Vertiv™ Liebert® Wireless Sensor Network (WSN) Guide Specification

1.0 GENERAL

1.1 Summary

The Liebert® Wireless Sensor Network (WSN) uses a gateway and sensor nodes that use a direct sensor to gateway communication path for environmental monitoring. Each application is different in that the final installed system performance is dependent on a number of factors that are not within Vertiv's control.

The sensor nodes contain multiple on-board or connected sensors allowing for multiple data points to be communicated wirelessly back to the gateway to be aggregated and displayed. Selected data is communicated out of the gateway to connected systems using wired means. The system can be controlled or monitored with system or user configuration values.

This solution offers a join process where advanced sensor nodes can be easily and securely added to the gateway using auto-discovery-programming cables are not required. After sensor nodes have been added securely, the network can be locked down to prevent unknown devices from entering the network. The gateway can support connectivity and communication with up to 300 sensor nodes on a fully populated system.

1.2 System Requirements

The PC or laptop that is used to configure the gateway must meet the following requirements:

- Chrome version 76.0.3808 or higher.
- 10/100 base-TX Ethernet communications protocol.

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2.0 PRODUCT

2.1 Hardware Components

The Vertiv™ Liebert® WSN is comprised of the following components:

- Gateway with antenna
- Sensor with mounting kit
- Extended battery kit (optional)

Gateways and sensors are intended for indoor use only.

2.2 Wireless Architecture

2.2.1 System Description

The Liebert® WSN architecture consists of a wireless gateway with an antenna that is capable of communicating to up to 300 wireless sensor nodes using a LoRa technology that uses a join process where advanced sensor nodes can be easily and securely added to the gateway using auto-discovery. Programming cables are not required. After sensor nodes have been securely added, the network can be locked down to prevent unknown devices from entering the network.

2.2.2 Gateway and Antenna

The wireless gateway shall process wireless sensor information for the purpose of communication and security to provide enhanced unit control and information that will be used in thermal visualization. The wireless sensor electronics shall be enclosed in an aluminum extrusion with ABS end caps and should only be installed in indoor environments.

The wireless gateway shall provide dual Ethernet (RJ45, 10/100 base-TX Cat5/6), RP-SMA antenna, and 2.1mm ID x 5.5mm OD Locking Barrel plug connections.

Liebert® WSN Gateway Specifications	
Item	**Description**
Voltage Input	• 2.1 mm ID x 5.5 mm OD locking barrel plug, 12 VDC (+/- 10%)
Power	• Current draw 12VDC • 400 mA (4.8W)
Ethernet	• Dual Ethernet ports • Two 10/100 base TX Ethernet RJ45 (Cat5/6)
Physical Parameter	• Outside dimensions with DIN rail: 2.9 x 3.9 x 6.8 in (74.6 x 98.3 x 173.3 mm) • Outside dimensions with DIN rail and antenna: 2.9 x 3.9 x 14 in (74.6 x 98.3 x 173.3mm) • Total weight: 1 lb., 7 oz. (652 g)
Operating Range	• 32°F to 140°F • 0°C to 60°C
RF Characteristics	• Maximum RF input level: -10 dBm • Maximum RF output level for US/CAN/AS-NZ: +27.8 dBm • Receiver sensitivity: -139 dBm at SF12 BW 125 kHz, -125 dBM at SF BW kHz • Frequency range (US/AS): 915 ISM Band (902 MHz to 9278 MHz)

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Liebert® WSN Gateway Specifications	
Item	**Description**
	• Max ERP: 24.9W at 867.1 MHz at 0℃
Agency Approval	• Certifications: FCC, IC, CE

Vertiv™ Liebert® WSN Gateway Antenna Specifications	
Item	**Description**
Frequency	• 865 – 928 MHz
Peak Gain	• 2.2 dBi
Average Gain	• 0.2 dBi
VSWR	• 3.0:1 maximum
Polarization	• Linear, vertical
Connector	• RP-SMA plug
Dimensions	• 137mm

Gateway Power

- The recommended input voltage is 12.0 VDC (+/- 10%) but can tolerate 1230 VDC.
- Power consumption shall be 4.8 watts at 12.0 VDC.
- Radio frequency power output from antenna is 865 – 928 MHz.

Gateway Communication

The wireless gateway shall provide two Ethernet ports for dual communication paths. The communication protocols supported from either port are private API and SNMP for externally connected clients.

2.3 Liebert® WSN Sensor

The WSN Sensor is an ultra-low power, long-range LoRa enabled wireless temperature and humidity sensor. The sensor shall be powered with two AAA Ultimate Lithium metal batteries[1].

The sensor shall be powered up when internal batteries are inserted or when the button on the front of the sensor enclosure is pressed.

The sensor shall have red, blue, and green LED lights to indicate that it has power, that it is joining a network, and payload data is sent to the LoRa server at its programmed rate. After the first five times a payload cycle has completed, the sensor shall go into a dark mode so that LEDs no longer light in order to maximize battery life.

The sensor shall have a built-in power supply to convert battery voltage to that which is required by internal circuitry. Design shall be to operate with a battery voltage range of approximately 2.0 V to 3.7 V.

[1] The Liebert® Wireless Sensor was tested with Energizer Ultimate Lithium batteries.

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Vertiv™ Liebert® WSN Sensor Specifications	
Item	**Description**
Power	• Two AAA Ultimate Lithium metal batteries
Micro-USB Port	• Micro USB Port as optional power source for sensor, 5 VDC
Device Dimensions	• 3.3 X 1.7 X 1.34 in (83.8 X 43.2 X 34 mm) with mounting bracket
Temperature	• Typical temperature accuracy +/- 0.3 deg. Celsius • Ambient operating temperature range -40°C to 125°C
Relative Humidity	• Typical relative humidity accuracy +/- 2% • Humidity operating range 0 to 100% RH
RF Frequencies	• Supported frequencies – 868 MHz and 915 MHz bands
LoRa Protocol	• Supports LoRa Class-A end device protocol
FLEXio	• Digital input: 3.3 VDC maximum • Digital output: 3.3 VDC at 8mA maximum • Analog input: 0 to 3.0 VDC measurement range (3.3VDC maximum) • Analog output: 0 to 3.0 VDC at 8mA maximum

2.3.1 Optional Expansion Battery Pack

An optional extended battery pack shall be available to provide supplemental power to the sensor. The optional expansion battery pack shall be powered with two AA Ultimate Lithium Metal batteries to supply primary power to the sensor. When battery voltage drops beneath the low battery threshold, the power shall automatically switch to the two AAA batteries inside of the sensor.

Liebert® WSN Extended Battery Pack Specifications	
Item	**Description**
Power	Two AA Energizer L91 Ultimate Lithium Batteries
Device Dimensions	3.3 X 1.7 X 2.2 in (83.8 X 43.2 X 55.9 mm) – with WSN-FLEX Sensor

2.3.2 FLEXio Interface

The sensor shall be equipped with a FLEXio interface to provide support of user-programmable digital/analog and input/output.

2.3.3 Wireless Sensor Mounting

The Liebert® WSN shall utilize a single radio deployment model allowing flexibility in installation applications.

The wireless sensor mounting hardware shall be provided with every wireless sensor to provide quick and secure mounting of the wireless sensor. The wireless sensor mounting bracket shall include an embedded rare earth magnet, appropriations for zip ties, and pre-drilled holes for wall mount screws. The mounting bracket (with magnet), zip ties, screws, and wall anchors shall be included with every wireless radio.

Mounting hardware shall allow wireless radio to be mounted on a rack door with minimal impedance to rack air flow.

The wireless sensor mounting shall include a factory installed DIN rail mounting.

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2.3.4 Control

The wireless radio battery life (with extended battery pack) shall be:

- A minimum of four years with a 40 second burst rate.
- ADR rate of 3 (spreading factor of 7, bandwidth 125 kHz).
- Power setting of 10.

The wireless sensors shall also have the capability of being powered locally via 5 V micro-USB power source while still being able to communicate wirelessly to the gateway.

2.3.5 Monitoring

The wireless sensor battery life, with extended battery pack, shall be:

- A minimum of 8.2 years with a 90 second burst rate.
- ADR rate of 3 (spreading factor of 7, bandwidth 125 kHz).
- Power setting of 10.

The wireless sensor shall also have the capability of being powered locally via 5 V micro-USB power source while still being able to communicate wirelessly to the gateway.

2.3.6 Worst Case

The wireless sensor battery life, with extended battery pack, shall be:

- A minimum of 3.7 years with a 390 second burst rate.
- ADR rate of 1.
- Power setting of 0.

The wireless sensor shall also have the capability of being powered locally via 5 V micro-USB power source while still being able to communicate wirelessly to the gateway.

2.3.7 Wireless Communication

The wireless sensor communications shall utilize a one-to-one LoRa communication path supporting the LoRa Class-A end device protocol.

2.3.8 Software

The software shall be accessed via an internal web page by typing the IP address of the gateway into the browser's address bar.

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The Vertiv™ Liebert® WSN Gateway web user interface shall provide the following features:

Feature	Description
Manage Devices	• List devices. • Tool to locate devices. • Tool to configure devices.
Date and Time Setup	• Tool to set the time and date using Coordinated Universal Time (UCT).
Configure/Reconfigure Ports	• Access to Port 1 and Port 2 to enter new values for IP address, subnet mask, and gateway.
Adding Sensors to Network	• WSNConnect used to automate network join requirements, manually entering sensor data is not necessary. • Devices are named the next sequential number available.
Use in Conjunction with BMS	• Gateway can be used in conjunction with a BMS by enabling SNMP.
Firmware Updates	• Firmware can be updated via upload of an encrypted .ZIP file (cannot be unzipped with Windows zip utilities).

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