SYSGRATION®

User Manual
Edge AI Box

AIX-800
Qualcomm® QCS-8550

Edition 1
Last Update 29 September 2024

Copyright Notice

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-800 Edge AI Box, check that the following materials have been included in the shipment:

- AIX-800 unit
- Accessories for AIX-800
  - 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

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°C (-40°F) or above 80°C (176°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.

Content

1 General Information

1.1 Introduction

AIX-800 is an intelligent edge computing terminal developed based on Qualcomm's QCS8550 platform, using an octa-core high-performance processor (1+3+4 architecture) with a large core frequency of up to 3.2GHz. It integrates a high-performance graphics engine and an AI engine with a comprehensive computing power of about 48 TOPS, and supports 5G NR sub-6G, Wi-Fi 7 (2.4G/5G/6GHz), BT5.3/BLE, GNSS (Optional, 5G version) and other wireless communication technologies (the 5G version and the Wi-Fi version are slightly different). AIX-800 edge computing terminal has a rich of industrial interfaces, including USB3.0, USB-C, HDMI, Audio, Ethernet RJ45, buttons, etc., which could be widely used in industrial control, smart manufacturing, security monitoring, intelligent robots, digital multimedia and other fields.

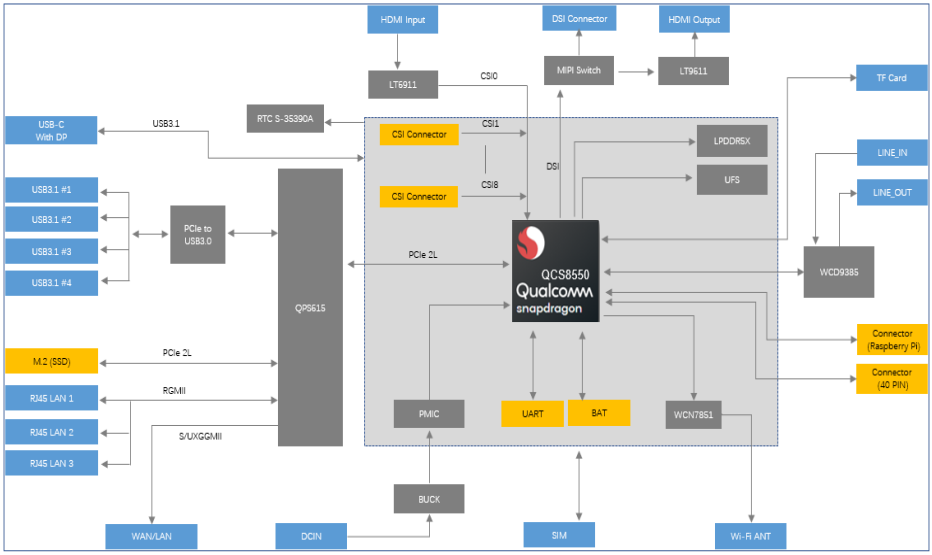
The AIX-800 is based on QCS8550 SoC and supports multiple operating systems, including Android, Linux. For different operating system support, please consult the local official sales channel.

1.2 Specifications

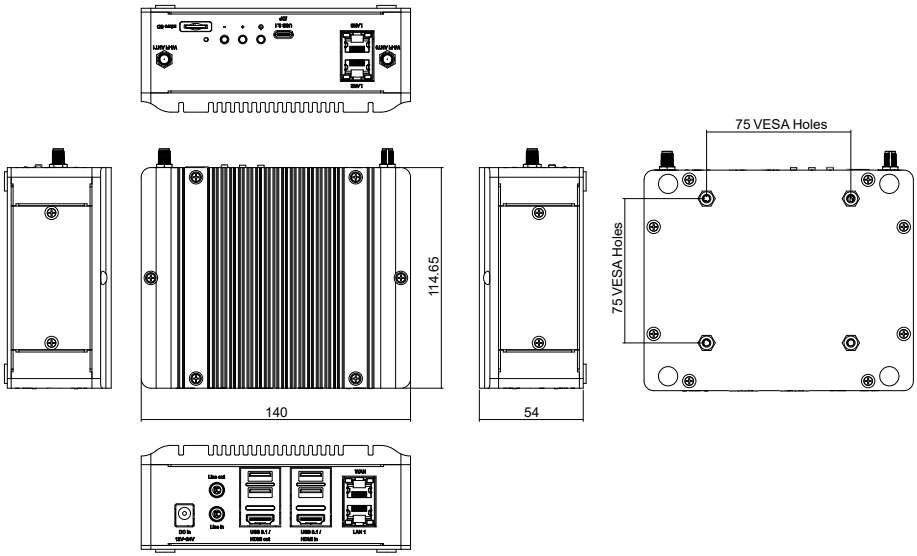
Function	Description
CPU Processor	Qualcomm QCS8550 (5G module FM160 optional for 5G + Wi-Fi version) Octa-core Qualcomm® Kryo™ 64-bit CPU 1 x Kryo Gold (3.2GHz) 4 x Kryo Gold (2.8GHz) 3 x Kryo Silver (2.0GHz)
GPU	Adreno 740
Operating system	Android/ Linux
SIM Card	4FF(Reserved, 5G Version)
Audio	Line in, 3.5mm Line out, 3.5mm
SD Card	Support (up to 2TB capacity)
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: LPDDR5x, 16GB ROM: UFS, 128GB
Power supply	DC12V, wide voltage input, recommend PSU typical 12V@5A
Wireless connection	Wi-Fi7: 802.11be, 2.4G/5G/6G HZ DBS, 2*2 MIMO BT: Android 5.3, Linux 5.2
Terminal dimension	140 x 115 x 54 mm
Work Temperature	-20 °C ~60 °C

1.3 System Block Diagram



1.4 Dimension

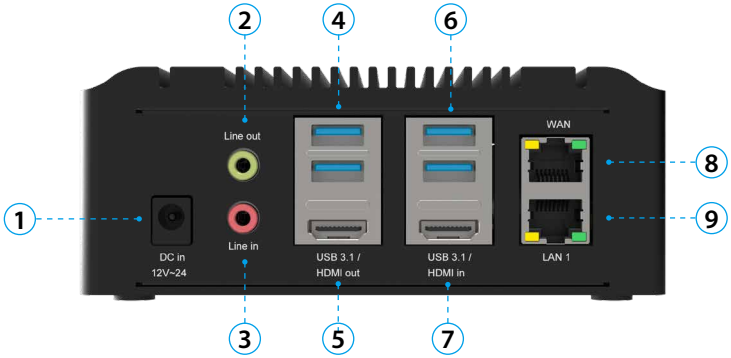


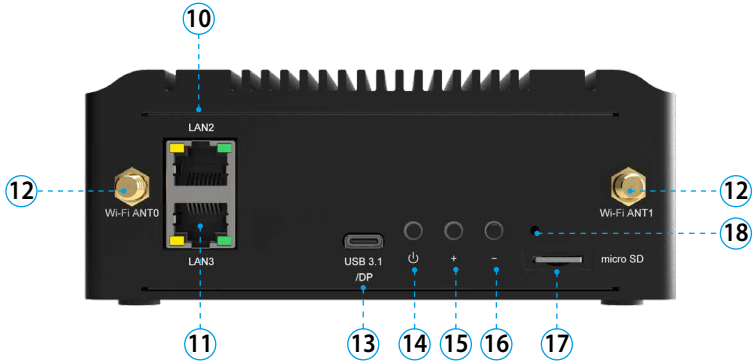
2 Interface Introduction

We provide the AIX-800 tailored to specific application scenarios and testing requirements. Some interfaces are reserved on board inside, including MIPI DSI, MIPI CSI, GPIO, Fan and Debugging interfaces.

2.1 Terminal External Interface

2.1.1 External Interface

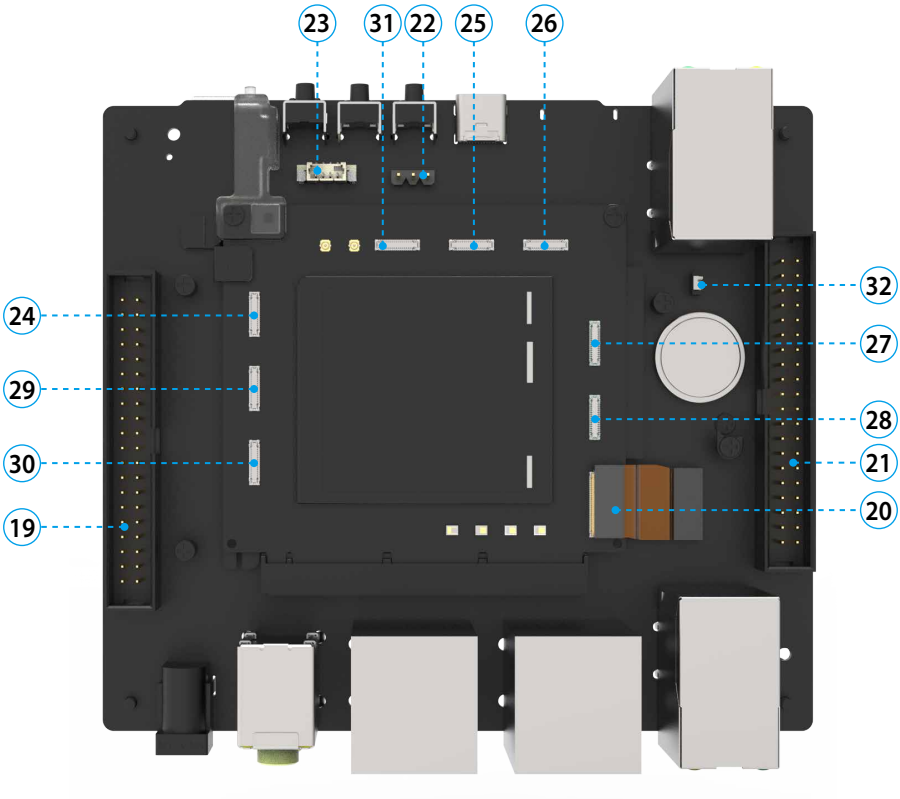




Interface No	Signal Definition	Function Description
1	DC_IN	Equipment power input, voltage range: 12V~24V, typical value 12V@5A
2	LINE OUT	Audio Output
3	LINE IN	Audio Input
4	USB3.0	USB3.0 interface, 5V/0.9A
5	HDMI_OUT	HDMI 1.4 signal output, resolution/frame rate max: 1080p/60fps*
6	USB3.0	USB3.0 interface, 5V/0.9A
7	HDMI_IN	HDMI 1.4 signal input, resolution/frame rate max: 720p/30fps
8	WAN	RJ45 Ethernet port (Users can configure as Lan)
9	LAN	RJ45 Ethernet port
10	LAN	RJ45 Ethernet port
11	LAN	RJ45 Ethernet port
12	WIFI RF	2 Wi-Fi antenna interfaces
13	USB Type-C	USB 3.1, 5V/0.9A, support DP (max resolution: 3840*2160 at 60Hz)
14	POWER	Power button; The device is powered on automatically when plug-in the DC power.
15	Volume +	Volume up key
16	Volume -	Volume down key
17	Micro SD	Micro SD card slot
18	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
19	Raspberry 40PIN	Raspberry Pi 40PIN functional interface (including GPIO, UART and other interfaces). See Table 2.2.2 below for details.
20	B2B Connector	B2B connector 50PIN internal GPIO port connection.
21	Qualcomm 40PIN	Qualcomm 40PIN universal interface (including UART, CAN, I2S and other interfaces). See Table 2.2.3 below for details.
22	Force boot	Forced download port (used in emergencies).
23	Fan	Fan interface, see table 2.2.8 below for details.
24/25/26	Camera Connector	C-PHY,see Table 2.2.5 below for details.
27/29/30/31	Camera connector	D-PHY,see Table 2.2.6 below for details.
28	LCD Connector	Connect display screen. See Table 2.2.4 below for details.
32	RTC Connector	Real-time-clock for system, recommend 120mAh@3.0V

2.2.2 Raspberry PI 40PIN interface signals (All GPIO signals of the interfaces are 3.3V)

PIN	Signal Definition	Pull	I^2C	SPI	UART	I2S	INT.
1	3V3						
2	5V						
3	GPIO28	PD	I^2C1_SDA				Y
4	5V						
5	GPIO29	PD	I^2C1_SCL				
6	GND						
7	GPIO00	PD	CCI_ I^2C_ SDA				Y
8	GPIO12	PD					Y
9	GND						
10	GPIO01	PD	CCI_ I^2C_SCL				
11	GPIO05						

12	GPIO175					LPI_I²S2_SCK	
13	GPIO40	PD	I²C4_SDA				Y
14	GND						
15	GPIO41	PD	I²C4_SCL				
16	GPIO47	PD			UART3_RX		Y
17	3V3						
18	GPIO61	PD	I²C5_SCL	SPI2_MOSI			
19	GPIO65	PD	I²C6_SCL	SPI3_MOSI			
20	GND						
21	GPIO64	PD	I²C6_SDA	SPI3_MOSO			
22	GPIO118	PD					
23	GPIO66	PD		SPI3_CLK	UART5_TX		
24	GPIO67	PD		SPI3_CS0	UART5_RX		
25	GND						
26	GPIO22	PD					
27	GPIO32	PD	I²C2_SDA				Y
28	GPIO33	PD	I²C2_SCL				
29	GPIO46	PD			UART3_TX		Y
30	GND						
31	GPIO62	PD		SPI2_CLK	UART4_TX		Y
32	GPIO91	PD					
33	GPIO124	PD					
34	GND						
35	GPIO176	PD				LPI_I²S2_WS	Y
36	GPIO63	PD		SPI2_CS0	UART4_RX		Y
37	GPIO60	PD	I²C5_SDA	SPI2_MISO			Y
38	GPIO180	PD				LPI_I²S2_DATA0	
39	GND						
40	GPIO181	PD				LPI_I²S2_DATA1	Y

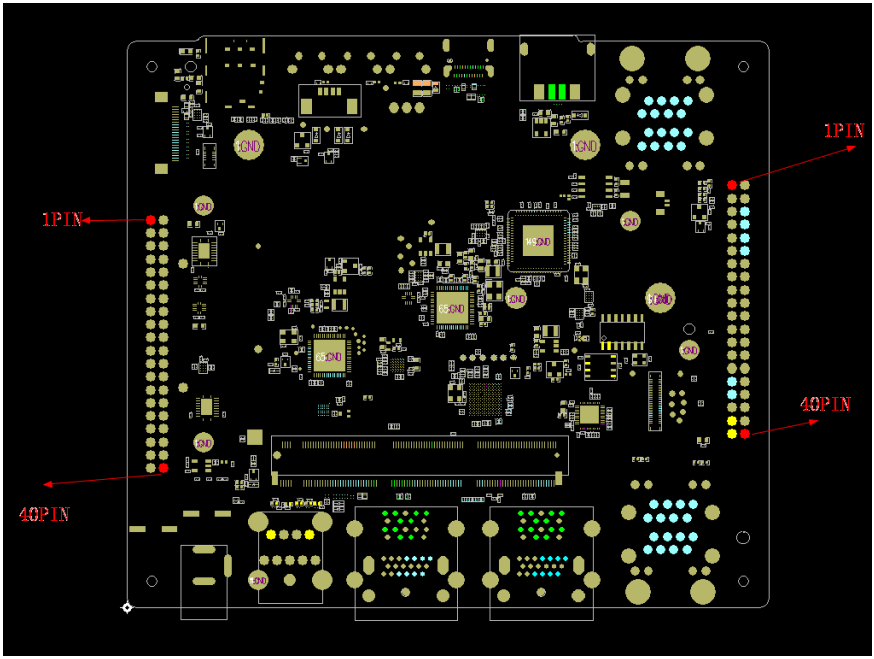
2.2.3 Qualcomm 40PIN Interface (All GPIO signals of the interfaces are 1.8V)

PIN	Signal Definition	PD	I²C	SPI	UART	DMIC	I²S	INT.
1	GPIO68	PD	I²C7_SDA	SPI4_ MISO				
2	1V8							
3	GPIO69	PD	I²C7_SCL	SPI4_ MISI				
4	GND							
5	GPIO70	PD		SPI4_ CLK	UART6_ TX			
6	GPIO171	PD				LPI_ DMIC_ CLK	LPI_ I²S1_ CLK	Y
7	GPIO71	PD		SPI4_ CS0	UART6_ RX			Y
8	GPIO_172	PD				LPI_ DMIC_ DATA	LPI_ I²S1_ WS	Y
9	GND							
10	GPIO173	PD				LPI_ DMIC2_ CLK	LPI_ I²S1_ DATA0	
11	GPIO36	PD	I²C3_SDA	SPI1_ MISO				
12	GPIO174	PD				LPI_ DMIC2_ DATA	LPI_ I²S1_ DATA1	Y
13	GPIO57	PD	I²C3_SCL	SPI1_ MISI				
14	GND							
15	GPIO38	PD		SPI1_ CLK	UART2_ TX			
16	VREG_ L8C	SENSOR 600mA						
17	GPIO39			SPI1_ CS0	UART2_ RX			Y
18	GPIO189	PD	SENSOR_ I³C_SCL					
19	GPIO190	PD	MAG_ ALPS_ I²C_SCL					Y
20	GPIO188	PD	SENSOR_ I³C_SDA					Y

21	GPIO191	PD	MAG_ ALPS_ I²C _SDA					Y
22	GPIO196	PD	SENSOR_ I²C_SDA					Y
23	GPIO06	PD						
24	GPIO197	PD	SENSOR_ I²C_SCL					Y
25	SYS_ THERM4	ADC						
26	GPIO183	PD				LPI_ DMIC4_ DATA	LPI_ I²S3_ DATA1	
27	GPIO26	PD			DEBUG_ UART_ TX			Y
28	VOUT_5V	500mA						
29	GPIO27	PD			DEBUG_ UART_ RX			Y
30	GPIO182	PD				LPI_ DMIC4_ CLK	LPI_ I²S3_ DATA0	
31	GPIO177	PD				LPI_ DMIC3_ CLK	LPI_ I²S3_ SCK	Y
32	AMUX_4	ADC						
33	GPIO178	PD				LPI_ DMIC3_ DATA	LPI_ I²S3_ WS	
34	GND							
35	GND							
36	AMUX_2	ADC						
37	CAN_L							
38	GND							
39	CAN_H							
40	PWM_ OUT	PWM						

Note

Instructions for the first pin of the 40 pins connector, refer to the following diagram.



2.2.4 DSI interface

PIN	Signal Definition	Function Description
1	LED_K	The backlight is positive
2	LED_K	The backlight is positive
3	LED_A	The backlight is Negative
4	CABC	Backlight brightness control (reserved)
5	LCM_AVDD	Bias the positive electrode
6	LCM_AVEE	Bias negative electrode
7	MDP_VSYNC_P	Sync signal (reserved)
8	DSI0_RESET_0	Reset, low effective
9	LCD_ID	ID
10	S_RESET_N	The Reset of TP is low valid
11	TS_INT_N	Interruption of TP
12	TS_SPI_MOSI_I2C_SCL	I2C_SCL of TP
13	TS_SPI_MISO_I2C_SDA	I2C_SDA of TP
14	VREG_L12B_1PB	IO power supply for LCD
15	VREG_L14B_3P2	TP power input

16	GND	Ground
17	DSI0_A0_LN0_P	DSI data signal
18	DSI0_B0_LN0_M	DSI data signal
19	GND	Ground
20	DSI0_C0_LN1_P	DSI data signal
21	DSI0_A1_LN1_M	DSI data signal
22	GND	Ground
23	DSI0_C1_CLK_M	DSI clock signal
24	DSI0_B1_CLK_P	DSI clock signal
25	GND	Ground
26	DSI0_NC_LN3_M	DSI data signal
27	DSI0_C2_LN3_P	DSI data signal
28	GND	Ground
29	DSI0_B2_LN2_M	DSI data signal
30	DSI0_A2_LN2_P	DSI data signal

2.2.5 C-PHY interface

PIN	Signal Definition	PIN	Signal Definition
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

2.2.6 D-PHY interface

PIN	Signal Definition	PIN	Signal Definition
1	MCLK	16	DGND
2	DGND	17	NC
3	DATA3_P	18	NC
4	DATA3_N	19	DGND
5	DGND	20	DOVDD-1.8V
6	CLK_N	21	DOVDD-2.8V
7	CLK_P	22	AGND
8	DGND	23	VSYNC
9	DATA0_P	24	DVDD-1.05V
10	DATA0_N	25	AFGND
11	DATA1_P	26	PWDN (NC)
12	DATA1_N	27	RST
13	DGND	28	SDA
14	DATA2_P	29	SCL
15	DATA2_N	30	AFVDD-2.8V

2.2.7 Fan Interface

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

2.2.8 Status LED

	LED Status	Color	Freq.
Power	Power on	Red	Always on
	Standby	Green	Always on

3 RF parameters

AIX-800 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/be(20M) : 2412-2472MHz 802.11n/ax/be(40M) : 2422-2462MHz 5GHz 802.11a/n/ac/ax/be(20M) : 5180-5825MHz 802.11n/ac/ax/be(40M) : 5190-5795MHz 802.11ac/ax/be(80M) : 5210-5775MHz 802.11ax/be(160M) : 5250-5570MHz 6GHz 802.11ax/be(20M) : 5955-7125MHz 802.11ax/be(40M) : 5965-7085MHz 802.11ax/be(80M) : 5985-7025MHz 802.11ax/be(160M) : 6025-6985MHz
Modulation Way	BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM
Frequency Interval	5MHz

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	℃
Storage temperature	-40	25	80	℃
Working environment humidity	20	40	90	%

5 Power Dissipation

Parameter	Power (W, Max.)	Remark
PSU	60	12V/5A
System Input	24	QCS8550 Module
USB3.0 x 4	18	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.

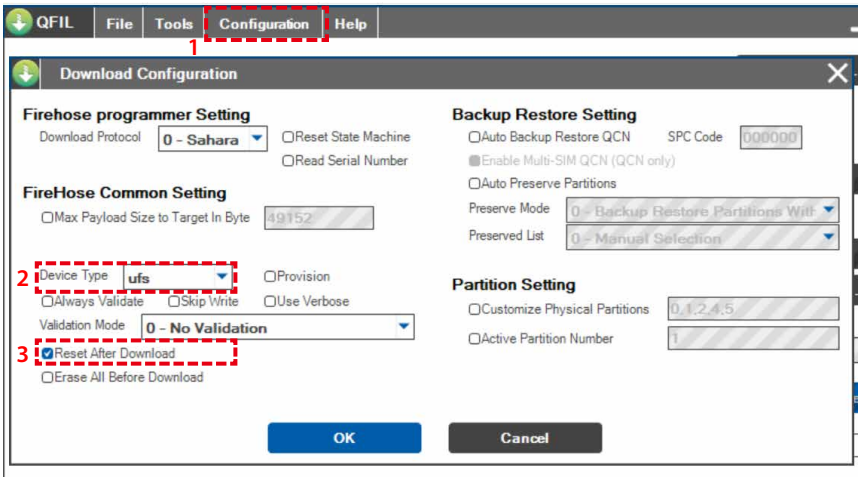
7. Additional Connectivity: You can also connect port 13 (USB Type-C) to your PC using a USB cable. If your PC has an ADB environment installed, you can enter commands on your PC to access the system.

6.2 Flashing Firmware Using Qualcomm QFIL Tool

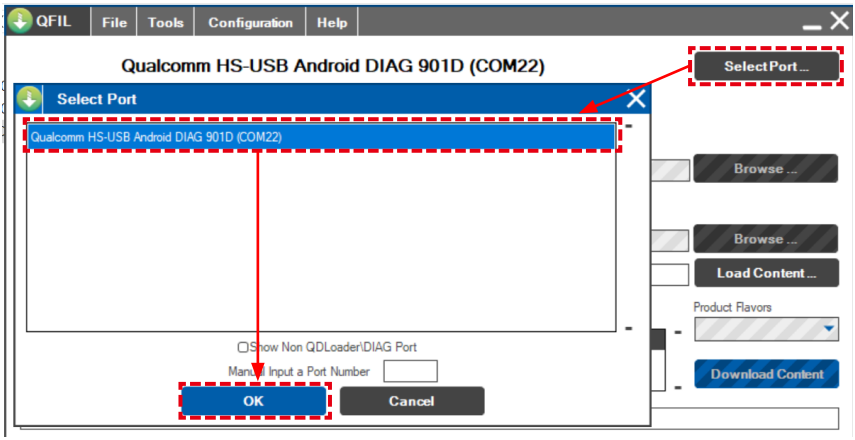
Note

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

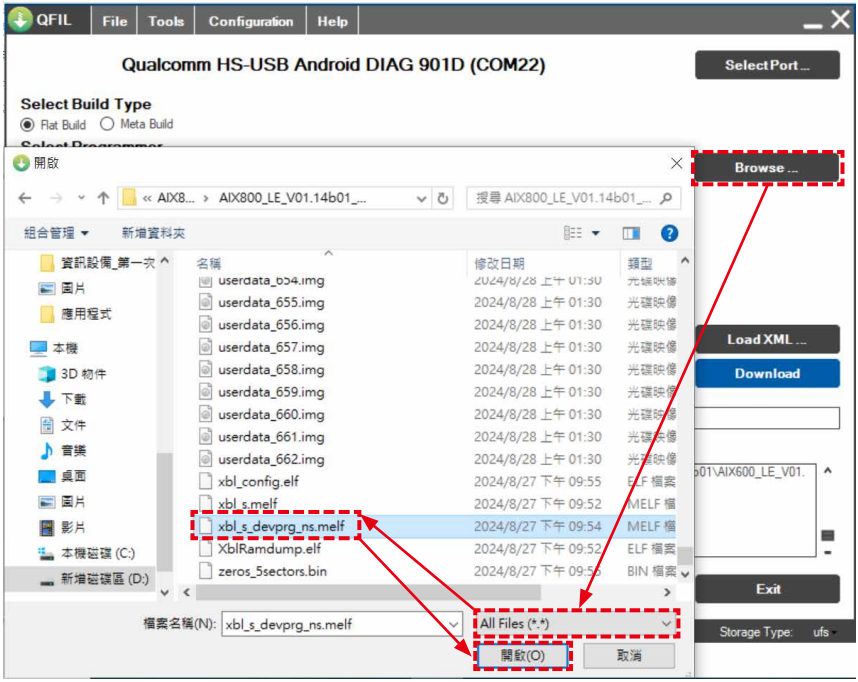
1. Open QFIL on your PC and configure it as follows:



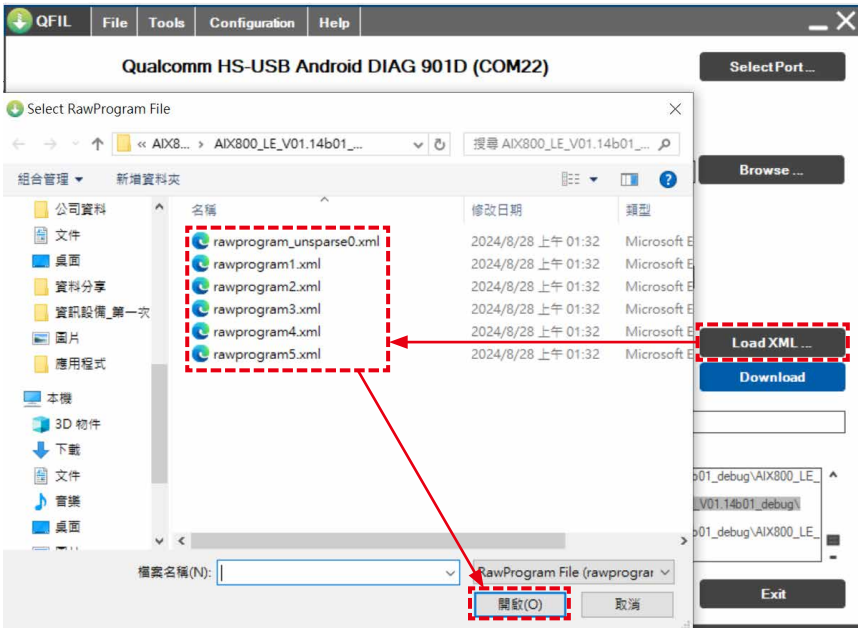
2. Click "Select Port" to choose the device port. You can either select port 901D, or use the adb command adb reboot edl to enter Emergency Download Mode and select port 9008.

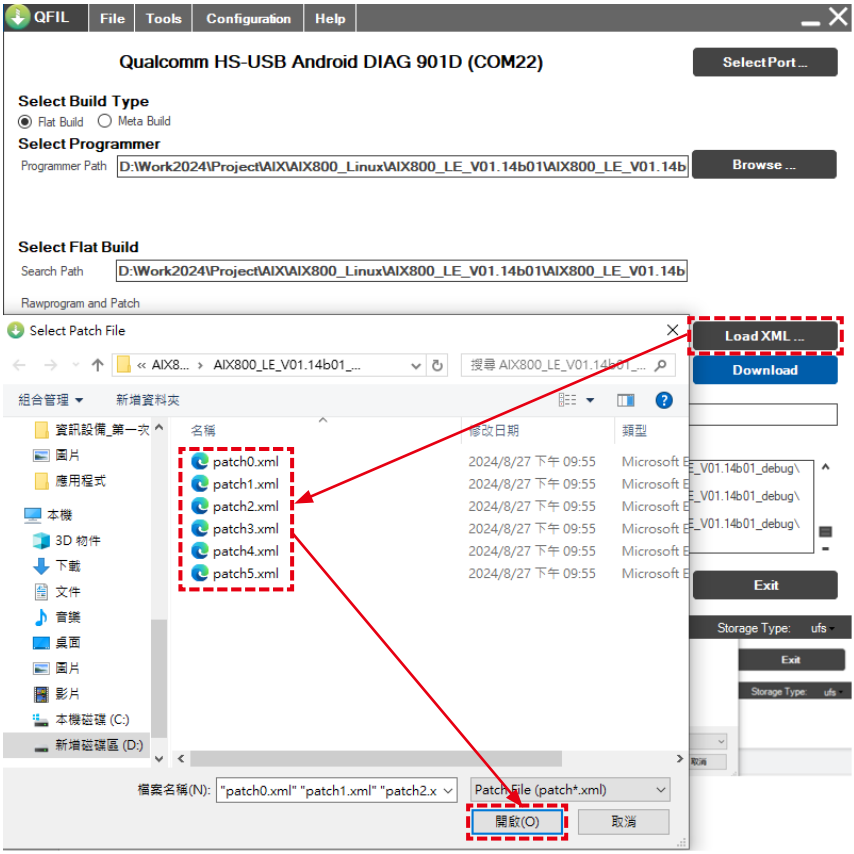


3. Click “Browse” to select the software version. Choose “All files” and then select the file xbl_s_devprg_ns.melf.

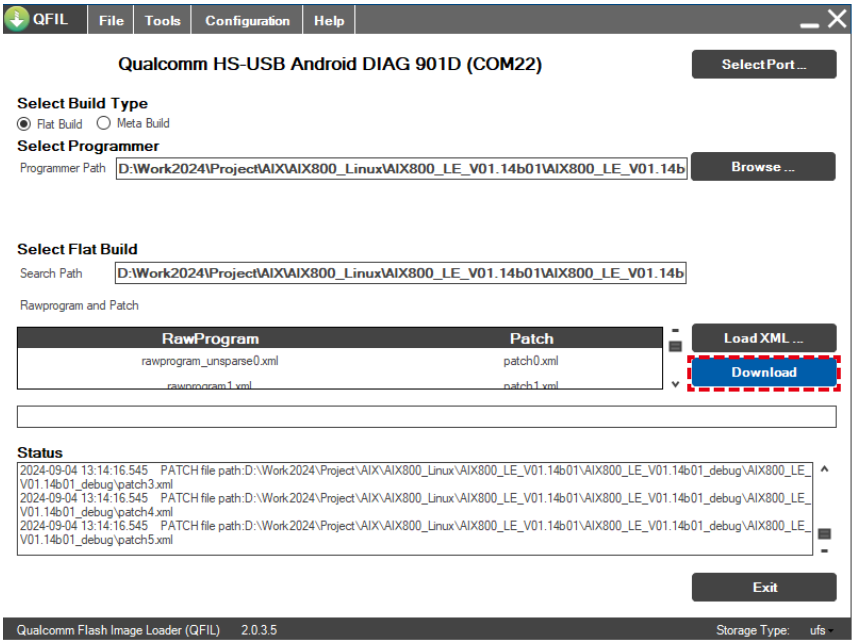


4. Click “Load XML” to select the XML file. Choose all necessary files and open them.




QFIL
File
Tools
Configuration
Help
Qualcomm HS-USB Android DIAG 901D (COM22)
Select Port ...
Select Build Type
Flat Build
Meta Build
Select Programmer
Programmer Path
D:\Work2024\Project\AIX\AIX800_Linux\AIX800_LE_V01.14b01\AIX800_LE_V01.14b
Browse ...
Select Flat Build
Search Path
D:\Work2024\Project\AIX\AIX800_Linux\AIX800_LE_V01.14b01\AIX800_LE_V01.14b
Rawprogram and Patch
Select Patch File
Load XML ...
Download
Exit
Storage Type:
ufs
組合管理
新增資料夾
名稱
修改日期
類型
patch0.xml
patch1.xml
patch2.xml
patch3.xml
patch4.xml
patch5.xml
2024/8/27 下午 09:55
檔案名稱(N):
"patch0.xml" "patch1.xml" "patch2.x
Patch File (patch*.xml)
開啟(O)
取消

5. Click “Download” to start flashing the software.



Contact information

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