

# **IQRF DPA**

# **Quick Start Guide**

**For DPA framework v2.00**

**For IQRF OS v3.05D and higher**

**For IQRF IDE v4.15 and higher**



Smarter wireless. Simply.

This document is intended as a step-by-step guide to get familiar with HWP. The approach is the same for all hardware profiles, either Demo HWP with common transceivers (TR) or General HWP with Data controlled transceivers (DCTR).

## Demo HWP vs. General HWP versions

### Limitations

- Demo HWP is limited to max. 5 Nodes (addresses 1 to 5). A node device having an unsupported address flashes periodically red LED after reset.
- Some Custom handler events are not supported. See IQRF DPA Technical guide for specification.
- Only one user peripheral  $PNum = 0x20$  with one command  $PCmd = 0x00$  is supported.

### Extensions

- Demo HWP supports the PWM peripheral (simple pulse-width modulated digital output).
- Discovery and FRC processes are indicated by LEDs flashing by default.

## DS-DPA-01 development set

To learn DPA usage, development set DS-DPA-01 can be used.



• DCTR-52DAT	IQRF smart transceiver	6 pcs
• CK-USB-04(A)	IQRF programmer and debugger	2 pcs
• DK-EVAL-04(A)	Universal portable development kit for (DC)TR modules	4 pcs
• CAB-USABMICRO	Micro USB cable 18.5 cm	2 pcs
• USB flash drive	Software and documentation	1 pc

## 1. Preparation

All SW, plug-ins, etc. are available on the flash disk and on [www.iqrf.org](http://www.iqrf.org).

- Prepare 5 pieces of DCTR-52DAT with OS 3.05D or higher as Nodes and one DCTR-52DAT module with OS 3.05D or higher as the Coordinator.
- Prepare 4 (5) pieces of DK-EVAL-04(A) and 1 (2) piece(s) of CK-USB-04(A).
- Unpack the Demo HWP (from the IQRF Startup package) into your computer.
- Install IQRF IDE 4.15 or higher. In case of troubles with installation (e.g. with USB drivers) refer to IQRF Quick Start guide.
- Launch IQRF IDE and open project `HWP-demo_XXXXXX.iqrfprj`. All necessary files and macros are included in the project.

## 2. HWP upload

### Creating Nodes

A. Plug a DCTR module in CK-USB-04(A), select the `DemoHWP-Node-SPI_*.iqrif` file in Project window and click the *Upload Plug-ins* button on the Toolbar (or use the F5 key).

B. Double-click on the configuration file `DPA-config_xxxxxxx.xml` in IDE Project window to open the *TR Configurations* window. Make the following settings:

- Select desired RF channel (RF Channel A) in the OS tab.
- Select desired RX Filter in the HWP tab.
  - For short range testing (within the room) you can leave the default value (35).
  - For operating in real conditions select 5.

This settings must be the same in the entire network!

Do not change other parameters for now.

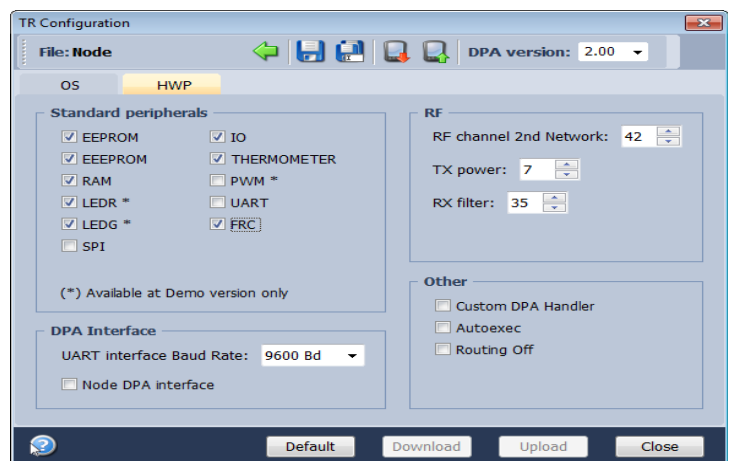
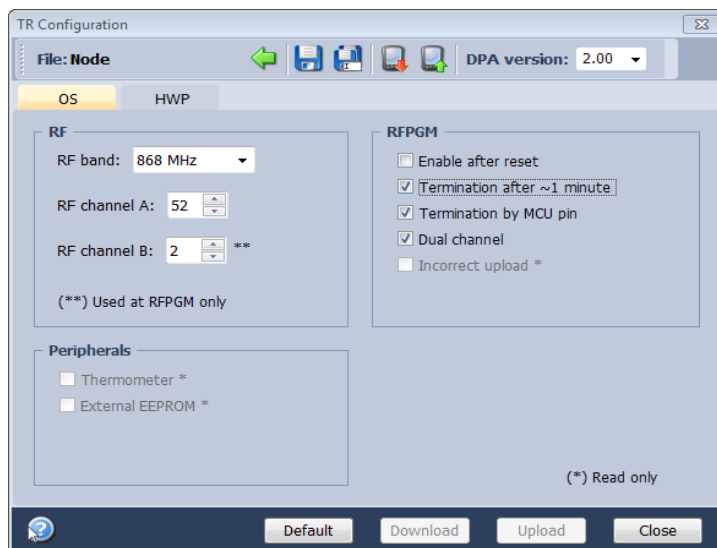
Save the configuration into the DCTR module by button *Upload*.

C. Plug this DCTR module in the DK-EVAL-04(A) kit

Repeat steps A to C for all Nodes.

### Creating the Coordinator

Use the same procedure but with the `DemoHWP-Coordinator-SPI_*.iqrif` and `DPA-config_xxxxxxx.xml` files. Then leave the DCTR module plugged in CK-USB-04(A).

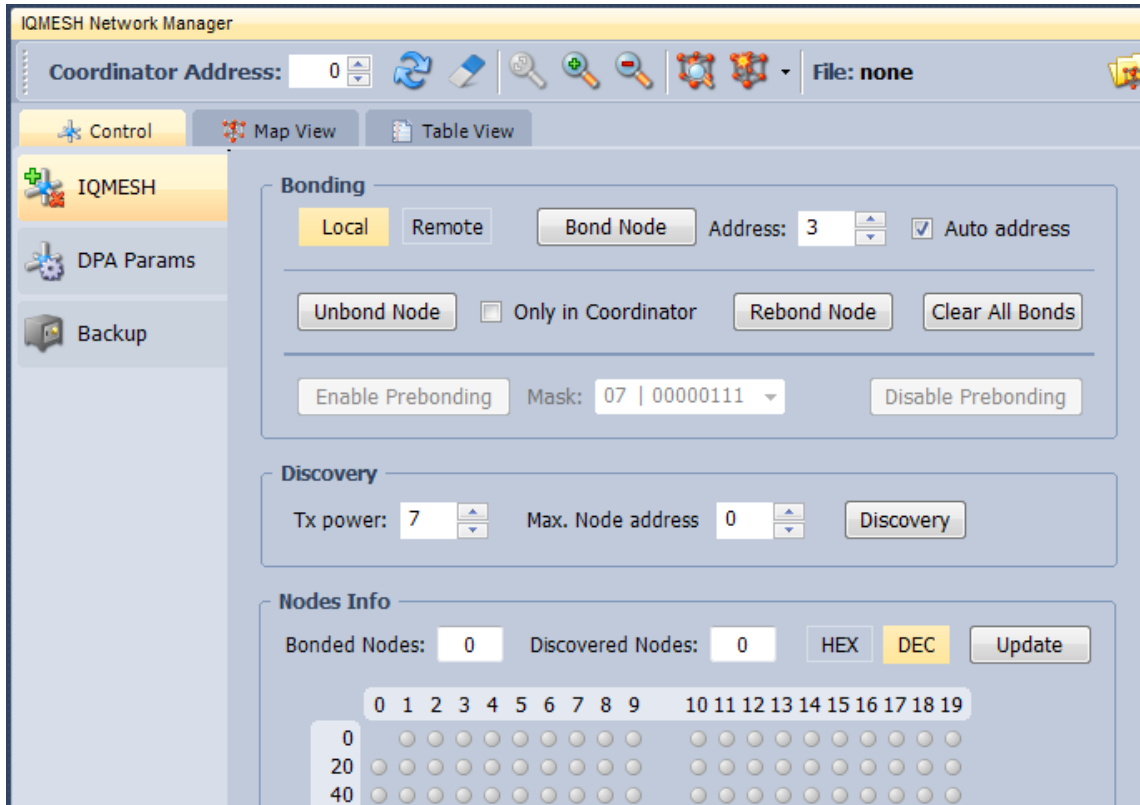


**Warning:** The Demo is optimized for operation on a table to demonstrate routing within a room by strong RX filter (35) in TR configuration. For real application all devices should have minor RX filter in TR configuration. Recommended value is from 35 to 5.

## 3. Bonding

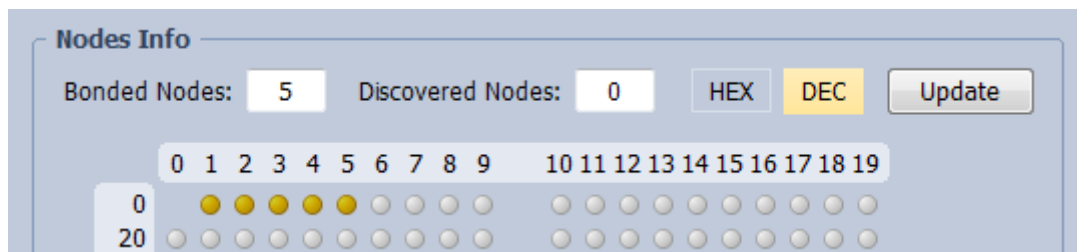
To use DPA, all Nodes in the network must be bonded to the Coordinator. To get all nodes bonded, follow next procedure:

- A. **All Nodes must be unbonded** and located in direct RF range to the Coordinator before bonding (local bonding).
  - In case the Node is already bonded the red LED once shortly flashes. Go to step Unbonding below in this case.
  - If the node is not bonded the red LED is flashing for 10 s and then the module falls into sleep.
- B. The Coordinator may possibly have stored some bonded Nodes from previous DCTR module usage. Thus, such bonding information should be cleared from the Coordinator memory first. Click the *Clear All Bonds* (in *IQMESH Network Manager* window, tab *Control* → *IQMESH*). Number of bonded Nodes should be 0, see the screenshot below.



- C. Activate the *Auto address* checkbox. Thus, addresses will be assigned automatically in ascending order starting from 1. Click the *Bond Node* button. The Coordinator stays cca 10 s in bond mode. During this period press the SW1 pushbutton (the one close to USB connector) on the DK-EVAL-04(A) kit containing the Node you are just going to bond. It is convenient to mark the assigned address on the DCTR module (e.g. by a label).

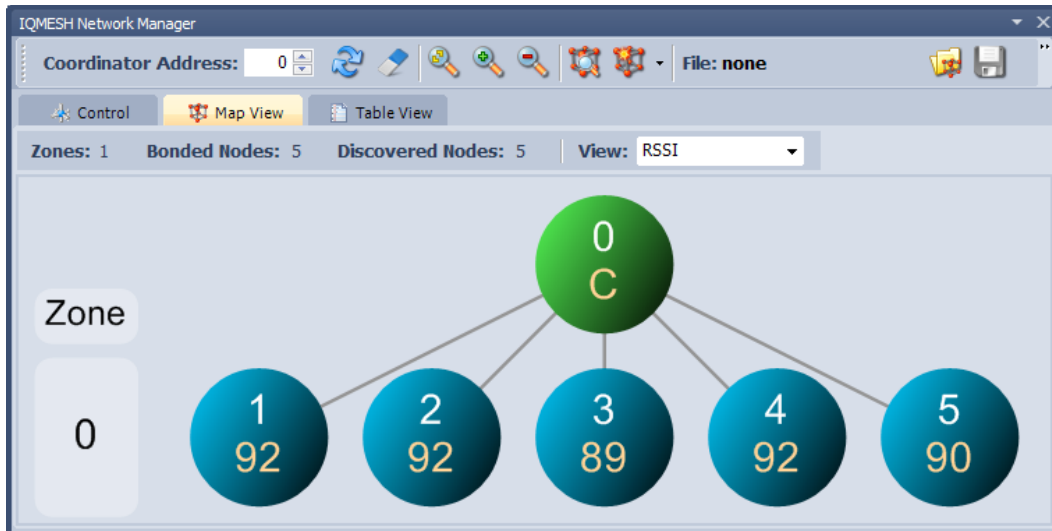
- D. Repeat step C for all Nodes. It should result in 5 bonded Nodes according to the screenshot below.



## 4. Discovery

Discovery is a process that sets up network topology to deliver data or commands to nodes out of the Coordinator direct range. Thanks to HWP just couple of clicks and all is done. Discovered topology can directly be reviewed in window *IQMESH Network Manager*, the *Map View* tab. Follow next steps to run Discovery and create different types of topologies.

- A. Place all Nodes close to the Coordinator and click the *Discovery* button (in window *IQMESH Network Manager*, the tab *Control* → *IQMESH*). If all Nodes are in direct range to the Coordinator the Discovery should take a few seconds only. Switch to the *Map View* tab after finishing Discovery. The topology like in the screenshot below should appear.



- B. Place Nodes in longer distance between each other (with respect to current RX Filter selected in *TR Configuration*). For test purpose it is recommended to reduce the range using a shielding, e.g. by inserting the kits with DCTR modules into plastic bags with anti-static proofing.
- D. Click the *Discovery* button. If not all Nodes are in direct range now, the Discovery process will take a bit longer. The result can look like on the screenshot below:



### Note

Displayed “topology” is only a tree visualization of parent Nodes (illustrating just the path which has been used to discover individual Nodes). This does not mean that packets can be delivered through displayed links only. Packets are delivered based on Directed flooding routing algorithm described in IQRF OS User 's guide.

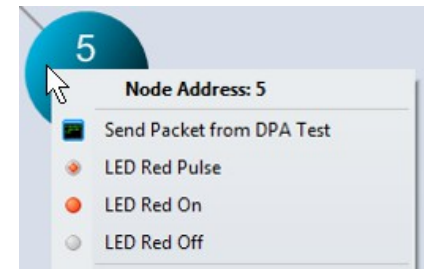
## 5. Examples

A quick test of the network functionality can be performed by the pop-up menu (example A below). For detailed testing of DPA commands the *Terminal – DPA Test* tool provides two ways how to set up a specific DPA command: using macros (example B) or manual arrangement of DPA packet (example C).

### A. Pop-up menu

For the simplest checking, a command to switch the red LED On/Off on selected Node can be immediately sent by clicking the left mouse button on the symbol of given Node in the map.

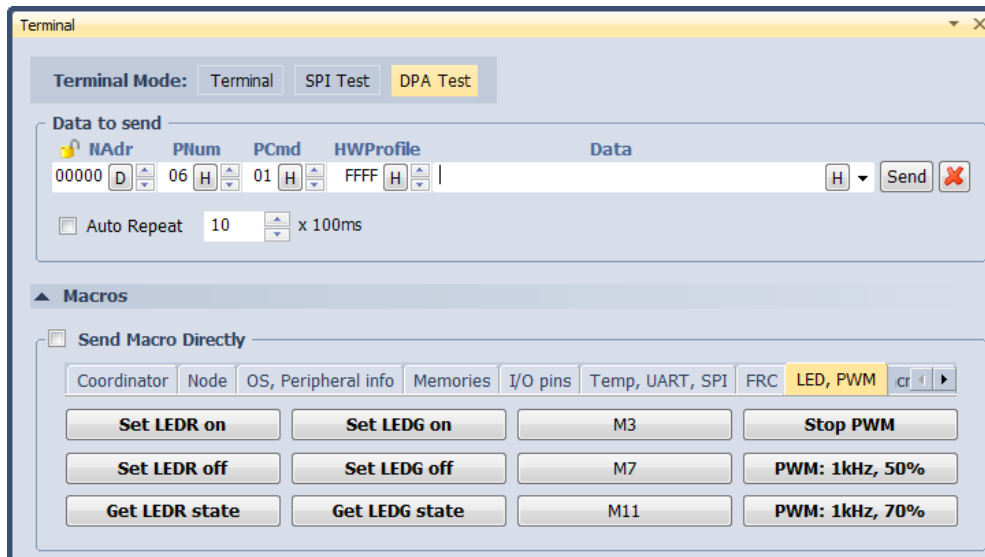
The command currently selected in the *DPA Test – Data to Send* window can be executed by the right mouse button click on the symbol of given Node in the map and by selecting the *Send Packet from DPA Test* item. *NAdr* is set automatically according to selected Node.



### B. Macros

Click on the particular macro and *PNum*, *PCmd*, *HWPprofile* and *Data* are automatically filled in. Then select *Node Address* in *NAdr* box (for Broadcast use address *0xFF*) and click the *Send* button.

- Go to LED macros and click on macro *Set LEDR on*. To switch all LEDs on, fill in *0xFF* in *NAdr* and Click *Send* button.
- Use various macros and Node addresses to test the functionality.

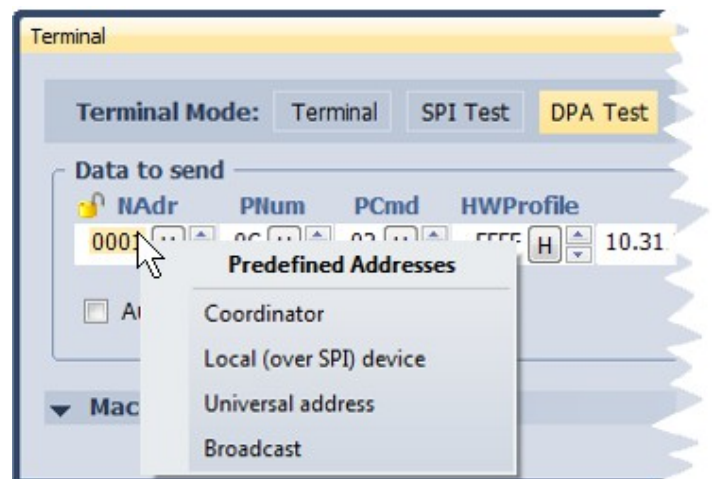


### C. DPA packet arranged manually

To get better understanding of DPA packet structure, you can also fill in the DPA packet manually. By clicking the right mouse button to the area for selecting *NAdr*, *PNum*, *PCmd* or *HWPProfile*, menu *Predefined Addresses*, *Predefined Peripherals*, *Predefined Commands* or *Predefined HWP* is displayed. These lists allow to select items defined by the DPA specification and directly arrange the packet.

- From menu *Predefined Addresses* select *Broadcast* or directly specify the address of given Node.
- From menu *Predefined Peripherals* select the LEDR peripheral.
- From menu *Predefined Commands* select the *Set on* command.
- From menu *Predefined HWP* select the *To All HWP* item.
- Click the *Send* button.

Test other peripherals and commands in the same way.



## 6. Unbonding

### Unbonding a Node on the Coordinator side

- Select the desired address of the Node in the *Address* field (IQMESH Network Manager – the *Control* → *IQMESH* tab)
- If the network is not created yet or given Node is not reachable, activate the *Only in Coordinator* checkbox.
- Click the *Unbond Node* button.

### Unbonding a Node on the Node side

- Press and hold button *SW1* (close to USB connector).
- Shortly press button *SW2*. Green LED shines for about 2 s.
- Release the *SW1* button immediately once the green LED stops shining.
- If the node is successfully unbonded, red LED is flashing and module falls asleep after 10 s.

### Note

Besides of *IQMESH Network Manager* and *DPA Test*, IQRF IDE provides also further tools (*Terminal Log* and *Packet Inspector*) for working with DPA especially for developers implementing or testing the DPA protocol. They are described in IQRF IDE Help.

## Document history

- 140821 Recommended RX filter added in Chapter 2.
- 140618 DCTR modules in DS-DPA-01 set are delivered without hardware profiles uploaded from 18 Jun 2014.
- 140513 First release for DPA framework v2.00.



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## Sales and Service

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