ThoR project newsletter #4

August 2020

Welcome to the fourth ThoR project newsletter!

This project has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation, under grant agreement No. 814523. ThoR has also received funding from the National Institute of Information and Communications Technology in Japan (NICT).

Like most activities over the last six months, the ThoR project has suffered significant interruptions and delays related to the COVID-19 restrictions. However, we are pleased to say that most partners are now able to work reasonably well, subject to the appropriate precautions. There are several things to report in this newsletter:

- New date for the 3rd Towards THz Comms Workshop (3TTCW)
- Photonic LO progress at University of Lille
- Modem bank parallelisation in ThoR by Siklu
- Implications of WRC 19 AI 1.15 for THz comms (TUBS/CIT)

More information is available on the project website www.thorproject.eu

3rd Towards THz Comms Workshop

11-12 Mar-2021
IMEC (Leuven)

SAVE THE DATE

The Beyond 5G Cluster has organised two previous workshops on THz communications. Unfortunately, the 3TTCW scheduled in Mar-2020 had to be postponed due to COVID-19 restrictions. However, we are pleased to announce a new date for the event: it will be held at IMEC (Leuven, Belgium) on THU/FRI 11-12 Mar-2021. There will be an evening reception on THU 11-Mar, and a workshop on FRI 12-Mar-2021 including guest speakers and a panel session. More details will be released on the workshop website soon!

https://terapod-project.eu/terapod_events/3rd-towards-thz-comms-workshop

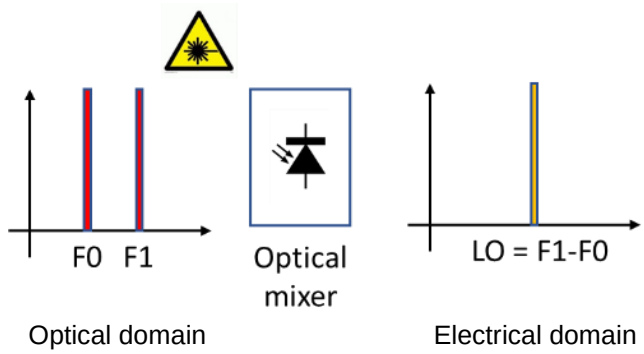
For more info contact Alan Davy (TERAPOD): adavy@wit.ie

EU Coordinator — Thomas Kürner — kuerner@ifn.ing.tu-bs.de
Japan Coordinator — Tetsuya Kawanishi — kawanishi@waseda.jp
Admin — Bruce Napier — bruce@vividcomponents.co.uk

Photonic LO progress

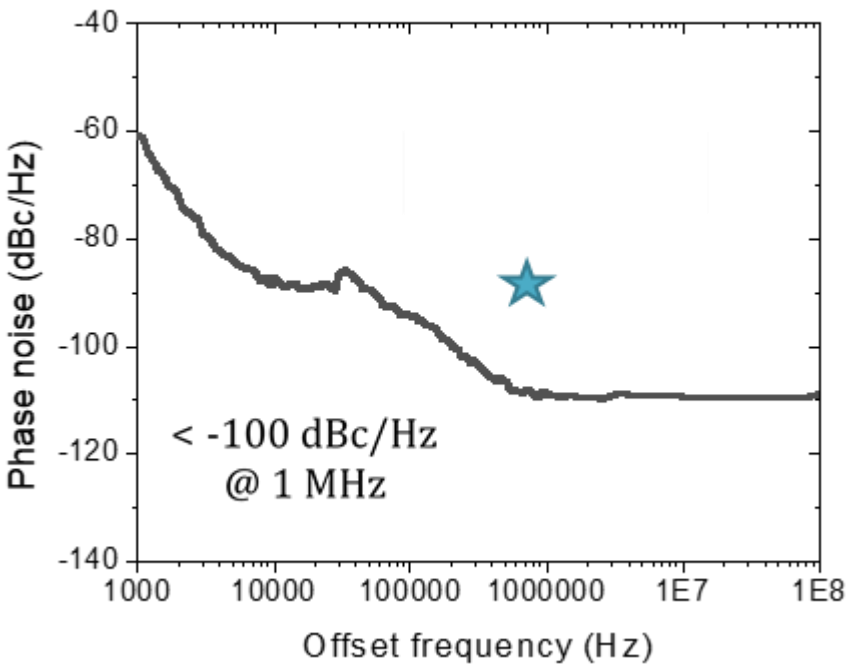
The ThoR project aims to provide a technical solution for back- and fronthauling operating in the 300 GHz frequency range. The ThoR system will be composed of modems in the standardized 60 and 70-80 GHz frequency bands and high performance 300 GHz RF transmit/receive modules. This concept is underpinned by a photonics-based local oscillator (LO) in in the 72-76 GHz frequency range, ensuring a very stable and high quality millimetre-wave signal. Usually, multiplication chains or transceivers are pumped by a low frequency LO, and the multiplication of this LO induces unwanted spurious components in the signal. ThoR aims to demonstrate the potential of this photonic LO-based approach. During the first half of the project, a photonics-based LO was developed at the University of Lille (France). The architecture of the photonic LO is based on the generation of a dual wavelength optical signal, frequency locked, optically down-converted within a photodiode acting as an optical mixer as shown in Fig. 1.

Fig. 1: Basic operation of the photonic LO in which an optical mixer down-converts optical signals to the electrical domain. The desired LO frequency is generating by mixing two optical signals, frequency locked at F_0 and F_1. The result of the mixing corresponds to the difference of the optical frequencies, i.e. F_1-F_0.



The performance of the photonic LO has been phase-noise qualified, in relation to the 60/70 GHz modem requirements. The next step within the ThoR project is the use of this photonic LO to drive the solid-state integrated III-V up/down conversion circuits during the scheduled joint EU-Japan demonstrations combining photonics/solid-state and travelling-wave tube sub-systems.

Fig. 2: Phase-noise performance of the photonic LO at 77 GHz. The star on the graph represents the minimum required phase noise for the modems defined by the consortium.



For more info contact Prof. Guillaume Ducournau
guillaume.ducournau@univ-lille.fr

Modem bank parallelisation in ThoR

The modem parallelisation concept used in the ThoR project has a number of important advantages:

- It makes use of existing chipsets operating at 70/80 GHz
- In ThoR it will be used with four modems, but it can be extended as required
- The method is flexible in both cost and performance

The up/down conversion scheme principle (illustrated in Fig. 3) uses a diplexer for each modem and there are two local oscillators (up/down). This requires little gain in the RF and the automatic gain control (AGC) is implemented in IF.

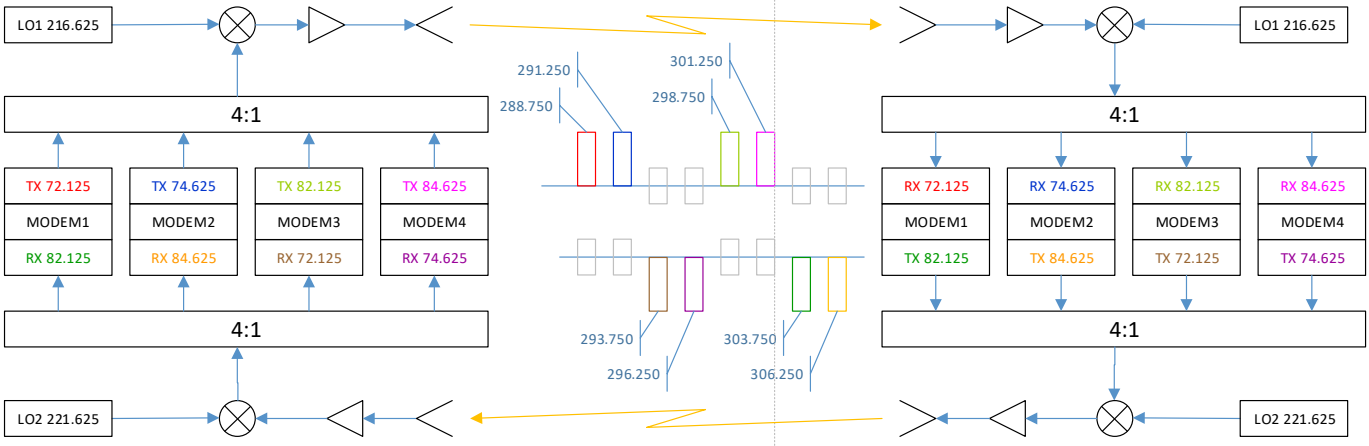


Fig. 3: Schematic showing the ThoR up/down conversion scheme

Summary & Outlook

- The ThoR modem parallelisation concept enables a trade-off between cost and modem performance
- Use of E-band modems enables the use of mature RF and modem technology to bring terahertz communication rapidly to the market
- Frequency combining scheme and modulations supported by the modem ensure efficient use of spectrum.

For more info contact Yigal Leiba yigal@siklu.com

Results of WRC 2019 AI 1.15 and its impact on THz communications

The Third International Workshop on Mobile Terahertz Systems (IWMTS) was held online 02-03 Jul-2020. This event included a paper by Thomas Kürner (TUBS) and Akihiko Hirata (CIT) on the implications of WRC 2019 AI 1.15 for THz comms. A related presentation, which is publicly available, was presented to the June meeting of the IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) which was also held online. This presentation from 07-Jun-2020 is available from the IEEE website:

https://mentor.ieee.org/802.15/documents

For more info contact Prof. Thomas Kürner Kuerner@ifn.ing.tu-bs.de