



INTELLIGENT ASSET MANAGEMENT & TRACKING

CASE STUDY & STRATEGIC REVIEW

Mobile RFID Asset Management vs Fixed RFID Vehicle Arrays

A Strategic Review for Fire and Rescue Services

A balanced assessment of the operational, engineering, financial and strategic considerations associated with fixed and mobile RFID approaches to appliance and enterprise asset management.

<25 sec

Full appliance inventory
verification

€4.68M+

Potential capital saving, 156
appliances

100–200%

Effective procurement ROI

12–24 mo

Typical operational payback
period

EXECUTIVE SUMMARY

A balanced assessment of fixed and mobile RFID for frontline operations

As Fire and Rescue Services continue to modernise asset management, operational readiness and compliance processes, RFID technology is increasingly recognised as a state-of-the-art capability for improving equipment accountability and asset visibility.

When specifying new appliances, it can be tempting to assume that fixed RFID infrastructure should be incorporated into every vehicle to provide automated inventory monitoring. Whilst this is technically achievable, operational experience suggests that fixed RFID arrays are not always the most practical, effective or scalable solution for frontline emergency service operations.

The purpose of this paper is not to dismiss fixed RFID technology. Rather, it is to provide a balanced assessment of the operational, engineering, financial and strategic considerations associated with both fixed and mobile RFID approaches.

Operational experience has demonstrated that fixed RFID installations can introduce significant complexity, installation costs and maintenance requirements whilst still not eliminating the need for firefighters to physically verify equipment presence and operational readiness.

By contrast, the iTrackPPE Mobile RFID solution provides a lower-cost, highly scalable and operationally proven alternative. Using a vehicle-mounted mobile RFID scanner, firefighters can complete a full appliance inventory verification in **under 25 seconds** whilst simultaneously maintaining visual inspection and equipment assurance.

Most importantly, organisations gain a strategic enterprise asset management platform rather than a single-purpose vehicle inventory solution.

THE OPERATIONAL REQUIREMENT

Fire and Rescue Services must ensure equipment is present, serviceable and ready

This applies not only to frontline operational equipment:

- ✓ PPE
- ✓ Breathing apparatus
- ✓ Technical rescue equipment
- ✓ Water rescue equipment
- ✓ HazMat equipment

But increasingly, to enterprise-wide assets too:

- ✓ ICT assets
- ✓ Mobile devices
- ✓ Radios
- ✓ Estates equipment
- ✓ Fleet assets
- ✓ Specialist tools

The challenge is therefore not simply how to monitor assets on an appliance, but how to establish a scalable and sustainable asset management capability across the entire organisation.

OPTION ONE

Fixed RFID vehicle arrays

Fixed RFID systems are designed to automatically detect RFID-tagged assets stored within a vehicle. A typical installation requires:

- ✓ RFID readers
- ✓ Multiple antennas
- ✓ Communication infrastructure
- ✓ Vehicle integration hardware
- ✓ Power supplies
- ✓ Cabling & connectors

Due to the compartmentalised nature of modern fire appliances, a single RFID reader is rarely sufficient. To achieve reliable coverage, antennas are often required throughout side lockers, rear lockers, crew cab storage, equipment drawers, slide-out trays and specialist storage compartments. Whilst technically possible, this creates significant installation complexity and cost.

ENGINEERING & ENVIRONMENTAL CHALLENGES

Fire appliances operate in some of the harshest conditions of any fleet

They are routinely exposed to:

- ✓ Extreme temperatures
- ✓ Vibration & shock loading
- ✓ Water ingress
- ✓ Off-road operations
- ✓ Frequent compartment access
- ✓ Heavy equipment handling

Whilst RFID technology itself is robust, a fixed installation introduces multiple physical components — antennas, cabling, connectors, mounting systems and communication equipment. Every additional component introduces a potential point of failure throughout the operational life of the appliance.

Frontline appliances remain in service for 10–15 years or more.

Lifecycle maintenance and replacement costs must form part of any procurement decision.

VEHICLE DESIGN & METAL ENVIRONMENT

Modern appliances are demanding environments for fixed RFID

Modern fire appliances are predominantly constructed from aluminium and metal storage systems. Although metallic structures can assist in containing RFID signals, they also create performance challenges. Factors such as aluminium bodywork, metal shelving, equipment trays, storage cages and locker partitions can all impact RFID read performance and often require additional antennas and extensive tuning.

This increases:

- ✓ Installation cost
- ✓ Maintenance requirements
- ✓ Design complexity
- ✓ Long-term ownership costs

THE FLEET REPLACEMENT REALITY

Very few services replace their entire fleet simultaneously

Fleet replacement programmes usually occur over many years, resulting in a mixed fleet of new appliances, existing frontline appliances, reserve appliances and specialist vehicles. Installing fixed RFID infrastructure into newly procured vehicles creates a situation whereby only part of the fleet benefits from the technology.

To achieve consistency, organisations are often forced to consider retrofitting existing appliances — introducing vehicle downtime, workshop requirements, engineering modifications, additional procurement costs and operational disruption. In practice, retrofitting fixed RFID infrastructure into existing appliances is often technically challenging and, in some cases, economically prohibitive due to vehicle design, storage layouts and installation constraints.

A mobile RFID solution avoids all of these issues. The same technology can be deployed immediately across new and legacy vehicles without modification.

10–15 yrs

Typical frontline appliance service life

0

Vehicle modifications required for mobile RFID

100%

Of fleet covered from day one, new or legacy

FALSE POSITIVES, FALSE NEGATIVES & OPERATIONAL ASSURANCE

RFID confirms the presence of a tag — not the equipment itself

One of the most important considerations when evaluating RFID technology is understanding what it actually confirms. RFID does not confirm the presence of the equipment itself, its condition, its operational readiness, whether damage has occurred, or whether equipment has been left at an incident.

False Positive Scenario

Following an incident, a piece of equipment is accidentally left behind. The RFID tag becomes detached and remains inside the appliance locker.

System reports: Asset Present

Reality: Equipment Missing

The system has successfully detected a tag but has not confirmed the presence of the asset itself.

False Negative Scenario

Antenna damage, connector failures, temporary signal shielding, damaged tags or equipment positioning can all interfere with detection.

System reports: Asset Missing

Reality: Equipment Present

The firefighter must open the locker, conduct a visual inspection and verify equipment presence — the physical inspection still takes place.

WHY VISUAL CHECKS REMAIN CRITICAL

Most equipment losses occur outside of routine storage

Operational experience consistently shows that most equipment losses occur:

- ✓ Following incidents
- ✓ Following training exercises
- ✓ During equipment exchanges
- ✓ During maintenance activities
- ✓ During transportation between locations

The most effective method of identifying missing or damaged equipment remains a disciplined physical inspection by operational personnel. Any efficiency gained from automated locker scanning can quickly be offset if personnel still need to investigate exceptions, validate missing assets or physically inspect equipment.

Technology should support professional operational assurance processes, not replace them.

THE ITRACKPPE MOBILE RFID APPROACH

Combining human verification with digital auditability

The iTrackPPE solution utilises a mobile RFID scanner securely mounted within a charging dock installed on the appliance. The scanner becomes part of the appliance inventory whilst remaining available for operational use.

When completing vehicle checks, firefighters:

- ✓ Open the locker
- ✓ Conduct a rapid RFID scan
- ✓ Visually inspect equipment
- ✓ Receive immediate inventory verification

This combines human verification, operational experience, RFID speed and digital auditability into a single efficient process.

RFID FOR ACCOUNTABILITY, QR FOR ASSET INTERACTION

A critical differentiator of the iTrackPPE platform

Many fixed RFID solutions focus solely on answering one question — *"Is the asset present?"* Whilst important, this is only a small part of effective asset management. Fire and Rescue Services also need to inspect equipment, record tests, manage servicing, report defects, record repairs, manage contamination and review maintenance history — requiring direct interaction with individual assets.

RFID for Speed

Rapid appliance inventories, bulk asset verification, accountability checks, asset location confirmation and fast stock auditing.

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Full appliance inventory, typically completed in

QR for Management

Using the same handheld device, personnel scan the QR code on an individual asset to record inspections, log defects, complete service records, document repairs, update contamination records and verify compliance status.

RFID answers **"Is the asset here?"** QR answers **"What do I need to do with this asset?"** Together they create a complete asset management ecosystem.

SPEED OF DEPLOYMENT

One of the greatest advantages of the Mobile RFID model

Unlike fixed RFID installations, mobile RFID does not require vehicle redesign, antenna infrastructure, extensive cabling, specialist engineering works or significant appliance downtime. Implementation is typically limited only by the organisation's ability to tag existing assets and register them within the system.

The same deployment approach applies equally to:

- ✓ New appliances
- ✓ Existing frontline appliances
- ✓ Reserve vehicles
- ✓ Specialist vehicles

This allows a consistent asset management process to be established across the entire fleet from day one.

OPERATIONAL PERFORMANCE

Near-instant accountability, without losing visual assurance

Using the iTrackPPE Mobile RFID solution, a complete appliance inventory can typically be verified in less than 25 seconds — delivering near-instant accountability whilst maintaining visual verification and operational assurance.

<25 sec

Appliance scan time

0

Vehicle redesign or antenna infrastructure
needed

Day 1

Consistent process across new & legacy
fleet

Rapid RFID accountability. Full visual assurance.

Neither one replaces the other.

COST BENEFIT ANALYSIS

Three procurement routes, one clear financial outcome

Estimated costs shown for a representative fleet of 156 appliances.

Solution	Cost Per Appliance	Fleet Cost (156 Appliances)
iTrackPPE Mobile RFID	€15,000	€2.34M
Fixed RFID — New Build	€30,000	€4.68M
Fixed RFID — Retrofit	€45,000+	€7.02M+

Fixed RFID — New Build

Estimated cost per appliance: **€30,000**. For a fleet of 156 appliances: **€4.68 million**.

Fixed RFID — Retrofit

Estimated cost per appliance: **€45,000+**. For a fleet of 156 appliances: **€7.02 million+**, before appliance downtime, engineering works, workshop capacity, project management costs and future maintenance liabilities.

iTrackPPE Mobile RFID

Including RFID scanner, vehicle dock and charger, RFID software platform, asset management capability and audit and compliance functionality. Estimated cost per appliance: **€15,000**. For a fleet of 156 appliances: **€2.34 million**. Installation requirements are minimal and consistent across both new and existing vehicles.

Capital Savings — €2.34 million compared with Fixed RFID New Build, and €4.68 million+ compared with Fixed RFID Retrofit — before considering downtime, maintenance and operational impact.

RETURN ON INVESTMENT

The financial case strengthens further under an ROI lens

For a representative fleet of 156 appliances:

Comparison	Saving Achieved
Mobile RFID vs New Build Fixed RFID	€2.34M
Mobile RFID vs Retrofit Fixed RFID	€4.68M+

ROI Against New Build Fixed RFID

Capital saving	€2.34M
Investment required	€2.34M
Effective procurement ROI	100%

ROI Against Retrofit Fixed RFID

Capital saving	€4.68M
Investment required	€2.34M
Effective procurement ROI	200%

PAYBACK PERIOD

Full payback typically within 12–24 months

Assuming only modest operational benefits from:

- ✓ Reduced asset losses
- ✓ Improved compliance
- ✓ Faster inventory checks
- ✓ Reduced replacement purchases
- ✓ Reduced administration
- ✓ Enhanced asset accountability

Compared against fixed RFID, the financial benefit is realised immediately —
the organisation avoids millions in capital expenditure from the outset.

BEYOND APPLIANCE INVENTORY MANAGEMENT

A fixed RFID array is fundamentally a vehicle inventory solution

Its value is largely confined to monitoring assets located within that appliance. The iTrackPPE platform has been designed as a scalable enterprise asset management system, capable of supporting asset classes across the whole organisation:

Operational Assets	Fleet Assets	Corporate Assets	Estates Assets
PPE	Vehicle Equipment	Radios	Tools
Breathing Apparatus	Specialist Attachments	Laptops & Tablets	Testing Equipment
Technical Rescue Equipment	Reserve Fleet Assets	Mobile Devices	Building Assets
Water Rescue Equipment		ICT Equipment	Stores Inventory
HazMat Equipment			

This significantly increases long-term organisational value and protects future investment.

PROVEN OPERATIONAL SUCCESS

Already deployed within South Yorkshire Fire and Rescue Service

The iTrackPPE Mobile RFID model has already been successfully deployed within South Yorkshire Fire and Rescue Service. The solution supports the management of frontline appliance assets, breathing apparatus equipment, technical rescue equipment, PPE and wider operational inventory.

This demonstrates that mobile RFID technology is **operationally proven, scalable and capable of supporting complex fire and rescue environments.**

COMPARATIVE ASSESSMENT

iTrackPPE Mobile RFID vs Fixed RFID Array, side by side

Area	iTrackPPE Mobile RFID	Fixed RFID Array
Capital Cost	Low	High
Deployment Speed	Fast	Slow
Vehicle Modifications	Minimal	Extensive
Vehicle Downtime	Minimal	Significant
Retrofit Existing Fleet	Simple	Often Prohibitive
Infrastructure Complexity	Low	High
Maintenance Burden	Low	High
False Positive Risk	Lower	Higher
False Negative Impact	Lower	Higher
Supports Visual Checks	Yes	No
Appliance Scan Time	Under 25 Seconds	Continuous Monitoring
Fleet-Wide Consistency	Immediate	Gradual
Supports QR Asset Management	Yes	Limited
Organisational Scalability	Excellent	Limited
Future-Proofing	High	Moderate
Return on Investment	High	Moderate

RECOMMENDATION

A more balanced and strategically valuable approach

Whilst fixed RFID vehicle arrays can provide automated asset detection, they introduce significant engineering complexity, infrastructure costs and lifecycle maintenance requirements. Importantly, they do not remove the need for firefighters to physically verify equipment presence, condition and readiness.

The iTrackPPE Mobile RFID solution provides a more balanced and strategically valuable approach by combining:

- ✓ Rapid RFID accountability
- ✓ Visual operational assurance
- ✓ QR-enabled asset interaction
- ✓ Lower capital expenditure
- ✓ Faster deployment
- ✓ Minimal engineering requirements
- ✓ Fleet-wide consistency
- ✓ Enterprise-wide scalability

For a fleet of 156 appliances, organisations could save between **€2.34 million and €4.68 million** in capital expenditure alone whilst gaining a fully scalable asset management platform capable of supporting every department and asset class.

CONCLUSION

RFID should enhance operational assurance, not replace it

Unlike fixed RFID vehicle arrays, which are primarily focused on detecting the presence of assets, iTrackPPE combines RFID for rapid accountability with QR technology for direct user interaction, maintenance management, compliance tracking and complete lifecycle control. This allows organisations not only to know that an asset is present, but also to understand its condition, its compliance status, its maintenance history and its operational readiness.

The result is a more complete, scalable and future-proof solution that delivers measurable value across the entire organisation.

For most Fire and Rescue Services, vehicle-mounted Mobile RFID provides the lowest-risk, most cost-effective and highest-value route to RFID-enabled asset management.

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