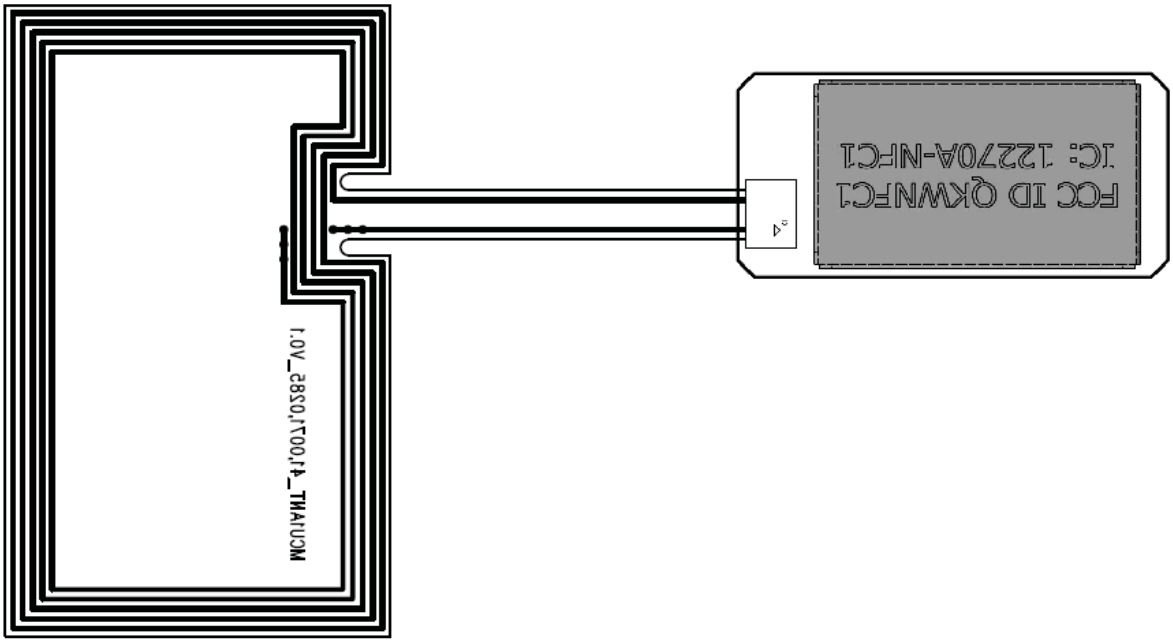
NFC1-Module

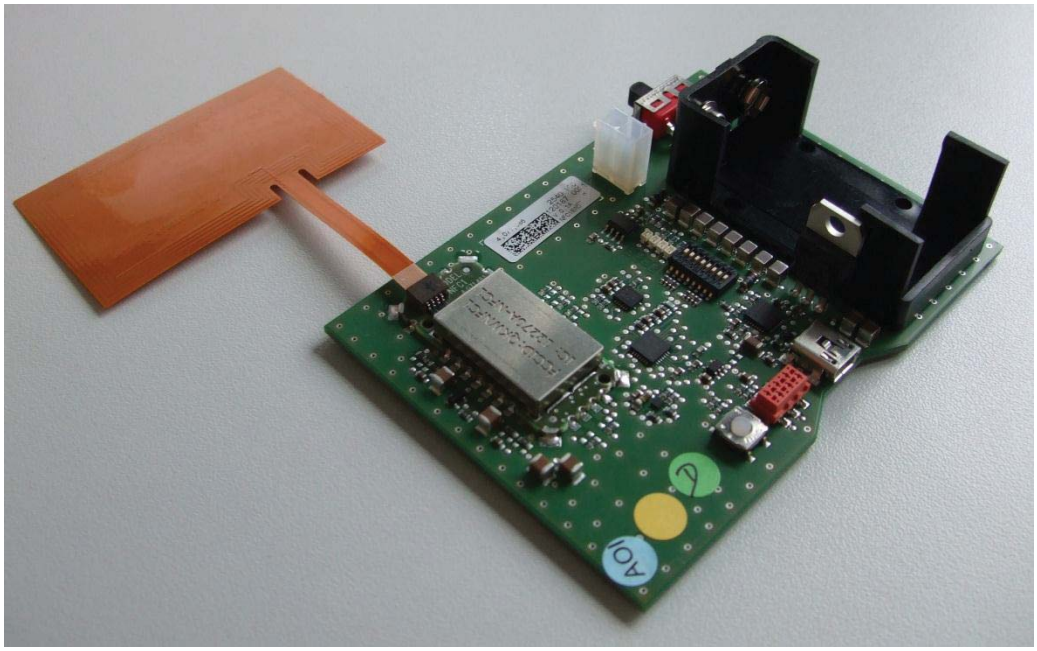
Integration Manual V1.01

The NFC1 module is targeted as an RFID-Reader and NFC-Device for integration into different Fronius products. A typical application of RFID is user authentication. Selling the single module directly to customers is not permitted.

It consists of two parts – the printed circuit board with the transmitter IC and the Flex-PCB loop antenna.



The circuit board of the module is designed to be soldered directly on to a host board, as shown below:



Definition:

RFID (Radio-frequency identification):

is the wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags contain electronically stored information. Some tags are powered by electromagnetic induction from magnetic fields produced near the reader.
(http://en.wikipedia.org/wiki/Radio-frequency_identification , 15-01-2015)

NFC (Near field communication):

is a set of ideas and technologies that enable smartphones and other devices to establish radio communication with each other by touching them together or bringing them into proximity, typically a distance of 10 cm (3.9 in) or less. Each full NFC device can work in 3 modes: NFC target (acting like a credential), NFC initiator (as a reader) and NFC peer to peer.
(http://en.wikipedia.org/wiki/Radio-frequency_identification , 15-01-2015)

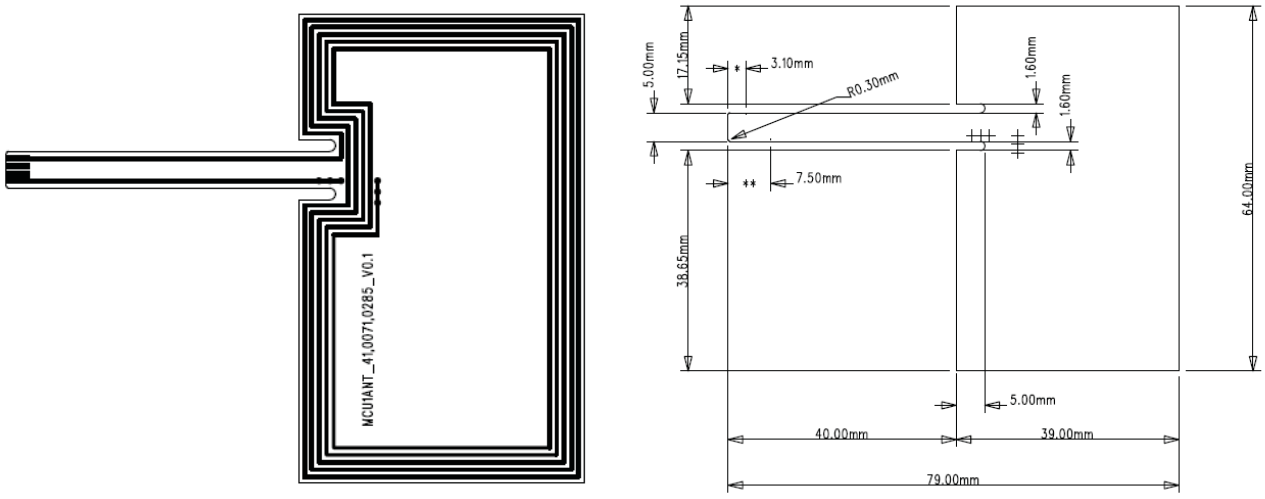
Module Description:

Antenna:

The antenna is part of the module and connected to the printed circuit board using a unique connector.

Its coil consists of 5 turns which have been integrated on a flexible printed circuit board.

The size of the antenna coil is 64 x 39mm.



Printed circuit board:

The printed circuit board of the module consists of three blocks: The transmitter IC, the analog circuit for the antenna and the quartz oscillator.

Transmitter IC:

Heart of the module is the transmitter IC. The transmitter IC is a full featured NFC controller. It builds a contactless front-end supporting various communication modes at different transfer speeds and modulation schemes.

The transmitter IC can be connected on a host controller through the serial interface.

An integrated CPU is decoupling the host controller from the timing constraints of RF communication and allowing autonomous operation.

Moreover, the transmitter IC provides an integrated power regulation unit.

A TX-overcurrent protection is shutting down the transmitter stage if a overcurrent happens.

Analog circuit:

The analog circuit contains all relevant components required to connect the antenna to the transmitter IC. It also ensures the transmission of energy and data to the target device as well as the reception of a target device answer.

Frequency generation:

A 27.12 MHz quartz oscillator is connected to the transmitter IC. It is the time reference for the RF front-end when the module is behaving in reader mode or ISO/IEC 18092 initiator as well as in target when configured in active communication mode.

Host connection:

Host connection is realized by a digital serial interface. Data inputs on the module are buffered (HT80C51MX processor in the transmitter IC).

Host interface supply (PVDD):

The interface part of the NFC1-Module must be supplied between 1.65V and 1.95V.
PVDD is buffered by a capacitor on the module.

Module supply and power regulation:

The NFC1 module must be supplied between 2.85V DC and 5.5V DC
VBAT is buffered by a capacitor on the module.

The module has a built-in power regulator (PMU). The part number of the power regulator is U1 (integrated inside the transmitter IC) which generates internal supplies required by the IC out of the VBAT supply:

/ DVDD: Digital supply (buffered by capacitor)
/ AVDD: Analog supply (buffered by capacitor)
/ TVDD: Supply for RF transmitter (buffered by capacitor)

Operational description:

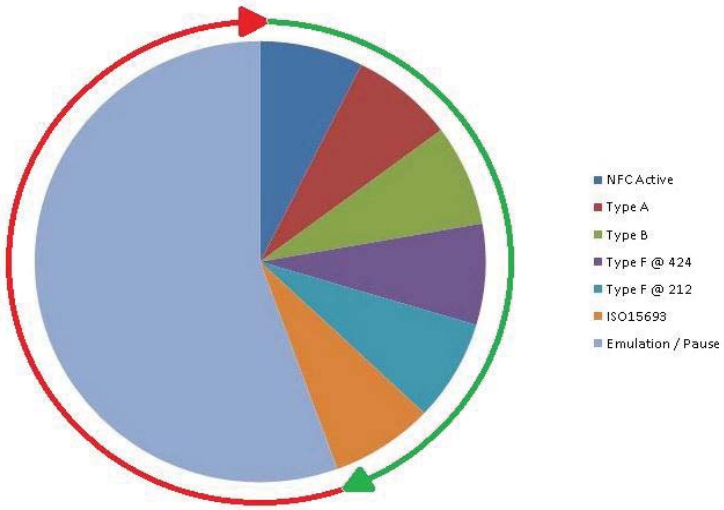
The circuit board of the module will be soldered directly on to a host board where it will be connected to the host processor through the serial interface. The host board also has to provide the power supply of the module.

After powering up or resetting by the module it has no autonomous function and the transmitter stage is deactivated.

A setup procedure has to be performed through the serial interface to set up the polling loop configuration and enable the single reader technologies.

Polling Loop:

After the setup procedure the module is in a polling loop what means the module polls for RFID/NFC targets off all enabled technologies. Regular after finishing a loop cycle a pause time is inserted and the rf-field is turned off (pause time). During this time the module is in card emulation / passive target mode.
Every single technology can be enabled / disabled individually, pause time can be configured.



The module stays infinitely in this loop until a reset from the user is received or a target is detected (placed into the field). A target can be a RFID transponder card (e.g. Mifare) or an NFC enabled device (not part of the EUT).

As soon a target is in the field the module stays in the technology of the current target and informs the host controller that a target is acquired. Now the host controller can perform some read / write operations on the target. Then it release it and restarts the polling loop.

Some targets allow higher baudrates. After target registration the highest allowed baudrate can be configured during the target activation procedure. The transmitter IC is changing to the highest allowed and supported baudrate automatically.

Modulation Schemes:

Direction	Technology	ISO14443A Mifare Jewel Topaz	ISO14443A Higher Transfer speeds	
	Speed (NOTE 1)	106 kbit/s	212 kbit/s	424 kbit/s
Module → PIC	Modulation	100% ASK	> 25% ASK	
	Coding	Miller Modified Coding		
PIC → Module	Modulation	Subcarrier Load Modulation (13.56MHz/16)		
	Coding	Manchester	BPSK	

Direction	Technology		Felica	
	Speed (NOTE 1)	106 kbit/s	212 kbit/s	424 kbit/s
Module → PIC	Modulation	-	8% – 12% ASK	
	Coding		Manchester	
PIC → Module	Modulation		Load Modulation (No Subcarrier)	
	Coding		Manchester Coding	

Direction	Technology	ISO14443B	ISO14443B Higher Transfer speeds	
	Speed (NOTE 1)	106 kbit/s	212 kbit/s	424 kbit/s
Module → PIC	Modulation	8% – 14% ASK		
	Coding	NRZ		
PIC → Module	Modulation	Subcarrier Load Modulation (13.56MHz/16)		
	Coding	BPSK		

Direction	Technology	ISO15693	
Module → VICC	Speed (NOTE 1)	1.56 kbit/s	26.48 kbit/s
	Modulation	10% - 30% or 100% ASK	
	Coding	Pulse Position Modulation	
VICC → Module	Speed	26.48 kbit/s	26.69 kbit/s
	Modulation	Subcarrier Load Modulation (Single)	Subcarrier Load Modulation (Dual)
	Coding	Manchester Coding	

Direction	Technology	ISO18092, ECMA430, NFCIP1		
	Speed (NOTE 1)	106 kbit/s	212 kbit/s	424 kbit/s
Active	Modulation	100% ASK	8% - 30% ASK	
	Coding	Miller	Manchester	
Passive	Modulation	Subcarrier Load Modulation (13.56MHz/16)	Load Modulation (No Subcarrier)	
	Coding	Manchester		

NOTE 1: The highest allowed baudrate is 424 kBit/s!

Labeling

Using a permanently affixed label, the modular transmitter will be labeled with its own FCC identification number, and, if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. The same applies to the IC (Industry Canada) identification number.

This exterior label can use wording such as the following:

For the USA:
“Contains FCC ID QKWNFC1”
Any similar wording that expresses the same meaning may be used.

For Canada:
“Contains IC: 12270A-NFC1”
Any similar wording that expresses the same meaning may be used.

FCC § 15.19
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.

Canada RSS-GEN 8.4

This device complies with Industry Canada’s licence-exempt RSSs. 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.

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;
2) l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

FCC § 15.21 (Warning Statement)

[Any] changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Version history

Date	Version	Description
09-03-2015	1.00	Preliminary release
22-06-2015	1.01	Changing text passage intended to permitted