LORAWAN VS. WI-HART FOR CORROSION MONITORING

As oil & gas operators expand the use of non-intrusive corrosion monitoring, wireless communication architecture becomes a critical factor in ensuring reliable, secure, and cost-effective data transmission. This case study compares 900MHz/LoRaWAN and 2.4GHz/-Wi-HART technologies specifically for wireless Ultrasonic corrosion monitoring using Sensor Networks' microPIMS sensors. The objective is to provide a balanced, application-focused perspective to support informed technology selection.

microPIMS® Sensor Hardware

microPIMS sensors provide high-resolution (0.001" accuracy), non-intrusive corrosion and temperature data to monitor for corrosion/erosion and predict useful asset life. microPIMS sensors can be configured as BOTH a 2.4GHz/WiHART or 900MHz/LoRaWAN and integrated and deployed with pre-existing customer infrastructure (HART or LoRa), on-premises data management, or hosted by cloud applications.

Typical monitoring requirements include:

- Low-bandwidth, periodic measurement reporting
- Multi-year battery operation
- Reliable alarm transmission for threshold exceedance
- Operation in remote or industrial RF-challenged environments
- Secure data transmission aligned with industrial standards

Technology Overview

LoRaWAN

LoRaWAN is a low-power wide-area network (LPWAN) protocol operating in sub-GHz license-free bands (868 – 915 MHz). It uses a star topology where sensors communicate directly with gateways, which forward data to network servers. It is widely adopted in IoT and remote monitoring applications.

STAR NETWORK TOPOLOGY

Wi-HART

Wi-HART is an industrial wireless protocol derived from the HART communication standard. Operating in the 2.4 GHz band, it uses a self-organizing mesh topology with redundant communication paths. It is commonly deployed in process automation and industrial instrumentation environments.

MESH NETWORK TOPOLOGY

Comparative Analysis

Range & Coverage

LoRaWAN typically offers long-range communication with fewer gateways, making it well-suited for geographically dispersed pipelines. Wi-HART extends coverage through mesh networking but requires a denser node deployment.

Power Consumption

LoRaWAN generally delivers lower power consumption due to its star topology and optimized duty cycles. Wi-HART mesh communication introduces additional routing overhead, which can increase energy usage.

Network Reliability

Wi-HART provides deterministic reliability through redundant mesh paths. LoRaWAN reliability depends on network design, gateway placement, and message configuration.

Scalability

LoRaWAN supports large-scale deployments with high node counts per gateway. Wi-HART networks scale effectively but require more careful network planning as node density increases.

Security

Both technologies use AES-128 encryption. Wi-HART aligns closely with industrial control system security practices, while LoRaWAN integrates well with cloud-based IoT security architectures.

Aspect	LoRaWAN	WirelessHART
Network Topology	Star (sensor to gateway)	Mesh (multi-hop routing)
Wireless Range	~1 mile (1.6km)	~50-100m & line-of-sight required
Repeaters Required	No	Yes – every ~50-100m or line-of-sight
Battery Life	Long life (~10 years)	Variable (~3-5years)
Battery Type	Commercially Available D-cell	Proprietary
Scalability	1,000+ sensors per gateway	~100+ sensors per gateway
RF Performance	Excellent (sub-GHz)	Low-Moderate interference
Installation Effort	<15 mins	>1+ hour
Long-term Maintenance	Minimal	Higher, due to routing dependenciess and battery life

Conclusion

There is no universal wireless solution for the deployment of sensors aimed specifically at ultrasonic corrosion and temperature monitoring. The optimal choice depends on operational priorities such as coverage distance, network redundancy, battery life expectations, integration requirements, and infrastructure constraints. When paired with high-quality non-intrusive sensing technologies like Sensor Networks' microPIMS sensors, both LoRaWAN and Wi-HART can effectively support corrosion monitoring strategies when properly engineered.

Selecting the correct wireless architecture should begin with a clear understanding of the application's environment and long-term integrity objectives. This will ensure data reliability and availability of your selected wireless corrosion monitoring system.