AN13382

Coexistence Overview for IW612

Rev. 2.0 — 21 April 2025 **Application note**

Document information

Information	Content
Keywords	IW612, Wi-Fi radio, Bluetooth radio, 802.15.4 radio, narrowband radios, coexistence, real time arbitration, interference avoidance, traffic priority, rules, central hardware Packet Traffic Arbiter (PTA), local hardware arbiter, coexistence software, request/grant
Abstract	Provides an overview of coexistence between Wi-Fi, Bluetooth, and 802.15.4 radios in tri-radio wireless devices

1 Scope

This document provides an overview of coexistence between Wi-Fi and narrowband radios in IW612. NXP's coexistence solution provides real time arbitration between on-chip radios on a per-packet basis.

2 Coexistence architecture overview

The coexistence architecture has three major components:

- Central hardware Packet Traffic Arbiter (PTA): arbitrates between on-chip Wi-Fi and narrowband radios. Controls the front end components such as RF switches.
- Local hardware arbiter: arbitrates the packets between Bluetooth and Bluetooth Low Energy (LE).
- Coexistence software: configures PTA and works with the Wi-Fi and narrowband firmware.

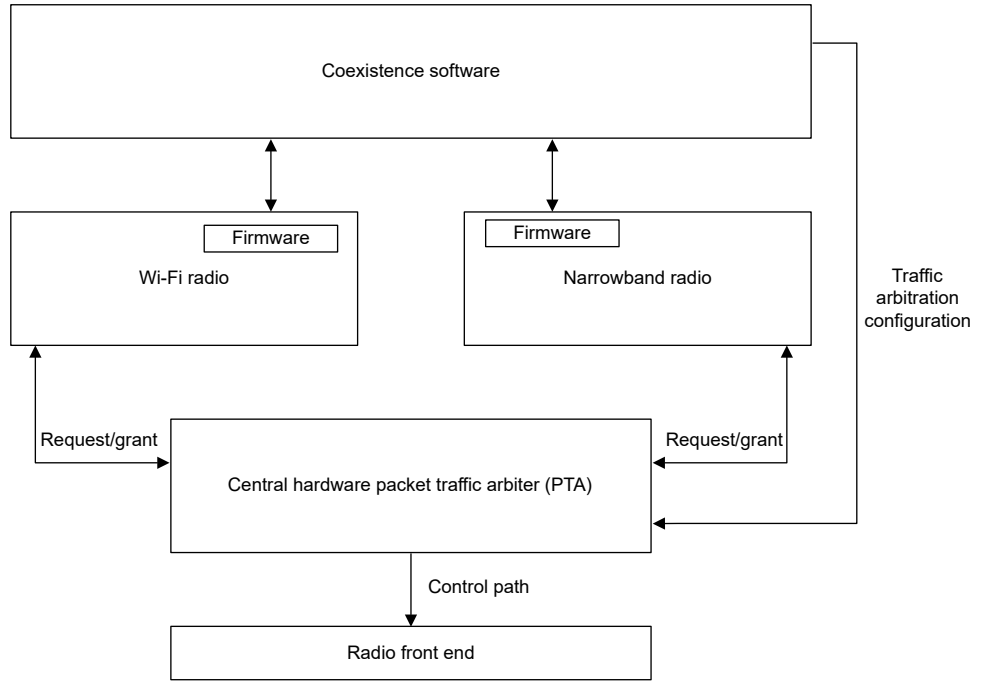

Figure 1. Coexistence subsystem

3 Coexistence mechanism

NXP's coexistence mechanism is a combination of interference avoidance and arbitration between Wi-Fi and narrowband radios.

Interference avoidance is the coordination between the Wi-Fi and Bluetooth/Bluetooth LE radios in order to avoid over-lapping frequency usage. The coordination helps Bluetooth to adapt the AFH map and avoid hopping into the Wi-Fi channel, reducing the interference to each other.

In addition to interference avoidance, the central hardware PTA provides real-time arbitration between the Wi-Fi and Bluetooth/Bluetooth LE radios on a per-packet basis. This arbitration can be statically enabled/disabled. The individual radios post a request to the central hardware PTA to access the radio front end. The hardware PTA grants access to the individual radios based on the configured priorities and on the grant rules.

Enable the operating channel of 802.15.4 radio far from the Wi-Fi channel (recommendation).

3.1 Traffic priority

Wi-Fi traffic priority is assigned based on the frame type and subtype of the Wi-Fi packets. On IW612, the priority assignment based on traffic category is also implemented.

Bluetooth/Bluetooth LE traffic priority is assigned based on the chosen profiles or operations.

802.15.4 traffic priority is assigned based on the chosen operations.

The firmware statically configures the priorities for the Wi-Fi, Bluetooth/Bluetooth LE, 802.15.4 traffic. The firmware also sets the arbitration rules in the central hardware PTA and local hardware arbiter.[1]

3.2 Arbitration request to the central hardware PTA

The Wi-Fi subsystem asserts a request with traffic priority and traffic direction to the central hardware PTA arbiter in the following situations:

- An incoming 802.11 packet is detected
- Any 802.11 packet transmission
- A fixed latency packet is expected (ACK/block ACK)

The Bluetooth subsystem asserts a request to the central hardware PTA in order to transmit or receive. The request is accompanied with priority, traffic direction, and frequency information.

The 802.15.4 subsystem asserts a request to the central hardware PTA in order to transmit or receive. The request is accompanied with priority, traffic direction and frequency information.

1 Any change to the current settings requires a firmware update.

3.3 Central hardware PTA grant rules

The central hardware PTA grants access based on the relative priority of the incoming requests when traffic collisions occur. This situation is illustrated in the following example.

Example of traffic interference

Context: A2DP streaming on Bluetooth radio and web browsing/email/file download on Wi-Fi radio.

In this context, and as illustrated in Figure 2;

- A2DP traffic is Bluetooth priority Level 3 within the Bluetooth controller
- Wi-Fi web-browsing traffic has priority level 1 within the Wi-Fi controller

Relative priority assignment - Based on the relative priority assignment in PTA, Bluetooth priority level 3 is higher compared to Wi-Fi priority level 1.

Conflict resolution - The central hardware PTA grants the traffic access to:

- A2DP and stops the Wi-Fi traffic that causes an interference/conflict
- Wi-Fi traffic when there is no interference/conflict with A2DP

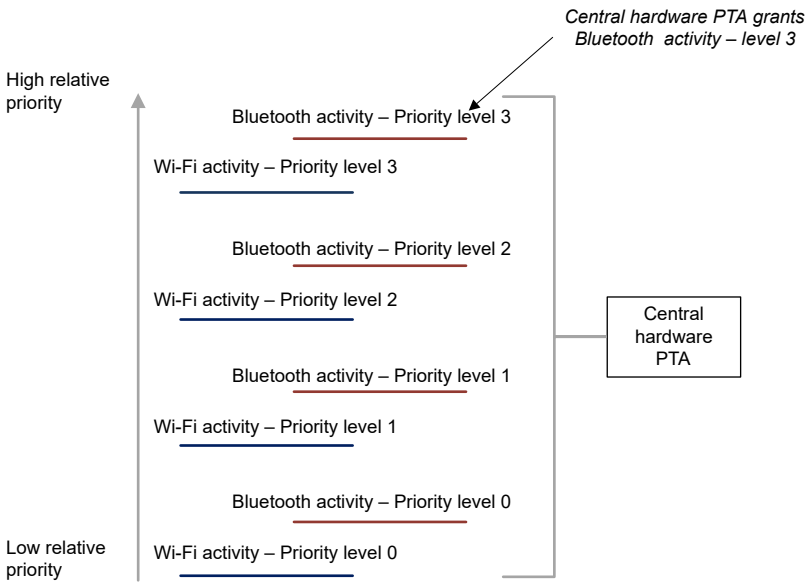

Figure 2. Central hardware PTA relative priority assignment example

4 Coexistence operating mode - Antenna configuration

4.1 Shared antenna application

In a shared antenna application, one antenna is shared between the Wi-Fi and narrowband radios. Access to the antenna is through an RF switch. Wi-Fi and narrowband radios do not have simultaneous access to the antenna. The central hardware PTA manages the arbitration between Wi-Fi and narrowband access to the antenna and controls the switch in real time.

4.2 Dedicated antenna application

In applications where the Wi-Fi and narrowband radios each have a dedicated antenna, the central hardware PTA arbitrates between the Wi-Fi and narrowband radios based on IW612 specification. The need for arbitration between Wi-Fi and narrowband depends on the antenna isolation, the target output powers, and the operating environments. The arbitration setup can be reviewed for each product implementation.

5 Revision history

Table 1. Revision history

Document ID	Release date	Description
AN13382 v.2.0	21 April 2025	• Changed the document access to public. • Section 1 "Scope": renamed Bluetooth as narrowband. • Section 2 "Coexistence architecture overview": renamed Bluetooth radio as narrowband radio and updated the figure. • Section 3 "Coexistence mechanism": – Renamed Bluetooth/Bluetooth LE as narrowband in the first paragraph. – Added the last paragraph about 802.15.4 radio. • Section 3.1 "Traffic priority": added 802.15.4 information. • Section 3.2 "Arbitration request to the central hardware PTA": added the last paragraph about 802.15.4 subsystem. • Section 4.1 "Shared antenna application": replaced Bluetooth with narrowband. • Section 4.2 "Dedicated antenna application": replaced Bluetooth with narrowband.
AN13382 v.1.0	27 June 2022	• Initial release

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