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# Polarization multiplexing based duplex radio-over-fiber link for millimeter wave signal transmission to a ring of multiple radio access units



**Key words:** Radio over fiber; Millimeter wave; Radio access units

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# Motivation

1. The increase in the number of users and in the bandwidth demand per user has forced service providers to explore higher frequencies that lie in the mm-wave region.

2. High frequency communication coupled with large bandwidth demand requires small cells that are lightened by multiple radio access units (RAUs).

3. Previously proposed schemes require complex RAUs for mm-wave signal generation and uplink signal transmission.

4. A novel scheme that combines polarization multiplexing with carrier reuse to simplify RAUs has been proposed.

# Main idea

1. The proposed architecture employs polarization multiplexing along with coherent multiple wavelength generation for duplex transmission of mm-wave signals to four different RAUs in a ring architecture.

2. Cost-efficiency is achieved by employing a single directly modulated laser source for transmission of duplex data to four RAUs.

3. To increase the capacity of the link, polarization multiplexing is used.

# Method

1. A coherent multiple wavelength signal is generated by employing direct modulation at the central unit.

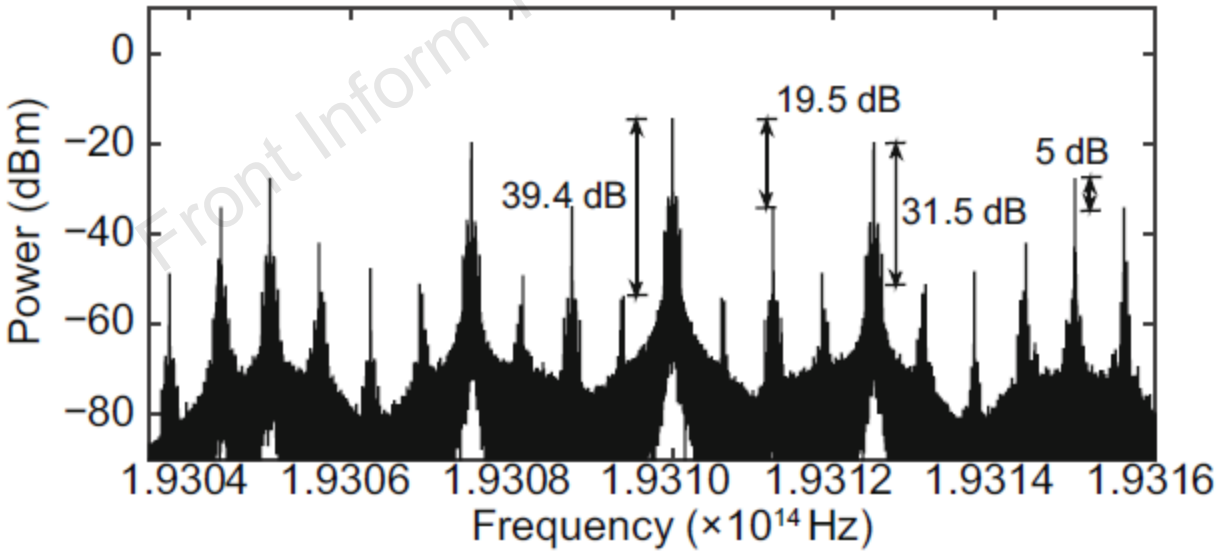
2. Single sideband optical signal is transmitted to avoid frequency dependent power fading.

3. Carrier reuse is employed at each of the four RAUs to transmit uplink data.

4. Millimeter-wave signals are generated at the RAUs through remote heterodyne detection.

# Major results

Optical spectra of the unmodulated and modulated wavelength division multiplexed (WDM) signal: spectrum of the modulated downlink WDM signal at the output of central unit



# Major results (Cont'd)

The proposed architecture provides increased coverage while maintaining good bit error rate (BER) results.

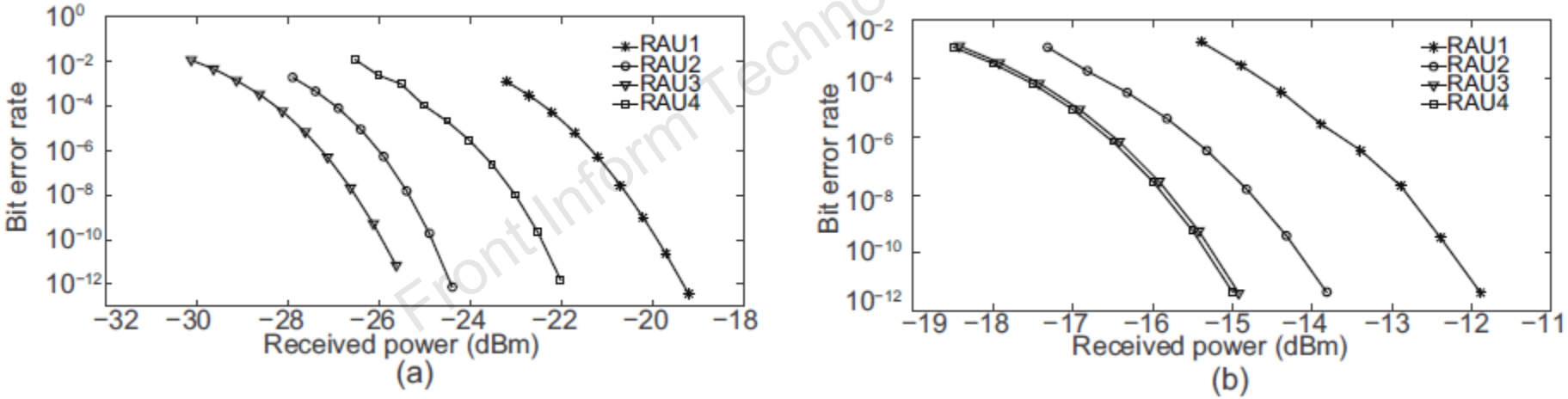



**Fig. 5 BER vs. received optical power: (a) DL signals received at RAUs; (b) UL signals received at CU (BER: bit error rate; DL: downlink; RAU: radio access unit; UL: uplink; CU: central unit)**

# Conclusions

1. A radio-over-fiber distributed antenna system architecture has been proposed, where mm-wave signals are transmitted to four different RAUs arranged in a ring topology.

2. The proposed architecture transmits duplex data of 128 Mb/s to each RAU in both downlink and uplink directions.

3. The RF signals are transmitted by polarization multiplexing a multi-wavelength source.

4. Millimeter-wave signals at 25 GHz are generated at each RAU using remote heterodyne detection.