Freescale BeeStack™

For ZigBee 2007
Documentation Overview

Document Number: BSDOZB2007
Rev. 1.0
10/2008

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About This Book

This document provides a brief overview of the Freescale BeeStack for ZigBee 2007 document set. BeeStack is the Freescale implementation of the ZigBee wireless network protocol stack for the ZigBee 2007 specification. The overviews contained in each chapter serve as an aid to finding the proper detailed document for any particular BeeStack topic.

Audience

This document is intended for software developers who write applications for BeeStack-based products using Freescale development tools.

Organization

This document is organized into the following sections.

Chapter 1	Introduction – describes this document.
Chapter 2	Freescale ZigBee Applications User's Guide for ZigBee 2007 – describes, step-by-step, how to install and run the sample applications on Freescale Reference Boards. Describes in detail the user interface for the applications.
Chapter 3	BeeStack Software Reference Manual for ZigBee 2007 – describes in detail the API to BeeStack (for ZigBee 2007) in a reference (not tutorial) style. Also includes an overview of ZigBee 2007 networking, including a diagram of the stack components.
Chapter 4	BeeStack Application Development User's Guide for ZigBee 2007 – describes how to develop an application for BeeStack, including discussions on major considerations for commercial applications.
Chapter 5	Freescale Platform Reference Manual for ZigBee 2007 – describes in detail the API to the Freescale Platform components shared among Freescale networking solutions (e.g. BeeStack, The Freescale IEEE 802.15.4 MAC and the Freescale Simple MAC). Many components interact with reference hardware such as switches, the LCD and LEDs. Other components include timers and the task scheduler.
Chapter 6	ZigBee Cluster Library Reference Manual – describes the API to the ZigBee Cluster Library, an add-on component used in many ZigBee Application Profiles.
Chapter 7	ZigBee Test Client Reference Manual – describes the API to the ZigBee Test Client (ZTC) test harness software. This component allows a PC to control and monitor the ZigBee node through a USB or a RS-232 port. This document also includes a step-by-step example of using the ZigBee Test Client and how to update the ZigBee Test Client to include new commands and events.

Revision History

The following table summarizes revisions to this document since the previous release (Rev. 0.0).

Revision History

Location	Description
Entire document	Updated for MC1322x EVK

Conventions

This document uses the following formatting conventions when detailing commands, parameters, and sample code:

`Courier mono-space` type indicates commands, command parameters, and code examples.

Bold style indicates the command line elements, which must be entered exactly as written.

Italic type indicates command parameters that the user must type in or replace, as well as emphasizes concepts or foreign phrases and words.

Definitions, Acronyms, and Abbreviations

ADC	Analog to digital converter
AF	Application framework
API	Application programming interface
APS	Application support sub-layer
Binding	Matching ZigBee devices based on services and needs
Cluster	A collection of attributes associated with a specific cluster-identifier
Endpoint	Component within a unit; a single IEEE 802.15.4 radio may support up to 240 independent endpoints
EVB	Freescale evaluation board
IEEE	Institute of Electrical and Electronics Engineers, a standards body
LED	Light-emitting diode
MAC	Medium access control sub-layer
NCB	Freescale Network Control Board
NWK	Network layer
Profile	Set of options in a stack or an application
SAP	Service access point
SARD	Freescale Sensor Reference Design
SRB	Freescale Sensor Remote Board
Stack	ZigBee protocol stack
ZDO	ZigBee device object(s)
ZDP	ZigBee device profile

802.15.4	An IEEE standard radio specification that underlies the ZigBee Specification

Chapter 1
Introduction

This overview document provides a high level content description of each Freescale BeeStack for ZigBee 2007 document. Use this overview to find the proper document for a particular BeeStack component or task.

Chapter 2
Freescale ZigBee Application User's Guide for ZigBee 2007

This guide describes in step-by-step form, how to install and run the sample applications on Freescale Reference Boards. It describes in detail the user interface for the applications.

Chapter 1 Introduction – introduces the Freescale implementation of ZigBee wireless sensor networks.

Chapter 2 Freescale Development Boards – provides detailed installation and device configuration information using the Freescale BeeKit Wireless Connectivity Toolkit tools.

Chapter 3 BeeKit and CodeWarrior – provides a simple home lighting control network to introduce users to simple ZigBee applications.

Chapter 4 Starting and Running a Simple ZigBee Network – provides a quick tutorial to form a ZigBee network using code built and loaded into two development boards in previous chapters.

Chapter 5 Creating a Wireless UART Application - shows how to create a Freescale Wireless UART application using the Freescale BeeKit Wireless Connectivity Toolkit.

Chapter 6 Creating a Smart Energy Network Application - shows how to create a Smart Energy Network consisting of three different applications using the Freescale BeeKit Wireless Connectivity Toolkit.

Chapter 7 Example Applications – provides several examples to allow users to configure and run ZigBee wireless home control applications.

Chapter 3
BeeStack Software Reference Manual for ZigBee 2007

This manual describes the API to BeeStack in detail. It also includes an overview of ZigBee networking, including a diagram of the stack components.

Chapter 1	Introduction – describes this document.
Chapter 2	ZigBee Overview – introduces ZigBee network concepts.
Chapter 3	BeeStack Overview – introduces the BeeStack architecture and source file structure.
Chapter 4	Application Framework – introduces the function calls, macros, and APIs available in the Application Framework (AF).
Chapter 5	Application Support Sub-layer – describes the function calls, macros, and APIs available in the Application Support Sub-layer (APS).
Chapter 6	ZigBee Device Objects – introduces the function calls, macros, and APIs available in the ZigBee device objects (ZDO).
Chapter 7	ZigBee Device Profile – introduces the ZigBee device profile (ZDP) and associated macros, function calls, and prototypes.
Chapter 8	Network Layer – describes the function calls and macros available in the network (NWK) layer.
Chapter 9	Application Support Layer – introduces the Application support functions and macros.
Chapter 10	BeeStack Common Functions – introduces the BeeStack common interface macros and function calls.
Chapter 11	User-Configurable BeeStack Options – introduces the BeeStack configurable items.
Chapter 12	BeeStack Security – describes how BeeStack supports full ZigBee security for stack profile 0x01 and stack profile 0x02 of the ZigBee 2007 specification.
Chapter 13	Permission Configuration Table - describes the optional BeeStack Permission Configuration Table feature.
Chapter 14	Frequency Agility – describes how BeeStack supports an example implementation of a frequency agility channel master which demonstrates how frequency agility could be implemented.
Chapter 14	Interpan Communication – details how BeeStack supports the Inter pan communication method that is specified by the Smart Energy/AMI application profile specification. The Interpan communication feature allows for communication outside the ZigBee network to very simple devices.

Appendix A Porting ZigBee 2006 to ZigBee 2007 – describes how to port from ZigBee 2006 to ZigBee 2007.

Chapter 4
BeeStack Application Development Guide for ZigBee 2007

This guide describes how to develop an application for BeeStack, including discussions on major considerations for commercial applications.

Chapter 1	Provides an overview of the BeeStack Application Development Guide, including what is and not included in the guide. This guide also describes a basic development process using both BeeKit and CodeWarrior. Note that this is in concept only. This guide is not a user guide for either BeeKit or CodeWarrior.
Chapter 2	Provides a step-by-step example of creating a custom sample application.
Chapter 3	Describes designing a new custom-profile application, including selecting a profile, clusters, attributes and endpoints. It also describes ZigBee 2007 security options.
Chapter 4	Describes selecting the appropriate hardware-related platform components, including the use of non-volatile memory, LEDs, the keyboard, RS-232 port, and general hardware selection.
Chapter 5	Describes using the non-hardware-related platform components appropriately, including the use of timers, messages, data queues, the task scheduler and low power library. It also describes how to determine how much RAM and Flash is available to the application and what to do if an application exceeds memory size.
Chapter 6	Describes debugging BeeStack applications, including use of the BDM, LEDs, ZigBee Test Client and ZigBee protocol over-the-air sniffers.

Chapter 5
Freescale Platform Reference Manual for ZigBee 2007

This manual describes in detail the API to the Freescale Platform components for ZigBee 2007 shared among Freescale networking solutions (For example, BeeStack, the Freescale IEEE 802.15.4 MAC, and the Freescale Simple MAC). Many components interact with reference hardware such as switches, the LCD and LEDs. Other components include timers and the task scheduler.

Chapter 1	Provides an overview of all the platform components and where they can be found in the directory structure in a BeeStack project.
Chapter 2	Describes the task scheduler API and compile-time options.
Chapter 3	Describes the timer API and compile-time options.
Chapter 4	Describes the LED API and compile-time options.
Chapter 5	Describes the LCD API and compile-time options.
Chapter 6	Describes the keyboard API and compile-time options.
Chapter 7	Describes the UART (SCI) API and compile-time options.
Chapter 8	Describes the non-volatile memory API and compile-time options.
Chapter 9	Describes the lower power API and compile-time options.

Chapter 6
ZigBee Cluster Library Reference Manual

This manual describes the API to the ZigBee Cluster Library, an add-on component used in many ZigBee Application Profiles, including Home Automation.

Chapter 1	Introduction – provides an overview of the ZigBee Cluster Library, as well as its purpose and use in Home Automation. It also contains a concise list of devices, clusters and attributes and commands supported by BeeStack.
Chapter 2	ZigBee Cluster Library API – describes the API and compile-time options for the ZigBee Cluster Library.
Chapter 3	Adding Custom Devices, Clusters and Attributes – introduces the function calls, macros, and APIs available in the Application Framework (AF).

Chapter 7
ZigBee Test Client Reference Manual

This manual describes the API to the ZigBee Test Client (ZTC) test harness software. This component allows a PC to control and monitor the ZigBee node through a USB port or RS-232 port. It includes a step-by-step example of using the ZigBee Test Client and how to expand the ZigBee Test Client to include new commands and events.

Chapter 1	Introduction - Presents an overview of the BeeKit development environment and the BeeStack protocol layers, including tools and system requirements.
Chapter 2	Creating the Test Environment - Outlines the required BeeKit development tools, their installation, and provides step-by-step installation and setup instructions to prepare both the host computer and ZigBee devices for a test network.
Chapter 3	Making New ZTC Commands - Details how users can modify the Test Tool for new applications.
Chapter 4	Wireless Network Monitoring and ZTC - Gives several examples of standard wireless sniffer tests for monitoring packets between wireless network devices.
Chapter 5	ZTC Frame Format - Describes the protocol frame format used by the ZTC.
Appendix A	Commands and Events - Includes the full list of commands and events supplied with this software, including the OpCode group identification number, the OpCode number, and the associated primitive.