

**Electrical Engineering and Information Technology**

**Title:** *Modified Sagnac Loop Coherent Phase Modulated RF Photonic Link*

**UMD18-09**

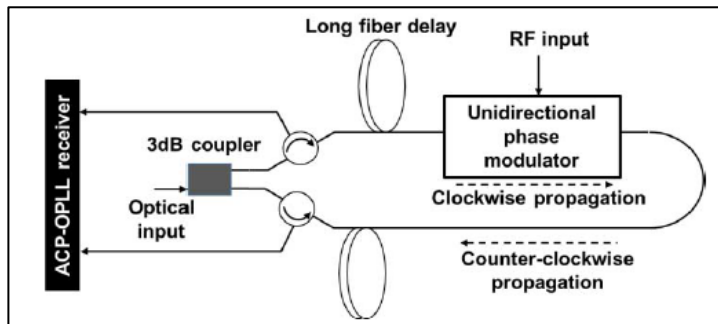
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- Applications:**
- Antenna remoting
  - Radar front end
  - Radio-over-fiber link for 5G wireless communication antenna systems

- Benefits:**
- Eliminates random optical phase perturbation commonly found inside long optical fibers.
  - RF information is only encoded on one of the counter-propagating optical signals inside the loop.
  - Stable signal transmission over a 1 km optical fiber has been demonstrated.
  - Long distance fiber transmission showed no penalty to the noise and linearity performance (except for higher optical loss).

**Technology Description:** A RF/Photonic link is desirable to allow an antenna to be placed remotely from its signal processing unit. A coherent phase modulated link with an attenuating-counter-propagating optical phase locked loop (ACP-OPLL) photonic integrated circuit (PIC) demodulator has been proposed for this use, but such a system is sensitive to environmental perturbations and is not suitable for links of greater than 1 kilometer distance. Sagnac loop topology, where the phase fluctuations in clockwise and counter-clockwise propagating signal should cancel due to the symmetry, has been proposed as an alternative but has not previously been applied with a linear ACP-OPLL phase demodulator. This invention represents the first modified Sagnac loop coherent phase modulated RF/photonic link employing an ACP-OPLL optical receiver. Except for the optical loss due to the long fiber, no penalties in the link noise and linearity performance were observed through a 1 km fiber transmission.

**Patent Status:** UMass Dartmouth has filed a provisional patent application on this invention. The invention is based on research published in [IEEE Photonics Technology Letters](#) in July 2017.



Modified Sagnac loop coherent PM RF photonic link, in accordance with the invention.

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