TERAWAY

Terahertz technology for ultra-broadband and ultra-wideband operation of backhaul and fronthaul links in systems with SDN management of network and radio resources

TERAWAY Factsheet

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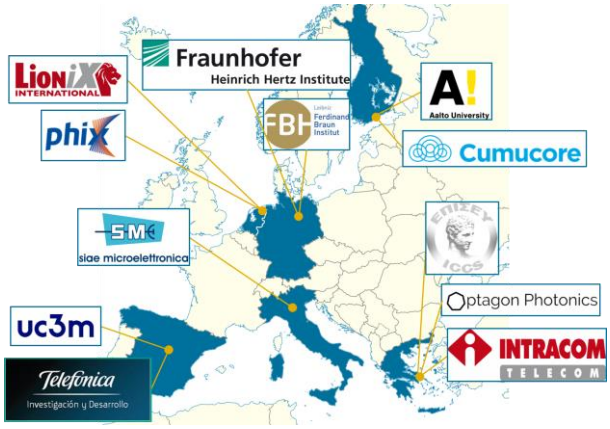
Consortium: 12 Partners (6 EU countries)



TERAWAY is a H2020 5GPPP Phase III project funded by the European Union aiming to develop a disruptive generation of THz transceivers for high-capacity BH and FH links in 5G networks.

Motivation

The 5G vision for a fully mobile and connected society drives today the herculean efforts worldwide on designing, developing and commercializing the next generation of wireless networks that can address the huge requirements in terms of coverage, traffic capacity, reliability, latency and network energy efficiency. Main results of these efforts designate that a wireless technology with high agility, but optical fiber-like capacity is necessary in order to act as a natural extension of the core (optical fiber) network and deliver this massive capacity to the gNB or to the radio part of it.

Terahertz (THz) wireless communication technology with carrier frequencies in the 300 GHz regime has been designated as a possible candidate for this extension due to the abundance of bandwidth that can be found there. However, despite the technical progress and the individual achievements that have been made in the field, THz technology appears still to be short in turning its indisputable potential at the conceptual level into true industrial impact. Reasons for that include i) the challenge to take advantage of the available bandwidth and generate broadband signals of high quality in a practical way, ii) the challenge to develop a common technology base and iv) make the operation of THz links compatible at the component and the system level with operation of conventional mmWave links, and v) the challenge to overcome the difficulties in the handling and the propagation of the THz waves.

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TERAWAY project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under G.A No 871668 and it is an initiative of the Photonics Public Private Partnership.

Concept - Objectives

TERAWAY comes as a technology intensive project aiming to develop a new generation of THz transceivers that can overcome these limitations and enable the commercial uptake of THz technology.

Leveraging optical concepts and photonic integration techniques, TERAWAY will develop a common technology base for the generation, emission and detection of wireless signals with selectable symbol rate and bandwidth up to 25.92 GHz within an ultra-wide range of carrier frequencies covering the W-band (92-114.5 GHz), D-band (130-174.8 GHz) and THz band (252-322 GHz).

In this way TERAWAY steps into providing for the first time the possibility to organize the spectral resources of a network within W/D/THz bands into a common pool of radio resources that can be flexibly coordinated and used.

The use of photonics will enable the development of multi-channel transceivers with amplification of the wireless signals in the optical domain and with multi-beam optical beamforming in order to have a radical increase in the directivity of each wireless beam.

In parallel, aiming to take the most out of the THz technology and enable its commercial uptake, the project will develop a new software defined networking (SDN) controller and an extended control hierarchy that will perform the management of the network and the radio resources in a homogeneous way with obvious benefits for the network performance and energy efficiency and with possibilities for the provision of network slices in order to support heterogeneous services.

TERAWAY Transmitter

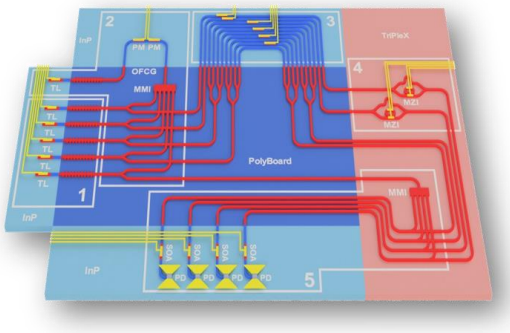

Figure 1. Artistic layout of the hybrid, photonics-enabled platform for the generation of W/D and THz signals. The following units are comprised and shown in the diagram: (1) Optical carrier generation unit, (2) Optical phase locking unit, (3) Optical modulation unit, (4) Optical filtering unit, and (5) Optical amplification, up-conversion and wireless emission unit.

TERAWAY Receiver

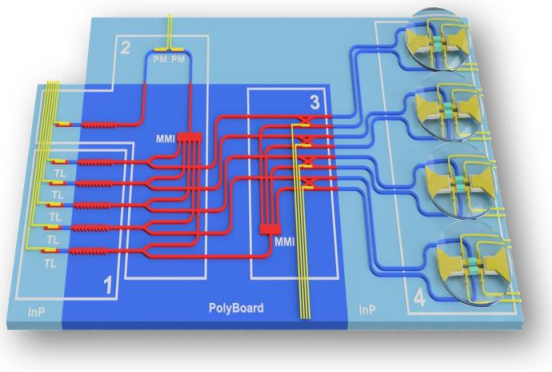

Figure 2. Artistic layout of the hybrid, photonics-enabled platform for the detection of W/D and THz signals. The following units are comprised and shown in the diagram: (1) Optical carrier generation unit, (2) Optical phase locking unit, (3) Optical phase shift unit, and (4) wireless detection and IQ photonic mixing unit. Silicon lenses are on top of each bow-tie antenna. Structures are not shown in scale.

At the end of this development, TERAWAY will make available a set of ground breaking transceiver modules including 4-channel modules operating from 92 up to 322 GHz, with possibility to offer 241 Gb/s total data rate, to have more than 400 m transmission reach in the THz band (and few Km in the lower bands), and with 4 wireless beams that can be independently steered and establish BH and FH connections between fixed terrestrial and moving network nodes.

The TERAWAY transceivers will be evaluated at the 5G demo site of AALTO in Finland, under an application scenario of communication and surveillance coverage of outdoor mega-events using moving nodes in the form of heavy-duty drones.

Impact

TERAWAY is expected to have a disruptive effect on the usability of the THz band (252-322 GHz), which can be considered today still as unexplored, by developing a technology base that will facilitate the thorough investigation of the THz transmission solutions and their incorporation inside a meaningful system environment, creating the conditions for their actual use inside next generation networks.

It will have a disruptive effect on the usage of the radio spectrum in three different ways and is expected to develop valuable knowhow and methodologies regarding the placement of the moving nodes and the management of their resources and have a disruptive impact on the dynamic scalability of the network capabilities.

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