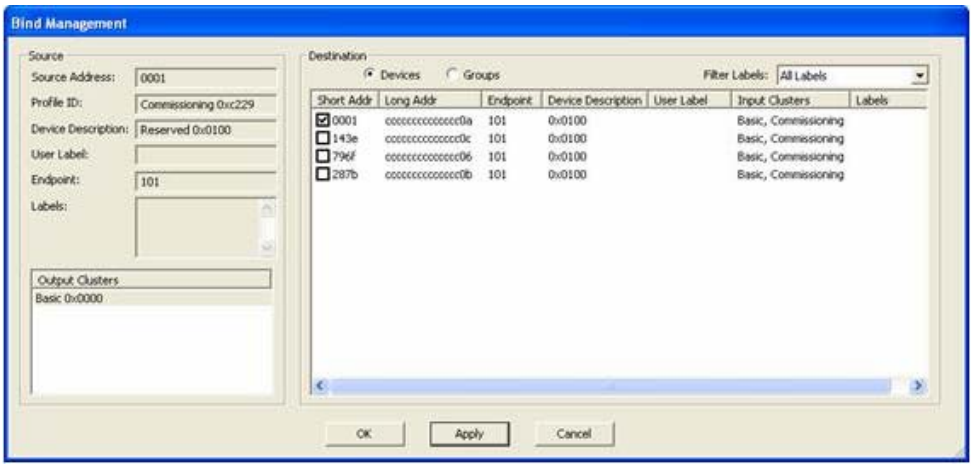
Bindings are connections between end devices in a ZigBee network, such as a connection between a light switch and the light that it operates. Each binding supports a specific Application Profile, and each message type is represented by a Cluster (within that profile).



You can create bindings between endpoints that use the same Application Profile and that have associated Output/Input Clusters (for example, one with an On/off Output Cluster, and another one with an On/off Input Cluster).

1. On the Device Manager dialog box, click the **Binding** tab. Then click  to perform a service discovery, during which the SNA will find and display details about each device's application profile and output/input clusters.
2. Select the endpoint for which you want to create a binding, and then click  to open the Bind Management dialog box.
3. On the Bind Management dialog box, select the Output Cluster for which you want to create the bindings. (If the device contains only one Cluster, it is automatically selected for you.)

   The SNA lists all of the available endpoints that match the selected Application Profile and Output Cluster.



4. To **add** a new binding, click the box next to its Short Address. You can also **remove** an existing binding, by clearing the box next to its Short Address.
5. Click **OK** to save the bindings and display their details on the Device Manager > Binding tab and also in the Visual Device Tree window.