User Manual of Wirnet iFemtoCell

1 Normal conditions of use

The Wirnet iFemtoCell is an indoor LoRa Nano Gateway for IoT chain. It is based on LoRa® technology provided by Semtech Company, it is compatible and interoperable with existing LoRa LPWAN.

The Wirnet iFemtoCell is declined into three versions to cover different countries and areas around the world:

	Wirnet iFemtoCell 868MHz	**Wirnet iFemtoCell 915MHz**	**Wirnet iFemtoCell 923MHz**
Geographical area	Europe, Russia Africa Middle East, India	North America Central America South America with the exception of Brazil	Asia: Indonesia, Malaysia, Korea, Japan, Taiwan, Hong Kong, Thailand, Vietnam, Papua New Guinea, Singapore, Philippines Oceania: Australia, New Zealand Brazil
ISM band	863 - 876 MHz	902 - 928 MHz	915 - 928 MHz
Downstream bandwidth (Tx of the Wirnet iFemtoCell)	863 - 873MHz	902 - 928 MHz	915 - 928 MHz
Upstream bandwidth (Rx of the Wirnet iFemtoCell)	863 - 873 MHz	902 - 928 MHz	915 - 928 MHz
Certifications	EN 300 220	FCC and IC CB scheme for: Mexico, Argentina, Chile, Bolivia, Colombia, Venezuela, Uruguay, Peru, Ecuador	FCC and EN 300 220 CB scheme for: Japan, Korea, Australia, Singapore, Indonesia, New-Zealand, Brazil

Please check the appropriate version for the dedicated country. Contact your reseller if required.
The present document addresses all the above Wirnet iFemtoCell versions.

2 Description of features

Here are the main functionalities of the Wirnet iFemtoCell:

- LongRange support:
  - Incorporate LoRa (TM) bidirectional communications technology:
    - 868MHz version → RX: 863- 873MHz , TX: 863-873MHz (according to HW capabilities)
    - 915MHz version → 902-928 MHz ISM band-hybrid mode (according to HW capabilities)
    - 923MHz version → RX: 915-928 MHz, TX: 915-928MHz (according to HW capabilities)
  - 49 LoRa demodulators over 9 channels + 1 x GFSK
- Embedded, remote and open low power communication station
- Open development framework based on standard Linux OS
- Internet connectivity over Wi-Fi, Ethernet or 3G/4G (with optional USB dongle)
- USB host interface allowing local software upgrade with USB mass-storage key

3 Safety

3.1 Warnings in this manual

Warnings provide important safety informations.
Warnings must be read before any action is taken that poses risks to persons or equipment.

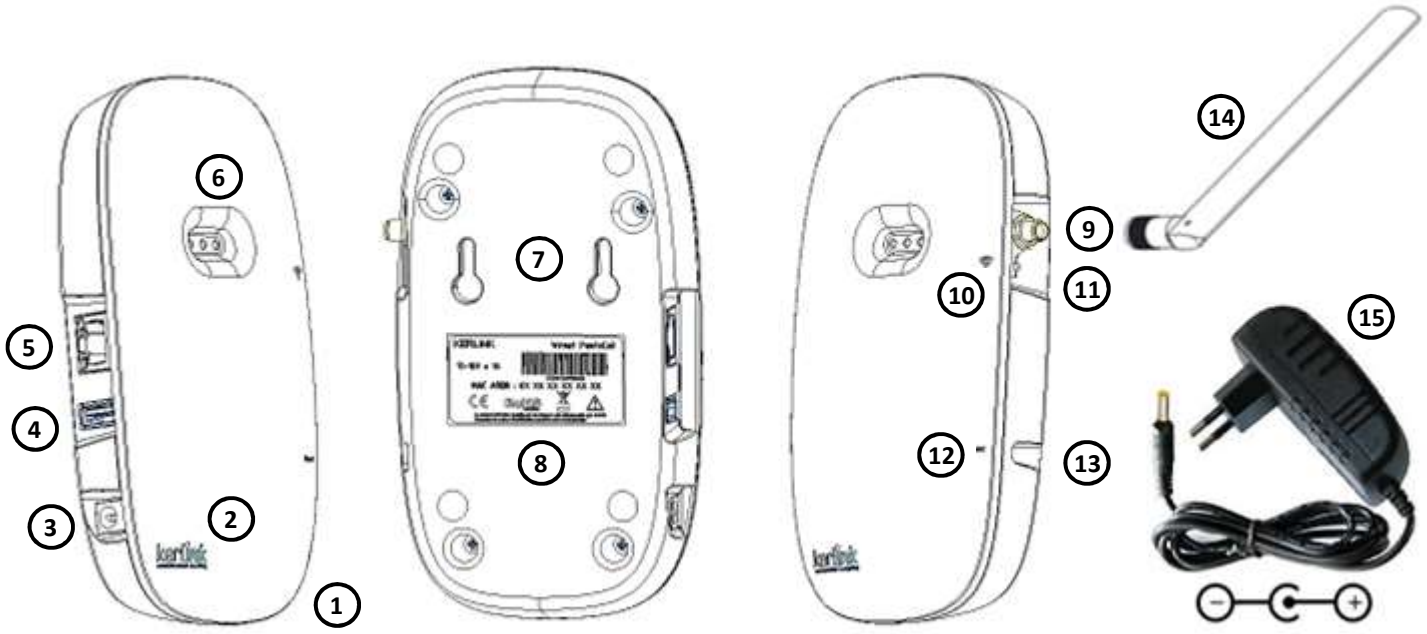
WARNING	Refers to a critical situation. In case of non-compliance, it may result in property damage.
i	Refers to useful information during manipulations.

3.2 Safety instructions

Please read this user manual carefully.
It is an integral part of the described equipment and it must be available at all times.

WARNING	• Only use the Wirnet iFemtoCell for its intended use, see chapter 1 "Normal conditions of use". • Only use the Wirnet iFemtoCell in the normal operating conditions described in chapter 10 "Technical characteristics". • Maintenance and repair must be carried out by qualified personnel authorized by the manufacturer. • The enclosure of the Wirnet iFemtoCell must not be opened by customer. • The Wirnet iFemtoCell should only be used with accessories or spare parts supplied by your reseller.

4 Overview of Wirnet iFemtoCell



(EU version used here as example - non contractual view)

Nomenclature:

N°	Components	N°	Components
1	Wirnet iFemtoCell	9	SMA connector for LoRa antenna
2	Silkscreened KERLINK marking	10	Silkscreened Wi-Fi (WPS) marking
3	Jack connector (for power supply)	11	Wi-Fi (WPS) push button
4	USB connector	12	Silkscreened Reset marking
5	RJ45 connector (Ethernet)	13	Reset push button
6	3 bicolor LEDs	14	LoRa antenna (862-873MHz , 902-928MHZ, 3dBi, 50Ω; vertical polarization)
7	Wall mounting oblong holes	15	AC power supply
8	Sticker with markings	16	User manual (this document)

5 Markings

5.1 Markings on sticker

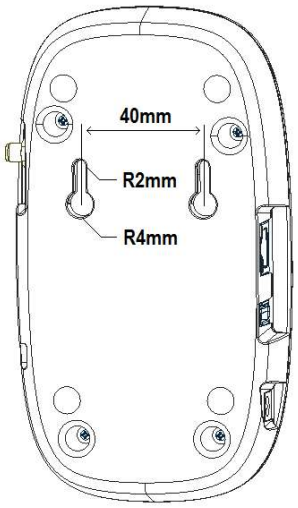
Symbol	Description	Symbol	Description
Wirnet iFemtoCell	Type of equipment		QR code
10-15V ⎓ 1A	Power supply informations	CE or other marking	CE marking indicating that the product complies with current European directives, or other marking depending on the country
Board ID	Serial number of board	RoHS	Marking indicating that the product complies with RoHS directives
Final product ID	Serial number of product		Do not dispose of with domestic waste
MAC ADDR	MAC address		Product must be installed on a non-flammable substrate (UL 94V0) Refer to the installation instructions before powering up

5.2 Markings on packaging

Symbol	Description	Symbol	Description
Wirnet iFemtoCell	Type of equipment		QR code
Final product ID	Serial number of product	CE or other marking	CE marking indicating that the product complies with current European directives, or other marking depending on the country
Packaging ID	Identifier of packaging	RoHS	Marking indicating that the product complies with RoHS directives
Software version	Version of embedded software		Do not dispose of with domestic waste
MAC ADDR	MAC address		Product must be installed on a non-flammable substrate (UL 94V0) Refer to the installation instructions before powering up

6 Installation of Wirnet iFemtoCell

6.1 Mounting of the enclosure



WARNING	The Wirnet iFemtoCell enclosure must be mounted on any concrete pedestal, concrete wall or any non-flammable surface (UL94-V0). It must not be mounted on a flammable surface.

The Wirnet iFemtoCell may be mounted on a wall using the two oblong holes.
Only two screws (not included) are needed, all mounting informations are mentioned on the following drawing:

6.2 Setting connections

WARNING	Before setting all connections, ensure that the power supply is not connected to the mains supply.

When the Wirnet iFemtoCell is installed, three configurations are possible regarding the technology used to access Internet:
- Ethernet connection, requiring an Ethernet access through a dedicated RJ45 cable
- Wi-Fi connection, requiring a Wi-Fi access point
- 3G/4G connection via USB dongle (optional) and an USIM subscription (not included)

The three configurations may be used in parallel. A typical example is the possibility to insure Ethernet backup by a 3G/4G link.

The required connections needed to operate the Wirnet iFemtoCell are listed below (see chapter 4 “Overview” for details of connectors):
- Power supply
- Ethernet cable (not included)
- LoRa antenna
- USB mass-storage key (not included)
- 3G/4G USB dongle (optional) and an USIM subscription (not included)

i	The Ethernet cable is not provided and must consist of two RJ45 T 568A (or 568B) plugs on each side. KERLINK recommends using a cable with the following characteristics: • Category: 6A • Shielding: STP (U/FTP) or SSTP (S/FTP) • Section conductors: AWG26 • External jacket: LSZH or PUR • Maximum length: 100 meters • Operating temperature range:-20°C to +55°C

i	In case of 3G/4G connection with USB dongle: • KERLINK recommends using a validated USB dongle (contact your reseller to have the list of validated USB dongles). Alternative dongle may require additional drivers and firmware update to be used. • To optimize the radio performances, when possible, KERLINK strongly recommends dissociating the 3G/4G USB dongle away from the enclosure and the LoRa antenna by using a 1 meter extension cable.

6.3 Power ON

Once the LoRa RF antenna, the Ethernet cable (if used) or the optional 3G/4G USB dongle (with USIM card inserted) and the power supply jack connector are connected, the Wirnet iFemtoCell can be powered ON by connecting the power supply onto the 230VAC mains supply.

i	The power supply is provided with E/F type cable (Europe) or B type cable (USA).

6.4 First connection

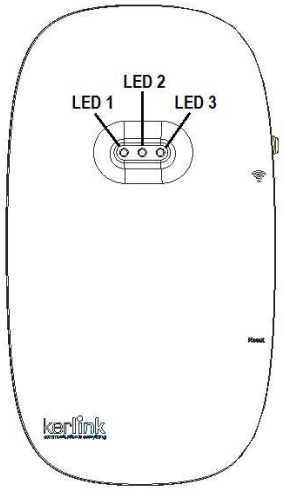
When the Wirnet iFemtoCell is installed, the first connection can be done by two different ways:

- Using Wi-Fi connection:
  - Press the WPS button (Wi-Fi Protected Setup) on the Wirnet iFemtoCell (see chapter 4 “Overview”) then press the WPS button on the Wi-Fi access point of the installation
  - The connection will be established automatically
- Using Ethernet connection:
  - Plug the Wirnet iFemtoCell to your box or internet router with an Ethernet cable
  - The connection will be established automatically

6.5 Functional check

To ensure the Wirnet iFemtoCell is started up, check the behavior of the LED indicators:

LED	Specification
LED 1: Power	RED blinking during the kernel boot GREEN blinking during system boot GREEN when boot is finished
LED 2: Backhaul	RED during boot **If the applicative software provided by KERLINK is installed:** • RED if applicative software is disconnected • GREEN blinking during applicative software connection • GREEN fix if applicative software is connected
LED 3: LoRa traffic	RED during boot **If the applicative software provided by KERLINK is installed:** • Applicative software management • Rx: GREEN blinking • Tx: RED blinking



i	Applicative software stands for embedded software running on the Wirnet iFemtoCell like KERLINK Small Private Network or another Packet Forwarder (software that forwards RF packets received to a server and emits RF packets that are sent by the server).

i	Please contact your reseller to know the LEDs behavior if the applicative software installed on the Wirnet iFemtoCell is not the one officially provided by KERLINK.

6.6 Configuration

Once the connection is established (Ethernet or Wi-Fi), a Web configuration interface is accessible from the Wirnet iFemtoCell.
This Web interface is accessible on any IP address that has been allocated by the network.

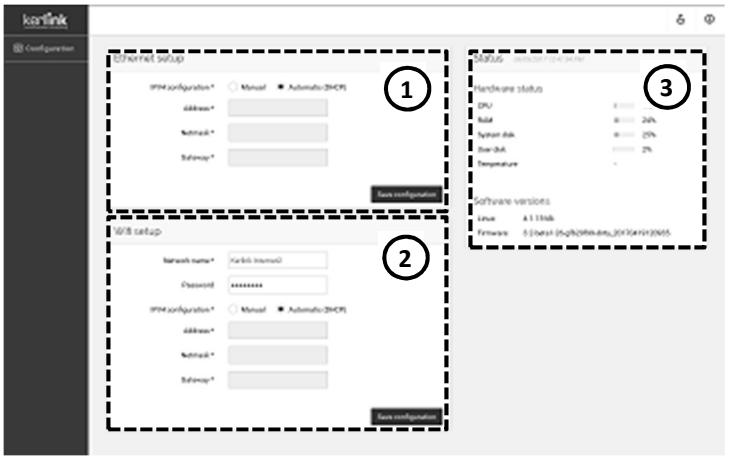
You first have to get the IP address that has been allocated to the Wirnet iFemtoCell by DHCP on either Ethernet or Wi-Fi and then point your Web browser to it. You can find this information from your Wi-Fi/Ethernet router on its administration interface.

For example:
http://192.168.1.13/

The login credentials are “admin” for user and “admin” for password.

The Web interface allows to configure the following items:

- Ethernet setup (frame 1):
  - IPV4 configuration: manual or automatic (DHCP)
  - In case of manual configuration:
    - Address
    - Netmask
    - Gateway
- Wi-Fi setup (frame 2):
  - Network name
  - Password
  - IPV4 configuration: manual or automatic (DHCP)
  - In case of manual configuration:
    - Address
    - Netmask
    - Gateway



The Web interface allows to get some status (frame 3):

- Hardware status:
  - CPU used
  - RAM used
  - System disk used
  - User disk used
- Software versions:
  - Linux
  - Firmware

7 Problems

Problem	Cause	How to fix?
The LEDs never turn on	The Wirnet iFemtoCell is not well powered	• Check the position/good connection of the power supply jack connector • Check that the power supply is properly connected to the mains supply
No LoRa data received	The LoRa antenna is not well connected	• Check that a LoRa endpoint is within range of the Wirnet iFemtoCell • Check the tightening of the LoRa antenna (SMA connector) • Check that the LoRa antenna is not deteriorated
No Internet access	No technology to access Internet is activated/available on the Wirnet iFemtoCell	**In case of Ethernet connection:** • Check the position/good connection of the RJ45 Ethernet connector • Check that the RJ45 cable is not deteriorated **In case of Wi-Fi connection:** • Check that the Wi-Fi access point is within range of the Wirnet iFemtoCell **In case of 3G/4G connection:** • Check that the USB dongle is well plugged • Check that the USB dongle is well supported by firmware

In case of a problem that cannot be resolved immediately from the table, contact your reseller. Do not use the Wirnet iFemtoCell to prevent further damage.

8 Disposal / Recycling

Do not dispose of the product with domestic waste. For proper disposal, contact a waste disposal company. The packaging of the product (cardboard and liners) can be disposed of with the used paper.

9 Warranty

Contact your reseller for warranty conditions of the Wirnet iFemtoCell.

WARNING	The Wirnet iFemtoCell is not warranted by KERLINK in case the enclosure is opened by customer for any reason.

10 Technical characteristics

Characteristic	**Wirnet iFemtoCell**
Enclosure material	PC + ABS
LED gasket material	Elastomer compound based on styrene-butadiene-styrene (SBS)
Dimensions L x H x P in mm: • Without LoRa antenna • With LoRa antenna	 160 x 90 x 35 mm 220 x 125 x 35 mm
Weight in g (with AC power supply and LoRa RF antenna)	280g
Operating temperature range	Enclosure: -20°C to +55°C Power supply: country dependent, please refer to power supply itself or contact your reseller
Power supply output voltage	12 VDC
Power consumption: • CPU module (20% load), Ethernet link ON • Wi-Fi (25%Tx,75%Rx) • 3G/4G USB dongle (HSPA, 25% Tx, 75% Rx) • Radio in Rx mode (x8 demodulator on)	 1.3W max 0.5W max 1W max 1.6W max
Ingress protection	IP31 / EN 60529
Humidity	95% non-condensing
Impact resistance	IK07
Flammability rating	UL94-V0
Connectors	1 x SMA or RP-SMA (LoRa antenna) 1 x jack connector (power supply) 1 x USB 1 x RJ45

11 Declaration of conformity

11.1 Wirnet iFemtoCell 868MHz

The Wirnet iFemtoCell 868 complies with requirements listed in the article 3 of the RED 2014/53/EU directive:

1. Electromagnetic compatibility (article 3.1-b of the RED Directive)
   Applied standard(s): EN 301 489-1 issue 1.9.2
   EN 301 489-3 issue 1.6.1
   EN 301 489-17 issue 2.2.1

2. Efficient use of the radio frequency spectrum (article 3.2 of the RED Directive)
   Applied standard(s): EN 300 328 issue 2.1.1
   EN 300 220-1 issue 3.1.1
   EN 300 220-2 issue 3.1.1

3. Safety (article 3.1-a of the RED Directive)
   Applied standard(s): EN 60 950-1 Ed. 2006+A11:2009+A1:2010+A12:2011+A2:2013

4. Magnetic field exposure
   Applied standard(s): EN 50 385 Ed. 2002

The Wirnet iFemtoCell 868 is considered as a category 2 receiver according to the EN 300 220-1.
The Wirnet iFemtoCell 868 has CE marking.

In Europe, the Wirnet iFemtoCell 868 station must comply with the ERC 70-3 requirements regarding duty cycle and maximum EIRP. They are summarized in the following table:

ERC 70-03 Band	Frequency (MHz)	Power	Duty cycle
h1.3	863-865	14dBm ERP	0,1%
h1.3	865-868	14dBm ERP	1%
h1.4	868-868,6	14dBm ERP	1%
h1.5	868,7-869,2	14dBm ERP	0,1%
h1.6	869,4-869,65	27dBm ERP	10%
h1.7	869,7-870	14dBm ERP	1%
h2	870-873	14dBm ERP	0,1%
h2.1	870-873	14dBm ERP	1%
Annex2/c	870-873	27dBm ERP	2,5%

i	The power supply of the Wirnet iFemtoCell 868 must be a limited power source.

i	• If the LoRa antenna is changed, the output power must be adjusted to take into account the gain of the antenna to not overrule the ERC 70-3 regulation. • Be careful, some countries in Europe may have specific frequency range, EIRP and duty cycles regulations. Check the local regulations before installing and commissioning the Wirnet iFemtoCell 868. • For other countries, outside Europe, check the frequency range, the maximum EIRP and duty cycle allowed.

11.2 Wirnet iFemtoCell 915MHz

The Wirnet iFemtoCell 915 complies to:
- IEC 60950-1:2005/A1:2009/A2:2013
- UL 60950 -1 : 2007, Amendment A1:2011, Amendment A2:2014
- CAN/CSA-C22.2 NO. 60950-1-07 / A1: 2011 / A2: 2014

The Wirnet iFemtoCell 915 complies to both FCC and IC regulations.
Applicable documents:
- CFR 47 FCC Part 15:
  - FCC 47 CFR Part 15 : 2016 - Part 15- Radio frequency devices
  - FCC PART 15.247 - Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz (frequency hopping and digitally modulated)
    - FCC Part 15.207 conducted emissions on AC mains in the band 150kHz – 30MHz
    - FCC Part 15.247 intentional radiated emissions
    - FCC Part 15.215 Additional provisions to the general radiated emissions limitations
- RSS 247:
  - RSP-100 Issue 11, January 2016 - Certification of Radio Apparatus
  - RSS-Gen – Issue 4, November 2014- General requirements and Information for the Certification of radio Apparatus
  - RSS-247 Issue 1, May 2015 - Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

The associated FCC and IC identifiers of the Wirnet iFemtoCell 915 are:

Model: Wirnet iFemtoCell 915
FCC ID: 2AFYS-KLK915WIFC
IC: 20637-KLK915WIFC

i	• The power supply of the Wirnet iFemtoCell 915 must be a limited power source. • Any changes or modifications to this equipment not expressly by Kerlink may cause, interference and void the FCC authorization to operate this equipment. • This device complies with Industry Canada's license-exempt RSSs. 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 of the device.

i	• Some conditions have to be respected to maintain the FCC and IC compliance of the devices in USA and Canada. Please contact your reseller to have details. • For others countries, check the specific regulations regarding maximum EIRP and duty cycle allowed.

WARNING	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* This equipment complies with RSS102's and FCC radiation exposure limits set forth for an uncontrolled environment under the following conditions: 1. This equipment should be installed and operated such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and user's/nearby person's body at all times. 2. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

11.3 Wirnet iFemtoCell 923MHz (certification on going)

The Wirnet iFemtoCell 923 **will be** compliant to:

- IEC 60950-1:2005/A1:2009/A2:2013
- CENELEC EN 60 950-1 (Ed. 2006/A11 : 2009/A1 : 2010/A12:2011/A2:2013)
- AS/NZS 60950.1 : 2011
- GB4943-2011
- K60950-1
- J60950-1

The Wirnet iFemtoCell 923 **will also be** compliant to both FCC and CE regulations.
Applicable documents:

- Article 3.2 of the RED Directive:
  Applied standard(s):
  - EN 300 220-1, issue 3.1.1
  - EN 300 220-2, issue 3.1.1
  - EN 300 328, issue 2.1.1

  The Wirnet iFemtoCell 923 is considered as a category 2 receiver according to the EN 300 220-1.
- AS/NZS 4268 2017 : Radio equipment and systems – Short range devices – Limits and methods of measurement
- ARIB STD-T108 - 920MHz-Band Telemeter, Telecontrol and Data Transmission Radio Equipment
- Clause 2, Article 58-2 of Radio Waves Act (Republic of Korea)
- IMDA Technical Specifications for Short Range Devices (IMDA TS SRD) – Issue 1 Rev 1, October 2016

i	The power supply of the Wirnet iFemtoCell 923 must be a limited power source.

i	• Depending on the countries, check the specific regulations applying, especially regarding frequency range, maximum EIRP, duty cycle allowed, maximum transmit duration, carrier sense mandatory or not… • Please contact your reseller to have details on specific rules for specific countries.

12 Contact

For additional information, please contact your reseller.