



Datasheet RR15 RFID Module

Art.-No. 2200 3227

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1. General Information / Security Advice

1.1. Notes on the Use of this Documentation

This user manual and integration guide uses different symbols to point out potentially dangerous situations. The following signs and symbols are used throughout the document.



ATTENTION

Declares a potentially hazardous situation. If this is not avoided, the product or something in its surrounding could be damaged.



NOTES

Declares notes for the user as well as other useful information, where no harmful or dangerous situations can be expected.

1.2. Security Advice

The RR15 HF RFID Module was not designed for use in dangerous environments. Using this product in applications where a failure could directly result in severe injuries or death (“high risk activities”) is not permitted. This includes but is not limited to applications in nuclear facilities, flight control systems, life support systems or weapon systems. The manufacturer denies the suitability of this device for such scenarios.

1.3. Export Restriction

The RR15 HF RFID Module contains components that underlie US export restrictions. It is therefore forbidden to export the product to countries that are on the US trade embargo list. The same applies to any countries that are on the EU embargo list.

1.4. Further Documentation

While this documentation explains the electrical and mechanical characteristics of the RR15 module, it might be useful to also read the Metratec Protocol Guide, which explains the ASCII protocols used to control the module in full detail. Source: <https://www.metratec.com>

2. Product Description

The RR15 HF RFID Module is an easy to use RFID module which can be integrated into host electronics without big effort. This allows you to equip your product with RFID functionality without designing your own RF board. Thanks to the tested and extremely flexible firmware you can read and write data to any tag that follows the ISO 15693 (NFC Type 5 tags) standard in no time. Even special features, e.g. sensor tags, can be used without firmware modifications. With its internal antenna a read range of up to 100mm is possible (with a credit card sized transponder).

Thanks to the fast firmware, the module is perfect for applications in printers and similar devices where high reading and writing speed is needed.



Figure 1. RR15 Module, top view

2.1. Product Revision History / Migrating from prior Revisions

This document applies to RR15 revisions starting from 01.00. All future revisions 1.xx will be according to this documentation. The hardware revision is printed on the board or can be checked using the Read Hardware Revision (RHR) command. RR15 modules feature the following improvements:

- native 3.3V UART interface
- switchable RF output power level
- up to 100 mm read range
- increased RX sensitivity

- two switchable receivers to avoid reading holes
- pre-tested EMI / EMC behaviour

2.2. Intended Use

The RR15 HF RFID Module reads RFID tags that comply to the ISO 15693 standard on a short range of 100mm. Using larger external antennas read ranges of up to 250 mm are possible using A4 size antennas and credit card sized tags. Custom tag commands can be used without firmware changes if the tags follow the ISO 15693 standard with regard to the air interface. For transponders that use the ISO 14443A or a protocol with MIFARE® technology, please use our QR14 RFID Module.

2.3. Technical Specification

The following table shows the technical specification of the RR15 module with minimum, typical and maximum values for each parameter (where applicable).

Table 1. Technical Specification

	Min.	Typ.	Max.
Supply Voltage Vcc	4.7V	5.0V	5.5V
Supply Current Standby		20 mA	
Supply Current RF on 200mW	135mA	150mA	160mA
Supply Current RF on 100mW	95mA	110mA	120mA
RF output power 200mW	150mW	200mW	225mW
V_In_low UART	-0.3V	0V	0.9V
V_In_high UART	2.3V	3.3V	3.45V
V_out_low UART	0V	0.1V	0.4V
V_out_high UART	2.9V	3.3V	3.45V

	Min.	Typ.	Max.
Operating Temperature ^[1]	-20°C	20°C	+70°C
Antenna port impedance	40Ohm	50Ohm	60Ohm
Carrier frequency ^[2]		13.56MHz	
Supported RFID Protocol		ISO 15693	
Dimensions		40 x 30 x 4.6mm	depends on connector fitted
Antenna Connector		Internal antenna, 530mm ² optional U.FL	
Communication Interface		3.3V UART	
Humidity		Non- condensing	

2.4. Pin assignments and description

All connections are available on a 2.54mm pitch 4 position THT row. This can be used to fit both board-to-board as well as board-to-wire connectors. Please specify on order.

Metratec recommends the JST S4B-EH-GU side entry wire-to-board connector which is also the default connector on the RR15.

Pins are marked in the top layer for reference. An Eagle library is available for easy integration into PCB designs. Power and UART connector is the 4 position pin header X1.

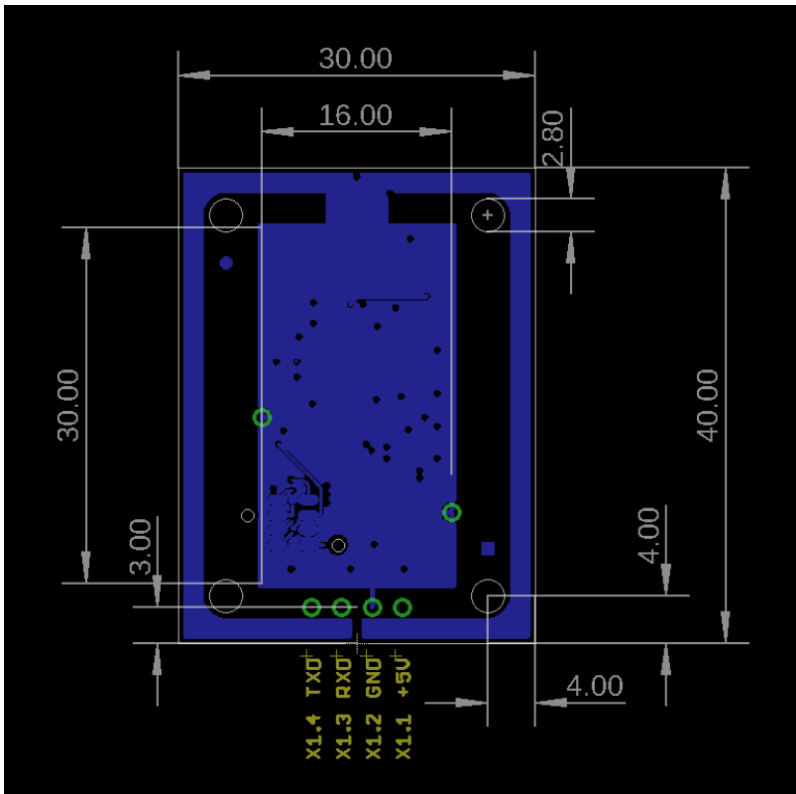


Figure 2. RR15 Pin Positions and Naming (top view)

Table 2. Power and UART Pin Connections

Pin Name	Pin Nr.	Pin Direction	PCB Marking	Pin Function
+5V	X1.1	PWR	“+”	main supply, connect low noise regulated 5V supply
GND	X1.2	Pass.	“G”	UART GND, internally connected to P_GND and G_GND
TXD	X1.3	out	“T”	3.3V UART Transmit data output 100Ohm series protection resistor and EMI low pass filter

Pin Name	Pin Nr.	Pin Direction	PCB Marking	Pin Function
RXD	X1.4	in	“R”	3.3V UART Receive data input 470Ohm series protection resistor and EMI low pass filter

2.5. Mechanical Specification

PCB dimensions of the RR15 are shown in Fig. 3. The 16 x 30 mm shield cage is 3mm high. Adding the PCB thickness, this yields a total of 4.6mm thickness of the module. Please keep in mind that the connector chosen for the particular design-in may add to the thickness both on the top and the bottom side due to THT pins and connector housing. Side entry connectors will extend way beyond the PCB edges as indicated by the red shaded rectangle in Fig. 2.

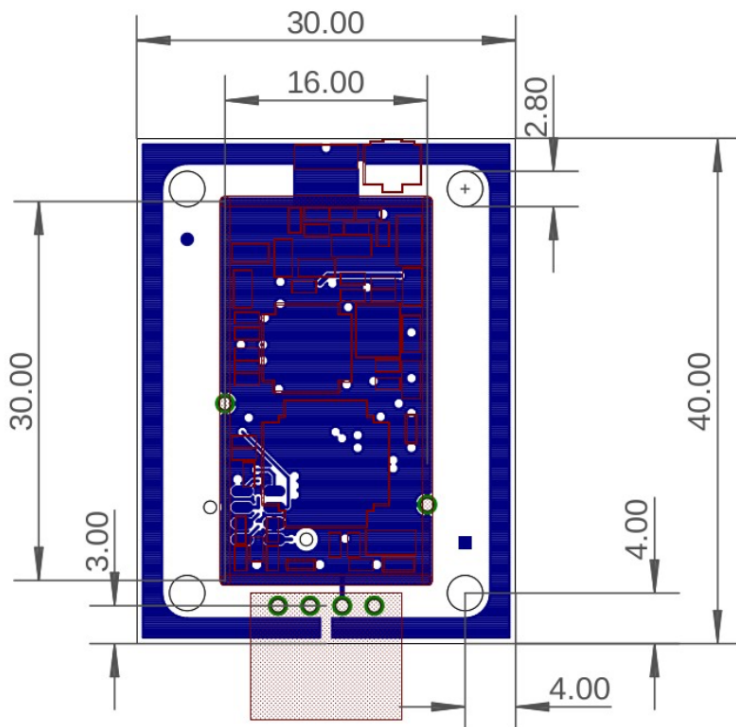


Figure 3. Mechanical Dimensions RR15

2.6. Scope of Delivery

The RR15 HF RFID Module comes with the following parts:

- RR15 HF RFID Module
- Documentation, Drivers and Demo Software are available via download from Metratec's website

2.7. Accessories

The following accessories and modules are available to extend and evaluate the functionality of the RR15 HF RFID Module:

- UDB Mini Evaluation Board
- HF Field Detector
- different RFID tags suitable for almost every application

[1] RFID performance may vary with temperature, check in application

[2] Usable worldwide.

3. RFID Integration Hints

The RR15 features an onboard antenna emitting a magnetic field at 13.56MHz. Therefore, the design should have no loops of wires or traces close to the module. This could lead to unintended inductive coupling and affect the function of the RFID module, the host and cause EMI problems.

There should be no wires or traces crossing the area behind the module, traces will detune the internal antenna and reduce reading performance. The same applies to metallic parts of substantial size close to the module. There should be no ground planes parallel to the module, keep the module area clear of copper in all PCB planes.

The module features complete shielding of all RF circuitry which is necessary for the FCC modular approval. However, copper plane and shield cage of the module were designed to work with the onboard antenna. The effect of adding additional metallic parts is rather unpredictable. Please contact Metratec if you have doubts that all of the above hints can be incorporated into your design. When using an external antenna connected via the U.FL connector the above applies to the external antenna. Only one antenna may be connected at a time.

4. Power Supply and Power Consumption

The module does not feature a reverse polarity protection. It is the task of the host board to supply a well filtered 5 V DC supply in order to achieve an optimum RFID performance.

All internal voltages are derived from the 5V supply using onboard regulators. However, RFID systems require a very high level supply quality. Use linear regulators with high precision and high control speed whenever possible. When using switching power supplies make sure the design is low noise over all load conditions and use an EMC optimized layout as well as shielded inductors.

4.1. Hints for additional EMC filtering

The RR15 Module contains an RF generator at 13.56 MHz which also generates harmonics. These will be radiated from the module below current certification limits. When integrating the module into another device with long cables or big ground planes, radiated emissions might increase. It is advisable to follow good layout practices and add additional EMC filtering to comply with all relevant norms. Common mode supply filters are required in most cases to comply with basic radiated emission rules. The following picture shows radiated emissions of a RR15 RFID engine mounted on a Metratec evaluation board.

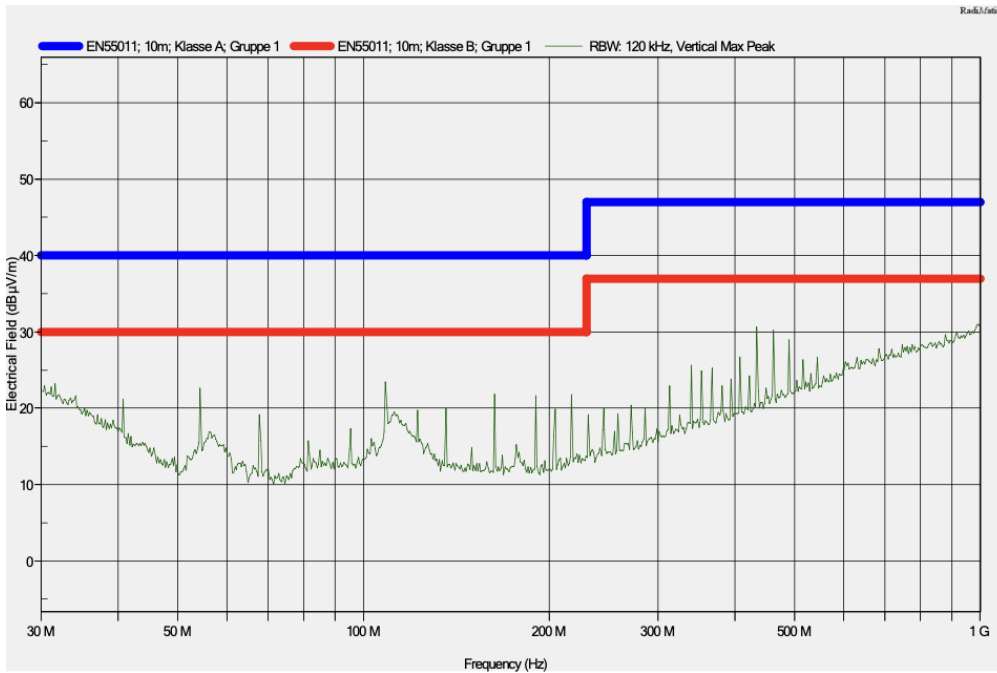


Figure 4. Radiated Emissions of RR15 frontend at full output power (200mW), external 2250 mm² antenna area

5. Communication

The RR15 HF RFID Module communicates with its host using a 3V3 UART connection. This enables direct connection to a host microcontroller. The communication details of the serial interface are given in the table below.

Table 3. Communication Interface Specification

	Min.	Typ.	Max.
Baudrate	114 000	115 200	116 500
Databits		8	
Parity		None	
Stopbits	1	1	1.5

There is a range of circuits available to convert the 3.3 V UART Signal to RS232, USB or Ethernet. Please contact Metrateg if you need advice on converter circuits.

The UART commands used to control the RR15 Module are described in the Metrateg ISO15693 Protocol Guide. This guide comprises a detailed description of all commands, response formats and examples. As this protocol is shared among several Metrateg products the guide is available in a separate document from Metrateg’s website.

6. Digital Inputs / Outputs (GPIOs)

The RR15 Module does not feature GPIOs. Please consider using the QR15 or the Dwarf15 from the same product family if your application needs input or output pins. Both feature 8 GPIOs.

7. Certification



ATTENTION

Changes or modifications to the module not expressly approved by Metratec could void the user's authority to operate the equipment.

7.1. CE / ETSI (EU)

The RR15 HF RFID Module complies with ETSI EN 300 330. Nonetheless, the integrator of the module has to make sure that all requirements are met by the final product. It is his obligation to declare product conformity. We recommend to assign this task to a qualified third-party test lab specialized on EMC measurements.

7.2. FCC (USA)

To fulfill all FCC requirements the integrator must test the final product to comply with FCC regulations regarding intentional and unintentional radiators before declaring FCC compliance of his own product. The module meets the requirements for an FCC modular approval as a single-modular transmitter. Please contact Metratec in case a modular approval is beneficial for your integration project.

7.3. IC (Canada)

Certification requirements for Industry Canada (IC) are similar to those of the FCC. Limits of ICES-003 for radiated emissions are similar to the formats specified in FCC Part 15 and CISPR 22. Industry Canada accepts FCC test reports or CISPR 22 test reports for compliance with ICES-003. The integrator is responsible for its product to comply with all relevant IC rules.

8. Further Notes

Electronic devices like the RR15 HF RFID Module are covered by the (German) ElektroG (electronic waste law) as well as the European WEEE directive and as such may not be disposed of by way of the normal household trash. Instead they have to be recycled properly. For you as our customer this is no additional burden, however, as you can send the device back to us for proper recycling. We assure you that the devices received back will be recycled properly and in an environmentally friendly way. Our WEEE Registration ID is DE 56060482.

When selecting electronic components we additionally made sure that all components are free of heavy metals and other harmful substances as required by the RoHS Directive for many industries. Hence, our products are produced in the most environmentally friendly way possible.



9. Version History

The following table shows the different version of this file.

Table 4. Version History

Version	Change	Changed by	Date
1.0	Created preliminary version, no modular approval yet, read range tbd	TM	17.3.2021
1.1	Updated layout, added missing info	KD	29.12.2022
2.0	Updated Layout, Port to new doc generation	KD	16.4.2023

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We are constantly improving our products. Changes in function, form, features can happen without prior notice.