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1. INTRODUCTION

1.1. Scope
Scope of this document is to provide a short guidance on how to configure and operate the Ethernet Extension board when connected to Telit EVB.

1.2. Audience
This document is intended for developers using Telit EVB platform with the Ethernet Extension board.

1.3. Contact Information, Support
For general contact, technical support services, technical questions and report documentation errors contact Telit Technical Support at:

- TS-EMEA@telit.com
- TS-AMERICAS@telit.com
- TS-APAC@telit.com

Alternatively, use:
http://www.telit.com/support

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:
http://www.telit.com

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.
Telit appreciates feedback from the users of our information.
1.4. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.
1.5. Related Documents

- Telit EVB User Guide, 1VV0301249
2. WIRED ETHERNET CONNECTION

2.1. Extension Card Description

The Ethernet extension card provides the option to use the SGMII, RGMII or PCIe interfaces of the Modem and SDK to a wired 10/100/1Gbps wired ethernet connection.

- The interface used for the Ethernet phy depends on the Modem capability.

The card includes the following main components:

1. An Atheros (Qualcomm) AR8151-B PCIe to 10/100/1000 Mbps Ethernet Transceiver.
2. An Automotive grade Marvel 88EA1512 Integrated 10/100/1000 Mbps Ethernet Transceiver.
3. An SFP slot for SGMII external ethernet transceivers.

2.2. Block Diagram

![Diagram of Ethernet Extension Card Block Diagram]

Figure 2-1 Ethernet Extension Card Block Diagram
2.3. **Ethernet Extension Card**

![Image of Ethernet Extension Card](image1)

*Figure 2-2 Ethernet Extension Card*

2.4. **Extension Card Connection to EVB**

![Image of Extension Connection to EVB](image2)

*Figure 2-3 Extension Connection to EVB*
2.5. Connection and Configuration

2.5.1. SGMII to Ethernet – AP mode (using Marvell 88AE1512)

- Insert a data SIM card into the proper EVB SIM slot.
- Connect one end of an ethernet cable to the board RJ45 connector marked as “SGMII/RGMII to Copper”. The other end of the cable should be connected to the device you want to provide internet connection to.
- Launch the serial port console connection to the modem (ADB).
- Login to the Console serial interface:
  
  User: root
  Password: oelinux123

- Type in the console prompt to run the following script and command:
  
  
  ```
  /etc/init.d/start_emac_le start
  ```

- Here is an example of the console log output:

  ```
  ~ # /etc/init.d/start_emac_le start
  [ 59.919608] emac start
  [ 60.095256] libphy: emac-mdio: probed
  [ 60.300883] arp_ignore is set
  [ 60.456426] qcom-emac 7c40000.qcom,emac eth0: TX queues 1, TX descriptors 512
  [ 60.462535] qcom-emac 7c40000.qcom,emac eth0: RX queues 1, Rx descriptors 256
  [ 60.674673] IPv6: ADDRCONF(NETDEV_UP): eth0: link is not ready
  
  done
  ~ # [ 61.030359] USB QCMAP NL IOCTL Snd GETNEIGH Succ
  [ 61.325290] USB QCMAP NL IOCTL Snd GETNEIGH Succ
  [ 63.976618] qcom-emac 7c40000.qcom,emac eth0: Link is Up - 1Gbps/Full - flow control
  
  rx/tx
  [ 63.983969] IPv6: ADDRCONF(NETDEV_CHANGE): eth0: link becomes ready
  [ 64.329999] QTI:Processing LINK_UP
  [ 64.338927] QTI:ETH mode
  [ 64.348761] QTI:Enable mobileap
  [ 64.359008] QTI:LINK_UP message posted
  [ 64.368956] QCMAP:Enable mobileap
  [ 64.719114] QCMAP:Enable mobileap done
  [ 64.730082] QTI:Setup TETHERED link
  [ 64.897145] device eth0 entered promiscuous mode
  [ 64.924247] bridge0: port 1(eth0) entered forwarding state
  [ 64.928817] bridge0: port 1(eth0) entered forwarding state
  [ 64.981444] QTI:LINK_UP Processed
  [ 65.368882] ETHERNET Client Mac Address is 5c:ff:35:d:fd:ec
  [ 70.568532] QCMAP:Ethernet Client IP Addr 192.168.225.35
  [ 79.934075] bridge0: port 1(eth0) entered forwarding state
  
  ~ # ifconfig
  bridge0  Link encap:Ethernet  HWaddr 1E:C6:69:49:51:35
  inet6 addr: fe80::1cc6:69ff:fe46:4e32/64 Scope:Link
  UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
  RX packets:153 errors:0 dropped:0 overruns:0 frame:0
  TX packets:92 errors:0 dropped:0 carrier:0
  collisions:0 txqueuelen:0
  RX bytes:12981 (12.6 KiB)  TX bytes:7282 (7.1 KiB)
  
  eth0  Link encap:Ethernet  HWaddr 00:80:48:BA:D1:30
  inet addr:169.254.4.1  Bcast:169.254.4.255  Mask:255.255.255.0
• Next, type in the console prompt: “QCMAP_CLI”. This will run a menu based tool to initialize the ethernet bridging configuration from the Cellular data connection to the device connected to the Ethernet cable.
• Select option “1” -> “2” -> 1 to initialized the MobileAP connection.

After MobileAP enable is successful, continue to enable the Backhaul by selecting from the menu: 6 -> 2 -> 1 -> 1

Here is an example of the resulted run:

inet6 addr: fe80::280:48ff:feba:d130/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:208 errors:0 dropped:0 overruns:0 frame:0
TX packets:103 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:20761 (20.2 KiB) TX bytes:9762 (9.5 KiB)
Interrupt:108

lo        Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
inet6 addr: ::1/128 Scope:Host
UP LOOBACK RUNNING MTU:65536 Metric:1
RX packets:3 errors:0 dropped:0 overruns:0 frame:0
TX packets:3 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:172 (172.0 B) TX bytes:172 (172.0 B)

rmnet0    Link encap:UNSPEC HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
UP RUNNING MTU:2000 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

~ #
Option > 1
1. Display Current Config
2. Enable/Disable mobileap
3. Get MobileAP status
4. Get Connected Device info
5. Enable/Disable/Reset Packet Stats
6. Get Packet Stats Status
7. Restore Factory Default Settings (*** Will Reboot Device)
8. Tear down/Disable and Exit
9. Please input MobileAP Stats([1-Enable/0-Disable]) : 1

MobileAP Enable succeeds.
Please select an option to test from the items listed below.
1. MobileAP Configuration
2. LAN Configuration
3. NAT/ALG/VPN Configuration
4. WLAN Configuration
5. Firewall Configuration
6. Backhaul Configuration
7. Tethering Configuration
8. Media Service Configuration
Option >
MobileAP Enable succeeds.
Please select an option to test from the items listed below.

1. MobileAP Configuration
2. LAN Configuration
3. NAT/ALG/VPN Configuration
4. WLAN Configuration
5. Firewall Configuration
6. Backhaul Configuration
7. Tethering Configuration
8. Media Service Configuration

Option > 8

1. Connect/Disconnect Backhaul
2. Get WWAN status
3. Get WWAN Statistics
4. Reset WWAN Statistics
5. Set Webserver WWAN access flag
6. Get Webserver WWAN access flag
7. Set WWAN Profile
8. Get WWAN Profile
9. Set Prefix Delegation Config
10. Get Prefix Delegation Config
11. Get Prefix Delegation Status
12. Enable/Disable TinyProxy
13. Get TinyProxy Status
14. Set IP Passsthrough Config
15. Get IP Passsthrough Config
16. Get IP Passsthrough State
17. Set Autoconnect Config
18. Get Autoconnect Config
19. Set Roaming
20. Get Roaming
21. Enable/Disable DDNS
22. Set DDNS Config
23. Get DDNS Config

Please input Backhaul State(1-Connect/0-Disconnect) : 1
Please input Call Type(1-IPV4; 2-IPV6) : 1

MobileAP Configuration

1. Connect/Disconnect Backhaul
2. Get WWAN status
3. Get WWAN Statistics
4. Reset WWAN Statistics
5. Set Webserver WWAN access flag
6. Get Webserver WWAN access flag
7. Set WWAN Profile
8. Get WWAN Profile
9. Set Prefix Delegation Config
10. Get Prefix Delegation Config
11. Get Prefix Delegation Status
12. Enable/Disable TinyProxy
13. Get TinyProxy Status
14. Set IP Passsthrough Config
15. Get IP Passsthrough Config
16. Get IP Passsthrough State
17. Set Autoconnect Config
18. Get Autoconnect Config
19. Set Roaming
20. Get Roaming
21. Enable/Disable DDNS
22. Set DDNS Config
23. Get DDNS Config

Option > 8
Below is the result after QCMAP CLI connection:

```
~ # [ 449.083973] QCMAP:bringup v4
[ 450.116923] QCMAP:WAN connected v4
```

```
~ # ifconfig
bridge0   Link encap:Ethernet  HWaddr 1E:C6:69:49:51:35
inet6 addr: fe80::1cc6:69ff:fe46:4e32/64 Scope:Link
UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
RX packets:766 errors:0 dropped:0 overruns:0 frame:0
TX packets:584 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:53486 (52.2 KiB)  TX bytes:41581 (40.6 KiB)

eth0      Link encap:Ethernet  HWaddr 00:80:48:BA:D1:30
inet addr:169.254.4.1  Bcast:169.254.4.255  Mask:255.255.255.0
inet6 addr: fe80::280:48ff:feba:d130/64 Scope:Link
UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
RX packets:949 errors:0 dropped:0 overruns:0 frame:0
TX packets:589 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:81620 (79.7 KiB)  TX bytes:50697 (49.5 KiB)

lo        Link encap:Local Loopback
inet addr:127.0.0.1  Mask:255.0.0.0
inet6 addr: ::1/128 Scope:Host
UP LOOPBACK RUNNING  MTU:65536  Metric:1
RX packets:3 errors:0 dropped:0 overruns:0 frame:0
TX packets:3 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:172 (172.0 B)  TX bytes:172 (172.0 B)

rmnet0    Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
UP RUNNING  MTU:2000  Metric:1
RX packets:19 errors:0 dropped:0 overruns:0 frame:0
TX packets:26 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:2552 (2.4 KiB)  TX bytes:2164 (2.1 KiB)

rmnet_data0 Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
inet addr:10.134.103.234  Mask:255.255.255.252
inet6 addr: fe80::bb80:2724:68c3:c489/64 Scope:Link
UP RUNNING  MTU:1500  Metric:1
RX packets:19 errors:0 dropped:0 overruns:0 frame:0
TX packets:26 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:2367 (2.3 KiB)  TX bytes:2164 (2.1 KiB)
```

It is visible from the output that the cellular data connection ip received is in rmnet_data0. The gateway IP for devices connecting to the Ethernet port is
192.168.225.1 and the bridge is configured to route between the cellular data connection and the connected devices on the Ethernet port.

Below is an example of the IP received by a PC connected to the port browsing the internet through the ethernet bridged cellular connection:

```
C:\Users\markge> ipconfig
Windows IP Configuration

Ethernet adapter Local Area Connection:
  Connection-specific DNS Suffix:   
  Link-local IPv6 Address:         ::fe80::f4:374b:a993:9a2a%11
  IPv4 Address:                    ::192.168.225.35
  Subnet Mask:                    255.255.255.0
  Default Gateway:                192.168.225.1
```

2.5.2. SGMII to Ethernet – STA mode (using Marvell 88AE1512)

- Insert a data-capable SIM card into the proper EVB SIM slot.
- Connect one end of an ethernet cable to the board RJ45 connector marked as “SGMII/RGMII to Copper”. The other end of the cable should connect to a router.
- Launch the serial port console connection to the modem (ADB).
- Login to the Console serial interface.
  - User: root
  - Password: oelinux123
- Type in the console prompt to run the following script and command:
  
  
  /etc/init.d/start_emac_le start
  
- Delete eth0 interface from the bridge: brctl delif bridge0 eth0
- Enable DHCP on Eth: dhcpcd eth0
- Test your connection.

2.5.3. PCIe to Ethernet (Using AR8151-B)

Initializing this interface connection should be similar as described in the previous paragraph.
### 2.6. Jumpers

The functions and default setting of the Jumpers on the board are described in the table below:

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Position</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1</td>
<td>Short</td>
<td>The 3.3V power input for SGMII/RGMII PHY (88EA1512)</td>
</tr>
<tr>
<td>J2</td>
<td>Short</td>
<td>The 3.3V power input for PCIe ETH PHY (AR8151)</td>
</tr>
<tr>
<td>J3</td>
<td>Short</td>
<td>The 3.3V power input for SFP module (optional)</td>
</tr>
<tr>
<td>J4</td>
<td>2-3</td>
<td>SGMII/RGMII PHY CONFIG pin: PHYAD bit 0 and VDDO_LEVEL. Pins 1-2; ’1’=2.5V Pins 2-3; ‘0’=3.3V</td>
</tr>
<tr>
<td>J5</td>
<td>2-3</td>
<td>SGMII/RGMII PHY VDDO pin: 3.3V/2.5V/1.8V digital IO supply. Pins 1-2: 1.8V Pins 2-3: 3.3V</td>
</tr>
<tr>
<td>J6</td>
<td>2-3</td>
<td>SGMII/RGMII PHY VDDO_SEL pin. Pins 1-2; ’0’=2.5V/3.3V Pins 2-3; ‘1’(VDDO)=1.8V</td>
</tr>
<tr>
<td>J7</td>
<td>1-2</td>
<td>SGMII/RGMII PHY Reset select: Select between Modem controlled GPIO or an onboard power monitor/manual reset. Pins 1-2; Power monitor. Pins 2-3; Modem GPIO.</td>
</tr>
</tbody>
</table>

*Table 1 Default Jumper Settings*
Figure 2-4 Jumpers Locations
2.7. Schematics
### 3. GLOSSARY AND ACRONYMS

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UART</td>
</tr>
<tr>
<td>SIM</td>
</tr>
<tr>
<td>SPI</td>
</tr>
<tr>
<td>I/O</td>
</tr>
<tr>
<td>GPIO</td>
</tr>
<tr>
<td>CLK</td>
</tr>
<tr>
<td>PCB</td>
</tr>
<tr>
<td>ETH</td>
</tr>
<tr>
<td>SGMII</td>
</tr>
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<table>
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<th>Date</th>
<th>Changes</th>
</tr>
</thead>
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<tr>
<td>1</td>
<td>2017-10-03</td>
<td>Added connection example console log and screenshots.</td>
</tr>
<tr>
<td>2</td>
<td>2019-05-22</td>
<td>Applicability updated (extended to LE910Cx)</td>
</tr>
<tr>
<td>4</td>
<td>2019-08-07</td>
<td>Updated pictures and schematics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Added updated Linux tool instructions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Added station mode instructions</td>
</tr>
<tr>
<td>5</td>
<td>2019-08-22</td>
<td>Minor editorial changes</td>
</tr>
</tbody>
</table>
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