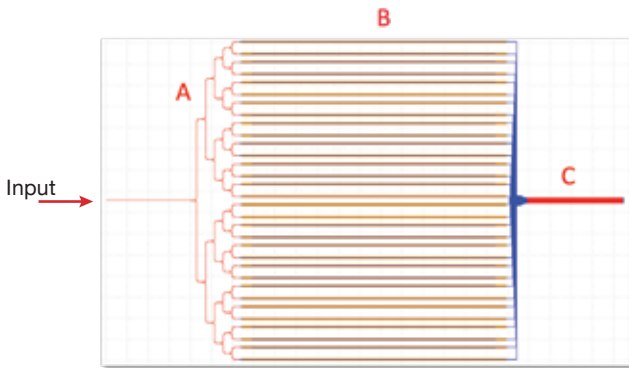
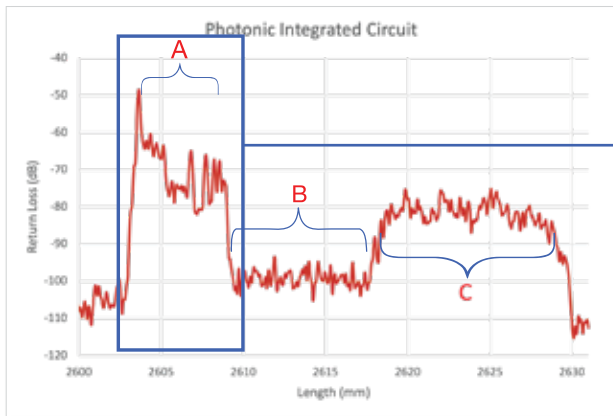
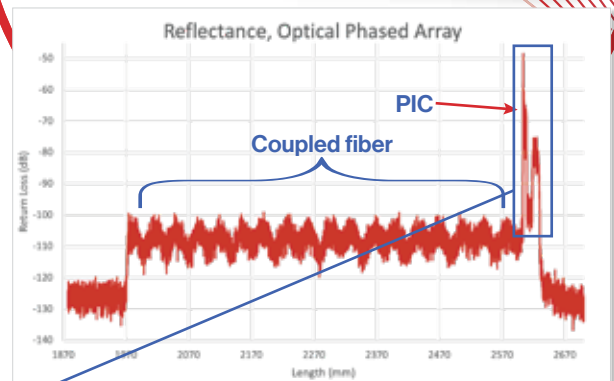


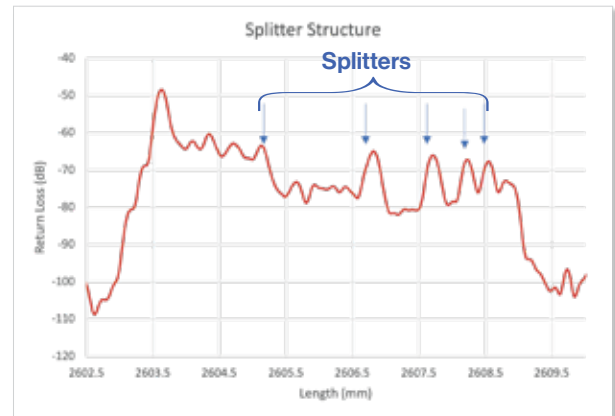
Photonic Integrated Circuit Analysis with the SPA-100



A device constructed of a 0.42m lead-in fiber coupled to an optical phased array (OPA) is analyzed, and the group index for various mediums is to be measured and compared against design values. The OPA has a splitter structure (A) consisting of five splitters constructed with silicon nitride, and 32 phase shifters constructed of low-loss silicon waveguides (B). At the output of each waveguide is a grating emitter (C).



From the graph above, one can see reflective events corresponding to splitters in area A and see the backscatter level drop in area B, which signifies a lower loss waveguide with less scattering. The grating emitter is constructed of the same waveguide structure as the splitter system, and as such, it shows similar higher backscatter levels.



Looking at the splitter structure, with a little bit of design knowledge, it is possible to identify the individual splitter components. Using these locations, knowing the design lengths, and measuring the distances between each component, it is possible to calculate the group index of this medium. The measured group index based on the splitter lengths is 2.025. The same process can be used to calculate the phase shifter group index and a value of 3.478 was calculated.

CONCLUSION

Using the exceptional resolution (<5um) of the SPA-100, it is possible to measure and confirm the group index of a photonic waveguide. For the optical phased array PIC, the design lengths of certain features were compared against the measured length of those features. Using multiple features and averaging the measured values it is possible to obtain an accurate (~1% error) measurement of the group index. For the silicon nitride waveguide a value of 2.025 was calculated compared to the simulated value of 2.029 (<1% disagreement) and for the low loss phase shifters a value of 3.7478 was calculated compared to the simulated value of 3.768 (<1% disagreement).