台揚企業集團
MTI Group

NOTE: APPROVAL ON THIS PAGE SIGNIFIES THE ENTIRE DOCUMENT APPROVED.

RU00-M04 RFID Spitfire Module

Specifications

REV	ECO NO.	DATE	CHANGE INFORMATION	AUTHOR
A1	ECO-	10-25-2016	New Release	江 東 曄

DARWING NO.: ***11- RU00-M04-X001-01***

APPROVED BY 葉曜誠

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。

MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

REVISION HISTORY

DARWING NO.: ***11- RU00-M04-X001-01*** TITLE: ***RU00-M04 RFID Spitfire Module Specification***

台揚集團智慧財產

任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。

MTI Group Proprietary Information

Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

台揚科技股份有限公司
MICROELECTRONICS TECHNOLOGY INC.
ISO 9001 Certified

RU00-M04-X001 / X011

Spitfire Module

Datasheet

Version 1.0.0

MTI Group Proprietary Information

Any unauthorized use, duplication, reproduction, reverse engineering, decompilation, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, the infringer may be accused and liable applicable legal penalties.

Copyright, Microelectronics Technology Inc.. All rights reserved.

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。

MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

Table of Contents

Figures

Tables

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。
MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

1 Introduction

The RU00-M04 is a FPC I/O connector, USB/UART interface that comprises a completely in integrated solution for EPC Gen 2 / ISO18000-63 (formerly 18000-6C) application.

This document provides instructions to the end-user to ensure optimal performance in their OEM hardware.

Model Number	Supported Regions	Operating Frequency
RU00-M04-X001	US	902.75MHz~927.25MHz
	EU	865.7MHz~867.5MHz
RU00-M04-X011	CN	920.625MHz~924.375MHz
	JP	916.8MHz~920.4MHz

Table 1: Band configurations

Regions configuration in different end-use products is limited by an original equipment manufacturer (OEM)

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。
MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

2 Regulatory Statement

● Federal Communication Commission Interference 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 (if EUT is portable device, please delete this item) (2) this device must accept any interference received, including interference that may cause undesired operation.

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 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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 21cm between the radiator & your body.

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。
MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

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 **2** conditions above are met, further transmitter test 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 can not 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 can not 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

FOR MOBILE DEVICE USAGE (>20cm/low power)

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains FCC ID:MAD-RU00-M03”. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

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 show in this manual.

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。
MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group’s intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

3 Specifications

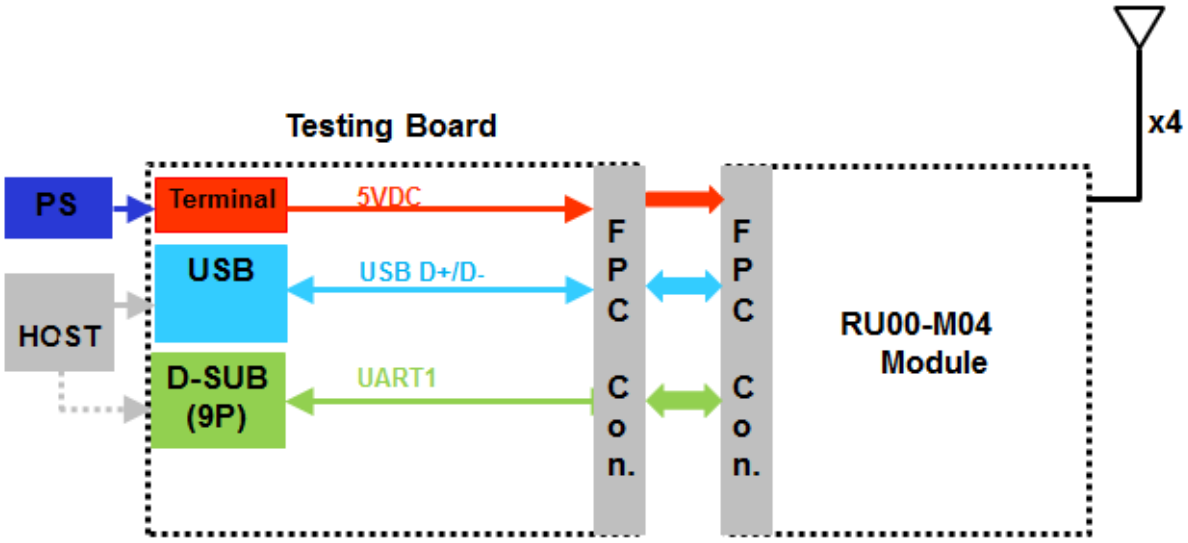
Item	Description	Specifications
1	Air Interface Protocol	EPCglobal UHF Class 1 Gen2 / ISO 18000-63 (formerly 18000-6C) Supports dense reader mode (DRM)
2	Tx Output Power	Range: +10 to +31.5 dBm
3	RF Connectors	UF.L*4
4	Dimensions	Spitfire Module + Back Plate : 75 mm by 44 mm by 9 mm
5	I/O Connector	FPC 20Pin
6	Rx Sensitivity	-74dBm. Assumes operation in profle 1, and a 15 dB antenna return loss at 31.5 dBm output power.
7	DC Power Supply	3.3 to 5.25 Volts (The min. voltage 3.3V is limited by USB interface)
8	Supported Regions	Worldwide regional support via FW configuration in different SKUs
9	Control Interface	UART or USB

Table 2: Specifications

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。
MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

4 Set up

HOST can control the ru00-m04 module through the USB or UART on the test board. The RU00-M04 can be easily powered by DC 5V. Set up refer to below figure.



台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。
MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

5 Pin Configurations and Descriptions

The module is controlled via 20-pin FPC I/O connector. The pin configurations are shown in Figure 2 and Table 3.

Figure 1: I/O Configurations

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。
MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

Pin Number	Pin Name	Type	Description
1,2,3	VDC	Power	Power Supply
4	GND	Ground	Ground
5	USB_nSENSE	Input	Active low pulse for USB enumeration process. The low pulse need be more than 1ms.
6	USB_D+	I/O	USB Data Signal Plus
7	USB_D-	I/O	USB Data Signal Minus
8	GND	Ground	Ground
9	UART1_TX	Output	UART Console Transmit Data
10	UART1_RX	Input	UART Console Receive Data
11	GND	Ground	Ground
12	ENABLE	Input	Active High Enable Device
13	WAKEUP	Input	Active High Wake up Device
14	GND	Ground	Ground
15	GPIO1	I/O	General Purpose Input/Output
16	GPIO2	I/O	General Purpose Input/Output
17	GPIO3	I/O	General Purpose Input/Output
18	GPIO4	I/O	General Purpose Input/Output
19	STATUS	Output	Status Indication
20	HEALTH	Output	Status Indication

Table 3: Pin Configurations of FPC connector

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。
MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

6 Mechanical Information

● Mechanical Outline (Draft)

Spitfire Module + Back Plate：75 x 44 x 9mm

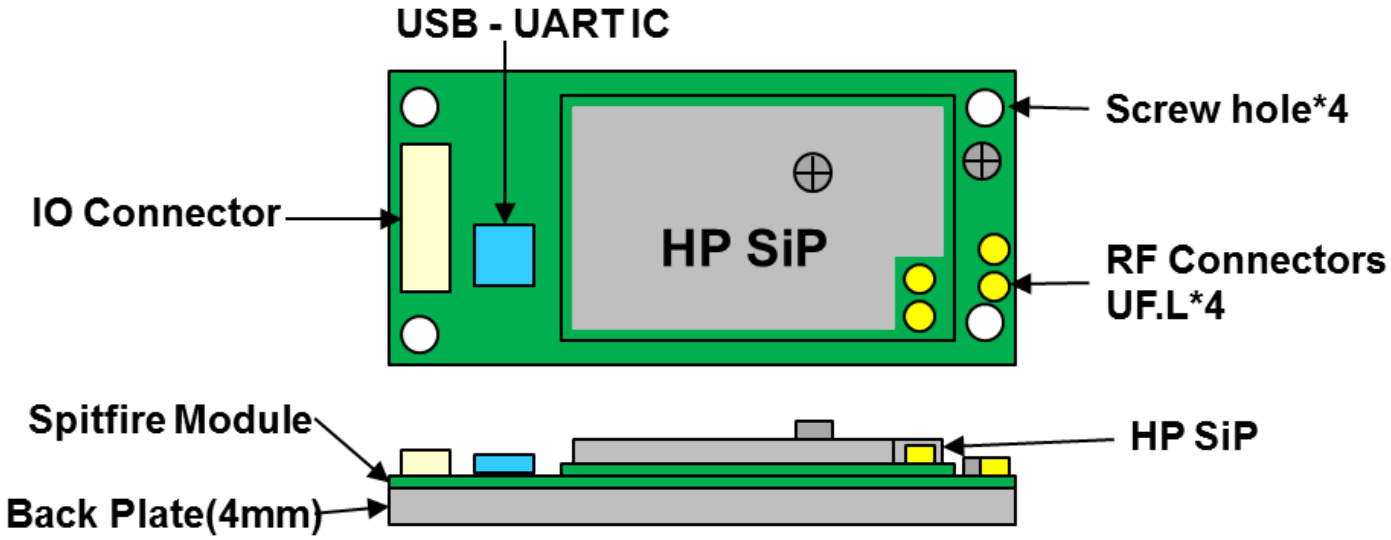


Figure 2: Package Mechanical Outline

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。
MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

7 Interfacing to the RU00-M04

➢ Power and Ground

All circuits on the RU00-M04 are powered from inputs at pin 1, 2, 3. The RU00-M04 operates with any supply voltage between 3.3 and 5.25V. Because the individual supplies within the part are regulated on the RU00-M04, a large amount of supply filtering is not required. A high value, low ESR tantalum capacitor (150uF or greater) is recommended and should be accompanied by a 0.1uF ceramic chip capacitor close to the pin.
All 4 available ground pins (pin4, 8, 11, 14) of the RU00-M04 must be connected to the user PCB via 20 pin FPC cable.

➢ Communication

The RU00-M04 has one UART ports, which utilizes 3.3V CMOS I/O over a pair of pins. The UART is compatible with a standard RS-232C serial port through an appropriate level translator IC. The user's host processor issues LLCS commands to the HOST UART (RX pin 10, TX pin 9), which can be configured for any standard UART data rate for 115.2k, 230.4k, 460.8k and 921.6 kbaud. The default rate is set to 115.2 kbaud. Please see the RU00-M04 data sheet for detailed I/O specifications.

➢ RF

The RU00-M04 is configured for monostatic operation, which requires only a single RF I/O pin for full duplex communication. There are four antenna port, they are required to be connected with 50ohm RF cable.

➢ GPIO

There are four user-configurable digital GPIOs on the RU00-M04. The signals are number GPIO1 – GPIO4 and occupy pins 15 – 18 respectively. Each GPIO operates at standard 3.3V CMOS logic levels with a minimum output current capability of 4 mA per pin while maintaining guaranteed noise margins. Appropriate interface circuitry and layout as well as handling of the OEM hardware should be applied. Please see the RU00-M04 data sheet for detailed I/O specifications.

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。
MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

➢ Enable

Pin 12 of the RU00-M04 comprises the ENABLE signal. The RU00-M04 is held in reset if the signal is held low. The ENABLE signal is bidirectional and is pulled down to 3.3V by ~10kΩ resistance internal to the RU00-M04. Any external connection to this pin must maintain a low impedance (<<10kΩ) other than when an external reset signal is applied. This allows the RU00-M04 to exert control of the reset line during power up and other situations that require it.

➢ Health and Status

RU00-M04 pin 20 is a dedicated digital output that indicates the HEALTH of the RU00-M04. After the RU00-M04 is successfully booted and in its operational state, the health output switches to low. Otherwise, the output is high. The OEM can digitally monitor this signal or use it to drive an LED for visual indication of the RU00-M04 health.

Pin 19 is a dedicated digital output that indicates the tag inventory STATUS of the RU00-M04. When the RU00-M04 is successfully inventorying one or more tags, it will generate 0.5ms minimum high pulse. The output remains low when no tags are being inventoried. Like the health signal, the OEM can monitor it via firmware or use it to drive an LED for visual indication to the device user.

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。

MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.

8 Revision History

Version Number	Description	Revision Date
1.0.0	Initial release	25-Oct-16

Table 4: Revision history

台揚集團智慧財產
任何未經授權逕予複製、重製、公開或使用本文之行為，將被視為侵害台揚集團之智慧財產權，將可因此負擔法律責任。

MTI Group Proprietary Information
Any unauthorized use, duplication, reproduction, or disclosure of this document may be considered as infringement of MTI Group's intellectual property rights, and the infringer may be accused and liable applicable legal penalties.