The WSN1120L is a low profile low power WiSense Sub 1-GHz wireless mesh node. It includes the CC1120 high-performance sub-GHz radio (from TI) and the MSP430G2955 microcontroller (from TI).
The module consists of two separate PCBs.

- The PCB on the top hosts the CC1120 radio.
- The PCB on the bottom hosts the microcontroller.

## Standards Compliance

<table>
<thead>
<tr>
<th>Region</th>
<th>Operating Frequency Range</th>
<th>Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>865-867 MHz</td>
<td>WPC (Self Certified)</td>
</tr>
</tbody>
</table>

The WSN1120L comes pre-programmed out of the box to operate as a WiSense mesh network reduced function device (RFD) in the 865-867 MHz license-free band (in India). Once the node joins a WiSense mesh network, it will periodically report the supply voltage. This reporting interval is configurable in real time through the Network Coordinator. Wireless communication between gateway and sensor nodes is bi-directional. This allows node behavior to be reconfigured during installation and at any time after installation. Very low standby mode current consumption less than 1 uA allows for long battery life. WiSense gateway can support up to 64 simultaneous sensor nodes in a single network. Each node has a unique IEEE assigned 64-bit address.
HARDWARE ARCHITECTURE

[Diagram of hardware architecture with various components such as U.FL Connector, Balun, CC1120 RADIO (865-867 MHz), 32 MHz Crystal, I2C EEPROM Serial ID: 64 bits Mem: 256 bytes, I2C EEPROM 128 KB (Firmware Upgrade), MSP430G2955 16 MHz 4KB RAM 56KB FLASH ADC-10 GPIO I2C SPI, 32 KHz Crystal, 14 Pin (7x2) Header-1, 14 Pin (7x2) Header-2, LED1, LED2, SPY-BI-WIRE 4 PINS, UART 3 PINS, and Vcc.]
Microcontroller PCB

- MSP430G2955 Ultra-low-power 16 bit microcontroller from TI
  - 56 KB flash, 4KB SRAM
  - Standby current (in LPM3) as low as 1 microamp.
  - Operating voltage: 1.8 V – 3.6 V
  - Multiple On-chip 10 bit ADC channels
  - On-chip power supply voltage measurement
  - On-chip temperature sensor
- 2 pin Spy-Bi-Wire protocol for development (Programming and debugging).
- SPI/GPIO interface to the radio module
- UART/I2C/SPI/1-wire/GPIO/ADC interface to sensors
- Onboard serial (I2C) EEPROM (AT24MAC602) with hardwired and globally unique 48-bit and 64-bit addresses.
- Onboard 128 Kilo-Bytes EEPROM (M24M01) for over the air firmware upgrade. EEPROM can store two full images.
- Onboard high accuracy 32 kHz crystal
- 1 three-pin right-angled header (UART) – Tx, Rx, and Gnd
- 1 four-pin right-angled header (Spy-Bi-Wire) – Vcc, Gnd, Test, Reset
- 2 LEDs
- 2 2x7 headers which expose most of the MSP430G2955 pins.
- Dimensions: 42 mm x 42 mm
Radio PCB

- CC1120 Transceiver (TI)
  - Low-cost sub-1 GHz transceiver designed for narrowband and very low-power wireless applications. The narrowband operation provides the link budget required to operate long-range links (1 KM and above).
  - Programmed by WiSense stack to operate in the 865-867 MHz license-free band in India
  - Operating voltage: 2.0 V – 3.6 V
  - Sensitivity: -123 dBm @ 1.2 kBaud (865-867 MHz)
  - Modulation: 2-FSK, 4-FSK, GFSK, and MSK supported as well as OOK and flexible ASK shaping. Default programmed modulation is 2-GFSK.
  - Programmable output power up to +13 dBm for all supported frequencies
  - Programmable data rate from 0 to 200 kbps. Lower the data rate, the higher the range. The default baud rate is 38.4 kbps.

- Onboard high accuracy 32 MHz crystal
- Antenna options (mutually exclusive)
  - U.FL antenna connector. Can use U.FL to SMA cable assembly to connect to the antenna outside the weatherproof enclosure.
  - PCB antenna.
- Interface
  - Two 1x7 2.54 mm pitch headers for mating with the microcontroller board.
- Dimensions
  - 37.61 mm x 37.61 mm
Range

- Line of Sight: More than 1000 meters @ 1.2 kbps
- Non Line of Sight: More than 500 meters @ 1.2 kbps

Power supply consideration

- The WSN1120L supply voltage range: 1.8 V to 3.6 V
- Note: Exceeding 3.6 V can damage the WSN1120L !!!
- The WSN1120L can be powered by a 3 V lithium coin cell or a pair of 1.5 V AA/AAA batteries in series. Note that the WSN1120L does not have a battery/coin cell holder. This needs to be purchased separately.
- Optional Solar + Li-Ion battery power supply unit (PSU).

Message reporting options:

1. Reports messages periodically with a configurable interval - Minimum (1 sec) / Maximum (1 day).

2. Reports messages only when it changes by a configurable percentage value with respect to the prior value reported. Also, reports measured temperature if no report sent for a configurable period of time.

3. Reports messages only when it crosses a configurable high or low threshold value. High and low hysterisis values are also configurable. Also, reports measured temperature if no report sent for a configurable period of time.
WiSense Network Stack Layers

Node Manager (PFD / RDF) Association / Dissociation

Network Mgr (Coordinator only) Allocate short addresses Manage node associations / dissociations

POWER MGMT

SYSTEM LOOP

Three 16 bit event flags

APPLICATION LAYER

FFD App / RDF App

ADAPTATION LAYER

SEGMENTATION / REASSEMBLY

NETWORK LAYER

ROUTING TABLE AODV-L PROTOCOL (MESH ROUTING)

MAC LAYER

VERY SIMILAR TO 802.15.4 CSMA/CA ACK TX/RX

DEVICE DRIVER LAYER

CC1101 SPI SENSOR-1 Sensor-2 Sensor-N UART

1-WIRE I2C

PHY LAYER

G-FSK MODULATION 1200 BPS
863 - 867 MHz

Network Gateway (Coord only)
PINOUT

Top View

P3_4 : UART TXD
P3_5 : UART_RXD
P3_6 : I2C SDA
P3_7 : I2C SCL

P2_0 : 10 bit ADC Chann 0 / Other Functionality - See datasheet
P2_1 : 10 bit ADC Chann 1 / Other Functionality - See datasheet
P2_2 : 10 bit ADC Chann 2 / Other Functionality - See datasheet
P2_3 : 10 bit ADC Chann 3 / Other Functionality - See datasheet
P2_4 : 10 bit ADC Chann 4 / Other Functionality - See datasheet
P2_5 : 10 bit ADC Chann 5 / Other Functionality - See datasheet

P3_1 : Used by Radio (Do not use)
P3_2 : Used by Radio (Do not use)
P3_3 : Used by Radio (Do not use)
P4_1 : Used by Radio (Do not use)

P1_4 : GPIO / Other Functionality - See datasheet
P1_5 : GPIO / Other Functionality - See datasheet
P1_6 : GPIO / Other Functionality - See datasheet
P1_7 : GPIO / Other Functionality - See datasheet
P3_1 : GPIO / Other Functionality - See datasheet
P3_2 : GPIO / Other Functionality - See datasheet
P3_3 : GPIO / Other Functionality - See datasheet
P4_2 : GPIO / Other Functionality - See datasheet
P4_3 : GPIO / Other Functionality - See datasheet
P4_4 : GPIO / Other Functionality - See datasheet
P4_5 : GPIO / Other Functionality - See datasheet


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WiSense Wireless Mesh / Star Network Architecture

Cloud

Sensor Node (WTN-PTX-SG-10)

Coordinator

Gateway

WiFi / 2G Backhaul

Sensor Node (WTN-PTX-SG-10)

Router (FFD)
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