Open Sniffer

Datasheet

Open Sniffer 2nd generation

Internet of things packet analyser

tool for 802.15.4 / Zigbee / 6LoWPAN networks

- Multiband 780/868/915/2400 MHz
- Web configuration
- Ethernet remote control and firmware upgrade
- Wireshark based
- HW/SW sources available

Available modes

- Sniffing mode
- Energy Detection scanner
- Injection mode
- Continuous wave & packet generator
- Network scan mode

Sniffing Mode

This is default mode of operation for the Open Sniffer device. Channel, band and modulation need to be selected. All captured frames are feed to Wireshark. Wireshark is the open source cross platform industry-standard software for analyzing wired and wireless networks.

Energy Detection Scanner

In this mode Open Sniffer scan within two seconds all available channels among all supported bands (780/868/915/2400 MHz) and display results to the end user.

Continuous Transmission Mode

This mode is aimed to testing purposes. Sniffer continuously emits packets to selected channel, transmission type, modulation and TX power.

Injection Mode

User defined frames are sent within this mode.

Network Scan

Scan over defined channels is done in order to find networks. Then PANID list is displayed.

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1 Getting Started

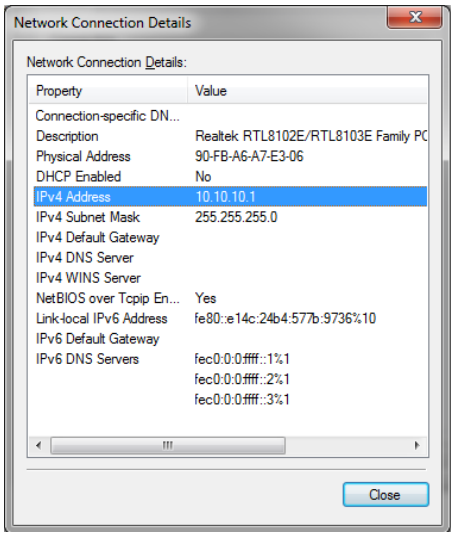
1.1 Open Sniffer Settings

Connect antennas (longer antenna to sub-GHz connector), ethernet cable and finally power cable to Open Sniffer. Plug in other side of ethernet cable and power cable to your host PC.

1.2 Setting TCP/IP at the host side

Implicitly Open Sniffer is set to static addressing to **IP address 10.10.10.2** and **mask 255.255.255.0**. Host's IP address must be within the same network scope as the Open Sniffer probe.

Set **host IP to 10.10.10.1 and network mask to 255.255.255.0**. In Windows this can be done via "Network and Sharing Center". Press CTRL+R and type "ncpa.cpl" Enter. Then you need to select network interface, where you have attached the sniffer and set IP and network address



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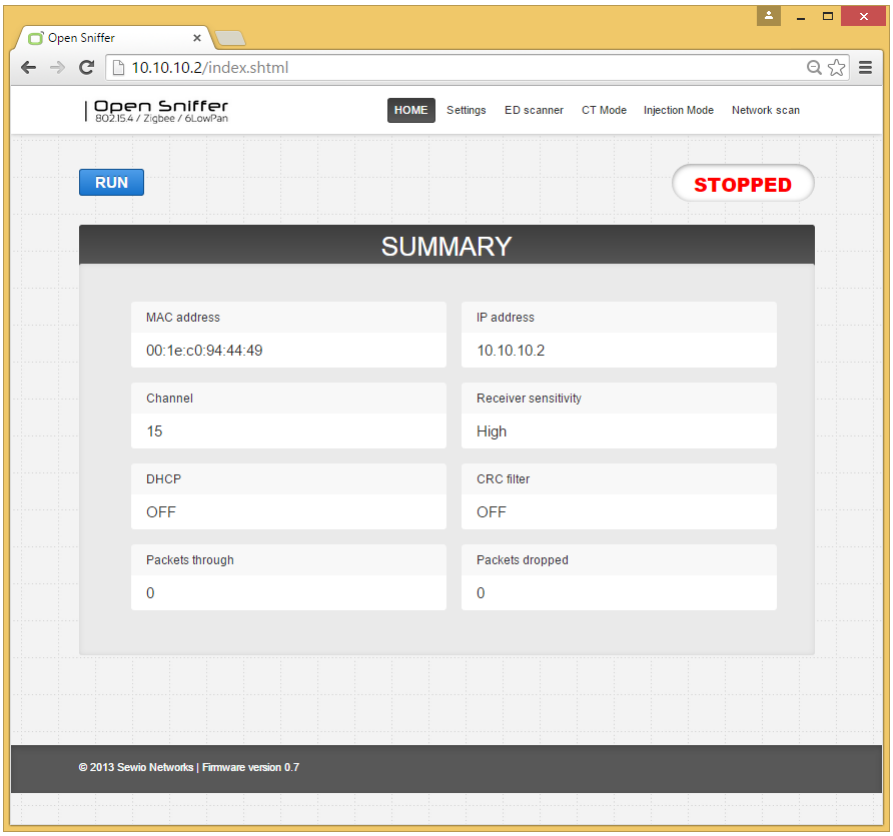
1.3 Connect to the Open Sniffer probe homepage

Please open an internet browser and point it to probe address **http://10.10.10.2**. Homepage should appear.



1.4 Wireshark

Open Sniffer acts as a probe which capturing 802.15.4 frames and send them to remote host computer. The frames are displayed, filtered and analyzed in Wireshark software.

a) Wireshark installation

Download, install and run Wireshark, **branch 1.12.x is strongly recommended**. Please select appropriate version for your operating system and architecture.

b) Start Wireshark capture

Select the Ethernet interface (linked to Open Sniffer) from the available network interfaces and start capturing frames.

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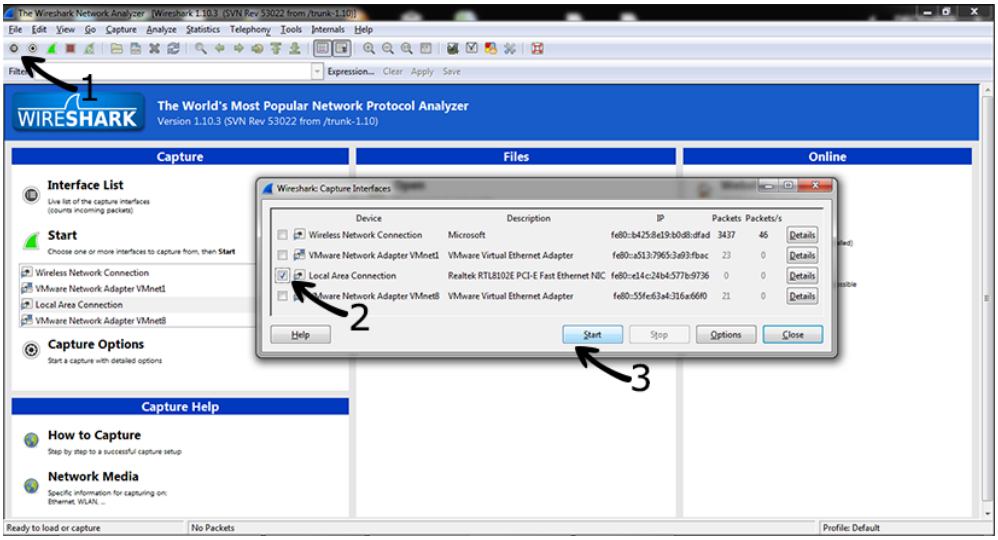
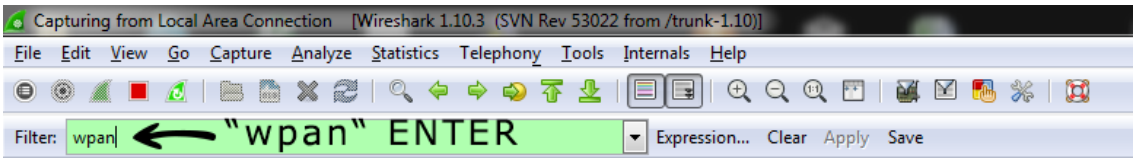
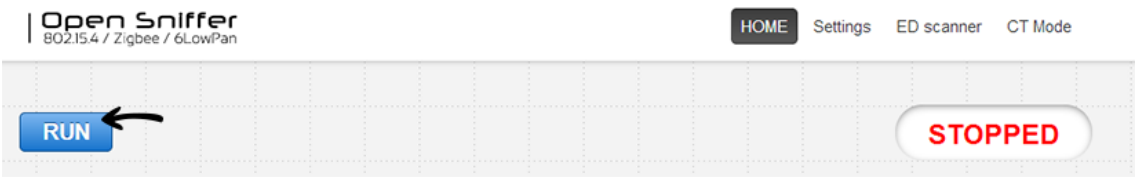


Wireshark implicitly shows all frames from wired and wireless networks delivered to the selected interface. Therefore, it is useful to apply 802.15.4 filter which is referred as "*wpan*".



c) <u>Start Open Sniffer</u>

Now the host side is prepared and you need to start the Open Sniffer probe via web interface. Point browser to sniffer's IP address (10.10.10.2) and press RUN.



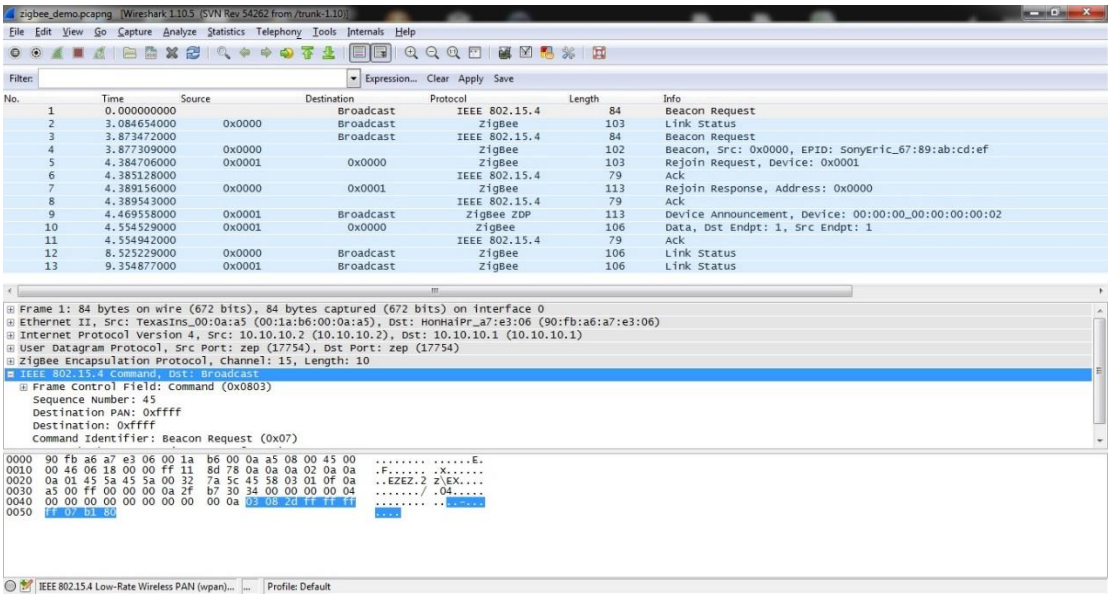
d) <u>Let's sniff some communication</u>

In following example two Zigbee nodes are used to generate some traffic. The Zigbee coordinator with NWK address 0×0000 and Zigbee router with NWK address 0×0001. You may generate your own traffic or download our captured data zigbee_demo (pcapng).

2 Adjusting Wireshark

2.1 Wireshark columns

Wireshark has default columns settings for wired Ethernet network, see picture below.



Columns are defined for the default Wireshark profile as follows:

Column name	Description
No.	Frame number counted from the start of capture in Wireshark. This is NOT number of packet received from Open Sniffer probe. It includes all packets delivered to the host's Ethernet interface
Time	Ethernet timestamp of the frame assigned by the operating system. This is NOT precise timestamp from Open Sniffer probe.
Source	Source Address
Destination	Destination Address
Protocol	Protocol
Length	Length of entire Ethernet frame including transportation overhead. This is NOT length of 802.15.4 frame
Info	Protocol details

From the table above it is obvious the default column settings are not associated with 802.15.4. Therefore, you can adjust columns to the 802.15.4 frame info. Let's refresh the encapsulation scheme for each 802.15.4 frame delivered to the host (see picture below). While the grey colored protocols are used only to transport the 802.15.4 frame through a network infrastructure, the ZEP – Zigbee Encapsulated Protocol carries all the important information such as sequence number, timestamp or channel number related to every 802.15.4 captured by the Open Sniffer probe.

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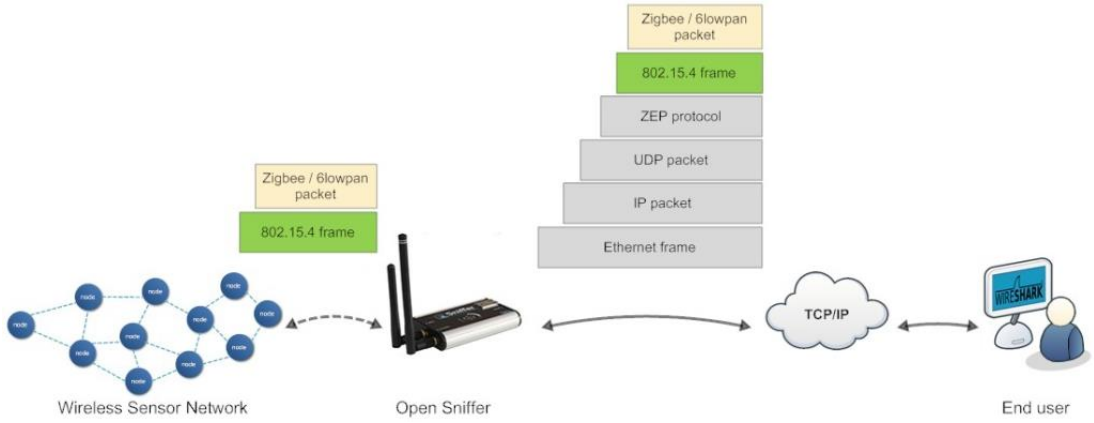

2.2 Install ZEPv3 plugin

Although, Wireshark natively contains ZEP protocol v2, we provide ZEPv3 which is backwards compatible and brings additional information related to 802.15.4 band, channel page and precise timestamp information.

a) Download ZEPv3 plugin from download page.
b) Extract and copy plugin to the Wireshark plugin folder.
c) Windows c:\Program Files\Wireshark\plugins\1.x.x\,
d) Linux /usr/local/lib/wireshark/plugins/1.x.x/.
e) Start Wireshark. menu Analyze -> Enabled Protocols (CTRL+SHIFT+E)
f) Uncheck ZEP, check ZEPv3
g) Apply, OK.
h) If the new dissector is not applied go to menu Analyze -> Decode as -> ZEPv3 -> Apply, OK.

ZEPv3 contains fields illustrated in picture below:

```
⊟ ZigBee Encapsulation Protocol, Channel: 15, Length: 10
    Protocol ID String: EX
    Protocol Version: 3
    Type: 1 (Data)
    Channel ID: 15
    Device ID: 2725
    LQI/CRC Mode: LQI
    Link Quality Indication: 255
    Sniffer Timestamp: 10.800535000 seconds
    Relative Timestamp: 0.000000000 seconds
    Absolute Timestamp: Dec 21, 2013 18:46:52.006090000 Central Europe Standard Time
    Differential Timestamp: 0.000000000 seconds (This is first packet)
    Sequence Number: 0
    Frequency band: 2400 MHz (4)
    Channel page: 0
    Length: 10 Bytes
```

2.3 Adjusting Wireshark columns to 802.15.4 frame

Note: The procedure below describes procedure to adapt Wireshark columns to 802.15.4 frames. You may skip it if you use our Wireshark 802.15.4 profile. Just download the profile, unpack and copy it to the \wireshark\profiles. Finally you need to activate this profile by click on the bottom Wireshark bar "Profile" -> "802.15.4"

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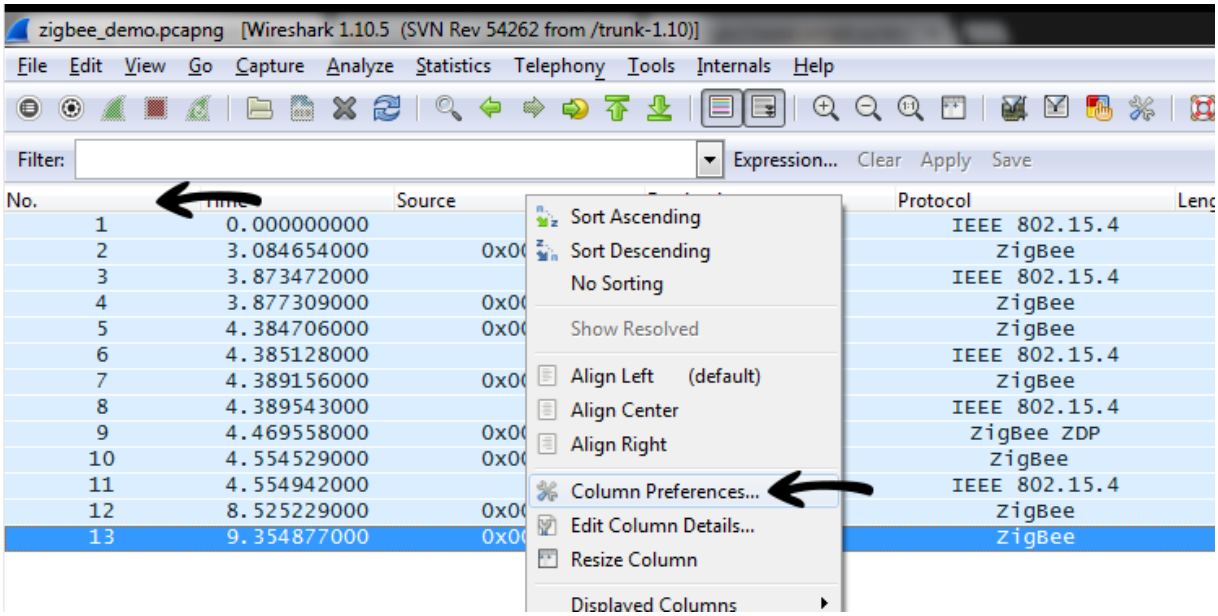
Adjusting columns procedure:

a) Right click on the columns header
b) Select Column Preferences
c) Adjust columns to 802.15.4



Implicit Wireshark column settings

Displayed	Title	Field type
☑	No.	Number
☑	Time	Time (format as specified)
☑	Source	Source address
☑	Destination	Destination address
☑	Protocol	Protocol
☑	Length	Packet length (bytes)
☑	Info	Information

Adjusted columns for 802.15.4

Displayed	Title	Field type
☑	No.	Custom (zepv3.seqno)
☑	Time	Custom (zepv3.time)
☑	Mac Src Address	Source address
☑	Mac Dst Address	Destination address
☑	Nwk Src Address	Custom (wpan.src16)
☑	Nwk Dst Address	Custom (wpan.dst16)
☑	Protocol	Protocol
☑	Length	Custom (zepv3.length)
☑	RSSI	Custom (wpan.rssi)
☑	LQI	Custom (zepv3.lqi)
☑	Info	Information

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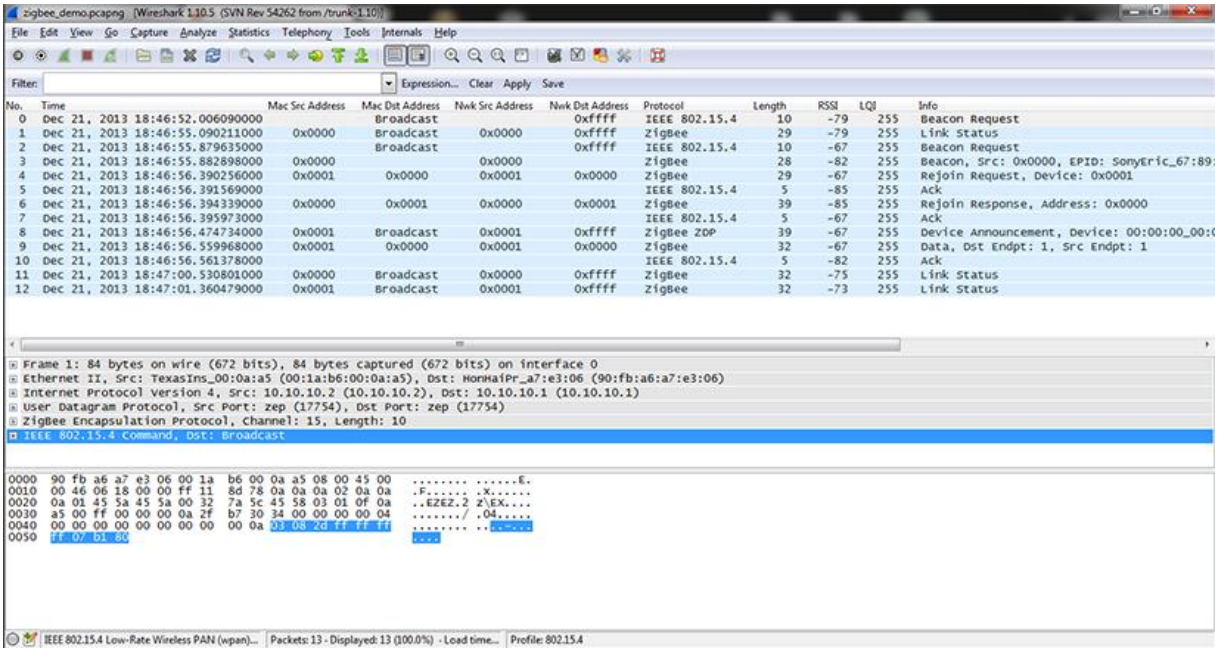
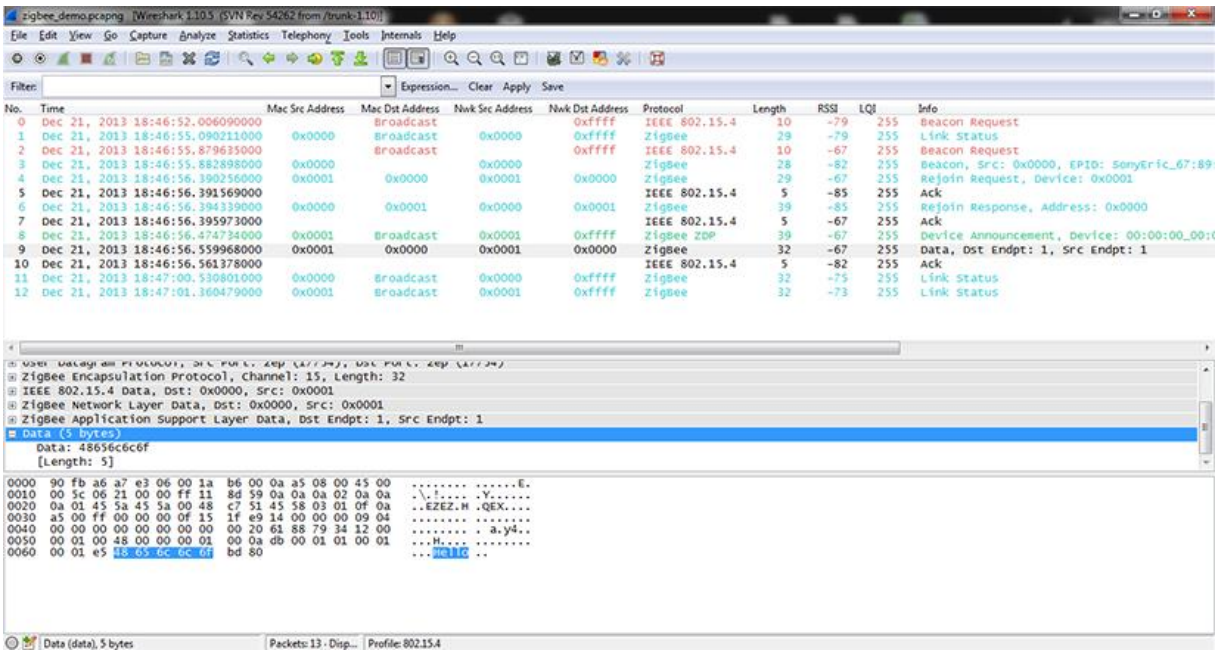
Adjusted Wireshark columns should seem like this:



Applying our 802.15.4 profile with predefined color rules:

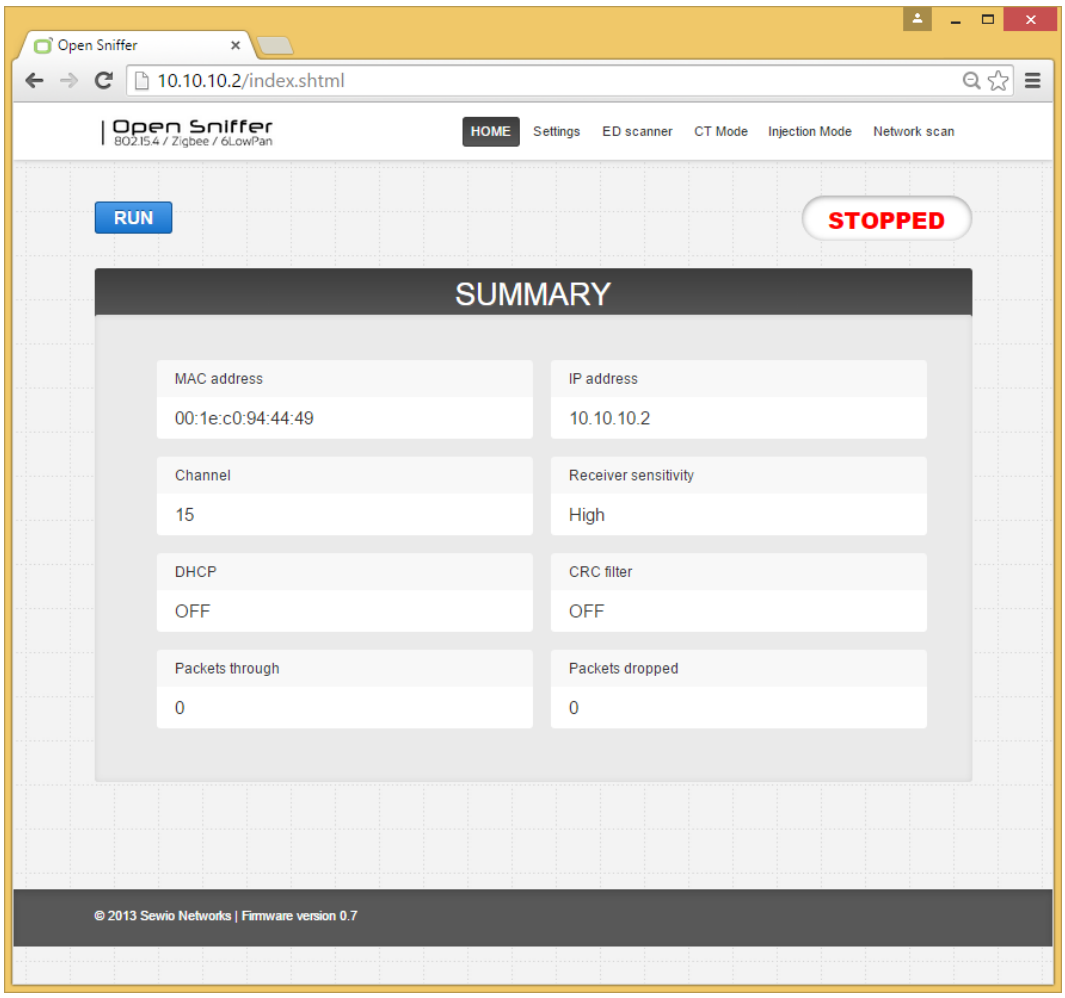


3 Sniffer configuration

3.1 Home page

RUN/STOP button and status field are located below the top menu. RUN/STOP button is present on every sub-page and always refers to sniffer mode.

Home page contains following summary information about an analyzer: MAC address, IP address, current channel, sensitivity, DHCP client mode, CRC filter option, number of 802.15.4 packets received and dropped. At the bottom of the home page firmware version is located.



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3.2 Settings page

Radio parameters, network configuration and host settings are done via this page.

Radio Settings contains following options

- Available Frequency and modulation

Freq / Channel	Modulation
780/0	OQPSK-RC-250
782/1	OQPSK-RC-250
784/2	OQPSK-RC-250
786/3	OQPSK-RC-250
868/0	BPSK-20
906/1	BPSK-40/OQPSK-SIN-250
908/2	BPSK-40/OQPSK-SIN-250
910/3	BPSK-40/OQPSK-SIN-250
912/4	BPSK-40/OQPSK-SIN-250
914/5	BPSK-40/OQPSK-SIN-250
916/6	BPSK-40/OQPSK-SIN-250
918/7	BPSK-40/OQPSK-SIN-250
920/8	BPSK-40/OQPSK-SIN-250
922/9	BPSK-40/OQPSK-SIN-250
924/10	BPSK-40/OQPSK-SIN-250
2405/11	OQPSK-250
2410/12	OQPSK-250
2415/13	OQPSK-250
2420/14	OQPSK-250
2425/15	OQPSK-250
2430/16	OQPSK-250
2435/17	OQPSK-250
2440/18	OQPSK-250
2445/19	OQPSK-250
2450/20	OQPSK-250
2455/21	OQPSK-250
2460/22	OQPSK-250
2465/23	OQPSK-250
2470/24	OQPSK-250
2475/25	OQPSK-250
2480/26	OQPSK-250

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- Receiver Sensitivity:
  - High - lower than -101 dBm
  - Medium - lower than -79 dBm
  - Low - lower than -64dBm
  - Lowest - lower than -48 dBm

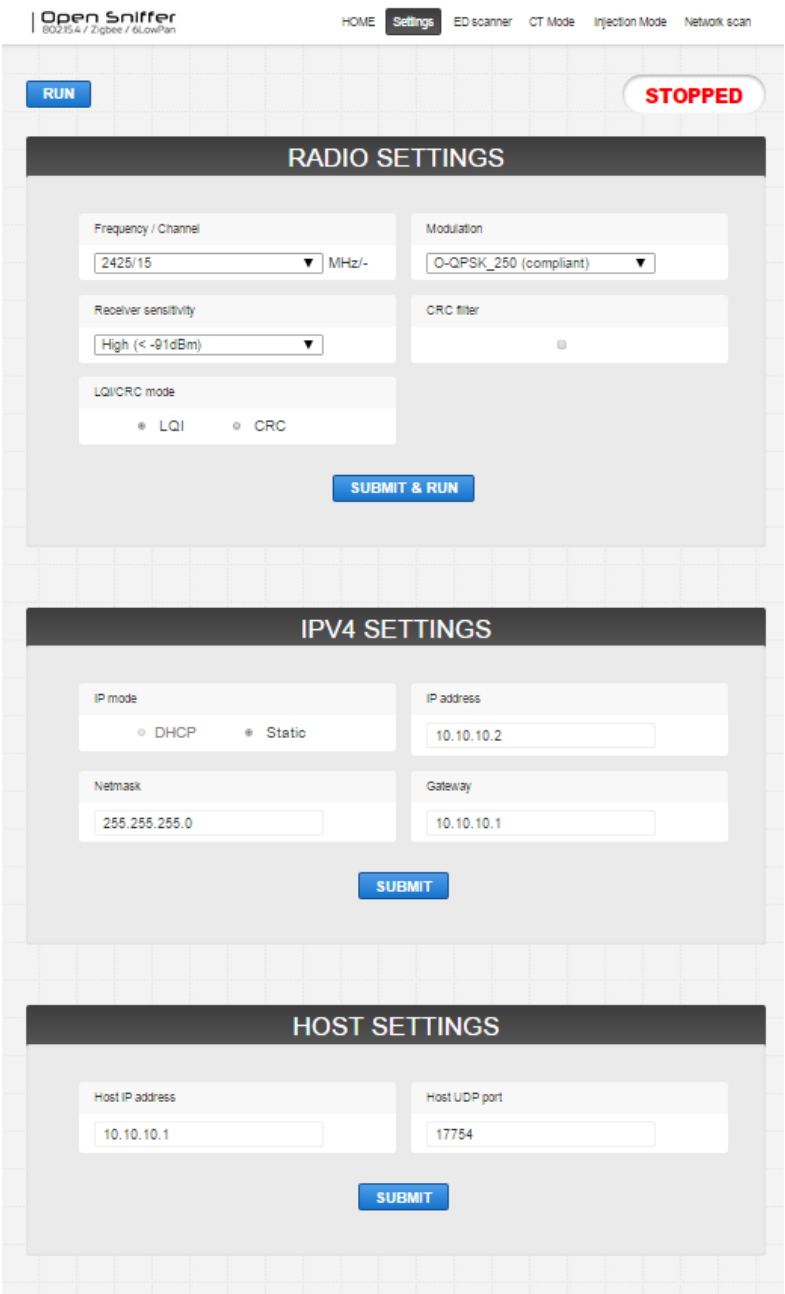
- CRC filter On/Off:
  IEEE 802.15.4 frames with wrong CRC are discarded

IPv4 settings related to Open Sniffer device contains:

- IP mode – DHCP client / Static IP address
- IP address
- Netmask
- Gateway

Host settings block contains:

- Host IP address – IP address of the host computer where Wireshark is running
- Host UDP port – should be set 17754, this identifies 802.15.4 data flow in Wireshark



4 ED Scanner page

This page provides Energy Detection measurement for the all 31 channels during 2s period. Results are shown in graph separated for each frequency band.

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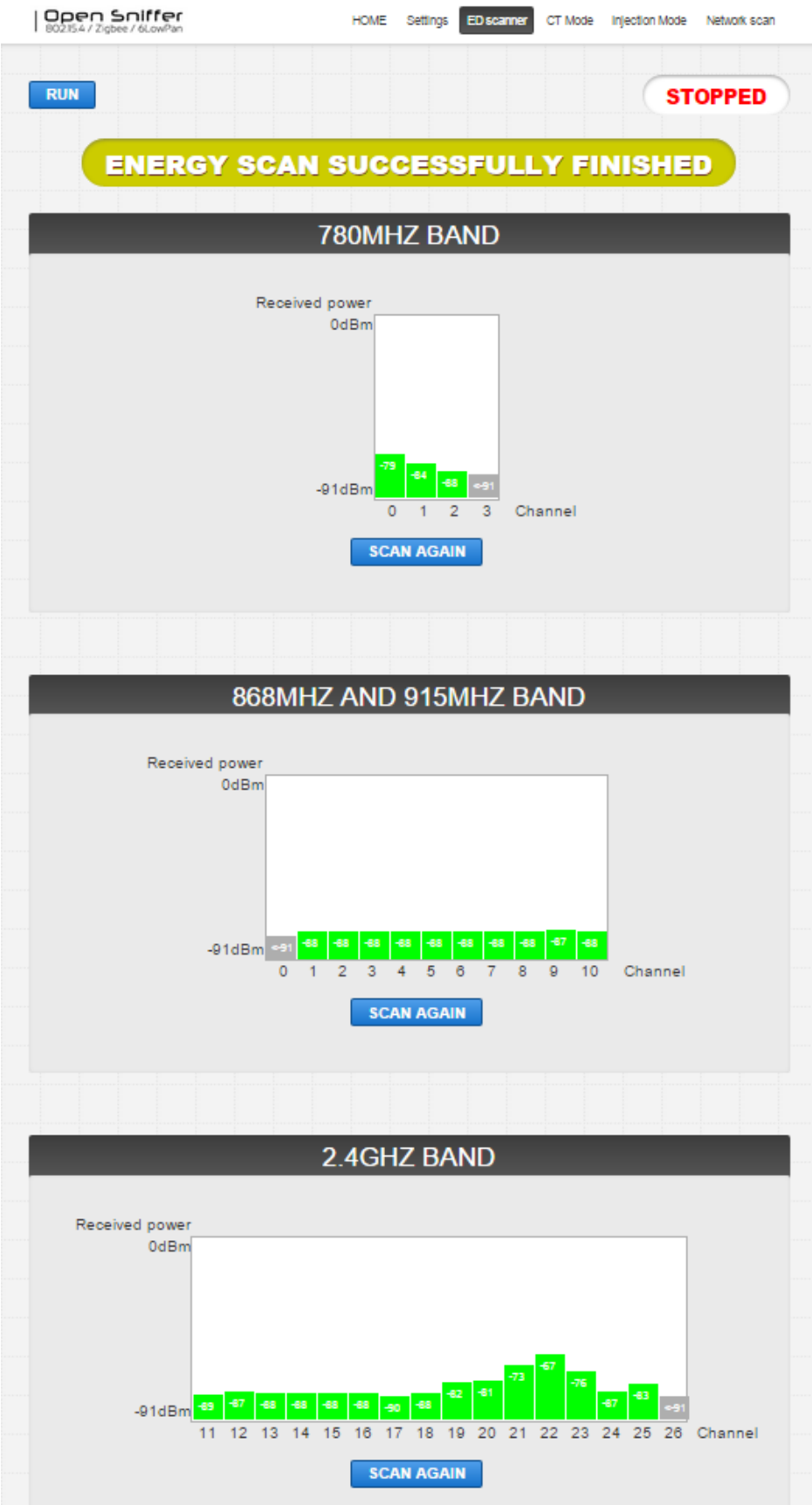

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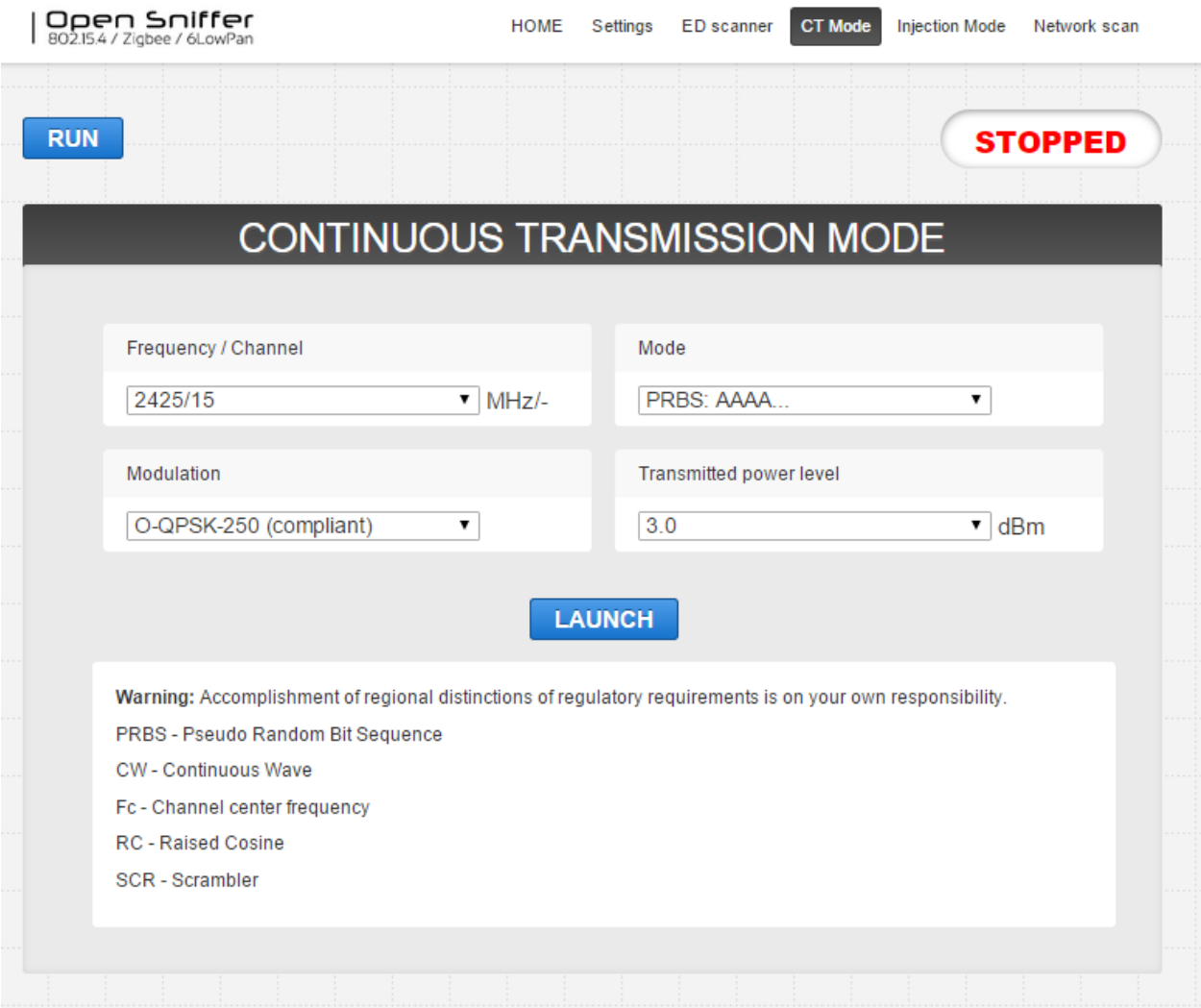
5 Continuous transmission (CT) page

This mode allows to transmit single tone signal (CW – Continuous Wave) or random signals (PRBS – Pseudo Random Binary Sequence). It is useful for RF related measurements (TX power, harmonics) and other test purposes such as generating RF noise on the particular channel.

CT mode is started by click on the LAUNCH button.



CW mode has 6 different frequencies:

- Fc + 0.50 MHz
- Fc – 0.50 MHz
- Fc + 0.25 MHz
- Fc – 0.25 MHz
- Fc + 0.10 MHz
- Fc – 0.10 MHz

Fc stands for the channel center frequency.

Note that in CW mode it is not possible to transmit a RF signal directly on the channel center frequency.

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PBRS mode transmits payload bytes continuously in the infinite loop.

There are 3 payloads available:

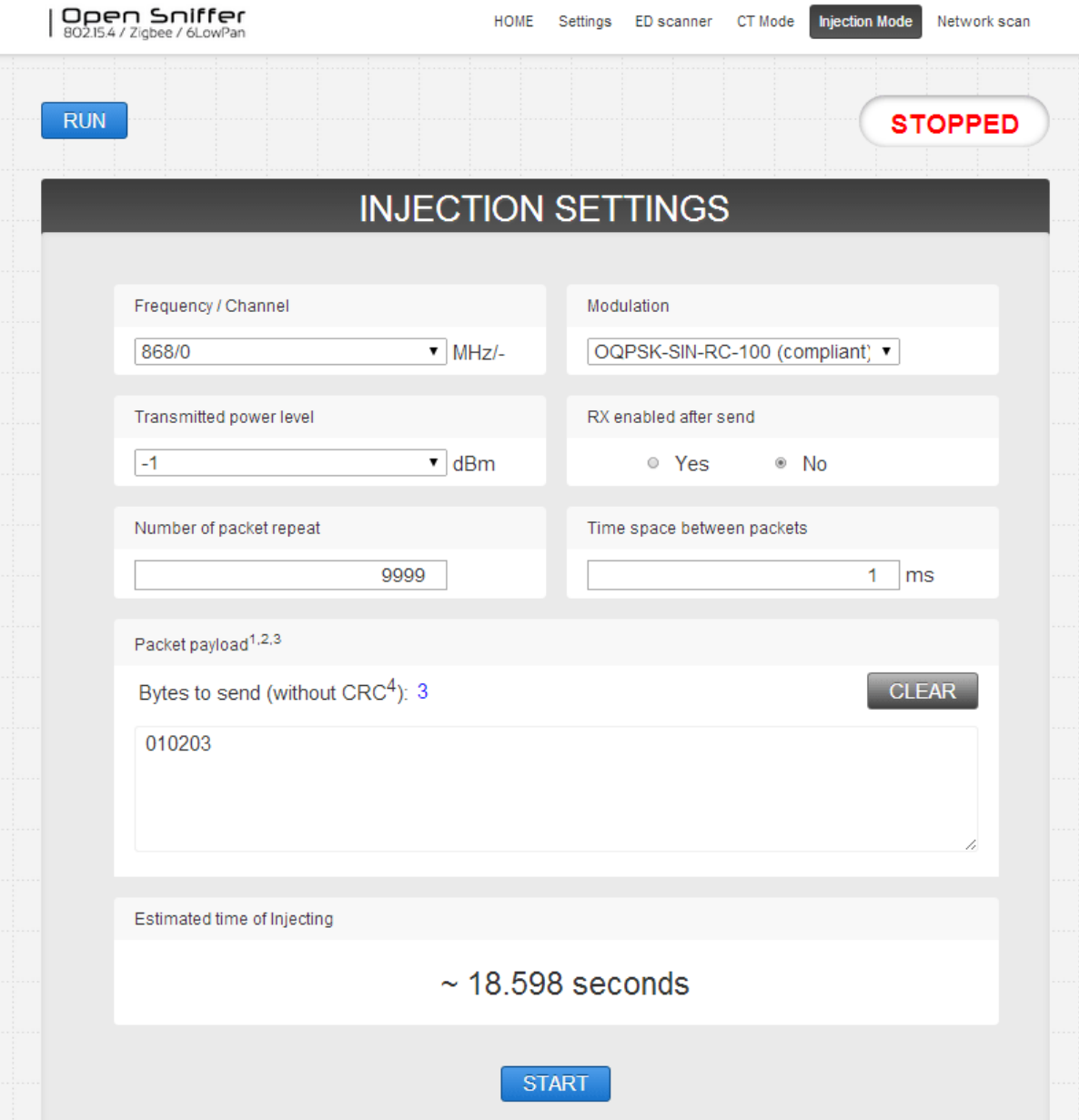
- PRBS: 0xAAAA… – Repeated hexadecimal value A (1010 binary).
- PRBS: 0×0000… – Repeated hexadecimal value 0 (0000 binary).
- PRBS: 0xFFFF… – Repeated hexadecimal value F (1111 binary).

Available modulation for PRBS mode is based on the selected channel:

- Channels 0 – 3 (780 Band): Modulation O-QPSK_250.
- Channel 0 (868 Band): Modulations BPSK_20 and modulation O-QPSK_100.
- Channels 1 – 10 (915 Band): Modulations BPSK_40 and O-QPSK_250.
- Channels 11 – 26 (2400 Band): Modulation O-QPSK_250.

6 Injection mode page

This mode is dedicated for packet transmitting. Several parameters such as payload, number of repetitions or delay among packets might be set.



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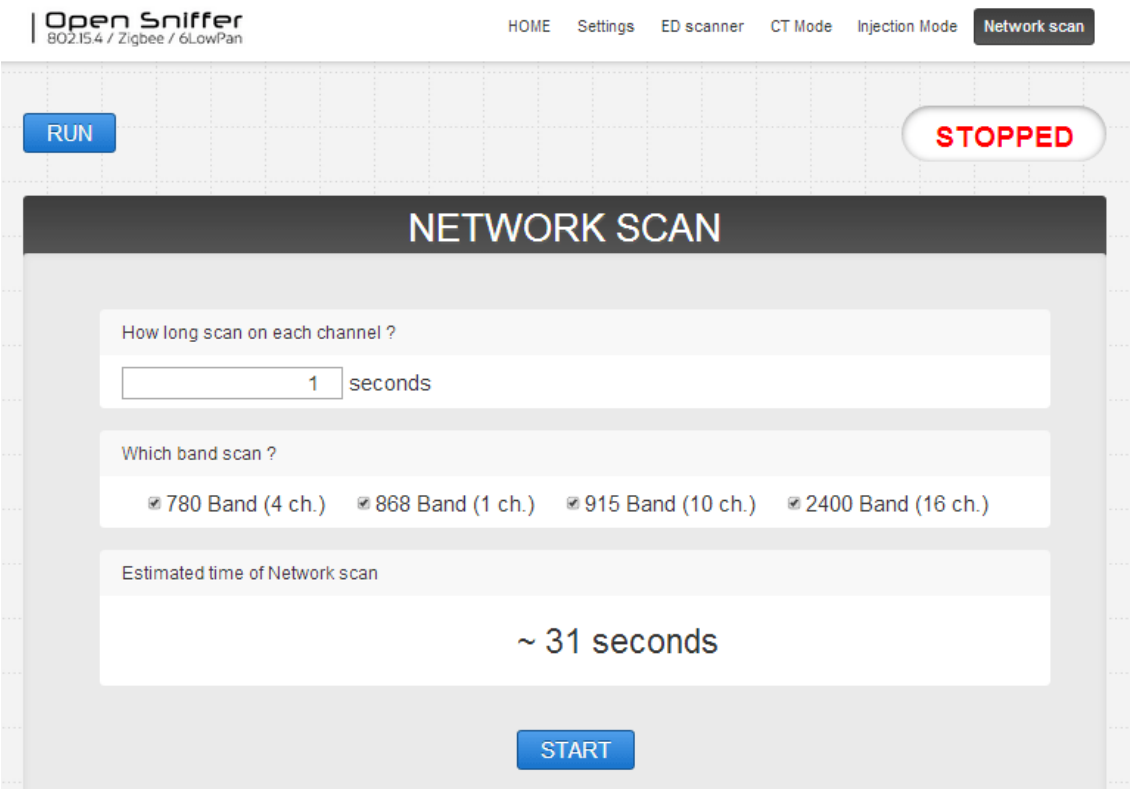
7 Network scan page

Network scan search for frames among specified channels and bands. If 802.15.4 network is found network PANID is displayed otherwise “unknown” network or no frame is shown.



8 Further Reading

How to control sniffer programmatically via HTTP protocol, Frequently Asked Questions or how to write your own Wireshark protocol dissector can be found at Open Sniffer product page.

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