Radio-over-Fiber Communication Using a Vertically Integrated Transceiver

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OVERVIEW:
There is a general agreement that the future market of broadband WLAN communications and in-building networks will lead to a convergence of fibre and radio systems. A very attractive solution is radio-over-fibre (RoF) technology where low cost and low-power base stations are being studied. This poster gives an overview and recent results on short range RoF communications where a novel high-speed full-duplex photonic component is used for optoelectronic conversion for up- and downlink. The key device is a multifunctional integrated vertical transceiver based on reflection/electroabsorption and photo detection in a semiconductor structure.

RoMF SYSTEM CONCEPT:
- RoF transmission system (fig. 1) based on WDM technique with only one multimode (MM) or polymer optical fiber (POF)
- A new Vertical ElectroAbsorption Transceiver (VEAT, see Transceiver Concept) is developed for O/E and E/O conversion in the Base Station. This device is a totally passive bidirectional optoelectronic component which provides a very low power consumption.
- Measurements are performed with a 50/50 MM Y-coupler instead of a MM circulator see fig. 1. A circulator will be included in next measures.

SYSTEM CONCEPT:
- Central Station
- Base Station
- MM/POF
- Antenna
- VEAT
- Signal processing

MODULATOR:
- The reflectivity contrast of the modulator and its linearity in the I-P caracteristic is an important value modulation depth. A linear contrast leads to a linear change in modulated optical power dependent on applied voltage. The reflectivity contrast is shown in fig. 4 and defined as Cu [dB].
- Between 0V and 6V the reflectivity contrast has ~17%. For high modulation depths the linearity depth will be considered.

DEVICE CHARACTERIZATION:
- The link loss of the system (fig. 5) is plotted versus Frequency in fig. 6. For WLAN RoF applications at around 2.5GHz the link loss is detected to be 75dB with an SNR of around 28dB in the system using Y-coupler. The usage of a circulator could provide a higher power budget.

PHOTODIODE:
- The photodiode has been characterized with respect to its I-P caracteristic (fig. 7).
- The frequency response of the photodiode is depicted in fig. 8. The SNR at 2.5 GHz is detected to be > 42 dB.

REFERENCES:

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Digital Data Transmission & Reception:
In section "Device Characterization" it has been shown, that the VEAT is capable of transmitting and receiving RF signals at frequencies higher than 2.5 GHz. Its digital data transmission behavior is analyzed in the following section by using NRZ modulation for the transmission systems shown in figs. 9 and 11. For each measurement the orange highlighted path with each 20m of multimode glass fiber (and additional Y-coupler in fig. 9) has been used and the results are shown in the corresponding eye diagrams (fig. 10 and 12). It has to be pointed out that the depicted path for the measurement of the modulator (fig. 9) has been taken with a Y-coupler instead of a circulator. Measurements with circulator in combination with BER analysis are planned to be presented in the corresponding paper.

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