

Renesas Synergy™ Software Package (SSP) v1.1.0 R11AN0024EU0140

Developer Examples

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Introduction

The purpose of this Application Note is to get you started using the Developer Example applications included with SSP. A Developer Example is a simple application demonstrating the functionality of each SSP Framework or HAL module. You can call each application via a command line interface on a serial terminal.

Target Device and Software Requirements

- DK-S7G2
- Renesas Synergy e² studio v5.0.0.043

NOTE: This release was tested with Renesas Synergy Software Package v1.1.0. The Developer Examples and the associated project template is automatically installed with any SSP v1.1 installer.

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1. Prerequisites

This guide assumes that you have installed the Synergy Software Package (SSP) and e² studio ISDE on your computer and have the DK-S7G2 board successfully configured and set up with the J-Link debugger. You can verify that board and e² studio ISDE are working correctly by running the ‘Blinky’ demonstration example available for all Renesas Synergy boards. In addition, you need a common PC hosted editor.

It is also helpful if you have some familiarity with the overall layout of the e² studio ISDE windows and with generating Synergy projects in e² studio, since the steps below are less ‘guided’ than the steps in the ‘Blinky’ project and they don't illustrate each window or command location used in each step.

All examples use a terminal emulator program such as Tera Term.

2. Overview

This document is intended for developers who use the Synergy DK-S7G2 Development Kit and want to get a quick start on how to use a module and its interface.

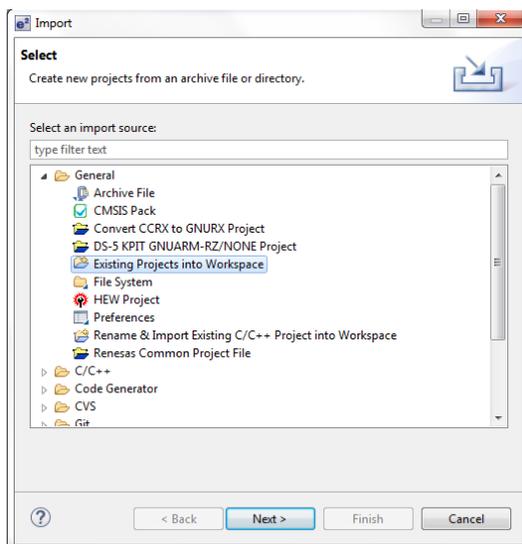
This document provides detailed information about how to exercise the module’s APIs from the command line using a terminal emulator like Tera Term.

This document also explains about how to select the Root menu in command line interface and how to select the specific modules menu from Root menu. Screen shots of the terminal window show the supported commands and how to use the commands.

3. Build and Run a Developer Example application

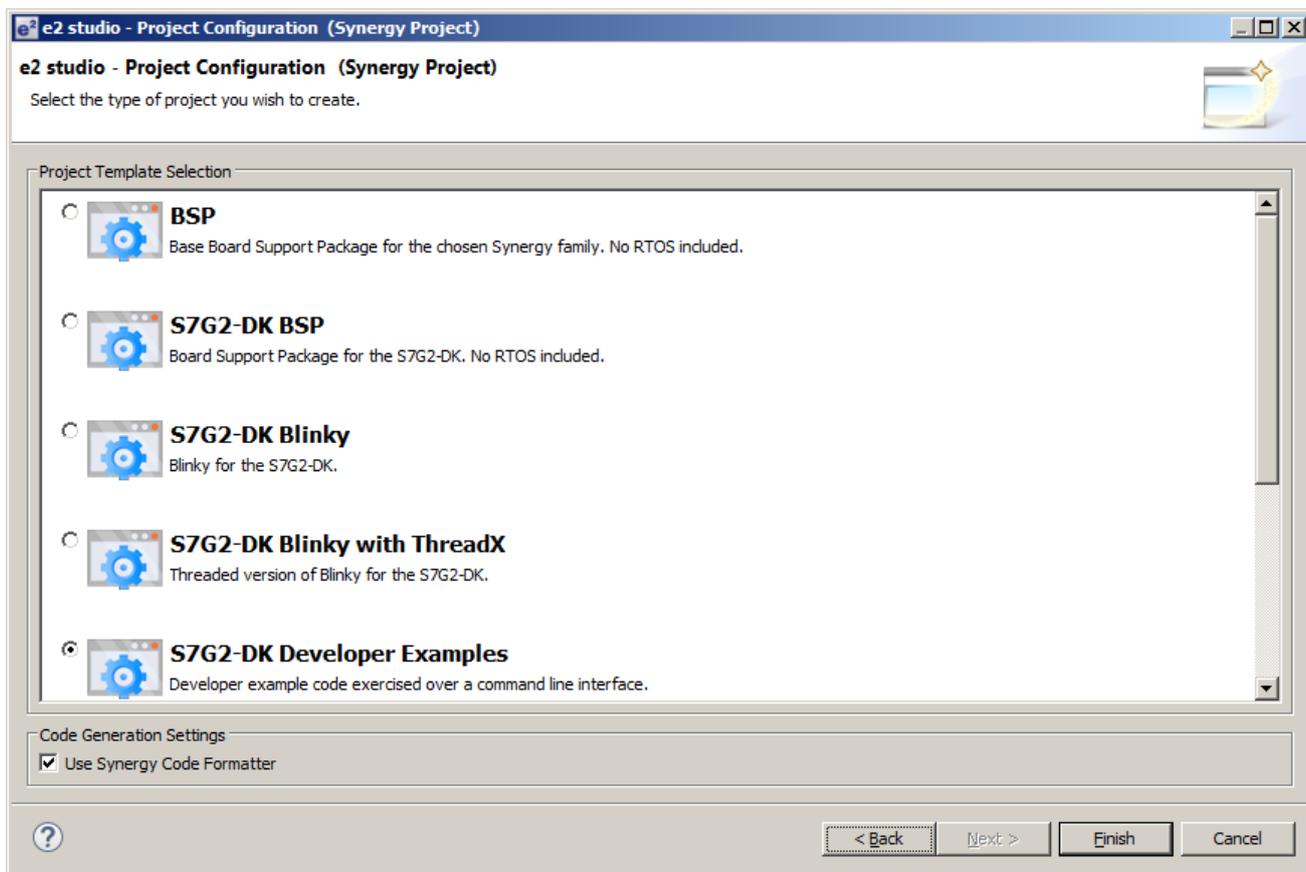
You can build and run all Developer Example applications described in this document by following these common steps:

STEP 1: Launch e² studio. Navigate to **File>New > Synergy Project**. The Import dialog box opens.



STEP 2: Enter a name for your project, select a license file, and click **Next**. Select version 1.1.0 of the SSP and the **S7G2 DK** board. Click **Next**.

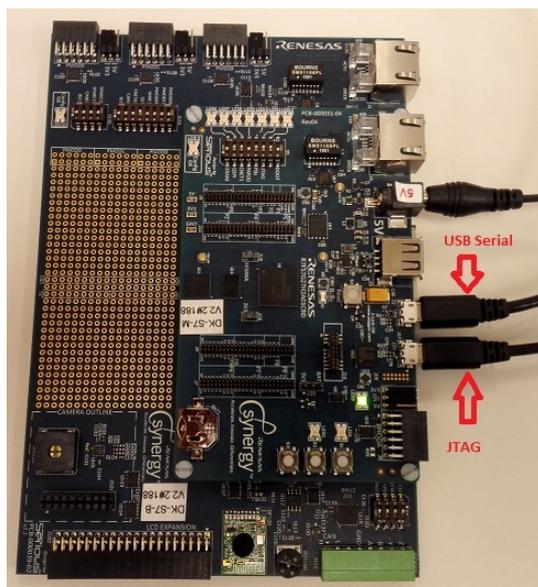
STEP 3: Select the project **S7G2-DK Developer Examples**. Click **Finish**.



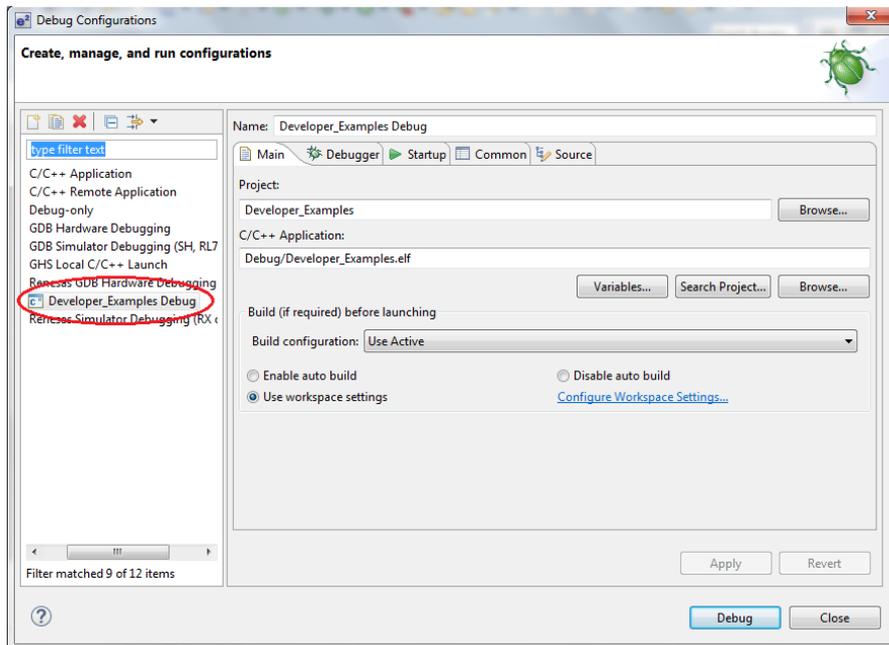
STEP 4: Build the project.

STEP 5: Connect the DK-S7G2 board to the host PC. Two connections are needed:

- a) The JTAG debug connection to program and debug the board
- b) The USB-CDC connection for console access



STEP 6: Power on the board. In ISDE, click **Run>Debug configurations**. A new debug configuration with the project name will be created. Click Debug.

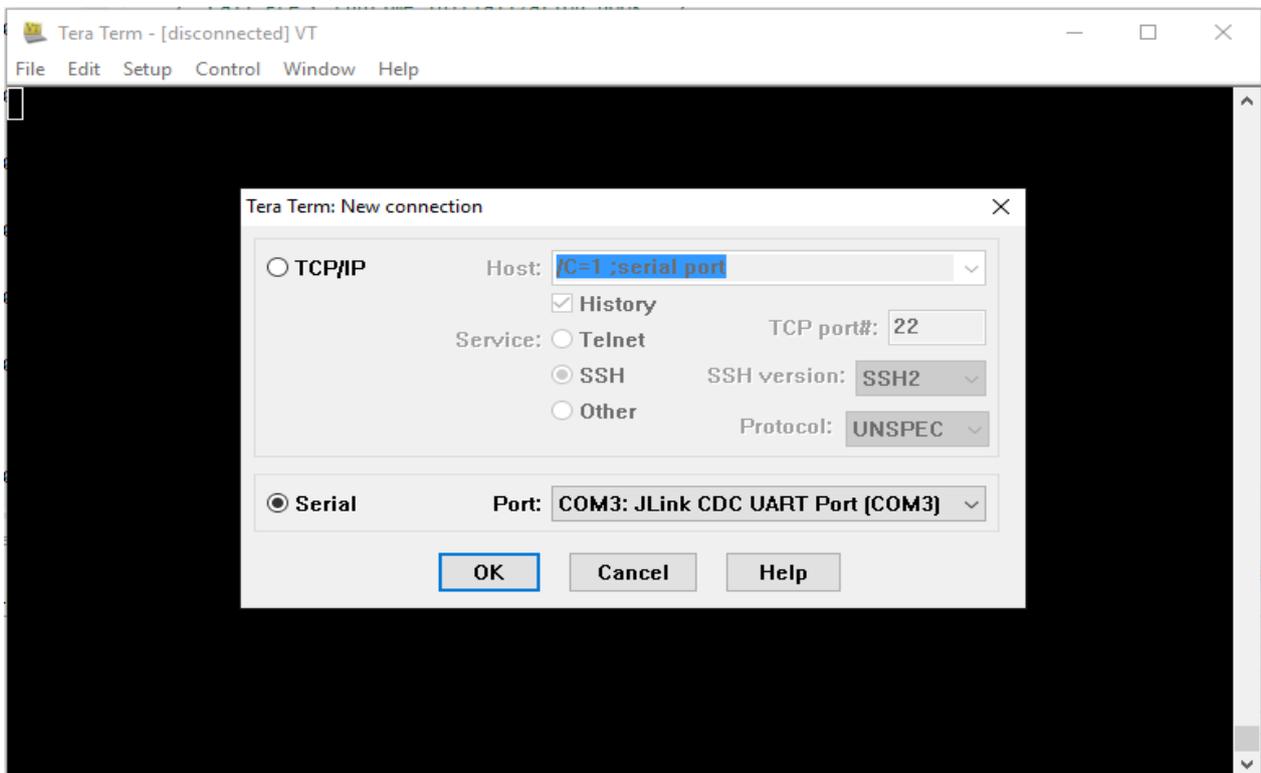


STEP 7: Click **Yes** to switch to the Debug Perspective if you are asked.

STEP 8: Click the Resume button  twice so that the application starts its scheduler.

STEP 9: If this is the first time launch, wait for the host PC to recognize the USB device as composite device and install the required driver. Once the driver is installed, launch Tera Term.

STEP 10: Choose the serial connection and choose the corresponding serial port (COM3: JLink CDC UART Port [COM3]).



STEP 11: Press the Enter key to get the console prompt.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

*****
*           Synergy Developer Example applications           *
*                   Version 1.1.0                          *
*           Hit ? to show command list                      *
*****
synergy>
    
```

STEP 12: Type ? and press Enter to get the Help menu showing a list of supported Developer Example applications.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>?
synergy Help Menu
  help : Prints the help information for Developer Example
  r_flash_hp : Exercise Flash HAL APIs
  r_sci_i2c : Exercise SCI_I2C HAL APIs
  r_gpt : Exercise Timer GPT HAL APIs
  r_adc : Exercise ADC HAL APIs
  r_qspi : Exercise QSPI Flash HAL APIs
  r_crc : Exercise CRC HAL APIs
  r_dac : Exercise DAC HAL APIs
  r_agt : Exercise Timer AGT HAL
  r_wdt : Exercise WDT HAL APIs
  r_rtc : Exercise RTC HAL APIs
  r_icu : Exercise EXTIRQ API's
  r_fmi : Exercise the FMI hal API's
  r_lpm : Exercise LPM HAL API's
  r_ioport : Exercise IOPORT HAL API's
  sf_audio_playback : Exercise Audio framework APIs
  sf_i2c : Runs a I2c Framework Application
  sf_adc_periodic : Exercise ADC framework APIs
  sf_thread_monitor : Runs a Thread Monitor Framework Application
  sf_el_fx : Exercise the FileX framework API's
  sf_el_ux_comms : Exercise COMMS framework APIs
  sf_touch_panel_i2c : Run I2c Touch framework Application
  sf_external_irq : Exercise the External IRQ framework API's
  sf_el_nx_comms : Runs a COMMS framework on NETX Application

synergy>
    
```

To enter the submenu for any of the Developer Examples, type the name of the application and press Enter. For example, to use the ADC Framework application, type `sf_adc_periodic`. To see a list of the supported APIs, press `?` and Enter.

NOTE: Commands typed in the Tera Term window are not case sensitive

4. Developer Example: ADC Periodic Framework

4.1 Introduction

The ADC Periodic Framework operates as follows:

The GPT timer is configured to trigger an ADC group scan at periodic intervals. When the scan is complete, a DTC operation is triggered which copies the scan result to a user buffer. When completing such iterations, you are notified about the data transfer.

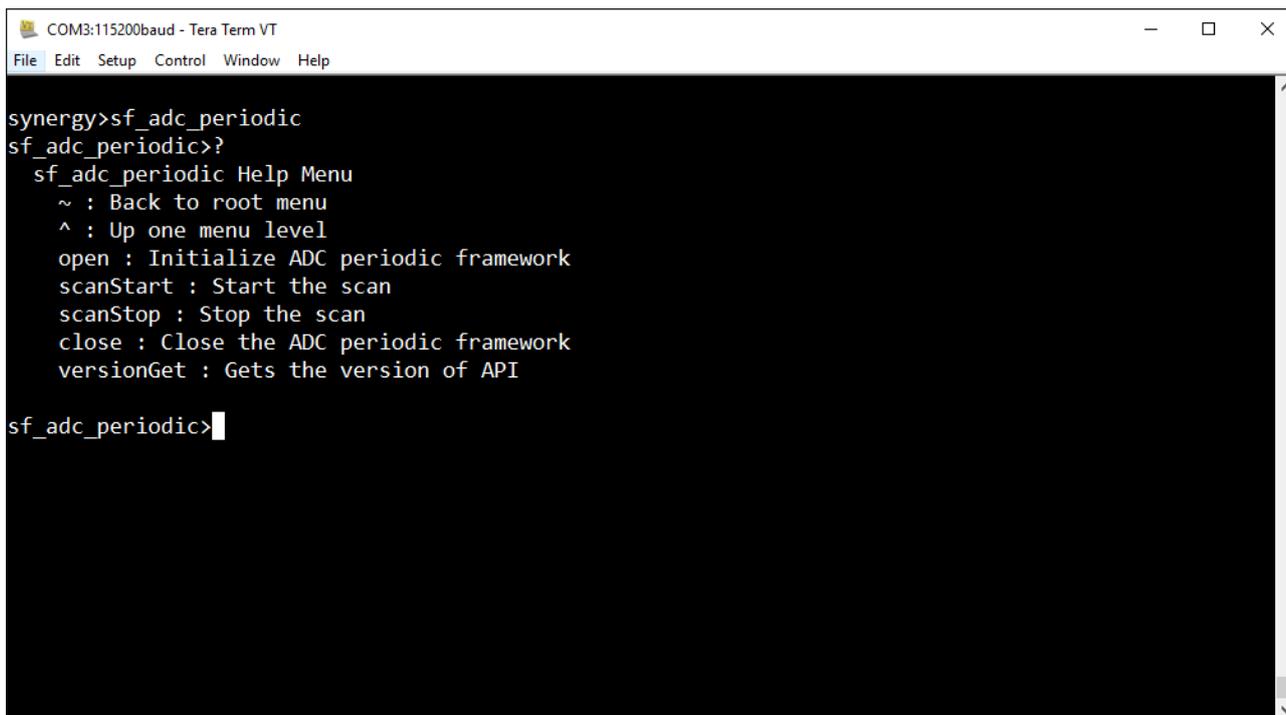
In this Developer Example, the ADC is configured to scan channel (AN000), which is connected to a potentiometer on the DK-S7G2. When the scan is complete, the DTC triggers a data transfer to the user buffer and the listening thread is notified. When receiving the notification, the thread uses I2C HAL drivers to interface to an on-board I/O expander which toggles the LEDs. This operation is repeated with the period configured for the GPT timer.

4.2 Run the ADC Periodic Framework application

Follow the steps described in Build and Run a Developer Example application to obtain the help menu with the list of applications in the terminal window.

To run the ADC Periodic Framework application, follow these steps:

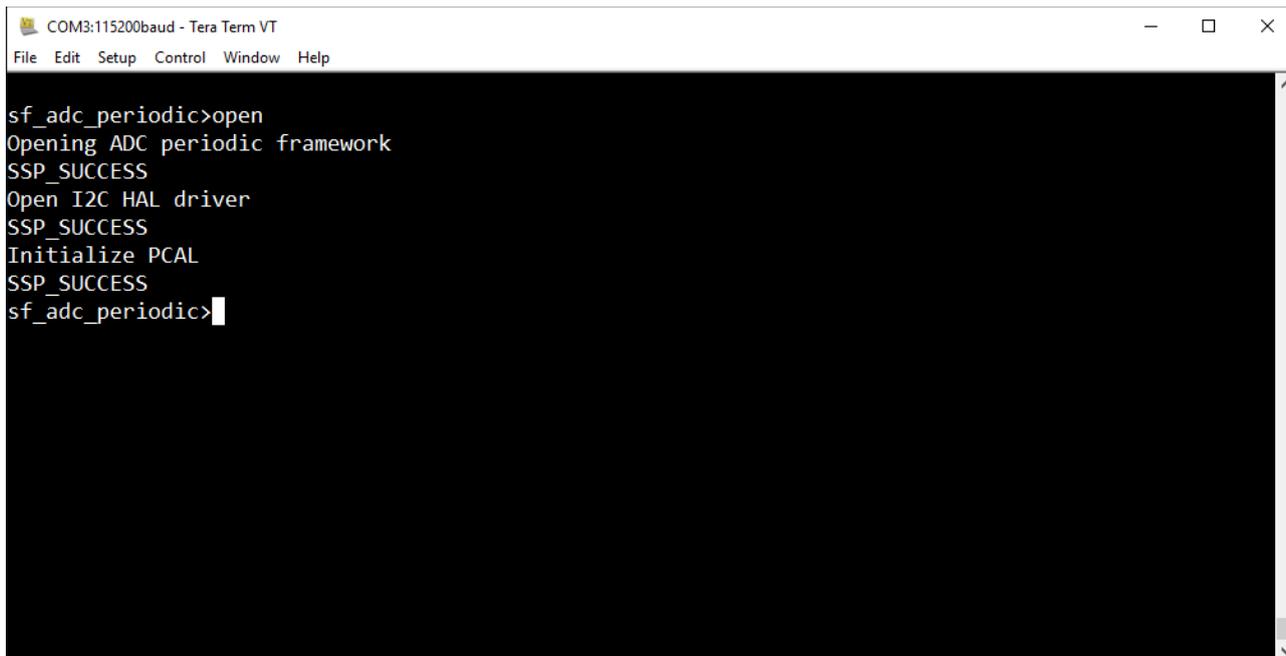
STEP 1: Type `sf_adc_periodic` in the terminal and press Enter to access the ADC Periodic Framework submenu. For help, type `?` and press Enter.

A screenshot of a Tera Term terminal window titled "COM3:115200baud - Tera Term VT". The terminal shows the following text:

```
synergy>sf_adc_periodic
sf_adc_periodic>?
  sf_adc_periodic Help Menu
  ~ : Back to root menu
  ^ : Up one menu level
  open : Initialize ADC periodic framework
  scanStart : Start the scan
  scanStop : Stop the scan
  close : Close the ADC periodic framework
  versionGet : Gets the version of API

sf_adc_periodic>
```

STEP 2: Execute the `open` command. It opens the SCI I2C HAL driver and configures the I/O expander. It also configures the ADC Periodic Framework, but as part of the thread entry function, the ADC framework is already opened. Thus it might result in an `SSP_ERROR_IN_USE`. You can safely ignore that error.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

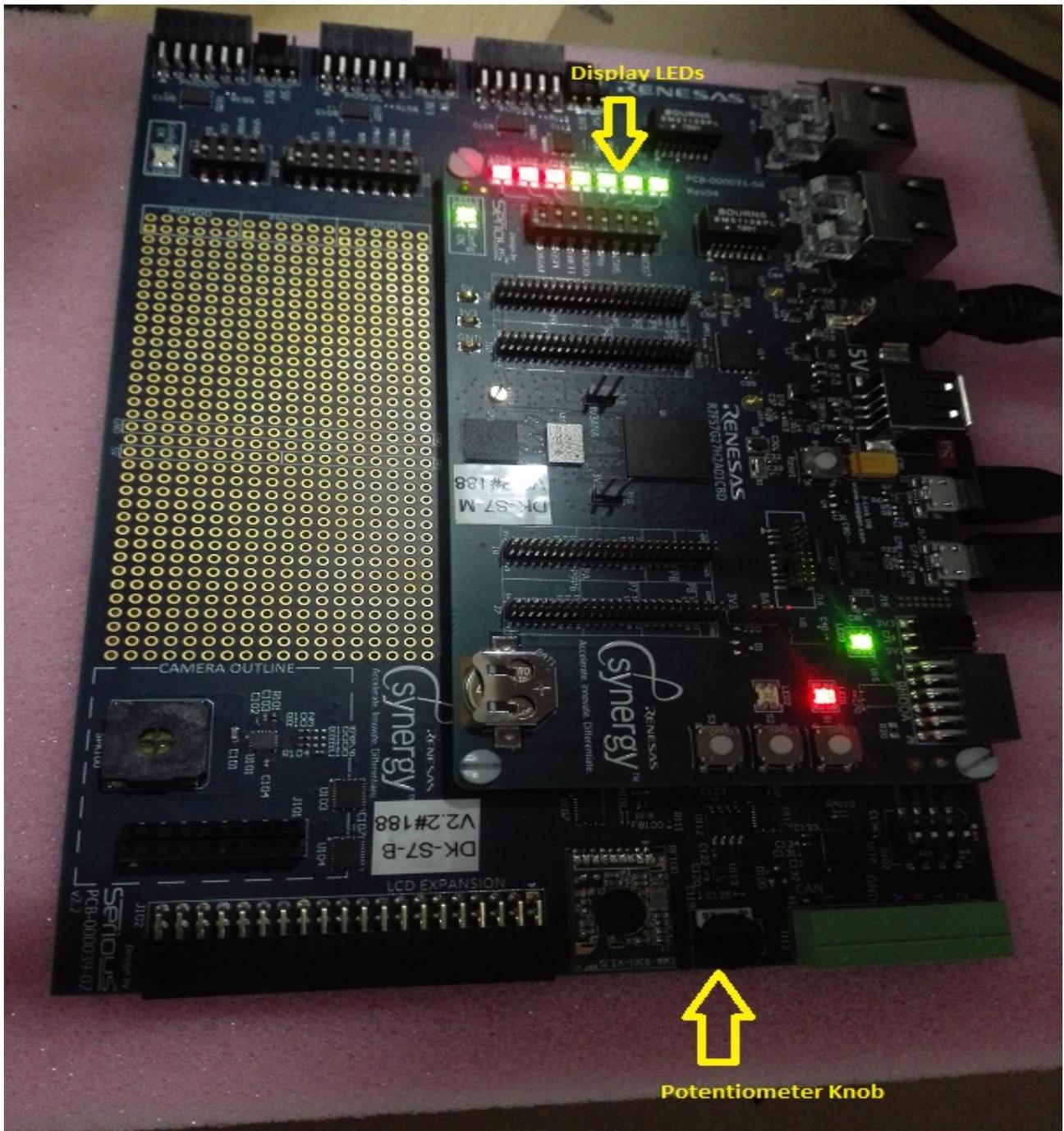
sf_adc_periodic>open
Opening ADC periodic framework
SSP_SUCCESS
Open I2C HAL driver
SSP_SUCCESS
Initialize PCAL
SSP_SUCCESS
sf_adc_periodic>
```

STEP 3: Start the scan using the command `scanStart`. Turn the knob of the potentiometer and observe that the LEDs toggle based on the direction of the motion of the knob.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_adc_periodic>scanStart
SSP_SUCCESS
sf_adc_periodic>
```



STEP 4: The scanStop command stops the periodic ADC scan. Once the scanStop command is executed, the state of the LEDs does not change with the motion of the potentiometer knob.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_adc_periodic>scanStop
SSP_SUCCESS
sf_adc_periodic>
```

STEP 5: Close the ADC framework instance by typing the `close` command. Closing the ADC Framework instance also closes the I2C HAL drivers that were opened as part of the `open` command.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_adc_periodic>close
SSP_SUCCESS
sf_adc_periodic>
```

5. Developer Example: ADC HAL driver

5.1 Introduction

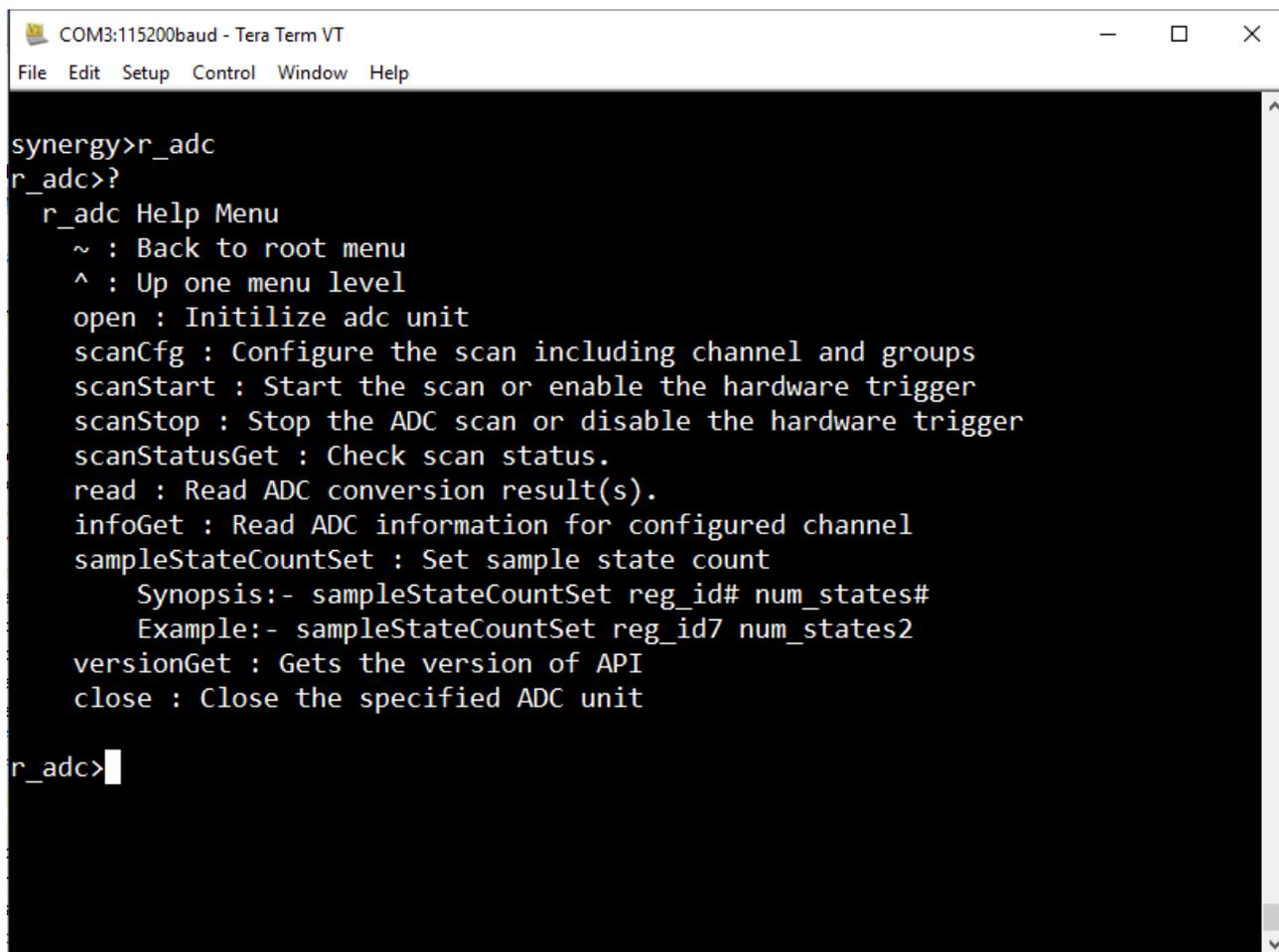
This Developer Example uses the ADC HAL APIs in single scan mode. On the DK-S7G2 board, channel 0 of the ADC is connected to a potentiometer. You can observe the changes in ADC value when the potentiometer knob is varied and a scan is performed.

5.2 Run the ADC HAL Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To perform a scan and read the ADC value, follow these steps:

STEP 1: Type `r_adc` in the terminal and press enter to access the ADC HAL submenu. For help, type `?` and press Enter.

A screenshot of a terminal window titled 'COM3:115200baud - Tera Term VT'. The window has a menu bar with 'File', 'Edit', 'Setup', 'Control', 'Window', and 'Help'. The terminal content shows a user entering 'synergy>r_adc' and 'r_adc>?', followed by a help menu listing various commands and their functions. The commands listed are: '~ : Back to root menu', '^ : Up one menu level', 'open : Initilize adc unit', 'scanCfg : Configure the scan including channel and groups', 'scanStart : Start the scan or enable the hardware trigger', 'scanStop : Stop the ADC scan or disable the hardware trigger', 'scanStatusGet : Check scan status.', 'read : Read ADC conversion result(s).', 'infoGet : Read ADC information for configured channel', 'sampleStateCountSet : Set sample state count', 'Synopsis:- sampleStateCountSet reg_id# num_states#', 'Example:- sampleStateCountSet reg_id7 num_states2', 'versionGet : Gets the version of API', and 'close : Close the specified ADC unit'. The prompt 'r_adc>' is visible at the bottom of the terminal.

```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>r_adc
r_adc>?
r_adc Help Menu
~ : Back to root menu
^ : Up one menu level
open : Initilize adc unit
scanCfg : Configure the scan including channel and groups
scanStart : Start the scan or enable the hardware trigger
scanStop : Stop the ADC scan or disable the hardware trigger
scanStatusGet : Check scan status.
read : Read ADC conversion result(s).
infoGet : Read ADC information for configured channel
sampleStateCountSet : Set sample state count
    Synopsis:- sampleStateCountSet reg_id# num_states#
    Example:- sampleStateCountSet reg_id7 num_states2
versionGet : Gets the version of API
close : Close the specified ADC unit

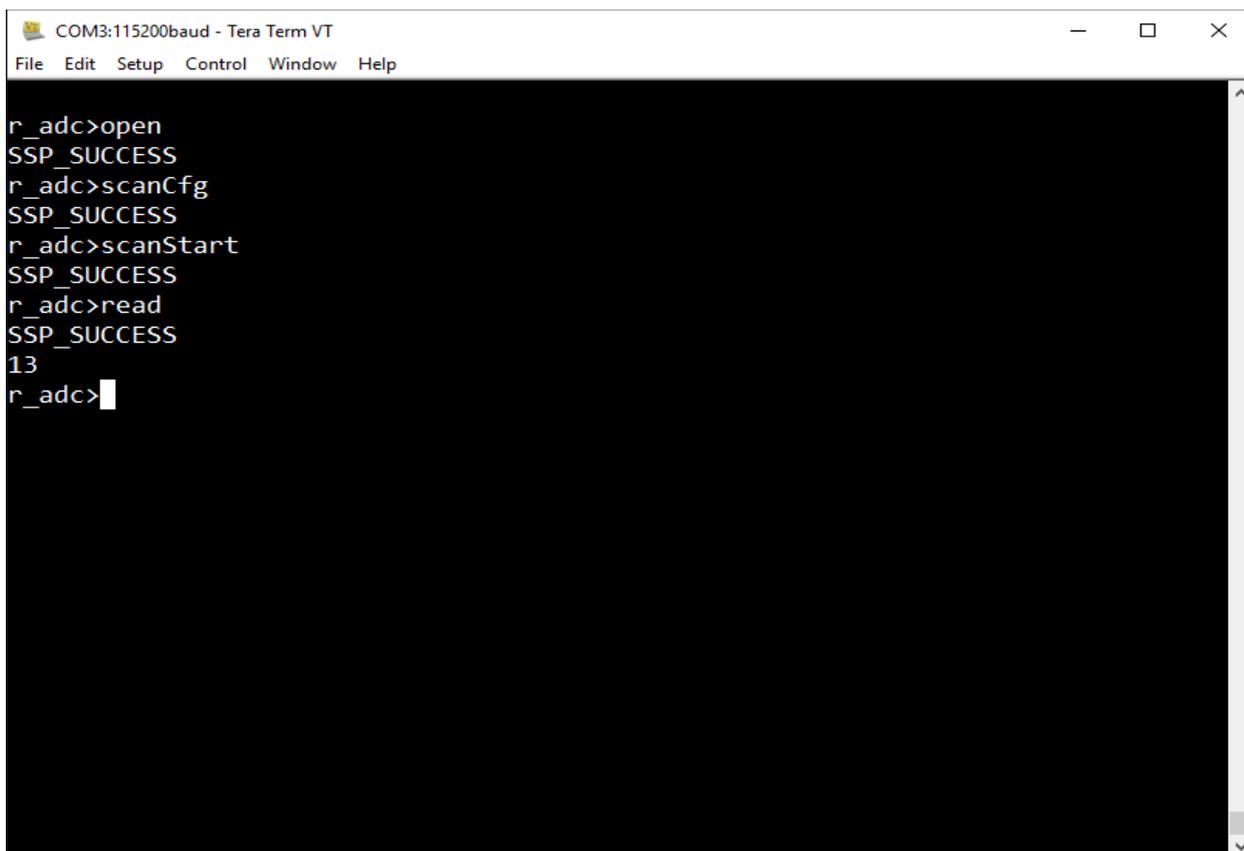
r_adc>
```

STEP 2: Invoke each menu item with the corresponding arguments to use the APIs. First configure the scan by executing the following commands in sequence:

1. open
2. scanCfg

To read the ADC value, first perform a scan using the `scanStart` command and then read the value using the `read` command:

1. scanStart
2. read



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_adc>open
SSP_SUCCESS
r_adc>scanCfg
SSP_SUCCESS
r_adc>scanStart
SSP_SUCCESS
r_adc>read
SSP_SUCCESS
13
r_adc>
```

6. Developer Example: Audio Playback Framework

6.1 Introduction

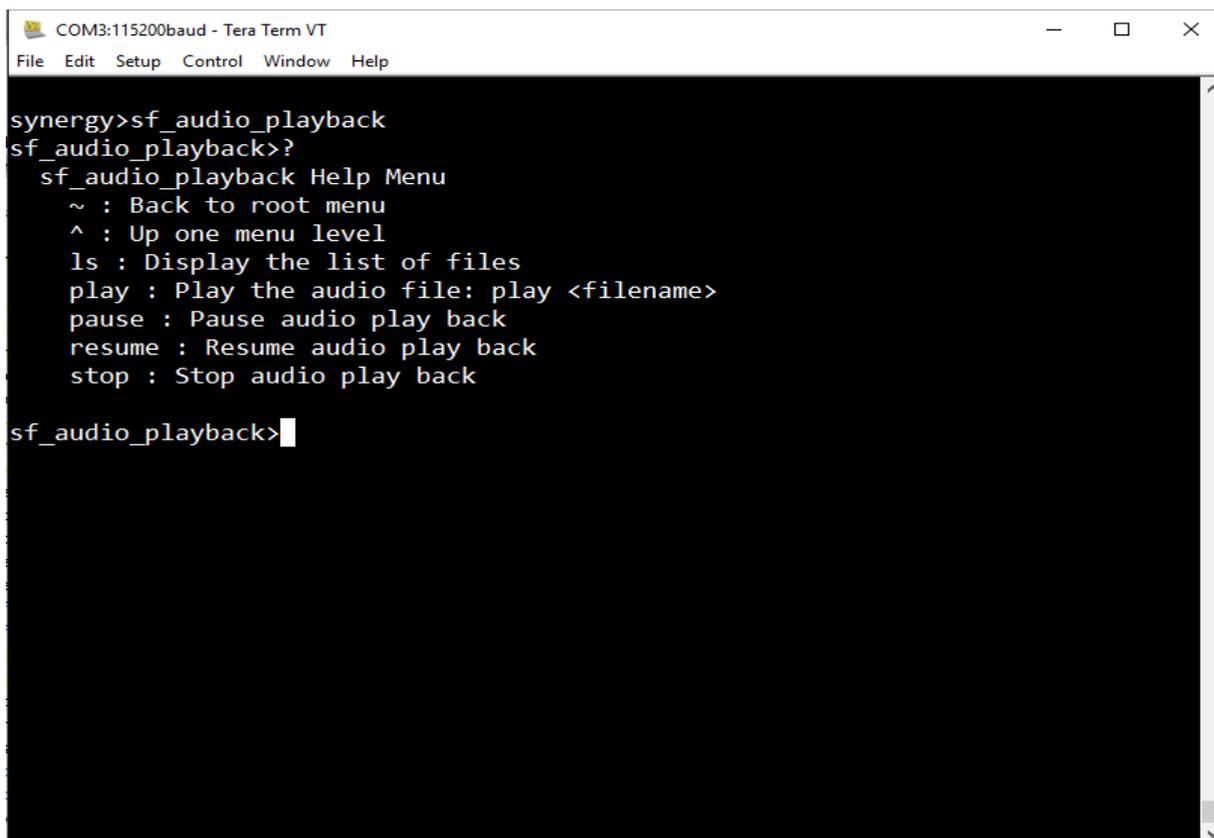
This Developer Example demonstrates the `play` API of the Audio Playback Framework. You can enable and configure the DAC to playback an audio file in .ogg format stored on an SD card and control the playback using the terminal. In addition to the Audio Playback Framework, the example also uses the FileX Adaptation Framework (FX_IO) and the SD/MMC card drivers.

6.2 Run the Audio Playback Framework application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the Audio Playback Framework application, follow these steps:

STEP 1: Type `sf_audio_playback` and press Enter to get the audio menu.

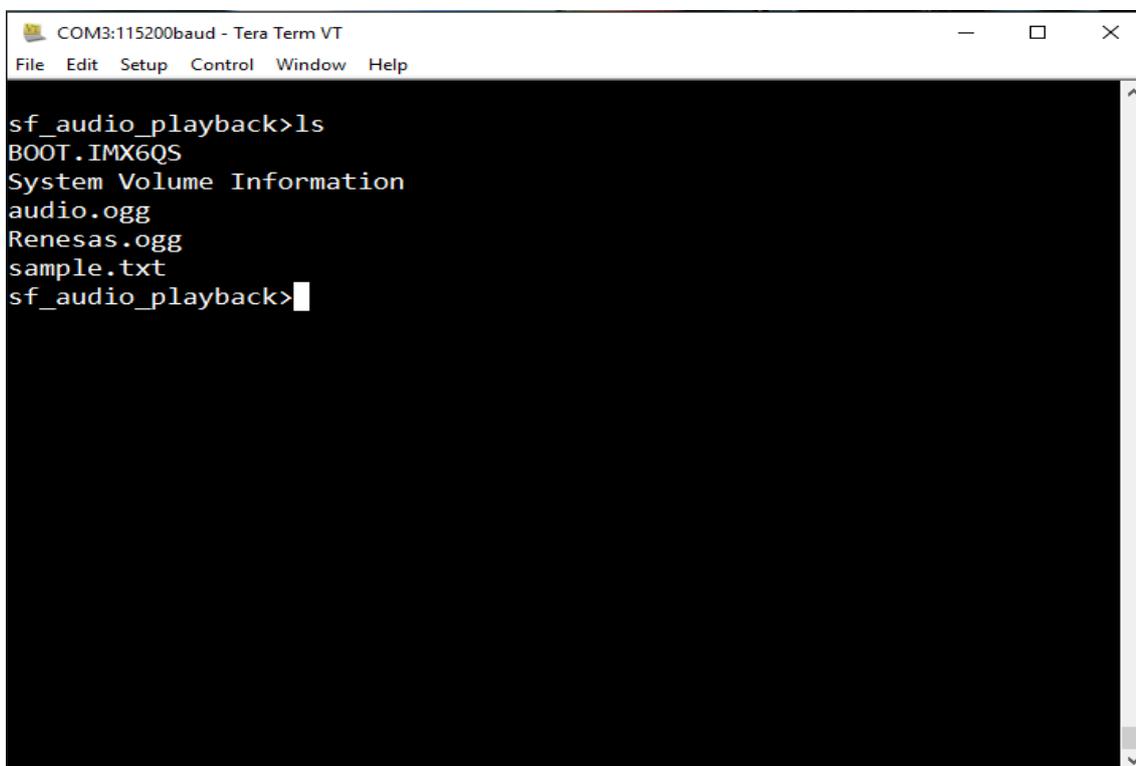


```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>sf_audio_playback
sf_audio_playback>?
sf_audio_playback Help Menu
~ : Back to root menu
^ : Up one menu level
ls : Display the list of files
play : Play the audio file: play <filename>
pause : Pause audio play back
resume : Resume audio play back
stop : Stop audio play back

sf_audio_playback>
```

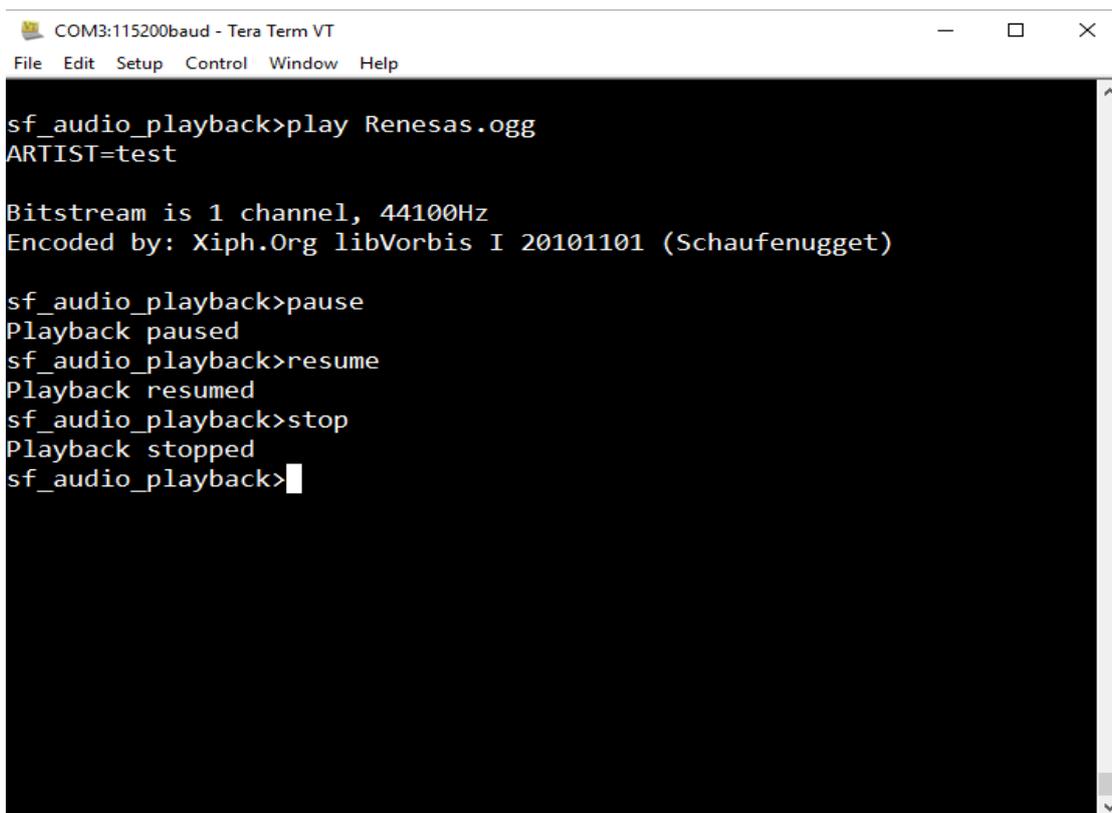
STEP 2: Type `ls` in the terminal and press enter to access the directory list of the SD card. For help, type `?` and press Enter.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_audio_playback>ls
BOOT.IMX6QS
System Volume Information
audio.ogg
Renesas.ogg
sample.txt
sf_audio_playback>
```

STEP 3: Type `play Renesas.ogg` in the terminal and press Enter to perform audio playback of `Renesas.ogg` stored on the SD card. For help, type `?` and press Enter. You can use `stop`, `pause` and `resume` in the same way.

A screenshot of a terminal window titled "COM3:115200baud - Tera Term VT". The window has a menu bar with "File", "Edit", "Setup", "Control", "Window", and "Help". The terminal content shows the following sequence of commands and outputs:

```
sf_audio_playback>play Renesas.ogg
ARTIST=test

Bitstream is 1 channel, 44100Hz
Encoded by: Xiph.Org libVorbis I 20101101 (Schaufenugget)

sf_audio_playback>pause
Playback paused
sf_audio_playback>resume
Playback resumed
sf_audio_playback>stop
Playback stopped
sf_audio_playback>
```

6.3 Limitations

The Audio Playback Developer Example has the following limitations:

- The only supported audio format is .ogg.
- Audio files must be in mono format with a sample rate of 44.1 kHz.
- The `stop`, `pause`, and `resume` commands of this Developer Example work by manipulating the audio thread and do not use the Audio Playback APIs directly.

7. Developer Example: DAC HAL driver

7.1 Introduction

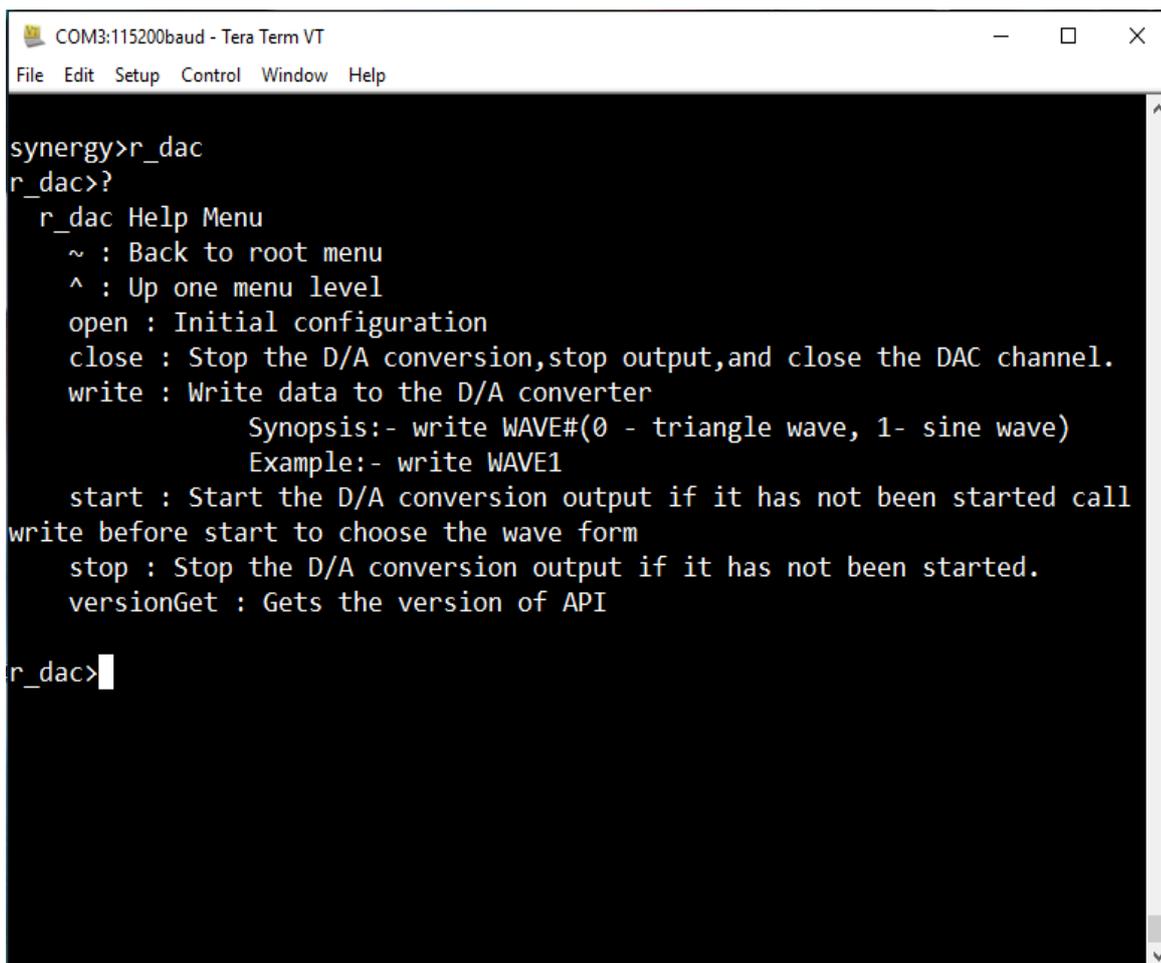
The Developer Example uses the APIs of the DAC HAL module from the terminal command line. The Developer Example generates a triangle and a sine wave on the DAC output.

7.2 Run the DAC HAL Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the DAC HAL driver application, follow these steps:

STEP 1: type `r_dac` and press Enter to get the DAC HAL menu.

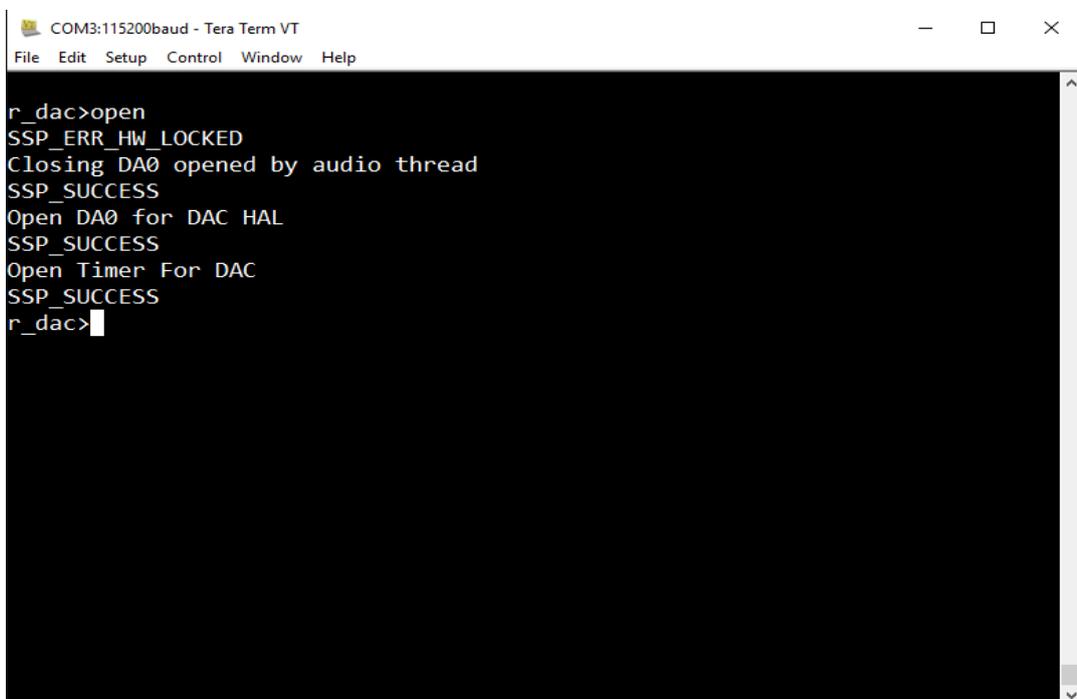


```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>r_dac
r_dac>?
r_dac Help Menu
~ : Back to root menu
^ : Up one menu level
open : Initial configuration
close : Stop the D/A conversion,stop output,and close the DAC channel.
write : Write data to the D/A converter
        Synopsis:- write WAVE#(0 - triangle wave, 1- sine wave)
        Example:- write WAVE1
start : Start the D/A conversion output if it has not been started call
write before start to choose the wave form
stop : Stop the D/A conversion output if it has not been started.
versionGet : Gets the version of API

r_dac>
```

STEP 2: Type open in the terminal and press Enter to initialize the DAC HAL module. For help, type ? and press Enter.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_dac>open
SSP_ERR_HW_LOCKED
Closing DA0 opened by audio thread
SSP_SUCCESS
Open DA0 for DAC HAL
SSP_SUCCESS
Open Timer For DAC
SSP_SUCCESS
r_dac>
```

STEP 3: Type start in terminal and press Enter to enable the DAC. For help, type ? and press Enter.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_dac>start
Start DAC
SSP_SUCCESS
Start Timer
SSP_SUCCESS
r_dac>stop
Stop DAC
SSP_SUCCESS
Stop Timer
SSP_SUCCESS
r_dac>
    
```

STEP 4: Type `write WAVE#` (`#=0` for triangle waveform `#=1` for sine wave form) in the terminal to select the waveform and then type `start` and press Enter to demonstrate the selected waveform’s Digital-to-Analog output. For help, type `?` and press Enter.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_dac>write WAVE 1
r_dac>start
Start DAC
SSP_SUCCESS
Start Timer
SSP_SUCCESS
r_dac>stop
Stop DAC
SSP_SUCCESS
Stop Timer
SSP_SUCCESS
r_dac>
    
```

7.3 Limitations

The `close` command in this Developer Example does not execute the `close` API of DAC HAL module to prevent a conflict with the Developer Example for the Audio Playback Framework, which also requires the DAC HAL module.

8. Developer Example: AGT HAL driver

8.1 Introduction

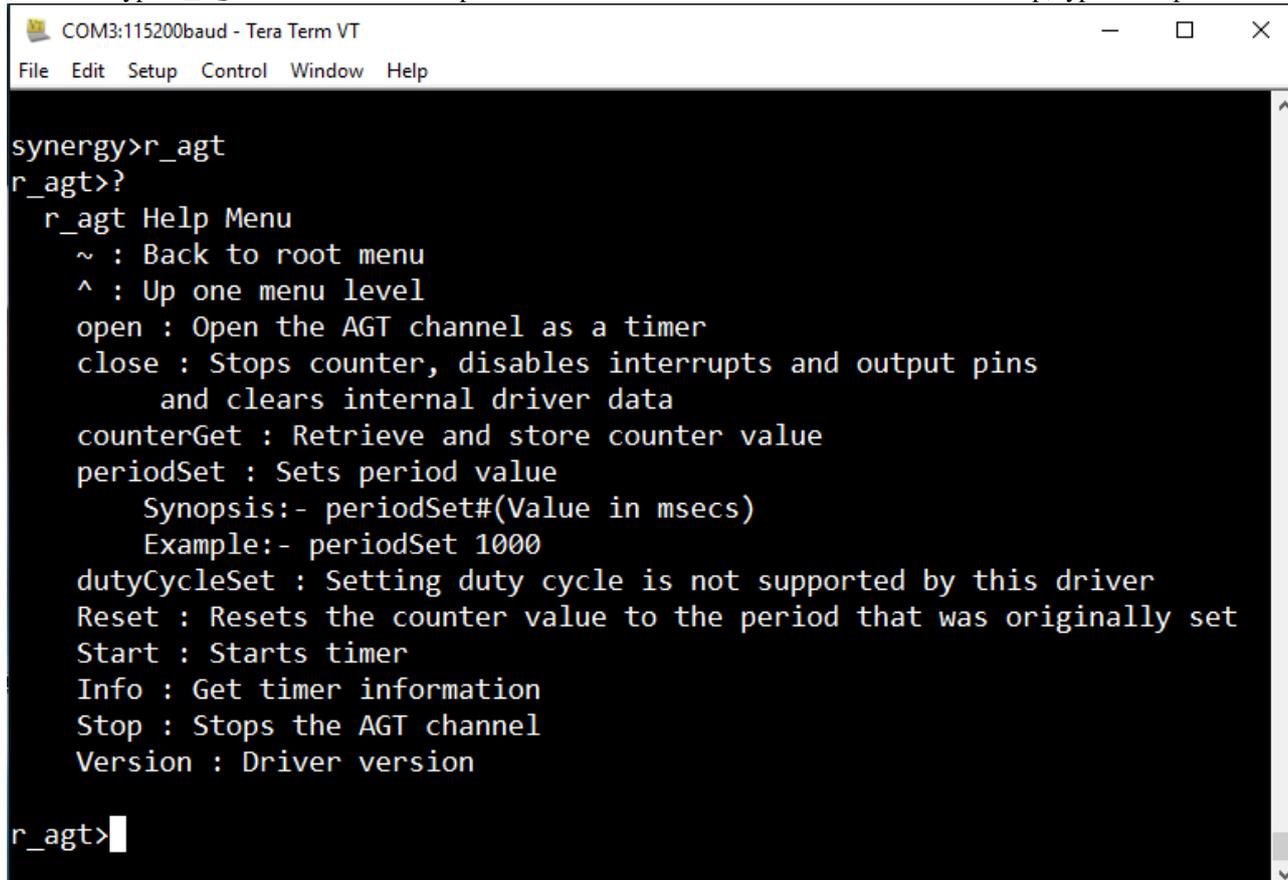
The AGT Hal driver Developer Example uses the periodic interrupt of the AGT. The interrupt toggles the LED1 on the DK-S7G2 board. The Developer Example also allows you to dynamically set the time period of the AGT timer from the command line interface while the timer is running.

8.2 Run the AGT HAL Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the AGT HAL driver application, follow these steps:

STEP 1: Type `r_agt` in the terminal and press Enter to access the AGT HAL submenu. For help, type `?` and press Enter.



```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>r_agt
r_agt>?
r_agt Help Menu
  ~ : Back to root menu
  ^ : Up one menu level
  open : Open the AGT channel as a timer
  close : Stops counter, disables interrupts and output pins
         and clears internal driver data
  counterGet : Retrieve and store counter value
  periodSet : Sets period value
              Synopsis:- periodSet#(Value in msecs)
              Example:- periodSet 1000
  dutyCycleSet : Setting duty cycle is not supported by this driver
  Reset : Resets the counter value to the period that was originally set
  Start : Starts timer
  Info : Get timer information
  Stop : Stops the AGT channel
  Version : Driver version

r_agt>

```

STEP 2: Using the `open` and then `start` commands starts the AGT to run for the period that is configured in the Synergy Configuration tool and passed into `open`.



```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_agt>open
SSP_SUCCESS
SSP_SUCCESS
r_agt>start
SSP_SUCCESS
r_agt>stop
SSP_SUCCESS
r_agt>close
SSP_SUCCESS
r_agt>

```

When the timer overflow interrupt occurs, LED1 on the DK-S7G2 board lights up. You can reconfigure the timer using `periodSet`

9. Developer Example: GPT HAL driver

9.1 Introduction

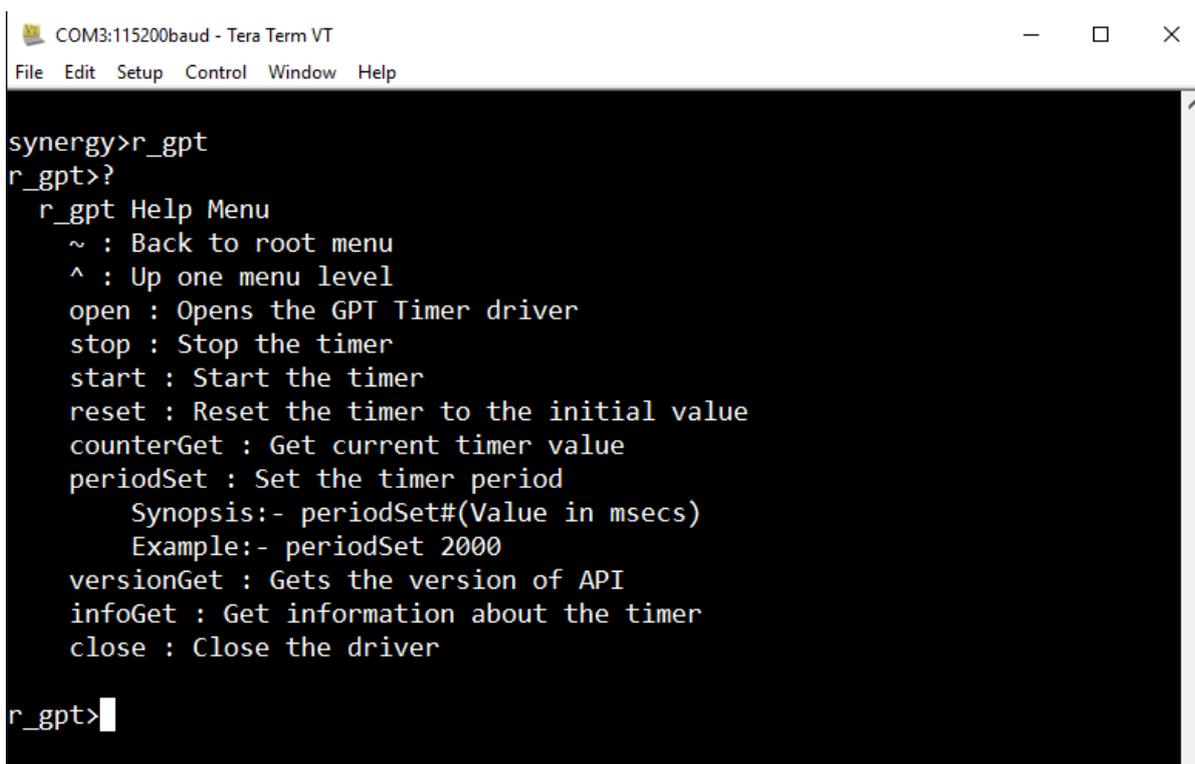
The GPT HAL driver Developer Example uses the GPT interrupt to toggle LED1 on the DK-S7G2 board.

9.2 Run the GPT HAL Driver applications

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the GPT HAL driver application, follow these steps:

STEP 1: Type `r_gpt` in the terminal and press Enter to access the GPT HAL submenu. For help, type `?` and press Enter.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>r_gpt
r_gpt>?
r_gpt Help Menu
~ : Back to root menu
^ : Up one menu level
open : Opens the GPT Timer driver
stop : Stop the timer
start : Start the timer
reset : Reset the timer to the initial value
counterGet : Get current timer value
periodSet : Set the timer period
    Synopsis:- periodSet#(Value in msecs)
    Example:- periodSet 2000
versionGet : Gets the version of API
infoGet : Get information about the timer
close : Close the driver

r_gpt>
```

STEP 2: Use the `open` and then `start` commands to run the GPT for the period configured in `periodSet`. When the timer overflow interrupt occurs, LED1 on the DK-S7G2 board lights up. You can reconfigure the timer using `periodSet`.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_gpt>open
SSP_SUCCESS
r_gpt>start
SSP_SUCCESS
r_gpt>stop
SSP_SUCCESS
r_gpt>close
SSP_SUCCESS
r_gpt>
```

10. Developer Example: CRC HAL driver

10.1 Introduction

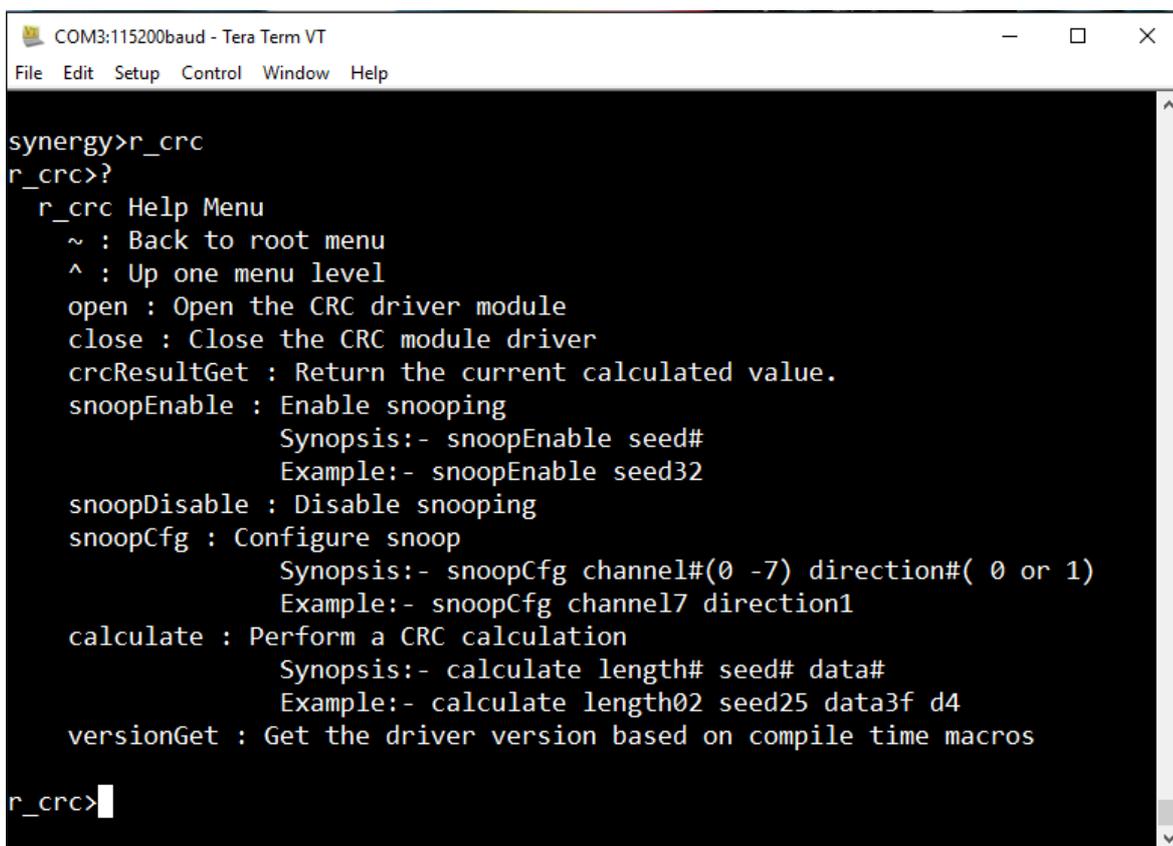
The cyclic redundancy check (CRC) detects errors in a dataset. The Developer Example uses the Snooping API function of the CRC HAL Module. The snoop function monitors read and writes to specific addresses. This function is useful in applications that require CRC code to be generated automatically in certain events, such as monitoring writes to the serial transmit buffer and reads from the serial receive buffer. The Developer Example uses the SCI I2C channels as an example.

10.2 Run the CRC HAL Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the CRC HAL driver application, follow these steps:

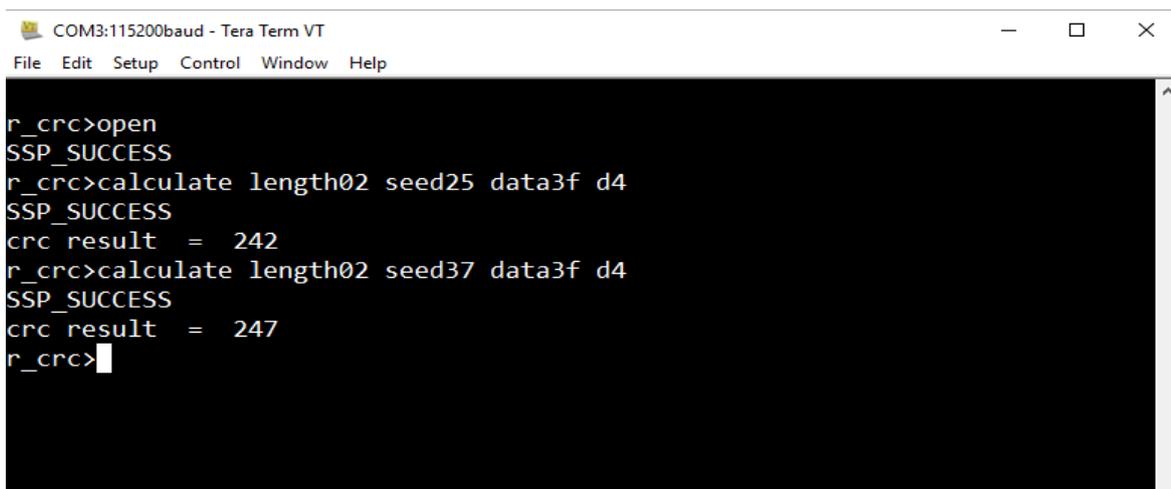
STEP 1: Type `r_crc` in the terminal and press Enter to access the CRC HAL submenu. For help, type `?` and press Enter.

A screenshot of a terminal window titled "COM3:115200baud - Tera Term VT". The terminal shows the following text:

```
synergy>r_crc
r_crc>?
r_crc Help Menu
~ : Back to root menu
^ : Up one menu level
open : Open the CRC driver module
close : Close the CRC module driver
crcResultGet : Return the current calculated value.
snoopEnable : Enable snooping
                Synopsis:- snoopEnable seed#
                Example:- snoopEnable seed32
snoopDisable : Disable snooping
snoopCfg : Configure snoop
                Synopsis:- snoopCfg channel#(0 -7) direction#( 0 or 1)
                Example:- snoopCfg channel7 direction1
calculate : Perform a CRC calculation
                Synopsis:- calculate length# seed# data#
                Example:- calculate length02 seed25 data3f d4
versionGet : Get the driver version based on compile time macros

r_crc>
```

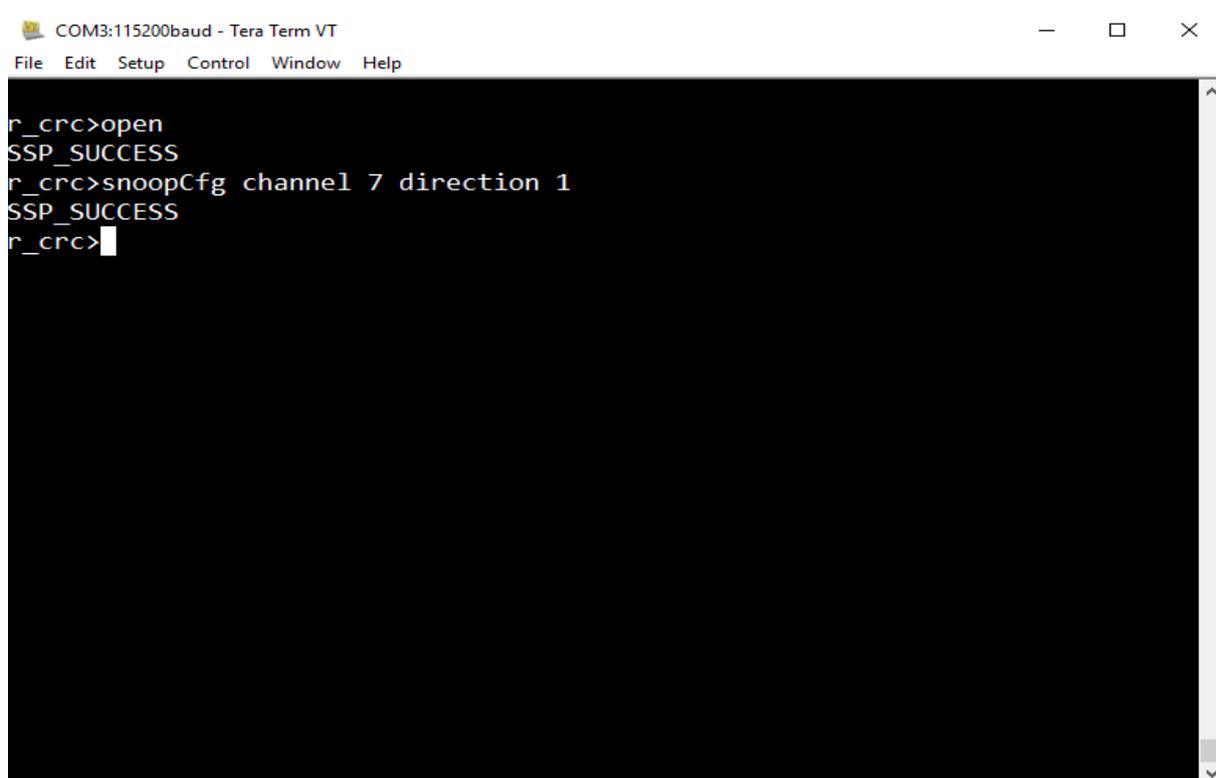
STEP 2: Invoke each menu item with the corresponding arguments to exercise the APIs. The example shows the CRC `calculate` command with length, seed and data option. It calculates CRC for the given length of data with a specific seed.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_crc>open
SSP_SUCCESS
r_crc>calculate length02 seed25 data3f d4
SSP_SUCCESS
crc result = 242
r_crc>calculate length02 seed37 data3f d4
SSP_SUCCESS
crc result = 247
r_crc>
```

The following example shows the CRC snoop operation using `snoopCfg` and `snoopEnable` command along with running an I2Cframework application.

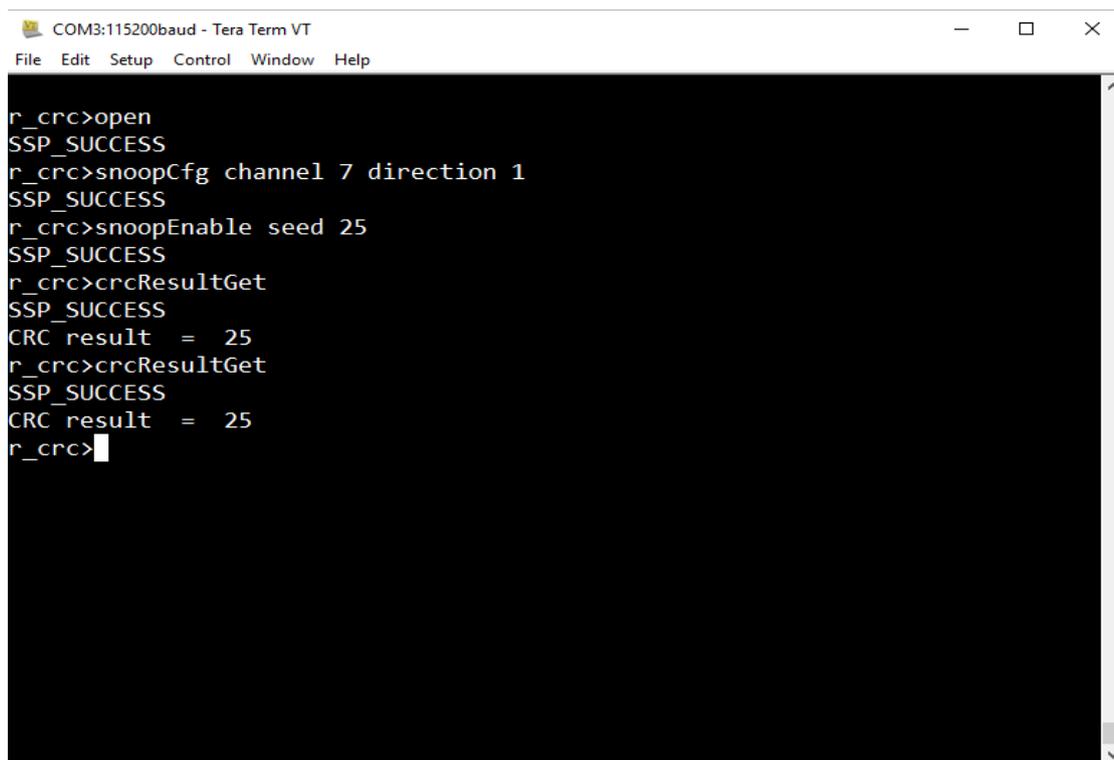
1. Enter `r_crc` followed by `open` and `snoopCfg` with channel and direction details



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_crc>open
SSP_SUCCESS
r_crc>snoopCfg channel 7 direction 1
SSP_SUCCESS
r_crc>
```

2. To validate snoop operation of `r_crc` any one SCI channel must be configured with respect to CRC snoop. In Developer Example `sf_i2c` uses SCI channel 7 so run the I2C Framework application from the `sf_i2c` menu and switch back to the `r_crc` menu and execute the following commands in sequence.

1. `open`
2. `snoopCfg`
3. `snoopEnable`
4. `crcResultGet`

A screenshot of a terminal window titled "COM3:115200baud - Tera Term VT". The window has a menu bar with "File", "Edit", "Setup", "Control", "Window", and "Help". The terminal output shows the following commands and responses:

```
r_crc>open
SSP_SUCCESS
r_crc>snoopCfg channel 7 direction 1
SSP_SUCCESS
r_crc>snoopEnable seed 25
SSP_SUCCESS
r_crc>crcResultGet
SSP_SUCCESS
CRC result = 25
r_crc>crcResultGet
SSP_SUCCESS
CRC result = 25
r_crc>
```

11. Developer Example: Flash HAL driver

11.1 Introduction

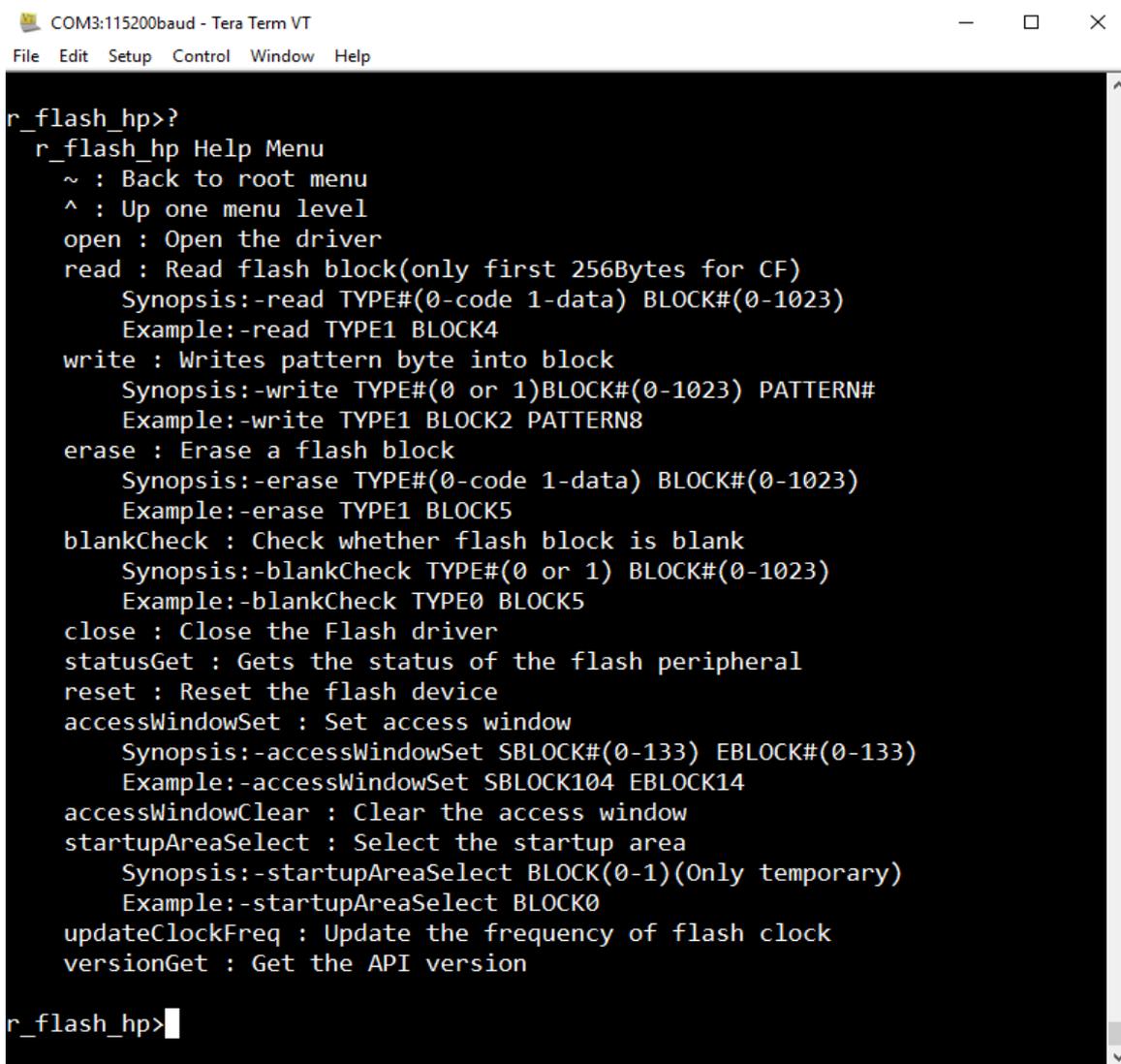
This example uses the high performance flash (flash HP) on the S7G2. The on-chip Flash consists of a code flash and a data Flash. The address range for code flash is 0x00000000 – 0x00400000 and the address range for data flash is 0x40100000 – 0x40110000. Code flash has blocks from 0-133, which is a total of 134 blocks. Data Flash has blocks from 0-1023 with a total of 1024 blocks. The code flash is defined as TYPE0 and data flash as TYPE1 in the Developer Example. The Flash Developer Example restricts the write and erase operations to certain code block regions since they may corrupt the Developer Example code itself. The Developer Example application will issue a warning message if you try to access a prohibited block and will not write to or erase that particular block.

11.2 Run the Flash HAL Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the Flash HAL driver application, follow these steps:

STEP 1: Type `r_flash_hp` and press Enter to access the flash HAL submenu. For help, type `?` and press Enter.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_flash_hp>?
r_flash_hp Help Menu
~ : Back to root menu
^ : Up one menu level
open : Open the driver
read : Read flash block(only first 256Bytes for CF)
      Synopsis:-read TYPE#(0-code 1-data) BLOCK#(0-1023)
      Example:-read TYPE1 BLOCK4
write : Writes pattern byte into block
      Synopsis:-write TYPE#(0 or 1)BLOCK#(0-1023) PATTERN#
      Example:-write TYPE1 BLOCK2 PATTERN8
erase : Erase a flash block
      Synopsis:-erase TYPE#(0-code 1-data) BLOCK#(0-1023)
      Example:-erase TYPE1 BLOCK5
blankCheck : Check whether flash block is blank
      Synopsis:-blankCheck TYPE#(0 or 1) BLOCK#(0-1023)
      Example:-blankCheck TYPE0 BLOCK5
close : Close the Flash driver
statusGet : Gets the status of the flash peripheral
reset : Reset the flash device
accessWindowSet : Set access window
      Synopsis:-accessWindowSet SBLOCK#(0-133) EBLOCK#(0-133)
      Example:-accessWindowSet SBLOCK104 EBLOCK14
accessWindowClear : Clear the access window
startupAreaSelect : Select the startup area
      Synopsis:-startupAreaSelect BLOCK(0-1)(Only temporary)
      Example:-startupAreaSelect BLOCK0
updateClockFreq : Update the frequency of flash clock
versionGet : Get the API version

r_flash_hp>
```

STEP 2: Use the `read` command to read from `block0` of the code block.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_flash_hp>open
SSP_SUCCESS
r_flash_hp>read TYPE0 BLOCK0
00000000 = E8 28 06 20 E5 6D 01 00 95 66 01 00 F5 6D 01 00
00000010 = F5 6D 01 00 F5 6D 01 00 F5 6D 01 00 00 00 00 00
00000020 = 00 00 00 00 00 00 00 00 00 00 00 00 F5 6D 01 00
00000030 = F5 6D 01 00 00 00 00 00 CD 04 03 00 A1 05 03 00
00000040 = 19 05 01 00 5D 05 01 00 A1 05 01 00 F1 51 01 00
00000050 = 89 E7 00 00 C9 E7 00 00 09 E8 00 00 65 64 01 00
00000060 = A9 64 01 00 A1 36 00 00 F5 6D 01 00 F5 6D 01 00
00000070 = 6D 1C 01 00 89 1C 01 00 A5 1C 01 00 CD DA 00 00
00000080 = 99 DA 00 00 35 DB 00 00 01 DB 00 00 00 00 00 00
00000090 = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
000000A0 = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
000000B0 = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
000000C0 = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
000000D0 = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
000000E0 = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
000000F0 = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
r_flash_hp>
    
```

STEP 3: Use the read command to read from block0 of the data block.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_flash_hp>open
SSP_SUCCESS
r_flash_hp>read TYPE1 BLOCK0
40100000 = 00 00 40 88 00 04 00 00 21 00 00 00 02 14 00 C0
40100010 = FB DF 9F 67 F7 FE FF 3B 7B FF BF E7 F4 FF BF E7
40100020 = FE D9 F3 7D F8 F3 FF 5F EF FD 7F D9 FF 7F 9F FB
40100030 = 0B 09 40 40 20 00 91 20 00 80 48 00 01 04 01 05
r_flash_hp>
    
```

STEP 4: Use the write command to write to block255 of the data block with any pattern value. The Developer Example disables the write into code flash area to protect from corrupting the code that runs the Developer Example program.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_flash_hp>open
SSP_SUCCESS
r_flash_hp>write TYPE 1 BLOCK 255 PATTERN 00
SSP_SUCCESS
r_flash_hp>read TYPE 1 BLOCK 255
40103FC0 = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
40103FD0 = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
40103FE0 = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
40103FF0 = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
r_flash_hp>

```

STEP 5: Use the erase command to erase to block255.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_flash_hp>open
SSP_SUCCESS
r_flash_hp>read TYPE 1 BLOCK 254
40103F80 = 22 00 90 80 85 00 04 22 04 24 0C 80 00 01 02 02
40103F90 = BF FF 7F CF FF 4F F7 6F E7 EF FE EE A6 F7 FF FF
40103FA0 = F1 FF FF EF FF F6 7E DF FF 7F F7 F7 7F 7E FF
40103FB0 = 03 10 E0 10 08 80 01 08 88 08 02 82 00 10 00 00
r_flash_hp>erase TYPE 1 BLOCK 254
SSP_SUCCESS
r_flash_hp>

```

11.3 Limitations

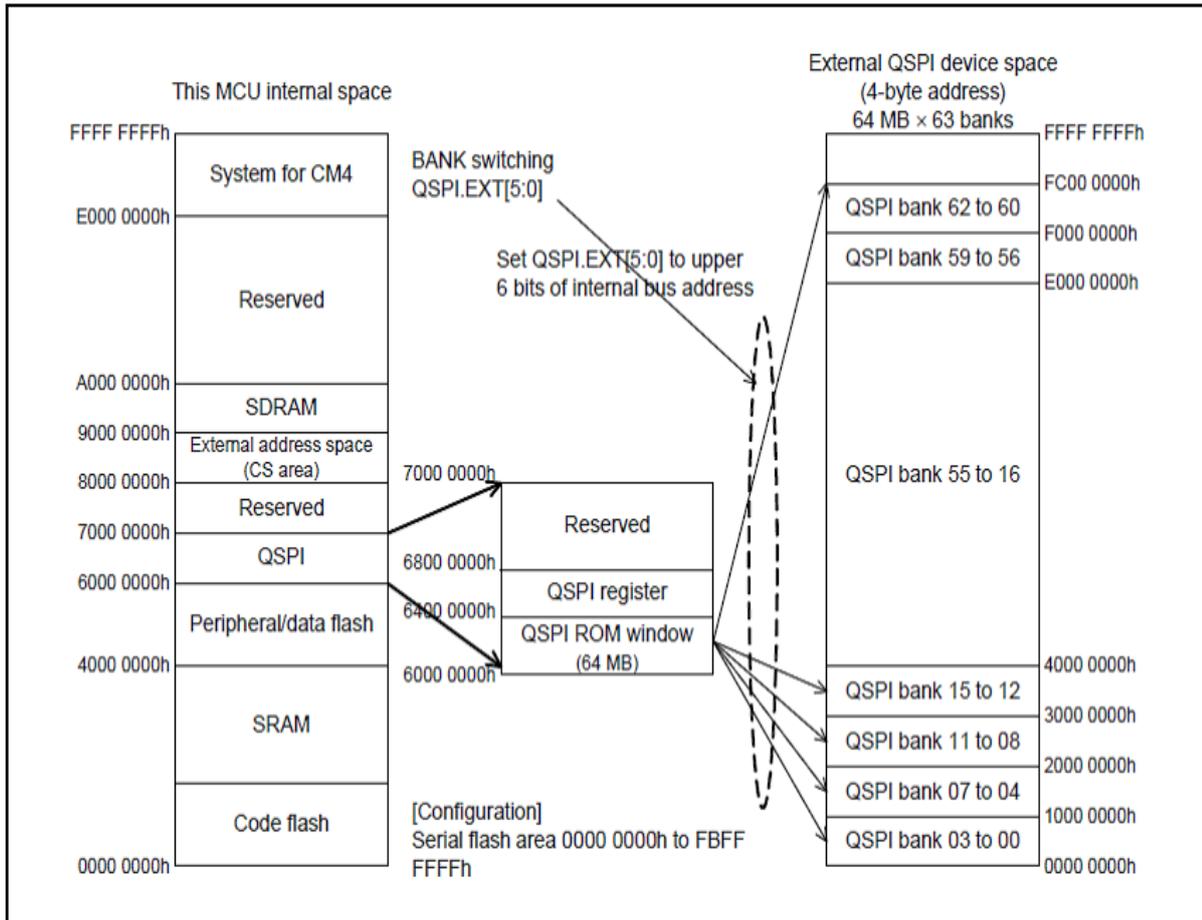
The Flash HAL Developer Example has the following limitations:

- The size of a block of data flash is 64 bytes. The size of a block of code flash is either 8 KB (BLOCK0 - BLOCK7) or 32 KB (BLOCK8 - BLOCK133). Since it is not practical to access huge volume of data (8 KB – 32 KB) over the command line interface, the write sizes are hardcoded to 256 bytes for code flash and 64 bytes for data flash. **This is a limitation in the Developer Example and not of the flash driver.**
- The current Developer Example will restrict write and erase operations to certain code block regions since it may corrupt the Developer Example code itself.

12. Developer Example: QSPI HAL driver

12.1 Introduction

The DK-S7G2 includes an external QSPI NOR flash from Micron (N25Q256A). This chip provides 256 MB of NOR flash with Execute-In-Place (XIP) capability. The SPI flash is mapped to the address 0x6000 0000 Hex to 0x63FF FFFF Hex (64 MB) of the MCU address space. Since the SPI flash is 256 MB in size, it is addressed in 4 byte address mode and accessed as 4 banks of 64 MB each.

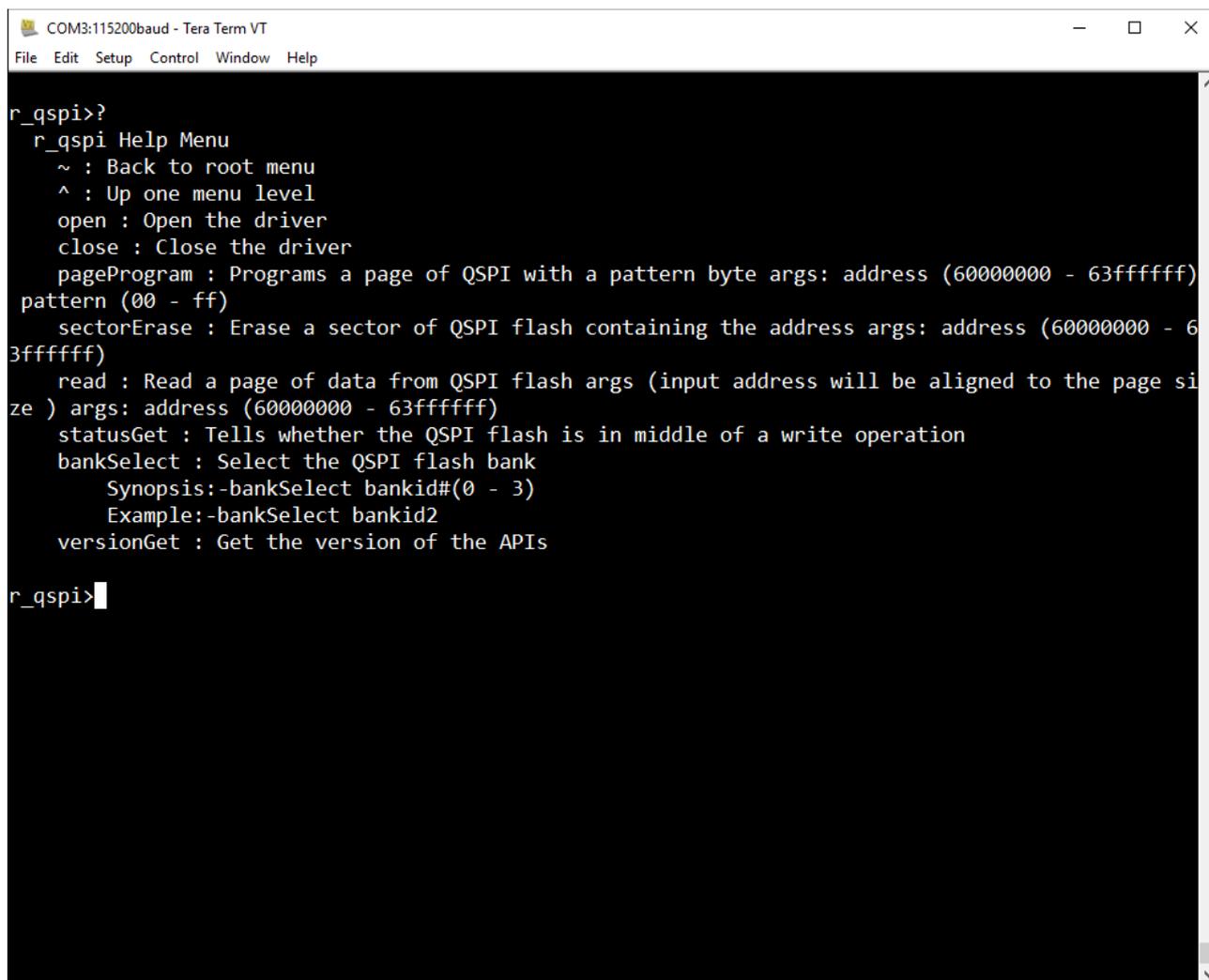


12.2 Run the QSPI HAL Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the QSPI HAL driver application, follow these steps:

STEP 1: Type `r_qspi` and press Enter to access the QSPI flash HAL sub menu. For help, type `?` and press Enter.

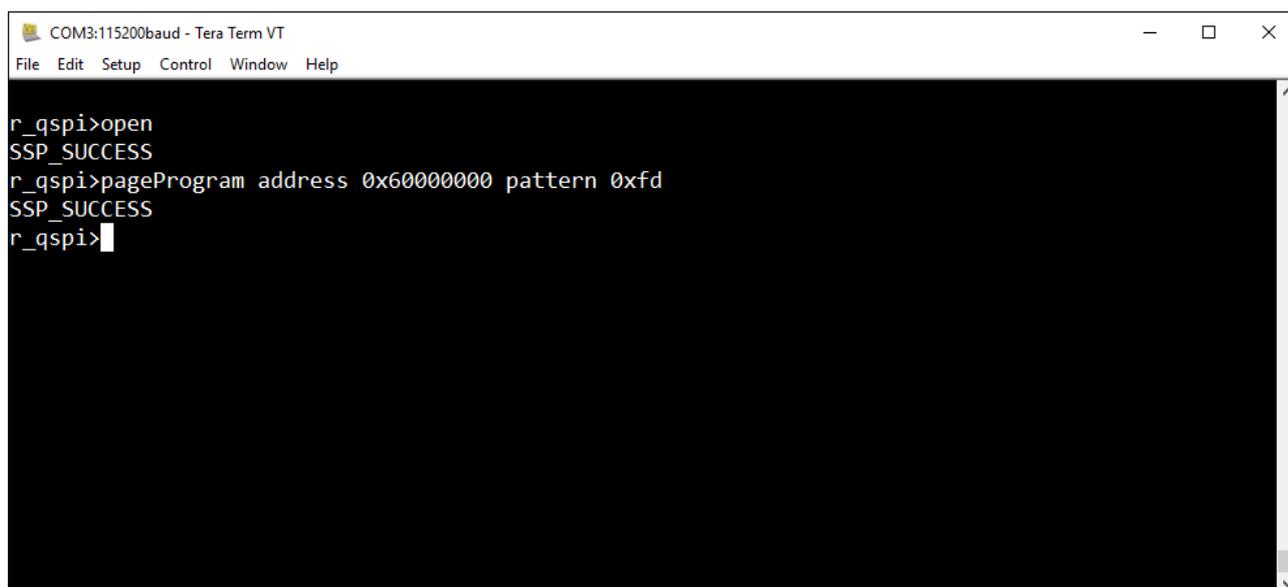


```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_qspi>?
r_qspi Help Menu
~ : Back to root menu
^ : Up one menu level
open : Open the driver
close : Close the driver
pageProgram : Programs a page of QSPI with a pattern byte args: address (60000000 - 63ffffff)
pattern (00 - ff)
sectorErase : Erase a sector of QSPI flash containing the address args: address (60000000 - 63ffffff)
read : Read a page of data from QSPI flash args (input address will be aligned to the page size) args: address (60000000 - 63ffffff)
statusGet : Tells whether the QSPI flash is in middle of a write operation
bankSelect : Select the QSPI flash bank
Synopsis:-bankSelect bankid#(0 - 3)
Example:-bankSelect bankid2
versionGet : Get the version of the APIs

r_qspi>
```

STEP 2: Use the `pageProgram` command to program a page of QSPI flash by filling it with a pattern byte. (The size of a page is 256 Bytes for this implementation of driver interface). For ease of use, the entire page containing the address will be filled with the byte pattern for a given address. This is the behavior of the command in the Developer Example and not of the driver itself.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_qspi>open
SSP_SUCCESS
r_qspi>pageProgram address 0x60000000 pattern 0xfd
SSP_SUCCESS
r_qspi>
```

STEP 3: Use the `read` command to read a page of data from QSPI flash. For ease of use, the entire page containing the address will be read and displayed for a given address. This is a behavior of the Developer Example command and not of the driver itself.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_qspi>read address 0x60000000
60000000 = FD FD
60000010 = FD FD
60000020 = FD FD
60000030 = FD FD
60000040 = FD FD
60000050 = FD FD
60000060 = FD FD
60000070 = FD FD
60000080 = FD FD
60000090 = FD FD
600000A0 = FD FD
600000B0 = FD FD
600000C0 = FD FD
600000D0 = FD FD
600000E0 = FD FD
600000F0 = FD FD
r_qspi>
    
```

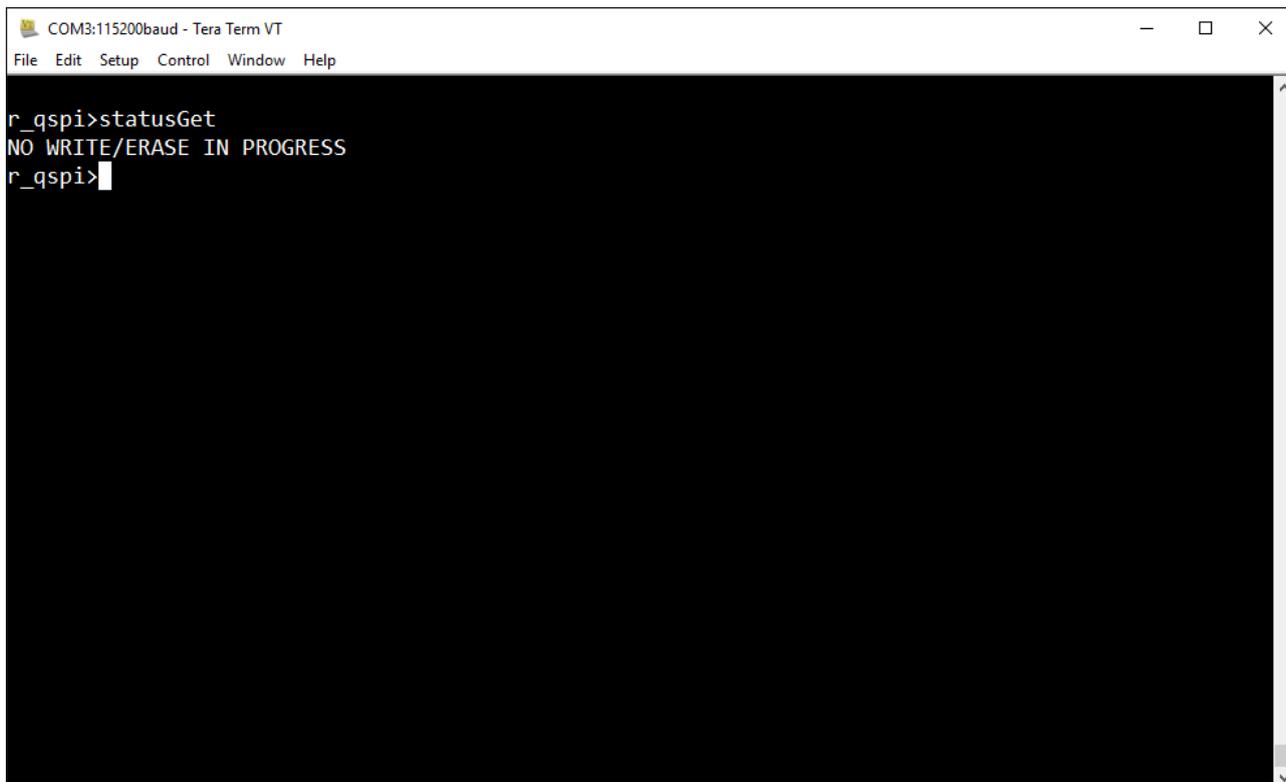
STEP 4: Use the `erase` command to erase a sector of QSPI flash. In this implementation of the driver, the sector size is 4 KB. Passing any address within a sector will erase the whole sector.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_qspi>sectorErase address 0x60000000
SSP_SUCCESS
r_qspi>read address 0x60000000
60000000 = FF FF
60000010 = FF FF
60000020 = FF FF
60000030 = FF FF
60000040 = FF FF
60000050 = FF FF
60000060 = FF FF
60000070 = FF FF
60000080 = FF FF
60000090 = FF FF
600000A0 = FF FF
600000B0 = FF FF
600000C0 = FF FF
600000D0 = FF FF
600000E0 = FF FF
600000F0 = FF FF
r_qspi>
    
```

STEP 5: Use the `statusGet` command to check the status of the QSPI erase/write. The status will return whether the device is busy doing a write/erase cycle.

A screenshot of a terminal window titled "COM3:115200baud - Tera Term VT". The window has a menu bar with "File", "Edit", "Setup", "Control", "Window", and "Help". The terminal content shows the command `r_qspi>statusGet` being entered, followed by the output `NO WRITE/ERASE IN PROGRESS`, and then the prompt `r_qspi>` with a cursor. The terminal background is black with white text.

```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_qspi>statusGet
NO WRITE/ERASE IN PROGRESS
r_qspi>
```

12.3 Limitations

The QSPI HAL Driver Development Example has the following limitations:

- The `read` and `pageProgram` commands are aligned to the device page size. It's an implementation behavior of the command line interface command and not a driver feature.
- The device supports 256 MB of memory. It can be accessed as 4 Banks of 64 MB each. The current version of the QSPI driver allows only access to bank 0 even when the bank selects API returns success for banks 0 -3.
- To perform a successful `pageProgram` command, the pages must be erased first. If a `pageProgram` is requested on a non-erased sector, the operation will fail, but the driver nonetheless will return success error code. This is a limitation of the driver and not of the Developer Example application.

13. Developer Example: RTC HAL driver

13.1 Introduction

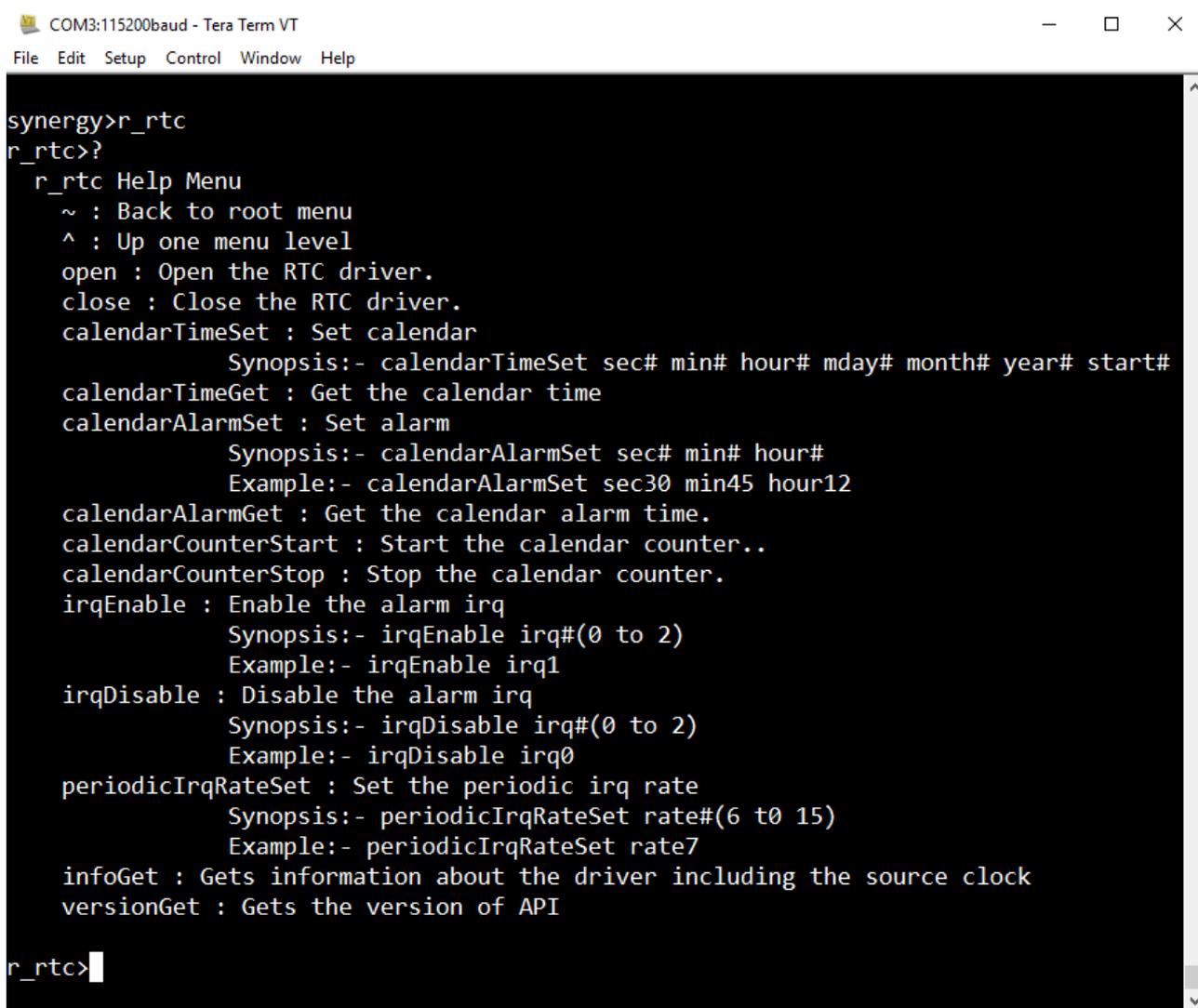
The Real Time Clock (RTC) Developer Example application uses the Low-speed on-chip oscillator as a clock source. The application allows to set the RTC configuration parameters such as time capture, alarm and periodic interrupt from the command line interface. Interrupts are handled by the callback function which inverts the state of the LED1 on the DK-S7G2 board.

13.2 Run the RTC HAL Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the RTC HAL driver application, follow these steps:

STEP 1:Type `r_rtc` in the terminal and press Enter to access the RTC HAL submenu. For help, type `?` and press Enter.

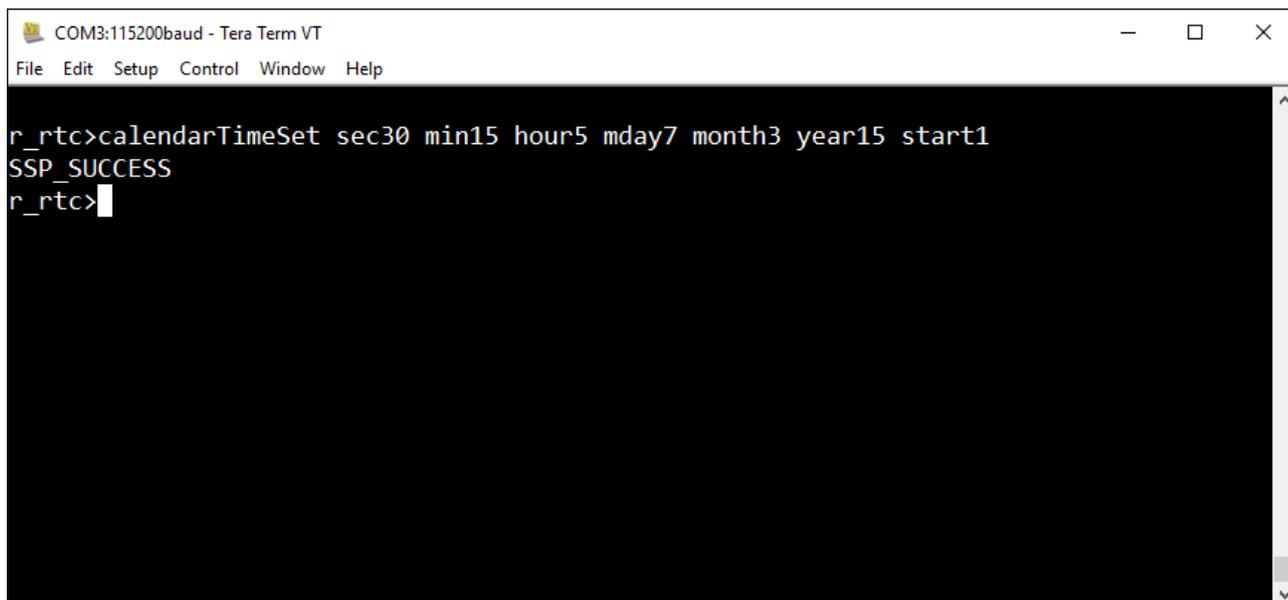


```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>r_rtc
r_rtc>?
r_rtc Help Menu
~ : Back to root menu
^ : Up one menu level
open : Open the RTC driver.
close : Close the RTC driver.
calendarTimeSet : Set calendar
    Synopsis:- calendarTimeSet sec# min# hour# mday# month# year# start#
calendarTimeGet : Get the calendar time
calendarAlarmSet : Set alarm
    Synopsis:- calendarAlarmSet sec# min# hour#
    Example:- calendarAlarmSet sec30 min45 hour12
calendarAlarmGet : Get the calendar alarm time.
calendarCounterStart : Start the calendar counter..
calendarCounterStop : Stop the calendar counter.
irqEnable : Enable the alarm irq
    Synopsis:- irqEnable irq#(0 to 2)
    Example:- irqEnable irq1
irqDisable : Disable the alarm irq
    Synopsis:- irqDisable irq#(0 to 2)
    Example:- irqDisable irq0
periodicIrqRateSet : Set the periodic irq rate
    Synopsis:- periodicIrqRateSet rate#(6 to 15)
    Example:- periodicIrqRateSet rate7
infoGet : Gets information about the driver including the source clock
versionGet : Gets the version of API

r_rtc>
```

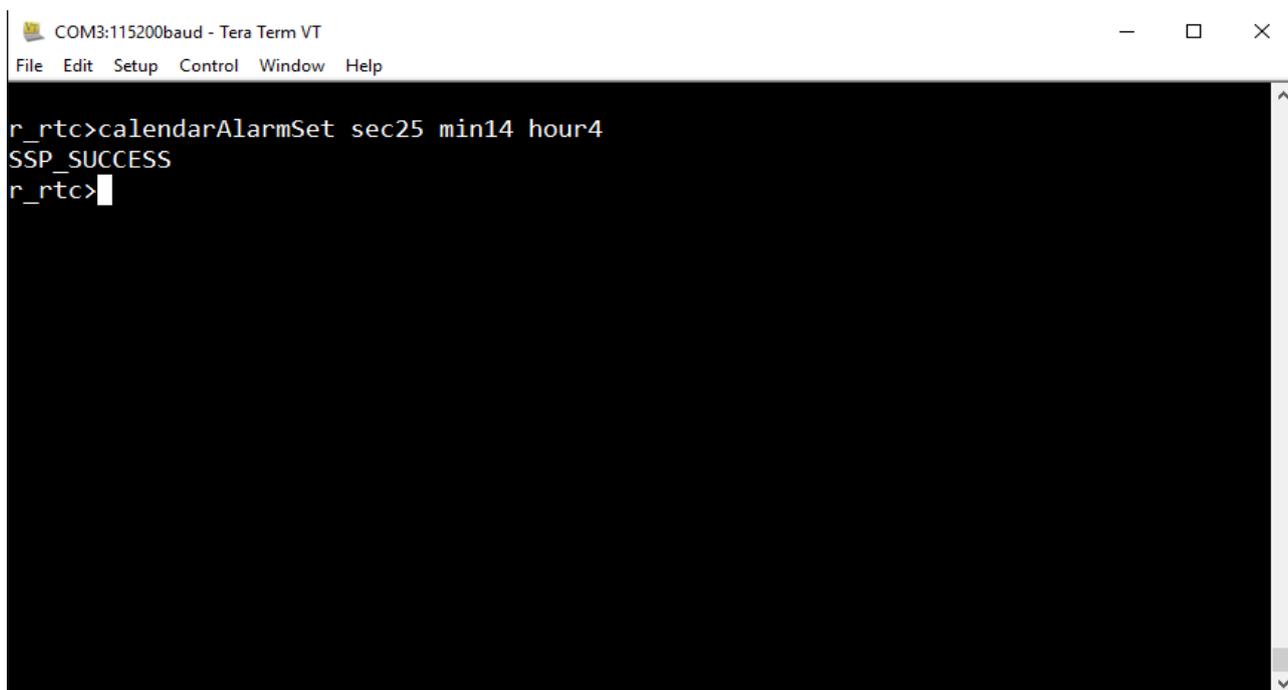
STEP 2: Type command open followed by `calendarTimeSet` to set the time.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

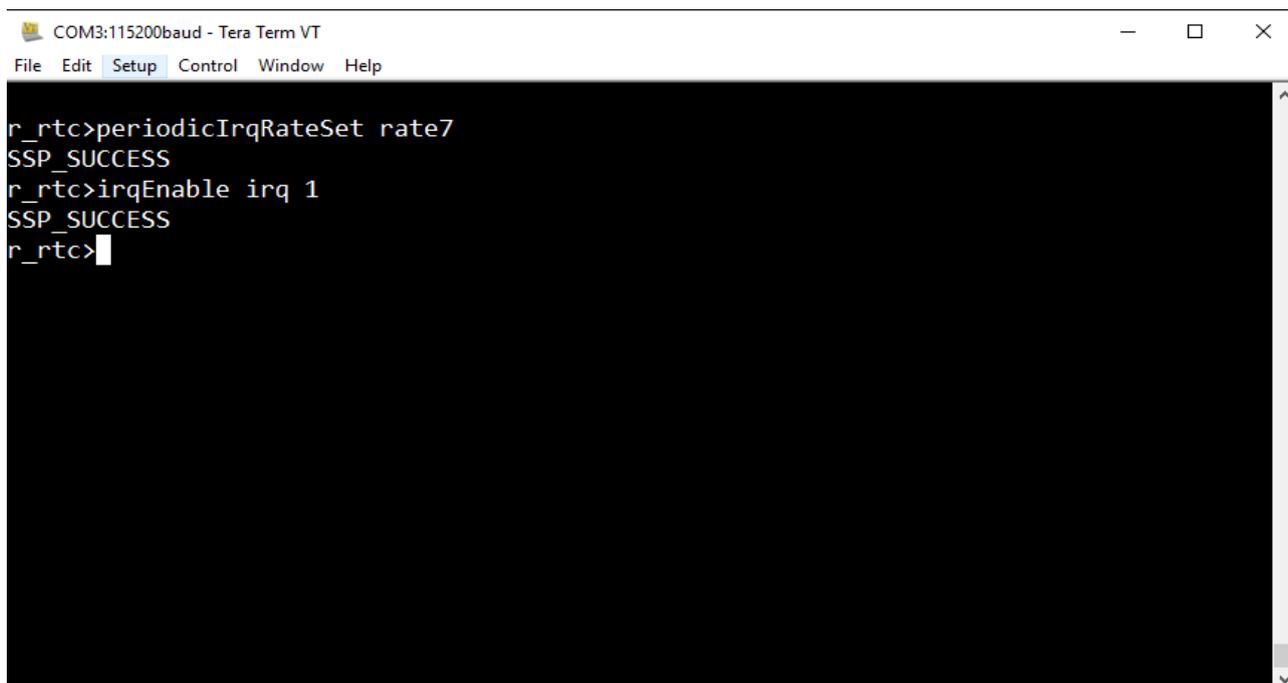
r_rtc>calendarTimeSet sec30 min15 hour5 mday7 month3 year15 start1
SSP_SUCCESS
r_rtc>
```

STEP 3: Type `calendarAlarmSet` to set the alarm.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_rtc>calendarAlarmSet sec25 min14 hour4
SSP_SUCCESS
r_rtc>
```

STEP 4: Type `periodicIrqRateSet` command followed by `irqEnable irq1` (1 for periodic). LED1 on the DK-S7G2 board blinks with the programmed period (`rate13` for a period of 0.5 sec).



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_rtc>periodicIrqRateSet rate7
SSP_SUCCESS
r_rtc>irqEnable irq 1
SSP_SUCCESS
r_rtc>
```

14. Developer Example: SCI I2C Framework

14.1 Introduction

The SCI I2C Framework Developer Example application accesses two I2C devices (I/O expanders connected to a bank of LEDs – see Developer Example: SCI I2C HAL driver) present on S7G2-DK board which are synchronized by the SCI I2C Framework. The application uses two threads which operate on each slave device. After opening each I2C slave device, each thread performs a write to the specific registers of the I2C device. The register state is displayed by

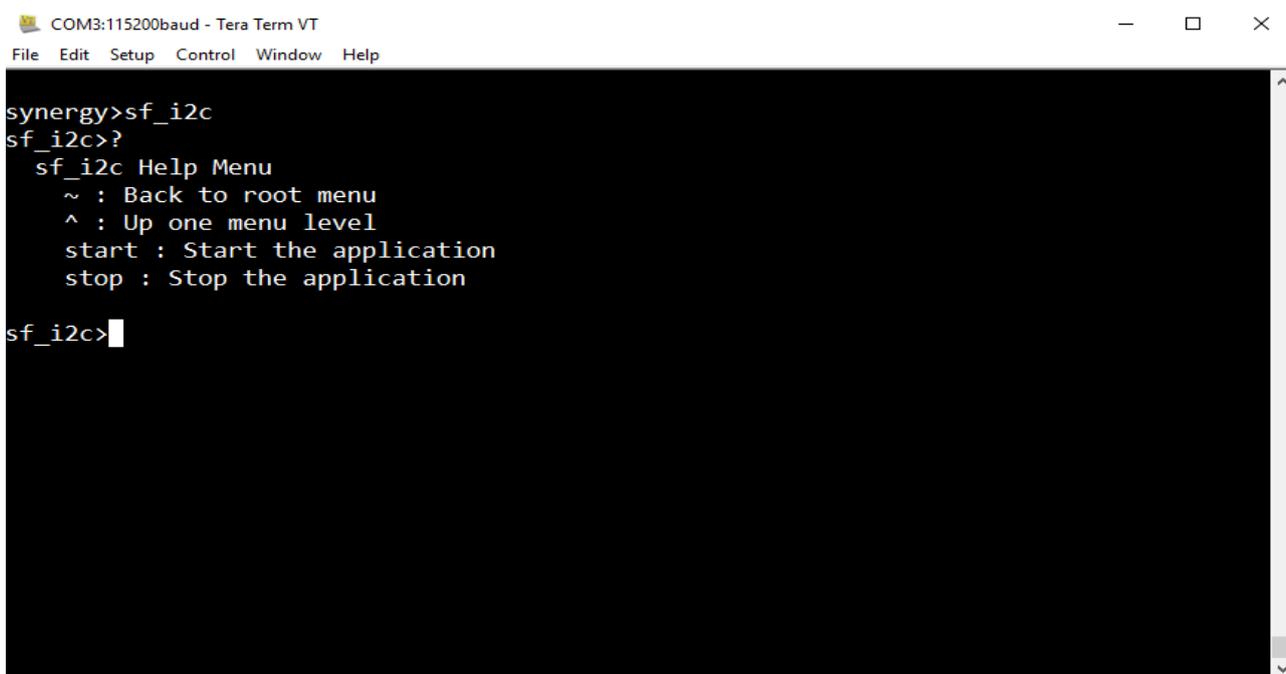
the LEDstateasON or OFF. The threads are synchronized by the I2C framework, which causes the Red and Green LEDs to light up synchronously.

14.2 Run the SCI I2C Framework application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the SCI I2C HAL driver application, follow these steps:

STEP 1: Type `sf_i2c` and press Enter to get the SCI I2C Framework application menu. For Help, type `?` and press Enter.

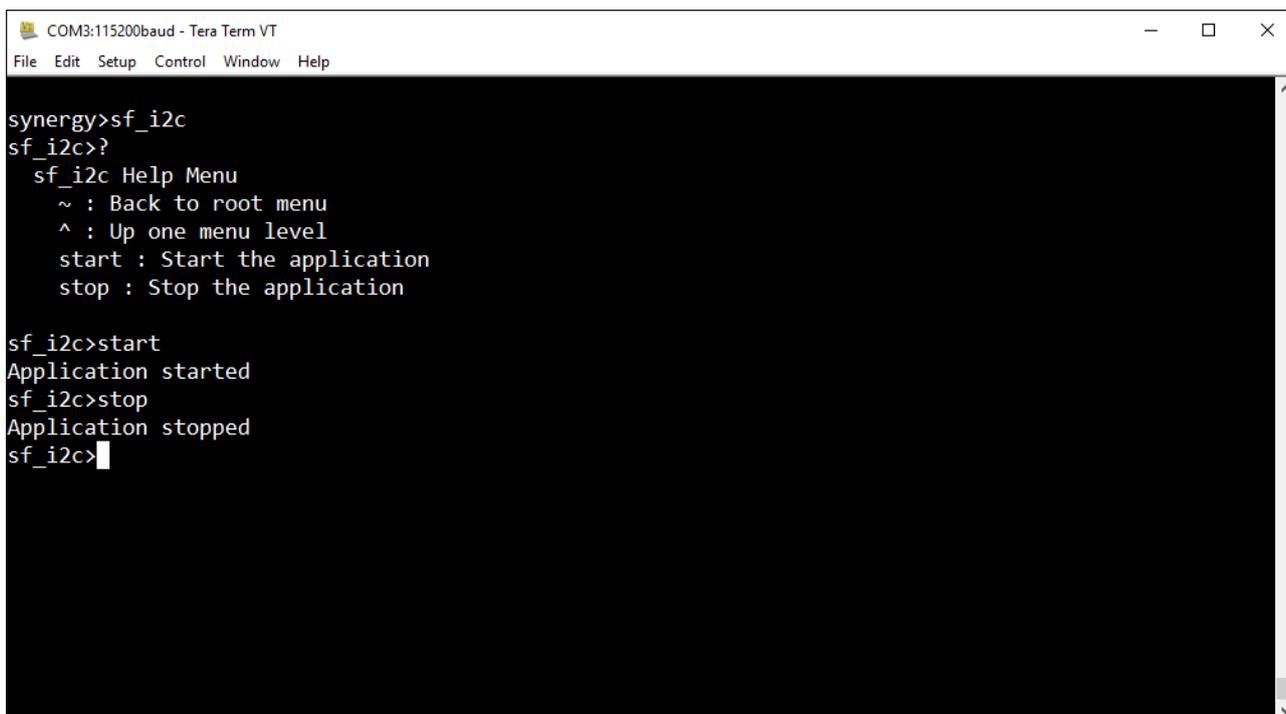


```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>sf_i2c
sf_i2c>?
  sf_i2c Help Menu
  ~ : Back to root menu
  ^ : Up one menu level
  start : Start the application
  stop : Stop the application

sf_i2c>
```

STEP 2: Type `start` in the terminal and press Enter to start I2C sample application which toggles two sets of LEDs via two different I2C I/O expanders on S7G2-DK board.

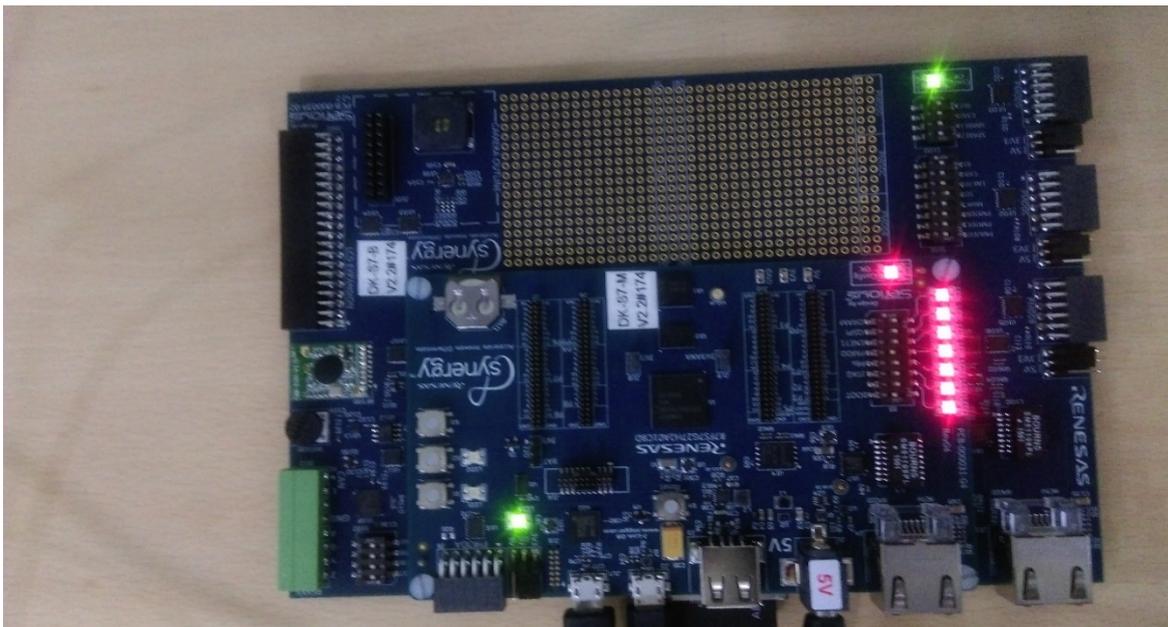


```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>sf_i2c
sf_i2c>?
  sf_i2c Help Menu
  ~ : Back to root menu
  ^ : Up one menu level
  start : Start the application
  stop : Stop the application

sf_i2c>start
Application started
sf_i2c>stop
Application stopped
sf_i2c>
```

STEP 3: Type `stop` in the terminal and press Enter to stop application which stops the toggling of LEDs.



15. Developer Example: SCI I2C HAL driver

15.1 Introduction

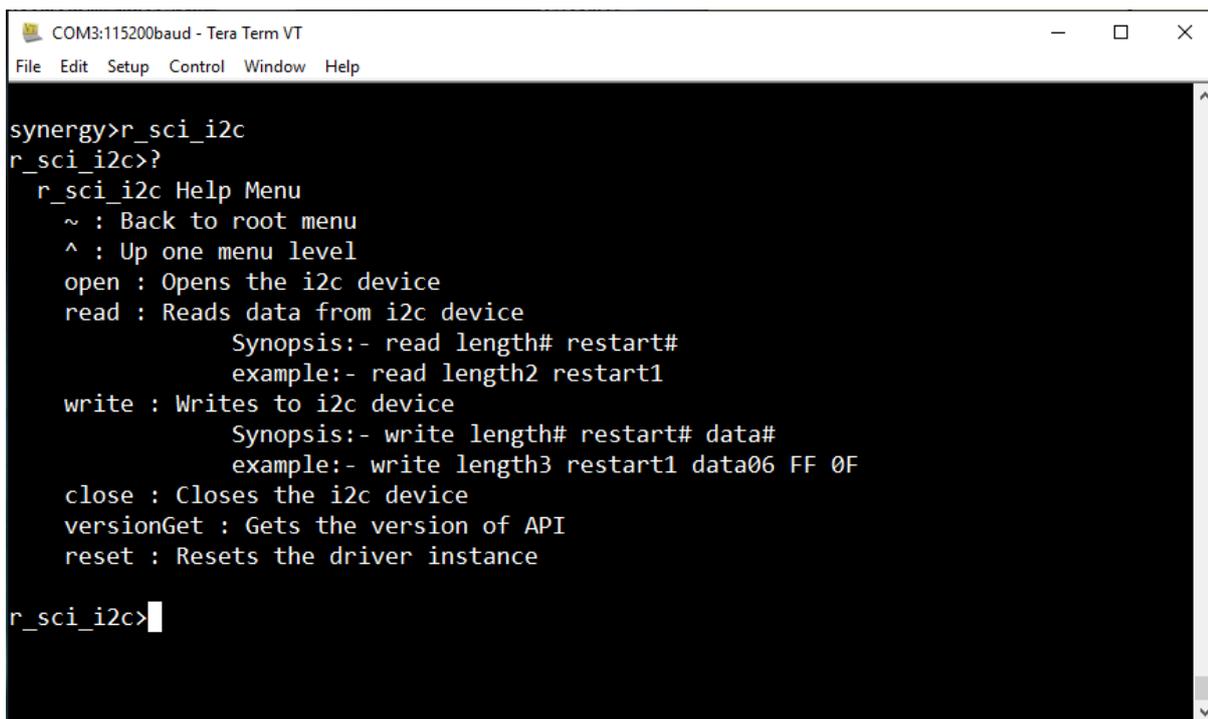
On the DK-S7G2 Development Kit, the SCI I2C bus is connected to an I2C controlled I/O expander (part PCAL9535A). This application configures the I/O expander on the DK-S7G2 as a slave device. The I/O expander toggles the LEDs on/off as the result of each write operation to the expander's registers, so you can visually see the output of the write operation. The slave address is 0x27 with 16 sub registers. For details of the I/O expander, see the PCAL9535A datasheet.

15.2 Run the SCI I2C HAL Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the SCI I2C HAL driver application, follow these steps:

STEP 1: Type `r_sci_i2c` in the terminal and press Enter to access the SCI I2C HAL submenu. For help, type `?` and press Enter.



```

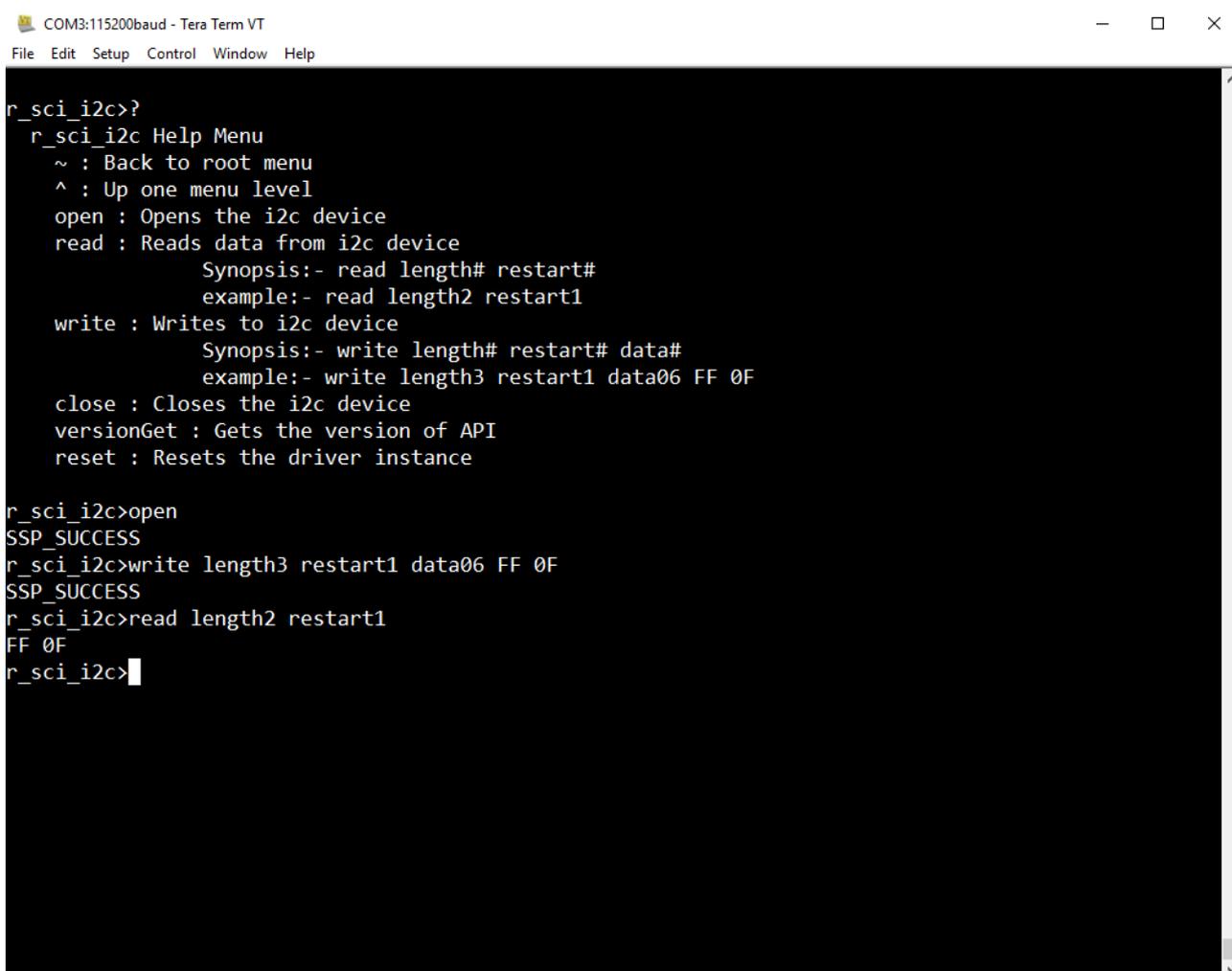
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>r_sci_i2c
r_sci_i2c>?
  r_sci_i2c Help Menu
  ~ : Back to root menu
  ^ : Up one menu level
  open : Opens the i2c device
  read : Reads data from i2c device
         Synopsis:- read length# restart#
         example:- read length2 restart1
  write : Writes to i2c device
         Synopsis:- write length# restart# data#
         example:- write length3 restart1 data06 FF 0F
  close : Closes the i2c device
  versionGet : Gets the version of API
  reset : Resets the driver instance

r_sci_i2c>

```

STEP 2: Invoke each menu item with the corresponding arguments to exercise the APIs. The example shows the SCI I2C write operation to the command byte register6 with values HEX 0x0F and 0xFF. You will see the LED lighting up on the board as result of command output. The respective read shows the value of the registers.



```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_sci_i2c>?
  r_sci_i2c Help Menu
  ~ : Back to root menu
  ^ : Up one menu level
  open : Opens the i2c device
  read : Reads data from i2c device
         Synopsis:- read length# restart#
         example:- read length2 restart1
  write : Writes to i2c device
         Synopsis:- write length# restart# data#
         example:- write length3 restart1 data06 FF 0F
  close : Closes the i2c device
  versionGet : Gets the version of API
  reset : Resets the driver instance

r_sci_i2c>open
SSP_SUCCESS
r_sci_i2c>write length3 restart1 data06 FF 0F
SSP_SUCCESS
r_sci_i2c>read length2 restart1
FF 0F
r_sci_i2c>

```

16. Developer Example: Communications Framework

16.1 Introduction

The Developer Example application shows the transport-agnostic Communication Framework of the SSP.

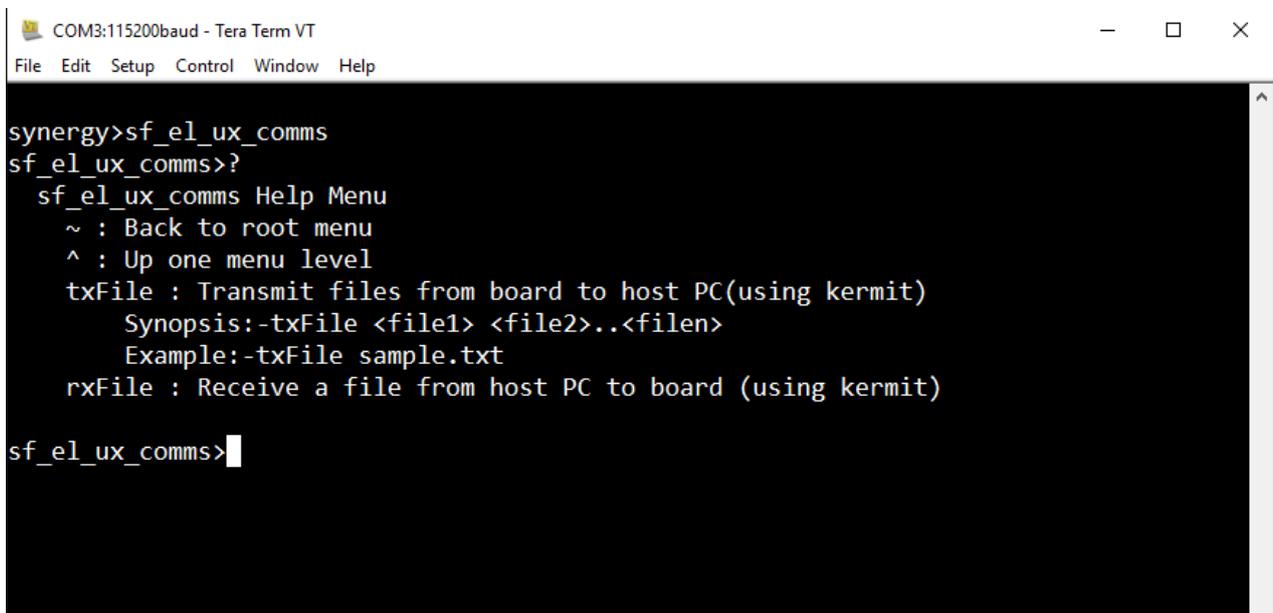
The Console Framework used to interact with Tera Term is built on top of the Communication Framework. In this example, we are using the USB Communications Framework built on top of USBx. It is the same instance that is used by console framework to interact with Tera Term. This example code provides additional file transfer capabilities between the Host PC and DK-S7G2 board using the **Kermit** protocol.

16.2 Communications Framework application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the Communication Framework application, follow these steps:

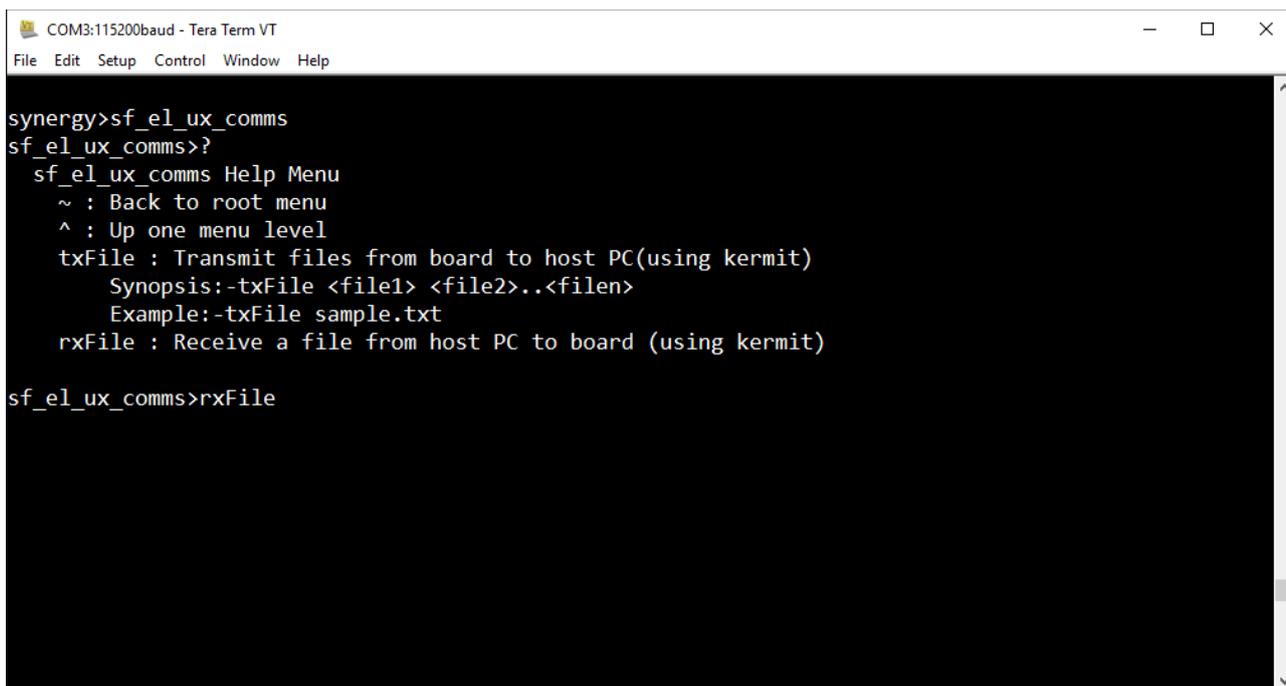
STEP 1: Type `sf_el_ux_comms` in the terminal and press Enter to access the `sf_el_ux_comms` sub menu. For help, type `?` and press Enter.

A screenshot of a terminal window titled "COM3:115200baud - Tera Term VT". The terminal shows the following text:

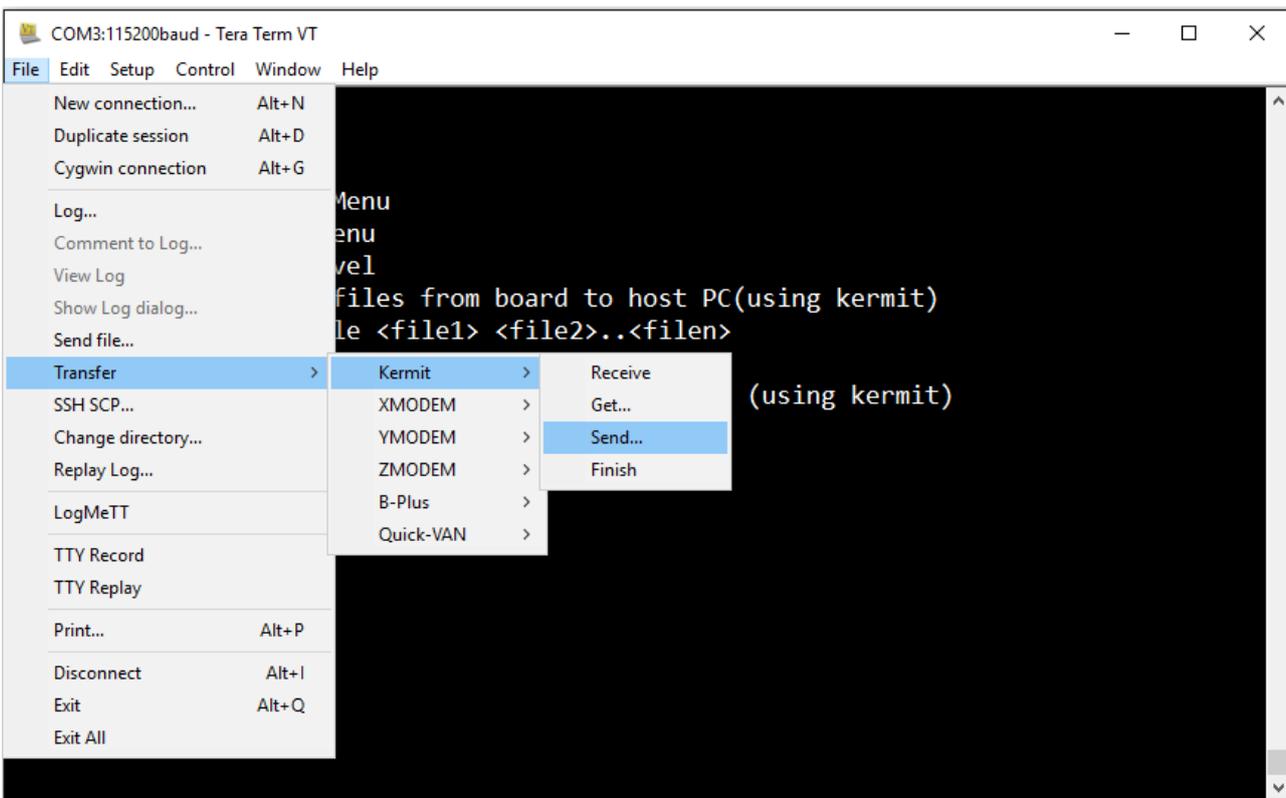
```
synergy>sf_el_ux_comms
sf_el_ux_comms>?
  sf_el_ux_comms Help Menu
  ~ : Back to root menu
  ^ : Up one menu level
  txFile : Transmit files from board to host PC(using kermit)
           Synopsis:-txFile <file1> <file2>..<filen>
           Example:-txFile sample.txt
  rxFile : Receive a file from host PC to board (using kermit)

sf_el_ux_comms>
```

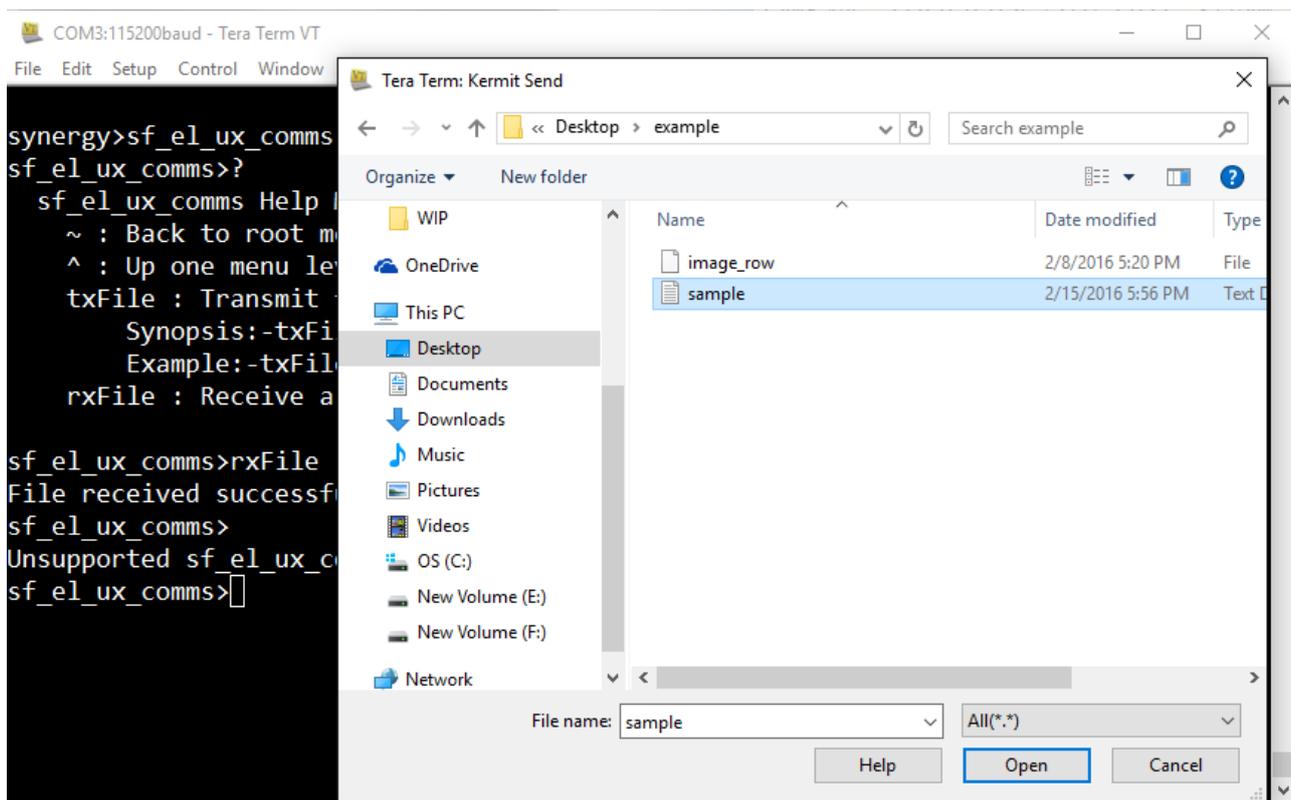
STEP 2: Use the `rxFile` command to receive file from the DK-S7G2. Type `rxFile` and press Enter. The board will then wait for the file transfer.



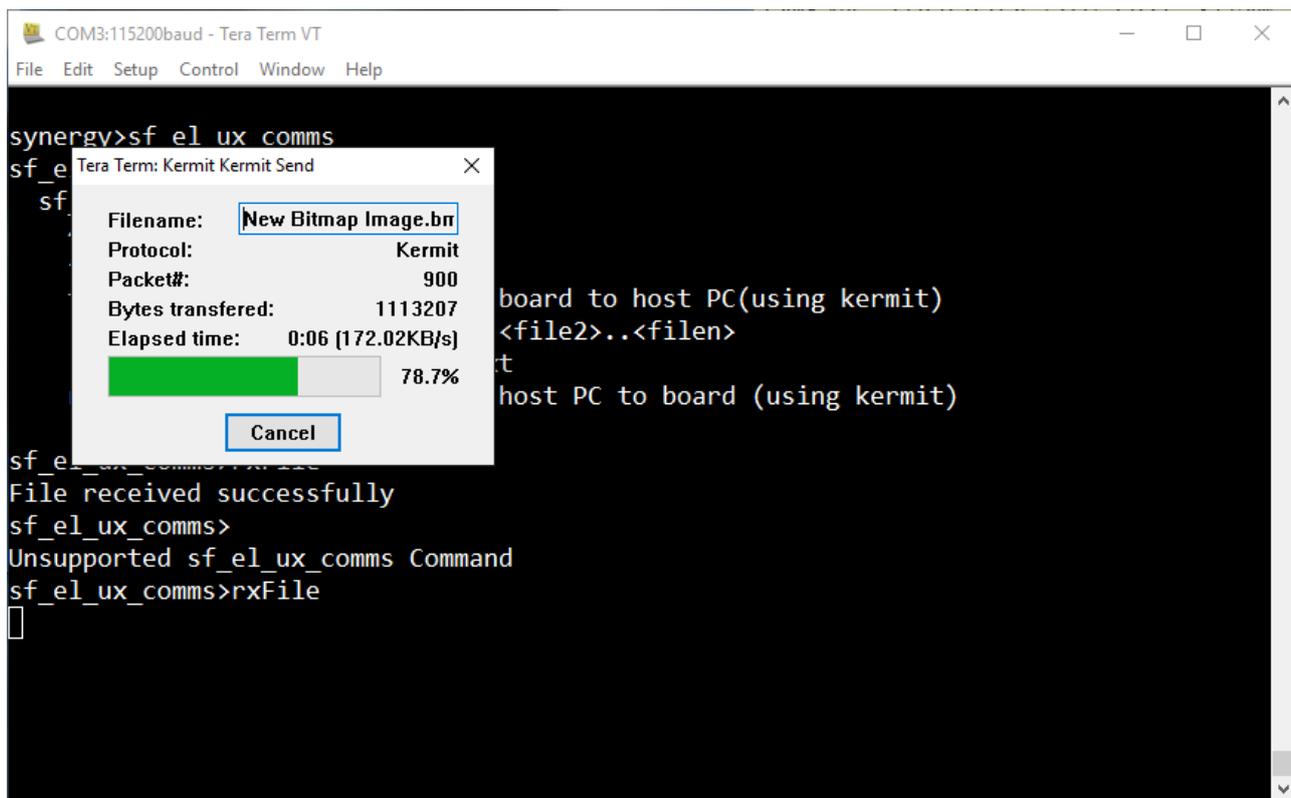
STEP 3: InTera Term, navigate to **File>Transfer>Kermit>Send**. The file explorer opens.



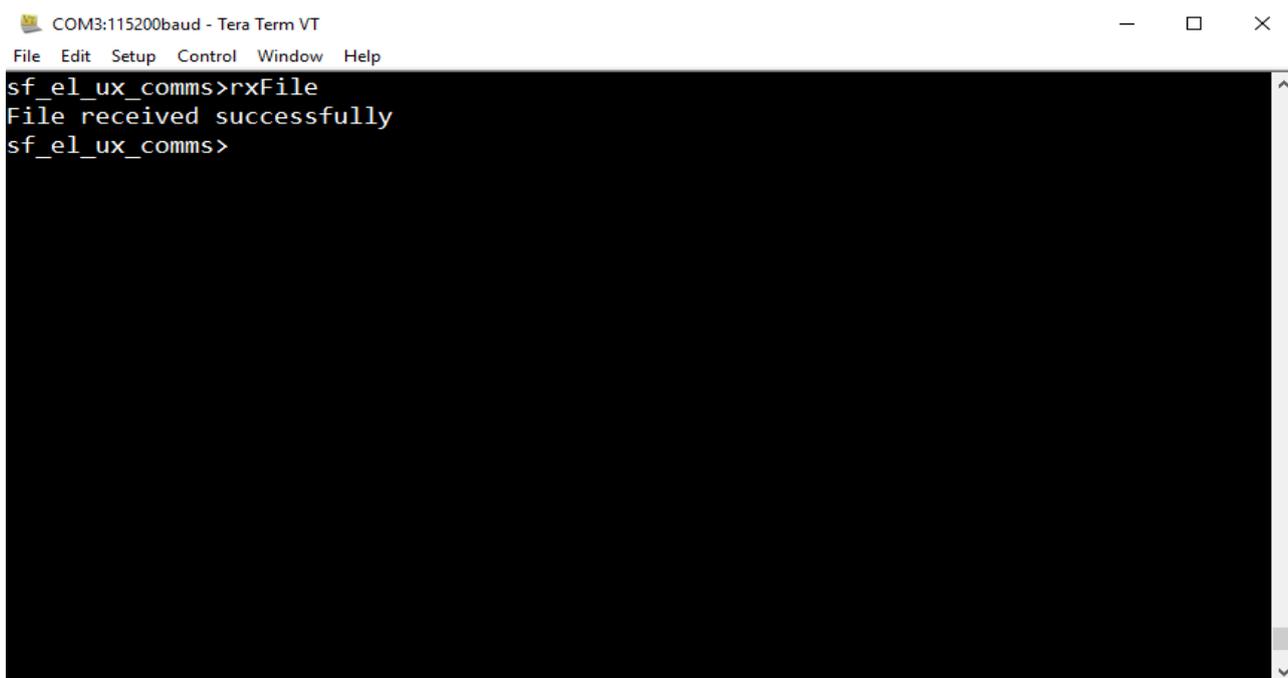
STEP 4: In the file explorer, choose the file to transmit from the host PC to the board.



STEP 5: Once the transfer has started, you can see the transfer progress window in Tera Term.

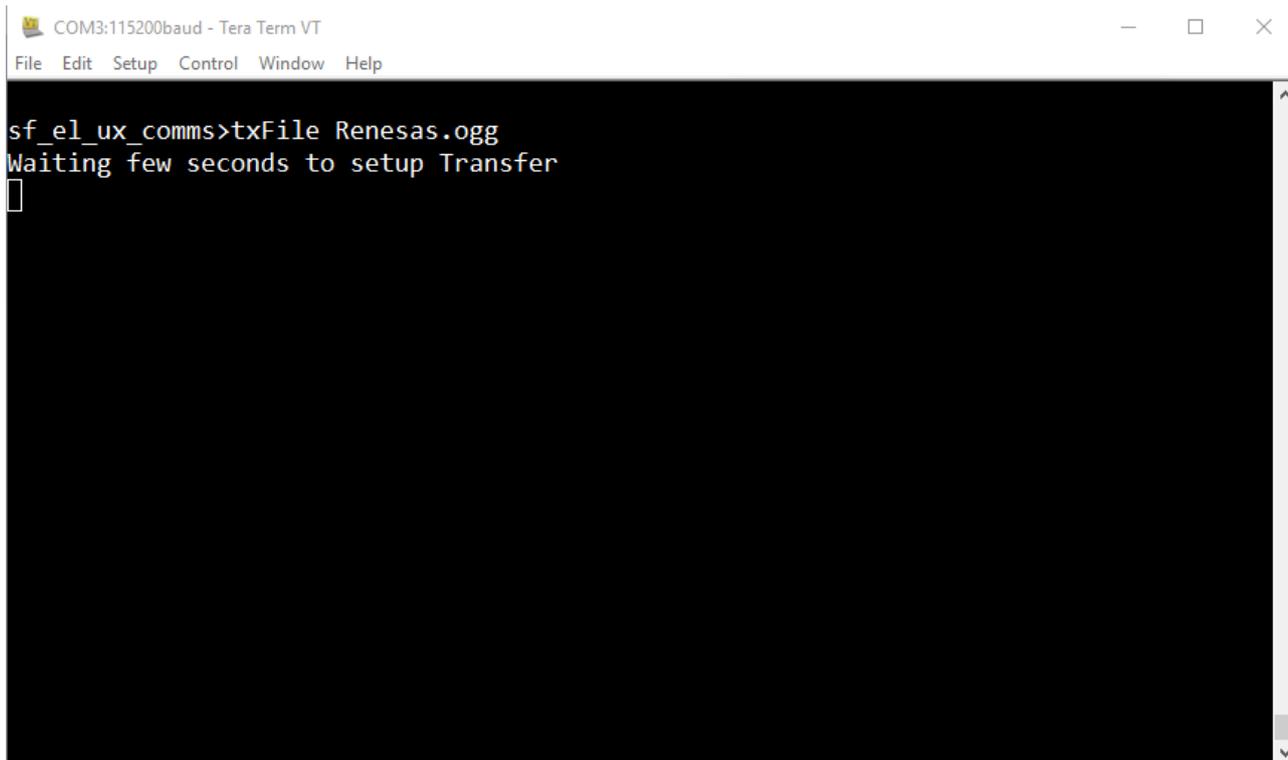


STEP 6: Once the transfer is complete, the rxFile command will return will with a success or failure notice.



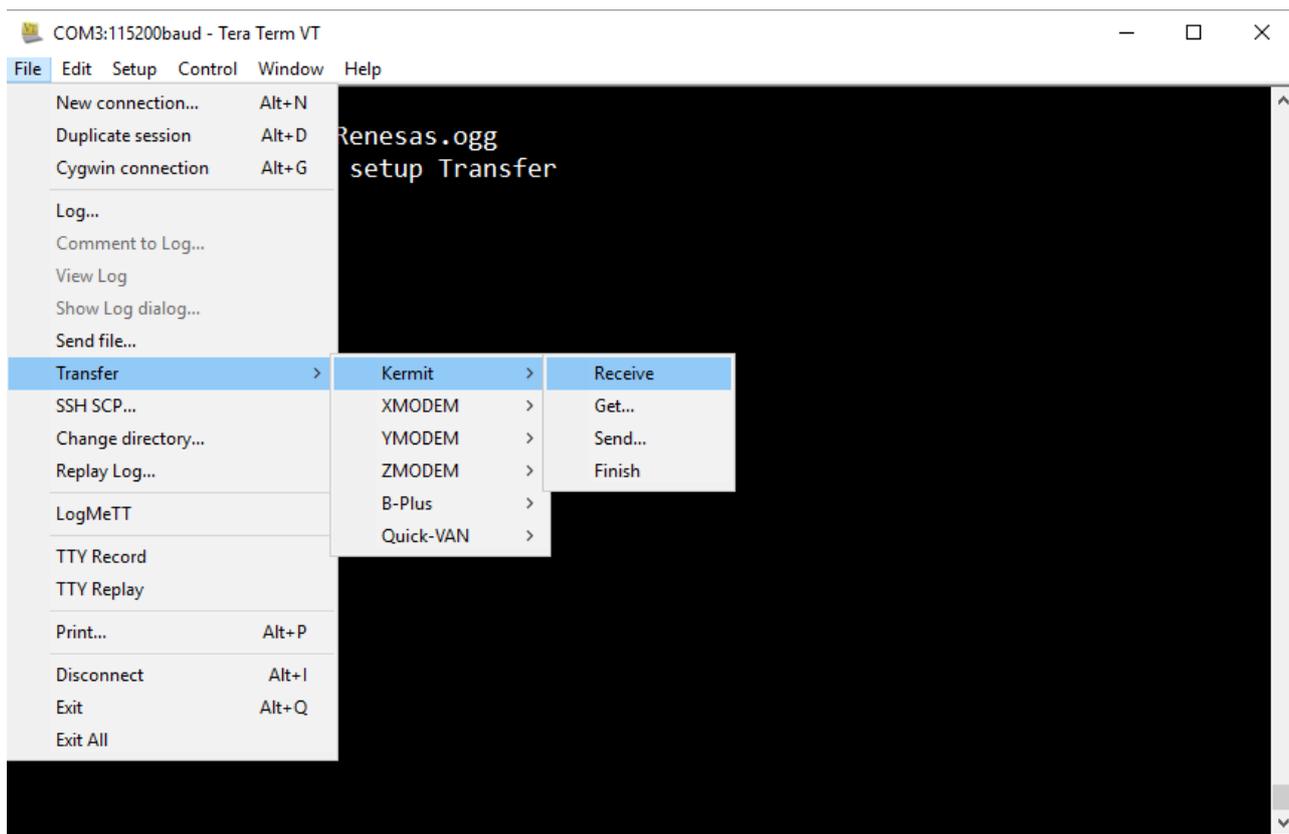
The screenshot shows a terminal window titled "COM3:115200baud - Tera Term VT". The menu bar includes "File", "Edit", "Setup", "Control", "Window", and "Help". The terminal text shows the command "sf_el_ux_comms>rxFile" being entered, followed by the response "File received successfully" and the prompt "sf_el_ux_comms>" on the next line.

STEP 7: Use the `txFile` command to send the file from DK-S7G2 board to the PC. The command use is `txFile<filename1><filename2>`.

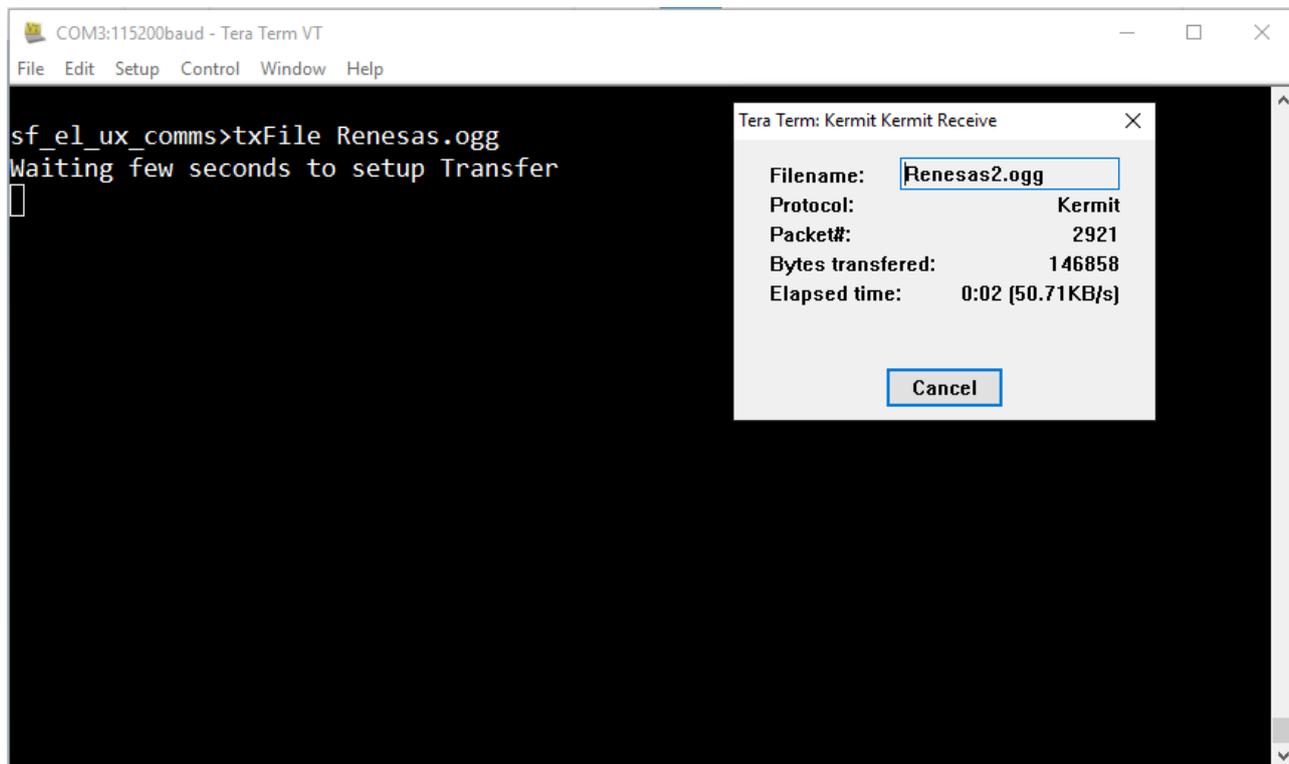


The screenshot shows a terminal window titled "COM3:115200baud - Tera Term VT". The menu bar includes "File", "Edit", "Setup", "Control", "Window", and "Help". The terminal text shows the command "sf_el_ux_comms>txFile Renesas.ogg" being entered, followed by the response "Waiting few seconds to setup Transfer" and a cursor on the next line.

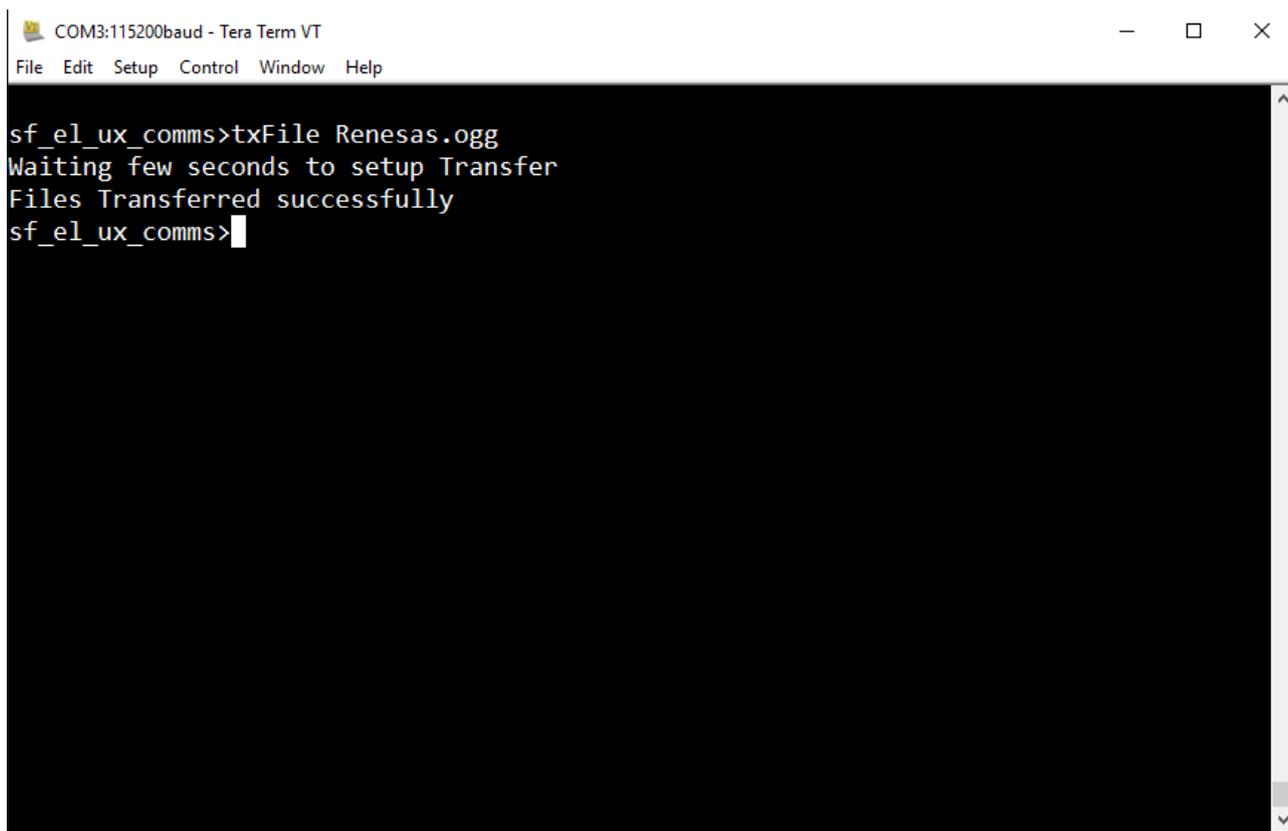
STEP 8: In Tera Term, choose **File>Transfer>Kermit>Receive**.



STEP 9: The application waits for about 10 seconds before it initiates the transfer. Once the transfer starts, the transfer speed is displayed in the progress window.



STEP 10: Once the transfer is closed, the transfer progress window will be closed and the console will print the status.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
sf_el_ux_comms>txFile Renesas.ogg
Waiting few seconds to setup Transfer
Files Transferred successfully
sf_el_ux_comms>
```

NOTES:

- The application uses the E-Kermit library which is licensed under the Revised 3-Clause BSD license.
- The application has only been tested using Tera Term.
- The application might not work if the file transferred is binary and contains a kermit-defined control character sequence.

17. Developer Example: FileX Framework

17.1 Introduction

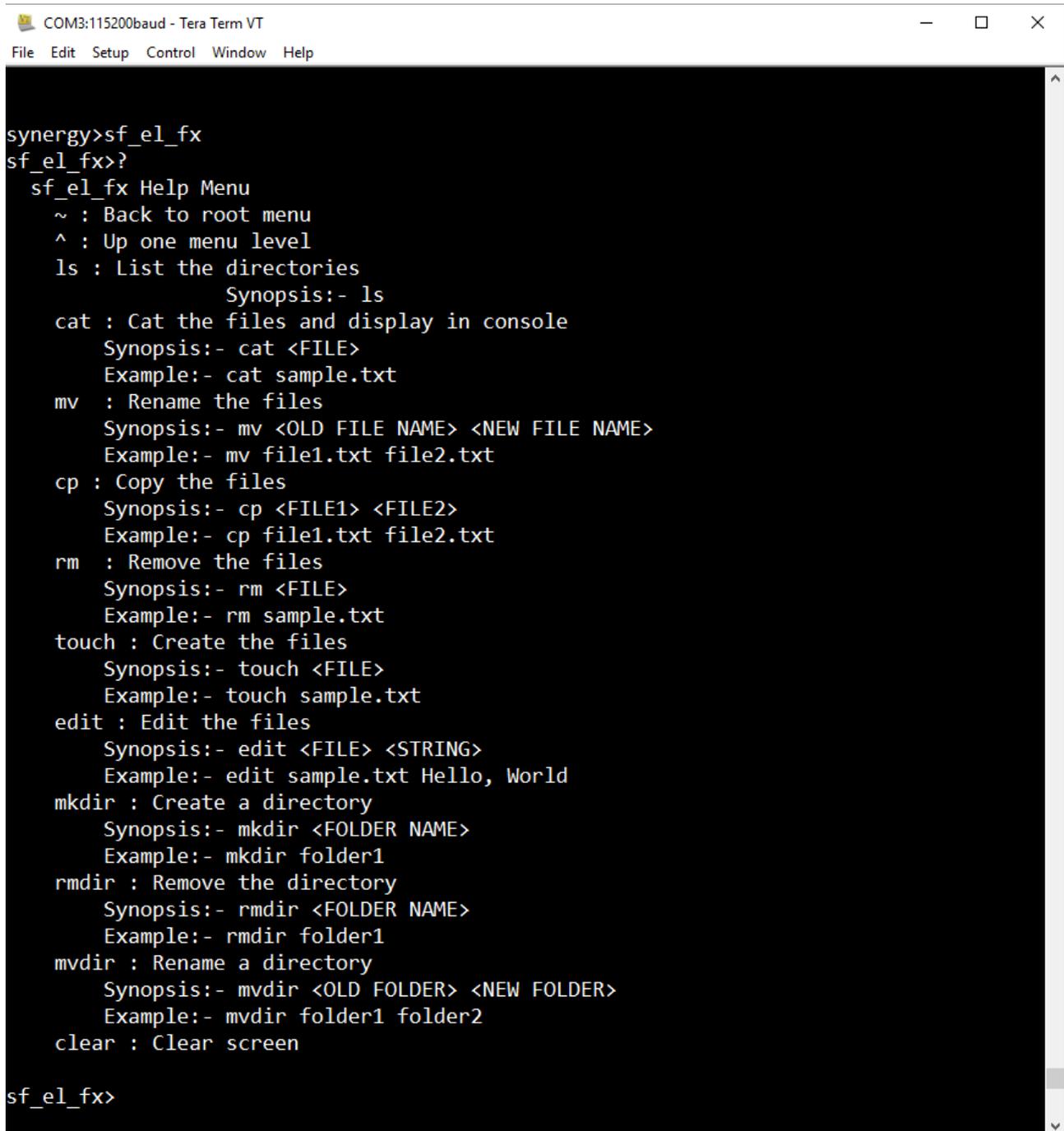
The FileX Framework is implemented with support from the Block Media Framework. The only block media device currently supported by the SSP is the SD/MMC block device. The Developer Example uses SD/MMC as the block media device and implements the commonly used file system APIs, which are similar to Linux commands, to demonstrate the FileX Framework.

17.2 Run the FileX Framework application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the FileX Framework application, follow these steps:

STEP 1: Type `sf_el_fx` in terminal and press Enter to access the `sf_el_fx` sub menu. For help, type `?` and press Enter.

A screenshot of a terminal window titled "COM3:115200baud - Tera Term VT". The window has a menu bar with "File", "Edit", "Setup", "Control", "Window", and "Help". The terminal content shows a user entering "synergy>sf_el_fx" and "sf_el_fx>?". The terminal then displays a help menu for "sf_el_fx" with the following text:

```
sf_el_fx Help Menu
~ : Back to root menu
^ : Up one menu level
ls : List the directories
    Synopsis:- ls
cat : Cat the files and display in console
    Synopsis:- cat <FILE>
    Example:- cat sample.txt
mv  : Rename the files
    Synopsis:- mv <OLD FILE NAME> <NEW FILE NAME>
    Example:- mv file1.txt file2.txt
cp  : Copy the files
    Synopsis:- cp <FILE1> <FILE2>
    Example:- cp file1.txt file2.txt
rm  : Remove the files
    Synopsis:- rm <FILE>
    Example:- rm sample.txt
touch : Create the files
    Synopsis:- touch <FILE>
    Example:- touch sample.txt
edit : Edit the files
    Synopsis:- edit <FILE> <STRING>
    Example:- edit sample.txt Hello, World
mkdir : Create a directory
    Synopsis:- mkdir <FOLDER NAME>
    Example:- mkdir folder1
rmdir : Remove the directory
    Synopsis:- rmdir <FOLDER NAME>
    Example:- rmdir folder1
mvdir : Rename a directory
    Synopsis:- mvdir <OLD FOLDER> <NEW FOLDER>
    Example:- mvdir folder1 folder2
clear : Clear screen
```

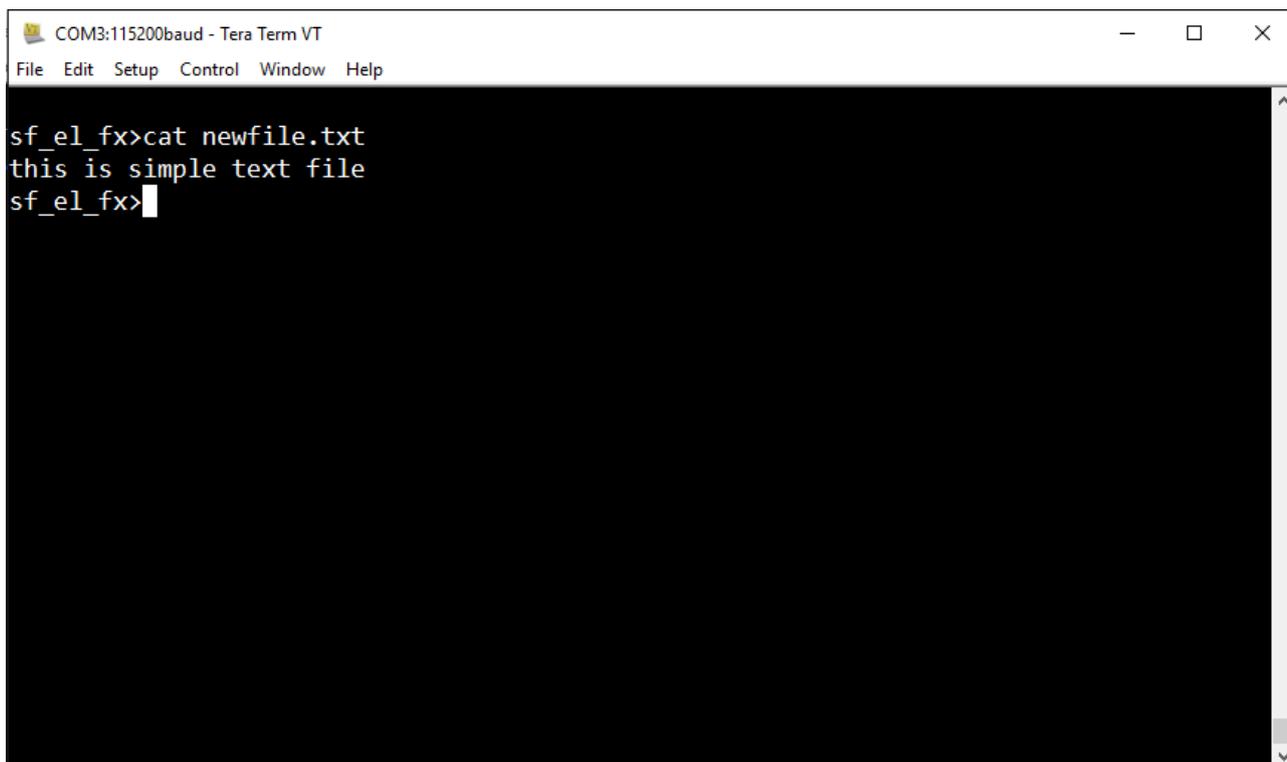
The terminal ends with "sf_el_fx>".

STEP 2: Type the `ls` command to list the files and directories on the SD card.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
sf_el_fx>ls
BOOT.IMX6QS
System Volume Information
audio.ogg
Renesas.ogg
image_row
New_Bitmap_Image.bmp
sf_el_fx>
```

STEP 3: Type the command `cat newfile.txt` to display the content of file in the console.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
sf_el_fx>cat newfile.txt
this is simple text file
sf_el_fx>
```

STEP 4: To rename the file, type the command `mv newfile.txt abc.txt` and `ls` to display.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_el_fx>mv newfile.txt abc.txt
sf_el_fx>ls
BOOT.IMX6QS
System Volume Information
audio.ogg
Renesas.ogg
image_row
New_Bitmap_Image.bmp
abc.txt
sf_el_fx>
    
```

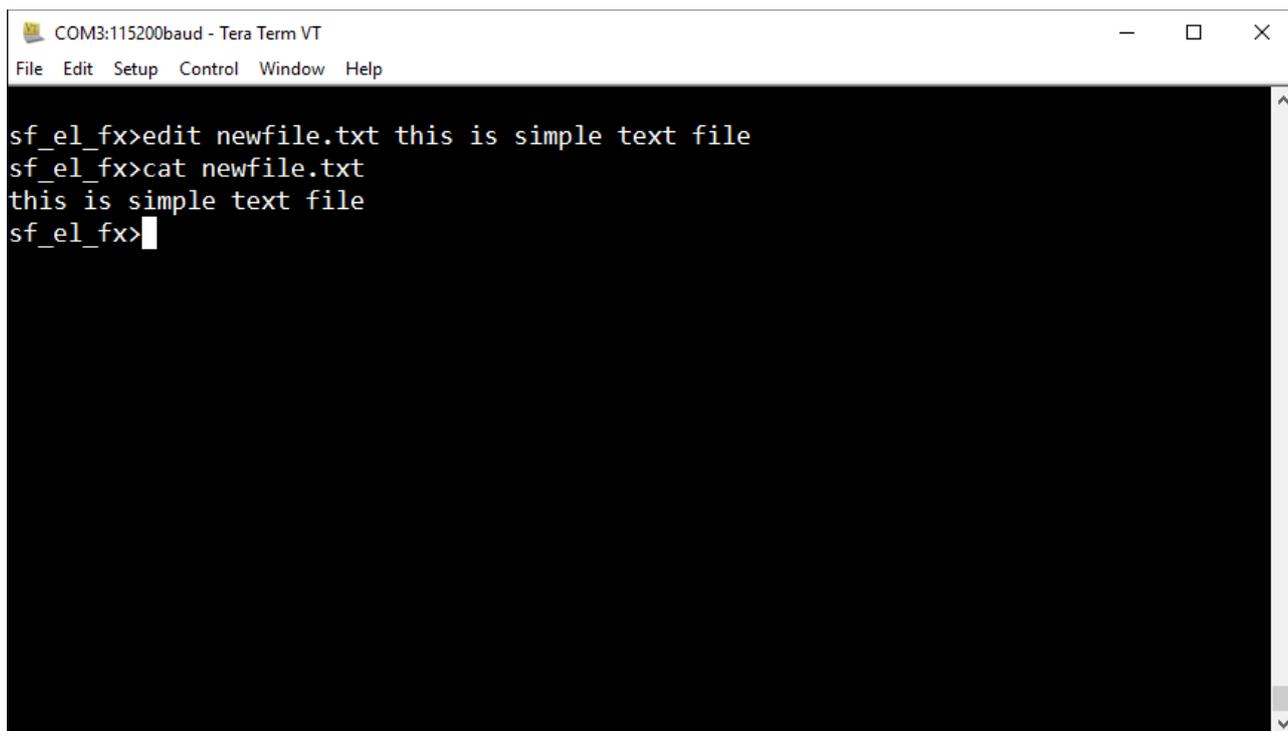
STEP 5: To copy the files, type the command `cp abc.txt newcopy.txt` and `ls` to display

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_el_fx>cp abc.txt newcopy.txt
sf_el_fx>ls
BOOT.IMX6QS
System Volume Information
audio.ogg
Renesas.ogg
image_row
newcopy.txt
New_Bitmap_Image.bmp
abc.txt
sf_el_fx>
    
```

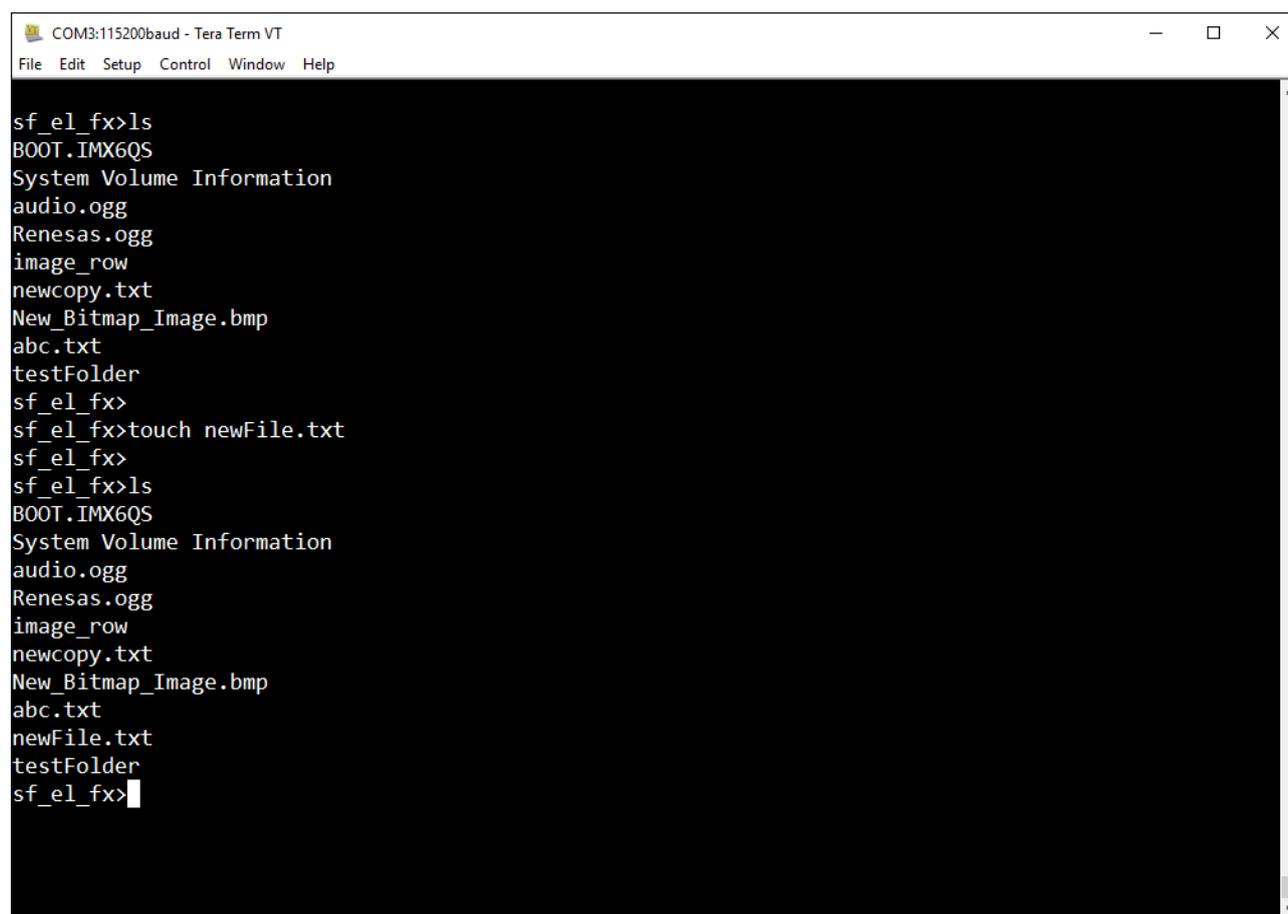
STEP 6: To edit a file, type the command `edit newfile.txt String` and use `catnewfile.txt` to display the edited content.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_el_fx>edit newfile.txt this is simple text file
sf_el_fx>cat newfile.txt
this is simple text file
sf_el_fx>
```

STEP 7: To create a file, type the command `touch newFile.txt`. The command creates a new file, which you can display using the `ls` command.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_el_fx>ls
BOOT.IMX6QS
System Volume Information
audio.ogg
Renesas.ogg
image_row
newcopy.txt
New_Bitmap_Image.bmp
abc.txt
testFolder
sf_el_fx>
sf_el_fx>touch newFile.txt
sf_el_fx>
sf_el_fx>ls
BOOT.IMX6QS
System Volume Information
audio.ogg
Renesas.ogg
image_row
newcopy.txt
New_Bitmap_Image.bmp
abc.txt
newFile.txt
testFolder
sf_el_fx>
```

STEP 8: To create directory, type command `mkdir newFolder`.

```

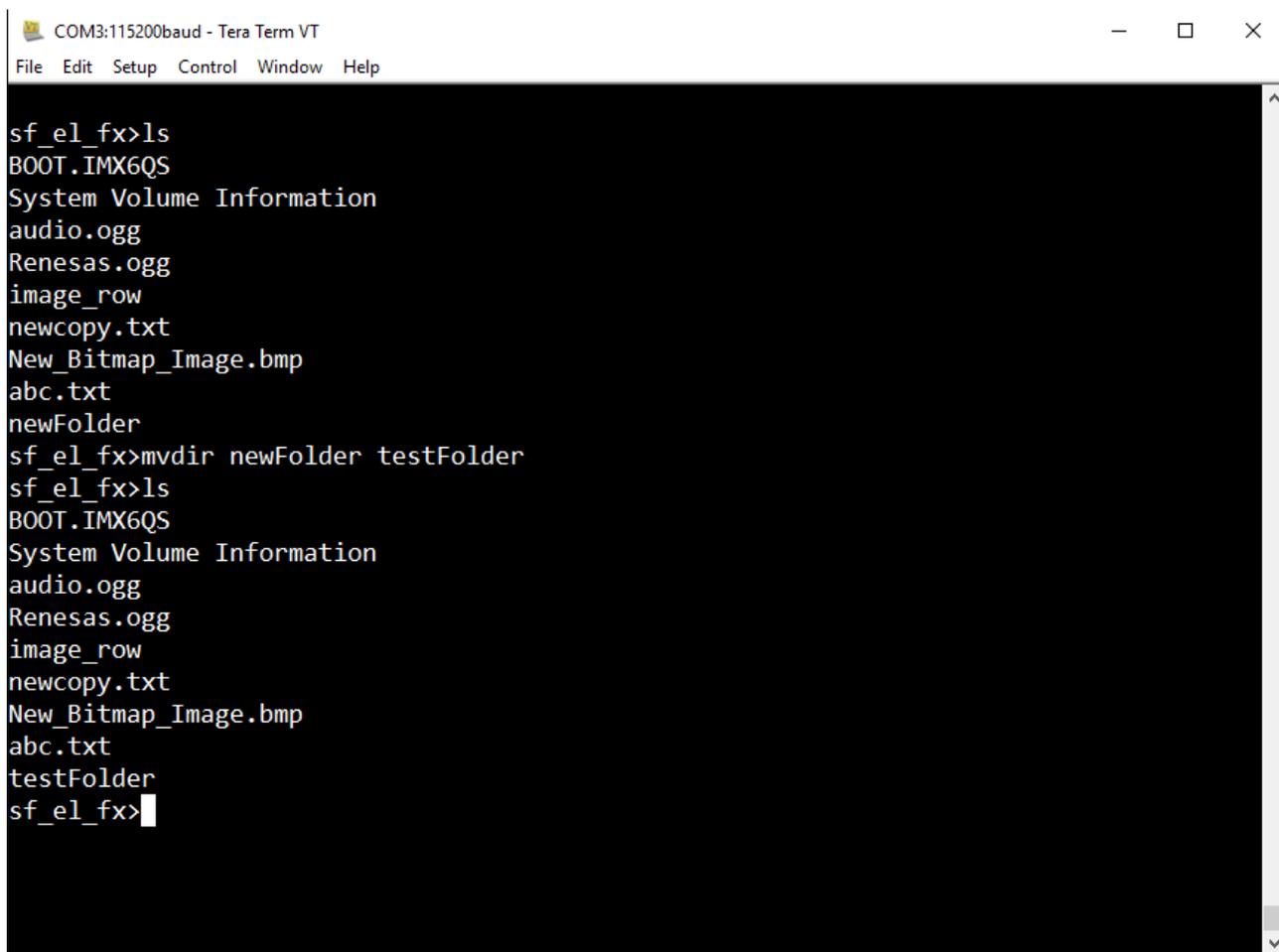
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
sf_el_fx>mkdir newFolder
sf_el_fx>ls
BOOT.IMX6QS
System Volume Information
audio.ogg
Renasas.ogg
image_row
newcopy.txt
New_Bitmap_Image.bmp
abc.txt
newFolder
sf_el_fx>
    
```

STEP 9: To remove a directory, type command `rmdir newFolder`.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
sf_el_fx>ls
BOOT.IMX6QS
System Volume Information
audio.ogg
Renasas.ogg
image_row
newcopy.txt
New_Bitmap_Image.bmp
abc.txt
newFolder
sf_el_fx>rmdir newFolder
sf_el_fx>ls
BOOT.IMX6QS
System Volume Information
audio.ogg
Renasas.ogg
image_row
newcopy.txt
New_Bitmap_Image.bmp
abc.txt
sf_el_fx>
    
```

STEP 10: To rename a directory, type command `mvdir newFoldertestFolder`.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_el_fx>ls
BOOT.IMX6QS
System Volume Information
audio.ogg
Renesas.ogg
image_row
newcopy.txt
New_Bitmap_Image.bmp
abc.txt
newFolder
sf_el_fx>mkdir newFolder testFolder
sf_el_fx>ls
BOOT.IMX6QS
System Volume Information
audio.ogg
Renesas.ogg
image_row
newcopy.txt
New_Bitmap_Image.bmp
abc.txt
testFolder
sf_el_fx>
```

18. Developer Example: HAL ICU Driver

18.1 Introduction

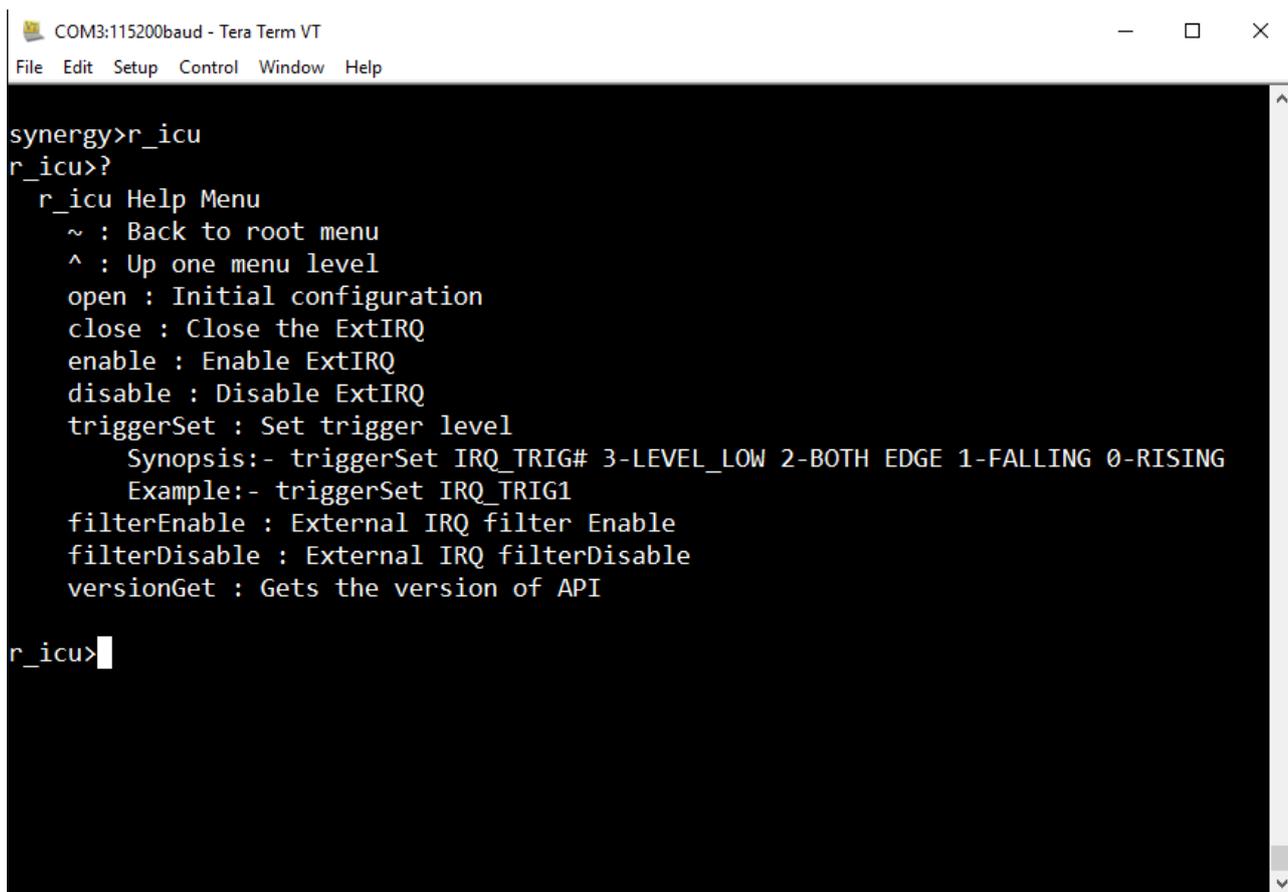
The Developer Example demonstrates the external IRQ using the ICU HAL modules. The Developer Example uses Port0 Pin6 configured as GPIO in Input mode to generate the External IRQ when you press button S1 on the DK-S7G2 Board. The application toggles LED1 each time you press the button.

18.2 Run the HAL ICU Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the HAL ICU driver application, follow these steps:

STEP 1: Type `r_icu` to get the ICU external IRQ menu. For help, type `?` and press Enter.

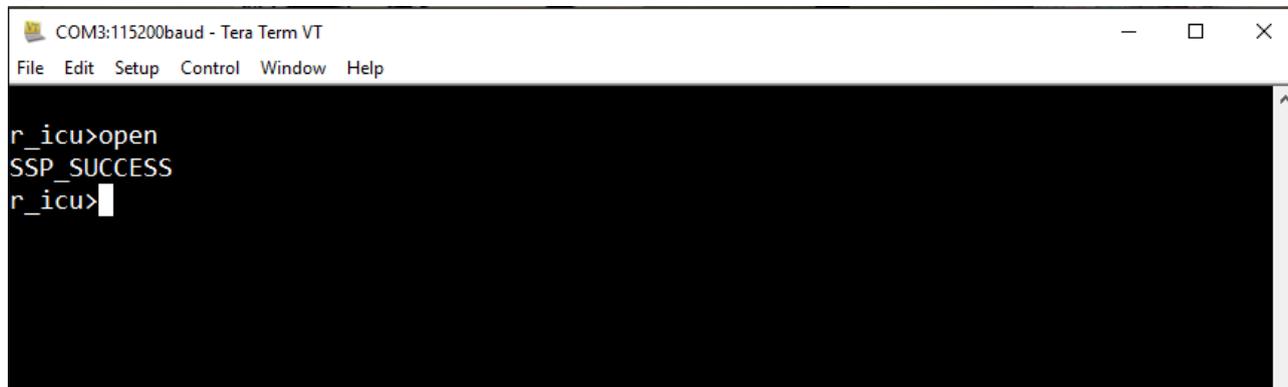


```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>r_icu
r_icu>?
r_icu Help Menu
~ : Back to root menu
^ : Up one menu level
open : Initial configuration
close : Close the ExtIRQ
enable : Enable ExtIRQ
disable : Disable ExtIRQ
triggerSet : Set trigger level
    Synopsis:- triggerSet IRQ_TRIG# 3-LEVEL_LOW 2-BOTH EDGE 1-FALLING 0-RISING
    Example:- triggerSet IRQ_TRIG1
filterEnable : External IRQ filter Enable
filterDisable : External IRQ filterDisable
versionGet : Gets the version of API

r_icu>
```

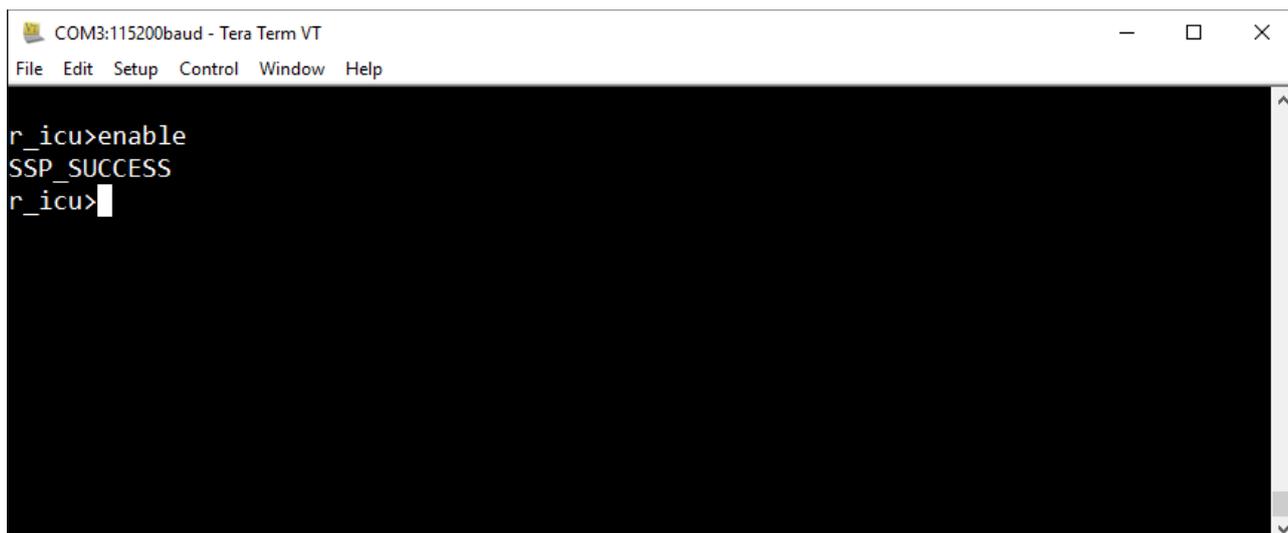
STEP 2: Type the open command to initialize the External IRQ.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_icu>open
SSP_SUCCESS
r_icu>
```

STEP 3: Type the enable command to enable the External IRQ.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_icu>enable
SSP_SUCCESS
r_icu>
```

STEP 4: Type the `triggerSet IRQ_TRIG#` command to enable the trigger for External IRQ.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_icu>triggerSet IRQ_TRIG 0
SSP_SUCCESS
r_icu>
```

STEP 5: Press button S1 on the DK-S7G2 Board to display the External IRQ trigger. LED1 toggles with each button press.

19. Developer Example: Thread Monitor Framework

19.1 Introduction

The Thread Monitor(TM) uses the Watchdog Timer as a low-level driver to reset the device if any of the threads registered in the Thread Monitor encounter an erroneous condition. The Developer Example explains how to register a thread for monitoring and how to figure out its minimum and maximum number of executions in a given window by enabling profiling mode.

The Developer Example uses a thread and registers this thread for monitoring with two possible arguments called `misbehave0` and `misbehave1`. The thread toggles green LED of LED1 for an infinite time if `misbehave0` is passed as an argument to the `demo_thread_monitor` command. If `misbehave1` is passed as an argument to `demo_thread_monitor`, the thread toggles the red led of LED1 10 times and enters an erroneous condition in which the thread locks in a `while(1)` loop and registered thread will not indicate thread monitor that it is active, which results in device reset.

NOTES:

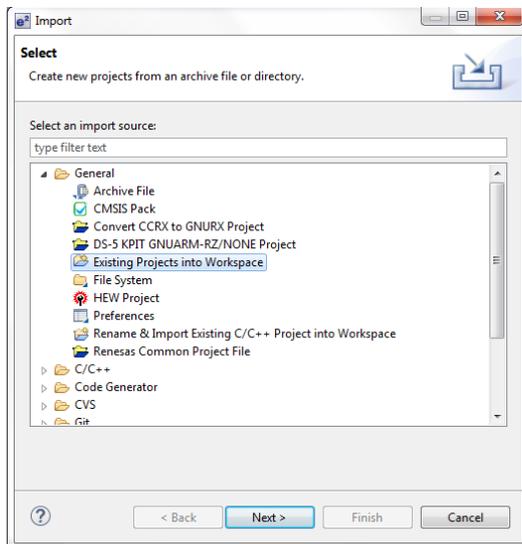
- The `closeAPI` of the Thread Monitor does not stop the WDT. You must refresh the WDT explicitly otherwise the device is reset. Refer to Thread Monitor SSP limitation.
- Disconnect the JTAG while running the application in normal mode (that is the profiling mode is disabled). Refer WDT SSP limitation.

19.2 Build and Run the Thread Monitor Framework application

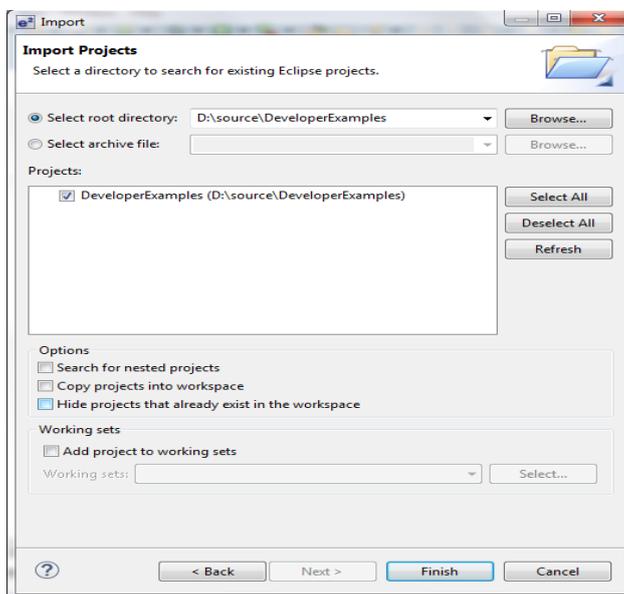
The steps required to build the application differ from the other Developer Examples because for the Thread Monitor you must configure the thread for profiling mode in the e² studio Project Configurator using the Threads tab.

STEP 1: Extract the downloaded project source into a work directory in the host PC.

STEP 2: Launch e² studio. Navigate to **File>Import**. The Import dialog box opens.



STEP 3: Select **Existing Project into Workspace** and click on **Next**. Browse to the root directory of the extracted project source and click **OK**. If e² studio recognizes the project, it will be shown in the **Projects** window. Make sure that checkbox next to it is checked and click the **Finish** button to import the project. (If a local working copy is required, check **Copy projects into workspace**.)



STEP 4: Open the configuration.xml file, select Thread Monitor module, and go to Properties to enable the profiling mode to capture thread's minimum and maximum count.

STEP 6: After getting the minimum and maximum values, set the values as count while registering the thread. If the count is outside of the minimum and maximum values, it is considered as misbehavior. Minimum and maximum depend on the design to design. Profiling mode helps user to get minimum and maximum count value. Once count value is extracted using profiling mode, set the same while registering for monitoring.

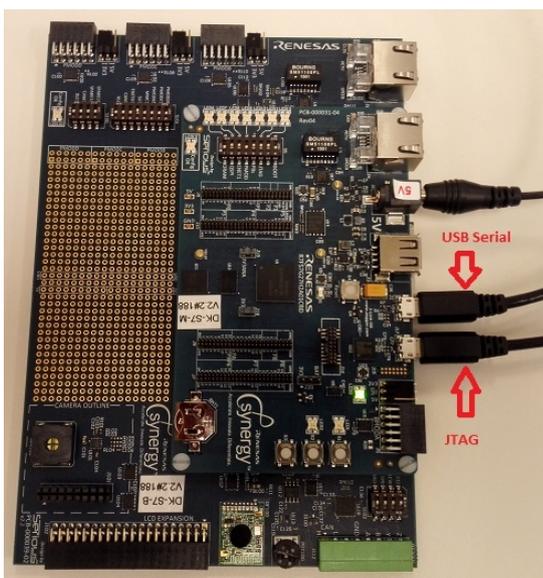
Disable profiling mode in the properties tab and rebuild the project.

NOTE: The project must be run without the JTAG debugger for the WDT reset to work. The JTAG cable will be disconnected in the following steps for this reason.

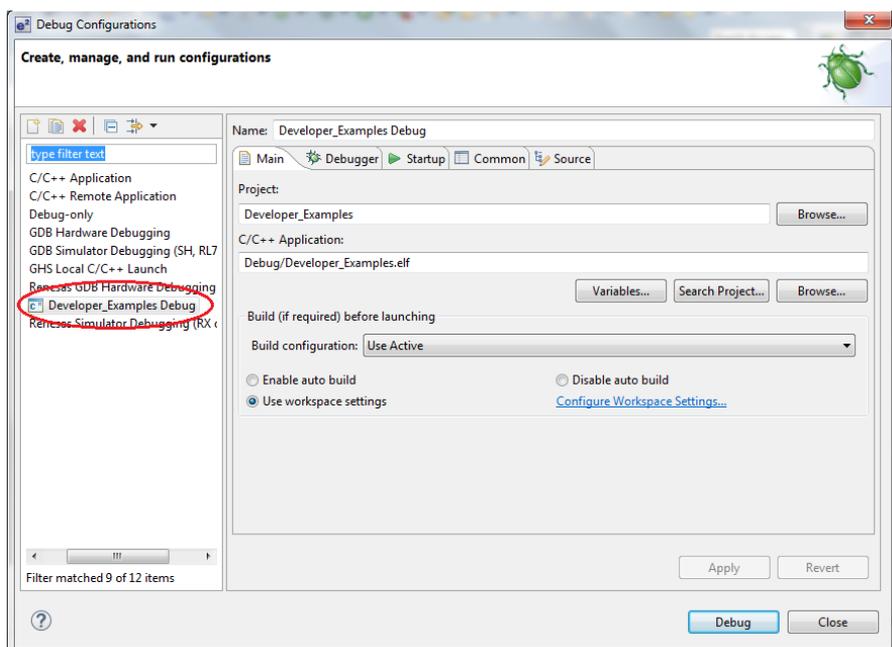
STEP 7: Clean and build the project.

STEP 8: Connect the S7G2 DK board to the host PC. Two connections are needed:

- a) The JTAG debug connection to program.
- b) The USB-CDC connection for console access



STEP 9: Power on the board. In ISDE, click on **Run>Debug configurations**. A new debug configuration with the project name will be created. Click **Debug**.

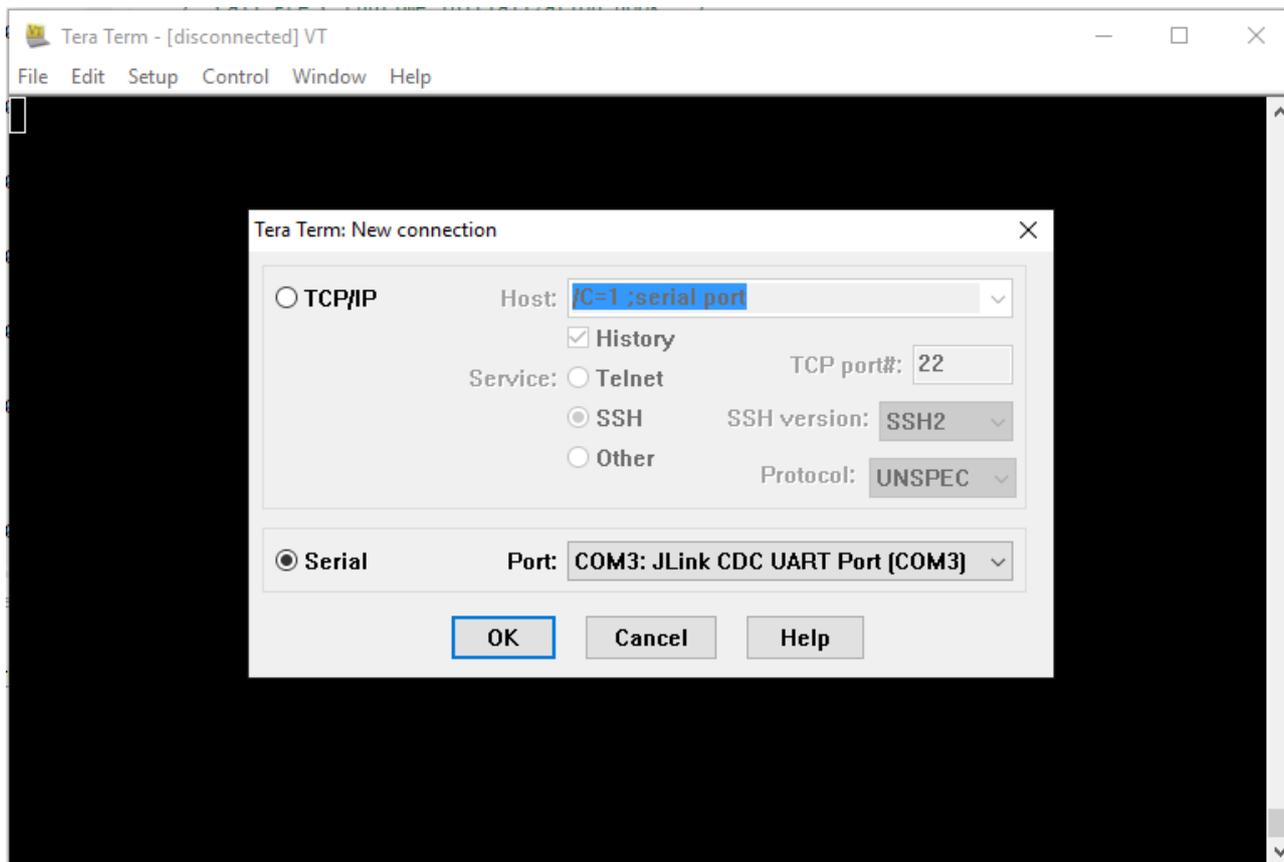


STEP 10: Click **Yes** to switch to the Debug Perspective if you are asked.

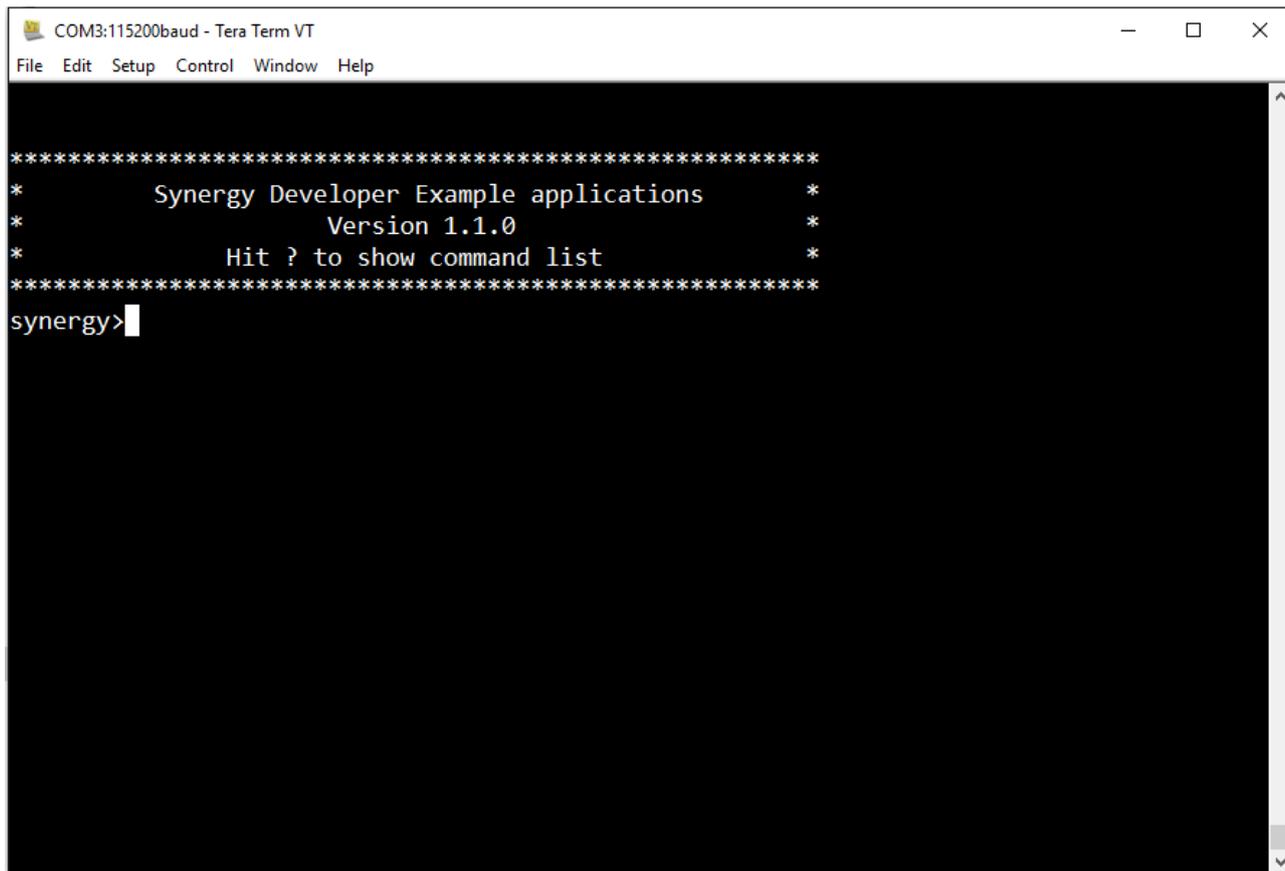
STEP 11: Click the Resume button  twice so that the application starts its scheduler.

STEP 12: Click the Stop button  and disconnect the JTAG. Press the Reset button in the board. Open Tera Term.

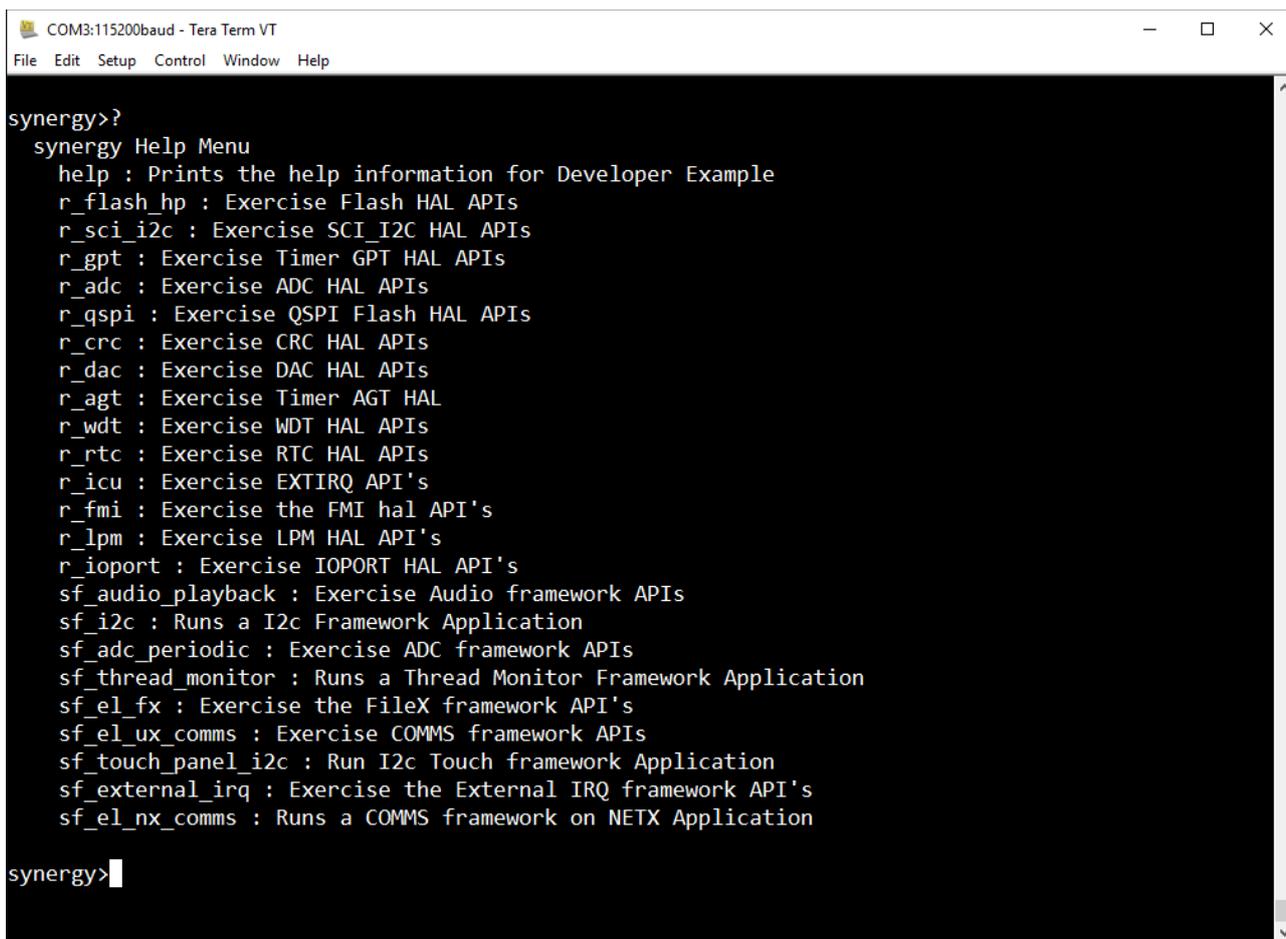
STEP 13: Choose the serial connection and choose the corresponding serial port.



STEP 14: Press the Enter key to get the console prompt.



STEP 15: Type ? and press Enter to get the Help menu.



```

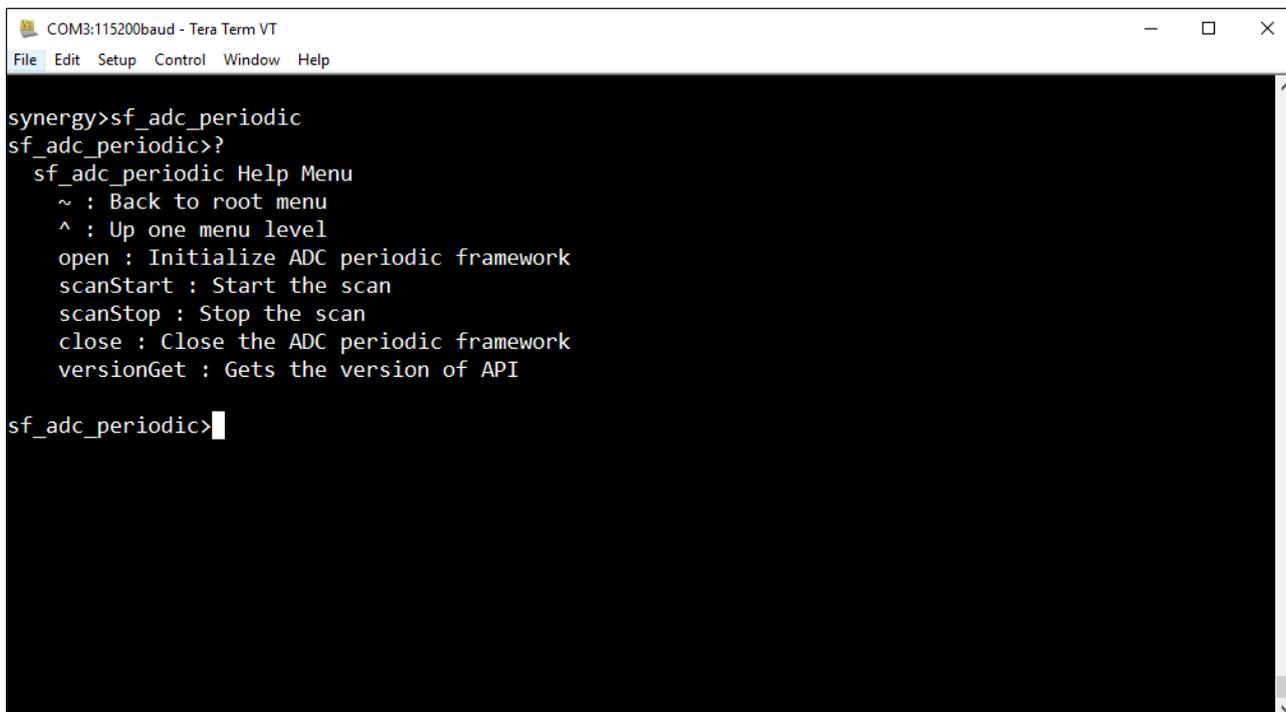
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>?
synergy Help Menu
  help : Prints the help information for Developer Example
  r_flash_hp : Exercise Flash HAL APIs
  r_sci_i2c : Exercise SCI_I2C HAL APIs
  r_gpt : Exercise Timer GPT HAL APIs
  r_adc : Exercise ADC HAL APIs
  r_qspi : Exercise QSPI Flash HAL APIs
  r_crc : Exercise CRC HAL APIs
  r_dac : Exercise DAC HAL APIs
  r_agt : Exercise Timer AGT HAL
  r_wdt : Exercise WDT HAL APIs
  r_rtc : Exercise RTC HAL APIs
  r_icu : Exercise EXTIRQ API's
  r_fmi : Exercise the FMI hal API's
  r_lpm : Exercise LPM HAL API's
  r_ioport : Exercise IOPORT HAL API's
  sf_audio_playback : Exercise Audio framework APIs
  sf_i2c : Runs a I2c Framework Application
  sf_adc_periodic : Exercise ADC framework APIs
  sf_thread_monitor : Runs a Thread Monitor Framework Application
  sf_el_fx : Exercise the FileX framework API's
  sf_el_ux_comms : Exercise COMMS framework APIs
  sf_touch_panel_i2c : Run I2c Touch framework Application
  sf_external_irq : Exercise the External IRQ framework API's
  sf_el_nx_comms : Runs a COMMS framework on NETX Application

synergy>

```

STEP 16: Type `sf_thread_monitor` in terminal and press Enter to access the Thread monitor framework submenu. For Help, type `?` and press Enter.



```

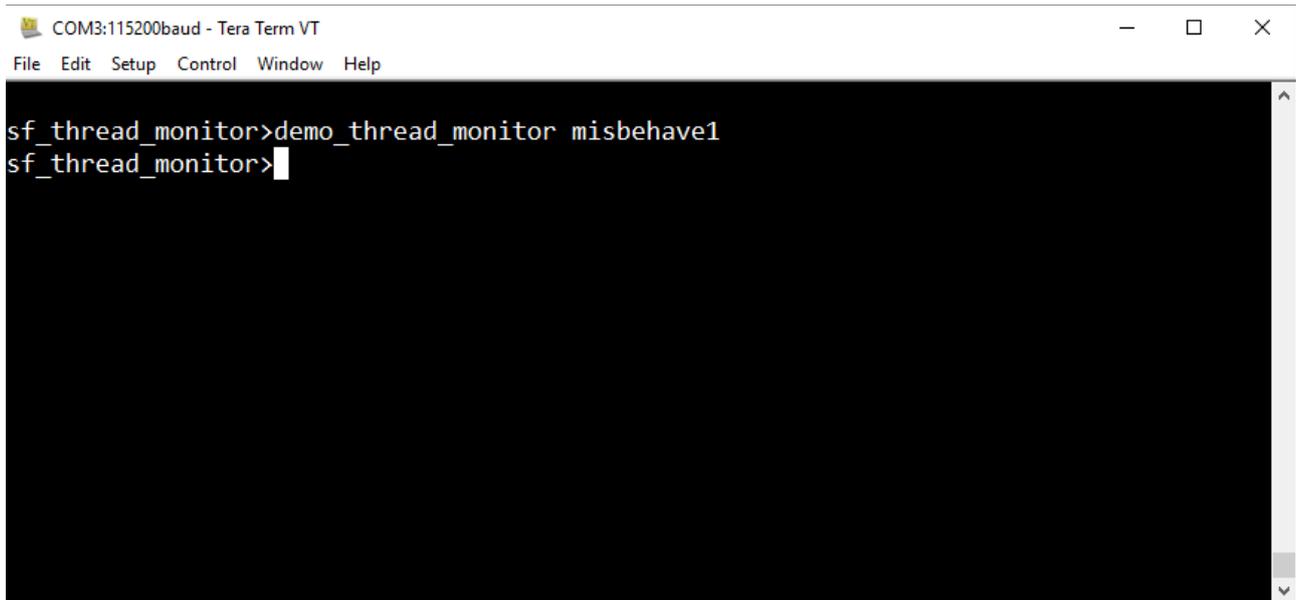
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>sf_adc_periodic
sf_adc_periodic>?
sf_adc_periodic Help Menu
  ~ : Back to root menu
  ^ : Up one menu level
  open : Initialize ADC periodic framework
  scanStart : Start the scan
  scanStop : Stop the scan
  close : Close the ADC periodic framework
  versionGet : Gets the version of API

sf_adc_periodic>

```

STEP 17: Run the `demo_thread_monitor` command with parameter `misbehave1` as argument. The red LED of LED1 toggles 10 times and the LED1 turns off and the device resets. After reset LED1 lights up again.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
sf_thread_monitor>demo_thread_monitor misbehave1
sf_thread_monitor>
```

20. Developer Example: WDT HAL driver

20.1 Introduction

The Watchdog Timer Developer Example uses the HAL APIs for WDT with output visible via an LED on the DK-S7G2 board.

The Developer Example demonstrates WDT functionality as follows:

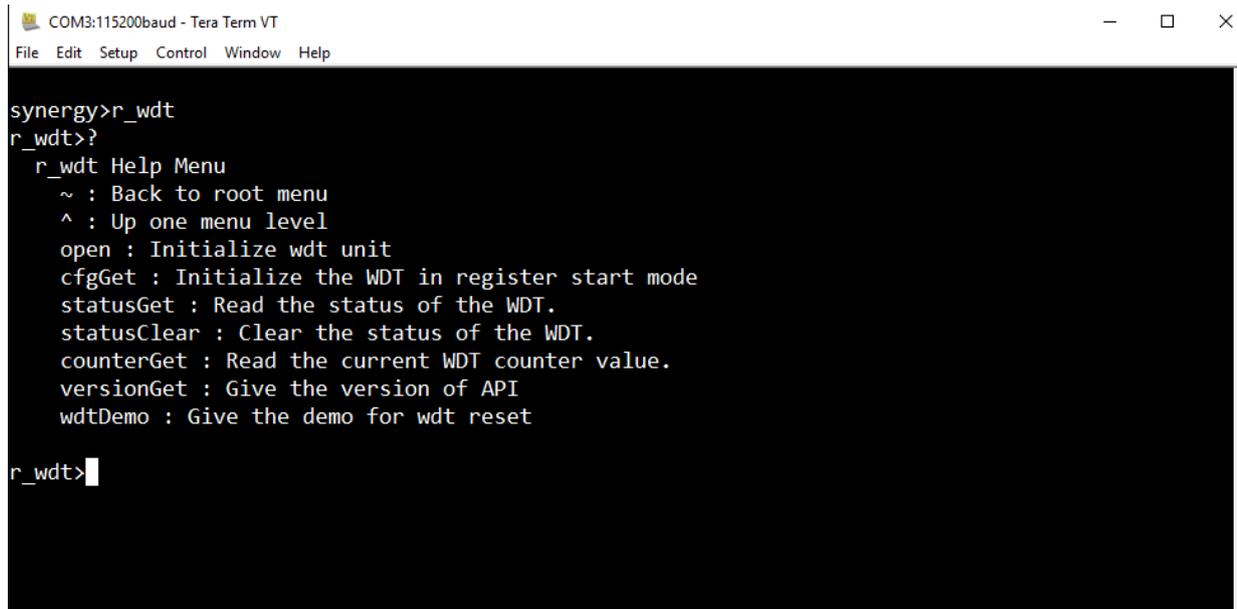
- Enables LED1 (GREEN) to demonstrate that the WDT is running.
- Enables LED1 (RED) to indicate WDT is about to expire.
- Disable LED1 to indicate that the WDT has expired.
- The WDT underflow count-down will be visible on the console.

20.2 Run the WDT HAL Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the WDT HAL driver application, follow these steps:

STEP 1: Type `r_wdt` in the terminal and press Enter to access the WDT HAL submenu. For help, type `?` and press Enter.



```

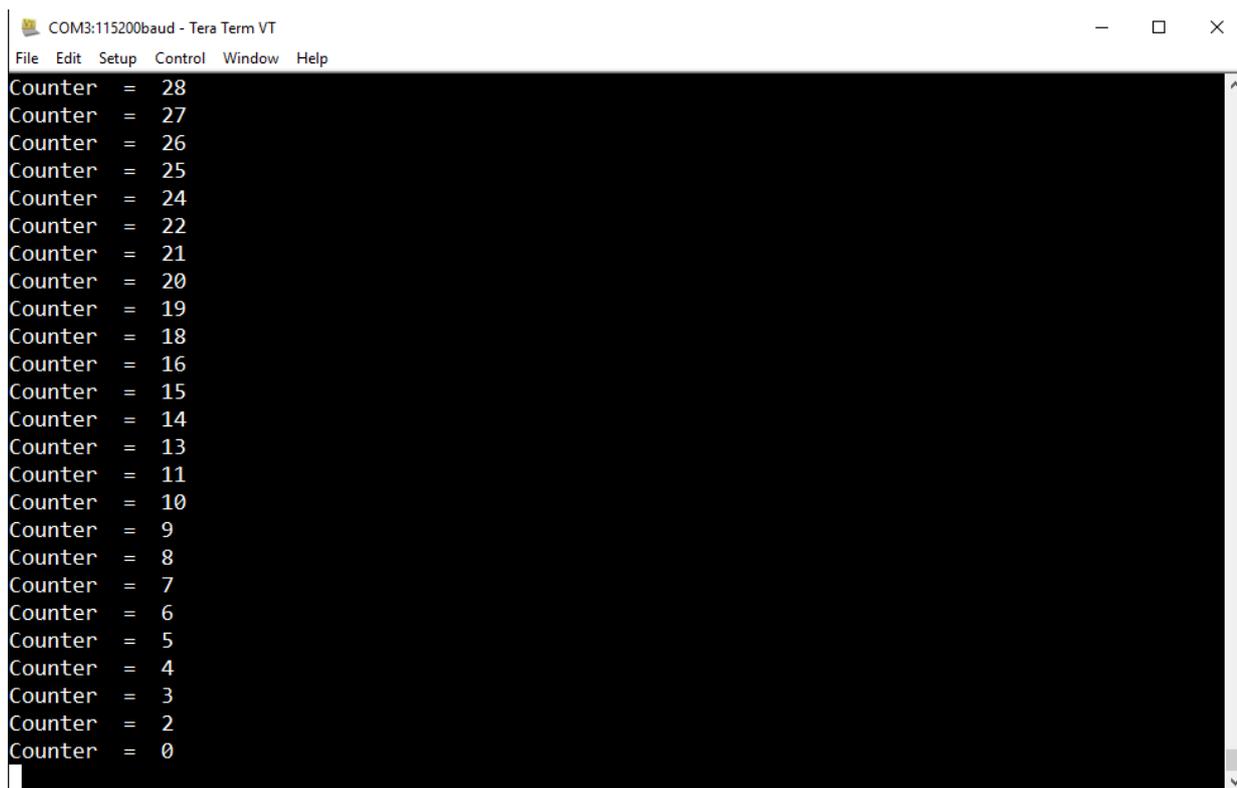
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>r_wdt
r_wdt>?
r_wdt Help Menu
~ : Back to root menu
^ : Up one menu level
open : Initialize wdt unit
cfgGet : Initialize the WDT in register start mode
statusGet : Read the status of the WDT.
statusClear : Clear the status of the WDT.
counterGet : Read the current WDT counter value.
versionGet : Give the version of API
wdtDemo : Give the demo for wdt reset

r_wdt>

```

STEP 2: The `open` command starts the WDT (when it is in register start mode). The WDT Developer Example application will turn on the Green LED on the DK-S7G2 board. When you execute the `wdtDemo` command, the application resumes one of the sleeping thread `hal_wdt_thread`. The RED LED will turn on as the thread resumes. Loop in the thread takes more than the expected time to complete and the WDT resets the device.



```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

Counter = 28
Counter = 27
Counter = 26
Counter = 25
Counter = 24
Counter = 22
Counter = 21
Counter = 20
Counter = 19
Counter = 18
Counter = 16
Counter = 15
Counter = 14
Counter = 13
Counter = 11
Counter = 10
Counter = 9
Counter = 8
Counter = 7
Counter = 6
Counter = 5
Counter = 4
Counter = 3
Counter = 2
Counter = 0

```

NOTES:

- The thread monitor framework uses the WDT. In order to reset the device in the WDT demo, close the thread monitor framework. If you do not close the thread monitor, it will continually refresh the WDT and it will never reset the device.
- When using a J-Link debugger, the WDT counter does not count and therefore will not reset the device or generate an NMI (Refer Limitations of WDT in SSP User's Manual). To reset the device, remove the J-Link debugger, reset the device, and then execute the steps from STEP 9 of Build and Run a Developer Example application: Launching the terminal.

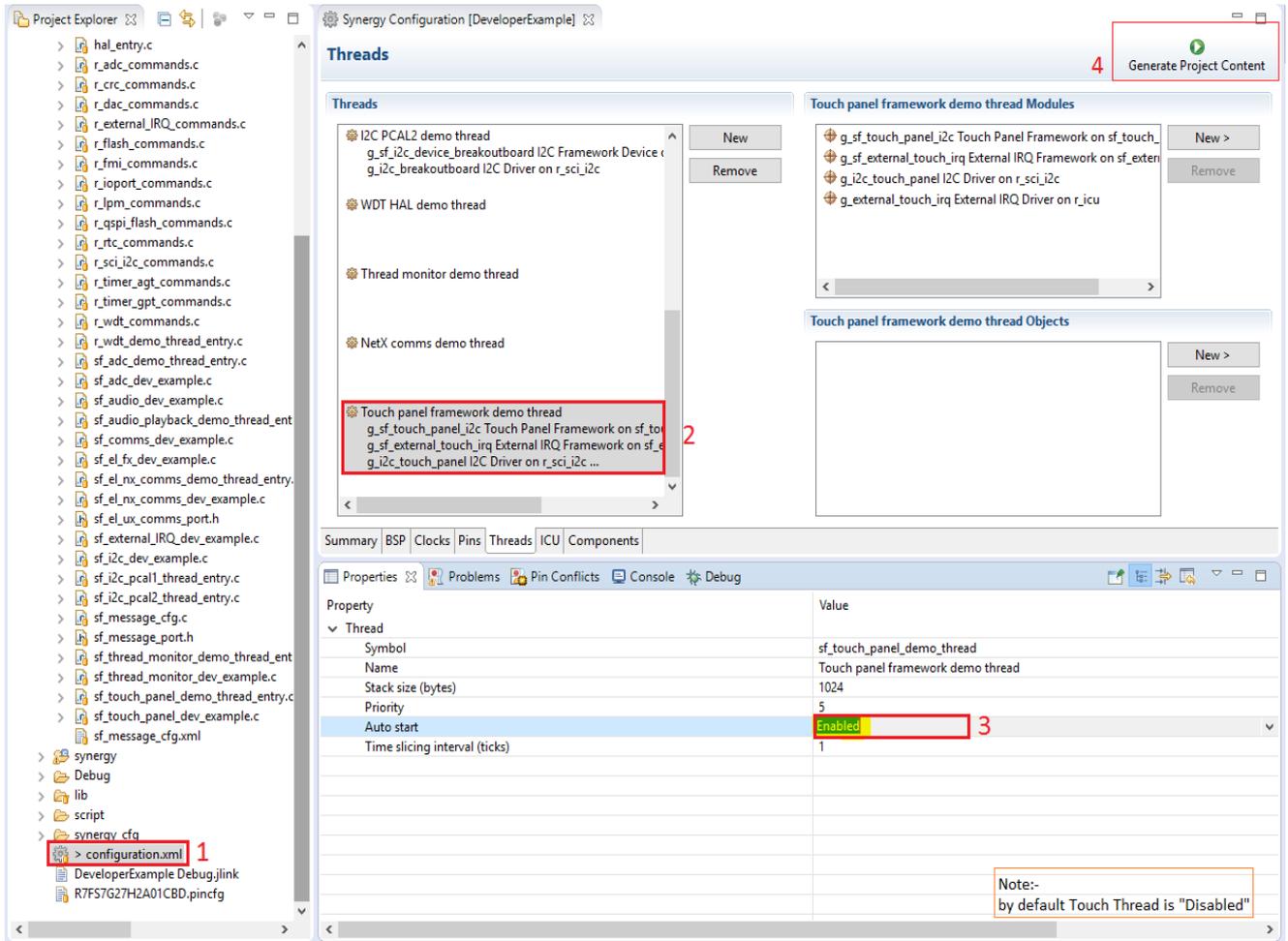
21. Developer Example: I2C Touch Panel Framework

21.1 Introduction

The I2C Touch Panel Framework uses External IRQ (Channel 7) and SCI I2C as low level driver and Messaging Framework to deliver the Touch Events to the respective subscribers. This Developer Example explains how to configure I2C touch panel framework instance, External IRQ framework instance, low level I2C driver, and the Messaging Framework in order to get touch event information from the DKS7 board. This document will also give step by step instructions as how to invoke the Developer Example for I2C touch panel framework on a DKS7 board. I2C Touch Panel Configuration Step

STEP 1: Open configuration.xml file, select Touch Thread, go to Properties tab, enable the Touch Thread to auto start. Click “Generate Project Content” to update configuration file and Build the project again.

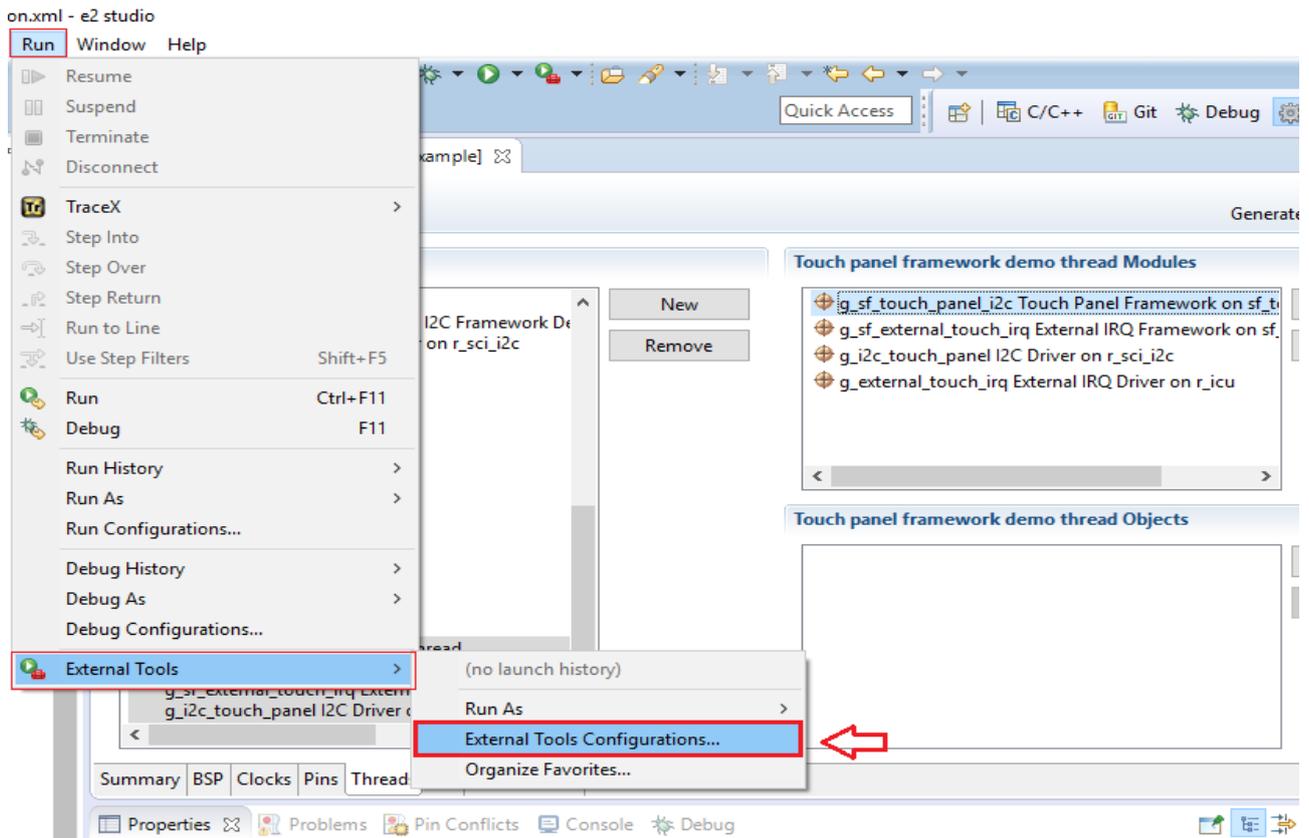
NOTE: To run the other I2C modules disable the “Auto start” thread.



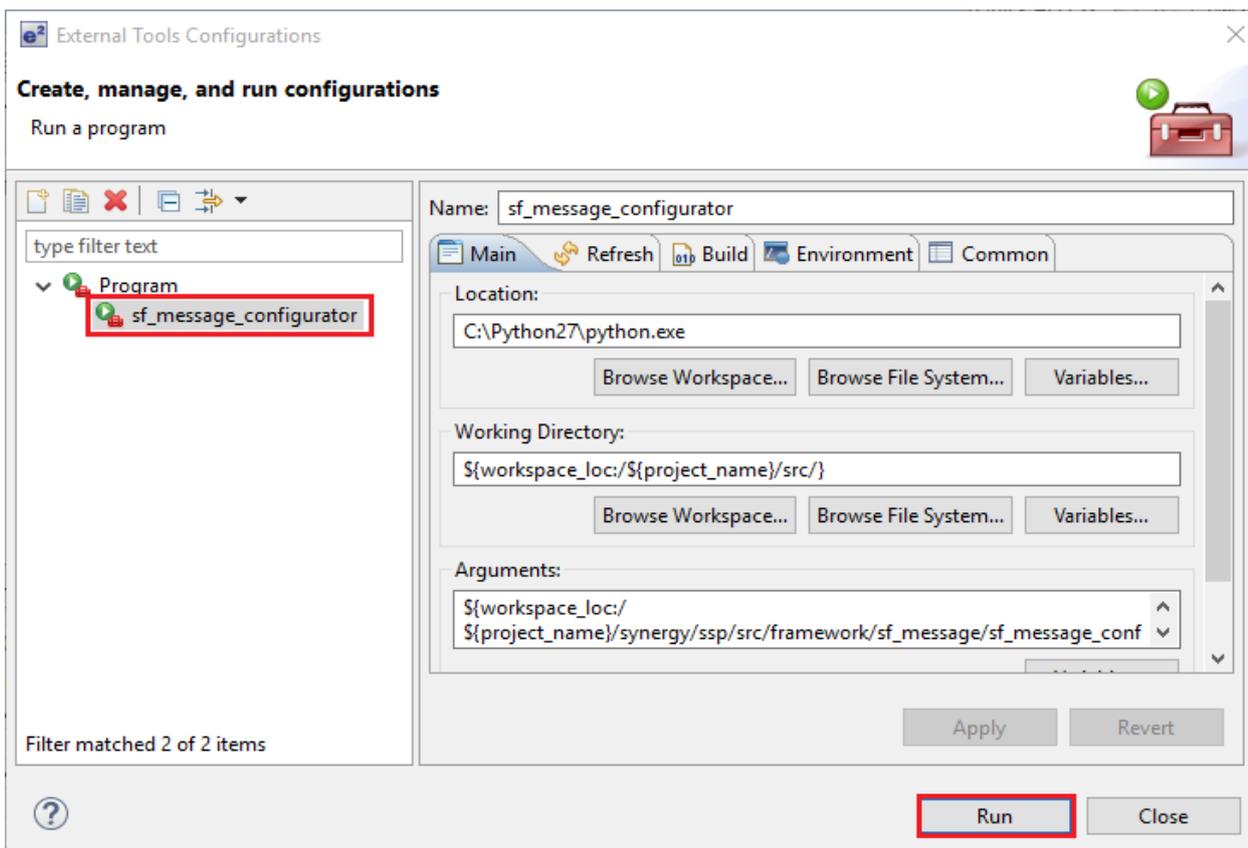
STEP 2: In Touch Thread go to Touch Thread Module section and select the I2C touch panel framework and do the following configuration as shown. Make sure the Touch Chip and Reset Pin configuration is same as in snapshot.

Property	Value
Common	
Parameter Checking	Default (BSP)
Module	
Name	g_sf_touch_panel_i2c
Touch Chip	g_sf_touch_panel_i2c_chip_sx8654
Messaging Framework Name	g_sf_message
Thread Priority	8
Hsize Pixels	800
Vsize Pixels	480
Update Hz	10
Reset Pin	IOPORT_PORT_07_PIN_11
Lower Level I2C API	SCI
Lower Level I2C Name	g_i2c_touch_panel
Lower Level External IRQ Framework API	SF_EXTERNAL_IRQ
Lower Level External IRQ Framework Name	g_sf_external_touch_irq

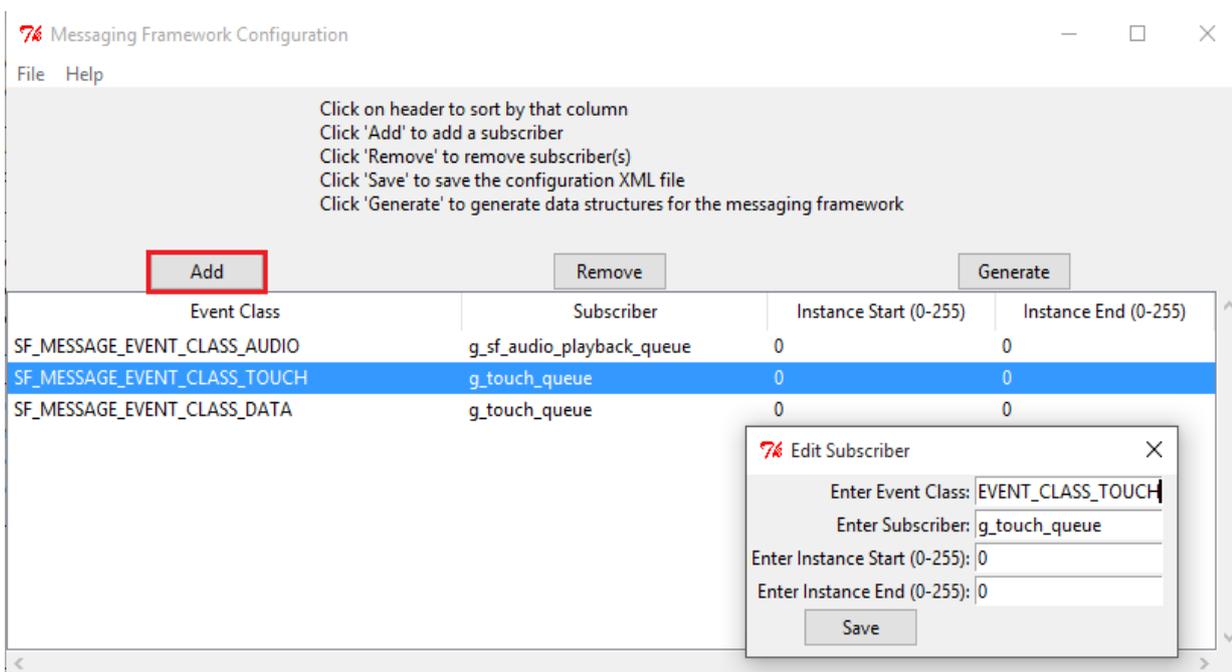
STEP 3: I2C Touch Framework require Messaging Framework to pass the touch event message. In order to configure that, go to the **Run menu ->External Tool->External Tool Configurations**.



The **External tools configuration window** displays. Select `sf_message_configurator` and click Run.



STEP 4: Click Add to configure the subscribers.



Event Class -> SF_MESSAGE_EVENT_CLASS_TOUCH

Subscriber -> g_touch_queue (queue created via configuration.xml).

Instance -> give zero for both start and stop.

Save and Generate; this will generate sf_message_cfg.c and sf_message_port.h file in Developer Example.

STEP 5: In configuration.xml file, select Touch Thread and go to External IRQ diver and make sure the following configuration is as shown in snapshot.

The screenshot shows the IDE configuration window with the 'Threads' tab selected. The 'Touch panel framework demo thread Modules' list includes:

- g_sf_touch_panel_i2c Touch Panel Framework on sf_t...
- g_sf_external_touch_irq External IRQ Framework on sf...
- g_i2c_touch_panel I2C Driver on r_sci_i2c
- g_external_touch_irq External IRQ Driver on r_icu

The 'Touch panel framework demo thread Objects' list is currently empty. Below the configuration tabs, the 'Properties' window is open, displaying the following table:

Property	Value
Common	
Parameter Checking	Default (BSP)
ICU	
ICU IRQ7	Priority 3
Module	
Name	g_external_touch_irq
Channel	7
Trigger	Falling
Digital Filtering	Enabled
Digital Filtering Sample Clock (Only valid when Digital Filtering is Enabled)	PCLK / 1
Interrupt enabled after initialization	True
Callback	NULL

STEP 6: Open the Pins tab under configuration.xml and configure the PORT_00_PIN_01 and PORT_07_PIN_11 as shown.

The screenshot shows the 'Pins' configuration window. The 'Pin Selection' tree on the left shows P001 selected. The 'Pin Configuration' panel on the right shows the following settings:

- Module name: P001
- Symbolic name: GPIO11
- Comment: TOUCH_IRQ
- P001 Configuration:
 - Mode: Input mode
 - IRQ: IRQ7_DS
- Chip input/output:
 - P001: GPIO

Pins Generate Project Content

Select pin configuration
R7F57G27H2A01CBD.pincfg

Pin Selection

type filter text

- ✓ P7
 - ✓ P700
 - ✓ P701
 - ✓ P702
 - ✓ P703
 - ✓ P704
 - ✓ P705
 - ✓ P706
 - ✓ P707
 - P708
 - P709
 - ✓ P711
 - P712
 - ✓ P713
- > P8
- > P9

Pin Configuration

Module name: P711
 Symbolic name: GPIO12
 Comment: TOUCH_RESET

P711 Configuration

Mode: Output mode
 Pull up: None
 Drive Capacity: Low
 Output type: CMOS

Chip input/output

P711: ✓ GPIO

Summary | BSP | Clocks | Pins | Threads | ICU | Components

STEP 7: Select i2c driver, and check the following configuration.

Threads

- I2C PCAL2 demo thread
 - g_sf_i2c_device_breakoutboard I2C Framework D...
 - g_i2c_breakoutboard I2C Driver on r_sci_i2c
- WDT HAL demo thread
- Thread monitor demo thread
- NetX comms demo thread
- Touch panel framework demo thread
 - g_sf_touch_panel_i2c Touch Panel Framework on...
 - g_sf_external_touch_irq External IRQ Framework o...
 - g_i2c_touch_panel I2C Driver on r_sci_i2c ...

Touch panel framework demo thread Modules

- g_sf_touch_panel_i2c Touch Panel Framework on sf...
- g_sf_external_touch_irq External IRQ Framework on sf...
- g_i2c_touch_panel I2C Driver on r_sci_i2c
- g_external_touch_irq External IRQ Driver on r_icu

Touch panel framework demo thread Objects

Empty object list with New > and Remove buttons.

Summary | BSP | Clocks | Pins | Threads | ICU | Components

Properties | Problems | Pin Conflicts | Console | Debug

Property	Value
Common	
Parameter Checking	Default (BSP)
ICU	
SCI7 RXI	Priority 5
SCI7 TXI	Priority 5
SCI7 TEI	Priority 5
SCI7 ERI	Priority 5
Module	
Name	g_i2c_touch_panel
Channel	7
Rate	Standard
Slave Address	0x48
Address Mode	7-Bit
Callback	NULL

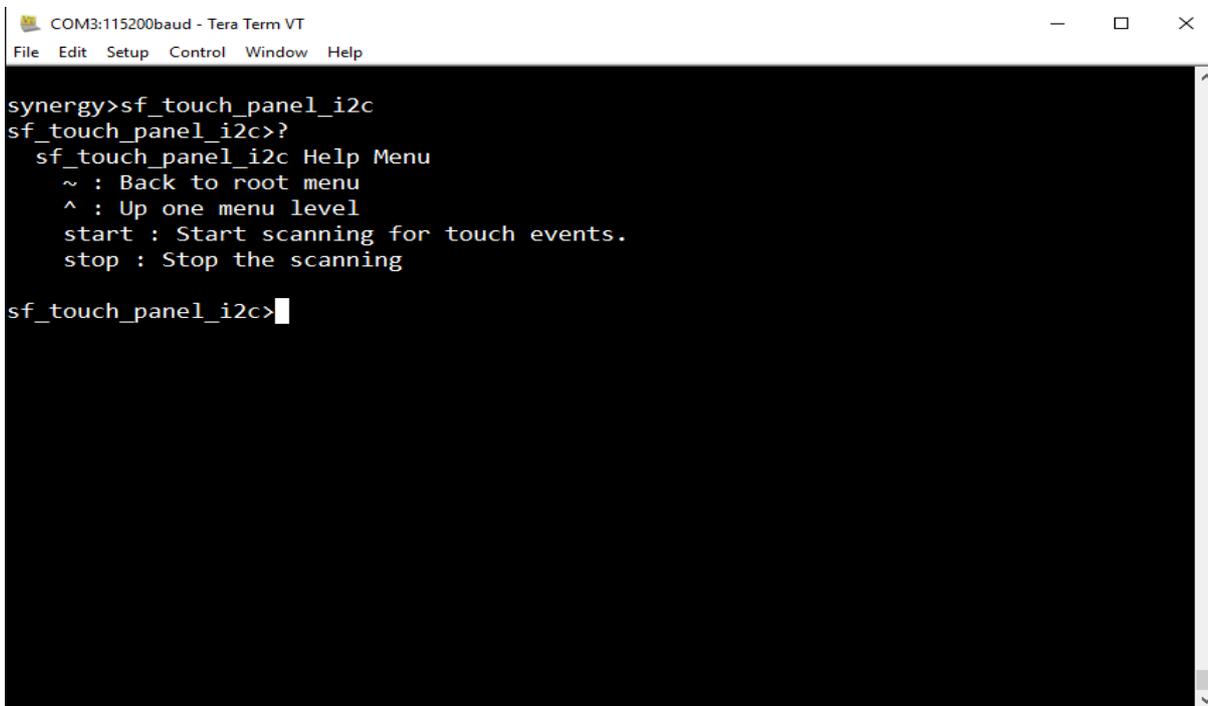
NOTE: The address of i2c touch device ic is 0x48.

21.2 Run the I2C Touch Panel Framework application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the I2C Touch Panel Framework application, follow these steps:

STEP 1: type `sf_touch_panel_i2c` in terminal and press Enter to access the I2C Touch Panel framework sub-menu. For Help, type "?" and press Enter.

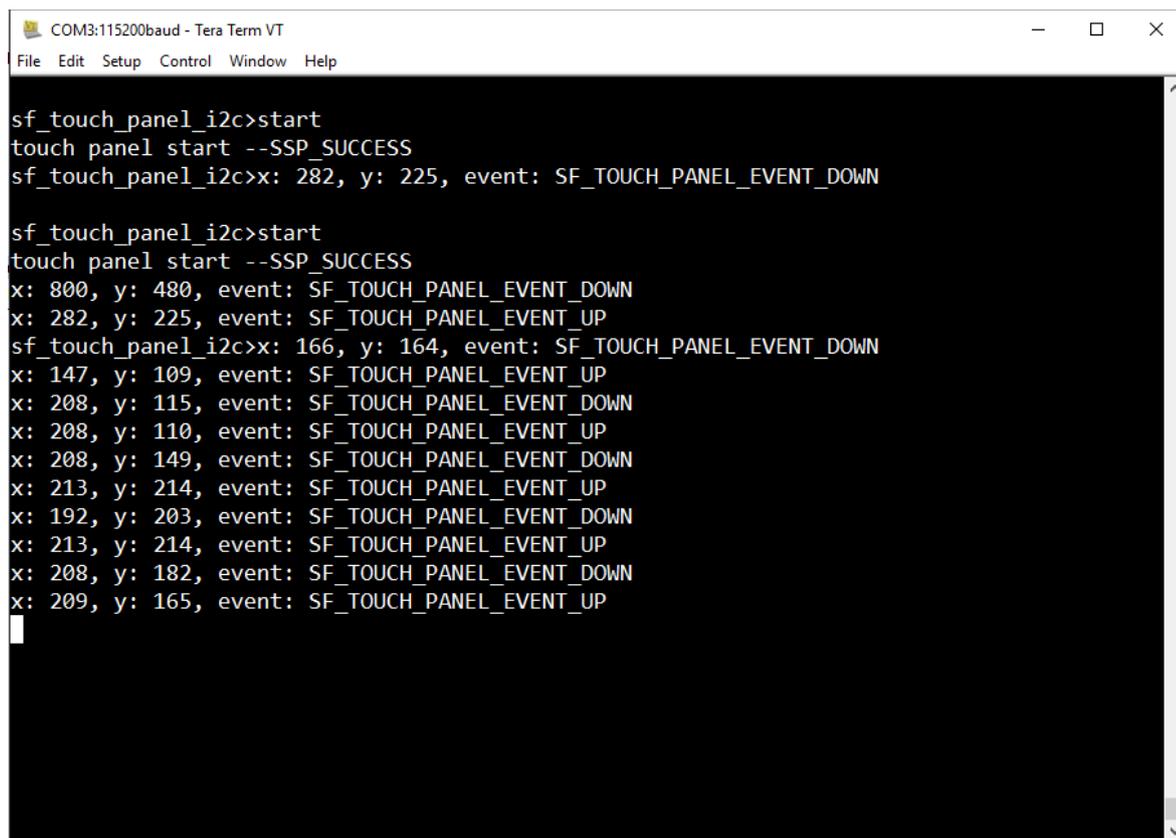


```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
synergy>sf_touch_panel_i2c
sf_touch_panel_i2c>?
sf_touch_panel_i2c Help Menu
~ : Back to root menu
^ : Up one menu level
start : Start scanning for touch events.
stop : Stop the scanning

sf_touch_panel_i2c>|
```

STEP 2: Enter the `start` command and touch the Touch Panel.

NOTE: For the `sf_touchpanel_I2C` framework to work properly there should be a touch event between `stop` and `start` command, for example, `stop →<touch>→ start`. However `start →<touch>→ start` is a valid combination and would cause the touch event to be generated. This is how the framework is implemented by the SSP and it is not a limitation of the Developer Example.

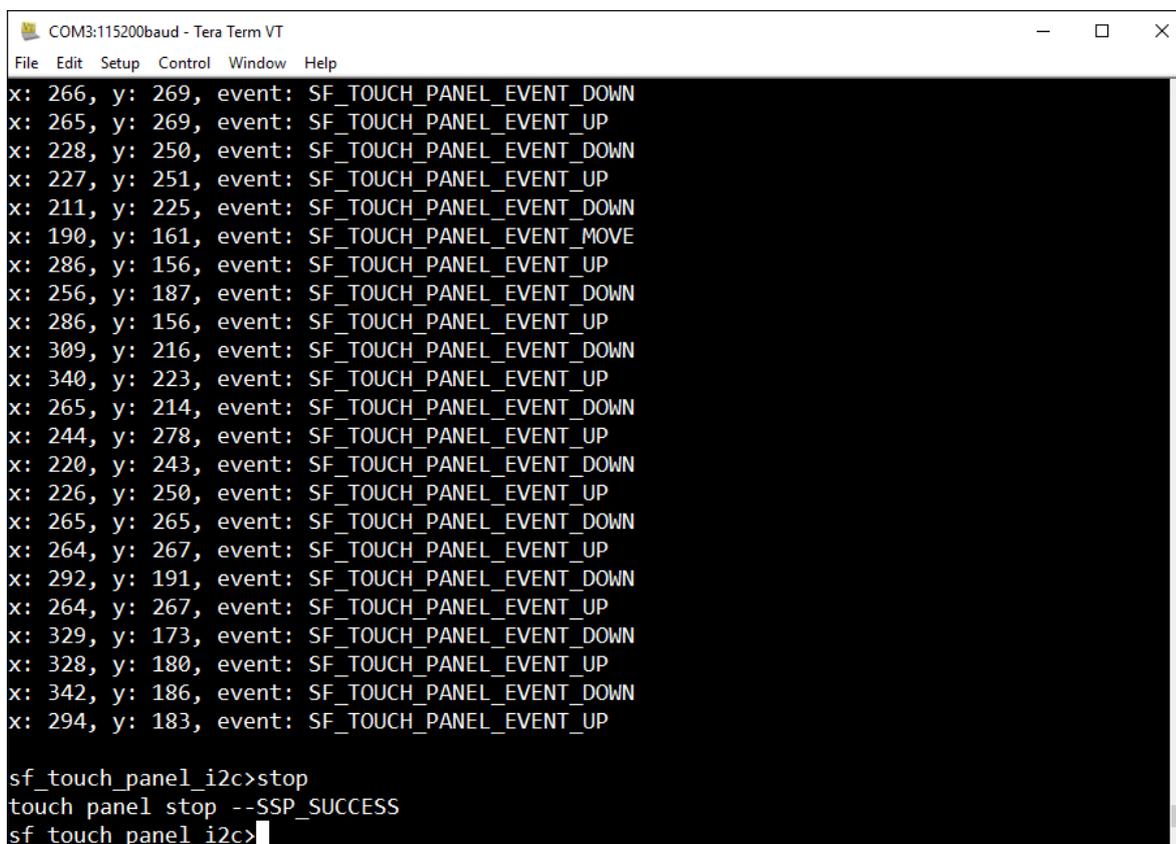


A screenshot of a terminal window titled "COM3:115200baud - Tera Term VT". The window contains the following text:

```
sf_touch_panel_i2c>start
touch panel start --SSP_SUCCESS
sf_touch_panel_i2c>x: 282, y: 225, event: SF_TOUCH_PANEL_EVENT_DOWN

sf_touch_panel_i2c>start
touch panel start --SSP_SUCCESS
x: 800, y: 480, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 282, y: 225, event: SF_TOUCH_PANEL_EVENT_UP
sf_touch_panel_i2c>x: 166, y: 164, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 147, y: 109, event: SF_TOUCH_PANEL_EVENT_UP
x: 208, y: 115, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 208, y: 110, event: SF_TOUCH_PANEL_EVENT_UP
x: 208, y: 149, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 213, y: 214, event: SF_TOUCH_PANEL_EVENT_UP
x: 192, y: 203, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 213, y: 214, event: SF_TOUCH_PANEL_EVENT_UP
x: 208, y: 182, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 209, y: 165, event: SF_TOUCH_PANEL_EVENT_UP
```

STEP 3: In order to stop touch sensing enter the Stop command.



A screenshot of a terminal window titled "COM3:115200baud - Tera Term VT". The window contains the following text:

```
x: 266, y: 269, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 265, y: 269, event: SF_TOUCH_PANEL_EVENT_UP
x: 228, y: 250, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 227, y: 251, event: SF_TOUCH_PANEL_EVENT_UP
x: 211, y: 225, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 190, y: 161, event: SF_TOUCH_PANEL_EVENT_MOVE
x: 286, y: 156, event: SF_TOUCH_PANEL_EVENT_UP
x: 256, y: 187, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 286, y: 156, event: SF_TOUCH_PANEL_EVENT_UP
x: 309, y: 216, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 340, y: 223, event: SF_TOUCH_PANEL_EVENT_UP
x: 265, y: 214, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 244, y: 278, event: SF_TOUCH_PANEL_EVENT_UP
x: 220, y: 243, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 226, y: 250, event: SF_TOUCH_PANEL_EVENT_UP
x: 265, y: 265, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 264, y: 267, event: SF_TOUCH_PANEL_EVENT_UP
x: 292, y: 191, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 264, y: 267, event: SF_TOUCH_PANEL_EVENT_UP
x: 329, y: 173, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 328, y: 180, event: SF_TOUCH_PANEL_EVENT_UP
x: 342, y: 186, event: SF_TOUCH_PANEL_EVENT_DOWN
x: 294, y: 183, event: SF_TOUCH_PANEL_EVENT_UP

sf_touch_panel_i2c>stop
touch panel stop --SSP_SUCCESS
sf_touch_panel_i2c>
```

22. Developer Example: FMI HAL driver

22.1 Introduction

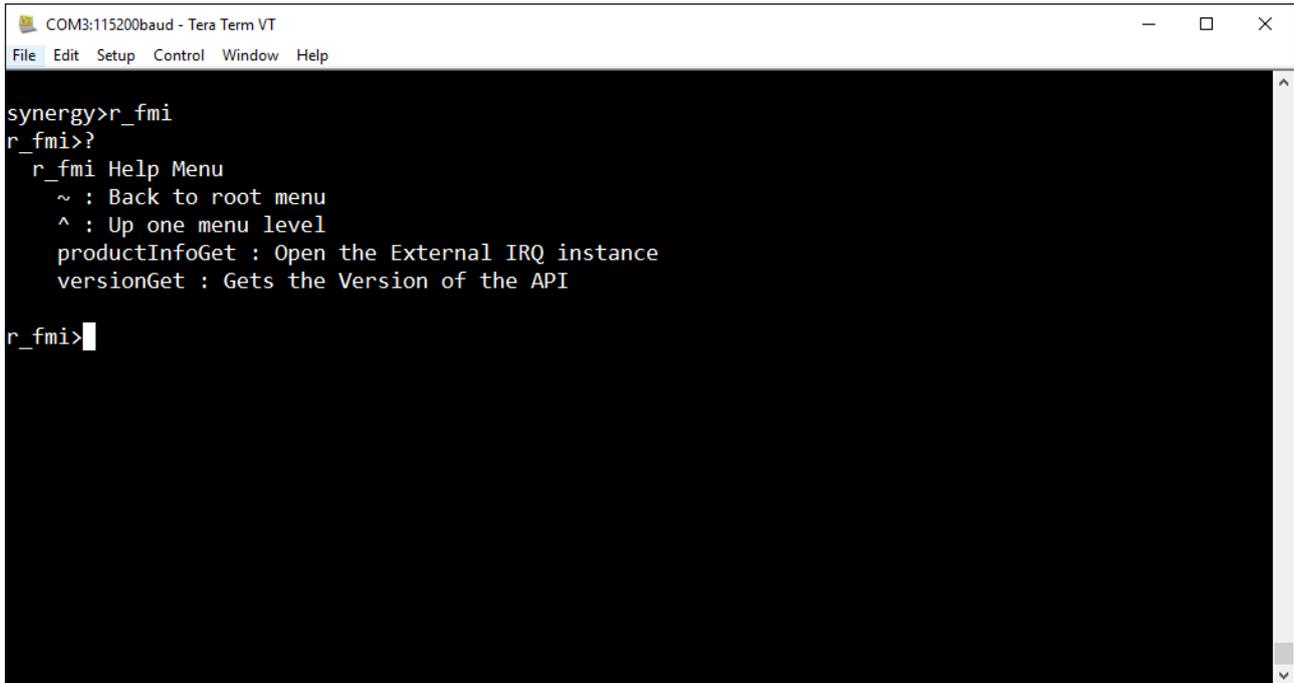
The FMI HAL Interface is a generic API for reading records from the Factory MCU Information flash table. The Developer Example demonstrates the FMI HAL by displaying the MCU information onto the console.

22.2 Run the FMI HAL Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the FMI HAL driver application, follow these steps:

STEP 1: Type `r_fmi` in the terminal and press Enter to access the FMI HAL submenu. For help, type `?` and press Enter.

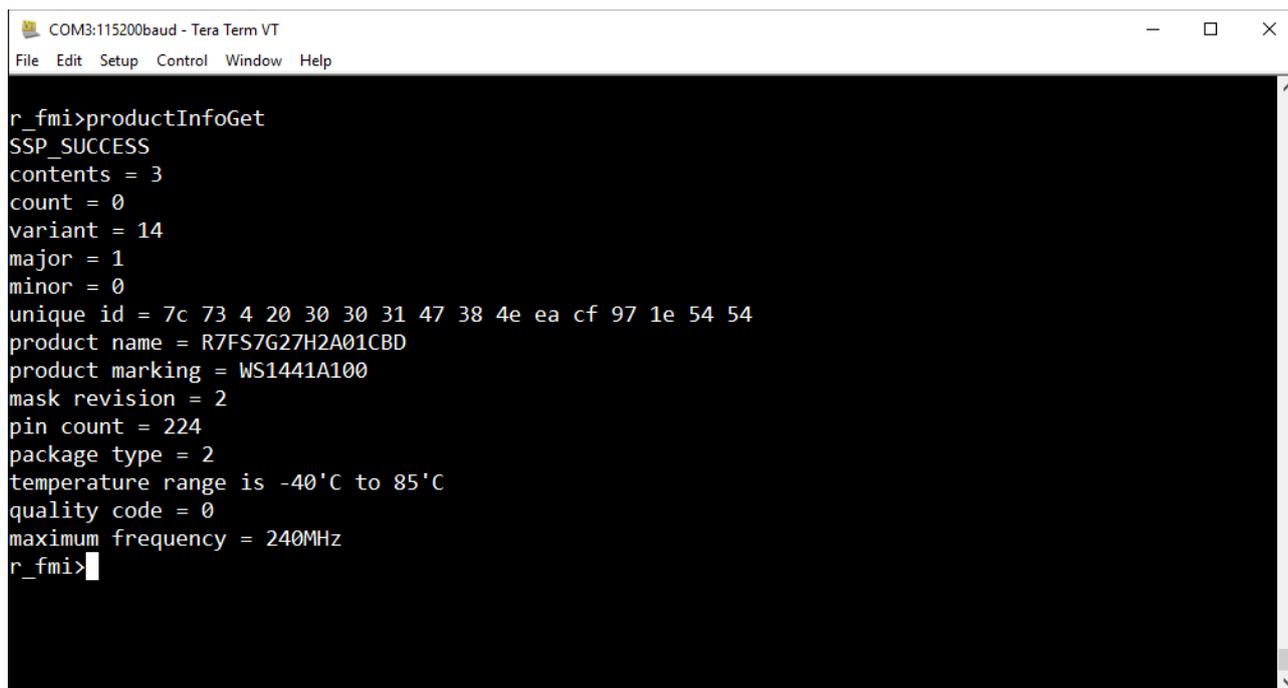


```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>r_fmi
r_fmi>?
r_fmi Help Menu
~ : Back to root menu
^ : Up one menu level
productInfoGet : Open the External IRQ instance
versionGet : Gets the Version of the API

r_fmi>
```

STEP 2: Type `productInfoGet` command to get the details of the device.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_fmi>productInfoGet
SSP_SUCCESS
contents = 3
count = 0
variant = 14
major = 1
minor = 0
unique id = 7c 73 4 20 30 30 31 47 38 4e ea cf 97 1e 54 54
product name = R7FS7G27H2A01CBD
product marking = WS1441A100
mask revision = 2
pin count = 224
package type = 2
temperature range is -40'C to 85'C
quality code = 0
maximum frequency = 240MHz
r_fmi>
```

23. Developer Example: LPM HAL driver

23.1 Introduction

The Developer Example demonstrates the LPM HAL driver APIs. LPM module is used to put device to sleep, software standby and deep software standby mode. It is also possible to stop or start any module.

23.2 Run the LPM HAL driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the LPM HAL driver application, follow these steps:

STEP 1: Type `r_lpm` in the terminal and press Enter to access the LPMHAL submenu. For help, type `?` and press Enter.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
synergy>r_lpm
r_lpm>?
r_lpm Help Menu
~ : Back to root menu
^ : Up one menu level
init : Open the LPM driver module Initialized the LPM
mstpcrSet : Set value of MSTPCRs
    Synopsis:- mstpcrSet modA# modB# modC# modD#
mstpcrGet : Get the values of all the Module Stop Control Registers
moduleStop : Stop a module
moduleStart : Run a module
operatingPowerModeSet : Set power mode
    Synopsis:- operatingPowerModeSet mode#(0-3) subosc#(0-1)
snoozeEnable : Config & enable snooze
    Synopsis:- snoozeEnable rxd# dtc# request# trigger#
snoozeDisable : Disable snooze mode
lowPowerCfg : Config low power mode
    Synopsis:- lowPowerCfg mode# enable# power# port#
wupenSet : Set value of WakeUp Interrupt Enable Register
    Synopsis:- wupenSet value#
wupenGet : Get the value of WakeUp Interrupt Enable Register
deepStandbyCancelRequestEnable : Enable Deep Standby
    Synopsis:- deepStandbyCancelRequestEnable pin# edge#
deepStandbyCancelRequestDisable : Disable Deep Standby
    Synopsis:- deepStandbyCancelRequestDisable pin#
enterLowPowerMode : Enter low power mode
versionGet : Get the driver version based on compile time macros

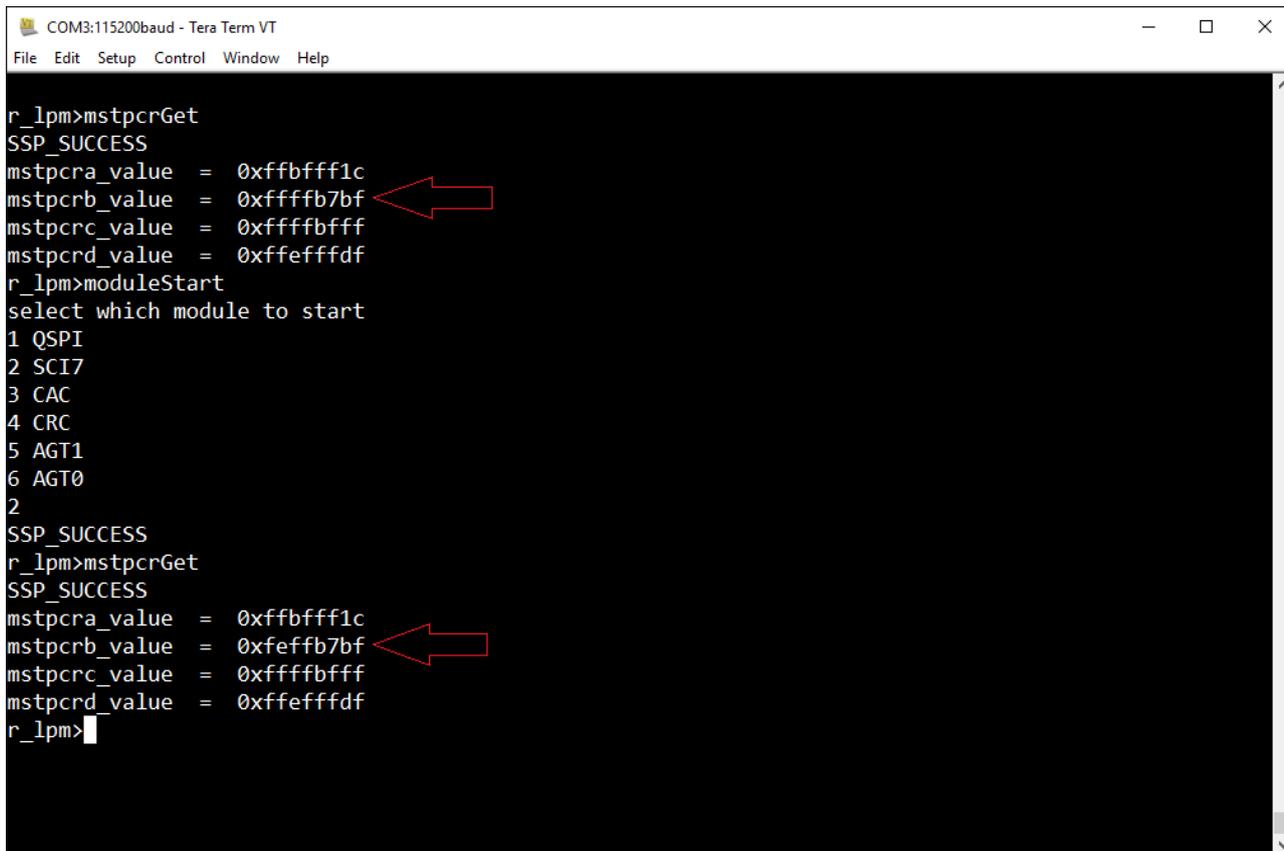
r_lpm>
    
```

STEP 2: To stop a module type `moduleStop` command. To validate we can use `mstpcrGet` command before and after executing `moduleStop` command. In the below picture SCI7 is stopped, which can be noticed by the value in the `mstpcrb` value. For example, `mstpcrb` value before stopping SCI7 was `0xfeffb7bf` and after stopping SCI7 is `0xffffb7bf`

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_lpm>mstpcrGet
SSP_SUCCESS
mstpcra_value = 0xffbfff1c
mstpcrb_value = 0xfeffb7bf
mstpcrc_value = 0xffffbfff
mstpcrd_value = 0xffefffd
r_lpm>moduleStop
select which module to stop
1 QSPI
2 SCI7
3 CAC
4 CRC
5 AGT1
6 AGT0
2
SSP_SUCCESS
r_lpm>mstpcrGet
SSP_SUCCESS
mstpcra_value = 0xffbfff1c
mstpcrb_value = 0xffffb7bf
mstpcrc_value = 0xffffbfff
mstpcrd_value = 0xffefffd
r_lpm>
    
```

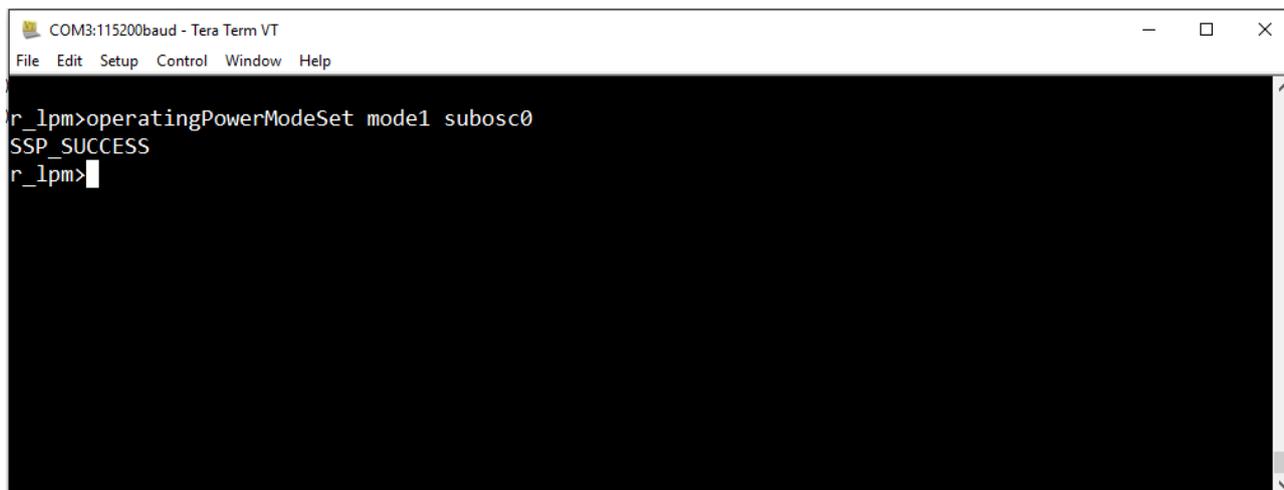
STEP 3: To stop a module type `moduleStart` command. To validate you can use `mstpcrGet` command before and after executing `moduleStart` command. In the below picture SCI7 is started, which can be noticed by the value in the `mstpcrb` value. For example, `mstpcrb` value before starting SCI7 was `0xffffb7bf` and after starting SCI7 is `0xfeffb7bf`.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_lpm>mstpcrGet
SSP_SUCCESS
mstpcra_value = 0xffbfff1c
mstpcrb_value = 0xffffb7bf
mstpcrc_value = 0xffffbfff
mstpcrd_value = 0xffefffd
r_lpm>moduleStart
select which module to start
1 QSPI
2 SCI7
3 CAC
4 CRC
5 AGT1
6 AGT0
2
SSP_SUCCESS
r_lpm>mstpcrGet
SSP_SUCCESS
mstpcra_value = 0xffbfff1c
mstpcrb_value = 0xfeffb7bf
mstpcrc_value = 0xffffbfff
mstpcrd_value = 0xffefffd
r_lpm>
```

STEP 4: To set operating mode type `operatingPowerModeSet` command.

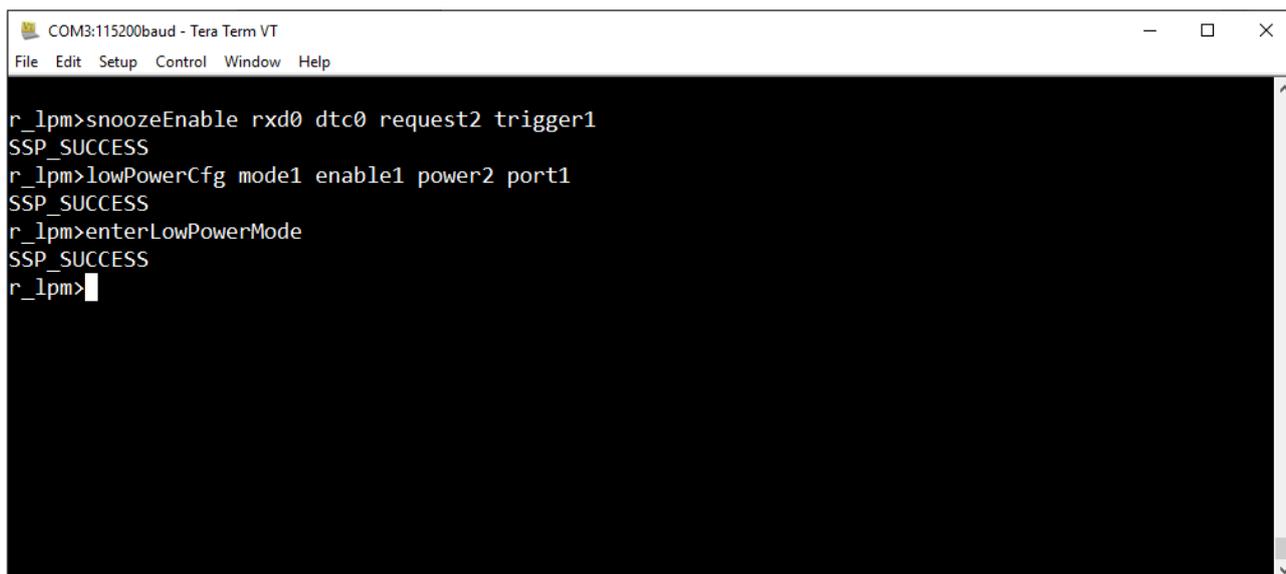


```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_lpm>operatingPowerModeSet mode1 subosc0
SSP_SUCCESS
r_lpm>
```

STEP 5: To snooze an interrupt in a low power mode execute following commands sequentially.

1. `snoozeEnable`
2. `lowPowerCfg`
3. `enterLowPowerMode`



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_lpm>snoozeEnable rxd0 dtc0 request2 trigger1
SSP_SUCCESS
r_lpm>lowPowerCfg mode1 enable1 power2 port1
SSP_SUCCESS
r_lpm>enterLowPowerMode
SSP_SUCCESS
r_lpm>
```

NOTE:

- `moduleStart` and `moduleStop` command allows only QSPI, SCI7, CAC, CRC, AGT1 and AGT0 modules to start and stop respectively. This is not the limitation of SSP.
- If SRAM is put to sleep it resets board and if USBFS is put to sleep it blocks the console so Developer Example restricts user to put certain modules like SRAM and USBFS into sleep.
- To set the device into the low power mode, user needs to run `lowPowerCfg` command followed by `enterLowPowerMode` command.

24. Developer Example: External IRQ Framework

24.1 Introduction

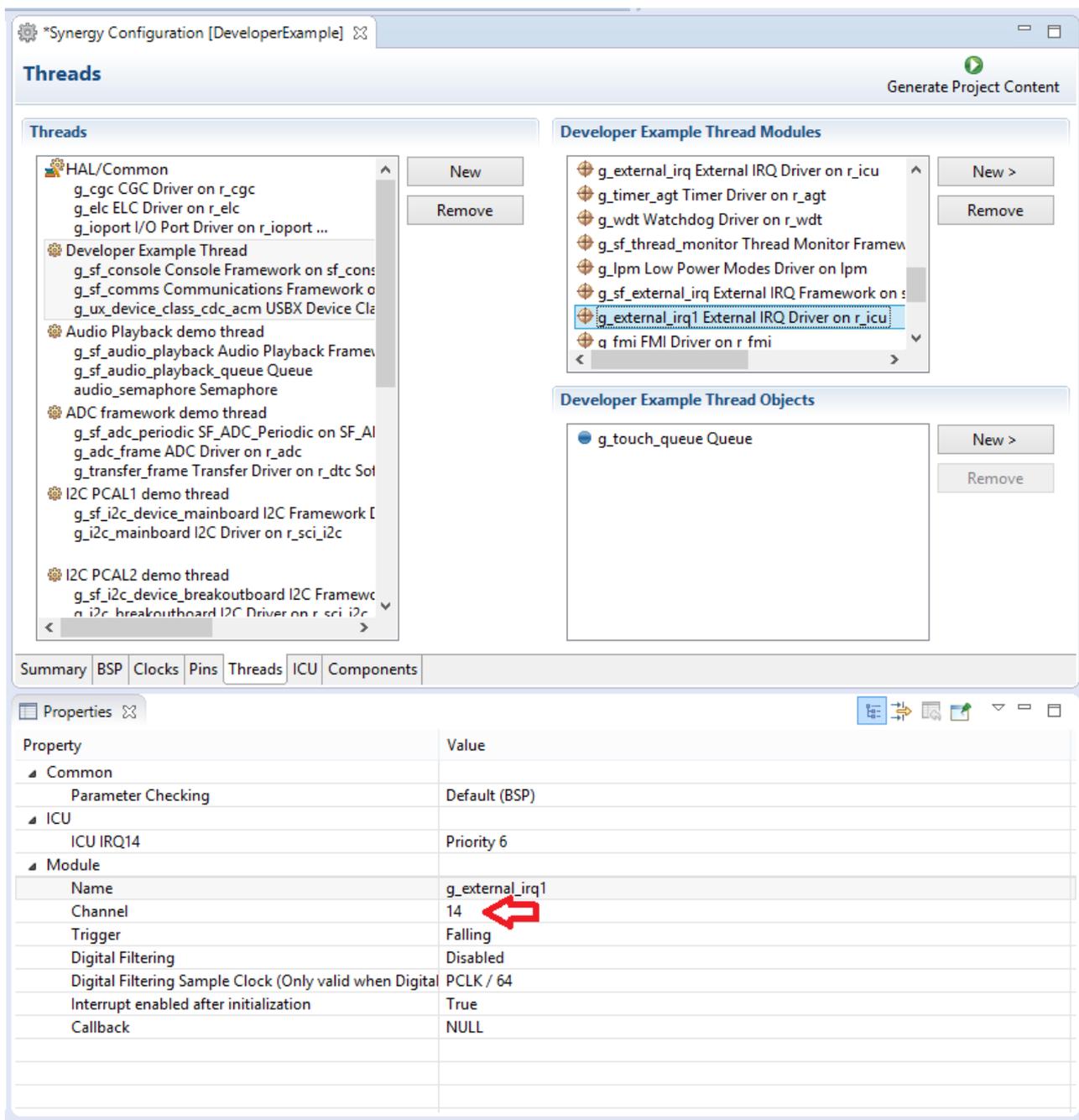
The External IRQ Framework uses External IRQ HAL module as a low level driver and waits for the user to give an external interrupt. In Developer Example, switch S2 is configured as a source of external IRQ. When the `wait` command is executed, the thread waits for an external IRQ, which can be given by pressing switch S2. The External IRQ Framework is integrated to CLI in Developer example from which all the APIs of External IRQ can be exercised.

24.2 Run the External IRQ Framework application

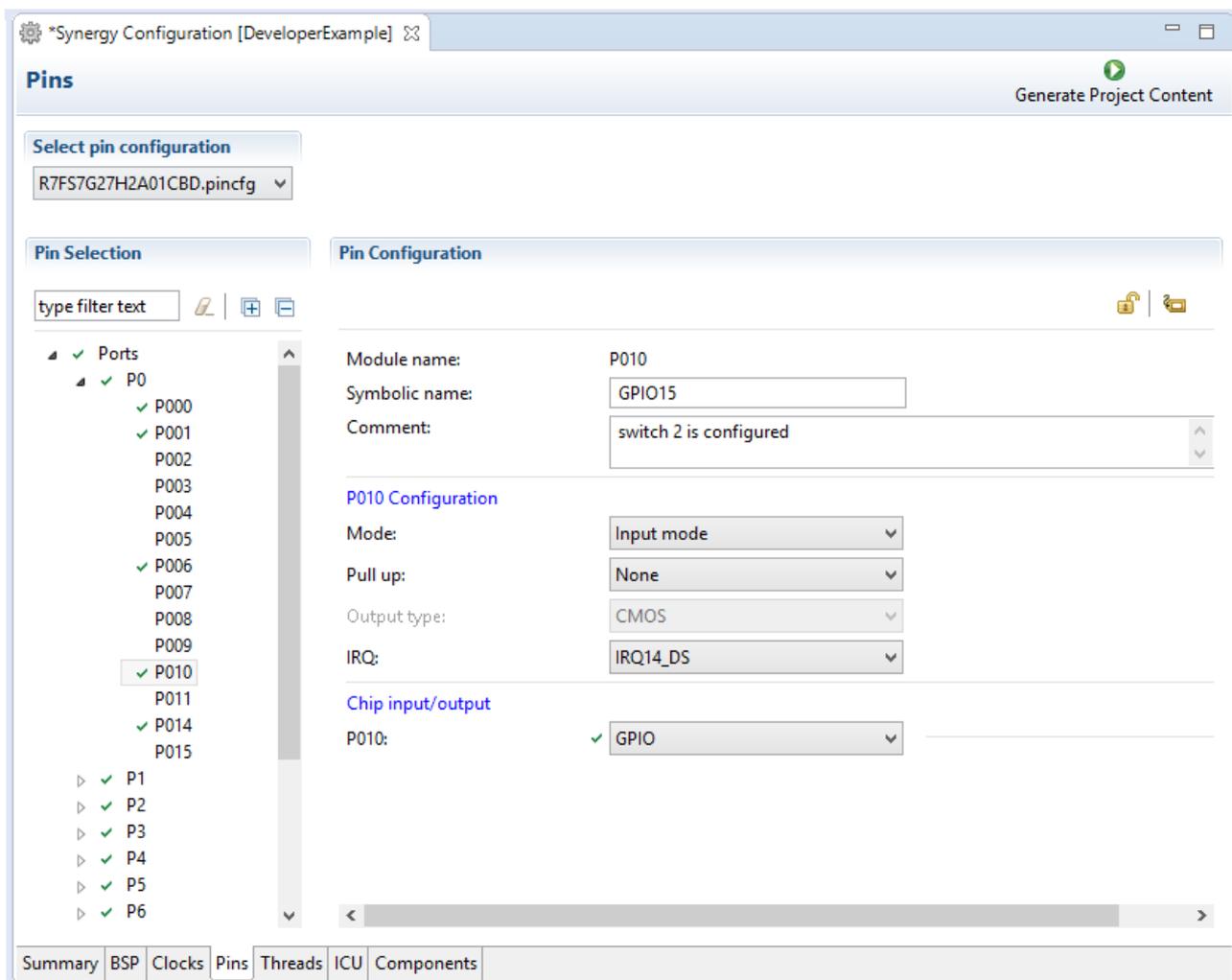
The following are the steps to configure switch S2 for an External IRQ HAL driver.

NOTE: In S7G2-DK V2.2 switch S2 is connected to P0_10 with IRQ channel 14.

The screen shot below shows the property of an external IRQ HAL module mapped to external IRQ framework.



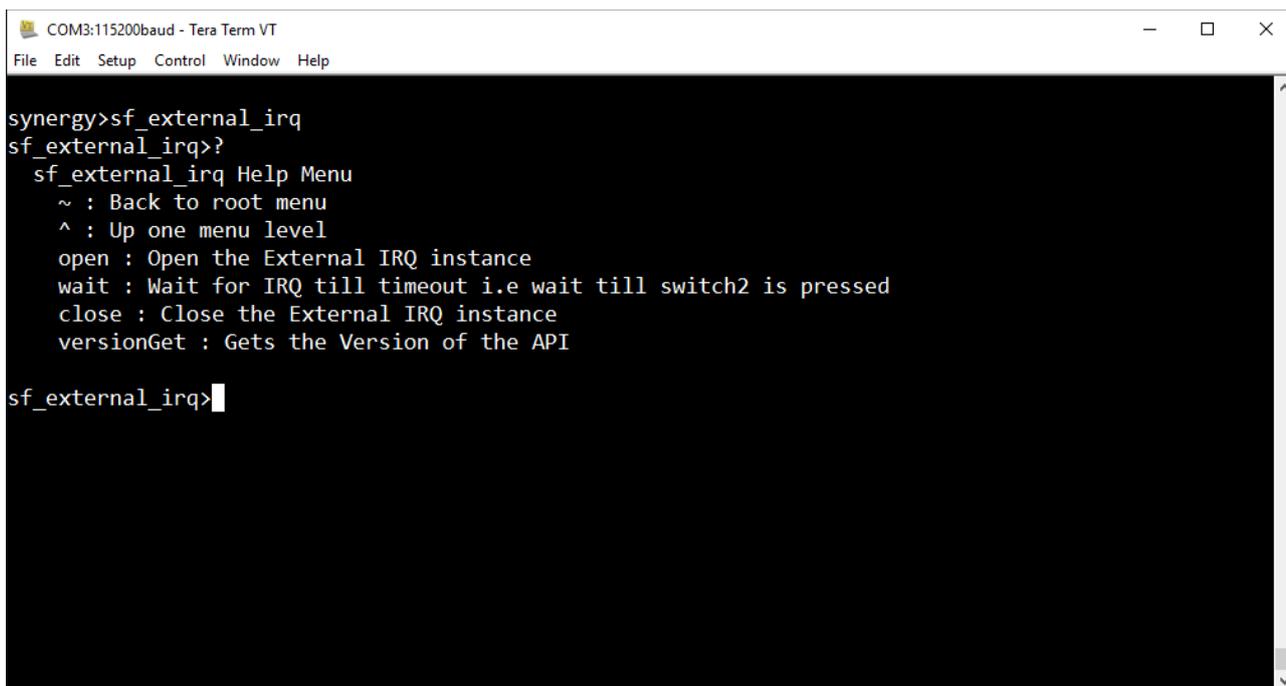
The screen shot below shows the pin configuration made for switch S2.



Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the External IRQ Framework application, follow these steps:

STEP 1: Type `sf_external_irq` in the terminal and press Enter to access the External IRQ Framework submenu. For help, type `?` and press Enter.

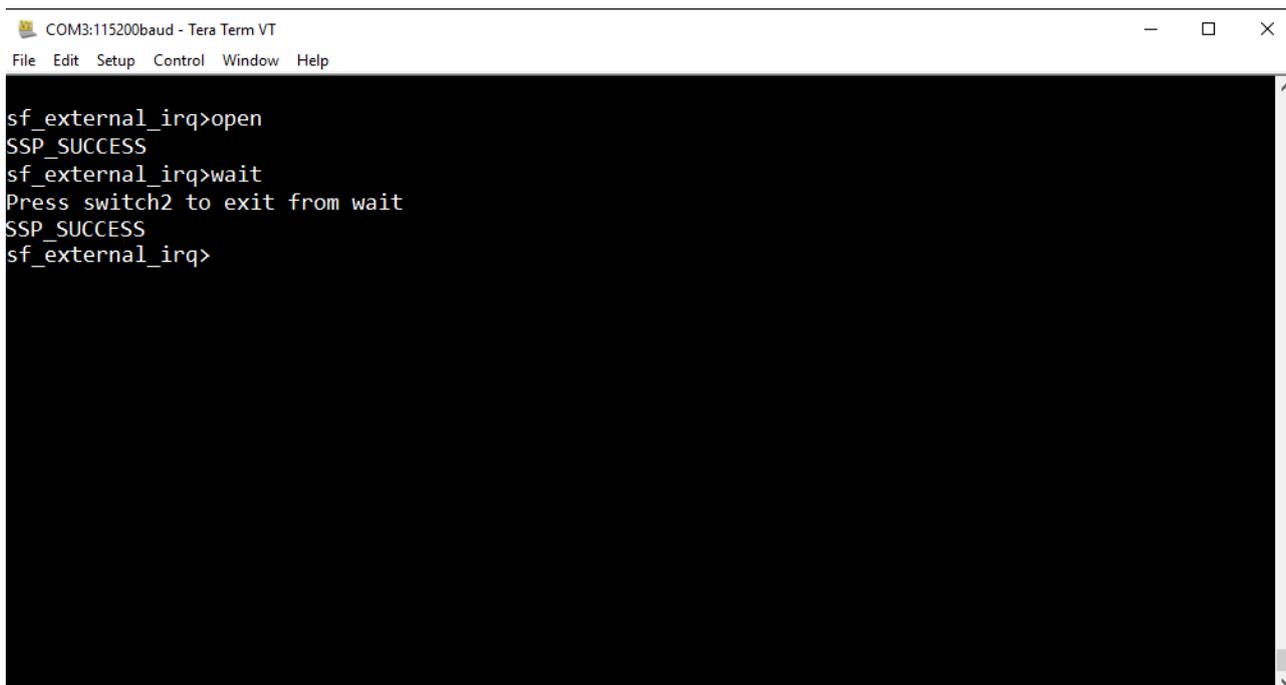


```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>sf_external_irq
sf_external_irq>?
  sf_external_irq Help Menu
  ~ : Back to root menu
  ^ : Up one menu level
  open : Open the External IRQ instance
  wait : Wait for IRQ till timeout i.e wait till switch2 is pressed
  close : Close the External IRQ instance
  versionGet : Gets the Version of the API

sf_external_irq>
```

STEP 2: To wait for an external IRQevent, type `open` command followed by the `wait` command. Once the `wait` command is executed a message is displayed on console and LED1 turns ON indicating it is waiting for external input. Press switch S2 to generate external interrupt.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_external_irq>open
SSP_SUCCESS
sf_external_irq>wait
Press switch2 to exit from wait
SSP_SUCCESS
sf_external_irq>
```

25. Developer Example: IOPort HAL driver

25.1 Introduction

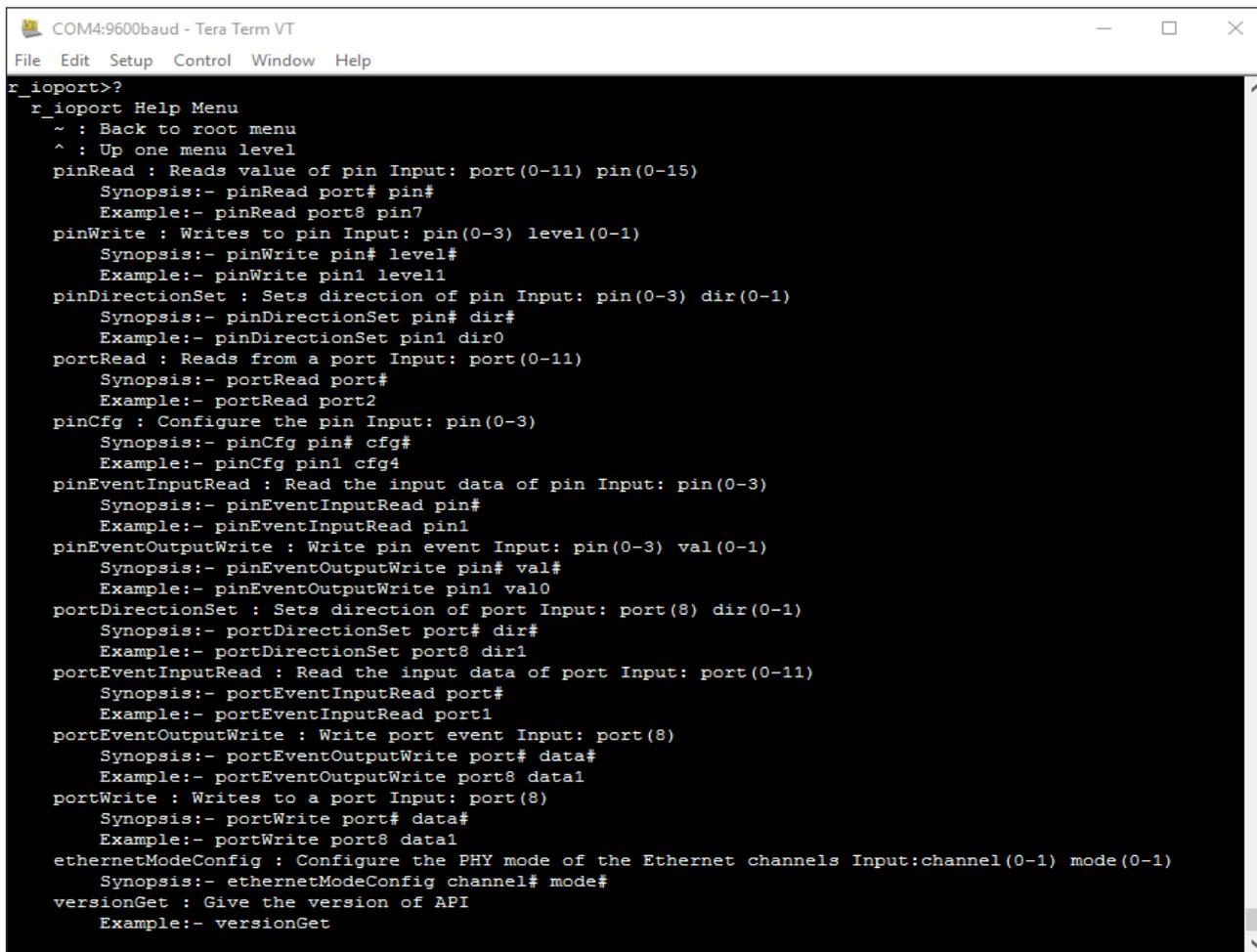
IOPort HAL Developer Example will demonstrate IOPorts HAL module and exercises the API's of IOPort HAL. This Developer Example uses only 4 pins of port8 (Pin7,8,9,10) to demonstrate the IO functionality and Exercising the HAL API's of IOPort module. Other pins are mapped to different peripherals and hence not used.

25.2 Run the IOPort HAL Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

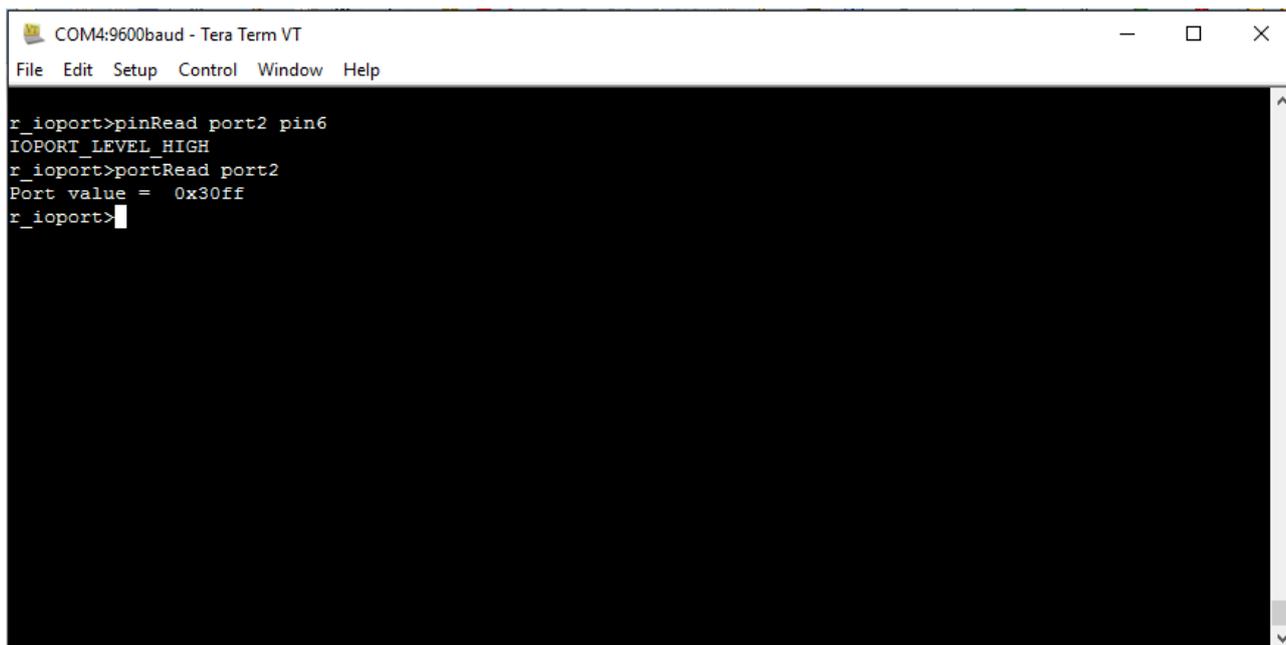
To run the HAL IOPort driver application, follow these steps:

STEP 1: Type `r_ioport` in terminal and press Enter to access the `r_ioportsub` menu. For help, type `?` and press Enter.



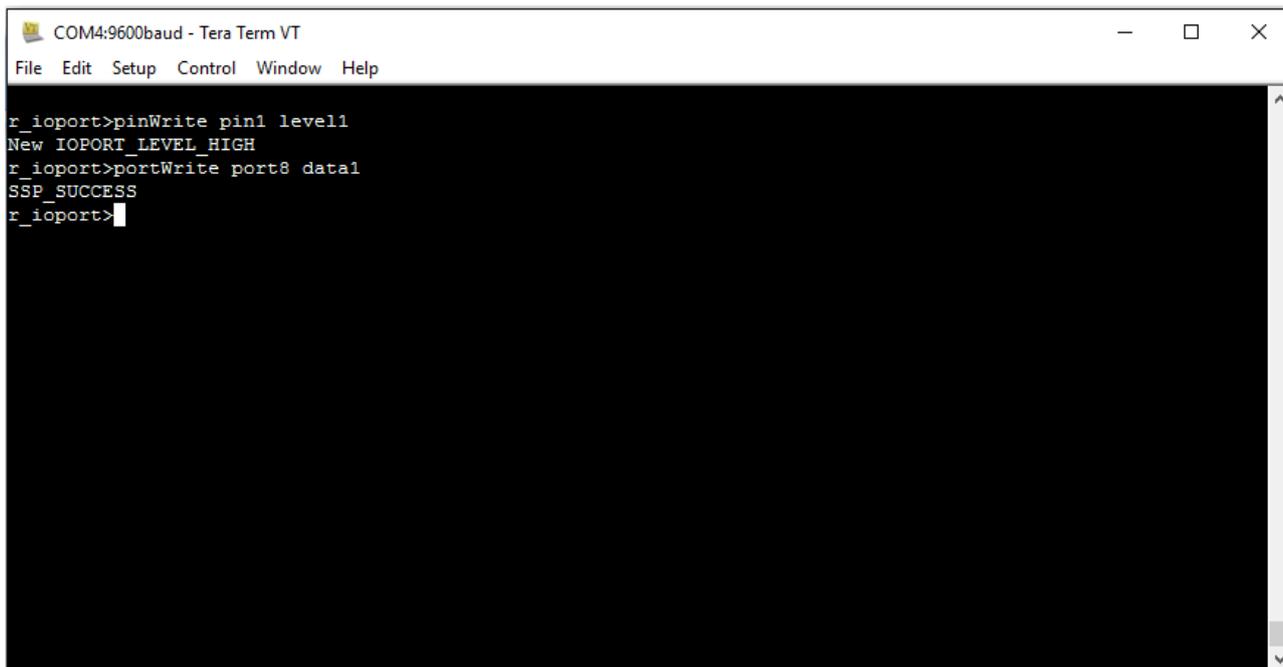
```
COM4:9600baud - Tera Term VT
File Edit Setup Control Window Help
r_ioport>?
r_ioport Help Menu
~ : Back to root menu
^ : Up one menu level
pinRead : Reads value of pin Input: port(0-11) pin(0-15)
Synopsis:- pinRead port# pin#
Example:- pinRead port8 pin7
pinWrite : Writes to pin Input: pin(0-3) level(0-1)
Synopsis:- pinWrite pin# level#
Example:- pinWrite pin1 level1
pinDirectionSet : Sets direction of pin Input: pin(0-3) dir(0-1)
Synopsis:- pinDirectionSet pin# dir#
Example:- pinDirectionSet pin1 dir0
portRead : Reads from a port Input: port(0-11)
Synopsis:- portRead port#
Example:- portRead port2
pinCfg : Configure the pin Input: pin(0-3)
Synopsis:- pinCfg pin# cfg#
Example:- pinCfg pin1 cfg4
pinEventInputRead : Read the input data of pin Input: pin(0-3)
Synopsis:- pinEventInputRead pin#
Example:- pinEventInputRead pin1
pinEventOutputWrite : Write pin event Input: pin(0-3) val(0-1)
Synopsis:- pinEventOutputWrite pin# val#
Example:- pinEventOutputWrite pin1 val0
portDirectionSet : Sets direction of port Input: port(8) dir(0-1)
Synopsis:- portDirectionSet port# dir#
Example:- portDirectionSet port8 dir1
portEventInputRead : Read the input data of port Input: port(0-11)
Synopsis:- portEventInputRead port#
Example:- portEventInputRead port1
portEventOutputWrite : Write port event Input: port(8)
Synopsis:- portEventOutputWrite port# data#
Example:- portEventOutputWrite port8 data1
portWrite : Writes to a port Input: port(8)
Synopsis:- portWrite port# data#
Example:- portWrite port8 data1
ethernetModeConfig : Configure the PHY mode of the Ethernet channels Input:channel(0-1) mode(0-1)
Synopsis:- ethernetModeConfig channel# mode#
versionGet : Give the version of API
Example:- versionGet
```

STEP 2: Type `pinRead` or `portRead` command it will display selected pin or port value in terminal.



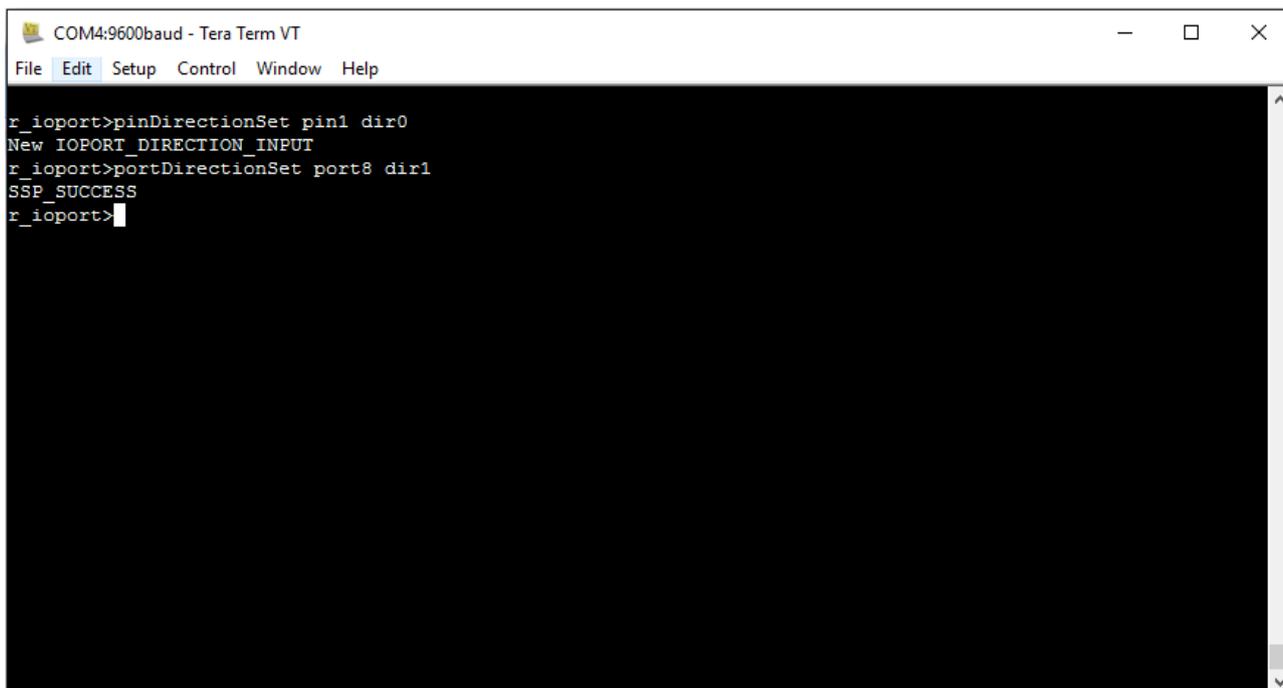
```
COM4:9600baud - Tera Term VT
File Edit Setup Control Window Help
r_ioport>pinRead port2 pin6
IOPORT LEVEL HIGH
r_ioport>portRead port2
Port value = 0x30ff
r_ioport>
```

STEP 3: Type `pinWrite` or `portWrite` command to update a value to the specific pin or port.



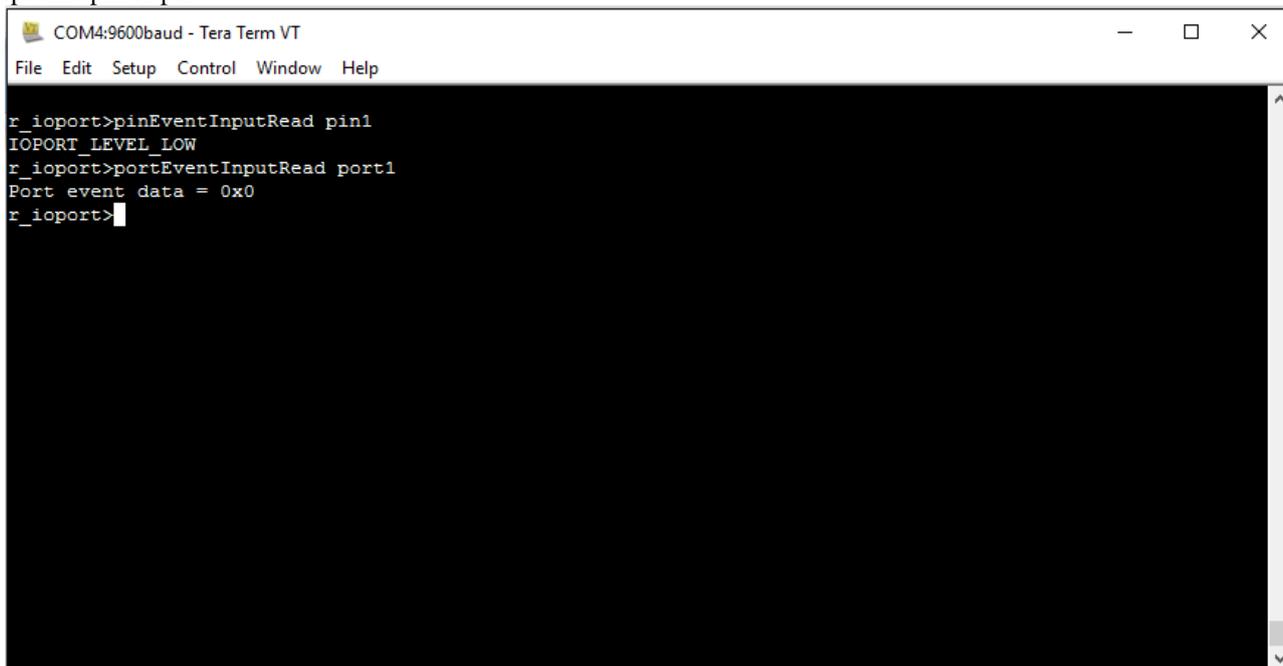
```
COM4:9600baud - Tera Term VT
File Edit Setup Control Window Help
r_ioport>pinWrite pin1 level1
New IOPORT_LEVEL_HIGH
r_ioport>portWrite port8 data1
SSP_SUCCESS
r_ioport>
```

STEP 4: Type `pinDirectionSet` or `portDirectionSet` command to set direction of particular pin or port.



```
COM4:9600baud - Tera Term VT
File Edit Setup Control Window Help
r_ioport>pinDirectionSet pin1 dir0
New IOPORT_DIRECTION_INPUT
r_ioport>portDirectionSet port8 dir1
SSP_SUCCESS
r_ioport>
```

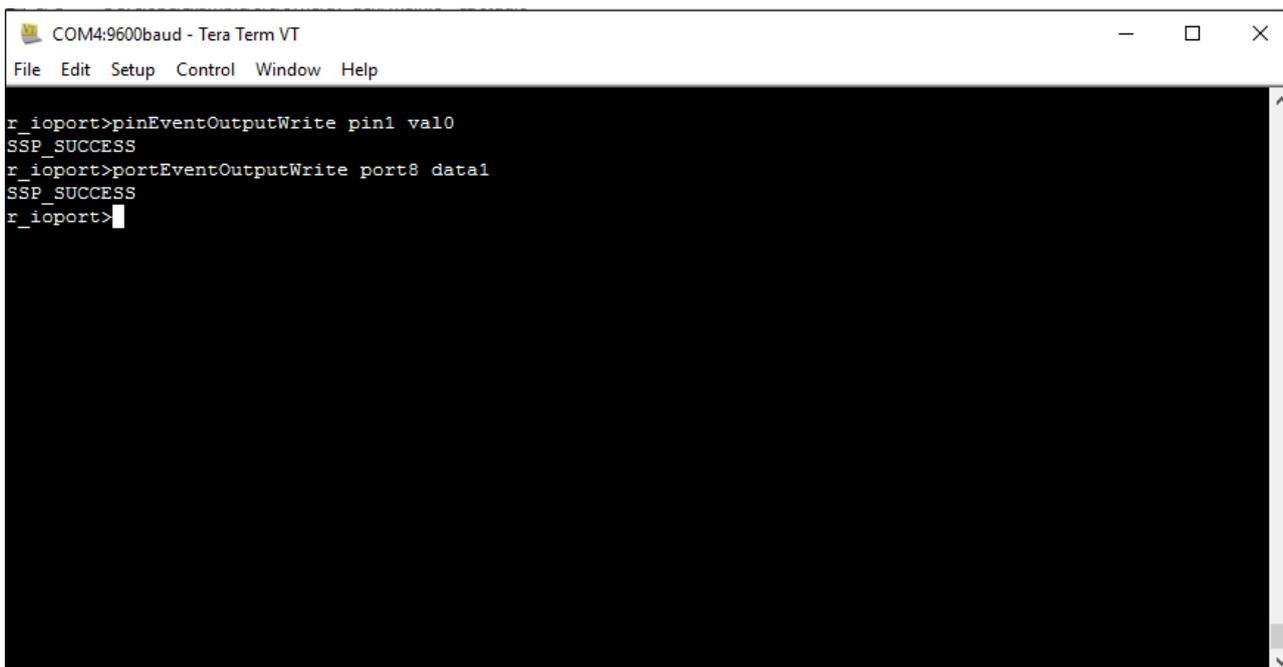
STEP 5: Type `pinEventInputRead` or `portEventInputRead` command to read the event input data of specific pin or port.



```
COM4:9600baud - Tera Term VT
File Edit Setup Control Window Help

r_ioport>pinEventInputRead pin1
IOPORT_LEVEL_LOW
r_ioport>portEventInputRead port1
Port event data = 0x0
r_ioport>
```

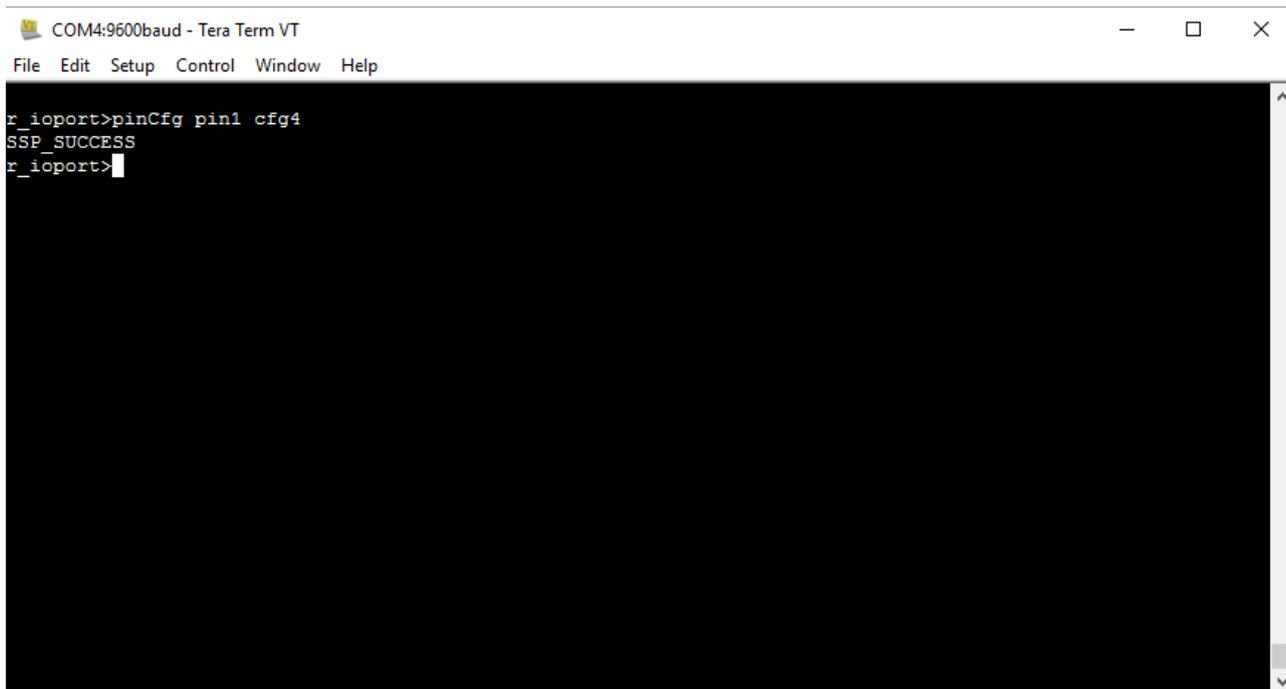
STEP 6: Type `pinEventOutputWrite` or `portEventOutputWrite` command to write the event output data value to a pin or port.



```
COM4:9600baud - Tera Term VT
File Edit Setup Control Window Help

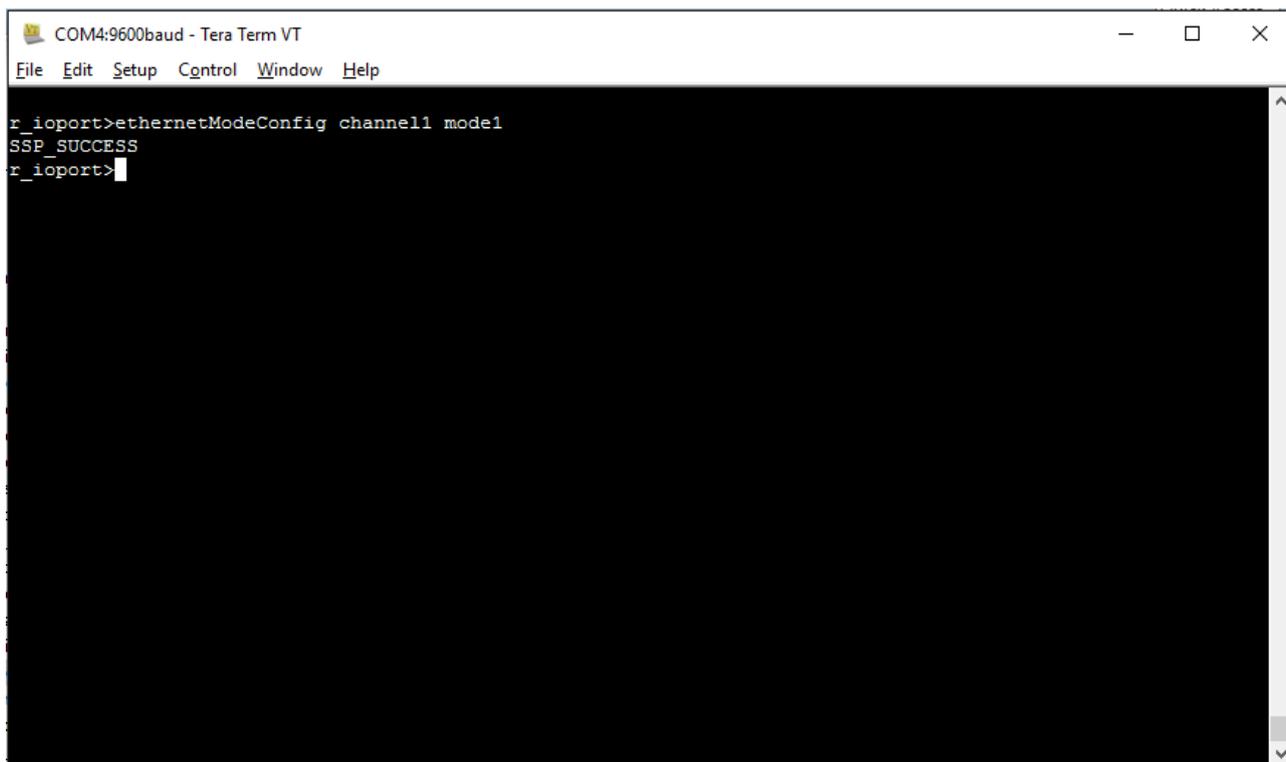
r_ioport>pinEventOutputWrite pin1 val0
SSP_SUCCESS
r_ioport>portEventOutputWrite port8 data1
SSP_SUCCESS
r_ioport>
```

STEP 7: Type `pinCfg` command to configure the setting of a pin.



```
COM4:9600baud - Tera Term VT
File Edit Setup Control Window Help
r_ioport>pinCfg pin1 cfg4
SSP_SUCCESS
r_ioport>
```

STEP 8: Type etherNetModeConfig command to configure Ethernet channel in PHY mode.



```
COM4:9600baud - Tera Term VT
File Edit Setup Control Window Help
r_ioport>etherNetModeConfig channel1 mode1
SSP_SUCCESS
r_ioport>
```

NOTES:

- It is recommended to reset the board before using for any other module.
- The Init command will reinitialize all the pins and console will not respond to any input hence not used.

26. Developer Example: Telnet Communications Framework

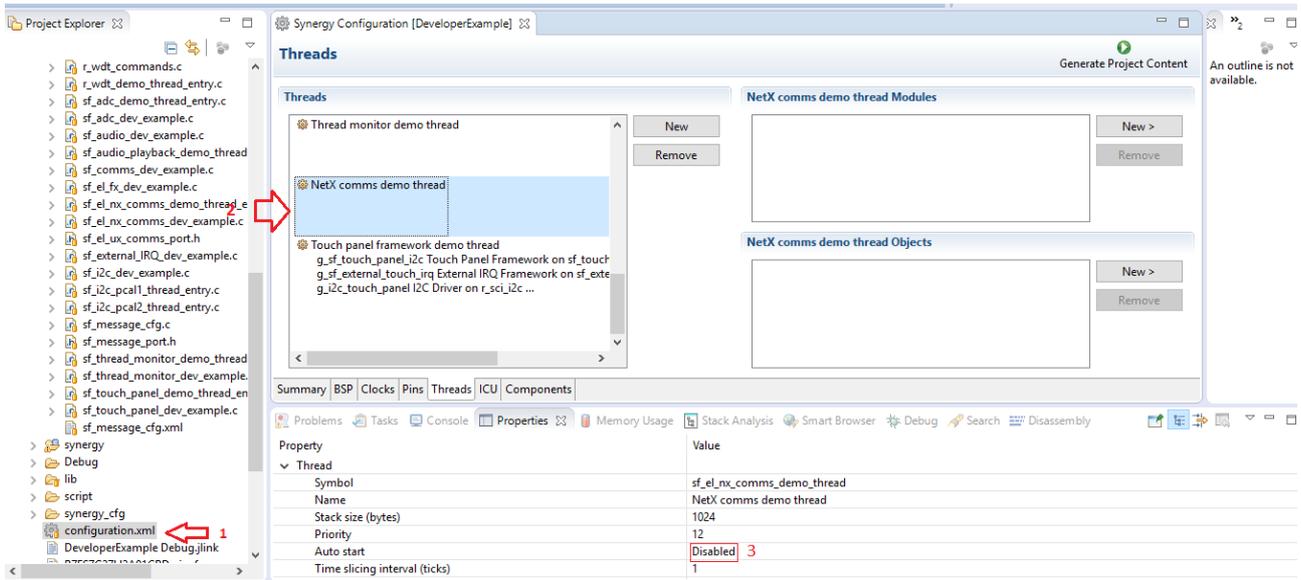
26.1 Introduction

This Developer Example uses the Telnet Communication Framework that uses NetX IPv4 TCP/IP Stack. The purpose of this Telnet Communication example is to demonstrate an echo server, which echoes back the characters typed by you on the console.

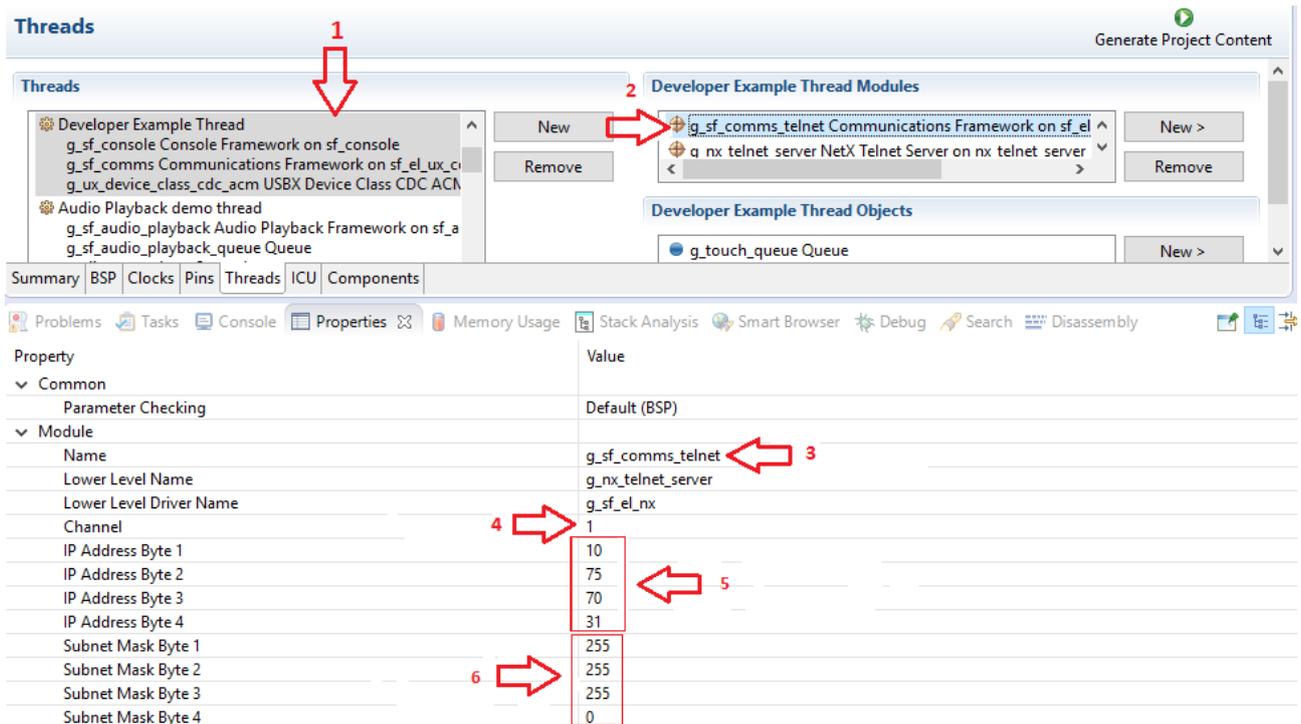
26.2 Telnet Communication Configuration Steps

To create a Telnet application, you have to make some configuration in configuration.xml file as shown below.

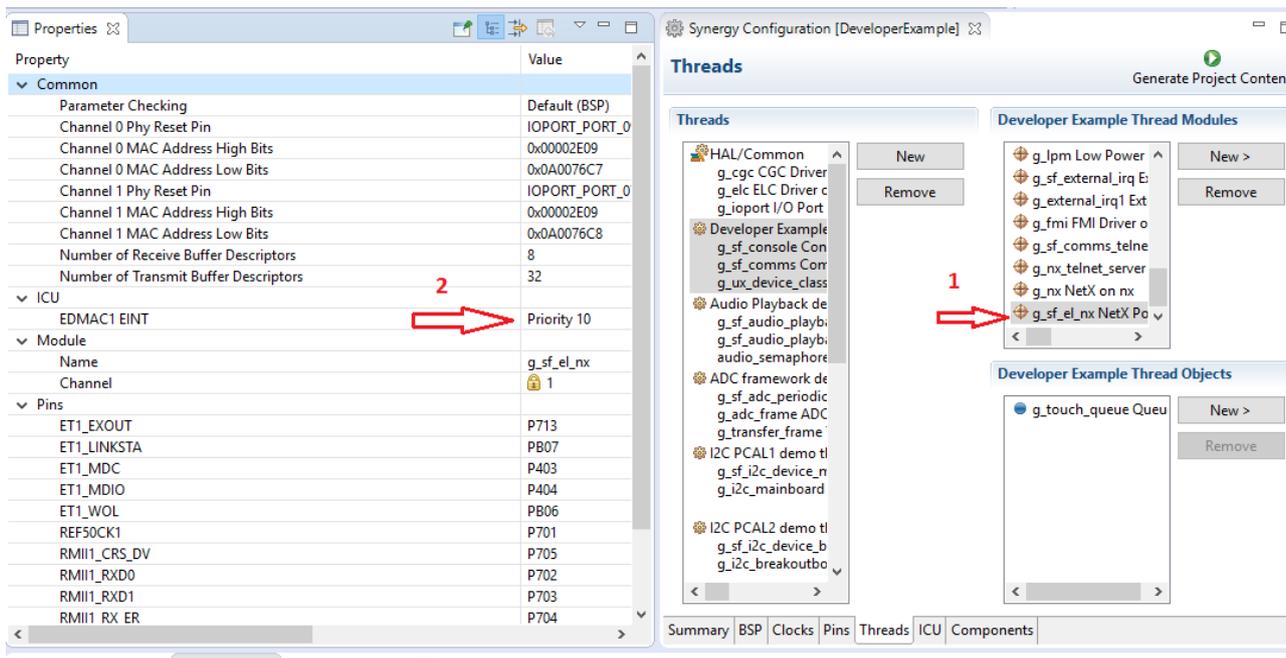
STEP 1: Open configuration.xml file, NetX comms demo thread and disable auto start.



STEP 2: In Developer Example thread, g_sf_comms_telnet_Communications Framework instance. Change the following fields.



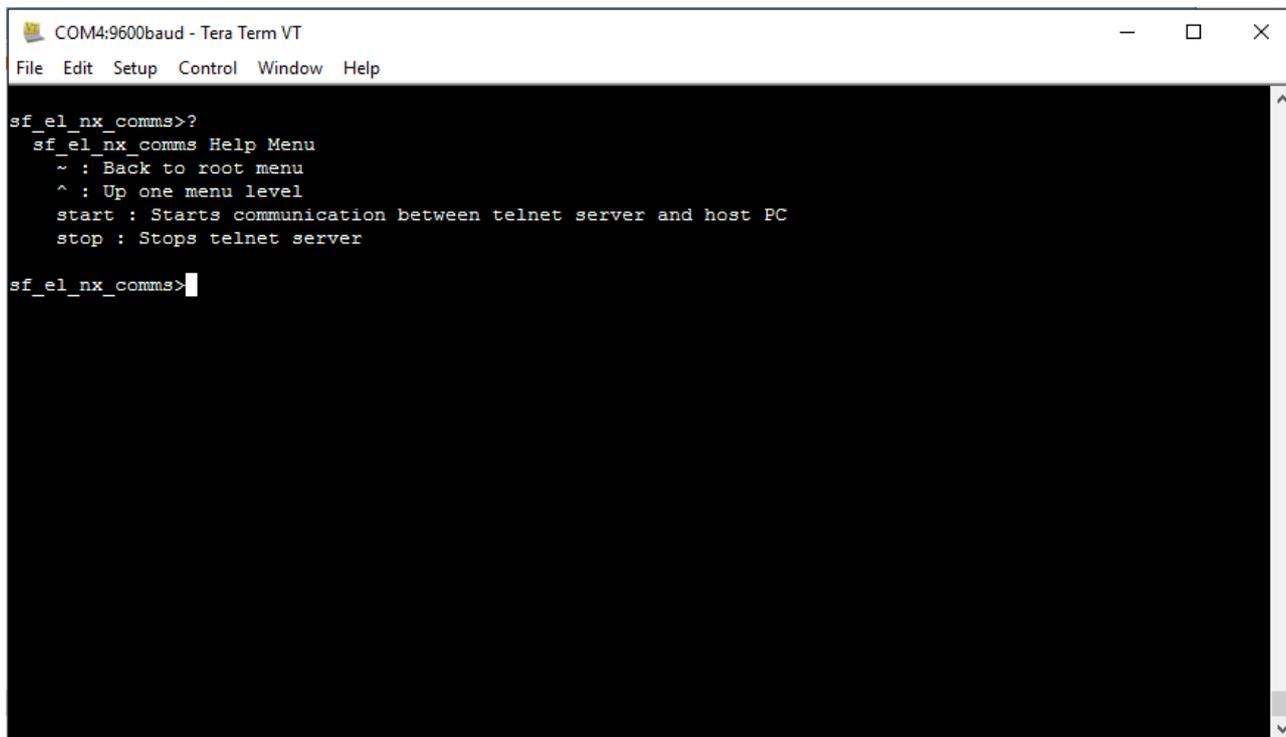
STEP 3: In the Developer Example thread, g_sf_el_nx Framework instance, enable the EDMAC1 EINT as shown and give a priority (say 10).



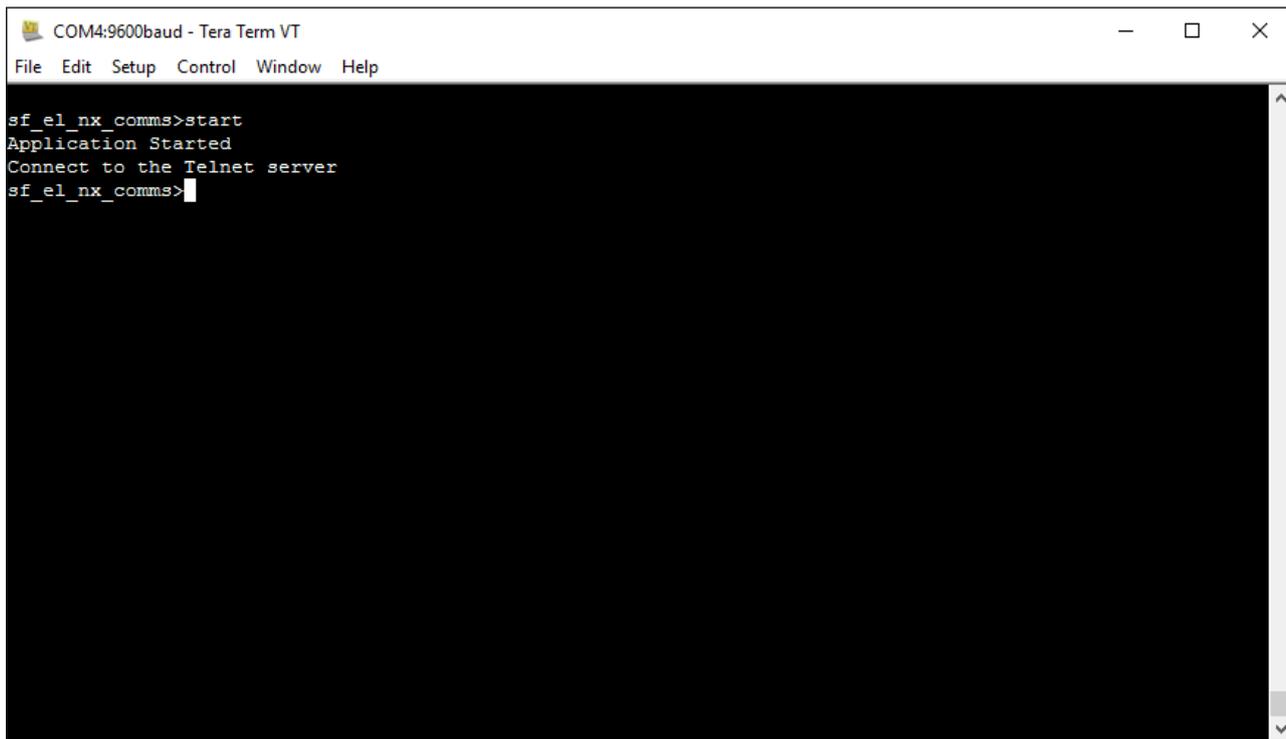
26.3 Run the Communications Framework application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

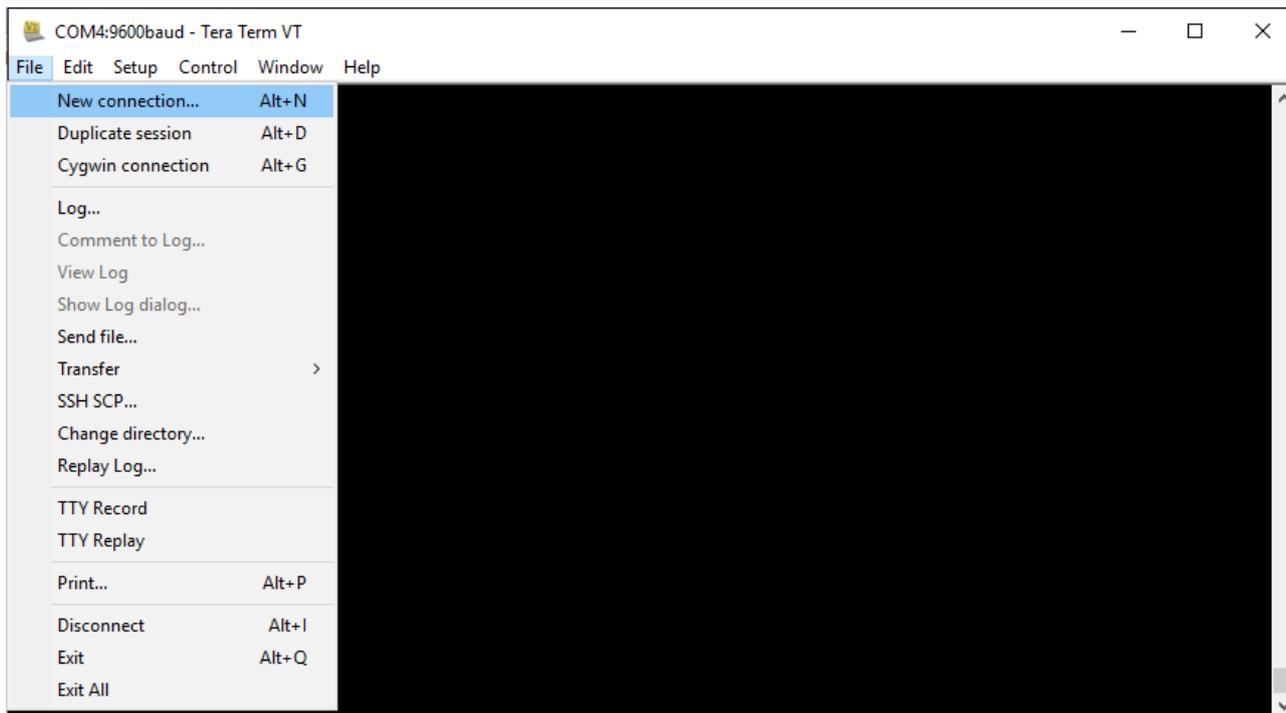
STEP 1: Type `sf_el_nx_comms` in the terminal and press Enter to access the `sf_el_nx_comms` sub menu. For Help, type `?` and press Enter.



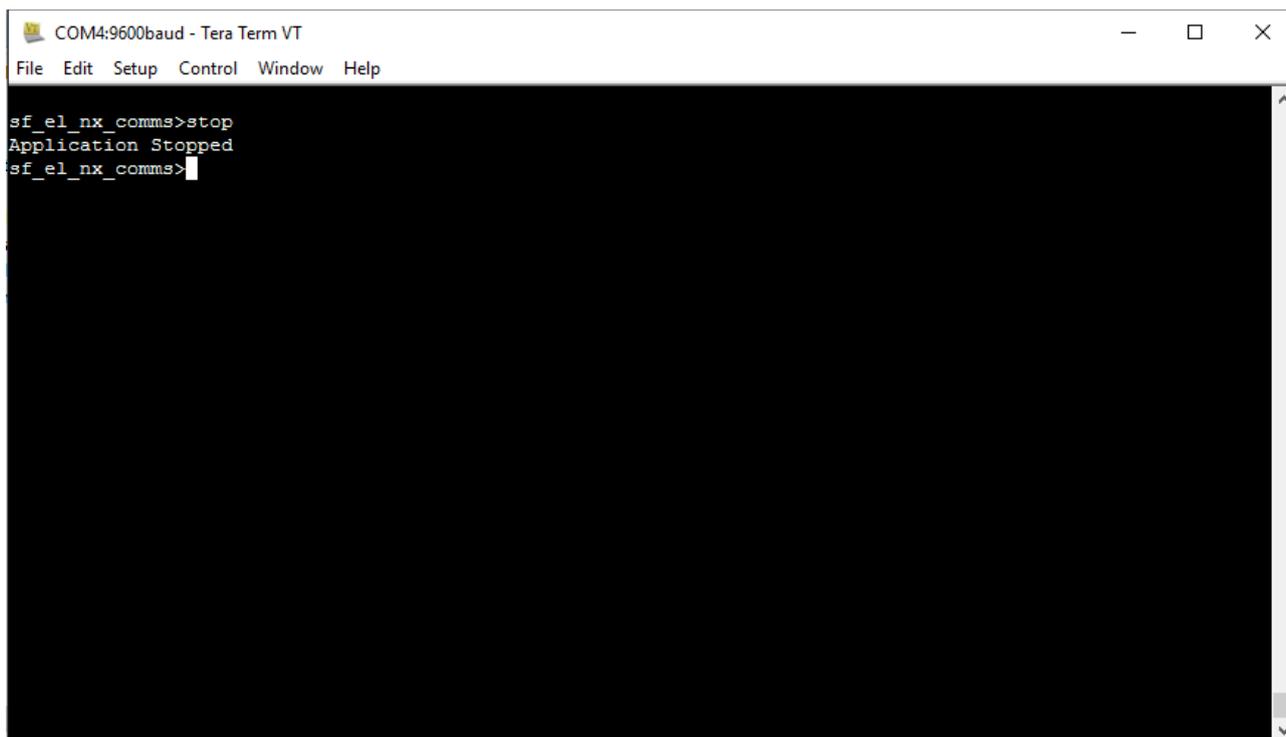
STEP 2: Use `start` command to start the application.



STEP 3: In Tera Term, navigate to **File>New connection**.



STEP 4: Select Telnet and give the IP address which is assigned to the device by configuration.xml file in the Host field and click OK.



```
COM4:9600baud - Tera Term VT
File Edit Setup Control Window Help
sf_el_nx_comms>stop
Application Stopped
sf_el_nx_comms>
```

NOTES:

- It is preferable to give static IP address to the server.
- The given IP address to the device should match the default Gateway address and domain name of the system.

27. Developer Example: Power Profiles Framework

27.1 Introduction

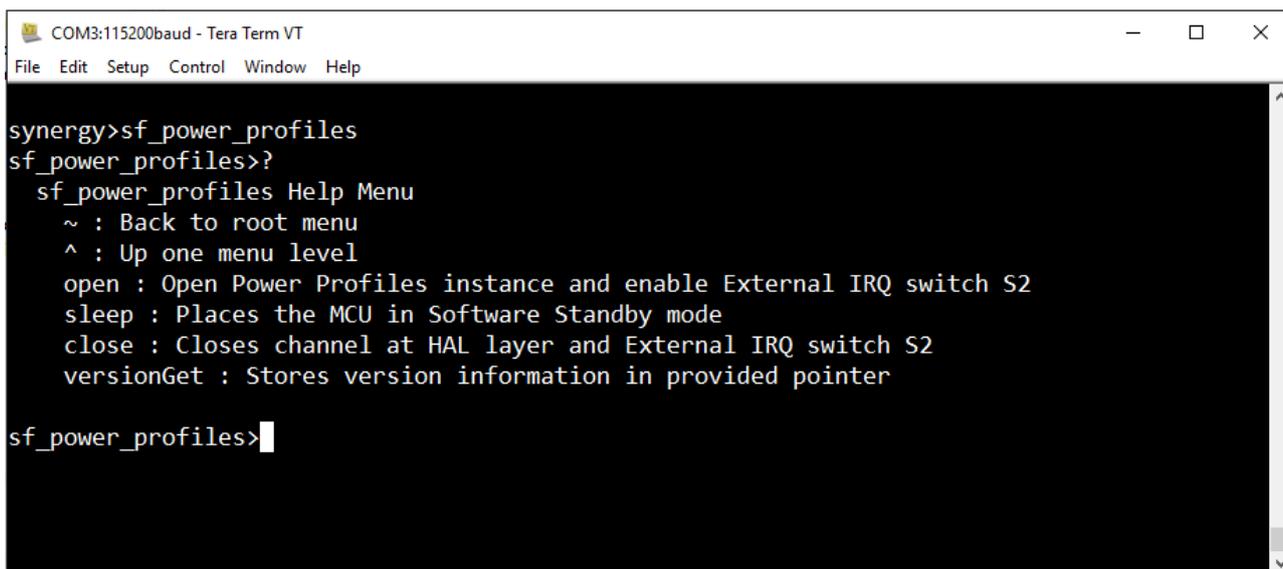
The power profiles framework supports run, RTC and external mode of operation. The Developer Example uses external mode, where switch S2 is configured and used as an external source to wake device from sleep. When sleep command is executed red LED1 glows indicating device has been put to software standby mode. Once switch S2 is pressed device wakes up and this is indicated by turning LED1 from red to green.

27.2 Run the Power Profiles Framework application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the Power Profiles Framework driver application, follow these steps:

STEP 1: Type `sf_power_profiles` in the terminal and press Enter to access the Power Profiles Framework submenu. For Help, type '?' and press Enter.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

synergy>sf_power_profiles
sf_power_profiles>?
  sf_power_profiles Help Menu
  ~ : Back to root menu
  ^ : Up one menu level
  open : Open Power Profiles instance and enable External IRQ switch S2
  sleep : Places the MCU in Software Standby mode
  close : Closes channel at HAL layer and External IRQ switch S2
  versionGet : Stores version information in provided pointer

sf_power_profiles>
```

STEP 2: Use the `open` and then `sleep` command to configure and enter the device into software standby mode. Red LED1 glows will indicate device entered software standby mode. Press switch S2 to wake up the device, LED1 turns from red to green indicating the state change. This is indicated by turning LED1 from red to green.



```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_power_profiles>open
SSP_SUCCESS
sf_power_profiles>sleep
SSP_SUCCESS
sf_power_profiles>close
SSP_SUCCESS
sf_power_profiles>
```

28. Developer Example: SCI SPI HAL Driver

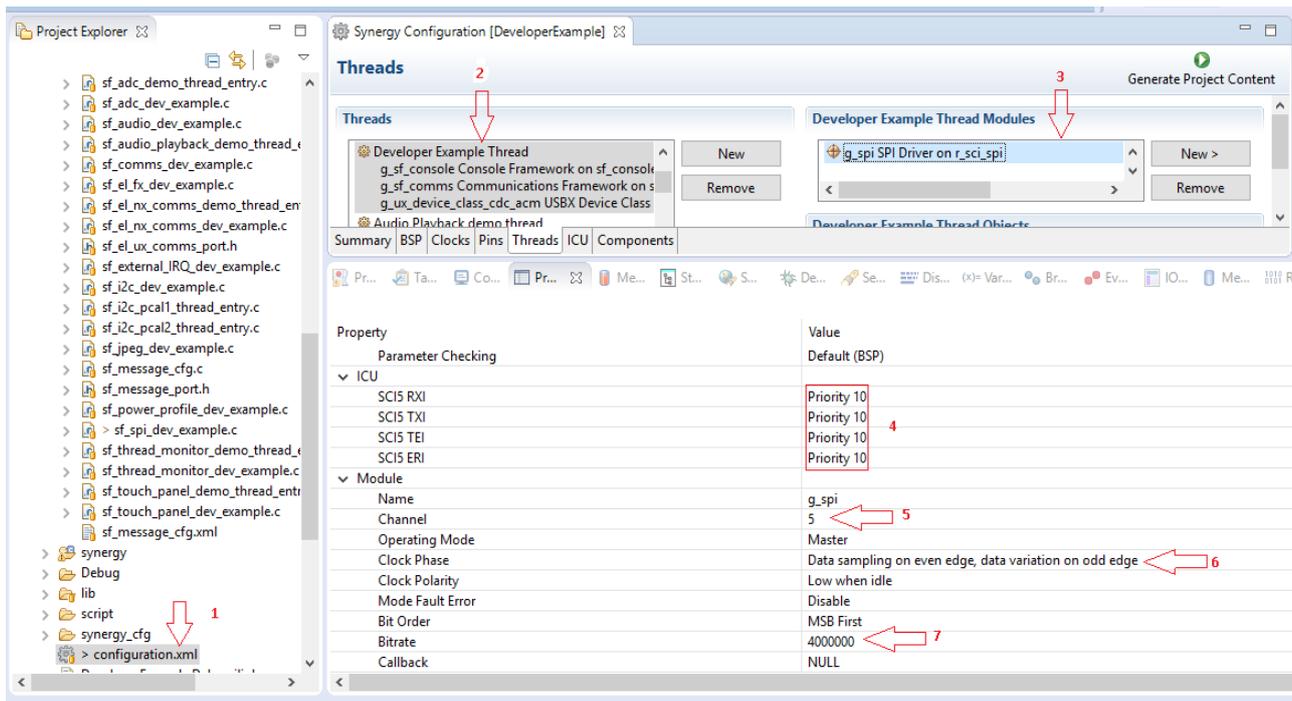
28.1 Introduction

This Developer Example exercises the SCI SPI HAL APIs using the on board Bluetooth Low Energy (BLE) device. The BLE device is connected to the SCI Channel 5.

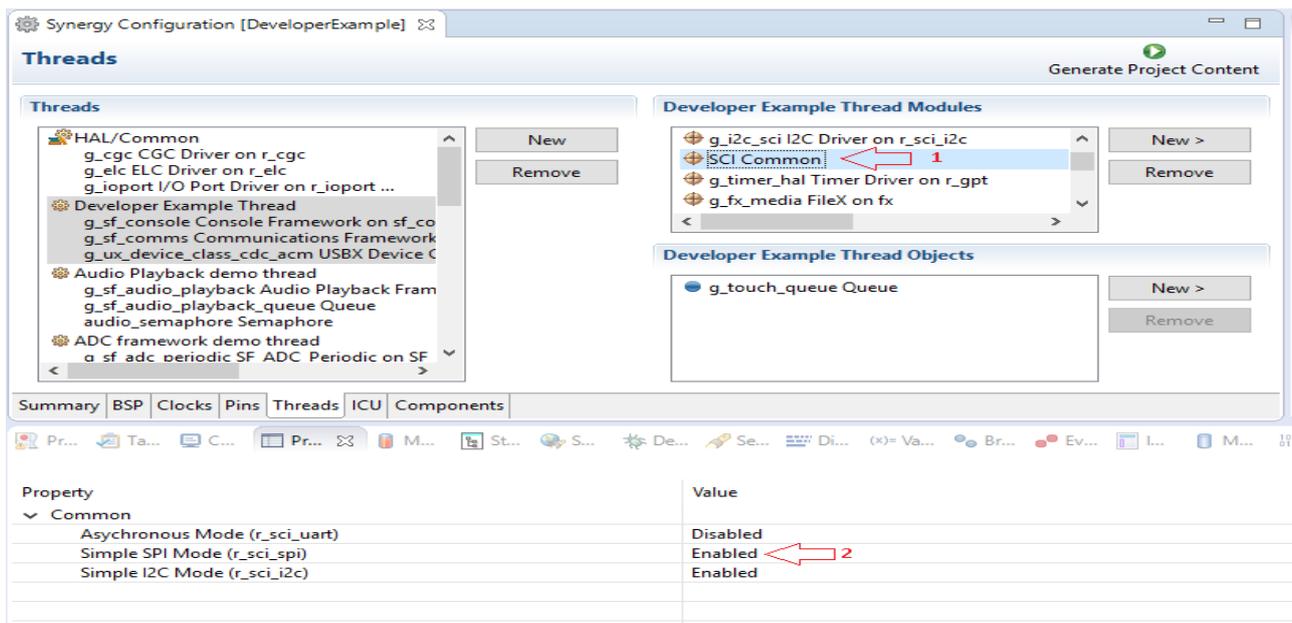
28.2 SCI SPI HAL driver configuration steps

To exercise a SPI HAL driver you need to make some configuration in `configuration.xml` file as mentioned below.

STEP 1: Open `configuration.xml` file, Developer Example Thread, add `r_sci_spi` driver and change the properties as shown below.



STEP 2: Next in the same Developer Example thread, SCI common, properties enable Simple SPI mode.



STEP 3: Next in the Pins tab, complete the following steps as shown below.

Synergy Configuration [DeveloperExample] Generate Project Content

Pins

Select pin configuration: R7FS7G27H2A01CBD.pincfg

Pin Selection

type filter text

- Peripherals ²
 - AGT
 - BUS
 - CAC_AD
 - CAN
 - CLKOUT_COMP.
 - CTSU
 - Debug
 - ETHER_MII
 - ETHER_RMII
 - GPT0
 - GPT1
 - KEY
 - LCD_GRAPHICS
 - PDC
 - QSPI
 - RIIC
 - RSPI
 - SCI0_2_4_6_8
 - SCI1_3_5_7_9 ³
 - SCI1
 - SCI3
 - SCI5
 - SCI7
 - SCI9
 - SDHI_MMC
 - SSI
 - TRACE

Pin Configuration

Module name: SCI5

SCI5 Configuration ⁴

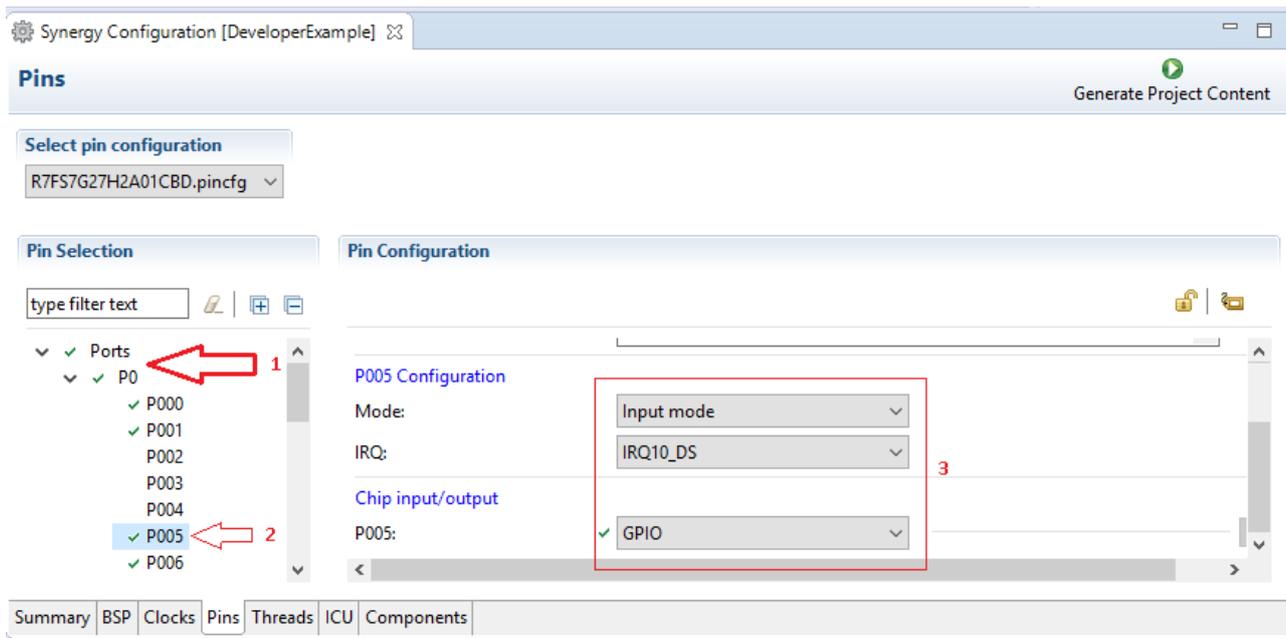
Operation Mode: Simple SPI (MOSI/MISO/SCK/SS) ⁵

Input/Output

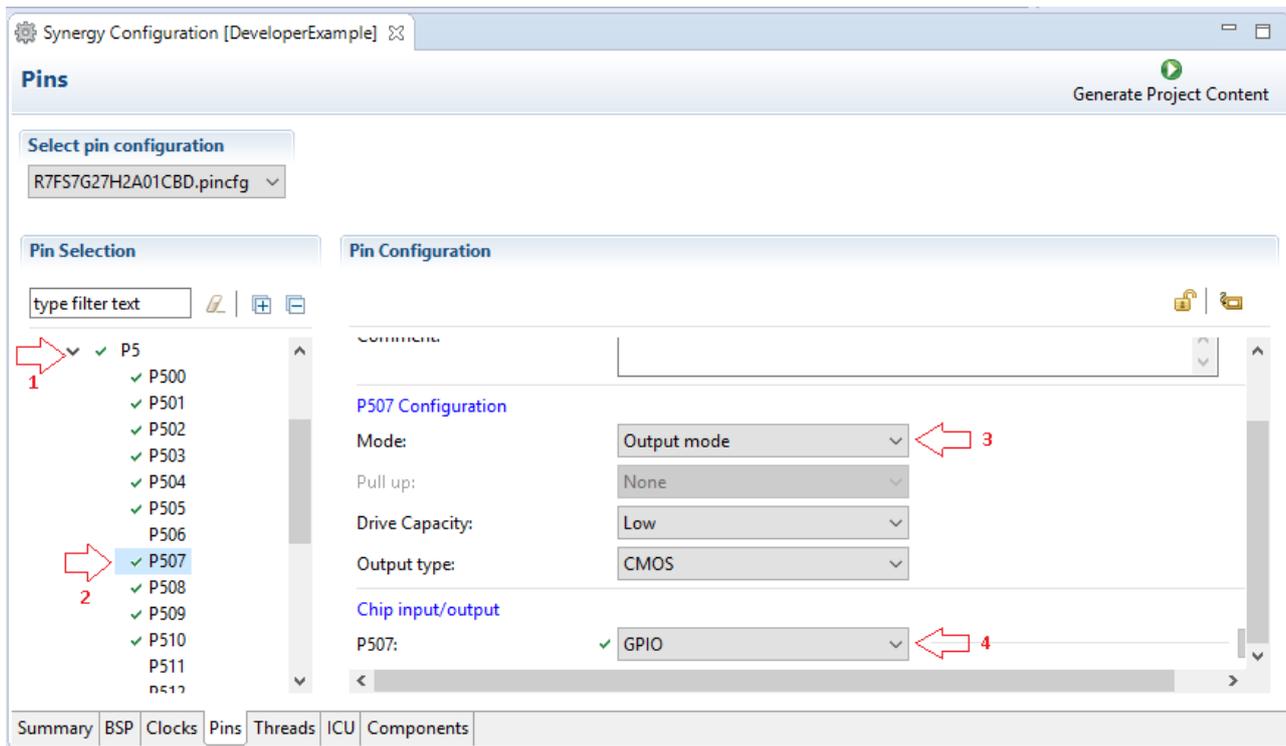
- CTS5_RT55_SS5: None
- RXD5_SCL5_MISO5: P510
- SCK5: P508
- TXD5_SDA5_MOSI5: P509

Summary | BSP | Clocks | Pins | Threads | ICU | Components

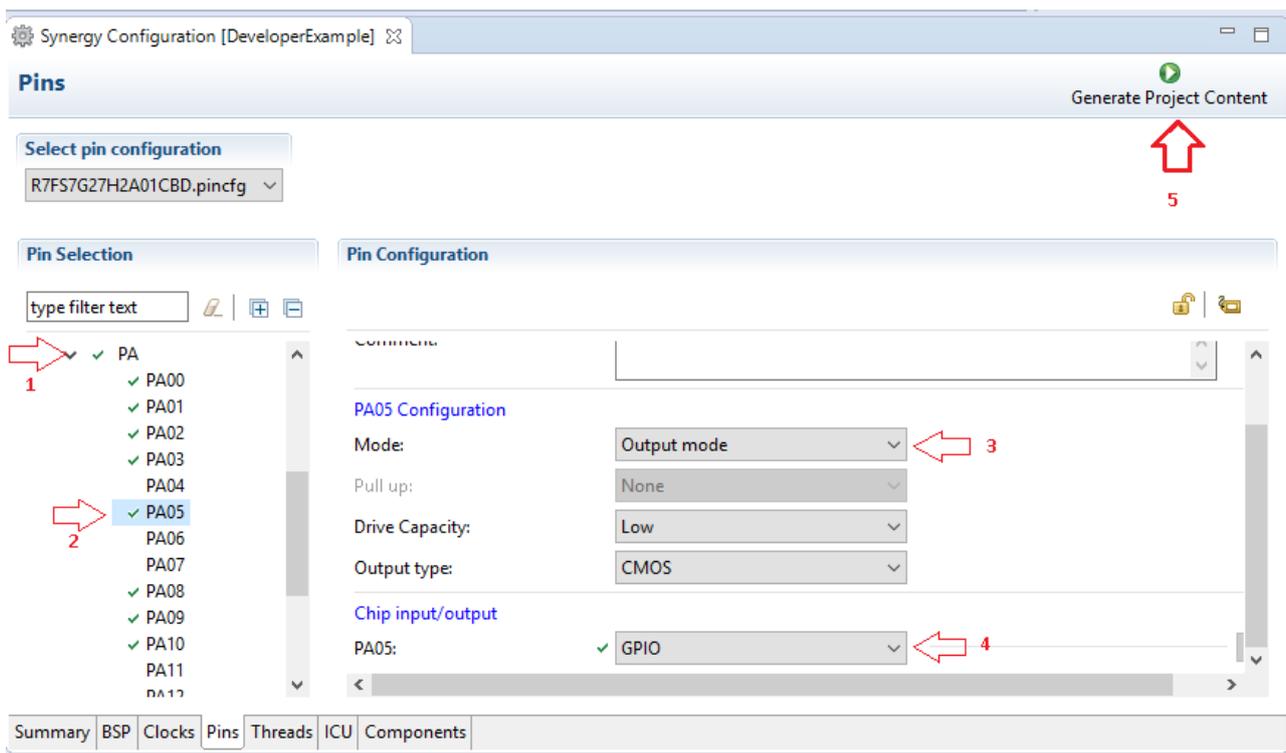
STEP 4: Next for setting the pin direction, complete the following as shown below.



STEP 5: Do the same for Port_5 Pin_7 and Port_A Pin_5.



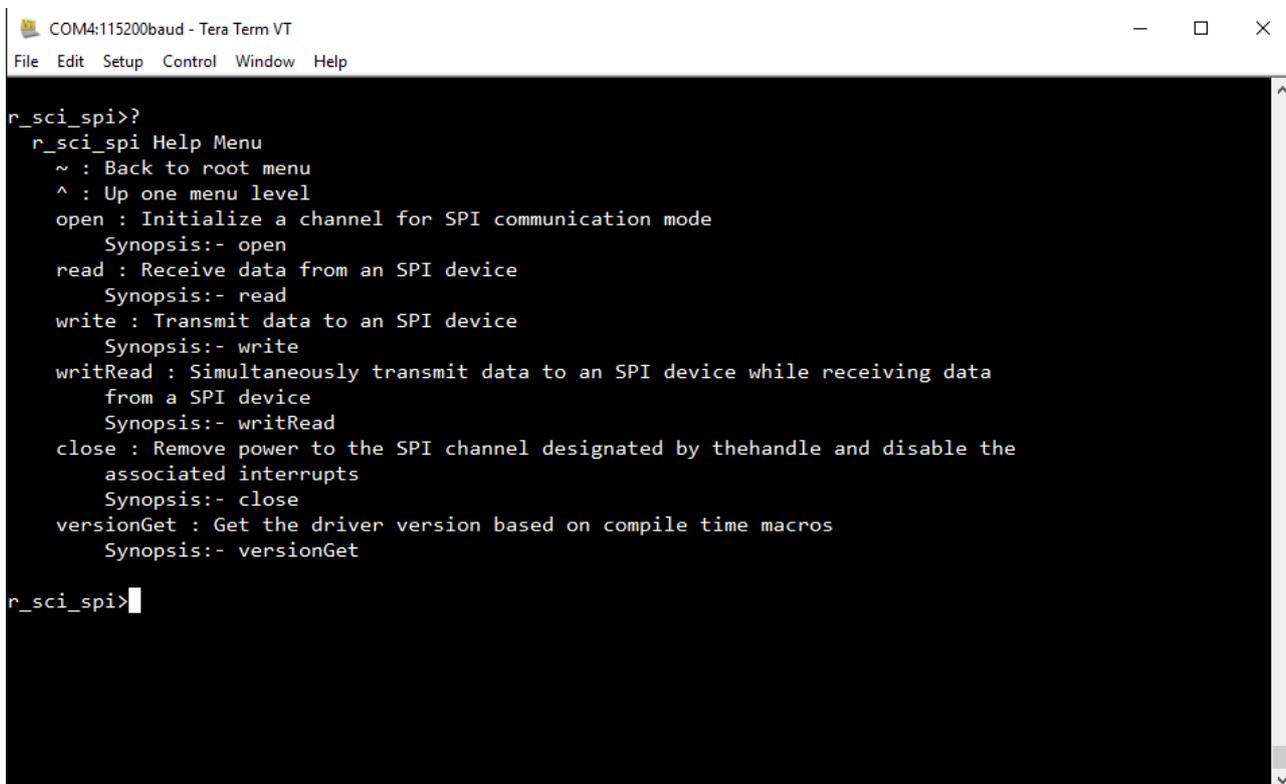
STEP 7: Save the configuration.xml file and click Generate Project Content as shown below.



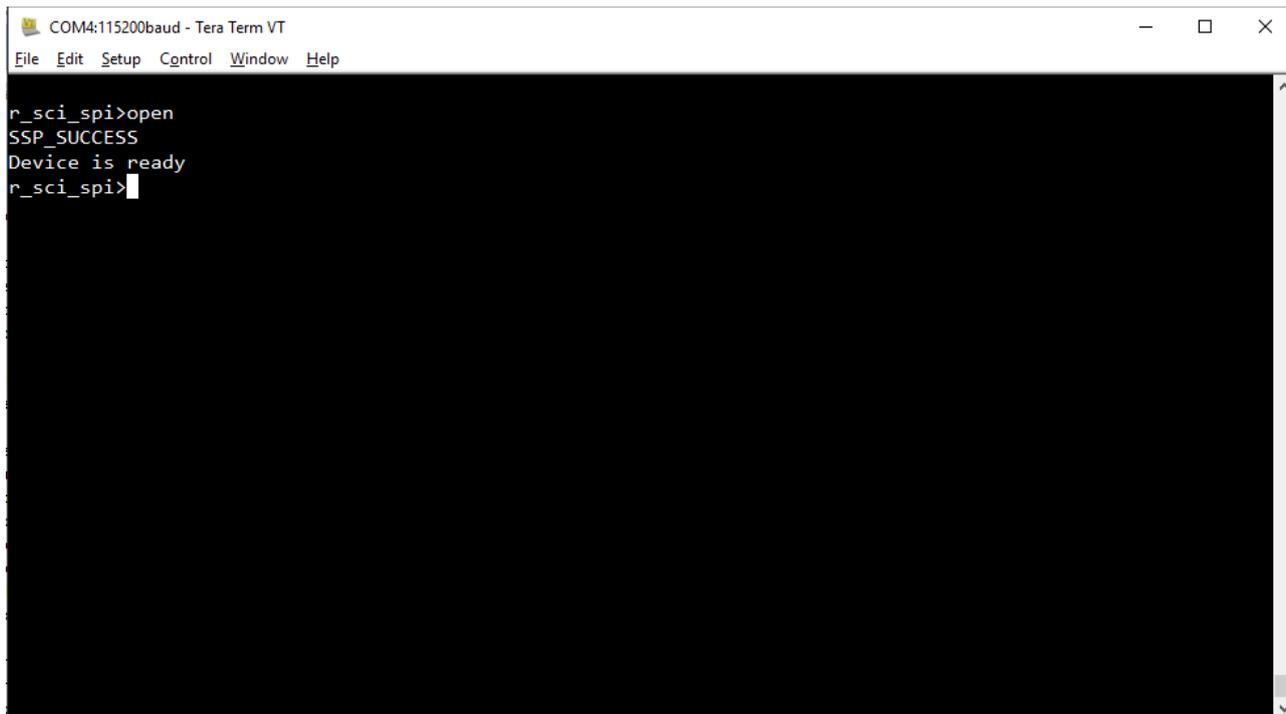
28.3 Run the SCI SPI HAL Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

STEP 1: Type `r_sci_spi` in the terminal and press Enter to access the `r_sci_spi` sub menu. For help, type `?` and press Enter.



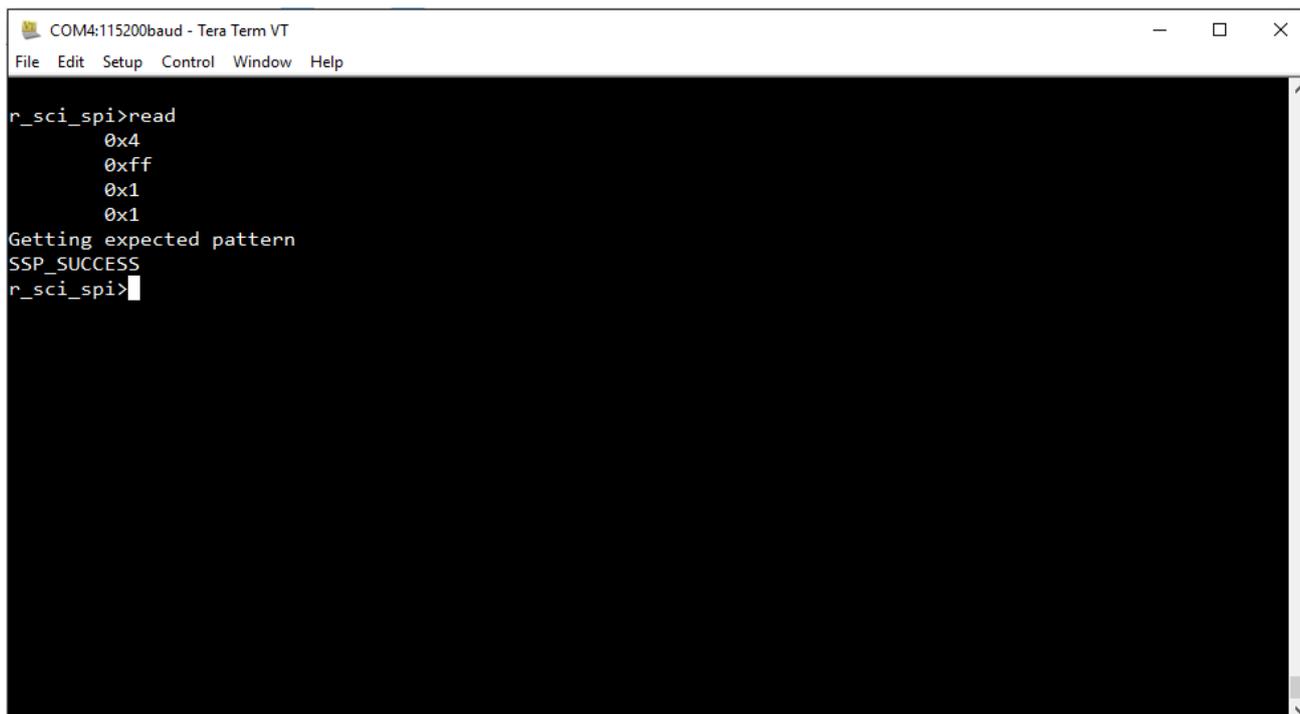
STEP 2: Use `open` command to initialize the driver.



```
COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_sci_spi>open
SSP_SUCCESS
Device is ready
r_sci_spi>
```

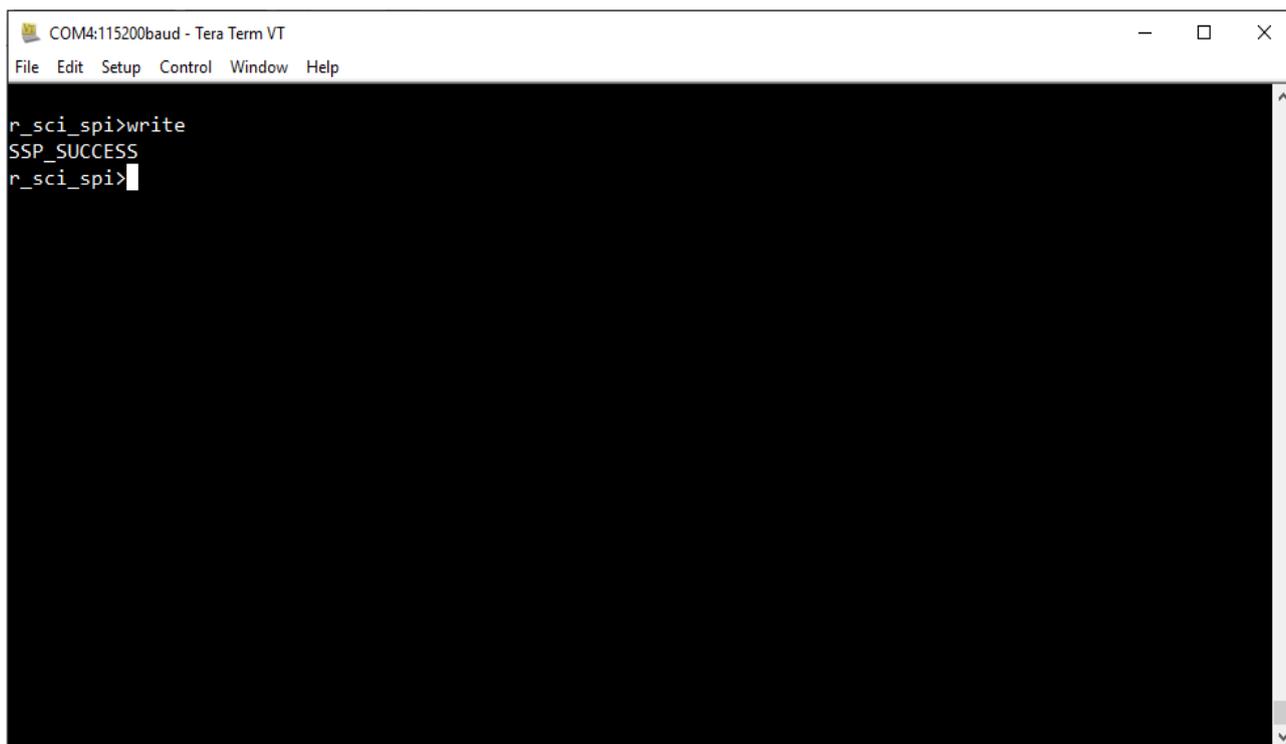
STEP 3: Type read command to read value from the slave device.



```
COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_sci_spi>read
    0x4
    0xff
    0x1
    0x1
Getting expected pattern
SSP_SUCCESS
r_sci_spi>
```

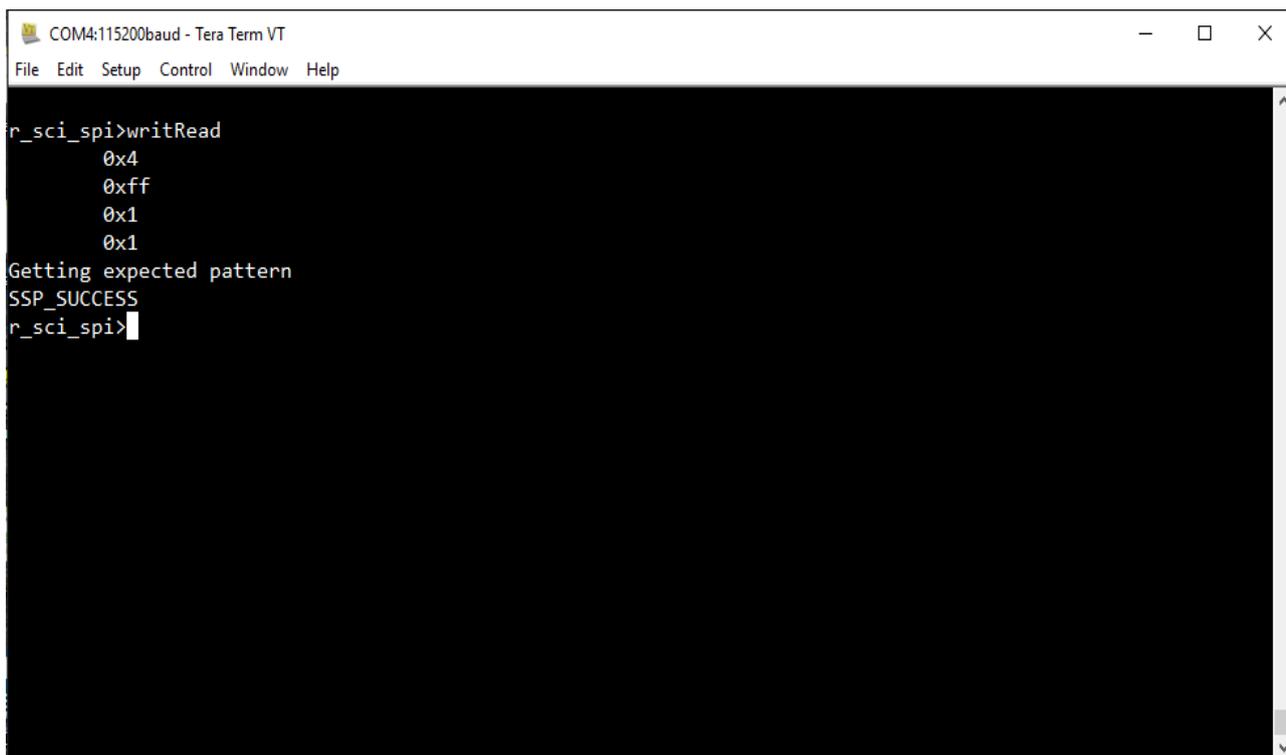
STEP 4: Type write command for writing to the slave device.



```
COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_sci_spi>write
SSP_SUCCESS
r_sci_spi>
```

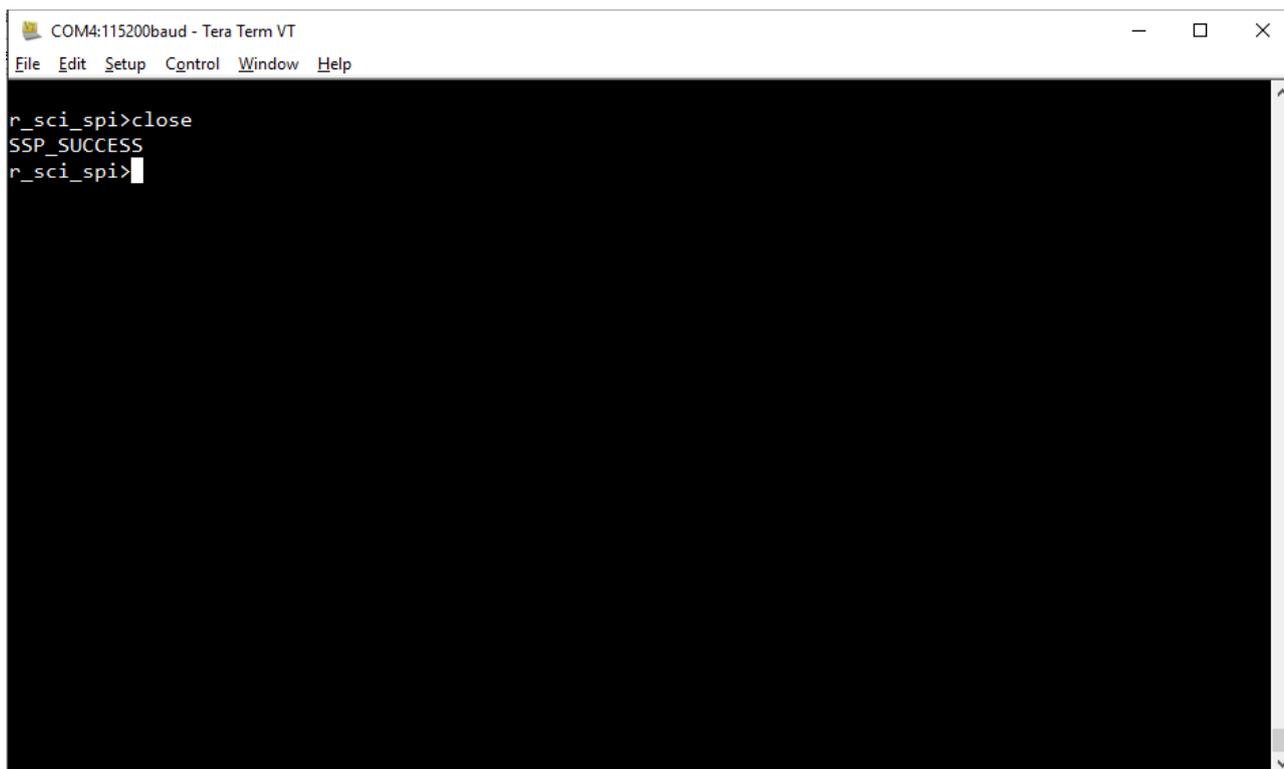
STEP 5: Type the writRead command to simultaneously write and read to the slave device.



```
COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help

r_sci_spi>writRead
    0x4
    0xff
    0x1
    0x1
Getting expected pattern
SSP_SUCCESS
r_sci_spi>
```

STEP 6: Type close command to close the driver.

A screenshot of a terminal window titled "COM4:115200baud - Tera Term VT". The window has a menu bar with "File", "Edit", "Setup", "Control", "Window", and "Help". The terminal output shows the following sequence of commands and responses:

```
r_sci_spi>close
SSP_SUCCESS
r_sci_spi>
```

NOTES:

1. In Developer Example `r_sci_spi` the `writeRead` command is written as `writRead` command this is due to the limitation of the console framework.
2. The configuration has to be done correctly else you will not get any response from the BLE.
3. For details of BLE see EM9301 datasheet.

29. Developer Example: SPI Framework

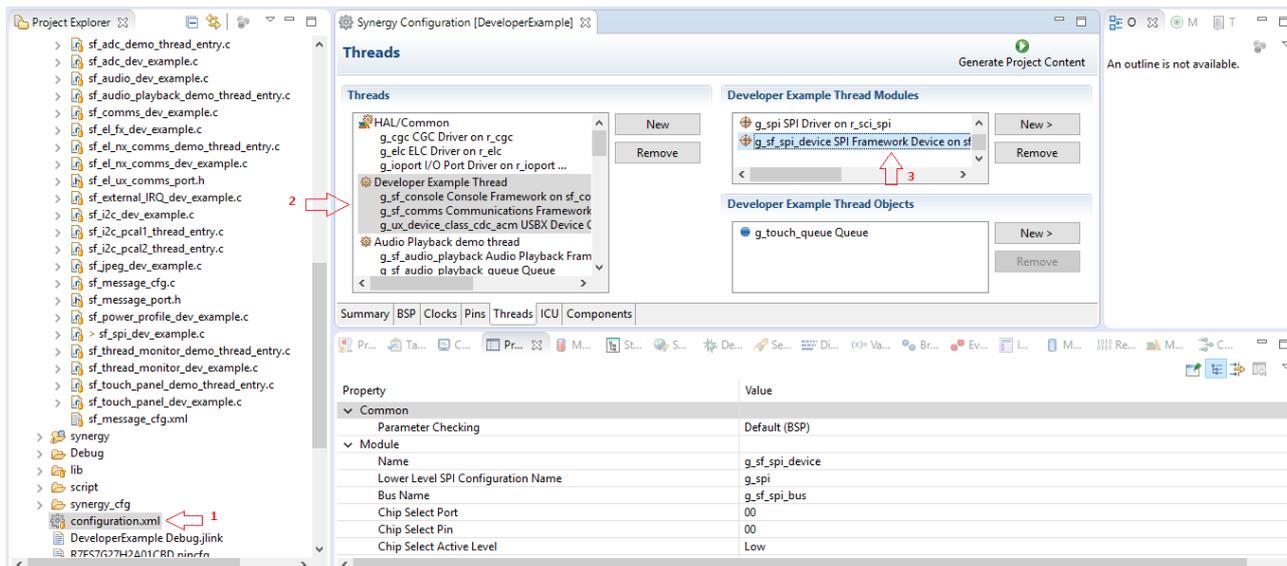
29.1 Introduction

SPI framework provides a thread safe mechanism to communicate between master and multiple slaves on the same SPI channel. Since the DK-S7G2 board has only one SPI slave device, this Developer Example for SPI Framework will just exercise the SPI Framework API's on the slave device.

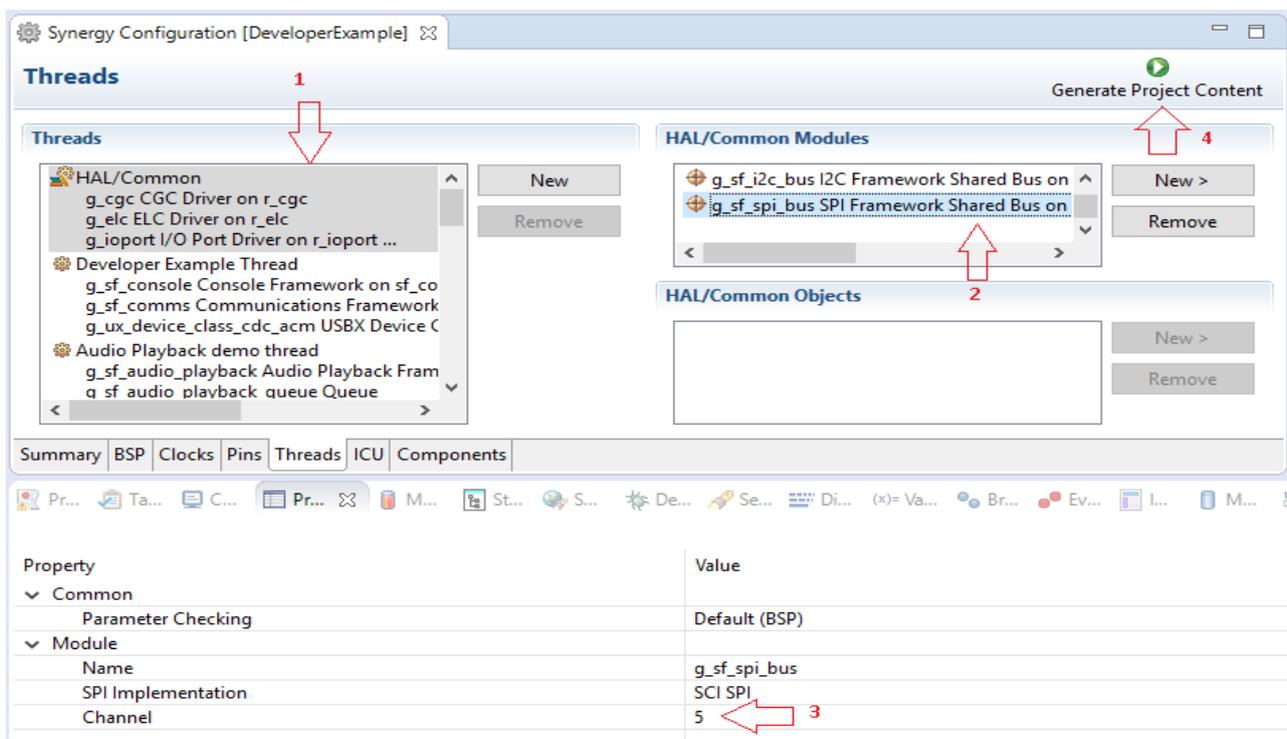
To configure the SPI Framework, you have to configure SCI SPI HAL driver first. See [SCI SPI HAL driver configuration steps](#) follow the steps detailed below to configure the SPI Framework.

29.2 SPI Framework configuration steps

STEP 1: Add the SPI driver in Developer Example Thread.



STEP 2: SPI Framework requires a SPI shared bus. Change the channel no in spi shared bus properties as shown below. Generate the Project Content.

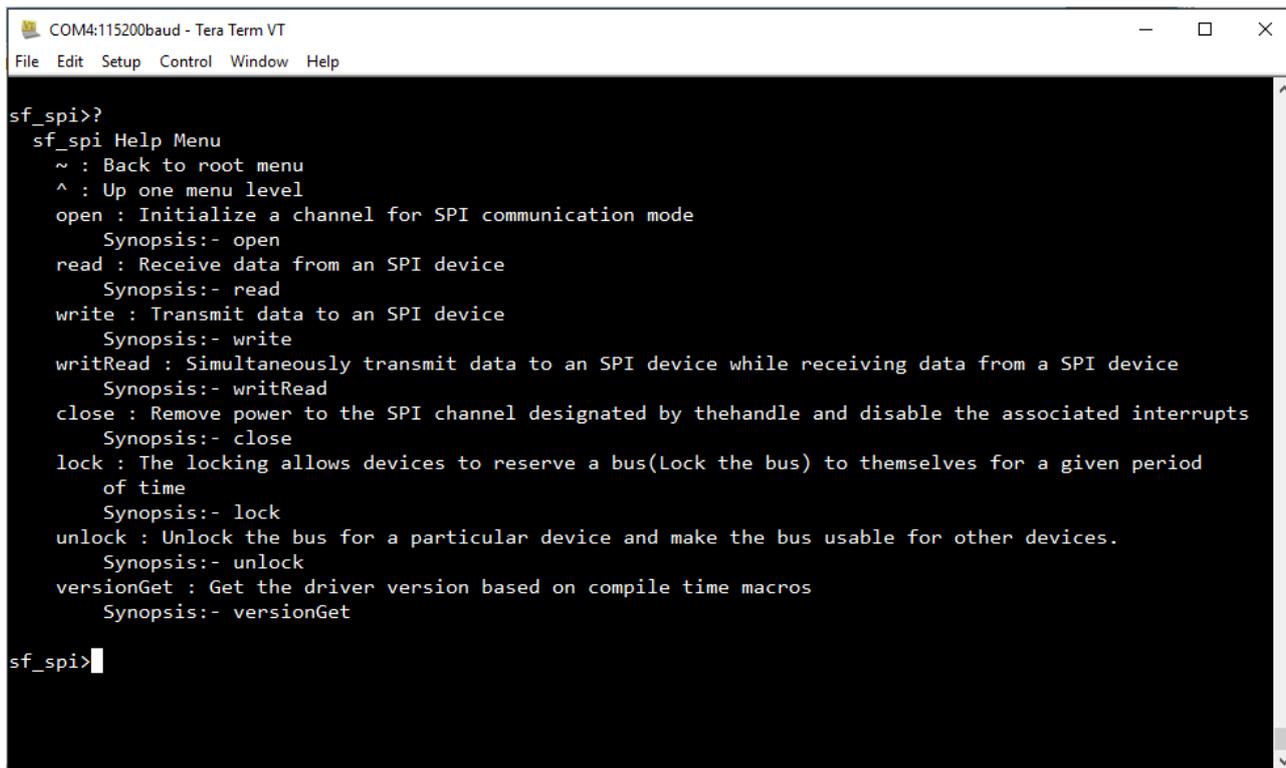


29.3 Run the SPI Framework application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

To run the SPI Framework application, follow these steps:

STEP 1: Type `sf_spi` in the terminal and press Enter to access the `sf_spi` sub menu. For help, type '?' and press Enter.



```
COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_spi>?
sf_spi Help Menu
~ : Back to root menu
^ : Up one menu level
open : Initialize a channel for SPI communication mode
      Synopsis:- open
read  : Receive data from an SPI device
      Synopsis:- read
write : Transmit data to an SPI device
      Synopsis:- write
writRead : Simultaneously transmit data to an SPI device while receiving data from a SPI device
      Synopsis:- writRead
close : Remove power to the SPI channel designated by thehandle and disable the associated interrupts
      Synopsis:- close
lock  : The locking allows devices to reserve a bus(Lock the bus) to themselves for a given period
      of time
      Synopsis:- lock
unlock : Unlock the bus for a particular device and make the bus usable for other devices.
      Synopsis:- unlock
versionGet : Get the driver version based on compile time macros
      Synopsis:- versionGet

sf_spi>
```

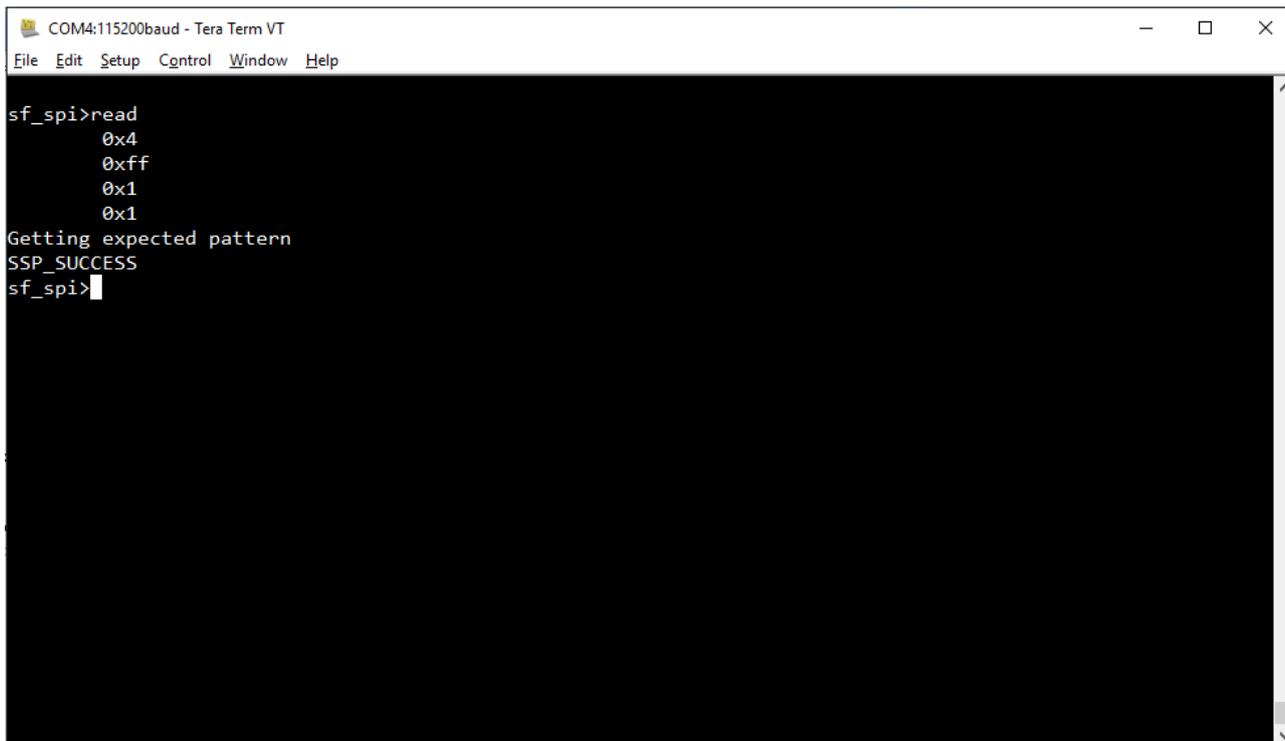
STEP 2: Type `open` in the terminal and press Enter to initialize the SPI Framework.



```
COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_spi>open
SSP_SUCCESS
Device is ready
sf_spi>
```

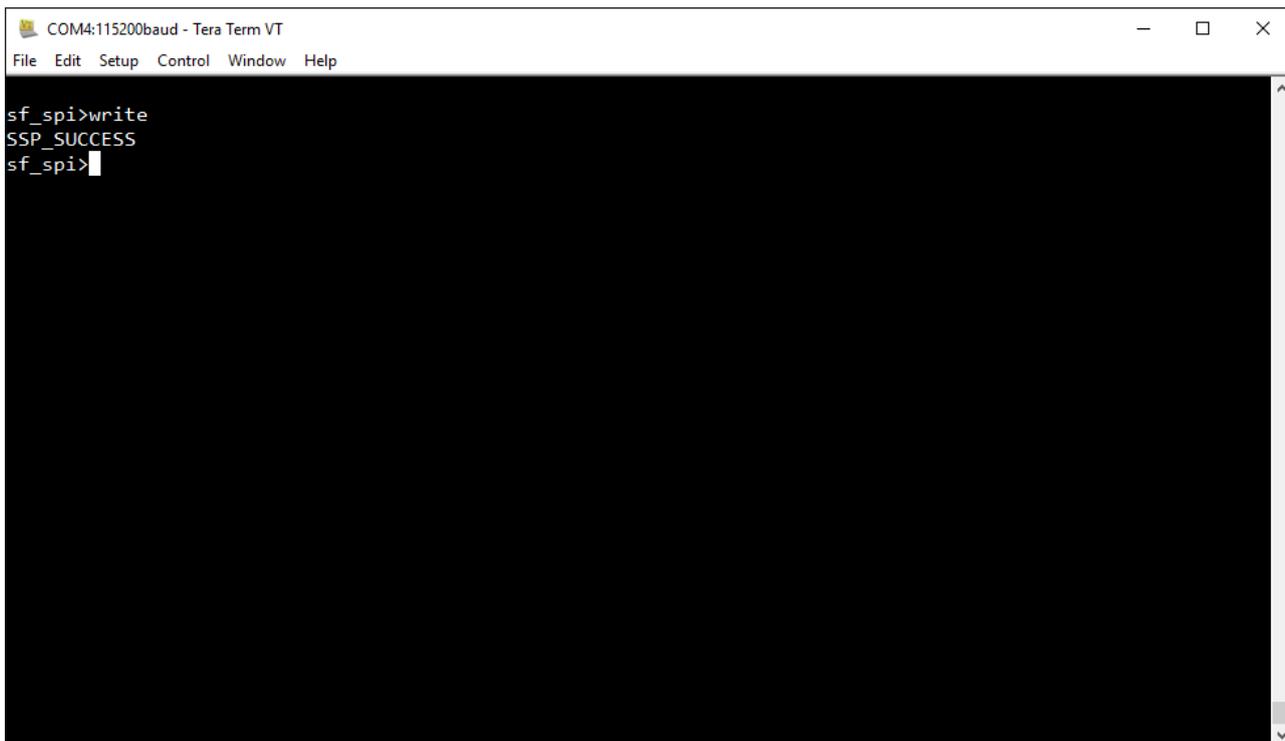
STEP 3: Type `read` command in the terminal and press Enter to read data from the slave device.



```
COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_spi>read
    0x4
    0xff
    0x1
    0x1
Getting expected pattern
SSP_SUCCESS
sf_spi>
```

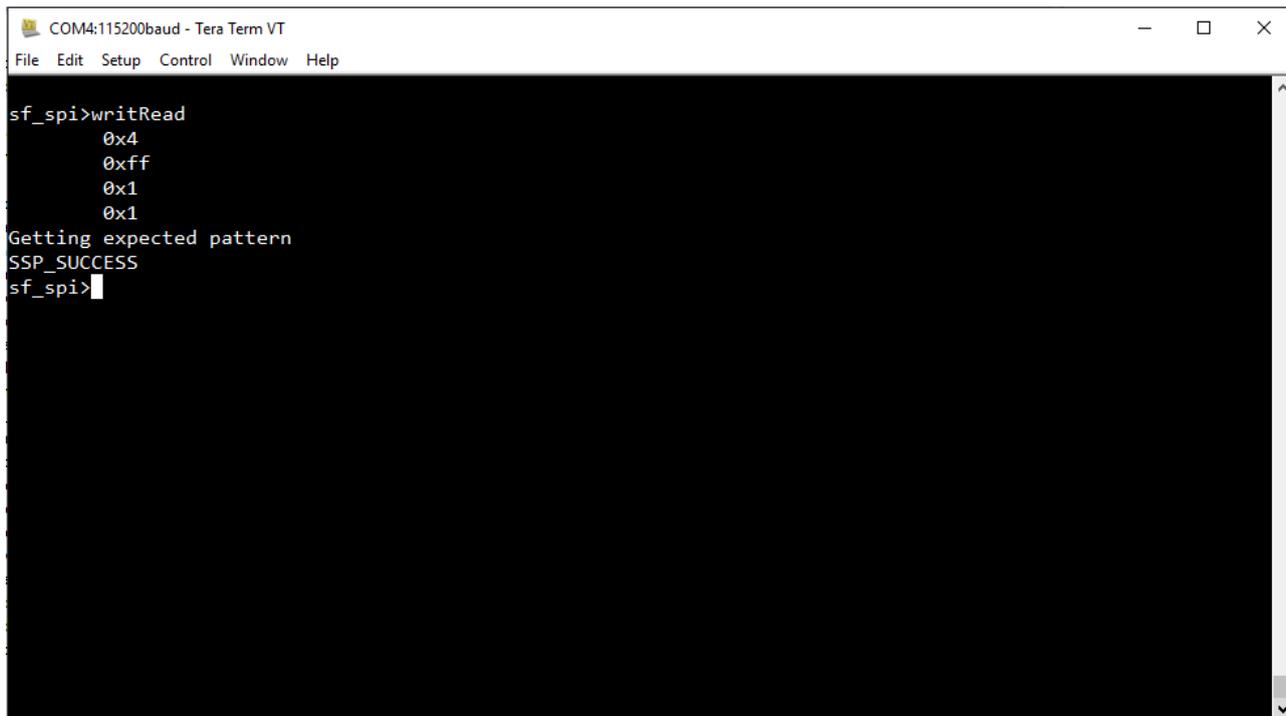
STEP 4: Type `write` command in terminal and press Enter to write data into slave device.



```
COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_spi>write
SSP_SUCCESS
sf_spi>
```

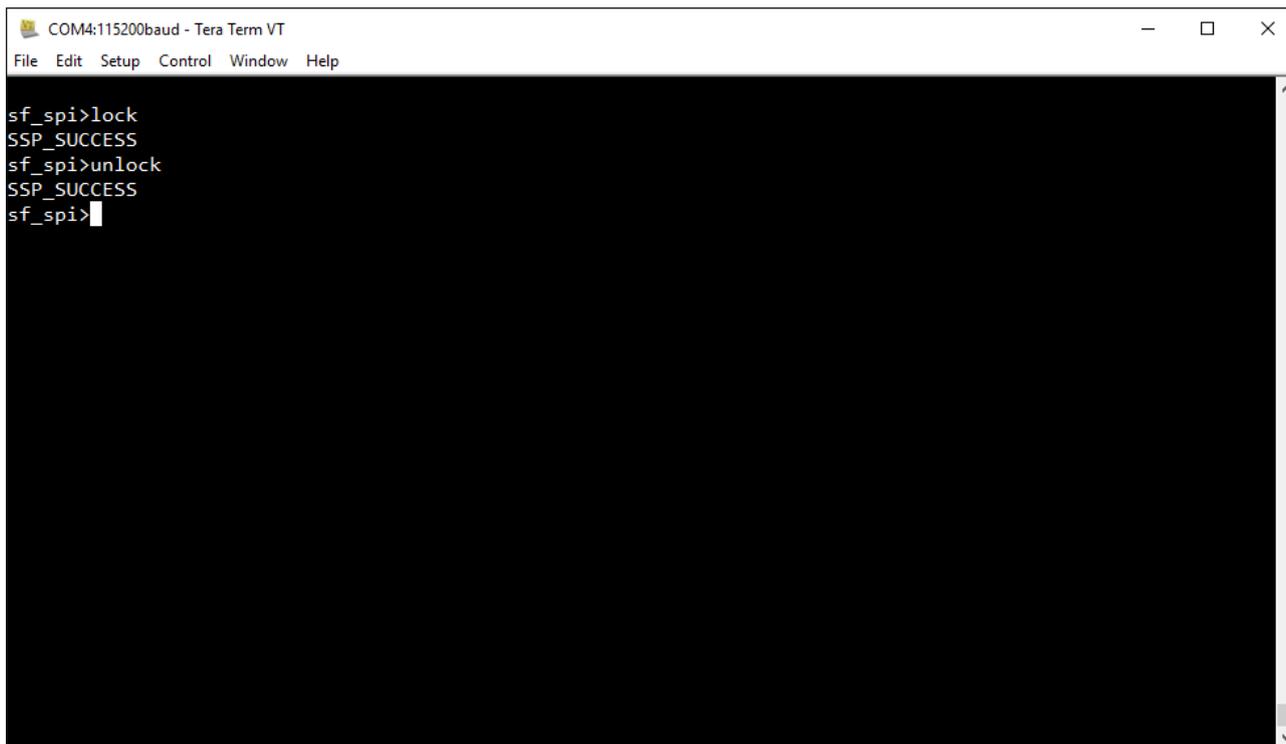
STEP 5: Type `writRead` command in terminal and press Enter for simultaneously write and read data from slave device



```
COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_spi>writRead
    0x4
    0xff
    0x1
    0x1
Getting expected pattern
SSP_SUCCESS
sf_spi>
```

STEP 6: Type `lock` and `unlock` commands to respectively lock and unlock the bus for a device.



```
COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_spi>lock
SSP_SUCCESS
sf_spi>unlock
SSP_SUCCESS
sf_spi>
```

STEP 7: Type `close` command to close the SPI Framework.



```
COM4:115200baud - Tera Term VT
File Edit Setup Control Window Help
sf_spi>close
SSP_SUCCESS
sf_spi>
```

NOTES:

1. In Developer Example, the command to perform write-read operation is writRead. This spelling mistake is introduced deliberately to bypass an issue with the console framework
2. Prior to the building and running the Developer Example, the configuration steps detailed in section ‘SPI Framework configuration steps’ should be followed to configure the BLE device correctly. Any wrong configuration will cause the device to not to respond to any of the commands.
3. During the write and write-read operations, a predetermined set of values are written to the BLE device instead of getting the data from the user. This is because BLE device expects to receive HCI commands and writing wrong or corrupt data might degrade the performance (or worse, cause damage) to the BLE module.
4. Developer example will exercise the write, read, and writRead API’s on BLE reset to observe the default expected values of BLE.
5. For details about BLE see the EM9301 datasheet.

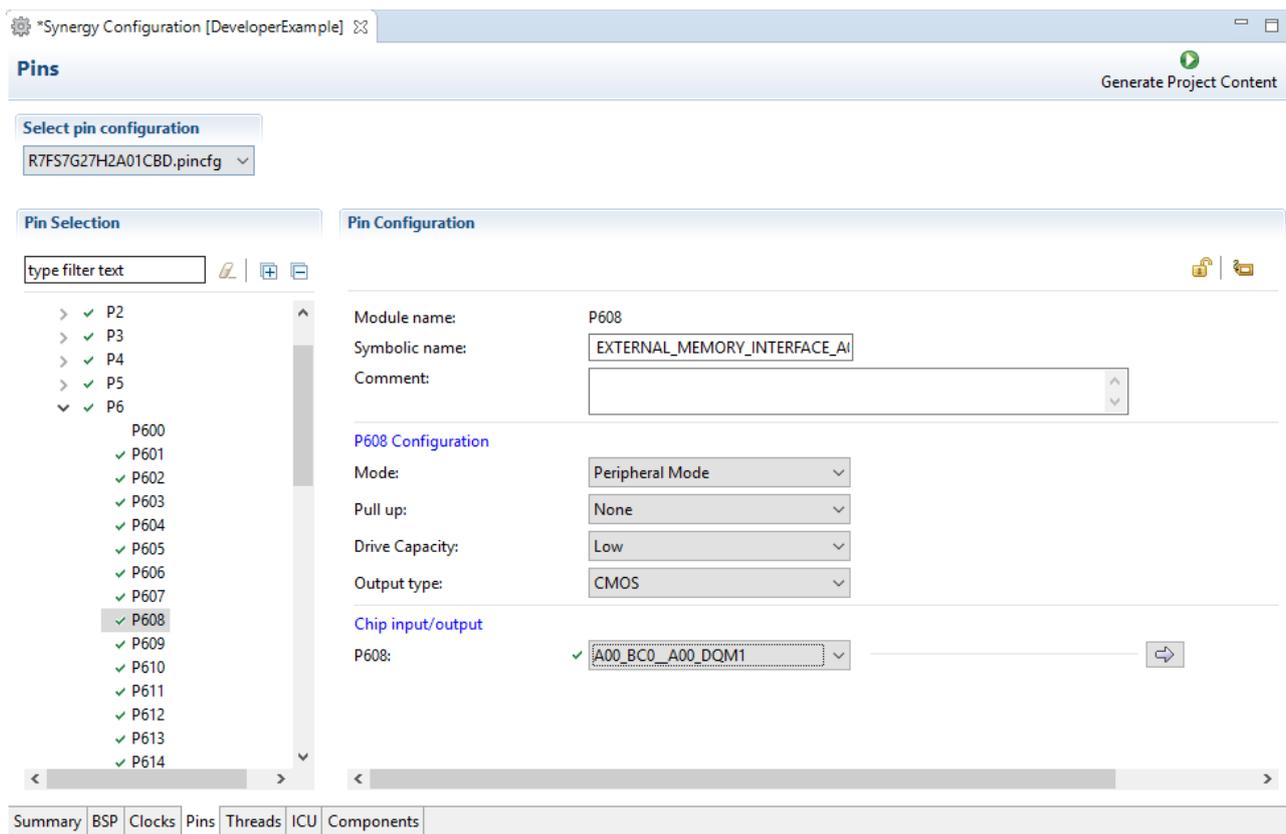
30. Developer Example: HAL JPEG Decode Driver

30.1 Introduction

The Developer Example exercises the JPEG decode driver interface to perform decode operation of a JPEG image. The resulting decoded image will be displayed in the e² studio debug window.

30.2 JPEG Decoder Pin Configuration

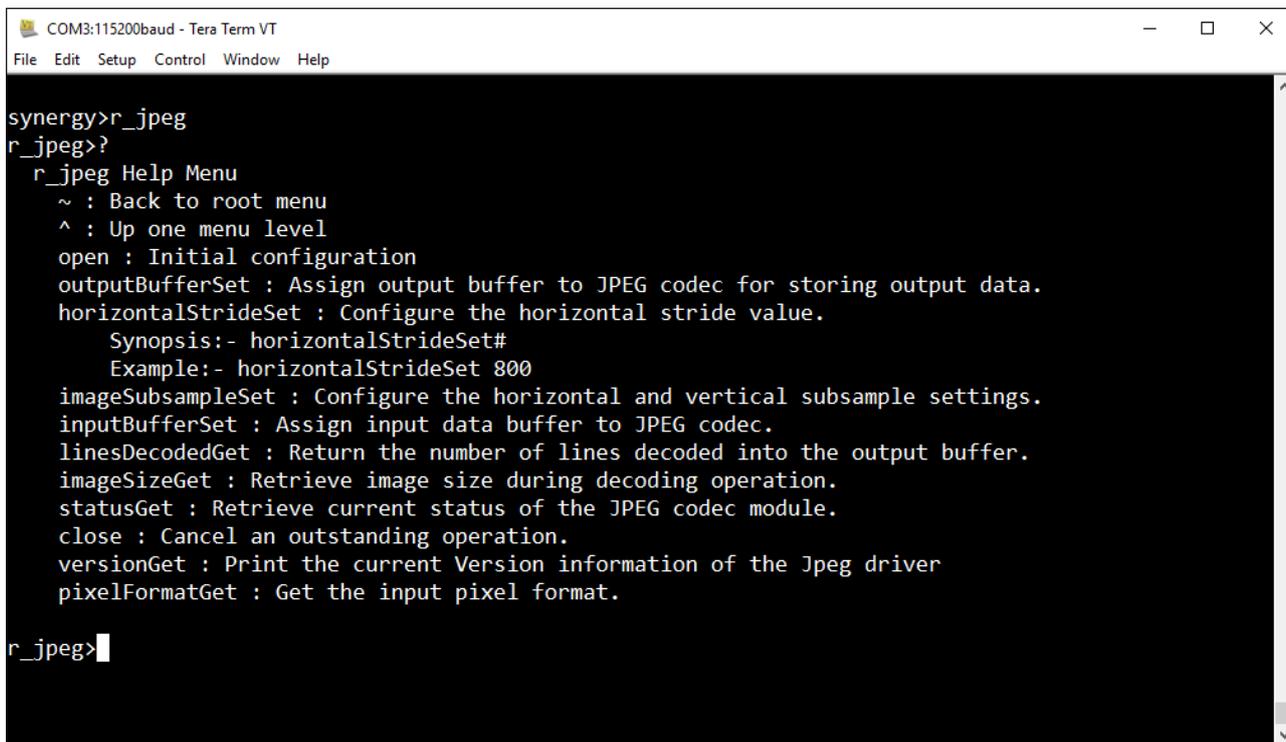
In order to run HAL JPEG and JPEG Framework change the pin (P6_8) configuration as shown below.



30.3 Run the HAL JPEG Decode Driver application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

Step1: Type `r_jpeg` in the terminal and press Enter to access the JPEG HAL submenu. For help, type '?' and press Enter.



Step 2: Type `open` in terminal to open the JPEG Driver.

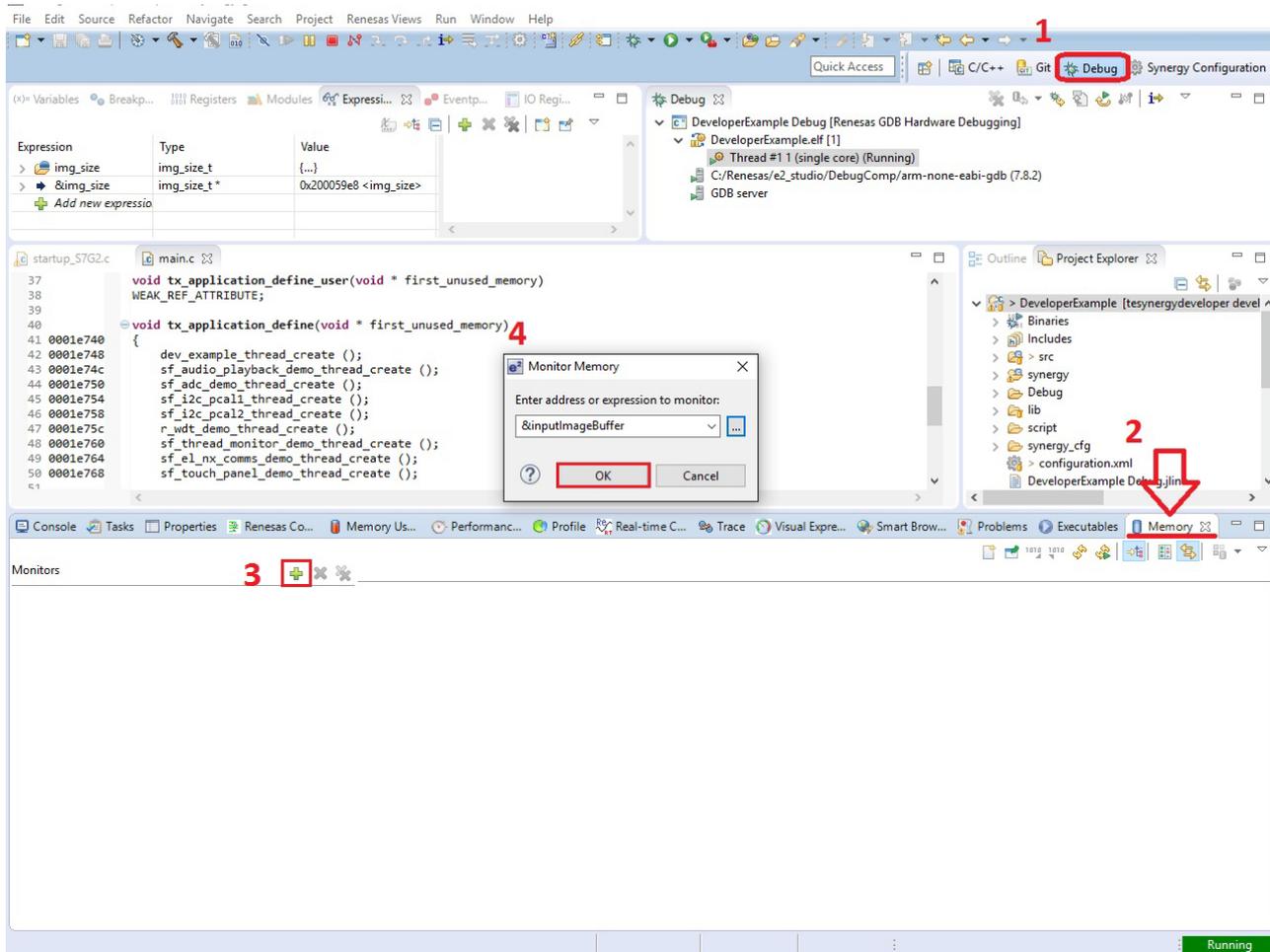


```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_jpeg>open
SSP_SUCCESS
r_jpeg>
```

Step 3: In e² studio's debug window go to memory tab and add the input image (`inputImageBuffer`) and output image (`outputImageBuffer`) buffer address.

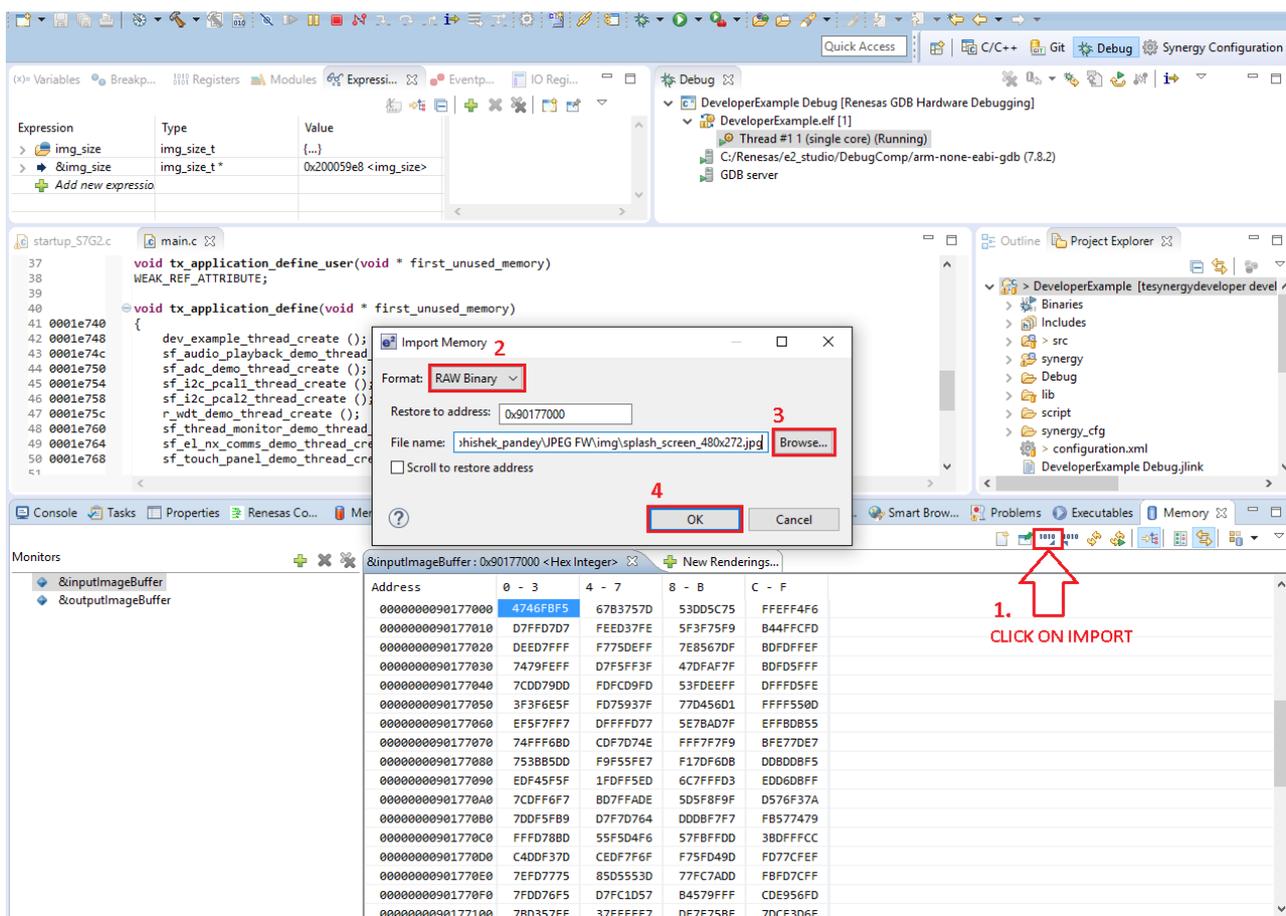
Sequence

1. Select  **Debug** prospective
2. Select  **Memory** tab
3. Click on add button 
4. Enter the address and press **OK**.



Follow a similar sequence for setting up `outputImageBuffer` address.

Step 4: Import the JPEG image from the file explorer to the `inputImageBuffer` address.



NOTE: Image size should not be greater than the allocated input buffer size (750 KB), otherwise the driver will return an error. You can increase the size of input buffer from the source code of HAL JPEG (file name r_jpeg_commands.c) by updating the INPUT_BUFF_SIZE value.

Step 4: In terminal execute the following command to set the input image and decoding parameter.

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
1 r_jpeg>inputBufferSet
SSP_SUCCESS
2 r_jpeg>imageSizeGet
Horizontal = 480
Vertical = 272
SSP_SUCCESS
3 r_jpeg>pixelFormatGet
JPEG_DECODE_COLOR_SPACE_YCBCR420
SSP_SUCCESS
4 r_jpeg>imageSubsampleSet

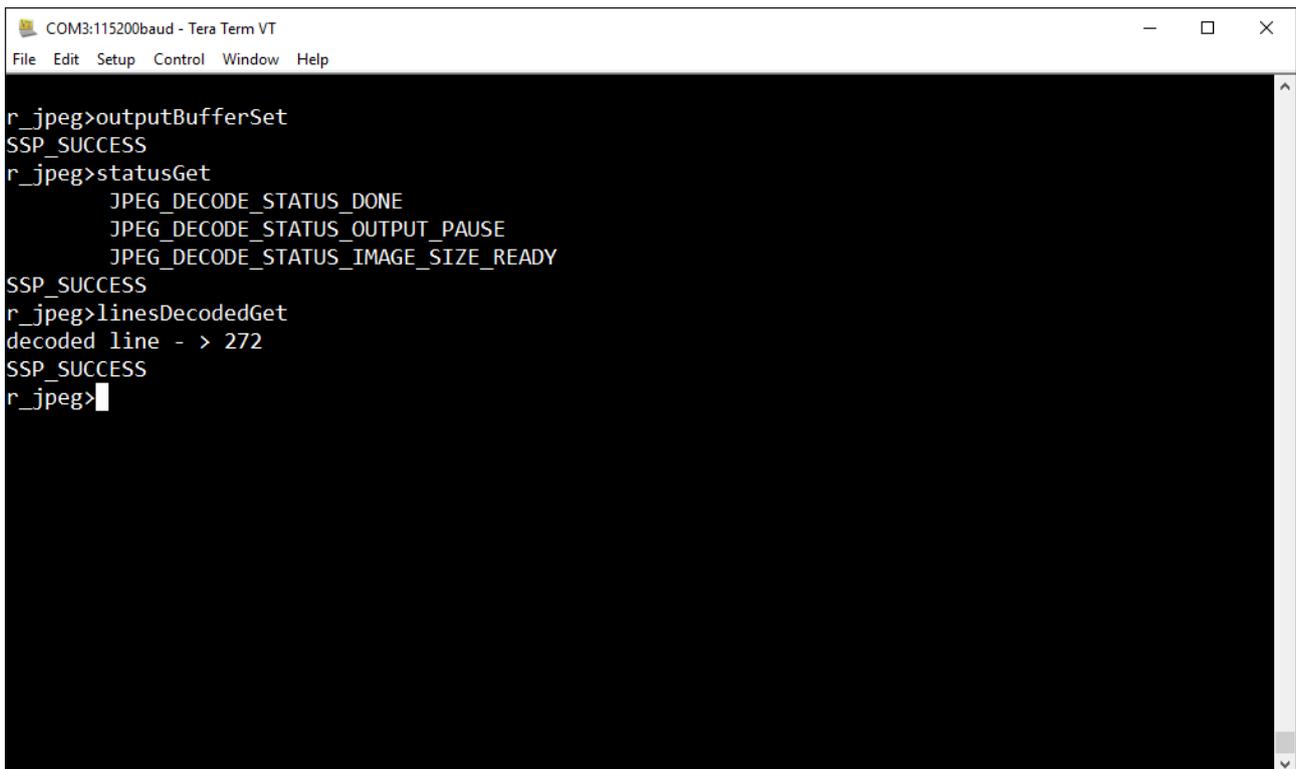
Set image Subsample for horizontal and vertical
--HINT This allows an application to reduce the size of the decoded image
0.JPEG_DECODE_OUTPUT_NO_SUBSAMPLE
1.JPEG_DECODE_OUTPUT_SUBSAMPLE_HALF
2.JPEG_DECODE_OUTPUT_SUBSAMPLE_ONE_QUARTER
3.JPEG_DECODE_OUTPUT_SUBSAMPLE_ONE_EIGHTH

For horizontal - 0
For vertical - 0
SSP_SUCCESS
5 r_jpeg>horizontalStrideSet 480
SSP_SUCCESS
r_jpeg>
    
```

- `inputBufferSet` command will set the address of `inputImageBuffer` to jpeg codec for decode operation.
- `imageSizeGet` and `pixelFormatGet` will print the image size(in pixel) and image pixel format on the console screen.
- Set the image sub-sample for horizontal and vertical by entering command `imageSubsampleSet` command.
- `horizontalStrideSet` sets the horizontal stride value by entering `horizontalStrideSet` along with value

NOTE: Horizontal stride value should not be less than the horizontal pixel value.

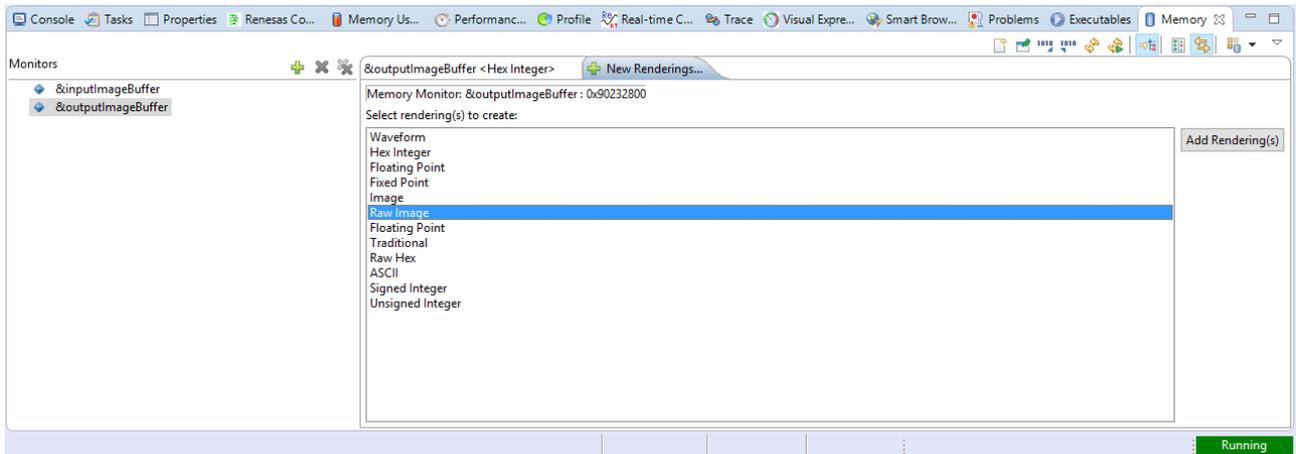
Step 5: Set the output buffer by entering `outputBufferSet` command in console. Set up output buffer image to trigger the JPEG decode operation. You can check your current decode operation status via `statusGet` command.



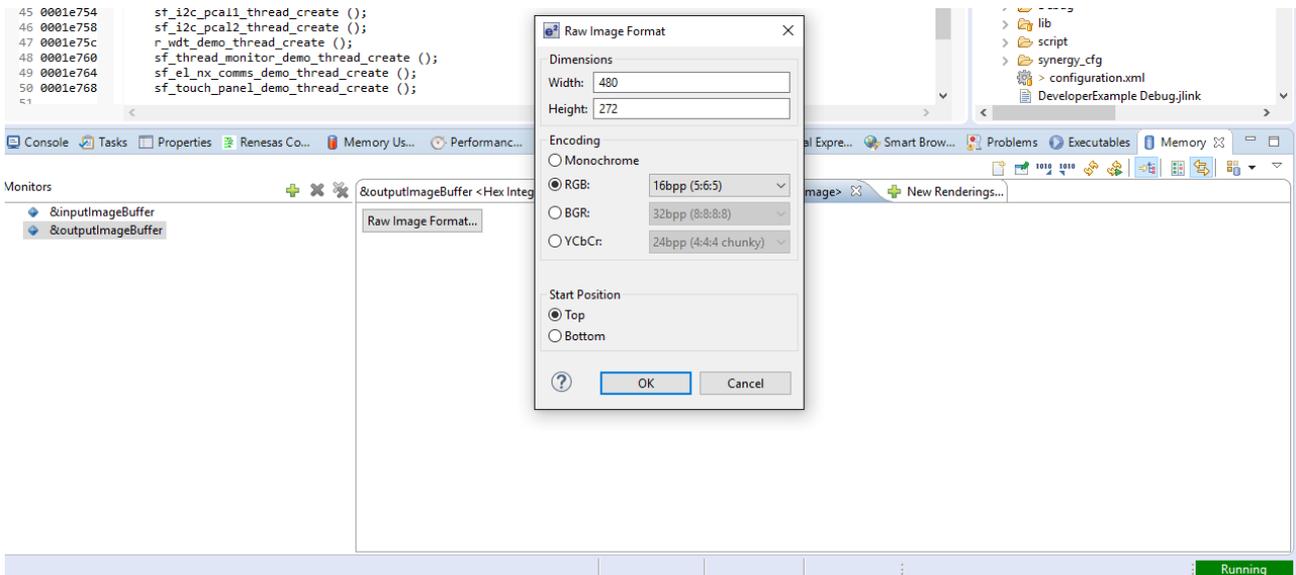
```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_jpeg>outputBufferSet
SSP_SUCCESS
r_jpeg>statusGet
    JPEG_DECODE_STATUS_DONE
    JPEG_DECODE_STATUS_OUTPUT_PAUSE
    JPEG_DECODE_STATUS_IMAGE_SIZE_READY
SSP_SUCCESS
r_jpeg>linesDecodedGet
decoded line - > 272
SSP_SUCCESS
r_jpeg>
```

`linesDecodedGet` command will return the number of line decoded by JPEG codec.

Step 6: If `statusGet` returns `JPEG_DECODE_STATUS_DONE` it means that your current JPEG operation is completed with success. In order to see the output image, go to the e² studio debug window under memory tab select `outputImageBuffer` and add raw image rendering and set the horizontal and vertical pixel width as well as RGB format.



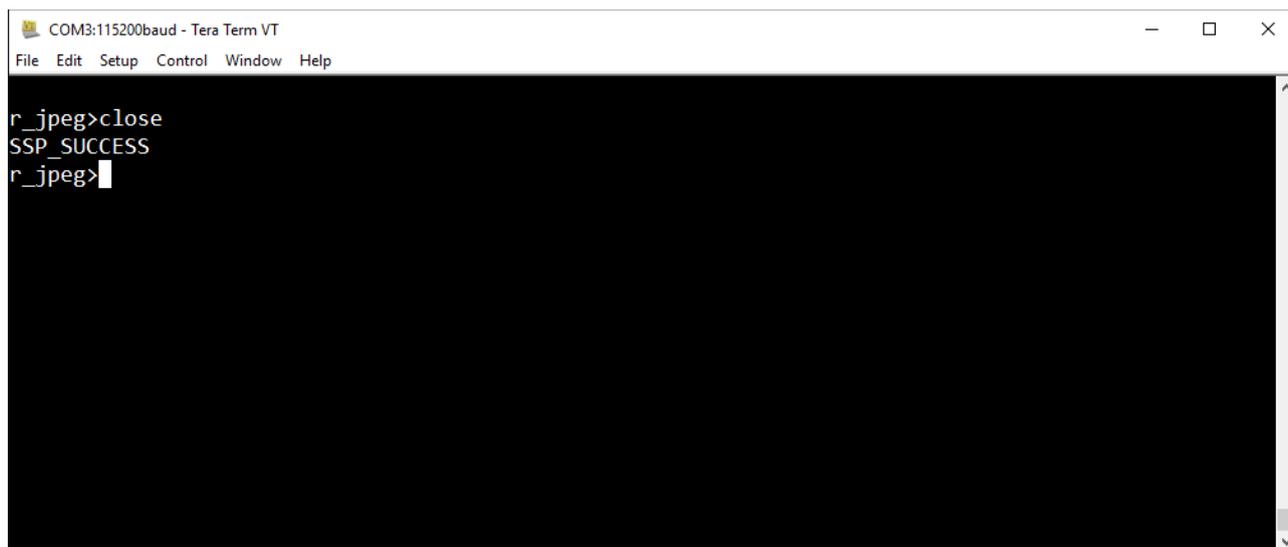
Select Encoding as RGB 565 with the Start Position at Top.



Final decode output image:



Step 6: Enter close command to close JPEG HAL driver.



```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
r_jpeg>close
SSP_SUCCESS
r_jpeg>

```

NOTE: Try this Developer Example with different image sub-sample values for horizontal and vertical as described in **Step 4** and see the effect on output image.

31. Developer Example: JPEG Decode Framework

31.1 Introduction

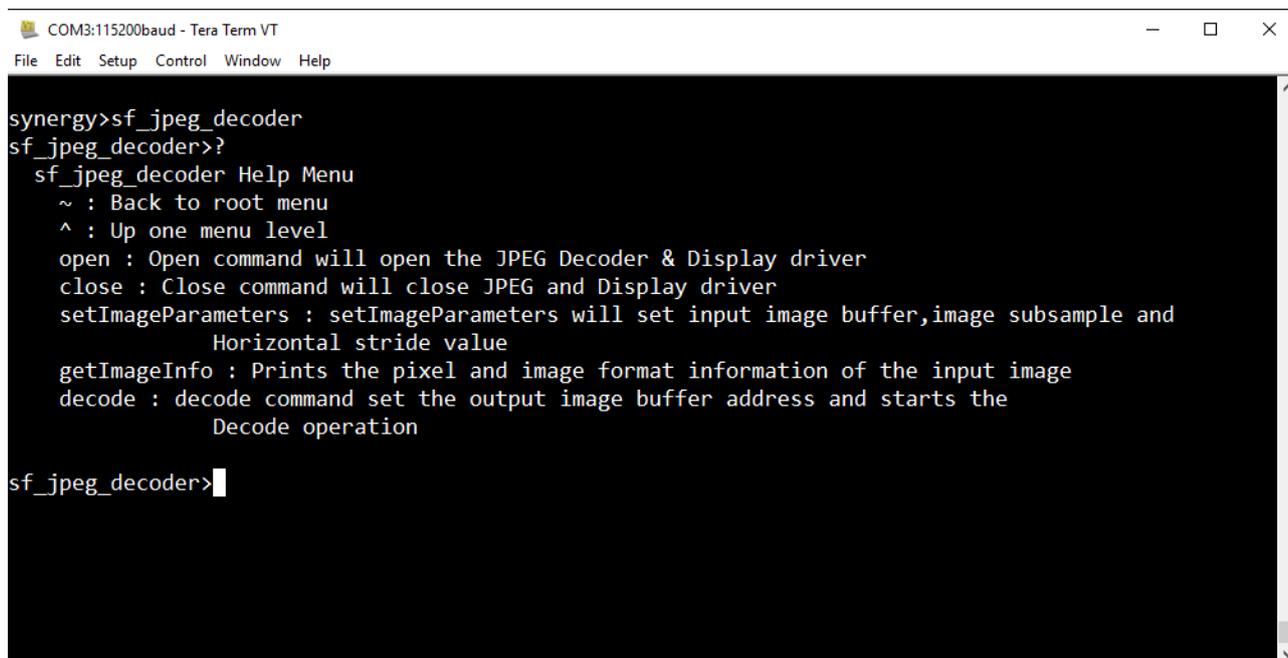
The Developer Example for JPEG Decode Framework will demonstrate the decode operation on JPEG image which include selecting image from SD card and displaying the decoded image on LCD screen.

31.2 Run the JPEG Decode Framework application

Follow the steps described in Build and Run a Developer Example application to obtain the Help menu with the list of applications in the terminal window.

NOTE: Change the pin configuration described in [JPEG Decoder Pin Configuration](#).

Step 1: Type `sf_jpeg_decoder` in the terminal and press Enter to access the JPEG HAL submenu. For Help, type “?” and press Enter.



```

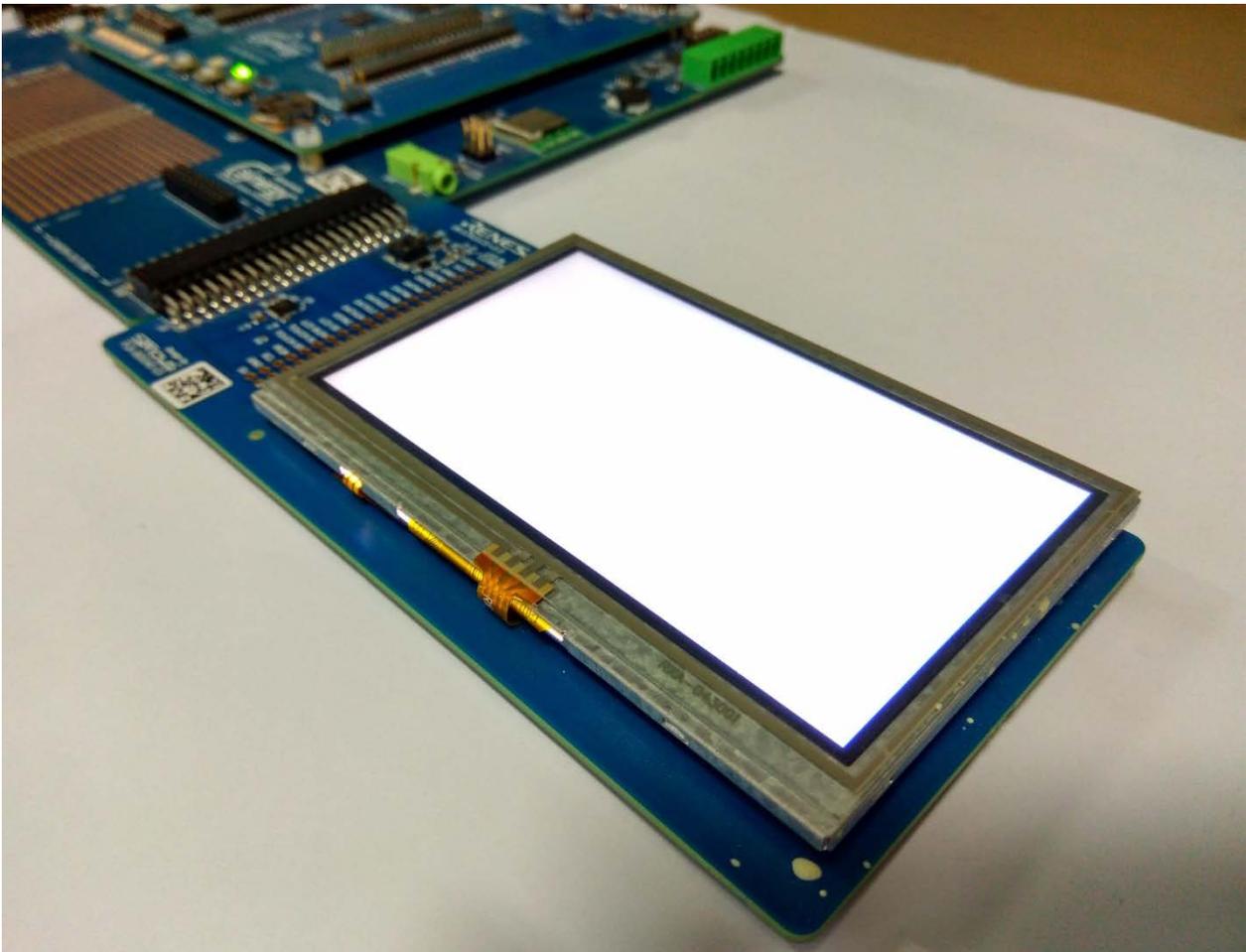
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
synergy>sf_jpeg_decoder
sf_jpeg_decoder>?
sf_jpeg_decoder Help Menu
~ : Back to root menu
^ : Up one menu level
open : Open command will open the JPEG Decoder & Display driver
close : Close command will close JPEG and Display driver
setImageParameters : setImageParameters will set input image buffer,image subsample and
                    Horizontal stride value
getImageInfo : Prints the pixel and image format information of the input image
decode : decode command set the output image buffer address and starts the
        Decode operation
sf_jpeg_decoder>

```

Step 2: Type `open` command to open the JPEG & GLCD Framework and Driver respectively.

```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
sf_jpeg_decoder>open
JPEG FW Open With - SSP_SUCCESS
GLCD Driver Open With - SSP_SUCCESS
Display start - SSP_SUCCESS
sf_jpeg_decoder>
sf_jpeg_decoder>
```

Execution of `open` command will turn the LCD panel ON.



Step 3: Type `setImageParameter` command to set the input image and image parameters. Entering `setImageParameter` command will show you the available images in the SD card on the console screen. Select any image and press the ENTER key. The JPEG codec processes the JPEG header and prints the image information, for example, the image size and pixel format in the console. It prompts you to set up the image sub-sample value for the horizontal and vertical. Select the appropriate value to reduce the size of the image or set to "0"(zero) for horizontal and vertical to keep the original size.

```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_jpeg_decoder>setImageParameters

System Volume Information
Renasas_Synergy.jpg
Renasas_Screen.jpg
Partly_Cloudy.jpg
Beach.jpg
Rainy.jpg
Grass.jpg
Space-Wallpaper.jpg
Sunflower.jpg

Select Image -Renasas_Synergy.jpg
JPEG CODEC STATUS ->
    JPEG_DECODE_STATUS_IDLE

    #Successfully set the input image#
Size of the image in pixel :-
Horizontal   : 480
Vertical     : 272
Pixel Format : JPEG_DECODE_COLOR_SPACE_YCBCR420
JPEG CODEC STATUS ->
    JPEG_DECODE_STATUS_IMAGE_SIZE_READY

Set image Subsample for horizontal and vertical
---HINT This allows an application to reduce the size of the decoded image
0.JPEG_DECODE_OUTPUT_NO_SUBSAMPLE
1.JPEG_DECODE_OUTPUT_SUBSAMPLE_HALF
2.JPEG_DECODE_OUTPUT_SUBSAMPLE_ONE_QUARTER
3.JPEG_DECODE_OUTPUT_SUBSAMPLE_ONE_EIGHTH

for horizontal - 0
for vertical   - 0

    Setting up horizontal stride

Horizontal stride set successfully
ALL Parameters Set Successfully
sf_jpeg_decoder>
```

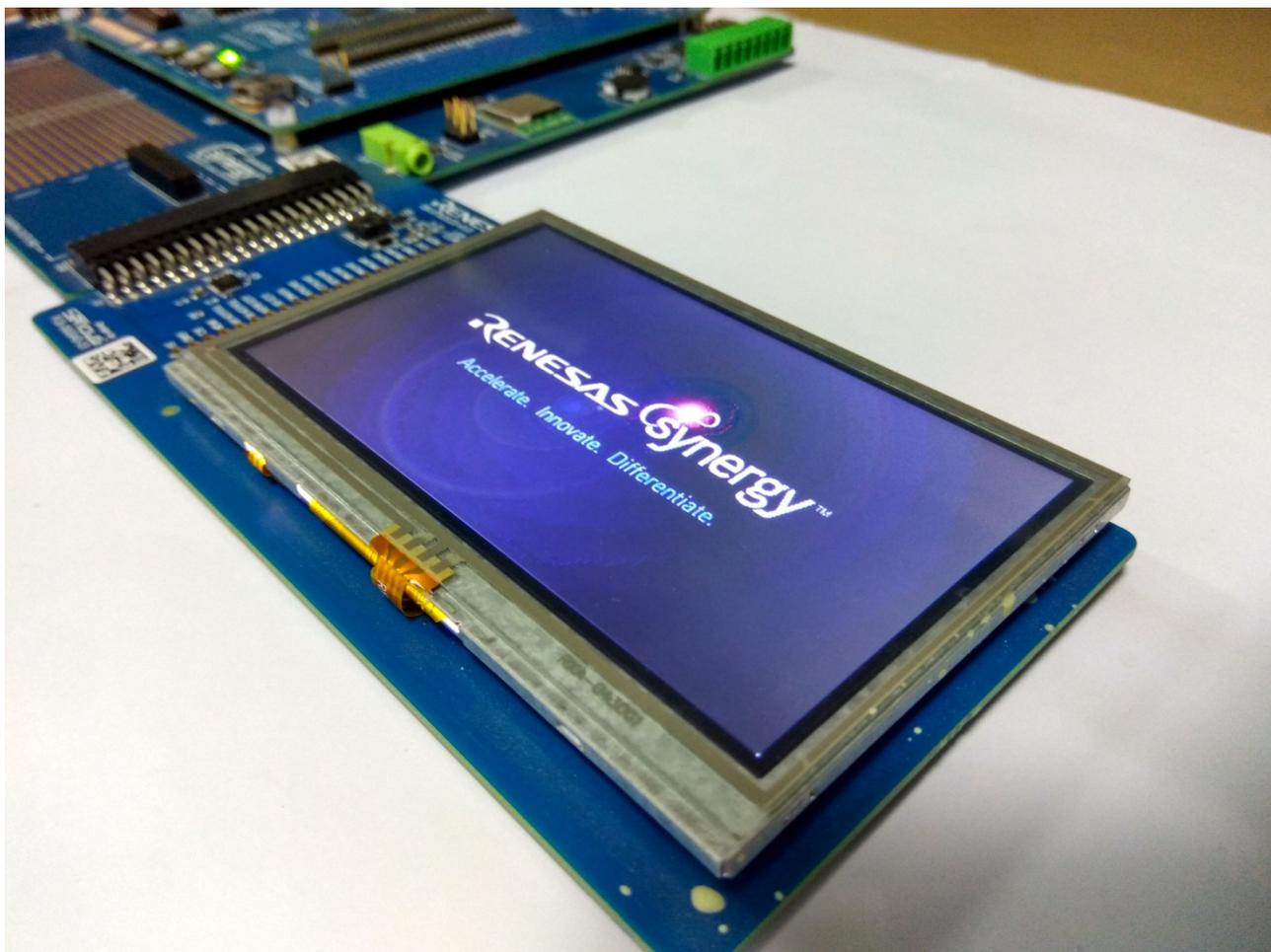
NOTE: In case If you fail to set the image or its parameters, you need to do `close>open` and then try with `setImageParameter` command.

Step 4: If the image and parameters are set with success, type the `decode` command to start the JPEG decode operation.

```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_jpeg_decoder>decode
JPEG CODEC STATUS ->
    JPEG_DECODE_STATUS_DONE
    JPEG_DECODE_STATUS_INPUT_PAUSE
    JPEG_DECODE_STATUS_OUTPUT_PAUSE
    JPEG_DECODE_STATUS_IMAGE_SIZE_READY
sf_jpeg_decoder>
```

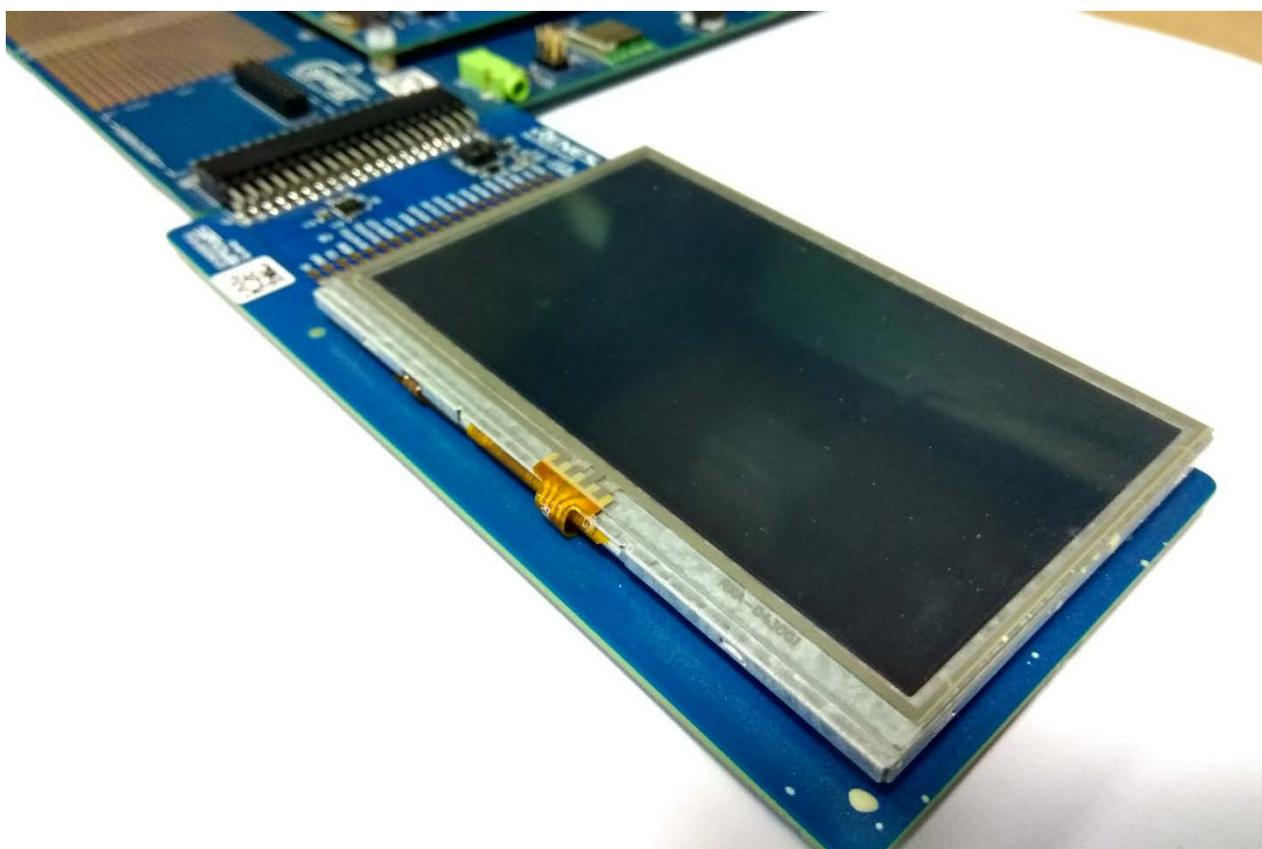
The decode command converts the jpeg file to a raw RGB image file that is displayed via the LCD screen.
(decode command will automatically display the decoded image on LCD screen)



Step 5: Enter close command to close JPEG and LCD.

```
COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help

sf_jpeg_decoder>close
Display driver Stop With - SSP_SUCCESS
JPEG Close With - SSP_SUCCESS
Display driver close With - SSP_SUCCESS
sf_jpeg_decoder>
```



32. Additional Technical Notices

Subscribe to the Synergy Technical Bulletin Board to receive the latest technical news and notifications about new features, known issues, workarounds, and release announcements. To subscribe, visit http://renesasrulz.com/synergy/synergy_tech_notes/f/214.aspx. Sign in to Renesas Rulz, and click 'Email Subscribe to this forum'.

Additional technical information, including informative papers and articles on SSP and Renesas Synergy can be found at the Synergy Knowledge Base, https://knowledgebase.renesas.com/Renesas_Synergy_Platform.

Website and Support

Support: <https://synergygallery.renesas.com/support>

Technical Contact Details:

- America: https://renesas.zendesk.com/anonymous_requests/new
- Europe: <http://www.renesas.eu/support/index.jsp>
- Japan: <http://japan.renesas.com/contact/index.jsp>

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Revision History

Rev.	Date	Description	
		Page	Summary
1.40	Sep 1, 2016	-	Initial version

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Handling of Unused Pins

Handle unused pins in accordance with the directions given under Handling of Unused Pins in the manual.

- The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

The state of the product is undefined at the moment when power is supplied.

- The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.

In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.

In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

- The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

- When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products

Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

- The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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