TECHNICAL OVERVIEW

Wireless Continuous Water Quality Monitoring System

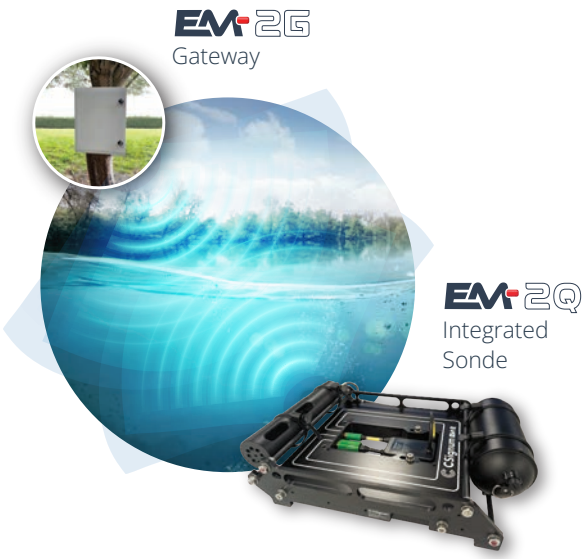
Cable-free, real-time data from the riverbed to the cloud to address the monitoring and compliance challenges of Section 82 of the UK Environmental Act.

THE CHALLENGE

Pollution from combined sewer overflows, agriculture, and industry is pushing rivers, reservoirs, and coastal waters to breaking point. Regulations like the UK Environment Act 2021 demand continuous, reliable monitoring. Traditional wired systems are costly, vulnerable to vandalism, and disruptive to ecosystems.

THE SOLUTION – CSIGNUM WIRELESS CWQM SYSTEM

There is an alternative approach - wireless monitoring utilising CSignum's patented EM-2 Electromagnetic Field communications system. This is delivered by utilising 2 x EM-2 Modems - one on the riverbed with an integrated Sonde and Battery pack (EM-2Q Sensor Assembly) and another EM-2 in a topside gateway with a telemetry device and battery pack (EM-2G Gateway)



together known as the Continuous Water Quality Monitoring (CWQM) System, creating an Electromagnetic field to deliver real time CWQM data to the cloud without the need for kiosks or stilling tube equipment on the Bankside.

A breakthrough in wireless monitoring.

- Installs discreetly on the riverbed
- Connects to industry-standard sondes
- Low environmental and visual Impact
- Securely transmits data to the cloud via a nearby gateway
- Suitable for installation/deployment in difficult catchment locations with high footfall, and environments susceptible to vandalism or high risk of flooding.

APPLICATION AND BENEFITS

From inland rivers to coastal waters, the EM-2Q and EM-2G modems deliver:

- **Continuous, real-time monitoring** for compliance
- **CSO monitoring** – identify timing and impact of sewage events
- **Resilience** – invisible, tamper-proof equipment
- **Scalable flexibility** – move and re-deploy as needed
- **Suitable for installation/deployment in difficult catchment locations** with high footfall, and environments susceptible to vandalism or high risk of flooding

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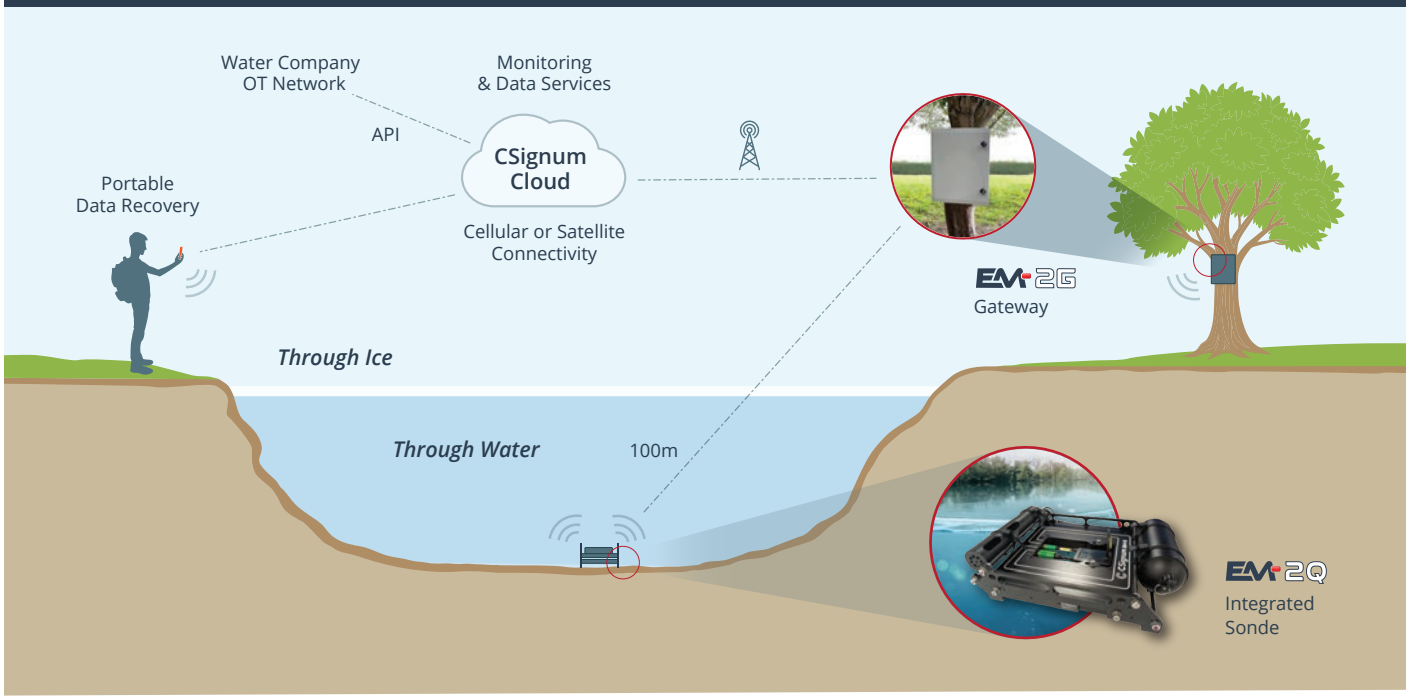
Wireless Continuous Water Quality Monitoring System



DELIVERING WIRELESS DATA THROUGH WATER

- **Electromagnetic Field Signalling (EMFS)**
  wirelessly communicating though water without cables
- **Buoyancy Recovery System**
  raising the equipment to the surface for maintenance at the push of a button
- **Sensor Compatibility**
  integrates with leading sondes and monitoring devices.

THE CWQM ADVANTAGE FOR WATER QUALITY MONITORING

- **Rapid Deployment:**
  EM-2Q's wireless technology enables quick and easy deployment of integrated sensor packages near the riverbed, eliminating the need for extensive riverbank infrastructure.
- **Reliable Communication:**
  Utilising Electromagnetic Field Signalling (EMFS), the underwater EM-2Q Sensor Assembly ensures dependable data transmission from submerged sensors to topside EM-2G Gateway devices, even through challenging mediums including fresh and salt water, ice, concrete, and rock.
- **Minimal Environmental Impact:**
  The system is designed to be environmentally friendly, non-disruptive to existing eco-systems and is not visible from the surface. This low visibility improves land owner acceptance, leading to reduced vandalism, tampering or theft.
- **Flexibility:**
  EM-2Q easily integrates with various sensor packs, including multiparameter sondes and security systems. The topside EM-2 Gateway unit can support multiple EM-2Q Sensor Assemblies and can be installed up to 100 meters away from either gateway (max 200m apart), offering significant flexibility in locating the communication relay point.

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SYSTEM OPERATION

Deployment

- The EM-2Q and EM-2G devices are configured via RS232 prior to deployment using CSignum's Windows-based configuration application. Key settings such as mode of operation, wake-up interval, and sonde parameters can be adjusted during this process. Once configured, the devices are installed and deployed in the field, operating autonomously on their onboard batteries for extended periods – typically several months, depending on configuration. A detailed application guide is available to support installation and setup.

Operation

- The EM-2Q device periodically wakes from sleep mode to activate the sonde by supplying 12V DC power (up to 2A). It then captures readings via RS232 and/or RS485 interfaces before returning to its low-power sleep state. Collected data is transmitted using CSignum's patented Electromagnetic Field Signalling (EMFS) technology to the EM-2G gateway located above ground. The gateway relays the sonde's raw data directly to a cellular modem, which utilizes LTE-M protocols to ensure global connectivity with minimal power consumption. Data is securely transmitted using MQTT to CSignum's cloud platform, where it can be accessed through either a proprietary graphical interface or an industry-standard API.

Recovery

- The EM-2Q is recovered using an inflatable buoyancy bag, which is activated via an over-the-air command sent from the above-ground EM-2G to the submerged EM-2Q. Upon receiving the command, the EM-2Q triggers a pressurised CO_2 canister to inflate the buoyancy bag, allowing the device to ascend to the surface for retrieval. A comprehensive application guide is available to support installation and deployment procedures.

TECHNICAL OVERVIEW

CSIGNUM CLOUD

- Hosted on Azure Cloud
- Application built on Grafana
- Data/SCADA integration available via API
- Example screen shot developed for Section 82 Continuous Water Quality Monitoring below
- Access is available on Mac/Windows from web browser or IOS/Android mobile phone.

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TECHNICAL SPECIFICATION

WIRELESS CWQM SYSTEM

Communication range EM-2G to EM-2Q on riverbed	100m
Measurement and upload interval	15 minutes to 24 hours
Data Presentation	CSignum cloud web interface or API interface to customer systems
Wireless Technology	Electro Magnetic Field Signalling (EMFS) Telemetry - UK cellular network
Standard Section 82 Parameters Monitored	pH, turbidity, conductivity, dissolved Oxygen, temperature, Ammonia

EM-2G GATEWAY

Cellular upload	LTE-M1, or RS232/RS485 to customer telemetry
Battery life on 15-minute measure and upload cycle	6 months
Dimensions	500mm x 500mm x 215mm
Weight	19.5kg (43lbs)
Tree or pole mount system (pole diameter)	100mm to 300mm diameter
IP Rating	IP66
Battery Type	Lithium-Ion
Telemetry Module	Siretta Zeta Module

Fence mount system available

EM-2Q SENSOR ASSEMBLY

Battery life on 15-minute measure and upload cycle	2.5 months (higher capacity battery available on request)
Water depth	100m for monitoring (airbag recovery option available up to 10m)
Dimensions	620mm x 460mm x 160mm
Weight	18kg (40lb)
Standard sondes (others available on request)	Xylem YSI EXO2s. In-Situ Aqua Troll AT700. Proteus
Battery Type	Proprietary Li-ion

EM-2 MODEM TECHNICAL OVERVIEW

Wireless Communications Data Rate	400bps
Wireless Range	100m with EM fields
Depth Rating	100m (328ft)
Ambient Operating Temp	-25°C to +55°C (-13°F to 131°F)
Dimensions	620mm x 460mm x 160mm
Data Interfaces	RS232 and RS485
Configuration Method	Graphical User Interface and ASCII commands
Power Input Connector	6-way Male Subconn (MCBH6M)
Battery	External Lithium rechargeable 300Wh and 700Wh options
Input Voltage	17 to 25V
Transmit Mode Power Consumption	Up to 23W
Receive Mode Power Consumption	< 70mW
Ultra-low Power Receive Mode (duty cycled)	< 5mW
External Sensor Interface	12-way Female Subconn (MCBH12F)
External Sensor Power Out	12V @1A (12W)
Receive Antenna	Omni-directional, for fixed and mobile deployments
Operating Modes	Low power, always on receive. ultra-low power, duty cycled receive. RTC wake - wake on serial data
Certification	CE, FCC, RSS, WEEE, ROHS, REACH

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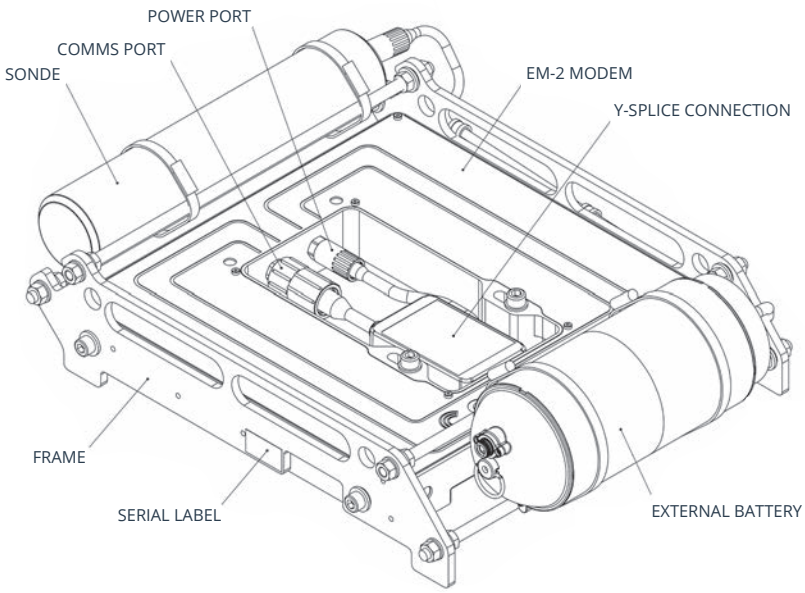
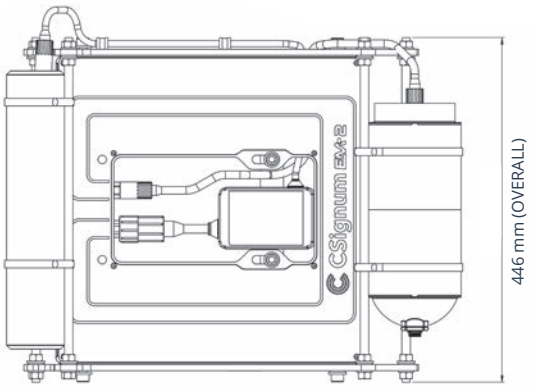
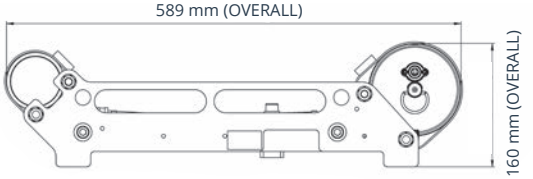
EM-2Q General Arrangement

WEIGHT: 18 KG APPROXIMATELY







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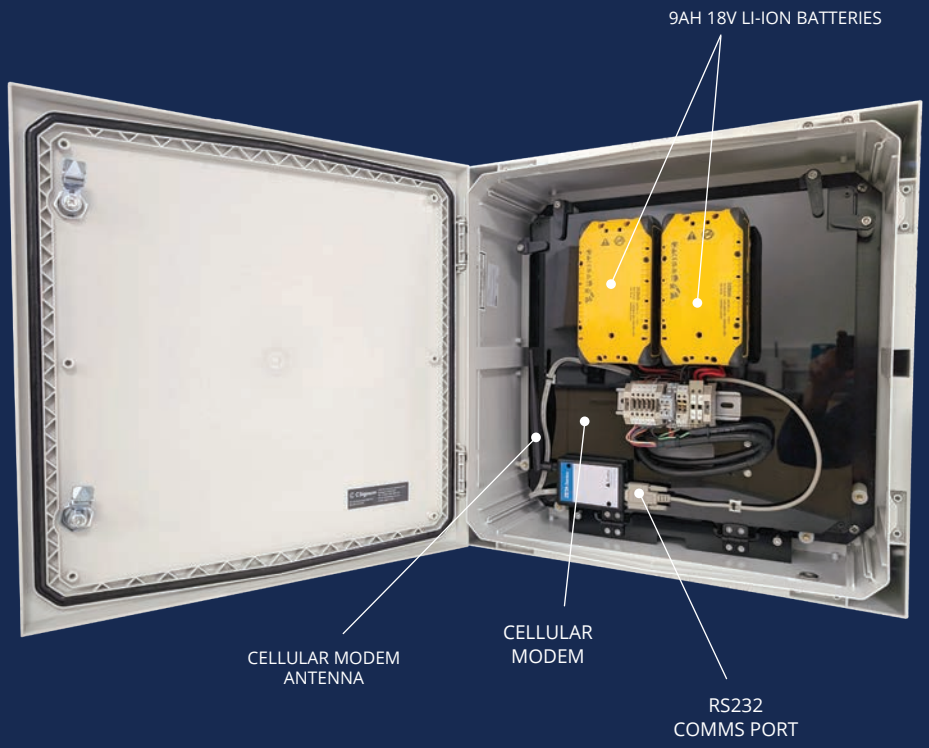
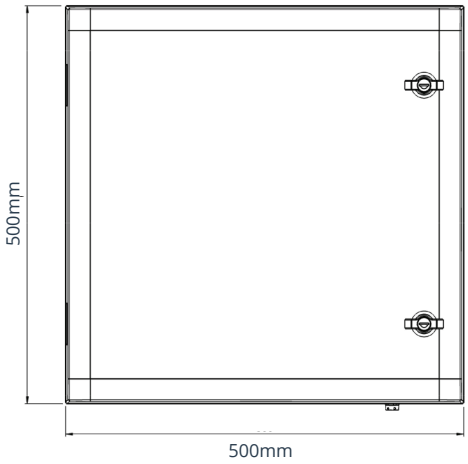
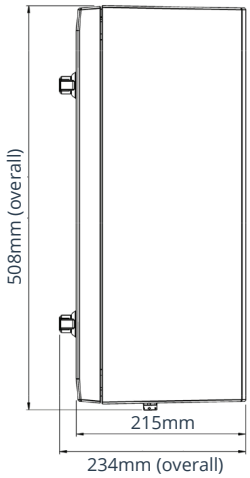
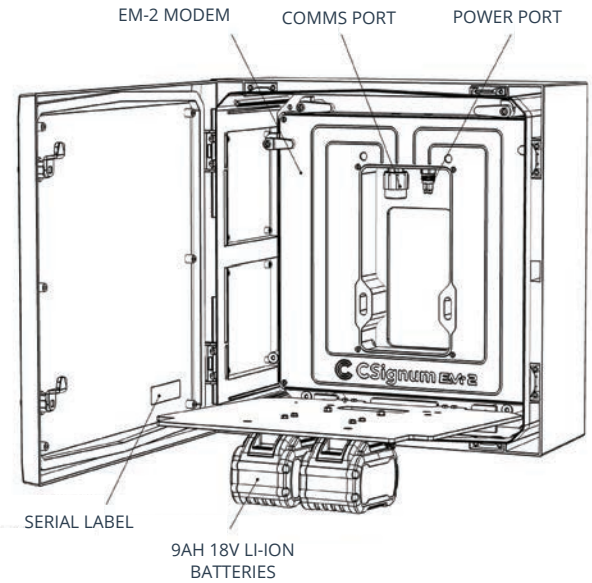
EM-2G General Arrangement



WEIGHT: 19.5KG APPROXIMATELY







VIEW SHOWING FRONT PANEL UN-LATCHED AND HINGED OPEN TO FACILITATE THE INSTALLATION OF THE EM-2 MODEM

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