User Manual

DA16600 Evaluation Kit

UM-WI-026

Abstract

This document describes how to set-up and use the DA16600 Evaluation Kit.

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1 Terms and Definitions

DPM	Dynamic Power Management
AP	Access Point
USB	Universal Serial Bus
UART	Universal Asynchronous Receiver-Transmitter
RTC	Real Time Clock
WPS	Wi-Fi Protected Setup
SSID	Service Set Identifier
SDK	Software Development Kit
ARP	Address Resolution Protocol

2 References

[1] DA16200, Datasheet, Dialog Semiconductor

[2] UM-WI-002, DA16200, SDK Programmer Guide, User Manual, Dialog Semiconductor

[3] UM-WI-023, DA16200, EVK User Manual, Dialog Semiconductor

[4] UM-B-114, DA14531, Devkit Pro Hardware, User Manual, Dialog Semiconductor

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3 DA16600 Module EVK

Figure 1 shows the hardware configuration of the DA16600 Module Evaluation Kit (EVK).

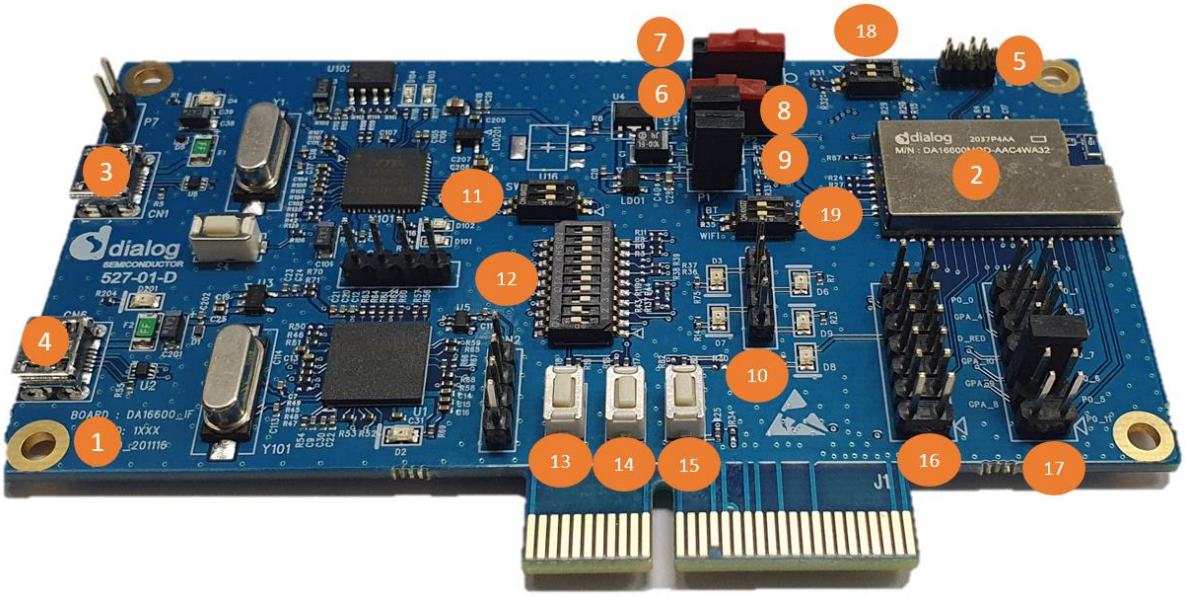


Figure 1: Hardware Configuration

DA16600 EVB has the following components:

1. **Main board**: DA16600 module (DA16600MOD-AAC) is installed.
2. **DA16600MOD-AAC Wi-Fi & Bluetooth® LE Combo Module**.
3. **USB Port**: UART0 is for debug, UART1 is for test.
4. **USB Port**: to debug, connect directly to DA14531, but do not use this port for normal operation.
5. **JTAG PIN**: allows connecting to I-jet (a JTAG debugger from IAR). See Figure 2.
   - Pin 7 is keyed with a white plug, so Pin 7 should be removed on EVK

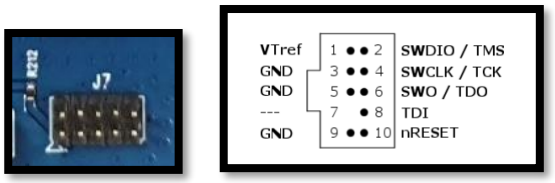


Figure 2: JTAG Pin Connection

6. **RTC Wake up2 key**: a switch to wake up the board from Sleep Mode.
7. **RTC Power key**: a switch to turn On/Off the board.
8. **Pin (P2)**: a jumper to measure current at Wi-Fi part. For normal operation, this pin should be shorted.
   - Pull out the Short Pin cap and connect the jumper wire to measuring equipment
9. **Pin (P1)**: a jumper to measure current at Bluetooth® LE part. For normal operation, this pin should be shorted.
   - Pull out the Short Pin cap and connect the jumper wire to measuring equipment
10. **Connector CN4**: GPIO test purpose connector.
    - To test GPIO in J2 and J14, connect to LED by this connector.

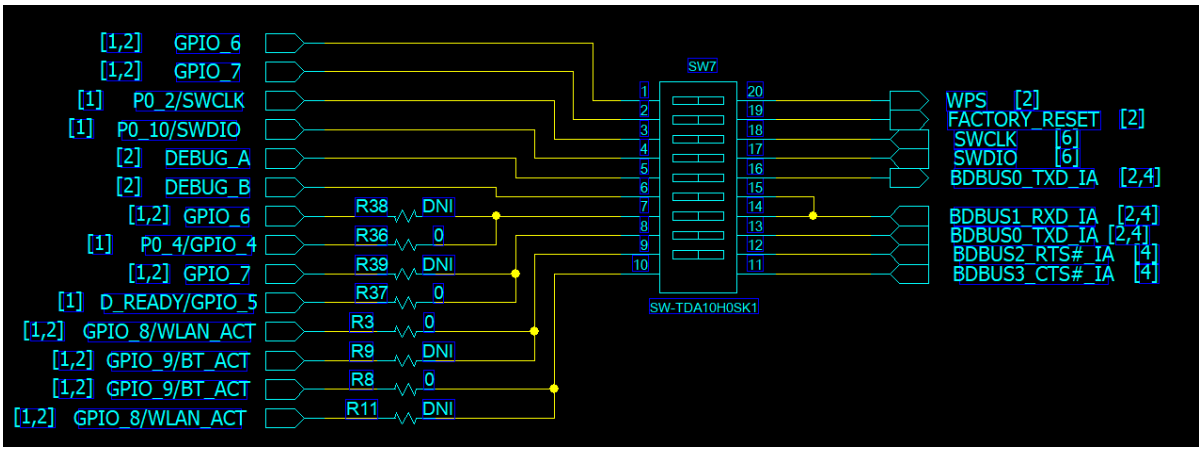
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11. **Switch SW3**: a switch to connect directly to DA14531 and use UART to check Bluetooth® LE performance.
    - This switch is set to Off in normal operation
12. **Switch SW7**: a multipurpose switch.
    - This switch is set to Off in normal operation
13. **Switch S2**: factory reset button using GPIOA7.
    - Set to ON at Pin2 of SW7 to use this switch
14. **Switch S1**: WPS button using GPIOA6.
    - Set to ON at Pin1 of SW7 to use this switch
15. **Switch S3**: reset button of DA14531 in test mode.
16. **Connector J2**: GPIO connector.
17. **Connector J14**: GPIO connector.
18. **Switch SW4**: a switch to control RF switch in DA16600MOD at test mode.
19. **Switch SW5**: a switch to check current consumption using power meter kit.

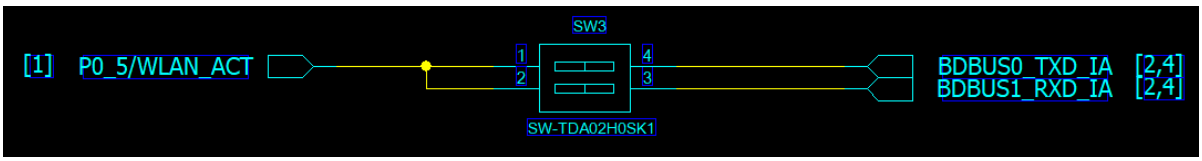
3.1 Description of Switch

3.1.1 Turn On Case of SW7



- Pin1 : When using the WPS function by GPIOA_6, turn on this pin to connect S1.
- Pin2 : When using the Factory reset function using GPIOA_7, turn on this pin to connect S2.
- Pin3,4 : When Debugging DA14531 by Keil.
- Pin5,6 : When check debug message of DA14531 in example application.
- Pin7,8 : When using UART1 of DA16200 by GPIOA_4,5.

3.1.2 Turn On Case of SW3

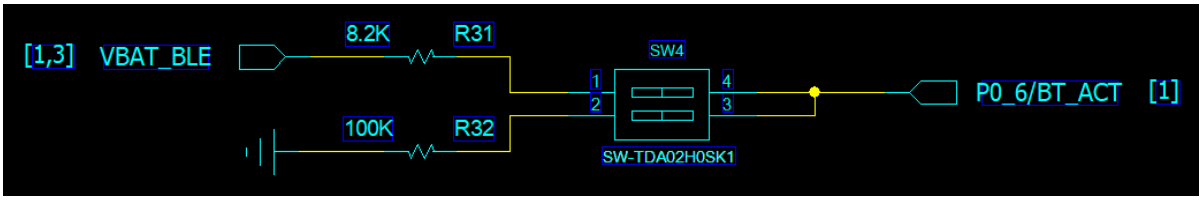


- Pin1,2 : When using UART1 of DA14531 by P0_5 (1-wire UART).

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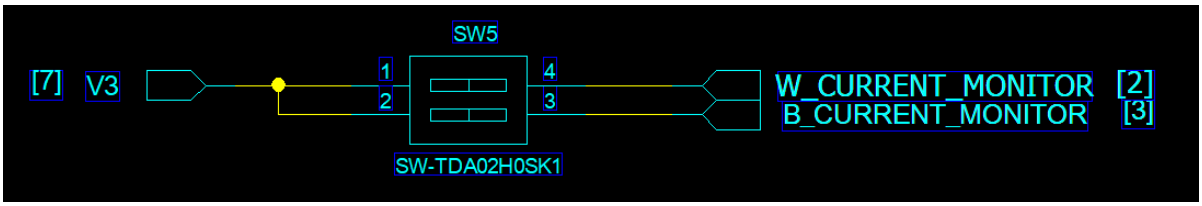
3.1.3 Turn On Case of SW4



When manually controlling the internal RF switch of DA16600.

- Pin1 : When RF path is connected to DA14531(Bluetooth® LE).
- Pin2 : When RF path is connected to DA16200(Wi-Fi).

3.1.4 Turn On Case of SW5



When measure the current consumption using power meter kit.

- Pin1 : When measure current consumption of DA16200 (Wi-Fi) which include RF switch.
- Pin2 : When measure current consumption of DA14531 (Bluetooth® LE).

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4 Wi-Fi Provisioning Setup

4.1 DA16600 Connecting the Board

This section describes the installation procedure for the drivers, the configuration of the serial port, and the steps needed to verify the connection with the PC as well as solutions to problems that may occur.

On first connection to a host PC running Microsoft Windows, the system detects several devices and automatically installs all necessary drivers. If drivers are not automatically installed, you can get them from the following url: http://www.ftdichip.com/Drivers/CDM/CDM21224_Setup.zip.

The Windows driver creates two virtual COM ports. The first COM port (lower number, COM35 in this example) provides a UART interface for debugging or firmware download between the PC and the DA16600. See Figure 3.

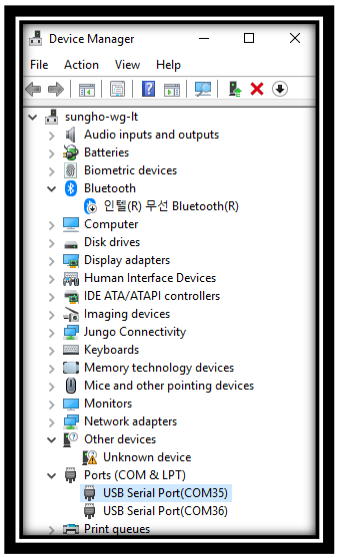


Figure 3: Check COM Ports on Device Manager

4.2 Configure the Serial Port for UART

For a Windows Host, the **Tera Term** utility is used to fully validate the connection to the DA16600 EVK.

Tera Term is a free software terminal emulator (communication program) which supports multiple communication including Serial port connections. Download **Tera Term** from https://ttssh2.osdn.jp. Run the **teraterm-x.yy.exe** and follow the installation wizard.

To make sure that the communication between the DA16600 EVK and host PC is properly established, you need to verify the UART connection between the two nodes. Do the following:

1. Connect the DA16600 EVK to the PC to USB Port via USB cable.
2. Verify that the host identifies two serial ports as shown in Figure 3 – the second is connected to UART (see Section 4.1).
3. In the **Windows Start** menu, open **Tera Term**.
4. In the **Tera Term: New connection** dialog, do the following:
   a. Select **Serial**.
   b. Select the COM Port to use.
   c. Click **OK**.

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5. Select **Setup > Serial Port** and configure your UART port using the parameters as shown in Figure 4.
6. Open the Lowest COM port number assigned to the DA16600 EVK.
   Figure 3 shows which port number to select in Device Manager in Windows. Make sure that the UART is configured as shown in Figure 4.

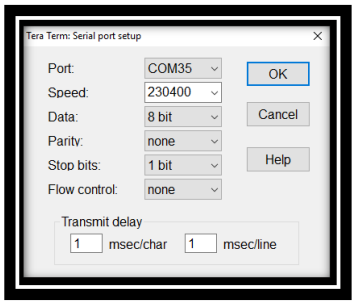


Figure 4: Serial Port Setup

4.3 Setup for Wi-Fi Provisioning Using Bluetooth® LE

DA16600 module may be used in a product like "Wi-Fi door-lock" where Wi-Fi is playing the main role, and Bluetooth® LE assists with Wi-Fi Provisioning at the product's initial setup (Out-of-Box). A Bluetooth® LE peer application (for example Android/IOS mobile App) interacts with users to set up DA16600 device - by giving Wi-Fi Provisioning information (for example Wi-Fi Home router's SSID, password, server info, and other).



Figure 5: Diagram of Provisioning via Bluetooth® LE

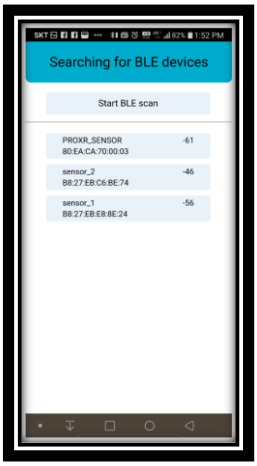
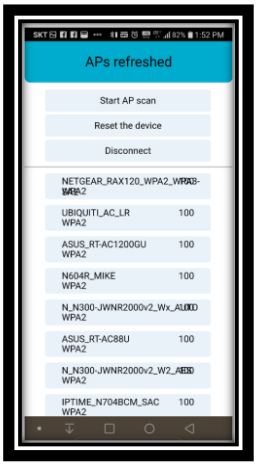
To set up Wi-Fi provisioning:

1. Check the prompt **[/DA16200] #**.
2. Run Provisioning App and follow the steps in Table 1.

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Table 1: Steps for Provisioning via Bluetooth® LE

1. Start **App** to scan Bluetooth® LE	2. Select **DA16600** to connect App to DA16600.	3. Press **Start AP Scan** button to find AP.
		
4. Choose application you want to connect to.	5. Enter password for the selected application.	6. Wi-Fi provisioning is completed.
		

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5 Current Measurement

For detailed information on Sleep mode, see the Low Power Operation Mode section in DA16200 Datasheet [1]. To measure current waveform, connect EVK's current measurement point (P1 and P2) with the measurement instrument (KEYSIGHT 14585A).

Figure 6 shows a typical test setup environment.

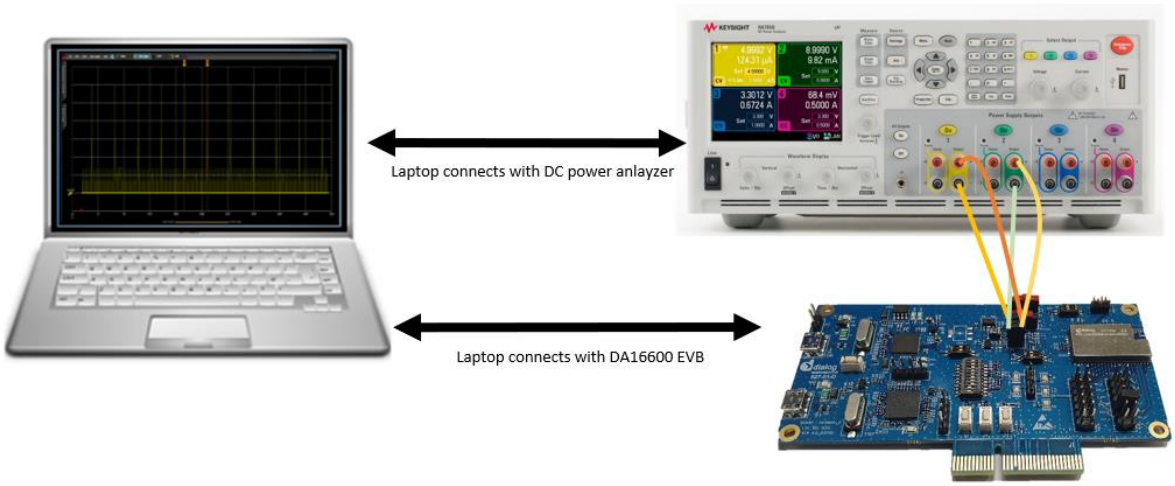


Figure 6: Current Test Environment

For more detailed information on using power meter kit, see DA16600_SB_Power_Meter_Kit_User_Manual [1].

6 Hardware Setup for RF Test

DA16600MOD consists of DA16200 and DA14531 chipsets, see chipset GUI guides for details:

[1] UM-WI-004_DA16200_AT_GUI_Tool_User_Manual_Rev_1v3

[2] AN-B-077 DA14531 Bluetooth Direct Test Mode v1.0

6.1 Wi-Fi Test Setup

GPIOA4 and GPIOA5 can be used with UART to test RF performance of DA16200.

Turn on pin 7 and 8 of SW7 to use UART with GPIOA4 and GPIOA5.



Figure 7: SW3 and SW7 Set to Use AT-GUI

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6.2 Bluetooth® LE Test Setup

P0_5 can be used with 1-wire UART to test RF performance of DA14531.

Turn on pin1 and 2 of SW3 to use UART and turn off pin 7 and 8 of SW7.

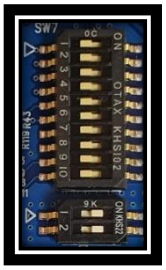


Figure 8: SW3 and SW7 Set to Use SmartSnippets

SW4 can control RF switch. Turn on pin1 of SW4 to control RF switch to Bluetooth® LE RF path.



Figure 9: SW4 Set to Use Bluetooth® LE RF Path

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7 Firmware Update

The security features of DA16600 support Secure Boot to avoid booting with fake or untrusted images and to protect against hacking. The DA16200 SoC includes a security hardware block called CryptoCell-312 (CC312). With proper security keys and certificates installed (in OTP and images), the DA16200 can boot in secure mode.

DA16600 requires four images. With a serial terminal tool, each image can be loaded individually:

- <Bootloader image>: also known as Second Bootloader
  - `DA16200_[image_type]-[vendor]-[major]-[minior]-[customer_ver]_[sflash_model].img`
    - [Image_type]: Bootloader (BOOT), Main, or System library (SLIB)
    - [vendor]: Internal use by vendor
    - [major]: Major version
    - [minor]: Minor version or SDK patch version
    - [customer_ver]: User-configurable customer version
    - [sflash_model]: sflash model or type used
  - For example: `DA16200_BOOT-GEN01-01-xxxxx-xxxxxx_W25Q32JW.img`
- <System Library image>: includes RF drivers and libraries for DPM
  - For example: `DA16200_SLIB-GEN01-01-xxxxx-xxxxxx.img`
- <Main image>: includes RTOS and applications
  - For example: `DA16200_RTOS-GEN01-01-xxxxx-xxxxxx.img`
- <DA14531 image>:
  - For example: `DA14531_multi_part_proxr_peri.img`

7.1 Flash MAP

DA16200 provides two images: #0 and #1. You can use these regions for each image set and change the index of the booting image set. The default value of the Boot Index is #0.

Table 2: 4 MB Serial Flash Memory Map

Address	Item	Size
0x0000_0000	2nd Bootloader	36 kB
0x0000_9000	Boot Index	4 kB
0x0000_A000	RTOS #0	1536 kB
0x0018_A000	SLIB #0 (RamLib + TIM)	64 kB
0x0019_A000	User Area #0	364 kB
0x0020_0000	RTOS #1	1536 kB
0x0038_0000	SLIB #1 (RamLib + TIM)	64 kB
0x0039_A000	User Area #01	448 kB

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7.2 Bootloader Image

<Bootloader image> is also known as the second bootloader and is the first thing loaded into memory for a factory-created DUT (for example with an empty flash).

Note that this image has SFDP information, which is important sflash type information, so always load this image before loading other images.

If you get a new SDK, then you should start with loading the <Bootloader image>. To load the <Bootloader image>:

1. Turn on the DA16600 board.
2. At the `[/DA16200]` prompt, type `reset` to go to the Mask ROM prompt `[MROM]`. See Figure 10.

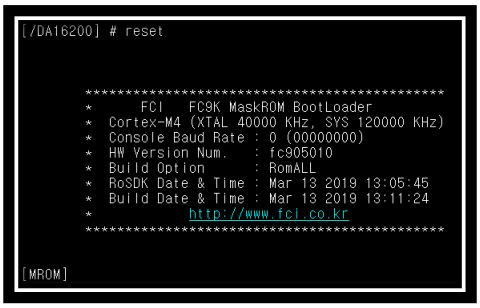


Figure 10: Mask ROM

3. At the `[MROM]` prompt, type `loady boot`. See Figure 11.

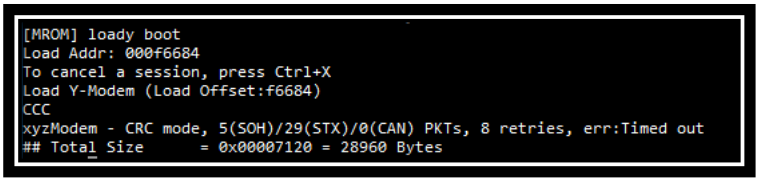


Figure 11: Bootloader Prompt on Command Window

4. Choose menu **File > Transfer > YMODEM > Send** to select the image file for the **Bootloader**. See Figure 12.
   - For example: `DA16200_BOOT-GEN01-01-xxxxx-xxxxxx_W25Q32JW.img`
   - The result is printed at the end of the transfer. Please ignore any messages like "`err:..`"

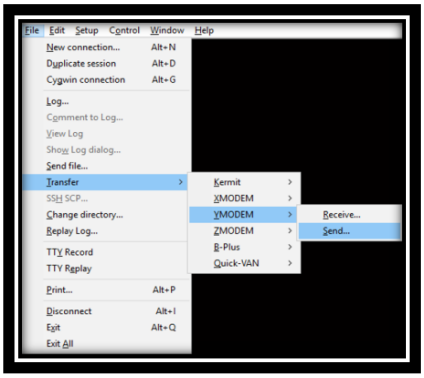


Figure 12: Load Image File

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7.3 System Library Image

The <System Library image> includes system libraries, RF drivers, and libraries to operate the DPM.

To load the <System Library image>:

1. At the `[MROM]` prompt, type `loady 18a000` to load a <System Library image> in boot index #0. See Figure 13.

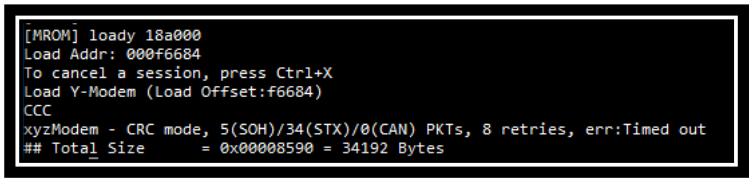


Figure 13: System Library Prompt on Command Window

2. Choose menu **File > Transfer > YMODEM > Send** to select the <System Library image> file. See Figure 14.
   - For example: `DA16200_SLIB-GEN01-xx-xxxxx-xxxxxx.img`

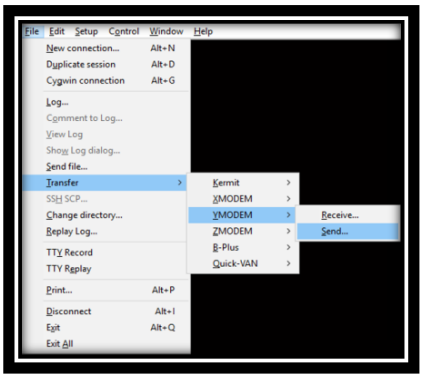


Figure 14: Load Image File

7.4 Main RTOS Image

This <Main image> contains RTOS, Wi-Fi libraries, and system/user applications.

To load the <Main image>:

1. At the `[MROM]` prompt, type `loady a000`. See Figure 15.

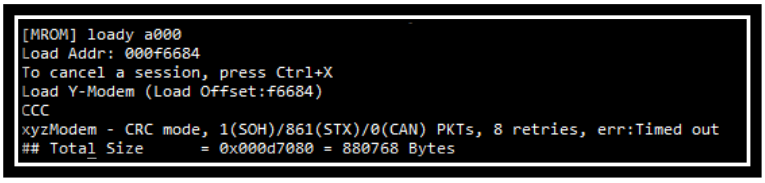


Figure 15: Main Image Prompt on Command Window

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2. Choose menu **File > Transfer > YMODEM > Send** to select the <Main image> file. See Figure 16.
   - For example: `DA16200_RTOS_GEN01-XX-YYYY-ZZZZZZ.img`

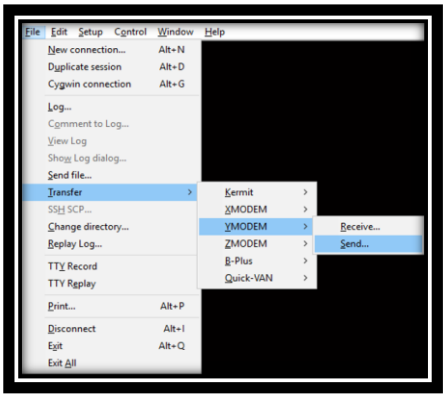


Figure 16: Load Image File

7.5 DA14531 Image

This <DA14531 image> is downloaded to DA14531 during booting sequence.

To load <DA14531 image>:

1. At the `[MROM]` prompt, type `loady 392000 1000 bin`. See Figure 17



Figure 17: DA14531 Image Prompt on Command Window

2. Choose menu **File > Transfer > YMODEM > Send** to select the <Main image> file.
   - For example: da14531_multi_part_proxr_peri`.img`

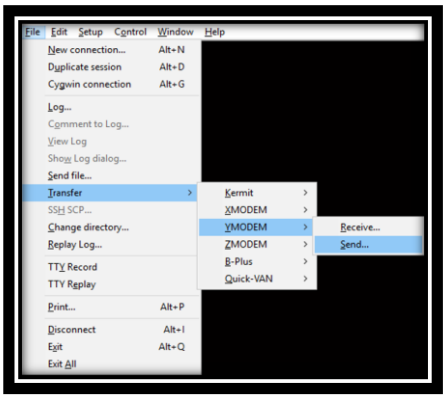


Figure 18: Load Image File

3. If the four images are loaded, then at the `[MROM]` prompt, type `boot` to boot your images.
4. Run `factory` reset as shown in Figure 19.

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Figure 19: Factory Mode Prompt on Command Window

NOTE
Now all four required images are loaded.

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7.6 Serial Flash Recovery

When the serial flash is replaced, the flash memory map is changed, or if you think that the flash memory is corrupted, then do the following to re-initialize or recover sflash and check the process:

1. Boot DA16200.
2. At the `[/DA16200] #` prompt, run `reset` command.
3. At `[MROM]` prompt, run `sflash info` command to read serial flash information.
   For example, SFLASH: ef601615.
   This is the flash product ID of W25Q32JW. See also the IDs below.

```
W25Q32JWSNIQ: ef601615
```

4. Run `ymodem sfdp` command.
5. In the `build\SBOOT\SFDP` folder, find Flash SFDP file which is corresponding to Flash ID as `W25Q32JW.bin`.
6. Run `sflash erase 0 400000` command `[MROM]` to erase the entire flash for recovery.

   Note that this command can take a long time to complete. Wait until the `[MROM]` prompt appears again.
7. Re-load all images in the specified order for serial flash recovery.
   a. `[MROM] loady boot`.
   b. `[MROM] loady 18a000`.
   c. `[MROM] loady a000`.
   d. `[MROM] loady 392000 1000 bin`.
8. Run `boot` command to boot DA16600.

   The image version is printed.
9. Initialize `NVRAM` for Serial Flash Recovery with following commands:

```
[/DA16200] # nvram
[/DA16200/NVRAM] # nvedit erase sflash
[/DA16200/NVRAM] # nvedit clear
[/DA16200/NVRAM] # nvcfg update sflash
update , sflash completed
[/DA16200/NVRAM] # nvedit load sflash
nvedit , load completed
[/DA16200/NVRAM] #
```

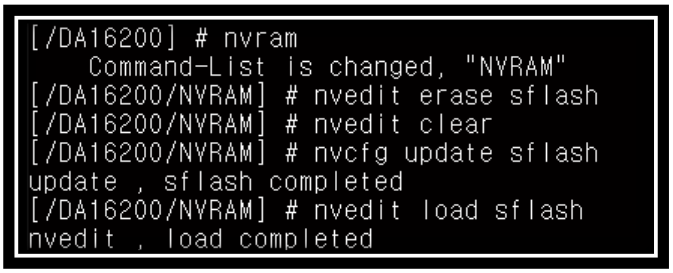


Figure 20: Initialize NVRAM

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7.7 Serial Flash Recovery from Boot

If there are any memory conflicts during updating the image or errors while building the SDK, the reason might be that it cannot run DA16200. In this case, you cannot do anything in the command window. DA16200 must be forced to enter boot mode. Do the following:

1. Use RTC_PWR_KEY to turn off (move to OFF position).
   - Connect two pins: Pin 11(F_CLK) and P12(GND) of J2. See Figure 21

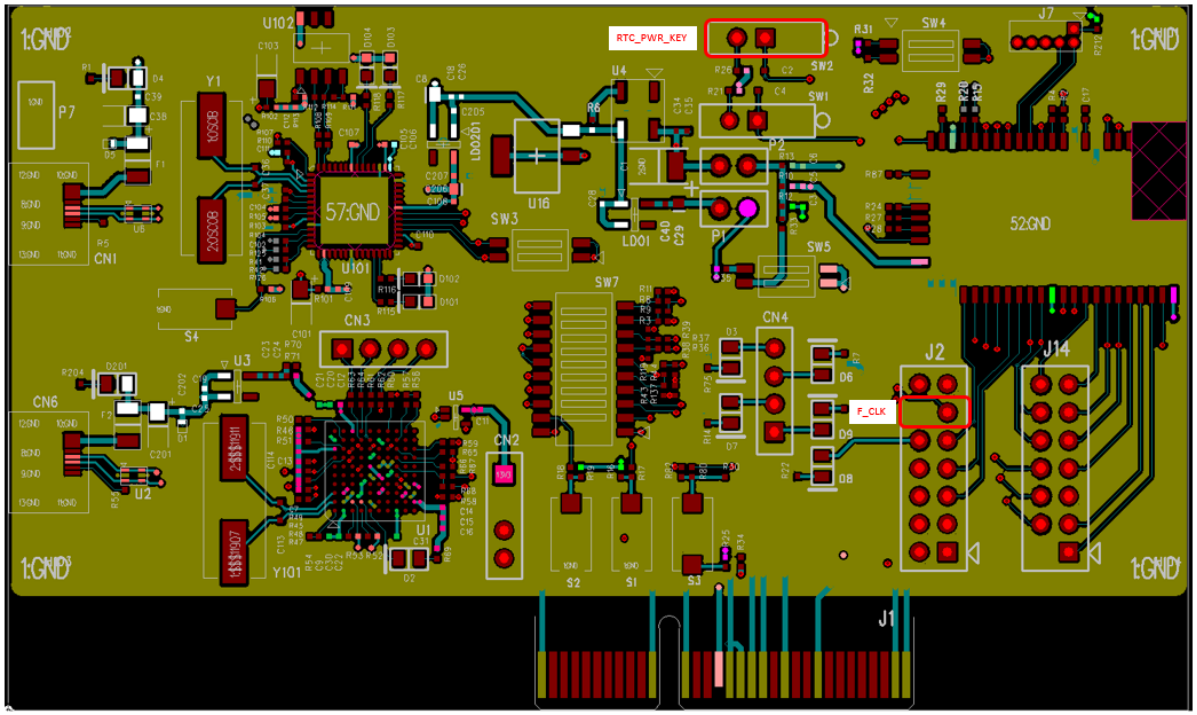


Figure 21: Recovery Point in the EVK

2. Use RTC_PWR_KEY to turn on (move to ON position).
   a. Turn on RTC_PWR_KEY to boot DA16600.
   b. Disconnect the two pins of J2. Pin 11 (F_CLK) and Pin 12 (GND).

   The DA16600 go into the BOOT mode. See Figure 22.

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3. At the `[BOOT] #` prompt, run `reset` command.
4. Do the steps in Section 7.6 from step 3.

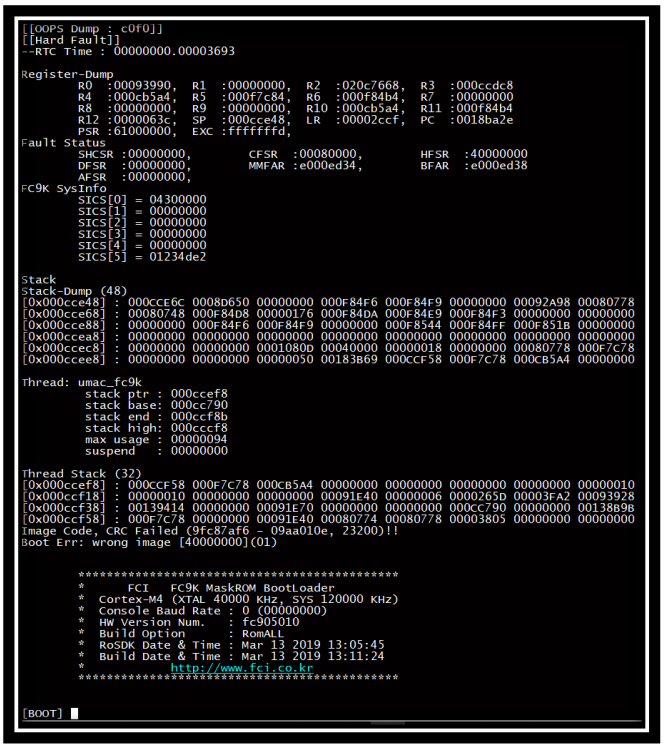


Figure 22: Run with BOOT Mode

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Revision History

Revision	Date	Description
1.2	28-Mar-2022	Update logo, disclaimer, copyright.
1.1	20-Jan-2021	Change board picture and add description of switch
1.0	30-July-2020	First Release.

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Status	Definition
DRAFT	The content of this document is under review and subject to formal approval, which may result in modifications or additions.
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