WiFi LoRa 32 V4

Wi-Fi/Bluetooth/LoRa

Battery Management

0.96inch OLED

Document Version

Version	Time	Description	Remark
V4.1.0	2025-08-11	Internal beta version	Richard
V4.2.0	2025-09-11	First Official Release Version	Richard

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Content

1. Introduction

1.1   Overview

Heltec WiFi LoRa 32 V4 is a fully upgraded version of the classic LoRa development board. Since its initial launch in 2017, this product series has been highly favored by developers and makers. Building upon the powerful features of its predecessors, the V4 version introduces comprehensive optimizations in Transmit Power, power management, expandability and other hardware design. It is suitable for various IoT applications such as smart cities, agricultural monitoring, smart homes, industrial control, security systems, and wireless meter reading, providing developers with a more efficient and flexible development experience.
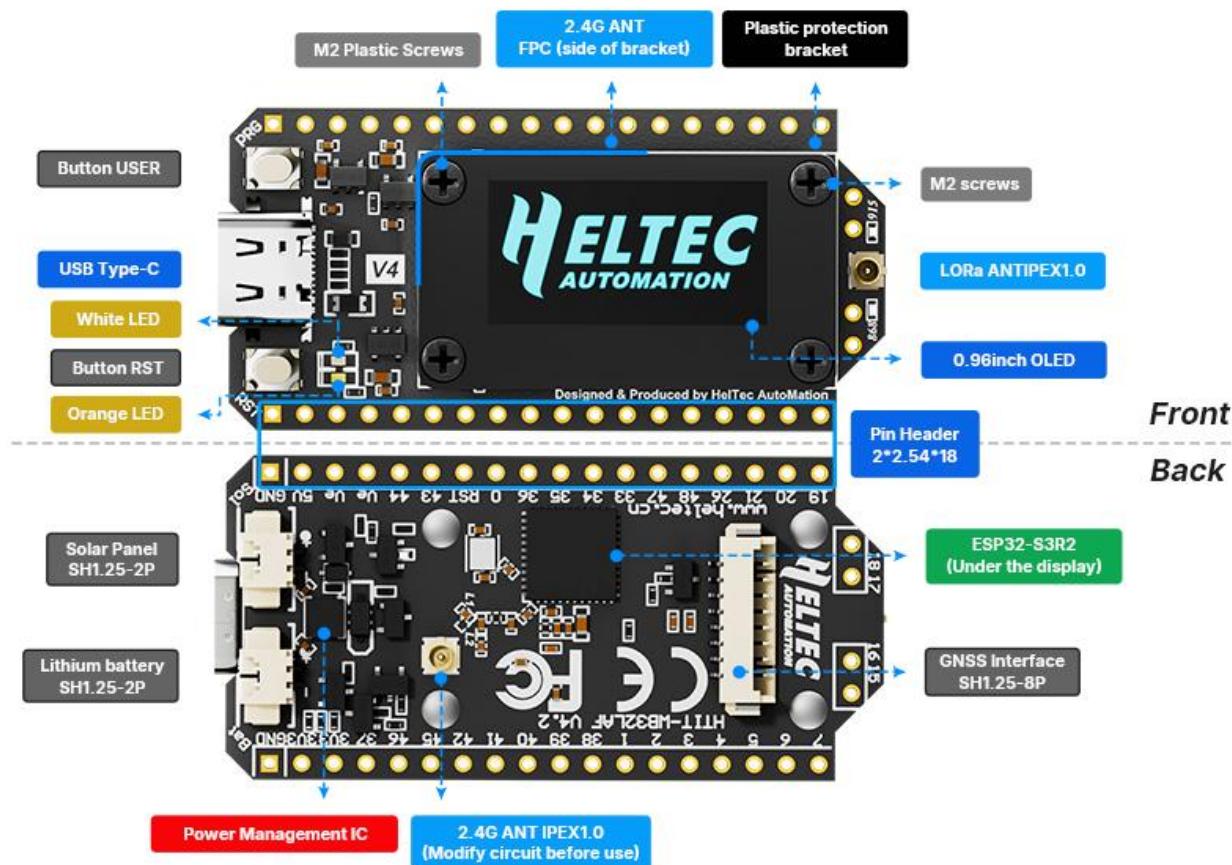
1.2   Features

- Base on **ESP32-S3R2 & SX-1262**, supports **Wi-Fi b/g/n**, **BLE**, and **LoRa** communication.
- **2MB PSRAM** and **16MB external Flash**, more suitable for UI and complex system .
- High-power version with LoRa transmission power increased to **28±1dBm**.
- Form factor and **pin compatibility** with WiFi LoRa 32 V3.
- PC **casing protects** the screen and integrates **FPC 2.4G antenna**.
- Added SH1.25-2P **solar panel interface**.
- Optimized **lithium battery management**.
- Added SH1.25-8Pin **GNSS interface**.
- **USB Type-C** interface with integrated voltage regulation, ESD protection, short-circuit protection, and RF isolation design;
- Low power consumption is less than **20µA**.

1.3   Application Scenarios

- Environmental Sensor
- Industrial Internet of Things
- Asset Tracking
- Remote Meter Reading
- Smart Agriculture
- Wireless Alarm
- Innovative Projects and Geek Application

1.4 Components

1.5 Variants
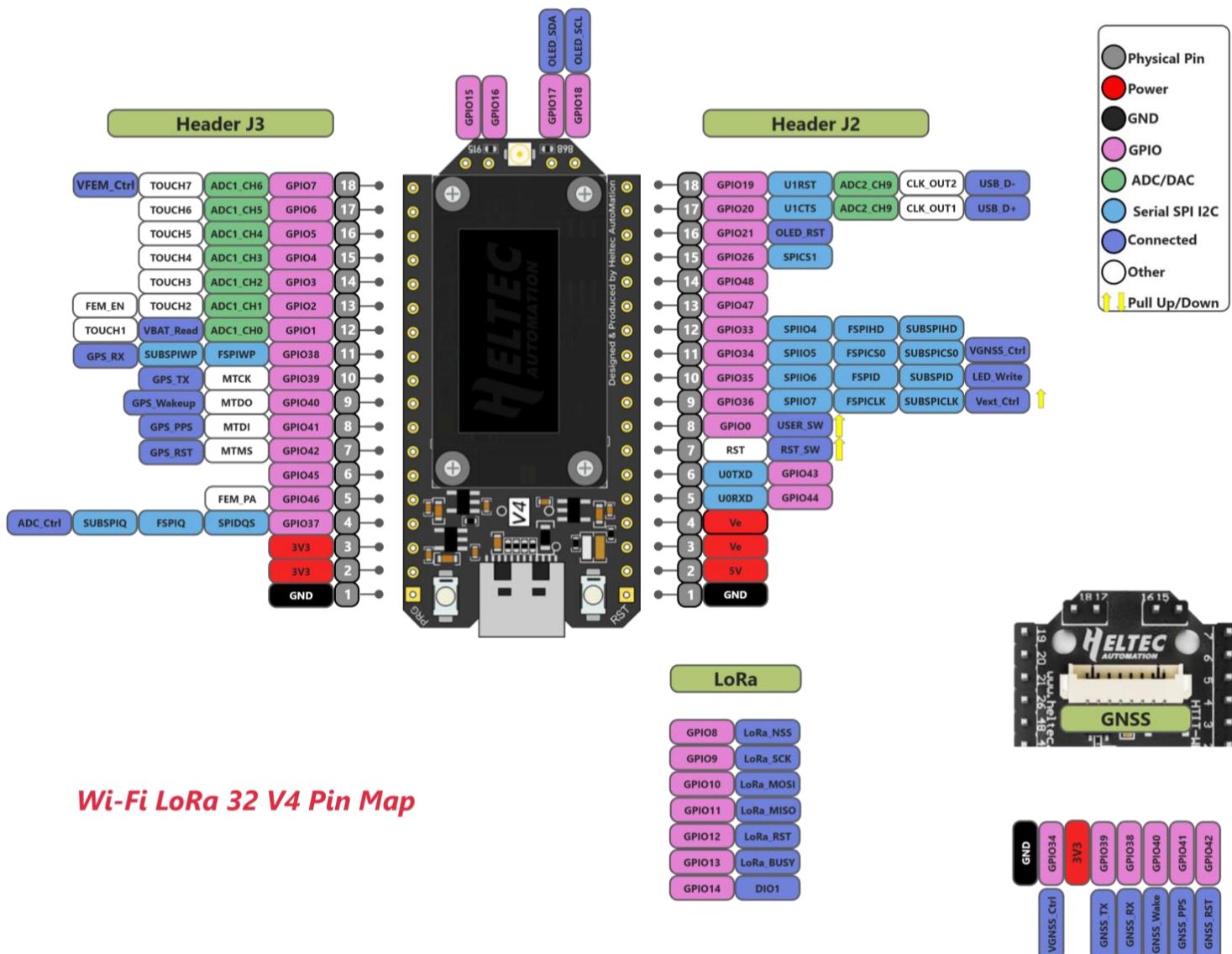
Table 1.5: Product variants

No.	Model	TX Power [dBm]	Description
1	HTIT-WB32LAF	28±1	868~928MHz, compatible with EU868, IN865, US915, AU915, AS923, KR920, and other regional standards.
2	HTIT-WB32LAF-N-HF	21±1	
3	HTIT-WB32LAF-N-LF	21±1	470~510MHz, compatible with CN470
4	HTIT-WB32LAF-N-433	21±1	433MHz

2. Pin Definition

2.1　Pin Layout

The following figure shows some common information and descriptions of the WiFi LoRa 32 pins. For more detailed functional information about each pin, please refer to the ESP32 chip manual. **ESP32-S3 MCU Datasheet**.

Wi-Fi LoRa 32 V4 Pin Map

2.2 Pin Description

2.2.1 Header J2

No.	Name	Type				Function
1	GND	G				Ground
2	5V	P				5V Power Supply
3	Ve	P				Output 3.3V
4	Ve	P				Output 3.3V
5	RX	I/O			IO MUX	**GPIO44**, U0RXD
6	TX	I/O			IO MUX	**GPIO43**, U0TXD
7	RST	I				CHIP_PU, **Reset Button**
8	0	I/O			IO MUX	**GPIO0**, **PRG Button**
9	36	I/O			IO MUX	**GPIO36**,SPIIO7,FSPICLK,SUBSPICLK,**Vext_Ctrl**
10	35	I/O			IO MUX	**GPIO35**, SPIIO6,FSPID, SUBSPID, **LED**
11	34	I/O			IO MUX	**GPIO34**, SPIIO5,FSPICS0, SUBSPICS0
12	33	I/O			IO MUX	**GPIO33**, SPIIO4,FSPIHD, SUBSPIHD
13	47	I/O			IO MUX	**GPIO47**, SPICLK_P_DIFF,SUBSPICLK_P_DIFF
14	48	I/O			IO MUX	**GPIO48**,SPICLK_N_DIFF,SUBSPICLK_N_DIFF
15	26	I/O			IO MUX	**GPIO26**, SPICS1
16	21	I/O		RTC	IO MUX	**GPIO21**, **OLED RST**
17	20	I/O	Analog	RTC	IO MUX	**GPIO20**,U1CTS,ADC2_CH9, **USB_D+**
18	19	I/O	Analog	RTC	IO MUX	**GPIO19**,U1RTS,ADC2_CH8, **USB_D-**

2.2.2 Header J3

No.	Name	Type			Function
1	GND	P			Ground.
2	3V3	P			3.3V Power Supply
3	3V3	P			3.3V Power Supply
4	37	I/O		IO MUX	**GPIO37**, SPIDQS, FSPIQ, SUBSPIQ, **ADC Ctrl**
5	46	I/O		IO MUX	**GPIO46**
6	45	I/O		IO MUX	**GPIO45**
7	42	I/O		IO MUX	**GPIO42,** MTMS, **GNSS_RST**
8	41	I/O		IO MUX	**GPIO41,** MTDI, **GNSS_PPS**
9	40	I/O		IO MUX	**GPIO40**, MTDO, **GNSS_Wakeup**
10	39	I/O		IO MUX	**GPIO39**, MTCK, **GNSS_TX**
11	38	I/O		IO MUX	**GPIO38**, FSPIWP, SUBSPIWP, **GNSS_RX**
12	1	I/O	Analog RTC	IO MUX	**GPIO1**, ADC1_CH0, TOUCH1, **VBAT_Read**[1]
13	2	I/O	Analog RTC	IO MUX	**GPIO2**, ADC1_CH1, TOUCH2
14	3	I/O	Analog RTC	IO MUX	**GPIO3**, ADC1_CH2, TOUCH3
15	4	I/O	Analog RTC	IO MUX	**GPIO4**, ADC1_CH3, TOUCH4
16	5	I/O	Analog RTC	IO MUX	**GPIO5**, ADC1_CH4, TOUCH5
17	6	I/O	Analog RTC	IO MUX	**GPIO6**, ADC1_CH5, TOUCH6
18	7	I/O	Analog RTC	IO MUX	**GPIO7**, ADC1_CH6, TOUCH7, **V$_{FEM}$_Control**

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[1] ADC1_CH0 is used to read the lithium battery voltage, the ADC_CTRL(37) pin needs to be pulled high. the voltage of the lithium battery is:

VBAT = 100 / (100+390) * VADC_IN1

2.2.3 Additional Pins

No.	Name	Type				Function
1	18	I/O	Analog	RTC	IO MUX	**GPIO18**, **OLED_SCL**
2	17	I/O	Analog	RTC	IO MUX	**GPIO17**, **OLED_SDA**
3	16	I/O	Analog	RTC	IO MUX	**GPIO16**, XTAL_32K_N
4	15	I/O	Analog	RTC	IO MUX	**GPIO15**, XTAL_32K_P

2.2.4 Peripherals (I2C/SPI/UART/I2S/PWM/etc.)

ESP32-S3 can integrates a rich set of peripherals. To learn more about on-chip components, please refer to **ESP32-S3 MCU Datasheet**.

Owing to the **GPIO Matrix** and **IOMUX** capabilities, the vast majority of GPIO pins can be configured for functions such as I2C, SPI, I2S, PWM or UART. For specific pin assignments and IOMUX correspondences, please refer to the list of pins marked with IOMUX functionality in Appendix Tables **2.2.1** and **2.2.2.**

Note: The original functionality of the reconfigured pins will be affected. Please select appropriate pins for your application. Such as OLED has occupied one I2C interface, while LoRa and Flash have each utilized a separate SPI interface.

3. Specifications

3.1 General specifications

Parameters	Description
Master Chip	ESP32-S3R2
LoRa Chip	SX-1262
Frequency	433~510 MHz, 863~928 MHz
Max. TX Power	21±1dBm, 28±1 dBm
Max. Receiving Sensitivity	-137 dBm
Wi-Fi	802.11 b/g/n, up to 150Mbps
Bluetooth	Bluetooth LE, Bluetooth 5, Bluetooth mesh
OLED	**SSD1315**(0.96Inch, 128*64 resolution)
Power Supply	5V@USB/Solar, 3.3-4.2V@Battery
Hardware Resource	7*ADC1 + 2*ADC2, 7*Touch, 3*UART, 2*I2C, 2*I2S, 4*SPI, etc.
Memory	384KB ROM; 512KB SRAM; 16KB RTC SRAM; 16MB Flash; 2MB PSRAM
Interface	USB Type-C; SH1.25-2P lithium battery interface; SH1.25-2P solar panel interface; 2*IPEX1.0 ANT(LoRa&2.4G); 2*18*2.54 Header Pins, 2*2*2.54 Header Pins
Operating Temperature	-40~85℃(OLED operating temperature: -40~ 70°C)
Dimensions	51.7 * 25.4* 10.7mm

3.2 Power Supply

USB or 5V can only be connected to one of them. When either USB or 5V input is connected,

the solar panel and lithium battery can be connected simultaneously.

Power Supply Mode	Minimum	Typical	Maximum	Company
Type-C USB(≥500mA)	4.7	5	6	V
Lithium battery(≥250mA)	3.3	3.7	4.2	V
5V pin(≥500mA)	4.7	5	6	V
3V3 pin(≥150mA)	2.7	3.3	3.5	V
Solar Panel	4.7	5	6	V

3.3 Power Output

*When using **VE** for external power supply, the **VextCtrl(GPIO36)** pin needs to be pulled low.*

Table 3.3: Power output

Pin	Minimum	Typical	Maximum	Company
3.3V			500	mA
5V@USB			500	mA
Ve			500	mA

3.4 Power Consumption(25℃）

Table 3.4: Power consumption

Mode	Condition	Min.	Typical	Max.	Unit
WiFi Scan	USB powered		119		mA
WiFi AP	USB powered		170		mA
BT	USB powered		115		mA
TX	14dBm,USB powered, 868 TX		290		mA
	17dBm,USB powered, 868 TX		330		mA
	22dBm,USB powered, 868 TX		400		mA
	27dBm,USB powered, 868 TX		750		mA
RX	TX disabled; RX enabled		75		mA
Sleep	USB powered		2		mA
	Battery powered		20		μA
	3.3V header powered		20		μA
Charging	USB@5V		500		mA

3.5 LoRa RF Characteristics

3.5.1 Transmit Power

Table3.5.1: Transmit power

Module	Frequency Band[MHz]	Maximum power[dBm]
HTIT-WB32LAF	863-928	28 ± 1
HTIT-WB32LAF-N	433/470-510/863-928	21±1

3.5.2 Receiving Sensitivity

The following table gives typically sensitivity level.

Table3.5.2: Receiving sensitivity

| Signal Bandwidth/[KHz]	Spreading Factor	Sensitivity/[dBm]
125	SF12	-137
125	SF10	-131
125	SF7	-122

3.6   LoRaWAN Frequency Plan
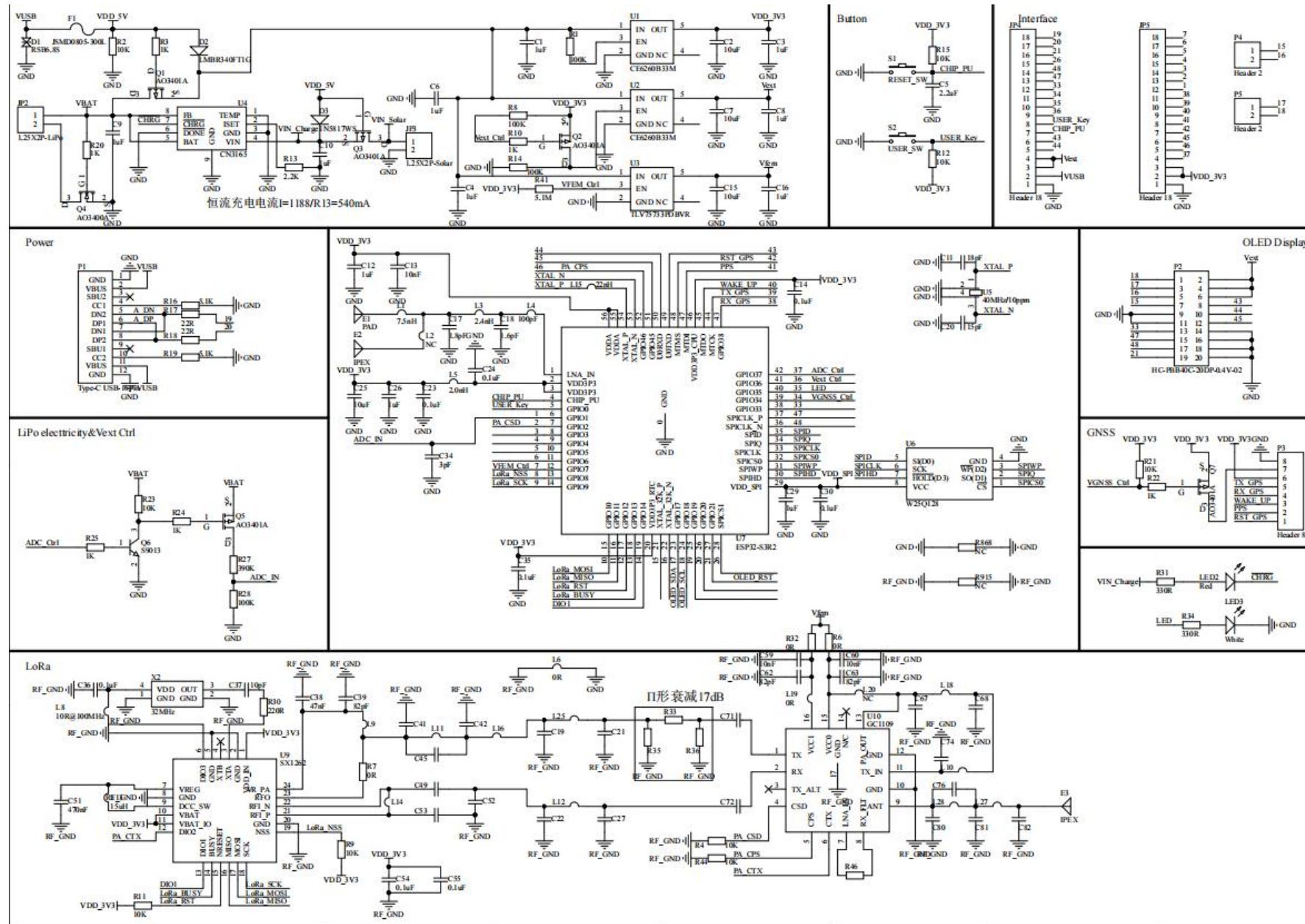
Supports LoRaWAN frequency channels and models corresponding table.

Table3.6: Frequency Plan
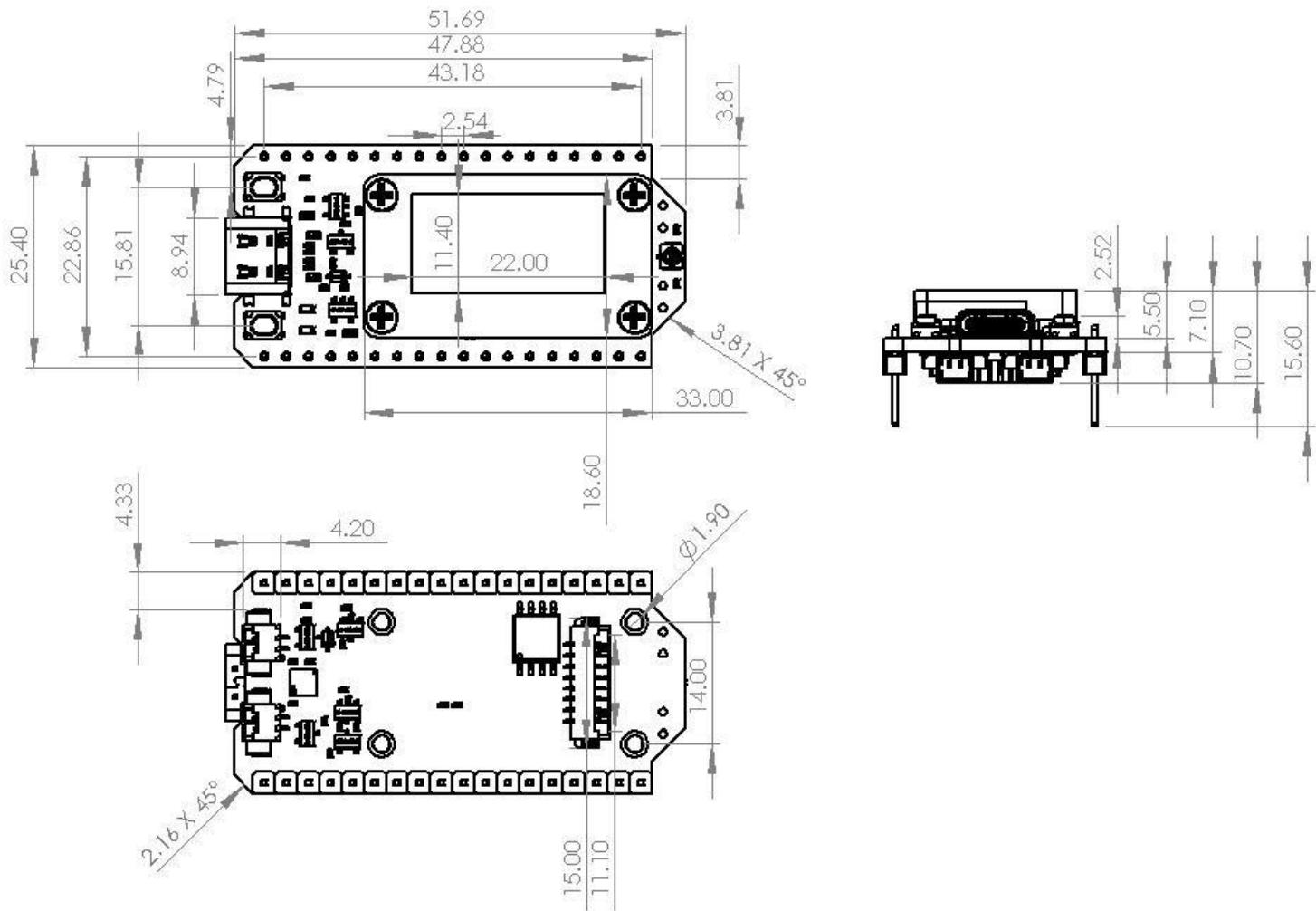
Region	Frequency(MHz)	Model
IN868	865~867	HTIT-WB32LAF/HTIT-WB32LAF-N-HF
EU868	863~870	HTIT-WB32LAF/HTIT-WB32LAF-N-HF
US915	902~928	HTIT-WB32LAF/HTIT-WB32LAF-N-HF
AU915	915~928	HTIT-WB32LAF/HTIT-WB32LAF-N-HF
KR920	920~923	HTIT-WB32LAF/HTIT-WB32LAF-N-HF
AS923	920~925	HTIT-WB32LAF/HTIT-WB32LAF-N-HF
CN470	470~510	HTIT-WB32LAF-N-LF

4. Schematic

(V4.2)

5. Dimensions

6. Resource

6.1 Relevant Resource

- **User Guide**

- **SDK**

  - **Heltec ESP (ESP32 & ESP8266) framework**

  - **Heltec ESP32 library**

- **Schematic diagram**

- **Downloadable resource**

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