

IQRF Design Step by Step

Application Note

AN005

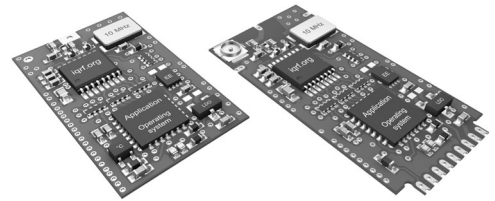


Simple way to smarter wireless solutions

How to start the first IQRF design

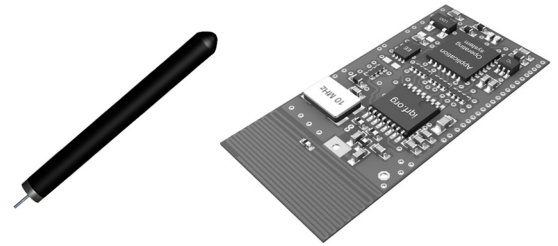
Select RF transceiver (TR module)

- TR-52B 6 I/O, fit to SIM card connector
- TR-53B 7 I/O, fit to SIM card connector, solder mounting possible



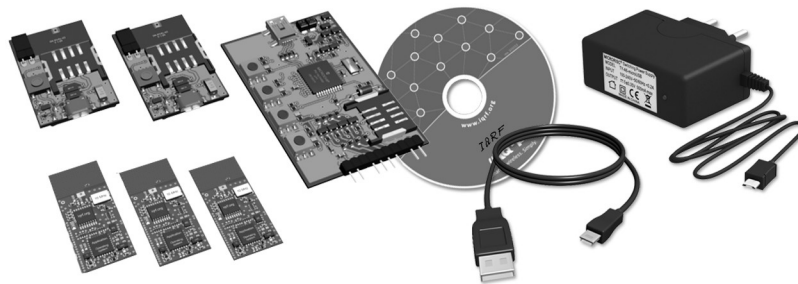
Select antennas

- Removable antenna AN-03 is suitable especially for development.
- TR module has on-board PCB antenna option
- Other antenna types, cables, connectors and antenna sets are also available.
- Application specific antenna design (with respect to the case) can be done by the IQRF manufacturer.



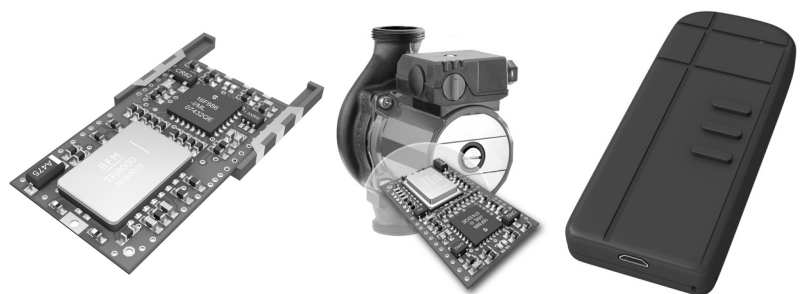
Select development hardware

IQRF development sets (e.g. DS-START) contain **all HW and SW needed** for effective development.



Select final hardware

- Customer's own equipment (e.g. provided with the SIM connector for the TR module)
- IQRF kit or gateway (e.g. RC-04, DK-EVAL-04, RC-03, GW-USB-03, CK-USB-04,...)



Installation of development tools

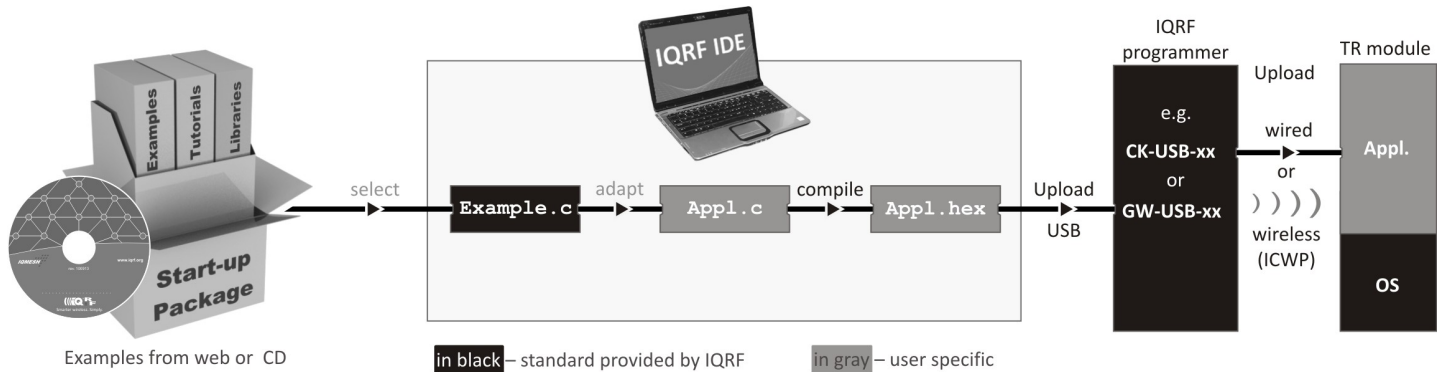
- All software and documentation is available in a single **Startup Package** – from the IQRF CD or downloaded from the IQRF web – www.iqrf.org/startup. You will be able to start IQRF programming from scratch and establish wireless communication very quickly.
- Unpack your IQRF **development set**. See IQRF Installation guide **AN003** for installation.



IQRF IDE usage

All SW development tools are integrated in the IQRF IDE environment:

- **Programming** – creation of user specific IQRF program
 - **Edit** – creation/modification of source code in C language
 - **Compile** – compiling the source program from C language to .HEX machine code
 - **Upload** – uploading the code into the TR module. Wireless upload (ICWP, In-Circuit Wireless Programming) is also possible – see Application note AN009.
- **Debug** – allows to stop program execution and watch internal values
- **SPI Test** – SPI communication with PC at the packet level (PC-side SPI communicator/monitor)
- **Terminal** – SPI communication with PC at the text message level



Upload

Checking of TR modules and development tools


- Plug two TR modules with the original program (from the factory, E09-LINK) to development kits and connect antennas and power supply according to the picture above. RF communication should be established immediately which is indicated by blinking the red LED on the TR module. RF range can now be tested in this way.
- Check connection between CK-USB-04 kit and PC: click the IQRF logo in IQRF IDE window. The LED on the CK should flash thrice.
- Upload the StartUp example from the package to TR module. LED should flash 3x.
- Change the number of flashes in the source program (see comments), compile and upload it and check the result.

Then you gain control over the whole development system and you are ready to start development.

Debug

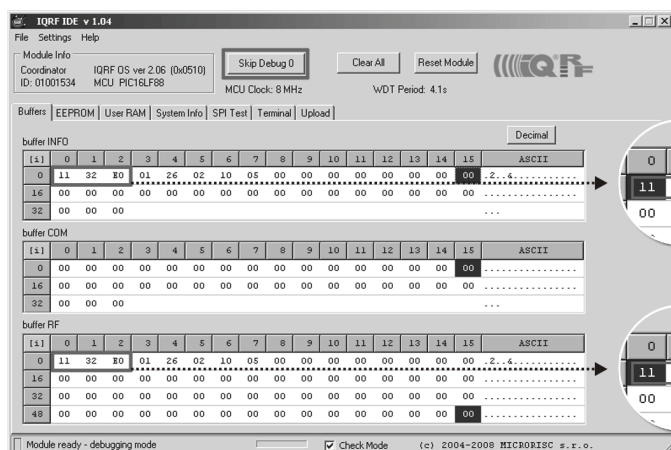
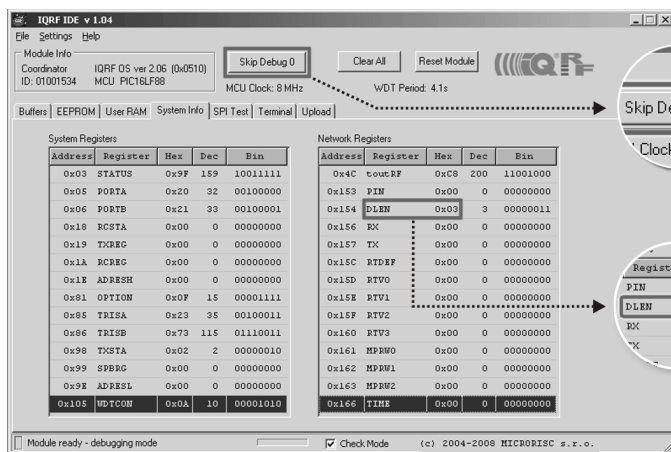
Debug is the most powerful IQRF IDE tool for debugging IQRF applications. The following information is displayed:

- Module Info
- System Info
- Buffer INFO
- MCU Clock
- Application Info
- User RAM
- Buffer COM
- Watchdog Period
- Network Info
- User EEPROM
- Buffer RF

The operating system offers the debug() function to be placed wherever you wish to display internal variables and registers. After selecting the Skip Debug button the application continues running until next debug() function is encountered and so on.

Example:

- The module sends 3B data (prepared in the buffer INFO in advance, 11, 32 and E0 in this case)
- Let's assume that the opposite side receives it and sends it back
- The module attempts to receive and verify the returned data
- Verification result is available in the W register:
 - W = 1 : O.K.
 - W = 2 : verification error
 - W = 3 : no data returned
- 1-st debug command (0): it is possible to check whether everything is correct before transmitting: data in the buffer RF, packet length and maximal response time (RF timeout).
- 2-nd debug command (1, 2 or 3): RF communication result checking.



```
copyBufferINFO2RF();
```

```
DLEN=3;
```

```
toutRF=200;
```

```
W=0;
```

```
debug();
```

```
PIN=0;
```

```
RFTXpacket();
```

```
if (RFRXpacket())
```

```
if (compareBufferINFO2RF(4))
```

```
W = 1;
```

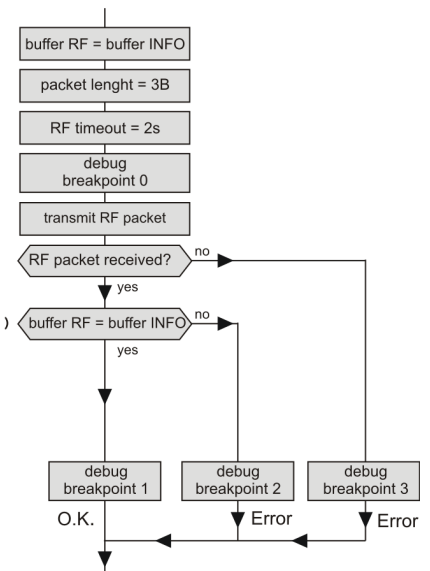
```
else
```

```
W = 2;
```

```
else
```

```
W=3;
```

```
debug();
```



Application examples

The Startup Package contains demo programs (examples E00 – E11) to get familiar with TR operation and OS functions. See Application note AN006 – IQRF examples.

User's own RF desings

- There are two basic kinds of IQRF communication: **Peer-to-peer** (simple, two or more points) or **IQMESH** (complex, sophisticated network). It is recommended to start with simple point-to-point communication without complex networking.
- Use an example or the template from the Package and modify it as you wish.
- Compile and program your application simply with the IQRF IDE.

Typical repeated procedure during debugging is:

- Edit external editor
- Save (Ctrl+S) external editor
- Compile (F10) IQRF IDE – the *Programming* tab
- Upload (F5) IQRF IDE – the *Programming* tab
- Debug IQRF IDE – the *Debug* and *Communication* tabs

Installation and development procedures are also described on the Introduction video available at www.iqrf.org/.

Recommended documentation

- IQRF OS User's guide
- IQRF OS Reference guide – description of OS functions
- SPI User's guide – implementation in IQRF TR modules

Document history

- 110107 Updated for IQRF OS v3.00
- 091201 Updated for IQRF OS v2.10
- 090902 First release

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Partners and distribution

Please visit www.iqrf.org/partners

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Simple way to smarter wireless solutions