



BeagleBone Tracking Cape Reference Manual

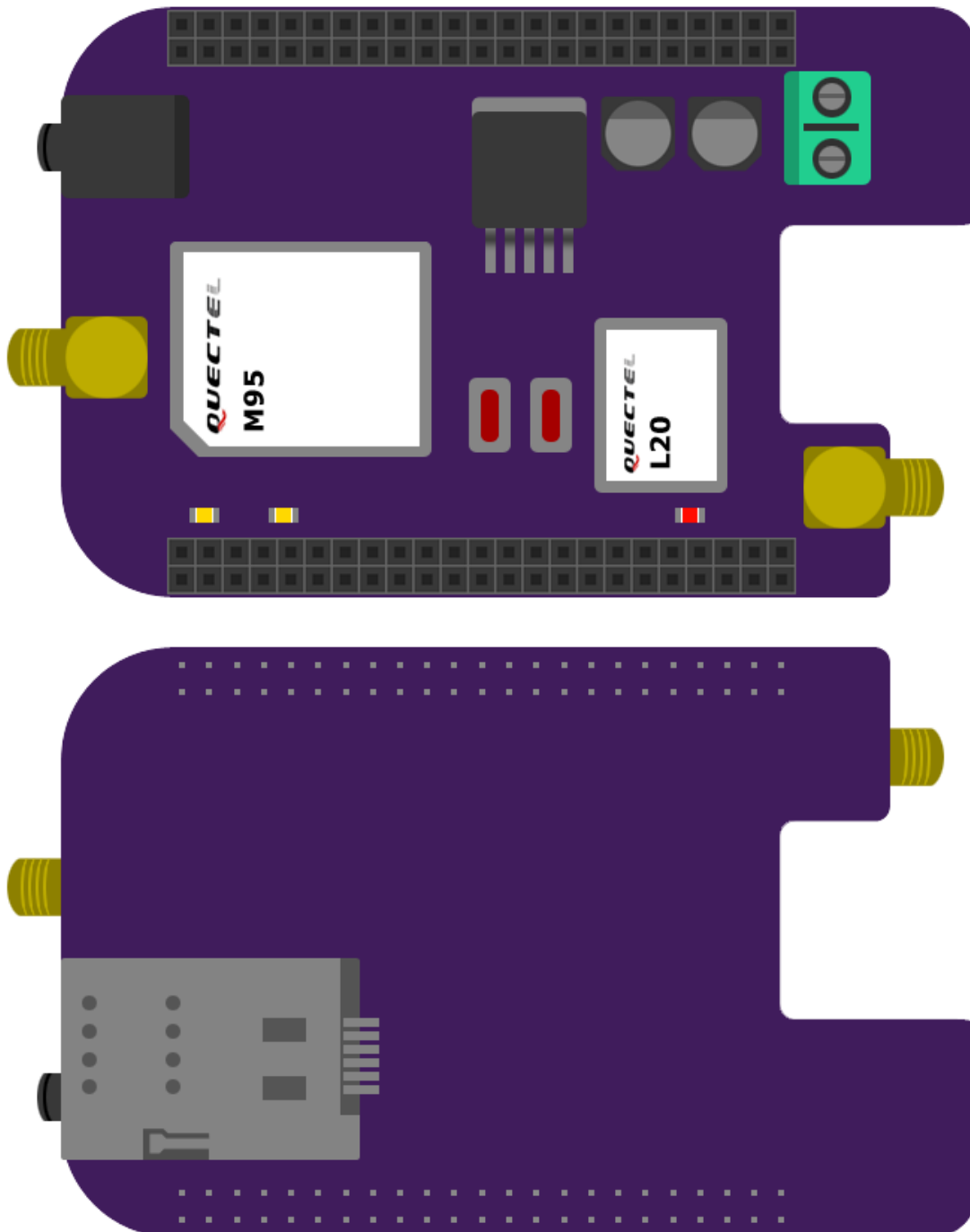




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Introduction

The Tracking Cape provides tracking capabilities to the BeagleBone with GPS and GPRS/GSM modules. It also allows to make/answer calls, to send/receive SMS and to get GPS data. Its main components are the M95 and L20 Quectel modules. The Tracking Cape works with both the original BeagleBone and the BeagleBone Black. This cape supports the Quad band GSM/GPRS (850MHz, 900MHz, 1800MHz and 1900MHz).



GSM/GPRS Module

M95 is one of the smallest Quad-band GSM/GPRS modules in LCC castellation packaging with the compact size of $19.9 \times 23.6 \times 2.65\text{mm}$, ultra low power consumption and extended temperature range.

With surface mounted technology, the low profile and small size of LCC package makes M95 easily embedded into the low-volume applications and ensures the reliable connectivity with the applications. This kind of package is ideally suited for large-scale manufacturing which has the strict requirements for cost and efficiency.

Built-in unique QuecFOTA™ technology allows M95 to update the firmware remotely. Additional features such as integrated TCP/IP protocol stack, serial multiplexer and enhanced AT commands guarantee fast and reliable transmission of data, voice, SMS via GSM/ GPRS network and extend the functionality of the application without adding cost.

Its tiny size and ultra low power consumption makes M95 a very cost effective and feature-rich platform that is quite suitable for a wide range of M2M applications such as VTS, Industry PDA, Personal Tracking, Wireless POS, Smart Metering and many other M2M applications.

More information:

http://www.quectel.com/UploadFile/Product/Quectel_M95_GSM_Specification_V1.0.pdf



GPS Module

L20 is a GPS receiver module with the highest performance which embeds the SIRFstarIVTM chip solution with the new ROM2.2 version. With 48 PRN channels, L20 acquires and tracks satellites in the shortest time even at indoor signal level. With a compact profile of 16.0 x 12.2 x 2.4mm, it perfectly suits for vehicle tracking, personal tracking, asset tracking, connected PND, security device and other industrial applications.

L20 supports aided-GPS function without the necessity of data download from server since it captures ephemeris data from satellites locally and predicts ephemeris out to 3 days.

The module contains an active jammer remover which tracks and removes up to 8 CW (Carrier Wave) type signals up to 80dB-HZ (equals to -90 dBm typ.) signal level. This feature has greatly improved the navigation performance.

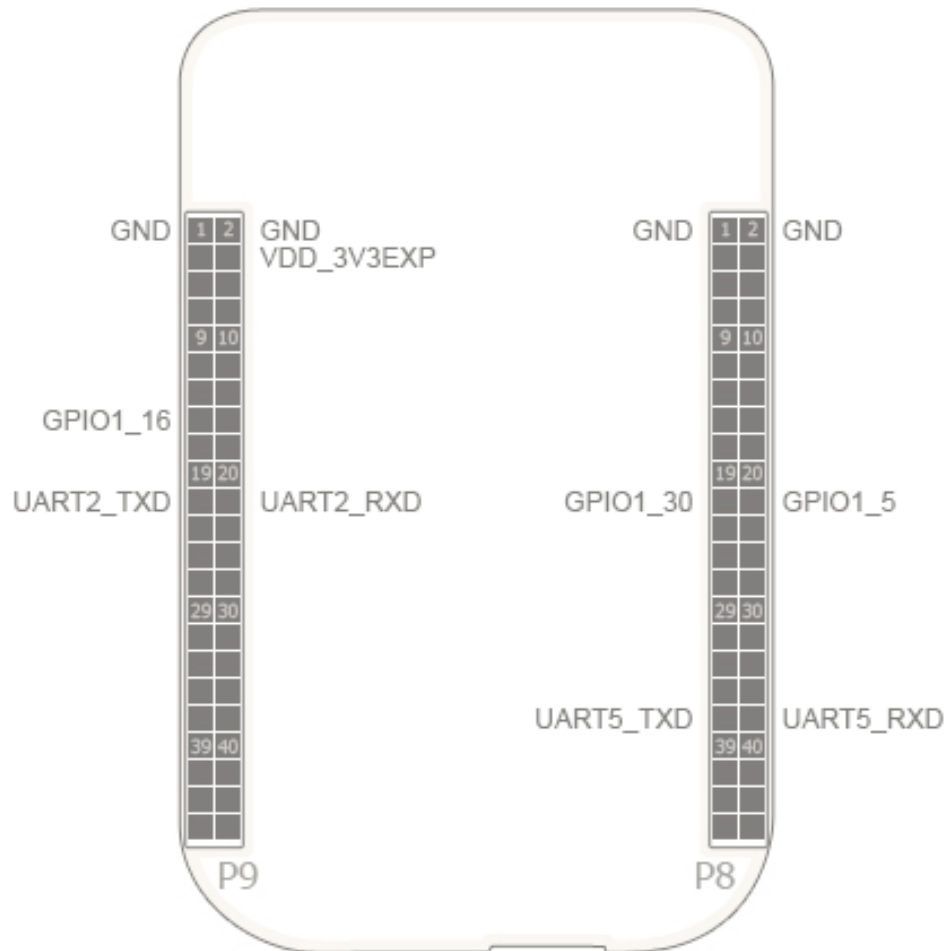
L20 also provides an important function which named GPIO Baud Rate Detection. With GPIO settings, L20 can be configured to output NEMA at standard baud rates.

More information:

http://www.quectel.com/UploadFile/Product/Quectel_L20_GPS_Specification_V2.0.pdf



Used pins



The Tracking Cape uses 12 pins as shown in the figure above.

M95 Quectel Module is connected to the UART2 pins and its default baud rate is 9600.

L20 Quectel Module is connected to the UART5 pins and its default baud rate is 4800.

GPIO1_16 pin is connected to the RING signal of M95 Module. Ring indicator (when the call, SMS, data of the module are coming, the module will output signal to the GPIO1_16).



There are 2 buttons on the cape: EMERG_OFF and PWRKEY. Both signals are also connected to GPIO1_30 and GPIO1_5 pins. EMER_OFF should only be used under emergent situation.

Note 1: If you want to use the GPIO1_30 and GPIO1_5, DO NOT use the eMMC. You **must** boot from microSD slot. Also, you have to solder the bottom layer missing resistors **R19** and **R21**. The resistors value is 4.7kohm – 0805 package.

Note 2: This cape **is not** compatible with HDMI framer. LCD pins can not be used while using this cape.



Antennas specifications

There are 2 female SMA connectors on the Tracking Cape used to connect GPS and GSM/GPRS antennas. It is recommended to connect antennas with correct specifications.

GPS Antenna

The Tracking Cape is configured to connect an active GPS antenna with the following specifications:

Center frequency: 1575.42 MHz

Band width: >5 MHz

Minimum gain: 15-20dBi (compensate signal loss in RF cable)

Maximum noise figure: 1.5dB

Maximum gain: 50dBi

Polarization: RHCP or linear

GSM/GPRS Antenna

GSM Quad band antenna.



Status LEDs

There are 3 status LED son the Tracking Cape: NETLIGHT, STATUS (GSM/GPRS module) and TIMEPULSE (GPS module).

NETLIGHT: There are 4 cases.

Off: The module is not running.

64ms On/800ms Off: The module is not synchronized with network.

64ms On/2000ms Off: The module is synchronized with network.

64ms On/600ms Off: GPRS data transfer is ongoing.

STATUS: M95 Module power indicator.

TIMEPULSE: 1 pulse per second when there is GPS reception, otherwise it keeps off.



Power supply

Due to low power consumption, the GPS module is connected directly to the BeagleBone VDD_3V3EXP pin. Anyway it is recommended to use the BeagleBone 5V DC jack when using the Tracking Cape.

The GSM/GPRS module needs an external power supply. Li-Po battery or power adapter could be used. The voltage is regulated by the cape.

Specifications: 3.3V to 12V – 2000mA.



Getting started

The first step is to configure the UART2 and UART5 ports. It can be done issuing the following commands.

Note: You can follow this steps or compile your own Device Tree Overlay files (.dtbo).

1. Download minicom to test modules communication:

```
$ sudo apt-get install minicom
```

2. Download and install the .dtbo files to configure ttyO2 and ttyO5 devices:

```
$ wget
http://ciudadoscuro.com/beaglebonecape/downloads/trackingCapedtbo.tar.xz

$ tar xf trackingCapedtbo.tar.xz

$ cd trackingCapedtbo

$ cp ttyO2_armhf.com-00A0.dtbo /lib/firmware/

$ cp ttyO5_armhf.com-00A0.dtbo /lib/firmware/

$ echo ttyO2_armhf.com >
/sys/devices/bone_capemgr*/slots

$ echo ttyO5_armhf.com >
/sys/devices/bone_capemgr*/slots
```



You have to do this after each reboot or you can add the last 2 commands to the `/etc/rc.local` file. Don't forget to replace the (*) sign with a number.

3. Now, you can try to connect to the modules with minicom. For the M95 module. Don't forget to turn the module on.

```
$ minicom -b 9600 -D /dev/ttyO2
```

If all is fine, you should receive an **OK** after sending **AT** (enter).

For the L20 module.

```
$ minicom -b 4800 -D /dev/ttyO5
```

You should receive something like:

```
$GPRMC,160354.000,A,0406.9630,N,07339.1394,W,0.00,330.23,280614,,,A*7E
$GPGGA,160355.000,0406.9630,N,07339.1394,W,1,10,0.9,485.2,M,4.4,M,,0000*76
$GPGSA,A,3,03,19,27,23,32,11,20,16,13,31,,,1.6,0.9,1.3*35
$GPRMC,160355.000,A,0406.9630,N,07339.1394,W,0.00,330.23,280614,,,A*7F
$GPGGA,160356.000,0406.9630,N,07339.1394,W,1,10,0.9,485.1,M,4.4,M,,0000*76
$GPGSA,A,3,03,19,27,23,32,11,20,16,13,31,,,1.6,0.9,1.3*35
$GPRMC,160356.000,A,0406.9630,N,07339.1394,W,0.00,330.23,280614,,,A*7C
$GPGGA,160357.000,0406.9630,N,07339.1394,W,1,10,0.9,485.1,M,4.4,M,,0000*77
```

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