

User Manual

DA16200 Evaluation Kit

UM-WI-047

Abstract

This user manual describes how to set up and use the DA16200 Evaluation Kit.

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DA16200 Evaluation Kit**1 Terms and Definitions**

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
EVK	Evaluation Kit
PCI	Peripheral Component Interconnect
JTAG	Joint Test Action Group
GPIO	General Purpose Input/Output
SPI	Serial Peripheral Interface
MCU	Micro Controller Unit
STA	Station
COM	Communication Port
SNTP	Simple Network Time Protocol
DHCP	Dynamic Host Configuration Protocol
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
APP	Application
MAC	Medium Access Control
DNS	Domain Name System
GARP	Gratuitous Address Resolution Protocol
CLI	Command Line Interface
WPA	Wi-Fi Protected Access
RSN	Robust Security Network
IEEE	Institute of Electrical and Electronics Engineers
NVRAM	Non-Volatile Random-Access Memory
PSK	Pre-Shared Key
TKIP	Temporal Key Integrity Protocol
WMM	Wi-Fi Multimedia
RTS	Request to Send
OTP	One Time Programmable Memory
DUT	Device Under Test
SFDP	Serial Flash Discoverable Parameter
RTOS	Real Time Operating System
ROM	Read-Only Memory
SLIB	System Library

2 References

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

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3 DA16200 Module EVK

Figure 1 shows the hardware configuration of the DA16200 Module Evaluation Kit (EVK).

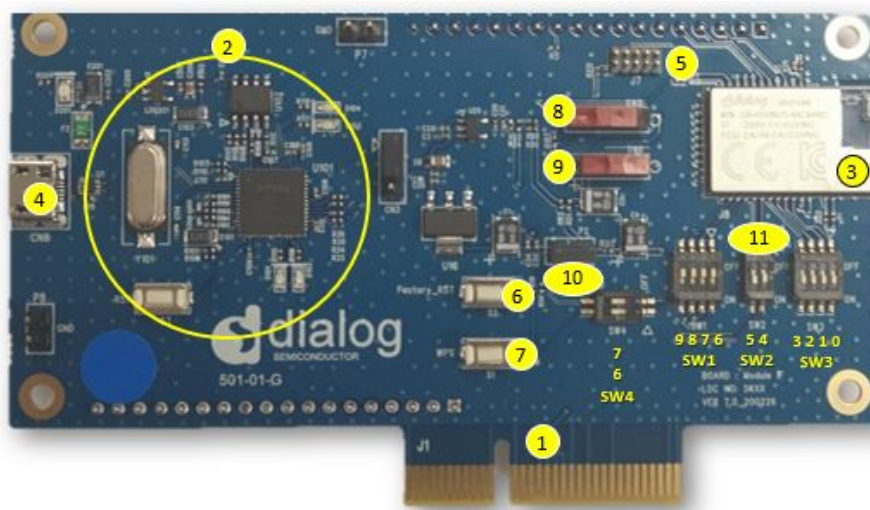


Figure 1: Hardware Configuration

DA16200 has the following components:

1. Main board: The DA16200 module (DA16200MOD-AAC4WA32) is installed on the PCI type main board.
2. USB Interface part.
3. DA16200MOD-AAC4WA32 Wi-Fi Module.
4. USB Port: UART0 (for debug) and UART1 (for AT command).
5. JTAG PIN: to be able to connect I-jet (a JTAG debugger from IAR). See Figure 2.
 - a. Pin 7 on each end is keyed with a white plug, so Pin 7 should be removed on EVK.



Figure 2: JTAG Pin Connection

6. Factory Reset Button: press for more than five seconds to initialize `nvr` data.
7. WPS Button: press to start WPS mode.
8. RTC Wake-up key: switch to wake up the board from Sleep Mode.
9. RTC Power key: switch to turn the board on/off.
10. Pin (P2): selected part in red color is for current measurement. For normal operation, this pin should be shorted. See Figure 3.
 - a. Pull out the Short Pin cap and use the jumper wire to connect to measuring equipment.

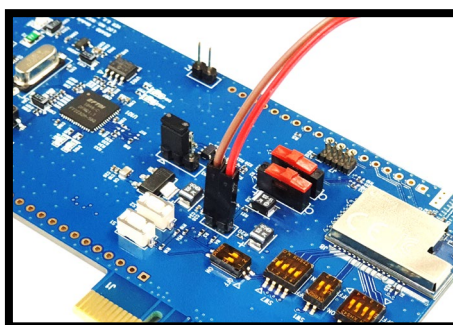


Figure 3: Test Point for Current Measurement

11. GPIO, SPI selective switch: SW2, SW3, SW4 (Default: on), SW1 (Default: off). See [Table 1](#).

Table 1: GPIO, SPI Selective Switch

Selective Switch	On	Off
SW3: GPIO 0, 1, 2, 3	Image download using SPI 1	Not defined
SW2: GPIO 4, 5	UART 1(TXD, RXD) to FT232H	UART 1 to external MCU for Test
SW1: GPIO 6, 7	Image download using SPI 2	WPS, Factory Reset
SW1: GPIO 8, 9	Image download using SPI 2	Not defined
SW4: GPIO 6, 7	WPS, Factory Reset	Not defined

4 Test Sequence

This section describes the test sequence for how we show the DA16200 benefits of the following test items:

- Ping test ([Section 6](#))
- Throughput test ([Section 7](#))
 - [Section 5.1](#), [5.2](#), [5.3](#) > [Section 7](#)
- SoftAP test ([Section 5.4](#))
 - [Section 5.1](#), [5.2](#) > [Section 5.4](#)
- Firmware update
 - [Section 5.1](#), [5.2](#) > [Section 9](#)

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5 Wi-Fi Mode Setup

This section describes how to set up the Station and Soft-AP modes that are supported by DA16200.

- Station: a mode that runs the 802.11 STA interface
- Soft-AP: a mode that runs the Software Access Point. Note that the Soft-AP mode does not support full-fledged commercial level Access Point features. This mode is normally used for Provisioning

NOTE

The DA16200 FreeRTOS SDK run as default CPU clock as 120 MHz. To use 120 MHz CPU clock on EVK board or the DA16200 SoC, after booting, customer/developer must change initial state by using the factory command.

5.1 DA16200 Connecting the Board

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

On first connection to a host PC with Microsoft Windows as operating system, the system will detect several devices and will automatically install all necessary drivers. If not automatically installed, then get the driver from the following URL: http://www.ftdichip.com/Drivers/CDM/CDM21224_Setup.zip.

There are two virtual COM ports created by the Windows driver. The first COM port (lower number, COM35 in this example) provides a UART interface for debugging or firmware download between the PC and the DA16200. The second (higher number, COM36 in this example) is used for ATCOMMAND. See [Figure 4](#).

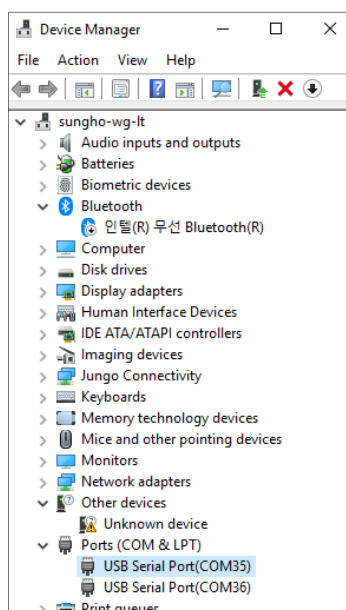


Figure 4: Check COM Ports on Device Manager

5.2 Configure the Serial Port for UART

On a Windows Host, the utility **Tera Term** is used to fully validate the connection to the DA16200 EVK. **Tera Term** is a free software terminal emulator (communication program) that supports multiple communication including serial port connections. Download **Tera Term** from <https://ttssh2.osdn.jp>. Run the **teraterm-x.yy.exe** executable and follow the installation wizard.

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To make sure that the communication between the DA16200 EVK and the host PC is properly established, the UART connection between the two nodes needs to be verified. For that purpose, do the following steps:

1. Connect the DA16200 EVK to the PC via USB cable to USB Port.
2. Check if the host discovered two serial ports as shown in [Figure 4](#). The second is connected to UART (see [Section 5.1](#)).
3. Open **Tera Term** from the Windows Start menu.
4. In the **Tera Term: New connection** dialog box:
 - a. Select **Serial**.
 - b. Select the COM Port to use.
 - c. Click **OK**.
5. Select **Setup > Serial Port** and configure your UART port with the parameters as shown in [Figure 5](#).
6. Open the Lowest COM port number assigned to the DA16200 EVK (see [Figure 4](#)), to figure out which port number is used by Windows by running the Device Manager. Make sure that the UART is configured as shown in [Figure 5](#).

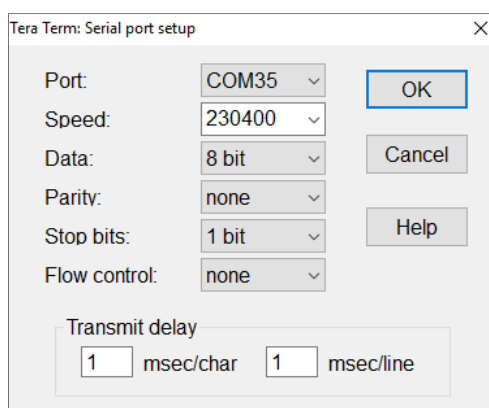


Figure 5: Serial Port Setup

5.3 Setup for Station Mode

After Serial Port setup is complete ([Section 5.2](#)), if you press the Enter key, depending on your board status, you may see one of the following prompts:

[/DA16200] #

or

[MROM]

If [MROM] is displayed, type "boot", then the board will boot and show the prompt "[/DA16200] #". Then you can start the Easy Setup procedure.

Easy Setup is a Wi-Fi configuration wizard to easily configure the Wi-Fi functions of DA16200.

1. Run command `setup`.
2. From here on, the setup query statements will continue. So answer the questions as in the following steps.
3. Stop all services for the setting. Are you sure? [Yes/No]: type **Yes**
See [Figure 6](#).

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```
[/DA16200] # setup
Stop all services for the setting.
Are you sure ? [Yes/No] : y
```

Figure 6: Easy Setup Start

4. COUNTRY CODE? [Quit] (Default KR) : type **US** for testing
See Figure 7.

```
DA16200 EASY SETUP
Country Code List:
AD AE AF AI AL AM AR AS AT AU AW AZ BA BB BD BE BF BG BH BL
BM BN BO BR BS BT BY BZ CA CF CH CI CL CN CO CR CU CX CY CZ
DE DK DM DO DZ EC EE EG ES ET EU FI FM FR GA GB GD GE GF GH
GL GP GR GT GU GY HK HN HR HT HU ID IE IL IN IR IS IT JM JO
JP KE KH KN KP KR KW KY KZ LB LC LI LK LS LT LU LV MA MC MD
ME MF MH MK MN MO MP MQ MR MT MU MV MW MX MY NG NI NL NO NP
NZ OM PA PE PF PG PH PK PL PM PR PT PW PY QA RE RO RS RU RW
SA SE SG SI SK SN SR SV TC TD TG TH TN TR TT TW TZ UA UG
UK US UY UZ VC VE VI VN VU WF WS YE YT ZA ZW
COUNTRY CODE ? [Quit] (Default KR) : US
```

Figure 7: Country Selection

5. MODE? [1/2/Quit] (Default Station): type **1**
See Figure 8.

```
SYSMODE(WLAN MODE) ?
1. Station
2. Soft-AP
MODE ? [1/2/Quit] (Default Station) : 1
```

Figure 8: Station Mode Selection

6. SELECT SSID? (1~30/Manual/Quit) : type **1**
See Figure 9.
- Select the SSID of the AP to which you want to connect. If there is no AP that you want to connect to, press **Enter** to rescan.
For example: SSID **ACST_AC_TEST2** is selected for testing.

```
STATION CONFIGURATION
=====
[NO] [SSID] [SIGNAL] [CH] [SECURITY]
-----
1 ACST AC TEST2 -33 1 WPA2
2 NETGEAR_RAX40 -46 6 WPA2
3 [Hidden] BSSID-fe:ec:da:f4:62:aa -48 6 WPA2
4 ZIO-2509N -50 13 WPA2
5 UBQUITI_AC_LR -51 6 WPA2
6 DLINK_880L -52 6 WPA / WPA2
7 IPTIME_A3004_YOL -57 1 WPA2
8 IPTIME_A3004_NPG -57 1 WPA2
9 N_A1004_W2_AES -57 11 WPA / WPA2
10 S6 Linksys EA7300 -57 6 WPA2
11 N804R_MIKE -57 10 WPA2
12 TPLINK_ArcherC7_Ver5 -59 1 WPA2
13 DA16200_9FFD71 -59 13 WPA2
14 TENDA_W311R -60 6 WPA2
15 DIRECT-B2-HP OfficeJet Pro 8710 -60 6 WPA2
16 in-test -62 2 WPA2
17 IPTIME_A3004 -64 1 WPA2
18 Google_NLS1304A_NPG -65 1 WPA2
19 DIRECT-D3-HP OfficeJet Pro 8710 -66 6 WPA2
20 PHICOMM_PSG1218 -66 11 WPA / WPA2
21 IPTIME_N8004_Tk -66 11 WPA
22 N_N804V_W2_AES_ENT-aillion -67 11 EAP
23 [Hidden] BSSID-0a:18:e7:e8:ca:05 -67 11 WPA2
24 [Hidden] BSSID-0e:18:e7:e8:ca:05 -67 11 WPA2
25 JMC_DIR-615_Wx_Auto -67 11 WPA / WPA2
26 N_N804V_W2_AES_ENT-Linux -68 11 EAP
27 LINKSYS_WRT54GL -69 1 WPA / WPA2
28 JMC_SWR-1100 -70 6 WPA2
29 JMC_DIR-615_Wx_Auto6 -70 11 WPA2
30 JMC_DIR-615_Wx_KeyUpdate_3600s -71 11 WPA2
=====
W] Manual Input
Enter] Rescan
=====
Select SSID ? (1~30/Manual/Quit) : 1
```

Figure 9: AP Selection

7. PSK-KEY (ASCII characters 8~63 or hexadecimal characters 64)? [Quit]
: ***** type the password that matches the encryption method of the selected AP.

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8. Do you want to set advanced WiFi configuration ? [No/Yes/Quit] (Default No) : type [ENTER]
9. WIFI CONFIGURATION CONFIRM? [Yes/No/Quit]: type **Y**.
10. IP Connection Type? [Automatic IP/Static IP/Quit]: type **A**
IP Connection Type: Automatic IP.
11. IP CONFIGURATION CONFIRM? [Yes/No/Quit]: type **Y**
12. SNTP Client enable: type **N**
If time synchronization is not needed, then there is no need to run the SNTP Client.
13. Once all settings are made, the configuration is saved and the system will reboot as shown in Figure 10.

```
Reboot...

WakeUp source is 0x0
[dpm_init_retmemory] DPM INIT CONFIGURATION<1>

*****
*                               *
* ----- DA16200 SDK Information ----- *
*                               *
* - CPU Type       : Cortex-M4 (120MHz) *
* - OS Type        : FreeRTOS 10.4.3   *
* - Serial Flash   : 4 MB               *
* - SDK Version    : 03.1.0.0 GEN      *
* - F/W Version    : FRTOS-GEN01-01-14071-000000 *
* - F/W Build Time : Apr  5 2021 10:42:37 *
* - Boot Index     : 0                 *
*                               *
*****

System Mode : Station Only <0>
>>> DA16x Supp Ver2.7 - 2020_07
>>> MAC address (sta0) : d4:3d:39:10:cc:78
>>> sta0 interface add OK
>>> Start STA mode...

>>> Network Interface <wlan0> : UP
>>> Associated with 70:3a:cb:25:f5:f8

Connection COMPLETE to 70:3a:cb:25:f5:f8

-- DHCP Client VLAN0: SEL<6>
-- DHCP Client VLAN0: REQ<1>
-- DHCP Client VLAN0: CHK<8>
-- DHCP Client VLAN0: BOUND<10>
   Assigned addr : 192.168.86.39
   netmask       : 255.255.255.0
   gateway       : 192.168.86.1
   DNS addr      : 192.168.86.1

   DHCP Server IP : 192.168.86.1
   Lease Time     : 24h 00m 00s
   Renewal Time   : 12h 00m 00s
```

Figure 10: Wi-Fi Configuration Completed

5.4 Setup for Soft-AP Mode

The setup for the Soft-AP mode is almost the same as for the STA mode. You can also use the Easy Setup to set up the Soft-AP mode. Do the following instructions:

1. At the prompt, run command **setup**.
2. From here on, the setup query statements will continue. So answer the questions as in the following steps.
3. MODE? [1/2/Quit] (Default Station): type **2**
See Figure 11.

```
SYSMODE(WLAN MODE) ?
  1. Station
  2. Soft-AP
MODE ? [1/2/Quit] (Default Station) : 2
```

Figure 11: Soft-AP Mode Selection

4. SSID? (Default 16200_9FFFFFF): **TEST AP**. See Figure 12.
 - Choose the SSID you want to use
5. CHANNEL? [1~11, Auto:0/QUIT]: press [ENTER]
6. AUTHENTICATION? [1/3/4/5/QUIT]: type **4**

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- ```

 ○ WPA2-PSK is recommended
7. ENCRYPTION? [1/2/3/Quit]: type 2
8. PSK-KEY (ASCII characters 8~63 or hexadecimal characters 64)? [Quit]
 : ***** Enter the password you want to use.

```



### Figure 12: Set Up AP

9. Do you want to set advanced Wi-Fi configuration? [No/Yes/Quit] (Default No): type **N**  
See [Figure 13](#).
10. WIFI CONFIGURATION CONFIRM? [Yes/No/Quit]: type **Y**
11. IP ADDRESS? [Quit] (Default 10.0.0.1): press **[ENTER]**
12. SUBNET? [Quit] (Default 255.255.255.0): press **[ENTER]**
13. GATEWAY? [Quit] (Default 10.0.0.1): press **[ENTER]**
14. IP CONFIGURATION CONFIRM? [Yes/No/Quit]: type **Y**
15. DHCP SERVER CONFIGURATION? [Yes/No/Quit]: type **Y**
16. DHCP SERVER LEASE IP Count (MAX 10)? [Quit] (Default 10): press **[ENTER]**
17. DHCP SERVER LEASE TIME (60 ~ 86400 SEC)? [Quit] (Default 1800): press **[ENTER]**
18. DHCP SERVER CONFIGURATION CONFIRM? [Yes/No/Quit]: type **Y**

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```

Do you want to Set advanced WiFi configuration ? [No/Yes/Quit] (Default No) : N
=====
SSID : TEST AP
CHANNEL : AUTO(ACS)
AUTH : WPA2
ENCRYPTION: AES(CCMP)
PSK KEY : 12345678
KEY TYPE : ASCII
WIFI MODE : 11b/g/n
=====
WiFi CONFIGURATION CONFIRM ? [Yes/No/Quit] : Y

IP ADDRESS ? [Quit] (Default 10.0.0.1) :
SUBNET ? [Quit] (Default 255.255.255.0) :
GATEWAY ? [Quit] (Default 10.0.0.1) :
DNS ? [Quit] (Default 8.8.8.8) :
=====
[WLAN1]
IP ADDRESS : 10.0.0.1
SUBNET : 255.255.255.0
GATEWAY : 10.0.0.1
DNS : 8.8.8.8
=====
IP CONFIGURATION CONFIRM ? [Yes/No/Quit] : Y

DHCP SERVER CONFIGURATION ? [Yes/No/Quit] : Y

DHCP SERVER LEASE IP Count(MAX 10) ? [Quit] (Default 10) :
DHCP SERVER LEASE TIME(60 ~ 86400 SEC) ? [Quit] (Default 1800) :
=====
[DHCP SERVER]
Start IP : 10.0.0.2
END IP : 10.0.0.11
DNS : 8.8.8.8
LEASE TIME: 1800
=====
DHCP SERVER CONFIGURATION CONFIRM ? [Yes/No/Quit] : Y

```

Figure 13: AP Mode Selection

```

Reboot...

WakeUp source is 0x0
[dpm_init_retmemory] DPM INIT CONFIGURATION<1>

* ----- DA16200 SDK Information -----
*
* - CPU Type : Cortex-M4 <120MHz>
* - OS Type : FreeRTOS 10.4.3
* - Serial Flash : 4 MB
* - SDK Version : V3.1.0.0 GEN
* - F/W Version : FRTOS-GEN01-01-14071-000000
* - F/W Build Time : Apr 5 2021 10:42:37
* - Boot Index : 0
*

System Mode : Soft-AP <1>

>>> DHCP Server Started
>>> DA16x Supp Ver2.7 - 2020_07
>>> Add SoftAP Interface <softap1>
>>> MAC address <softap1> : d4:3d:39:10:cc:79
>>> softap1 interface add OK
>>> AP Operating Channel: AUTO
>>> Soft-AP ACS : ideal ch is 10

>>> Network Interface <wlan1> : UP
BSS Isolate Disabled

Soft-AP is Ready <d4:3d:39:10:cc:79>

```

Figure 14: AP Setup Completed

Once all settings are made as given above, the configuration is saved, and the system will reboot. A message is printed that Soft-AP mode started successfully. See [Figure 14](#).

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### 6 Ping Test

DA16200 has a command `ping` to verify communication test (Ping Test).

#### 6.1 Test Setup

For a communication test (Ping Test) there are two stations (DA16200 and Laptop) and an Access Point (AP) required. Both must be connected to the same sub-network AP. See [Figure 15](#). DA16200 must be connected to the AP via WI-FI, and the laptop must be connected to the AP with an Ethernet cable. After configuration, DA16200 will be ready for the test. In this test, a Ping application that runs on the laptop acts as a network peer that sends a unicast packet to DA16200. This is to check if DA16200 can successfully wake up and receive the unicast packets in real-time.

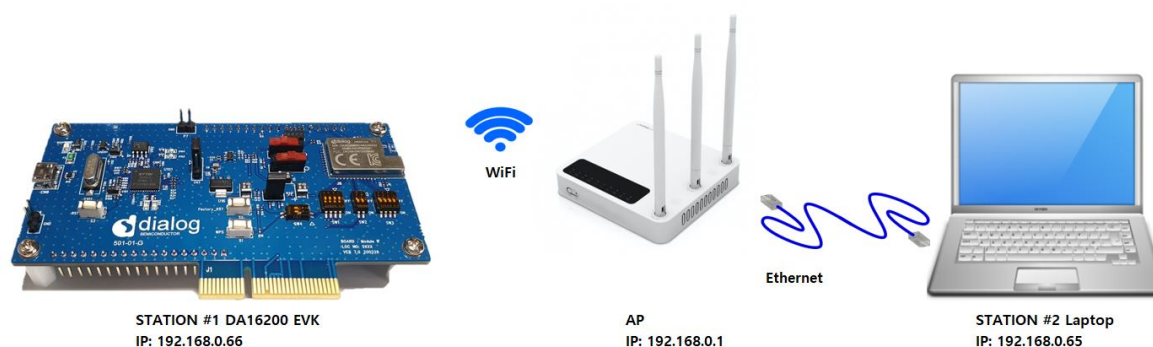


Figure 15: Ping Test Environment

1. Run the command window as administrator.
2. Type command `ipconfig` to see what the IP address is of the laptop. See [Figure 16](#).  
For example: the laptop's IP is 192.168.0.65, and the Default Gateway IP is 192.168.0.1

```
Connection-specific DNS Suffix . :
Link-local IPv6 Address : fe80::9809:ccc1:b552:e47f%19
IPv4 Address. : 192.168.0.65
Subnet Mask : 255.255.255.0
Default Gateway : 192.168.0.1
```

Figure 16: Ethernet IP Address Assign

3. Run the DA16200 terminal window and set DA16200 in Station mode (see [Section 5.3](#)).  
For example: the assigned IP of DA16200 is 192.168.0.66. See [Figure 17](#).

```
Connection COMPLETE to 88:36:6c:42:79:6c
-- DHCP Client WLAN0: SEL
-- DHCP Client WLAN0: REQ
-- DHCP Client WLAN0: BOUND
 Assigned addr : 192.168.0.66
 netmask : 255.255.255.0
 gateway : 192.168.0.1
 DNS addr : 168.126.63.1

 DHCP Server IP : 192.168.0.1
 Lease Time : 02h 00m 00s
 Renewal Time : 01h 40m 00s
```

Figure 17: DA16200 IP Address Assign

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## 6.2 Add ARP Record

This section describes how to add a DHCP assigned IP address to the ARP table and to change that IP address from a dynamic to a static IP address.

Since retransmission logic is not included in the higher protocol (TCP/UDP), an additional ARP record is required for ping tests between the laptop and the DA16200.

1. Use command `arp -s 192.168.0.66 ec-9f-f9-32` to add an ARP record manually.

**NOTE**

When you set the ARP cache to static with command `arp -s` on higher versions of Windows, you may get an error like Failed to add ARP entry, Access is denied.

It is recommended to use command `netsh` to change the network settings.

2. Do the following steps to change the ARP record to a static IP address:
  - a. Use command `arp -a` to view the ARP table of the network interface. See [Figure 18](#).  
For example: `C:\WINDOWS\system32>arp -a`

```
Interface: 192.168.0.65 --- 0x13
Internet Address Physical Address Type
192.168.0.1 88-36-6c-42-79-6c dynamic
192.168.0.66 ec-9f-0d-9f-f9-32 dynamic
192.168.0.255 ff-ff-ff-ff-ff-ff static
224.0.0.2 01-00-5e-00-00-02 static
224.0.0.22 01-00-5e-00-00-16 static
224.0.0.251 01-00-5e-00-00-fb static
224.0.0.252 01-00-5e-00-00-fc static
239.255.255.250 01-00-5e-7f-ff-fa static
255.255.255.255 ff-ff-ff-ff-ff-ff static
```

Figure 18: Check ARP Record

- b. Use command `netsh interface show interface` to find the interface name. See [Figure 19](#).  
For example: `C:\WINDOWS\system32>netsh interface show interface`

```
C:\WINDOWS\system32>netsh interface show interface

Admin State State Type Interface Name

Enabled Connected Dedicated Ethernet
Enabled Disconnected Dedicated Wi-Fi
```

Figure 19: Interface Name for ARP Record

- c. Use the interface name found for DA16200 to set the ARP cache to static with command `C:\WINDOWS\system32> netsh interface ipv4 add neighbors "<Interface Name>" "<IP>" "<MAC>"`. See [Figure 20](#).  
For example: `C:\WINDOWS\system32> netsh interface ip add neighbors "Ethernet" "192.168.0.66" "ec-9f-0d-9f-f9-32"`
- d. Use command `arp -a` on the laptop to check if the ARP cache is configured correctly. See [Figure 20](#).  
For example: `C:\WINDOWS\system32>arp -a`  
DA16200's IP address 192.168.0.66 is added to the ARP table as a static type.

## DA16200 Evaluation Kit

```
C:\WINDOWS\system32>netsh interface ip add neighbors "Ethernet" "192.168.0.66" "ec-9f-0d-9f-f9-32"

C:\WINDOWS\system32>arp -a

Interface: 192.168.0.65 --- 0x13
Internet Address Physical Address Type
192.168.0.1 88-36-6c-42-79-6c dynamic
192.168.0.66 ec-9f-0d-9f-f9-32 static
192.168.0.255 ff-ff-ff-ff-ff-ff static
224.0.0.2 01-00-5e-00-00-02 static
224.0.0.22 01-00-5e-00-00-16 static
224.0.0.251 01-00-5e-00-00-fb static
224.0.0.252 01-00-5e-00-00-fc static
239.255.255.250 01-00-5e-7f-ff-fa static
255.255.255.255 ff-ff-ff-ff-ff-ff static
```

Figure 20: Success ARP Record for DA16200

- e. Use command `arp -d` or `netsh interface ip delete arpcache` to initialize the ARP cache.

### 6.3 Perform Ping Test

Ping application is a simple generic application provided by Network Stack for network management purposes. Its main purpose is to check if a node is alive in the same subnetwork. Ping just sends out a request once and then waits for a reply. Ping prints the result only if a Reply packet arrives from the peer.

- Run a ping on the laptop. See [Figure 21](#).  
For example: `C:\WINDOWS\system32>ping 192.168.0.66 -t`  
Next, DA16200 receives the ping message and sends a reply.

```
C:\WINDOWS\system32>ping 192.168.0.66 -t

Pinging 192.168.0.66 with 32 bytes of data:
Reply from 192.168.0.66: bytes=32 time=135ms TTL=128
Reply from 192.168.0.66: bytes=32 time=2623ms TTL=128
Reply from 192.168.0.66: bytes=32 time=5ms TTL=128
Reply from 192.168.0.66: bytes=32 time=2451ms TTL=128
Reply from 192.168.0.66: bytes=32 time=16ms TTL=128
Reply from 192.168.0.66: bytes=32 time=2473ms TTL=128
Reply from 192.168.0.66: bytes=32 time=11ms TTL=128
Reply from 192.168.0.66: bytes=32 time=2478ms TTL=128
Reply from 192.168.0.66: bytes=32 time=14ms TTL=128
Reply from 192.168.0.66: bytes=32 time=2567ms TTL=128
Reply from 192.168.0.66: bytes=32 time=11ms TTL=128
Reply from 192.168.0.66: bytes=32 time=2458ms TTL=128
Reply from 192.168.0.66: bytes=32 time=34ms TTL=128
Reply from 192.168.0.66: bytes=32 time=2465ms TTL=128
Reply from 192.168.0.66: bytes=32 time=11ms TTL=128
Reply from 192.168.0.66: bytes=32 time=2461ms TTL=128
Reply from 192.168.0.66: bytes=32 time=13ms TTL=128
Reply from 192.168.0.66: bytes=32 time=2549ms TTL=128
Reply from 192.168.0.66: bytes=32 time=21ms TTL=128
Reply from 192.168.0.66: bytes=32 time=2511ms TTL=128
Reply from 192.168.0.66: bytes=32 time=9ms TTL=128
Request timed out.

Ping statistics for 192.168.0.66:
 Packets: Sent = 22, Received = 21, Lost = 1 (4% loss),
 Approximate round trip times in milli-seconds:
 Minimum = 5ms, Maximum = 2623ms, Average = 1205ms
Control-C
^C
```

Figure 21: Ping Test

#### NOTE

If you have multiple network interfaces enabled, then put the `arp` entry under the specific interface.  
For example: `arp -s 192.168.20.52 aa-ff-00-88-66-80 -S 192.168.100.100`  
192.168.100.100 is the interface from which the ping command should be sent. In this case, specifying the network interface is required in the ping command.  
For example: `ping 192.168.20.52 -S 192.168.100.100`



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## 7 Throughput Test

DA16200 has command `iperf` to measure the packet transfer performance. This is known as the throughput test. To do the throughput test, prepare the DA16200 to operate in Station mode (see Section 5.1). This section shows the throughput test with the use of a TCP client/server protocol.

### 7.1 Test Setup

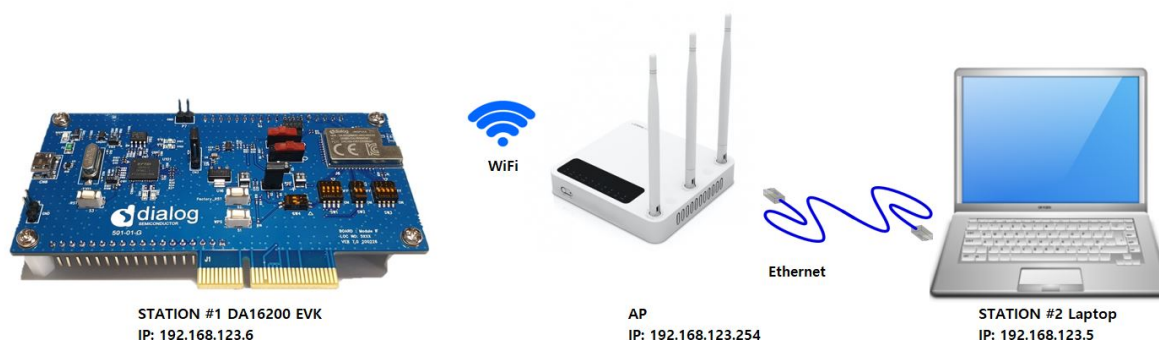


Figure 22: Iperf Test Environment

The Iperf tool should be ready on your laptop. **Iperf Version 2.0.5** is recommended.

To set up Iperf tool, do the following:

1. Download Iperf from <https://iperf.fr/iperf-download.php>.
2. Create a folder called **Iperf** on your drive C.
3. Unzip the downloaded file and move the contents to the Iperf folder.
4. Prepare the DA16200 to operate in Station mode. See Sections 5.1 to 5.3.
5. Use command `iperf` or `iperf -h` to see the available options in Iperf. See Figure 23.
  - For example: `[/DA16200/NET] # iperf`

```
usage: iperf [-s][-c host][options]
iperf [-h] [-v]

client/server:
 -i # seconds between periodic bandwidth reports
 -u use UDP rather than TCP
 -p, # server port to listen on/connect to
 -f, [kmkm] format to report: Kbits, Mbits, KBytes, MBytes
 -d finish service
 ex) iperf -d -c -u : udp client
 iperf -d -c : tcp client
 iperf -d -u : udp server
 iperf -d : tcp server

server specific:
 -s run in server mode
 -T # Rx Time Out Min:1 sec. 'F' Forever

client specific:
 -c <host> run in client mode, connecting to <host>
 -t # time in seconds to transmit for (default 10 secs)
 -x # tcp API mode default:socket 1:basic tcp 2:altcp
 -y # Transmit delay, tick 1~100
 -Y # PacketSize option (UDP default 1470, IPV6 1448 TCP 1000)
 -n # UDP Tx packet number
 -P, # Pair Index (0,1,2)
 (default Max, Step 1~100 Mbps)
 -o use Main Packet Pool

Miscellaneous:
 -h print this message
 -v print version

[/DA16200/NET] #
```

Figure 23: Iperf Test Command

### 7.2 Iperf Test with Client Mode

To set up the Iperf test with Client mode, do the following:

1. Connect the laptop you want to use as a server to the AP.
2. In the command window, use the command `ipconfig/all` to find the IP address. See Figure 24.

## DA16200 Evaluation Kit

```

Ethernet adapter Ethernet:

Connection-specific DNS Suffix :
Description : Realtek PCIe GBE Family Controller
Physical Address. : 58-20-B1-40-45-B3
DHCP Enabled. : Yes
Autoconfiguration Enabled : Yes
Link-local IPv6 Address : fe80::9809:ccc1:b552:e47f%19(Preferred)
IPv4 Address. : 192.168.123.5(Preferred)
Subnet Mask : 255.255.255.0
Lease Obtained. : Saturday, August 24, 2019 9:27:47 AM
Lease Expires : Saturday, August 24, 2019 11:27:46 AM
Default Gateway : 192.168.123.254
DHCP Server : 192.168.123.254
DHCPv6 IAID : 89661617
DHCPv6 Client DUID. : 00-01-00-01-23-3E-21-DA-58-20-B1-40-45-B3
DNS Servers : 168.126.63.1
 168.126.63.2
NetBIOS over Tcpip. : Enabled

```

Figure 24: Check IP Address

**NOTE**

The IP address can be different depending on the home AP setting.

3. For stable Iperf testing, run the Windows Security APP to turn off the network firewall.
  - It is recommended to disable the laptop from all network firewalls before attempting a test. See Figure 25.

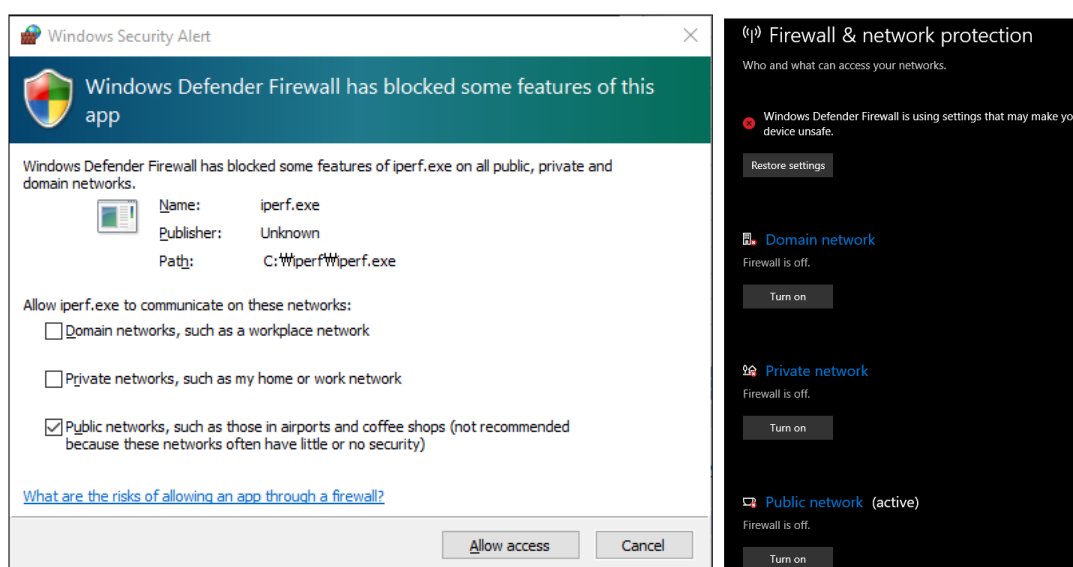


Figure 25: Disable Firewall for Iperf Test

4. In the command window, move to the directory where Iperf is installed, and type `iperf -s` to configure the TCP server.

```

C:\Wiperf>iperf -s

Server listening on TCP port 5001
TCP window size: 208 KByte (default)

```

Figure 26: Run Iperf Server on PC

**NOTE**

When you see the message as shown in Figure 26, the Iperf test is ready to start.

5. In the DA16200 console window, run the Iperf test with Client mode. See Figure 27.

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- For example: [/DA16200/NET] #iperf -c 192.168.123.5 -t 5 -i 1
- The format of the command type is:
- iperf [-s/-c] [DESTINATION IP] (-u) -i [INTERVAL TIME] -t [TEST TIME]

```
[/DA16200/NET] # iperf -l wlan0 -c 192.168.123.5 -t 5 -i 1
[/DA16200/NET] #
[TCP] Transmit Test (Client) ==> 192.168.123.5:5001
```

| TCP_TX: | No      | [Interval] | [Transfer]    | [Bandwidth]      | [Dst IP:Port]      |
|---------|---------|------------|---------------|------------------|--------------------|
| TCP_TX: | 0001    | 0.00– 1.00 | 2.043 MBytes  | 17.146 Mbits/sec | 192.168.123.5:5001 |
| TCP_TX: | 0002    | 1.00– 2.00 | 2.110 MBytes  | 17.706 Mbits/sec | 192.168.123.5:5001 |
| TCP_TX: | 0003    | 2.00– 3.00 | 2.074 MBytes  | 17.403 Mbits/sec | 192.168.123.5:5001 |
| TCP_TX: | 0004    | 3.00– 4.00 | 2.110 MBytes  | 17.706 Mbits/sec | 192.168.123.5:5001 |
| TCP_TX: | 0005    | 4.00– 5.00 | 2.081 MBytes  | 17.461 Mbits/sec | 192.168.123.5:5001 |
| TCP_TX: | [Total] | 0.00– 5.01 | 10.443 MBytes | 17.487 Mbits/sec | 192.168.123.5:5001 |

Figure 27: Run Iperf Client on the DA16200

### 7.3 Iperf Test with Server Mode

A server mode test should be run with a configuration that is opposite to that of client mode. In this case, the DA16200 is prepared as a server. The laptop becomes a client and sends data to the DA16200.

1. In the DA16200 console window, check the assigned IP address for DA16200 as in [Figure 28](#).

```
Connection COMPLETE to b8:55:10:e0:98:0a
-- DHCP Client WLAN0: SEL
-- DHCP Client WLAN0: REQ
-- DHCP Client WLAN0: BOUND
 Assigned addr : 192.168.123.6
 netmask : 255.255.255.0
 gateway : 192.168.123.254
 DNS addr : 168.126.63.1

 DHCP Server IP : 192.168.123.254
 Lease Time : 02h 00m 00s
 Renewal Time : 01h 00m 00s
```

Figure 28: Check the IP Address of DA16200

2. Run the Iperf test with Server mode on the DA16200 console window. See [Figure 29](#).
  - For example: [/DA16200/NET] # iperf -I wlan0 -s

```
[/DA16200/NET] # iperf -s
TCP Server start
[/DA16200/NET] #
[/DA16200/NET] #
[/DA16200/NET] #
```

```
[TCP] Receive Test (Server)
TCP_RX:[No] [Interval] [Transfer] [Bandwidth]
```

|         |         |            |              |                  |                     |
|---------|---------|------------|--------------|------------------|---------------------|
| TCP_RX: | [Total] | 0.00– 5.12 | 9.750 MBytes | 15.974 Mbits/sec | 192.168.123.5:50625 |
|---------|---------|------------|--------------|------------------|---------------------|

Figure 29: Run Iperf Server on Terminal

3. In the command window, run the Iperf test with Client mode. See [Figure 30](#).
  - For example: C:\iperf>iperf -c 192.168.123.6 -t 5 -i 1

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```
C:\Wiperf>iperf -c 192.168.123.6 -t 5 -i 1

Client connecting to 192.168.123.6, TCP port 5001
TCP window size: 208 KByte (default)

[3] local 192.168.123.5 port 50625 connected with 192.168.123.6 port 5001
[ID] Interval Transfer Bandwidth
[3] 0.0- 1.0 sec 2.12 MBytes 17.8 Mbits/sec
[3] 1.0- 2.0 sec 1.88 MBytes 15.7 Mbits/sec
[3] 2.0- 3.0 sec 2.00 MBytes 16.8 Mbits/sec
[3] 3.0- 4.0 sec 1.88 MBytes 15.7 Mbits/sec
[3] 4.0- 5.0 sec 1.88 MBytes 15.7 Mbits/sec
[3] 0.0- 5.0 sec 9.75 MBytes 16.3 Mbits/sec
```

Figure 30: Run Iperf Client on the Laptop

## DA16200 Evaluation Kit

# 8 DA16200 Commands

The DA16200 has various console commands to operate its functions. The UART0 interface connects the console with a serial terminal tool. Some commands in the following sections may be disabled according to the SDK's features configuration.

## 8.1 Console Commands

The DA16200 console commands are categorized as follow:

- **root**
  - [/DA16200] #
- **sys**
  - [/DA16200/SYS] #
- **nvr**
  - [/DA16200/NVRAM] #
- **net**
  - [/DA16200/NET] #
- **user**
  - [/DA16200/USER] #

Use command `help` or `?` (Question mark) to list the available commands and options.

There is a function to display the console command history, and up to five commands can be saved. Use the following keys and characters to access the history function:

- `↑` or `↓` (arrow key) on your keyboard: show the command history one by one
- `!` (Exclamation mark): view the list of the command history
- `!` (Exclamation mark) + Number: select and execute one previous command in the list

It is possible to move between categories. Use these options:

- `top`: move to the highest rank, root
- `up`: move to one step upper-rank category
- **Category command** (for example, `sys`, `nvr`, `net`): move to the category. To run each command of each category, go to the category first, or prefix the category name to the command as shown in the example:
  - `net`
  - `net.ifconfig`

## DA16200 Evaluation Kit

## 8.1.1 Root Commands

Table 2: Root Commands

| Command    | Parameters                                                      | Description                                                                                                                                                                                                                                                                                                   |
|------------|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| help/?     | (none)                                                          | Display help information for the corresponding category.                                                                                                                                                                                                                                                      |
| up         | (none)                                                          | Move up one rank category.                                                                                                                                                                                                                                                                                    |
| top        | (none)                                                          | Move to the Root category.                                                                                                                                                                                                                                                                                    |
| factory    | (none)                                                          | Factory reset for all settings.                                                                                                                                                                                                                                                                               |
| ps         | (none)                                                          | Display thread information.                                                                                                                                                                                                                                                                                   |
| setup      | (none)                                                          | DA16200 general function setting wizard (Easy Setup).<br>Make step-by-step configuration settings for elements such as SYSMODE, WI-FI, and NETWORK.                                                                                                                                                           |
| reboot     | (none)<br>[mode]                                                | Reboot.<br><ul style="list-style-type: none"> <li>por: POR rebooting</li> </ul>                                                                                                                                                                                                                               |
| reset      | (none)                                                          | Reset to the Bootloader prompt.                                                                                                                                                                                                                                                                               |
| ver        | (none)                                                          | Display SDK version and system information.                                                                                                                                                                                                                                                                   |
| time       | [option]                                                        | Display or set the current time.<br><ul style="list-style-type: none"> <li>time set [YYYY-MM-DD] [hh:mm:ss]: set date and time</li> <li>time zone [-hh:mm]: set time zone</li> <li>time boot: display booting time</li> <li>time uptime: display booting duration</li> <li>time help: display help</li> </ul> |
| getwlanmac | (none)                                                          | Display the MAC address for network interfaces.                                                                                                                                                                                                                                                               |
| setwlanmac | [xx:xx:xx:xx:xx:xx<br>  xx-xx-xx-xx-xx-xx-<br>xx  xxxxxxxxxxxx] | Set up the MAC address for network interfaces.<br>For example: setwlanmac aa:bb:cc:00:00:02   aa-bb-cc-00-00-02   aabbcc000002                                                                                                                                                                                |

## 8.1.2 Network Commands

To move to the network command category, type the command `net`.

Table 3: Network Commands

| Command  | Parameter                                         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ifconfig | (none)<br>[interface<br>wlan0 wlan1]<br>[options] | Display or set the basic network setting and status.<br><ul style="list-style-type: none"> <li>ifconfig: display basic network settings information</li> <li>ifconfig -a: display details of all network interfaces</li> <li>ifconfig [wlan0 wlan1]: display details of a network interface</li> <li>ifconfig [wlan0 wlan1] [ipaddress] [subnet] [gateway]: set static IP addresses to a network interface</li> <li>ifconfig [wlan0 wlan1] dhcp: enable/disable DHCP to a network interface</li> <li>ifconfig [wlan0 wlan1] [up down]: go up/down a network interface</li> <li>ifconfig [wlan0 wlan1] [start stop renew release]: DHCP client command</li> <li>ifconfig [wlan0 wlan1] [dns] [DNS ServerIP]: set DNS server address (static IP) to a network interface</li> <li>ifconfig help: display help</li> </ul> |

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| Command  | Parameter                                                                                             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ping     | -I [interface wlan0 wlan1]<br>[domain ip] -n<br>[count] -l<br>[size] -w<br>[timeout] -i<br>[interval] | <p>Ping test to the target address with a certain option.</p> <ul style="list-style-type: none"> <li>[interface wlan0 wlan1]: <ul style="list-style-type: none"> <li>Network interface. With no designated interface, an interface for a subnet band of the same destination IP address is designated</li> </ul> </li> <li>[count]: the count of ping tests</li> <li>[size]: the size of data to be transmitted (max. 10000)</li> <li>[timeout]: waiting time for a response to the transmitted message (min. 10 ms)</li> <li>[interval]: waiting time for message transmission (min. 10 ms)</li> <li>[-6]: ping test with an IPv6 address</li> </ul> <p>For example: ping 172.16.0.1 -l 1024 -n 10 -w 1000 -i 1000<br/>ping -6 fe80::1:2 -I wlan0</p> |
| arp      | [interface]<br>[options]                                                                              | <p>Display the ARP table of a network interface.</p> <ul style="list-style-type: none"> <li>a: display the ARP table of every interface</li> <li>d: delete all from the ARP table</li> <li>Help: display help</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| arp send | [interface]<br>[dst<br>ipaddress]                                                                     | <p>Transmit the ARP request message of the target IP.</p> <p>For example: arp send wlan0 10.0.0.1</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| garpsend | [interface]<br>[option]                                                                               | <p>Transmit a GARP message with the option:</p> <ul style="list-style-type: none"> <li>0: normal garp</li> <li>1: check IP conflict</li> </ul> <p>For example: arp send wlan0</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| dhcpcd   | [interface]<br>[options]                                                                              | <p>DHCP server setting.</p> <ul style="list-style-type: none"> <li>boot [on off]: automatic start setting with a certain interface</li> <li>range &lt;Start IP ADDRESS&gt; &lt;END IP Address&gt;: IP lease band setting (max. 10)</li> <li>lease_time &lt;Integer&gt;: lease time setting (min. 60 sec)</li> <li>dns &lt;IP Address&gt;: lease IP DNS server address setting</li> <li>response_delay &lt;Integer&gt;: time of response delay</li> <li>status: display DHCP Server status</li> <li>lease [0 1]: display IP lease table <ul style="list-style-type: none"> <li>Display tables including un-allotted tables when flag = 1</li> </ul> </li> </ul>                                                                                         |
| iperf    | [-s -c host]<br>[options]                                                                             | Setup Iperf client/server.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| cli      | [options]                                                                                             | Refer to the CLI section.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| debug    | [options]                                                                                             | <p>Execute various types of debug commands.</p> <ul style="list-style-type: none"> <li>arp [on off]: arp debug message output on/off</li> <li>dhcpc [level]: DHCP Client debug level setting (level = 0~5 default 1)</li> <li>umac [on off] mask: debug umac 1 0x4</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## DA16200 Evaluation Kit

### 8.2 CLI command

#### 8.2.1 Overview

The DA16200 supplicant plays a key role in providing users with Wi-Fi functionality. Major functions include IEEE 802.11 management frame, various security functions (WPA and RSN by IEEE 802.11i), and Command Line Interface (CLI) to control DA16200 Wi-Fi performance.

The CLI in DA16200 can execute commands in the network command state.

For example, in the Station mode, the network information of DA16200 is obtained with CLI command: [/DA16200/NET] cli status. See [Figure 31](#).

```
[/DA16200] # net
Command-List is changed, "NET"
[/DA16200/NET] # cli status
sta0
mac_address=ec:9f:0d:9f:ff:fe
bssid=88:36:6c:42:79:6c
ssid=ACST_AC_TEST2
id=0
mode=STATION
pairwise_cipher=CCMP
group_cipher=CCMP
key_mgmt=WPA2-PSK
channel=1
wpa_state=COMPLETED
handshake_state=3
[/DA16200/NET] #
```

**Figure 31: CLI Check**

#### 8.2.2 CLI Format

There are four CLI formats (Type A~D):

- Read/Write Parameter (Type A)
  - Read: [/DA16200/NET] # cli [CLI]
  - Write: [/DA16200/NET] # cli [CLI] <VALUE>
- Write Only Parameter (Type B)
  - [/DA16200/NET] # cli [CLI] <VALUE> or cli [CLI] <OPTION> <VALUE>
- Read Only Parameter (Type C)
  - [/DA16200/NET] # cli [CLI] or cli [CLI] <OPTION>
- Execution Parameter (Type D)
  - [/DA16200/NET] # cli [CLI] or cli [CLI] < OPTION>

#### 8.2.3 Common Commands

**Table 4: CLI Commands in Common Mode**

| CLI    | Parameter | Description                                                                                                      |
|--------|-----------|------------------------------------------------------------------------------------------------------------------|
| status | (none)    | Get the main information on the interface being operated at DA16200.<br>For example: [/DA16200/NET] # cli status |



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| CLI            | Parameter | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| save_config    | (none)    | <p>Save all parameters modified through CLI, and so forth in NVRAM.<br/>(Saved values become applicable after a reboot) (D).</p> <p>For example: [/DA16200/NET] # cli save_config</p> <p>* Information saved in NVRAM may be inquired with the following command:</p> <p>For example:</p> <pre>[/DA16200/NVRAM] # printenv</pre> <pre>Total length (95) country_code (STR,03) ..... KR SYSMODE (STR,02) ..... 0 0: NETMODE (STR,02) ..... 1 NO_Profile (STR,02) ..... 1 NO_ssid (STR,16) ..... "ACST AC TEST1"</pre>                                                                                                                                                                                                                                      |
| select_network | <mode>    | <p>Execute a motion in a certain mode (STA access, AP operation, and so forth) (D).</p> <ul style="list-style-type: none"> <li>• &lt;mode&gt; STA: 0   AP: 1</li> </ul> <p>For example: [/DA16200/NET] # cli select_network 0</p> <ul style="list-style-type: none"> <li>• Implement STA access</li> </ul> <p>* For a certain mode through the select_network CLI, the following tasks need to be carried out first:</p> <ul style="list-style-type: none"> <li>• add_network (profile generation)</li> <li>• SSID generation through set_network</li> <li>• For AP operation, set up the frequency and country code values with command set_network</li> <li>• For security, generate WPA or WEP key values with command set_network (option)</li> </ul> |
| add_network    | <mode>    | <p>Generate a specific mode (STA, AP) Profile (access information table) (D).</p> <p>&lt;mode&gt;: 0(STA)   1(AP)</p> <p>For example: [/DA16200/NET] # cli add_network 1</p> <ul style="list-style-type: none"> <li>• Generate a profile for AP Mode</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| remove_network | <mode>    | <p>Delete a certain mode (STA, AP) profile (D).</p> <p>&lt;mode&gt;: 0(STA)   1(AP)</p> <p>For example: [/DA16200/NET] # cli remove_network 1</p> <ul style="list-style-type: none"> <li>• Delete a profile for AP Mode</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

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| CLI             | Parameter                       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| set_net<br>work | <mode><br><variable><br><value> | <p>Set parameter values for a specific mode (STA, AP) (B).</p> <p>&lt;mode&gt;: 0(STA)   1(AP)</p> <p>&lt;variable&gt;: a specific parameter</p> <ul style="list-style-type: none"> <li>ssid: [STA] Operation SSID for AP SSID/[AP] AP interface to be connected</li> <li>psk: passphrase or PSK values</li> <li>proto: for WPA use, set up the version (&lt;WPA(=WPA1)&gt;   &lt;RSN(=WPA2)&gt;   &lt;WPA RSN&gt;)</li> <li>key_mgmt: key management mode (&lt;NONE&gt;   &lt;WPA_PSK&gt;   &lt;WPA-EAP&gt;)</li> <li>pairwise: unicast data message encryption mode (&lt;TKIP&gt;   &lt;CCMP&gt;   &lt;TKIP CCMP&gt;)</li> <li>group: broadcast data message encryption mode (&lt;TKIP&gt;   &lt;CCMP&gt;   &lt;TKIP CCMP&gt;)</li> <li>wep_key#: WEP key (#:0~3) values</li> <li>wep_tx_keyidx: WEP key index to be used</li> <li>frequency: [AP] Operation Frequency (MHz)</li> <li>mode: Operation Mode &lt;0(STA)&gt;   &lt;2(AP)&gt;</li> <li>Wi-Fi_mode: &lt;0(BGN)&gt;   &lt;1(GN)&gt;   &lt;2(BG)&gt;   &lt;3(N)&gt;   &lt;4(G)&gt;   &lt;5(B)&gt;</li> <li>beacon_int: [AP] Beacon transport interval</li> <li>dtim_period: [AP] DTIM interval</li> <li>ap_power: [AP] Output Power (dBm)</li> <li>isolate: 'Isolate' Use (&lt;0(off)&gt;   &lt;1(on)&gt;)</li> <li>-disabled: automatic profiling prevented upon rebooting (&lt;0(off)&gt;   &lt;1(on)&gt;)</li> </ul> <p>&lt;value&gt;: settings for a certain variable</p> <p>For example: [/DA16200/NET] # cli set_network 1 ssid 'DA16200_AP'</p> <ul style="list-style-type: none"> <li>For DA16200 AP operation, SSID= DA16200_AP setting</li> </ul> <p>For example: [/DA16200/NET] # cli set_network 1 beacon_int 200</p> <ul style="list-style-type: none"> <li>For DA16200 AP operation, Beacon interval 20 ms setting</li> </ul> <p>For example: [/DA16200/NET] # cli set_network 0 key_mgmt WPA_PSK</p> <ul style="list-style-type: none"> <li>For DA16200 STA operation, access in the WPA PSK security mode</li> </ul> <p>* A profile needs to be generated with command add_network so that a profile can be set with command set_network (with no profile, 'FAIL')</p> |
| get_net<br>work | <mode><br><variable>            | <p>Get specific parameter values for a specific mode (STA, AP) (C).</p> <p>&lt;mode&gt;: 0(STA)   1(AP)</p> <p>&lt;variable&gt;: a specific parameter</p> <p>For example: [/DA16200/NET] # cli set_network 0 ssid</p> <ul style="list-style-type: none"> <li>Inquiry of an object subject to DA16200 STA access ("TEST_BED_AP")</li> </ul> <p>For example: [/DA16200/NET] # cli set_network 1 psk</p> <ul style="list-style-type: none"> <li>For DA16200 AP operation, inquiry of the PSK password setting</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| country         | <value>                         | <p>Set a country related to channel operation (A).</p> <p>&lt;value&gt;: Country Code that meets ISO 3166-1 alpha-2 standards</p> <p>Default: KR</p> <p>For example: [/DA16200/NET] # cli country US</p> <ul style="list-style-type: none"> <li>Set the Country Code to US</li> </ul> <p>For example: [/DA16200/NET] # cli country</p> <ul style="list-style-type: none"> <li>KR</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

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| CLI   | Parameter | Description                                                                                              |
|-------|-----------|----------------------------------------------------------------------------------------------------------|
| flush | (none)    | For every interface (STA, AP), DA16200 deletes the Profile and closes the DA16200 service operation (D). |

## 8.2.4 STA Commands

Table 5: CLI Commands on STA Mode

| Command        | Parameters          | Description                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| scan           | (none) or<br><freq> | Active scanning (Probe Request Broadcast) (D).<br>For <freq> inputs, it is possible to scan APs of a certain frequency range (MHz) only (option)<br>For example: [/DA16200/NET] # cli scan <ul style="list-style-type: none"> <li>Scans all channels that correspond to the current country setting</li> </ul>                                                                          |
| disconnect     | (none)              | Disconnect the accessed AP (D).<br>For example: [/DA16200/NET] # cli disconnect <ul style="list-style-type: none"> <li>OK (With no AP being accessed, 'FAIL')</li> </ul>                                                                                                                                                                                                                |
| roam           | (none) or<br><oper> | Roaming On/Off and Roaming status inquiry (A).<br><oper> run: On   stop: Off<br>Default: Roaming Off<br>For example: [/DA16200/NET] # cli roam <ul style="list-style-type: none"> <li>Roaming = STOP, Threshold = -65</li> <li>Usage: cli roam [run/stop]</li> </ul> For example: [/DA16200/NET] # cli roam stop <ul style="list-style-type: none"> <li>Roaming function-off</li> </ul> |
| roam_threshold | <value>             | Roaming triggering RSSI value (dBm) setting (B).<br><value>: Roaming threshold RSSI (dBm)<br>Default: -65 (dBm)<br>For example: [/DA16200/NET] # cli roam_threshold -85 <ul style="list-style-type: none"> <li>Set the roaming threshold to -85 dBm</li> </ul>                                                                                                                          |

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## 8.2.5 Soft-AP Commands

Table 6: CLI Commands on Soft-AP Mode

| Command        | Parameter | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ap             | <option>  | <p>AP interface beginning/closing/restarting (Applicable with no reboot after main information modification of AP interface SSID, PSK, and so on) (D).</p> <p>&lt;option&gt;: start   stop   restart</p> <p>For example: [/DA16200/NET] # cli ap start</p> <ul style="list-style-type: none"> <li>AP interface initiating (If it is being operated, 'FAIL')</li> </ul> <p>For example: [/DA16200/NET] # cli ap stop</p> <ul style="list-style-type: none"> <li>AP interface closing (If not being operated, 'FAIL')</li> </ul> <p>For example: [/DA16200/NET] # cli set_network 1 ssid 'DA16200_AP2'</p> <p>For example: [/DA16200/NET] # cli ap restart</p> <ul style="list-style-type: none"> <li>Modify SSID of the interface of AP being operated</li> </ul> <p>For example: [/DA16200/NET] # cli set_network 1 pairwise TKIP</p> <p>For example: [/DA16200/NET] # cli ap restart</p> <ul style="list-style-type: none"> <li>Modify the AP interface encryption mode to TKIP</li> </ul> |
| ap_chan_switch | <Ch.>     | <p>Modify the AP interface operation channel (B).</p> <p>&lt;Ch.&gt;: AP operation channel (1~14) or frequency (MHz)</p> <p>For example: [/DA16200/NET] # cli ap_chan_switch 3</p> <ul style="list-style-type: none"> <li>Modify the AP interface channel to 3 (242 MHz)</li> </ul> <p>For example: [/DA16200/NET] # cli ap_chan_switch 11 2462</p> <ul style="list-style-type: none"> <li>Modify the AP interface channel to 11 (2462 MHz)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| ap_status      | (none)    | <p>Get main information about the interface at DA16200 (C).</p> <p>For example:</p> <pre>[/DA16200/NET] # cli ap_status state=ENABLED phy=fc9k_phy0 freq=2472 num_sta_non_erp=0 num_sta_no_short_slot_time=0 num_sta_no_short_preamble=0 olbc=0 num_sta_ht_no_gf=0 num_sta_no_ht=0 num_sta_ht_20_mhz=0 num_sta_ht40_intolerant=0 olbc_ht=0 ht_op_mode=0x0 cac_time_seconds=0 cac_time_l</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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| Command        | Parameter                                                                                  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| all_sta        | (none)                                                                                     | <p>Output the list information of STA being accessed to the AP interface (C).</p> <p>For example:</p> <pre>[/DA16200/NET] # cli all_sta 50:77:05:DB:C4:3E flags=[AUTH] [ASSOC] [AUTHORIZED] [SHORT_PREAMBLE] [WMM aid=1 capability=0x431 listen_interval=10 mode = 802.11n timeout_next=0 rx_packets=632 tx_packets=9 rx_bytes=67451 tx_bytes=4767 connected_time=77 sta_count=1</pre>                                                                                                                                                                                                                               |
| deauthenticate | <addr>                                                                                     | <p>The deauthenticate message is transmitted to the access STA with a certain MAC address to cancel the access (D).</p> <p>&lt;addr&gt;: MAC address of the access STA</p> <p>For example: [/DA16200/NET] # cli deauthenticate aa:ff:01:00:00:00</p> <ul style="list-style-type: none"> <li>Transmit the de-authentication message to STA whose MAC address is AA:FF:01:00:00:00</li> </ul>                                                                                                                                                                                                                          |
| disassociate   | <addr>                                                                                     | <p>The disassociation message is transmitted to the access STA with a certain MAC address to cancel the access (D).</p> <p>&lt;addr&gt;: MAC address of the access STA</p> <p>For example: [/DA16200/NET] # cli disassociate aa:ff:01:00:00:00</p> <ul style="list-style-type: none"> <li>Transmit the disassociation message to STA whose MAC address is AA:FF:01:00:00:00</li> </ul>                                                                                                                                                                                                                               |
| wmm_enabled    | <value>                                                                                    | <p>WMM function availability setting and inquiry (A).</p> <p>&lt;value&gt;: On: 1   Off: 0</p> <p>Default: Off</p> <p>For example: [/DA16200/NET] # cli wmm_enabled 1</p> <ul style="list-style-type: none"> <li>Use the WMM function</li> </ul>                                                                                                                                                                                                                                                                                                                                                                     |
| wmm_ps_enabled | <value>                                                                                    | <p>WMM-PS function availability setting and inquiry (A).</p> <p>&lt;value&gt;: On: 1   Off: 0</p> <p>Default: Off</p> <p>For example: [/DA16200/NET] # cli wmm_ps_enabled 1</p> <ul style="list-style-type: none"> <li>Use the WMM-PS function</li> </ul>                                                                                                                                                                                                                                                                                                                                                            |
| wmm_params     | <target><br><category><br><AIFS><br><CWmin><br><CWmax><br><Burst (AP) or TxOP Limit (STA)> | <p>Set up details of DA16200 AP or STA's certain category WMM parameters (B).</p> <p>&lt;target&gt;: ap   sta</p> <p>&lt;category&gt;: be(best-effort)   bk(background)   vi(video)   vo(voice)</p> <p>For example: [/DA16200/NET] # cli wmm_params ap be 3 15 63 10</p> <ul style="list-style-type: none"> <li>For WMM AP's best-effort category, AIFS = 3, CWmin = 15, CWmax = 63, and Burst = 10</li> </ul> <p>For example: [/DA16200/NET] # cli wmm_params sta vo 4 7 15 60</p> <ul style="list-style-type: none"> <li>For WMM STA's voice category, AIFS = 4, CWmin = 7, CWmax = 15, TXOP_Limit = 60</li> </ul> |

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| Command           | Parameter        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| all_wmm           | (none)           | Inquiry of all parameters that can be set up using wmm_params CLI (C).<br>For example: [/DA16200/NET] # cli all_wmm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| acl_mac           | <addr>           | Add the MAC address to the Access Control Management List (B).<br><addr>: AP MAC Address<br>For example: [/DA16200/NET] # cli acl_mac AA:FF:01:00:00:06<br><ul style="list-style-type: none"> <li>• Add MAC address AA:FF:01:00:00:06 to ACL</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| acl               | <oper><br><addr> | Set up, delete, or inquire the use of ACL (A).<br><oper>: allow   deny   clear   delete (If none, inquire of it)<br><addr>: AP MAC Address (only when oper = "delete")<br>[/DA16200/NET] # cli acl [allow/deny/clear/delete mac_address]<br>For example: [/DA16200/NET] # cli acl<br>For example: [/DA16200/NET] # cli acl allow<br><ul style="list-style-type: none"> <li>• Access allowed only for AP Lists in ACL</li> </ul> For example: [/DA16200/NET] # cli acl deny<br><ul style="list-style-type: none"> <li>• Access denied only for AP Lists in ACL</li> </ul> For example: [/DA16200/NET] # cli acl clear<br><ul style="list-style-type: none"> <li>• Entire ACL clear</li> </ul> For example: [/DA16200/NET] # cli delete aa:ff:01:00:00:08<br><ul style="list-style-type: none"> <li>• Delete AA:FF:01:00:00:08 from ACL</li> </ul> |
| ap_max_inactivity | <value>          | If there is no data frame exchange of accessed STA during the time setting, disconnect the STA (A).<br><value>: inactivity timeout (sec)<br>Default: 300 (sec)<br>For example: [/DA16200/NET] # cli ap_max_inactivity 600<br><ul style="list-style-type: none"> <li>• Disconnect the access STA with no data frame exchange for 600 seconds</li> </ul> For example: [/DA16200/NET] # cli ap_max_inactivity 0<br><ul style="list-style-type: none"> <li>• Uncheck data frame exchange of the accessed STA</li> </ul> For example: [/DA16200/NET] # cli ap_max_inactivity<br><ul style="list-style-type: none"> <li>• Read ap_max_inactivity value</li> </ul>                                                                                                                                                                                      |
| ap_send_ka        | <value>          | A function to send 'keep-alive' NULL packets to the accessed STA at intervals of 30 seconds and check ACK receipts (A).<br><value>: On: 1   Off: 0<br><ul style="list-style-type: none"> <li>• On: if the STA accessed to DA16200 AP interface goes out of coverage or is closed abnormally, the disconnect will occur after the 'ap_max_inactivity timeout' passes</li> <li>• Off: if there is no constant data frame exchange with the STA accessed to DA16200 AP interface for ap_max_inactivity timeout, then disconnect.</li> </ul> Default: 0 (not used)<br>For example: [/DA16200/NET] # cli ap_send_ka 1<br><ul style="list-style-type: none"> <li>○ ap_send_ka = 1</li> </ul>                                                                                                                                                           |

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| Command    | Parameter | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ap_rts     | <value>   | <p>For AP mode operation, set up the RTS Threshold value to be used (A).</p> <p>&lt;value&gt;: The standard for the size of packets that use the RTS Control Frame (bytes)</p> <p>Default: 2437 (bytes)</p> <p>For example: [/DA16200/NET] # cli ap_rts 1000</p> <ul style="list-style-type: none"> <li>• Use RTS for transmission of 1000 bytes or larger frames</li> <li>• ap_rts = 1000</li> </ul> <p>For example: [/DA16200/NET] # cli ap_rts</p> <ul style="list-style-type: none"> <li>• ap_rts = 2437</li> </ul>          |
| greenfield | <value>   | <p>Enable/Disable use of Greenfield.</p> <p>&lt;value&gt;: On: 1   Off: 0</p> <p>If Greenfield is on, DA16200 uses 11n HT mode only. In that case, 11b, 11g information, and STA access are not allowed.</p> <p>Default: 0 (not used)</p> <p>For example: [/DA16200/NET] # cli greenfield 1</p> <ul style="list-style-type: none"> <li>• Use the Greenfield function</li> <li>• Greenfield = 1</li> </ul> <p>For example: [/DA16200/NET] # cli greenfield</p> <ul style="list-style-type: none"> <li>• Greenfield = 0</li> </ul> |

## 8.2.6 Advanced Commands

Table 7: Advanced CLI Commands

| Command | Parameters | Description                                                                                                                                                                                         |
|---------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| wps_pbc | (none)     | Run WPS PBC (Push Button Configuration).                                                                                                                                                            |
| wps_pin | <pin>      | <p>Run WPS PIN method.</p> <p>&lt;pin&gt; pin code (any: generate a random code)</p> <p>For example: [/DA16200/NET] # cli wps_pin 27833513</p> <p>For example: [/DA16200/NET] # cli wps_pin any</p> |

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## 9 Firmware Update

The security features of DA16200 support Secure Boot to avoid booting with fake or untrusted images and to protect against being hacked. 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 a secure mode.

### NOTE

Secure Boot operation of the DA16200 FreeRTOS will be supported from the DA16200 FreeRTOS SDK Official Release version.

This feature is not provided in the current Alpha/Draft SDK package.

The DA16200 requires two images. With a serial terminal tool, each image can be loaded individually into the DA16200.

- <Bootloader image>: also known as Second Bootloader
  - DA16200\_[image\_type]-[vendor]-[major]-[minor]-[customer\_ver]\_[sflash\_model].img
    - [Image\_type]: Bootloader (FBOOT), or Main (FRTOS)
    - [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\_FBOOT\_GEN01-01-XXXX-000000\_IS25WP016D.img
- <Main image>: includes RTOS and applications
  - For example: DA16200\_FRTOS\_GEN01-01-XXXX-000000.img

### 9.1 Flash MAP

DA16200 provides two image sets: #0 and #1. It is possible to use these regions for each image set and change the index of the booting image set. The default value of the Boot Index points to #0.

**Table 8: 2 MB Serial Flash Memory Map**

| Address     | Item              | Size   |
|-------------|-------------------|--------|
| 0x0000_0000 | Second Bootloader | 136 kB |
| 0x0002_2000 | Boot Index        | 4 kB   |
| 0x0002_3000 | RTOS #0           | 928 kB |
| 0x0010_B000 | RTOS #1           | 928 kB |

**Table 9: 4 MB Serial Flash Memory Map**

| Address     | Item              | Size    |
|-------------|-------------------|---------|
| 0x0000_0000 | Second Bootloader | 136 kB  |
| 0x0002_2000 | Boot Index        | 4 kB    |
| 0x0002_3000 | RTOS #0           | 1792 kB |
| 0x001E_2000 | RTOS #1           | 1792 kB |



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### 9.2 Bootloader Image

<Bootloader image> is also known as the second bootloader, which 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 other images are loaded.

If you get a new SDK, then always load the <Bootloader image> first.

1. Power on the DA16200 board.
2. At the [/DA16200] prompt, type `reset` to go to the Mask ROM prompt [MROM]. See Figure 32.

```
[/DA16200] # reset

* FCI FC9K MaskROM BootLoader
* Cortex-M4 (XTAL 40000 KHz, SYS 120000 KHz)
* Console Baud Rate : 0 (00000000)
* HW Version Num. : fc905010
* Build Option : RomALL
* RoSDK Date & Time : Mar 13 2019 13:05:45
* Build Date & Time : Mar 13 2019 13:11:24
* http://www.fci.co.kr

[MROM]
```

Figure 32: Mask ROM

3. At the [MROM] prompt, type `loady boot`. See Figure 33.

```
[MROM] loady boot
Load Addr: 000f6684
To cancel a session, press Ctrl+X
Load Y-Modem (Load Offset:f6684)
CC
xyzModem - CRC mode, 7(SOH)/29(STX)/0(CAN) PKTs, 9 retries, err:Timed o
ut
Total Size = 0x00007070 = 28784 Bytes
[MROM]
```

Figure 33: Bootloader Prompt on Command Window

4. To select the image file for the **Bootloader**, choose menu **File > Transfer > YMODEM > Send**. See Figure 34.
  - For example: DA16200\_FBOOT\_GEN01-01-XXXX-000000\_IS25WP016D.img
  - The result is printed at the end of the transfer  
Please ignore any messages like "err:.."

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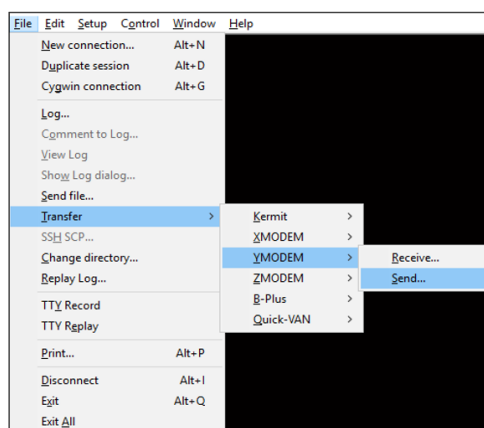


Figure 34: Load Image File

### 9.3 Main RTOS Image

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

1. At the [MROM] prompt, type `loady 23000`. See Figure 35.

#### NOTE

DA16200 has a different address based on flash size and boot index (the default is 4 MB).

The RTOS address map register depends on the flash memory size. Therefore, the address must be `0x23000` for boot index 0 or `0x1E2000` for boot index 1. In this case, at the [MROM] prompt, type `loady 23000` or `loady 1e2000`.

If the customer/developer uses a 2 MB SFLASH MAP for the application, the address must be `0x23000` for boot index 0 or `0x10B000` for boot index 1. In this case, at the [MROM] prompt, type `loady 23000` for boot index #0 or `loady 10B000` for boot index #1.

For more details, please refer to DA16200 SDK Programmer Guide [2].

```
[MROM]
[MROM] loady 23000
Load Addr: 000f6684
To cancel a session, press Ctrl+X
Load Y-Modem (Load Offset:f6684)
CC
xyzModem - CRC mode, 4(SOH)/896(STX)/0(CAN) PKTs, 6 retries, err:Timed out
Total Size = 0x000dfdd0 = 916944 Bytes
```

Figure 35: Main Image Prompt on Command Window

2. To select the <Main image> file, choose menu **File > Transfer > YMODEM > Send**. See Figure 36.
  - For example: `DA16200_FRTOS_GEN01-XX-YYYY-ZZZZZZ.img`

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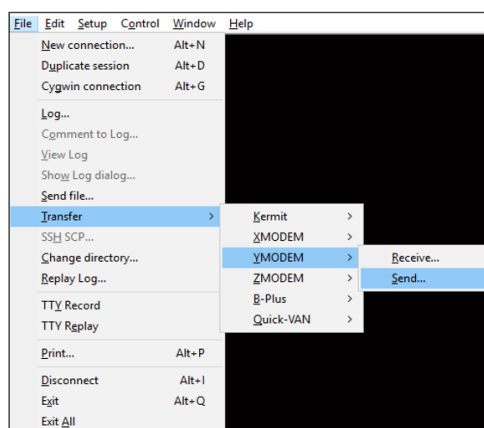


Figure 36: Load Image File

3. If the three images are loaded, then at the [MROM] prompt, type `boot` to boot your images.
4. Run `factory reset` as shown in Figure 37.

```
[/DA16200] # factory
FACTORY RESET IN/y/?] y

Start Factory-Reset ...

Rebooting....

Wakeup source is 0x0
[dpm_init_retmemory] DPM INIT CONFIGURATION<1>

* DA16200 SDK Information *

* - CPU Type : Cortex-M4 (120MHz)
* - OS Type : FreeRTOS 10.4.3
* - Serial Flash : 4 MB
* - SDK Version : V3.1.0.0 GEN
* - F/W Version : FRTOS-GEN01-01-14071-000000
* - F/W Build Time : Apr 5 2021 10:42:37
* - Boot Index : 0

System Mode : Station Only <0>
>>> DA16x Supp Ver2.7 - 2020_07
>>> MAC address (sta0) : d4:3d:39:10:cc:78
>>> sta0 interface add OK
>>> Start STA mode...
```

Figure 37: Factory Mode Prompt on Command Window

Now firmware update is done.

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## 9.4 Download Image with Script (Macro)

You can download all images automatically with the use of a script.

1. In the **Control** menu, select **Macro**.
2. In the **MACRO: Open macro** dialog box, choose a .ttl file. See Figure 38.

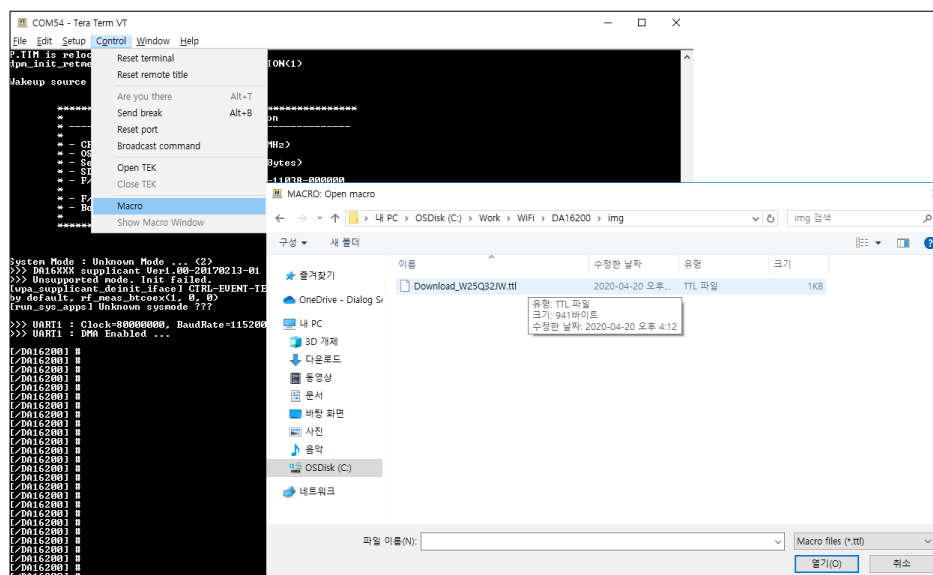


Figure 38: Load Macro

3. The download starts with the bootloader image. See Figure 39.

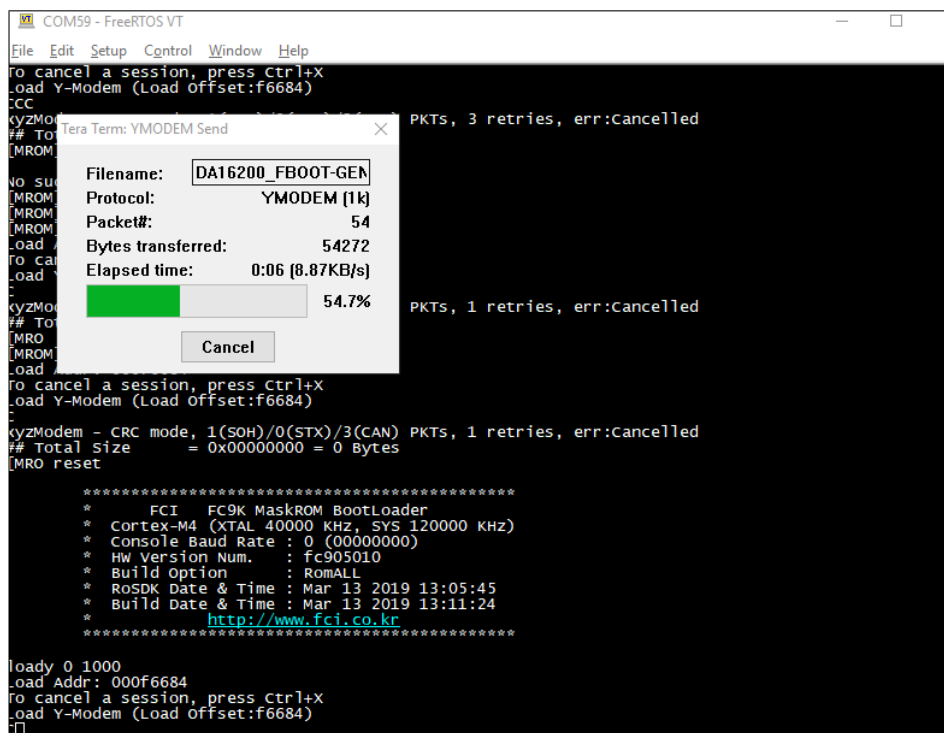


Figure 39: Download Bootloader

4. Download RTOS image. See Figure 40.

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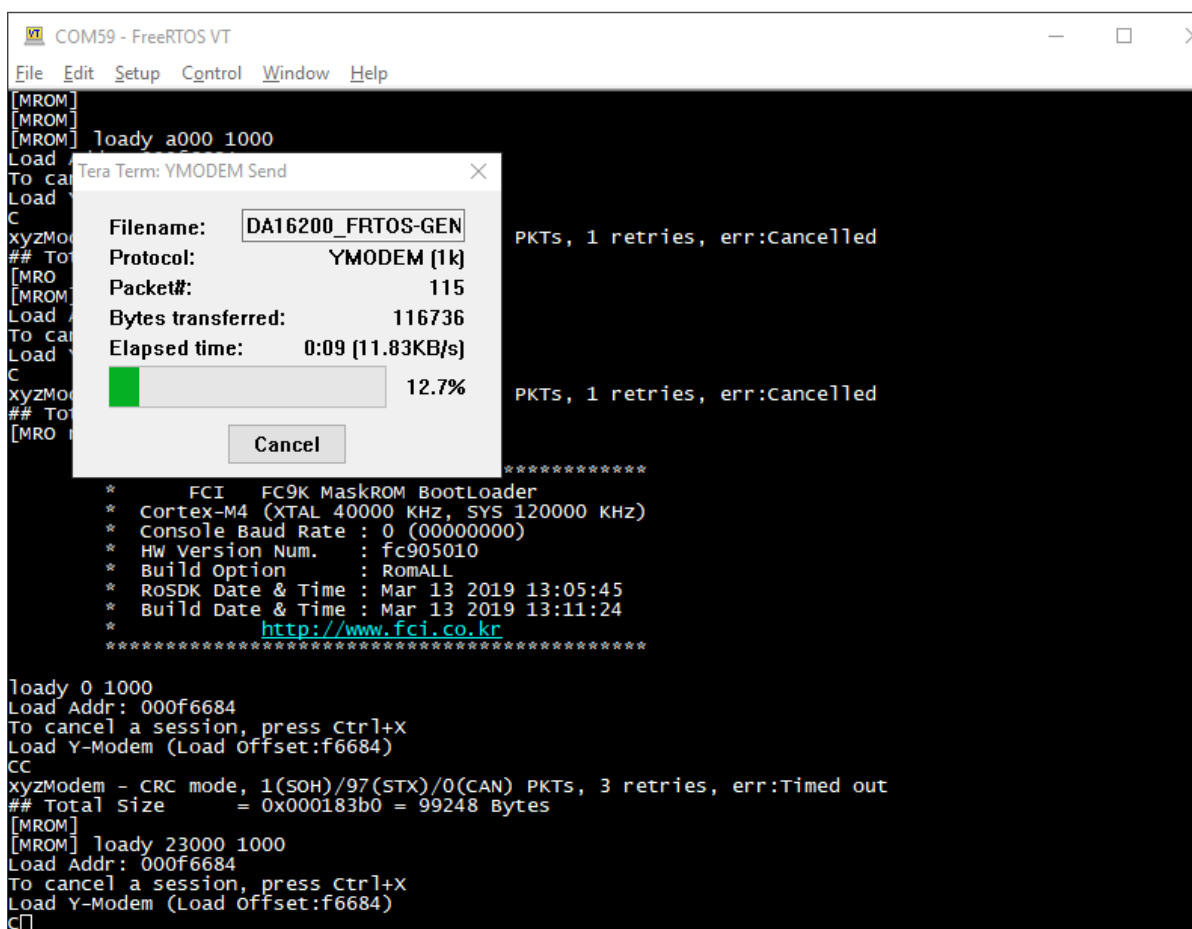


Figure 40: Download RTOS Image

5. DA16200 will boot automatically after all images are downloaded.

**NOTE**

TTL command references

send : Sends data.

Format : send <data1> <data2>....

sendln : Sends data with new line.

Format : sendln <data1> <data2>....

waitln : Waits a line that contains string.

Format : waitln <string1> [<string2> ...]

mpause : Pauses.

Format : mpause <time>, milliseconds

getdir : Gets the current working directory for MACRO.

Format : getdir <strvar>

strconcat : Appends a string.

Format : strconcat <strvar> <string>

ymodemsend : Sends a file from the host with the YMODEM protocol.

Format : ymodemsend <filename>

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## 9.5 SFDP Checking

SFDP information of SFLASH is added to the boot loader image. When the boot loader image loads into the DA16200, SFDP information is copied to the Retention Memory.

However, under certain conditions, the ROM of the DA16200 has the task to clear the contents of Retention Memory. If the SFDP information in the Retention Memory is deleted due to certain conditions, the bootloader image should be loaded again. In this case, we recommend that the **boot loader image** and the **other two image files** (RTOS and SLIB) are loaded again.

If the images load normally, then use the command `[/DA16200] # brd f80000 100` to check if the SFDP information is copied to the Retention Memory. See [Figure 41](#).

Example code to read the Retention Memory and check if SFDP is alive:

- `[/DA16200] # brd f80000 100`

```
[/DA16200] # brd f80000 100
00F80000 : 00 00 00 02 FF FF FF FF FF FF FF FF 00 00 00 40@
00F80010 : A1 00 91 FC C0 15 F8 20 00 30 08 00 C0 1D 00 000.
00F80020 : 0B 00 00 00 C0 D4 01 80 00 00 00 00 54 C1 A8 5ET.^
00F80030 : 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 64d
00F80040 : 53 46 44 50 15 16 60 EF 00 00 40 00 F5 20 F1 FF SFDP...@
00F80050 : FF FF FF 01 44 EB 08 6B 08 3B 04 BB EE FF FF FF ...B.k.;
00F80060 : FF FF 00 FF FF FF 44 EB 0C 20 0F 52 10 D8 00 FF ...D..R...
00F80070 : 11 34 1E F3 83 3A 00 CC CC 43 1C 62 7A 75 7A 75 ...4....C.bzuzu
00F80080 : 07 CD D5 5C 42 00 EF 40 FF 7F 00 01 07 02 36 39 ...WB..@....69
00F80090 : 3C FF E1 E0 FF 00 00 00 32 68 68 68 32 64 00 04 <.....2hhh2d..
00F800A0 : 00 04 00 00 00 00 00 00 90 9F AB 5A 05 01 04 06 ...Pf....8....2.
00F800B0 : 50 66 99 00 00 B9 AB 38 FF B7 E9 00 00 02 32 00 ...2....5.....
00F800C0 : 02 32 00 20 00 0B 60 35 00 00 00 00 00 00 00 00 ... (Px.@@@
00F800D0 : 00 00 00 00 28 50 78 A0 40 40 40 80 00 00 00 00
00F800E0 : 00 00 00 00 FF FF FF FF FF FF FF FF FF FF FF FF
00F800F0 : 5B 8A D5 7C 00 00 00 00 00 00 00 00 00 00 00 00 [...]
```

Figure 41: SFDP

## 9.6 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 follow the steps below to re-initialize or recover sflash and check the process:

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

W25Q32JWSNIQ: ef601615

IS25WP016D: 9d701514

IS25LQ032B: 9d401615s

4. Run command `ymodem sfdp`
5. In the `build\SBOOT\SFDP` folder, find Flash SFDP file which is corresponding to Flash ID as `W25Q32JW.bin`.
6. Run command `[MROM] sflash erase 0 200000` to erase the entire flash for recovery.

**NOTE**

This command can take a long time to complete. Please wait until the `[MROM]` prompt appears again.

7. Reload all images in the specified order for serial flash recovery.
  - `[MROM] loady boot`
  - `[MROM] loady 23000`
8. Run command `boot` to boot DA16200. The image version is printed.
9. Initialize NVRAM for Serial Flash Recovery with the following commands:

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```
[/DA16200] #
[/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] # factory? Y
```

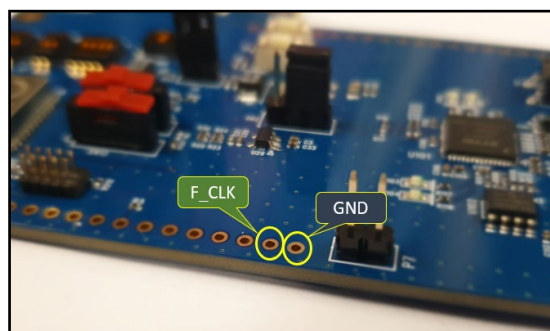
```
[/DA16200] # nvr
Command-List is changed, "NVRAM"
[/DA16200/NVRAM] # nvedit erase sflash
[/DA16200/NVRAM] # nvedit clear
[/DA16200/NVRAM] # nvcfg update sflash
update , sflash completed
[/DA16200/NVRAM] # nvedit load sflash
nvedit , load completed
```

**Figure 42: Initialize NVRAM**

### 9.7 Serial Flash Recovery from Boot

If there are any memory conflicts during updating the image or errors while building the SDK, there may be a case that it cannot run DA16200. In this case, you cannot do anything in the command window. DA16200 must be forced to enter boot mode. Follow the procedure below.

1. Use RTC\_PWR\_KEY to power off (move to OFF position).
  - Connect the two pins. Pin 17(F\_CLK) and pin 18(GND) in the header Pin (J3) of the external connector of EVK. See [Figure 43](#)
  - F\_CLK is connected to Pin 21 of the module connector



**Figure 43: Recovery Point in the EVK**

2. Use RTC\_PWR\_KEY to power on (move to ON position).
  - Boot DA16200. Turn the power on when the two pins are connected
  - Disconnect the two pins. Pin 17 (F\_CLK) and pin 18 (GND)
3. See the DA16200 go into the **BOOT** mode. See [Figure 44](#).
4. At the `[BOOT] #` prompt, run command `reset`.
5. Do the steps in section [9.6](#) from step 3 to step 9.

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```

[[OOPS Dump : c0f0]]
[[Hard Fault]]
--RTC Time : 00000000.0003693

Register-Dump
R0 : 00093990, R1 : 00000000, R2 : 020c7668, R3 : 000ccdc8
R4 : 000cb5a4, R5 : 000f7c84, R6 : 000f84b4, R7 : 00000000
R8 : 00000000, R9 : 00000000, R10 : 000cb5a4, R11 : 000f84b4
R12 : 0000063c, SP : 000cce48, LR : 00002ccf, PC : 0018ba2e
PSR : 61000000, EXC : ffffffff

Fault Status
SHCSR : 00000000, CFSR : 00080000, HFSR : 40000000
DFSR : 00000000, MMFAR : e000ed34, BFAR : e000ed38
AFSR : 00000000

FC9K SysInfo
SICS[0] = 04300000
SICS[1] = 00000000
SICS[2] = 00000000
SICS[3] = 00000000
SICS[4] = 00000000
SICS[5] = 01234de2

Stack
Stack-Dump (48)
[0x000cce48] : 000cce6c 0008d650 00000000 000f84f6 000f84f9 00000000 00092a98 00080778
[0x000cce68] : 00080748 000f84d8 00000176 000f84da 000f84e9 000f84f3 00000000 00000000
[0x000cce88] : 00000000 000f84f6 000f84f9 00000000 000f8344 000f84ff 000f831b 00000000
[0x000cce88] : 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
[0x000cce88] : 00000000 00000000 0001080b 00040000 00000018 00000000 00080778 000f7c78
[0x000cce88] : 00000000 00000000 00000050 00183b69 000ccf58 000f7c78 000cb5a4 00000000

Thread: umac_fc9k
stack_ptr : 000cccf8
stack_base : 000cf90
stack_end : 000ccf8b
stack_high : 000cccf8
max_usage : 00000094
suspend : 00000000

Thread Stack (32)
[0x000cccf8] : 000ccf58 000f7c78 000cb5a4 00000000 00000000 00000000 00000000 00000010
[0x000ccf18] : 00000010 00000000 00000000 00091e40 00000006 0000265b 00003fa2 00093928
[0x000ccf38] : 00139414 00000000 00091e70 00000000 00000000 000cc790 00000000 00138b98
[0x000ccf58] : 000f7c78 00000000 00091e40 00080774 00080778 00003805 00000000 00000000
Image Code, CRC Failed (9fc3af6 - 09aa010e, 23200)!!
Boot Err: wrong image [40000000](01)

* FCI FC9K MaskROM BootLoader
* Cortex-M4 (XTAL 40000 Khz, SYS 120000 Khz)
* Console Baud Rate : 0 (00000000)
* HW Version Num. : fc905010
* Build Option : RomALL
* ReSDK Date & Time : Mar 13 2019 13:05:45
* Build Date & Time : Mar 13 2019 13:11:24
* http://www.fci.co.kr

[BOOT]

```

Figure 44: Run with BOOT Mode

## 9.8 Boot Index Change

To change the boot index, you must change the boot index number and then reboot. After the reboot is complete, verify that the version printed at boot and the **boot\_idx** values have changed.

The following console commands can change the boot index:

- `boot_idx 0` // to boot with boot index 0
  - `boot_idx 1` // to boot with boot index 1
- ```

[/DA16200] # boot_idx 1 // or boot_idx_0
[/DA16200] # reboot

```

...

```

*****
*
* DA16200 SDK Information
* -----
*
* - CPU Type : Cortex-M4 (80MHz)
* - OS Type : FreeRTOS 10.3.0
* - Serial Flash : 4 MB
* - SDK Version : V3.0.0.0 GEN Alpha
* - F/W Version : FRTOS-GEN01-01-12942-000000
* - F/W Build Time : Nov 10 2020 18:39:27
* - Boot Index : 1
*
*****

```

9.9 MAC Address Checking

By default, a MAC address is programmed in the OTP. However, if for some reason there is no MAC address or MAC address is cleared.

For example: `[/DA16200] # setwlanmac aa:ff:00:00:00:00`

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At prompt [/DA16200] # type command `getwlanmac` to check where the MAC address was written. One of the following lines is displayed: MAC TYPE: OTP MAC or NVRAM MAC. See example:

```
[/DA16200] # getwlanmac  
MAC TYPE: OTP MAC  
WLAN0 - EC:9F:0D:9F:F9:34  
WLAN1 - EC:9F:0D:9F:F9:35
```

NOTE
Each EVK should have a unique address, and the last number of address must be even.

10 Country Codes

Table 10: Country Codes

Code	Country	Code	Country	Code	Country	Code	Country
AD	Andorra	EC	Ecuador	LC	Saint Lucia	RE	Reunion
AE	United Arab Emirates	EE	Estonia	LI	Liechtenstein	RO	Romania
AF	Afghanistan	EG	Egypt	LK	Sri Lanka	RS	Serbia
AI	Anguilla	ES	Spain	LS	Lesotho	RU	Russia
AL	Albania	ET	Ethiopia	LT	Lithuania	RW	Rwanda
AM	Armenia	EU	Europe	LU	Luxembourg	SA	Saudi
AR	Argentina	FI	Finland	LV	Latvia	SE	Sweden
AS	Samoa	FM	Micronesia	MA	Morocco	SG	Singapore
AT	Austria	FR	France	MC	Monaco	SI	Slovenia
AU	Australia	GA	Gabon	MD	Moldova	SK	Slovakia
AW	Aruba	GB	United Kingdom	ME	Montenegro	SN	Senegal
AZ	Azerbaijan	GD	Grenada	MF	Saint Martin	SR	Suriname
BA	Bosnia	GE	Georgia	MH	Marshall Islands	SV	El Salvador
BB	Barbados	GF	French Guiana	MK	Macedonia	SY	Syria
BD	Bangladesh	GH	Ghana	MN	Mongolia	TC	Turks Caicos
BE	Belgium	GL	Greenland	MO	Macao	TD	Chad
BF	Burkina Faso	GP	Guadeloupe	MP	Northern Mariana Islands	TG	Togo
BG	Bulgaria	GR	Greece	MQ	Martinique	TH	Thailand
BH	Bahrain	GT	Guatemala	MR	Mauritania	TN	Tunisia
BL	Barthelemy	GU	Guam	MT	Malta	TR	Turkey
BM	Bermuda	GY	Guyana	MU	Mauritius	TT	Trinidad and Tobago
BN	Brunei	HK	Hong Kong	MV	Maldives	TW	Taiwan
BO	Bolivia	HN	Honduras	MW	Malawi	TZ	Tanzania
BR	Brazil	HR	Croatia	MX	Mexico	UA	Ukraine
BS	Bahamas	HT	Haiti	MY	Malaysia	UG	Uganda
BT	Bhutan	HU	Hungary	NG	Nigeria	UK	United Kingdom
BY	Belarus	ID	Indonesia	NI	Nicaragua	US	USA
BZ	Belize	IE	Ireland	NL	Netherlands	UY	Uruguay
CA	Canada	IL	Israel	NO	Norway	UZ	Uzbekistan
CF	Central Africa	IN	India	NP	Nepal	VA	Vatican City

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Code	Country	Code	Country	Code	Country	Code	Country
CH	Switzerland	IR	Iran	NZ	New Zealand	VC	St. Vincent and Grenadines
CI	Ivory Coast	IS	Iceland	OM	Oman	VE	Venezuela
CL	Chile	IT	Italy	PA	Panama	VI	Virgin Islands, US
CN	China	JM	Jamaica	PE	Peru	VN	Vietnam
CO	Colombia	JO	Jordan	PF	Polynesia	VU	Vanuatu
CR	Costa Rica	JP	Japan	PG	Papua New Guinea	WF	Wallis and Futuna Islands
CU	Cuba	KE	Kenya	PH	Philippines	WS	Samoa
CX	Christmas Island	KH	Cambodia	PK	Pakistan	YE	Yemen
CY	Cyprus	KN	St. Kitts and Nevis	PL	Poland	YT	Mayotte
CZ	Czech	KP	North Korea	PM	St. Pierre and Miquelon	ZA	South Africa
DE	Germany	KR	South Korea	PR	Puerto Rico	ZW	Zimbabwe
DK	Denmark	KW	Kuwait	PT	Portugal	ALL	ALL
DM	Dominica	KY	Cayman Islands	PW	Palau		
DO	Dominican Rep	KZ	Kazakhstan	PY	Paraguay		
DZ	Algeria	LB	Lebanon	QA	Qatar		

Revision History

Revision	Date	Description
1.0	05-Apr-2021	First Release.

DA16200 Evaluation Kit

Status Definitions

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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