

Datasheet RR15 RFID Module

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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.

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.

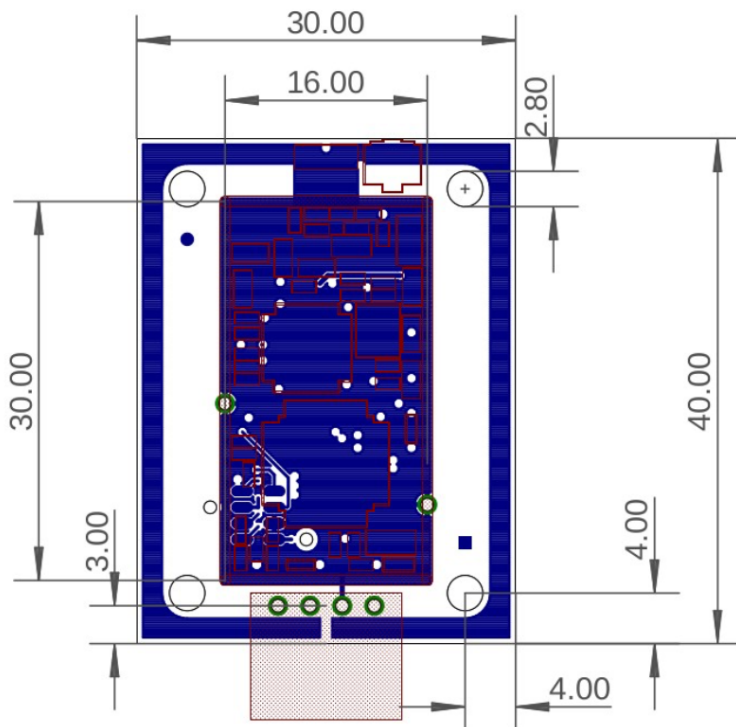


Figure 3. Mechanical Dimensions RR15

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.

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

The FCC ID of the RR15 is:

YUH-RR15.

7.2.1. FCC Statement

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

7.2.2. Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2. 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.

7.2.3. 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.

7.2.4. Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

7.2.5. Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01r01

List of applicable FCC rules

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

Specific operational use conditions

Not applicable

Limited module procedures

Not applicable

Trace antenna designs

Not applicable

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 20 cm between the radiator and your body.

Antennas

This radio transmitter FCC ID: YUH-RR15 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.	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
NFC	/	PCB Loop antenna	-18 dBi	13.56 MHz

Label and compliance information

The final end product must be labeled in a visible area with the following:
"Contains FCC ID: YUH-RR15".

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.

Additional testing, Part 15 Subpart B disclaimer

The 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 Subpart B.

Note EMI Considerations

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

How to make changes

This module is stand-alone modular. If the end product will involve multiple simultaneously transmitting modular transmitters in a host, the host manufacturer has to consult with the module manufacturer for the installation method in end system. According to the KDB 996369 D02 Q&A Q12, that a host manufacturer 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.

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
2.1	FCC statement added	TM	15.1.2026

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