

ZigBee Sleepy End Device Lab Worksheet

In this worksheet we provide a step-by-step guide to create, build and run ZigBee 3.0 end device and sleepy end device applications based on EmberZNet Stack 6.6.4. If you use a later release in the future, most of the instructions should still apply, although there could be minor differences not foreseen at the time of this document.

These exercises help you get familiar with ZigBee 3.0 in the EmberZNet Stack, Simplicity Studio v4 development environment, and the Wireless Start Kit (WSTK) with EFR32MG modules. We assume that you have a WSTK and the following software requirements:

- Simplicity Studio 4
- EmberZNet 6.6.4
- GCC 7.2

KEY FEATURES

- Step-by-step guide to creating, building and running ZigBee 3.0 applications based on EmberZNet 6.6.4
- Use Simplicity Studio v4 as the development tool
- ZigBee end device polling
- Zigbee end device keepalive and aging
- Zigbee end device rejoin

1 Pre-requisites

Make sure you have installed the EmberZnet 6.6.4 SDK and GCC toolchain on your PC.

1.1 Check EmberZnet SDK

- 1. Launch Simplicity Studio v4.
- 2. "Windows"→"Preference"→"Simplicity Studio"→"SDKs", make sure "EmberZnet 6.6.4" is installed

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Figure 1 Check SDK in Simplicity Studio

1.2 Check Toolchains

1. Launch Simplicity Studio v4.

2. "Windows"→"Preference"→"Simplicity Studio"→"Toolchains", make sure GCC toolchain is installed.



Figure 2 Check Toolchain in Simplicity Studio

1.3 Coordinator

We will provide a coordinator here and all trainee's devices can join this coordinator.

1.4 How to flash the program

- 1. Start Simplicity Studio, then connect your device to PC;
- 2. In the menu bar, find the icon *for "Flash Programmer"*, press it;
- 3. In the popup window, select the device;

	Select a device to program	
Flash Prog ect Device		
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Figure 3 Select device

4. Then in the next window, click "browse" to select the generated image (.s37 or .hex) of your project, press "Program". You can also press "erase" if needed. Normally you just need to erase the device once before when you start the hands-on. The generated image is in the binary folder of your project. You can select it in "Project Explorer".

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Figure 4 Select image

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Ei	a 5 Elash application

1.5 How to open console

Simplicity Studio has integrated a console so that it's convenient to debug through console. To use the console, you need:

Simplicity IDE

- 1. Change to "Simplicity IDE" perspective
- 2. Select your adapter in the "Debug Adapters" window, right click and select "connect";

3. Select your adapter in the "Debug Adapters" window, right click and select "Launch console";

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Figure 6 Launch console

1.6 How to start Capture

1. Change to "Simplicity IDE" perspective

Simplicity IDE

- 2. Select your adapter in the "Debug Adapters" window, right click and select "connect";
- 3. Select your adapter in the "Debug Adapters" window, right click and select "Start Capture";

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Figure 7 Start Capture

How to start Energy ProfilerStart Energy Profiler: 1.7

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Figure 8 Start Energy Profiler

2. In the tool, on the left top, select "Quick Access", then select "Start Energy Profiler Capture";

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Figure 9 Start Energy Profiler Capture

3. Select your adapter;

4. When the debugger is connected (Normally if you just programmed a new image, the debugger will keep connected), the sleep current will be much higher. You need to unplug/plug the cable and then measure again.

2 Build the ZigBee sleepy end device

- 1. Go to File -> New -> Project. This will bring up the New Project Wizard
- 2. Select "Silicon Labs AppBuilder Project". Click Next.
- 3. Select "Silicon Labs Zigbee". Click Next.
- 4. Select our latest EmberZNet stack for SoC (in this case EmberZNet 6.6.4 GA SoC). Click Next.
- 5. On the bottom, select "ZigbeeMinimal". Click Next.
- 6. Name your project, such as "MyZSED". Click Next.
- 7. In next window (Project Setup), select board to BRD4162A, and compiler to "GCC v7.2" (If you don't have it, please install any other). Click Finish.

5	$ \square$ \times
Project setup Select the board, part, and initial build configurations.	
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Part: Search EFR32MG12P332F1024GL125 Check the configurations to include in the project	✓
✓ GNU ARM v4.9.3 ✓ Default ✓ GNU ARM v7.2.1 ✓ Default (active) ✓ IAR ARM (v8.30.1.114) ✓ Default	Select All Select <u>N</u> one Set <u>A</u> ctive
Manage build targets Image build targets <	Cancel

Figure 10 select board and compiler

- 8. The new project should have been created now, with the project configuration file (an .isc file) open.
- 9. Click "Zigbee Stack" tab, select "Zigbee Device Type" to "Sleepy End Device".

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🔻 Zi	igbee									
-	ZigBee PRO network configu	ration								
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	Primary (default)	Sleepy End Device 🔹	Zig	Bee 3.0 Secu	rity					
		Coordinator or Router Router End Device Sleepy End Device								

Figure 11 Select Zigbee device type

10. Click "ZCL clusters" tab,

a. In "ZCL device type" field, set "ZCL device type" to "HA Temperature Sensor"



- Figure 12 ZCL device type
- b. Make sure cluster "Temperature Measurement" server side is selected, then make sure the attribute "measured value" is selected. After that, turn to "Reporting" tab, and make sure the attribute "measured value" is selected. After this step, we can save temperature data in attribute "measured value" of cluster "Temperature Measurement", and we also can report this attribute to the coordinator.

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- Figure 13 attribute and reporting
- c. Select attribute "manufacture name" under cluster "Basic", then set the default value to your name. We set this so that we can trace the reported data from the gateway side.

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Figure 14 set manufacture name

d. Under cluster "Basic", in "Reporting" tab, enable reporting of attribute "manufacture name", set the min interval to 15 seconds and max interval to 30 seconds.

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Figure 15 enable reporting of attribute "manufacture name"

11. Click "Plugins" tab:

a. Enable "Idle/Sleep" plugin, then in the properties of this plugin, enable the option "Stay awake when NOT joined"; So that when device hasn't joined, the device can still keep awake, then you can use the command line to operate. Please also enable the option "Use button to force wakeup or allow sleep". When the device is asleep, the command line interface won't be available. With this interface, you can use button0 to force the device stay awake and use button1 to force the device allow sleep. 🚴 General 🔥 701 (1 M HAL A Pluging S Callbacks A Includes A Other options R Bluetooth GATT

i configuration his section to select or unselect the plugins that you want to use in your application		
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🔲 🌗 Dynamic Multiprotocol UI Demo Code Stub, provides API: dmp-ui		need to stay awake. For devices with an RX-on-when-idle network (such as a router), the plugin will attempt to idle the processor
EEPROM, provides API: eeprom		when it has no other tasks to perform. Idling helps save power by halting the main loop of the application, but does not interfere with
EEPROM POWERDOWN		the timely handling of interrupts. For example, when idling, the radio can still receive packets. On devices with only sleepy networks
🔄 ∢D> Em4, provides API: em4		(such as sleepy end devices), the plugin will attempt to deep sleep when there are no other tasks to perform. In deep sleep, the radio
🗹 🕸 End Device Support		is shut down and the node will not receive packets, so deep sleep is only appropriate for devices that are not expected to be always
Fragmentation, provides API: fragmentation		
□ 🕪 Gateway MQTT Transport		
General Response Commands		Reset to default
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🔲 🐗 Micrium RTOS		> S Implemented callbacks (5)
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🗌 🐢 Radio Coexistence CLI		> 📩 APIs (1)
Security Sensor Interface		> 🚀 Plugin extensions (1)
Silicon Labs Device UI		
Simple Clock		
✓ ⊲ Simple Main, provides API: main		

Figure 16 Plugin "Idle/Sleep"

b. Select "End Device Support" plugin, in the properties, set the short poll interval to 1s and long poll interval to 10s.

Plage configuration Use this section to select or unelect the plugins that you want to use in your application Image: Configuration server Image: Configuration server <	🎄 General 🔥 ZCL Clusters 🎄 Zigbee Stack 🎄 Printing and CLI 🜘 HAL 🗇 Plugins 🖉 Callbacks 🎄 I	ncludes 🐊 Other options 🚯 Bluetooth GATT	
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□ □ Dynamic Multiprotecol Win Demo UI Code, provides API: dmp-ui □ >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	Device Table provider API: device-table		
□ ○ Dynamic Multiprotocol UD Demo Code, provides API: dmp-ui □ ◇ Dynamic Multiprotocol UD Demo Code Stub, provides API: dmp-ui □ ◇ Dynamic Multiprotocol UD Demo Code Stub, provides API: dmp-ui □ ◇ Dynamic Multiprotocol UD Demo Code, provides API: dmp-ui □ ◇ Dynamic Multiprotocol UD Demo Code, provides API: dmp-ui □ ◇ Dynamic Multiprotocol UD Demo Code, provides API: dmp-ui □ ◇ Endo Dexice Support □ ◇ Endo Dexice Support □ ◇ Endo Dexice Support □ ◇ General Response Commands □ ◇ General Response Commands □ ◇ Interpan □ ◇ Interpan □ ◇ Low Voltage Shutdown □ ◇ Macrum RUS □ ◇ Parctet Handriff urrovides API: madreff	Dynamic Multiprotocol Demo III Code, provides API: dmp-demo-ui		
□ ○ Dynamic Multiprotocol UD Demo Code Stub, provides API: dmp-ui Reset to defaul □ ○ EEPROM Provides API: eard □ □ ○ Fragmentation, provides API: fragmentation □ □ ◇ Fragmentation, provides API: fragmentation □ □ ◇ Gateway MUIT Transpot □ □ ◇ Gateway MUIT Transpot □ □ ◇ Interpan □ □ ◇ Interpan □ □ ◇ United List □ □ ◇ Manufacturing Library CLI □ □ ◇ Manufacturing Library CLI ○ □ ◇ Marufacturing Library CLI ○	Dynamic Multiprotecto UII Demo Code, provides API: dmp-ui		*
Options: Reset to defaul Coptions: Reset to defaul Reset to defaul Short Poll Interval (seconds): 1 Coptions: Reset to defaul Coptint default set	Dynamic Multiprotocol UI Demo Code Stub. provides API: dmp-ui		
Image: Short Poll Interval (seconds): Imag	EEPROM provides API: eeprom	Options:	Reset to defaults
Image: Support 10 Image: Support 11 Imag	EEPROM POWERDOWN	Short Poll Interval (seconds):	
Image: Support Image: Support Image: Support Image: Sup	↓ Em4, provides API: em4	Long Poll Interval (seconds):	10
Image: Supervision provides API: fragmentation Image: Supervision Provides API: main, micrium-rtos Image: Supervision Provides API: main, micrium-rtos Image: Supervision Provides API: main, micrium-rtos Image: Supervision Provides API: main, micrium-rtos Image: Supervision Provides API: main, micrium-rtos	🔽 🚸 End Device Support	cong for mental (seconds)	
Image: Steway MQIT Transport Wake Timeout Bitmask: 0x0000018 Image: Steway MQIT Transport Image: Steway MQIT Transport Image: Steway MQIT Transport Image: Steway MQIT Transpor	□ 🕪 Fragmentation, provides API: fragmentation	Wake Timeout (seconds):	3
General Response Commands Max Number of Missed Polls: 3 ✓ Heartbeat Max Number of Missed Polls: 3 ✓ Interpan Enable Poll Completed Callback 3 ✓ Unked List Callback Callback ✓ Manufacturing Library CLI Callback Callback ✓ Manufacturing Library Cla Callback Callback ✓ Micrium RTOS Corporides API: main, micrium-rtos Soc Source files (4) ✓ Micrium RTOS Corporides API: main, micrium-rtos Host source files (1) ✓ Hot roum RTOS Another Control Tomoides API: main, micrium-rtos Host source files (1)	Gateway MQTT Transport	Wake Timeout Bitmask:	0x00000018
Imax Number of Number of Sequential Region (move) attempts:[0-255] Imax Number of Sequential Region (move) attempts:[0-255] Im	General Response Commands	May North as of Missed Dellas	
✓ hide/Sileep, provides API: idle-sleep Max Number of Sequential Rejoin (move) attempts:[0-255] 3 ▲ Interpan □ Linked List ▲ Linked List □ Linked List ▲ Marufacturing Library CLI □ Manufacturing Library Ota ▲ Micrium RTOS △ Micrium RTOS GCC, provides API: main, micrium-rtos ▲ Marufacturing Library Ota △ Marufacturing Library Ota ▲ Marufacturing Library Ota △ Micrium RTOS GCC, provides API: main, micrium-rtos	🗌 📣 Heartbeat	Max Number of Missed Polis:	5
□ Interpan □ Linked List □ Linked List □ Main/acturing Library CLI □ Manufacturing Library Ota □ Micrium RIOS □ Micrium RIOS □ Micrium RIOS □ Main/acturing Library Ota □ Micrium RIOS	🖂 🚸 Idle/Sleep, provides API: idle-sleep	Max Number of Sequential Rejoin (move) attempts:[0-255]	3
	🗌 🥠 Interpan	Enable Poll Completed Callback	
	Linked List	Attempt Rejoins using a well-known Trust Center Link K	ev (NOT RECOMMENDED, NOT SECURE)
	↓ All All All All All All All All All Al		
Manufacturing Library CLI Manufacturing Library Cla	AC Address Filtering	Details (double-click on files to show content):	
↓ Manufacturing Library Ota > ▲ Common source files (4) ↓ Micrium RTOS > ▲ SOC source files (1) ↓ Micrium RTOS GCC, provides API: main, micrium-rtos > ▲ Host source files (1) ↓ Parket Handoff provides API: main, micrium-rtos > ▲ Host source files (1)	Manufacturing Library CLI	Located at: C:\SiliconLabs\SimplicityStudio\v4\deve	!oper\sdks\gecko_sdk_suite\v2.6\protocol\zigbee\tool\appbuilder\\\app\framework
A Micrium RUS Micrium RTOS GCC, provides API: main, micrium-rtos A Packet Handoff provides API: market-bandoff A backet Handoff provides API: market-bandoff	Anutacturing Library Ota	> 🛃 Common source files (4)	
$ a_{\mu}$ minim RUS SUC, provides AP: main, minimum-ros $ b_{\mu}$ Solution $ b_{\mu}$ S	Micrium RIOS A Micrium RTOS CCC annuida ADI: unin minimum dan	> 🐣 SOC source files (1)	
Size Packet Handout Drovides API: Dacket-handout	Micrium RIOS GCC, provides API: main, micrium-rtos	> 🐣 Host source files (1)	
→ Demail Line Manager		> S Implemented callbacks (28)	
→ Prefix Gormanager > S ² Defined callbacks (3)	Permit Join Manager	> S Defined callbacks (3)	
Service General laterage	Appendix Constellet CL1 Appendix Sensor Interface	Setup contributions (2)	
Silicol barrell	Silicon Labs Device III	> P Options (8)	
Simple Clock	simple Clock	> 🐉 Plugin extensions (1)	

- Figure 17 Plugin "End Device Support"
- c. Enable plugin "Reporting", and in the properties, set reporting table size to 10. With this step, the attributes which will be reported will be saved in the reporting table and will be reported periodically or reported after it is changed.

lugin configuration Use this section to select or unselect the plugins that you want to use in your application	
	Plugin: ◆ Reporting Quality: ✓ Production Ready Description: Ember implementation of reporting. Reports are asynchronous messages sent out when an ZCL attribute has changed. This plugin supports the binding- based interpretation of reporting in which reports are asynchronous messages sent out when an ZCL attribute has changed. This plugin supports the binding- based interpretation of reporting in which reports are sent to corresponding entries in the binding table. Either the node sending the reports, the node receiving the reports. or another device may create the binding table. Either the node sending the reports, more details, please refer to Zigbee Application Framework Developer Guide. Options: Reset to defau Reporting table size[1-255] 10 Malow reports to send via group bindings (zigbee 3.0 mandatory behavior) Details (double-click on files to show content): Compon source files (3) Commo source files (3) See Compon source files (3) Set portinuations(2) See Set contributions (2) Set portinues (2) See Orbitom S(2) Set portions(1)

Figure 18 Plugin "Reporting"

d. Enable plugin "Find and Bind Initiator". With this step, the sleepy end device can start the "finding and binding" process, and with that, it can setup the binding table automatically. You can refer to Zigbee BDB spec section 8.5/8.6 to learn more about this procedure.

Plugin configuration			
Use this section to select or unselect the plugins that you want to use in your application			
Simple Clock Simple Main, provides API: main Siepy Message Queue Stack Protection for IAR, provides API: stack-protection Stack Protection for IAR, provides API: stack-protection Source API: stack-protection	Plugin: Image: All production ready Quality: Image: Production Ready Description: This plugin provides the functiona to create a binding to those device	lity to find devices that are performing the find and bind process for a target, and then optionally at s.	tempts
	Options: Target Responses Count:[0-255] Target Responses Delay:[0-65535] Details (double-click on files to show the common source files (2) > Sommon source files (2) > Sommon source files (2) > Sommon source files (2) > Source stup contributions (1) > Potions (2) > Options (2) > Plugin extensions (1)	5 MILLISECOND_TICKS_PER_SECOND*3 ow content): SimplicityStudio\v4\developer\sdks\gecko_sdk_suite\v2.6\protocol\zigbee\tool\appbuilder\\\app)	t to default

Figure 19 Plugin "Find and Bind Initiator"

12. Click "Callbacks" tab:

a. Unfold "Non-cluster related", enable "Main Init" callback emberAfMainInitCallback; You can input "Main Init" in the filter to find it quickly.

Printing and	d CLI 🔘 HAL 🕸 Plugins 🛱 Callbacks
n your code o	therwise, you will get linker errors when building you
Use	Туре
\checkmark	Custom callback
	Use

Figure 20 Callback "Main Init"

b. Unfold "Non-cluster related", enable "Stack Status" callback emberAfStackStatusCallback;

🚴 General ZCL Clusters 🍰 Zigbee Stad	ck 🛛 🙈 Printing an	id CLI 🔘 HAL 🖘 P	lugins 🕼	Callbacks	🚴 Includes	🚴 Ot
Callbacks						
By enabling callbacks, you will have to implen	nent them in your co	de otherwise, you will gei	t linker errors	when building	g your device.	
	-			-		
stack status						
Name	Use	Type				
✓ ♣ Non-cluster related		.7F-				
S Stack Status	\checkmark	Custom callback				
> A Plugin-specific callbacks						
> 🖧 Handlers defined by stack						
A Callbacks defined by APIs						
> Å General						
> 🙏 Measurement & Sensing						

- Figure 21 Callback "Stack Status"
- c. Unfold "Plugin-specific callbacks", enable "Complete" callback emberAfPluginFindAndBindInitiatorCompleteCallback of plugin "find and bind initiator";

-) Utr
in your cod	e otherwise, you will get linker errors when building your device.	
Use	Туре	
	Plugin specific: End Device Support	
\checkmark	Plugin specific: Find and Bind Initiator	
\checkmark	Plugin specific: Network Steering	
	in your code	in your code otherwise, you will get linker errors when building your device. Use Type Use Plugin specific: End Device Support ✓ Plugin specific: Find and Bind Initiator ✓ Plugin specific: Network Steering

Figure 22 Callback "Find and Bind Initiator Complete"

13. Click "Printing and CLI" tab, enable the debug print of "Reporting":

🚴 General 🔥 ZCL Clusters 🍰 Zigbee Stack 🍰	Printing and CLI	🕘 HAL 🚸 Plugins	🗲 Callbacks
▼ Debug Configuration			
Inable debug printing			
Functional area	Compiled in	Enabled at star	
✓ General-purpose debug printing areas			
Core	\checkmark	\checkmark	
Debug	\checkmark	\checkmark	
Application	\checkmark	\checkmark	
Security			
Attributes			
Reporting	\checkmark	\checkmark	
Service discovery			
Registration			
ZDO (ZigBee Device Object)	\checkmark	\checkmark	

Figure 23 Printing and CLI

- 14. Click "Includes" tab, scroll to the bottom (You might need to scroll the bar on the very right as well), in the "Event Configuration" field, hit "New" button to add a custom event customWriteAttributeEventData and its handler customWriteAttributeEventHandler.
- 15. Save the modified Project .ISC file and click "Generate". Notice the project files appearing in Project Explorer. A window saying "generating successfully" will appear. Click OK.
- 16. Edit <projectnane>_callbacks.c:

a.

Modify function emberAfStackStatusCallback as below:

```
bool emberAfStackStatusCallback(EmberStatus status)
{
    // This value is ignored by the framework.
    if (EMBER_NETWORK_UP == status) {
        //start find and bind procedure when joins network
        EmberStatus status = emberAfPluginFindAndBindInitiatorStart(1);
        emberAfCorePrintln("Find and bind initiator %p: 0x%X", "start", status);
    }
    return false;
}
```

b. Add function emberAfPluginFindAndBindInitiatorCompleteCallback as below:

```
void emberAfPluginFindAndBindInitiatorCompleteCallback(EmberStatus status)
{
   emberAfCorePrintln("Find and bind initiator %p: 0x%X", "complete", status);
}
```

c. Add the following source code snippets to read temperature from adc:

```
#include "em_adc.h"
EmberEventControl customWriteAttributeEventData;
static void AdcSetup(void)
{
    /* Enable ADC clock */
    CMU_ClockEnable(cmuClock_ADC0, true);
    /* Base the ADC configuration on the default setup. */
```

```
ADC_Init_TypeDef init = ADC INIT DEFAULT;
  ADC InitSingle TypeDef sInit = ADC INITSINGLE DEFAULT;
  /* Initialize timebases */
 init.timebase = ADC TimebaseCalc(0);
  init.prescale = ADC PrescaleCalc(400000, 0);
  ADC Init(ADCO, &init);
  /* Set input to temperature sensor. Reference must be 1.25V */
 sInit.reference = adcRef1V25;
 sInit.acqTime = adcAcqTime8; /* Minimum time for temperature sensor */
sInit.posSel = adcPosSelTEMP;
 ADC InitSingle(ADC0, &sInit);
}
static uint32 t AdcRead(void)
{
 ADC Start(ADCO, adcStartSingle);
 while ( (ADCO->STATUS & ADC STATUS SINGLEDV) == 0 ) {
 }
 return ADC DataSingleGet(ADC0);
}
static float ConvertToCelsius(int32 t adcSample)
{
 uint32 t calTemp0;
 uint32 t calValue0;
  int32 t readDiff;
  float temp;
  /* Factory calibration temperature from device information page. */
  calTemp0 = ((DEVINFO->CAL & DEVINFO CAL TEMP MASK)
             >> _DEVINFO_CAL_TEMP_SHIFT);
  calValue0 = ((DEVINFO->ADC0CAL3
                /* _DEVINFO_ADC0CAL3_TEMPREAD1V25 MASK is not correct in
                   _current_CMSIS. This is a 12-bit value, not 16-bit. */
                & OxFFFO)
               >> DEVINFO ADCOCAL3 TEMPREAD1V25 SHIFT);
 if ((calTemp0 == 0xFF) || (calValue0 == 0xFFF)) {
   /* The temperature sensor is not calibrated */
   return -100.0;
  }
  /* Vref = 1250mV
    TGRAD ADCTH = 1.84 mV/degC (from datasheet)
  */
  readDiff = calValue0 - adcSample;
  temp = ((float)readDiff * 1250);
  temp /= (4096 * -1.84);
  /* Calculate offset from calibration temperature */
 temp = (float)calTemp0 - temp;
  return temp * 100;
}
void customWriteAttributeEventHandler()
{
   int32 t sample = 0;
   intl6 t temp = 0;
   emberEventControlSetInactive(customWriteAttributeEventData);
   sample = AdcRead();
   temp = ConvertToCelsius(sample);
   emberAfCorePrintln("sample=%d", sample);
```

17. Select the project in Project Explorer window and compile your project by clicking on the Build icon ⁶. Ensure that the build completes with 0 errors.

- 3 Test and observe the polling and the current.
 - 1. Choose one WSTK as the sleepy end device, flash bootloader (You can use the pre-built bootloader described below) to WSTK, and then flash sleepy end device application to WSTK.

```
\label{eq:siliconLabsSimplicityStudio} w4\developer\sdks\gecko\_sdk\_suite\v2.6\platform\bootloader\sample-apps\bootloader\_storage-internal-single\efr32mg12p332f1024g1125-brd4162a
```

```
Please choose the pre-built bootloader bootloader-storage-internal-single-combined.s37
```

2. On the console of the switch, run following command to join the network.

```
//Find a joinable network and join it
MyZSED> plugin network-steering start 0
```

- 3. After the device joined a network, it will enter sleep mode. In this case, the command line is not available. If you need to run debug command, please press button0 to force the device stay awake. After you finished debugging, press button1 to allow the device to enter sleep mode. Make sure you have unplug then plug the cable once after you flashed the program. (The debugger could cause a high current).
- 4. Use info command to check whether you joined the right network.

```
//Check the pan id and channel of ZSED. They should be the same as we provided.
MyZSED> info
MFG String:
AppBuilder MFG Code: 0x1002
node [(>)000B57FFFE648DD8] chan [18] pwr [3]
panID [0x2019] nodeID [0x0000] xpan [0x(>)A3E54612381CBF6B]
parentID [0xFFFF] parentRssi [0]
stack ver. [6.4.1 GA build 408]
nodeType [0x01]
Security level [05]
network state [02] Buffs: 73 / 75
Ep cnt: 2
ep 1 [endpoint enabled, device enabled] nwk [0] profile [0x0104] devId [0x0100] ver [0x00]
   in (server) cluster: 0x0000 (Basic)
    in (server) cluster: 0x0003 (Identify)
    in (server) cluster: 0x0004 (Groups)
    in (server) cluster: 0x0005 (Scenes)
    in (server) cluster: 0x0006 (On/off)
ep 2 [endpoint enabled, device enabled] nwk [0] profile [0x0104] devId [0x0100] ver [0x00]
    in (server) cluster: 0x0000 (Basic)
    in (server) cluster: 0x0003 (Identify)
    in (server) cluster: 0x0004 (Groups)
    in (server) cluster: 0x0005 (Scenes)
    in (server) cluster: 0x0006 (On/off)
Nwk cnt: 1
nwk 0 [Primary (pro)]
  nodeType [0x04]
  securityProfile [0x05]
```

5. If you joined a wrong network, please leave the network and join again.

```
//Leave network
MyZSED> network leave
//join again
MyZSED> plugin network-steering start 0
```

6. Make sure you have joined the right network before you continue.

7. Get the NWK key by "keys print" command, then add it to Simplicity Studio.

MyZSED>keys print EMBER SECURITY LEVEL: 05 NWK Key out FC: 00000010 NWK Key seq num: 0x00 NWK Key: 78 87 4D 1F DE B4 08 21 5B 83 DE 43 E9 FD B4 CC Link Key out FC: 0000002 TC Link Key Index IEEE Address In FC Type Auth Key (>)90FD9FFFFE7B81BD 0000F003 L 95 34 1A 83 18 22 AC A5 89 4E 45 90 60 DA D3 У D7 Link Key Table Index IEEE Address Type Auth Key In FC 0/0 entries used. Transient Key Table Index IEEE Address In FC TTL(s) Flag Key 0 entry consuming 0 packet buffer.

8. Start a capture with Network Analyzer, observe the polling interval. Normally it should poll every 10 seconds.

9. Start a capture, then reset the sleepy end device. Observe the rejoin procedure in the sniffer.

10. Observe the periodically report and also the polling at this stage;

2 saved filters AND		
10.00 p/s 0.000s	<u> </u>	
Time:not set Real time:N/A Nodes:0 Event:none		8

•	•
(0000)	(838F)

actions total:2 sho	own:2								
Time	Duration	Summary	NWK Src	NWK Dest	P#	M#	E#	Error Status	Warning Sta
Today, 10:28:30	1.016	ZCL: ReportAttributes	838F	0000	4				
Today, 10:28:31	0.022	ZCL: DefaultResponse	0000	838F	4				
s total:25 shown:2	20 Decoders: Au	ito-detecting decoder stack, Default							
Time	Type	Summary	N	AC Src	MAC Dest	Event e	ror status	Event warning state	us
Today 10:28:13	Packet	Data Request		18F	0000				
Today, 10:28:13	Packet	802 15 4 Ack	0	00	838F				
Today, 10:28:23	Packet	Data Request	8	18F	0000				
Today, 10:28:23	Packet	802 15 4 Ack	0	00	838F				
Today, 10:28:30	Packet	ZCI : ReportAttributes	8	38F	0000				
Today, 10:28:30	Packet	802.15.4 Ack	00	000	838F				
Today, 10:28:31	Packet	Data Request	8	38F	0000				
Today, 10:28:31	Packet	802.15.4 Ack	00	000	838F				
Today, 10:28:31	Packet	APS Ack	00	000	838F				
Today, 10:28:31	Packet	802.15.4 Ack	83	38F	0000				
Today, 10:28:31	Packet	Data Request	83	38F	0000				
Today, 10:28:31	Packet	802.15.4 Ack	00	000	838F				
Today, 10:28:31	Packet	ZCL: DefaultResponse	00	000	838F				
Today, 10:28:31	Packet	802.15.4 Ack	8	38F	0000				
Today, 10:28:31	Packet	APS Ack	83	38F	0000				
Today, 10:28:31	Packet	802.15.4 Ack	00	000	838F				
Today, 10:28:32	Packet	Data Request	83	38F	0000				
-		000.15.1.4		0.00	0205				
Today, 10:28:32	Packet	802.15.4 Ack	00	000	838F				
Today, 10:28:32 Today, 10:28:33	Packet Packet	Data Request	8	38F	0000				

Figure 24 Observe the report and polling

11. Start Energy Profiler and measure the sleepy current. Record the average current;



Figure 25 Observe the current