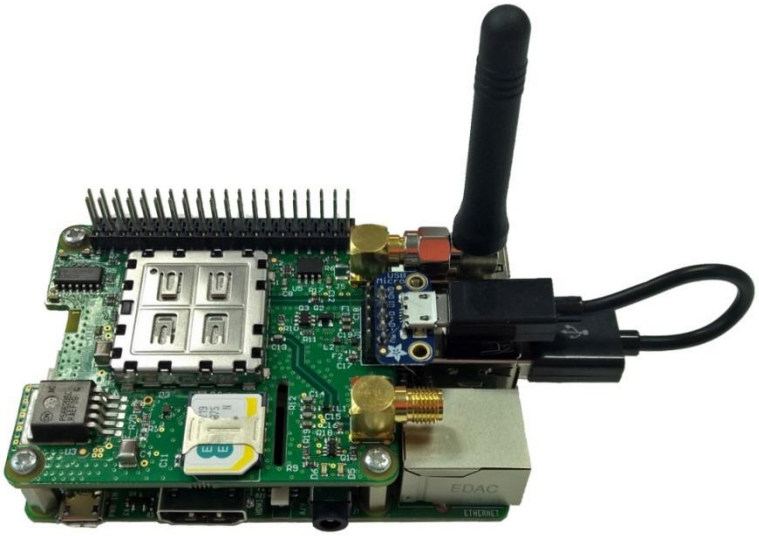
PiloT

USER MANUAL



The PiloT is a WAN communications board which provides an HSPA wireless interface for the Raspberry Pi 2 and 3. Conforming to the HAT specification, the PiloT also provides location information using an on-board GNSS* solution.

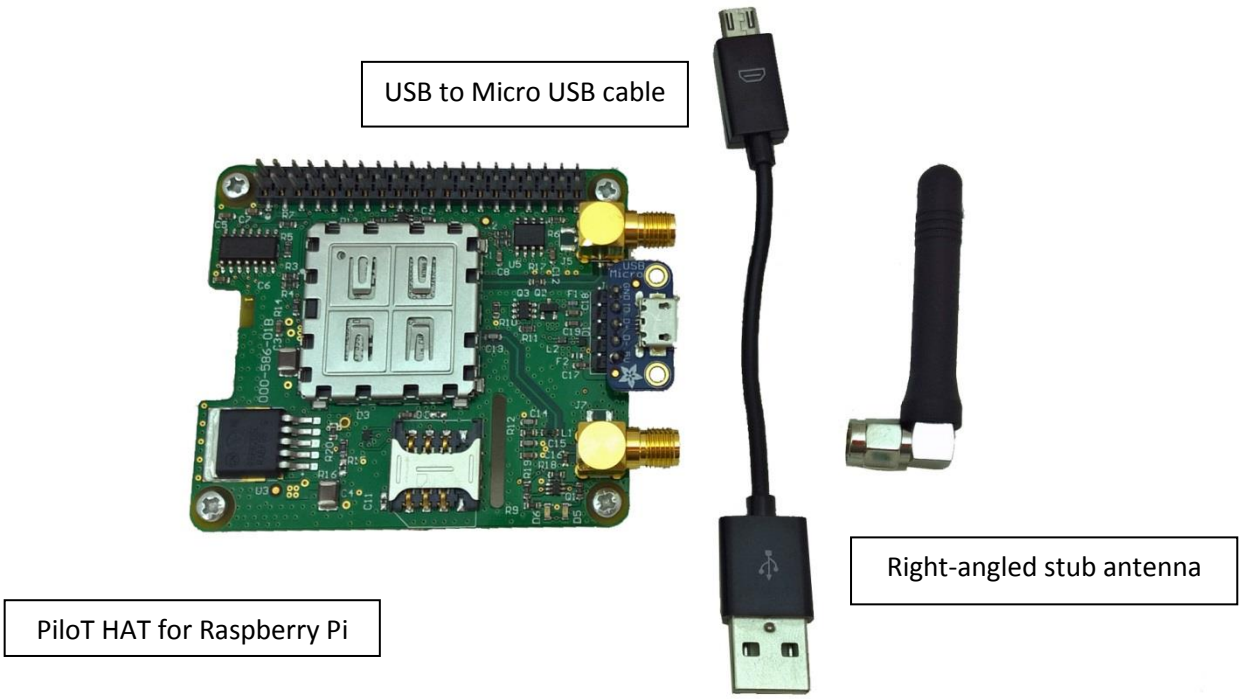
***HL8548-G variant only**

Contents

Specification

EMBEDDED WIRELESS MODULE	Sierra Wireless HL8548-G / HL8518
FREQUENCY BANDS	**HSPA —** B1 (2100MHz) / B2 (1900MHz) / B5 (850MHz) / B6 (850MHz) / B8 (900MHz) / B19 (800MHz) **EDGE/GPRS —** 850/900/1800/1900MHz
3G PROTOCOLS	WCDMA (UMTS), HSDPA, HSUPA, HSPA+
GNSS SUPPORT (HL8548-G variant only)	SiRF V GPS + GLONASS
INTERFACES	Serial, USB (CDC-ACM, CDC-ECM)
SIM	3V Micro-SIM
POWER	From Raspberry Pi or direct (can also power Raspberry Pi)
AT COMMAND INTERFACE	3GPP 27.007 standard, plus proprietary extended commands
IP STACK	On-board or Raspberry Pi

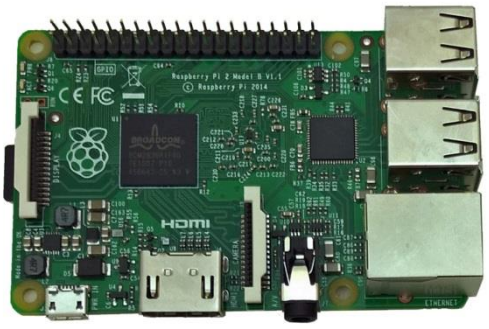
Box contents



Required equipment

All variants:

Right-angled stub antenna



Raspberry Pi 2 or 3

SIM card

PiloT HAT for Raspberry Pi

USB to Micro USB cable

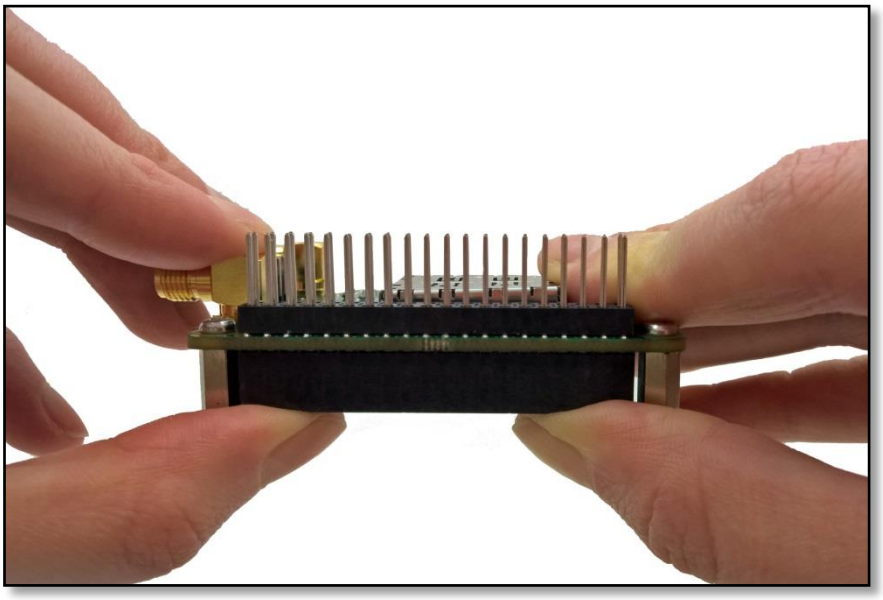
#1 Pozidriv screwdriver

HL8548-G variant only:

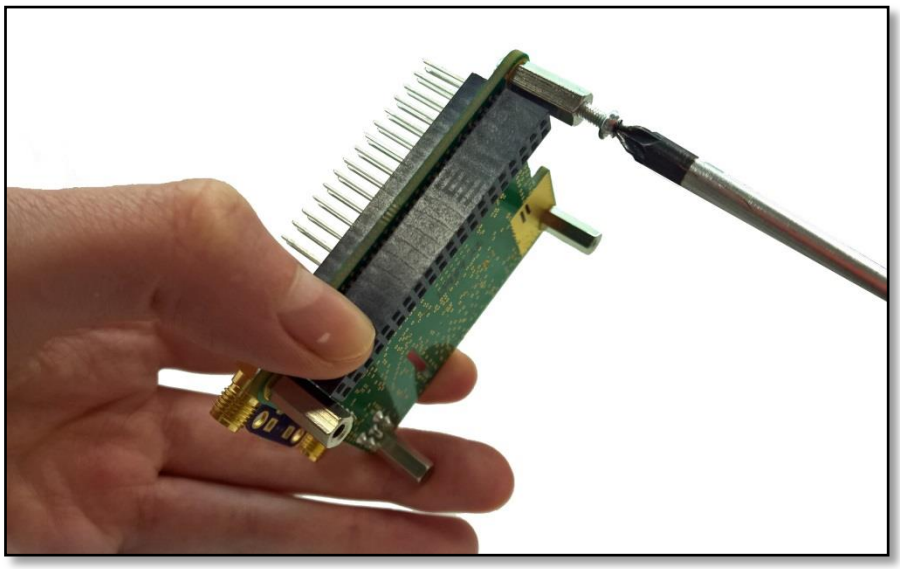
GPS/GNSS antenna

Recommended: 2J GNSS patch antenna: http://linkwave.co.uk/magneticadhesive-patch-antenna

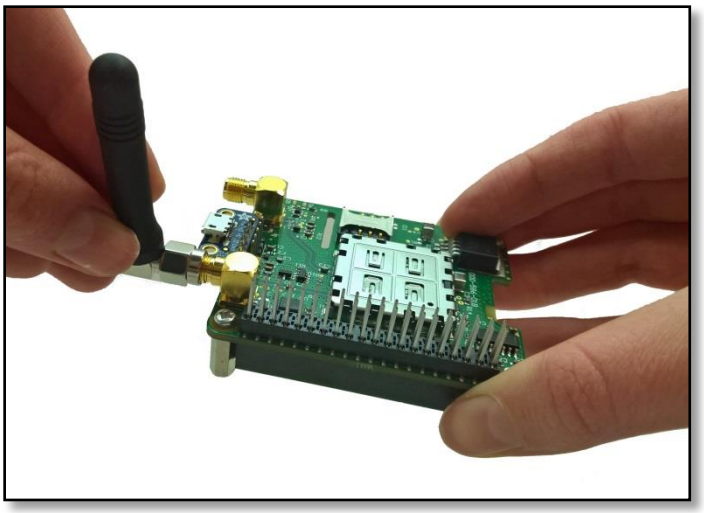
Step-by-Step Assembly



Step one – Gently push the 40 way pins all the way through the holes in the socket.

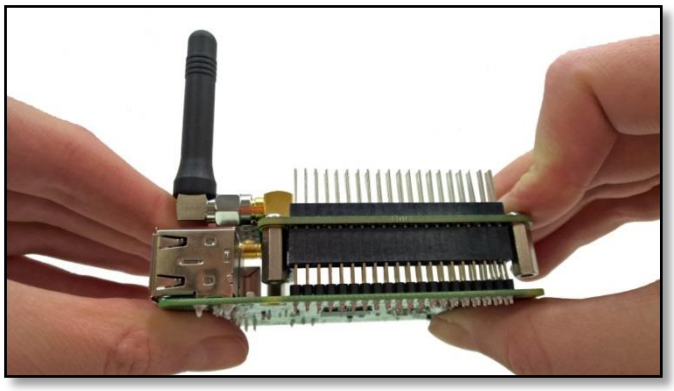


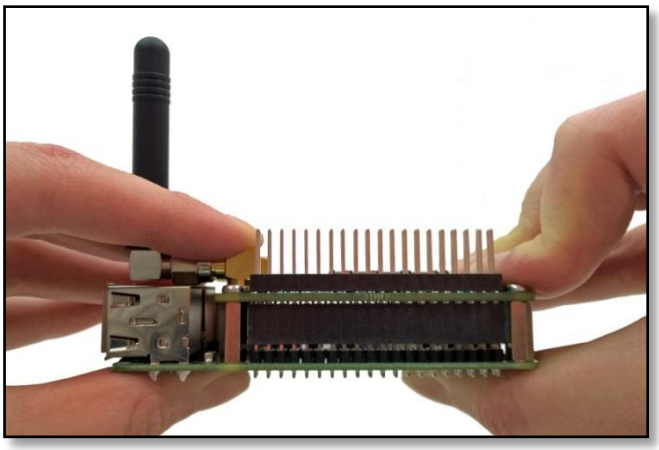
Step two – Remove the four screws from the mounting pillars.



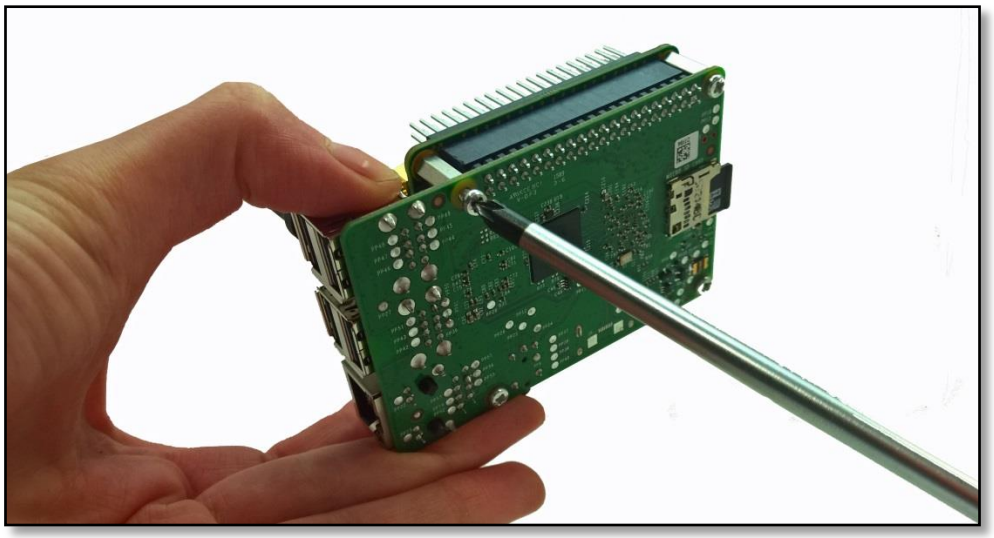
Step three – Screw the right-angled stub antenna on to the SMA WAN antenna connector located next to the 40 pin header.

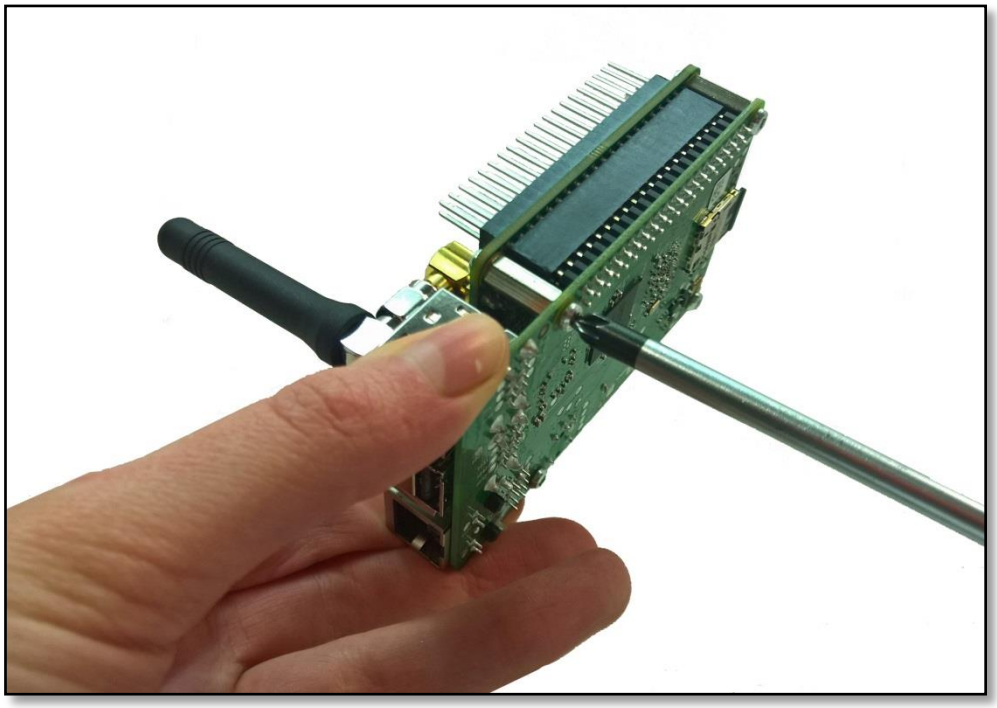
Please note: when using the GNSS (HL8548-G) variant, you will also need to use a GNSS antenna when using the GNSS function. Please screw this onto the other SMA WAN antenna connector alongside the right-angled stub antenna.



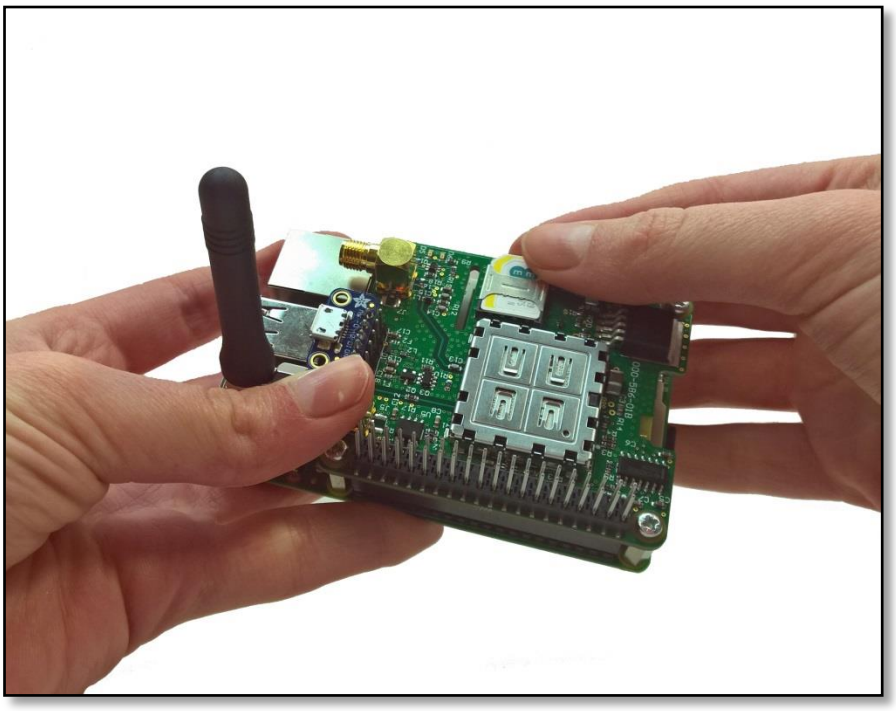


Step four – Align the 40 way socket with the 40 way header on the Raspberry Pi. Gently press together.



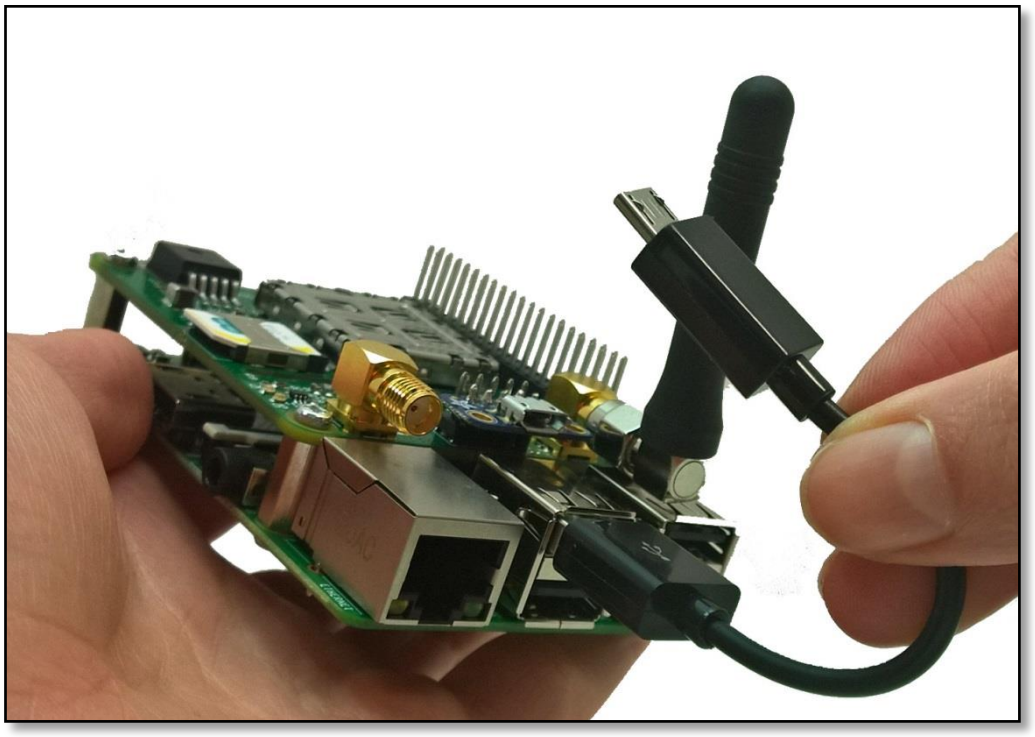


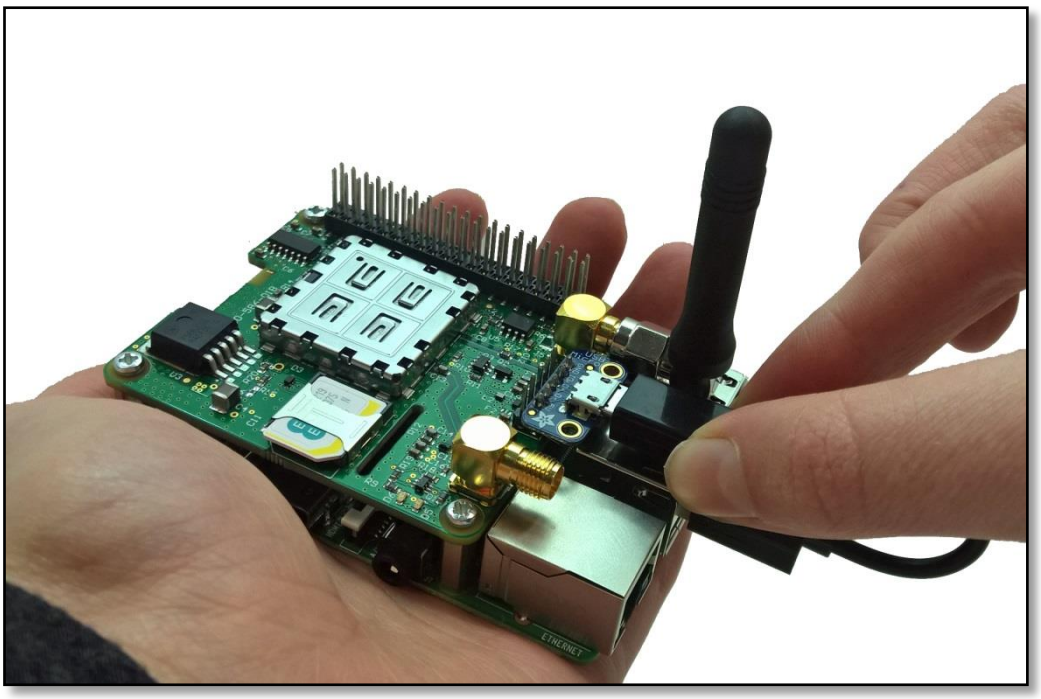
Step five – Ensure the PiloT is securely mounted on the Raspberry Pi by inserting the four screws (see **step two**) into the holes at the bottom of the Raspberry Pi. Gently tighten using a #1 Pozidriv screwdriver.



Step six – Insert the SIM card into the SIM card holder, ensuring the chamfer is located as shown on the photo, and the contact side is face down.

Step seven – Insert the USB end of the USB to Micro USB cable into the top centre USB socket.





Step eight – Insert the Micro USB side of the USB to Micro USB cable into the Micro USB socket located above the USB socket.

Using the PiloT

The following instructions are based on use of Raspbian Jessie OS.

Firstly, install Minicom using the following code:

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

To redirect the system console and stop login prompts being sent over the serial port, enter:

```
sudo raspi-config
```

Then go to **Advanced Options > Serial >** answer **'No' >** click **'OK'**
Tap to finish.
Click **'Yes'** to reboot
Tap the right arrow twice and press **'enter'** to finish.

PiloT power supply control

The PiloT power supply is controlled by a Raspberry Pi IO pin. A logic "1" output enables a power supply regulator which supplies the PiloT with power. Note that the regulator may switch on by default when power is applied to the Raspberry Pi.

PiloT HL module ON/OFF control

The PiloT module ON pin is used to turn on the HL module's internal power supply.

The PiloT module ON pin is GPIO21 on the Raspberry Pi.

The HL module will automatically power on when the PiloT power supply powers on. Once the module is powered off, the ON pin will need to be pulsed to turn the module back on again.

To power on, insert the following commands:

```
gpio -g mode 6 out
gpio -g write 6 1
gpio -g mode 21 out
gpio -g write 21 1
gpio -g write 21 0
```

Connecting to the PiloT via a UART port

To enable handshaking on the serial port, enter the following commands:

```
gpio -g mode 16 ALT3
gpio -g mode 17 ALT3
```

You are now able to use AT commands to communicate with the HL module on the PiloT.
For a full list of AT commands for the Sierra Wireless HL modules, visit the Source.

To use AT commands, open a Minicom session by entering the following:

```
minicom -D /dev/ttyAMA0
```

Check the AT commands are working by typing 'AT' and pressing enter.

This should return 'OK'.

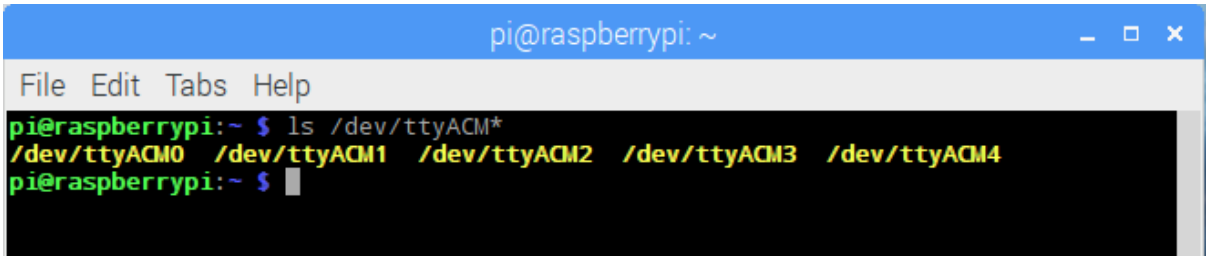
Exit Minicom (**Ctrl A then X** > enter).

Connecting via USB

The USB interface provides several USB endpoints to the Raspberry Pi. These can be set using the AT+USBCOMP command. Serial endpoints can be seen by typing the following:

```
ls /dev/ttyACM*
```

This should respond as below:



A serial session can be instigated using the command below:

```
minicom -D /dev/ttyACM0
```

Using IP

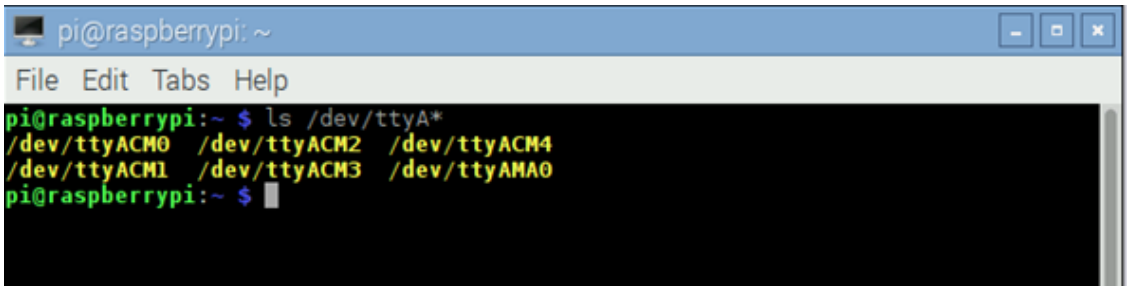
Using Minicom, enter the following command, which changes the USB end points to provide a CDC ECM interface:

```
AT+KUSBCOMP=2
```

Close Minicom (**Ctrl A then X** > enter), then power cycle the Raspberry Pi by removing and reinserting the power cable.

Within a Raspberry Pi shell session, enter the following command:

```
ls /dev/ttyA*
```



Type:

```
ifconfig
```

A new Ethernet device should appear in the reported list. On a Raspberry Pi 2, this should be '**eth1**'.

Edit the interface configuration file:

```
sudo nano /etc/network/interfaces
```

Change or add the entry for eth1 as follows:

```
#auto eth1
#allow-hotplug eth1
iface eth1 inet dhcp
pre-up ifconfig $IFACE down
dns-nameservers 8.8.8.8 8.8.4.4
```

Save the file by holding **Ctrl A + X**
Press **'Y'**
Then 'enter'.

Configure the HL8 bearer APN by opening a Minicom session to **/dev/ttyAMA0** or **/dev/ttyACM0**, then entering the following command using the appropriate APN according to your selected network:

```
AT+CGDCONT=1,"IP","Access Point Name"
```

Configure the APN username and password:

```
AT+WPPP=1,1,"username","password"
```

Configure dynamic DNS request:

```
AT+XDNS=1,1
```

To start an IP session:

```
AT+XCEDATA=1,0
```

To stop an IP session:

```
AT+CGACT=0,1
```

Power off

To power off the PiloT, open a Minicom session with **/dev/ttyAMA0** or **/dev/ttyACM0**.
Power off by entering the following command:

```
at+cpof
```

Using GPS

Please note: the optional GPS function is only available for the HL8548-G variant of the Pilot. Please see specification and/or related documents for more information.

The following instructions set up an NMEA feed over the Raspberry Pi serial port.

Ensure the PiloT is powered on by following the instructions on page 9.

Connect to the PiloT using Minicom:

```
minicom -D /dev/ttyAMA0
```

Change the speed of the serial port to 9600bps

```
AT+IPR=9600
```

Change Minicom serial speed to 9600bps and reconnect by holding **Ctrl + A**
Then **'Z' > 'O' >** Arrow down to **'Serial port setup' >** enter **> 'E' > 'C'**
Press enter, then press 'Esc', then arrow down to 'exit' and press enter.

To direct the NMEA output to the physical serial port, enter:

```
AT+GPSNMEA=1,1,FFFF,FF
```

Start GPS output on the serial port

```
AT+GPSSTART=2
```

(See HL8548 AT Command Guide for more details of GPS commands)

NMEA sentences should now stream from /dev/ttyAMA0.

To stop running GPS, open a Minicom session on /dev/ttyACM0 and enter:

```
AT+GPSSTOP
```

Close Minicom (**Ctrl + A**, then **X** > enter).

Changing back the serial speeds

When using Minicom after changing the serial speeds, you may find that you are unable to type commands in Minicom. This is because the different serial ports are not running at the same speed.

To rectify this, hold **Ctrl + A** (in Minicom)**,** and check the bps at the bottom of the terminal.

If it reads 9600bps, change the Minicom serial speed back to 115200bps and reconnect by holding:

Ctrl + A

Then **'Z' > 'O' > 'Serial Port Setup' > 'E' > 'E'**

Then arrow down to 'exit' and enter, then press 'Esc', then arrow down to 'exit' and enter'.

Type **AT&W** and enter to save settings.

Exit Minicom.

OR

If it reads 115200bps and you are unable to type commands in Minicom, change the Minicom serial speed to 9600bps and reconnect by holding:

Ctrl + A

Then **'Z' > 'O' > 'Serial Port Setup' > 'E' > 'C'**

Then arrow down to 'exit' and enter, then press 'Esc', then arrow down to 'exit' and press 'enter'.

Then, in the Minicom session, change the speed of the serial port to 115200bps by typing in the following command and pressing enter:

```
AT+IPR=115200
```

Then change the Minicom serial speed back to 115200ps and reconnect by holding:

Ctrl + A

Then **'Z' > 'O' > 'Serial Port Setup' > 'E' > 'E'**

Then arrow down to 'exit' and enter, then press 'Esc', then arrow down to 'exit' and press 'enter'.

You should now be able to effectively type AT commands.

Type **AT&W** and enter to save settings.

Exit Minicom.

Related documents

Access further data about the HL modules at the Sierra Wireless technical information site (the Source) using the following links:

http://source.sierrawireless.com/devices/hl-series/hl8548/

http://source.sierrawireless.com/devices/hl-series/hl8518/

Acronyms

Acronym or term	Definition
APN	An **Access Point Name** (APN) is the name of a gateway between a GSM, GPRS, 3G or 4G mobile network and another computer network.
AT Command	A set of device commands used to control modems, preceded by “AT” (meaning **ATtention**).
CDC ECM	**Communications Device Class** (CDC) and **Ethernet Control Model** (ECM) are protocols for Ethernet-style networking over USB.
DNS	The **Domain Name System (DNS)** is a hierarchical decentralized naming system for computers, services, or any resource connected to the Internet or a private network.
EDGE	**Enhanced Data rates for GSM Evolution** (EDGE) is a digital mobile phone technology that allows improved data transmission rates as a backward-compatible extension of GSM. EDGE is considered a pre-3G radio technology and is part of ITU's 3G definition.
GLONASS	GLONASS or **GLObal NAvigation Satellite System** is a space-based satellite navigation system operating in the radio navigation-satellite service. It provides an alternative to GPS and is the second alternative navigational system in operation with global coverage and of comparable precision.
GNSS	A satellite navigation system with global coverage may be termed a **global navigation satellite system** (GNSS).
GPRS	**General Packet Radio Service** is a packet-oriented mobile data service on 2G and 3G cellular communication systems.
GPS	**Global Positioning System** is a system that uses a series of 24+ satellites to provide navigational data.
HAT	A HAT **(Hardware Attached on Top)** is an add-on board for the Raspberry Pi that conforms to a specific set of rules which enhance usability.

HSPA	**High Speed Packet Access** (HSPA) is an amalgamation of two mobile telephony protocols: High Speed Downlink Packet Access (HSDPA) and High Speed Uplink Packet Access (HSUPA).
IO	**Input/output** is the communication between an information processing system. Inputs are the signals or data received by the system and outputs are the signals or data sent from it.
IP	The **Internet Protocol** (IP) is the protocol by which one computer communicates with another on the Internet. Each device is identified on the internet by a uniquely assigned IP address.
Minicom	**Minicom** is a text-based modem control and terminal emulation program for Unix-like operating systems. It is a menu-driven communications program.
SIM	A **subscriber identity module** or **subscriber identification module (SIM)** is an integrated circuit that securely stores the international mobile subscriber identity (IMSI) and the related key used to identify and authenticate subscribers on mobile telephony devices.
SMA	SMA **(SubMiniature version A)** connectors are semi-precision coaxial RF connectors developed as a minimal connector interface for coaxial cable with a screw type coupling mechanism.
USB	A **Universal Serial Bus** is an industry standard developed that defines the cables, connectors and communications protocols used in a bus for connection, communication, and power supply between computers and electronic devices.
WAN	A **wide area network** (WAN) is a telecommunications network or computer network that extends over a large geographical distance.

Further resources:

Tutorial: connect your hardware to the cloud:
https://doc.airvantage.net/av/howto/hardware/3rdparty_getting_started/

Tutorial: build a simple end-to-end IoT application:
https://doc.airvantage.net/av/howto/hardware/samples/raspberry-hl-mqtt/