

USER MANUAL

LoRaWAN Concentrator miniPCIe-SPI BEL-LWCC-915



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Revision History:

Revision Date	Revision No	Description of Changes (in brief)
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1. Introduction

The BEL-LWCC-915 LoRaWAN Concentrator miniPCIe-SPI card is a gateway front end module based on Semtech SX1302 Corecell Design in Mini PCIe Form Factor. It enables system integrators to build high-performance, certified LoRaWAN gateway solutions. The module acts as an air interface at 915MHz band for data collection from sensors. The BEL-LWCC-915 in conjunction with a computing element can transmit and receive data with LoRa standard and perform remote data collection. The LoRa modem in the module can give wireless remote access with low time-on-air links with longer battery life of the system. The LoRa module needs very less power in transmit mode owing to the higher sensitivity of the receive modems. It can also sense multiple spreading factors simultaneously thereby reducing collisions on the air and better response times.

a. Features

Frequency band	: US915
Operational Frequencies	: 902-928MHz
Channels	: 72 Uplink + 8 Downlink
Modulation	: LoRa Chirp Spread Spectrum
Maximum Data rate	: 21.9Kbps
Supply voltage	: 3.3V
Data Interface	: mPCIe 52 pin
RF interface	: Single u-FL connector
Antenna Interface	: Omnidirectional with RP-SMA connector
Antenna Type	: Omni Rubber Duck Antenna
Antenna Gain(typical)	: 3dBi +/-0.5dB
LED indications	: Config OK, TX status, RX status
Dimensions	: 51mm x 30mm x 4mm (LxWxH)

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2. FCC Compliance Statement (USA)

FCC ID: 2A9HG-BELLWCC915

Compliance Statements: 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.
2. This device must accept any interference received, including, an interference that may cause undesired operation.

Caution Statements:

- Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
- This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

INFORMATION TO THE USER

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.

3. Hardware Information

The BEL-LWCC-915 LoRaWAN Concentrator miniPCIe-SPI card works on an SPI interface. The interface signals and the power supply for the card is embedded on 52 pin mini-PCIe connector. The module works on 3.3V DC supplied through the mini-PCIe connector. The 52 pin connector details are as given below in Table 1. The electromechanical details of the mini-PCIe connector may be found in the PCI Express ® Mini card Electromechanical Specification Revision 1.2 released by PCISIG.

Table 1. Pin details of mini-PCIe connector

PIN	SYMBOL	Signal Type	Description
1	NC		
2	VCC_5V	POWER	5V Power
3	NC	--	
4	GND	POWER	
5	NC	--	
6	GPIO6	INPUT/OUTPUT	
7	NC	--	
8	NC	--	
9	GND	POWER	
10	NC	--	
11	NC	--	
12	NC	--	
13	NC	--	
14	NC	--	
15	GND	POWER	
16	ENABLE	INPUT	Power enable the module (active high)
17	HOST_SCK	INPUT	SPI clock for SX1302 and SX1261
18	GND	POWER	
19	HOST_MISO	output	SPI data for SX1302 and SX1261
20	NC	--	
21	GND	POWER	
22	SX1302_RESET	INPUT	Reset Signal for SX1302
23	HOST_MOSI	INPUT	SPI data for SX1302 and SX1261
24	SX1261_BUSY	OUTPUT	BUSY signal for SX1261
25	HOST_CSN	INPUT	SPI Chip Select for SX1302
26	GND	POWER	

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27	GND	POWER	
28	SX130x_GPIO_8	INPUT	SX1302 GPIO_8
29	GND	POWER	
30	I2C_SCL	INPUT	Temperature Sensor I2C clock
31	PPS	input	PPS from GPS to module
32	I2C_SDA	INPUT/OUTPUT	Temperature Sensor I2C data
33	NC	--	
34	GND	POWER	
35	GND	POWER	
36	USB_D-	--	
37	GND	POWER	
38	USB_D+	--	
39	VCC	POWER	3.3V Power
40	GND	POWER	
41	VCC	POWER	3.3V Power
42	NC	--	
43	GND	POWER	
44	SX1261_NSS	INPUT	SPI Chip Select for SX1261
45	SWCLK	INPUT	--
46	SX1261_DIO1	INPUT	SX1261 DIO1
47	SWDIO	INPUT/OUTPUT	--
48	SX1261_NRESET	INPUT	SX1261 RESET
49	MCU_NRESET	INPUT	--
50	GND	POWER	
51	MCU_BOOT0	INPUT	--
52	VCC	POWER	3.3V Power

This module needs commands to be given on SPI interface by a host processor. Based on the configuration data given by the host processor the module changes state. The data is also been given through the same interface. There is an onboard temperature sensor used for monitoring and it communicates on an I2C bus which also is routed through the mini-PCIE interface.

Hardware Instructions to Module users to comply with FCC Certification

The BEL-LWCC-915 when used with a host system has to comply to the following conditions to ensure the certification is valid

- 1) The Antenna has to be same type and the gain can't be larger than typical gain in manual.
- 2) The FCC ID for BEL-LWCC-915 is 2A9HG-BELLWCC915 which need to be displayed on the outer surface of the Host with Contains FCC ID: 2A9HG-BELLWCC915.

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4. Firmware Information

The firmware for the module should reside on the host processor communicating with BEL-LWCC-915 LoRaWAN Concentrator miniPCIe-SPI card. The source code for the same is available at https://github.com/Lora-net/sx1302_hal. The basic configuration for the radio modules in the BEL-LWCC-915 is available in a .conf file at github. The screenshot for the same is shown in Figure 1.

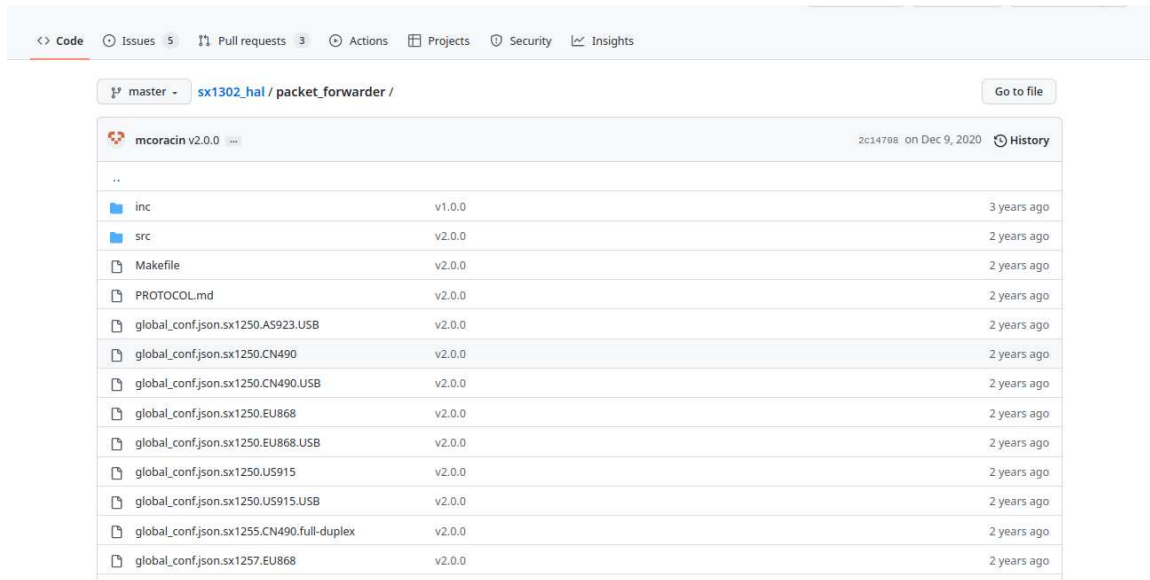


Figure.1. Configuration file location at github

For the BEL-LWCC-915 module global.conf.json.sx1250.US915 is the configuration file to be used. This configuration file can be edited with various parameters for the user to set up measurements as available in the documents section of github or M/s Semtech's developer portal. The successful configuration will enable the LED indication on the board. Further there are two more firmwares which can test transmit mode and receive mode separately.

For transmit testing the source code is available at https://github.com/Lora-net/sx1302_hal/tree/master/libloragw/tst. test_loragw_hal_tx.c is the source file for transmit test. The various parameters for editing will be available once it is executed. The screenshot for the same is shown in Figure 2.

master sx1302_hal / libloragw / tst / Go to file

mcoracin v2.0.0		
test_loragw_cal_sx125x.c	v2.0.0	2 years ago
test_loragw_capture_ram.c	v2.0.0	2 years ago
test_loragw_com.c	v2.0.0	2 years ago
test_loragw_com_sx1250.c	v2.0.0	2 years ago
test_loragw_com_sx1261.c	v2.0.0	2 years ago
test_loragw_counter.c	v2.0.0	2 years ago
test_loragw_gps.c	v2.0.0	2 years ago
test_loragw_hal_rx.c	v2.0.0	2 years ago
test_loragw_hal_tx.c	v2.0.0	2 years ago
test_loragw_l2c.c	v1.0.0	3 years ago
test_loragw_reg.c	v2.0.0	2 years ago
test_loragw_sx1261_rssi.c	v2.0.0	2 years ago
test_loragw_toa.c	v2.0.0	2 years ago

Figure.2. Transmit test file location at github

For receive testing the source code is available at https://github.com/Lora-net/sx1302_hal/tree/master/libloragw/tst. test_loragw_hal_rx.c is the source file for transmit test. The various parameters for editing will be available once it is executed. The screenshot for the same is shown in Figure 2.

To use this module as a packet forwarder which is a typical test case where the module works as gateway and gives data to an end server packet_forwarder application is available at github. The Source code is available at https://github.com/Lora-net/sx1302_hal/tree/master/packet_forwarder. The screenshot for the same is shown in Figure 3.

Lora-net / packet_forwarder Public Notifications Fork 666 Star 663

< Code Issues Pull requests Actions Projects Wiki Security Insights

mcoracin v4.0.1		
lor_pkt_fwd	v4.0.1	6 years ago
util_ack	v3.0.0	7 years ago
util_sink	v3.0.0	7 years ago
util_tx_test	v4.0.0	6 years ago
.gitignore	v2.0.0	8 years ago
LICENSE	v1.3.0	9 years ago
Makefile	v3.0.0	7 years ago
PROTOCOL.TXT	v4.0.0	6 years ago
VERSION	v4.0.1	6 years ago
compile.sh	v4.0.0	6 years ago
readme.md	v4.0.1	6 years ago

About
A LoRa packet forwarder is a program running on the host of a LoRa gateway that forwards RF packets receive by the concentrator to a server through a IP/UDP link, and emits RF packets that are sent by the server.

Readme
View license
663 stars
116 watching
666 forks

Releases 15
v4.0.1 Latest on Apr 5, 2017
+ 14 releases

Figure.3. Packet Forwarder test file location at github.

Firmware Instructions to Module users to comply with FCC Certification

The BEL-LWCC-915 when used with a host system has to comply to the following conditions to ensure the certification is valid

- 1) The firmware shouldn't be modified in such a way that the power delivered is more than that specified in the test report.