PiloT®

USER MANUAL: 4G

The PiloT® is a WAN communications board which provides a 2G / 3G / 4G 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**

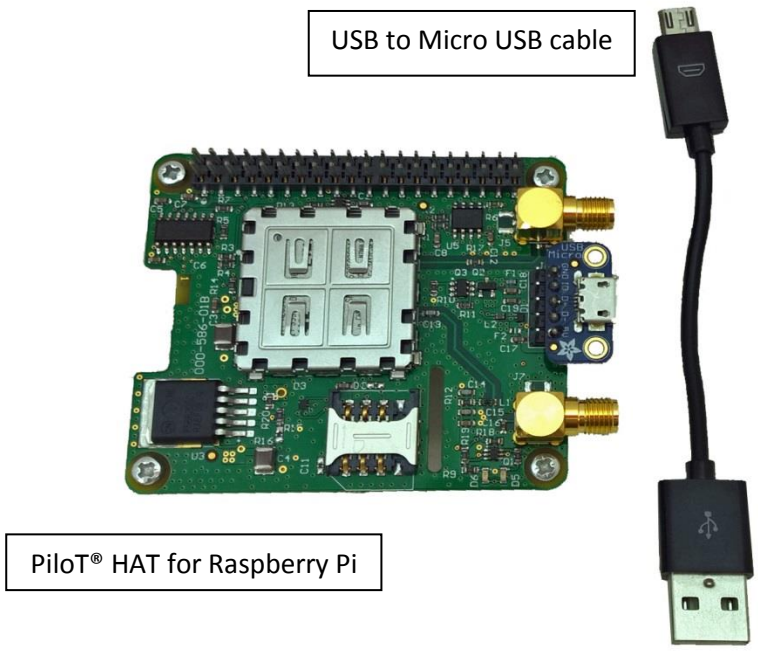
Contents

Specification

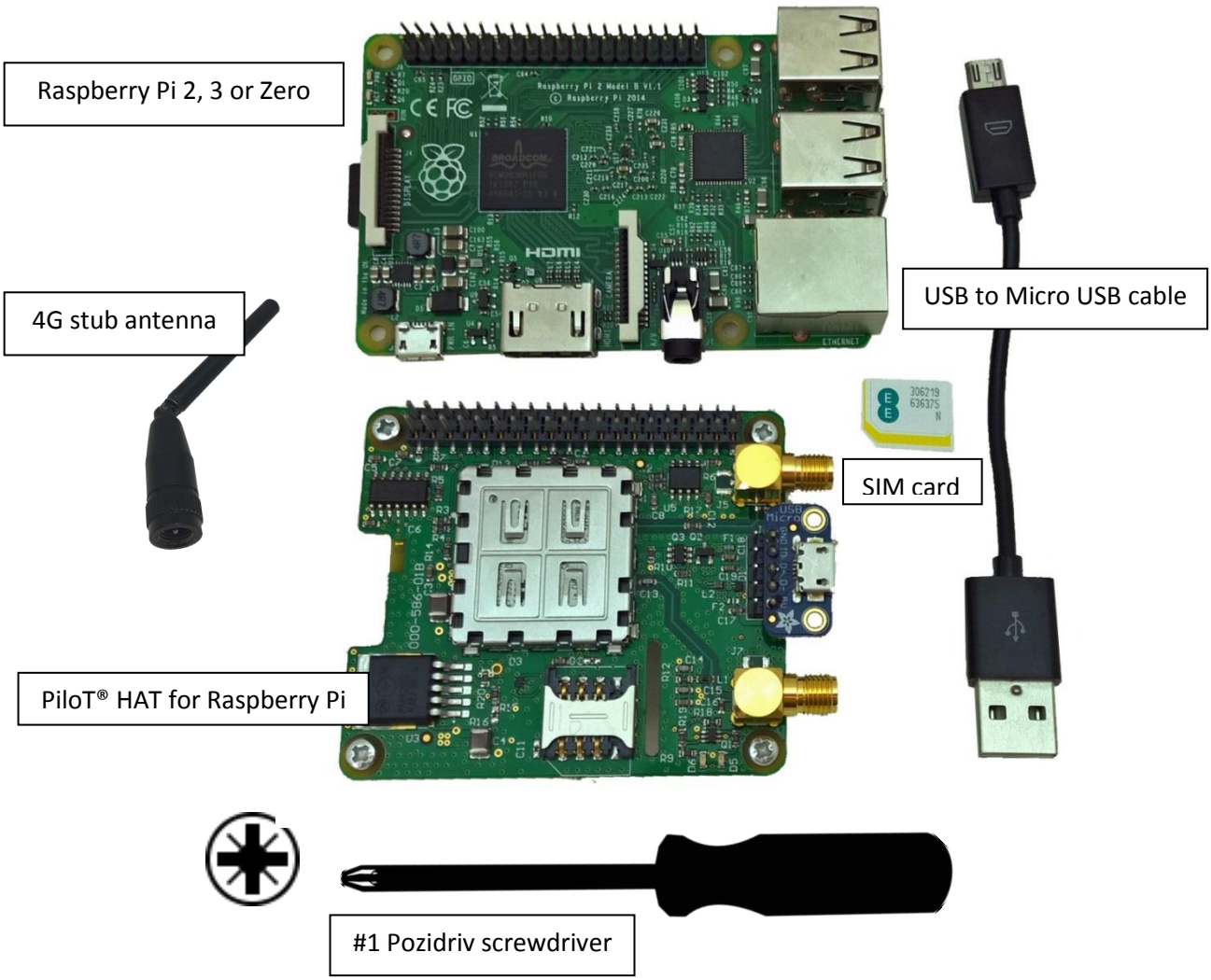
EMBEDDED WIRELESS MODULE	Sierra Wireless HL7692
FREQUENCY BANDS	LTE: B3, B8, B20
INTERFACES	Serial, USB (CDC-ACM, CDC-ECM)
SIM	3V Micro-SIM
POWER	From Raspberry Pi or direct (can also power Raspberry Pi)
AT COMMAND INTERFACE	3GPP 27.007 standard, plus proprietary extended commands
IP STACK	On-board or Raspberry Pi

To compare PiloT® variants and view specifications for the on-board HL modules, click here.

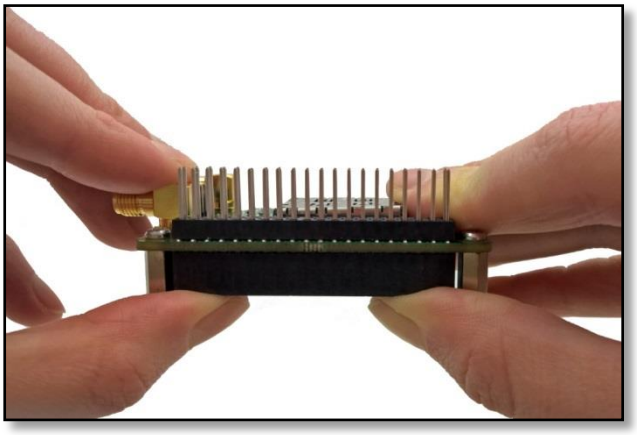
Box contents



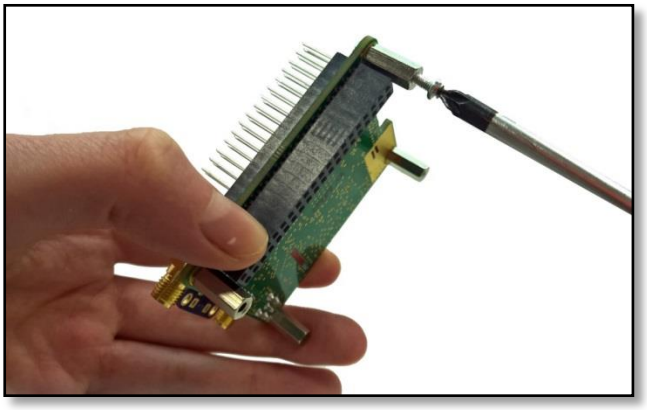
Required Equipment



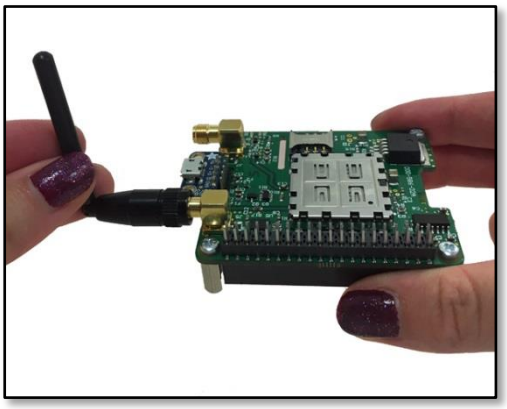
PiloT® Assembly



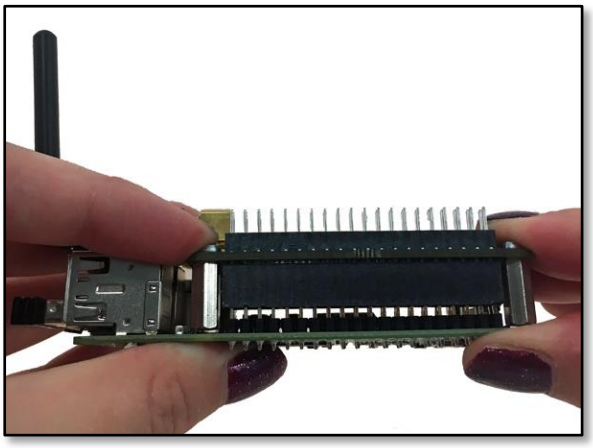
Step one
Gently push the 40 way pins all the way through the holes in the socket.



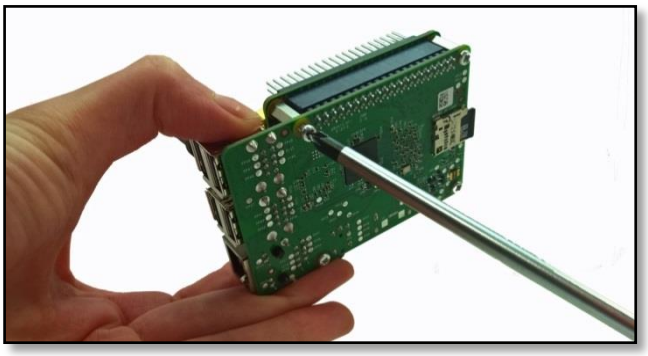
Step two
Remove the four screws from the mounting pillars.



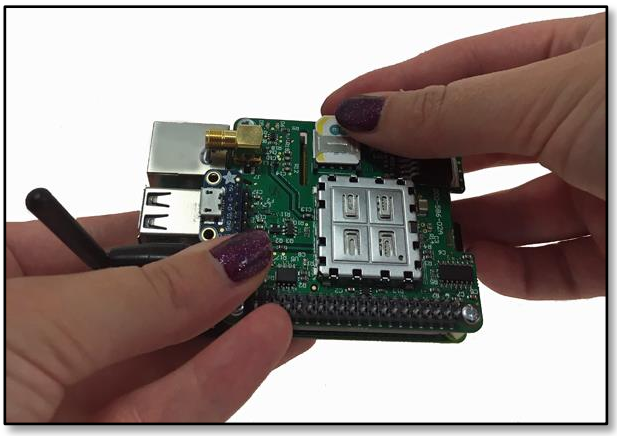
Step three
Screw the right-angled stub antenna on to the SMA WAN antenna connector located next to the 40 pin header.



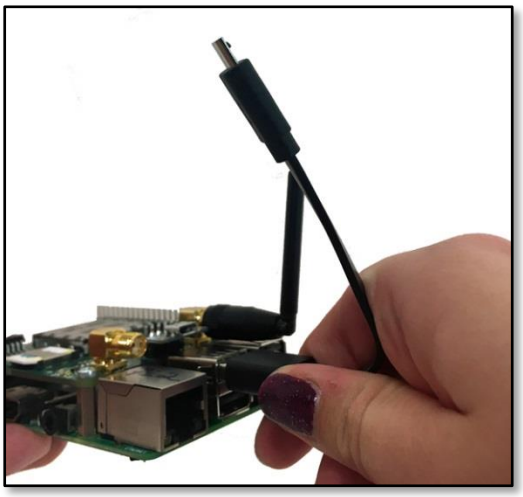
Step four
Align the 40 way socket with the 40 way header on the Raspberry Pi. Gently press together.



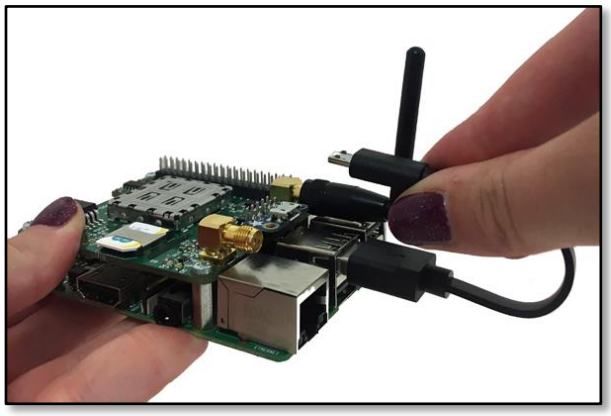
Step five
Ensure the PiloT® is securely mounted on the Raspberry Pi by inserting the four screws (see **step two**) into the holes at the bottom of the Raspberry Pi. Gently tighten using a #1 Pozidriv screwdriver.

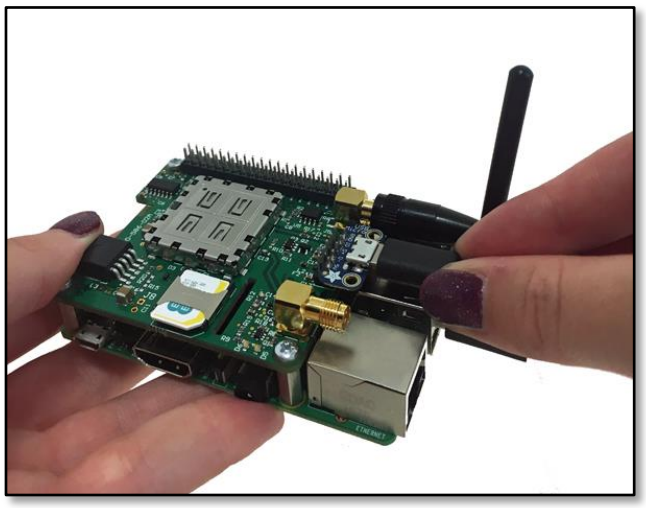


Step six
Insert the SIM card into the SIM card holder, ensuring the chamfer is located as shown on the photo, and the contact side is face down.



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®

Please note: this document provides instructions for using the 4G (HL7692) variant of the PiloT® over the USB serial port.

The following instructions are based on use of Raspbian Stretch.

Firstly, download the files necessary for pppd usage here: https://github.com/linkwavetech/HL_RPiPpp

Store these scripts in a file on the Raspberry Pi.

Note: please ensure your file names are created without spaces.

Firstly, update the device's package lists by entering the following command:

```
sudo apt-get update
```

Upgrade software:

```
sudo apt-get upgrade
```

Install Minicom using the following command:

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

PiloT® power supply control

The PiloT® power supply is controlled by Raspberry Pi GPIO pin 6. 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 may 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
sleep 2
gpio -g write 21 0
```

Copy scripts for PPPD usage

Copy the scripts downloaded earlier for pppd to use by accessing the directory where the documents are located:

```
cd file_name
```

Then, enter the following commands:

```
sudo apt-get install ppp
sudo cp pppPilot /etc/ppp/peers/
sudo cp chatUp /etc/chatscripts/
sudo cp chatDown /etc/chatscripts/
```

Configure HL module

The chat script is written to automate configuration on modem APN, PAP or CHAP authentication settings. Alternatively, this can be carried out manually using a terminal and AT commands.

Please note:

- The example uses PAP authentication
- If using a physical serial port, baud rate and handshake settings will be needed.
- This script only needs to be run when the modem settings need to be changed - the modem retains the settings after a power cycle
- PPP's built in authentication isn't used as not all modules respond to this.

Staying in the directory where the ppp documents are stored, edit the file "chatHLsetup" to match the credentials required for your SIM cards by entering:

```
sudo nano chatHLsetup
```

If the SIM doesn't require authentication credential settings, set both the username and password to empty strings ("").

Then execute the chat script as follows:

```
chat -v -f ./chatHLsetup > /dev/ttyACM0 < /dev/ttyACM0
```

Save file (hold A & X + click Y, then enter)

Make an IP connection

To make an IP connection with the HL module on-board the PiloT, enter:

```
sudo pppd /dev/ttyACM0 115200 call pppPilot
```

Check script execution

Open a new shell terminal.

Enter:

```
tail -f /var/log/syslog
```

Wait around 10 seconds for the connection to be made.

Check IP interface

To check the IP interface, use a Raspberry Pi shell session to enter the following:

```
ifconfig ppp1
```

Example response:

```
pi@raspberrypi:~ $ ifconfig ppp1
ppp1: flags=4305<UP,POINTOPOINT,RUNNING,NOARP,MULTICAST>  mtu 1500
        inet 178.101.151.219  netmask 255.255.255.255  destination 178.101.151.2
19
        ppp  txqueuelen 3  (Point-to-Point Protocol)
        RX packets 16  bytes 1918 (1.8 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 42  bytes 2772 (2.7 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

pi@raspberrypi:~ $
```

Test communication with another host by using a ping command followed by a URL:

```
ping <web address>
```

To stop ping output, press ctrl + C.

Talk to the modem directly from the Raspberry Pi

In a new shell session, access Minicom by entering the following:

To connect over USB:

```
sudo minicom -D /dev/ttyACM2
```

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.

LED function

For LED function activation, enter the following commands in minicom (**minicom –D /dev/ttyACM2**):

To monitor network connections, use of the left LED is recommended. To use the LED to indicate whether the PiloT is connected to the network, enter the following command:

```
at+ksync=2,7
```

To switch off the left LED, send:

```
at+ksync=0
```

To switch on the right LED, send:

```
at+kgpio=8,1
```

To switch off the right LED, send:

```
at+kgpio=8,0
```

For further details, please see the HL Series command guide.

To exit Minicom, hold ctrl + A, then press 'X' and enter.

Connecting to the PiloT® via a UART port

Enable handshaking on the serial port, enter the following commands:

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

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

```
sudo raspi-config
```

Then go to **Interfacing Options > Serial**
Answer **'No'** to "Would you like a login shell to be accessible over serial?"
Answer **'Yes'** to "Would you like the serial port hardware to be enabled?"
Tap to finish and click **'Yes'** to reboot.

To connect to Minicom over the serial port:

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

Check that AT commands are working by typing AT and pressing enter.

This should respond 'OK'.

To exit Minicom, hold ctrl + A, then press 'X' and enter.

Power off

To power down the PiloT, open Minicom (minicom –D /dev/ttyACM2) and enter the following:

```
at+cpof
```

Exit Minicom, allow a five second delay, then, in a Raspberry Pi shell session, enter the following:

```
gpio -g write 6 0
```

Related documents

Access further data about the HL modules at the Sierra Wireless technical information site (the Source).

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.
LTE	LTE (**Long Term Evolution**) is a 4G (fourth generation) mobile communications standard.
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/