

RAEM2

Remote Acoustic Emission Monitoring System

PRODUCT MANUAL



Version: 1.0.2

05/November/2024

1. Structural Construction

RAEM2 is an integrated state monitoring system that integrates acoustic emission sensors, batteries, data acquisition modules, and communication modules into a small aluminum alloy cylindrical housing. The bottom of the housing is equipped with magnets, and RAEM2 can be magnetically attracted to the surface of ferromagnetic materials. RAEM2 supports multiple communication methods, such as 4G or LoRa, and has Bluetooth short-range inspection function. The IoT cloud platform is used for remote data monitoring and parameter configuration.

RAEM2 is time triggered collection, and the device automatically wakes up to collect data according to its sleep time. Not relying on computers, it has high reliability and is suitable for long-term continuous unmanned status monitoring.

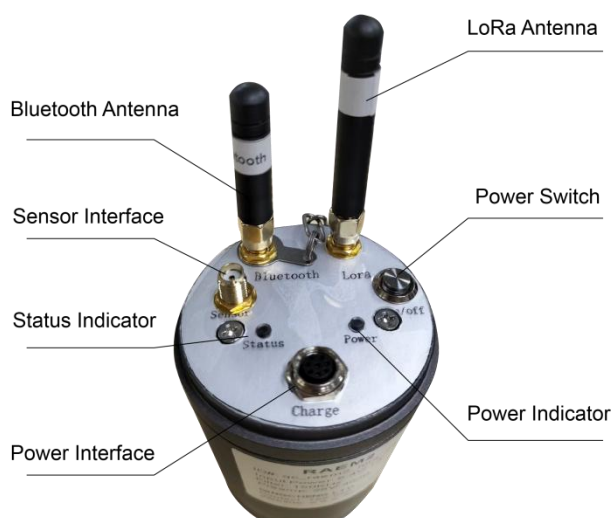
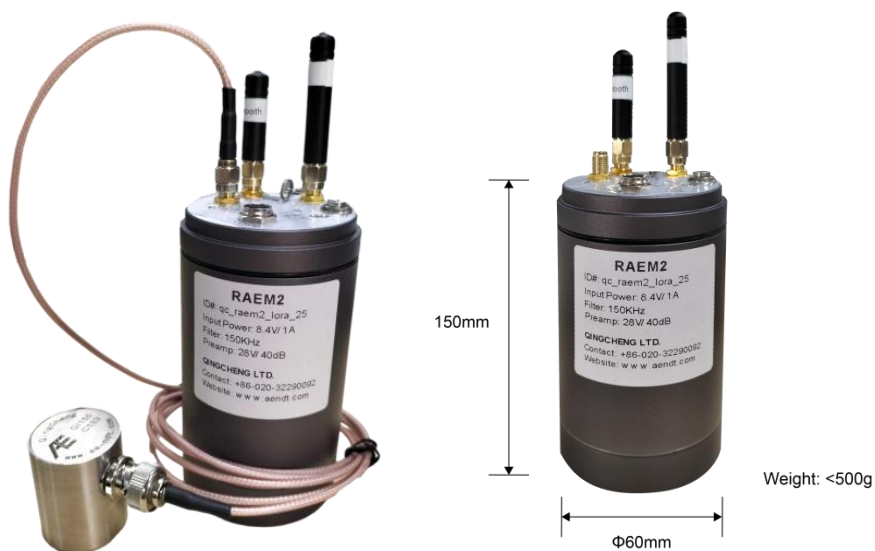
- Integrating data collection, processing, and transmission, remote monitoring through cloud platform
- Long term continuous unmanned automatic data collection, processing, and output
- Sleep function, low power consumption, small size, integrated, fully wireless, system automatic calibration

❖ Internal Sensor Version



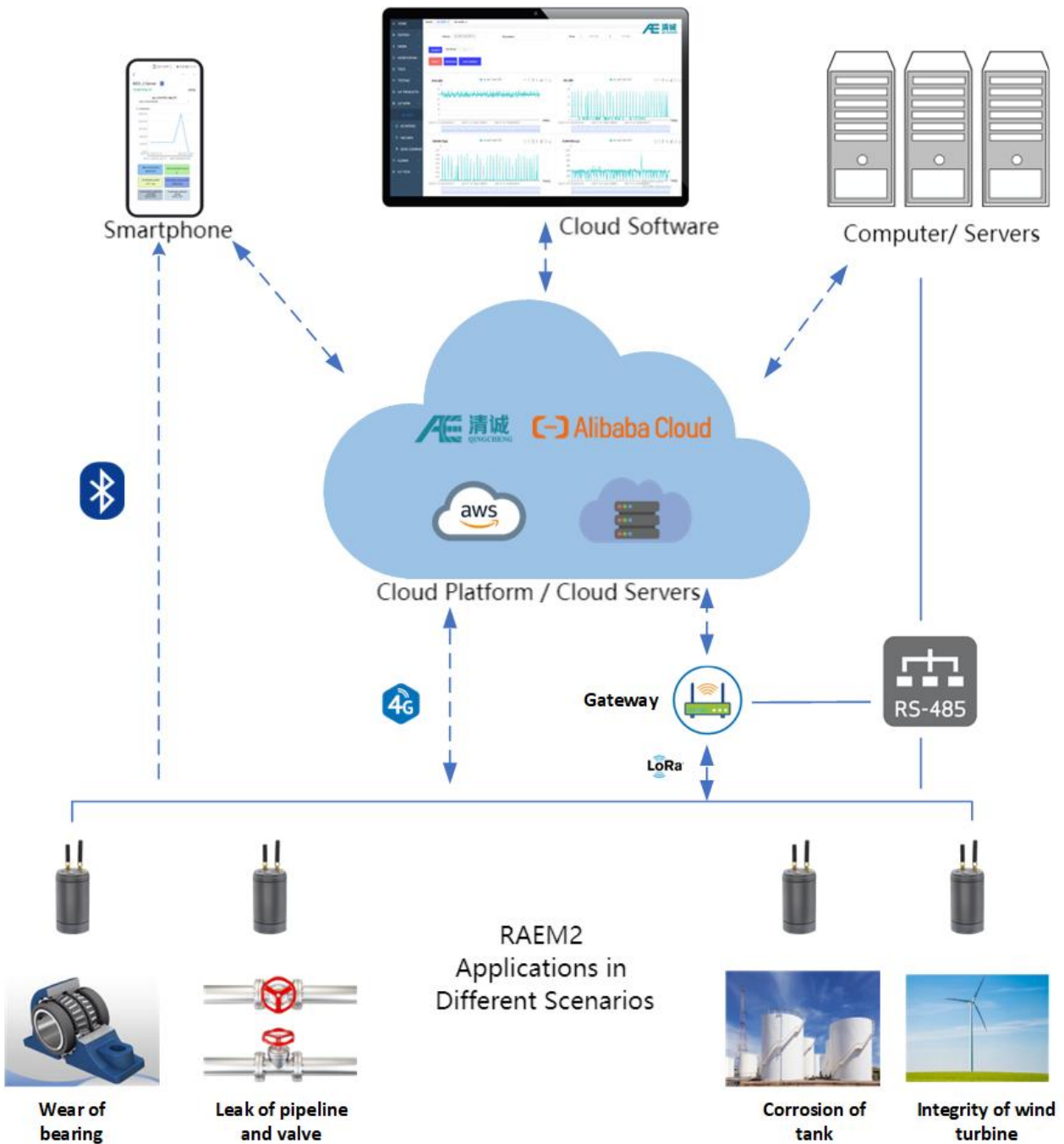


External Sensor Version



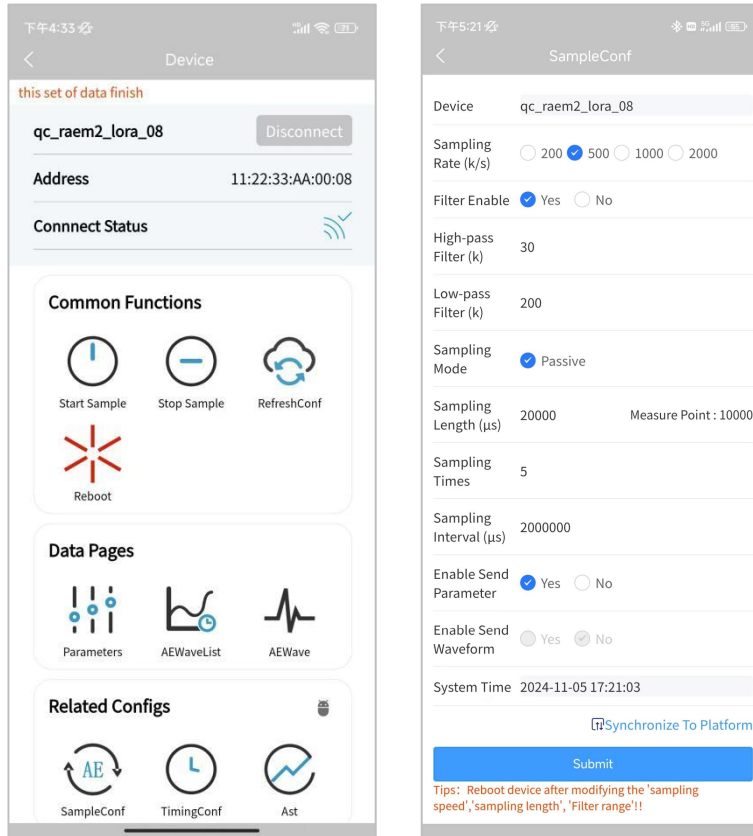
2. System Introduction

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

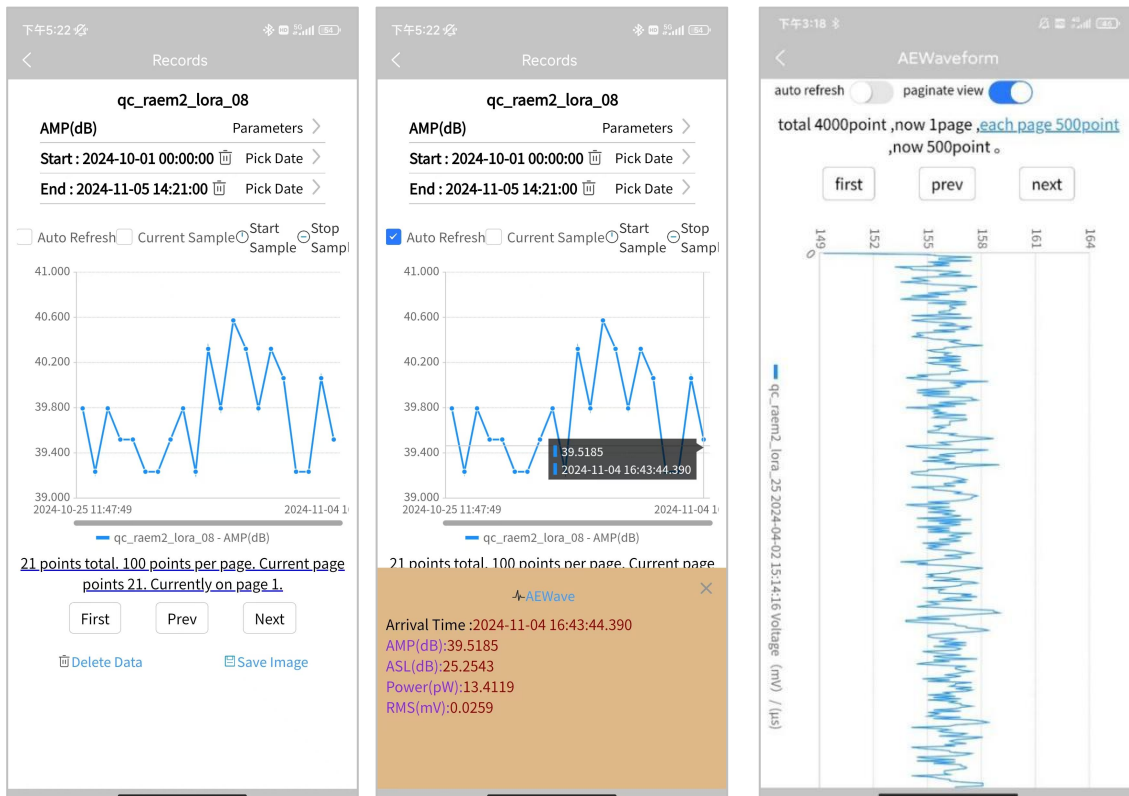


❖ Onsite Inspection with Bluetooth APP

- Remote configuration: online parameter settings, remote control of device start and stop, and timed parameter configuration. (Note: The minimum sampling interval is 200ms)

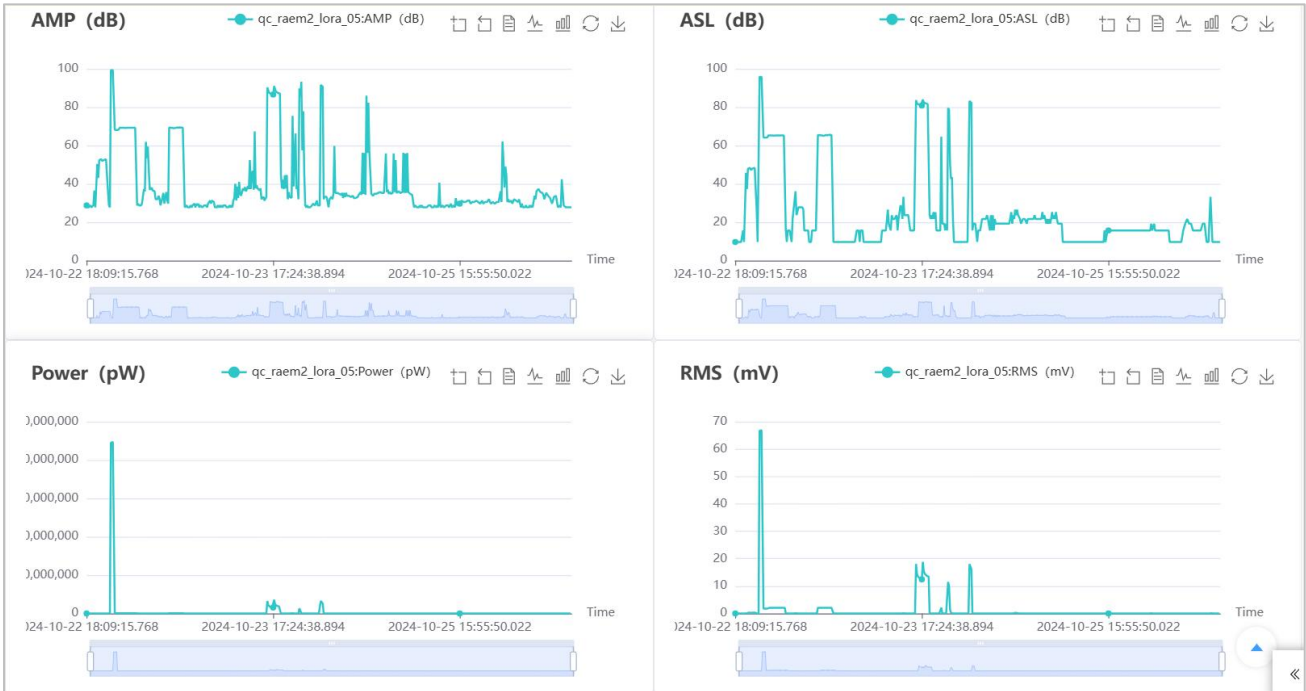


- Real time/historical parameter and waveform data display. Parameters: optional amplitude, average signal level (ASL), power, RMS. (Note: Lora version does not currently support sending waveform data)



❖ Qingcheng Cloud Platform

- Data can be uploaded to the cloud based IoT platform for display and analysis. (Note: Lora version does not currently support sending waveform data)
- **AE characteristic parameters:** amplitude, average signal level (ASL), power, RMS.



- **Remote configuration:** Remote configuration of parameters, control of device start or stop, timed configuration. (Note: The minimum sampling interval is 200ms)

Firmware Upgrade

AE Parameter Config

AE Filter Config

AE Timing Config

Bind Alarm Scene

* Serial Number: qc_raem2_lora_08

Sampling Rate(k/s): 200 500 1000 2000

Sampling Mode: Active Passive Continuous Sampling

Sampling Length(us): Sampling Point Count: 10000

Sampling Times(times):

Sampling Interval(us):

Enable Sending Parameters: Yes No

Enable Sending Waveform: Yes No

System Time:

3. Technical Features

Hardware Technical Specification

Channel	Single channel	Input frequency	10kHz-400kHz
Sampling accuracy	16-Bit	Sampling Rate	Optional 200k/s, 500k/s, 1000k/s, 2000k/s
Communication method	4G/LoRa, RS485	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°C~+60°C	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: Lora version only has interval sampling mode)		
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 (Note: LoRa version doesn't support waveform)		
Power supply	Various methods are available: 1. External 8.4VDC power supply 2. Built-in rechargeable battery (3000mA@7.4V) 3. Built-in lithium battery with low self-discharge rate (7000mAh@7.4V, non-rechargeable)		
Timing acquisition sleep time accuracy	±1min (Note: ±3min with LoRa version)		
Battery life in internal	Wake up once a day for 1 second each time		

sampling mode	Capable of working for 3 years theoretically (using a 7000mAh lithium-ion battery); Using a 3000mAh rechargeable battery: It is recommended to charge it at least once every 3 months
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 ϕ 60mm, height 105mm (including 150k sensor but not antenna); height 117mm (including 40k sensor but not antenna) External sensor version: diameter ϕ 60mm, 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

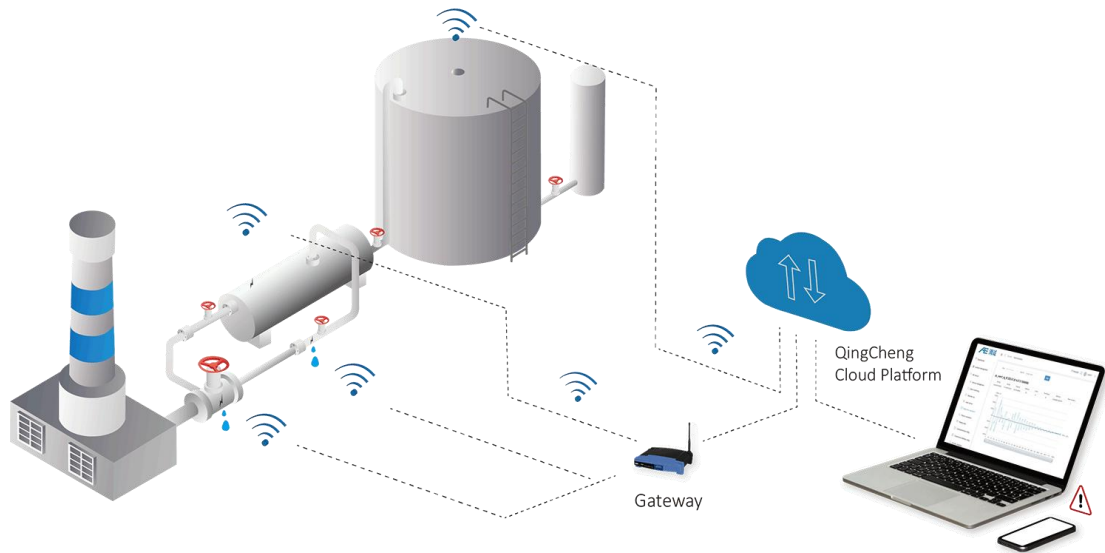
4. Application Introduction

Applications are suitable for:

- rotating bearing status monitoring
- valve pipeline leakage monitoring
- tool wear monitoring
- wind power main bearing status monitoring
- yaw bearing status 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.).

