Rayson Technology Co., Ltd.

BTM-NL15X(Nordic nRF54L15) Bluetooth 6.0-(Channel Sounding) Overview

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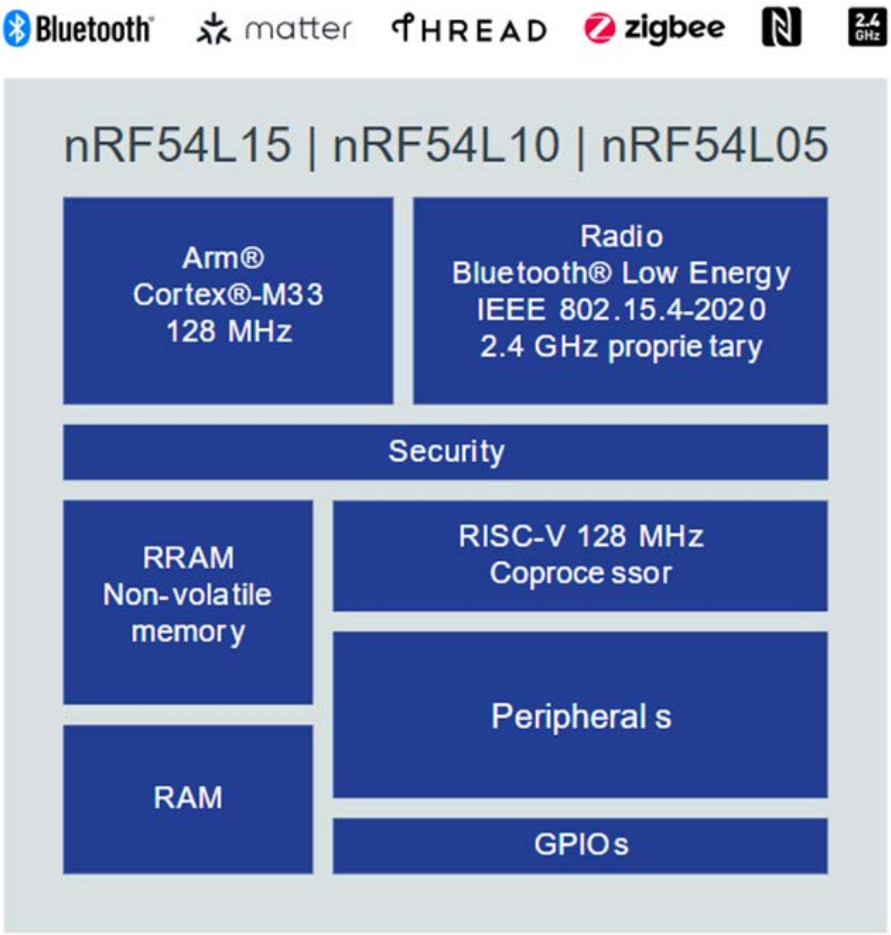
The nRF54L series supports low-power Bluetooth, Bluetooth Mesh, Thread, Matter, Zigbee, Amazon Sidewalk, and 2.4 GHz proprietary protocols, with enhanced features such as a data transfer rate of up to 4 Mbps. This series is designed for future applications and supports the Bluetooth 6.0 specification, including Bluetooth Channel Sounding technology.

A. **nRF54LXX IC Series**

Three new wireless SoCs are introduced: nRF54L15, nRF54L10, and nRF54L05, offering higher efficiency and processing power to support a wide range of IoT applications.



B. **Introduction to Nordic nRF54L15 SoC Chip Features**

Key Features:

- Nordic chip equipped with ARM Cortex M33 + RISC-V 128MHz co-processor
- Memory Capacity:
  - nRF54L15 (1.5MB NVM, 256KB RAM)
  - nRF54L10 (1.0MB NVM, 192KB RAM)
  - nRF54L05 (0.5MB NVM, 96KB RAM)
- The nRF54L series offers improved performance and lower power consumption compared to the nRF52 series
- Multi-protocol support: Supports Bluetooth, Thread, Matter, Zigbee, Amazon Sidewalk, and is compatible with Bluetooth 6.0 specification
- Process and Security: Built using 22nm process technology to enhance performance and power efficiency; includes security features such as TrustZone isolation and tamper sensors.

Product Applications:

- Supports low-power Bluetooth and IoT applications, such as wearable devices, medical equipment, smart home systems, and more.
- The nRF54L15 offers the most powerful features, making it suitable for high-demand applications; the nRF54L10 and nRF54L05 are ideal for large-scale, cost-effective products.

C. **Bluetooth Specification 6.0 - Channel Sounding Overview**

Channel Sounding is a Bluetooth technology designed to accurately measure the distance between two Bluetooth devices, typically used to improve the positioning accuracy between devices. It achieves higher distance measurement precision than traditional Received Signal Strength Indicator (RSSI) by measuring the signal propagation characteristics between devices, reaching centimeter-level accuracy.

How Channel Sounding Technology Works:

P BR (Phase-Based Ranging)

PBR is a ranging method used in channel sounding technology that calculates

the distance between two devices based on the phase difference of the signal. The core principle of this technology is to measure the changes in the signal's phase.

- **Principle**: When a signal is transmitted between Bluetooth devices, it propagates through the air, and its phase changes with the variation in distance. The PBR method measures the phase difference between the transmitted and received signals, allowing the calculation of the distance the signal has traveled.
- **Advantages**: PBR offers very high accuracy, typically achieving centimeter-level precision, and is less susceptible to external interference (such as multipath effects or attenuation). This makes it more accurate than traditional signal strength-based distance measurement methods (like RSSI).
- **Application Scenarios**: PBR is widely used in situations requiring high-precision positioning, such as smart locks, precise location tracking, and other distance-based security applications.

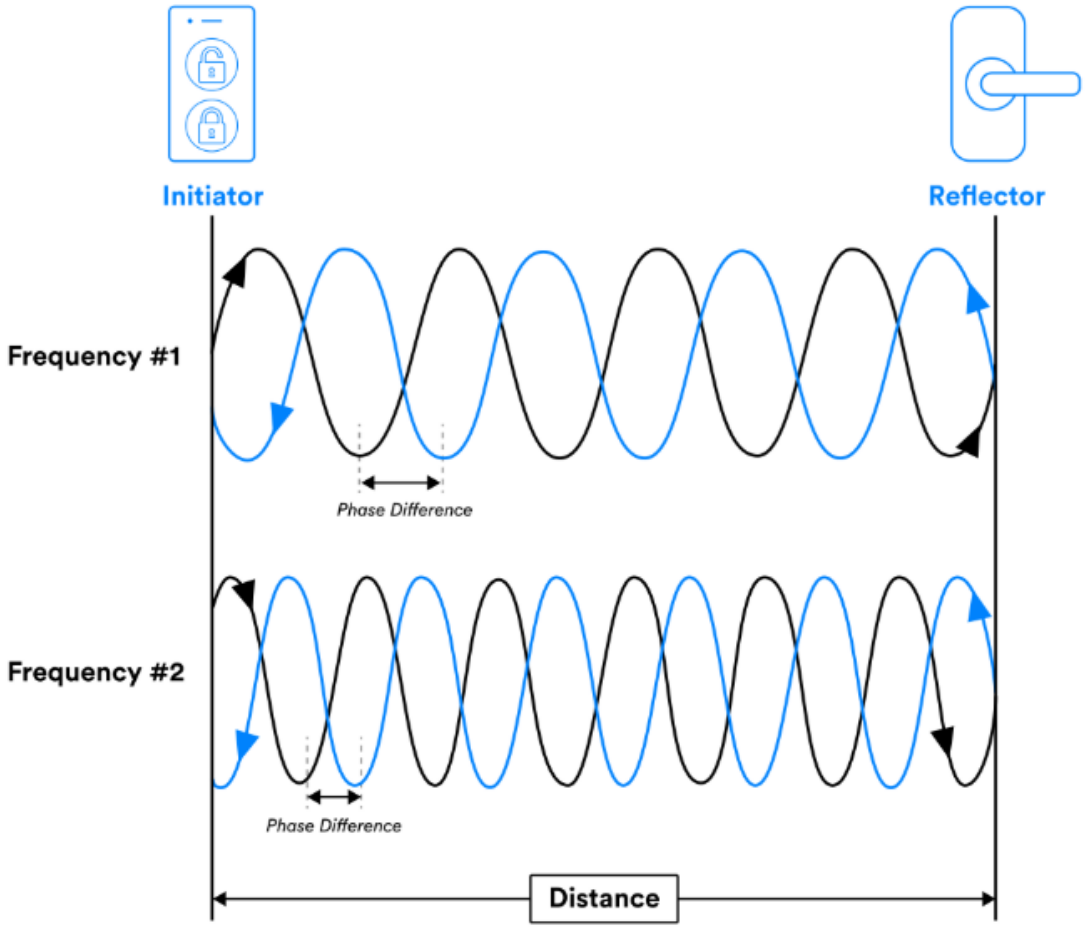


Image Source: Bluetooth SIG

RTT (Round-Trip Time) Measurement

RTT is another ranging method used in channel sounding technology, which calculates the distance based on the time it takes for a signal to travel from one device to another and back.

- **Principle**: The RTT method calculates the distance by measuring the time it takes for a signal to travel from the sender to the receiver and return (the "round-trip time"). Based on the signal propagation speed in the air, the distance between the two devices can be calculated.
- **Advantages**: The accuracy of RTT is influenced by the precise measurement of the signal propagation time, enabling it to provide more accurate distance data. This is particularly important for applications that require high precision, such as location tracking and accurate interaction between smart devices.
- **Application Scenarios**: RTT is typically used in Bluetooth 5.1 and higher versions for precise positioning technologies, and is widely applied in indoor positioning, item tracking, asset management, and similar scenarios.

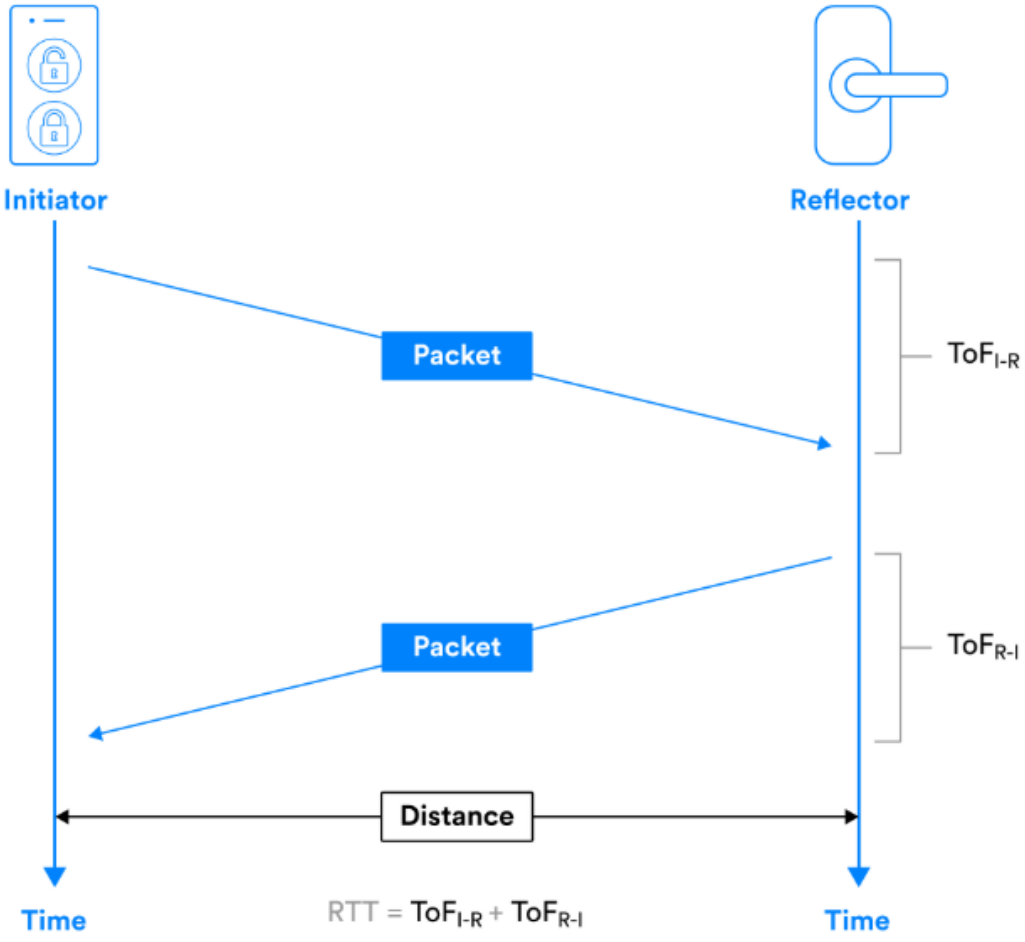


Image Source: Bluetooth SIG

Reference Sources:

- Bluetooth Channel Sounding
- nRF54LXX Product Overview