

LoRa Concentrator Module

Linxdot LM-1001

Package contents



Overview

LM-1001 is a LoRa concentrator card with mini-PCIe form factor based on SX1302, which enables an easy integration into an existing router or other network equipment with LoRa Gateway capabilities. It can be used in any embedded platform offering a free mini-PCIe slot with SPI or USB connection. Furthermore, ZOE-M8Q GPS chip is integrated on board.

LM-1001 is a complete and cost efficient LoRa gateway solution offering up to 10 programmable parallel demodulation paths which are 8xSF5-SF12 LoRa demodulators, 8xSF5-SF10 LoRa demodulators, 125 /250 / 500 kHz LoRa demodulator and (G)FSK demodulator. It can detect at any time, any packet in a combination of 8 different spreading factors(SF5 to SF12) and 10 channels, and demodulate up to 16 packets at any time. It targets smart metering fixed networks and Internet-of-Things (IoT) applications, covering up to 500 nodes per square kilometer in an

Main features

- Compatible with Mini PCI-e Edition specification with heat sink.
- SX1302 base band processor emulates 8 x8 channel LoRa packet detectors, 8 x SF5-SF12 LoRa demodulators, 8 x SF5-SF10 LoRa demodulators, one 125 /250 / 500 kHz high-speed LoRa demodulator and one (G)FSK demodulator .
- Optional built-in extra MCU to convert SPI interface of SX1302 to USB2. 0.
- Voltage of Mini PCI-e is 3.3 V, compatible with 3G/LTE card of Mini PCI-e type.
- Tx power up to 27dBm, Rx sensitivity down to -139dBm@SF12, BW 125 kHz.
- Supports latest LoRaWAN 1.0.2 protocol.
- Supports global license-free frequency band (EU868, US915, AS923, AU915, KR920, IN865 and AS920).
- Supports optional SPI or USB interfaces.
- Built-in ZOE-M8Q GPS module.
- Optional LBT (Listen-Before-Talk) function.

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Pin configuration

Item	Pin(s)	Item	Pin(s)
GND	4, 9, 15, 18, 21, 26, 27, 29, 34, 35, 37, 40, 43, 50	USB_D+	38
3.3V	2, 24, 39, 41, 52	SPI_SCK	45
1PPS	19	SPI_MISO	47
RESET	22	SPI_MOSI	49
USB_D-	36	SPI_CSN	51



Specifications

LoRa Module	SX1302 base band processor emulates 8x8 channel
Frequency	EU868, US915, AS923, AU915, KR920, IN865 and AS920
LoRaWAN Version	LoRaWAN V1.0.2
Range	Urban: 2~4km Suburb: 5~10km, Open Area: 15km
Node Numbers	500 nodes/km ²
TX Power	27dBm (Max)
RX Sensitivity	-139dBm@SF12, BW 125 kHz
Power Supply	DC 3.3V
Hardware Interface	Mini-PCIE
Software Interface	Supports optional SPI or USB interfaces
USB	Optional built-in extra MCU to convert SPI interface of SX1302 to USB2.0.
Antenna Interface	1* UFL connectors for LoRa
Power Consumption	TX (Max): 513mA RX (Max): 101 mA
Working Environment	Indoor/Outdoor
Dimensions	Dimension (L x W x H): 50.9 x 30 x 3mm Weight: 7.5g
Temperature Range	Storage Temperature: 40°C ~ +85°C Operation Temperature: 40°C ~ +85°C
Compliance	FCC, CE, UKCA, RCM

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FCC Statement

FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247
External Antenna with gain 2dBi(LoRa)

FCC Regulatory Compliance:

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.

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.

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

time. It targets smart metering fixed networks

If power exceeds the limit and the distance(Over 20cm distance in actual use between the device and user) is compliance with the requirement

RF Exposure Compliance:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and any part of your body.

Notice to OEM integrator

If the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. The end product shall have the words "Contains Transmitter Module FCC ID: 2AUCLLM-1001".

The device must be professionally installed.

The intended use is generally not for the general public. It is generally for industry/commercial use. The connector is within the transmitter enclosure and can only be accessed by disassembly of the transmitter that is not normally required. The user has no access to the connector.

Installation must be controlled. Installation requires special training.

Any company of the host device which installs this module with unlimited modular approval should perform the test of radiated & conducted emission and spurious emission, etc. according to FCC part 15C: 15.247 , 15B Class B requirement, only if the tests result comply with FCC part 15C: 15.247 , 15B Class B requirement, then the host can be sole legally.

When the module is installed inside another device, the user manual of the host contain below 1) This device may not cause harmful interference.

2) This device must accept any interference received, including interference that may cause undesired operation.

Compliance list INTEGRATION INSTRUCTIONS for 996369 D03 OEM the and 996369 D03 OEM by Sections 2.2 through 2.10.

Requirement	Yes	N/A	Comment
2.2 List of applicable FCC rules List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required. ³	YES		Refer to instruction FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247
2.3 Summarize the specific operational use conditions Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.	YES		Refer to instruction The module is limited to the following antenna: Antenna Type: External Antenna Antenna Gain: 2dBi
2.4 Limited module procedures If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions. A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum	NO		This is a single Modular and full approve

<p>signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.</p> <p>This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.</p>		
<p>2.5 Trace antenna designs</p> <p>For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects: layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.⁴</p> <p>a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);</p> <p>b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);</p> <p>c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;</p> <p>d) Appropriate parts by manufacturer and specifications;</p> <p>e) Test procedures for design verification; and</p>	<p>No</p>	<p>The modular has a External Antenna</p>

<p>f) Production test procedures for ensuring compliance.</p> <p>The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.</p>		
<p>2.6 RF exposure considerations</p> <p>It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).</p>	YES	<p>Refer to instruction</p> <p>The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device. This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.</p>
<p>2.7 Antennas</p> <p>A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an "omni-directional antenna" is not considered to be a specific "antenna type")).</p> <p>For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration</p>	YES	<p>Refer to instruction</p> <p>The module is limited to the following antenna:</p> <p>Antenna Type: External Antenna Antenna Gain: 2dBi</p>

instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.			
2.8 Label and compliance information Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating "Contains FCC ID" with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.	YES	Refer to instruction If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: 2AUCLLM-1001 Or Contains FCC ID: 2AUCLLM-1001"	
2.9 Information on test modes and additional testing requirements Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host. Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer's determination that a module as installed in a host complies with FCC requirements.	YES	Refer to instruction Any company of the host device which install this modular with limit modular approval should perform the test of radiated & conducted emission and spurious emission, etc. according to FCC part 15C: 15.247, 15B Class B requirement, Only if the test result comply with FCC part 15C: 15.247, 15B Class B requirement, then the host can be sold legally. The module is installed in the host and can be transmitted independently.	
2.10 Additional testing, Part 15 Subpart B disclaimer The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC	Yes	refer to instruction The module is installed in the host, and the host must be evaluated to comply with Part 15 Subpart B requirements	

transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed. ⁶			
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