ERICSSON

Mining without blind spots

How 5G precise indoor positioning drives safety and productivity

Contents

The mining blind spot

Modern mining operations are under pressure like never before. Rising safety regulations, operational costs, and environmental and social governance (ESG) commitments are forcing mines to rethink how they operate. Mining operators must maintain continuous awareness of people, machines, and assets to ensure safety, sustain productivity, and reduce operational risk.

Achieving this level of visibility remains a challenge. Traditional tracking methods leave critical gaps: Global Navigation Satellite System (GNSS) fails underground and indoors, Wi-Fi-based systems struggle with interference and scale, and proprietary RTLS technologies are costly and difficult to manage. These limitations create blind spots that slow operations, increase the potential for accidents, and hinder advanced automation initiatives.

In today's competitive environment, mines cannot afford to operate without complete visibility. Precise indoor positioning provides the foundation for safer, smarter, and more efficient mining.

Why precise indoor positioning matters in mining

Precise indoor positioning gives mining teams continuous, real-time visibility across surface, underground, and enclosed environments. Its impact is measurable, driving improvements in safety, efficiency, and overall operational performance.

Key benefits include:

- Blast clearance verification: Confirm personnel and equipment have safely exited exclusion zones — minimizing downtime and production delays.
- Collision avoidance: Enhance safety by detecting potential hazards in tight corridors, workshops, and high-traffic areas.
- Emergency mustering: Track personnel in real time during incidents to speed response and improve situational awareness.
- Fleet optimization: Improve machine utilization, reduce idle time, and increase operational throughput.
- Remote operations and automation: Enable safe remote and autonomous operations, reducing human exposure to high-risk environments.

Beyond these immediate outcomes, precise indoor positioning also creates a foundation for digital transformation and operational intelligence, including predictive maintenance, traffic flow optimization, and integration with digital twin platforms. Mines adopting precise positioning gain a competitive advantage, both in safety performance and productivity metrics.

Why legacy approaches fall short

Traditional approaches often fail in mining environments due to coverage, cost, or accuracy limitations:

Technology	GNSS	Wi-Fi positioning	RTLS (UWB/BLE)
Works well	Open-pit surface tracking	Small or low-density zones	Localized precision
Limitations in mining	Indoor, underground, and enclosed facilities	Interference, inconsistent accuracy, high maintenance cost; never a possibility for an open pit mine that is 4 km by 2 km	Proprietary tag-based, fragmented coverage, expensive to scale

Mines need a unified, scalable solution capable of providing reliable, accurate positioning across every operational environment — from open benches to deep tunnels and enclosed plants.

The 5G positioning model

Ericsson Private 5G integrates communication and positioning into a single, unified network, providing continuous visibility with 1–3-meter accuracy, even in challenging underground and surface environments. Unlike traditional systems requiring separate networks or proprietary tags, 5G positioning is built into the network itself, making it scalable, reliable, and device-agnostic.

Key advantages include:

Device-agnostic tracking

Any 5G-enabled handset, tablet, wearable, or machine modem can be located. This eliminates the need for dedicated asset tags or specialized hardware, reducing deployment complexity and cost.

Lower total cost of ownership (TCO)

By integrating communications and positioning, mines avoid deploying multiple proprietary overlay systems. Costs for infrastructure, maintenance, and device management are significantly reduced compared to Wi-Fi or RTLS-based approaches.

Open APIs and integration-ready architecture

Positioning data flows seamlessly into enterprise systems such as fleet management, safety dashboards, emergency response platforms, and digital twins, ensuring that actionable insights reach the right teams in real time.

Global standards

Ericsson leverages 3GPP-compliant technology, ensuring compatibility with commercial devices and future-proofing deployments as the 5G ecosystem evolves.

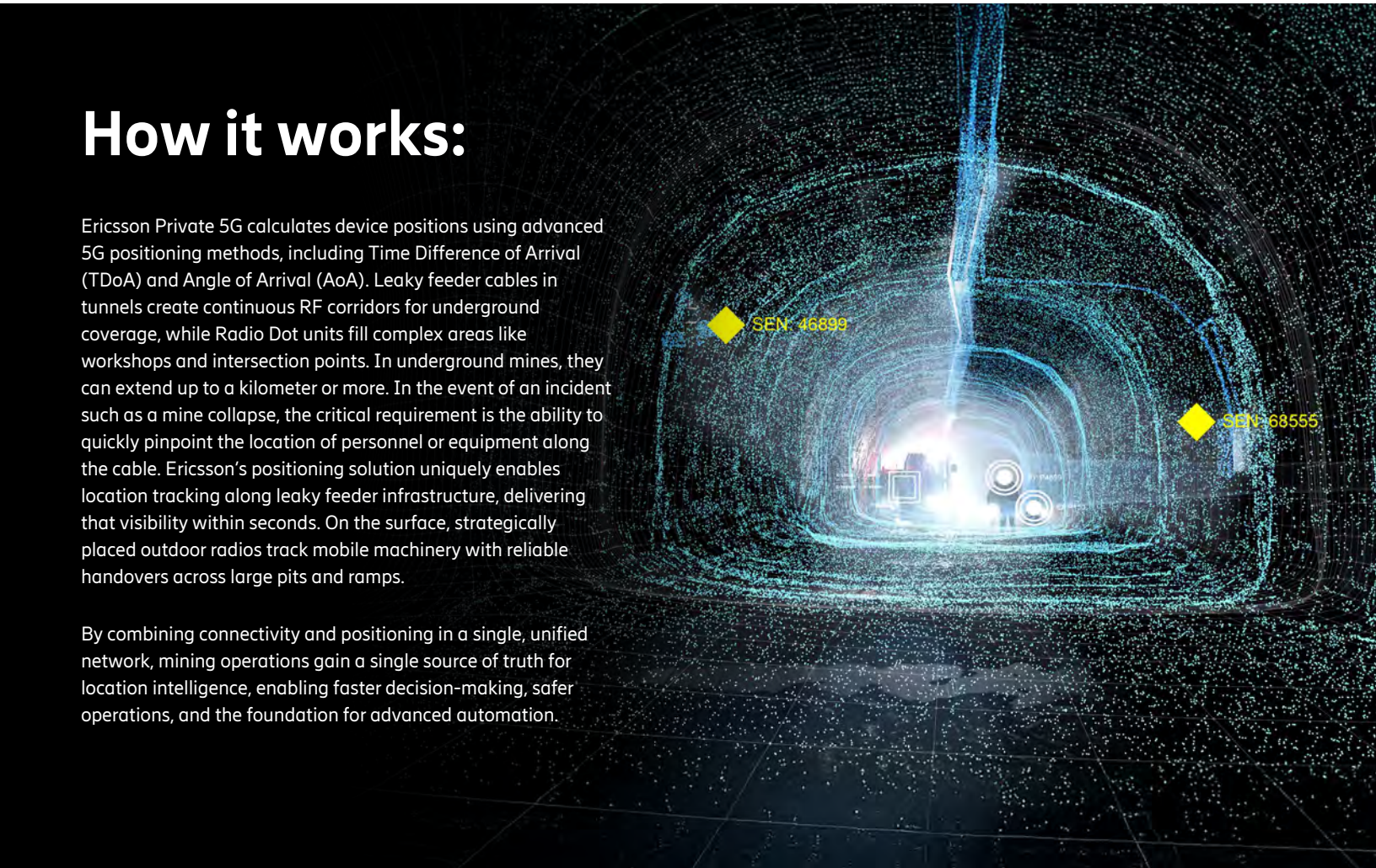
Flexible deployment

The system can complement existing infrastructure or serve as a full-scale, standalone solution for greenfield mines or operations undergoing digital transformation.

How it works:

Ericsson Private 5G calculates device positions using advanced 5G positioning methods, including Time Difference of Arrival (TDoA) and Angle of Arrival (AoA). Leaky feeder cables in tunnels create continuous RF corridors for underground coverage, while Radio Dot units fill complex areas like workshops and intersection points. In underground mines, they can extend up to a kilometer or more. In the event of an incident such as a mine collapse, the critical requirement is the ability to quickly pinpoint the location of personnel or equipment along the cable. Ericsson's positioning solution uniquely enables location tracking along leaky feeder infrastructure, delivering that visibility within seconds. On the surface, strategically placed outdoor radios track mobile machinery with reliable handovers across large pits and ramps.

By combining connectivity and positioning in a single, unified network, mining operations gain a single source of truth for location intelligence, enabling faster decision-making, safer operations, and the foundation for advanced automation.



High-value mining use cases

Precise indoor positioning powered by Ericsson Private 5G transforms mining operations by providing real-time visibility and actionable insights across both surface and underground environments. With continuous, accurate location data, operators can enhance safety, optimize productivity, and prepare for future automation initiatives. Below are high-value use cases where precise positioning delivers strong safety and productivity results:

Blast-zone clearance and verification

- Automated alerts detect personnel or equipment in restricted zones prior to blasting.
- Audit trails allow supervisors to verify clearance quickly and reduce delays.
- Real-time tracking ensures that production does not need to pause unnecessarily while maintaining safety compliance.

Collision avoidance

- Real-time proximity alerts warn workers and operators of potential collisions.
- Configurable network rules can slow or stop vehicles automatically in high-risk areas.
- Historical collision data can inform operational planning to reduce recurring risks.

Emergency mustering

- Mustering dashboards display the real-time location of personnel by level, area, or tunnel segment.
- Linear positioning narrows search zones, accelerating emergency response and reducing risk.
- Integration with communication systems ensures alerts and status updates are sent instantly to supervisors.

Lone-worker protection

- Continuous monitoring triggers alerts when workers are stationary for unusual periods or enter restricted zones.
- Supports ESG and safety reporting requirements.
- Reduces incident response time and allows targeted assistance for at-risk personnel.

Remote and autonomous equipment operations

- Operators can control machinery from safe locations, removing human presence from high-risk zones.
- Autonomous and teleremote vehicles operate reliably underground and on surface, supported by continuous location awareness.
- Positioning enables safe coordination of multiple autonomous vehicles, minimizing collisions and optimizing workflow.

Fleet and asset optimization

- Real-time visibility of mobile machines and high-value assets ensures efficient dispatching and reduces downtime.
- Historical location data supports predictive maintenance by analyzing machine movement patterns and usage cycles.
- Streamlined asset tracking prevents costly losses, supports workflow integration with CMMS systems, and reduces time spent locating critical equipment.

Together, these use cases demonstrate that Ericsson Private 5G combined with precise positioning is not just a safety tool — it's a strategic enabler for operational excellence, cost reduction, and automation readiness.

Deployment considerations

Successfully leveraging precise positioning requires strategic planning and thoughtful execution. Mining environments pose unique challenges: tunnels, rock strata, metal support, and sprawling facilities all affect signal propagation and network performance.

Key considerations include the following:

Strategic alignment

- Identify high-impact use cases and measurable KPIs
- Prioritize foundational applications first (personnel and asset tracking)

Network design

- Underground: leaky feeders, Radio Dots, redundancy in power and nodes
- Surface: outdoor radios, dense indoor coverage in workshops, plants, and camps
- Validate with signal simulation and real-world testing

Integration & data governance

- Use open APIs to connect positioning data to enterprise systems
- Implement role-based access, retention policies, and secure audit trails
- Historical data supports safety analysis and predictive maintenance

Pilot validation & scaling

- Pilot high-impact zones, testing under realistic operational conditions
- Refine deployment patterns, geofencing, and alert configurations
- Incrementally expand using proven templates across additional pits, tunnels, and surface facilities

Getting started on the path to precise positioning

Implementing precise indoor positioning in mining doesn't have to be complex.

The key is to start with clear objectives, focus on high-value areas, and follow a structured deployment plan that delivers quick wins while laying the foundation for long-term innovation. The following steps provide a practical roadmap to move from initial assessment to full-scale adoption.

- **Assessment:** Map high-risk areas and operational bottlenecks
- **Strategic partnership:** Collaborate with experienced 5G and mining solution providers like Ericsson
- **Deployment and validation:** Connect devices, geofences, and alerts; test under real conditions
- **Training and operational integration:** Educate staff, establish workflows, and embed them into daily operations
- **Scaling and evolution:** Expand across the mine and introduce advanced applications such as autonomous coordination, digital twins, and predictive maintenance

No more blind spots

Ericsson Private 5G with network-native positioning provides continuous visibility across surface, underground, and enclosed operations. Mines can:

- Verify blast zones efficiently
- Reduce collisions and incidents
- Improve emergency mustering
- Optimize fleet and asset utilization
- Enable safe remote and autonomous operations

With a single, unified platform, mines gain lower TCO, flexible deployment, device-agnostic tracking, and a foundation for safer, smarter, and more productive operations. As mining operations evolve, precise positioning over private 5G will be a key driver of sustainable growth, automation, and continuous improvement.

About Ericsson

Ericsson enables communications service providers to capture the full value of connectivity. The company's portfolio spans Networks, Digital Services, Managed Services, and Emerging Business and is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's investments in innovation have delivered the benefits of telephony and mobile broadband to billions of people around the world. The Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

www.ericsson.com/mining