

***Evaluation guide book of KAGA FEI  
Wireless Module on the ESPRESSObin  
(88W8887)***

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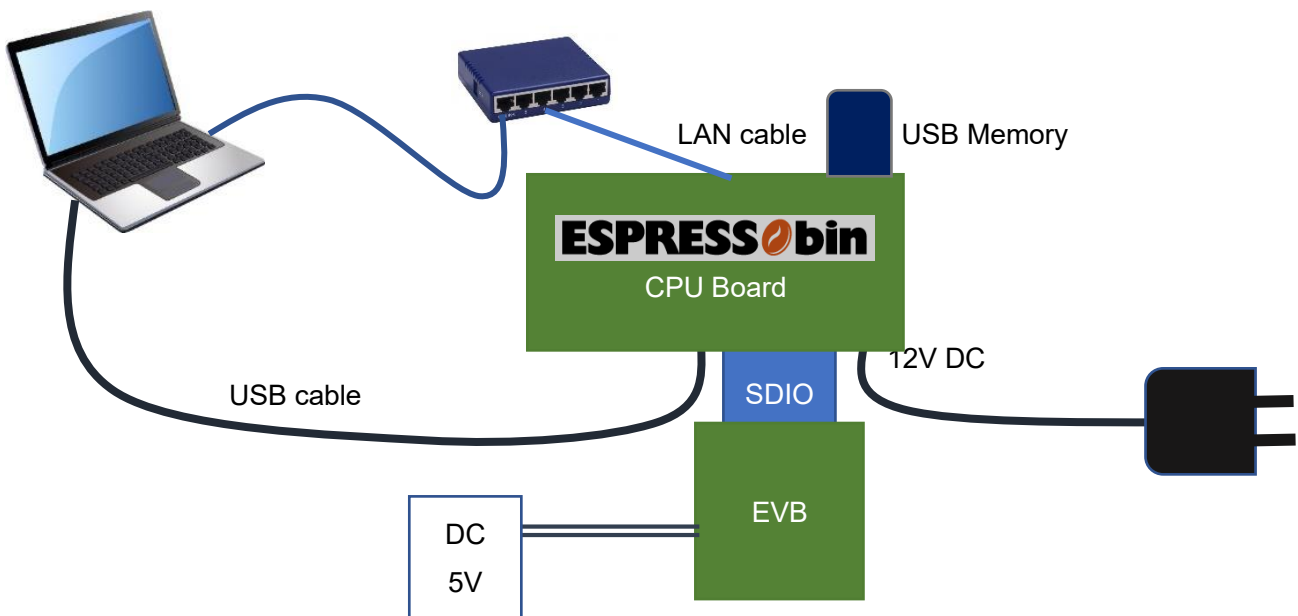
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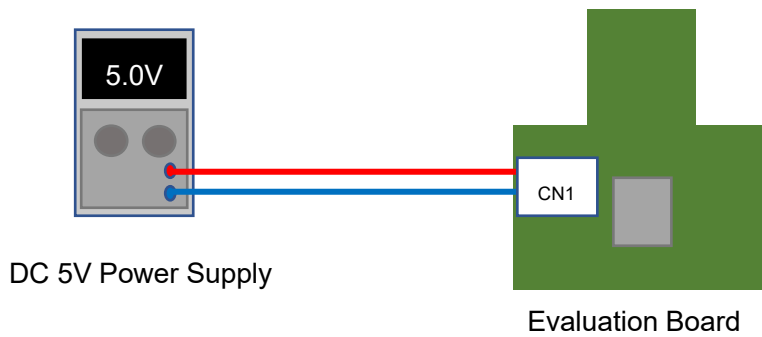
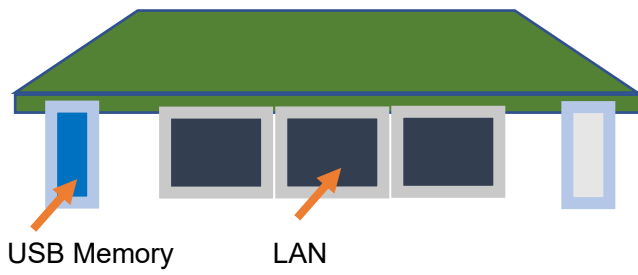
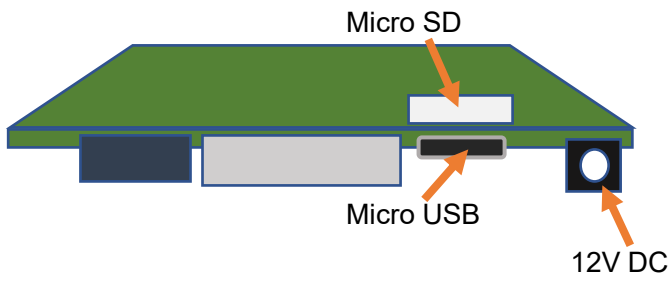
### Rev. History

26-June.2023> Rev.1.0    Initial Release

# 1. Block Diagram for Hardware



Detailed Block Diagram



## 2. Open serial console on the PC

First connect the ESPRESSObin and the PC with the USB cable.

ESPRESSObin power supply remains OFF.

Open the corresponding port with serial communication software. (terminal software)

Follow the tutorial for your OS to make sure you have everything needed.

Windows:

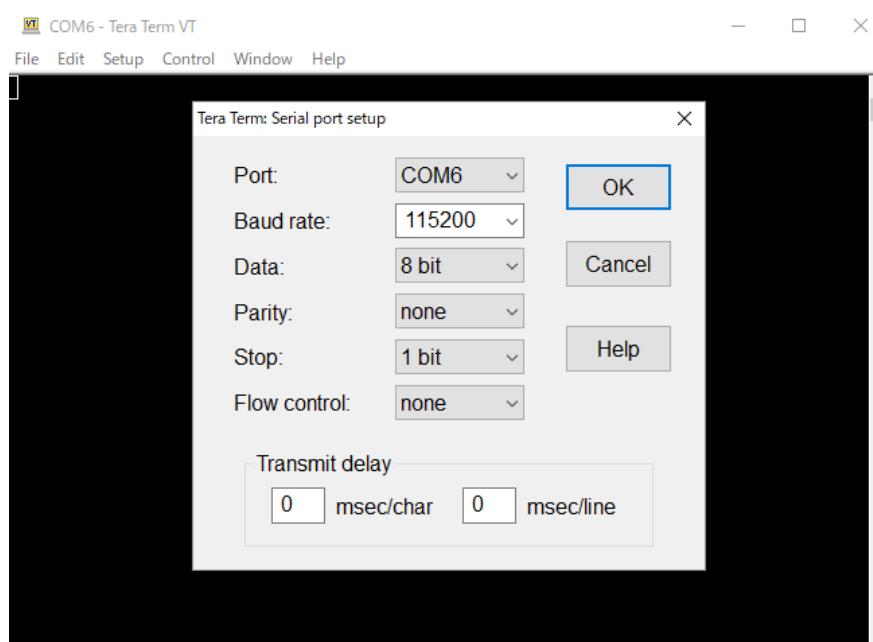
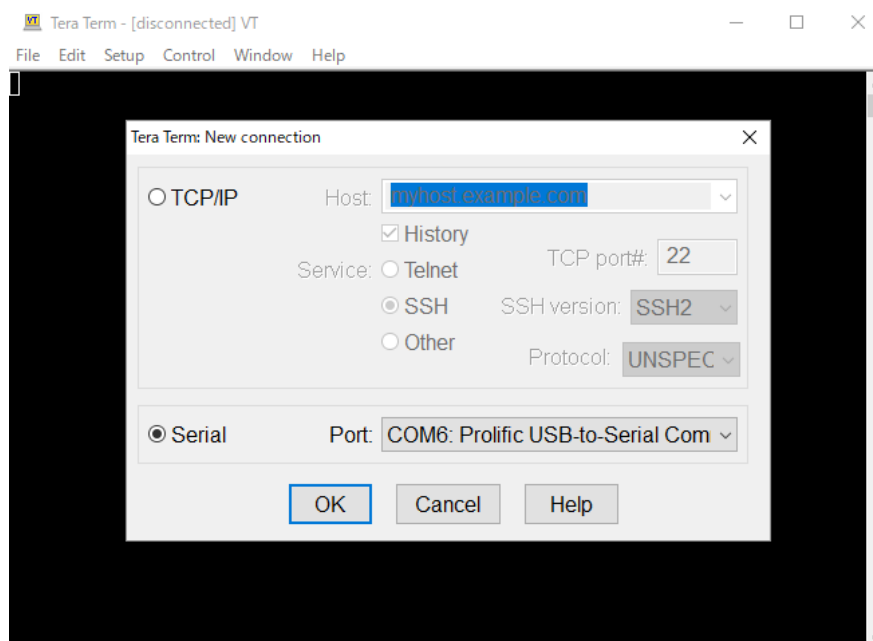
<http://wiki.espressobin.net/tiki-index.php?page=Serial+connection+-+Windows>

Linux

<http://wiki.espressobin.net/tiki-index.php?page=Serial+connection+-+Linux>

*For example*

*Tera Term on the Windows PC*



### 3. Power on the ESPRESSObin

Plug your power adapter to the 12V DC Jack.

When the ESPRESSObin starts to boot, you can check following messages.

```
TIM-1.0
WTMI-armada-17.10.1-b90dbf0
ENTER init_ddrden
DDR_TOPOLOGY is 4 :    DDR3, 1CS 1G
WTMI_CLOCK=2
  ⏪ (skip)
MMC:  sdhci@d0000: 0, sdhci@d8000: 1
SF: Detected w25q32dw with page size 256 Bytes, erase size 4 KiB, total 4 MiB
Net:  eth0: neta@30000 [PRIME]
Hit any key to stop autoboot:  0
  Please press "ENTER" key when the above message is displayed.
Marvell>>
```

Enter the following in order. (**Blue** letter part)

```
Marvell>> run bootusb
starting USB...
USB0:  Register 2000104 NbrPorts 2
Starting the controller
  ⏪ (skip)
Ubuntu 14.04 LTS localhost.localdomain ttyMV0

localhost login: root (automatic login)

Last login: Thu Jan  1 00:00:20 UTC 1970 on ttyMV0
Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 4.4.8-armada-17.02.2-g8148be9-dirty aarch64)
```

When the ESPRESSObin starts normally, you can check above message.

“bootusb” works with SDIO 3.0. (ultra-high speed)

If you want to operate with SDIO 2.0 (high speed), please change to "bootusbH". (**run bootusbH**)

Refer to “6. About SDIO switching” for setting on the evaluation board.

## 4. Load WLAN and Bluetooth driver

```

root@localhost:~# cd /home/8887/bin_sd8887
root@localhost:/home/8887/bin_sd8887# insmod mlan.ko
root@localhost:/home/8887/bin_sd8887# insmod sd8887.ko cal_data_cfg=none
[ 169.071741] wlan: Loading MWLAN driver
[ 169.076218] wlan: Driver loaded successfully
root@localhost:/home/8887/bin_sd8887# cd ../bin_sd8887_bt/
root@localhost:/home/8887/bin_sd8887_bt# insmod bt8887.ko
[ 178.215970] BT: Loading driver
[ 178.219525] BT: Driver loaded successfully
root@localhost:/home/8887/bin_sd8887_bt#

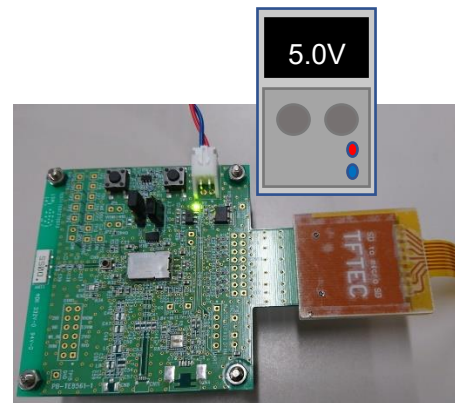
```

Insert 88W8887 evaluation board into SDIO of ESPRESSObin.

Please note that it is easy to come off.



Turn on the power of evaluation board



The evaluation board will be recognized and the following message will be displayed.

```

root@localhost:/home/8887/bin_sd8887_bt# [ 68.499234] vendor=0x02DF device=0x9135 class=0
function=1
[ 68.504945] SDIO: max_segs=128 max_seg_size=65536
[ 68.509804] rx_work=1 cpu_num=2
[ 68.524226] Request firmware: mrvl/sd8887_uapsta_a2.bin
[ 69.651638] WLAN FW is active
[ 74.665275] wlan: version = SD8887-15.68.7.p189-C4X15C605-GPL-(FP68)
[ 74.673418] ahci-mvebu d00e0000.sata: couldn't get PHY in node sata: -517
[ 74.696088] orion-ehci d005e000.usb: init d005e000.usb fail, -517
[ 74.721036] ahci-mvebu d00e0000.sata: couldn't get PHY in node sata: -517
root@localhost:/home/8887/bin_sd8887_bt#

```

When the driver install succeed, you can check “WLAN FW is active” message.

\*If “WLAN FW is active” is not displayed, power off evaluation board, remove the evaluation board from the SD slot, insert it in the SD slot again, and turn the power of the evaluation board on again.

## 4.1. WLAN operation check

### Confirmation of wireless LAN interface

```
root@localhost:/home/8887/bin_sd8887_bt# iwconfig
```

```
mlan0 IEEE 802.11-DS ESSID:""  
Mode:Managed Access Point: Not-Associated Bit Rate:1 Mb/s  
Tx-Power=17 dBm  
Retry limit:9 RTS thr=2347 B Fragment thr=2346 B  
Encryption key:off  
Power Management:on  
Link Quality=0/5 Signal level=0 dBm Noise level=0 dBm  
Rx invalid nwid:0 Rx invalid crypt:0 Rx invalid frag:0  
Tx excessive retries:0 Invalid misc:0 Missed beacon:0  
  
wfd0 IEEE 802.11-DS ESSID:""  
Mode:Managed Access Point: Not-Associated Bit Rate:1 Mb/s  
Tx-Power=17 dBm  
Retry limit:9 RTS thr=2347 B Fragment thr=2346 B  
Encryption key:off  
Power Management:on  
Link Quality=0/5 Signal level=0 dBm Noise level=0 dBm  
Rx invalid nwid:0 Rx invalid crypt:0 Rx invalid frag:0  
Tx excessive retries:0 Invalid misc:0 Missed beacon:0  
  
uap0 IEEE 802.11-DS ESSID:""  
Mode:Master Frequency:2.437 GHz Access Point: Not-Associated  
Encryption key:off  
Link Quality:0 Signal level:0 Noise level:0  
Rx invalid nwid:0 Rx invalid crypt:0 Rx invalid frag:0  
Tx excessive retries:0 Invalid misc:0 Missed beacon:0
```

## Perform a "scan"

```
root@localhost:/home/8887/bin_sd8887_bt# iwlist wlan0 scan
```

```
wlan0 Scan completed :
```

```
Cell 01 - Address: 1C:*.:.*.:.*.:.*
```

```
ESSID:"WG1400HP-2G" [4]
```

```
Mode:Master
```

```
Frequency=2.417 GHz (Channel 2)
```

```
Quality:5/5 Signal level:-45 dBm Noise level:-96 dBm
```

```
Encryption key:on
```

```
Bit Rates:1 Mb/s; 2 Mb/s; 5.5 Mb/s; 11 Mb/s; 6 Mb/s
```

```
9 Mb/s; 12 Mb/s; 18 Mb/s; 24 Mb/s; 36 Mb/s
```

```
48 Mb/s; 54 Mb/s
```

```
Extra:Beacon interval=100
```

```
IE: IEEE 802.11i/WPA2 Version 1
```

```
Group Cipher : CCMP
```

```
Pairwise Ciphers (1) : CCMP
```

```
Authentication Suites (1) : PSK
```

```
Cell 02 - Address: 1C:*.:.*.:.*.:.*
```

```
ESSID:"WG1400HP-5G" [24]
```

```
Mode:Master
```

```
Frequency=5.18 GHz (Channel 36)
```

```
Quality:5/5 Signal level:-42 dBm Noise level:-96 dBm
```

```
Encryption key:on
```

```
Bit Rates:6 Mb/s; 9 Mb/s; 12 Mb/s; 18 Mb/s; 24 Mb/s
```

```
36 Mb/s; 48 Mb/s; 54 Mb/s
```

```
Extra:Beacon interval=100
```

```
IE: IEEE 802.11i/WPA2 Version 1
```

```
Group Cipher : CCMP
```

```
Pairwise Ciphers (1) : CCMP
```

```
Authentication Suites (1) : PSK
```



## 4.2. Bluetooth operation check

Confirmation of wireless Bluetooth interface

```
root@localhost:/home/8887/bin_sd8887_bt# hciconfig
hci0:  Type: BR/EDR  Bus: SDIO
       BD Address: AC:3F:A4:84:D1:89  ACL MTU: 1021:7  SCO MTU: 120:6
       UP RUNNING PSCAN
       RX bytes:918 acl:0 sco:0 events:42 errors:0
       TX bytes:1182 acl:0 sco:0 commands:42 errors:0
```

Perform a “inquiry” and “connection”

```
root@localhost:/home/8887/bin_sd8887_bt# hcitool -i hci0 scan
Scanning ...
      XX:D2:24:BA:9C:02      n/a
      XX:E0:10:E2:48:89      n/a
      XX:CB:57:6A:9A:5C      n/a
      E4:A7:A0:4A:C7:42      H00028472-PC
```

```
root@localhost:/home/8887/bin_sd8887_bt# hcitool -i hci0 cc E4:A7:A0:4A:C7:42
```

```
root@localhost:/home/8887/bin_sd8887_bt# hcitool -i hci0 con
```

Connections:

```
< ACL E4:A7:A0:4A:C7:42 handle 1 state 1 lm SLAVE
```

## 4.3. wpa\_supplicant operation check

```
root@localhost:/home/8887/bin_sd8887_bt# cd /home/wpa_supplicant/
root@localhost:/home/wpa_supplicant# wpa_supplicant -Dwext -imlan0 -c ./wpa01.conf
Successfully initialized wpa_supplicant
rfkill: Cannot open RFKILL control device
ioctl[SIOCSIWESSID]: Bad address
mlan0: Trying to associate with 1c:b1:7f:e4:82:22 (SSID='WG1400HP-2G' freq=2417 MHz)
mlan0: Associated with 1c:b1:7f:e4:82:22
mlan0: WPA: Key negotiation completed with 1c:b1:7f:e4:82:22 [PTK=CCMP GTK=CCMP]
mlan0: CTRL-EVENT-CONNECTED - Connection to 1c:b1:7f:e4:82:22 completed [id=0 id_str=]
```

\*Please create "conf" file according to your environment and use it.

#### 4.4. hostapd operation check

Confirmation of hostapd is done by loading WLAN driver.

```
root@localhost:~# cd /home/hostapd/bin_sd8887_hostapd/
root@localhost:/home/hostapd/bin_sd8887_hostapd# insmod mlan.ko
root@localhost:/home/hostapd/bin_sd8887_hostapd# insmod sd8887.ko cal_data_cfg=none
[ 48.945206] wlan: Loading MWLAN driver
[ 48.950034] wlan: Driver loaded successfully
root@localhost:/home/hostapd/bin_sd8887_hostapd# [ 67.816250] vendor=0x02DF device=0x9135
class=0 function=1
[ 67.821827] SDIO: max_segs=128 max_seg_size=65536
[ 67.826581] rx_work=1 cpu_num=2
[ 67.833097] Request firmware: mrvl/sd8887_uapsta_a2.bin
[ 68.959540] WLAN FW is active
[ 73.962215] creating custom regulatory domain failed
[ 73.990290] wlan: version = SD8887-15.68.7.p189-C4X15C605-GPL-(FP68)
[ 73.998035] orion-ehci d005e000.usb: init d005e000.usb fail, -517
[ 74.006669] ahci-mvebu d00e0000.sata: couldn't get PHY in node sata: -517
[ 74.049723] orion-ehci d005e000.usb: init d005e000.usb fail, -517
[ 74.057792] ahci-mvebu d00e0000.sata: couldn't get PHY in node sata: -517
```

\*Please create "conf" file according to your environment and use it.

```
root@localhost:/home/hostapd/bin_sd8887_hostapd# cd ..
root@localhost:/home/hostapd# hostapd ./test_hostapd.conf
Configuration file: ./test_hostapd.conf
rfkill: Cannot open RFKILL control [ 246.128457] get_channel when AP is not started device
[ 246.137962] get_channel when AP is not started
[ 246.143303] get_channel when AP is not started
uap0: interface state UNINITIALIZED->COUNTRY_UPDATE
Using interface uap0 with hwaddr ac:3f:a4:84:d2:88 and ssid "ESP_AP_test"
[ 246.233170] wlan: Starting AP
[ 246.248426] wlan: AP started
[ 246.253711] Set AC=3, txop=47 cwmin=3, cwmax=7 aifs=1
[ 246.259356] Set AC=2, txop=94 cwmin=7, cwmax=15 aifs=1
[ 246.265744] Set AC=0, txop=0 cwmin=15, cwmax=63 aifs=3
[ 246.271371] Set AC=1, txop=0 cwmin=15, cwmax=1023 aifs=7
uap0: interface state COUNTRY_UPDATE->ENABLED
uap0: AP-ENABLED
uap0: STA e4:a7:a0:4a:c7:3e IEEE 802.11: associated ← Connection from client (station)
uap0: AP-STA-CONNECTED e4:a7:a0:4a:c7:3e
uap0: STA e4:a7:a0:4a:c7:3e RADIUS: starting accounting session 00000041-00000000
uap0: STA e4:a7:a0:4a:c7:3e WPA: pairwise key handshake completed (RSN)
```

## 5. Manufacturing utility (MFG)

\*Please restart ESPRESSObin before MFG operation.

### 5.1. Wired network settings



**Windows PC**  
192.168.1.100



```
root@localhost:~# ifconfig -a
```

```

bond0    no wireless extensions.
lan0     no wireless extensions.
wan      no wireless extensions.
lan1     no wireless extensions.
lo       no wireless extensions.
ethX     no wireless extensions.

```

```
root@localhost:~# ifconfig ethX up
```

```
root@localhost:~# ifconfig lan0 192.168.1.10 up
```

You can set the IP address arbitrarily.

### 5.2. Load WLAN and Bluetooth driver with MFG firmware

```
root@localhost:~# cd /home/8887/bin_sd8887
```

```
root@localhost:/home/8887/bin_sd8887# insmod mlan.ko
```

```
root@localhost:/home/8887/bin_sd8887#
```

```
insmod sd8887.ko cal_data_cfg=none mfg_mode=1 fw_name=mrvl/sdio8887_sdio_combo.bin
```

```
[ 127.544784] wlan: Loading MWLAN driver
```

```
[ 127.552974] wlan: Driver loaded successfully
```

```
root@localhost:/home/8887/bin_sd8887# cd ../bin_sd8887_bt/
```

```
root@localhost:/home/8887/bin_sd8887_bt# insmod bt8887.ko
```

```
[ 287.204131] BT: Loading driver
```

```
[ 287.207515] BT: Driver loaded successfully
```

Turn on the power of the evaluation board and insert it into SDIO of ESPRESSObin.

```
root@localhost:/home/8887/bin_sd8887_bt#
```

```
[ 328.904607] vendor=0x02DF device=0x9135 class=0 function=1
```

```
[ 328.912467] SDIO: max_segs=128 max_seg_size=65536
```

```
[ 328.917119] rx_work=1 cpu_num=2
```

---

```
[ 328.925621] Request firmware: mrvl/sdio8887_sdio_combo.bin
[ 329.963455] WLAN FW is active
[ 329.985829] IOCTL failed: fffffc038154800 id=0x20000, sub_id=0x20006 action=1,
status_code=0x2
[ 329.994793] set mac address failed! status=-1, error_code=0x2
[ 330.011301] wlan: version = SD8887-0.0.0.p0-C4X15C605-GPL-(FP68)
[ 330.021305] ahci-mvebu d00e0000.sata: couldn't get PHY in node sata: -517
[ 330.030038] orion-ehci d005e000.usb: init d005e000.usb fail, -517
[ 330.053699] ahci-mvebu d00e0000.sata: couldn't get PHY in node sata: -517
[ 330.069738] orion-ehci d005e000.usb: init d005e000.usb fail, -517
```

### 5.3. Run “MFG Bridge” application

```
root@localhost:/home/8887/bin_sd8887_bt# cd ../bin_mfgbridge/
root@localhost:/home/8887/bin_mfgbridge# ./mfgbridge
UART: initialize ...
Can't get port settings: Input/output error
NET: initialize ...
NET: socket bind is completed!
NET: initialization is completed.
NET: server port: 9930
NET: client port: 9931
```

Execute "DutApi\_w8887\_BrdigeEth.exe" on the Windows PC side.

(Please refer to " 8887\_MFG\_Bridge\_User\_Guide" for details. It can be download from KAGA FEI's web site. At first, please register according to the procedure described in the document enclosed with this evaluation kit.)

```
NET: new connection from 192.168.1.100
Initialize drvwrapper ....
no nfc /dev/mnfcchar0no nfc /dev/mfmchar0Initialize drvwrapper for BT ....
DRV: driver is initialized.
NET: socket FD = 5
NET: receive a packet (bytes = 40)
BRDG: process Rx msg ...
NET: WLAN command.
DRV: send host cmd thr ioctl
DRV: host cmd is completed
NET: send a msg.
NET: the msg is sent.
NET: socket FD = 5
NET: receive a packet (bytes = 36)
BRDG: process Rx msg ...
NET: WLAN command.
DRV: send host cmd thr ioctl
DRV: host cmd is completed
NET: send a msg.
NET: the msg is sent.
NET: socket FD = 5
NET: receive a packet (bytes = 0)
NET: close client socket
De-Initialize drvwrapper for BT....
De-Initialize drvwrapper ....
NET: socket FD = 4
NET: new connection from 192.168.1.100
Initialize drvwrapper ....
no nfc /dev/mnfcchar0no nfc /dev/mfmchar0Initialize drvwrapper for BT ....
DRV: driver is initialized.
NET: socket FD = 5
NET: receive a packet (bytes = 16)
BRDG: process Rx msg ...
HCI Command
Rx Event E for 09 10
In Cmd 09 10
NET: send a msg.
NET: the msg is sent.
```

```
Name:      Dut labtool
Version:   2.0.0.96
Date:      May  2 2017 (11:53:53)

Note:
1. =====WiFi tool=====
2. =====BT  tool=====
3. =====FM  tool=====
4. =====NFC tool=====

Enter CMD 99 to Exit
Enter option: 1
```

```
Enter option: 1
Name:      DutApiClass
Interface:  EtherNet
Version:    2.0.0.96
Date:      May  2 2017 (11:53:34)

Note:
C:\Users\j\Documents\Downloads\ESPRESSO\bin\MFG-W8887-MF-WIFI-BT-FM-BRG-FC-WIN-X86-2.0.0.96-15.2.7.p123\bin\release\
  \setup.ini
Dut's IP 192.168.1.10:9930
Host's IP 192.168.1.100:9931
DutIf_UdpIp::delay 0
DutIf_UdpIp::vg_IfSpy 0
TCP connecting...
DutIf_InitConnection: 0
-----
W87xx (802.11a/g/b/n/ac) TEST MENU
-----
Enter option:
```

```
-----
W87xx (802.11a/g/b/n/ac) TEST MENU
-----
Enter option: 45
DutIf_GetMACAddress: 0x00000000
DutIf_GetMACAddress: ac.3f.a4.84.d1.88
Enter option:
```

```
Enter option: 99
Exiting
DutIf_Disconnection: 0
1. =====WiFi tool=====
2. =====BT  tool=====
3. =====FM  tool=====
4. =====NFC tool=====

Enter CMD 99 to Exit

Enter option: 2
Name:      DutApiClass
Interface:  Version:    2.0.0.96
Date:      May  2 2017 (11:53:36)

Note:
C:\Users\j\Documents\Downloads\ESPRESSO\bin\MFG-W8887-MF-WIFI-BT-FM-BRG-FC-WIN-X86-2.0.0.96-15.2.7.p123\bin\release\
  \setup.ini
Dut's IP 192.168.1.10:9930
Host's IP 192.168.1.100:9931
DutIf_UdpIp::delay 0
DutIf_UdpIp::vg_IfSpy 0
TCP connecting...
Dut_Bt_OpenDevice: 0x00000000
-----
W87xx (BT) TEST MENU
-----
Enter option: 45
45
Dut_Bt_GetBDAddress: 0x00000000
BD_ADDRESS: AC-3F-A4-84-D1-89
Enter option:
```

## 6. About SDIO switching

This is the setting of SDIO bus speed switching on each evaluation board.

CN2 : VIO\_SD Voltage Select

No.	Pin name	Direction	Description
1	3.3V	Output	3.3V output. (high speed)
2	VIO	Input	Input for VIO_SD.
3	1.8V	Output	1.8V output. (ultra-high speed)

Setting: 1-2 short -> high speed

Setting: 2-3 short -> ultra-high speed

