

# **CATS-01**

## **IQRF Service tool**

**Firmware v0.61**

## **User's guide**



## Description

CATS-01 is a service and debug tool to analyze RF signal. It allows to scan and monitor RF communication. General RF is detected, not only IQRF packets.

CATS-01 is a fixed non-generic device. No parts can be programmed by the user. Functionality can be extended by future firmware upgrades.



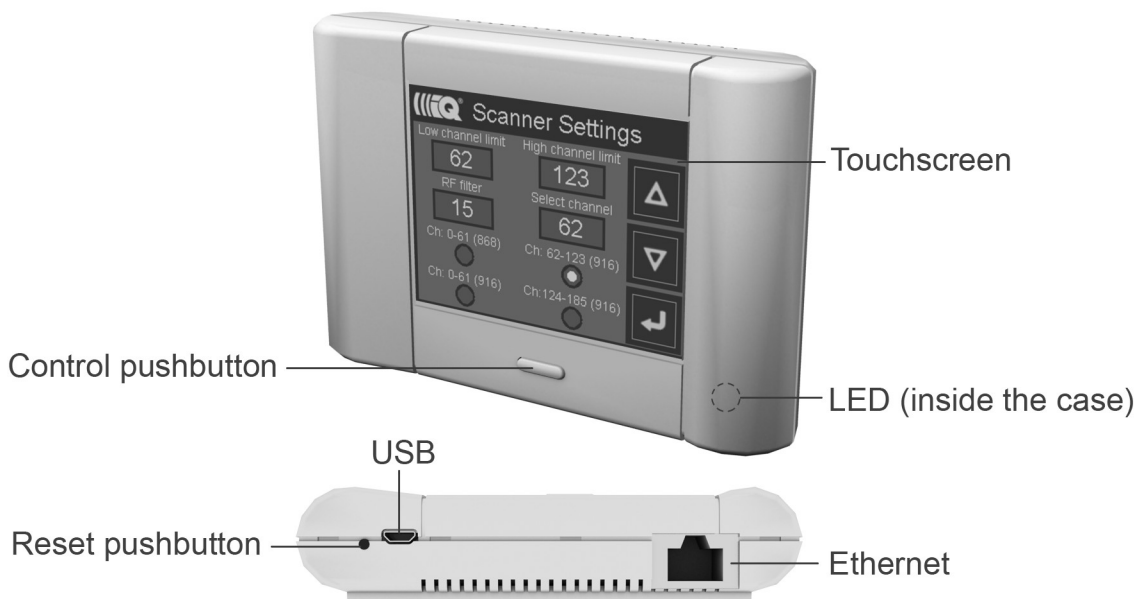
## Applications

- IQRF application debug and development
- RF scanner
- Network installation hints for channel choice

## Key features

- Based of the GW-QVGE-01A gateway
- 868 MHz and 916 MHz ISM band scanner
- Displaying activity in individual channels
- SD Flash memory card inside
- USB connectivity
- Ethernet connectivity (reserved for future firmware versions)
- Firmware upgrade supported

## Parts and controls



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## Hardware

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Main unit is based on the touchscreen oriented **GW-QVGE-01A** gateway with TR module TR-52BA inside.

*For electrical specifications and more information about the GW refer to the GW-QVGE-01A User's guide.*

### Power supply indication

Power supply and internal accumulator condition is indicated by dual color LED inside the case and a buzzer. Following states are recognized:

- |                                 |   |
|---------------------------------|---|
| • Green LED flash in 3 s period | Supplied from external power source, internal accumulator is charged. |
| • Red LED flash in 3 s period   | Supplied from internal accumulator, voltage is higher than 3.5 V.     |
| • Red LED flash in 0.5 s period |   |
| • Warning sound in 10 s period  | Supplied from internal accumulator, voltage is lower than 3.5 V.      |
| • Warning screen for 3 s        | Voltage dropped under 3.45 V. Device is just switched to sleep then.  |

When powered from accumulator, battery icon on the top of main screen displays battery status (inner blue bar length corresponds to exhausting level).

### Reset pushbutton

Press (by a pin) during operation or Sleep invokes restart of the device. The bootloader is activated first. If there is a different application program on SD card inside it is uploaded and executed otherwise the original program is run. See *Firmware upgrade* below.

### SD card

- CATS-01 must be operated with inserted SD card containing original data from the factory. If it is missing or data is corrupted only *System* is available in the *Main menu*.
- Additional files can be possibly added:
  - License keys to access possible optional firmware parts for given device, see *Functionality extension*.
  - Free space on the SD card can be used to store screenshots created by the user, see *System / Display*.
- SD card can be used to upgrade firmware, see *Firmware upgrade*.
- SD card inside the device is accessible by a PC via USB as a standard external disk unit.

## Control and indication

### Control pushbutton

Condition	Press duration	Function
Operation	Less than 1 s	Return to main menu
	1 s to 2.5 s	Screenshot saved to SD card (if enabled)
	2.5 s to 10 s	Switch to Sleep mode (confirmation required)
	More than 10 s	Factory settings restored for some parameters (Beep enable and Backlight times, see <i>System / Sound</i> and <i>System / Display</i> ). Touchscreen calibration invoked.
Sleep	Any	Wake-up, invoking the application

### Control and navigation via touchscreen

Besides of physical control parts there are also control objects accessible from the touchscreen. Handling is the same whenever they are displayed.

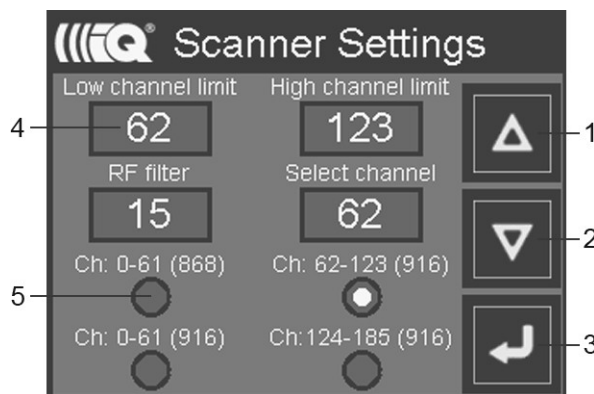
Arrow keys – navigation buttons (1), (2) and (3):

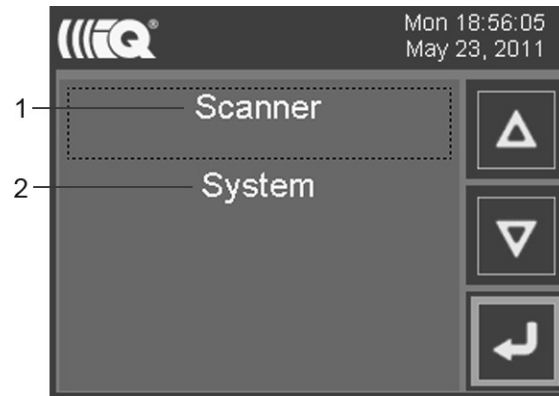
- Up (1)            Next item, increment of a numeric value
- Down (2)        Previous item, decrement of a numeric value
- Back (3)         Return to previous screen (and confirm possible changes)

Edit boxes (4) for numeric parameters. Two methods are available to setup values:

- Click the edit box to highlight the parameter and make it accessible for change via arrow keys Up (1) and Down (2).
- Doubleclick the edit box to change the parameter via numeric keypad.

Radiobuttons (5) are intended to choose only one of a predefined set of options.



**Main menu**

Main screen menu items: *Scanner* (1) and *System* (2). Other functions may be added optionally, see *Functionality extension*.

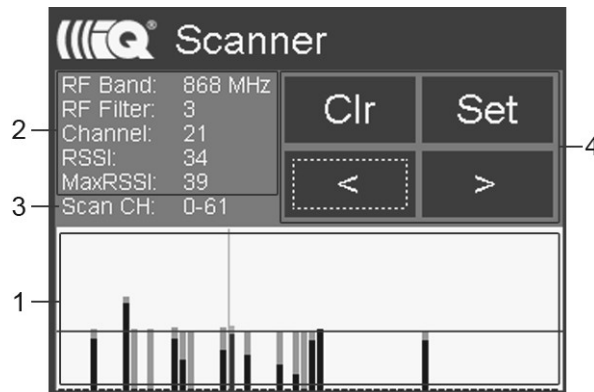
## Scanner

Scanner is intended to monitor RF communication with respect to RF channels. See IQRF OS User's guide for more information about displayed parameters.

### Scanner main screen

Activity in individual channels and parameters of RF signal in selected channel are monitored. All 62 channels (0 to 61) of 868 MHz band can be monitored at the same time but 186 channels of the 916 MHz band must be separated to three groups and the user selects just one of them to be scanned and currently displayed.

Additionally, selected group can be reduced by the user. Channels are scanned one by one. Scanning of one channel takes about 0.4 ms. Thus, to get higher resolution, number of scanned channels can be reduced by Low/High channel limits. See *Scanner settings*.



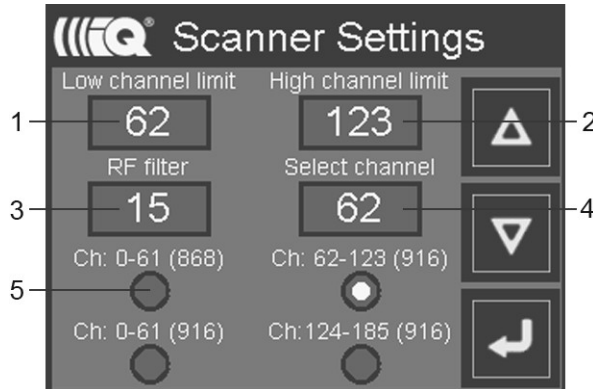
The screen is separated to following parts:

- RF activity in individual channels (1). The following information is displayed:
  - Whether a communication is running in individual channels. Active channels are displayed by bars.
  - Signal strength (current as well as the maximal detected one). Heights of bars are proportional to signal strengths.
    - Dark blue                      Current RSSI in the channel
    - Light blue                      Max. RSSI detected in the channel
    - Dark red                      Current RSSI in currently selected channel
    - Light red                      Max. RSSI detected in currently selected channel
    - Black horizontal line        RF level defining minimal incoming signal strength to be detected. See RF filter.
    - Red vertical line              Currently selected channel
- Details about currently selected channel (2).
  - RF Band                      Selected RF band
  - Channel                      Selected RF channel
  - RF Filter                      Specified RF level to filter incoming signal.
  - RSSI                      Current RSSI value in selected channel.
  - Max. RSSI                      Maximal RSSI value detected in selected channel
- Scan CH                      Selected group of scanned channels (3)
- Area with four control buttons (4):
  - "<" and ">"                      Channel selection (to display details)
  - Clr                      To clear Max. RSSI values scanned and displayed up to now. The same can be achieved by double click to the field (1).
  - Set                      Switch to the *Scanner settings* screen for setting of scanning parameters.

## Scanner settings

The following parameters can be selected here:

- Low channel limit (1) Channels with lower numbers will be not monitored
- High channel limit (2) Channels with higher numbers will be not monitored
- RF Filter (3) RF level to filter incoming signal (0 to 64). Weaker signals are ignored.
- Select channel Channel for displaying details (from *Low channel limit* to *High channel limit*)
- Ch (4) RF band and group of channels
  - channels 0 to 61 for 868 MHz
  - channels 0 to 61, 62 to 123 or 124 to 185 for 916 MHz



## Typical usage of the Scanner

### Watching activity in a channel

To evaluate a specified channel (e.g. to decide whether it is suitable for current communication in given network), reduce scanned channels for about  $\pm 5$  channels around.

### Choosing a free channel

To choose a free channel (before a network installation etc.), let the Scanner run for an appropriate time and watch Max. RSSI (the light blue bars) then.

## Hints for IQMESH design

Experience from usage of CATS-01 scanner can be utilized for design of user IQRF applications. To manage channels effectively either in point-to-point or in IQMESH applications, scanning methods described here can be applied in TR modules by users. Robust communication should be designed to allow switching RF channels with respect to current RF traffic and noise.

### Example – scanning channels in an infinite loop

```

...
i = 0;
while(1)
{
    clrwdt();
    setRFchannel(i);

    if (checkRF(RF_FILTER)) // Ignore signals with lower level
    {
        pulseLEDR(); // LED flash if a signal is detected in the channel
    }

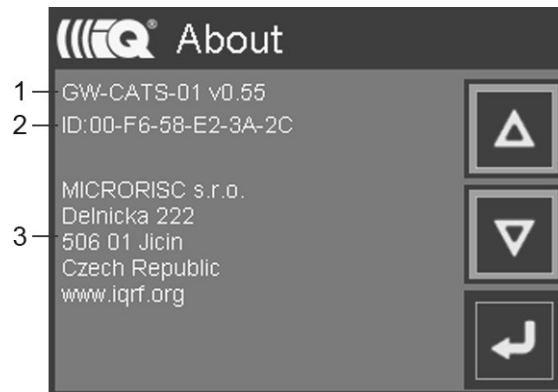
    ++i;
    if (i > 61)
        i = 0;
}

```

## System

This screen is intended for control and information functions regarding the device. Submenu items: *About*, *TR module*, *GW Status*, *Date Time*, *Sound* and *Display*.

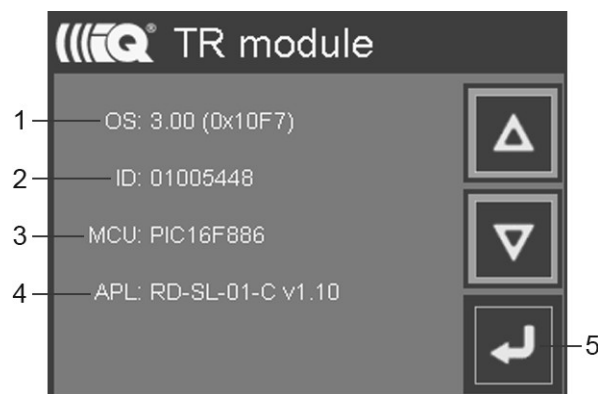
### About



Detailed data concerning the device and the manufacturer:

- Item (1) Device type and firmware version
- Item (2) MAC address (unique for each device)
- Item (3) Manufacturer

### TR module



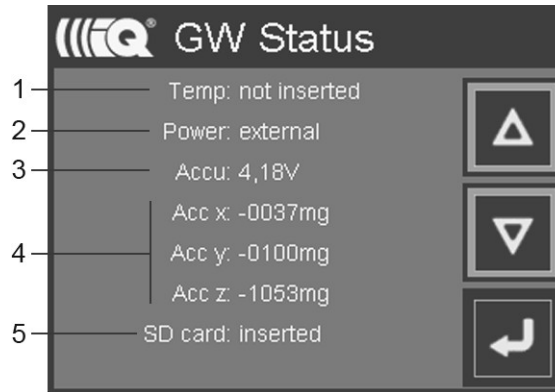
Detailed data concerning TR module inside:

- Item (1) Version of operating system built-in the TR module
- Item (2) TR module identification (TR Module info, unique for each TR)
- Item (3) MCU type inside the TR
- Item (4) Type and version of firmware currently uploaded in TR module. It depends on the last selected function of CATS-01 (in case of optional CATS-01 functions). See *Functionality extension*.

Button (5) should be used to return to menu *System*.



## GW Status



- Temp (1) Internal temperature sensor (optional): Available / Not available
- Power (2) Supplied from external power source or from battery
- Accu (3) Accumulator voltage
- Acc (4) Inertial sensor outputs (x, y and z values)
- SD card (5) Inserted / Not inserted

## Date Time



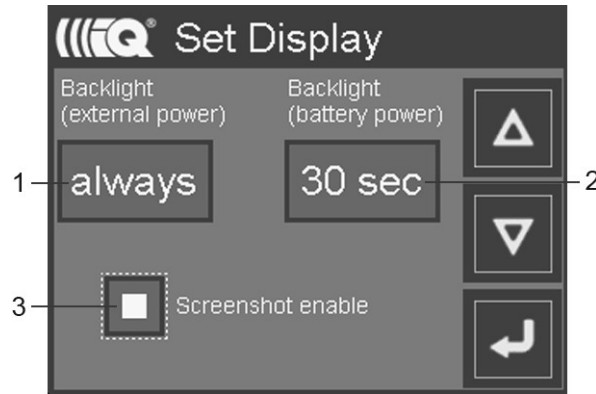
Internal real-time clock/calendar data is displayed and can be changed in a standard way. This menu item can be invoked also by click to the area where time and date is displayed on main screen.

- Item (1) Month
- Item (2) Day
- Item (3) Year
- Item (4) Hour
- Item (5) Minute
- Item (6) Second

## Sound



Acoustic indication can be enabled/disabled by checkbox *Beep*.

**Display**


- Backlight
  - (external power) If powered externally
  - (battery power) If powered from the battery
- Screenshot enable
 

There is a possibility to create screenshots. If enabled, current screenshot is stored to SD card to the `S_SHOTS` directory when control pushbutton is pressed for 1 s to 2.5 s. It takes several seconds. Starting and finishing is indicated by beeps. This option is always disabled after device restart.

**Firmware upgrade**

CATS-01 firmware can be upgraded by the user with a new version released by the manufacturer. To accomplish this, follow the steps below:

- Download a new firmware version (the `gwapl_fw.hex` file) from the product web page.
- Connect CATS-01 to PC via micro USB cable. Internal SD card should be detected as a disk unit.
- Copy the firmware to the SD card to the `GWSYSTEM` directory. The file name must remain unchanged.
- Disconnect CATS-01 from the PC and reset the device. New FW should be detected and upgraded automatically.

**Functionality extension**

CATS-01 is designed to support various functionality depending on the license. Thus, if there are any optional parts in given firmware available it is possible to make it accessible by extending the license keys.

To accomplish this, follow the steps below:

- Ask the manufacturer for license keys to chosen option for your device (specified by the MAC address).
- Connect CATS-01 to PC via micro USB cable. Internal SD card should be detected as a disk unit.
- Copy the license keys to the SD card to the `GWSYSTEM` directory.
- Disconnect CATS-01 from the PC and reset the device. New functionality should be made accessible automatically.

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**Product information**

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**Pack list**

- GW-QVGE-01A with the CATS-01 firmware programmed
  - SD Flash memory card inside with respective licence key included
  - TR-52BA transceiver module with *Scanner* application inside
  - Accumulator (soldered)
- Power source TY-A6-microUSB (5V DC, 500 mA, stabilized, with micro USB connector)

**Recommended options**

- CAB-USBABMICRO-100 Micro USB cable

**Ordering code**

- CATS-01 IQRF debug and service tool

**Document history**

- 110929 Based on GW-QVGE-01A with power-down mode. FW v0.61.
- 110801 916 MHz scan added (FW v0.56), screenshots supported, documentation extended.
- 110506 First release (FW v0.43)

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*Complies with FCC directives FCC CFR, Title 47, Part 15, Section 15.209, FCC CFR, Title 47, Part 15, Section 15.249*

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