GW-USB-06

FW v1.04

IQRF USB Gateway

User's Guide

Description

GW-USB-06 is an IQRF gateway with USB connectivity. It is intended as an interface between IQRF network and PC or similar devices with USB.

The user can implement specific functionality by software for internal TR transceiver.
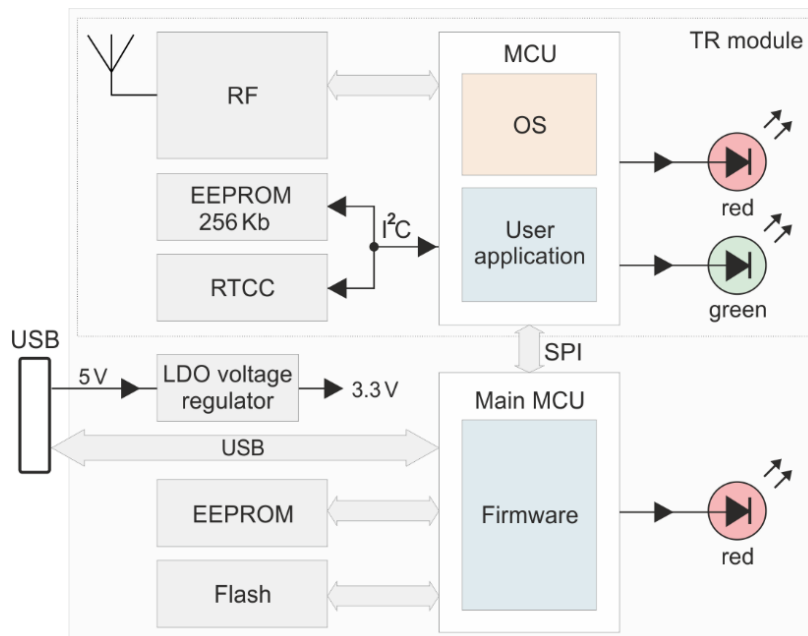
Key features

- PC connectivity via USB interface
- USB interface (CDC and Custom device, MICRORISC VID & PID)
- Custom device, CDC IQRF, CDC SPI and CDC UART modes
- TR transceiver and internal antenna, bidirectional RF
- TR transceiver programming via USB and IQRF IDE
- RTCC (real-time clock/calendar)
- 3 LEDs
- Compact USB-stick style
- Bootloader for firmware upgrade

Applications

- IQRF – PC interface
- IQRF gateway
- Diagnostic tool
- Wireless programmer (RFPGM) for TR modules

Block diagram

Electrical specifications

*Typical values **unless otherwise stated***

Supply voltage	5.0 V supplied from USB
USB	V2.0 Compliant SIE
TR transceiver	TR-72D compatible, without temperature sensor
Supply current	About 15 mA (TR not transmitting), 50 mA max. (TR transmitting)
RF band	868 MHz or 916 MHz [3] (software configurable)
RF channels	See IQRF OS User's guide, Appendix *Channel maps*
RF data modulation	GFSK (Gaussian Frequency Shift Keying)
RF data transmission bit rate [1]	19.836 kb/s
RF IC RF sensitivity	-106 dBm (STD RX mode, `checkRF(0)`)
RF IC RF output power	11 dBm, programmable in 8 levels (0 – 7)
RF range [2]	500 m
Antenna	Built in PCB
Operating temperature	0 °C to +70 °C
Dimensions	59.3 mm x 23.5 mm x 12.3 mm (including the cover)
Weight	12 g (including the cover)

Note 1: Several RF bit rates different from 19.836 kb/s will be available in future IQRF OS versions.
Note 2: Arrangement:
- Two GW-GSM-06 devices plugged via USB cables, in vertical positions, 1.6 m above the ground, in free space.
- The range is significantly shortened when the GW is plugged directly in a USB device.
- The range is significantly shortened in direction of longitudinal axis (the GW placed in horizontal position).

Test software: `E09-LINK` example (STD mode, `setRFpower(7)`, `checkRF(0)`)**,** bit rate 19.836 kb/s.
Note 3: 916 MHz band is available from IQRF OS v3.08D.

Caution: *Electrostatic sensitive device. Observe appropriate precautions for handling.*

Absolute maximum ratings

Stresses above listed maximum values may cause permanent damage to the device and affect device reliability. Functional operation at these or any other conditions beyond those specified is not supported.

Supply voltage (V_{CC})	5.5 V
Storage temperature	-20 °C to +70 °C

Hardware

GW-USB-06 consists of main MCU, memories and the TR-72D compatible circuitry with RTCC added. Firmware of the main MCU is fixed. Specific functionality of the device can be implemented by user application software for the TR transceiver inside. This (except of RTCC usage) can also be developed using the CK-USB-04A development kit. For detailed information refer to CK-USB-04A User's guide.

Power supply

GW-USB-06 is intended to be supplied from a host via USB connector. LDO voltage regulator converts 5 V from USB to 3.3 V for all internal circuitry. RTCC has a temporary backup by decoupling capacitors, see below (RTCC).

Reset

Reset can be invoked by connecting a disconnected GW-USB-06 to USB or by the Reset USB Device command in CDC IQRF mode. Actual reset is executed ~5 s after the command is issued. This delay allows to disconnect USB communication on host side in time. See the *CDC Implementation in IQRF USB devices* User's guide.

USB

GW-USB-06 supports Custom device and three types of CDC USB modes. Proper USB driver(s) must be installed in the host device. Refer to the *IQRF USB drivers Installation guide* if needed.

TR transceiver

Wireless IQRF transceiver compatible with TR-72D, without temperature sensor. Refer to the TR-72D datasheet for details.

Antenna

PCB antenna on GW-USB-06 board.

RTCC

Real-time clock/calendar MCP7940NT by Microchip shares the I2C serial bus with serial EEPROM. It can be controlled from TR transceiver. Decoupling capacitors ensure RTCC backup for 30 s after disconnecting power supply which allows to quickly replug the device from one host USB to another keeping the RTCC running.

RTCC is supported by demo RTCC example available on www.iqrf.org/GW-USB-06 product page.

Serial Flash memory

8 Mb Flash memory SST25VF080B-80-4I (by SST) with serial SPI interface is connected to main MCU. It is not supported in current firmware version, reserved for future use and optional on request.

LEDs

LED1 (red) and LED2 (green) are dedicated to TR transceiver (compatible with LEDs on discrete TR transceivers). LED 3 indicates USB modes and other status information.
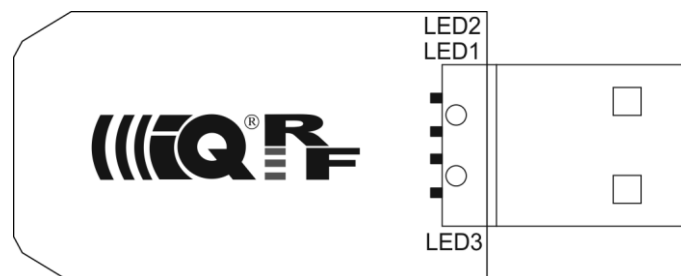
Basic components

IC	Type	Manufacturer	Note
Main MCU	PIC18F26J50-I/ML	Microchip	
Flash	SST25VF080B-80-4I	Microchip	8 Mb, SPI
EEPROM	24AA16-I/MC	Microchip	16 Kb, I2C, connected to main MCU
TR MCU	PIC16LF1938–I/MV	Microchip	
RF IC	SPIRIT1	STMicroelectronics	
RF balun	BALF-SPI-01D3	STMicroelectronics	
EEPROM	24AA256-I/CS16K	Microchip	256 Kb, I2C, connected to TR MCU
RTCC	MCP7940NT-I/MNY	Microchip	I2C
LDO voltage regulator	MCP1700T-3002E/TT	Microchip	3.3 V

For more information refer to datasheets of ICs used.

Firmware

Firmware upgrade

GW-USB-06 firmware can be upgraded by the user with new versions possibly released by the factory using the IQRF IDE v4.31 or higher, menu *Tools – IQRF Device Manager – Upload FW*. See IQRF IDE Help.

LED 3 indication

After GW-USB-06 reset (by reconnecting the USB cable), current USB mode is indicated by a series of flashing of LED 3 as follows:

- Custom Device   1 x
- CDC IQRF   2 x
- CDC SPI   3 x
- CDC UART   4 x

In idle state LED 3 is not flashing (Custom Device mode) or flashes with 1 s period (CDC xxx mode). If it is needed to find out the current USB mode, the reset of the device must be performed.

LED3 flashes 3x after the *Indicate USB Device* command (key F11) in respective IQRF IDE (to identify the kit in case of multiple IQRF USB devices or IDE instances).

LED3 flashing in 300 ms period means missing firmware (see *Firmware upgrade* below).

USB modes

GW-USB-06 supports four USB modes:

- Custom Device
- CDC IQRF
- CDC SPI
- CDC UART

Proper USB drivers must be installed in the host equipment. See the IQRF document *Install_Guide_USB_Drivers*. If used with IQRF IDE, both USB drivers (Custom Device and CDC) are installed transparently within the IQRF IDE installation.

USB mode selection

- Using IQRF IDE: Menu *Tools – USB Classes* (for all modes, see IQRF IDE Help).
- Using commands in CDC IQRF protocol (from CDC IQRF mode only). See the *CDC Implementation in IQRF USB* devices User's guide (`User_Guide_CDC_xxxxxx.PDF`).
- Using the sequence 1 s inactive *** 1 s inactive sent from a USB host application (for switching from CDC SPI or CDC UART to CDC IQRF only). The switching is performed after about 5 s.

See chapter *LEDs* for indication of current mode. The last selected mode is restored after start-up or reset.

Custom Device mode

Full communication with the IQRF IDE is enabled in this mode.
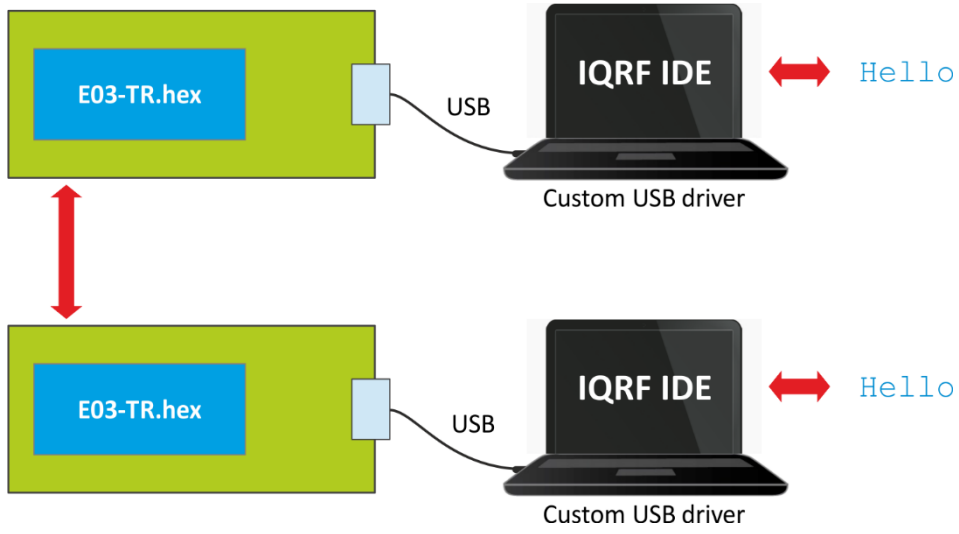
CDC IQRF mode

After connecting to PC a virtual serial port is created in this mode. The user can create one's own PC program and communicate via this port using the protocol described in document *CDC Implementation in IQRF USB devices* User's guide.

This protocol enables:

- Communication with TR transceiver
- Communication with the USB device itself
- Confirmation of commands
- Information about error states

This mode is recommended for communication with custom (USB host) applications and is supported by the IQRF SDK (Software Development Kit, open source). The application in TR transceiver must use SPI communication.
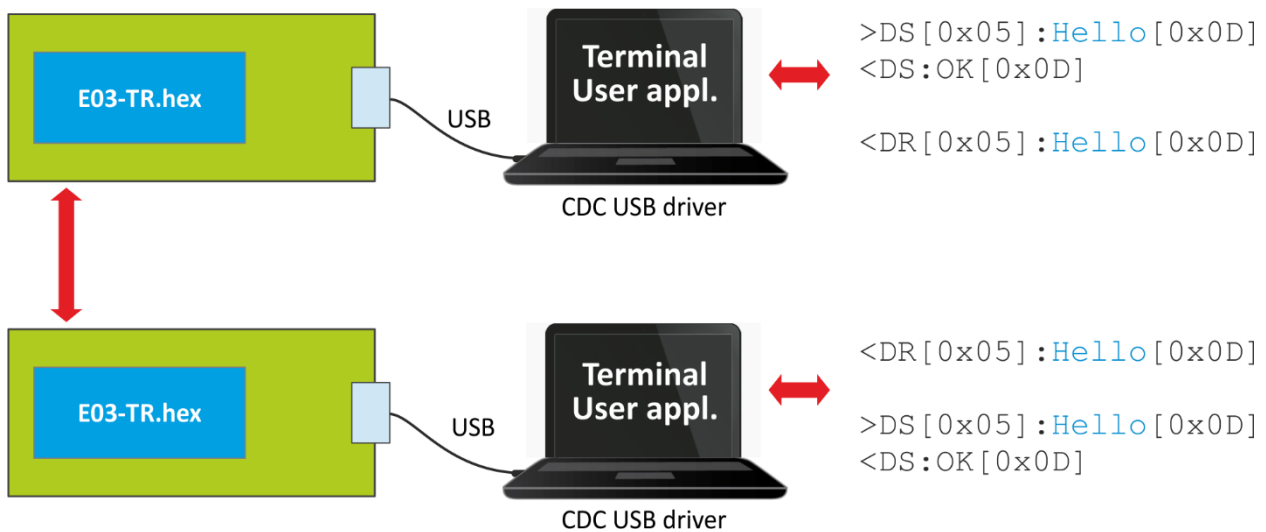
Tip

For testing a communication in CDC mode various SW terminals operating with PC serial ports are available. Select a terminal enabling to issue direct byte commands and data. Refer to the communication protocol described in *CDC Implementation in IQRF USB devices* User's guide.

Recommended terminal: Docklight, www.docklight.de. There is a project containing all supported commands for this terminal available at www.iqrf.org/218. It is necessary just to select the COM port used.

Unsuitable terminals: Windows Hyperterminal and Tera Term.

CDC SPI mode

After connecting to PC a virtual serial port is created in this mode.

This mode is intended for testing of user application for TR transceiver utilizing SPI communication. It works similarly as the CDC IQRF mode but it has no protocol implemented and the data is transferred transparently. It can be used also in case when the user (a USB host) application does not allow to implement any proprietary protocol. Otherwise, the CDC IQRF mode is recommended.

The application in TR transceiver must use SPI communication.
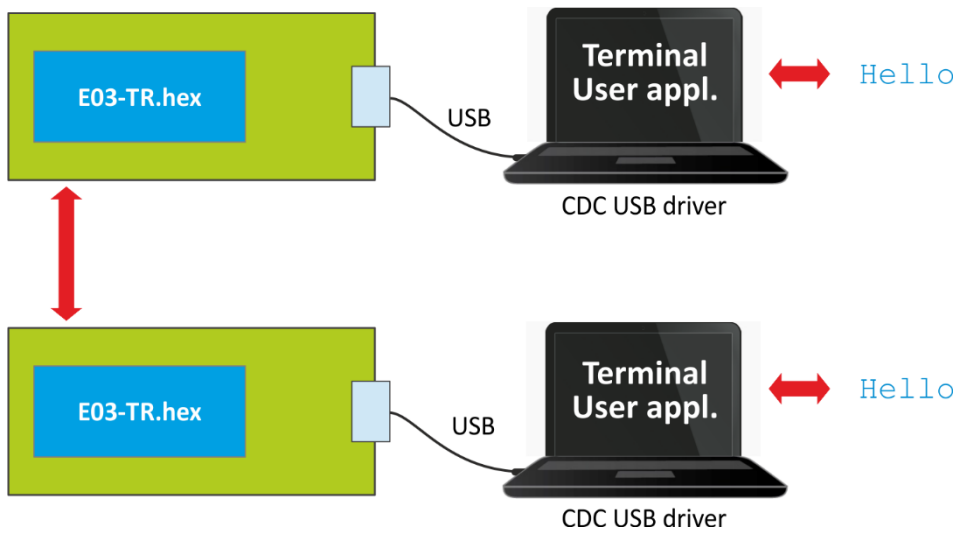
CDC UART mode

After connecting to PC a virtual serial port is created in this mode.

Application

Testing of user applications for TR transceiver using UART communication

UART parameters

- Voltage levels: 3 V
- Baud rates: 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200 Bd
- Data bits: 8
- Parity: None, Odd, Even, Mark, Space
- Stop bits: 1
- Operation: duplex
- Number of data bytes in a packet: max. 64
- End of packet detection timeout: cca 3 * transmission time for one byte (with respect to given baud rate)

This mode has no protocol implemented and the data is transferred transparently.

The application in TR transceiver must use UART communication.
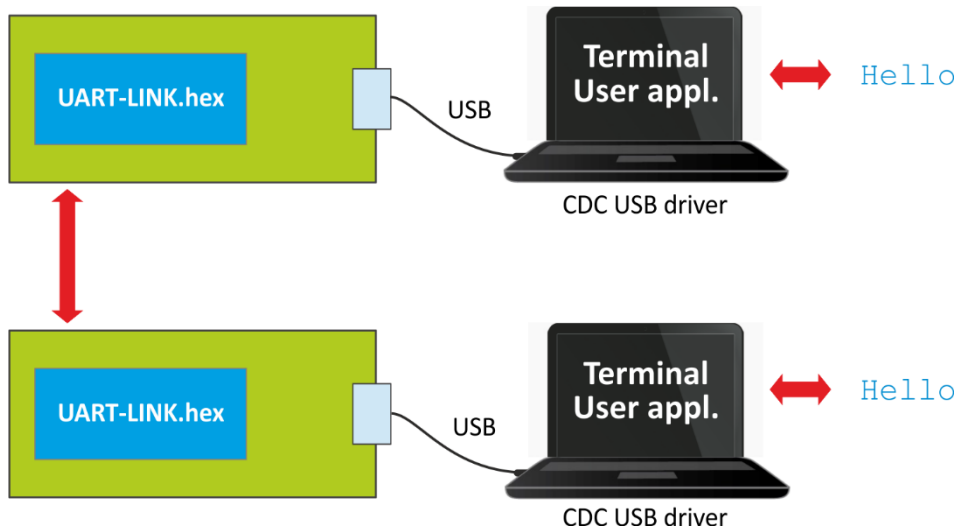
Application

> *Users have to ensure observing local provisions and restrictions relating to the use of short range devices by software, e.g. the CEPT ERC/REC 70-03 Recommendation and subsequent amendments in EU.*

The functionality of TR transceiver inside the GW is fully user programmable. Factory default application is E03-TR (one of basic IQRF examples).

Installing

See the *IQRF Quick Start guide* and IQRF IDE Help.

Operating system

See *IQRF OS User's guide* and *IQRF OS Reference guide*.

DPA framework and DCTR

See DPA Framework technical guide.

Programming

Programming the application is similar to the CK-USB-04A development kit usage. See the *IQRF Quick Start guide*, *CK-USB-04A User's guide* and IQRF application examples included in IQRF Startup package (www.iqrf.org/startup).

Upload

GW-USB-06 enables to upload an application code into IQRF TR transceivers in following ways:

- Wired upload using IQRF IDE running in the GW-USB-06 host.
- Wireless upload (RFPGM – RF Programming ™), e.g. when the GW is hosted on an equipment not supporting IQRF IDE. Switching between RFPGM and operation modes must be solved in the application in this case. See *IQRF OS User's guide* (Appendix RFPGM) and IQRF IDE (*Tools → CATS Service Tools → Control* menu, *Create CATS* button).

Debug

The application in internal TR transceiver can be debugged similarly as in discrete TR transceivers. See the *IQRF Quick Start guide*, IQRF IDE Help and IQRF application example E06-RAM included in IQRF Startup package (www.iqrf.org/startup).

Product information

Pack list

- GW-USB-06   USB gateway, with E03-TR example uploaded in TR transceiver.

Ordering codes

- GW-USB-06   USB gateway (serial Flash memory included).

Document history

- 160122   First release.

Sales and Service

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Partners and distribution

Please visit www.iqrf.org/partners.

Quality management

ISO 9001 : 2009 certified

Complies with ETSI directives EN 301489-1 V1.9.2:2011, EN 301489-3 V1.6.1:2013, EN 300220-1 V2.4.1:2012, EN 300220-2 V2.4.1:2012 and VO-R/10/05.2014-3.

Complies with directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE).

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