



loadsensing^w

WORLDSENSING

WIRELESS MONITORING SYSTEM

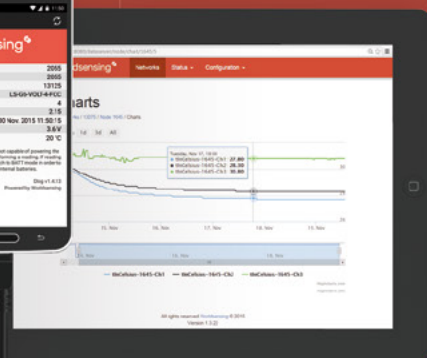
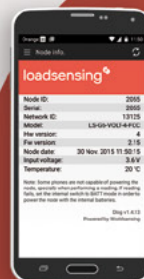
GATEWAY

loadsensing^w

WIRELESS
DATA UNIT

loadsensing^w

SOFTWARE SUITE



WIRELESS TILTMETER





WORLDSENSING

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.

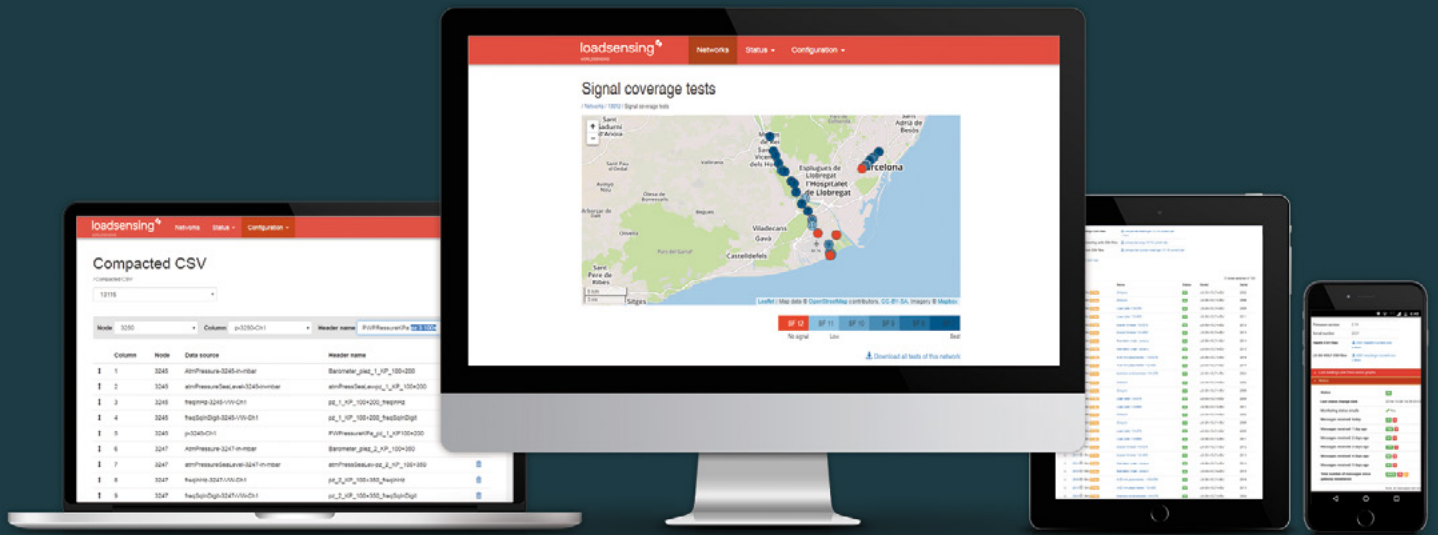
Mining and construction companies and operators of bridges, tunnels, dams, railways and many other inaccessible assets can now work with reliable data. Having access to this information and real-time insights enables operators to anticipate needs, manage their workforce, diminish risks, and even prevent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

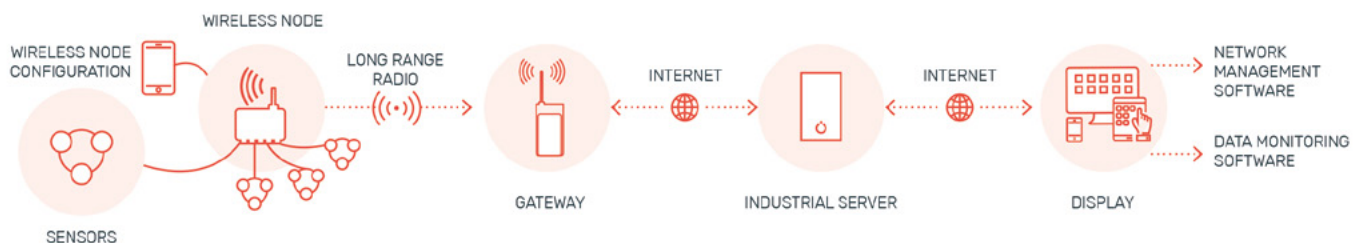
NETWORK AND ASSET MANAGEMENT SOFTWARE

- 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:	$\pm 15^\circ$
Accuracy ($\pm 5^\circ$):	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 $+85^\circ\text{C}$): 0.12 Hz

Accuracy (-40 to $+85^\circ\text{C}$): 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



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

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



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

BATTERY LIFE ESTIMATION **

Channels & Sampling	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

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

Soft LSH 14 C-size spiral cell

Node-mobile cable

External mounting brackets for wall mounting

Plate for pole mounting

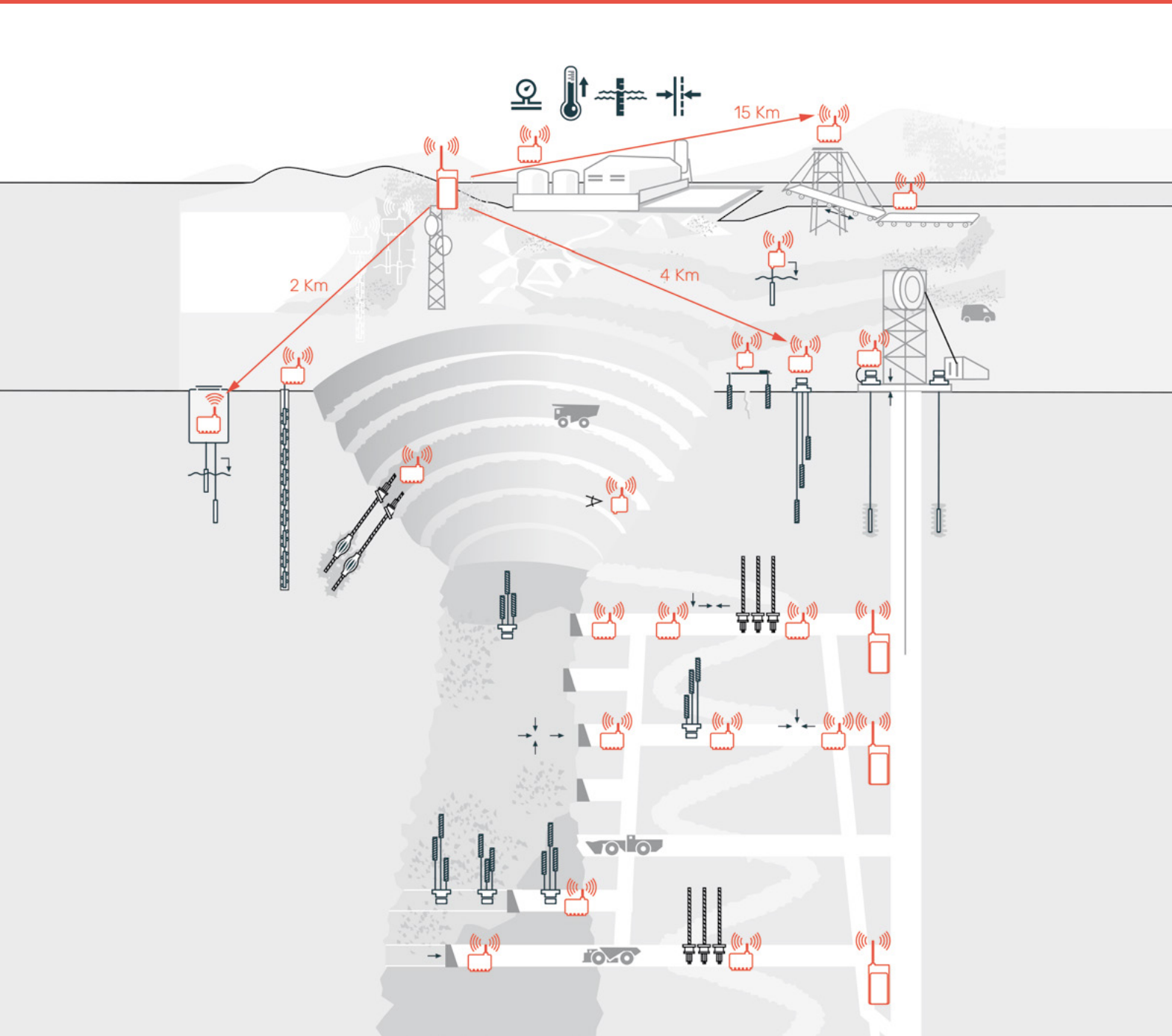
Tiltmeter horizontal mounting plate

Tiltmeter vertical mounting bracket

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



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 ½ 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:

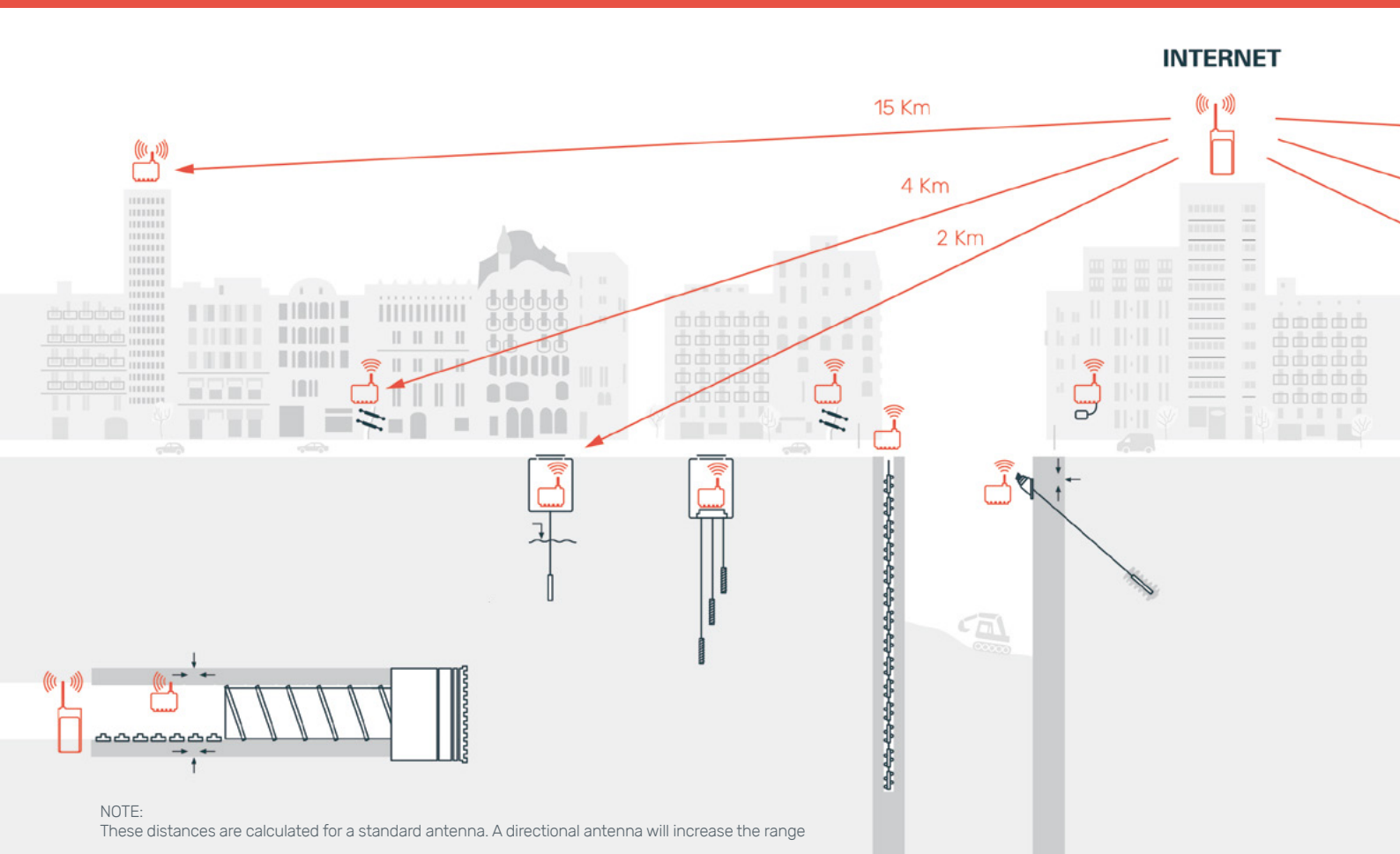
868 MHz ISM band

915 MHz FCC ISM band

915-928 MHz ISM band



HOW IT WORKS IN CITIES



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



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 installée 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 antenne ou 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 apparatus complies with Canadian ICES-003

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