Evaluation of Radio over Plastic Optical Fiber Communications

Muhammad Waseem1,2, Alicia López1, Pedro Luis Carro2, María Ángeles Losada1
1: Grupo de Tecnologías Fotónicas (GTF) 2: Grupo Communication Networks and Information Technologies (CeNIT)
Instituto de Investigación en Ingeniería de Aragón (I3A), Universidad de Zaragoza
Mariano Esquillor s/n, 50018, Zaragoza, Spain. Tel. +34-64956724, e-mail: 806405@unizar.es

In this work, we have experimentally evaluated the performance of a Radio over Plastic Optical Fiber (RoPOF) communications link by simultaneously transmitting Long-Term Evolution (LTE) and Narrow-Band Internet of Things (NB-IoT) signals over 75-meters of PMMA large-core Graded-Index POF (GI-POF).

Experimental Setup
- MATLAB LTE Toolbox
- DAC/ADC: Zed Board (Xilinx Zynq-7000)
- Laser Diode L658P040
  - Wavelength 658 nm
  - Nominal power 40 mW
- 75-meter Graded-Index POF
- Receiver SPD-2-650

Results
- 10-MHz LTE @ 800 MHz
- Guardband NB-IoT @ PRB 50
  - Low SNR @ low input RF power
  - Non-linearities @ high input RF power
  - NB-IoT power boost has little impact over LTE EVM
  - EVM are below quality thresholds for most input RF powers:
    - 8% for LTE
    - 17.5% for NB-IoT

Non-linearities metrics: PSD, PAPR, ACPR
- Output PAPR slightly decreases from 2 dBm consequently with ACPR and EVM increase

Conclusions
The combined transmission of NB-IoT and LTE over the POF meets the standard quality for both services, for a wide range of input RF powers.
A high power boost to the NB-IoT signal results in a better transmission performance over a wider range of input powers, with hardly any impact over the LTE signal.
Non-linear effects, determined by the values of PAPR and ACPR, do not severely affect LTE transmission except at the highest analysed input RF powers.

The reported results demonstrate the feasibility of RoPOF transmission over PMMA large-core GI-POF for future short-range networks.

Acknowledgments
This research was funded by the Spanish Ministry of Science and Innovation (MICINN/FEDER), grant numbers RTI2018-095684-B-I00 and RTI2018-094669-B-C33, and by the Aragón Government (DGA), under grant numbers T20-20R and T31-20R.