

TECHNICAL INFORMATION MANUAL

Revision 1 – 12/04/2023

R9101C

Lepton⁹x1

**30dBm 1-Port RAIN
RFID Reader Module**



R9104C

Lepton⁹x4

**30dBm 4-Port RAIN
RFID Reader Module**



Visit the [Lepton⁹x1 R9101C](#) and [Lepton⁹x4 R9104C](#) web pages,
you will find the latest revision of data sheets, manuals,
certifications, technical drawings, software and firmware.
All you need to start using your reader in a few clicks!

Scope of the Manual

The goal of this manual is to provide the basic information to work with the Lepton⁹x1 R9101C and Lepton⁹x4 R9104C Readers.

Change Document Record

Date	Revision	Changes	Pages
12/04/2023	01	First revision	-

Reference Document

[RD1] EPCglobal: EPC Radio-Frequency Identity Protocols Class-1 Generation-2 UHF RFID Protocol for Communications at 860 MHz – 960 MHz, Version 2.0.1 (April 2015).

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1 INTRODUCTION

Description

Reader

The Lepton⁹x1 (Model R9101C) and Lepton⁹x4 (Model R9104C), embedded readers of the easy2read[®] product line, are ultra compact readers for low power, high performance RAIN RFID applications.

With programmable output power from 10 dBm to 30 dBm, the readers can detect tags at more than 5 m of distance (depending on antenna and tag dimensions).

Due to their low power consumption, the modules are specifically designed to be easily integrated in battery powered devices.

The radio frequency core of the modules is based on the Impinj E910 IC that permits to achieve fast reading speed and to be used in dense reader and dense tag environments for top-class rated performances.

The compactness of the devices allows to embed the Lepton⁹x1 and Lepton⁹x4 inside industrial handhelds, smartphone accessories and other compact form factor devices.

The Lepton⁹x1 and Lepton⁹x4 comply with and can operate in both European and US regulatory environments and, thanks to their multiregional capabilities, they are ideal for integration in devices requiring compliance to different geographical regions.

The Lepton⁹x1 and Lepton⁹x4 are designed on the basis of the Lepton⁹ with the aim to facilitate the integration for those who prefer to use connectors instead of automatic manufacturing required by the SMD form factor. In addition, Lepton⁹x4 is a turnkey solution for systems requiring up to 4 antenna ports.



Fig. 1.1: Lepton⁹x1 (Model R9101C) Reader – top view



Fig. 1.2: Lepton[®]x4 (Model R9104C) Reader – top view

Evaluation Board

The [Mod. R4320CEVB - Evaluation Board](#) allows managing the Lepton[®]x1 and Lepton[®]x4 readers directly using an USB interface (via the embedded USB to UART converter). This board is particularly suited for Lepton[®]x1 and Lepton[®]x4 readers evaluation and SW development purpose. For more information, please refer to § *Evaluation Board* chapter page 16.

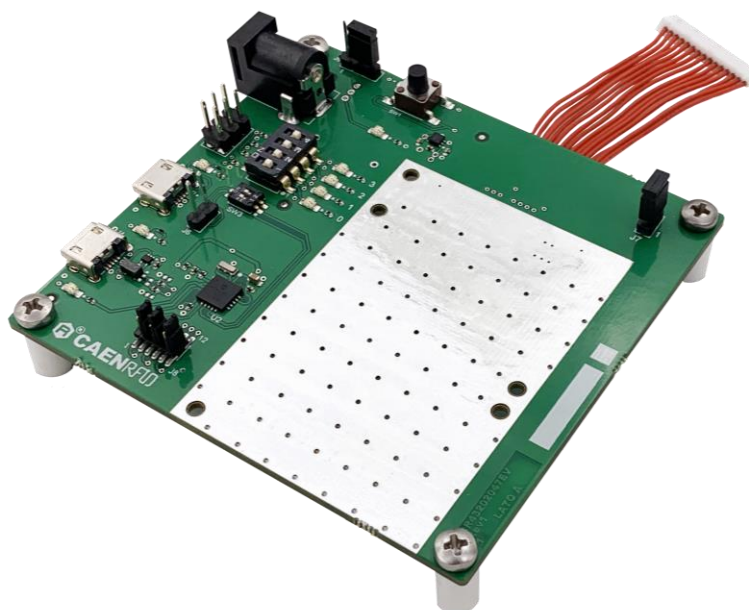


Fig. 1.3: Evaluation Board for Lepton[®]x1 and Lepton[®]x4 readers

Ordering Options

	Code	Description
Reader	WR9101CXAAAA	Lepton [®] x1 - 30dBm Reader Module
	WR9104CXAAAA	Lepton [®] x4 - 30dBm Reader Module
Accessories	WALIM0000005	Power Supply for R4320CEVB
	WR4320CXEBX	Lepton [®] x1 and Lepton [®] x4 - Evaluation Board

2 TECHNICAL SPECIFICATIONS

Technical Specifications

Frequency Range	865.600÷867.600 MHz (ETSI EN 302 208 v3.3.1) 902÷928 MHz (FCC part 15.247)
RF Power	Configurable from 10 dBm to 30 dBm (from 10 mW to 1 W) conducted power
RX Sensitivity	-90dBm -10%PER, assuming 20 dB antenna RL @ 30 dBm output
Antenna VSWR Requirement	< 2:1 for optimum performances
Antenna Connectors	- 1 MMCX jack (Model R9101C Lepton ⁹ x1) - 4 MMCX jack (Model R9104C Lepton ⁹ x4)
Frequency Tolerance	±10ppm over the entire temperature range
Number of Channels	4 channels (compliant to ETSI EN 302 208 v3.3.1) 50 hopping channels (compliant to FCC part 15.247)
Standard Compliance	EPC C1G2 / ISO18000-63
I/O Interface	4 I/O lines 3.3V level $I_{out} = 8mA \text{ max}$
Connectivity	- UART Serial Port • Baudrate: from 9.6 to 921.6 kbps, default 921.6 kbps • Databits: 8 • Stopbits:1 • Parity: none • Flow control: none - 3.3 V I/O voltage level
Power Supply	3.2 ÷ 5.25 V DC
Power Consumption	- 8W max @ RF out = 30 dBm - 80 mW in idle mode – Ready to receive commands
Dimensions	- Model R9101C Lepton ⁹ x1: (L) 51 x (W) 42 x (H) 8.1 mm ³ (2.01 x 1.65 x 0.32) inches ³ - Model R9104C Lepton ⁹ x4: (L) 60 x (W) 42 x (H) 8.1 mm ³ (2.36 x 1.65 x 0.32) inches ³
Operating Temperature	-20°C to +70°C
Weight	- 30 g (Model R9101C Lepton ⁹ x1) - 34 g (Model R9104C Lepton ⁹ x4)

Tab. 2.1: Lepton⁹x1 R9101C and Lepton⁹x4 R9104C Technical Specifications



Warning: The RF settings must match the operating country/region to comply with local laws and regulations.

The usage of the reader in different countries/regions from the one in which the device has been sold is not allowed.

Key Features

- RAIN RFID (UHF EPC Class1 Gen2, ISO 18000-63) compliant
- Both ETSI and FCC support in the same module
- Ultra compact size
- Up to 30 dBm (1W) output power
- -90 dBm Rx sensitivity, assuming 20 dB antenna return loss
- Inventory (FastID, Tag Population Estimate, Select, Session, Target)
- Access (Read, Write, Lock, Kill, BlockPermalock, and QT)
- Shielded to prevent unwanted radiation and provide noise immunity in embedded environments
- Single mono-static RF port
- Field upgradability via firmware updates
- UART serial interface using CAEN RFID easy2read® protocol

3 HARDWARE INTERFACE

Introduction

An example R9101C Lepton⁹x1/R9104C Lepton⁹x4 system-level block diagram for an embedded system is shown in *Fig. 3.1: Lepton⁹x1 R9101C/Lepton⁹x4 R9104C - Example of Block Diagram*. This figure shows the electrical connections that may and must be made to control the R9101C Lepton⁹x1/R9104C Lepton⁹x4. In the figure, the required connections are illustrated with solid lines. Recommended and optional connections are illustrated with different dotted and dashed line patterns. More details for each connection are listed in the following paragraphs.

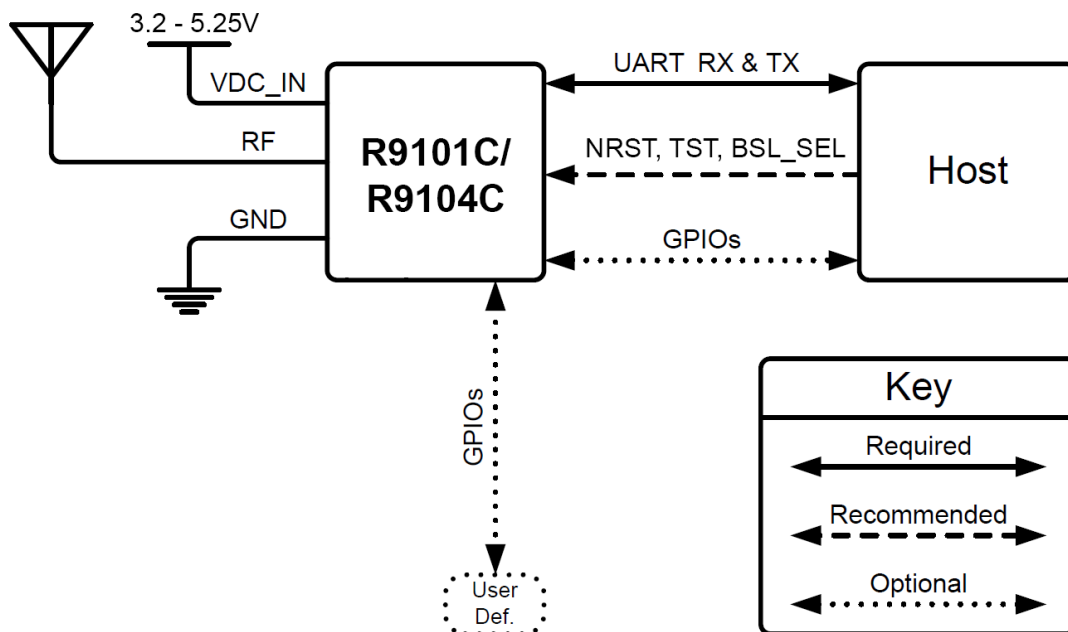


Fig. 3.1: Lepton⁹x1 R9101C/Lepton⁹x4 R9104C - Example of Block Diagram

Required connections:

- VDC_IN and GND are required to power the R9101C Lepton⁹x1/R9104C Lepton⁹x4.
- RF is required to connect to the UHF RFID antenna.
- UART1 Tx and Rx are required to communicate with the system host.

Recommended connections:

- nRST is used to reset the R9101C Lepton⁹x1/R9104C Lepton⁹x4 if UART communication is not available. This connection is highly recommended. This pin is internally driven strong low during software resets, so it should only be driven externally by an open drain signal. It must not be driven strong high.
- TST and BSL_SEL shall be used for the FW recovery/upgrade procedure.

In order to start the Boot Strap Loader of Lepton⁹ internal microcontroller NRST, TST and BSL_SEL signals shall be driven as in the picture below:

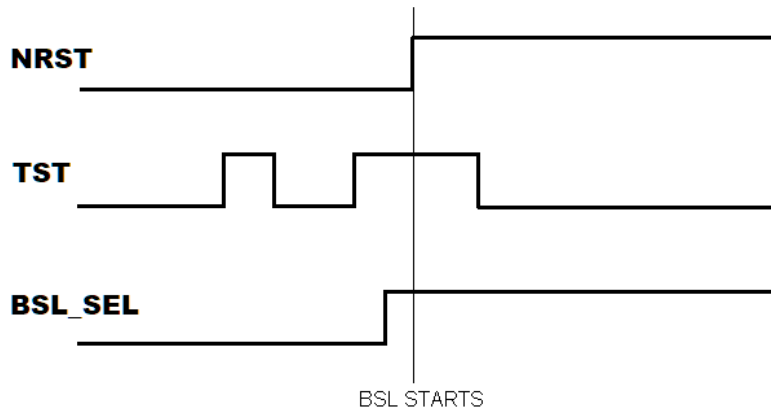


Fig. 3.2: BSL sequence

The BSL program execution starts when TST pin has received a minimum of two positive transitions and if TST is high while /RST rises from low to high. BSL_SEL shall be at high level before BSL starts. Pulses length and distance between edges of all signals shall be 10ms at least.

Optional connections:

- GPIOs allow interaction with the R9101C Lepton⁹x1/R9104C Lepton⁹x4 as both digital inputs and outputs. They may be used to trigger inventory, generate events based on inventory activity, or provide general-purpose user-controlled digital I/O.

Power Supply

The R9101C Lepton⁹x1/R9104C Lepton⁹x4 is powered by a voltage applied to the VDC_IN pin (pin 3 and 4) relative to the GND pins. The supply voltage operating range is 3.2V to 5.25V. Power consumption varies from about 8W to about 80mW depending on the operating mode. The power supply is internally bypassed and regulated, and no external bypass or bulk storage capacitance is required, as long as the input voltage is stable.

If R9101C Lepton⁹x1/R9104C Lepton⁹x4 activity is not required at all times, and power reduction is desired, the VDC_IN supply voltage may be externally gated to remove power to the device.

RF Connection

The Lepton⁹x1 R9101C has a single MMCX jack RF port, the Lepton⁹x4 R9104C has four MMCX jacks RF ports. Each RF port shall be connected to a 50 Ω antenna via a MMCX plug and 50 Ω cable.

UART Communication

The R9101C Lepton⁹x1/R9104C Lepton⁹x4 has one full-duplex UART standard interface, accessible using pins UART-RX, UART-TX. Such UART implements the host communication interface via easy2read[®]. The Tx pin is output from the R9101C Lepton⁹x1/R9104C Lepton⁹x4, the Rx pin is input to the R9101C Lepton⁹x1/R9104C Lepton⁹x4. Interface settings are by default 921,600 baud, with 8 data bits, 1 stop bit, and no parity bit (8-n-1 configuration).

UART interface signals are 3.3 V relative to GND. The specific VIH, VIL, VOH and VOL specifications may be found in the § *Device Input and Output Specifications* paragraph page 15. The TX pin is driven strong high and low with a sink/source current of about 8 mA. If the load on a pin draws more than the 8 mA sink and source current, the pin is not guaranteed to meet the VOH and VOL specs listed in § *Device Input and Output Specifications* paragraph page 15. Excessive current sunk or sourced on the GPIO pins can also cause electrical damage to the device.



Warning: Voltages outside of the maximum IO operating voltage range of -0.3 to 4.0 V should not be applied to the UART pins. This can cause permanent damage to the device.

Reset Pin

The R9101C Lepton⁹x1/R9104C Lepton⁹x4 may be reset by a logic low voltage on the NRST pin (pin 14). Usage of this pin is recommended in all designs. It may be used to reset the part if an unexpected operating state is entered. The R9101C Lepton⁹x1/R9104C Lepton⁹x4 does have an internal watchdog circuit that will reset it if abnormal operation occurs, but the NRST pin provides a further level of reliability.

The NRST pin is pulled high (3.3 V) by an internal 51,1 k Ω nominal resistor. To reset the part, drive the pin strong low for at least the minimum reset pulse width as specified in § *Device Input and Output Specifications* paragraph page 15 (approximately 25 μ s). This pin may be driven active low to reset the part, but should not be driven strong high. Driving the pin strong high prevents the R9101C Lepton⁹x1/R9104C Lepton⁹x4 from resetting itself in case user requested software reset. This pin should be driven using an “open drain drives low” drive mode, which creates either a strong low voltage or a floating voltage output.

GPIO Pins

The R9101C Lepton⁹x1/R9104C Lepton⁹x4 GPIOs can be controlled using the easy2read[®] interface. Their drive mode, direction, and state are all controllable via easy2read[®]. There are two directions: input and output. In both input and output directions, there are three possible pin states: high, low, and float. For more details on using easy2read[®] to control the GPIOs, see the easy2read[®] protocol documentation.

In the output direction, the GPIOs are driven strong high and low with a source and sink current of 8 mA, and in float mode the pin is not driven either high or low, leaving the pin floating, also known as “high impedance” or “high-Z”. The pins are driven to 3.3 V nominally. If the load on a pin draws more than the 8 mA sink and source current, the pin is not guaranteed to meet the VOH and VOL specs listed in the § *Device Input and Output Specifications* paragraph page 15.



Warning: Excessive current sunk or sourced on the GPIO pins can also cause electrical damage to the device.

In the input direction, the high and low states apply a pull-up or pull-down resistor, and in float mode the pin is not pulled either high or low, leaving the pin floating, also known as “high impedance” or “high-Z”. The pull-up and pull-down resistors are about 35 k Ω nominal. See the § *Device Input and Output Specifications* paragraph page 15 for more specific ratings. The inputs logic levels are proportional to 3.3 V. Specific VIH and VIL specs may be found in the § *Device Input and Output Specifications* paragraph page 15.



Warning: Voltages outside of the maximum IO operating voltage range of -0.3 to 4.0 V should not be applied to the pins, no matter their configuration. This can cause permanent damage to the device.

External Connections and Mechanical Drawings

The location of the connectors is shown in Fig. 3.3: R9101C Lepton⁹x1 mechanical drawings and connectors locations (units: mm) and Fig. 3.4: R9104C Lepton⁹x4 mechanical drawings and connector locations (units: mm). Their part numbers are listed here below:

Antenna Ports: RF Coax Connector Huber+Suhner type 82_MMCX-S50-0-2/111_K (to be used with Huber+Suhner type 11_MMCX-50-1-1/111_O)

MOLEX Connector: PCB Header Molex type 53261-1571 (to be used with Molex Type 51021-1500 + 15pcs crimp terminal type 50058-8100)

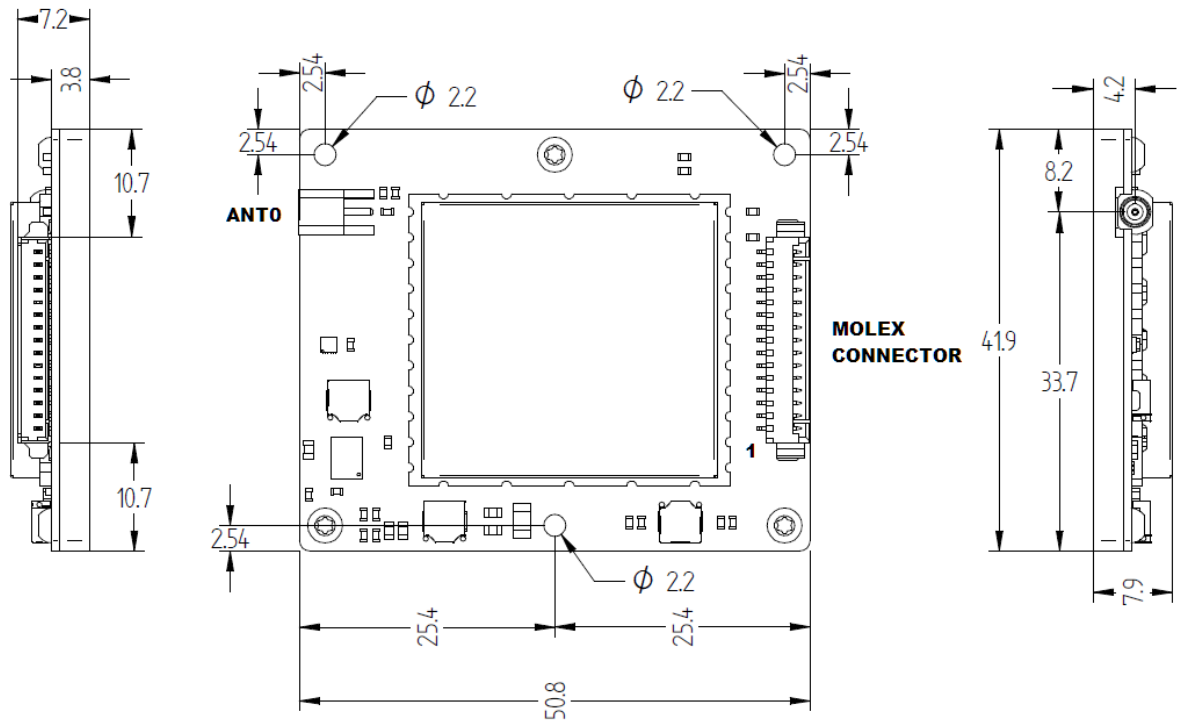


Fig. 3.3: R9101C Lepton⁹x1 mechanical drawings and connectors locations (units: mm)

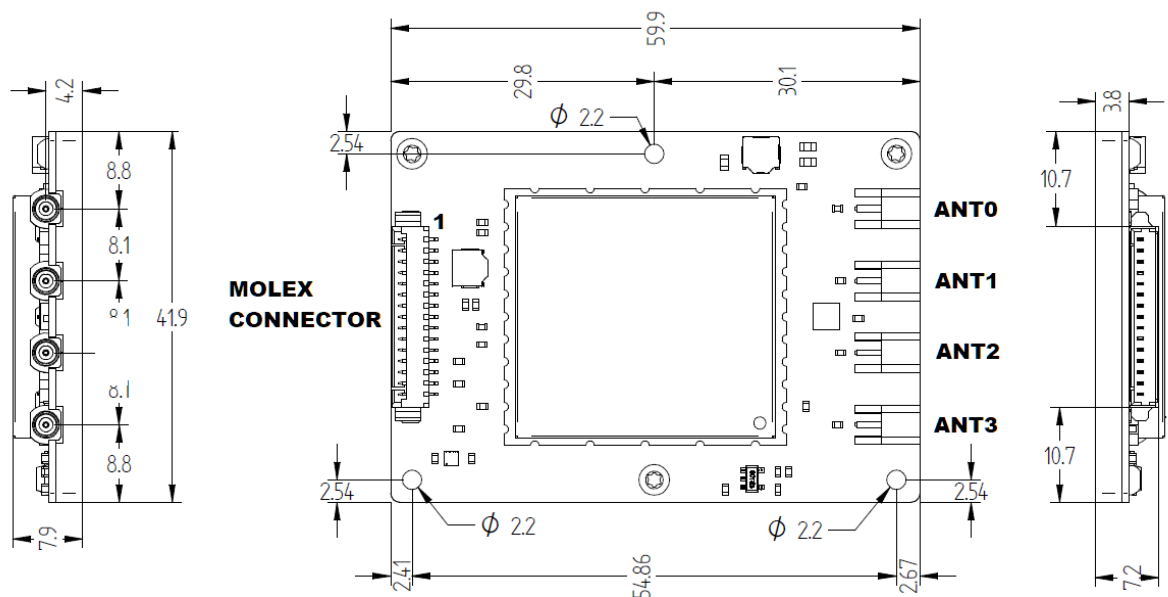


Fig. 3.4: R9104C Lepton⁹x4 mechanical drawings and connector locations (units: mm)

Pin #	Name	Direction	Function
1	GND	-	Ground
2	GND	-	Ground
3	VDC_IN	-	Supply voltage
4	VDC_IN	-	Supply voltage
5	GPIO0	IN/OUT	General purpose I/O #0
6	GPIO1	IN/OUT	General purpose I/O #1
9	GPIO2	IN/OUT	General purpose I/O #2
8	GPIO3	IN/OUT	General purpose I/O #3
9	RXD	IN	UART RX (input to the module)
10	TXD	OUT	UART TX (output from the module)
11	WKUP - RFU	IN/OUT	Reserved for future use
12	STATUS - RFU	IN/OUT	Reserved for future use
13	TST	IN	TST pin to be used for FW recovery/upgrade
14	nRST	IN	Active low reset. Connect to open drain driver.
15	BSL_SEL	IN	Boot Strap Loader interface enable signal

Tab. 3.1: Power supply and interface connector pin listing and signal definitions

Electrical Specifications

Absolute Maximum Ratings

The absolute maximum ratings (see *Tab. 3.2: Absolute Maximum Ratings*) define limitations for electrical and thermal stresses. These limits prevent permanent damage to the R9101C Lepton⁹x1/R9104C Lepton⁹x4.

Operation outside maximum ratings may result in permanent damage to the device.

Parameter	Min.	Max.	Unit	Conditions
Supply voltage	-0.3	5.5	V	VDC_IN pin relative to GND
IO voltage	-0.3	4.0	V	Non-VDC_IN pin voltages relative to GND
RF input power	-	+30	dBm	Incident to pin 1 (RF)
Storage temperature	-30	+100	°C	
Humidity	-	95	% RH	Non-condensing
ESD immunity	-	2	kV	Human-body model, all I/O pads

Tab. 3.2: Absolute Maximum Ratings

Operating Conditions

This section describes operating voltage, frequency, and temperature specifications for the R9101C Lepton⁹x1/R9104C Lepton⁹x4 during operation.

Parameter	Min.	Max.	Unit	Conditions
Supply	3.2	5.25	V	VDC_IN relative to GND
Temperature	-20	+70	°C	Ambient Temperature
Frequency	902	928	MHz	FCC part 15.247
	865.6	867.6	MHz	ETSI EN 302 208 v3.3.1

Tab. 3.3: Operating Conditions

Device Functional Specifications

This section describes operating voltage, frequency, and temperature specifications for the R9101C Lepton⁹x1/R9104C Lepton⁹x4 during operation.

Parameter	Typ.	Unit	Description
Supply Current			Current consumed by Lepton ⁹ R9100C via VDC_IN pin
Active mode - 5V supply	8	W	+30 dBm transmit power Inventorying tags
Idle mode – low latency	300	mW	Ready to receive easy2read [®] protocol packets. Lower latency to return to Active mode.
Idle mode – standard latency	80	mW	Ready to receive easy2read [®] packets

Tab. 3.4: Supply Current Specifications

UHF Gen 2 RFID Radio Specifications

Parameter	Min.	Typ.	Max.	Unit	Conditions
Frequency	902		928	MHz	See § Tab. 2.1: Lepton ⁹ x1 R9101C and Lepton ⁹ x4 R9104C Technical Specifications page 7
	865.6		867.6	MHz	
Input impedance		50		Ω	
Input match		-10		dB	S11
Rx sensitivity		-85		dBm	10%PER, assuming 20 dB antenna RL @ 30 dBm output

Tab. 3.5: RF Receiver Specifications

Parameter	Min.	Max.	Unit	Notes
Tx Power	10	30	dBm	Meets FCC and equivalent regulatory constraints
Tx Power Error		1	dB	Difference between desired Tx power and actual Tx power
Return Loss	0		dB	No damage into open RF port at 30 dBm at any phase angle
Frequency	865.6	867.6	MHz	ETSI EN 302 208 v3.3.1
	902	928	MHz	FCC part 15.247

Tab. 3.6: RF Transmitter Specifications

Device Input and Output Specifications

Parameter	Min.	Typ.	Max.	Unit	Conditions
nRST					
VIL	-0.3		0.8	V	
VIH	2		3.6	V	
Hysteresis voltage		400		mV	
Internal pull-up resistor	14	21	25	k Ω	
Reset pulse width	25			μ s	
Digital inputs					
VIL	-0.3		0.8	V	
VIH	2		3.6	V	
Hysteresis voltage		400		mV	
Internal pull-down resistor	20	35	50	k Ω	
Digital outputs					
VOL	0.0		0.6	V	
VOH	2.7		3.6	V	
Drive current (sink or source)	8			mA	
UART					
Default baud rate			921.6	kbaud	
Configurable baud rate	9.6		921.6	kbaud	
Data bits		8		bits	
Parity bit		None			
Stop bits		1		bits	

Tab. 3.7: Digital Interface Specification

EPC Class-1 Generation-2 Operation

Supported RF modes

The R9101C Lepton⁹x1/R9104C Lepton⁹x4 supports the following link profiles, whose characteristics are reported in the following table:

Link Profile	Regulation	Forward Link Profile			Reverse Link Profile	
		R2T Modulation	Tari	PIE	T2R Modulation	Link Frequency
1	ETSI	PR-ASK	20 μ s	2	Miller M=2	320 kHz
2	ETSI	PR-ASK	20 μ s	2	Miller M=4	320 kHz
3	FCC	PR-ASK	20 μ s	2	Miller M=4	250 kHz
4	ETSI	PR-ASK	15 μ s	2	Miller M=2	320 kHz
5	ETSI/FCC	PR-ASK	20 μ s	2	Miller M=8	160 kHz
6	FCC	PR-ASK	7.5 μ s	2	FM0	640 kHz
7	FCC	PR-ASK	7.5 μ s	2	Miller M=2	640 kHz
8	FCC	PR-ASK	7.5 μ s	2	Miller M=4	640 kHz
9	FCC	DSB-ASK	6.25 μ s	2	FM0	640 kHz
10	FCC	DSB-ASK	6.25 μ s	2	Miller M=2	640 kHz

Tab. 3.8: RF Modes – Forward and Reverse Link Profiles

4 EVALUATION BOARD

Technical Specifications Table

Digital I/O	Four I/O lines 3.3 V out @ 3mA, 5 V tolerant
UART via USB Port	USB micro female connector Baudrate: 115200 Databits: 8 Stopbits: 1 Parity: none Flow control: none 9.6÷115 kbit/s data rate (settable) It appears as USB serial port; drivers for all Windows OS
LED display	GREEN: power from AC/DC adapter GREEN: USB connection YELLOW: UART to USB interface activity GREEN: GPIO[0..3]
Dimensions	(W)81 x (L)76 x (H)18 mm ³ (3.2 x 3.0 x 0.7) inch ³
Electrical Power	DC Voltage 5V +/-5% Current consumption: 2A max.
Operating Temperature	-20 °C to +70 °C

Tab. 4.1: R4320CEVB – Lepton⁹x1 and Lepton⁹x4 Evaluation Board - Technical Specifications

Connection Diagram

The following block diagram shows how to connect the R9101C Lepton⁹x1/R9104C Lepton⁹x4 with the PC host via the R4320CEVB service board.

In the evaluation board R9101C Lepton⁹x1/R9104C Lepton⁹x4 UART interface is accessible via a Microchip UART to USB converter.

The board equipped with R9101C Lepton⁹x1/R9104C Lepton⁹x4 readers shall be powered by an external 5V 1A min. DC adapter. The use of the Power Supply for R4320CEVB (WALIM0000005) is recommended (see § *Ordering Options* page 6).

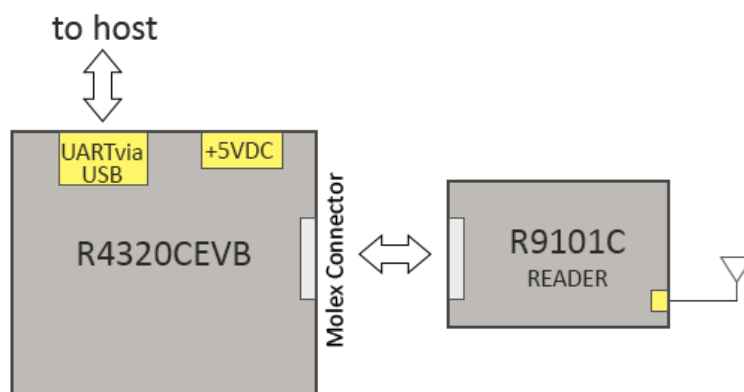


Fig. 4.1: Evaluation Board R4320CEVB – R9101C Reader Connection Diagram

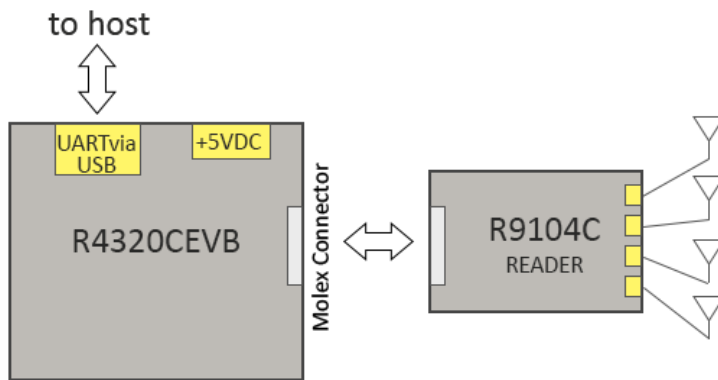


Fig. 4.2: Evaluation Board R4320CEVB – R9104C Reader Connection Diagram

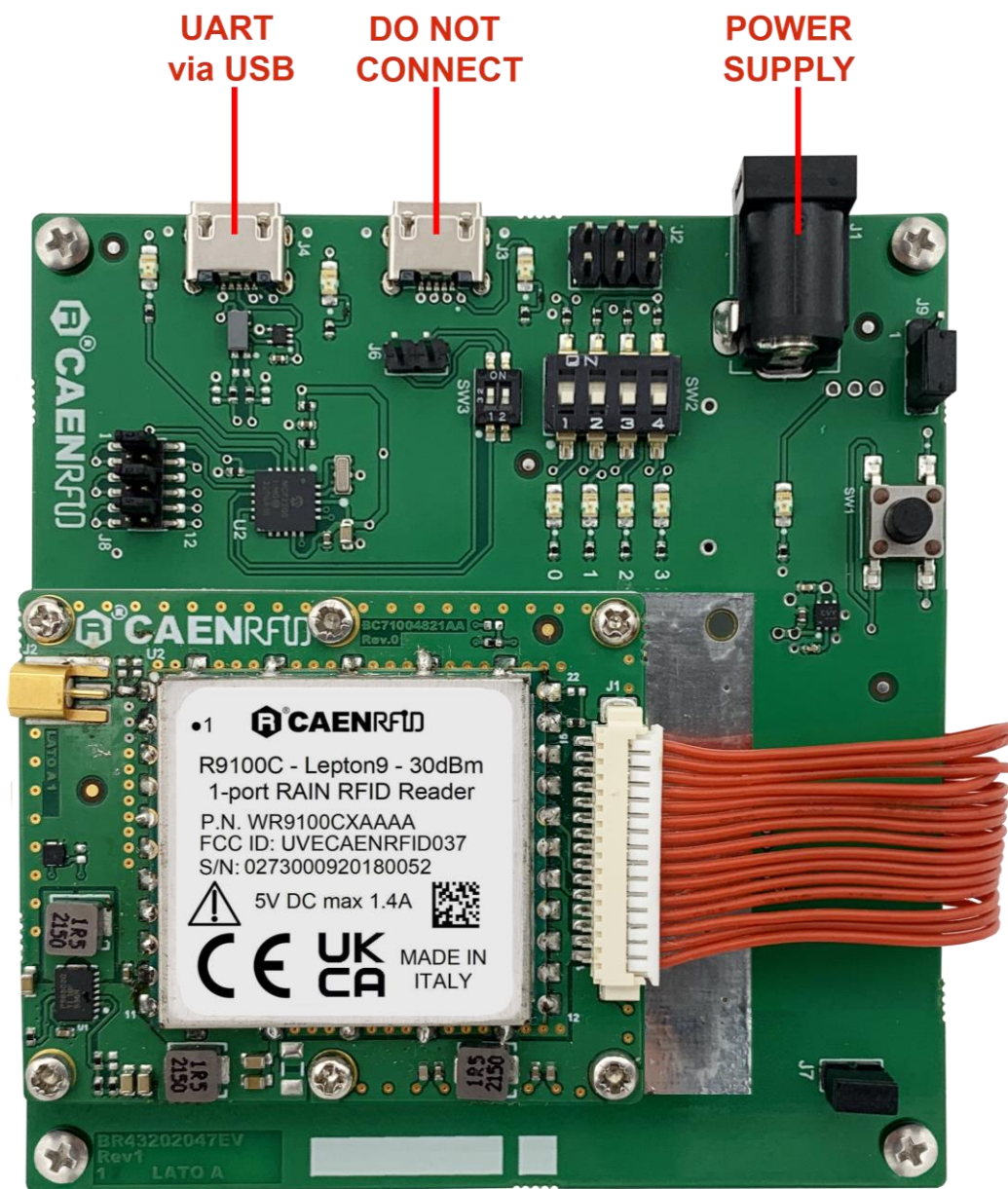


Fig. 4.3: Evaluation Board R4320CEVB – R9101C Reader Interface Connectors

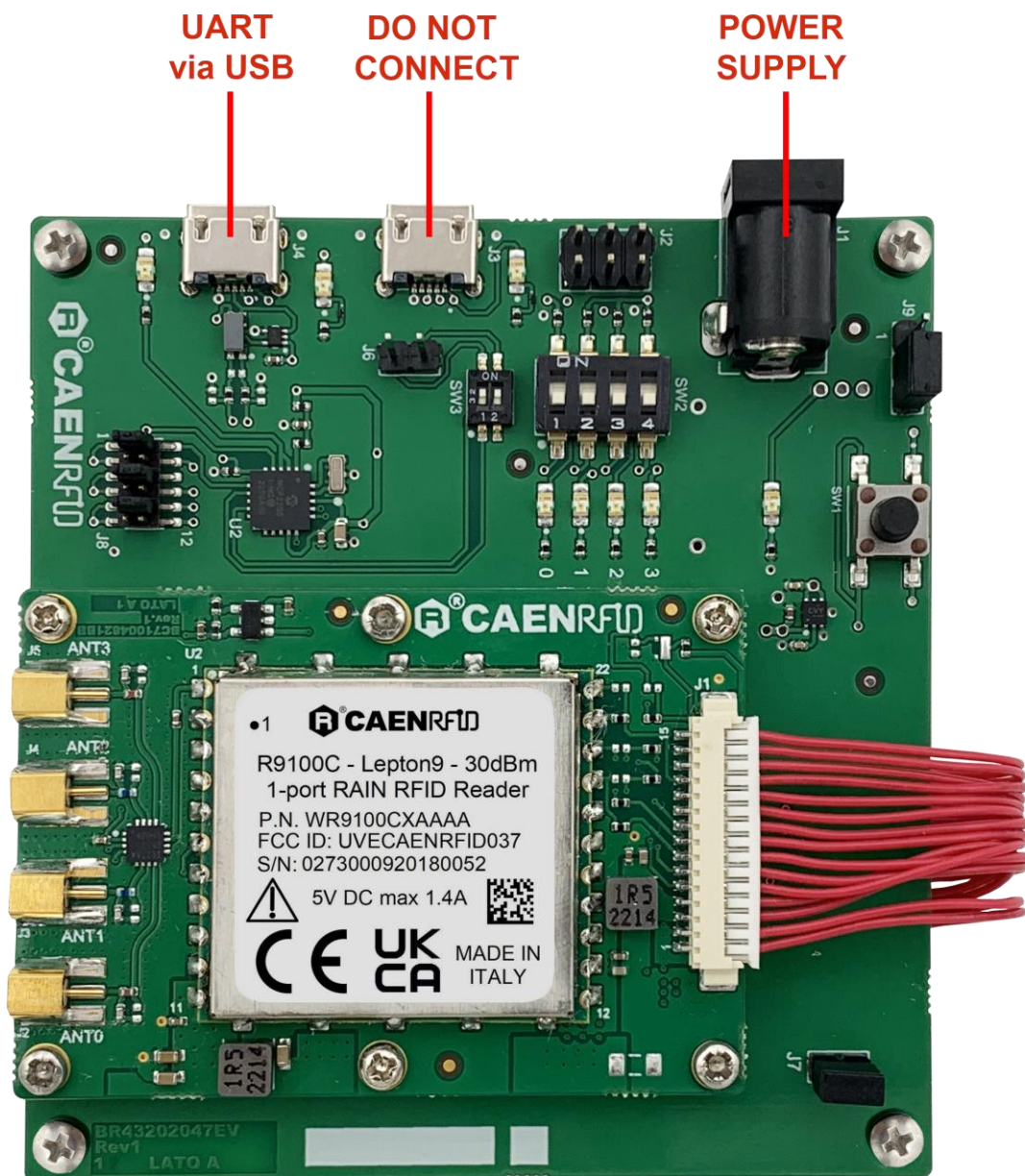


Fig. 4.4: Evaluation Board R4320CEVB – R9104C Reader Interface Connectors

Installation Notice

Fix the R9101C Lepton⁹x1/R9104C Lepton⁹x4 reader to the R4320CEVB board using 3 M2x12 countersunk screws and 3 M2 screws nuts and connect the Molex connectors.

The reader case shall be kept electrically isolated via thermal sildpad from the ground plane.

The correct way to connect the R9101C Lepton⁹x1/R9104C Lepton⁹x4 module to the R4320CEVB evaluation board is shown in the following picture:

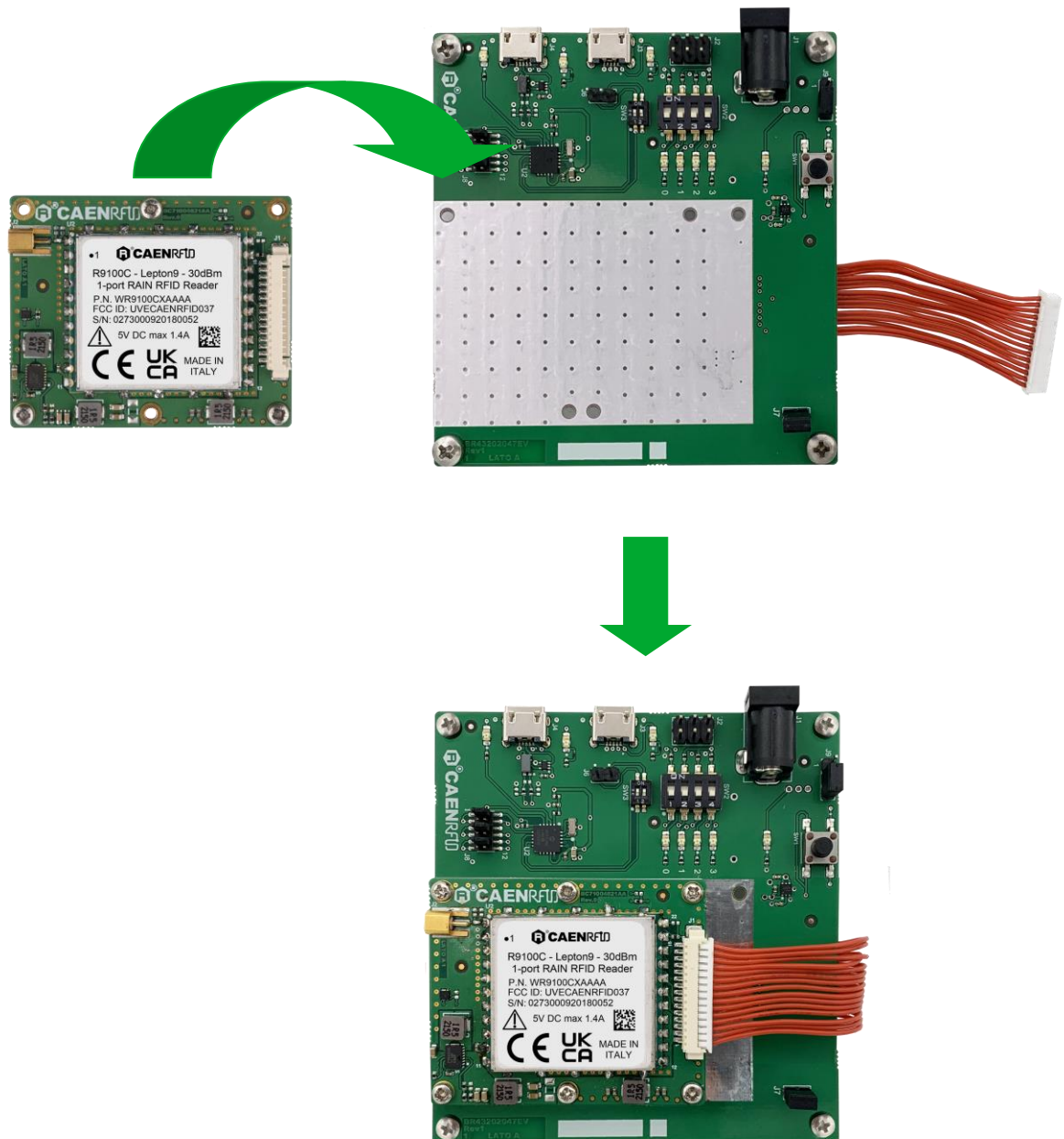


Fig. 4.5: Connection of the R9101C module to the R4320CEVB evaluation board

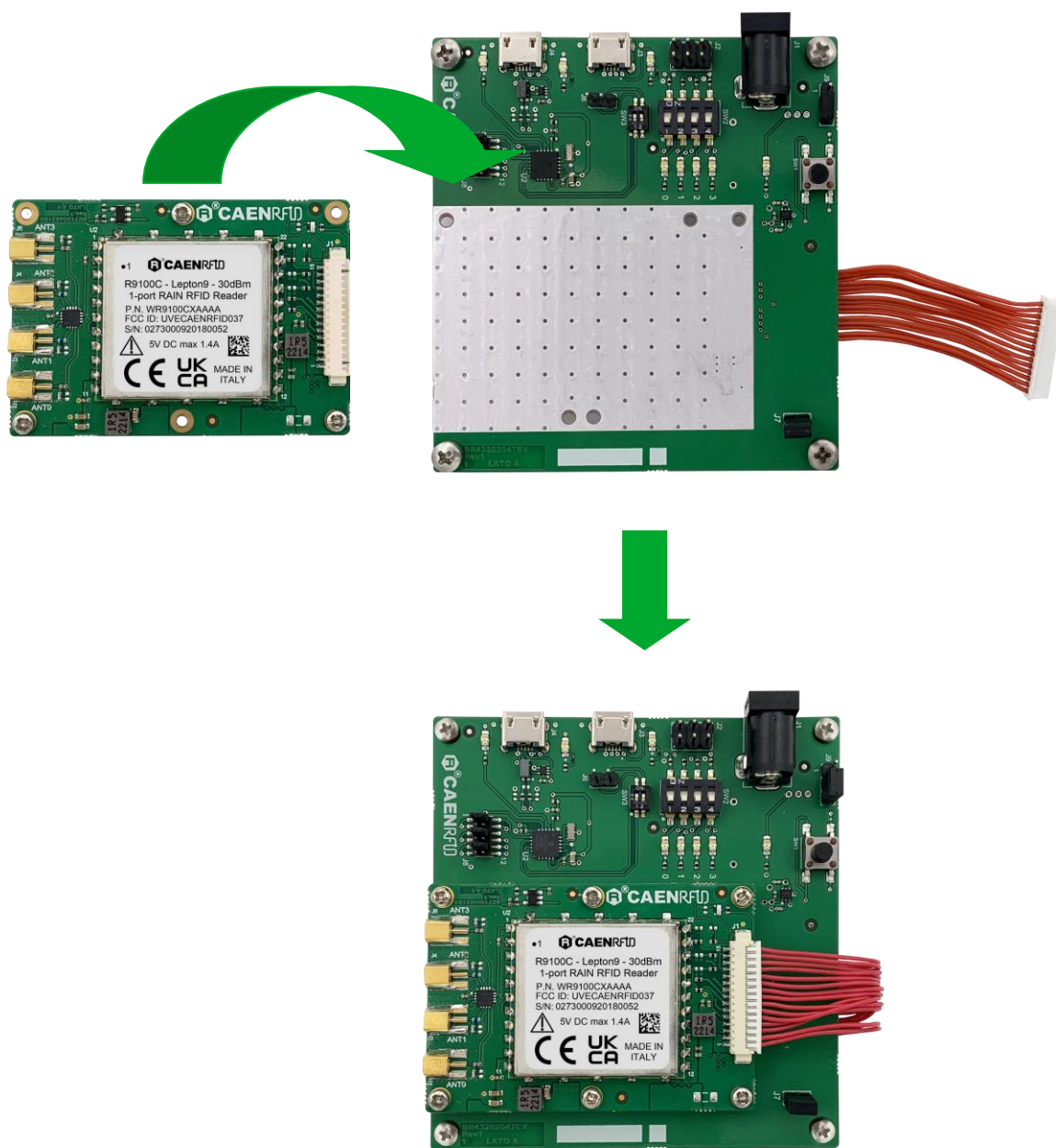


Fig. 4.6: Connection of the R9104C module to the R4320CEVB evaluation board

Connecting to the R9101C Lepton⁹x1/R9104C Lepton⁹x4 reader

USB Communication Setup



Warning: If your PC is running a Windows version older than Windows 10, to correctly operate with the reader, you need to install the *FTDI USB driver*. You can find it easily via a WEB research.

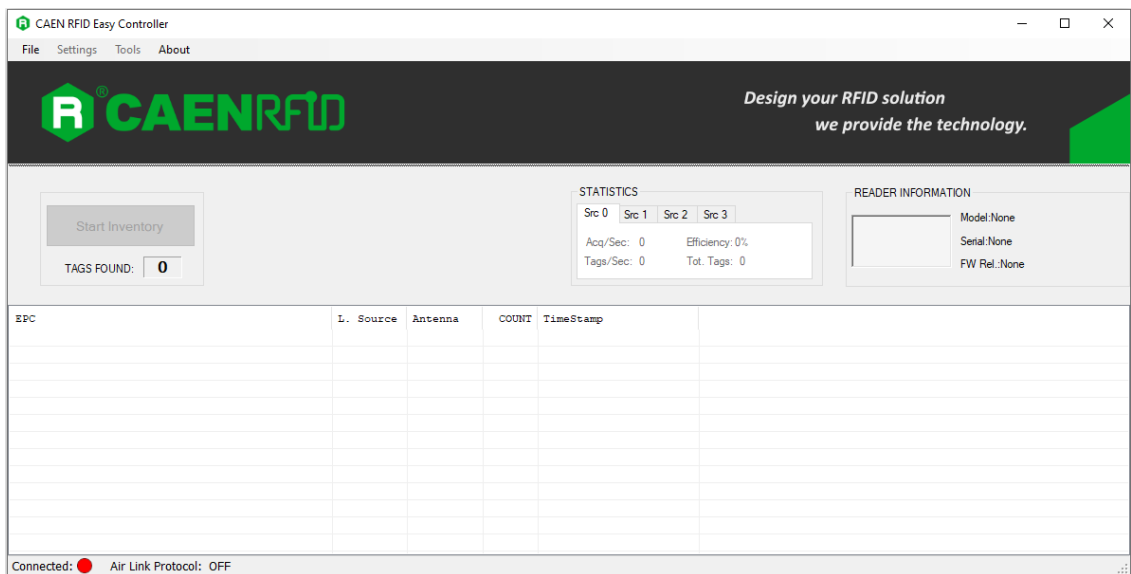
Evaluation Board USB-UART Details

R4320CEVB board embeds an FTDI FT232BL UART to USB converter. This part allows a PC to communicate with the R9101C Lepton⁹x1/R9104C Lepton⁹x4 over USB. The Microchip MCP2200 part achieves this by enumerating as an USB device and adding a COM port. In Windows, this COM ports can be viewed in the Device Manager under the “Ports (COM & LPT)” category.

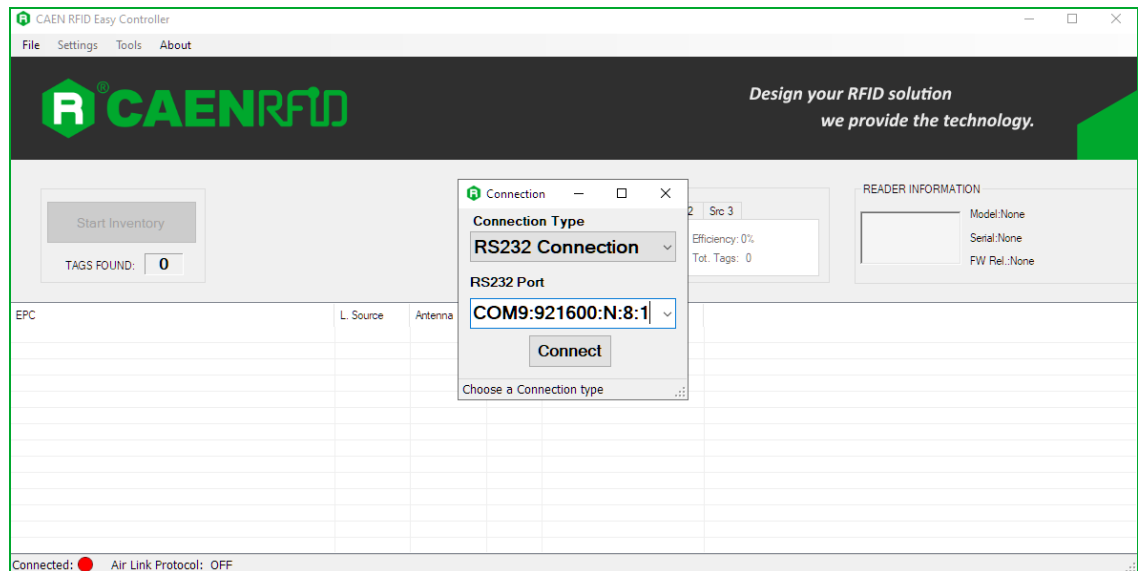
Easy Controller

Follow these steps to connect the R9101C Lepton⁹x1/R9104C Lepton⁹x4 using the *Easy Controller* application for Windows:

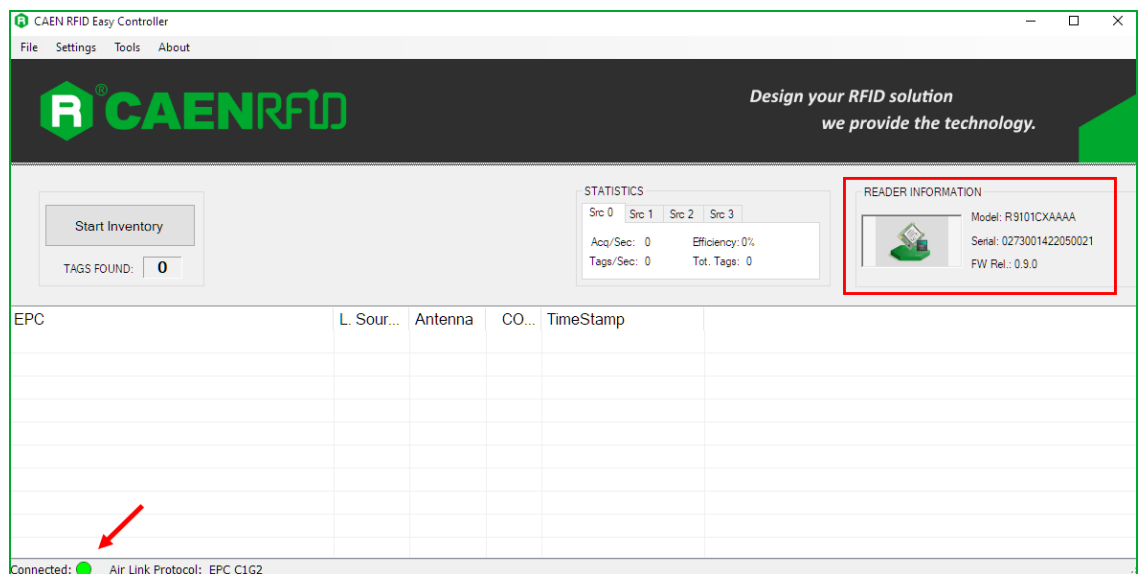
1. Download the latest version of the *Easy Controller software* from the [Lepton⁹x1 R9101C web page](#) or [Lepton⁹x4 R9104C web page](#), *Downloads* section and install it.
2. Launch the *Easy Controller* application:



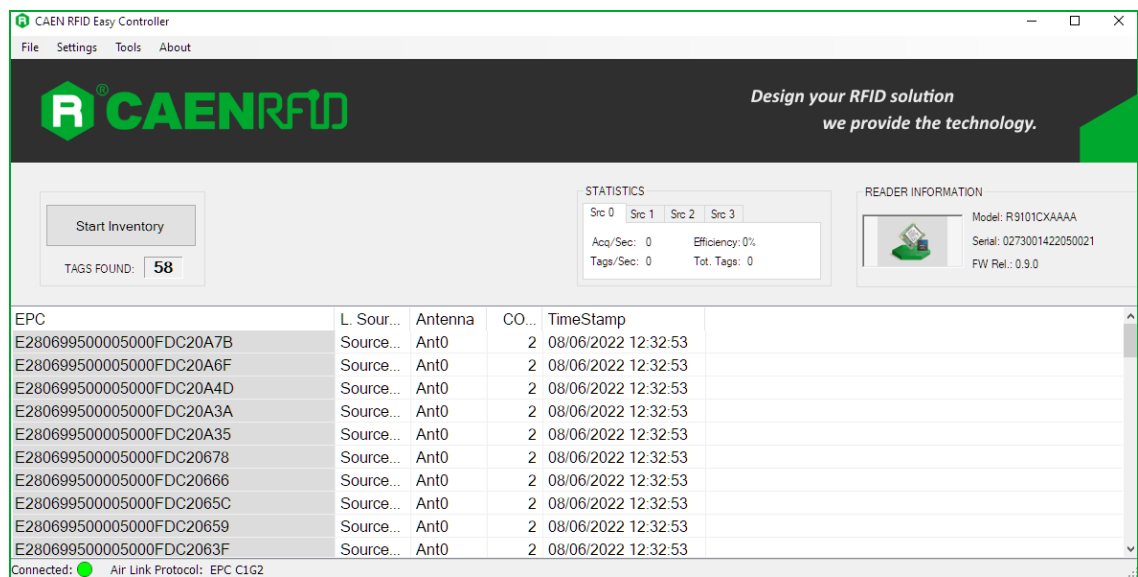
- On the main screen click on *File* → *Connect*. A Connection window will open. Select the *Connection Type* (RS232) and specify the RS232 port (COM 9 in this example). In order to connect to the module via Easy Controller software the serial settings shall be added to the COM port address since R9101C Lepton⁹x1/R9104C Lepton⁹x4 module has a different baudrate (921600bps) from default value used by the SW:



- To verify if the connection with the reader has been established, check the green dot on the bottom left side of the sidebar and on the *READER INFORMATION* box you can find information on reader model, serial number and firmware release:



- Place one or more tags near the antenna connected to the reader, click on *Start Inventory* and see tags information displayed on the main window:



EPC	L. Sour...	Antenna	CO...	TimeStamp
E280699500005000FDC20A7B	Source...	Ant0	2	08/06/2022 12:32:53
E280699500005000FDC20A6F	Source...	Ant0	2	08/06/2022 12:32:53
E280699500005000FDC20A4D	Source...	Ant0	2	08/06/2022 12:32:53
E280699500005000FDC20A3A	Source...	Ant0	2	08/06/2022 12:32:53
E280699500005000FDC20A35	Source...	Ant0	2	08/06/2022 12:32:53
E280699500005000FDC20678	Source...	Ant0	2	08/06/2022 12:32:53
E280699500005000FDC20666	Source...	Ant0	2	08/06/2022 12:32:53
E280699500005000FDC2065C	Source...	Ant0	2	08/06/2022 12:32:53
E280699500005000FDC20659	Source...	Ant0	2	08/06/2022 12:32:53
E280699500005000FDC2063F	Source...	Ant0	2	08/06/2022 12:32:53

Connected: ● Air Link Protocol: EPC C1G2

For more information on the CAEN RFID *Easy Controller for Windows* application usage, please refer to the relevant user manual: you can download it from the [Lepton⁹x1 R9101C web page](#) or [Lepton⁹x4 R9104C web page](#), *Downloads* section or in the [Manual and Documents](#) web area.

Technical Drawings

The following drawing shows the R4320CEVB components position.

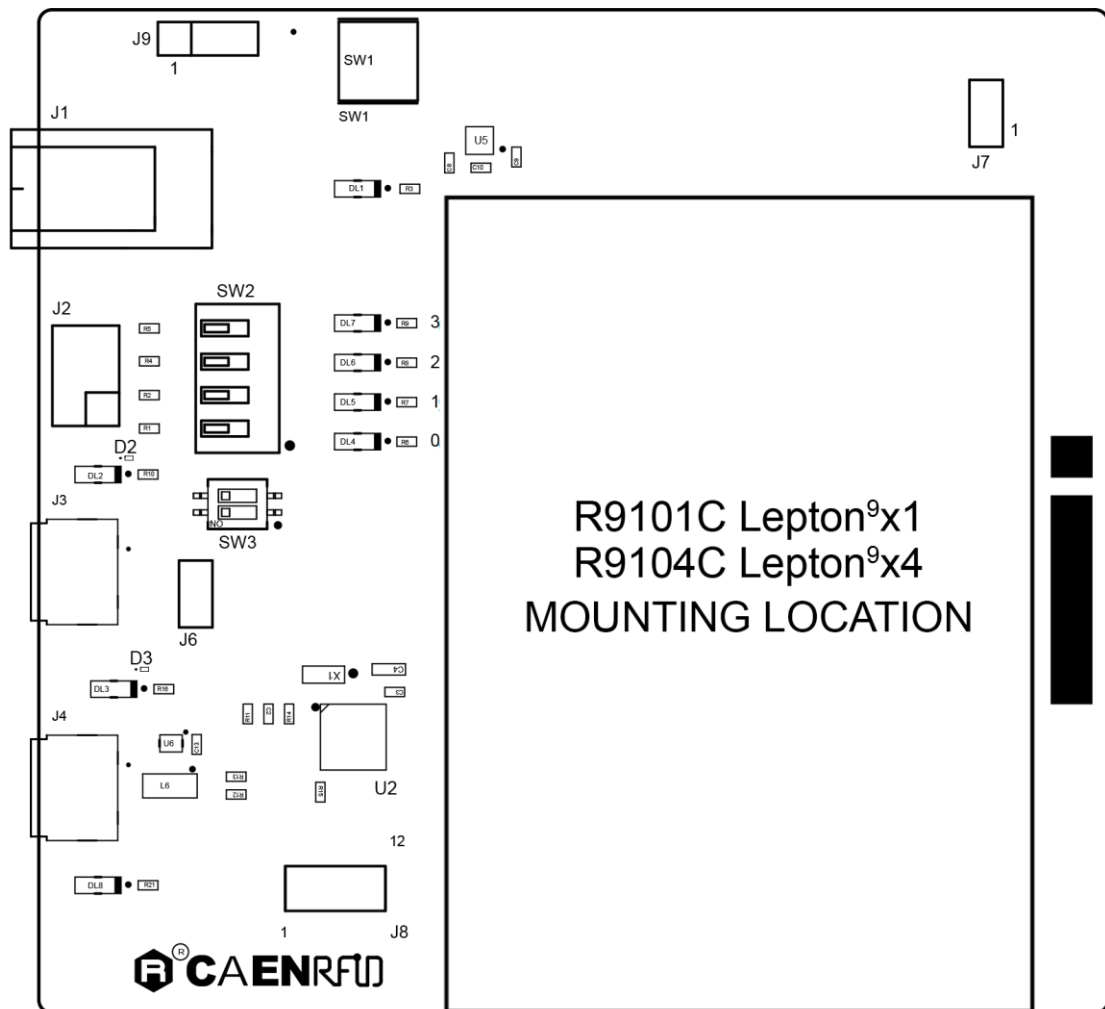


Fig. 4.7: R4320CEVB Technical Drawing

Electrical Schematic

The electrical schematic of the R4320CEVB is shown in the following figure:

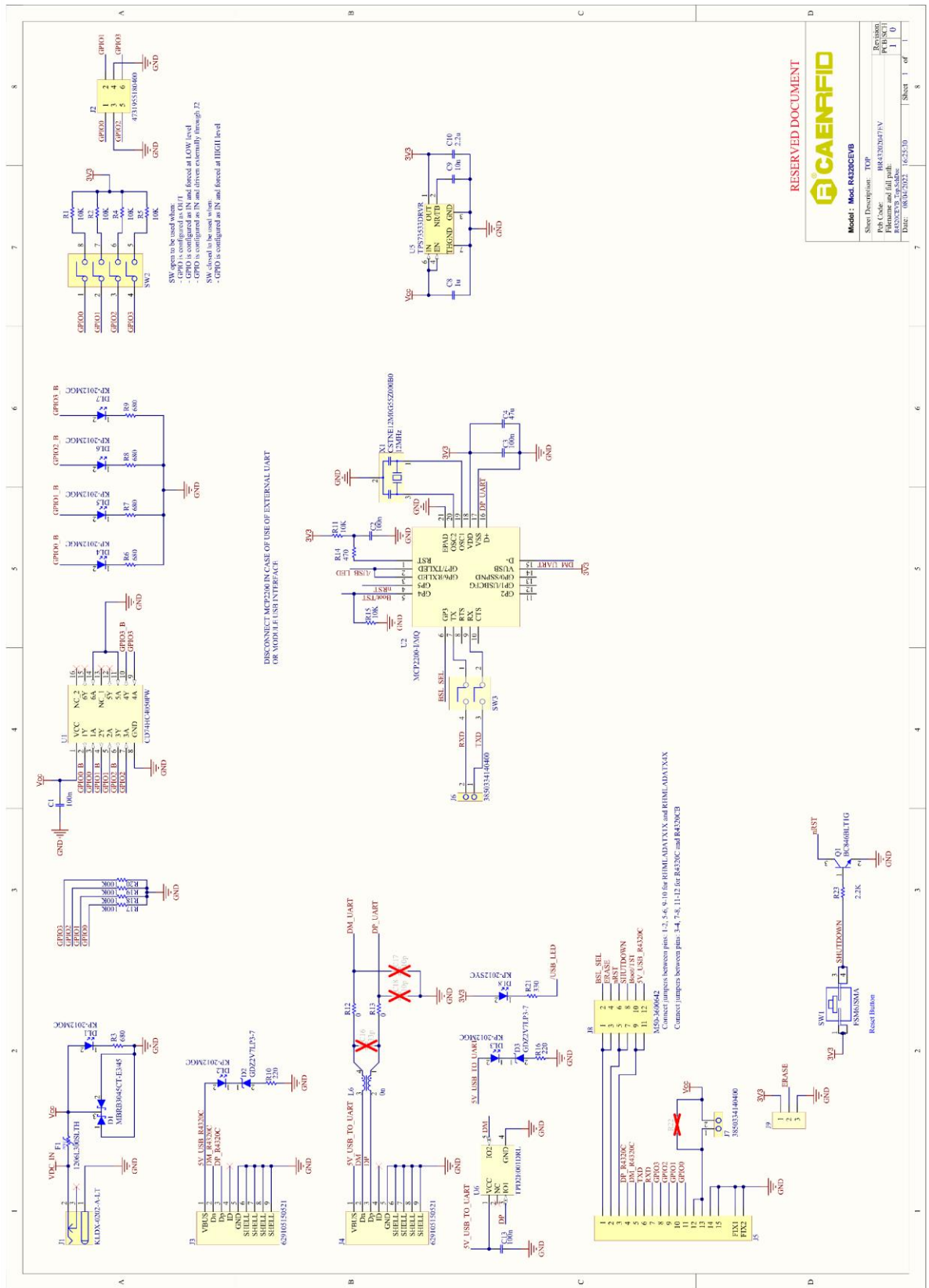


Fig. 4.8: R4320CEVB Electrical Schematic

External Connections

Please refer to *Fig. 4.7: R4320CEVB Technical Drawing* page 24.

J1: Power Supply connector: central pin (2.1mm diam.) is the negative terminal. The use of the Power Supply for R4320CEVB (WALIM0000005) is recommended (see § *Ordering Options* page 6).

J2: header for GPIO external connection

- J2-1 = GPIO0 (in/out)
- J2-2 = GPIO1 (in/out)
- J2-3 = GND
- J2-4 = GND
- J2-5 = GPIO2 (in/out)
- J2-6 = GPIO3 (in/out)

J3: Micro USB female connector, **not supported by R9101C Lepton⁹x1/R9104C Lepton⁹x4 modules**

J4: Micro USB female connector for UART via USB interface

J6: Header that can be used to connect UART signals to an external device (see § *Electrical Schematic* page 25 for details)

J7: Jumper that can be removed and connected to a multimeter terminals for module current consumption measurements purposes.

Jumpers and Switches

Please refer to *Fig. 4.7: R4320CEVB Technical Drawing* page 24.

SW1

SW1: Press it to reset R9101C Lepton⁹x1/R9104C Lepton⁹x4 modules

SW2

SW2: Can be used to drive module GPIOs according to the following configurations:

SW open to be used when

- GPIO is configured as OUT
- GPIO is configured as IN and forced at LOW level
- GPIO is configured as IN and driven externally through J2

SW closed to be used when

- GPIO is configured as IN and forced at HIGH level

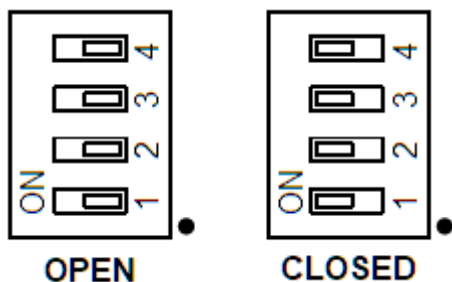


Fig. 4.9: SW2 configuration

SW3

SW3: Shall be used to correctly select communication interface of R9101C Lepton⁹x1/R9104C Lepton⁹x4 module with the host:

SW open to be used when

- UART interface is used directly connected to external device (i.e. microcontroller inside customer board)

SW closed to be used when

- UART via USB interface is used (connection to PC via J4 connector)

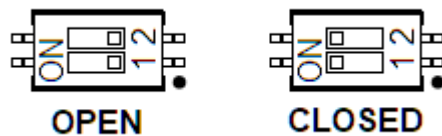


Fig. 4.10: SW3 configuration

J8



Warning: J8 is a jumper block for reader family configuration!

J8: Jumper block for reader family configuration:

- Connect jumpers between pins: 3-4, 7-8, 11-12 for Hadron reader family
- Connect jumpers between pins: 1-2, 5-6, 9-10 for Lepton reader family

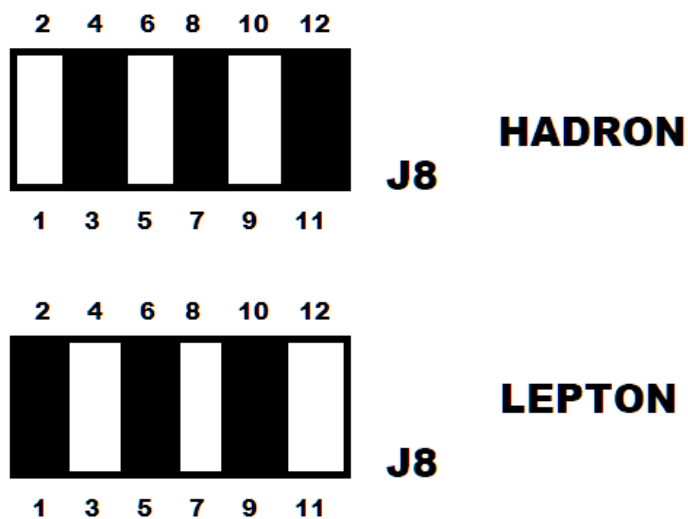


Fig. 4.11: J8 jumper block configurations

J9

J9: Jumper for FW Recovery/Upgrade Procedure, not supported by R9101C Lepton⁹x1/R9104C Lepton⁹x4 modules

LEDs

Please refer to *Fig. 4.7: R4320CEVB Technical Drawing* page 24.

DL1 (green) = Power Supply

DL2 (green) = not supported

DL3 (green) = UART via USB connection

DL4 (green) = GPIO0

DL5 (green) = GPIO1

DL6 (green) = GPIO2

DL7 (green) = GPIO3

DL8 (yellow) = UART via USB communication activity

5 REGULATORY COMPLIANCE

CE Compliance (mod. R9101C)

Reference standard:

ETSI EN 301 489-1 V2.2.3:2019

ETSI EN 301 489-3 V2.1.1:2017

ETSI EN 302 208 V3.3.1:2020

IEC 62368-1:2018

See § *Lepton⁹x1 R9101C CE DECLARATION OF CONFORMITY* page 31 for the Lepton⁹x1 R9101C CE Compliance Certificate.



Warning: The CE compliance is guaranteed only if the reader is used as described in this manual

CE Compliance (mod. R9104C)

Reference standard:

ETSI EN 301 489-1 V2.2.3:2019

ETSI EN 301 489-3 V2.1.1:2017

ETSI EN 302 208 V3.3.1:2020

IEC 62368-1:2018

See § *Lepton⁹x4 R9104C CE DECLARATION OF CONFORMITY* page 32 for the Lepton⁹x4 R9104C CE Compliance Certificate.



Warning: The CE compliance is guaranteed only if the reader is used as described in this manual

UKCA Compliance (mod. R9101C)

Reference standard:

ETSI EN 301 489-1 V2.2.3:2019

ETSI EN 301 489-3 V2.1.1:2017

ETSI EN 302 208 V3.3.1:2020

BS EN 62368-1:2014+A11:2017

See § *Lepton⁹x1 R9101C UKCA DECLARATION OF CONFORMITY* page 33 for the Lepton⁹x1 R9101C UKCA Compliance Certificate.



Warning: The UKCA compliance is guaranteed only if the reader is used as described in this manual

UKCA Compliance (mod. R9104C)

Reference standard:

ETSI EN 301 489-1 V2.2.3:2019

ETSI EN 301 489-3 V2.1.1:2017

ETSI EN 302 208 V3.3.1:2020

BS EN 62368-1:2014+A11:2017

See § *Lepton⁹x4 R9104C UKCA DECLARATION OF CONFORMITY* page 34 for the Lepton⁹x4 R9104C UKCA Compliance Certificate.



Warning: The UKCA compliance is guaranteed only if the reader is used as described in this manual

RoHS Directive

The R9101C Lepton⁹x1 and R9104C Lepton⁹x4 RFID Readers are compliant with the EU Directive 2015/863/EU (RoHS3) and the UK Regulation 2012 SI 2012/3032 (RoHS) on the Restriction of the Use of certain Hazardous Substances in Electrical and Electronic Equipment.

R9101C LEPTON⁹X1

CE DECLARATION OF CONFORMITY

We

CAEN RFID Srl
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55049 Viareggio (LU)
Italy
Tel.: +39.0584.388.398 Fax: +39.0584.388.959
Mail: info@caenrfid.com
Web site: www.caenrfid.com

herewith declare under our own responsibility that the product:

WR9101CXAAAA - Lepton⁹x1 - 30dBm Reader Module

corresponds in the submitted version to the following standards:

ETSI EN 301 489-1 V2.2.3:2019

ETSI EN 301 489-3 V2.1.1:2017

ETSI EN 302 208 V3.3.1:2020

IEC 62368-1:2018

and declare under our sole responsibility that the specified product meets the principle requirements and other applicable regulations of directives 2014/53/EU (RED) and 2015/863/EU (RoHS3)

Date: 12/04/2023

A blue ink signature of Adriano Bigongiari, Chief Executive Officer, is written over the company name and address.

CAEN RFID Srl
Via Vetràia, 11
55049 VIAREGGIO - ITALY
VAT IT 02032050466

Adriano Bigongiari (Chief Executive Officer)

On the basis of this declaration, this product will bear the following mark:



The compliance is guaranteed only if the reader is used as described in the Lepton⁹x1 - Lepton⁹x4 - Technical Information Manual Technical Information Manual.

R9104C LEPTON⁹X4

CE DECLARATION OF CONFORMITY

We

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Mail: info@caenrfid.com
Web site: www.caenrfid.com

herewith declare under our own responsibility that the product:

WR9104CXAAAA - Lepton⁹x4 - 30dBm Reader Module

corresponds in the submitted version to the following standards:

ETSI EN 301 489-1 V2.2.3:2019

ETSI EN 301 489-3 V2.1.1:2017

ETSI EN 302 208 V3.3.1:2020

IEC 62368-1:2018

and declare under our sole responsibility that the specified product meets the principle requirements and other applicable regulations of directives 2014/53/EU (RED) and 2015/863/EU (RoHS3)

Date: 12/04/2023

A blue ink signature of Adriano Bigongiari over a company stamp.

CAEN RFID Srl
Via Vetraia, 11
55049 VIAREGGIO - ITALY
VAT IT 02032050466

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R9101C LEPTON⁹X1

UKCA DECLARATION OF CONFORMITY

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Mail: info@caenrfid.com
Web site: www.caenrfid.com

herewith declare under our own responsibility that the product:

WR9101CXAAAA - Lepton⁹x1 - 30dBm Reader Module

corresponds in the submitted version to the following standards:

ETSI EN 301 489-1 V2.2.3:2019

ETSI EN 301 489-3 V2.1.1:2017

ETSI EN 302 208 V3.3.1:2020

BS EN 62368-1:2014+A11:2017

and declare under our sole responsibility that the specified product meets the principle requirements and other applicable regulations of directives UK Regulation 2016 No. 1206 and UK Regulation 2012 SI 2012/3032 (RoHS).

Date: 12/04/2023

A blue ink signature of Adriano Bigongiari, Chief Executive Officer, is written over the company's contact information.

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55049 VIAREGGIO - ITALY
VAT IT 02032050466

Adriano Bigongiari (Chief Executive Officer)



On the basis of this declaration, this product will bear the following mark:

The compliance is guaranteed only if the reader is used as described in the Lepton⁹x1 - Lepton⁹x4 - Technical Information Manual Technical Information Manual.

R9104C LEPTON⁹X4

UKCA DECLARATION OF CONFORMITY

We

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Mail: info@caenrfid.com
Web site: www.caenrfid.com

herewith declare under our own responsibility that the product:

WR9104CXAAAA - Lepton⁹x4 - 30dBm Reader Module

corresponds in the submitted version to the following standards:

ETSI EN 301 489-1 V2.2.3:2019

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ETSI EN 302 208 V3.3.1:2020

BS EN 62368-1:2014+A11:2017

and declare under our sole responsibility that the specified product meets the principle requirements and other applicable regulations of directives UK Regulation 2016 No. 1206 and UK Regulation 2012 SI 2012/3032 (RoHS).

Date: 12/04/2023

A blue ink signature of Adriano Bigongiari, with the company name and address printed below it.

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