

RAEM2

Remote Acoustic Emission Monitoring System

TECHNICAL MANUAL



Version: 1.0.1

10/April/2024

01 Structural Construction

RAEM2 is an all-in-one condition monitoring system that integrates an acoustic emission sensor, battery, data acquisition module, and communication module into a small aluminum alloy cylinder housing with a magnet built into the bottom so RAEM2 can be magnetized to the surface of a ferromagnetic material. RAEM2 supports a variety of communication methods, such as 4G or LoRa, with Bluetooth short-range local inspection. The IoT cloud platform is used for remote data monitoring and parameter configuration.

RAEM2 is time-triggered. The device automatically wakes up to collect data based on the configured sleep time. Independent of computers with high reliability, suitable for long-term unattended condition monitoring.

RAEM2 with built-in sensor:

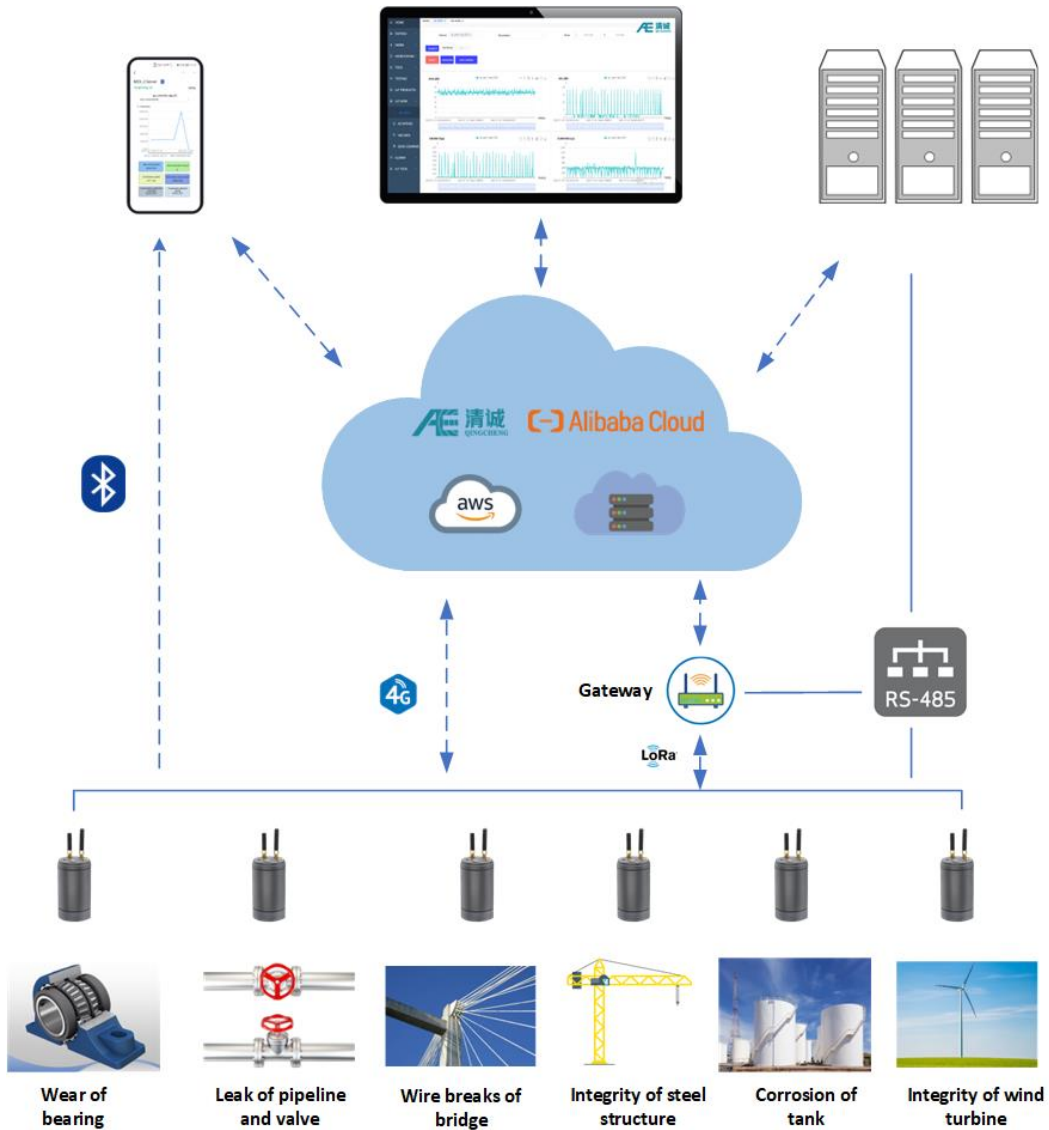


RAEM2 with external sensor:



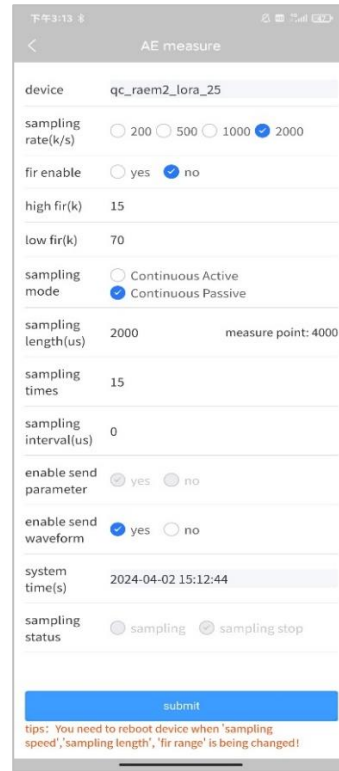
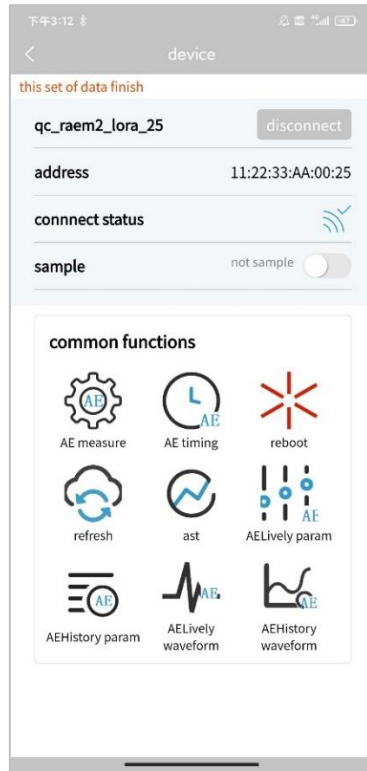
02 System Introduction

RAEM2 system integrates data collection, processing and transmission, cloud platform remote monitoring.

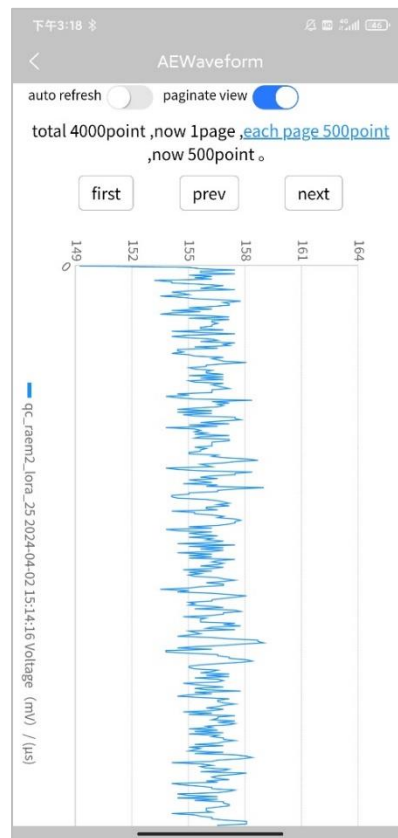
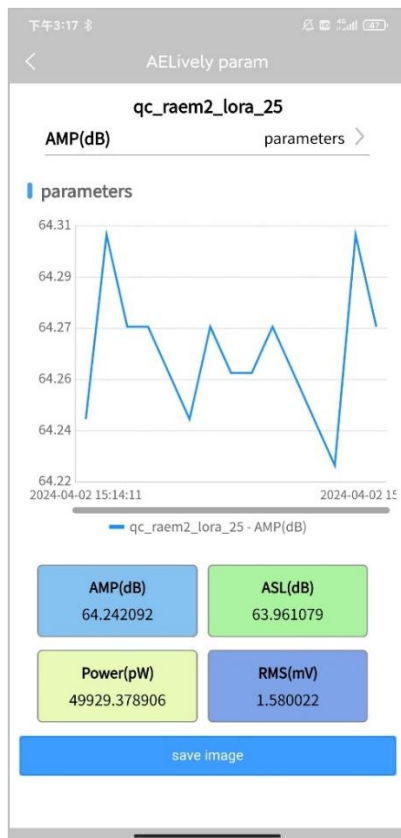


Onsite Inspection with Bluetooth APP

- **Remote configuration:** online parameter setting, remote control of equipment, and timing parameter configuration. (Note: minimum of Sampling Interval is 100-200ms)



- Historical waveform and parameter query: Amplitude, ASL, power, RMS could be selected and minimum time accuracy is minute.
- Online real-time parameter and waveform display.



Qingcheng Cloud Platform

- Data can be uploaded to the IoT Cloud Platform for display and analysis.

AE parameters: Amplitude, ASL, power, RMS.



- Remote configuration:** Remotely configure parameters, control device starts or stops, and timing configuration. (Note: minimum of Sampling Interval is 100-200ms)

Firmware Upgrade

Parameter Config

Timing Config

Bind Alarm Scene

* Series NO.

Sampling Rate(k/s) 200 500 1000 2000

Enable Fir Yes No

High Fir(k)

Low Fir(k)

Sampling Mode Lora Continuous Active Mode Lora Continuous Passive Mode

Sampling Point Count: 4000

Sampling Length(us)

Sampling Times(times)

Sampling Interval(us)

Enable Sending Parameters Yes No

Enable Sending Waves Yes No

System Time(timestamp)

Sampling Status Sampling Sampling stop

03 Technical Features

Hardware technical parameter table

Channel	Single channel signal input	Input frequency	10kHz-400kHz
Sampling accuracy	16-Bit	Sampling Rate	Optional 200k/s, 500k/s, 1000k/s, 2000k/s
Communication method	4G/LoRa, Bluetooth	Mobile phone inspection	Bluetooth
Bandwidth of 4G	LTE-FDD: B1/B3/B5/B8 LTE-TDD: B34/B38/B39/B40/B41	Bluetooth maximum communication distance	13m in open area
Operating temperature	-20℃~+60℃	Charging voltage	8.4V
Protection level	IP65	Trigger mode	Time trigger
Dynamic Range	Built-in sensor version: 60dB External sensor version: 70dB	Maximum signal	100dB
Sampling length	2000Ksps: 500us~15000us 1000Ksps: 1000us~30000us 500Ksps: 2000~60000us 200Ksps: 5000~150000us	Sensor	GI150 (60kHz-400kHz) or GI40 (15kHz-70kHz)
Sampling method	Continuous sampling mode, Interval sampling mode, Timing sampling mode (Note: Only interval sampling mode in Lora version)		
System noise (Amplitude)	Built-in sensors version ≤ 40dB, external sensor version ≤ 30dB		
Voltage output to preamplifier	28V40dB/12V34dB/5V26dB		
Digital filter	128-order, the filtering range is related to the sampling rate, the maximum is 1/2 of the sampling rate		

Data output	Parameters (amplitude, RMS, power, ASL), waveform
Power supply	Various methods are available: 1. External 8.4VDC power supply 2. Built-in rechargeable battery (3000mA@8.4V) 3. Built-in lithium battery with low self-discharge rate (7000mAh@8.4V, non-rechargeable)
Timing acquisition sleep time accuracy	±1min (±2min with LoRa version)
Battery life in internal sampling mode	Wake up every day 1 time, 1 second each time 3 years (with lithium battery), 1 year (with rechargeable battery)
Battery life in continuous sampling mode	24h (with lithium battery), 15h (with rechargeable battery)
Weight	<500g (including battery, magnet, antenna)
Dimensions	Built-in sensor version: diameter φ60mm, height 105mm (including 150k sensor but not antenna); height 117mm (including 40k sensor but not antenna) External sensor version: diameter φ60mm, height 105mm (Antenna not included)
LoRa gateway theoretical maximum number of connected RAEM2 devices	200 units
The longest communication distance of LoRa gateway	10km in open area
LoRa gateway network access method	Wired Ethernet, Wi-Fi,4G
LoRa gateway working frequency	EU433、CN470-510、 CN779-787、 EU863-870、 US902-928、 AU915-928、 AS923、 KR920-923

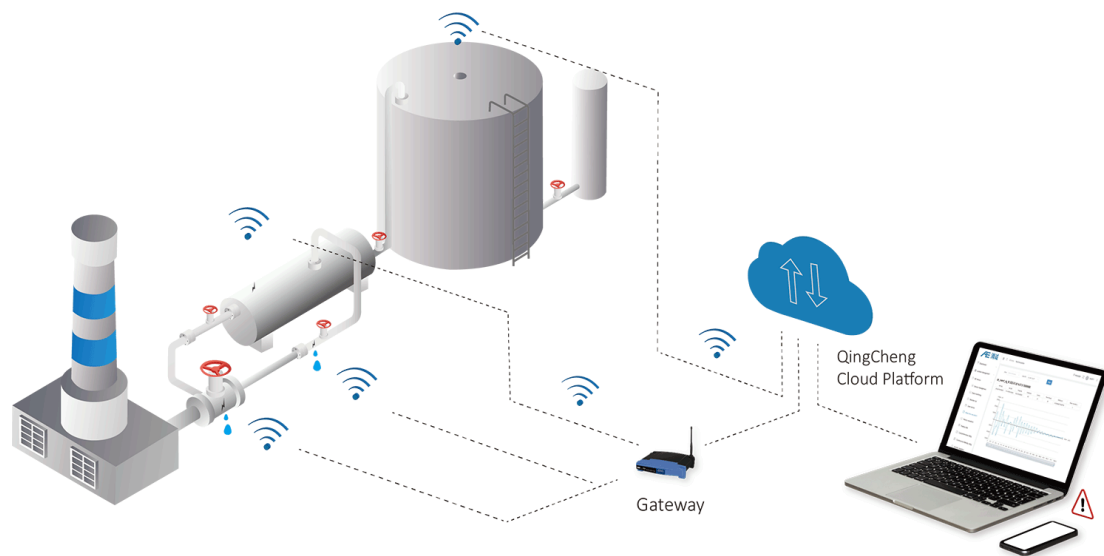
04 Application Introduction

The RAEM2 monitoring system is suitable for rotating bearing condition monitoring, valve pipeline leakage monitoring, tool wear monitoring, transformer partial discharge monitoring, wind turbine bearing condition monitoring.

Pipeline and valve cracking and leakage monitoring:

Pipelines and valves often suffer from corrosion and leakage after long-term operation. Without effective detection in the early stage, small corrosion or leakage will grow rapidly and eventually lead to major losses. RAEM2 monitoring system is suitable for monitoring steady-state signals. It can 365-day continuously online monitoring to

identify pipeline or valve leakage in early stage.



Acoustic wave (acoustic emission) monitoring of rotating equipment:

RAEM2 remote monitoring system collects and processes the acoustic emission signals of each component of the rotating equipment, and then upload data to Cloud Platform through LoRa and 4G. Users can do onsite inspections through Bluetooth APP on their mobile phone, or view real-time data through the cloud platform to remote monitor the status of the rotating equipment. (Damage status, lubrication status, etc.).

