Interfacing network with the DEQ regulator

TABLE OF CONTENTS

TABLE OF FIGURES

Used hardware:

TP-Link Wi-Fi= TP-Link TL-WR702N
TP-Link Powerline = TP-Link TL-PA2010
SIM card modem = Teltonika RUT 500

1. AN OBJECT WITHOUT INTERNET CONNECTION

1.1. Direct link between the computer and the DEQ regulator

When the object on which the regulator is to be installed, is without an internet access, it's possible to connect it to the computer via Ethernet cable directly. We only need standard UTP cable.

CONNECTION DIAGRAM:

Figure 1: Connection diagram computer- DEQ regulator

When we wire the computer and the DEQ regulator together, we also need to change network parameters on the computer.

STEP BY STEP COMPUTER NETWORK CONFIGURATION (Windows 7):

1) Open CONTROL PANEL/NETWORK AND SHARING CENTER/CHANGE ADAPTER SETTINGS
2) Find LOCAL AREA CONNECTION and make sure that is enabled.
3) Right mouse click on LOCAL AREA CONNECTION and select PROPERTIES
4) Select INTERNET PROTOCOL VERSION 4 and press on button PROPERTIES
5) Select USE THE FOLLOWING IP ADDRESS and set IP as 192.168.1.100 and mask 255.255.255.0 as shown in the figure 2.

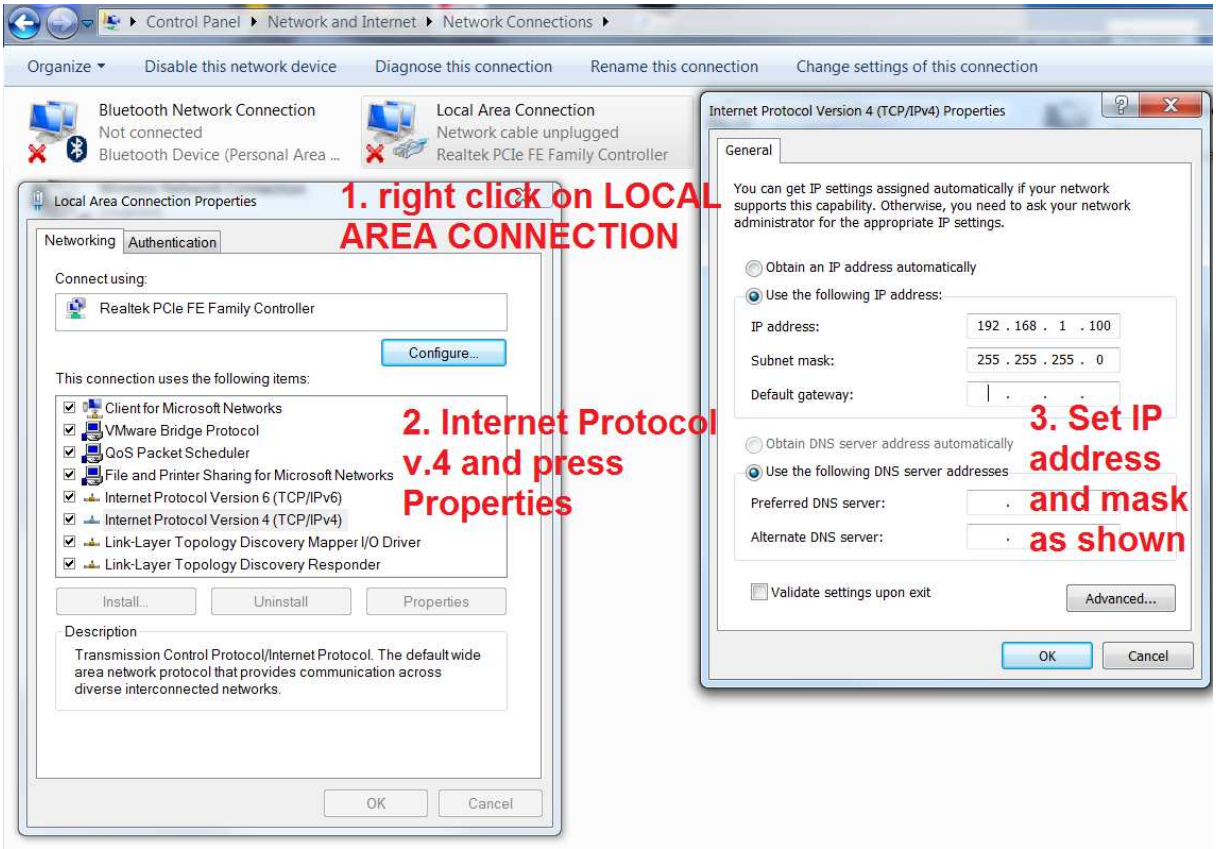


Figure 2: Local area connection parameters for direct wiring the computer to the DEQ regulator

6) Press OK.

Test: After setting the configuration we open the internet browser, enter 192.168.1.234 and check if window of internal server opens (figure 3).

Figure 3: An internal server

Explanation: In this mode we can only use DEQ regulator's internal server to communicate with regulator.

1.2. Connecting the DEQ regulator on an access point

CONNECTION DIAGRAM:

Figure 4: Connection diagram, TP-Link Wi-Fi as ACCESS POINT

STEP BY STEP CONFIGURATION TP-LINK AS ACCESS POINT MODE (Version 1):

1) Plug the TP-Link into the socket, connect on it with computer via Wi-Fi (SSID of Wi-Fi is TP-LINK_7C2A or something similar)
2) Open the internet browser and enter 192.168.0.1
3) Login in router with username admin and password admin
4) Navigate to QUICK SETUP/next/ ACCESS POINT/next
5) Set Wireless Network Name (SSID) to deq, set password to profeldeq, next

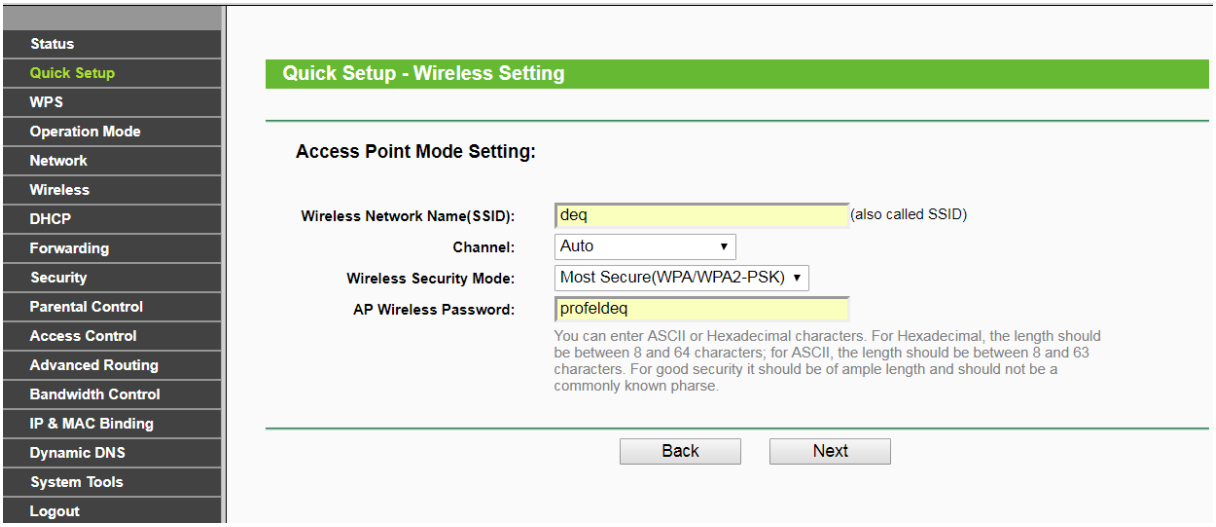


Figure 5: Access Point Wireless Settings

6) Set type to Static IP, set IP address to 192.168.1.254 / next and reboot

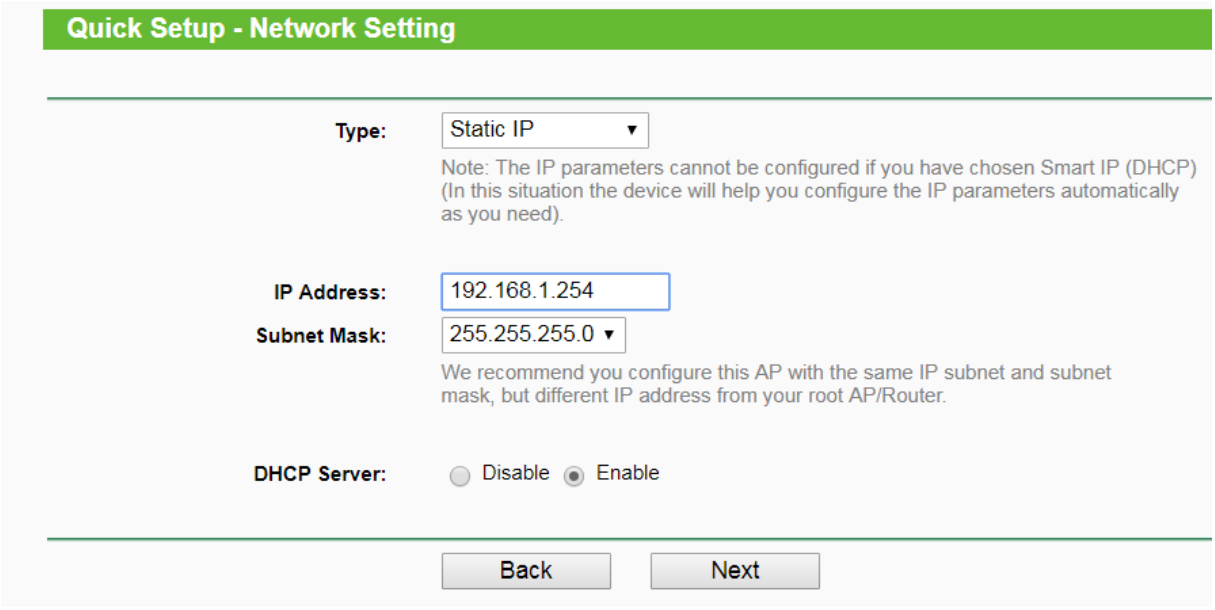


Figure 6: Access Point Network Setting

7) Connect to Wi-Fi deq. Open the internet browser and enter 192.168.1.254
8) Login in router with username admin and password admin
9) Navigate to DHCP/ DHCP Settings and set END IP address to 192.168.1.240 / save

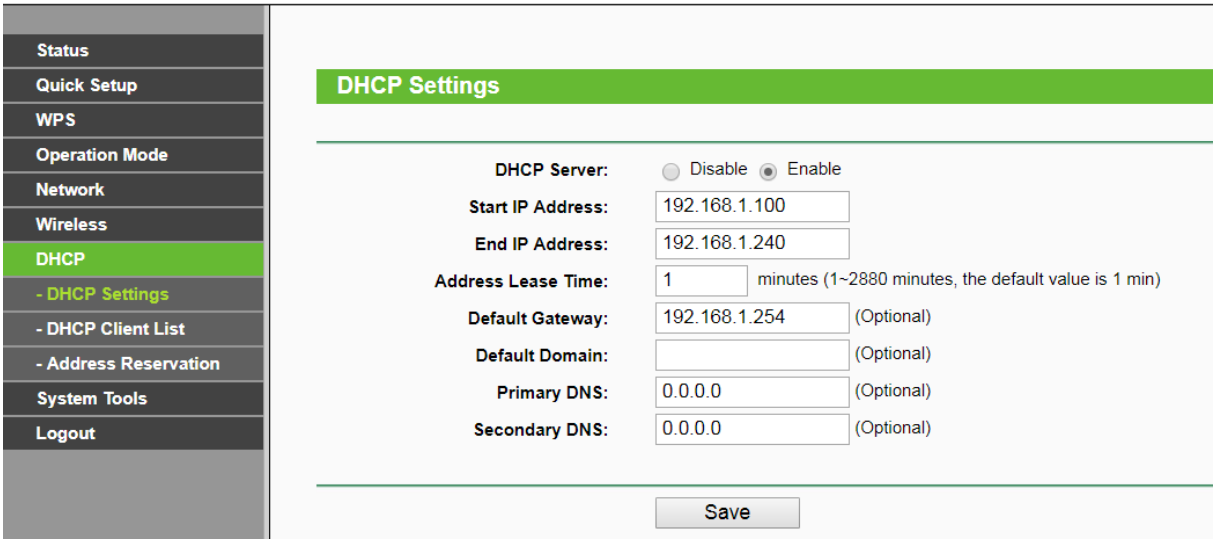


Figure 7: Access Point DHCP Settings

10) Navigate to DHCP/ADDRESS RESERVATION and enter specific MAC address of regulator, reserved IP address must be set 192.168.1.234 / save

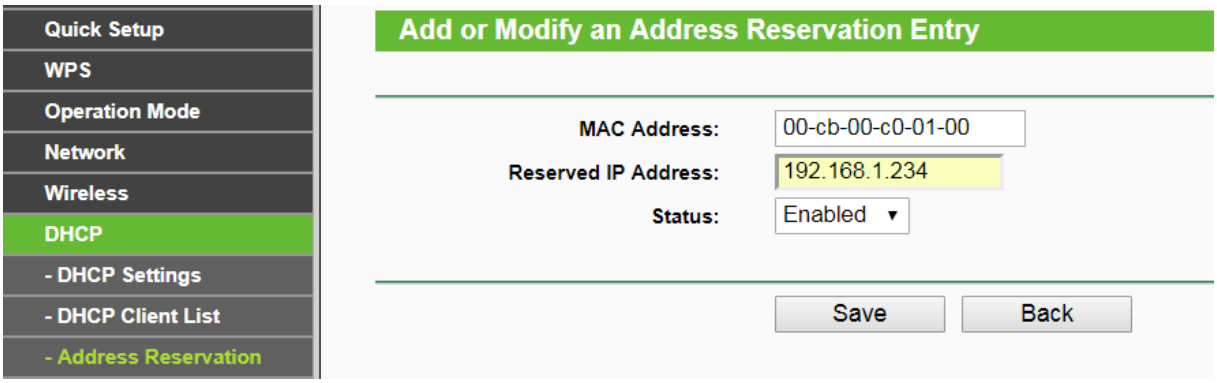


Figure 8: Access Point address reservation

11) Reboot TP-Link and open internet browser and enter 192.168.1.234

Test: Open the internet browser, then enter 192.168.1.234 and check if window of internal server opens (figure 3). If it opens, is all properly configured.

Explanation: A solution for areas where there is no Internet access. Communication with DEQ regulator is only possible through internal server. We create a local Wi-Fi network, without internet access. We need an access point (AP), and we can configure TP-Link Wi-Fi as Access Point. We set the parameters as shown in the figure 5, 6 and 7. At the end (as shown in the figure 8) we have to set the default MAC address to the default IP address to 192.168.1.234, which is entered into any browser. When everything is set, we connect TP-LINK Wi-Fi to the DEQ regulator. If we managed to configure TP-Link Wi-Fi correctly, the internal server (figure 3) would open. If it doesn't, try to restart TP-LINK Wi-Fi or/and the DEQ regulator.

1.3. Connecting the DEQ regulator on the GSM network

When the object is without internet access, we can use hardware, that supports internet access through the GSM network. We can use router RUT500, that has free slot for SIM card. First we configure the router, then we wire the DEQ regulator on it, as shown in the figure 9.

CONNECTION DIAGRAM:

Figure 9: Wiring the router RUT 500 to the DEQ regulator

STEP BY STEP ROUTER RUT500 CONFIGURATION:

1) Unscrew the front cover on the RUT500 and insert the SIM card
2) The SIM card must have a pre-set 4 digit PIN code and the SIM card Lock has to be disabled (Check the SIM card by inserting it into the phone)
3) Tighten all 3 antennas to the router (for Wi-Fi and GSM)
4) Plug the router into power supply and connect the computer on Wi-Fi named TELTONIKA MOBILE VIDEO SOLUTION
5) Open the internet browser and enter 192.168.8.1
6) Login in router with username admin and password admin01
7) Navigate to Router configuration/Network/3G

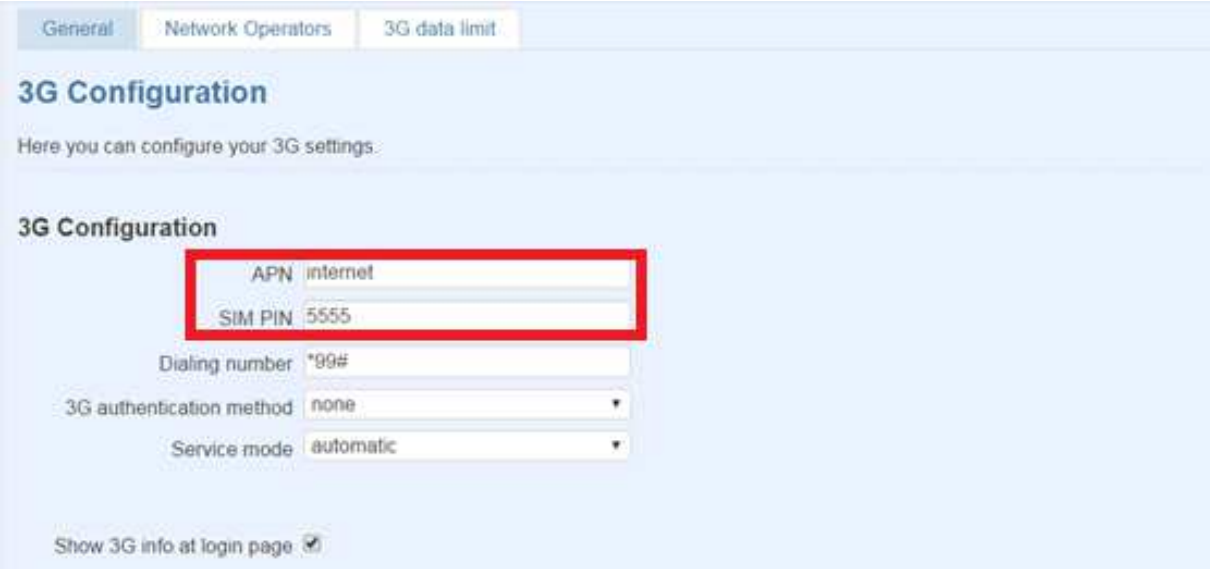


Figure 10: Configuration RUT 500 – 3G settings

8) You get APN from specific mobile provider, SIM PIN must be entered as is set on the SIM card. Attention! When an incorrect PIN code is entered, we quickly block the SIM card so it can no longer be used.
9) Press SAVE.
10) In order to protect the RUT 500 router and also protect yourself against unwanted costs caused by other people, we suggest setting up the Wi-Fi protection. Navigate to Network/ Wireless. We suggest WPA2-PSK encryption and at least 8 digit password (figure 11)

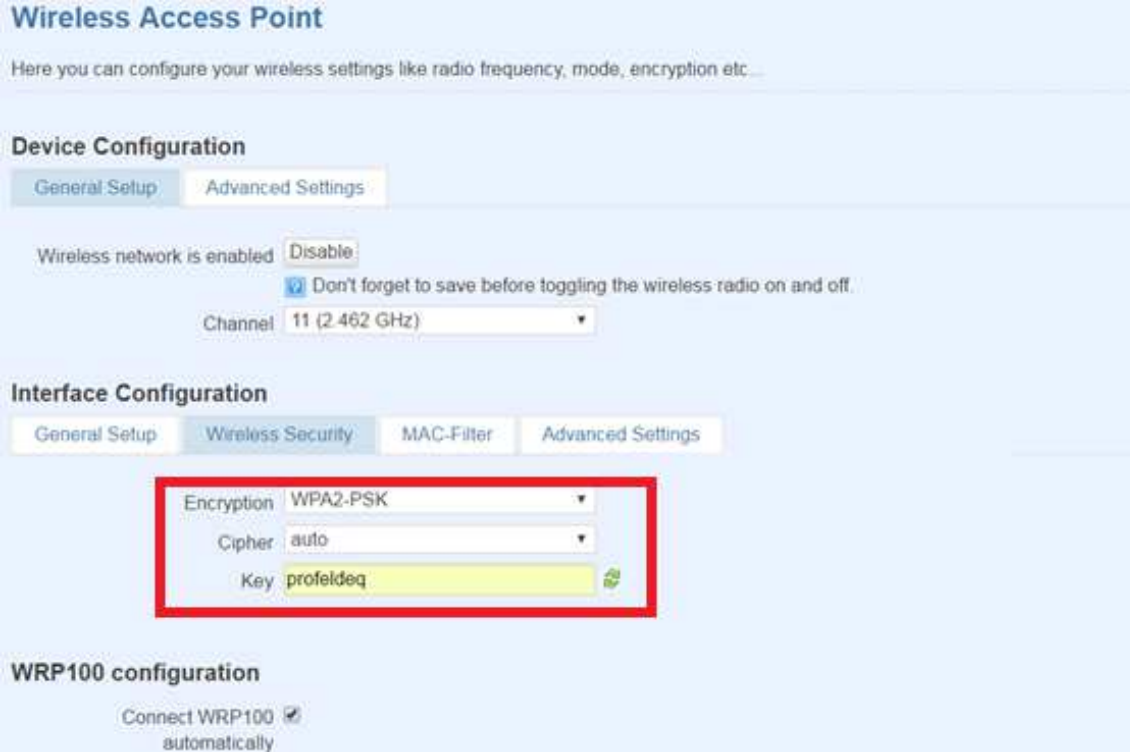


Figure 11: Configuration RUT 500 – wireless security (optional)

Test: We can test the router by opening any internet page. If any page opens, the GSM (3G) data transfer works. Of course, we need to be connected to the TELTONIKA MOBILE VIDEO SOLUTION Wi-Fi network.

We also have to check on our site www.deq.si if the DEQ regulator is refreshing every minute. If it doesn't you should reset the DEQ regulator and the router (figure 13).

2. OBJECT WITH INTERNET ACCESS

2.1. Wired Access

2.1.1. Direct wired access

CONNECTION DIAGRAM:

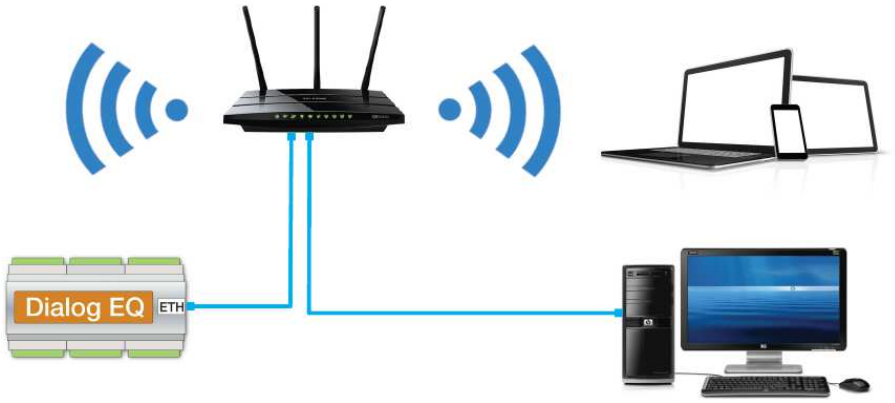


Figure 12: Direct wired connection between the computer and the DEQ regulator

STEP BY STEP MAIN ROUTER CONFIGURATION:

1) Connect the main router/ modem and the DEQ regulator by UTP cable. DEQ regulator obtains an IP address through DHCP protocol automatically. If it doesn't, restart it.
2) Every regulator has own MAC address. If the main router allows, set for the specific MAC address of the DEQ regulator static IP address to 192.168.1.234

Test: We can test the regulator DEQ's connectivity on Web page www.deq.si. After entering username and password, list of devices sorted by the MAC address with the identifier´s name (usually client's names) is opened (figure 13).

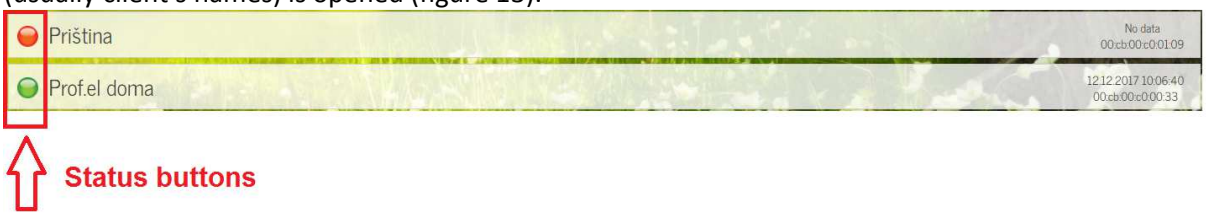


Figure 13: A list of devices by MAC address and users on the web page **www.deq.si**

Each regulator in the device list on the www.deq.si webpage has a button (on the left side) that indicates device status:

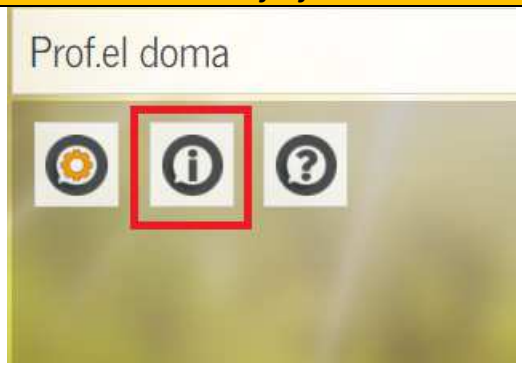
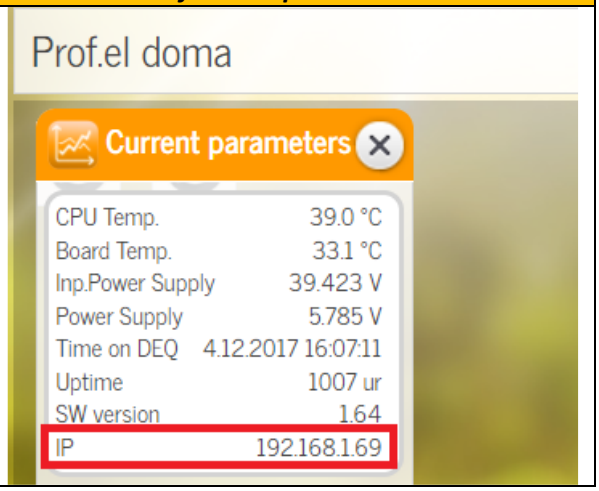
- Green Button: **DEQ works properly** and sends information to the cloud every minute.
- Yellow Button: DEQ was connected, but more than 5 minutes have passed since the last received data. DEQ works normally, only sending information to the cloud has stopped.
- Red button: The customer most likely doesn't have Internet connection and sets DEQ directly through the internal server only.

By clicking on the device in a device list (figure 13), a picture of a »house« opens. The house represents basically an interactive graphical user interface, which communicates to the DEQ regulator. Apperance of the application can be seen in the figure 14.

Figure 14: WEB-based graphical user interface

When the regulator is connected directly to the router, it can still connect to the internal server. Only in this mode IP address is no longer 192.168.1.234, but it is assigned randomly depending on customer's router configuration. The internal server IP can be found by pressing the info key in the upper left corner of the regulator web application on www.deq.si. (See TABLE 1)

Table 1: Location of the IP address of Internal server

Position of Info icon	*Info icon open on-click*
	

2.1.2. Wired access over an existing power grid

CONNECTION DIAGRAM:

Figure 15: Wiring the DEQ regulator to the router via two Powerline adapters

This type of connection is used in areas with "limited" Internet access (we have Internet access on the site, but not near the DEQ regulator, either because the distance from the main router is too long or the loss of the signal due to thick, reinforced walls is too large...). With the help of two Tenda 200 or TP-Link's AV200, we create a network that allows data to be transmitted over an existing electrical network.

STEP BY STEP POWERLINE CONFIGURATION:

1) We use the Powerline adapter (in our case we used Tenda200 or TP-Link AV200).
2) Insert adapters into the 230VAC socket (one next to DEQ and one next to the router)
3) Pair both of the adapters by pressing both on the button for "pairing"
4) Connect the UTP cable to DEQ regulator and to the first adapter, then connect the other UTP cable to another adapter and to the router (figure 15)
5) Additional TP-Link Powerlines can be easily added by pressing the "pairing" button (up to 8 units can be connected).
6) To exit the running Powerline connection, hold the "pairing" button for 8s.
7) Restart DEQ regulator.

Test: Test internet access – figure 15. Instead of wiring the DEQ regulator, wire the computer and check, if is internet access on computer. If internet connection works, replace computer with regulator DEQ instead.

Check if the DEQ regulator sends information in “cloud” every minute. Wire all devices as seen in figure 15, open the website www.deq.si and check if circle/button is green (figure 13).

2.2. Wi-Fi connection

CONNECTION DIAGRAM:

Figure 16: Connection diagram, TP-Link Wi-Fi as CLIENT

STEP BY STEP CONFIGURATION TP-LINK CLIENT MODE (Version 1):

1) Connect the TP-Link to the power supply (via USB to the computer)
2) From Wi-Fi networks, choose the one with TP-LINKxxx and connect to it
3) Enter 192.168.0.1 into the browser
4) Enter the router password admin / admin
5) Go under Network / LAN and set the IP address to 192.168.1.254 / save

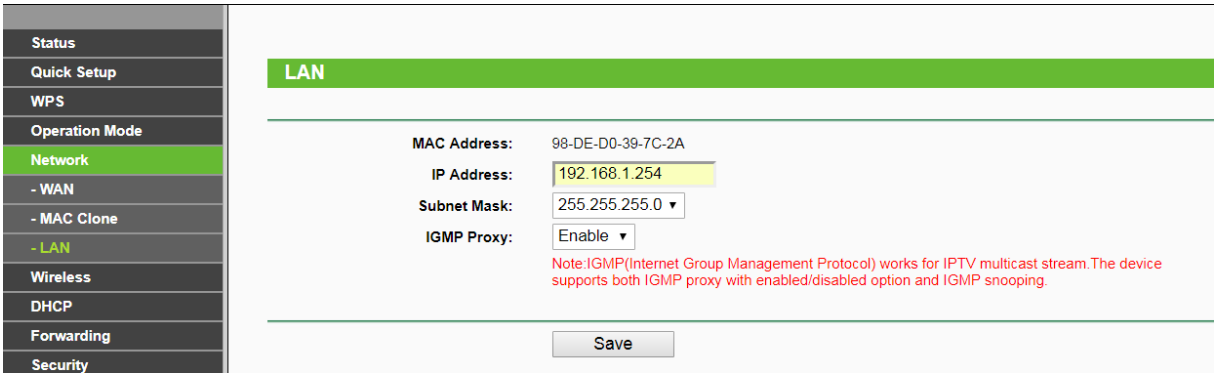


Figure 17: Client Network settings

6) The router resets itself and logs in to the new address http://192.168.1.254/ re-enter the router password admin / admin
7) Go to DHCP / DHCP settings and fix the END IP Address to 192.168.1.240, than press save.

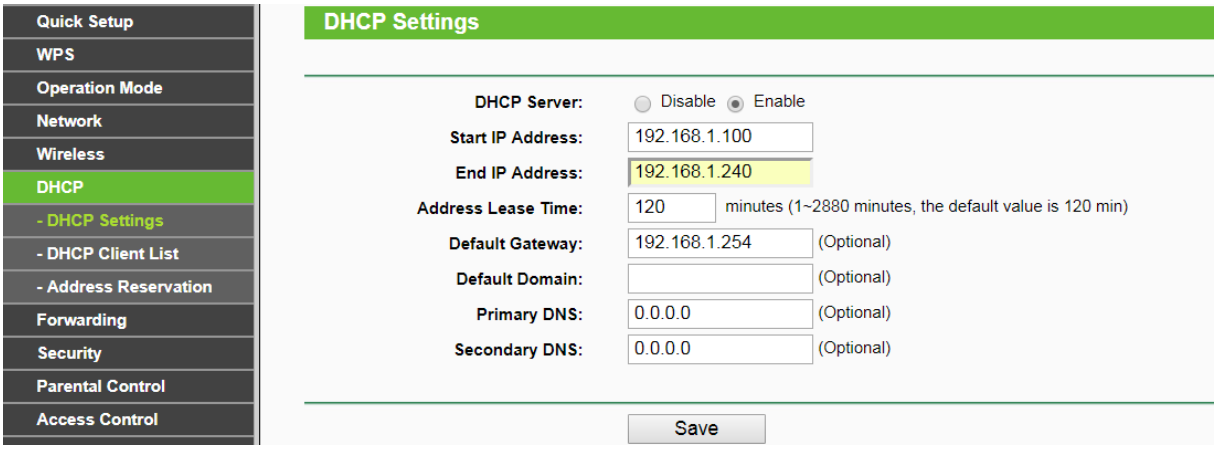
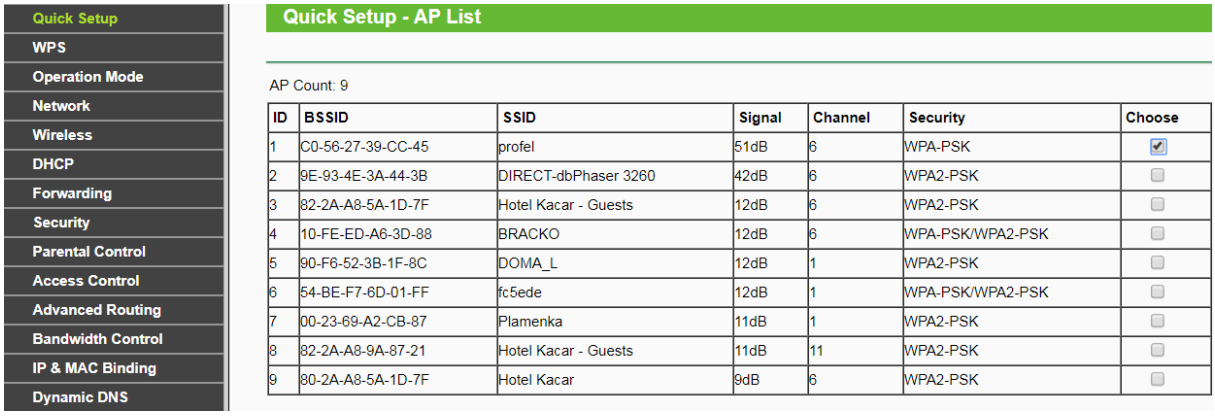


Figure 18: Client DHCP settings

8) Go to DHCP / Address reservation and press “add new”.
9) In the IP box enter 192.168.1.234 and the MAC number should be entered as is written on the side of the DEQ regulator (instead of: there must be written -)
10) Quick setup / next
11) Choose client / next
12) A list of all available networks opens. We must find client’s network and press the check mark on it / next.



ID	BSSID	SSID	Signal	Channel	Security	Choose
1	C0-56-27-39-CC-45	profel	51dB	6	WPA-PSK	☑
2	9E-93-4E-3A-44-3B	DIRECT-dbPhaser 3260	42dB	6	WPA2-PSK	☐
3	82-2A-A8-5A-1D-7F	Hotel Kacar - Guests	12dB	6	WPA2-PSK	☐
4	10-FE-ED-A6-3D-88	BRACKO	12dB	6	WPA-PSK/WPA2-PSK	☐
5	90-F6-52-3B-1F-8C	DOMA_L	12dB	1	WPA2-PSK	☐
6	54-BE-F7-6D-01-FF	fc5ede	12dB	1	WPA-PSK/WPA2-PSK	☐
7	00-23-69-A2-CB-87	Plamenka	11dB	1	WPA2-PSK	☐
8	82-2A-A8-9A-87-21	Hotel Kacar - Guests	11dB	11	WPA2-PSK	☐
9	80-2A-A8-5A-1D-7F	Hotel Kacar	9dB	6	WPA2-PSK	☐

Figure 19: A list of all available networks

13) Under the Root AP wireless password, we enter the Wi-Fi client password (identical to the one on the main router) / next / next / reboot.

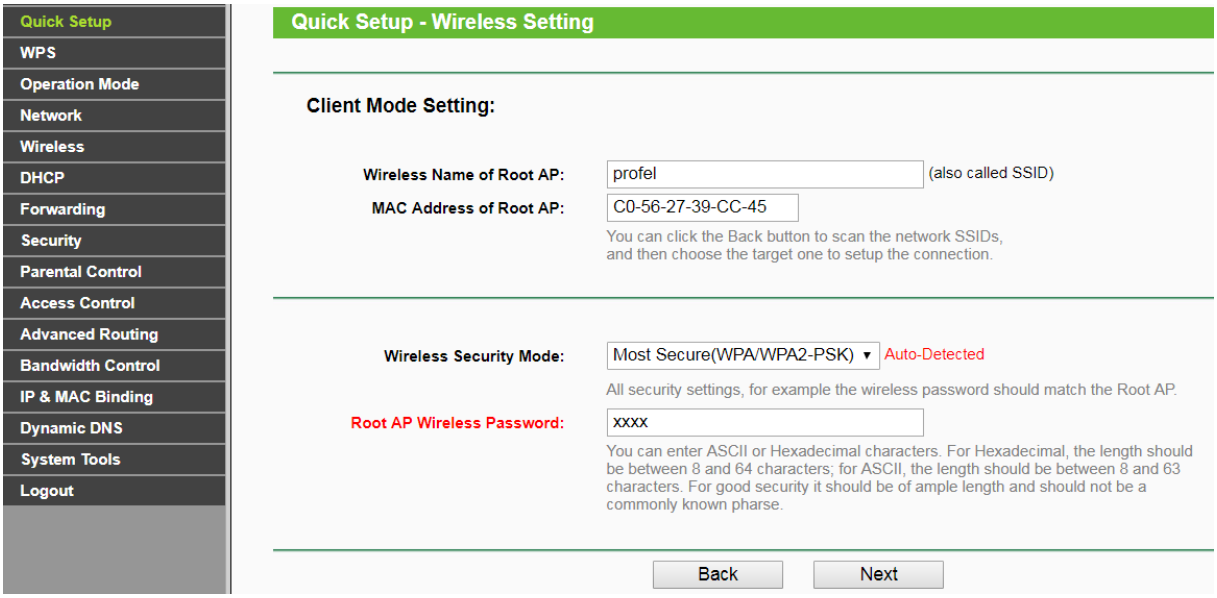


Figure 20: Client mode quick setup version 1

STEP BY STEP CONFIGURATION TP-LINK CLIENT MODE (Version 2):

1) Connect the TP-Link to the power supply (via USB to the computer)
2) Connect to TP-Link Wi-Fi (TP-LINKxxx)
3) Enter 192.168.0.254 into the browser
4) Enter the router password admin / admin
5) Go to the Basic Settings / network section
6) Change the SMART IP (DHCP) type to Static IP and correct the IP address in 192.168.1.254 and press the save button. (In the case if the client router is at 192.168.0.xxxx)
7) Router resets itself and logs on to the new address http://192.168.1.254/ re-enter admin / admin
8) Go to the Advanced settings / DHCP settings and fix the END IP Address to 192.168.1.240, press OK and reset the router.
9) Go back to Basic Settings / network, set SMART IP (DHCP) instead of Static IP and press save, the router is reset.
10) We go to Advanced settings / Address reservation and press Add New
11) Under the MAC address, enter the MAC number of the DEQ regulator into the box "Reserved IP Address", then enter 192.168.1.234 and press save

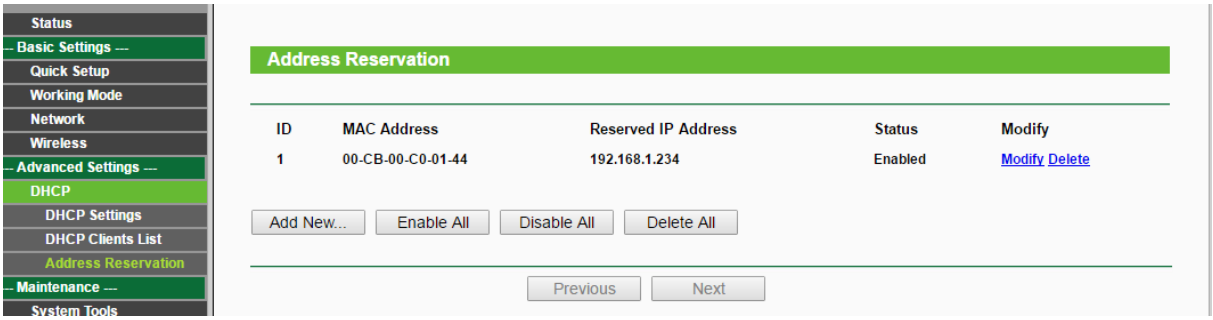


Figure 21: Client address reservation

12) Go to Basic Settings / Quick Setup and press next.

13) Select CLIENT and press next.
14) Press Survey, then select the client's network and press Connect
15) Under security options set the security algorithm as is in client's house. (WEP, WPA or WPA2…)
16) Under password enter the Wi-Fi password of the main router.

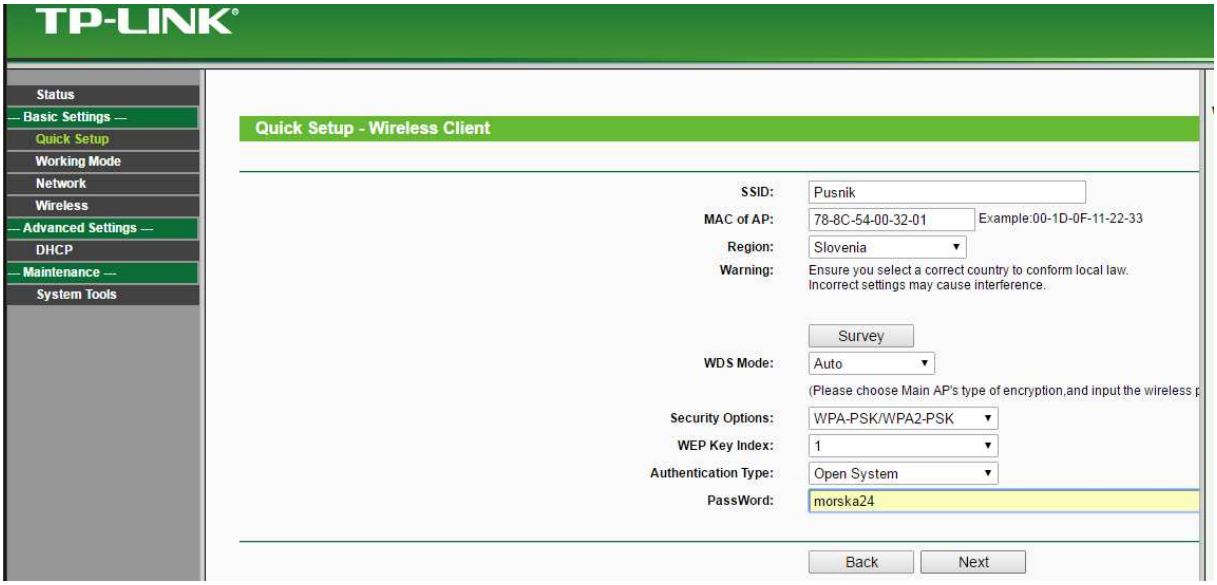


Figure 22: Client mode quick setup version 1

17) Press next and reboot.
18) The router is no longer visible, but is "masked" as a client's network between Wi-Fi connections

Test: Wire the computer and the configured TP-Link via UTP cable. Disable Wireless Network Connection on the computer and enable Local Area Connection. If internet access is working, then TP-Link is properly configured.

We should also try if the DEQ regulator is sending information in "cloud" every minute. This can be checked on www.deq.si. On the left side of regulator there is a circle/button, which is green, yellow or red. If it is green, then DEQ regulator is sending information every minute and everything is working ok (figure 13).

Explanation: Solution for the areas where is a possibility of internet access via Wi-Fi. Internal server also works, but we firstly need to check on which IP our router has assigned it. The simplest way is on web page www.deq.si (table 1). Then we can enter IP in internet browser and internal server opens (figure 3).

2.3. REPEATER

This mode is intended to extend the reach of the existing network. TP-link increases the reach of the Wi-Fi signal from the main router. The position of TP-Link is essential for this mode. We must put it

on such a place, where the signal from the main router is still good enough. With a good placement of TP-Link, we can avoid the walls or extend the existing wireless network from main router to the additional floor in the house, the yard…

CONNECTION DIAGRAM:

Figure 23: Connection diagram, TP-Link Wi-Fi as REPEATER

STEP BY STEP CONFIGURATION TP-LINK REPEATER MODE (Version 1)

1) Connect the TP-Link to the power supply (via USB to the computer)
2) From Wi-Fi networks, choose the one with TP-LINKxxx and connect to it
3) Enter 192.168.0.254 into the browser
4) Enter the router password admin / admin
5) Go under Network / LAN and set the IP address to 192.168.1.254 / save
6) Router resets itself and logs in to the new address http://192.168.1.254/ re-enter admin / admin
7) Go to DHCP / DHCP settings, fix the END IP Address to 192.168.1.240 and press save.
8) Go to DHCP / Address reservation and press add new.
9) Under IP, enter 192.168.1.234 and the MAC number should be entered as it is written on the side of the DEQ regulator (instead of: there must be written -)
10) Quick setup / next
11) Choose range extender / next
12) A list of all available networks opens. We must find client's network and press the check mark on it / next. If we find none, TP-Link is too far from main router (figure 24).

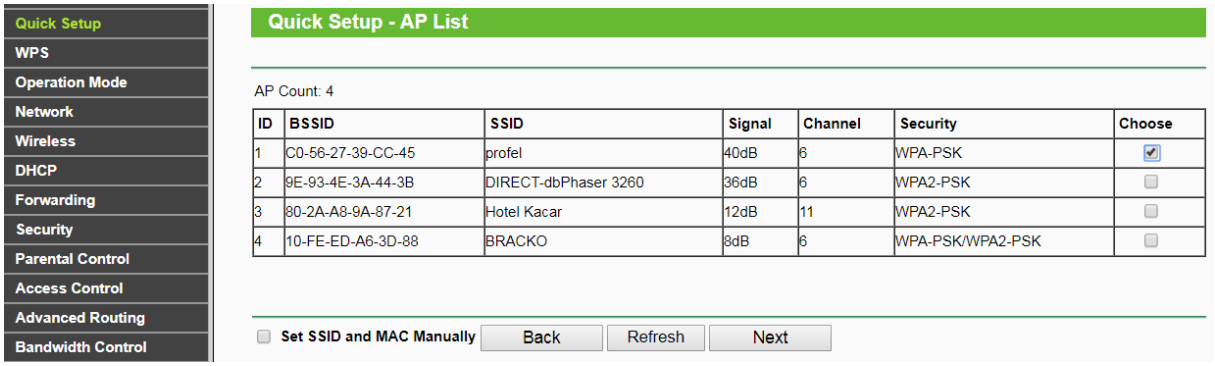


Figure 24: A list of all available networks

13) Under the Root AP wireless password, we enter the Wi-Fi client password (identical to the one on the main router) / next / next / reboot.

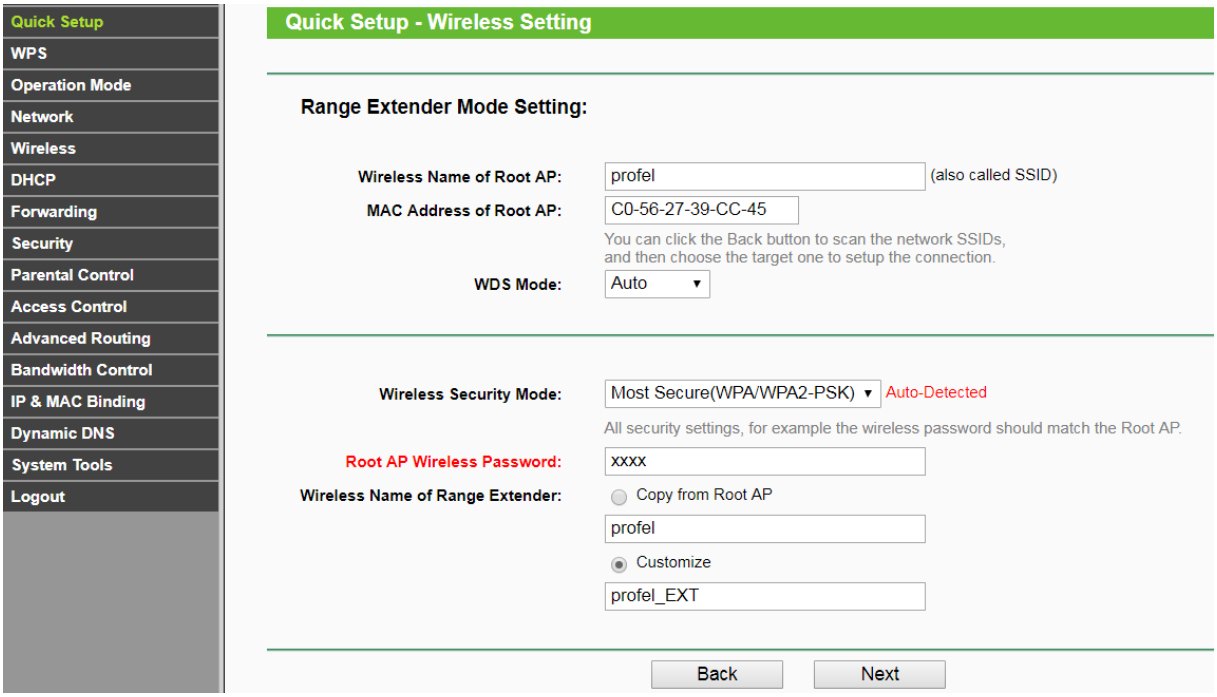


Figure 25: Repeater mode quick setup

14) Type set to Smart IP / next/ reboot.

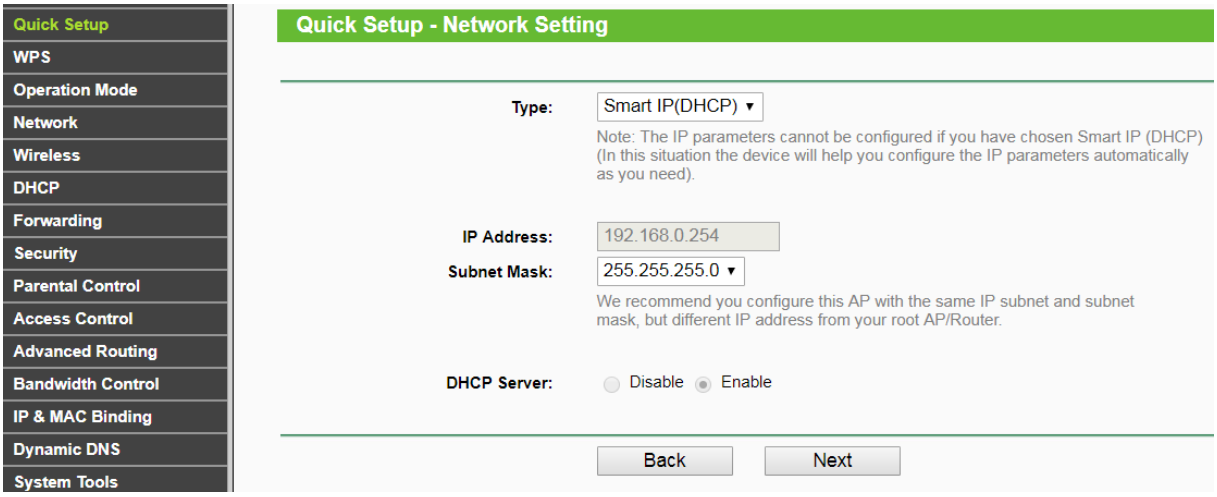


Figure 26: Repeater mode Network Settings

Test: We can check if the router mode works properly by connecting the computer on Wi-Fi, which we have created for repeating. In our case the Wi-Fi name is profel_EXT (figure 25-at the bottom of the picture). When we are connected to this Wi-Fi, we check by computer if we have internet access.

Check on website www.deq.si if specific regulator is sending information every minute (a circle/button next to the regulator´s name is green).

Explanation: Solution for the areas where there is an option of internet access via Wi-Fi, but the signal from main router is too weak. Internal server also works, but it is necessary to check IP on www.deq.si to determine right address to connect to DEQ regulator via browser. (table 1).