User's manual

1. INTRODUCTION

The EUT-002 is a smallest module in the market and highly integrated transmission module for contactless communication at RFID 13.56 MHz (HF) applications. Its simplified interface, ultra low power consumption, standard RF output port and superior performance, make it easy to integrate any device with EUT/RFID technology. The EUT-002 is a highly integrated transmission module for contactless communication at 13.56 MHz. The embedded firmware handles the ISO 14443A and MIFARE reader protocol as well as the basic FeliCa Reader protocol and the complete EUT IP-1 protocol.

1.1 Module and EUT Features

■ Module profile and Footprint 20(mm)x20(mm)x 3.2(mm)
■ EUT profile and Footprint 90(mm)x60(mm)x 8(mm)
■ Internal oscillator to connect 27.12 MHz crystal
■ Supports ISO/IEC 14443A/Mifare
■ Supports Mifare Classic encryption in reader/writer mode
■ Supports Mifare higher transfer speed communication at 212 kbit/s and 424 kbit/s
■ Supports contactless communication according to the FeliCa scheme at 212 KBaud and 424 KBaud
■ Integrated RF interface for EUT IP-1 up to 424 Kbaud
■ Ultra low power consumption
■ 2.5 - 3.6 V power supply
■ Easy Connection to Flex antenna
■ Supported High Speed Serial UART (similar to RS232 with 0 and PVDD voltage levels) host interface

1.2 Operating modes:

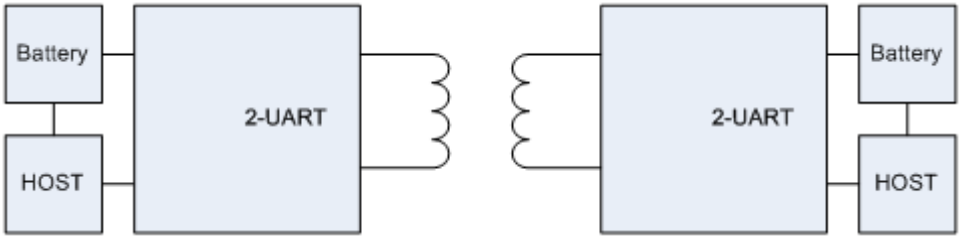
The EUT-002 supports 2 different operating modes

- Reader/writer mode for ISO14443A Mifare and FeliCa cards
- EUT Mode (EUT IP-1 mode)

The Analog circuitry handles the modulation and demodulation of the analog signals according to the reader /writer mode and EUT mode communication scheme.
The RF level detector detects the presence of an external RF field at 13.56 MHz.
The mode detector detects a MIFARE, FeliCa or EUT coding of an incoming signal in order to prepare the internal receiver to demodulate signals that are sent to the EUT-002 Module.
The integrated contactless UART interface and the firmware handle the protocol requirements for the communication schemes including the RF based protocols as well as the protocols for host communication.
The microcontroller with its embedded firmware allows autonomous management of communication both on the RF interface and with the host. Various host interfaces are implemented to fulfil different customer requirements.

1.2.1 Reader/Writer Operating mode

The EUT-002 can act as a reader / writer for ISO14443A/MIFARE® or FeliCa cards.



In the reader/ writer mode the EUT-002 EUT enables communication to a passive ISO14443A/MIFARE or FeliCa card. The EUT-002's firmware and contactless UART handle the ISO 14443A/MIFARE and FeliCa protocol.

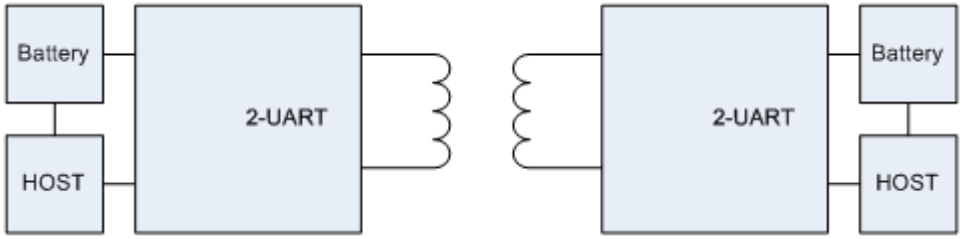
1.2.2 EUT MODE

EUT communication differentiates between an active and a passive communication.

Active EUT Mode means both the initiator and the target are using their own RF field for the communication.

Passive EUT Mode means that the target answers to an initiator command in a load modulation scheme.

The initiator is active i.e. generating the RF field.

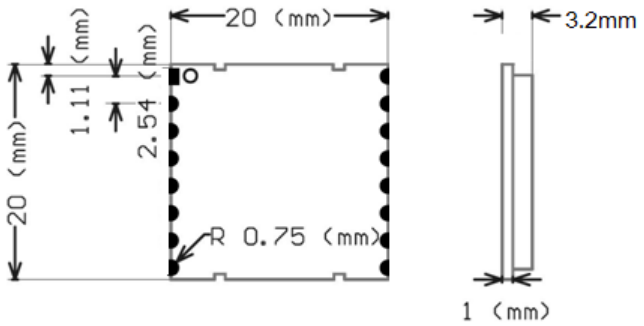


İnitiator: generates RF field @ 13.56 MHz and starts the EUT communication

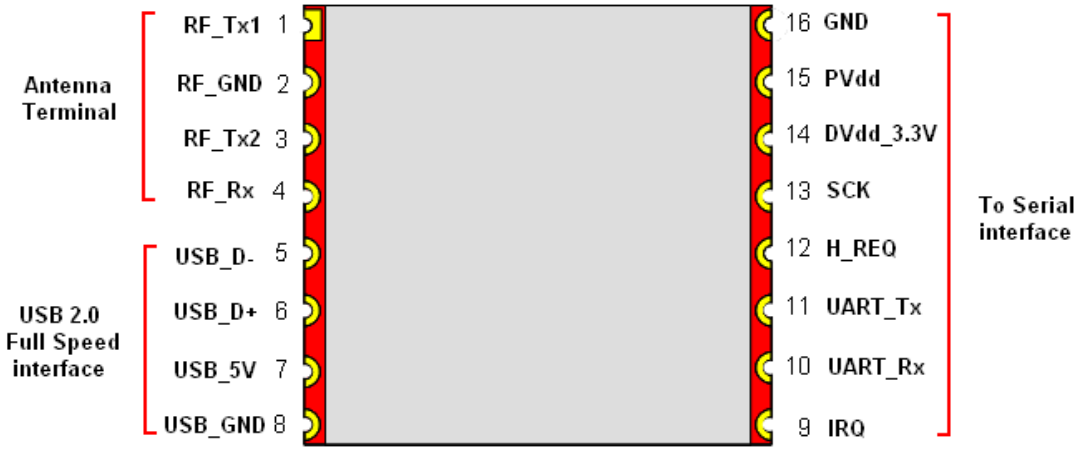
Target: responds to initiator commands either using load modulation scheme (RF field continuously generated by Initiator) or using modulation of self generated RF field (no RF field generated by initiator)

2.Mechanical Characteristics

2.1 Dimensions



2.2 -X Pinning Diagram



EUT-002 Pin Assignment (Top view)

2.3 -X Pin Description

Port	Pin	I/O	Description
RF_Tx1	1	O	Transmitter 1: delivers the modulated 13.56 MHz energy carrier
RF_GND	2	PWR	Transmitter Ground
RF_Tx2	3	O	Transmitter 2: delivers the modulated 13.56 MHz energy carrier
RF_Rx	4	I	Receiver Input: Input pin for the reception signal, which is the load modulated 13.56 MHz energy carrier from the antenna circuit
USB_D-	5	IO	USB D-
USB_D+	6	IO	USB D+
USB_5V	7	PWR	USB power supply.
USB_GND	8	PWR	Module substrate ground
IRQ	9	IO	Interrupt request: Output to signal an interrupt event to the host
UART_Rx	10	IO	Serial UART Rx (similar to RS232 with 0 and PVDD voltage levels)
UART_Tx	11	IO	Serial UART Tx (similar to RS232 with 0 and PVDD voltage levels)
H_REQ	12	IO	Request or acknowledge line from the host
SCK	13	IO	Serial interface clock. In test mode this signal is used as input and output test signal
DVdd+3.3V	14	PWR	Digital Power Supply
PVdd	15	PWR	Pad power supply
GND	16	PWR	Module substrate ground

2.4 Absolute maximum ratings

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
USB_5V	USB Supply Voltage (USB mode)		4.2	5	5.25	V
	Supply Voltage (non USB mode)	V_{BUS} = DV_{DD}; Gnd = 0 V	2.5	3.3	3.6	V
$DV_{dd\_3.3V}$	Supply Voltage	DV_{DD} Gnd = 0 V	2.5	3.3	3.6	V
PV_{DD}	Supply Voltage for host interface	Gnd = 0 V	1.6		3.6	V
I_{USB_5V}	Maximum load current (USB mode)	measured on V_{BUS}			180	mA
	Maximum Inrush current limitation	At power up (curlimoff =0)			130	mA
I_{DVDD}	Transmitter Supply Current	During RF Transmission, DV_{DD}= 3 V		60	130	mA
P_{totusb}	continuous total power dissipation in USB mode	T_{amb} = -30 to +85 °C			0.6	W
P_{tot}	continuous total power dissipation in non USB mode	T_{amb} = -30 to +85 °C			0.2	W
T_{amb}	operating ambient temperature		-30		+85	°C

3.EUT Mechanical Characteristics

3.1 EUT(Component-U1)-MAX3232 Pin Description

RS-232 Serial Protocol(+12V~-12V) to UART TTL Protocol(+3V~-3V)

Port	Pin	I/O	Description
C1+	1	PWR	Positive Terminal of Voltage-Doubler Charge-Pump Capacitor
U+	2	PWR	+5.5V Generated by the Charge Pump
C1-	3	PWR	Negative Terminal of Voltage-Doubler Charge-Pump Capacitor
C2+	4	PWR	Positive Terminal of Voltage-Doubler Charge-Pump Capacitor
C2-	5	PWR	Negative Terminal of Voltage-Doubler Charge-Pump Capacitor
U-	6	PWR	-5.5V Generated by the Charge Pump
T2OUT	7	IO	RS-232 Transmitter Outputs
R2IN	8	IO	RS-232 Receiver Inputs
R2OUT	9	IO	TTL/CMOS Receiver Outputs
T2IN	10	IO	TTL/CMOS Transmitter Inputs
T1IN	11	IO	TTL/CMOS Transmitter Inputs
R1OUT	12	IO	TTL/CMOS Receiver Outputs
R1IN	13	IO	RS-232 Receiver Inputs
T1OUT	14	IO	RS-232 Transmitter Outputs
GND	15	PWR	Ground
VDD	16	PWR	Power Supply

3.2 EUT(Component-U2)-XX1117 Pin Description

Power 5V to 3.3v LDO

Port	Pin	I/O	Description
Vin	1	PWR	DC Input Voltage
Vout	2	PWR	DC Output Voltage
GND	3	PWR	Ground
N.C.	4		(Connected to DC Output Voltage)

4. EUT-002 Host interfaces

Two different host interface interfaces are proposed with the EUT-002 Module. One is using the USB interface and the other one use the HSU (High Speed UART: similar to RS232 with 0 and PVdd voltage levels) interface.

4.1 High speed UART interface

Port	Pin	I/O	Description
IRQ	9	IO	Interrupt request: Output to signal an interrupt event to the host
UART_Rx	10	IO	UART RX (Serial reception line of the EUT-002-UART)
UART_Tx	11	IO	UART TX (Serial transmission line of the EUT-002-UART)
H_REQ	12	IO	Request or acknowledge line from the host

HSU interface default configuration is:

Data bit : 8 bits

Parity bit : none

Stop bit : 1 bit

Baud rate : 9600 bauds

Data order : LSB first

Baudrate:

Default baudrate is 9600 bauds. EUT-002 HSU is up to 1288 kbauds. The HSU speed is changeable with SetSerialBaudrate command (command code 10h, parameter = baudrate).

The host controller must send an ACK frame after reception of SetSerialBaudrate response. EUT-002 will switch to the new baudrate only after reception of this ACK frame.

4.2 How to change HSU speed in SCRTester?

To activate sending of ACK frame after reception of a command, use ".config(10,01)" in SCRTester.

Example of script file:

```
.config(10,01);          // SCRTester is forced to send the optional ACK
10 06;                   // SetSerialBaudrate (460.8 kbauds)
.config(00, 460800);     // Change baudrate of SCRTester to 460.8 kbaud
.config(10, 00);         // Deactivate the optional ACK option
```

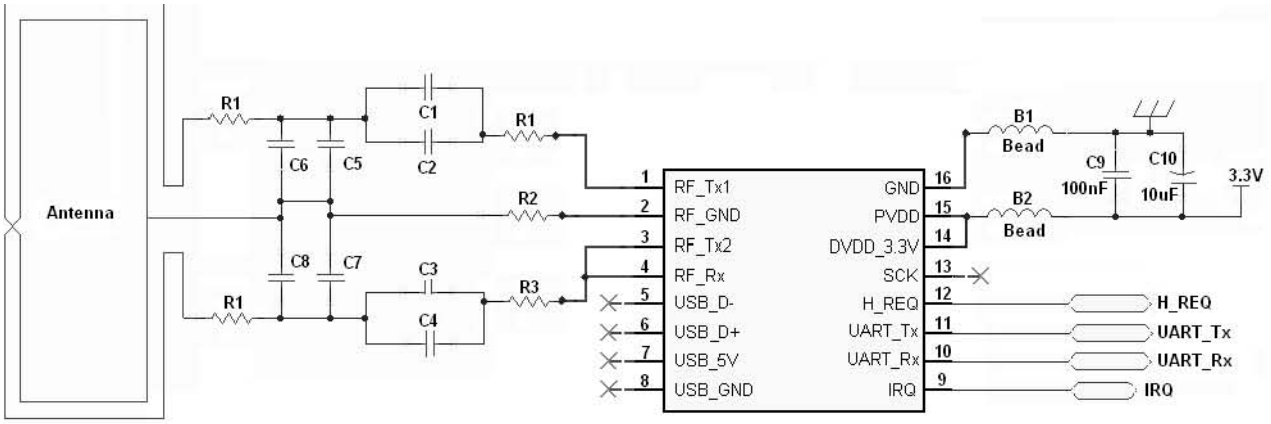
Handshake mode in HSU

4 lines are connected between the host controller and EUT-002 Module: UART_Rx, UART_Tx, H_REQ and IRQ.

Remark: in handshake mode, IRQ line is **not** set low by EUT-002 when ACK frame is ready (different behaviour than standard mode + use of IRQ).

00h	01h	02h	03h	04h	05h	06h	07h	08h
9.6 kbauds	19.2 kbauds	38.4 kbauds	57.6 kbauds	115.2 kbauds	230.4 kbauds	460.8 kbauds	921.6 kbauds	1288 kbauds

5. EUT Reference Schematic



We provide the EUT-002-UART pins defined and inculde EUT ambient circuit design. And highly recommend using this diagram for reference design.

6. EUT-002 EUT Layout Guide

1. If the system implementation is complex (i.e. RFID reader module is a subsystem of a greater system with other modules (Bluetooth, WiFi, micros & clocks), special considerations should be taken to ensure that there isn't any noise coupling into the supply lines. If needed, special filtering/regulator considerations should be used to minimize or eliminate that noise in these unique systems. This will ensure optimal RFID reader performance.

2. Avoid crossing of digital lines under RF signal lines. Also, avoid crossing of digital lines with other digital lines whenever possible. If the crossings are unavoidable, 90 degree crossings should be used to minimize coupling of the lines.

3. Trace line lengths should be minimized whenever possible. Especially, the RF output path, x'tal connections, and control lines from the reader to the micro. Proper placement of the reader, micro, xtal and RF connection/connector will help facilitate this.

7. EUT-002 EUT Transponder Support List

Transponder Support			
Product Name	Memory (bits)	Manufacturer	Protocol
Mifare S50	1K	NXP	ISO14443A
Mifare S70	4K	NXP	ISO14443A
Mifare UL	0.5K	NXP	ISO14443A

8. SALES AND SERVICE INFORMATION

To obtain information about Jogtek Corp. products and technical support, reference the following information.

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Tel : +886-2-6606-9066
Fax : +886-2-2659-6884
www.jogtek.com

Federal Communication Commission Interference Statement

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.

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.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual:

This device complies with Part 15 of 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.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX FCC ID: VZPNFC-002 ". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.