Waveshare A7670E

Waveshare A7670E LTE Cat-1 HAT for Raspberry Pi User Manual

Enabling LTE Cat-1 / 2G Communication & LBS Positioning

1. Introduction

The Waveshare A7670E LTE Cat-1 HAT is an expansion board designed for Raspberry Pi series boards, providing LTE Cat-1 and 2G communication capabilities, along with LBS (Location-Based Service) positioning. This HAT integrates the A7670E module, supporting various communication protocols and features essential for IoT applications, remote monitoring, and data transmission.

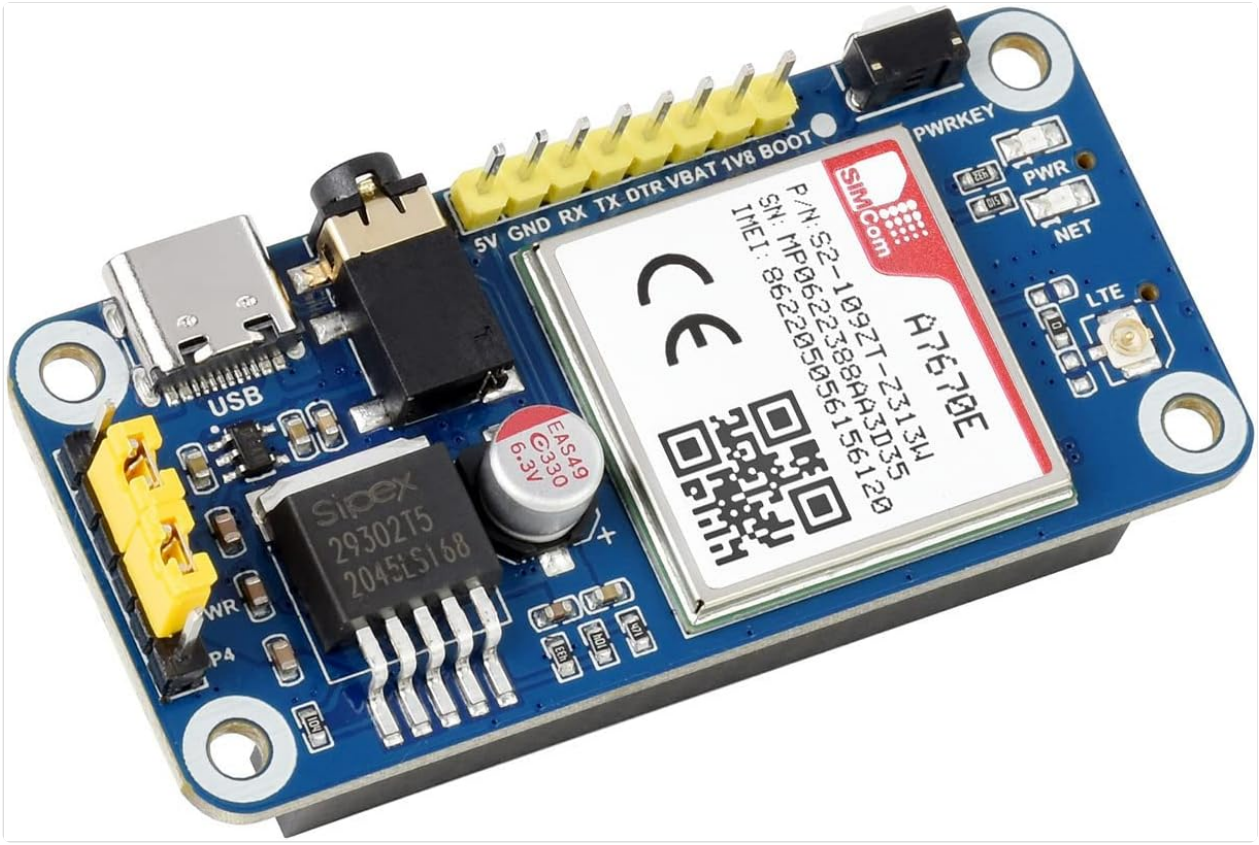


Figure 1: Waveshare A7670E LTE Cat-1 HAT module. This image displays the compact design of the A7670E HAT, highlighting its various components including the SIM card slot, USB port, audio jack, and GPIO pins.

2. Features

- Standard Raspberry Pi 40PIN GPIO extension header, compatible with Raspberry Pi series boards.
- Supports communication protocols including TCP/IP, HTTP(s), MQTT(s), FTP(s), and SSL.
- Supports dial-up networking, telephone calls, and SMS functionality.
- LBS base station positioning for approximate location information via mobile network.
- TTS (Text To Speech) feature, converting Chinese/English texts into spoken words.
- Onboard USB interface for AT Commands testing and network communication.
- Integrated audio jack for sound recording, telephone calls, and listening to TTS output.
- Breakout common A7670X module control pins for easy connection with host boards like Arduino/STM32.
- SIM card slot supporting 1.8V/3V SIM cards.
- Two LED indicators for monitoring operating status.
- Onboard voltage translator, allowing operating voltage configuration to 3.3V or 5V via jumper.

For different regions, we provide multiple LTE Cat-4/Cat-1 HATs to choose from:

SIM7600A-H 4G HAT	LTE Cat-4	mainly applicable in North America (US, CA)
SIM7600E-H 4G HAT	LTE Cat-4	mainly applicable in Europe, Southeast Asia, West Asia, Africa, China, South Korea
SIM7600E LTE Cat-1 HAT	LTE Cat-1	
A7670E Cat-1 HAT		
A7600E Cat-1/GSM/GPRS HAT		
SIM7600SA-H 4G HAT	LTE Cat-4	mainly applicable in Australia, New Zealand, Taiwan, Latin America
SIM7600CE 4G HAT	LTE Cat-4	mainly applicable in China, and some Southeast Asia countries
SIM7600CE-CNSE 4G HAT		
SIM7600CE-JT1S 4G HAT		
A7600C1 Cat-1/GSM/GPRS HAT	LTE Cat-1	
SIM7600G-H 4G HAT	LTE Cat-4	the global version

Please check the supported bands according to your local service provider, select the proper one when placing order.

Figure 2: Overview of A7670E HAT features. This graphic summarizes the key functionalities such as multi-band support, Cat-1/GSM/GPRS, LBS positioning, dial-up, cloud platform compatibility, and phone call/SMS support.

3. Package Content

Verify that all items listed below are included in your package:

- A7670E LTE Cat-1 HAT module
- LTE Antenna
- USB Type A to Type C cable
- Screws and standoffs for mounting

Figure 3: Contents of the A7670E HAT package. This image shows the A7670E module, an LTE antenna, a USB-C cable, and mounting hardware (screws and standoffs).

4. Setup

4.1 Physical Connection to Raspberry Pi

1. Align the 40-pin GPIO header of the A7670E HAT with the GPIO pins on your Raspberry Pi board.
2. Gently press the HAT onto the Raspberry Pi's GPIO header until it is securely seated.
3. Use the provided standoffs and screws to secure the HAT to the Raspberry Pi for stability.

Features At A Glance

The **A7670E Cat-1 HAT** is an LTE Cat-1 module, which supports wireless communication modes including LTE-TDD, LTE-FDD, GSM, GPRS and EDGE, with up to 10Mbps downlink rate and 5Mbps uplink rate. It supports Windows/Linux operating systems and multiple network protocols. The module size is the same as SIM7000/SIM7070 series, and the AT commands is mostly compatible with SIM7600 series. It is suitable for IoT applications like remote information processing, monitoring devices, POS, industrial routers, remote diagnosis, and so on.

- Standard Raspberry Pi 40PIN GPIO extension header, supports Raspberry Pi series boards
- Supports protocols including TCP/IP, HTTP(s), MQTT(s), FTP(s), and SSL
- Supports dial-up, telephone call, SMS
- Supports LBS base station positioning, it is able to get the approximate position info via mobile network
- TTS (Text To Speech) feature, texts in Chinese/English can be converted into spoken words
- Onboard USB interface, for testing AT Commands, network communication, and so on
- Onboard audio jack for sound recording, making telephone call, listening the TTS resulting speech, etc.
- Breakout common used control pins of the A7670X module, make it easy to connect with hosts boards like Arduino/STM32
- SIM card slot, supports 1.8V/3V SIM card
- 2x LED indicators, easy to monitor the operating status
- Onboard voltage translator, operating voltage can be configured to 3.3V or 5V via jumper
- Comes with development resources and manual (examples for Raspberry Pi/Arduino/STM32)

Specifications

FREQUENCY BAND	
LTE Cat-1	LTE-FDD: B1, B3, B5, B7, B8, B20
2G	GSM/GPRS/EDGE: 900/1800 MHz
SMS AND AUDIO	
SMS	Supported types: MT, MO, CB, Text, PDU
	Storage: USIM card (CB couldn't be stored on SIM card)
Audio feature	Standard 3.5mm audio jack for audio input/output
OTHER	
Power supply	5V
Operating voltage	5V / 3.3V (configured via jumper)
Operating temperature	-30°C ~ 80°C
Storage temperature	-45°C ~ 90°C
Dimensions	65 × 30.5mm

Figure 4: A7670E HAT connected to a Raspberry Pi. This image illustrates the HAT mounted directly onto the Raspberry Pi's 40-pin GPIO header, showing a compact and integrated setup.

4.2 SIM Card Installation

1. Locate the SIM card slot on the A7670E HAT.
2. Insert a 1.8V or 3V SIM card into the slot, ensuring correct orientation as indicated on the module.
3. Gently push the SIM card until it clicks into place. To remove, push again to release.

4.3 Antenna Connection

1. Connect the provided LTE antenna to the IPEX1 connector on the A7670E HAT.
2. Ensure the connection is secure for optimal signal reception.

4.4 Voltage Configuration

The operating voltage can be configured to 3.3V or 5V using the onboard jumper. Refer to the module's silkscreen for jumper positions. Ensure the correct voltage is selected to match your Raspberry Pi model or other host board requirements.

5. Operating Instructions

5.1 Dial-Up on Windows/Linux

The A7670E HAT supports dial-up networking. For detailed instructions on setting up dial-up on Windows or Linux operating systems, refer to the comprehensive development resources provided by Waveshare. This typically involves installing drivers and configuring network settings to establish a connection.

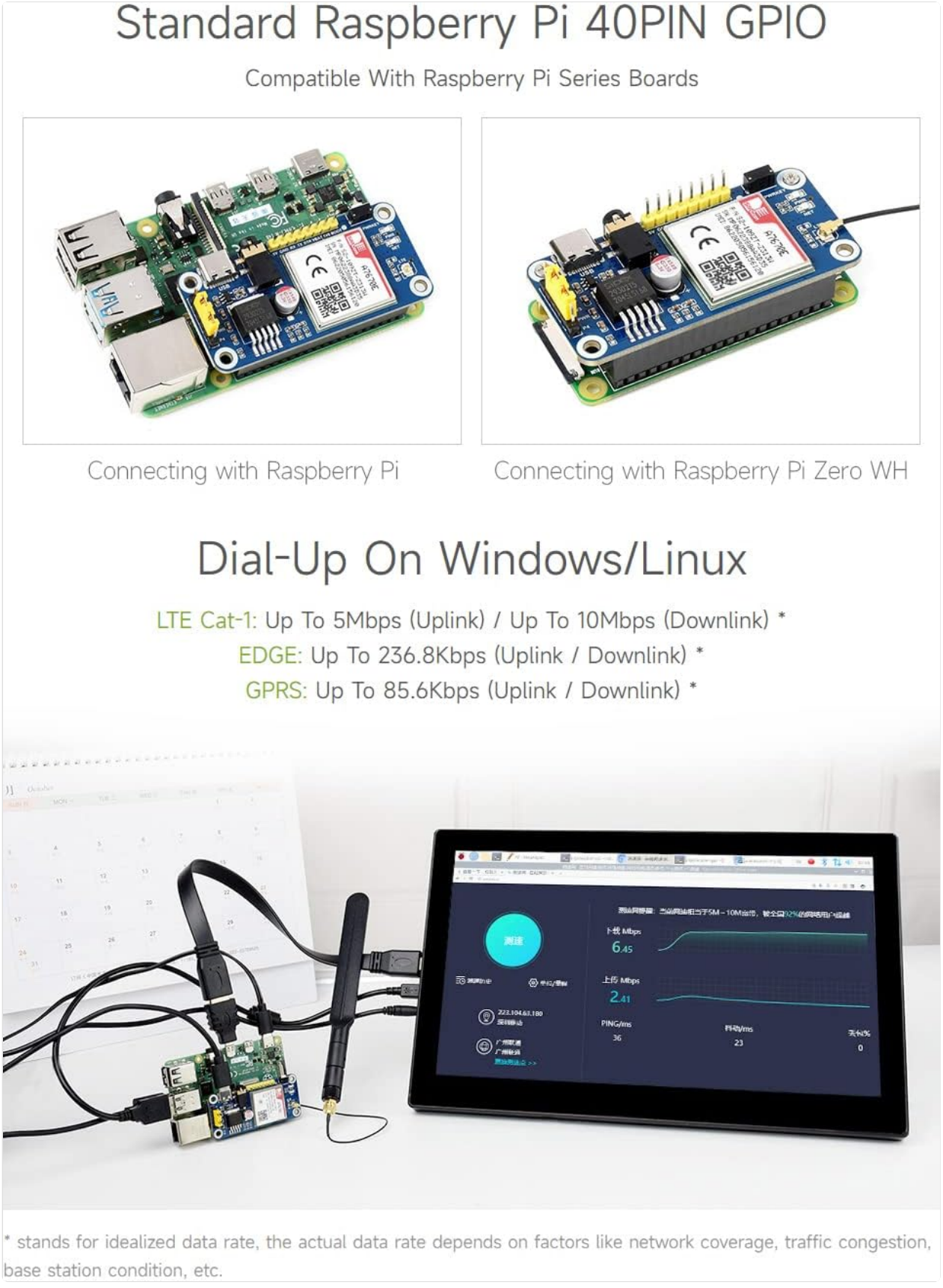


Figure 5: Example of dial-up connection on a Windows/Linux device using the A7670E HAT. This image shows a Raspberry Pi connected to a display, demonstrating network connectivity via the HAT.

5.2 Cloud Communication

The module supports various cloud communication protocols including TCP/IP, HTTP(s), MQTT(s), FTP(s), and SSL. This enables the Raspberry Pi to send and receive data from cloud platforms for IoT applications. Communication can be established via USB or UART using AT commands.

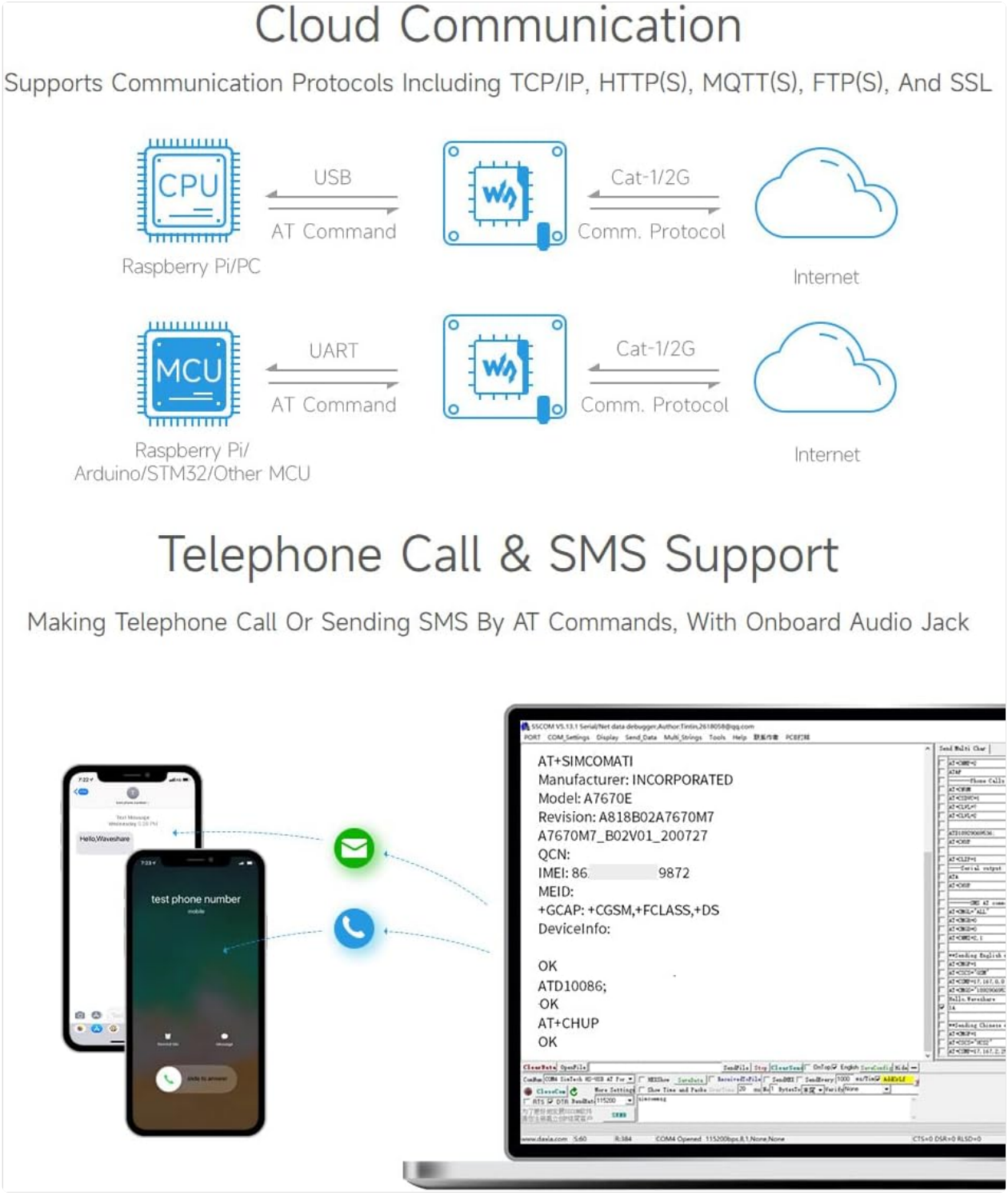


Figure 6: Diagram illustrating cloud communication pathways. This graphic depicts how the Raspberry Pi (or other MCU) communicates with the A7670E module via USB or UART, which then connects to the internet using Cat-1/2G protocols for cloud services.

5.3 Telephone Call & SMS Support

The A7670E HAT can be used for making telephone calls and sending/receiving SMS messages. This functionality is typically controlled via AT commands sent to the module. The onboard audio jack allows for connecting a headset for voice communication.

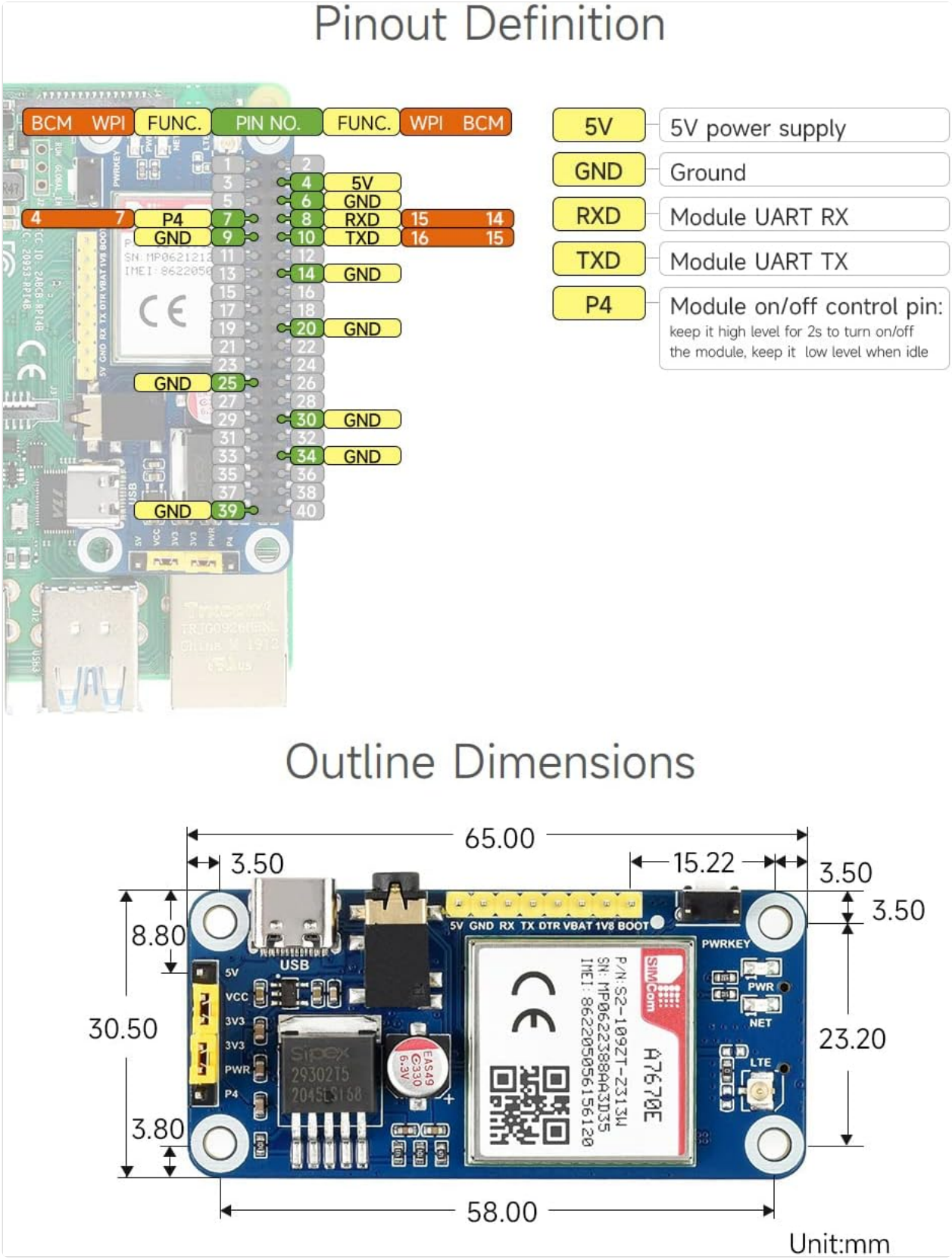


Figure 7: Demonstration of telephone call and SMS functionality. This image shows a mobile phone interface for calls and messages, alongside a terminal window displaying AT commands for module control.

5.4 AT Commands

The A7670E module is controlled primarily through AT commands. These commands are sent via the USB interface or UART. Refer to the A7670E module's AT Command Set documentation for a complete list of commands and their usage. Examples for Raspberry Pi, Arduino, and STM32 are available in the provided development resources.

6. Specifications

Feature	Description
Frequency Band (LTE Cat-1)	LTE-FDD: B1, B3, B5, B7, B8, B20
Frequency Band (2G)	GSM/GPRS/EDGE: 900/1800 MHz
SMS Support	MT, MO, CB, Text, PDU
Audio Feature	Standard 3.5mm audio jack for audio input/output
Power Supply	5V
Operating Voltage	5V / 3.3V (configurable via jumper)
Operating Temperature	-30°C ~ 80°C
Storage Temperature	-45°C ~ 90°C
Dimensions	65 × 30.5mm
Connectivity	GPIO, USB
Operating System Support	Windows, Linux
SIM Card Slot	Supports 1.8V and 3V SIM card
UART	Supports AT commands through UART, compatible with 3.3V/5V operating voltage
USB Port	Supports AT commands testing, network communication, firmware upgrading, etc.
Antenna Connector	LTE main antenna

7. Pinout Definition

The A7670E HAT utilizes the Raspberry Pi's 40-pin GPIO header. Understanding the pinout is crucial for advanced integration and custom applications.

Selection Guide

	A7670E	A7600C1	A7600E	SIM7600E
Applicable regions	**A7600C1:** China **A7670E / A7600E / SIM7600E:** Europe, Southeast Asia, West Asia, Africa, China, South Korea			
Band				
LTE Cat-1	**LTE-FDD** B1, B3, B5, B7, B8, B20	**LTE-FDD** B1, B3, B5, B8 **LTE-TDD** B34, B38, B39, B40, B41	**LTE-FDD** B1, B3, B5, B7, B8, B20 **LTE-TDD** B38, B40	**LTE-FDD** B1, B3, B5, B7, B8, B20 **LTE-TDD** B38, B40, B41
3G	N/A			**UMTS/HSPA+** B1, B5, B8
2G	**GSM/GPRS/EDGE** 900/1800 MHz			
GNSS	N/A			GPS/Beidou/GLONASS/GALILEO/QZSS
Data Rate				
LTE Cat-1	10Mbps(DL)/5Mbps(UL)			
3G (HSPA+)	N/A			42Mbps(DL)/5.76Mbps(UL)
2G (GPRS/EDGE)	236.8Kbps(DL/UL)			
Software Features				
Network protocol	TCP/IP/IPV4/IPV6/Multi-PDP/FTP/FTPS/HTTP/HTTPS/DNS			
Dial-up protocol	PPP/RNDIS			PPP/NDIS/RNDIS
USB driver	Windows XP/7/8/10, Linux (driver free for Raspbian)			
Hardware Interfaces				
SIM card slot	Compatible with 1.8V and 3V SIM card			
UART	Supports AT commands through UART, compatible with 3.3V/5V operating voltage			
USB port	Supports AT commands testing, network communication, firmware upgrading, etc.			
USB to UART	N/A			Supports serial debugging, or login to Raspberry Pi
Audio jack	Supports audio actions like making telephoto call			
Antenna connector	LTE main antenna			LTE main antenna + LTE diversity antenna + GNSS antenna
Dimensions	65 × 30.5mm	65 × 56.0mm		
Applications				
Examples	Healthcare, smart payment, Internet talk, environmental monitoring, energy monitoring, fleet management, smart industry, intelligent agriculture, etc.			

Figure 8: Pinout diagram for the A7670E HAT. This diagram details the function of each pin on the 40-pin GPIO header, including power, ground, UART (RXD, TXD), and control pins like P4 (module on/off control).

8. Outline Dimensions

The physical dimensions of the A7670E HAT are important for enclosure design and integration into projects.

Selection Guide

	A7670E	A7600C1	A7600E	SIM7600E
Applicable regions	**A7600C1:** China **A7670E / A7600E / SIM7600E:** Europe, Southeast Asia, West Asia, Africa, China, South Korea			
Band				
LTE Cat-1	**LTE-FDD** B1, B3, B5, B7, B8, B20	**LTE-FDD** B1, B3, B5, B8 **LTE-TDD** B34, B38, B39, B40, B41	**LTE-FDD** B1, B3, B5, B7, B8, B20 **LTE-TDD** B38, B40	**LTE-FDD** B1, B3, B5, B7, B8, B20 **LTE-TDD** B38, B40, B41
3G	N/A			**UMTS/HSPA+** B1, B5, B8
2G	**GSM/GPRS/EDGE** 900/1800 MHz			
GNSS	N/A			GPS/Beidou/GLONASS/GALILEO/QZSS
Data Rate				
LTE Cat-1	10Mbps(DL)/5Mbps(UL)			
3G (HSPA+)	N/A			42Mbps(DL)/5.76Mbps(UL)
2G (GPRS/EDGE)	236.8Kbps(DL/UL)			
Software Features				
Network protocol	TCP/IP/IPV4/IPV6/Multi-PDP/FTP/FTPS/HTTP/HTTPS/DNS			
Dial-up protocol	PPP/RNDIS			PPP/NDIS/RNDIS
USB driver	Windows XP/7/8/10, Linux (driver free for Raspbian)			
Hardware Interfaces				
SIM card slot	Compatible with 1.8V and 3V SIM card			
UART	Supports AT commands through UART, compatible with 3.3V/5V operating voltage			
USB port	Supports AT commands testing, network communication, firmware upgrading, etc.			
USB to UART	N/A			Supports serial debugging, or login to Raspberry Pi
Audio jack	Supports audio actions like making telephoto call			
Antenna connector	LTE main antenna			LTE main antenna + LTE diversity antenna + GNSS antenna
Dimensions	65 × 30.5mm	65 × 56.0mm		
Applications				
Examples	Healthcare, smart payment, Internet talk, environmental monitoring, energy monitoring, fleet management, smart industry, intelligent agriculture, etc.			

Figure 9: Outline dimensions of the A7670E HAT. This image, also showing the pinout, includes measurements in millimeters for the module's length, width, and component placement.

9. Selection Guide

Waveshare offers various LTE HATs. The following table provides a comparison to help in selecting the appropriate module for specific regional and application requirements.

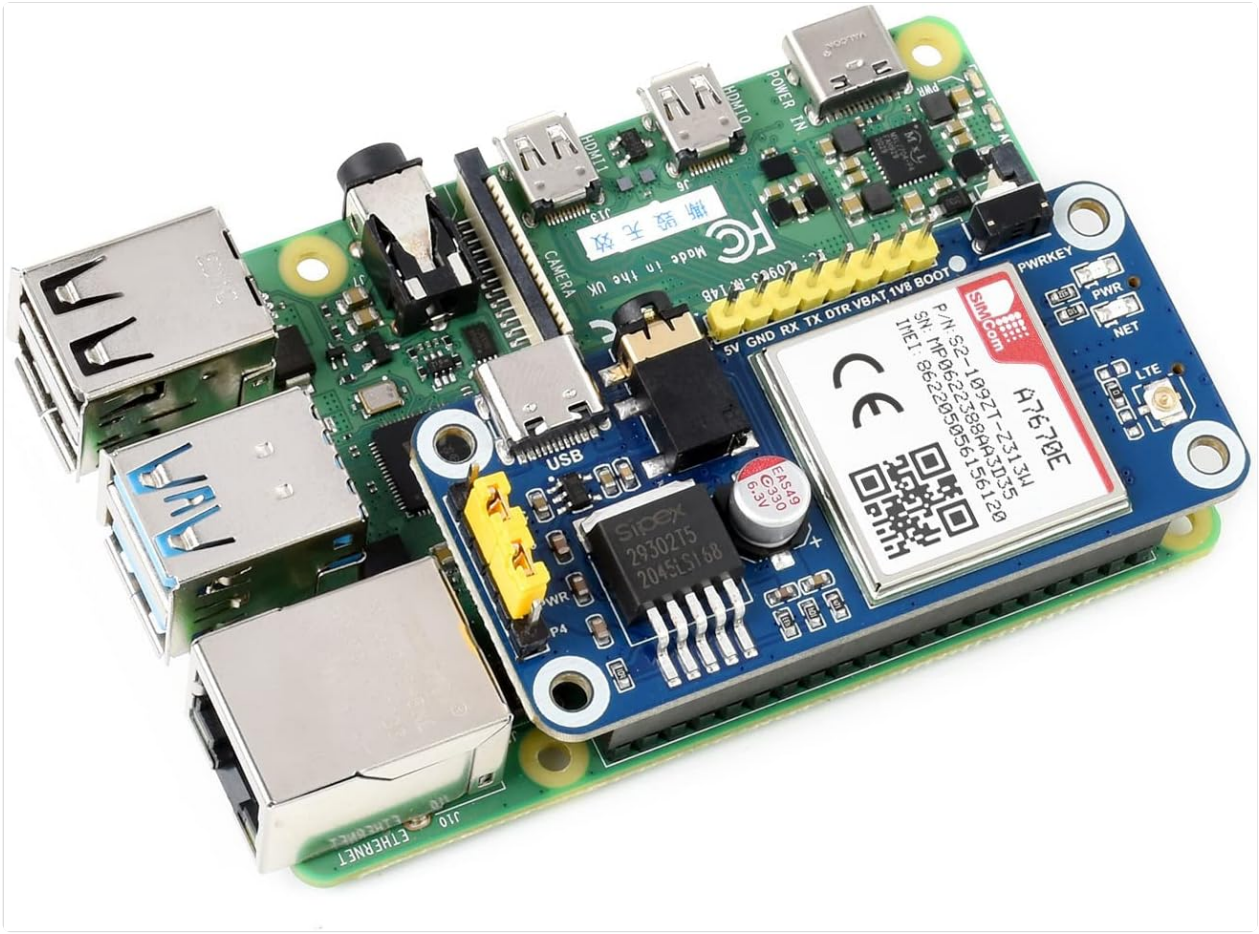


Figure 10: Comparison table for Waveshare LTE HATs. This guide outlines different models (A7670E, A7600C1, A7600E, SIM7600E) with their applicable regions, supported bands, data rates, software features, and hardware interfaces.

10. Maintenance

To ensure the longevity and optimal performance of your A7670E LTE Cat-1 HAT, consider the following:

- Keep the module in a clean, dry environment, away from dust and moisture.
- Avoid exposing the HAT to extreme temperatures or direct sunlight.
- Ensure proper ventilation when integrated into an enclosure to prevent overheating.
- Periodically check for firmware updates from Waveshare to benefit from performance improvements and bug fixes.

11. Troubleshooting

If you encounter issues with your A7670E LTE Cat-1 HAT, consider the following common troubleshooting steps:

- **No Power/LEDs Off:** Verify the power supply to your Raspberry Pi and ensure the HAT is correctly seated on the GPIO pins. Check the voltage jumper setting.
- **No Network Connection:**
  - Ensure the SIM card is correctly inserted and active with a valid data plan.
  - Check antenna connection.
  - Verify network coverage in your area.
  - Confirm correct APN settings in your software configuration.

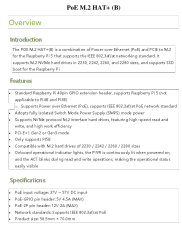
- **AT Commands Not Responding:**
  - Ensure the USB cable is connected or UART pins are correctly wired.
  - Verify the serial port settings (baud rate, parity, data bits, stop bits).
  - Check if the module is powered on (PWRKEY pin control).
- **LBS Positioning Inaccurate:** LBS positioning relies on cellular network base stations and may provide approximate location data, not precise GPS coordinates. Accuracy can vary significantly based on network density.

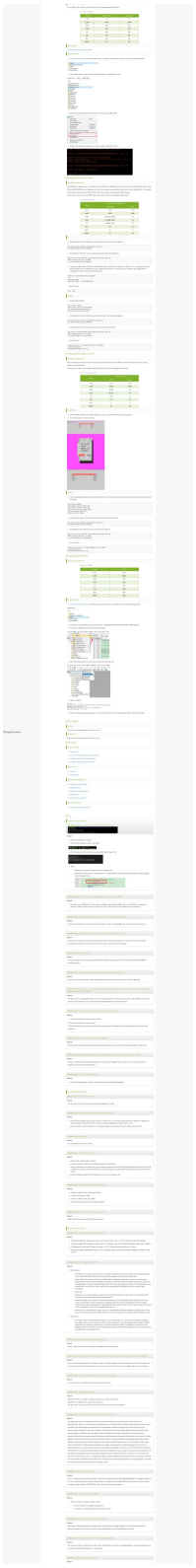
For more detailed troubleshooting or specific technical issues, refer to the official Waveshare documentation and support resources.

12. Warranty and Support

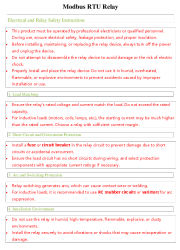
Waveshare products typically come with a standard manufacturer's warranty. For specific warranty terms and conditions, please refer to the official Waveshare website or contact their customer support directly.
Technical Support: Waveshare provides comprehensive development resources, including documentation, example code for Raspberry Pi/Arduino/STM32, and technical support. These resources are essential for successful integration and operation of the A7670E HAT.
For further assistance, visit the Waveshare Official Website or their dedicated product support pages.

Related Documents - A7670E

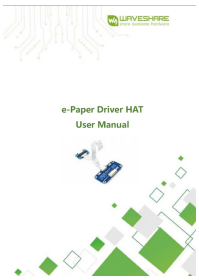
	Waveshare PoE M.2 HAT+(B) for Raspberry Pi 5: Installation and User Guide A comprehensive guide to installing and configuring the Waveshare PoE M.2 HAT+(B) for Raspberry Pi 5, enabling Power over Ethernet and M.2 NVMe SSD support for enhanced performance and storage.
	



[Waveshare 2.13inch e-Paper HAT (B) User Manual and Technical Guide]
Comprehensive guide for the Waveshare 2.13inch e-Paper HAT (B), covering hardware connections, software setup, programming principles, and troubleshooting for Raspberry Pi, Arduino, Jetson Nano, and STM32.



[Modbus RTU Relay: User Manual and Technical Guide]
Comprehensive guide to the Modbus RTU Relay, covering safety instructions, hardware connection, software setup with SSCOM and Modbus Poll, and detailed command protocols for various operations. Includes examples for Raspberry Pi, STM32, Arduino, and PLC integration.

	[Waveshare e-Paper Driver HAT User Manual: Connect SPI E-Paper Displays to Raspberry Pi, Arduino, STM32] User manual for the Waveshare e-Paper Driver HAT, detailing its features, product parameters, interface specifications, and supported e-Paper models. Includes setup guides for Raspberry Pi, Arduino, and STM32 development boards.
	[Waveshare Stepper Motor HAT User Manual] Comprehensive user manual for the Waveshare Stepper Motor HAT, detailing its features, specifications, hardware, control protocols, demo codes, and troubleshooting for Raspberry Pi projects.
	[PI4-CASE-4G-5G-M.2 Assembly Tutorial: Install Raspberry Pi 5G HAT] Comprehensive assembly tutorial for the PI4-CASE-4G-5G-M.2, designed to house a Raspberry Pi 4 with a 4G/5G M.2 module. Follow these step-by-step instructions to install your SIM card, antennas, and mounting hardware for a complete setup.