loadsensing

WORLDSENSING

WIRELESS MONITORING SYSTEM

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THE CONNECTED INFRASTRUCTURE SOLUTION
MONITORING HOW STRUCTURES EVOLVE

Loadsensing is a data acquisition and monitoring system which combines state-of-the-art wireless monitoring and advanced software tools. It is widely recognized as the leading solution for connecting and monitoring infrastructures in remote locations.

Loadsensing devices are battery-powered and equipped with long-range, low-power wide area network (LPWA) radio communications and are compatible with a wide range of geotechnical sensors. The software suite is web-based and facilitates real-time data capture and analytics. It is also possible to set automatic alarms to make operations safer.

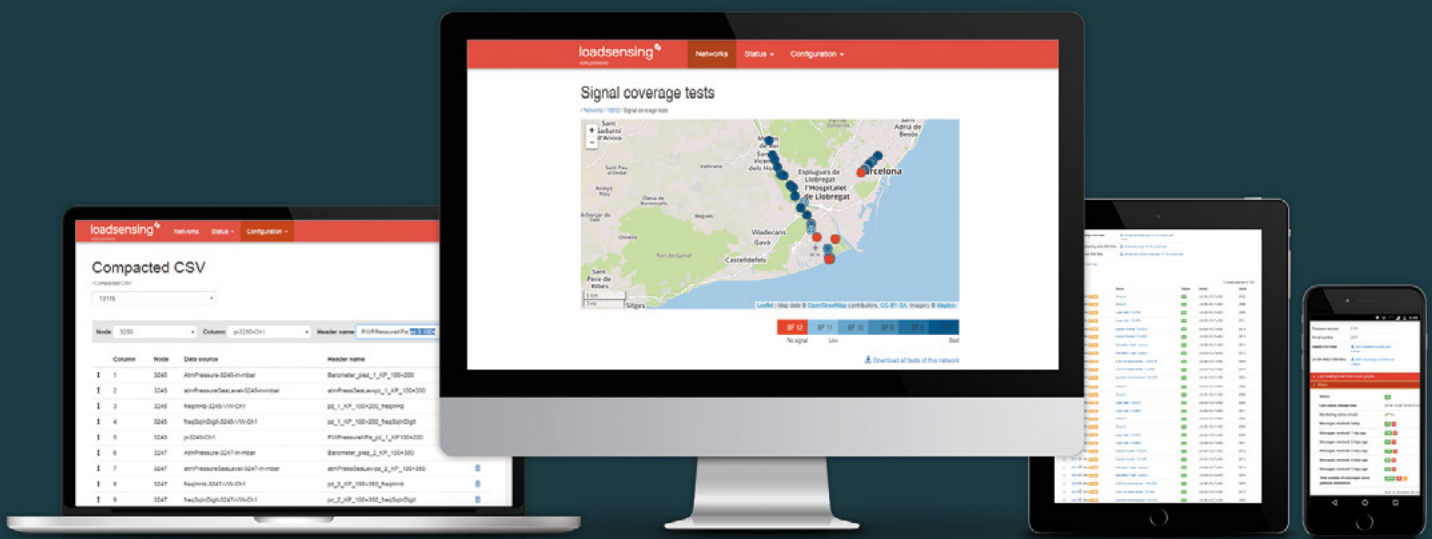
Mining and construction companies and operators of bridges, tunnels, dams, railways and many other inaccessible assets can now work with reliable data. Having access to this information and real-time insights enables operators to anticipate needs, manage their workforce, diminish risks, and even prevent disasters.

FEATURES

- Long-range communication of over 9 miles / 15km
- Truly low-power, 10 years of unattended runtime
- Wireless LPWA communication
- Supports most structural and geotechnical sensors (vibrating wire, digital, analog)
- Wireless tiltmeter
- Integrated alarm system
- User-friendly web software

BENEFITS

- Leverage already formatted data to optimize operations
- Remotely monitor hard-to-access infrastructures
- Cover a wide area with geotechnical sensors
- Easily add sensors to extend measurement range
- Save resources through fast implementation
- Decrease costs through easy maintenance
- Diminish risks and make operations safer

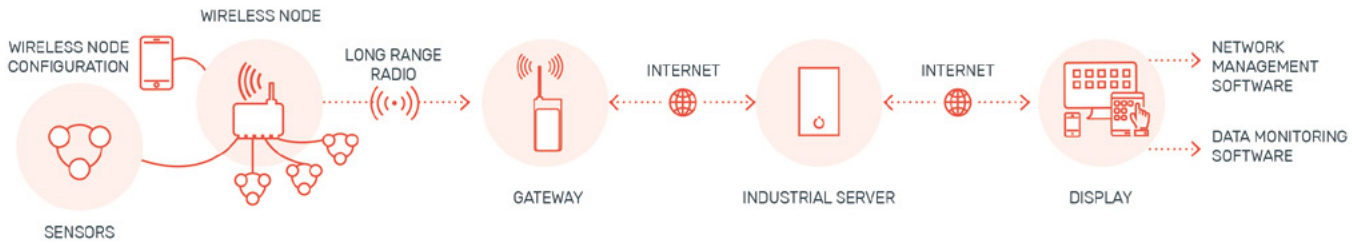


SOFTWARE SUITE

NETWORK AND ASSET MANAGEMENT SOFTWARE
Network communications configuration and control
Wireless data unit and sensor attributes display
Wireless data unit configuration
Sensor data in near real time
Conversion of raw sensor data in engineering units
Manual and automatic data download in .csv
Data transmitted in a secure manner
Remote change of sensor's sampling rate
Data accessible through Modbus TCP
Able to push data on user FTP

DATA MANAGEMENT SOFTWARE
Sensor data visualization and download (tables and graphs)
Topological view
Creation of virtual variables
Configuration of alarm thresholds
Alarms sent to stakeholders by email
Automatically generated reports (tables, graphs and notes)

HOW IT WORKS



Operational Intelligence for Mines and Industrial Companies

Worldsensing is not only among the best in the world at connecting distributed infrastructures with smart devices, we also know how to extract intelligence from collected data to transform operations. Our software solutions combine location intelligence with infrastructure monitoring.

NODE: LS-G6-INC15
BOX DIMENSIONS (WxLxH): 100x100x61 mm
OVERALL DIMENSIONS: 150x120x61 mm (excluding antenna)
EXTERNAL ANTENNA: 100 mm length (including connector)
HOUSING MATERIAL: Aluminium alloy
Internal C-size 3.6 V High power batteries, from 1 up to 2 batteries

NODE: LS-G6-VW-1P (POLYCARBONATE)
BOX DIMENSIONS (WxLxH): 151x80x60 mm
OVERALL DIMENSIONS: 160x85x60 mm
INTERNAL ANTENNA
RADIO COVERAGE: 60 % of the achieved with the external antenna
WITHOUT GROUNDING
HOUSING MATERIAL: Polycarbonate
Internal C-size 3.6 V High power batteries, 1 battery

WIRELESS TILTMETER
LS-G6-INC15

APPLICATIONS

Remote tilt monitoring from retaining and building walls
Landslide monitoring
Bridge pier monitoring
Structural load monitoring
Ground subsidence

SPECIFICATIONS

Type:	MEMS (Micro-Electro-Mechanical) Inclinometer
Range:	± 15°
Accuracy (± 5°):	0.03% FS / 0.004°
Accuracy full range:	0.17% FS / 0.025°
Resolution:	0.001°
Repeatability:	0.005°
Axes:	Two (biaxial)
Temperature sensor resolution:	0.1 °C
Temperature sensor accuracy:	±0.5 °C

BATTERY LIFE ESTIMATION Wireless tiltmeter

SAMPLING RATE	Barcelona temperature profile*	Singapore temperature profile*
5 min	1.2 years	1.1 years
1 h	5.8 years	4.7 years
6 h	8.3 years	6.4 years

* Estimations for 2 x saft LSH 14 batteries

VIBRATING WIRE 1ch and 5ch NODES
LS-G6-VW-1P, LS-G6-VW-1M, LS-G6-VW-5

VIBRATING WIRE NODE 1ch and 5ch

VIBRATING WIRE	
Measurement method: Embedded algorithms increasing immunity to noise	
Excitation wave:	+/- 5 V
Measurement range:	300 to 7,000 Hz
Resolution (-40 to +85°C):	0.12 Hz
Accuracy (-40 to +85°C):	0.018 % FS
THERMISTOR	
Measurement range:	0 ohm to 4 Mohm
Resolution:	1 ohm
Accuracy (20°C):	0.05°C (0.04 % FS)
BAROMETER	
Pressure Range:	300 to 1,100 hPa
Relative Accuracy (950 to 1,050 hPa at 25°C):	±0.12 hPa

BATTERY LIFE ESTIMATION Vibrating wire nodes

CHANNELS & SAMPLING	BATTERIES*	BATTERY LIFE ESTIMATION*
1 CH 5 min	1 cell	3 years
1 CH 30 min	1 cell	7 years
5 CH 5 min	1 cell	1,5 years
5 CH 5 min	4 cell	5 years
5 CH 30 min	1 cell	4 years
5 CH 30 min	4 cell	>10 years

* Nominal capacity of each battery: 5,8 Ah.
Considering laboratory conditions

Specifications are subject to review and change without notice

Nodes: LS-G6-ANALOG-4, LS-G6-DIG-2 and LS-G6-VW 5 ch
BOX DIMENSIONS (WxLxH): 100x200x61 mm
OVERALL DIMENSIONS: 140x220x61 mm
(excluding antenna)
EXTERNAL ANTENNA: 114 mm length (including connector)
HOUSING MATERIAL: Aluminium alloy
Internal C-size 3.6 V High power batteries, from 1 up to 4 batteries

NODE: LS-G6-VW-1M (ALUMINIUM)
BOX DIMENSIONS (WxLxH): 100x100x61 mm
OVERALL DIMENSIONS: 140x120x61 mm (excluding antenna)
EXTERNAL ANTENNA: 114 mm length (including connector)
HOUSING MATERIAL: Aluminium alloy
Internal C-size 3.6 V High power batteries, 1 battery

ANALOG NODE
LS-G6-ANALOG-4

ANALOG NODE 4ch
Each channel is individually configured by the user
Power supply: 5 V DC / 12 V DC / 24 V DC up to 60 mA selectable for each channel
VOLTAGE
Measuring ranges [V DC]: +/-10 ; +/-1.25 (8x)
Accuracy (-40 to +85°C): +/- 0.05 % FS
CURRENT LOOP (2-3 wires)
Measuring range: 4-20 mA
Accuracy (0 to +50°C): 0.05 % FS
POTENTIOMETER (POT)
Accuracy (0 to +50°C): +/- 0.02 % FS
FULL WHEATSTONE BRIDGE (FWB)
Accuracy (0 to -50°C): +/- 0.1 % FS
THERMISTOR
Accuracy (0 to +50°C): +/- 0.2°C
PT 100
Accuracy (20°C): +/- 0.8°C

Channels & Sampling	BATTERY LIFE ESTIMATION **				
	Current @12V@24mA	Current @24V@24mA	Voltage @12V@24mA	FWB@5V@0.7 kΩ	Pot@5V@1.5 kΩ
Warm up time	1 second	1 second	1 second		
1 CH 5 min	6 months	4 months	5 months	1.5 years	1.5 years
1 CH 6 hours	>10 years	>10 years	>10 years	8.5 years	>10 years
4 CH 5 min	1.5 months	39 days	2 months	1.5 months	7 months
4 CH 6 hours	8 years	6.5 years	>10 years	8.5 years	>10 years

** Estimations for 4 x saft LSH 14 batteries.
Considering laboratory conditions

DIGITAL NODE
LS-G6-DIG-2

DIGITAL NODE
One RS485 channel and two SDI-12 channels
Power supply: 12 V DC up to 120 mA
RS485 full or half duplex supported
Suitable for a chain of in-place inclinometers
Modbus RTU RS485
Supported sensors: RTS, Sisgeo and Geosense digital inclinometers

BATTERY LIFE ESTIMATION **
RST and Sisgeo chains of Inclinometers

Number of sensor	Sampling rate		
	6 hours	30 minutes	3 minutes
10 (RST)	>10 years	2.5 years	4 months
30 (RST)	5.2 years	4 months	26 days
10 (SISGEO)	4 years	5 months	30 days

SHARED SPECIFICATIONS

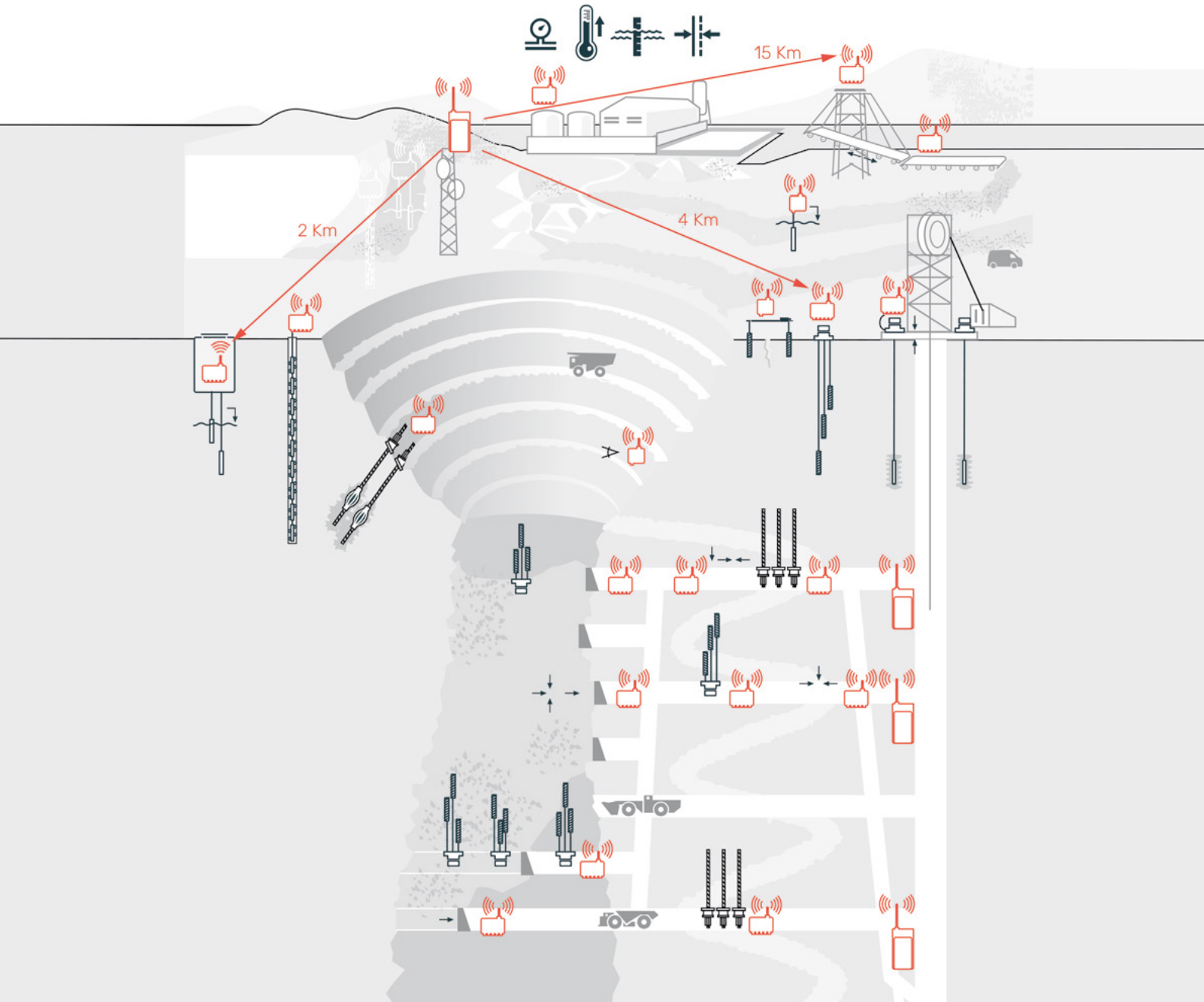
INTERNAL DATA STORAGE
Up to 72,500 readings including time and 5 sensors
Up to 200,000 readings including time and 1 sensor
Sampling rate: 30 seconds to 1 day
Time synchronization by radio: Time discipline better than ± 10 seconds
Operating temperature: -40°C to 80°C (-40°F to 175°F)
Weather protection: IP67

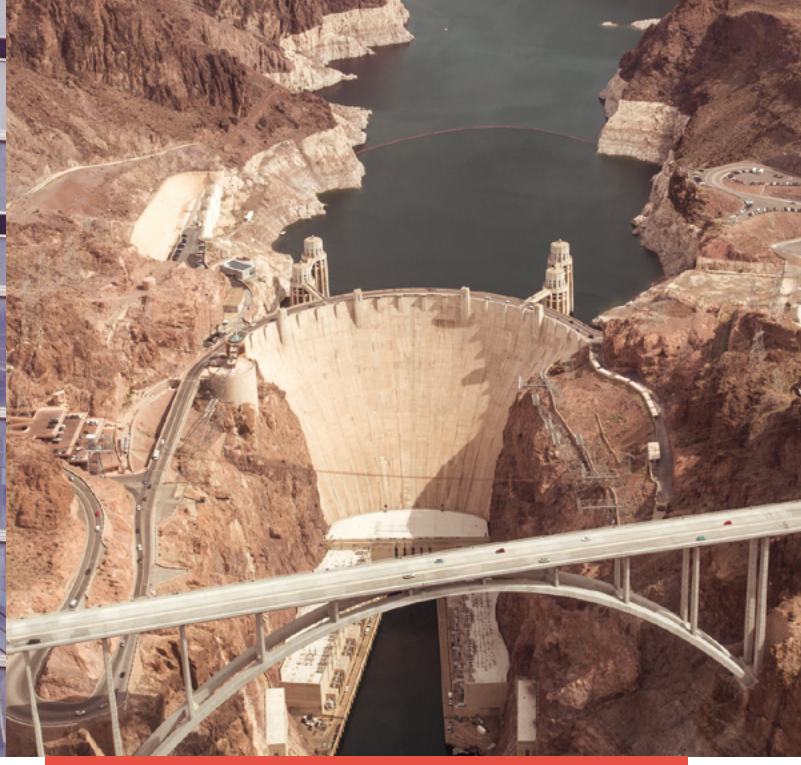
ACCESSORIES

ACCESSORIES
Saft LSH 14 C-size spiral cell
Node-mobile cable
External mounting brackets for wall mounting
Plate for pole mounting
Tiltmeter horizontal mounting plate
Tiltmeter vertical mounting bracket

Specifications are subject to review and change without notice

HOW IT WORKS IN MINES





CONFIGURATION APP

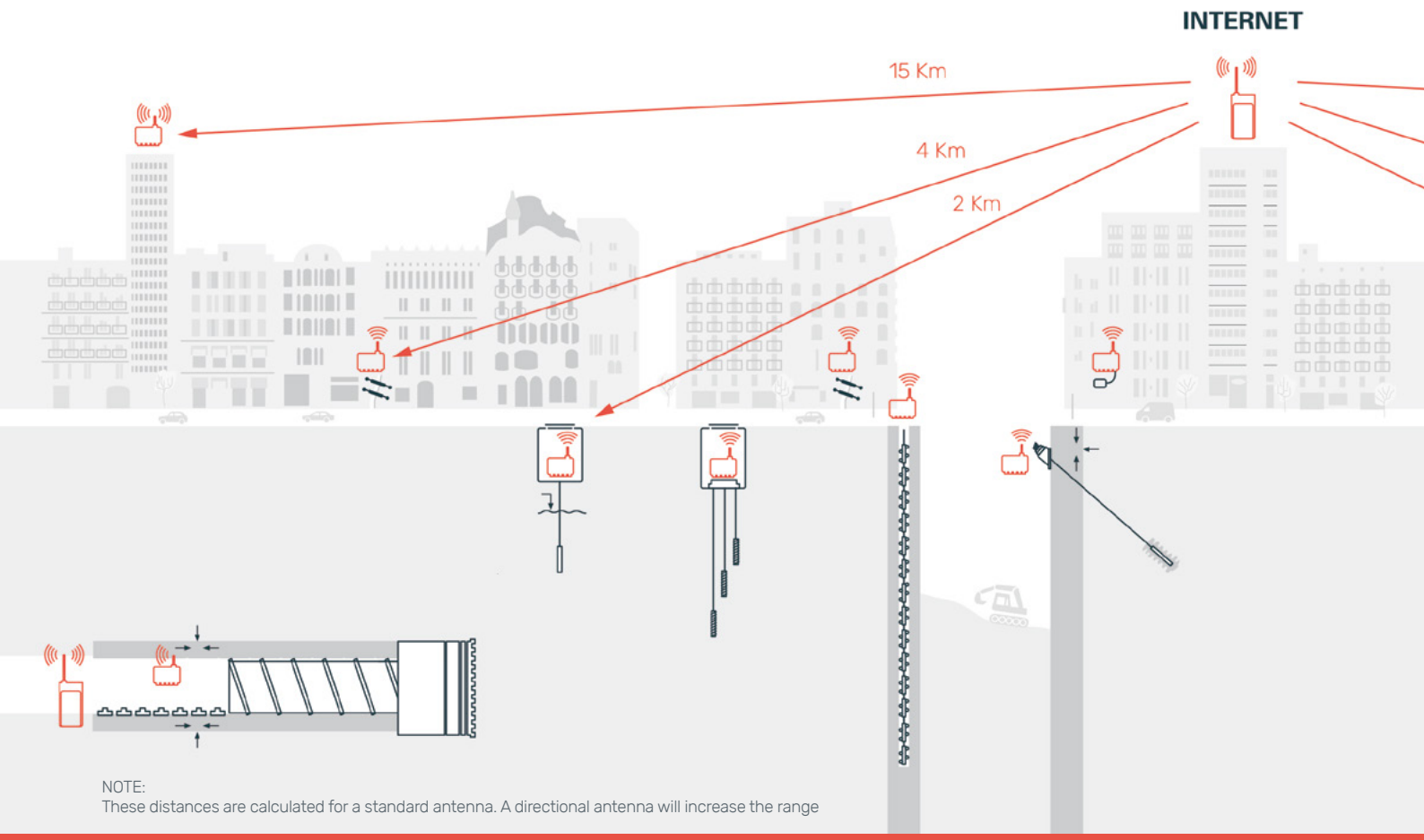
DLOG APP
Simple and fast connection to wireless node
Runs on Android devices
Easy sensor configuration: ID, sampling rate, frequency sweep, interface type, etc.
Checks radio signal coverage
Records coordinates (GPS)
Downloads data from wireless node and sends by e-mail or saves it on the Android device
Takes current reading
Updates wireless node firmware

GATEWAY

BASE STATION
ISM Sub 1 GHz band, sensitivity: down to -137 dBm
Detachable omnidirectional ¼ dipole
Integrated GPS antenna
GNSS High Sensitivity GPS module
POWER
Power supply: 48 V DC PoE
Nominal: 3 Watts
DC power supply (ex.: solar panel use): 11 to 30 Volts
MECHANICAL
Size: 210 x 310 x 170 mm, including mounting kit
Weight: 2 kg including mounting kit
IP67 rating
Operating range: -20 to + 60 °C
NETWORK INTERFACES
10/100 Ethernet WAN (RJ45 PoE)
Integrated 3G Modem & Antenna (HSDPA, EDGE, GPRS) quad band

LS gateways:
868 MHz ISM band
915 MHz FCC ISM band
915-928 MHz ISM band

HOW IT WORKS IN CITIES



NOTE:
These distances are calculated for a standard antenna. A directional antenna will increase the range

RADIO & APPLICATIONS

LONG RANGE RADIO	
OPEN FIELD:	15 km
CITY STREET:	4 km
MANHOLE IN A CITY STREET:	2 km
TUNNEL:	4 km

RADIO SPECS
ISM sub 1 GHz operating frequency bands adjustable to each territory requirements
No repeaters needed
High sensitivity: down to -137 dBm
Transmission: +14 dBm high efficiency / +20 dBm
Maximum link budget: 151 dB / 157 dB
Remote sampling rate change
Bidirectional communications capabilities

WORLD SENSING
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Regulatory Information USA

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Class B device notice

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

RF exposure safety

This device is a radio transmitter and receiver.

It is designed not to exceed the emission limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission.

The antenna must be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Permitted Antenna

This radio transmitter model, FCC ID: 24HN4-LS-G6-VW-1M has been approved by FCC to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Type	**Max Gain**
External antenna: Wellshow AR017 GSM Quad Band Antenna	+2 dBi

Regulatory Information Canada

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Les changements ou modifications non expressément approuvés par la partie responsable de la conformité pourraient annuler l'autorisation de l'utilisateur d'utiliser l'équipement.

This device complies with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions: (1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR de l'ISDE applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RF exposure safety

This device is a radio transmitter and receiver.

It is designed not to exceed the emission limits for exposure to radio frequency (RF) energy set by the ISED.

The antenna must be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Le modèle est un émetteur et un récepteur radio.

Il est conçu pour ne pas dépasser les limites d'émission pour l'exposition à l'énergie radiofréquence (RF) établie par l'ISDE.

L'antenne doit être installé de façon à garder une distance minimale de 20 cm entre la source de rayonnements et votre corps.

L'émetteur ne doit pas être colocalisé ni fonctionner conjointement avec à autre antenneou autre émetteur.

Permitted Antenna

This radio transmitter model, IC: 21260-LSG6VW1M has been approved by the ISED to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Type	**Max Gain**
External antenna: Wellshow AR017 GSM Quad Band Antenna	**+**2 dBi

Le présent émetteur radio modèle, IC: 21260-LSG6VW1M a été approuvé par ISDE pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal.

Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Type	**Max Gain**
External antenna: Wellshow AR017 GSM Quad Band Antenna	**+**2 dBi

CAN ICES-3 (B)/NMB-3(B)

This Class *B* digital ap*par*atus complies with Canadian ICES-003

Cet appareil numérique de clase B est conforme à la norme Canadienne ICES-003