Perytons

Perytons™ Multi-Channel Analysis

Background

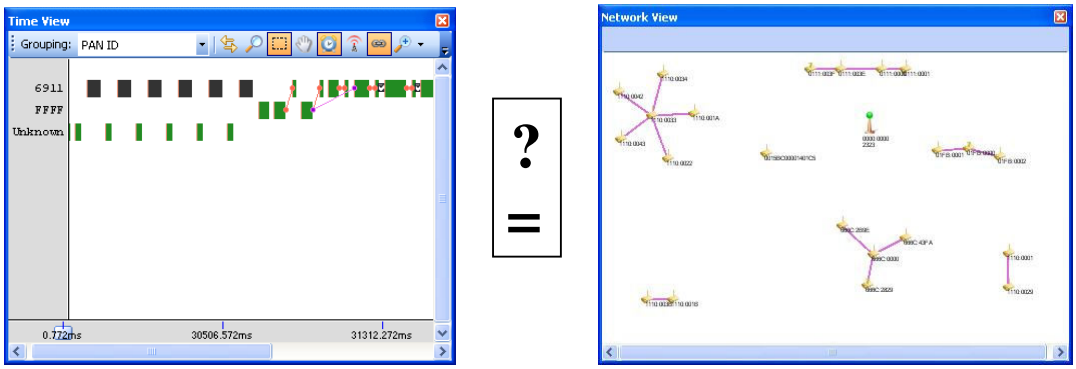
The IEEE 802.15.4 PHY layer defines 16 possible channels in the 2.4GHz band (denominated as channel numbers 11 to 26). A 802.15.4 Personal Area Network (PAN) will typically use one of these 16 channels. A given network will choose a channel either by user configuration or automatically according to channel noise level sensed.

A device looking to join a network would look for it in a process called "Scan" (unless it is manually pre-configured with the channel number). During a "Passive Scan" the device scans the channels and on each of them looks for a beacon transmission with the right PAN ID. During an "Active Scan", the device transmits a beacon request message on each channel, and waits for the network coordinator to respond.

Analyzing 802.15.4/ZigBee network(s) with a conventional, single channel analyzer

A typical single-channel analyzer is capable of capturing only one of the 16 possible channels. The user needs to set the analyzer to the right channel, or the analyzer should actively or passively look for it.

The following figures show messages received in a single channel setup vs. the actual network topology where the messages have been received from:



While this may be satisfactory for debugging a single network with a predefined channel, it raises a severe limitation when analyzing multiple networks or dynamic environments with dynamic channel assignments. For example, two networks that currently use two separate channels but have some interaction in between them (e.g. mutual interference, or data transfer between them by using one of the devices as a relay) can't be simultaneously analyzed by a traditional analyzer. Similarly, an “Active Scan” captured by a single channel analyzer will only show occasional transmissions on the channel currently monitored by the analyzer.

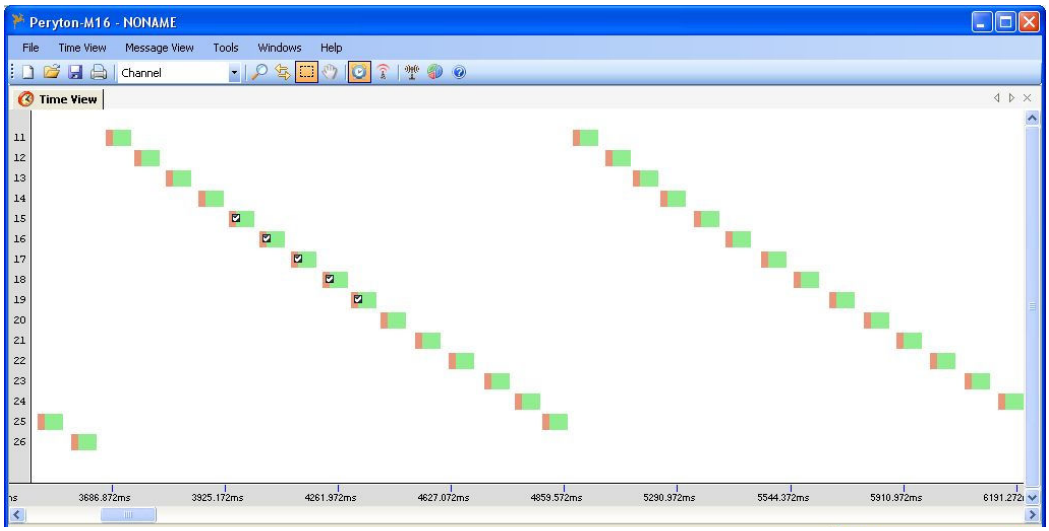
Single channel analysis is also an obstacle for certification labs looking to ensure that the device under test follows the exact rules defined by the standard. With a single channel analyzer one can't make sure the device under test doesn't transmit on a wrong channel, or doesn't correctly implement the "Active Scan" process. A common workaround is to use a spectrum analyzer to make sure the device is not transmitting out of channel. However, while this maybe satisfactory when testing one device in the lab, it doesn't help in a multiple-device environment because the message content is essential in order to identify the problematic device and the scenario which caused the erroneous transmission.

Analyzing 802.15.4/ZigBee networks with a Perytons multi-channel analyzer

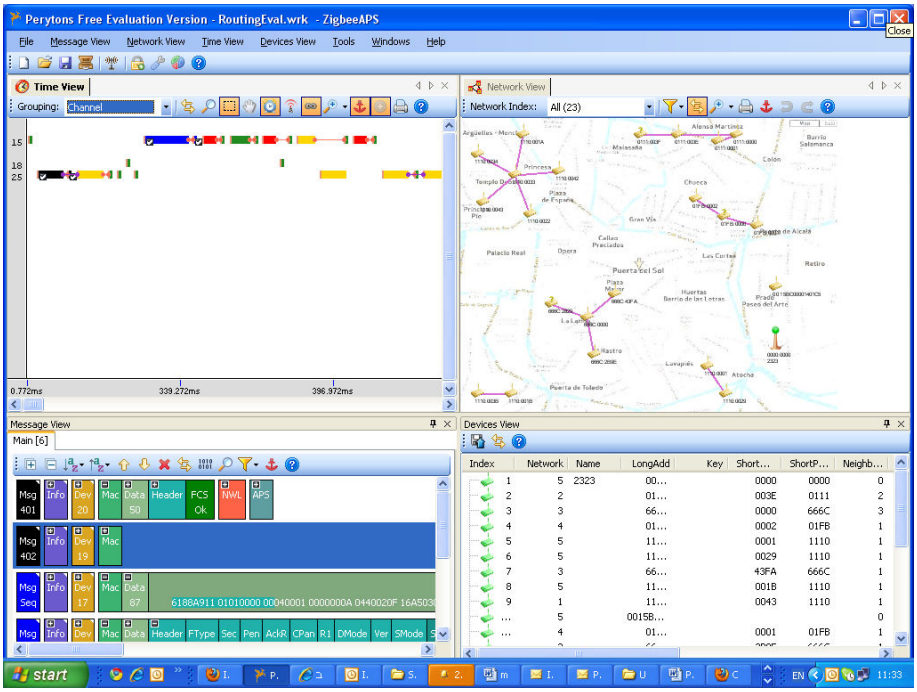
The Perytons analyzer is the first analyzer in the market capable of simultaneously capturing data from multiple channels. This allows the analyzer to capture all the 802.15.4 traffic in the 2.4GHz band simultaneously.

Using the multi-channel Perytons analyzer can capture single-network data without prior knowledge of the channel selected by the network, and it can just as easily capture data from multiple networks, displaying dynamic channel allocation processes such as "Active Scan" and immediately identifying devices that transmit on the wrong channel.

The following plot shows an active scan in the Perytons analyzer Time-View window:



The following figures show a typical screenshot of a multi-channel Peryton-M4 analyzer including time, message device and network topology views:



The use of 802.15.4/ZigBee USB dongles as RF receivers keeps the multi-channel analyzer compact and easy to carry by a field technician. The following pictures show Peryton-M7, 7 simultaneous channels capturing kit.