

# Using the Ember EM2420DK Development Board with the Daintree Networks Sensor Network Analyzer

Application Note AN003



EMBER EM2420DK  
Development Board

Via Ethernet/IP



HOST COMPUTER

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Sensor Network Analyzer Release 2.3 (2008-07-31)

## About the Sensor Network Analyzer

The Daintree Networks Sensor Network Analyzer (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.

The SNA works in conjunction with Daintree's 2400E Sensor Network Adapter to provide analysis for small and large networks. With multi-node capture, analysis of large networks across wide areas (such as multiple rooms within a facility) is possible.

The SNA software can also use the Ember EM2420 Developer Kit as a packet sniffing node.

This application note describes how to use the SNA software with the EM2420 Developer Kit. You can find out more about the SNA software in general, refer to the following:

- **Quick Start Guide:** Included with the SNA application. From the SNA **Help** menu, select **Quick Start Guide**, or else from the Windows **Start** menu, select **Daintree Networks > Documentation > SNA Quick Start Guide**.
- **User Guide:** Included with the SNA application. From the SNA **Help** menu, select **User Guide**, or else from the Windows **Start** menu, select **Daintree Networks > Documentation > SNA User Guide**.
- **FAQs and other support resources:** These are available from the Daintree Networks web site at [www.daintree.net/support](http://www.daintree.net/support)

To find out more about the Ember 2420 Developer Kit in general, refer to the following (which is provided in the development kit):

- Ember Studio User's Guide

## Getting started

In summary, getting started involves the following steps, each of which is described in detail in the following sections:

1. Install the Sensor Network Analyzer software
2. Install the sniffer firmware for the Ember board
3. Configure the IP address for the Ember board and test connectivity
4. Start the SNA software, and then add the Ember board as a capture device
5. Select the Ember EM2240DK as the current capture device

Once connected and configured, you can use the Ember EM2240DK as a packet sniffer/capture node with the Sensor Network Analyzer.

## 1. Installing the SNA software

This software contains the firmware driver you need for the Ember 2420 board, so you need to install it before connecting the board to your PC.

1. Go to [www.daintree.net/register](http://www.daintree.net/register) to register your software and download the latest release.
2. Enter your email address together with the 15-digit alpha-numeric registration code from the software CD case. After you click Next, an activation code will be emailed to the address you supply.
3. Follow the link provided to download the latest release of the SNA software, plus the *Sensor Network Analyzer Quick Start Guide*. Daintree **strongly** recommends that you download the latest version of the software to ensure you have the latest functionality and fixes.
4. Follow the instructions in the *Quick Start Guide* to install and activate the software.

## 2. Installing the sniffer firmware

The 2420 board requires dedicated packet sniffer firmware to run with the Daintree Networks Sensor Network Analyzer. The following provides a summary of the steps required to install this firmware. Refer to the **Ember Studio User's Guide** if you need more detailed instructions.

1. Set **serial configuration array headers** to enable use of the 2420 serial port connection.



2. Connect the UART1 port on the Ember board to the serial port of the host computer (leave the board's Ethernet port disconnected).
3. Power on the Ember board.
4. Start the **Ember Studio** application. If the Connection Wizard starts, click **Cancel**.
5. Select **Tools > BootLoader > Serial** to open the Serial Bootload dialog box.



6. Enter the COM port, and then Browse to select the file **sniff-em2420-dev.bin** in the **C:\Program Files\Daintree Networks\Firmware\Ember** directory.
7. Click the **Bootload** button, and then wait for the install to complete. The bar at the bottom of the dialog box shows the progress.
8. When the bootload is complete, power off the Ember board. Then connect the Ethernet cable and power the board back on.

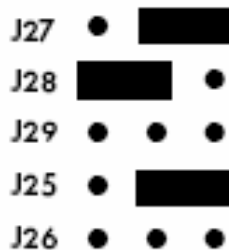
### 3. Configuring the IP address and testing connectivity

By default the Ember Node is configured to use DHCP. For use with the SNA, Daintree recommends that you configure the board with a static IP address.

If you do not know the current IP address of the Ember node, you can configure the static IP address via the serial port. If you do know the current IP address of the node, you can use a telnet session as described below.

#### 3.1 Configure a static IP address using the serial port

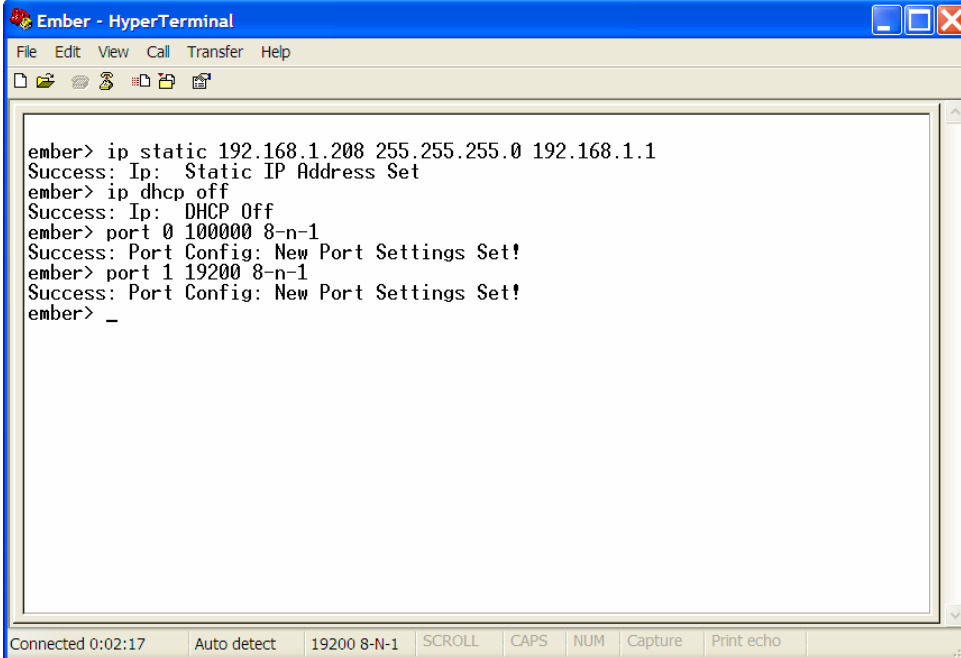
1. Set **serial configuration array headers** to enable use of the 2420 serial port connection.



2. Connect the UART1 port on the Ember board to the serial port of the host computer (leave the board's Ethernet port disconnected).
  3. Power on the Ember board.
  4. Open a hyper-terminal window to the given COM port using the serial port parameters (19200, 8, N, 1)
  5. Set the static IP address as follows, selecting a free address on the desired subnet
- ```
ember> ip static <ip_addr> <net_mask> <gateway>
ember> ip dhcp off
```
6. While in the terminal window. enter the following to set the data-rate of the packet interface:

```
ember> port 0 100000 8-n-1
ember> port 1 19200 8-n-1
```

An example terminal window is shown below:



```
Ember - HyperTerminal
File Edit View Call Transfer Help
ember> ip static 192.168.1.208 255.255.255.0 192.168.1.1
Success: Ip: Static IP Address Set
ember> ip dhcp off
Success: Ip: DHCP Off
ember> port 0 100000 8-n-1
Success: Port Config: New Port Settings Set!
ember> port 1 19200 8-n-1
Success: Port Config: New Port Settings Set!
ember> _

Connected 0:02:17  Auto detect  19200 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
```

7. Disconnect the serial port connection and power off the Ember node by disconnecting the power.
8. Configure the board headers for packet capture as described in section 3.3.

### 3.2 Configure a static IP address using a telnet connection

The following instructions assume that the existing IP address is known or able to be discovered.

1. Discover the IP address allocated by DHCP (for example, by examining the DHCP server table if you have access, or by sending a UDP broadcast message to port 4920).
2. Telnet to that IP address on port 4902.
3. Set the static IP address as follows, selecting a free address on the desired subnet:  
**ember> ip static <ip\_addr> <net\_mask> <gateway>**  
**ember> ip dhcp off**
4. In the telnet window, enter the following to set the data rate of the packet interface:  
**ember> port 0 100000 8-n-1**

An example telnet dialog is shown below:

```

C:\>telnet 192.168.1.200 4902
Trying 192.168.1.200...
Connected to 192.168.1.200.
Escape character is '^]'.

ember> ip static 192.168.1.208 255.255.255.0 192.168.1.1
ip static 192.168.1.208 255.255.255.0 192.168.1.1
Success: Ip: Static IP Address Set
ember> ip dhcp off
ip dhcp off
Success: Ip: DHCP Off
ember> port 0 100000 8-n-1
port 0 100000 8-n-1
Success: Port Config: New Port Settings Set!
ember> config
config
ember05 192.168.1.208 255.255.255.0 192.168.1.1
STATIC
100000 8-n-1 19200 8-n-1 38400 8-n-1
v. 1.1b10 RCM3400, Aug 27 2004 15:45:52
ember> quit
Connection closed by foreign host.

C:\>

```

5. Reboot the Ember board by disconnecting and reconnecting the power. Wait approximately 30 seconds for the board to boot and reconfigure.
6. Configure the board headers for packet capture as described in section 3.3.

### 3.3 Configure the Ember board headers for packet capture

After configuring the IP address, you need to reset the board's headers and check the IP connection.


1. Reset the **serial configuration array headers** as shown to enable use of the back channel data and control interface.

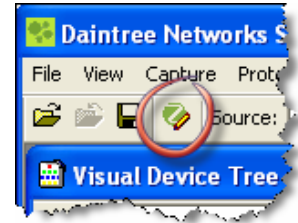


2. Power on the Ember device by connecting the power. Wait approximately 30 seconds for the node to boot and reconfigure.
3. Disconnect any serial connection and connect the Ember board via Ethernet.
4. Test connectivity to the Ember board using a ping test to the address configured earlier:

```
C:\> ping 192.168.1.208
```

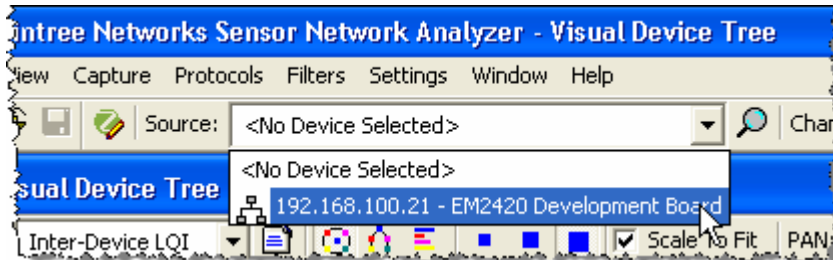
## 4. Adding the Ember board as an SNA capture device


1. If you have not already done so, start the SNA software.
2. From the **Settings** menu, select **Device Manager**, or click the Device Manager icon from the main SNA toolbar.
3. On the Device Manager **Summary** tab, click  and then select **Add Ethernet**.
4. On the Add Ethernet dialog box **Ethernet Settings** tab, enter the following values:
  - o **Type:** EM2420 Development Board
  - o **Hostname\IP Address:** Enter the static IP address that you set in step 3 of the previous procedure.
  - o **Mode:** Disabled for this board
5. Click the **User Settings** tab, and then enter the following values:
  - o **User Label:** Enter the name by which you want to identify this device
  - o **Image:** Not required
6. Click **OK** to save the new definition. When you return to the Device Manager Summary tab, you'll notice that the Ember board has been added to your list of devices.



## 5. Selecting the Ember board as the current capture device

1. In the SNA main window, select the Ember board from the **Source** list.



If the Ember board is not available from the list, click  to get the SNA software to search/scan for capture devices and refresh the Source list.

2. Select the **Channel** on which you want to capture traffic.

Click  to start the capture.

## Known limitations

The EM2420 board is not able to capture 802.15.4/ZigBee packets at the maximum possible data rate. Even though these boards use an Ethernet connection to the host computer, this connection can only forward packets at the maximum rate of the internal serial connection on the developer board. The maximum data rate supported by the EM2420 developer boards is 100 kbps. As such, at high data rates, some packets may not be detected by the Ember board. Where full rate capture is required, you should use the Daintree Networks Sensor Network Adapter.

Multiple EM2420 developer boards cannot be used with the SNA simultaneously. If multi-point capture is required, you should use multiple Daintree Networks Sensor Network Adapters.

If the Ember 2420 board is in use by the SNA application, it cannot be used concurrently by any other application.

## Where to next?

We recommend that you start exploring the SNA menus to get an understanding of the full capabilities of this product.

Detailed descriptions of all options are available in the *Sensor Network Analyzer User Guide*, which you can open from the SNA **Help** menu and the Windows **Start** menu. You can also find FAQs and other supporting information on the Daintree web site at [www.daintree.net/support](http://www.daintree.net/support)

The Daintree web site includes other useful information, such as

- [www.daintree.net/solutions](http://www.daintree.net/solutions) for product information including data sheets and an animated tour
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