Open Dynamic Spectrum Sharing with minimal Energy

The spectrum is getting crowded by communication devices with very heterogeneous capabilities. While this trend is most pronounced in the open bands (e.g., ISM bands), to overcome the spectrum scarceness, more open licensing is to be expected. Dynamic coexistence of heterogeneous systems requires however a careful design of the channel access rules. Indeed, in the figure below we show the impact of an 802.15.4 transmitter on an 802.11 receiver. Theoretically, the listen-before-send of the 802.15.4 device, and its low output power (0dBm) should avoid harming 802.11. Even when implementing both interference mitigation techniques, we note a significant throughput decrease of the 802.11 link when 802.15.4 is on. This shows that the interference problem is often underestimated and important research is needed to solve this problem now and for future licensed systems.

Another assumption about spatial spectrum sharing is that the pathloss follows a clear trend. Through measurements, we showed pathloss cannot be that easily modeled and we proposed a technique for in-site pathloss prediction. This will significantly improve spatial reuse and spatial planning of wireless networks [1].

Our research focuses on optimal dynamic coexistence of heterogeneous systems. We look at:

- **Spectrum Modeling**: spectrum use in time, space and frequency by experiments determines what is useful spectrum opportunity information.
- **Spectrum Sensing**: obtaining run-time information about spectrum use intelligently (statistical learning) and energy efficiently (sub-sampling) to reduce the cost of information.
- **Spectrum Decision**: optimal use of spectrum using learned spectrum use opportunities allows one to translate the obtained information into a utility improvement. This determines the value of information.