EM-2Q

CSignum In-Situ

CSignum & In-Situ: Advancing Wireless Water Quality Monitoring



Across the UK, water quality monitoring is a growing priority, driven by regulatory mandates such as the Environment Act 2021, which requires real-time data collection at thousands of combined sewer overflows (CSOs) and other critical water bodies.

However, deploying large-scale monitoring networks presents significant challenges, particularly in urban areas and ecologically sensitive locations.

A fully wireless solution eliminates many of the practical limitations of conventional cabled monitoring systems.



Under current and evolving UK regulations, agencies and utilities must enhance transparency in water quality reporting. Real-time monitoring is essential for tracking pollutants, stormwater overflow events, and overall ecosystem health. Yet, traditional monitoring solutions often require infrastructure on riverbanks, raising concerns about environmental impact, permitting, landowner agreements, and vulnerability to vandalism.

While wireless sensors have revolutionised industrial applications, water quality monitoring has lagged due to the limitations of conventional radio signals, which cannot be transmitted through water.

CSignum and In-Situ are addressing these challenges with CSignum's Electromagnetic Field Signaling (EMFS) technology integrated with In-Situ's Aqua TROLL multiparameter water quality sonde enabling real-time monitoring without cables or riverbank infrastructure.

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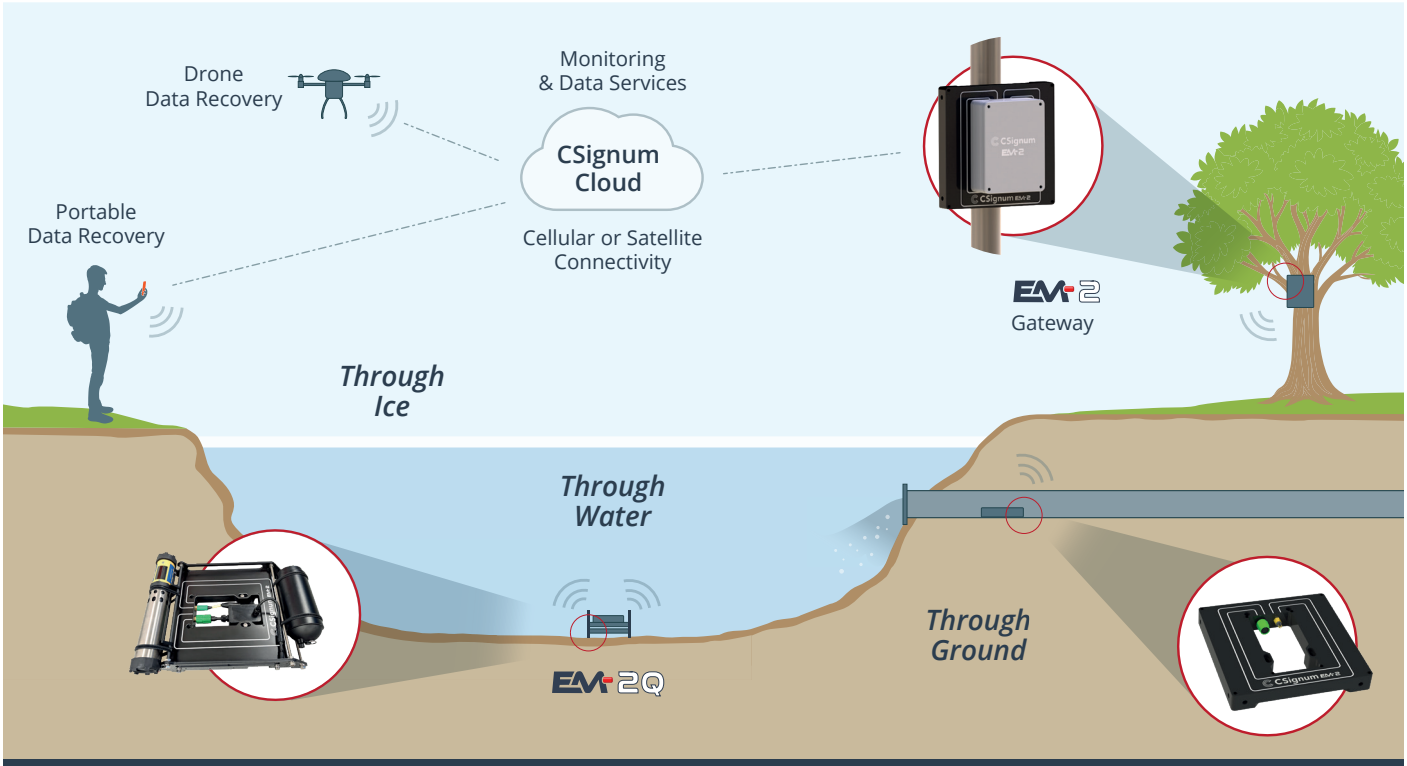
A BREAKTHROUGH IN WIRELESS WATER QUALITY MONITORING

CSignum's Electromagnetic Field Signalling (EMFS) technology provides a unique solution, enabling seamless underwater data transmission. The EM-2Q system allows sensors to be placed discreetly on the riverbed, transmitting real-time data through the water surface to an EM-2 riverside gateway equipped with a cellular modem. The gateway, which can be installed up to 100 meters away from the river, (or by using a portable EM-2 gateway), uploads data via cellular networks to cloud services for remote analysis.



CSignum EM-2Q Wireless Water Quality Monitoring

WIRELESS DATA TRANSMISSION FROM IN-SITU AQUA TROLL SONDES

The Aqua TROLL 700 sonde, known for its high-precision multiparameter sensing, is deployed on the riverbed and paired with the CSignum EM-2Q wireless transmission system. The EM-2Q solution accepts any of the Aqua TROLL multiparameter sondes, but is ideally suited for the Aqua TROLL 700. This setup allows for seamless, real-time data transmission from underwater sensors to a riverside EM-2 gateway equipped with a cellular modem, eliminating the need for wired connections that can be costly, difficult to install, and vulnerable to environmental damage.

For real-time, online data requirements, such as those in the Environmental Act 2021, the EM-2 gateway ensures reliable data uploads to CSignum's cloud platform for remote access and analysis. Unlike cabled systems, which must be installed directly on the riverbank, the wireless system can be discreetly mounted on a tree, pole, or existing infrastructure, protecting it from flooding and vandalism. In many installations, the upstream and downstream monitoring locations around an outflow can be served by a single EM-2 gateway.

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KEY BENEFITS OF THE CSIGNUM AND IN-SITU INTEGRATION

- **Reliable, Real-Time Data Collection:**
  In-Situ Aqua TROLL sondes capture six key water quality parameters at high-frequency intervals, ensuring compliance with UK regulations.
- **Fully Wireless Transmission:**
  CSignum's EMFS technology enables through-water data transfer, removing the need for cables, buoys, or visible infrastructure.
- **Flexible Gateway Placement:**
  Can be positioned 100 meters from the river, avoiding land use restrictions.
- **Long Battery Life:**
  The riverbed unit operates for three months per charge, while gateway battery lasts for six months. Battery packs are fully rechargeable.
- **Easy Retrieval & Maintenance:**
  Remote command inflates buoyancy recovery bag, bringing the riverbed system to the surface for maintenance and calibration without entering the water.
- **Reduced Environmental Impact:**
  The riverbed system is hidden below the surface, requiring no construction on riverbanks.
- **Lower Risk of Vandalism & Flood Damage:**
  The wireless gateway can be mounted on a tree, pole, or existing infrastructure up to 100m from the riverbank,, keeping it safe from floodwater and tampering.
- **Consistent Cost Per Site:**
  A standard wireless monitoring system is applicable to all sites giving a known cost per installation, even before the site survey stage.

OPTIMISED FOR CONTINUOUS MONITORING & REMOTE MAINTENANCE

The riverbed system is designed for low maintenance, with a single submersible battery powering both the CSignum EM-2Q and the integrated Aqua TROLL sonde.

Since sondes require periodic retrieval for sensor cleaning and calibration, the system incorporates battery swaps into routine maintenance, avoiding additional service visits. When maintenance is required, the remote recovery feature inflates a small buoyancy bag on demand, raising the system to the surface using the EMFS wireless link. The sensor can then be unclipped, serviced, and reinstalled, the EM-2Q battery changed, and the recovery system reset without entering the water, or heavy equipment.

SYSTEM OVERVIEW

- The **In-Situ Aqua TROLL 700 sonde** is integrated with the EM-2Q and deployed on the lakebed, measuring key water quality parameters such dissoved oxygen, temperature, pH and ORP, turbidity, conductivity, fDOM, Nitrate, salinity, TSS, total chlorophyll and blue-green algae.
- **CSignum's EM-2Q wireless unit** transmits real-time data through the water to an EM-2 gateway equipped with a cellular modem located up to 100 meters away from the lake.
- The **EM-2 gateway** uploads data via cellular networks to the CSignum cloud platform, or with customer's existing telemetry or data analysis platform, ensuring compliance with UK mandates.



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PROVEN PERFORMANCE IN REAL-WORLD CONDITIONS

The CSignum EM-2Q system, integrated with an Aqua TROLL 700 sonde, was recently deployed in a small lake under winter conditions to continuously monitor water quality. The Aqua TROLL 700 sonde measures six key water quality parameters at 15-minute intervals, uploading data to the CSignum cloud platform for remote monitoring, regulatory compliance reporting, and easy trend analysis.

Despite a thick layer of ice covering the lake, EMFS technology has ensured uninterrupted wireless data transmission, demonstrating the system's reliability in extreme environments.

The riverbed unit's single battery lasts three months, while the topside gateway battery lasts six months before requiring a swap-out; both are rechargeable.

RAPID DEPLOYMENT FOR POLLUTION EVENTS & EMERGENCY MONITORING

The CSignum and In-Situ solution also supports investigative and emergency deployments during pollution incidents. Unlike traditional cabled systems that require extensive infrastructure, the wireless solution can be installed within hours, providing high-frequency data while the incident is still active.

When rapid environmental assessments are needed, operators can retrieve contiguous time series data on demand via the through-water wireless link.

Using a portable EM-2 gateway and a tablet PC, field teams can immediately query deployed sensors, ensuring rapid response and decisions based on real-time data.

A NEW ERA OF WIRELESS WATER QUALITY MONITORING

The collaboration between CSignum and In-Situ is redefining real-time water quality monitoring by combining CSignum's groundbreaking wireless technology with In-Situ's industry- leading water quality sensors.

This scalable, fully wireless IoT solution transforms how water utilities, environmental agencies, and researchers collect, analyse, and respond to water quality data and reduces the logistical challenges of monitoring in urban, remote, or high-risk locations. As regulatory requirements evolve and demand for real-time monitoring increases, CSignum and In-Situ are delivering the next generation of smart water monitoring solutions - making high-quality, real-time data more accessible than ever.

CONCLUSION

CSignum and In-Situ are revolutionising water quality monitoring in the UK with a fully wireless, real-time data solution that eliminates the need for cabled infrastructure. By combining CSignum's EM-2Q wireless communication technology with In-Situ's advanced water quality sensors, this collaboration delivers a cost-effective, low-impact system designed for rapid deployment in even the most challenging environments.

With the UK's Environment Act 2021 mandating real-time water quality monitoring and public reporting at every CSO, utilities and environmental agencies face increasing regulatory and operational pressures. The CSignum-In-Situ partnership provides a scalable, easy-to-install solution that ensures continuous access to critical water quality data, supporting proactive environmental management and regulatory compliance. Together, we are setting a new benchmark for water monitoring, safeguarding the UK's rivers, lakes, and coastal waters for future generations.



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