Wireless Tracker V2

WiFi/LoRa/BLE/Solar/GNSS

Development Kit

https://heltec.org

Document version

Version	Time	Description	Remark
V1.0	2023-05-16	Documents creating	Richard
V1.1	2023-05-21	Document structure update	Richard
V1.1.1	2024-10-10	Update the GNSS module parameter description	Richard
V2.1	2025-9-5	TX Power has been upgraded from 21 to 27dBm	Ashley

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Contents

1. Description

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1.1 Overview

Wireless Tracker is a development kit based on ESP32-S3FN8. It integrates both SX1262 and UC6580 to provide fast GNSS solution for IoT. Collaborate with the sample programs and development tools we provide, you can track any object and then upload that data wirelessly by Wi-Fi, Bluetooth, LoRa.

Wireless Tracker supports L1 + L5 and supports GPS, GLONASS, BDS, Galileo, NAVIC, QZSS multi-system joint positioning. It is perfectly compatible with Arduino, can be widely used in development such as bicycle sharing services, tracking pets or livestock, locating vehicles, tracking children, etc.

The wireless tracker V2.1 has been upgraded as follows:

- ✧ Maximum TX Power: Increased from 21 ± 1 dBm to 28 ± 1 dBm, enabling extended communication range and improved link reliability.
- ✧ GNSS Active Antenna: Enhanced with an upgraded low-noise amplifier (LNA) to achieve stronger signal reception and higher positioning accuracy.
- ✧ Display Protection: Equipped with a dedicated plastic bracket to provide additional mechanical protection for the screen during operation.
- ✧ Solar Interface: Newly added solar power interface to support sustainable outdoor operation and extended battery life

1.2 Wireless Tracker are available in two product variants:

Table 1.1: Product model list

No.	Model	Description
1	Wireless Tracker-LF	470~510MHz working LoRa frequency, used for China mainland (CN470) LPW band.
2	Wireless Tracker-HF	For EU868, IN865, US915, AU915, AS923, KR920 and other LPW networks with operating frequencies between 863~928MHz.

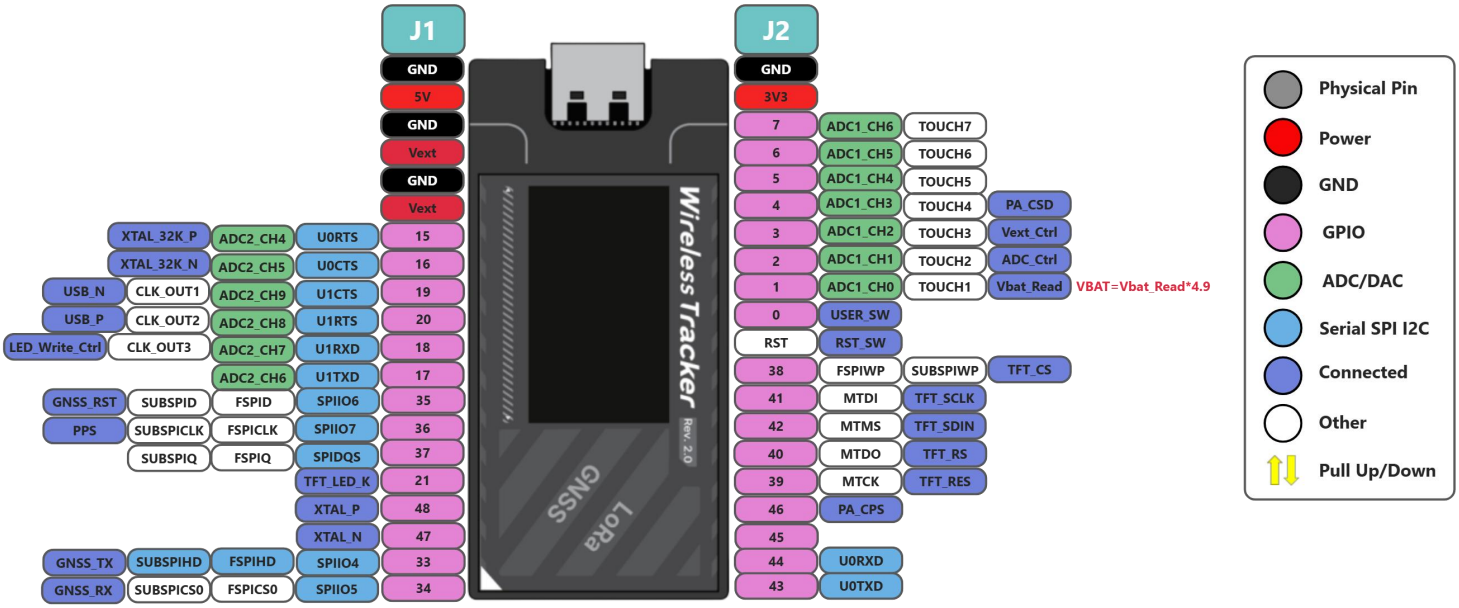
1.3 Product features

- ✧ ESP32-S3FN8+SX1262+UC6580 Chipset, supports Wi-Fi, LoRa, Bluetooth, GNSS.
- ✧ High-power version with LoRa transmission power increased to **28±1dBm**.
- ✧ Low power design of dual-frequency multi-system based on 22nm technology.
- ✧ Supports L1 + L5, supports GPS, GLONASS, BDS, Galileo, NAVIC, QZSS multi-system joint positioning.[1]
- ✧ Type-C USB interface with a complete voltage regulator, ESD protection, short circuit protection, RF shielding, and other protection measures.
- ✧ Onboard SH1.25-2 lithium battery and **solar interfaces** with integrated management for charging, overcharge protection, power monitoring, and automatic USB/battery switching.
- ✧ Onboard Wi-Fi, Bluetooth dedicated 2.4GHz metal spring antenna, reserved IPEX (U.FL) interface for LoRa and GNSS use.
- ✧ Onboard 0.96-inch 80×160 RGB TFT-LCD for displaying debugging, battery status, and more, equipped with a dedicated **plastic bracket** for added protection.
- ✧ The GNSS active antenna is enhanced with an upgraded low-noise amplifier (**LNA**), providing stronger signal reception and improved positioning accuracy.

[1] See the GNSS module manual for details on supported projects.

2. GPIO Interface

2.1 GPIO Assignment



HT-Tracker_V2 Pin map

2.2 GPIO Interface

2.2.1 Header J1

Table 2-2-1: Pin description

NO.	NAME	TYPE	FUNCTION
1	**GND**	P	**Ground**
2	**5V**	P	Power Supply **5V**
3	**GND**	P	**Ground**
4	**Vext**	P	Power supply for built-in TFT and GNSS, **3.3V**
5	**GND**	P	**Ground**
6	**Vext**	P	Power supply for built-in TFT and GNSS, **3.3V**
7	**GPIO15**	I/O	U0RTS, ADC2_CH4, **XTAL_32K_P**
8	**GPIO16**	I/O	U0CTS, ADC2_CH5, **XTAL_32K_N**
9	**GPIO19**	I/O	CLK_OUT2, ADC2_CH8, U1RTS, **USB_N**
10	**GPIO20**	I/O	CLK_OUT1, ADC2_CH9, U1CTS, **USB_P**
11	**GPIO18**	I/O	U1RXD, ADC2_CH7, CLK_OUT3, **LED_Write_Ctrl**
12	**GPIO17**	I/O	U1TXD, ADC2_CH6
13	**GPIO35**	I/O	SPI06, FSPID, SUBSPID, **GNSS_RST**
14	**GPIO36**	I/O	SPI07,FSPICLK, SUBSPICLK, **PPS**
15	**GPIO37**	I/O	SPIDQS, FSPIQ, SUBSPIQ
16	**GPIO21**	I/O	**TFT_LED_K**
17	**GPIO48**	I/O	**XTAL_P**
18	**GPIO47**	I/O	**XTAL_N**
19	**GPIO33**	I/O	SPIIO4, FSPIHD, SUBSPIHD, **GNSS_TX**
20	**GPIO34**	**I/O**	SPI05, FSPICS0, SUBSPICS0, **GNSS_RX**

2.2.2 Header J2

Table 2-2-2: Pin description

NO.	NAME	TYPE	FUNCTION
1	**GND**	P	**Ground**
2	**3V3**	P	Output **3.3V**
3	**GPIO7**	I/O	ADC1_CH6, TOUCH7
4	**GPIO6**	I/O	ADC1_CH5, TOUCH6
5	**GPIO5**	I/O	ADC1_CH4, TOUCH5
6	**GPIO4**	I/O	ADC1_CH3, TOUCH4, **PA_CSD**
7	**GPIO3**	I/O	ADC1_CH2, TOUCH3,**Vext_Ctrl**
8	**GPIO2**	I/O	ADC1_CH1, TOUCH2, **ADC_Ctrl**
9	**GPIO1**	I/O	ADC1_CH0, TOUCH1, **Vbat_Read**
10	**GPIO0**	I/O	**USER_SW**
11	**RST**	I/O	**RST_SW**
12	**GPIO38**	I/O	FSPIWP, SUBSPIWP, **TFT_CS**
13	**GPIO41**	I/O	MTDI, **TFT_SCLK**
14	**GPIO42**	I/O	MTMS, **TFT_SDIN**
15	**GPIO40**	I/O	MTMS, **TFT_RS**
16	**GPIO39**	I/O	MTMS, **TFT_RES**
17	**GPIO46**	I/O	**PA_CPS**
18	**GPIO45**	I/O	
19	**GPIO44**	I/O	U0RXD
20	**GPIO43**	I/O	U0TXD

3. Specifications

3.1 General specifications

Table 3-1: General specifications

Parameters	Description
Master Chip	ESP32-S3FN8 (Xtensa®32-bit lx7 dual core processor)
LoRa Chipset	SX1262
GNSS Chipset	UC6580
Frequency	470~510MHz, 863~928MHz
Max TX Power	28 ± 1dBm
Receiving sensitivity	-135dBm
Wi-Fi	802.11 b/g/n
Bluetooth	Bluetooth LE: Bluetooth 5, Bluetooth mesh
Interface	Type-C USB; 2*1.25 lithium battery interface; LoRa ANT(IPEX); GNSS ANT(IPEX)
Battery	Support 3.7V lithium battery and Solar Panl
Operating temperature	-20 ~ 70℃
Dimensions	65.48mm* 28.06mm* 13.52mm

3.2 Power supply

Except when USB or 5V Pin is connected separately, lithium battery can be connected to charge it. In other cases, only a single power supply can be connected.

Table 3-2: Power supply

Power supply mode	Minimum	Typical	Maximum	Company
Type-C USB(≥500mA)	4.7	5	6	V
Clithium 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

3.3 Power output

Table 3-3: Power output

Coutput pin	Electric current	Company
3.3v Pin	500	mA
5v Pin (Usb Powered Only)	500	mA
Vext Pin	350	mA

3.4 Power characteristics

Table 3-4: Power characteristics

Mode	USB power	VBAT/battery powered	Unit
Wi-Fi Scan	109	106	mA
Wi-Fi AP	147	150	mA
BT	107	101	mA
GNSS	120	89	mA
Sleep	**1.2mA**	**25 μA**	

3.5 LoRa RF characteristics

3.5.1 Transmit power

Table3-5-1: Transmit power

Operating frequency band	Maximum power value/[dbm]
470~510	28 ± 1
867~870	28 ± 1
902~928	28 ± 1

3.5.2 Receiving sensitivity

The following table gives typically sensitivity level of the Wireless Trackerr-(L/H).

Table3-5-2: Receiving sensitivity

Signal bandwidth/[khz]	Spreading factor	Sensitivity/[dbm]
125	SF12	-135
125	SF10	-130
125	SF7	-124

3.5.3 Operation Frequencies

Wireless Tracker supports LoRaWAN frequency channels and models corresponding table.

Table3-5-3: Operation Frequencies

REGION	FREQUENCY (MHZ)	MODEL
EU433	433.175~434.665	Wireless Tracker-LF
CN470	470~510	Wireless Tracker-LF
IN868	865~867	Wireless Tracker-HF
EU868	863~870	Wireless Tracker-HF
US915	902~928	Wireless Tracker-HF
AU915	915~928	Wireless Tracker-HF
KR920	920~923	Wireless Tracker-HF
AS923	920~925	Wireless Tracker-HF

3.6 GNSS Characteristics

3.6.1 Basic information

Table3-6-1: Basic information

Channel	96
Update frequency	Max 10 Hz
Data format	NMEA-0183，Unicore，RTCM 3.x
Frequency point	BDS: B2a
	GPS: L1+L5
	GLONASS: G1
	Galileo: E1+E5a
	QZSS: L1+L5
	SBAS: L1
	NAVIC: L5*(Specific firmware)

3.6.2 Sensitivity (Unit: dBm)

Talbe3-6-2: Sensitivity

Sensitivity	GNSS	BDS	GPS	GAL	GLONASS
Cold boot	-148	-146	-148	-144	-144
Warm boot	-156	-155	-155	-154	-148
Trace	-165	-163	-165	-163	-158
Recapture	-156	-154	-156	-154	-152

4. Mechanical Specification

5. Resource

5.1 Relevant Resource

- Heltec ESP (ESP32 & ESP8266) framework (Already included Heltec ESP32 LoRaWAN library)
- Heltec LoRaWAN test server based on SnapEmu
- User Manual Document

5.2 Contact Information

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