Pepper C2R Module User Manual

Manual version: V1.2[1]
06/03/2026

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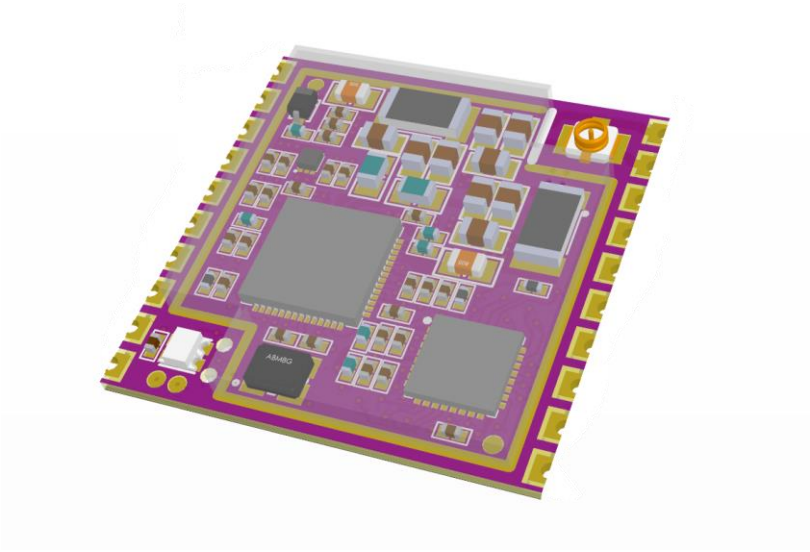
[1] The newest User manual can be found on our website: https://eccel.co.uk/wp-content/downloads/Pepper_C2/C2R_Module_User_manual.pdf

1. Introduction

1.1 Device Overview

Features

- Low cost RFID Reader with MIFARE® Classic® in 1K, 4K memory, ICODE, MIFARE Ultralight®, NTAG21x
- lifetime firmware updates
- Command interface via UART and USB
- UART baud rate up to 921600 bps
- Hight speed USB-UART emulated interface
- USB HID keyboard emulation
- Configurable RGB LED indicator for RFID events
- 6 configurable GPIOs
- Stand-alone mode (polling)
- High transponder read and write speed
- -25°C to 85°C operating range
- Multiple internal reference voltages
- RoHS compliant
- CE (RED) and FCC compliant. ISED/PSE and other approvals easily obtained



Applications

- Access control
- Monitoring goods
- Approval and monitoring consumables
- Pre-payment systems
- Managing resources
- Contact-less data storage systems
- Evaluation and development of RFID systems

Description

The Pepper C2 Module RFID reader is the advanced successor to the Pepper C1 Module, maintaining full compatibility with most of the tag types and protocols supported by its predecessor. It offers lifetime firmware updates, ensuring continuous improvements and security. The device features a configurable USB interface, capable of emulating either a UART interface or functioning as a HID profile, such as keyboard emulation. Additionally, the Pepper C2 Module is cost-optimized compared to previous C1 modules, providing enhanced functionality at a competitive price point.

2. Electrical specification

2.1 Absolute maximum ratings

Stresses beyond the absolute maximum ratings listed in the table below may cause permanent damage to the device. These are stress ratings only, and do not refer to the functional operation of the device that should follow the recommended operating conditions.

Symbol	Parameter	Min	Max	Unit
T_S	Storage temperature	-40	+125	°C
T_A	Ambient temperature	-40	+85	°C
V_{DDMAX}	Supply voltage (pin 8)	4.5	5.5	V

Table 2-1. Absolute maximum ratings

2.2 Operating conditions

Symbol	Parameter	Min	Typ.	Max	Unit
T_S	Operating temperature	-25	25	+85	°C
H	Humidity	5	60	95	%
V_{DD}	Supply voltage (pin 8)	4.5	5	5.5	V

Table 2-2. Operating conditions

2.3 Current consumption (V_{DD} = 5V)

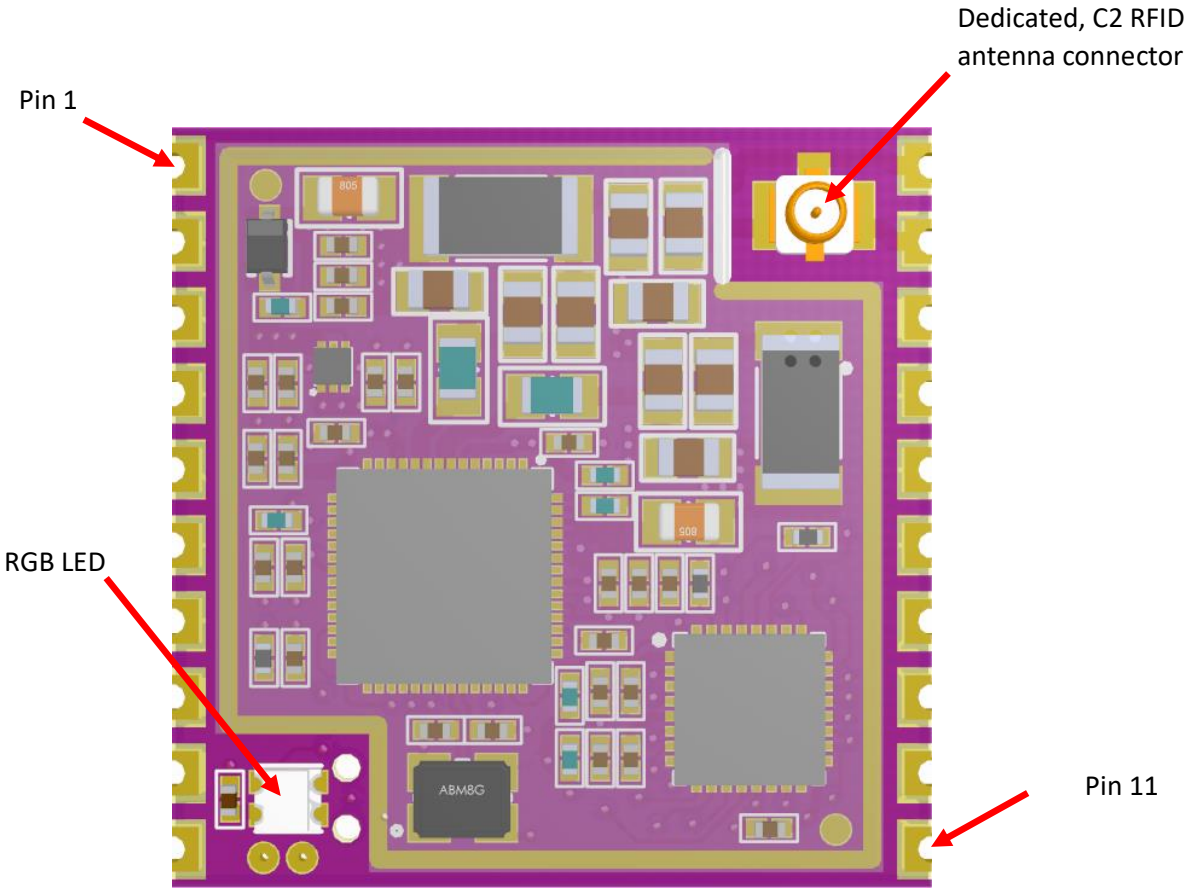
Symbol	Parameter	Typ.	Max	Unit
I_{RFON}	RF field on (no tag, polling 200ms)	97	110	mA
	RF field on (tag in the RF field, polling 200ms)	295	315	mA
	RF field on (continuously)	300	322	mA
	RF field on (tag on antenna)	316	336	mA
I_{RFOFF}	RF field off	23	30	mA
Sleep mode	RF field off	2	3	mA

Table 2-3. Current consumption

**A metal environment near the antenna can increase the current consumption of the RFID Reader. Therefore, it is recommended to ensure a minimum 500mA of current from the power supply.*

3. Getting started

3.1 IO and peripherals



3.1.1 Pinout description

Number	Name	Description
1	NC	Leave pin unconnected
2	UART2_TX	Secondary UART/Console logs data transmit pin
3	BUTTON	Button pin
4	UART2_RX	Secondary UART/Console Logs data receive pin
5	UART0_TX	Main UART data transmit pin
6	UART0_RX	Main UART data receive pin
7	RESET	Active low reset pin (3.3V Level)
8	V_{DD}	Main power supply – recommended value 5.0V
9	GND	Ground
10	NC	Leave pin unconnected
11	USB-	USB Data Negative Signal
12	USB+	USB Data Positive Signal
13	GPIO2	General Purpose Input Output pin no. 2
14	GPIO1	General Purpose Input Output pin no. 1
15	RS485_DE	UART2 RS485 Driver Enable pin
16	RS485_RE	UART2 RS485 Receiver Enable pin
17	GPIO0	General Purpose Input Output pin no. 0
18	GND	Ground for RFID Antenna. Can be connected to the main ground when on-board RFID antenna is used
19	RFID ANT1	RFID antenna signal no. 1. Do not use when on-board antenna connector is used.
20	RFID ANT2	RFID antenna signal no. 2. Do not use when on-board antenna connector is used.

**All digital signals are at 3.3V level*

3.2 Typical connection

The Pepper C2R Module can be connected to a host (computer or another device) using USB or UART0. Both interfaces can be used for communication using the binary protocol described below.

The Module also has secondary UART (UART2) available. Using this connection, the user can view output logs which contain additional information about temporary executing commands. The default configuration is : baud: 115200, Data: 8 bit, Parity: none, Stop bits: 1 bit, Flow Control: none. Data lines can be configured to work using any free GPIO's available on the module. Additionally, it can be used to operate the RS485 interface with hardware flow control using the DE and Re lines (pin no. 15 and 16).

The Pepper C2 device can be connected directly to a host computer using a standard USB interface. In the same way it can be powered to operate as a standalone device by using power sources such as a USB charger or power bank.

The computer operating system should recognize this device as a virtual com port or USB serial device and it should appear in Windows device manager as a COM port.

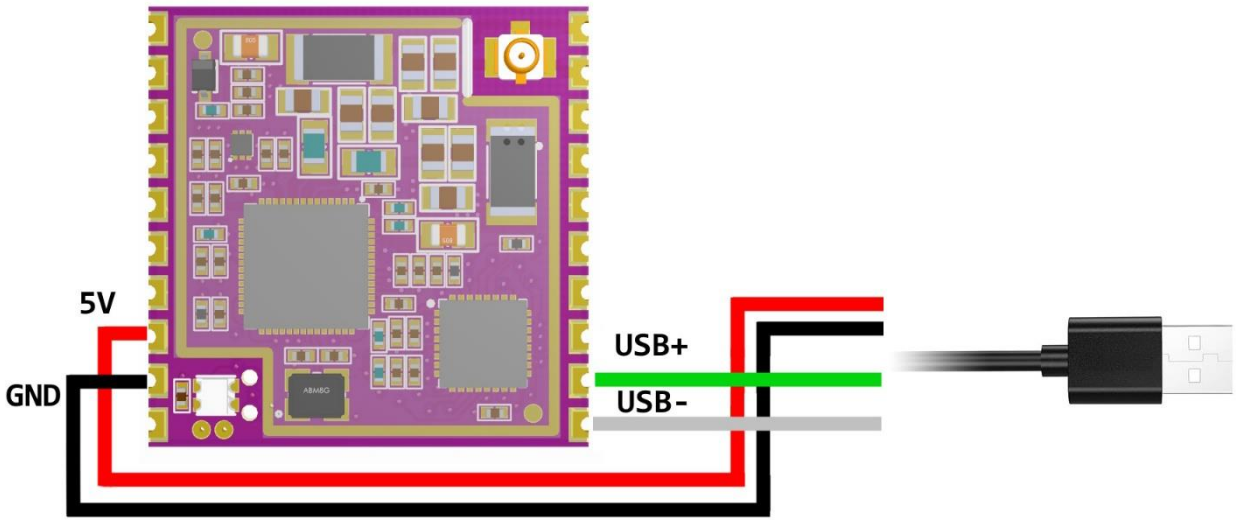


Figure 3-1. Typical connection

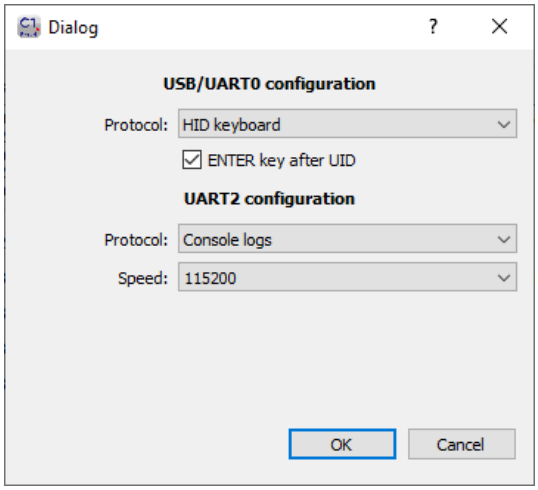
Hint *– If you don't have a USB-UART converter to see the logs on the UART2, you can temporary change the default log interface from UART2 to UART0 in Cx-client UART configuration button. Then, the logs should be available on the USB port*

3.3 HID keyboard emulation

The RFID reader can be configured to enable USB port emulation of the HID Keyboard profile. With this functionality, UID numbers of tags read during polling are transmitted as a keyboard input stream to any host device that accepts USB keyboards. To activate this profile, the Cx-client application should be used to select the HID Keyboard profile for the USB port within the USB/UART configuration menu.

Once the device is configured via the USB/UART0 interface in HID Keyboard mode, further connection to this port using the Cx-client application becomes unavailable. In order to temporarily restore the binary protocol, the BUTTON pin should be held at LOW state for 3 seconds. During this process, the device's RGB LED blinks once every second and

flashes red when the default UART emulation profile has been temporarily restored. Additionally, configuration options allow enabling automatic transmission of the ENTER key after each UID is sent.



3.4 Factory reset

To restore the device to its factory default settings, the button pin must be held at LOW state for 10 seconds. The device will indicate the completion of the factory reset process by flashing the RGB LED in white.

4. Mechanical dimension

4.1 Pepper C2R Module

All dimensions are in mm.

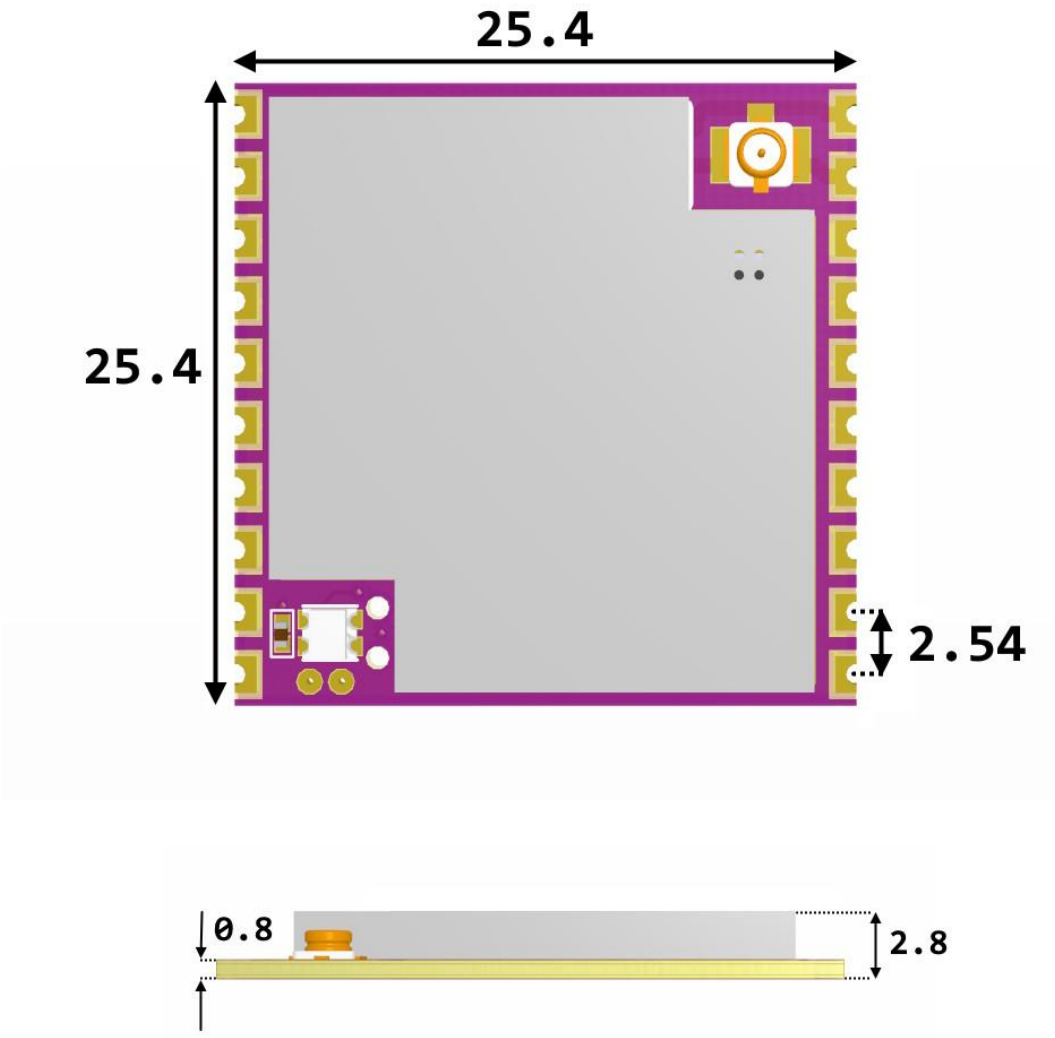


Figure 4-1

5. Configuration and functional description

Here is the document describing configuration, communication protocol, commands and all functions of the Pepper C2 reader:
https://eccel.co.uk/wp-content/downloads/Pepper_C2/C2_software_manual.pdf

Eccel provides a variety of free tools & libraries ready to be downloaded from this link:
https://eccel.co.uk/support-free-libraries/

> **Note:** Should you experience any difficulties integrating our readers into your device, please contact us at technical@eccel.co.uk. Our team can provide integration support and, where required, adapt the software and/or hardware to meet specific customer requirements. We specialize in developing custom solutions. Further information is available at: https://eccel.co.uk/custom-design/

6. RF Emissions and Susceptibility Approvals

Eccel have tested and declare that this product meets all the requirements of the relevant RF directives (RED) to be declared CE (European Union) and UKCA (United Kingdom) compliant. Please see our declaration of conformity for this on the downloads tab of the product webpage.

This product is designed to be incorporated into products easily and quickly such that those products can pass any national or regional statutory RF requirements and certifications such as FCC (USA), ISED (Canada) and PSE (Japan) for example.

This product is designed to meet all statutory RF requirements applicable worldwide using the most cost effective but robust design methodology.

Eccel is pleased to offer customers very cost-effective certification for their end equipment that incorporate this product. Prices start from £3K per approval/ certification. Please contact us for more details at sales@eccel.co.uk.

7. FCC Warning

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.

Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

> This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. Country Code selection feature to be disabled for products marketed to the US/Canada. This device is intended only for OEM integrators under the following conditions:
> The antenna must be installed such that 5mm is maintained between the antenna and users, and The transmitter module may not be co-located with any other transmitter or antenna, As long as the two conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.
> Important Note: In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.
> End Product Labeling
> The final end product must be labeled in a visible area with the following:
> "Contains FCC ID: 2ALHY-C2RMODULE”

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter

2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 5mm between the radiator & your body.

2.7 Antennas

This radio transmitter FCC ID: 2ALHY-C2RMODULE has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna No.	Operate frequency band	Antenna Type	Maximum antenna gain
C2R Family External PCB Antennas	13.553 - 13.567MHz 13.56MHz center frequency	PCB Track Loop Antenna	1

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following" Contains FCC ID: 2ALHY-C2RMODULE".

2.9 Information on test modes and additional testing requirements

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

2.11 Note EMI Considerations

Host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties.

2.12 How to make changes

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system. According to the KDB 996369 D02 Q&A Q12, that a host manufacture only needs to do an evaluation (i.e., no C2PC required when no emission exceeds the limit of any individual device (including unintentional radiators) as a composite. The host manufacturer must fix any failure.

8. Revision history

Revision	Date	Changes
1.0	22-Oct-2025	Initial release
1.1	03-Dec-2025	Current consumption section updated
1.2	06-Mar-2026	FCC Warning section added

No responsibility is taken for the method of integration or final use of the Pepper C2 readers.

More information about the Pepper C2 reader and other products can be found on the website:

http://www.eccel.co.uk

or alternatively contact Eccel Technology via e-mail at:

sales@eccel.co.uk