

# User Manual

# Edge AI Box

AIX-600

Qualcomm® QCS-6490



Edition 1

Last Update 29 September 2024

## Copyright Notice

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## Declaration of Conformity

FCC Class A



### Note

This equipment has been tested and found to comply with the limits for a Class A digital device of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in such cases users will be required to correct the interference at their own expense.



### Warning

***Any modifications to this device that are not approved by the relevant standards authority may void the authority granted to the user by the FCC to operate this equipment.***

## Packing List

Before installing the AIX-600 Edge AI Box, check that the following materials have been included in the shipment:

- AIX-600 unit
- Accessories for AIX-600
  - Antenna x 2
  - Power Adapter x 1

If any of these items are missing or damaged, contact your distributor or sales representative immediately.

## Technical Support and Assistance

Visit the Sysgration website at <http://www.sysgration.com> to obtain the latest product information.

For technical support or additional assistance, contact your distributor, sales representative, or Sysgration's customer service center. Please have the following information ready before calling:

- Product name and serial number
- Description of your peripheral attachments
- Description of your software (operating system, version, application software, etc.)
- A complete description of the problem
- The exact wording of any error messages

## Contact information

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TEL: +886-2-2790-0088

## Safety Instructions

1. Read these safety instructions carefully.
2. Retain this user manual for future reference.
3. Disconnect the equipment from all AC outlets before cleaning. Use only a damp cloth for cleaning; do not use liquid or spray detergents.
4. For pluggable equipment, ensure the power outlet socket is located near the equipment and easily accessible.
5. Protect the equipment from humidity.
6. Place the equipment on a stable surface during installation. Dropping or allowing the equipment to fall may cause damage.
7. The openings of the enclosure are for air convection. Protect the equipment from overheating by not covering the openings.
8. Verify that the voltage is correct before connecting the equipment to a power outlet.
9. Position the power cord away from high-traffic areas and avoid placing anything over it.
10. Note all cautions and warnings on the equipment.
11. If the equipment will not be used for an extended period, disconnect it from the power source to prevent damage from transient overvoltage.
12. Never pour liquid into any opening, as this may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should only be opened by qualified service personnel.
14. Have the equipment checked by authorized service personnel if any of the following occur:
  - The power cord or plug is damaged.
  - Liquid has penetrated the equipment.
  - The equipment has been exposed to moisture.
  - The equipment is malfunctioning or does not operate according to the user manual.
  - The equipment has been dropped or damaged.
  - The equipment shows obvious signs of breakage.

15. Do not store the equipment in environments where temperatures fluctuate below  $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ) or above  $80^{\circ}\text{C}$  ( $176^{\circ}\text{F}$ ), as this may cause damage. Store the equipment in a controlled environment.



**Warning**

Because of the risk of electric shock, do not remove the equipment cover during operation or when connected to a power outlet.



**Caution!**

To avoid short circuits and otherwise damaging the device, do not allow fluids to come in contact with the device. If fluids are accidentally spilled on the equipment, remove the affected unit from service as soon as possible and contact service personnel to verify that personal safety is not compromised.

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# 1 General Information

## 1.1 Introduction

The AIX-600 is an intelligent edge computing terminal developed based on Qualcomm's QCS6490 platform, using an octa-core high-performance processor (1+3+4 architecture) with a large core frequency of up to 2.7 GHz. It integrates a high-performance graphics engine and an AI engine with a comprehensive computing power of about 12 TOPS, and supports 5G NR sub-6G, Wi-Fi 6e (2.4 GHz/5 GHz/6 GHz), BT5.2/BLE, GNSS (Optional, 5G version), and other wireless communication technologies (the 5G version and the Wi-Fi version are slightly different). The AIX-600 edge computing terminal has a rich set of industrial interfaces, including USB 3.0, USB 2.0, USB-C, HDMI, Audio, Ethernet RJ45, and buttons, making it suitable for use in industrial control, smart manufacturing, security monitoring, intelligent robots, digital multimedia, and other fields.

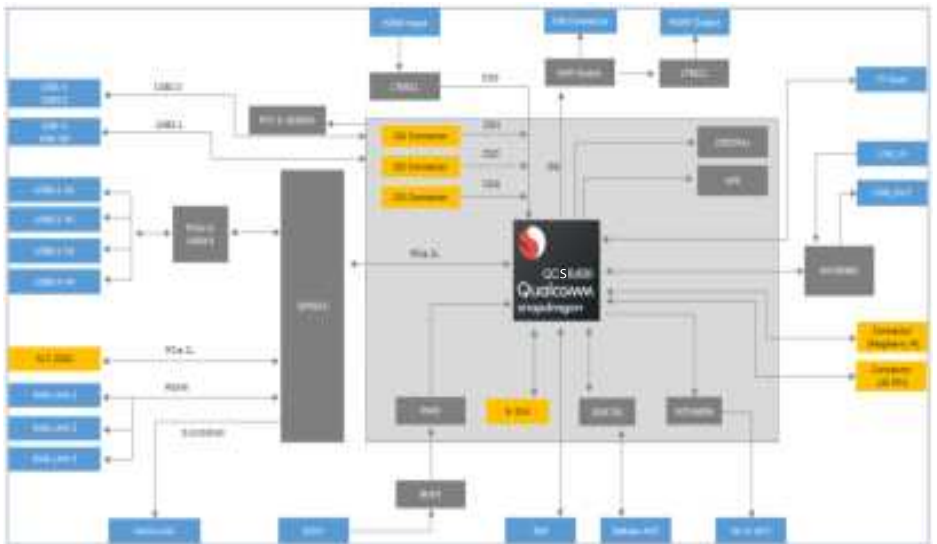
The AIX-600 is based on the QCS6490 SoC and supports multiple operating systems, including Android, Linux, Ubuntu, and Windows IoT. For details on operating system support, please consult the local official sales channel.

## 1.2 Specifications

Function	Description
CPU Processor	Qualcomm QCS6490 Kryo™ CPU 6xx , Octa-core, 1 x A78 @ 2.7GHz 3 x A78 @ 2.4GHz 4 x A55 @1.9 GHz
GPU	Adreno 642
Operating system	Ubuntu/ Android/ Linux/ Windows IOT*
SIM Card	4FF(Reserved, 5G Version)
Audio	Line in, 3.5mm Line out, 3.5mm
SD Card	Support (up to 2TB capacity)
External SSD	M.2 M-Key Port, Support WiFi Version
5G	M.2 B-Key Port, Support 5G Version. The M-Key and B-Key can't exist at the same time currently.
RTC	Support RTC, recommend 120mAh@3V, CR1632X

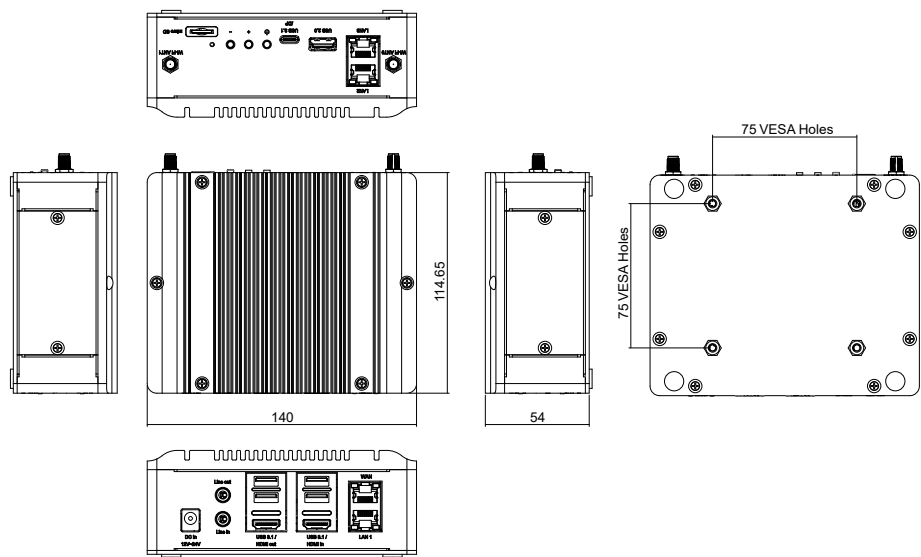
MIPI-DSI interface	Onboard connector, compatible with Raspberry Pi DSI 4 lane interface, support TP (verified Raspberry Pi 7 inch)
40 PIN GPIO interface 1	Onboard connector, compatible Raspberry Pi interface, typical 3.3V voltage, refer to below table 2.2.2
40 PIN GPIO interface 2	Refer to below table 2.2.3
Storage	RAM: LPDDR4x/5, 8GB ROM: UFS, 128GB
Power supply	DC12V, wide voltage input, recommend PSU typical 12V@5A
Wireless connection	Wi-Fi: 802.11ax, 2.4G/5G /6G DBS, 2*2 MIMO BT: Android 5.3, Linux 5.2, Ubuntu 5.2
Terminal dimension	140 x 115 x 54 mm
Work Temperature	-20 °C ~ 60 °C

### 1.3 System Block Diagram





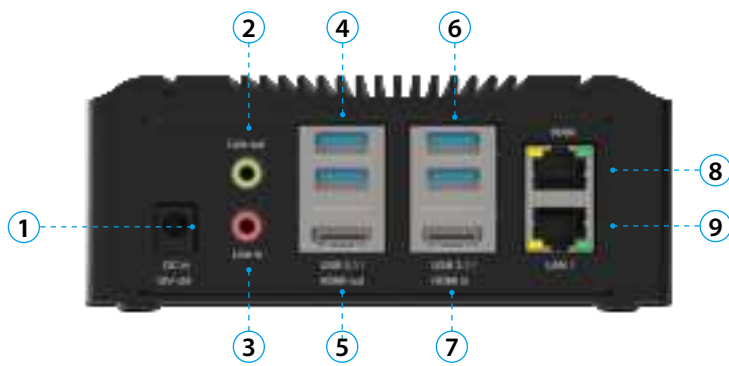
# 1.4 Dimension

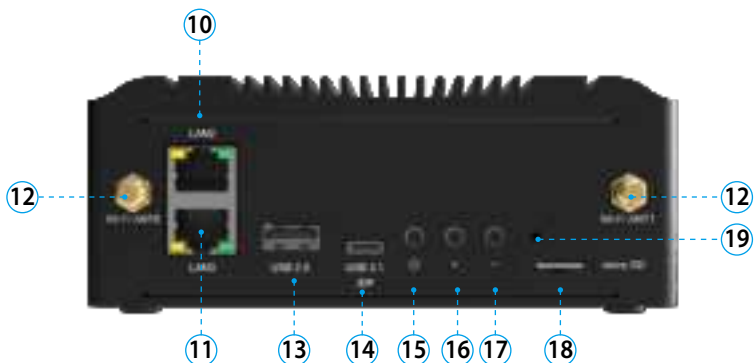


# 2 Interface Introduction

We provide the AIX-600 tailored to specific application scenarios and testing requirements. The board includes several reserved interfaces, such as MIPI DSI, MIPI CSI, GPIO, fan, and debugging interfaces.

## 2.1 Terminal External Interface



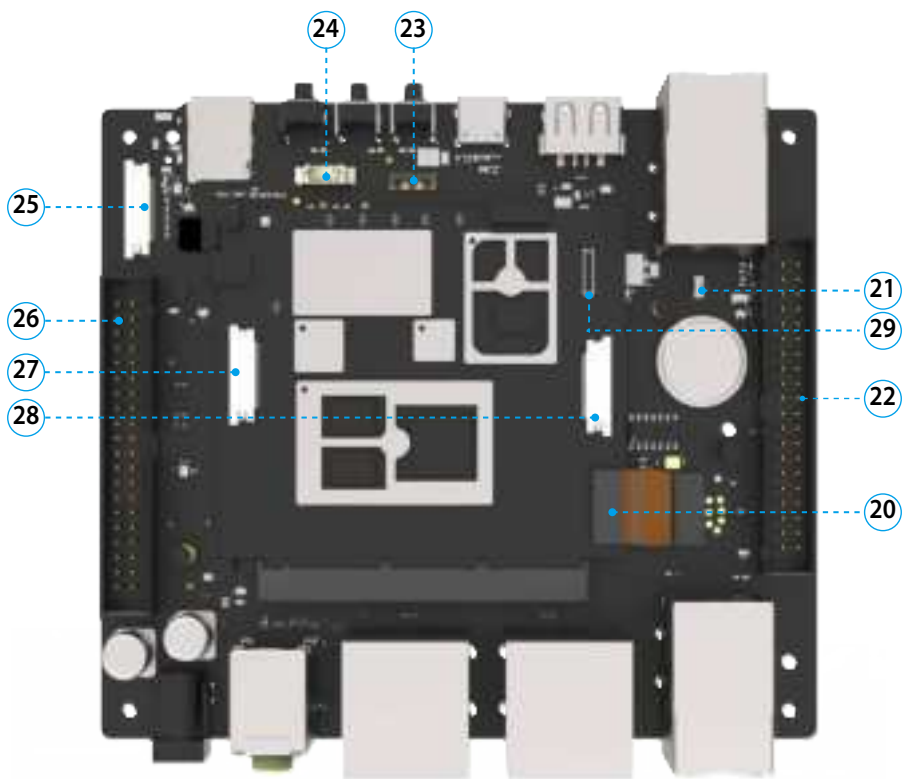


### 2.1.1 External Interface

Interface No	Signal Definition	Function Description
1	DC_IN	Equipment power input, voltage range: DC12V, typical value 12V@5A
2	LINE OUT	Audio Output
3	LINE IN	Audio Input
4	USB3.0	USB 3.0 interface, 5V/0.9A
5	HDMI_OUT	HDMI 1.4 signal output, resolution/frame rate: 1080p/60fps*
6	USB3.0	USB 3.0 interface, 5V/0.9A
7	HDMI_IN	HDMI 1.4 signal input, resolution/frame rate: 720p/30fps
8	WAN	RJ45 Ethernet port(User can configure as LAN)
9	LAN	RJ45 Ethernet port
10	LAN	RJ45 Ethernet port
11	LAN	RJ45 Ethernet port
12	WIFI/BT RF	2 Wi-Fi/BT antenna interfaces
13	USB2.0	USB2.0 Interface
14	USB Type-C	USB 3.1, 5V/0.9A, support DP (max resolution: 3840*2160 at 60Hz)
15	POWER	Power button; The device is powered on automatically when plug-in the DC power.
16	Volume +	Volume up key
17	Volume -	Volume down key
18	Micro SD	Micro SD card slot
19	Power LED	On/Off indicator

\* DSI and HDMI-out are mutually exclusive, with HDMI-out having higher priority. To use the 7-inch LCD screen, remove HDMI-out before powering on.

2.2 Inside Onboard Interface



## 2.2.1 Inside onboard interface

Interface No	Signal Definition	Function Description
20	B2B Connector	B2B connector 50PIN internal GPIO port connection.
21	RTC connector	Real-time-clock for system, recommend 120mAh@3.0V
22	Qualcomm 40PIN	Qualcomm 40PIN universal interface (including UART, CAN, I2S and other interfaces). See Table 2.2.3 below for details.
23	Force boot	Forced download port (used in emergencies).
24	Fan	Fan interface, see table 2.2.5 below for details.
25	LCD connector	Connect display screen. See Table 2.2.4 below for details.
26	Raspberry 40PIN	Raspberry Pi display 40PIN functional interface (including GPIO, UART and other interfaces). See Table 2.2.2 below for details.
27	Raspberry Camera Connector 22PIN	Raspberry Pi Camera connector, connect to Camera, see Table 2.2.4 below for details.
28	Raspberry Camera Connector 22PIN	Raspberry Pi Camera connector, connect to Camera, see Table 2.2.4 below for details.
29	Camera connector	30pin C-PHY interface, see below table 2.2.6

## 2.2.2 Raspberry PI 40PIN interface signals

PIN	Signal Definition	Function Description (All GPIO signals of the interfaces are 3.3V)
1	3V3	3.3V Power
2	5V	5 V Power
3	GPIO00	Can be configured as I2C needs to be combined with GPIO1 or ordinary GPIO
4	5V	5 V Power
5	GPIO01	Can be configured as I2C needs to be combined with GPIO00 or ordinary GPIO
6	GND	Ground
7	GPIO76	Normal GPIO or PWM (GCC_GP1_CLK_MIRB)
8	UART_TX	Can be configured as QUP0_SE3 UART or ordinary GPIO14

9	GND	Ground
10	UART_RX	Can be configured as QUP0_SE3 UART or ordinary GPIO 15
11	GPIO129	Ordinary GPIO
12	I2S0_SCK	I2S0 Interface , It can also be configured as a normal GPIO
13	GPIO62	Can be configured as QUP1_SE7 UART or Normal GPIO
14	GND	Ground
15	GPIO63	Ordinary GPIO
16	GPIO35	Ordinary GPIO
17	3V3	3.3V Power
18	GPIO41	Can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO
19	QUP1_SE4_SPI_MOSI	QUP1_SE4, can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO
20	GND	Ground
21	QUP1_SE4_SPI_MISO	QUP1_SE4, can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO
22	GPIO54	1. Ordinary GPIO. If DSI TP is not used, it can be configured as UART (needs to be combined with GPIO55); 2. QUP1_SE4_SPI CS2
23	QUP1_SE4_SPI_SCLK	QUP1_SE4, can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO
24	QUP1_SE4_SPI_CS0	QUP1_SE4, can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO
25	GND	Ground
26	GPIO55	1. Ordinary GPIO, if DSI TP is not used, it can be configured as UART (needs to be combined with GPIO54) 2. QUP1_SE4_SPI CS1
27	ID_SD	QUP0_SE2_I2C is reserved and can be configured as ordinary GPIO
28	ID_SC	QUP0_SE2_I2C is reserved and can be configured as ordinary GPIO

29	GPIO34	Common GPIO
30	GND	Ground
31	GPIO42	Ordinary GPIO
32	GPIO77	Ordinary GPIO, GCC_GP2_CLK_MIRB
33	GPIO78	Ordinary GPIO, GCC_GP3_CLK_MIRB
34	GND	Ground
35	I2S0_WS	I2S0 Interface, Can be configured as ordinary GPIO
36	GPIO43	Ordinary GPIO
37	GPIO40	Ordinary GPIO
38	I2S0_DATA0	I2S0 Interface, Can be configured as ordinary GPIO
39	GND	Ground
40	I2S0_DATA1	I2S0 Interface, Can be configured as ordinary GPIO

### 2.2.3 Qualcomm 40PIN Interface

PIN	Signal Definition	Function Description (All GPIO signals of the interfaces are 3.3V)
1	GPIO36	QUP1_SE1 can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO. GPIO36/GPIO37 is compatible with RTC INT1/INT2 currently. When the RTC function is not needed, adjust R1821-R1822/R1823-R1834 to restore the full-featured QUP
2	1V8	The 1.8V power supply is used for external power supply. It is only recommended to be used as a pull-up power supply for the IO port.
3	GPIO37	QUP1_SE1 can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO. GPIO36/GPIO37 is compatible with RTC INT1/INT2 currently. When the RTC function is not needed, adjust R1821-R1822/R1823-R1834 to restore the full-featured QUP
4	GND	Ground
5	GPIO38	QUP1_SE1 can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO. GPIO36/GPIO37 is compatible with RTC INT1/INT2 currently. When the RTC function is not needed, adjust R1821-R1822/R1823-R1834 to restore the full-featured QUP
6	LPI_I2S1_CLK	LPI I2S AUDIO INTERFACE 1, Can also be configured as DMIC1 Interface

7	GPIO39	QUP1_SE1 can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO. GPIO36/GPIO37 is compatible with RTC INT1/INT2 currently. When the RTC function is not needed, adjust R1821-R1822/ R1823-R1834 to restore the full-featured QUP
8	LPI_I2S1_WS	LPI I2S AUDIO INTERFACE 1, Can also be configured as DMIC1 Interface
9	GND	Ground
10	LPI_I2S1_DATA0	LPI I2S AUDIO INTERFACE 1, Can also be configured as DMIC2 Interface
11	GPIO56	QUP1_SE6, can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO
12	LPI_I2S1_DATA1	LPI I2S AUDIO INTERFACE 1, can also be configured as DMIC2 Interface
13	GPIO57	QUP1_SE6, can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO
14	GND	Ground
15	GPIO58	QUP1_SE6, can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO
16	VREG_L8C	L8C sensor 1V8 Power, MAX 15mA
17	GPIO59	QUP1_SE6, can be configured as SPI or UART+GPIO (when full-featured UART is not required) or I2C+GPIO or GPIO
18	LPI_I2C2_SCL	LPI_I2C2 for Sensor
19	LPI_I2C0_SCL	LPI_I2C0 for Sensor
20	LPI_I2C2_SDA	LPI_I2C2 for Sensor
21	LPI_I2C0_SDA	LPI_I2C0 for Sensor
22	LPI_I2C1_SCL	LPI_I2C1 for sensor
23	PMU7250B_GPIO11	PMU7250B GPIO LV is reserved for controlling the power supply of QCA8337, and the external output can be disconnected through the R1820 resistor.
24	LPI_I2C1_SDA	LPI_I2C1 for sensor
25	PMU7250B_GPIO12	PMU7250B GPIO LV
26	LPI_GPIO155	LPI_GPIO155 can be configured as LPI_I2S2

27	DEBUG_UART_TX	Can be configured as an ordinary GPIO, used as a debug serial port by default, or as an ordinary serial port.
28	VOUT_5V	5V power supply is output externally, and the current should not exceed 500mm.
29	DEBUG_UART_RX	Can be configured as an ordinary GPIO, used as a debug serial port by default, or as an ordinary serial port.
30	LPI_GPIO154	LPI_GPIO154 can be configured as LPI_I2S2
31	LPI_DMIC3_CLK	DMIC3 INTERFACE
32	PM7325_ADC_AMUX1_GPIO02	ADC IN_PUT channel 1
33	LPI_DMIC3_DATA	DMIC3 INTERFACE can be configured as LPI_I2S2
34	GND	Ground
35	GND	Ground
36	PM7325_ADC_AMUX1_GPIO02	ADC IN_PUT channel 2
37	CAN_L	CAN bus interface
38	GND	Ground
39	CAN_H	CAN bus interface
40	PWM_OUT	PWM output, reserved for fans currently



## 2.2.4 CSI interface (Raspberry D-PHY)

PIN	Signal Definition	Function Description (All GPIO signals of the interfaces are 3.3V)
1	GND	Ground
2	CAM1_D0_N	MIPI DATA LAN0 N
3	CAM1_D0_P	MIPI DATA LAN0 P
4	GND	Ground
5	CAM1_D1_N	MIPI DATA LAN1 N
6	CAM1_D1_P	MIPI DATA LAN1 P
7	GND	Ground
8	CAM1_CLK_N	MIPI CLK N
9	CAM1_CLK_P	MIPI CLK P
10	GND	Ground
11	CAM1_D2_N	MIPI DATA LAN2 N
12	CAM1_D2_P	MIPI DATA LAN2 P
13	GND	Ground
14	CAM1_D3_N	MIPI DATA LAN3 N
15	CAM1_D3_P	MIPI DATA LAN3 P
16	GND	Ground
17	CAM_GPIO	Camera Power On
18	CAM_LED EN	LED EN
19	GND	Ground
20	SCL0	Camera I2C SCL0
21	SDA0	Camera I2C SDA0
22	+3.3V	Power 3.3V

## 2.2.5 Fan Interface

PIN	Signal Definition	Function Description
1	5V	Power 5V
2	PWM INPUT	PWM signal
3	/	/
4	GND	Ground

## 2.2.6 C-PHY interface

PIN	Signal Definition	PIN	
1	DGND	16	AFVDD-2V8
2	CS1_C2	17	CCI_SCL
3	CS1_B2	18	CCI_SDA
4	CS1_A2	19	CAM_RST
5	DGND	20	PWDN
6	CS1_C1	21	AGND
7	CS1_B1	22	DVDD_1V1
8	CS1_A1	23	VSYNC
9	DGND	24	AGND
10	CS1_C0	25	AVDD-2V9
11	CS1_B0	26	DOVDD_1V8
12	CS1_A0	27	DGND
13	DGND	28	DVDD_1V1
14	DGND	29	DVDD_1V1
15	MCLK	30	DGND

## 2.2.7 Status Light

LED	Status	Color	Frequency
Power	Power-on	Red	Always on
	Standby	Green	Always on

### 3 RF parameters

AIX-600 product supports Wi-Fi only version and 5G+Wi-Fi version. Different versions have different antenna configurations.

#### 3.1 WIFI radio frequency parameters

Parameter	Characteristic
Antenna type	External SMA antenna, 2
Impedance	50Ω
Frequency Range	2.4GHz 802.11b/g/n/ax(20M): 2412-2472MHz 802.11n/ax(40M): 2422-2462MHz  5GHz 802.11a/n/ac/ax(20M): 5180-5825MHz 802.11n/ac/ax(40M): 5190-5795MHz 802.11ac/ax(80M): 5210-5775MHz 802.11ax(160M): 5250-5570MHz  6GHz 802.11ax(20M): 5955-7115MHz 802.11ax(40M): 5965-7085MHz 802.11ax(80M): 5985-7025MHz 802.11ax(160M): 6025-6985MHz
Modulation Way	BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM
Frequency Interval	5 MHz

## 4 Electrical and Environmental Parameters

### 4.1 Electrical and Environmental parameters

Parameter	Minimum value	Typical value	Maximum value	Unit
Power input	10.2	12	13.8	V
working temperature	-20	25	60	°C
Storage temperature	-40	25	80	°C
Working environment humidity	20	40	90	%

## 5 Power Dissipation

Parameter	Power (W, Max.)	Remark
PSU	60	12V/5A
System Input	18	QCS6490 Module
USB3.0 x 4	18	5V, 900mA
USB2.0 x 1	4.5	5V, 900mA
5G Module*	10	FM160 Module
SSD	5.8	Read
	5.6	Write

\* 5G module/SSD are in either different SKU

# 6 Device Firmware Flashing Procedure Using Qualcomm QFIL Tool

## 6.1 Connecting and Setting Up Your Interface

1. Plug in the HDMI Cable: Connect an HDMI cable between the monitor and interface 5 (HDMI\_OUT).
2. Power On: Press the Power On button for 3 seconds until a green LED light flashes. Ensure that you plug in the HDMI cable before powering on the device.
3. Verify Display: You should see the image on the monitor. Once the HDMI output display is normal, you can unplug and reinsert the HDMI cable, and it should still display correctly.
4. Connect Peripherals: Connect the mouse and keyboard to ports 4 or 6 (USB 3.0). The following icon “Weston-terminal” should appear on the screen.
5. Access the Command Line Interface: Click on the Weston-terminal icon in the upper left corner of the screen to open the command line interface.
6. Enter Commands: Use the command line interface to enter commands and access the system.
7. Additional Connectivity: You can also connect port 14 (USB Type-C) to your PC using a USB cable. If your PC has an ADB environment installed, you can enter commands on your PC to access the system.



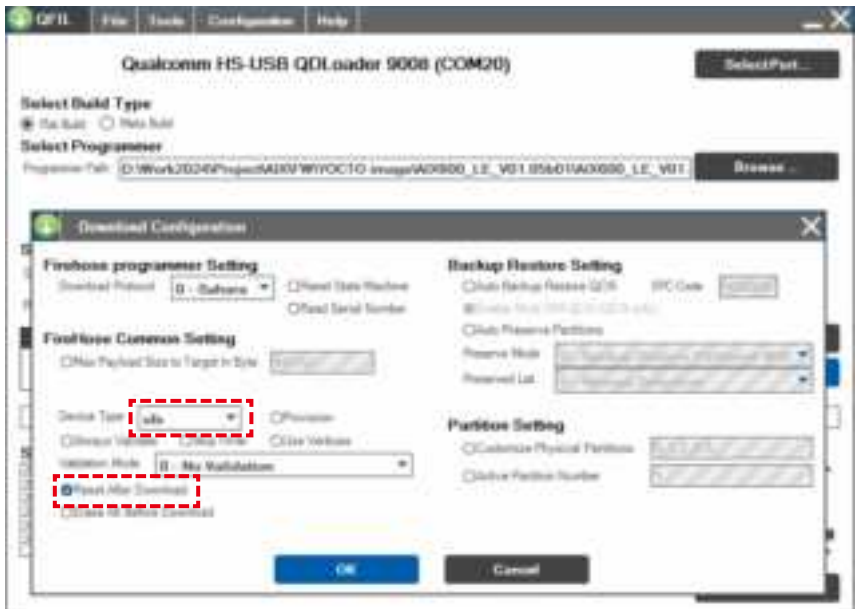


## Note

Download the QFIL Tool to assist in flashing or installing firmware on devices powered by Qualcomm chipsets. The tool can be downloaded here:

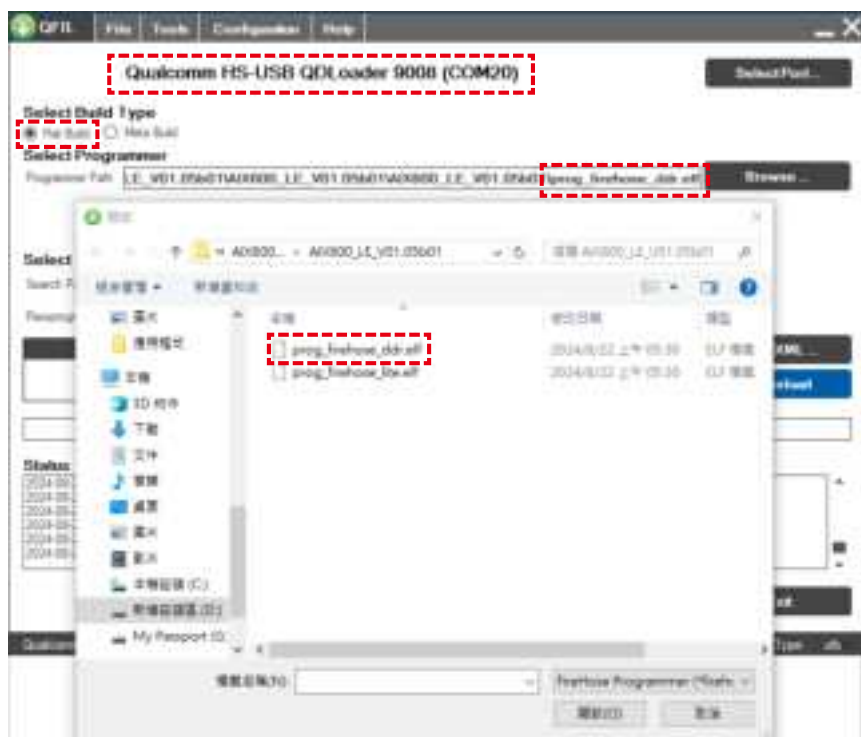
[https://qfiltool.com/#google\\_vignette](https://qfiltool.com/#google_vignette)

1. Power On and Connect: Power on the device and connect it to the computer using the USB Type-C port.
2. Open Qualcomm QFIL Tool: Launch the Qualcomm QFIL tool, go to the download configuration interface, and select the appropriate configuration settings.



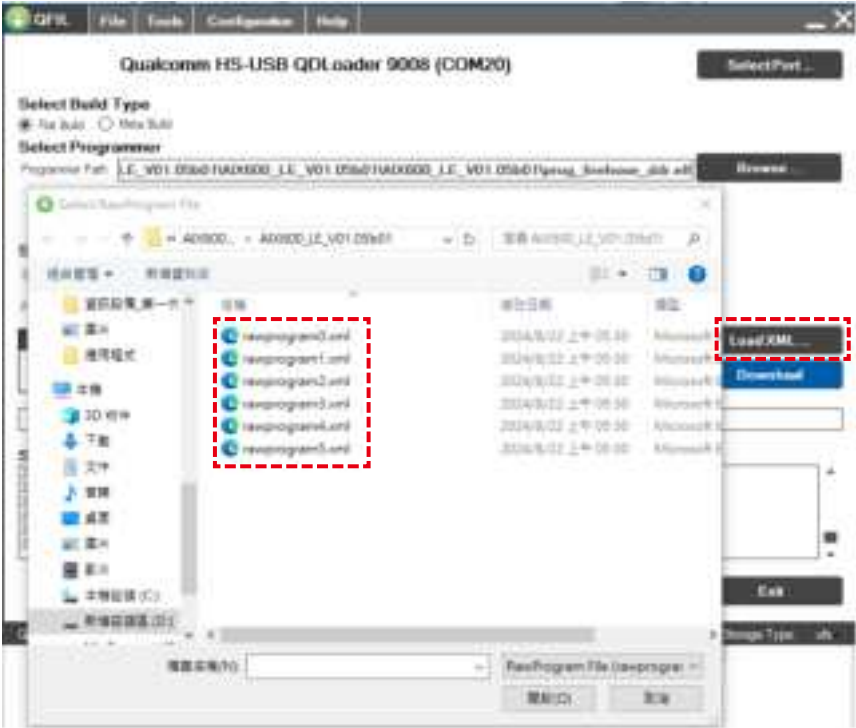


4. Select Flat Build Option: Choose the “Flat Build” option and then select the prog\_firehostedr.elf file from the version directory.

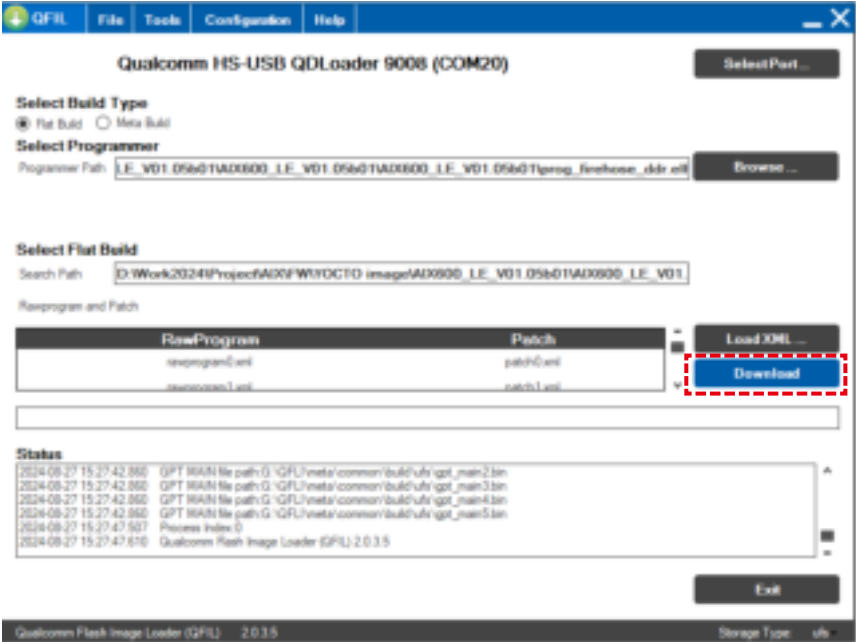




5. Load XML File: Click the “Load XML” button to load the XML file. Select “All” twice, as depicted in the image below.



6. Start Download: Click the “Download” button to begin the flashing process. Once you receive a success message, you can exit the tool.



Make sure to follow the steps in the order provided for successful firmware flashing.

## Contact information

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