The Importance of Ultra-Wideband (UWB) and Channel 9 at a Glance

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A snapshot of the secured and precise positioning technology for access control management at Aliro and the Connectivity Standards Alliance, and why the currently used frequency band must be protected.

Notice and Disclaimer

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1. Executive Summary

Ultra-Wideband (UWB) is a core enabling technology of the Aliro standard for secure, interoperable access control released in February 2026 by the Connectivity Standards Alliance (Alliance).

While Near Field Communication (NFC) and Bluetooth® Low Energy (BLE) handle tap, proximity ranging, and data transfer, UWB is the only Aliro option that delivers secured, centimeter-class ranging with relay-attack resistance, the capability that makes trustworthy hands-free access possible.

Practically all UWB devices operate on Channel 9 (approximately 7.7–8.3 GHz. It is the only UWB channel harmonized across all major regions and is already deployed in more than one billion devices.

Channel 9 is therefore not one option among many — it is the single point of global interoperability on which the UWB ecosystem and Aliro depend.

UWB earns its place as a technology coexisting successfully with several other services in unlicensed frequency bands. Its very low transmit power (−41.3 dBm/MHz EIRP) and low duty cycle allow it to coexist with incumbent satellite, fixed-link, and radar services without causing harmful interference for over 20 years.

That coexistence is now at risk. Studies launched at the World Radiocommunication Conference 2023

(WRC-23), to be decided under Agenda Item 1.7 at WRC-27, are examining whether the range around Channel 9 should be identified for high-power International Mobile Telecommunications (IMT) use. Ubiquitous high-power IMT transmitters in this band would degrade UWB receiver performance and jeopardize the installed base and future investment.

The Alliance's position on this development is therefore, in brief:

- Preserve Channel 9 worldwide as a globally harmonized band for low-power UWB for short and mid-term implementations.
- Enable thoughtful expansion above 8.5 GHz (e.g., Channel 12) for optional next-generation sensing and tracking, extending the ecosystem beyond Channel 9 in the long term.

2. Introduction

Ultra-Wideband (UWB) is a technology that has been around for decades, but only in the last seven years has it seen a major uptake in large volumes. It uses Impulse radio technology and is standardized within IEEE 802.15.4.

Operating in the range 6 – 9 GHz, UWB allows secured and precise positioning of devices such as smartphones, vehicles, or respective anchor infrastructures. Thanks to the underlying technology, it works seamlessly in indoor and outdoor environments.

Several industry consortia worked together to form a single fully interoperable ecosystem. This includes:

- FiRa Consortium, providing a holistic standardized UWB framework supporting many use cases
- Car Connectivity Consortium (CCC), using UWB within Digital Keys in all kinds of vehicles
- Profibus Omlox, focusing on industrial asset tracking and RTLS based on UWB
- Connectivity Standards Alliance (Alliance) with its standards around Aliro, Matter, and Zigbee.

This document provides an overview of the importance of UWB while used in Aliro, the recently released standard of the Alliance for Access Control, explaining the technology and importance of UWB for IoT and other applications, and elaborating on the importance of continuous discussion for UWB regulatory aspects in general, and particularly the most widely used UWB Channel 9.

3. Aliro and its role within the IoT ecosystem and the Alliance

As cybersecurity threats grow, organizations increasingly rely on access control solutions to protect sensitive resources and comply with data privacy regulations. These solutions are used to ensure only authorized users and systems can access protected spaces or information without compromising convenience for the user while using smartphones or other smart devices.

Access control is already embedded in our daily life, from office buildings and homes to vehicles and public venues. However, the shift from traditional mechanical keys towards digital credentials in smart devices has introduced significant complexity. Multiple products must work together to open, manage, distribute, and secure access points, and today, these products often come from different manufacturers with incompatible systems.

The lack of interoperability across vendors creates inefficiency, raises costs, and limits flexibility for organizations that deploy access control. No single standard has governed how these systems communicate, leaving the market fragmented and slow in the past.

To address this, the Connectivity Standards Alliance (Alliance), a global body of over 800 member organizations focused on open standards for connected devices within the IoT, launched Aliro 1.0 in March 2026, complementing existing Zigbee and Matter standards.

Aliro is a unified, open standard designed to enable secure and seamless access control across products and providers.[1]

Aliro 1.0 Key Features:

- **Broad applicability**: Aliro supports use cases across corporate offices, universities, hospitality, and residential buildings (both single-family and multi-unit).
- **Industry-wide development**: More than 200 cross-industry stakeholders contributed to the standard.[3]
- **Established technologies**: Aliro builds on widely adopted connectivity technologies, specifically Near Field Communication (NFC), Bluetooth Low Energy (BLE), and Ultra-Wideband (UWB).
- **Strong security and privacy**: The standard uses asymmetric cryptography to ensure trusted interactions between user devices (such as smartphones or wearables) and access readers, while safeguarding user privacy.
- **Back-end neutrality**: Aliro does not mandate a specific back-end system, giving organizations flexibility in their infrastructure choices.
- **Certification program**: A formal certification process, managed through Authorized Test Labs, ensures compliance and quality.

Aliro reduces implementation, integration, and maintenance costs while increasing flexibility both within and across sectors. It also aligns with the work of other industry consortia, including the FiRa Consortium, Car Connectivity Consortium, NFC Forum and Bluetooth SIG, promoting harmonization rather than duplication. A closer examination of Aliro's underlying technology, particularly the role of Ultra-Wideband, offers further insight into how the standard achieves secure, precise, and seamless access control.

3.1 Aliro implementations

Serving as a digital access framework, Aliro enables interoperability for smart and secure access. It is designed to work across the above-mentioned multiple radio technologies, grounded in robust security and providing opportunities for different user experiences.[2]

3.1.1 User experience using different wireless technologies

Aliro is designed to be technology-agnostic, meaning the same digital key and credentials can function across different communication technologies and device types. It supports three connectivity options, each suited to different use cases: (Table 1)

Mode	Technology	Range	Best suited for
Tap-to-unlock	NFC	Close contact	Turnstiles, elevators, battery-constrained readers
Remote unlock	Bluetooth Low Energy (BLE)	A few meters	Smart locks requiring proximity-based control
Hands-free access	BLE combined with UWB	Several meters	Seamless entry without removing a device from a pocket or bag or entering a garage or car park

Table 1: Connectivity technologies used within Aliro

Each Technology contributes:

- **NFC (Near Field Communication)** provides fast, energy-efficient unlocking through a simple tap. It delivers predictable user intent (the user clearly chooses to interact) and is mandatory in every Aliro 1.0 deployment. NFC also ensures backward compatibility with existing products such as smart cards.
- **BLE (Bluetooth Low Energy)** extends the communication range to several meters, enabling device discovery and remote lock control. It is an optional addition.
- **UWB (Ultra-Wideband)**, when combined with BLE, enables the most advanced use case: Full hands-free and secured access, aka passive entry. BLE handles the initial device discovery, while UWB adds precise distance measurement and directional awareness. This allows the system to understand a user's trajectory and grant access only when clear intent is determined.

UWB is fundamental to achieving the required security level for passive entry. UWB's time-of-flight measurements provide strong protection against relay attacks, a common vulnerability in which an attacker intercepts and retransmits signals to gain unauthorized access from a distance.

UWB can verify the actual physical proximity of the user's device, making such attacks extremely difficult. Additionally, UWB enables in-out detection, meaning the system can distinguish whether a person is entering or exiting a space, which is very important in access control measurements. (Figure 1)

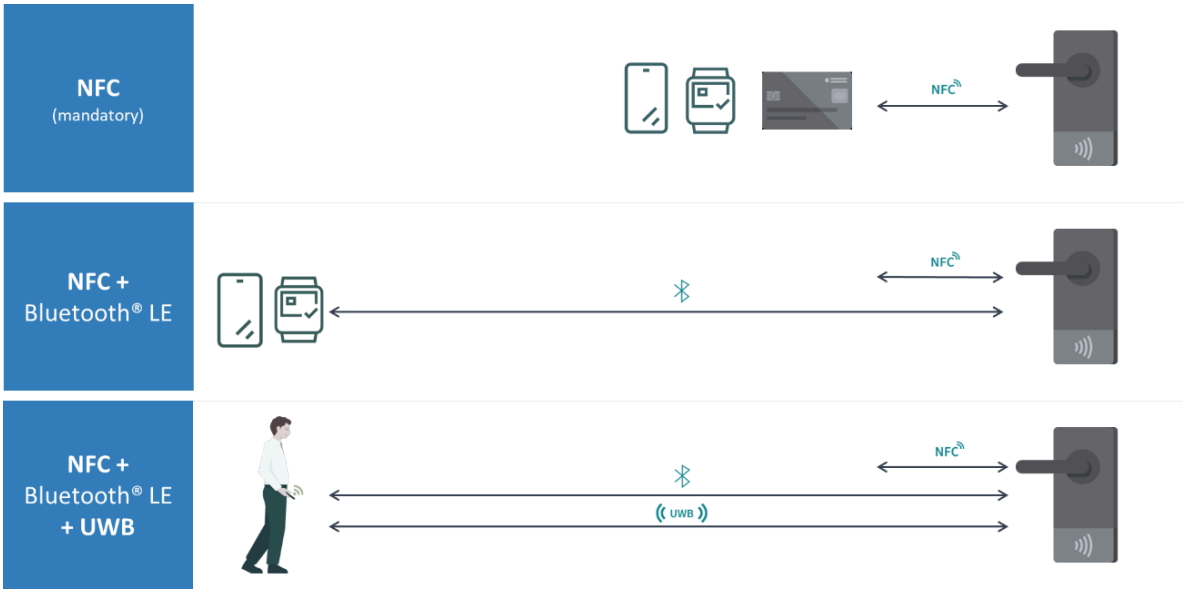

Figure 1: Aliro 1.0 has adopted different wireless technologies (Source: Infineon Technologies)

While every Aliro deployment must include NFC as a baseline technology, ensuring universal compatibility and backward support for existing infrastructure, BLE and UWB are optional enhancements that organizations can adopt depending on their needs. However, only the combination of BLE and UWB delivers secured hands-free access with relay-resistant distance verification and directional awareness. Organizations seeking the highest level of convenience and security will therefore benefit from deploying all three technologies together. (Figure 1)

3.1.2 Security and a typical Aliro interaction

Aliro is built on hardware-backed cryptography and mutual authentication between a user device (phone, watch, or card) and a reader. It supports online and offline operation and a range of credential types — long-lived device-bound credentials, time-limited or single-use guest passes, role or group credentials, and site- or area-scoped keys — with issuance, renewal, suspension, and revocation handled by a back-end system. This flexibility lets Aliro serve private homes, commercial buildings and the hospitality sector alike.

A typical interaction begins before the door opens:

- **Enrolment / provisioning** — the issuer verifies the user and securely delivers a credential bound to the device hardware, with defined scope, validity, and revocation rules.
- **Discovery and PHY negotiation** — the reader advertises its capabilities; the device selects the best radio and establishes a secure, replay-resistant session via challenge-response.
- **UWB distance bounding** — where implemented, UWB confirms the device is genuinely nearby before the credential is presented.

- **Policy evaluation** — the reader checks who, where, when, how close and which factors are required.
- **Actuation and audit** — the reader unlocks or denies and writes an event-log entry.

Aliro also supports device-management needs (on-device permission updates, background refresh of revocation lists, rapid revocation for lost devices, key sharing) and failover behaviors, e.g., falling back to an NFC tap if hands-free fails or enforcing stricter time windows when offline.

3.2 Outlook for Aliro

Aliro 1.0 is the foundation of the interoperable access control journey, not the finished article.[3] The Aliro Working Group is developing enhancements — new application-level features, additional technology implementations, security improvements, and updated regulatory requirements — while preserving backwards compatibility to protect existing investments.

Because access-control deployments have long life cycles, the radios Aliro relies on, and above all, UWB Channel 9, must remain available for the long term. That makes the regulatory question in Section 5 strategically important for the whole standard.

4. UWB technology and market context

4.1 What makes UWB different

UWB is a short-range, low-power wireless technology that uses wideband impulse radio and time-of-flight measurement (see Figure 2). Each channel is typically 500 MHz wide — far wider than Bluetooth® or Wi-Fi® — which is what gives UWB its precision and its robustness in multipath environments such as crowded indoor spaces. UWB spectrum spans 3.1–10.6 GHz, but in practice, almost all devices operate at 8 GHz (Channel 9) for maximum compatibility and futureproofing.[4]

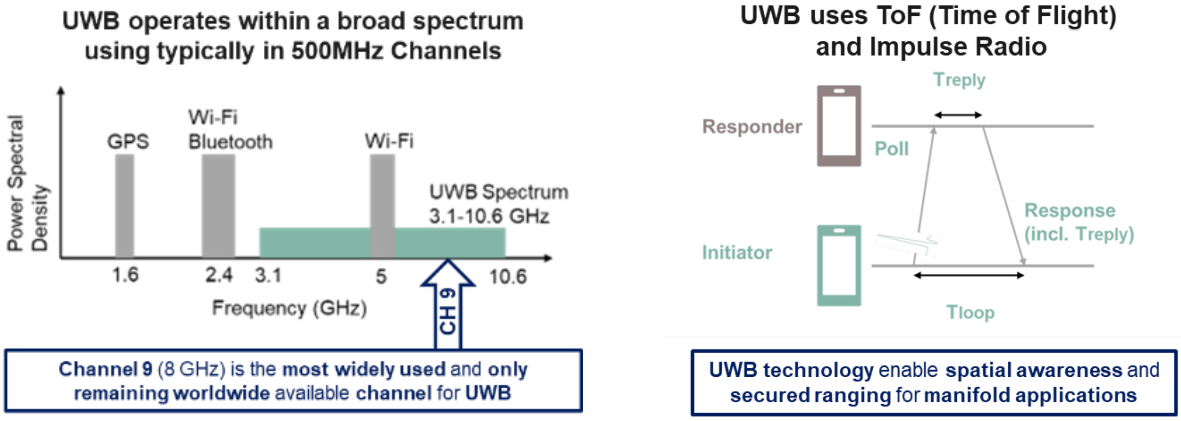

Figure 2: Characteristics and spectrum use of UWB

Crucially, UWB transmits at extremely low power (−41.3 dBm/MHz EIRP) and at a low duty cycle. It can therefore share spectrum with incumbent services — including satellite systems, fixed links, and radar — without causing harmful interference. This is why UWB is widely known within the ecosystem to "invisibly" coexist with other technologies.

State-of-the-art UWB adds strong security on top of precise ranging — notably Scrambled Timestamp Sequence (STS) using secret keys held in a Secure Element — to defeat relay and man-in-the-middle attacks.

These properties have made UWB the technology of choice across a growing set of use cases:

- Digital car keys (Car Connectivity Consortium)
- Hands-free unlocking and secure building access (Alliance, Aliro)
- Locating personal items, such as item-finder tags (FiRa, Omlox)
- Tap-free payment in car-related settings such as toll, drive-through, parking (FiRa, CCC)
- Access and payment in public transport (FiRa)
- Point-and-trigger control of smart-home devices and proximity sensing (FiRa, Alliance)
- Real-time location and navigation in commercial and industrial settings (FiRa, Omlox)

4.2 Standardization has matured the technology

Early UWB standards, written around twenty years ago, targeted high-data-rate, short-range communication. Over time, IEEE standardization shifted UWB toward secure, precise ranging and spatial awareness – the way it is used today.

IEEE standard	Year	What it added
802.15.4a	2007	Impulse-radio UWB with ~2-nanosecond pulse widths
802.15.4z	2020	Secure fine-ranging at PHY/MAC; higher pulse-repetition modes; strengthened security
802.15.4ab	expected 2027	Extended range via Narrowband-Assisted ranging; more data rates; standardised sensing

Table 2. IEEE 802.15.4 UWB milestones.

Several consortia (Aliro/Alliance, CCC, FiRa, omlox) build on the same IEEE 802.15.4 base, which is the foundation of cross-industry interoperability as shown in Figure 3.

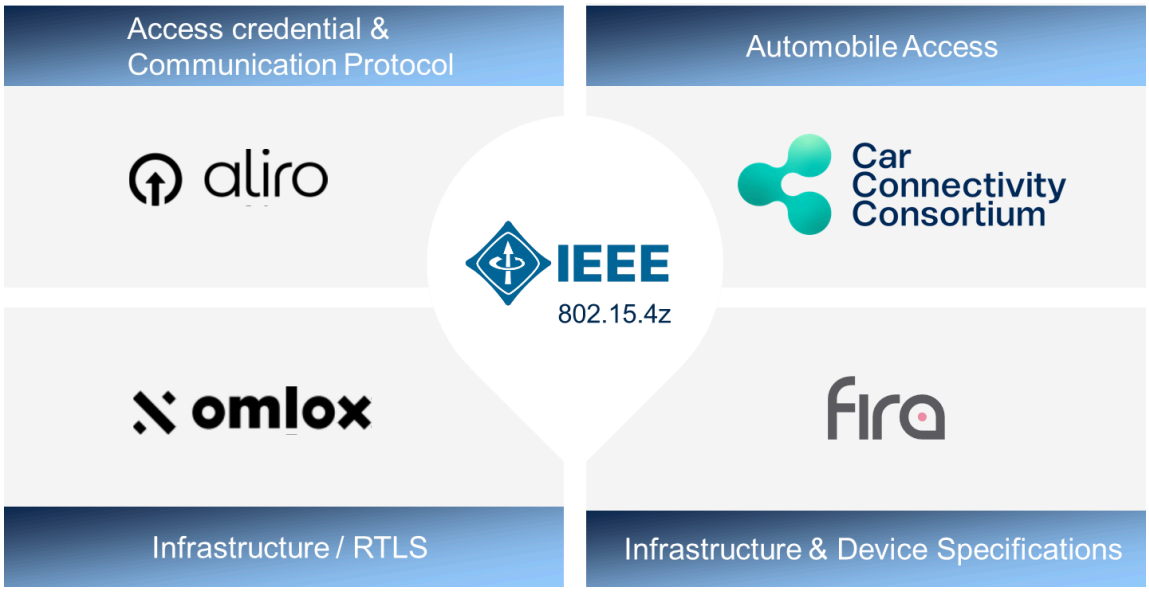

Figure 3: UWB adoption by various industry standards

4.3 Demand for UWB products is accelerating

UWB has been built into smartphones to enable secure access and context-aware interfaces.

ABI Research projects that by 2028, nearly half of all smartphones shipped will include UWB, rising above 52% by 2030, with close to 1.4 billion UWB-enabled devices shipping annually by 2030. Alliance-relevant segments — Aliro access control and Matter smart-home — are among the fastest-growing.

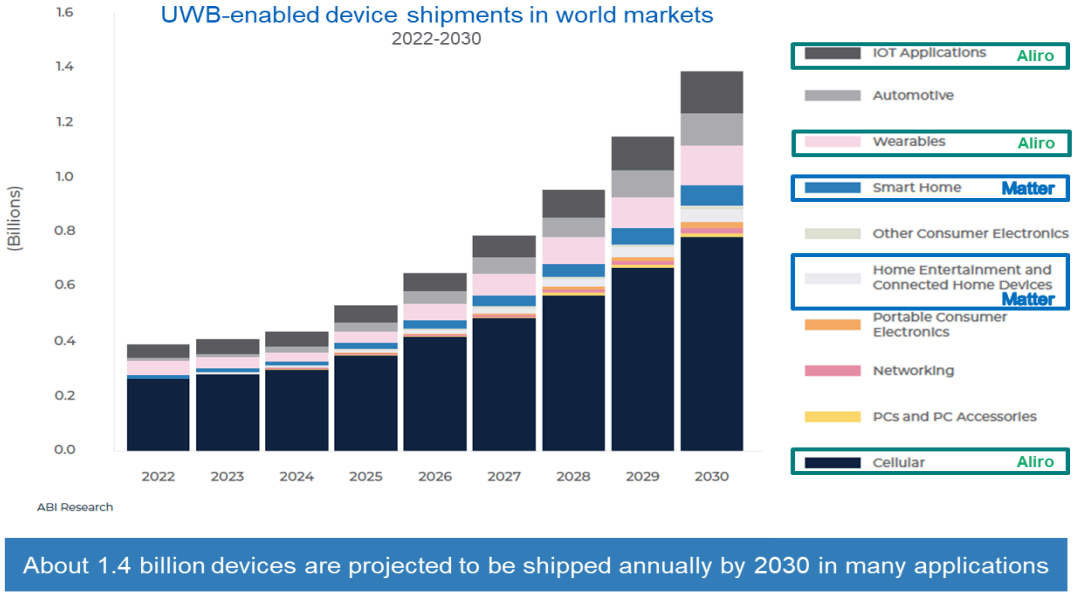

Figure 4: Historic and anticipated future shipments of devices using UWB technology, incl. Aliro / Matter use cases.

4.4 Continuous innovation will trigger manifold new use cases for UWB

Based on this projection, the momentum of UWB technology within the different ecosystems becomes obvious. Today's application using UWB already touches our daily life, but it is expected that based on the continuous enhancement of the technology and the creativity of the players involved, manifold new use cases involving UWB will be created. Precise and secured ranging is expected to advance our everyday life beyond today's market prediction. Apart from convenience, security and safety aspects, UWB is expected to have a significant impact on the worldwide economy and society as shown by a study from Telecom Advisory Service[5].

4.5 Economic and Societal Impact

UWB is projected to generate roughly **$36.7 billion in annual global economic impact by 2030** — $6.6 billion in direct GDP, $15.3 billion in producer surplus from operational efficiency, and $14.9 billion in consumer surplus from time savings and convenience. Direct annual GDP impact alone is expected to grow from $1.8 billion in 2022 to $6.6 billion in 2030, supporting an estimated 287,800 job-years globally over the period. [5]

Global Total Economic Impact of UWB (2022-2030)

Area	2022	2023	2024	2025	2026	2027	2028	2029	2030	CAGR
Gross Domestic Products	$1.82	$1.93	$2.36	$3.02	$3.74	$4.44	$5.14	$5.87	$6.65	17.33%
Producer Surplus	$1.88	$2.77	$3.58	$4.74	$6.35	$8.18	$10.30	$12.68	$15.26	29.93%
Consumer Surplus	$3.11	$4.04	$4.55	$5.63	$7.25	$9.18	$11.13	$13.04	$14.94	21.66%
Total	$6.82	$8.74	$40.49	$13.40	$17.34	$21.80	$26.57	$31.60	$36.76	23.44%

USD billion

Beyond measurable output, UWB delivers public-safety benefits that GDP and surplus figures do not fully capture — child-presence detection in vehicles, firefighter tracking in emergency response, and real-time patient monitoring in healthcare — reducing injuries, preventing fatalities, and lowering healthcare, insurance and legal costs.

5. The case for Channel 9

UWB's long-term value depends on continued, guaranteed access to the right spectrum. Because that access is set by national and regional regulators, sustained engagement is essential, in particular **the future of Channel 9 itself**.

5.1 A Continuity for UWB Channel 9

Beyond these boundary conditions, the allocation of the underlying bands is itself under discussion. Several bands originally opened for UWB have already been reallocated to other services and are no longer available. Attention, therefore, now centers on the band where industry has already coalesced and made significant investment: channel 9. (Figure 6)

UWB channel 9 (see also Chapter 3) spans approximately 7.7 to 8.3 GHz and sits within the broader global UWB operating range.

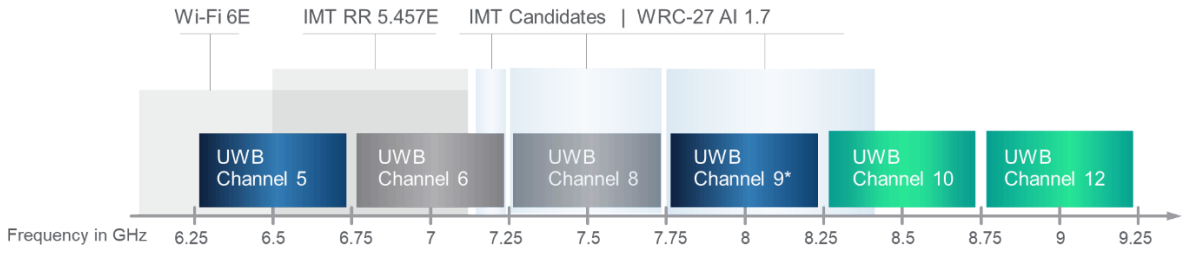

Figure 6: UWB channels allocated across the frequency, Source: FiRa Consortium[4]

Today, it is the only UWB channel available worldwide and is deployed in billions of devices.

While industry consortia support principally multiple UWB channels, channel 9 is the most widely used channel for UWB devices and remains the center of industry investment due to its global harmonization as displayed in Figure 7.

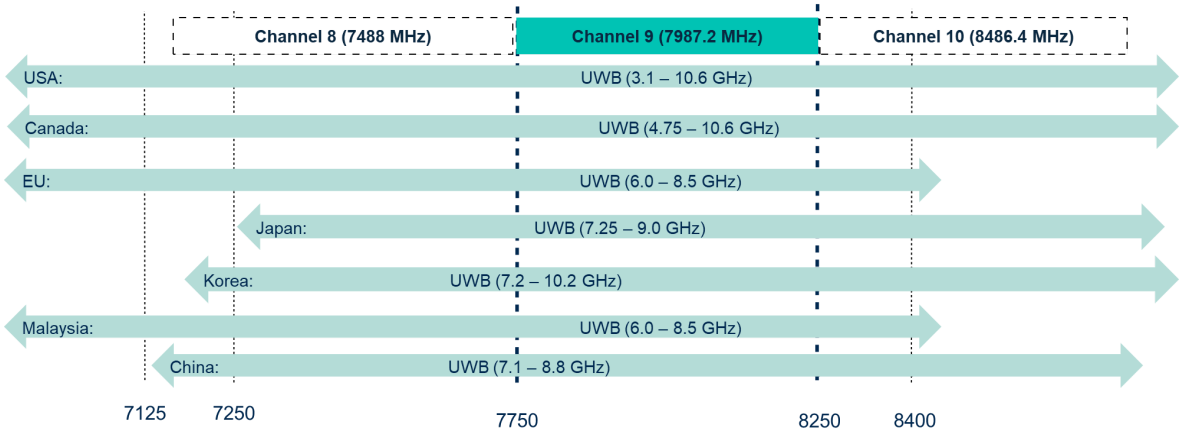

Figure 7: UWB Global Spectrum Harmonization, channel 9 is the only one that can be used globally. Source: FiRa Consortium[4]

UWB coexists effectively with incumbent satellite, fixed-link, and radar services in the 6–8.5 GHz range thanks to its very low power and duty cycle.

The risk is asymmetric: if this band was identified for high-power, ubiquitous IMT use, widespread high-power transmitters would degrade UWB receivers — even though UWB

causes no comparable problem for them. The portion of the band around 8 GHz is therefore essential to continuity for existing deployments and to future growth. Preserving this globally harmonized channel provides regulatory certainty, protects an installed base of more than one billion devices, and sustains ecosystem development.

5.2 WRC-23 and WRC-27 Agenda Item 1.7

The trigger for current concern is the ITU process. The World Radiocommunication Conference 2023 (WRC-23) initiated studies that will be decided under **Agenda Item 1.7 at WRC-27**, examining whether the range around Channel 9 should be identified for IMT. Those studies have already prompted coordinated action by the UWB consortia ahead of WRC-27. The Alliance view is that the band should remain protected for low-power UWB.

6. Conclusion

UWB has evolved from a niche wireless technology into a foundational enabler of secure, precise spatial awareness. It now underpins access control and real-time location services, personal-device tracking, smart-home automation, mobility, and industrial operations. Its ability to measure true physical distance with high accuracy, low latency, and strong security makes it a critical complement to Wi-Fi®, Bluetooth® LE, and NFC — and that is exactly why the Alliance chose UWB as a core element of the Aliro standard.

UWB will remain the technology that enables precise, secure access to doors and openings across many verticals, and it may extend into Matter smart-home use cases for proximity ranging and sensing. Sustaining that momentum — and protecting the long-life-cycle investments of the access-control industry — depends on regulatory alignment.

The globally harmonized band at 8 GHz (UWB Channel 9) underpins billions of deployed devices and remains the only worldwide channel available for certified products. **Preserving this band will provide the certainty the ecosystem needs** for continued innovation, investment, and deployment.

The Alliance fully supports a joint, cross-consortium approach to regulators worldwide to secure that outcome.

7. References

[1,2,3] Aliro FAQ; Aliro launch page; Aliro press release

[4] *The Technology and Applications Behind Ultra-Wideband*— A Whitepaper

[5] *FiRa UWB Socio-Economic Study* White Paper