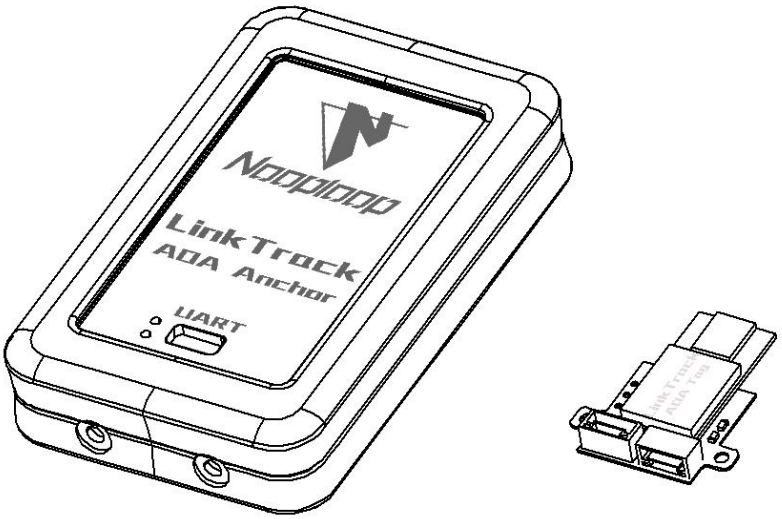
LinkTrack AOA

Datasheet V1.1



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Product Series： LinkTrack AOA

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1 Introduction

1.1 Product Overview

LinkTrack AOA Datasheet

Overview

LinkTrack AOA is an UWB high-precision tracing system that independently developed by Nooploop. The multiple core technologies, including high-precision wireless synchronization and wireless positioning algorithm, make the ranging and direction-finding more accurate and the operation more reliable and the experience more optimal. With continuous innovation, it dedicates to provide tracing solution of high-precision, high reliability and better experience to the industry.

LinkTrack AOA consists of TAG、ANCHOR and MONITOR to suffice more scenarios required by the users. The typical repeated ranging accuracy is ± 5cm and the repeated direction-finding accuracy is ±5° and the refresh rate is as high as 200Hz. It integrates ranging, direction-finding, timing and communication, which make the ranging and direction-finding well as the bilateral communication feasible.

Key Features

- Communication technology based on UWB （Ultra-wide band）
- Integration of ranging, direction-finding, timing and communication
- Refresh rate is as high as 200Hz
- Repeated ranging accuracy is ±5cm
- Repeated direction-finding accuracy is ± 5°
- Max. communication distance is 120 meters
- Support UART communication
- Voltage monitoring, protection against reverse connection
- Power voltage [3.6,5.5]V
- AOA Anchor power consumption 1.5W
- AOA tag 0.6W
- RF operating frequency [6240,6739.2] MHz
- Adjustable range for transmitting gain 0~33.5dB
- Unique ID，encrypted transmission

Applications

- Tracing
- Industrial surveying
- Landing aid
- Navigation and positioning

1.2 Naming Rules

Table 1: Naming Rules

Name	Abbreviation	Note
LinkTrack AOA Anchor	LTAOAA, LTAOAAnchor	*
LinkTrack AOA Tag	LTAOAT, LTAOATag	*

1.3 Product Structure

The communication interface of Anchor and Tag for LinkTrack are both UART. Both UART port of Tag have the same electrical connection.

UART：The interface line sequence abbreviates for “V G R T”（or“T R G V”），which corresponds to VCC、GND、RX、TX（or TX、RX、GND、VCC），from top to bottom, the line sequence in the figure(from left to right) correspond to port;； LTAOAA has an UART port，LTAOAT has an UART port with two identical electrical connection.

Among others, VCC is power source, GND is the power ground.

Figure 1: Structure schematic diagram of Anchor for LinkTrack AOA

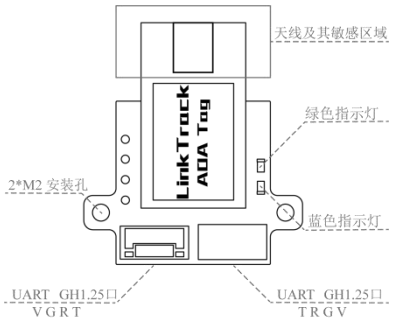

Figure 2: Structure schematic diagram of Tag for LinkTrack AOA

1.4 Technology Overview

UWB is a carrier-free communication technology, transmitting data by utilizing the Non-sinusoidal narrow pulses of nano-second or micro-second. The UWB has many advantages, such as high resolution, strong penetration, low power consumption, anti-multipath and high security, therefore, it is widely applied to communication and positioning.

UWB is electromagnetic wave, which has same transmission speed in the vacuum with speed of light. By measuring the TOF (time of flight) from TAG TO ANCHOR and multiplying the speed of light, the distance from ANCHOR can be obtained by TAG.

The upper plate of LTAOAA carries the antenna array, the phase difference of radio can be obtained through such array and then get the relative angle.

Once obtained the distance and angle, then, a polar coordinate is identified, then, the plane position coordinate of X, Y can be calculated accordingly. If the environmental information (such as obstruction position, path) is known, so is the location to go, then, the real-time navigation can be realized.

In the same positioning system, in order to suffice the orderly operation of multiple nodes, the rigorous time synchronization for each node in the system are set. The node will send out the time stamp after synchronization for timing.

The essence for the wireless communication based on UWB is to transmit the user data to other nodes through the wireless packet, realizing the communication among nodes.

1.5 Mode Overview

LinkTrack AOA consists of two hardware, LTAOAT and LTAOAA. LTAOAT supports TAG，LTAOAA supports ANCHOR and MONITOR. Generally, TAG and ANCHOR are essential role and MONITOR is optional. The naming rules are as shown in below:

Naming rule for TAG： In general, TAG will not be differentiated by ID and will be abbreviated as T.

Naming rule for ANCHOR： In general, if the ID for an ANCHOR is i， then, it will be abbreviated as Ai，if ID is 0, then, the ANCHOR is abbreviated as A0。

Naming rule for MONITOR： In general，since there is no quantity limit for MONITOR, it will not be distinguished by ID and will be abbreviated as M.

The function and output data for each role are shown as Table 2.

Table 2: Function description for Role

Role	Description
MONITOR	● **Measuring:** Measure the angle from itself to TAG and signal strength within the range； ● **Monitoring:** Monitor the distance, angle, signal strength for all TAG to all ANCHOR； ● **Data transmission:** Receive the transmitted data from TAG to ANCHOR within the range；
ANCHOR	● **Measuring:** Measure the distance, the angle from itself to TAG and signal strength within the range； ● **Monitoring:** Monitor the distance, angle, signal strength for all TAG to other ANCHOR； ● **Data transmission:** Receive the data transmitted from TAG within the range, transmit data to MONITOR and TAG within the range.
TAG	● **Measuring:** Measure the distance, the angle from itself to ANCHOR and signal strength within the range； ● **Data transmission:** Receive the data transmitted from ANCHOR within the range, transmit data to ANCHOR and MONITOR within the range.

2 Typical Specifications

Table 3: Typical specification

Parameters	LTAOAT	LTAOAA	Note
Type of Antenna	Single antenna onboard	Antenna array onboard	*
Weight: g	3.1	45	*
Size: mm	27*32*7	84*53*16	*
Color	Black		*
Shell Material	NONE	ABS	*
Communication Interface	UART serial port		Signal line for TTL is 3.3V level.
UART Baudrate	115200~3000000 adjustable		*
Update Rate: Hz	1~200 adjustable		*
Repeated Ranging Accuracy: cm	±5		*
Repeated Direction-finding Accuracy: °	±5		*
Angle range: °	150		*
Communication Distance: m	120		Open space
Voltage: V	[3.6,5.5]		*
Power Consumption: W	0.6	1.5	*
Operating Frequency: MHz	[6240,6739.2]		Central frequency is 6489.6MHz
Transmitting Gain: dB	[0,33.5]		Adjustable
Operation Temperature: ℃	[-20,80]		Roughly tested in the actual scenario, the specified environment of real practice shall prevail.
Cold Boot Time：S	0.3		The time from start to normal operation

3 Setting and Function

3.1 System Parameters

The System in the documents refer to a set of independently operated LinkTrack AOA system，the System Parameters for the same system shall be same.

System Parameters consists of System CH、System ID and TX Gain and the main role is to suffice the criterion of frequency and transmitted power that allowed by different countries and regions.

1. Meet the operation demands for multiple system to operate at the same time.
2. Adapt to more environments.

3.1.1 System CH

System CH consists of RF channel and code. LinkTrack AOA supports 6 RF channels and 2 coding schemes, therefore, 12 combination can be obtained. At present, **the recommended System CH is 9、and then is 8，other channels are not supported**. The node for the same System shall be set the same System CH.

The configuration of each System CH is shown in Table 4.

Table 4: Details of System CH

System CH	Centre Frequency (MHz)	Band (MHz)	Bandwidth (MHz)	Encoder Mode
0	3494.4	[3244.8,3744]	499.2	Encoder Mode0
1	3494.4	[3244.8,3744]	499.2	Encoder Mode1
2	3993.6	[3744,4243.2]	499.2	Encoder Mode0
3	3993.6	[3744,4243.2]	499.2	Encoder Mode1
4	4492.8	[4243.2,4742.4]	499.2	Encoder Mode0
5	4492.8	[4243.2,4742.4]	499.2	Encoder Mode1
6	3993.6	[3328,4659.2]	1331.2	Encoder Mode0
7	3993.6	[3328,4659.2]	1331.2	Encoder Mode1
8	6489.6	[6240,6739.2]	499.2	Encoder Mode0
9	6489.6	[6240,6739.2]	499.2	Encoder Mode1
10	6489.6	[5980.3,6998.9]	1018.6	Encoder Mode0
11	6489.6	[5980.3,6998.9]	1018.6	Encoder Mode1

3.1.2 System ID

System ID is a variable to distinguish the identity of different System, **the node for the same System shall be set the same System ID**.

3.1.3 TX Gain

The adjustable range for TX Gain is [0,33.5] dB. The gain for the transmitted power can be as big as 33.5dB by regulating TX Gain. In general, the bigger the TX Gain, the further the communication distance. **The node for the same System shall be set the same TX Gain.**

3.2 Role Parameters

Please check Table 5 for parameters of LinkTrack AOA Role.

Table 5: Parameter table of Role

Role	Parameters				
	Capacity	UpdateRate (Hz)	DT MaxLength (Byte)	DT Rate (bps)	Delay (ms)
TAG	1	1,2,5,10,25,50,100,200	20	160*UpdateRate	1000/UpdateRate
ANCHOR	4		20	160*UpdateRate	
MONITOR	INF		0	0	

Role：role. LTAOAT supports TAG，LTAOAA supports both ANCHOR and MONITOR.

Capacity：capacity. The Max. capacity while each role operates at the same time.

UpdateRate：Update rate, which refers to the frequency of output data frame. It will not affect parameters, such as Capacity、DT Rate and Delay. In particular, as for ANCHOR and MONITOR，when there is no TAG operating in the system, it will automatically output data frame at a frequency of 1Hz，when TAG operates, it will automatically resume to the UpdateRate to output.

DT MaxLength：The Max. length for single frame data transmission. If it exceeds the DT MaxLength，then the exceeding part will be abandoned and will not be sent. For example, if the data transmission sent to Tag for a single time is 15 bytes, then, ANCHOR and MONITOR will receive the frame data from the tag.

DT Rate：Date transmission rate, which refers to the band width of current role sent to another Role.

Delay：Delay, which refers to the delay for the variable output of data frame.

3.3 Baudrate

The communication speed for UART.

Table 6: Baudrate parameter list

Baudrate	Note
115200,230400,460800,921600,1000000,1200000,1500000,2000000,3000000	Baud rate can be set to the corresponding parameters in the list.

3.4 Indicator Light

It supports to set to turn on or turn off the indicator light.

Table 7: The meaning of Indicator Light

Description	Status
In operation	The green light will flip once whenever the communication interface sends a frame of data; the blue light will flip once whenever a frame of data is sent to the communication interface. If no new state is detected within 1 second, the light with relative color will automatically turn off.
The direct node for the firmware update	Both blue and green light are quickly flickering at a high-frequency of 0.05 second
The Anchor and Monitor that no tag is in	The green light is flickering at a frequency of 1 second

operation	
The node is not electrified	Blue and green light are always off
The indicator light is off	

3.5 Filter Factor

Filter Factor represents the noise coefficient of Kalman Filter(KF for short）. Among others, the role of Filter Factor for TAG is to determine the distance to ANCHOR. And the Filter Factor for ANCHOR and MONITOR is to determine the angle of TAG. The Filter Factor is relying on the filter effect: the larger the number, the better the smooth effect, but the larger the data delay; the smaller the number, the weaker the smooth effect and the smaller the delay; when the number is 0, it signifies that there is no filter and the output data is the original measuring data.

3.6 RSSI

The node can output the signal instruction FP RSSI that received by the first path and the RX RSSI, the total received signal, the resolution is 0.5dB. Among others, FP RSSI signifies the signal strength that firstly received by the node and RX RSSI represents all signal strength that received by the node. The difference between FP RSSI and RX RSSI can be a reference to judge the circumstance of line of sight and non-line of sight.

3.7 Voltage Monitoring

The power passes through the communication interface, the node can monitor the voltage through the internal voltage monitoring and have them sent through the communication protocol frame.

4 Firmware

The official version of firmware is VA.B.C， the beta test version is VA.B.C BetaD. NAssistant can be used to check the availability of latest firmware for all LinkTrack series and upgrade accordingly.

5 Software

NAssistant is the matched debugging software for LinkTrack AOA, which is mainly used for configuration debugging, state display, functional application and firmware upgrade.

Configuration debugging： To configure the relative parameters of node, such as frequency band, mode, Baud rate and refresh rate and so on.

State display： To display the operation state of each node in the system, such as one-dimensional waveform display and etc.

Functional application： For application and development, such as the data import and export, motion trace storage, history track playback and so on.

Firmware upgrade： To upgrade the firmware of the product.

6 Mechanical Specifications

6.1 Size

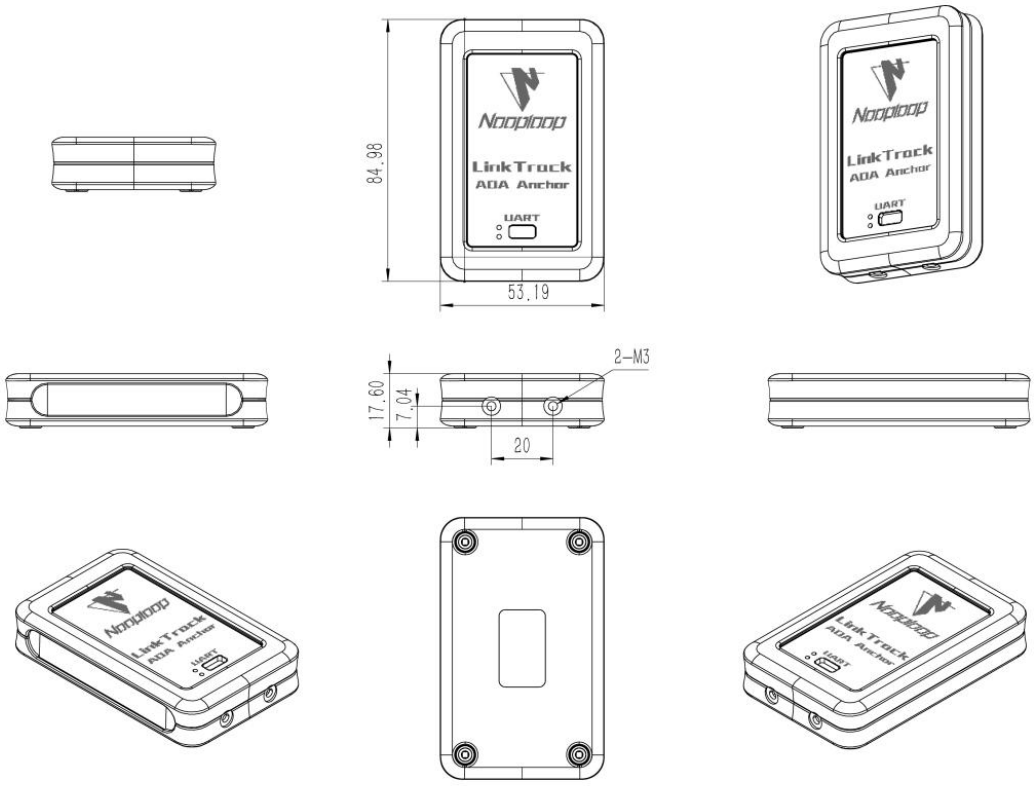

Figure 3: Dimension figure of LinkTrack AOA Anchor，unit: mm

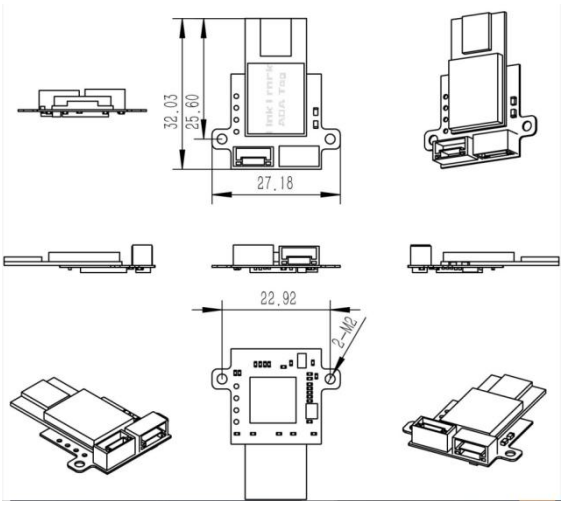

Figure 4: Dimension figure of LinkTrack AOA Tag, Unit: mm

6.2 Figure

Note: The product photos do not signify the size of actual product

Figure 5: 3D diagram for LinkTrack AOA Anchor

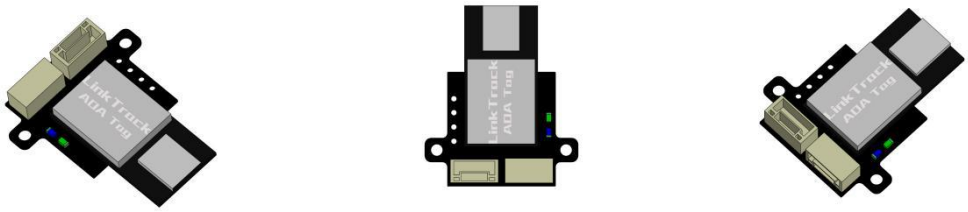

Figure 6: 3D diagram for LinkTrack AOA Tag

7 Abbreviation and Acronyms

Table 8: Abbreviation and Acronyms

Abbreviation	Full Title
UWB	Ultra-Wide band
AOA	Angle of Arrive
PNT	Positioning.Navigation. And Timing
PNTC	Positioning.Navigation.Timing.And Communication
DT	Data Transmission
LOS	Line of Sight
NLOS	Non-Line of Sight
RSSI	Received Signal Strength Indication

8 Update Log

Table 9: Update log

Version	Date	Description
1.0	20200620	● Released the initial manual
1.1	20200811	● Added Filter Factor and modified Bardrate ● Modified the described problem of UART serial port line sequence ● Added the parameter unit of temperature ● Modified the bandwidth of System CH10 and 11

9 Further Information

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