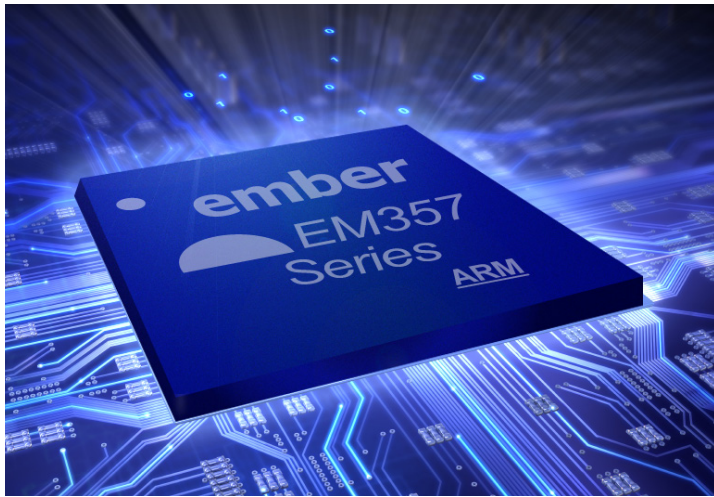


0008-02-08-00-000 (Rev. A)
ZICM357P2 - Evaluation Kit User's Guide

ZICM357P2 Evaluation Kit User Guide

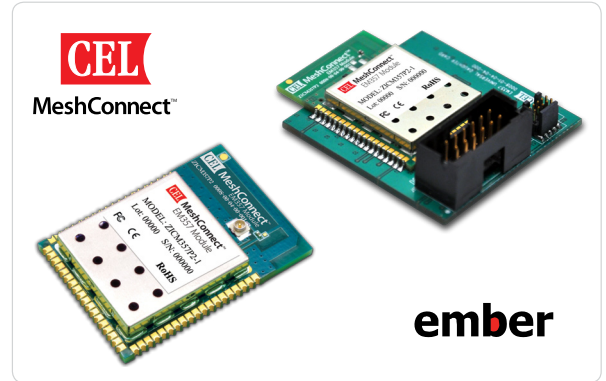


Introduction

The ZICM357P2 Evaluation Kit (ZICM357P2-KIT1-1) provides a simple evaluation platform for the California Eastern Laboratories MeshConnect™ ZICM357P2 module. The ZICM357P2 module is based upon Ember's EM357 System-On-Chip IC which integrates a 2.4 GHz IEEE 802.15.4 compliant transceiver.

The purpose of this document is to instruct the user on how to use the firmware which is factory preprogrammed onto the modules on the evaluation boards included with the kit. The firmware allows the execution of simple tests for FCC validation, manufacturing tests and a basic IEEE 802.15.4 communication demo.

This document details two additional basic demonstrations which place the ZICM357P2 modules in various operating modes, which allow for setting and/or testing various parameters. The user can also link the two boards in a simple IEEE 802.15.4 Point-to-Point network to perform Range and Packet Error Rate (PER) tests.



Recommended Development Tools

The CEL ZICM357P2-KIT1-1 Evaluation Kit does not include all tools necessary for a complete development environment. In addition to the CEL Kit (the hardware platform) a software platform is necessary. The software components needed are the ZigBee stack and a software development environment. The Ember ZigBee stack is built targeting the IAR Embedded WorkBench for ARM. Ember offers two kits, one with the bundled compiler and one without, however, both kits include the ZigBee networking stack. The part numbers for the Ember Development Kits are detailed below:

Development Tool	Description
EM35X-DEV	Includes 30-day trial license for IAR Embedded Workbench
EM35X-DEV-IAR	Includes a standalone license for IAR Embedded Workbench

Development Kit Available

ZICM357P2-KIT1-1
 Evaluation and Development
 Kit for the MeshConnect
 EM357 Module.

Table of Contents

INTRODUCTION	1
RECOMMENDED DEVELOPMENT TOOLS	1
TABLE OF CONTENTS	2
EVALUATION APPLICATIONS	3
COMMAND LINE INTERFACE (CLI) MODE	3
ENTERING CLI MODE	4
CLI COMMANDS	5
POINT-TO-POINT (P2P) MODE	6
ENTERING P2P MODE	6
RANGE TEST	6
PACKET ERROR RATE (PER) TEST	7
DOWNLOAD FIRMWARE TO THE EVALUATION BOARDS	7
INSIGHT ENVIRONMENT SETUP	8
INSIGHT DESKTOP ADAPTERS VIEW	8
CONNECTING THE ZICM357P2 TO THE INSIGHT ADAPTERS	8
UPLOADING A FIRMWARE APPLICATION	9
UPLOADING AN APPLICATION	9
RELOADING AN APPLICATION	9
REFERENCES & REVISION HISTORY	10

Evaluation Applications

The factory pre programmed (and certified) firmware allows the evaluation boards to operate in two different modes: Command Line Interface (CLI) mode or Point-to-Point (P2P) test mode. The P2P mode allows for the boards to communicate with one another in a standalone configuration (not connected to a PC), while the CLI mode is a terminal-based mode for modifying the settings and parameters of the ZICM357P2 module. The CLI mode also allows for the execution of simple tests for FCC validation and manufacturing tests.

Command Line Interface (CLI) Mode

The CLI is a manufacturing software component of the evaluation firmware which provides the capability to test and validate the physical layer of the ZICM357P2 module. This mode can also be used in conjunction with the P2P mode to change some of the device parameters in order to customize the P2P mode tests.

Locating the COM Port Assignment

Once the USB driver has been successfully installed (see the Universal Evaluation Board User Guide) a Virtual COM port has been created. In order to interface to the terminal program on the PC, the COM port assignment is needed. The Windows Device Manager can be used to identify the assigned COM port, as well as verify that the drivers have been properly installed. To determine which COM port has been assigned to the evaluation board, please follow the steps listed above:

STEPS

1. Right-click on the My Computer icon on your computer's desktop, or the My Computer entry from the Start Menu.
2. Select Properties and the System Properties window will be displayed.
3. Click on the Hardware tab and then click on the Device Manager button. The Device Manager will be displayed.
4. Scroll-down and expand the Ports (COM & LPT) section. One of the items in the list of available ports should read Silicon Labs CP210x USB to UART Bridge (COM#), where # is the assigned COM port. The screenshot shown in Figure 1 has been assigned to COM5.

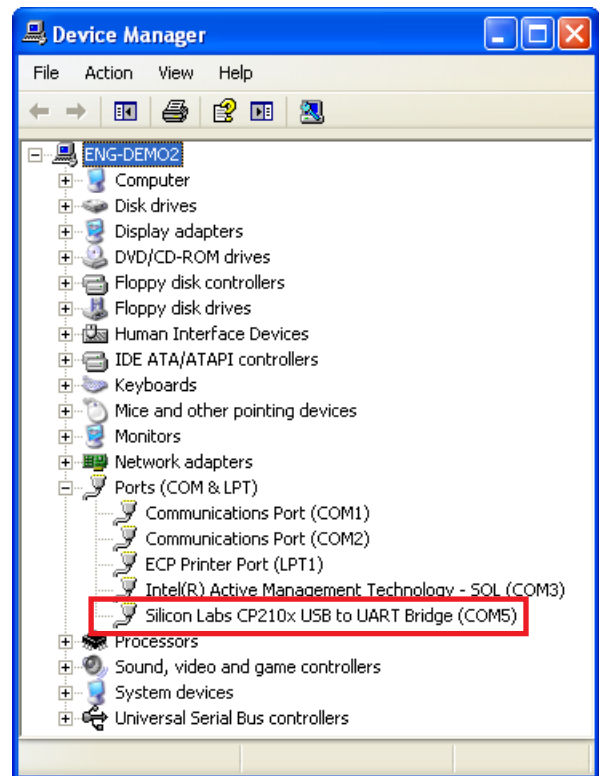


Figure 1: CP2101 COM Port Assignment

5. Make note of the assigned COM port as it will be needed when the CEL Universal Evaluation Board with the ZICM357P2 module is used with the front-end software.

Connecting to the Evaluation Board via Terminal

Once the COM port has been identified, the user will need to connect the evaluation board to the PC and establish a connection to a terminal program of the user's choice. The instructions below assume that the HyperTerminal program, which is included in Microsoft Windows XP, is being targeted.

STEPS

1. Connect the evaluation board to the PC through the USB cable.
2. From the **Start menu**, choose **All Programs** → **Accessories** → **Communications** → **HyperTerminal**.
3. HyperTerminal will open a **New Connection** dialog, prompting for a name to be assigned for this connection. Enter a name, choose an icon and click the OK button to proceed.
4. In the **Connect To** window, choose the previously determined COM# from the pull-down menu in the **Connect using** field and click the **OK** button.
5. In the **COM# Properties** window, enter the following parameters and click the **OK** button.

Bits per second:	115200
Data bits:	8
Parity:	N
Stop bits:	1
Flow control:	None

6. Power-cycle the evaluation board or press and release the RESET button to enter CLI mode. Wait five seconds and CLI mode will be entered. See the following section for further details.

Entering CLI Mode

When the evaluation board with the factory preprogrammed firmware is power-cycled or the RESET button is pressed and released, the evaluation board automatically enters CLI mode five seconds after the LEDs finish cycling from left to right. Alternatively, during the five second window Switch #3 (SW3) may be pressed and released bypassing the timeout and CLI mode will be entered immediately. When the evaluation board is in CLI mode all the boards LED's are initially off. CLI mode supports several commands for modifying the settings and parameters of the ZICM357P2 module and the execution of simple tests for FCC validation and manufacturing tests. When in CLI mode, typing the "help" command (minus the quotes) will display the high level menu of supported commands. The following section lists the various commands supported by the CLI mode.

CLI Commands

The following table (Table 1.) details the commands and functions which are available for use through the terminal interface when the evaluation board is configured for use in CLI mode.

COMMAND	DESCRIPTION	COMMAND	DESCRIPTION
HELP	Prints the Help menu list of commands.	MFG TONE <[START] [STOP]>	Shows how to use <code>mfglibStartTone()</code> and <code>mfglibStopTone()</code> to transmit a tone over a radio.
VERSION	Prints the firmware version number information.	MFG STREAM <[START] [STOP]>	Shows how to use <code>mfglibStartStream()</code> and <code>mfglibStopStream()</code> to transmit a stream of random characters over a radio.
INFO	Prints various information about the device and device status, including app version, network status, EUI-64 of device, mfg mode status and stack status.	MFG SEND <numPackets> test- packet <length>	Shows how to use <code>mfglibSend()</code> to send a packet of (length) bytes of the test-packet payload (numPackets) times.
NETWORK	Prints the network help menu list of commands.	MFG SEND <numPackets> random <length>	Shows how to use <code>mfglibSend()</code> to send a packet of (length) bytes of a random payload (numPackets) times.
NETWORK FORM <channel> <power> <panid in hex>	Command for forming a network with channel and power settings for a particular panid in hexadecimal format.	MFG SEND <numPackets> message <first 8 bytes> <second 8 bytes>	Shows how to use <code>mfglibSend()</code> to send packets of specified payload (numPackets) times .
NETWORK JOIN <channel> <power> <panid in hex>	Command for joining a network with channel and power settings for a particular panid in hexadecimal format.	MFG CHANNEL SET <channel>	Shows how to use <code>mfglibSetChannel()</code> to set the radio channel.
NETWORK INIT	Command for initializing a network.	MFG CHANNEL GET	Shows how to use <code>mfglibGetChannel()</code> to get the radio channel.
NETWORK LEAVE	Command for leaving a network.	MFG POWER SET <power>	Shows how to use <code>mfglibSetPower()</code> to set the radio transmit power level.
NETWORK PJOIN <time>	Command for permitting joining a network for a period of time (in seconds).	MFG POWER GET	Shows how to use <code>mfglibGetPower()</code> to get the radio transmit power level.
RESET	Resets the device.	LED	Prints the list of LED control commands.
TOKEN	Prints list of token commands	LED OFF <lednum>	Use <code>led off x</code> to turn BOARDLEDx off.
TOKEN INIT	Initializes all the mfg tokens.	LED ON <lednum>	Use <code>led on x</code> to turn BOARDLEDx on.
TOKEN Calibrate	Calibrate the current channel	LED TOGGLE <lednum>	Use <code>led toggle x</code> to toggle BOARDLEDx
FLASH READ <address in dec> <length in dec>	Command for reading flash contents.	CONFIG	Prints the list of config control commands.
FLASH WRITE <address in dec> <length in dec> <data as string of hex bytes>	Command for writing flash contents.	CONFIG DISPLAY	Displays the device configuration
FLASH ERASE <start address in dec> <length in dec>	Command to erase flash contents.	CONFIG SET <CHANNEL> <TXPOWER> <TXSTATE> <PANID>	Sets the device configuration
MFG	Prints list of mfg commands.	CONFIG SAVECURRENT	Saves current device configuration to NVRAM on the evaluation board.
MFG START <want_callback>	Shows how to use <code>mfglibStart()</code> to start use of <code>mfglib</code> test functionality and packet receive functionality. Receive handler callback is 0 for false, 1 for true.	CONFIG DEFAULT	Sets the device configuration to default one
MFG END	Shows how to use <code>mfglibStop()</code> to end use of <code>mfglib</code> test functionality.	SENSOR	Displays the sensor output
		BUZZER	Enables to buzz the onboard buzzer
		DSLEEP	Puts the module into deep sleep state.

Table 1: CLI Commands

CLI Command Example - Changing the Channel / Power Out

Once a serial connection has been completed and established and CLI mode has been entered, the following <config set> can be entered into the terminal to alter the RF Settings. The first parameter of the <config set> is the Channel #, the second is the Ember Power Step (prior to the Power Amplifier), the third is the Transmit State ('0' is Idle, '1' is Tone and '2' is Stream) and the fourth parameter sets the Personal Area Network Identification (PANID). A "Tone" transmits a CW signal and a "Stream" transmits a continuously modulated signal. After making changes a power-cycle is required for the new settings to take effect.

Example 1 (Changing to Channel #11, Transmit Power +20 dBm and PANID 0x01FF):

```
config set 11 8 0 1FF
```

Example 2 (Changing to Channel #15, Transmit Power +9.5 dBm and PANID 0x1234):

```
config set 15 -14 0 1234
```

Example 3 (Changing to Channel #20, Transmit Power +3 dBm and PANID 0xABCD):

```
config set 20 -20 0 ABCD
```

P2P Mode

The factory preprogrammed firmware includes a P2P mode which provides the capability to build and operate a simple IEEE 802.15.4 network between two evaluation boards. The user can also utilize the CLI mode to change settings and parameters to allow for more exhaustive evaluations in the P2P mode testing. The following procedures, however, assume that any changes to the

parameters have been saved to the NVRAM of both boards during the CLI session, have been returned to the factory default settings or have been changed to complementary settings on both of the evaluation boards.

Entering P2P Mode

When an evaluation board with the factory preprogrammed firmware is power-cycled or the RESET button is pressed and released, the evaluation board automatically enters CLI mode five seconds after the LEDs finish cycling from left to right. In order to enter P2P mode either Switch #0 (SW0) or Switch #1 (SW1) must be pressed and released within the aforementioned five second window. You will need two evaluation boards to perform the P2P testing, one configured with SW0, which will be referred to as the Transmitter, and the other configured with SW1, which will be referred to as the Receiver.

Range Test

- **Description:** The TX evaluation board repeatedly transmits packets over the default channel and requests an acknowledgement of each packet from the RX evaluation board.
- **Configuration #1:** Power-cycle or RESET the first evaluation board and within the five second window (after the LEDs have cycled from left to right) press and release the Switch #1 (SW1) pushbutton. If successful, LED1 will illuminate, indicating that the network configuration has been completed and the board has been configured as the receiver. The following default values have been assigned as below:

My Address:	0x8001
Destination Address:	0x8000
PAN ID:	0x01FF
Channel #:	15
Power Level:	+20 dBm

- **Configuration #2:** Power-cycle or RESET the second evaluation board and within the five second window (after the LEDs have cycled from left to right) press and release the Switch #0 (SW0) pushbutton. If successful, LED2 will illuminate, indicating that the network configuration has been completed and the board has been configured as the transmitter. The following default values have been assigned as below:

My Address (MyAddr):	0x8000
Destination Address:	0x8001
PAN ID:	0x01FF
Channel #:	15
Power Level:	+20 dBm

- **Start / Stop:** Pressing SW1 after configuration will commence the Range test.
- **Indications:** On the transmitter evaluation board, LED0 will blink for each packet being transmitted until the Range test is stopped. On the receiver evaluation board, LED1 will blink with the successful receipt of each packet. LED1 will stop blinking when no packets are being received.

Packet Error Rate (PER) Test

- **Description:** The TX evaluation board transmits 100 packets with a predefined message over the default channel and requests an acknowledgement of each packet from the RX evaluation board. At the end of the PER test, the LEDs indicate the success or failure of the packet receipt.
- **Configuration #1:** Power-cycle or RESET the first evaluation board and within the five second window (after the LEDs have cycled from left to right) press and release the Switch #1 (SW1) pushbutton. If successful, LED1 will illuminate, indicating that the network configuration has been completed and the

board has been configured as the receiver. The following default values have been assigned as below:

My Address:	0x8001
Destination Address:	0x8000
PAN ID:	0x01FF
Channel #:	15
Power Level:	+20 dBm

- **Configuration #2:** Power-cycle or RESET the second evaluation board and within the five second window (after the LEDs have cycled from left to right) press and release the Switch #0 (SW0) pushbutton. If successful, LED2 will illuminate, indicating that the network configuration has been completed and the board has been configured as the transmitter. The following default values have been assigned as below:

My Address (MyAddr):	0x8000
Destination Address:	0x8001
PAN ID:	0x01FF
Channel #:	15
Power Level:	+20 dBm

- **Start / Stop:** Pressing SW0 after configuration will commence the PER test.
- **Indications:** On the transmitter evaluation board, LED0 will blink for each packet being transmitted until all 100 packets have been transmitted. If a receiver is within range and configured to transmit acknowledgments, LED3 will toggle to indicate the transmission failure of a packet. At the conclusion of the PER test LED3 will illuminate if the PER test was successful. If LED2 is illuminated at the conclusion of the PER test, a test failure has occurred (not all ACKs were received).

On the receiver evaluation board, LED1 will blink with the successful receipt of each packet. LED1 will stop blinking when no packets are being received.

Download Firmware to the Evaluation Boards

The CEL evaluation boards support the Ember InSight network, which operates over Ethernet. Ember's InSight Desktop along with the InSight Adapter can be used for download firmware to the evaluation boards. Each ZICM357P2-based node is connected to the InSight network via its own InSight Adapter 3 (ISA3).

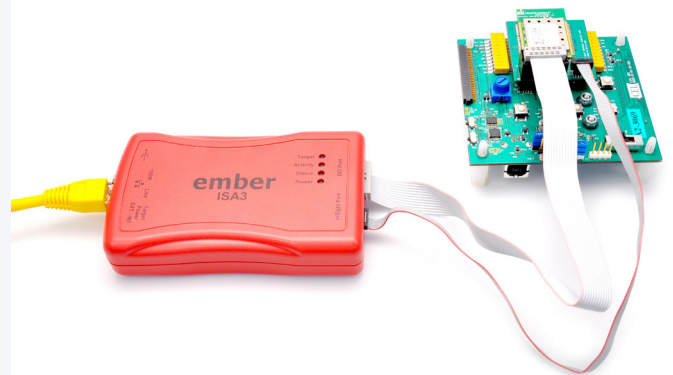
For further details on InSight Desktop, the InSight Adapter and InSight Network, refer to Ember and the following documents:

1. InSight Desktop User Guide
2. InSight Adapter (ISA3) Technical Specification

Insight Environment Setup

To setup an InSight environment, follow the following steps:

1. Connect the Ember supplied Power-over-Ethernet (PoE) switch so it has access to a DHCP server.
2. Connect the following to the PoE switch:
 - a. All the InSight Adapter ISA3s which will be used.
 - b. The PC workstation where InSight Desktop is installed.
3. Connect the ZICM357P2 modules to the ISA3 via the ISA and DEI ports found on the module carrier boards.
4. Verify that each ZICM357P2 evaluation board powers up by checking the status of the PWR LED.



Insight Desktop Adapters View

Launch the InSight Desktop application on the PC workstation that is connected to the InSight Network. On startup, the InSight Desktop automatically discovers and lists all InSight Adapters which are connected on the local subnet. Figure 2 displays two InSight Adapter ISA3s which have been found.

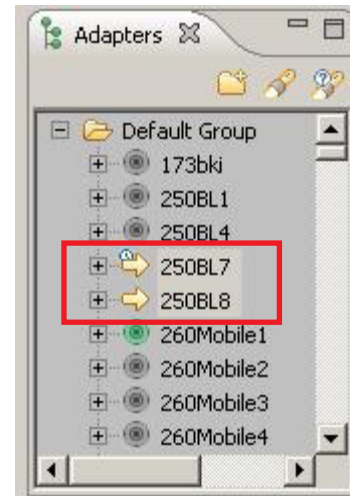


Figure 2: InSight Desktop Adapters View

Connecting the ZICM357P2 to the Insight Adapters

In order to interact with any adapter, you first must establish a connection between that adapter and the InSight Desktop software.

- To Connect an Adapter: Right-click on the adapter from the Adapters View and select Connect from the pop-up menu.
- To Disconnect an Adapter: Right-click on the adapter from the Adapters View and select Disconnect from the pop-up menu.

Uploading a Firmware Application

One can upload or reload an application to the selected adapter's node using the InSight Desktop application.

Uploading an Application

To upload an application, follow the steps outlined below:

1. Ensure the adapter is connected as described previously.
2. Right-click on the connected adapter from the Adapter View and select **Upload Application** from the pop-up menu.
3. Select an application image from the dialog's list, or browse for a binary image. The browse list maintains the previously loaded application images.

Reloading an Application

To reload an application, follow the steps outlined below:

1. Ensure the adapter is connected as described previously.
2. Right-click on the connected adapter from the Adapter View and select **Redo last upload** from the pop-up menu.
3. One can also use the **CTRL-Y** shortcut to redo the last action taken upon the adapter.

References & Revision History

References

[InSight Desktop User Guide Version 2.1 Build 35, Ember Corporation](#)

[InSight Adapter \(ISA3\) Technical Specification, 120-2010-000C, Ember Corporation](#)

[Universal Evaluation Board User Guide, California Eastern Laboratories](#)

[MeshConnect ZICM357P2-1 Datasheet, California Eastern Laboratories](#)

Revision History

Revision	Date	Description
A (0008-02-08-00-000)	12/15/11	Initial Release.

About CEL

California Eastern Laboratories (CEL) has over 50 years of experience providing a wide range of RF and wireless semiconductors, Optocouplers and Solid State Relays, Fiber Optics and Detectors. CEL develops the MeshConnect™ line of professional grade modules that provide hardware and software solutions in the 2.4 GHZ (IEEE 802.15.4/SNAP/ZigBee). These solutions offer customers qualified and certified platforms that greatly simplify design and greatly reduce time to market. For more information, visit our MeshConnect products and solutions at www.cel.com/MeshConnect.

CEL MeshConnect™
Professional Grade Wireless Radio Solutions

California Eastern Laboratories
4590 Patrick Henry Drive
Santa Clara, CA 95054
(408) 919-2500