Efficient Inter-Channel Interference Monitoring using DSP in Standard Coherent Receivers

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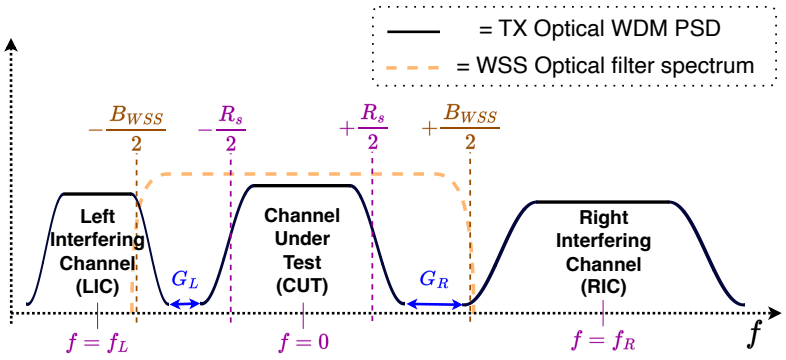
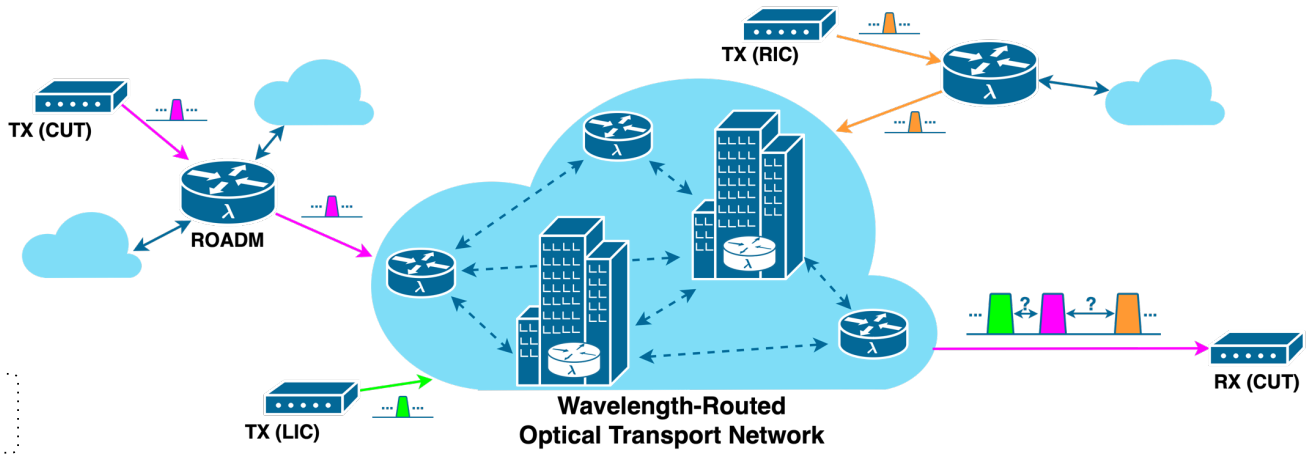
Inter-Channel Interference (ICI) over Wavelength-Routed Flexible Optical Networks

- **Flexible Wavelength-Routed Optical Networks** efficiency can be increased by maximizing each channel throughput.
- The **symbol rate** of a given Channel Under Test (CUT) can be maximized, provided that the **neighboring WDM channels position** is known.
- **Digital Signal Processing** at the CUT Receiver can be a cost-effective solution to monitor the possible occurrence of **Inter-Channel Interference**.



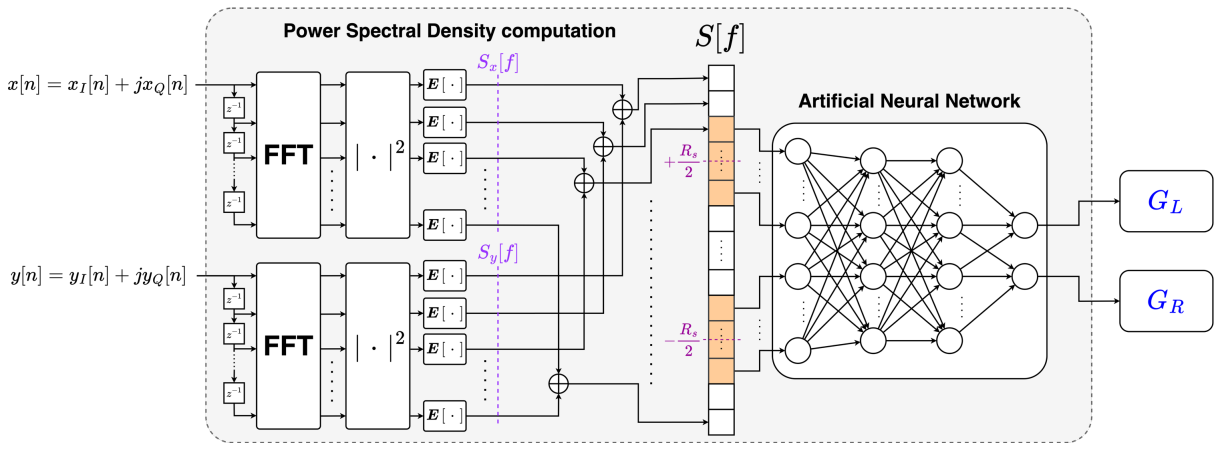


- **ICI monitoring** can be performed by estimating the **guard-bands** with respect to the interfering channels.
- Guard-band estimation through DSP must be performed in a **Dynamic Optical Network Scenario**, where several features of the interfering channels may vary
  - *Symbol rate*, *Spectral Shaping*, *Signal Power*, etc. .

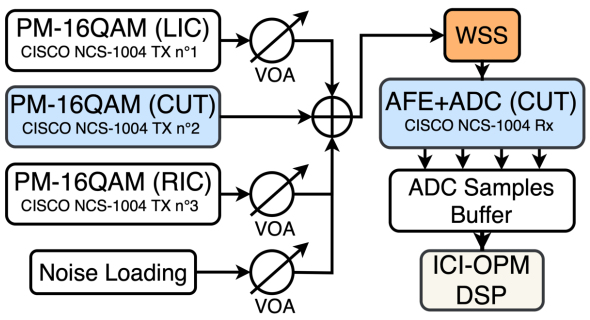
The ICI-monitoring ANN-based Digital Signal Processing Algorithm

The developed ICI-monitoring DSP scheme consists of two main steps:

1. A **Dual-Polarization Power Spectral Density (PSD)** is estimated from the **Received Digital Signal** samples to obtain *spectral information* on the neighboring channels
2. An **Artificial Neural Network (ANN)** processes part of the dual-polarization PSD to estimate the *LIC and RIC guard-bands* G_L *and* G_R

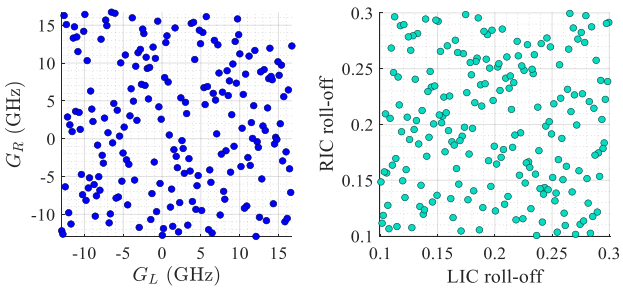


Experimental Implementation using Commercial Coherent Transceivers

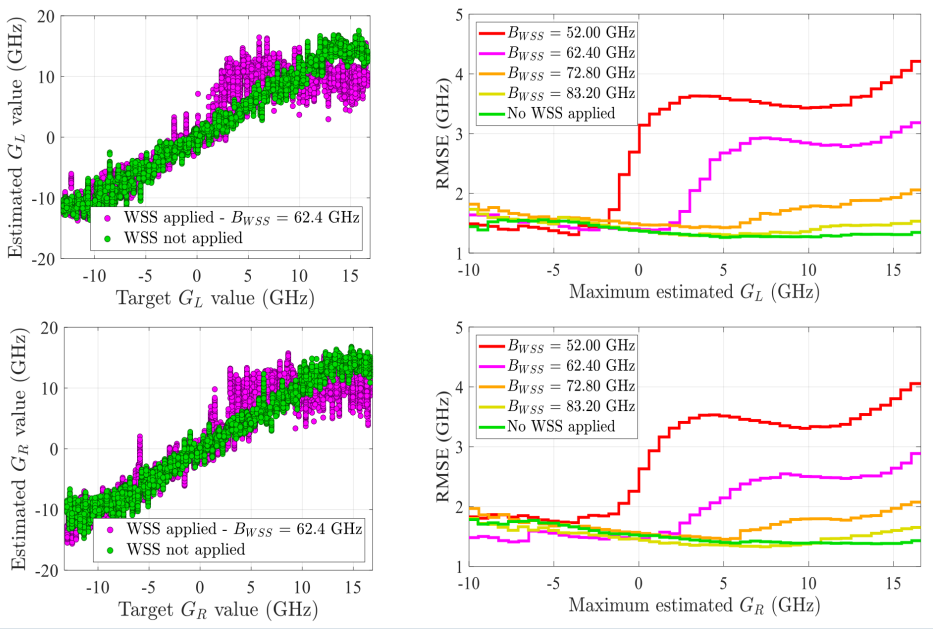


Experimental Setup

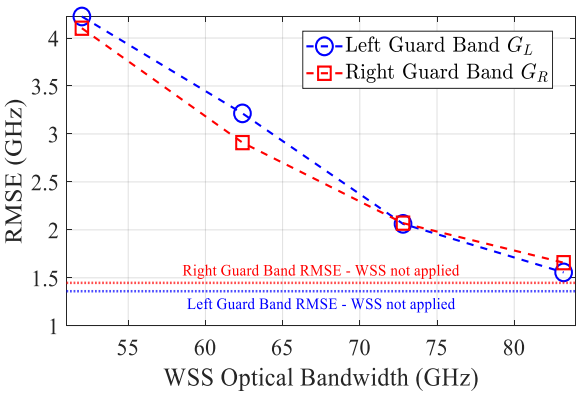
- The ANN-based DSP algorithm is tested in an **experimental setup** using **Commercial Coherent Transceivers**
- An ***efficient dataset*** of ADC samples to optimize and test the ANN is obtained by varying the LIC and RIC using a **Latin Hypercube Sampling** approach
- A *Wavelength Selective Switch (WSS)* is employed in the setup to emulate different **Optical Filtering** scenarios at the receiver



Experimental Dataset Design using Latin Hypercube Sampling



- Without Optical Filtering, the algorithm estimates both left and right guard-bands with a **Root Mean Square Error (RMSE)** of **1.5 GHz** (with CUT symbol rate equal to *52 GBaud*).
- The *RMSE progressively increases as the WSS bandwidth is reduced*
- Nevertheless, **the DSP algorithm is accurate as long as interfering channels are not canceled by optical filtering.**



ICI-monitoring performance is significantly impacted by Optical Filtering Penalty