MACOM®

Partners from RF to Light

RF on Fiber Phase Stabilization

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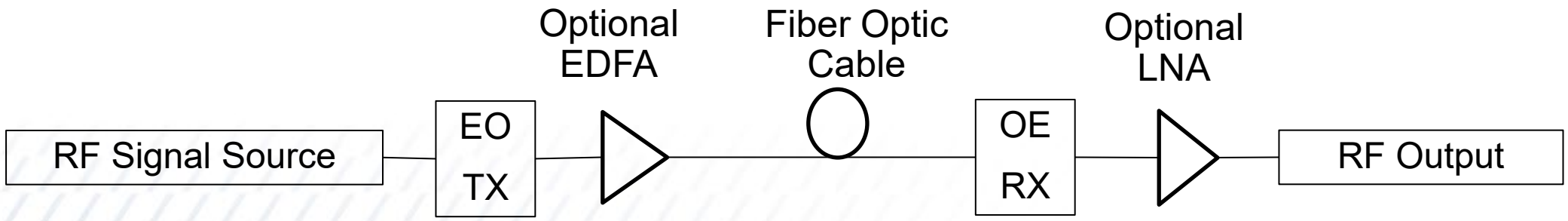
RF on Fiber

- Transport of analog signals over optical fiber
- Bandwidth up to 60 GHz commercially available
- Optical Amplification (EDFA) 20 dB Gain with <5 dB NF
- No EMI or crosstalk on optical fiber

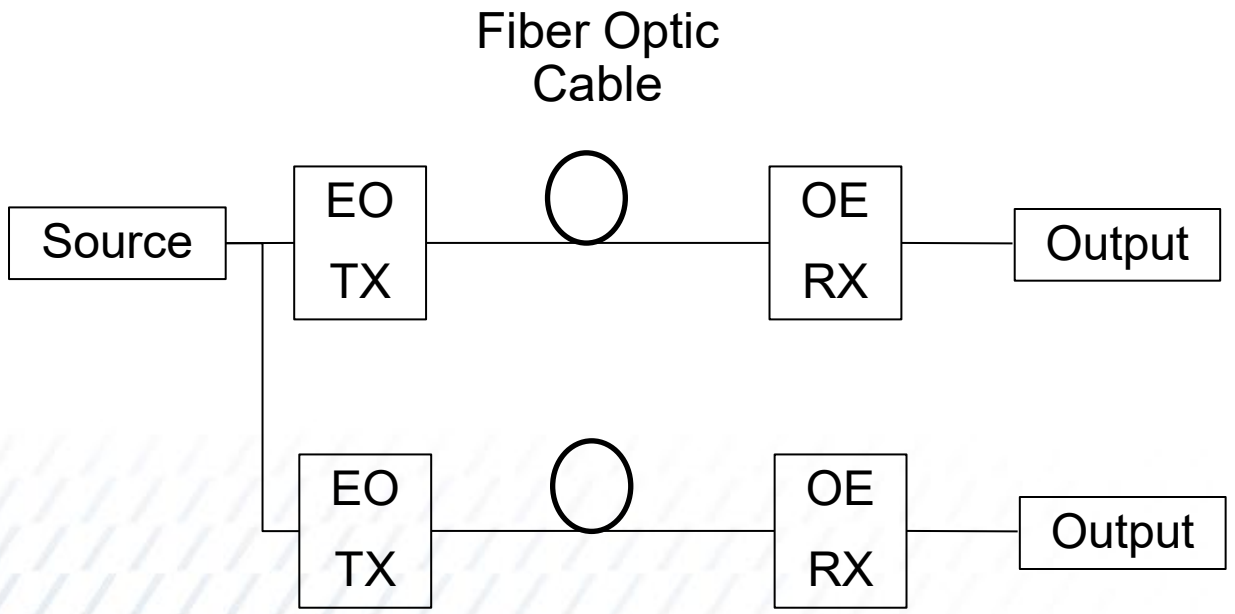


Optical Fiber Properties

- Delay: 0.2 m/ns
- Loss: 0.2 dB/km, 10 dB loss in 50 km
- Temperature dependence: ~40 ps/km/K
  - 10° C change on 1 km span provides a 400 ps change
  - For 1 GHz that is 0.8π phase shift
- Chromatic Dispersion: 18 ps/nm/km

Precise Time and Frequency Distribution

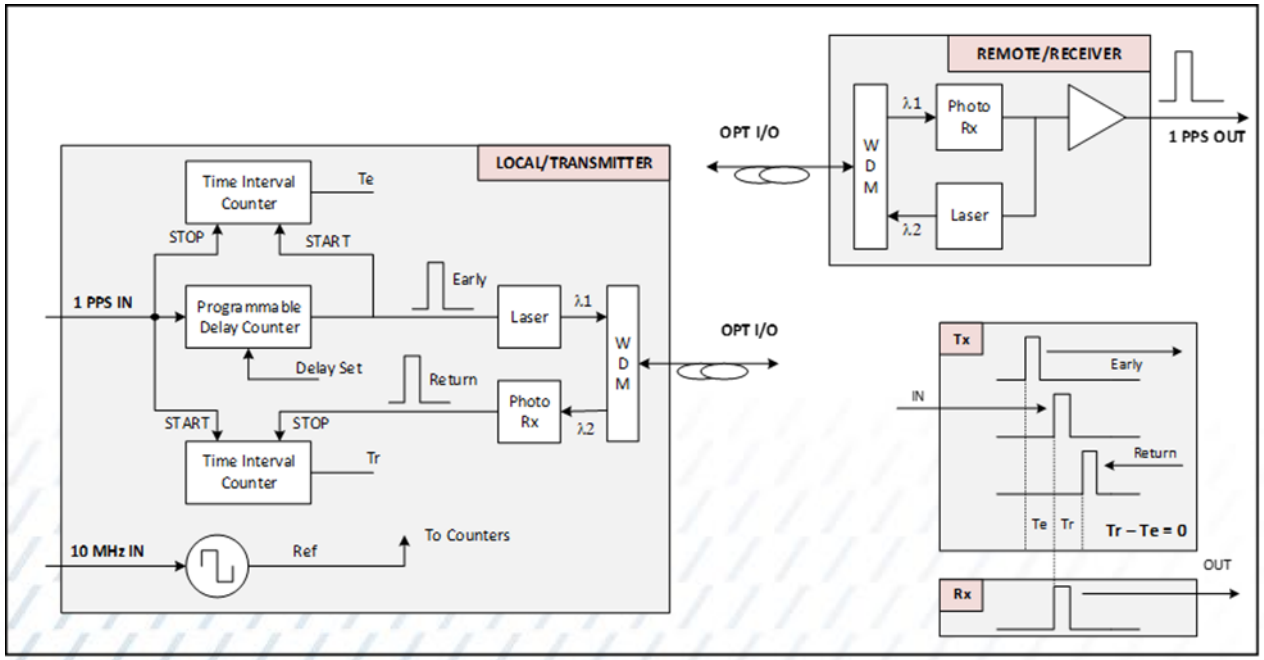
- Clock Distribution: 1 PPS, IRIG, 10 MHZ

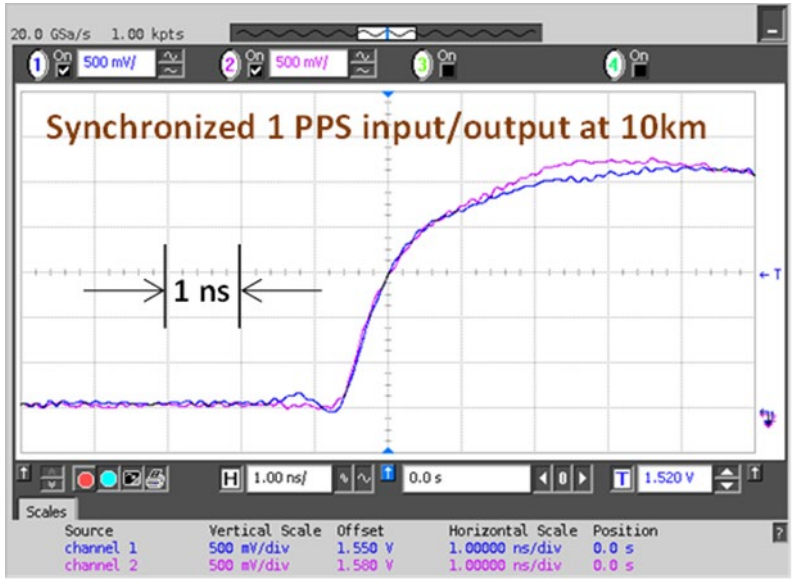


Phase Compensation: Single Signal

Clock and Frequency Distribution

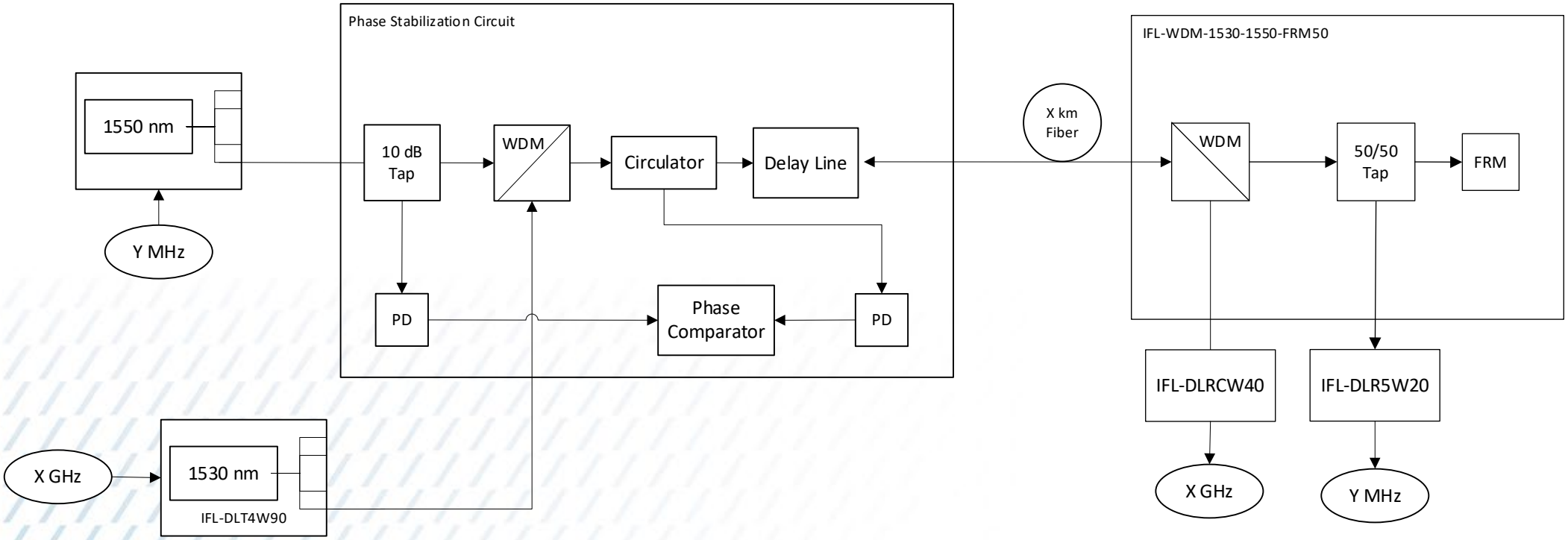
- Temperature variation changes fiber length causing drift in arrival times
- Measure phase variation of return path signals
- Compensate by changing pulse transmission time





Phase Compensation: Multiple Signals

- Transmission of frequency reference and data signals on same fiber
- Transmission of frequency reference to multiple sites
- Use variable delay line to compensate for fiber variation to < 1 ps



Phase Stabilization

Two approaches to phase compensation

- Single channel use transmitter adjustment to get ±0.25 ns
- Multiple channels use fiber delay line for adjustment to get < 1ps

Questions?