Chipcon Products
from Texas Instruments

Application Note:

Upgrading To Z-Stack v1.4.3
For The CC2430

Document Number: F8W-2007-0030

Version	Description	Date
1.0	Initial release.	11/08/2007
1.1	Added section on OSAL timer function removal. Updated changed file lists.	12/10/2007

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1. Purpose

This document describes considerations to make when upgrading to Texas Instruments Z-Stack™ version v1.4.3, discussing changes made between the v1.4.2 and v1.4.3 releases of Z-Stack. Primarily, changes have been made to reduce code size, increasing flash memory space available for user applications. This document discusses changes to the "core" (***ZSt ⋉k-CC   -   e e***) and the "full" (***ZSt ⋉k-CC   - - e e***) packages.
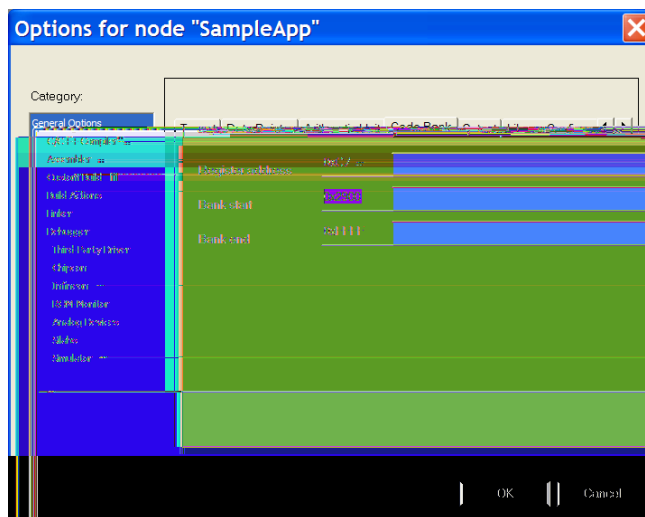
2. Details of Changes

2.1 IAR Compiler Upgrade

The IAR EW8051 compiler has been upgraded from version 7.20I to 7.30B. Compilation of the Z-Stack and TIMAC libraries, as well as, all testing of Z-Stack v1.4.3 occurred under version 7.30B of the IAR compiler. Note that library and project files provided with the Z-Stack v1.4.3 package are not compatible with EW8051 version 7.20 or earlier. To work with Z-Stack v1.4.3, you must install EW8051 version 7.30B.

2.2 IAR Project File Changes

Project files (*.ewp) that were created with pre-7.30 versions of the IAR compiler will be automatically converted to the 7.30B format when first opened by the IAR Embedded Workbench IDE. Depending on the version of Z-Stack being upgraded, modifications to project files may be needed. If upgrading from v1.4.1 or earlier, please refer to the "Upgrading To Z-Stack v1.4.2 For The CC2430" document for additional information to complete the transition.

The default setting for Code Bank *"Bank start"* has changed from 0x2000 to 0x2900 to accommodate the addition of a new memory segment (BANK_RELAYS) produced by the IAR compiler/linker for code reduction of banked function calls. This value needs to correspond with the _CODE_END (default setting has been changed to 0x28FF) declaration found in the linker control files (*f w   cl* or *f w   p cl*). *"Bank start"* should be set to the value of _CODE_END plus one. Note that the value of _CODE_END and *"Bank start"* may need to be increased when the developer adds function calls to their application that cause the compiler/linker to add BANK_RELAYS. It is recommended that *"Bank start"* be set as low as possible to maximize the code space available for BANK1.

2.3 IAR Banked Function Changes

As indicated in Section 2.2, IAR changed the way that function calls are made across banked memory boundaries. Functions achieve banked calls by making an *LCALL* to an item in the BANK_RELAYS segment in BANK0, which executes banked call (*BCALL*). This allows the linker to share a BANK_RELAY element for all calls to a specific banked function, resulting in code savings in Z-Stack devices. A new function, *?BDISPATCH*, was added to the ***chipcon ⋉nked code support s*** file to perform these indirect banked function calls.

2.4 DMA Modifications

The use of DMA for non-volatile memory functions (NV) has been eliminated, resulting in reduced code size and significantly faster operation. Refer to Section 2.5 for more information on changes to NV. The use of DMA for security functions (AES and CCM) is now optional, defaulting to "not used" to minimize code size. Enabling DMA for security (add HAL_DMA=TRUE to the compiler command-line options) provides slightly higher throughput.

2.5 Device Reset Optimization

The delay between reset and normal device operation has been noticeably reduced. Changes that were introduced with Z-Stack v1.4.2, to increase reliability of the Non-Volatile (NV) memory system, resulted in a lengthy start-up time, possibly seconds, when the NV_INIT and NV_RESTORE features were in use. Reset time improvement came in two areas: switching the CC2430 from 16 to 32 MHz earlier in the reset process, and re-design of the NV driver (*AccessCodeSp ce s* and *OSAL Nv c*) to move data between FLASH and RAM in blocks instead of byte-by-byte.

2.6 ZDO Processing Redesign

The ZDO layer was modified to include a generic interface that delivers ZDO service discovery information to an application without changing code in the ZDO modules (*ZDApp c*, *ZDO ject c,* and *ZDProfile c*). This change also reduced the code size of the ZDO module by only including parsing functions when needed. Please read the following documentation for details on ZDO message handling:

- "ZDO Parsing Functions" in the *Z-St ck API* document
- "ZDO Message Requests" in the *Z-St ck Developer s Guide* document
- "Changes To TransmitApp" in the *Migr ting Applic tion Fro   X* document

2.7 OSAL_Timer Functions Removed

Two seldom used functions in the *OSAL Ti ers c* file have been removed. Calls to *osal_start_timer()* should be replaced with *osal_start_timerEx()*. Calls to *osal_stop_timer()* should be replaced with *osal_start_timerEx()*. Note that the *timerEx()* functions require a task_id parameter – see *OSAL Ti ers h* for function prototypes. The removed timer functions called *osal_self()* (to determine the task_id) has been removed from *OSAL c* file.

2.8 OSAL_Tasks Table Redesign

The OSAL tasks table has been changed from a linked list that was populated by an application initialization module (such as *OSAL S pleApp c*) to a constant table. Significant code size reduction was achieved by eliminating the linked list handling function in *OSAL T sks c*. This change assumes that applications never need to add or delete tasks after the initialization phase, a feature that has not been implemented or tested in prior Z-Stack releases. Refer to *OSAL S pleApp c* for an example of constant task table usage.

2.9 ZigBee 2004 Compatibility Removed

Support for backward compatibility to the ZigBee 2004 protocol has been removed. Elimination of this feature, previously enabled by the DEF_PROTO_VERS=1 compile option, results in code size reduction and reduced software complexity. Z-Stack now defaults to ZB_PROT_V1_1, which specifies the ZigBee 2006 protocol.

2.10 Coordinator Binding Removed

Support for Coordinator Binding has been removed since it is not part of the ZigBee 2006 specification. Elimination of this legacy feature, previously enabled by the COORDINATOR_BINDING compile option, results in code size reduction and reduced software complexity.

2.11 CC2430-RevB Support Removed

Support for Rev-B versions of the CC2430 has been removed from the low-level TIMAC. Attempts to run Z-Stack on versions prior to Rev-D will cause an ASSERT during the reset/initialization phase. By default, an ASSERT will hang the device in an infinite loop, flashing the LEDs. ASSERTS can also be used to reset the device (normally used in production code) by enabling the ASSERT_RESET option in the linker command file, *f wConfig cfg*.

2.12 Support For Z-Tool 2.0

Z-Tool 2.0 is being introduced with Z-Stack v1.4.3 to provide enhanced debugging and testing capabilities. Key new features of Z-Tool 2.0 include support for Simple API, multiple device control and logging, and enhanced scripting for automated testing. Note that Z-Tool is only provided in the "full" Z-Stack package.

2.13 Changes to Installed Files

Refer to the tables in Sections 2.13.1 and 2.13.2 for file changes to the "core" and "full" installers, respectively. Pay particular attention to items with **NEW** or **REMOVED** in the **Change** column. Folder updates are indicated when there is no entry in the **File** column. Changes to project files (*.ewp and *.ewd) can be made with the IDE or by editing the project files directly. Note that source code files in this release have an updated copyright statement, which is not considered a change that requires inclusion in the lists that follow.

2.13.1 Changes to "Core" Installed Files

The following "core" Z-Stack files have been changed since the v1.4.2 release:

File	Location	Change
hal_aes.c	…\Components\hal\target\CC2430BB	Modified
hal_aes.h	…\Components\hal\target\CC2430BB	Modified
hal_board_cfg.h	…\Components\hal\target\CC2430BB	Modified
hal_ccm.c	…\Components\hal\target\CC2430BB	Modified
hal_dma.c	…\Components\hal\target\CC2430BB	Modified
hal_dma.h	…\Components\hal\target\CC2430BB	Modified
hal_led.c	…\Components\hal\target\CC2430BB	Modified
hal_mcu.h	…\Components\hal\target\CC2430BB	Modified
hal_sleep.c	…\Components\hal\target\CC2430BB	Modified
hal_aes.c	…\Components\hal\target\CC2430DB	Modified
hal_aes.h	…\Components\hal\target\CC2430DB	Modified
hal_board_cfg.h	…\Components\hal\target\CC2430DB	Modified
hal_ccm.c	…\Components\hal\target\CC2430DB	Modified
hal_dma.c	…\Components\hal\target\CC2430DB	Modified
hal_dma.h	…\Components\hal\target\CC2430DB	Modified
hal_led.c	…\Components\hal\target\CC2430DB	Modified
hal_mcu.h	…\Components\hal\target\CC2430DB	Modified
hal_sleep.c	…\Components\hal\target\CC2430DB	Modified
hal_aes.c	…\Components\hal\target\CC2430EB	Modified
hal_aes.h	…\Components\hal\target\CC2430EB	Modified
hal_board_cfg.h	…\Components\hal\target\CC2430EB	Modified
hal_ccm.c	…\Components\hal\target\CC2430EB	Modified
hal_dma.c	…\Components\hal\target\CC2430EB	Modified
hal_dma.h	…\Components\hal\target\CC2430EB	Modified
hal_led.c	…\Components\hal\target\CC2430EB	Modified
hal_mcu.h	…\Components\hal\target\CC2430EB	Modified
hal_sleep.c	…\Components\hal\target\CC2430EB	Modified
mac_api.h	…\Components\mac\include	Modified
mac_backoff_timer.c	…\Components\mac\low_level\srf03	Modified
mac_rx.c	…\Components\mac\low_level\srf03	Modified
mac_rx_onoff.c	…\Components\mac\low_level\srf03	Modified
mac_tx.c	…\Components\mac\low_level\srf03	Modified
mac_tx.h	…\Components\mac\low_level\srf03	Modified
mac_csp_tx.c	…\Components\mac\low_level\srf03\single_chip	Modified

mac_mcu.c	…\Components\mac\low_level\srf03\single_chip	Modified
mac_mcu.h	…\Components\mac\low_level\srf03\single_chip	Modified
mac_radio_defs.h	…\Components\mac\low_level\srf03\single_chip	Modified
MT_AF.c	…\Components\mt	Modified
MT_AF.h	…\Components\mt	Modified
MT_ZDO.c	…\Components\mt	Modified
MT_ZDO.h	…\Components\mt	Modified
MTEL.c	…\Components\mt	Modified
MTEL.h	…\Components\mt	Modified
OSAL.c	…\Components\osal\common	Modified
OSAL_PwrMgr.c	…\Components\osal\common	Modified
OSAL_Tasks.c	…\Components\osal\common	Modified
OSAL_Timers.c	…\Components\osal\common	Modified
OSAL.h	…\Components\osal\include	Modified
OSAL_Tasks.h	…\Components\osal\include	Modified
OSAL_Timers.h	…\Components\osal\include	Modified
ZComDef.h	…\Components\osal\include	Modified
AccessCodeSpace.s51	…\Components\osal\mcu\ccsoc	Modified
OSAL_Nv.c	…\Components\osal\mcu\ccsoc	Modified
AF.c	…\Components\stack\af	Modified
AF.h	…\Components\stack\af	Modified
APS.h	…\Components\stack\nwk	Modified
APSMEDE.h	…\Components\stack\nwk	Modified
BindingTable.h	…\Components\stack\nwk	Modified
NLMEDE.h	…\Components\stack\nwk	Modified
nwk.h	…\Components\stack\nwk	Modified
nwk_globals.c	…\Components\stack\nwk	Modified
nwk_globals.h	…\Components\stack\nwk	Modified
nwk_util.h	…\Components\stack\nwk	Modified
reflecttrack.h	…\Components\stack\nwk	Modified
ssp.h	…\Components\stack\sec	Modified
ZGlobals.c	…\Components\stack\sys	Modified
ZDApp.c	…\Components\stack\zdo	Modified
ZDApp.h	…\Components\stack\zdo	Modified
ZDCache.c	…\Components\stack\zdo	**REMOVED**
ZDCache.h	…\Components\stack\zdo	**REMOVED**
ZDConfig.c	…\Components\stack\zdo	Modified
ZDObject.c	…\Components\stack\zdo	Modified
ZDObject.h	…\Components\stack\zdo	Modified
ZDProfile.c	…\Components\stack\zdo	Modified
ZDProfile.h	…\Components\stack\zdo	Modified
ZDSecMgr.c	…\Components\stack\zdo	Modified
Migrating Application From 1.4.X	…\Documents	**NEW**
Upgrading To Z-Stack v1.4.3	…\Documents	**NEW**
Z-Stack API	…\Documents	Modified
Z-Stack Developer's Guide	…\Documents	Modified
Z-Stack User's Guide	…\Documents\CC2430	Modified
EndDevice.lib	…\Projects\zstack\Libraries\TI2430DB\bin	Modified
EndDeviceMt.lib	…\Projects\zstack\Libraries\TI2430DB\bin	Modified

Router.lib	…\Projects\zstack\Libraries\TI2430DB\bin	Modified
RouterMt.lib	…\Projects\zstack\Libraries\TI2430DB\bin	Modified
Security.lib	…\Projects\zstack\Libraries\TI2430DB\bin	Modified
ZLOAD.lib	…\Projects\zstack\Libraries\TI2430DB\bin	Modified
TIMAC-CC2430.lib	…\Projects\zstack\Libraries\TIMAC\bin	Modified
SampleApp.ewd	…\Projects\zstack\Samples\SampleApp\CC2430DB	Modified
SampleApp.ewp	…\Projects\zstack\Samples\SampleApp\CC2430DB	Modified
OSAL_SampleApp.c	…\Projects\zstack\Samples\SampleApp\Source	Modified
SampleAppHw.h	…\Projects\zstack\Samples\SampleApp\Source	Modified
f8w2430.xcl	…\Projects\zstack\Tools\CC2430DB	Modified
f8w2430pm.xcl	…\Projects\zstack\Tools\CC2430DB	Modified
f8wConfig.cfg	…\Projects\zstack\Tools\CC2430DB	Modified

2.13.2 Changes to "Full" Installed Files

In addition to the "core" installer file changes listed in Section 2.13.1, the following Z-Stack "full" installer files have been changed since the v1.4.2 release:

File	Location	Change
MT_SAPI.c	…\Components\mt	Modified
MT_SAPI.h	…\Components\mt	Modified
sapi.c	…\Components\stack\sapi	Modified
sapi.h	…\Components\stack\sapi	Modified
zcl.c	…\Components\stack\zcl	Modified
zcl.h	…\Components\stack\zcl	Modified
zcl_closures.c	…\Components\stack\zcl	Modified
zcl_general.c	…\Components\stack\zcl	Modified
zcl_general.h	…\Components\stack\zcl	Modified
zcl_hvac.c	…\Components\stack\zcl	Modified
zcl_hvac.h	…\Components\stack\zcl	Modified
zcl_lighting.c	…\Components\stack\zcl	Modified
zcl_lighting.h	…\Components\stack\zcl	Modified
zcl_ms.c	…\Components\stack\zcl	Modified
zcl_ss.c	…\Components\stack\zcl	Modified
zcl_ss.h	…\Components\stack\zcl	Modified
Simple API for Z-Stack	…\Documents	Modified
Z-Stack ZCL API	…\Documents	Modified
Power Management For The CC2430DB	…\Documents\CC2430	Modified
Developer Notes - Over Air Download	…\Documents\CC2430	Modified
SampleLight.ewd	…\Projects\zstack\HomeAutomation\SampleLight\CC2430DB	Modified
SampleLight.ewp	…\Projects\zstack\HomeAutomation\SampleLight\CC2430DB	Modified
OSAL_SampleLight.c	…\Projects\zstack\HomeAutomation\SampleLight\Source	Modified
zcl_samplelight.c	…\Projects\zstack\HomeAutomation\SampleLight\Source	Modified
zcl_samplelight.h	…\Projects\zstack\HomeAutomation\SampleLight\Source	Modified
zcl_samplelight_data.c	…\Projects\zstack\HomeAutomation\SampleLight\Source	Modified
SampleSwitch.ewd	…\Projects\zstack\HomeAutomation\SampleSwitch\CC2430DB	Modified
SampleSwitch.ewp	…\Projects\zstack\HomeAutomation\SampleSwitch\CC2430DB	Modified
OSAL_SampleSw.c	…\Projects\zstack\HomeAutomation\SampleSwitch\Source	Modified
zcl_samplesw.c	…\Projects\zstack\HomeAutomation\SampleSwitch\Source	Modified

zcl_samplesw.h	…\Projects\zstack\HomeAutomation\SampleSwitch\Source	Modified
zcl_ha.c	…\Projects\zstack\HomeAutomation\Source	Modified
zcl_ha.h	…\Projects\zstack\HomeAutomation\Source	Modified
GenericApp.ewd	…\Projects\zstack\Samples\GenericApp\CC2430DB	Modified
GenericApp.ewp	…\Projects\zstack\Samples\GenericApp\CC2430DB	Modified
GenericApp.c	…\Projects\zstack\ Samples\GenericApp\Source	Modified
OSAL_GenericApp.c	…\Projects\zstack\ Samples\GenericApp\Source	Modified
SimpleApp.ewd	…\Projects\zstack\Samples\SimpleApp\CC2430DB	Modified
SimpleApp.ewp	…\Projects\zstack\Samples\SimpleApp\CC2430DB	Modified
SimpleApp.h	…\Projects\zstack\Samples\SimpleApp\Source	Modified
SimpleCollector.c	…\Projects\zstack\Samples\SimpleApp\Source	Modified
SimpleController.c	…\Projects\zstack\Samples\SimpleApp\Source	Modified
SimpleSensor.c	…\Projects\zstack\Samples\SimpleApp\Source	Modified
SimpleSwitch.c	…\Projects\zstack\Samples\SimpleApp\Source	Modified
cc2430_OADApp.xcl	…\Projects\zstack\Tools\CC2430DB	Modified
SampleApp.ewd	…\Projects\zstack\ Utilities\Location\CC2430DB	Modified
SampleApp.ewp	…\Projects\zstack\ Utilities\Location\CC2430DB	Modified
SampleApp.c	…\Projects\zstack\Utilities\Location\Source	Modified
SampleApp.h	…\Projects\zstack\Utilities\Location\Source	Modified
SerialApp.ewd	…\Projects\zstack\Utilities\SerialApp\CC2430DB	Modified
SerialApp.ewp	…\Projects\zstack\Utilities\SerialApp\CC2430DB	Modified
OSAL_SerialApp.c	…\Projects\zstack\Utilities\SerialApp\Source	Modified
SerialApp.c	…\Projects\zstack\Utilities\SerialApp\Source	Modified
TransmitApp.ewd	…\Projects\zstack\Utilities\Transmit\CC2430DB	Modified
TransmitApp.ewp	…\Projects\zstack\Utilities\Transmit\CC2430DB	Modified
OSAL_TransmitApp.c	…\Projects\zstack\Utilities\Transmit\Source	Modified
TransmitApp.c	…\Projects\zstack\Utilities\Transmit\Source	Modified
ZPortApp.ewd	…\Projects\zstack\Utilities\ZPortApp\CC2430DB	Modified
ZPortApp.ewp	…\Projects\zstack\Utilities\ZPortApp\CC2430DB	Modified
OSAL_ZPortApp.c	…\Projects\zstack\Utilities\ZPortApp\Source	Modified
TI.ZCmdMatchings.dll	…\Tools\ZOAD	Modified
TI.ZPI.dll	…\Tools\ZOAD	Modified
TI.ZStack.CommonLib.dll	…\Tools\ZOAD	Modified
TI.ZStack.ZAppLib.dll	…\Tools\ZOAD	Modified
TI.ZStack.ZPortLib.dll	…\Tools\ZOAD	Modified
ZOAD.exe	…\Tools\ZOAD	Modified
TI.Config.xml	…\Tools\Z-Tool	**NEW**
TI.MasterKeyListDev.xml	…\Tools\Z-Tool	**NEW**
TI.MasterKeyListNwk.xml	…\Tools\Z-Tool	**NEW**
TI.ZCmdMatchings.dll	…\Tools\Z-Tool	**NEW**
TI.ZPI.dll	…\Tools\Z-Tool	**NEW**
TI.ZPI.xml	…\Tools\Z-Tool	**NEW**
TI.ZScript.dll	…\Tools\Z-Tool	**NEW**
TI.ZStack.CommonLib.dll	…\Tools\Z-Tool	**NEW**
TI.ZStack.ZPortLib.dll	…\Tools\Z-Tool	**NEW**
ZPI Help.chm	…\Tools\Z-Tool	**NEW**
Z-Tool 2.0.exe	…\Tools\Z-Tool	**NEW**
Z-ToolHelp.chm	…\Tools\Z-Tool	**NEW**