Integration Guide

Mizar Radio Module 915 MHz

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Document history

Date	Author	Notes
April 19th, 2012	Davide Carli	Initial draft
May 2nd, 2012	Davide Carli	Added details on test command(s) 0x86
May 31th, 2012	Davide Carli	In-depth documentation of test commands
July 18th, 2012	Davide Carli	Added data on current consumption in DEEP SLEEP status
April 15th, 2013	Davide Carli	Updated the description of some test commands
December 20th, 2013	Davide Carli	Document splitted in 433 MHz and 915 MHz versions RF Characteristics updated according to FW 2.01A and 2.01B Removed outdated information
January 15th, 2014	Davide Carli	RF Characteristics updated according to FW 2.02B
February 11th, 2014	Pier Giorgio Peruzzi	Added Operational description and Interface description

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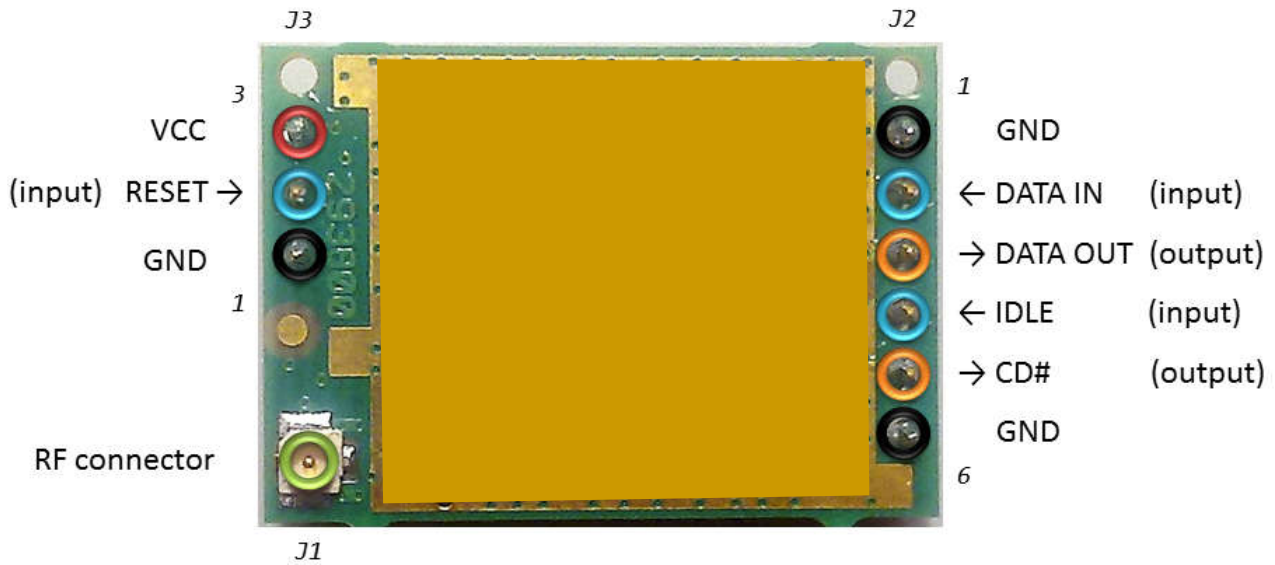Subject: Integration Guide – Mizar Radio Module 915 MHz

DATALOGIC
AUTOMATIC DATA CAPTURE
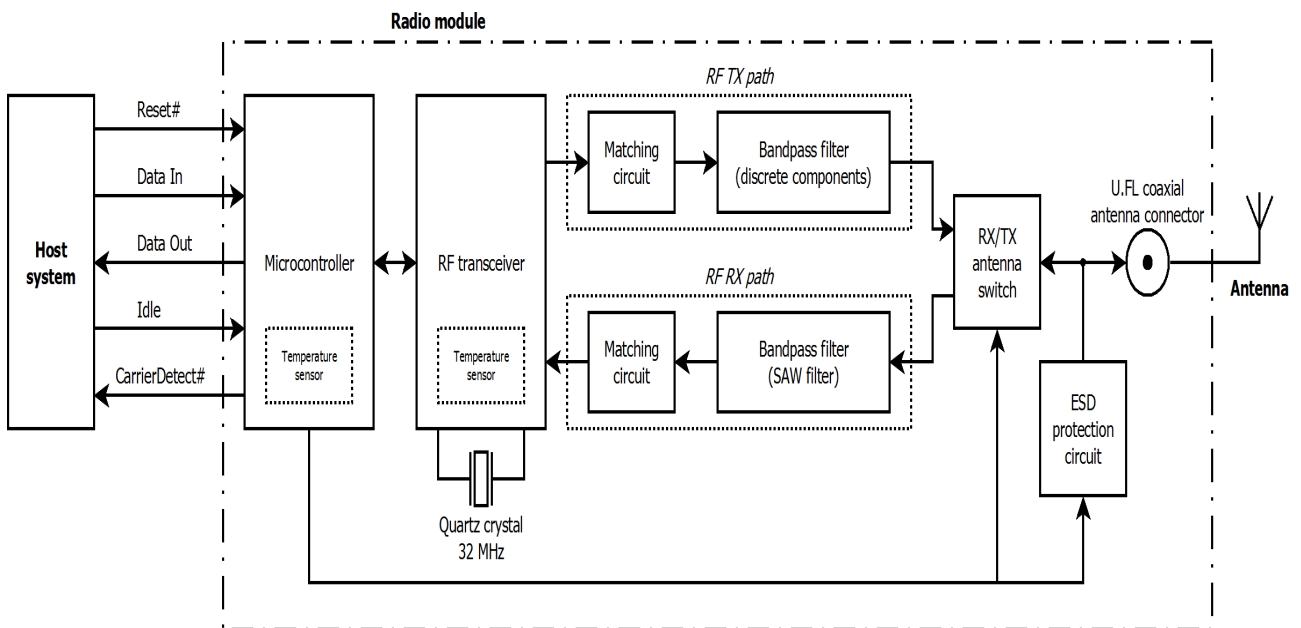
Introduction

Mizar radiofrequency (RF) module operates in the 902-928 MHz ISM frequency band.

Pinout

Block diagram

Operational description

The equipment is a radio module to be integrated inside cordless devices.

It is based upon an FSK (Frequency Shift Keying Modulation) Half-Duplex transceiver working in the ISM band from 902 to 928 MHz.

The radio module has a UART interface to exchange data and commands.

Working modes

Radio module can operate in the follow working modes :

- Low Speed, Low Power, fixed channel (among 25 channels)
  - FSK, Bitrate 36864 bps, RZ Manchester encoded, Frequency deviation +/- 75KHz

- Low Speed, Frequency Hopping Mode over 25 channels
  - FSK, Bitrate 36864 bps, RZ Manchester encoded, Frequency deviation +/- 75KHz

- High Speed, Digital Transmission Mode, fixed channel (among 12 channels)
  - FSK, Bitrate 500,000 bps, NRZ, Frequency deviation +/- 220KHz

- High Speed, Digital Transmission + frequency agility Mode over 12 channels
  - FSK, Bitrate 500,000 bps, NRZ, Frequency deviation +/- 220KHz

Default mode after power-up is Low Speed Low Power mode.

Radio module can receive commands to allow to change its working mode.

Functional states

Radio module can be set in one of the following states during operation:

Idle State

Radio module stays in low power receiving mode with a limited capability to receive data. RF transmission is not allowed while radio is set in Idle state.

Receive State

It is the normal default state. In this state the radio receives the RF packets, decodes the packets and sends them to the Host device. In this mode the transceiver checks continuously the RF signal and demodulates it. The demodulated and filtered signal is sent to the microcontroller inside the radio module which decodes it and sends decoded data to the Host by means of the UART interface. Only valid demodulated data packets are sent to the Host.

Transmission State

This state is enabled from the host when it needs to transmit data. The transmission state is enabled sending a data packet to the radio module over the UART interface. The microcontroller in the radio module checks for the integrity of the data packet and enables the transceiver to modulate and transmit to the RF interface, preceded by a short preamble burst. Radio module exits automatically from this state when the complete packet has been transmitted, and returns to the receive state.

Radio module operates in CSMA-CA (carrier sense multiple access – collision avoidance) : transmission is enabled when the RF channel is not busy by the use of a "carrier detect" function. Radio module accesses the channel in a fair way using a backoff algorithm.

Interface description (pinout reference)

UART 2-pin interface, used to exchange data from the Host:
> DATA_OUT (output pin) : transmits data to Host.
> DATA_IN (input pin) : receives data from Host.

CD# – (output pin) Carrier Detect :
> When radio is in receive mode, this pin signals the presence of RF carrier.

IDLE - (input pin) :
> A high level on this pin forces the radio module in Idle State.

RESET (input pin) :
> A low level on this pin resets the radio module.

VCC and GND :
> Radio module power supply.

RF Port :
> Radio Frequency Connector for the antenna.

Electrical characteristics

Table 1

Parameter	Min.	Typ.	Max.	Unit
Power supply voltage (between VCC pin and GND pin)	3,1	3,3	3,6	V
Operating temperature range	-30	---	+85	°C

RF characteristics

Low speed mode

Table 2

Parameter	Typ. value	Unit
Modulation	RZ Manchester	
Bit rate (over-the-air)	36864	bit/s
Frequency deviation	± 75,000	kHz
Number of supported channels	25	
Index of default channel	8	
Center frequency of default channel	910,00000	MHz

Table 3

Channel index	Channel center frequency [MHz]
1	902,80050
2	903,82900
3	904,85750
4	905,88600
5	906,91450
6	907,94300
7	908,97150
8	910,00000
9	911,02850
10	912,05700
11	913,08550
12	914,11400
13	915,14250
14	916,17100
15	917,19950
16	918,22800
17	919,25650
18	920,28500
19	921,31350
20	922,34200
21	923,37050
22	924,39900
23	925,42750
24	926,45600
25	927,48450

High speed mode

Table 6

Parameter	Typ. value	Unit
Modulation	NRZ	
Bit rate (over-the-air)	500000	bit/s
Frequency deviation	± 220,000	kHz
Number of supported channels	12	
Index of default channel	4	
Center frequency of default channel	910,00000	MHz

Table 7

Channel index	Channel center frequency [MHz]
1	903,64900
2	905,76600
3	907,88300
4	910,00000
5	912,11700
6	914,23400
7	916,35100
8	918,46800
9	920,58500
10	922,70200
11	924,81900
12	926,93600

Federal Communications Commission (FCC) Statement

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

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.

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 of the device.

FCC RF 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 20cm between the radiator & your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

In accordance with KDB 447497 D01, section 4.3.1, this module is exempt from Head/Body SAR testing when installed in a host product with a Head/Body to antenna separation distance of ≥ 17mm.

If the module is to be used with a smaller separation distance than the above, SAR testing must be performed.

In accordance with KDB 447497 D01, section 4.3.1, this module is exempt from Extremity SAR testing when installed in a host product with a Extremity to antenna separation distance of ≥ 7mm.

If the module is to be used with a smaller separation distance than the above, SAR testing must be performed.

Industry Canada (IC) Statement
This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

In accordance with RSS-102, section 2.5.1, this module is exempt from Head/Body SAR testing when installed in a host product with a Head/Body to antenna separation distance of ≥40mm.
If the module is to be used with a smaller separation distance than the above, SAR testing must be performed.

In accordance with RSS-102, section 2.5.1, this module is exempt from Limb-Worn/Extremity SAR testing when installed in a host product with a Limb-Worn/Extremity to antenna separation distance of ≥ 15mm

If the module is to be used with a smaller separation distance than the above, SAR testing must be performed.

Canada, avis d'Industry Canada (IC)
Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le
brouillage est susceptible d'en compromettre le fonctionnement.

Caution: Exposure to Radio Frequency Radiation.
To comply with RSS 102 RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.
Pour se conformer aux exigences de conformité CNR 102 RF exposition, une distance de séparation d'au moins 20 cm doit être maintenue entre l'antenne de cet appareil et toutes les personnes

Conformément à la section 2.5.1 du RSS-102, ce module est exempté de test SAR tête / corps lorsqu'il est installé dans un produit hôte avec une distance de séparation antenne tête / corps ≥ 40 mm.

Si le module doit être utilisé avec une distance de séparation inférieure à celle indiquée ci-dessus, un test SAR doit être effectué.

Conformément à la section 2.5.1 du RSS-102, ce module est exempté de test de SAR / extrême-membre lorsqu'il est installé dans un produit hôte avec une distance de séparation d'antenne supérieure / supérieure-à-antenne de ≥ 15 mm.

Si le module doit être utilisé avec une distance de séparation inférieure à celle indiquée ci-dessus, un test SAR doit être effectué.

End Product Labeling:
The final end product must be labeled in a visible area with the following:
"Contains FCC ID: U4F0022, IC: 3862D-006".

Antenna list

Rubber Antenna *P/N: ANT-916-CW-QW*	
Rubber Antenna *P/N: G-RA0K14155047-BON*	
Printing Antenna *P/N: 663316020*	
ANTENNA CABLE GM4100-910	