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PARAFAIT

RF Tag Readers – User Manual

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Notice

About this document

Purpose

This is a document to guide you through the setup and usage of Semnox's Parafait RF Tag Readers.

Technical Support

We are here to help!

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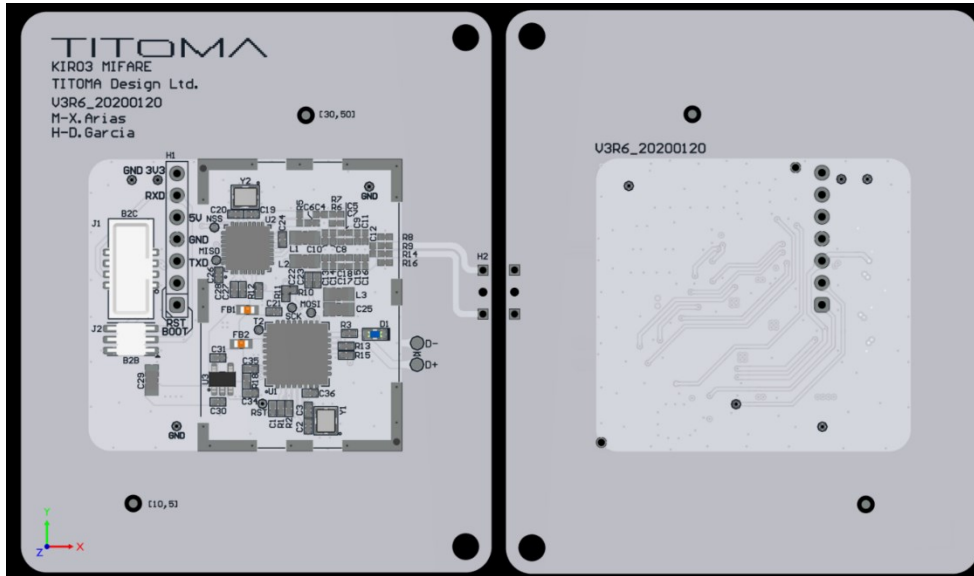**Phone**: +91 9008005544, +91 9482128588
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Contents

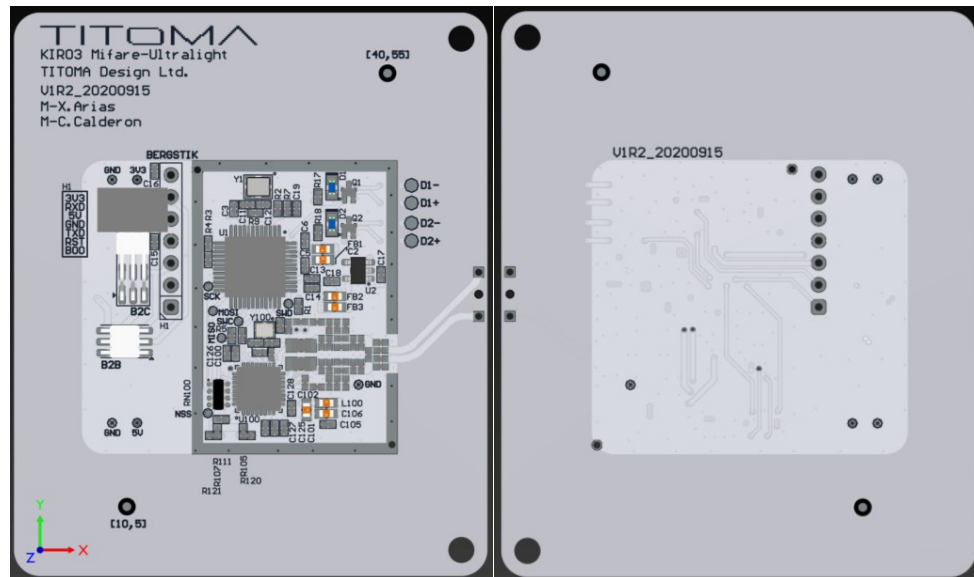# 1. Product Overview

1.1   Hardware Identification

1.1.1 Mifare

- Product Name: Parafait RF Tag Reader 1
- Model Number: PARARFTRDR001
- FCC ID: G7H-SPRFTR001

- Trademark: Semnox
- Brand: Parafait

1.1.2 Ultralight C

- Product Name: Parafait RF Tag Reader 2
- Model Number: PARARFTRDR002
- FCC ID: G7H-SPRFTR002

- Trademark: Semnox
- Brand: Parafait

1.2   Operational Description

The Parafait RF Tap Readers are RFID readers operating at 13.56 MHz using Mifare protocols for communicating with passive tags. When the reader is ON and a tag is nearby of the reader it will be energized by the 13.56 MHz field.

The Parafait RF Tag Readers circuitry consists of a 13.56 MHz NFC reader fronted IC, inductive coupling external antenna coil, and a microcontroller. The IC internal transmitter is able to drive an antenna designed to communicate with ISO/ESC 14443A/MIFARE cards, tags, and transponders. The Digital module manages the complete ISO/IEC 14443A framing and error detection functionality (parity and CRC).

2. Features

- RF Operating Frequency: 13.56 MHz
- Modulation: ASK
- Antenna Type: Build-in coil antenna
- Tags Supported: Mifare classic cards, Ultralight C Cards variants, and Parafait Radian Wristbands
- Interfaces: UART
- Input Voltage: 5 VDC
- Maximum current consumption: 350 mAh
- Operating distance: Up to 50 mm, depending on the tag.
- Dimension: 65 mm × 54.5 mm

3. Pinning information

Jack in the Mifare	Jack in the Ultralight	Pin	Symbol	Type	Description
J1 – B2C	H3 – B2C	1	GND - <	Power[3]	GND
J1 – B2C	H3 – B2C	2	GND	Power[3]	GND
J1 – B2C	H3 – B2C	3	5V0	Power[3]	Power supply 5 VDC
J1 – B2C	H3 – B2C	4	RXD	Input[3]	UART RX
J1 – B2C	H3 – B2C	5	3V3	Power[23]	Power Supply for internal testing 3.3 VDC
J1 – B2C	H3 – B2C	6	TXD	Output[3]	UART TX
J1 – B2C	NA[4]	7	GND	Power[3]	GND
J1 – B2C	NA[4]	8	GND	Power[3]	GND
J2 – B2B	H2 – B2B	1	GND - <	Power[3]	GND
J2 – B2B	H2 – B2B	2	GND	Power[3]	GND
J2 – B2B	H2 – B2B	3	RXD	Input[3]	UART RX
J2 – B2B	H2 – B2B	4	5V0	Power[3]	Power supply 5VDC
J2 – B2B	H2 – B2B	5	TXD	Output[3]	UART TX
J2 – B2B	H2 – B2B	6	3V3	Power[23]	Power Supply for internal testing 3.3 VDC
H1	H1	1	BOOT	Input[1]	Boot Select
H1	H1	2	RST	Input[1]	JTAG nRST
H1	H1	3	TXD	Output[1]	UART TX
H1	H1	4	GND	Power[1]	GND
H1	H1	5	5V	Power[1]	Power supply 5VDC
H1	H1	6	RXD	Input[1]	UART RX
H1	H1	7	3V3	Power[12]	Power Supply for internal testing 3.3 VDC

Note 1: Do not use H1, test purpose only, wrong use can corrupt the Parafait RF Tap Reader 1.

Note 2: Warning! Do not use 3V3, test purpose only, wrong use will permanently damage the Parafait RF Tap Reader 1.

Note 3: Do not use J1 and J2 at the same time.
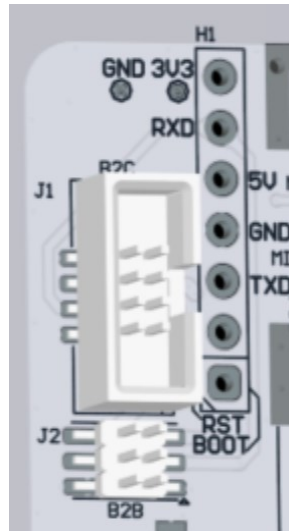
Parafait RF Tag Reader 1 Jacks   *Parafait RF Tag Reader 2 Jacks*
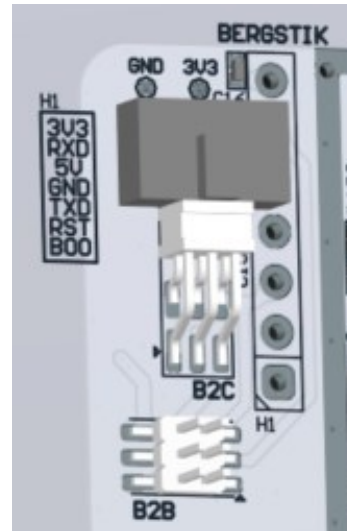
4. Communication Protocol

4.1   Communication Settings

The communication protocol is byte-oriented. Both sending and receiving bytes are in hexadecimal format. The communication parameters are as follow:

- Baud rate: 9600 bps (default)
- Data: 8 bits
- Stop: 1 bit
- Parity: None
- Flow control: None

4.2   Commands Format

The communication works through the following command format:

CMD_AA_BB_CC_DD_EE_END

Where:

1. **CMD/END**:
   - All commands start with "CMD" (0x43,0x4D,0x44) and ends with "END" (0x45,0x4E,0x44)

2. **AA**: Command code.

Device	AA	Command Code	Command Description
Common	00	Reset	Generates reset pulse to Mifare chip
	05	Scan	Scans for Available cards in the field and displays 4Digit UID as a response command.
Mifare	01	Set key	Stores 6-BYTE KEY in the controller
	02	Authenticate	Authenticate command for a block
	03	Read	Read the addressed page and display 16-BYTE data
	04	Write	Write 16-BYTE of data to the addressed page
Ultralight C	08	Read	Read the addressed page + 4 data and display 16-BYTE data
	09	Write	Write 4-BYTE of data to the addressed page
	10	Store key	Stores key in flash
	11	Authenticate	Authenticate with set key
	12	Set key	Reads stored key in flash and configure the module

3. **BB**: Length of the message.
   - Indicates the total number of bytes from the command code to the CRC byte in (AA to EE)
   - There are four types of messages supported: 0x05, 0x08, 0x0A and 0x14.
4. **CC**: Command parameter.
   - Information like a page number.
5. **DD**: Command data.
   - Information like data, key, etc.
6. **EE**: CRC -> Cyclic redundancy check.
   - This is the result of performing XOR operation between AA, BB, CC, DD.

4.3 Commands Overview

	Commands	AA Cmd code	BB Length	CC Cmd parameter	DD Cmd data	EE CRC	Description
Common	Reset	0x00	0x05	0x00	0x00	0x05	Resets RF chip
	Scan	0x05	0x05	0x00	0x00	0x05	Scan cards in the field, returns UID
Mifare	Set key	0x01	0x0A	0x00	6 bytes key	CRC	Sets Mifare key.
	Authenticate	0x02	0x05	Page Number	0x00	CRC	Authenticate addressed Page with set key
	Read	0x03	0x05	Page Number	0x00	CRC	Read addressed Page, returns 16 bytes.
	Write	0x04	0x14	Page Number	16-byte data	CRC	Writes 16-byte data to addressed page
Ultralight C	Read	0x08	0x05	Page Number	0x00	CRC	Reads addressed page + 4 data, total 16 bytes
	Write	0x09	0x08	Page Number	4 bytes data	CRC	Writes 4 bytes data to addressed page
	Store key	0x10	0x14	0x00	16 bytes key data	CRC	Stores key in Flash
	Authenticate	0x11	0x05	0x00	0x00	CRC	Authenticate with set key
	Set key	0x12	0x05	0x00	0x00	CRC	Reads stored key in flash and configures the module.

4.4 Response Format

Parafait RF Tap Reader 1 answer to the commands following the next response format:

RES_AA_BB_CC_DD_EE_END

Where:

1. **RES/END:** All commands starts with "RES" (0x52,0x45,0x53) and ends with "END" (0x45,0x4E,0x44)
2. **AA**: Command code.
   - Indicates the command code passed during the command cycle.
3. **BB**: Length of the Response.
   - Indicates the total number of bytes from the command field to the CRC byte (AA to EE)
4. **CC**: Response code.

Command	Response	Response Description
For all commands	0x01	Invalid/junk command
	0x02	Invalid length
	0x08	CRC error
	0x40	Unsupported command
	0x00	Success
For scan command	0x30	ISO compliant card found
	0x43	Mifare classic found
	0x75	Ultralight C found
	0x32	No card found
For read command	0x08	Read fail
	0x00	Success
For authentication command	0x06	Authentication failed
	0x00	Success
For write command	0x07	Write failed
	0x00	Success
For key store command	0x03	Key store failed
	0x00	Success

5. **DD**: Command data.
   - Information like data, key, etc.
6. **EE**: CRC -> Cyclic redundancy check.
   - This is the result of performing XOR operation between AA, BB, CC, DD.

Note 4: During power-ON, Firmware rev will be transmitted from UART. Any invalid/junk data other than command will be ignored and no response from Parafait Tag Reader 1 expected.

4.5 Examples of communication

4.5.1 Common device

- **Reset**:

Command: 43 4D 44 5F 00 5F 05 5F 00 5F 00 5F 05 5F 45 4E

Response: 52 45 53 5F 00 5F 05 5F 00 5F 00 5F 05 5F 45 4E 44

- **Scan**:

No card: 52 45 53 5F 05 5F 05 5F 32 5F 00 5F 32 5F 45 4E 44

Mifare card: 52 45 53 5F 05 5F 09 5F 43 5F 0B 0C 18 0D A5 5F F8 5F 45 4E 44

Ultralight C: 52 45 53 5F 05 5F 0B 5F 75 5F 04 E6 58 DA 3D 5A 80 5F 59 5F 45 4E 44

4.5.2 Mifare

- **Set key**: FF FF FF FF FF FF

Command: 43 4D 44 5F 01 5F 0A 5F 00 5F FF FF FF FF FF FF 5F 0B 5F 45 4E

Response: 52 45 53 5F 01 5F 05 5F 00 5F 00 5F 04 5F 45 4E 44

- **Authenticate page 16:**

Command: 43 4D 44 5F 02 5F 05 5F 10 5F 00 5F 17 5F 45 4E 44

Authentication fail: 52 45 53 5F 02 5F 05 5F 06 5F 00 5F 01 5F 45 4E 44

Authentication success: 52 45 53 5F 02 5F 05 5F 00 5F 00 5F 07 5F 45 4E 44

- **Read the page 16 and display 16byte data:**

Command: 43 4D 44 5F 03 5F 05 5F 10 5F 00 5F 16 5F 45 4E 44

Read Fail: 52 45 53 5F 03 5F 05 5F 08 5F 00 5F 0E 5F 45 4E 44

Read success:

52 45 53 5F 03 5F 14 5F 00 5F 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 5F 17 5F 45 4E 44

52 45 53 5F 03 5F 14 5F 00 5F FF 11 FF 22 FF 33 FF 44 FF 55 FF 66 FF 77 FF 88 5F 9F 5F 45 4E 44

- **Writing page 16:**

Command: 43 4D 44 5F 04 5F 14 5F 10 5F FF 11 FF 22 FF 33 FF 44 FF 55 FF 66 FF 77 FF 88 5F 88 5F 45 4E

Write fail: 52 45 53 5F 04 5F 05 5F 07 5F 00 5F 06 5F 45 4E 44

Write success: 52 45 53 5F 04 5F 05 5F 00 5F 00 5F 01 5F 45 4E 44

4.5.3 Ultralight C

- **Set key:**

Command: 43 4D 44 5F 12 5F 05 5F 00 5F 00 5F 17 5F 45 4E

Response: 52 45 53 5F 12 5F 05 5F 00 5F 00 5F 17 5F 45 4E 44

- **Store default key:** 49 45 4D 4B 41 45 52 42 21 4E 41 43 55 4F 59 00

Command:

43 4D 44 5F 10 5F 14 5F 00 5F 49 45 4D 4B 41 45 52 42 21 4E 41 43 55 4F 59 46 5F 72 5F 45 4E 44

Response: 52 45 53 5F 10 5F 05 5F 00 5F 00 5F 15 5F 45 4E 44

- **Authenticate command for a block**

Command:43 4D 44 5F 11 5F 05 5F 00 5F 00 5F 14 5F 45 4E 44

Authentication fail: 52 45 53 5F 11 5F 05 5F 06 5F 00 5F 03 5F 45 4E 44

Authentication pass: 52 45 53 5F 11 5F 05 5F 00 5F 00 5F 05 5F 45 4E 44

- **Read the page 4 and display 16byte data starts from page 4.**

Command: 43 4D 44 5F 08 5F 05 5F 04 5F 00 5F 09 5F 45 4E 44

Read fail: 52 45 53 5F 08 5F 05 5F 08 5F 00 5F 05 5F 45 4E 44

Read success:

52 45 53 5F 08 5F 14 5F 00 5F 09 08 07 06 06 06 06 06 06 06 06 06 06 06 06 06 5F 1C 5F 45 4E 44

52 45 53 5F 08 5F 14 5F 00 5F 01 02 03 04 06 06 06 06 06 06 06 06 06 06 06 06 5F 18 5F 45 4E 44

- **Write 4-byte data to page 4**

Command: 43 4D 44 5F 09 5F 08 5F 04 5F 01 02 03 04 5F 01 5F 45 4E

Write fail: 52 45 53 5F 09 5F 05 5F 07 5F 00 5F 0B 5F 45 4E 44

Write success: 52 45 53 5F 09 5F 05 5F 00 5F 00 5F 0C 5F 45 4E 44

5. Federal Communication Commission Interference Statement

This device complies with Part of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

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.

5.1 Radiation Exposure Statement

This equipment complies with FCC mobile radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body. If the module is installed in a portable host, a separate SAR evaluation is required to confirm compliance with relevant FCC portable RF exposure rules.

5.2 Integration Instructions

The module is limited to OEM (Original Equipment Manufacturer) installation ONLY. And, the module has been granted modular approval for mobile applications.

For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module. The host must meet the requirements to satisfy the module limiting conditions: shield and power supply regulation.

The OEM integrators for host products may use this module in their final products without additional FCC certification, but, **per FCC KDB 996369 D03 OEM Manual v01 guidance the following conditions must be strictly followed when using this certified module**.

5.2.1 KDB 996369 D03 OEM Manual v01 rule sections

2.2. List of Applicable FCC Rules

This module has been tested for compliance with FCC Part 15 Subpart C Paragraph 15.225.

2.3. Summarize the specific operational conditions.

The module is tested for standalone RF exposure conditions. Any other usage conditions such as co-location with other transmitters or being used in portable conjunction will need a separate reassessment through a class II permissive change application or new certification.

2.4. Limited module procedures

Not applicable.

2.5.   Trace antenna designs.

Not applicable.

2.6. RF exposure considerations

This equipment complies with FCC mobile radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your

body. If the module is installed in a portable host, a separate SAR evaluation is required to confirm compliance with relevant FCC portable RF exposure rules.

2.7. Antennas

The following antenna has been certified for use with this module; antennas of the same type with equal or lower gain may also be used with this module. The antenna must be installed such that 20 cm can be maintained between the antenna and users.

- **Antenna manufacturer / model:** Semnox / Mifare Antenna
- **Antenna type:** Coil Antenna
- **Antenna connector:** RF Pin

2.8. Label and compliance information

A label must be affixed to the outside of the host product with the following statements:
In the case of the Parafait RF Tag Reader 1
This device contains FCC ID: G7H-SPRFTR001.

In the case of the Parafait RF Tag Reader 2
This device contains FCC ID: G7H-SPRFTR002.

The grantee's FCC ID can be used only when all FCC compliance requirements are met.

2.9. Information on test modes and additional testing requirements

This transmitter is tested in a standalone mobile RF exposure condition and any simultaneous transmission with other transmitters or portable use will require a separate class II permissive change re-evaluation or new certification.

2.10. Additional testing, Part 15 Subpart B disclaimer

This transmitter module is tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement applicable to the final host. The final host will still need to be reassessed for compliance with this portion of rule requirements if applicable.

As long as all conditions above are met, further transmitter tests 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: If these conditions cannot be met (for example simultaneous transmission with other transmitters, 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.

5.3   Manual Information to the End-User

The OEM integrator has to be aware to not 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 for the host product shall include all required regulatory information/warning as shown in this manual and must indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

5.4   OEM/Host manufacturer responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the FCC rules. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment.

If the final host/module combination is intended for use as a portable device (see classifications below) the host manufacturer is responsible for separate approvals for the SAR requirements from FCC Part 2.1093.

5.5   Device Classifications

Since host devices vary widely with design features and configurations module integrators shall follow the guidelines below regarding device classification and simultaneous transmission, and seek guidance from their preferred regulatory test lab to determine how regulatory guidelines will impact the device compliance. Proactive management of the regulatory process will minimize unexpected schedule delays and costs due to unplanned testing activities.

The module integrator must determine the minimum distance required between their host device and the user's body. The FCC provides device classification definitions to assist in making the correct determination. Note that these classifications are guidelines only; strict adherence to a device classification may not satisfy the regulatory requirement as near-body device design details may vary widely. Your preferred test lab will be able to assist in determining the appropriate device category for your host product and if a KDB or PBA must be submitted to the FCC.

Note, the module you are using has been granted modular approval for mobile applications.

Portable applications may require further RF exposure (SAR) evaluations. It is also likely that the host/module combination will need to undergo testing for FCC Part 15 regardless of the device classification. Your preferred test lab will be able to assist in determining the exact tests which are required on the host/module combination.

5.6   FCC Definitions

Portable: (§2.1093) — A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

Mobile: (§2.1091) (b) — A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. Per §2.1091d(d)(4) In some cases (for example, modular or desktop transmitters), the potential conditions of use of a device may not allow easy classification of that device as either Mobile or Portable. In these cases, applicants are responsible for determining minimum distances for compliance for the intended use and installation of the device based on evaluation of either specific absorption rate (SAR), field strength, or power density, whichever is most appropriate.

6. Technical Support

For any further queries, we are here to help!

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