Product Specification

Product Name: AoA positioning Locator
Model Name: DSGW-200

Revision History

Specification		Sect.	Update Description	By
Rev	Date			
1.0	2021-03-21		New version release	
2.0	2021-06-08		Add zigbee and z-wave function， LoRa module PCIe interface	
3.0	2021-08-21		Add the I/Q data	
4.0	2022-02-22		Add different location mode	

Approvals

Organization	*Name*	*Title*	*Date*

Feature / Mode	Wi-Fi 2.4G/5G	AOA	Zigbee3.0	Z-Wave	Lora	LTE CatM1	Li battery
DSGW-200-1	●	●	●	●	●	●	●
DSGW-200-2	●	●				●	
DSGW-200-3	●	●					

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1. Introduction

1.1 Purpose& Description

DSGW-200 is indoor Locator for Bluetooth AoA Positioning. It can reach a positioning accuracy of 0.3-1 meters in the 2D plane. At the same time, it has the characteristics of low power consumption, low delay, low radiation and strong anti-interference. A signal locator can achieve 2Dpositioning.

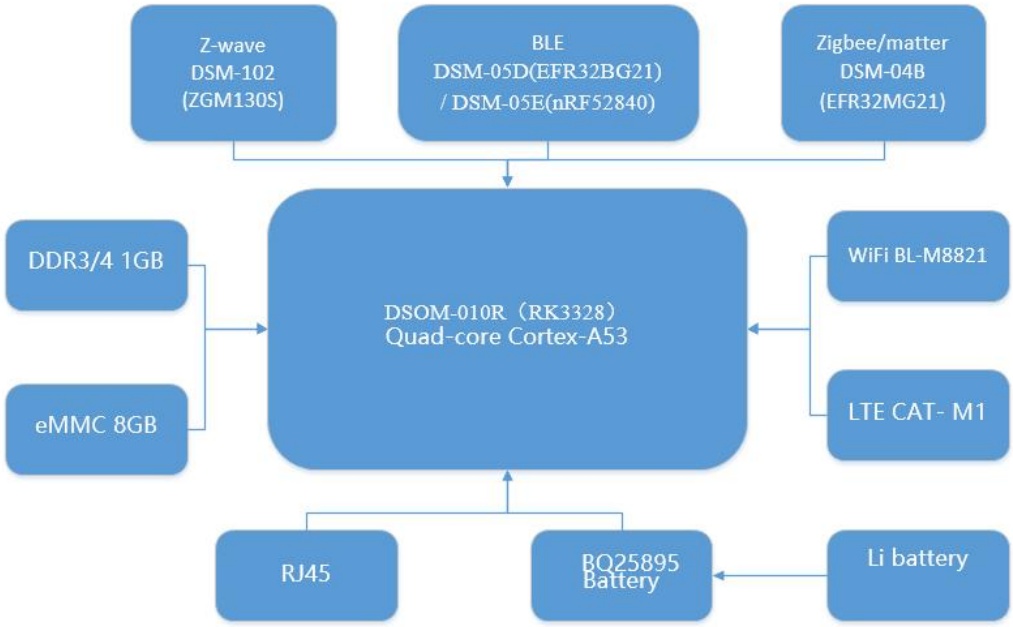
DSGW-200 is suitable for personnel tracking and real-time positioning of assets in smart healthcare, smart factories, smart factories, smart offices, and smart education.

DSGW-200 also have IoT gateway function, it support the Zigbee, Z-wave, BLE wireless protocol.

1.2 Product Feature Summary

- Support 5V USB type-c power supply
- Support IEEE802.3-2012 Type 1, the IEEE802.3-2012 Type 1 requires a power supply device (PSE) to provide 44 to 57V, and the power of the powered device (PD) must not exceed 12.95 W and the current does not exceed 350 mA.
- Support IEEE802.11ac, IEEE802.11a,IEEE802.11n,IEEE802.11g,IEEE 802.11b Protocol
- Support 4G LTE cat M1
- Support Bluetooth 5.2
- Support zigbee3.0
- Support Z-wave
- Support LoRa
- One WAN/LAN variable network port
- Support USB2.0
- Backup Li battery

1.3 Hardware block diagram



2. Mechanical Requirement

2.1 Drawings

2.2 Size

3. Specifications

3.1 Technical Specification

Category	Specifications
Power Supply	USB type-C 12V/2A
Reset button	The reset button is hole button, After pressing the reset button for more than 5 seconds, the Locator will be restored to the factory settings.
Switch	On/Off power
Network Interface	The network interface supports CAT-5/CAT-5E to transmit data and POE Power Supply (voltage range is 44~ 57V). It is WAN/LAN variable.
USB	USB3.0
PCIe	For LoRa Module
SIM card	Micro SIM card
Indicator LEDs	1).Power &battery LED 2). BLE LED 3).Wi-Fi LED 4) LTE indicator
Antenna array direction finding	4*4 Antenna Array
Li battery	6000mAH (It can last 4 hours without DC power)
Installation method	Ceiling
RTC	Real Time Clock operated from on board battery
Operating Temperature	-10℃~55℃
Storage Temperature	-40℃~65℃
Operating humidity	10%~90%
Cooling	Heat dissipation silicone/aluminum
IP rating	IP53
positioning accuracy	0.3-1 meter
Detect range	360° array antenna, Angle of Arrival measurement in the 2.4GHz band

3.2 Performance Requirement

	• IEEE wireless LAN standard: IEEE802.11ac; IEEE802.11a; IEEE802.11n; IEEE802.11g; IEEE 802.11b • Data Rate: IEEE 802.11b Standard Mode:1,2,5.5,11Mbps IEEE 802.11g Standard Mode:6,9,12,18,24,36,48,54 Mbps IEEE 802.11n: MCS0~MCS7 @ HT20/ 2.4GHz band

Wi-Fi Performance	MCS0~MCS7 @ HT40/ 2.4GHz band MCS0~MCS9 @ HT40/ 5GHz band IEEE 802.11ac: MCS0~MCS9 @ VHT80/ 5GHz band • Sensitivity: VHT80 MCS9 : -60dBm@10% PER(MCS9) /5GHz band HT40 MCS9 : -63dBm@10% PER(MCS9) /5GHz band HT40 MCS7 : -70dBm@10% PER(MCS7) /2.4GHz band HT20 MCS7 : -71dBm@10% PER(MCS7) /2.4GHz band • Transmit Power: IEEE 802.11ac: 13dBm @HT80 MCS9 /5GHz band IEEE 802.11ac: 16dBm @HT80 MCS0 /5GHz band IEEE 802.11n: 14dBm @HT20/40 MCS7 /5GHz band IEEE 802.11n: 16dBm @HT20/40 MCS0 /5GHz band IEEE 802.11n: 16dBm @HT20/40 MCS7 /2.4GHzband IEEE 802.11g: 16dBm @54MHz IEEE 802.11b: 18dBm @11MHz • Wireless Security: WPA/WPA2, WEP, TKIP, and AES • Working mode: Bridge, Gateway, AP Client • Range: 50 meters minimum, open field • Transmit Power:17dBm • Highest Transmission Rate: 300Mbps • Frequency offset: +/- 50KHZ • Frequency Range (MHz): 2412.0~2483.5 • Low Frequency (MHz):2400 • High Frequency (MHz):2483.5 • E.i.r.p (Equivalent Isotopically Radiated power)(mW)<100mW • Bandwidth (MHz):20MHz/40MHz • Modulation: BPSK/QPSK, FHSSCCK/DSSS, 64QAM/OFDM
Bluetooth-Performance	• TX Power: 19.5dBm • Range: 150 meters minimum, open filed • Receiving Sensibility:-80dBm@0.1%BER • Frequency offset: +/-20KHZ • Frequency Range (MHz):2401.0~2483.5 • Low Frequency (MHz):2400 • High Frequency (MHz):2483.5 • E.i.r.p (Equivalent Isotopically Radiated power)(mW)<10mW • Bandwidth (MHz):2MHz • Modulation: GFSK

Zigbee Performance	• TX Power: 19.5dBm • Range: 100 meters minimum, open filed • Receiving Sensibility:-94dBm • Frequency offset: +/-20KHZ
Z-wave Performance	• TX power up to13dBm (20mW) • RX sensitivity: @100kbps-97.5dBm • Range: 100 meters minimum, open filed • Default Frequency: 916MHz(Different country withdifferent frequency)
LoraWAN Performance	• Frequency band support: RU864, IN865, EU868, US915, AU915, KR920, AS923 • TX power up to 27dBm, RX sensitivity down to -139dBm @SF12, BW125kHz
LTE Cat M1	Operation Frequency Band: 850/900/1800/1900MHZ • Global:LTE:FDD:B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B26/B28 • North America: LTE TDD:B2/B4/B12/B13 LTE TDD:B39(for cat.M1 only)
WAN/LAN	10/100M bps

4. QA Requirements

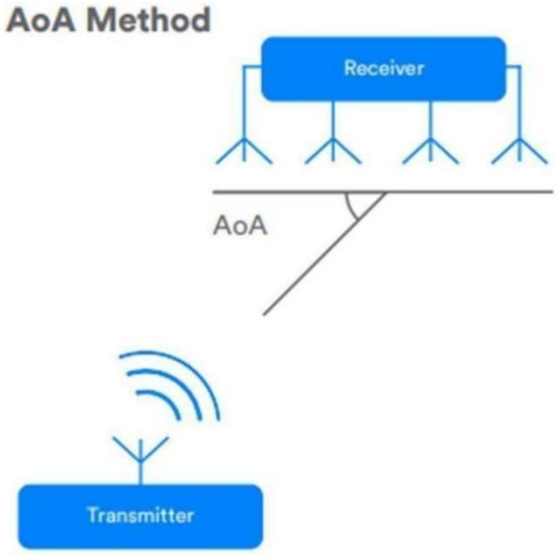
4.1 Quality and Testing Information

Information Description	Standard(Yes) custom(No)
ESD Testing	Yes
RF Antenna Analysis	Yes
Environmental Testing	Yes
Reliability Testing	Yes
Certification	FCC, CE, Bluetooth(BQB), PTCRB, RoHs

5. Application

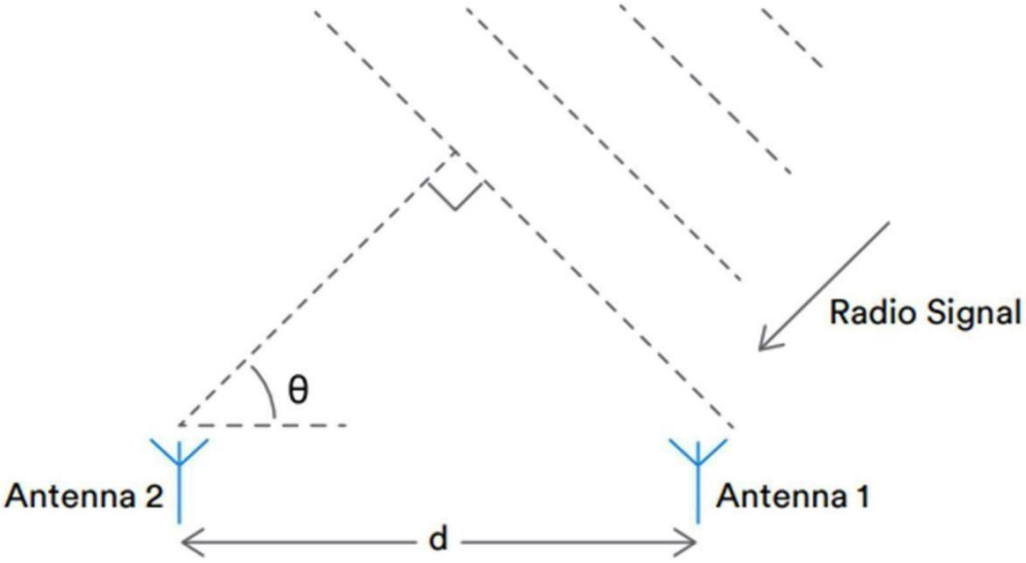
The gateway has an array antenna, the beacon sends Bluetooth data, and the gateway can receive or send Bluetooth signals when switching between different antennas.

Antenna array design



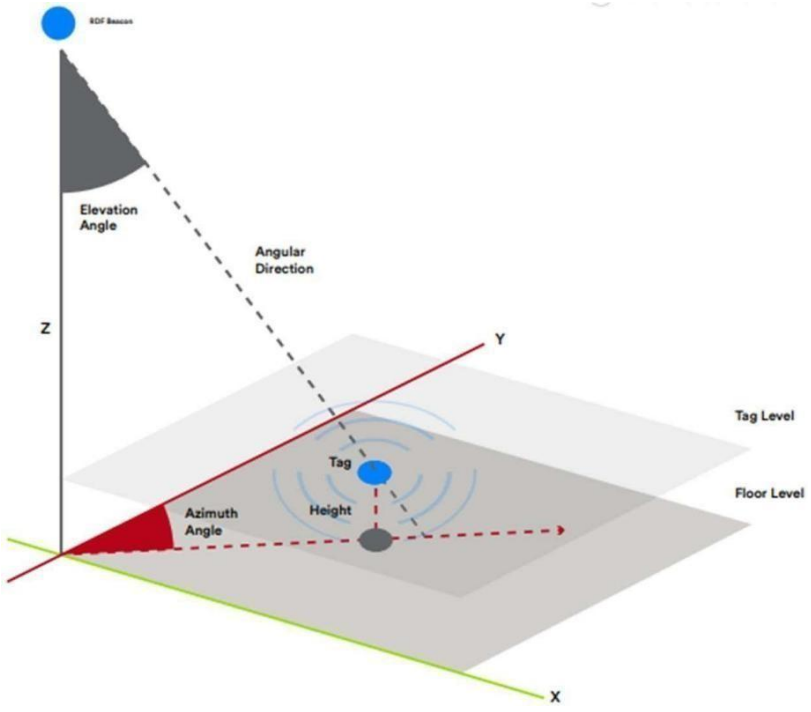
Angle of arrival operation

Measure and detect the phase difference of the Bluetooth signal between different receiving antennas， and then calculate the angle of arrival of the signal based on this information and the known distance between the different antennas.



Derive AoA from the phase difference of different antenna signals

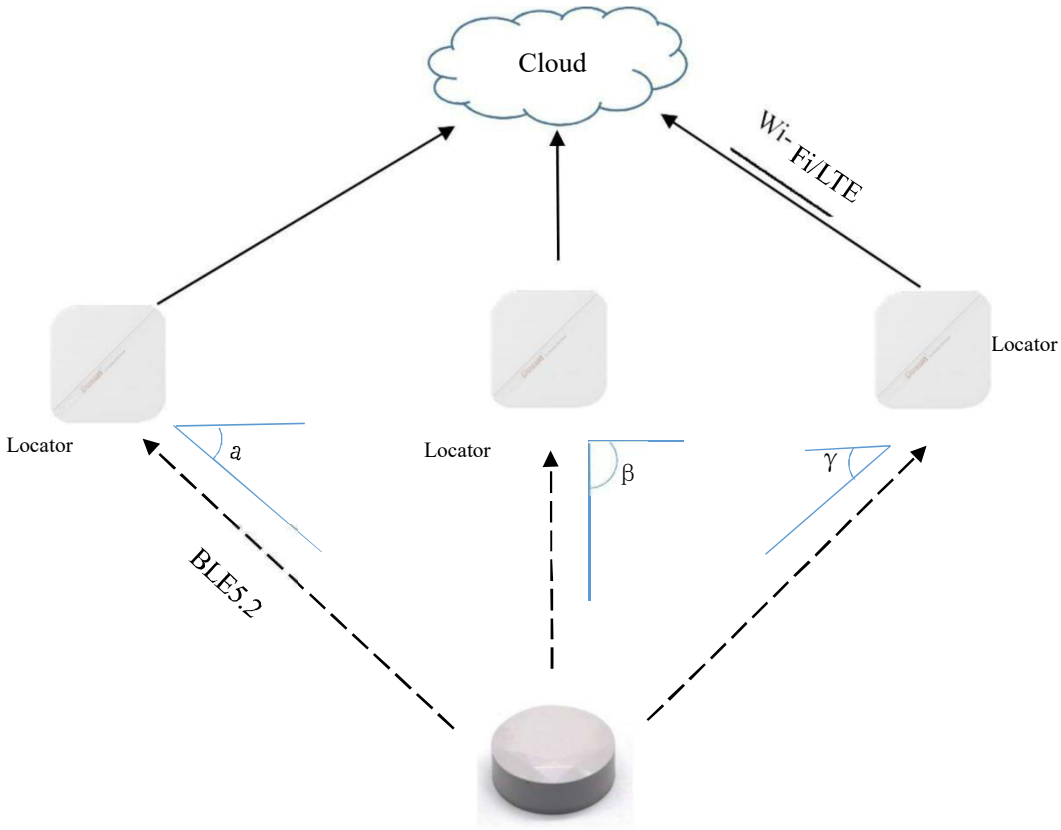
AoA technology only provides relative azimuth and/or elevation angle data between the sending and receiving devices, and other information is needed to calculate the absolute X, Y, and Z coordinates of the Bluetooth asset tag. Figure shows the mechanism to achieve this calculation. In this example, the receiver coordinates and direction are known, and AoA is used to derive azimuth and elevation data from the Bluetooth asset tag.



Determine the X, Y, and Z coordinates of the Bluetooth asset tag from the known location of the Bluetooth receiver and the azimuth and elevation information generated by AoA

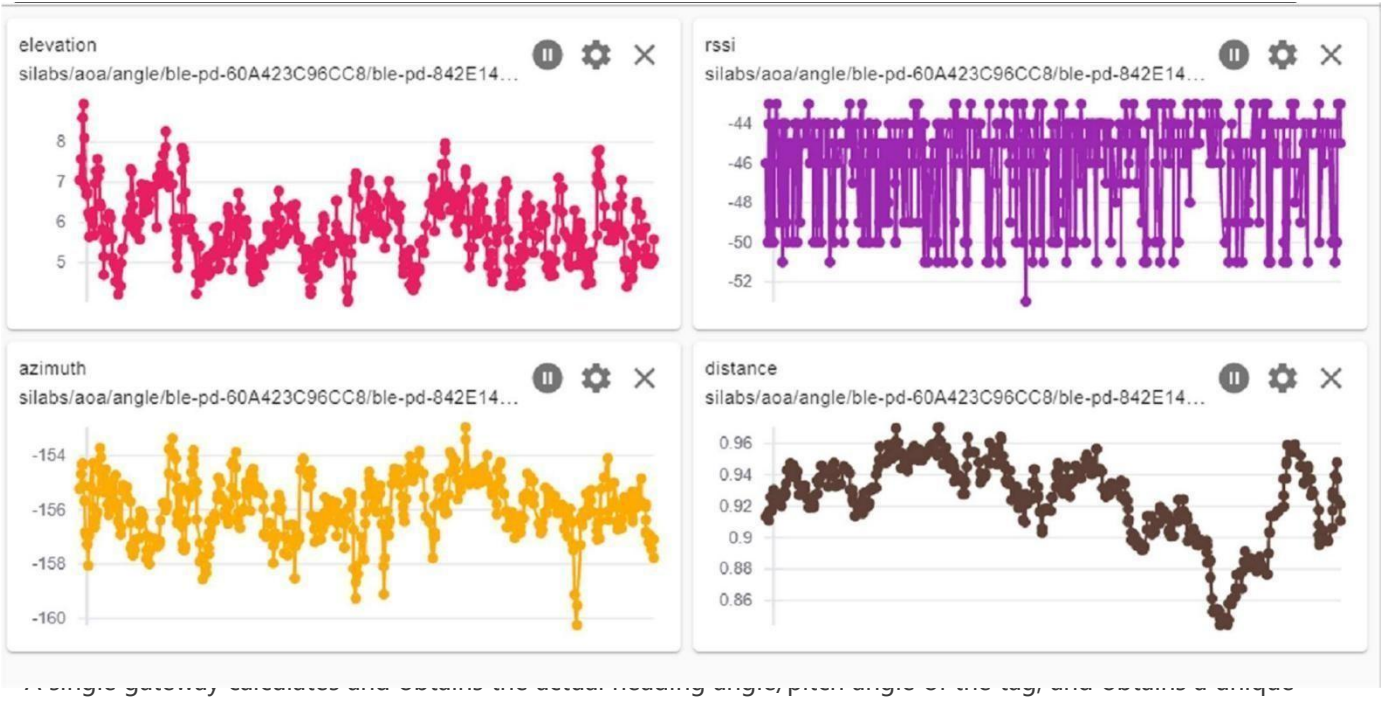
There are other ways to calculate the X, Y, and Z coordinates of the tracked device, such as using multiple receivers to detect the signal sent by the asset tag, and then using triangulation or trilateral measurement to calculate the asset location.

System structure

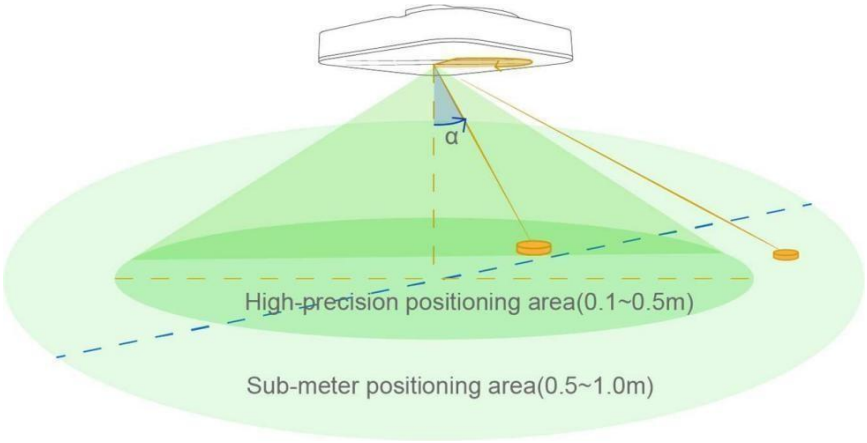


6. I/Q data

Elevation, RSSI, Azimuth, Distance



ray. According to the determined tag height, a single gateway can calculate and obtain a unique spatial absolute coordinate.

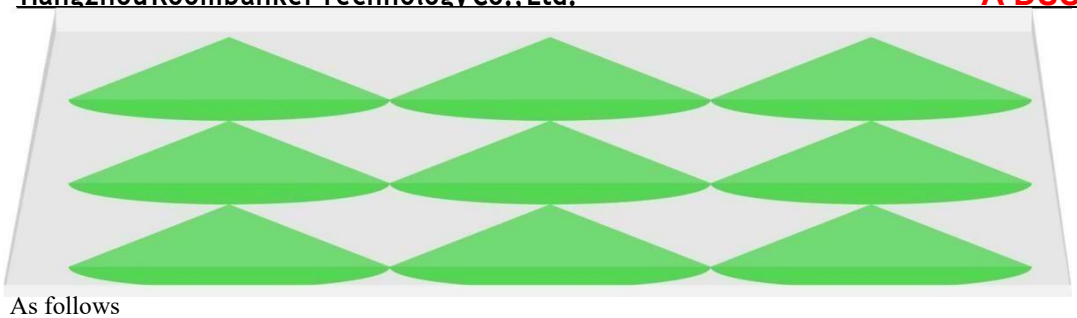


Coverage depends on your installation height, Angle α maximum value:

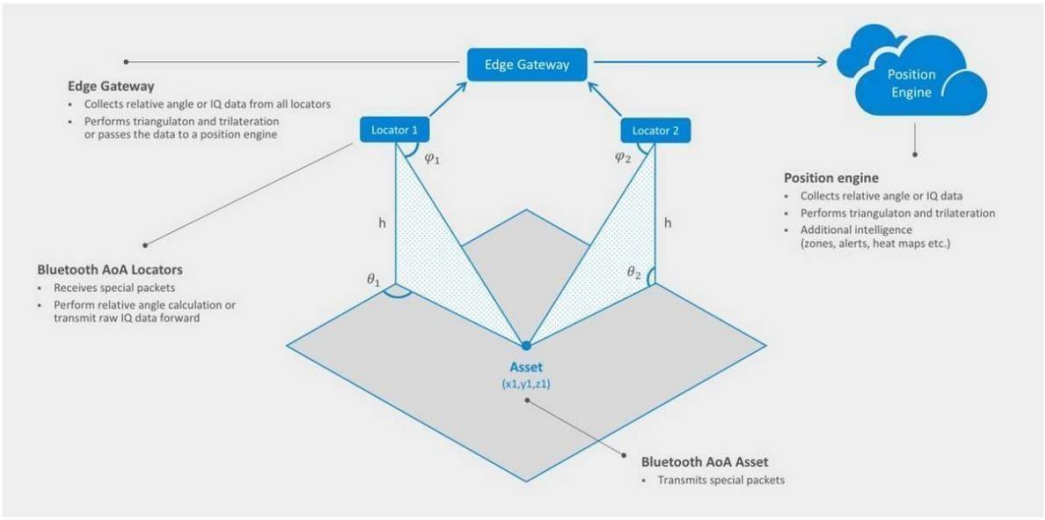
Height =h , α= 60℃ ， Coverage r= h*tagα ≈2h

8. Multiple gateways - Large Area

The strap-down combination of multiple gateways obtains a larger positioning coverage space, and multiple anchor course angel calculations improve the global spatial accuracy level.



As follows



9. Beacons

Using Nordic beacons, the beacon broadcast frequency is 1s, and the maximum number is 50
Using silicon labs beacons, there is an enhanced method, which can support up to 1000 beacons

10. Application scenarios

- Real-time tracking of the elderly and children
- Product tracking
- Toolmanagement
- Indoor navigation
- Asset positioning