

Functional Spec for OSM RFID



Purpose of Functional Spec Document explained [here](#).

Basecamp tasks for this device are assigned [here](#)

Versions and Status

Party	Stage	Date
Mike Diliberto / Tomer Harrary	Initial Authoring	2/22/20
Mike D	Gate 1 Review	2020/03/26
Tomer H	Customer Review	2020/03/26

Overview

Introduction

Up to 4 connected RFID transceiver pads

2 ODC connections for integration into the IOE system

Allows for both place and lift experiences

ODC commands can change polling time

Connections

Antennas

4 Antenna connections via R-SMA

The PCB edge mounted R-SMA connectors used in the module. The Digikey part 142-0701-841 as the reference.

NOTE: The maximum length of the coaxial cable (distance between reader and antennas) is 10m.

NOTE: The impedance of all RF channels is 50 ohm.

ODC interface

- Socket type: RJ-25 socket with top side lock tab location
- Voltage range: 10-24V
- Max unit power consumption from the ODC power line: 1.3W
- Max current through ODC bus: 1.5A (polyfuses)
- ODC port configuration: Audio/Hi-power (optional by resistors; Audio by default)
- Data lines ESD protection IEC 61000-4-2, level 4 (ESD)
 - ±23 kV Contact Discharge
 - ±15 kV Air-Gap Discharge

2 ODC ports as per the [current ODC spec](#)

Transmitter unit

- Transmitter chipset: [TRF7970](#)
 - Carrier frequency: 13.56MHz
 - Transmit power: 23dBm (200mW)

Cables

An RG316* cable is used to connect the antennas to the device. RG316 impedance is 50Ohm. The cable shall have attenuation less than 25dB/100m@100MHz (or 8.2dB/10ft@100MHz).

* During the purchase of the cable, special attention should be paid to the production date: should not be purchased a cable which was stored in warehouses without special packaging for more than 6 months: when the cable is stored unpacked on the warehouses with high humidity, its characteristics deteriorate significantly.

The Antenna and RFID box will both have R-SMA connections

RFID Tags Supported

Supports [ISO15693](#) tags

Outform development will focus on ISO15693

Anti-collision algorithm: up to 4 tags on the same antenna (for ISO15693 only)

Indicator Lights

PWR- device itself is powered and working

ODC pwr- is on when ODC bus is receiving power

ODC RX- blinks when device receives ODC command

CFG- button used for assigning ODC address manually

ANT 1, ANT 2, ANT 3, ANT 4- shows which antenna is connected and blinks every time the OSM RFID does a “pull request” to check if a tag is registered by the antenna (default is 200ms per pull request, so will be blinking constantly when antenna is connected).

Antenna Detection

Each antenna can detect up to 4 tags at the same time, for a total of 16 simultaneous reads

Tags can be read from no farther than 50mm away (on the average)

Antennas must be able to read through material of up to 30mm thickness, assuming material is non-ferrous.

Materials to be tested: Solid wood, acrylic, engineered wood (MDF/OSB), corian, ABS, glass.all at various different thicknesses

Need to create testing matrix

Hardware

MCU unit

STM32F103RG.

Memory unit

I2C M24128. Memory to keep up to 1012 tag's IDs + device settings + Serial Number + ID.

RFID unit

TRF7970A (13.56MHz multiprotocol RFID transceiver)

RF switch: PE42440 (1 -> 4)

Status LEDs

Green side LED: ODC power

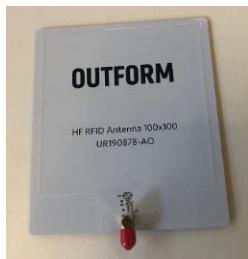
Yellow side LED: ODC commands

4 top green LEDS: antennas polling

Green top LED: unit power

Antennas

Antennas design:



25x25mm

- 5 turns
- Conductor spacing: 0.3mm
- Conductor width: 0.3mm
- Outer diameter: 25mm
- Inner diameter: 19.6mm
- Inductance: 1.229uH

60x60mm

- Turns: 3
- Conductor spacing: 0.2mm
- Conductor width: 0.8mm
- Outer diameter: 60mm
- Inner diameter: 54.4mm
- Inductance: 1.33351uH

100x100mm

- Turns: 2
- Conductor spacing: 0.2mm
- Conductor width: 0.5mm
- Outer diameter: 100mm
- Inner diameter: 97.6mm
- Inductance: 1.12396uH

Power

The device is powered from the ODC bus

Power demand is likely to be under 200ma

Likely this section will simply reference the [overall tech specs doc](#) for max per chain and other discussions

Software

OIE Integration

How do we program these devices in the OIE?

Concept:

- All tags have unique SN
- We program the OIE to that SN while we create the experience
- We need to be able to custom make the tags with custom serial numbers

Firmware

Modes of operation

There are three modes of operation available, Passive, Active, and Event Reporting. Event Reporting is enabled by default and supports all currently known use cases for the interactive collection.

Passive mode (not in current release)

The RFID module sends an event report only by RFID status request command. The RFID module

Active mode (not in current release)

The RFID sends reports while the tag(s) is(are) present on the antenna(s). The tag IDs are sent continuously, at the same polling cycle interval (approximately).

Event Report mode (default mode)

The RFID module initiates event report as an event appears: tag appeared or tag disappeared. One single command for every change.

ODC command set

The device supports the following commands and functions:

- 0x0000 – ACK
- 0x0001 - NACK
- 0x0005 – enter programming mode (bootloader)
- 0x0006 – program data block. The device should support this command in two modes:
 - in bootloader mode (0x0005) to update the FW
 - in the normal mode for tag IDs programming into external memory. In the normal mode the device can write up to 64 bytes per time (M24128's page writing mode).
Currently not implemented
- 0x0007 – Execute program
- 0x0008 – Reboot device
- 0x0009 – Offer address (with button)
- 0x000A – Accept address
- 0x000B – Request device info
- 0x000C – Device info
- 0x0014 – Power (voltage reading). *Currently not implemented*
 - Raw 0x0014 0x01 0x01
 - Raw 0x0014 0x02 0x01 xx
 - Raw 0x0014 0x03 0x01
 - Raw 0x0014 0x04 0x01 0x0C (min)
- 0x0036 – Discover start. *Currently not implemented*
- 0x0037 – Discover device. *Currently not implemented*
- 0x0038 – Address request. *Currently not implemented*
- 0x0039 – Force address. *Currently not implemented*
- 0x003A – Config string set. *Currently not implemented*
- 0x003B – Config string request. *Currently not implemented*
- 0x003C – Config string. *Currently not implemented*
- 0x003E – RFID configure

- Device keeps information about the current antennas configuration and operating mode in external non-volatile memory and returns to the last configuration/mode after power up. See “External Memory Map” and “App’s settings” sections
- 0x003F – RFID read request
- 0x0040 – RFID reading

The complete details about the Outform Device Communications (ODC) protocol are available in the [ODC spec document](#).

Emissions and Immunity

The device will adhere to the [Outform emissions and immunity standard](#)

Future Builds

In the future for 2nd generation, we will add several new features

- Add passive and active modes
- 8 ports and 16 ports for antennas
- Automatic ODC addressing using DHCP

FCC 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 (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party 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.