Technical Documentation

for metraTec QR14 HF RFID Module

Date: December 2016

Version: 1.5

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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 QR14 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 QR14 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 QR14 module, it might be useful to also read the metraTec Protocol Description for metraTec Readers using MIFARE® Technology, which explains the protocols used to control the module in full detail.

All further documents can be either found at the metraTec's product web page or are listed at: http://www.metratec.com → Support → Downloads → Documentation

2 Product Description

The QR14 HF RFID Module is an easy to use RFID module which can be integrated into your 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 protocols using MIFARE® Classic and MIFARE Ultralight® technology in no time. With its internal antenna a read range of up to 50mm is possible.

Thanks to the quick firmware, the module is perfect for applications in access systems, time attendance systems, printers and similar devices where high reading and writing speed is needed.

2.1 Intended Use

The QR14 HF RFID Module reads RFID tags that follow the MIFARE Classic and MIFARE Ultralight protocol on a short range of 30-50 mm. For transponders that use the ISO 15693 standard, please use our QR15 RFID Module.

2.2 Technical Specification

Power Supply	5 V DC, 90 mA
Communication	5 V UART
Antenna Connector	Internal Antenna
Transmit frequency	13.56 MHz
RF output power	250 mW
Supported RFID Protocol	MIFARE Classic, MIFARE Ultralight
Temperature Range	-20 °C to +70 °C
Dimensions	5.08 x 5.08 mm (2" x 2")

2.3 Module Building Blocks

The QR14 module consists of four building blocks, each of them carrying out one of the following functions:

- *UART-communication and power supply* – host communication via 5 V UART and 5 V power supply are connected to the host board via pin

- *Microcontroller* – the heart of the QR14 running the metraTec firmware

- *RF Frontend* – generates the signal transmitted to the tag and evaluates the Tag response

- *Internal antenna* – the internal 50 mm x 50 mm antenna can achieve reading distances up to 50 mm
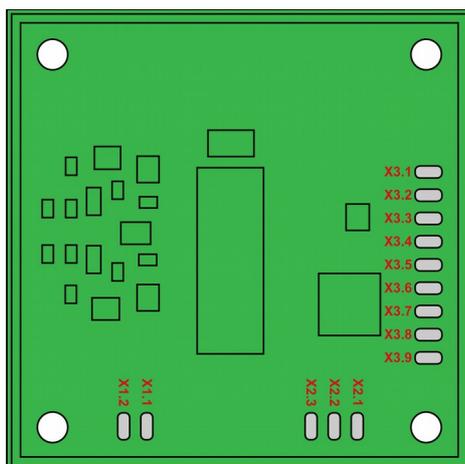

Fig. 1: QR14 Module

Fig. 2: Pin headers and jumper on the QR14 (GPIOs are optional)

2.4 Mechanical Specification
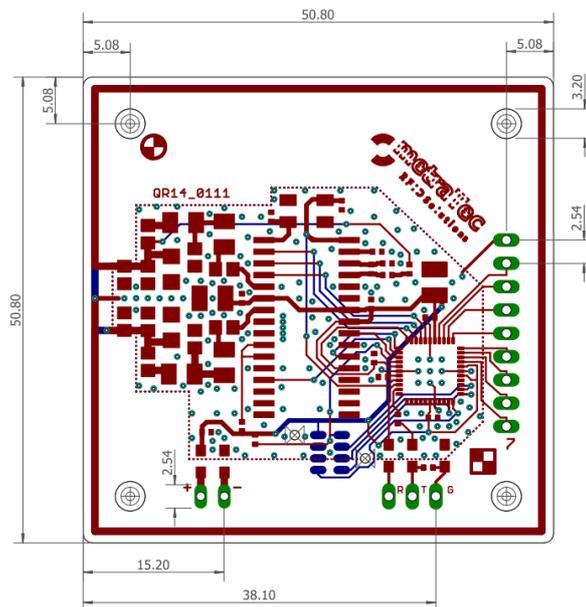
Fig. 3: Dimensions of QR14 (in mm)

2.5 Scope of Delivery

The QR14 HF RFID Module comes with the following parts:

- QR14 HF RFID Module

- Documentation, Drivers and Demo Software are available via download from metraTec's website

2.6 Accessories

The following accessories and modules are available to extend and evaluate the functionality of the QR14 HF RFID Module:

- UDB Mini Evaluation Board

- HF Field Detector

- different RFID tags suitable for almost every application

3 Power Supply and Power Consumption

The module does not feature a power supply nor reverse polarity protection. It is the task of the host board to supply a well filtered 5V DC supply in order to achieve an optimum RFID performance.

Pin	Pin Function
X1.1	GND
X1.2	5 V DC

Tab. 1: Power Supply Pins

Power supply voltage	5 V DC
Current consumption, RF on	90 mA
Current consumption, RF off	50 mA
Current consumption, sleep	10 mA
GPIO voltage level	5 V

Tab. 2: DC characteristics

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 switching speed is above 500 kHz and use an EMC optimized layout as well as shielded inductors.

3.1 Hints for additional EMC filtering

The QR14 Module contains an RF generator at 13.56 MHz which generates harmonics. These will be radiated from the module below all official limits. When integrating the module into another device with long cables or big ground planes, this effect might increase. It might be advisable to add additional EMC filtering to comply with all relevant norms.

The following figure shows a possible schematic that can be used to fulfill most relevant norms. If you use this set up, do not connect the GND pin of the UART (between reader module and main device).

CM Choke z.B. WE 744212331   Ferrit z.B. WE 742792656   2u7 z.B. 7440320027

+VS_RFID

RFID_GND

L1
3   4
1   5

AGND   GND

L2
1   2
+

C1
100n

GND

L3
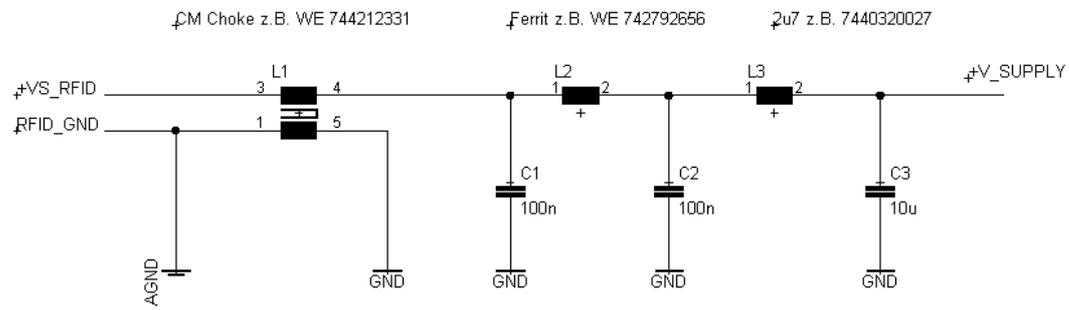1   2
+

C2
100n

GND

+V_SUPPLY

C3
10u

GND

Fig. 4: Schematic for additional EMC filtering

4 Communication

The QR14 HF RFID Module communicates with its host using a 5 V UART connection. This enables direct connection to a host microcontroller. The communication details of the serial interface are 115.200 Baud, 8 Databits, 1 Stopbit, no Parity, no Handshake/Flowcontrol.

There is a range of circuits available to convert the 5 V UART Signal to RS232, RS422/485 or to USB or Ethernet. Please contact metraTec if you need advice on such converter circuits.

Pin	Pin Function
X2.1	GND
X2.2	Tx
X2.3	Rx

Tab. 3: UART Pin connections

The UART commands used to control the QR14 Module are described in the metraTec Protocol Guide. This guide comprises a detailed description of all commands, response formats and examples. As this protocol is shared among several metraTec products the guide is available in a separate document.

Please see: www.metratec.com --> Support --> Downloads --> Documentation

5 Optional Modifications

5.1 General Purpose Inputs/Outputs (GPIOs)

The QR14 Module has eight freely configurable input/output pins which can be set and read via the module. To use these GPIOs, just solder on a pin header or cables into the corresponding vias (X3). All signals are 5 V DC signals.

> ⚠️ **ATTENTION**
>
> Please make sure that you only connect 5 V level devices to the GPIOs or use the right level shifter if connecting other devices. Many automation devices use 24 V DC inputs/outputs. If you connect these without proper protection, this will most likely destroy the QR14.

Pin	Pin Function
X3.1	GND
X3.2	Input/Output 0
X3.3	Input/Output 1
X3.4	Input/Output 2
X3.5	Input/Output 3
X3.6	Input/Output 4
X3.7	Input/Output 5
X3.8	Input/Output 6
X3.9	Input/Output 7

Tab. 4: Overview of digital input/output pins

5.2 External Antenna Connector

The QR14 has the option to add an external antenna connector (MMCX connector) next to the GPIOs. Please contact our technical support for further instructions on how to enable this and how to use an external antenna with the module.

6 Certification

⚠️ **ATTENTION**

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

6.1 CE / ETSI (EU)

The QR14 HF RFID Module complies with ETSI Rule 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.

6.2 FCC (USA)

The QR14 HF RFID Module complies with Part 15 of the FCC Rules. Since the module has no internal power supply regulation as well as no RF shielding (which would disturb the internal antenna) the device cannot get a full modular approval according to FCC Rules (see FCC document DA 00-1407)

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.

6.3 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.

7 Further Notes

Electronic devices like the QR14 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.

8 Version History

Version	Change	Changed by	Date
1.0	created	KD	11.03.2009
1.1	Pin Description added	KD	15.11.2010
1.2	Mechanical Dimensions added	KD	19.06.2012
1.3	Corrected use of Label MIFARE®	CS	20.01.2014
1.4	Minor changes, Further Notes added	CS	16.06.2015
1.5	update address and images	KS	05.12.2016

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