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TeraGreen

Towards Energy-Efficient Tbps Wireless Links

Towards Energy-Efficient Tbps Wireless Links in the Sub-THz Band The TeraGreen Approach

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TeraGreen at a glance

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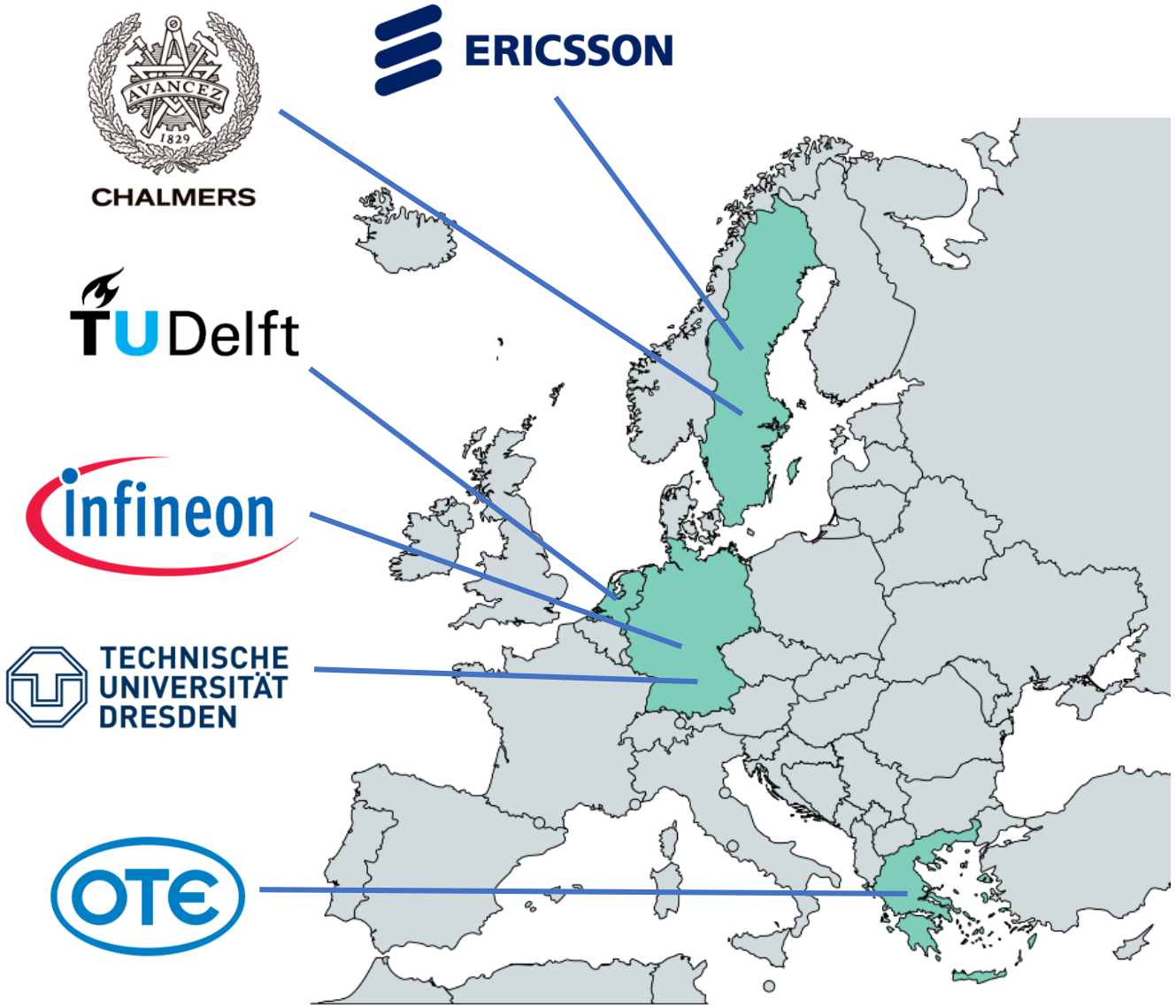
- **Action:**
  HORIZON-JU-SNS-2023-STREAM-B-01-05
  HORIZON-JU-RIA
- **GA No:** 101139117
- **EU Contribution:**
  5.0 m€
- **Coordinator:**
  TECHNICAL UNIVERSITY OF DELFT
- **Consortium:**
  6 partners / 4 countries
- **Starting date**
  1/1/2024
- **Duration:**
  48 Months



TeraGreen vision

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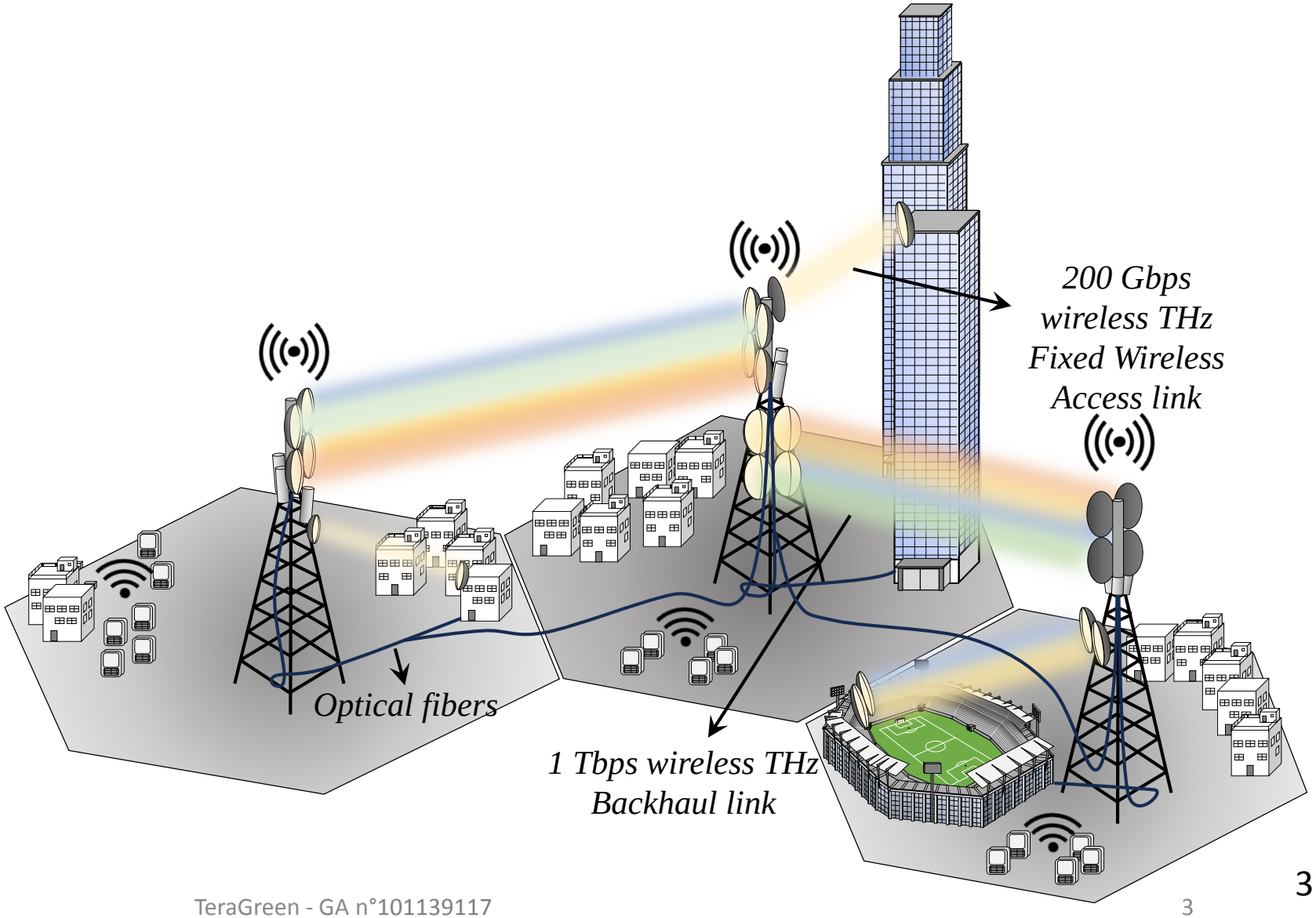
- TeraGreen proposes THz wireless links as an alternative to the wired, fiber or microwave links that can support the densification of small cells required for future 6G networks.
- Based on the TeraGreen technology both fronthaul and backhaul can be served by THz wireless links in the 300GHz band with 200Gbps to 1Tbps capacities to connect small cells in dense urban areas in a power-friendly and eco-friendly manner.



TeraGreen innovations

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New silicon micro-technology and advanced packing for mass markets

- The TeraGreen transceivers will be developed using one of the most advanced silicon processes in the world with great market potential. The advent of nm-scale SiGe technologies offers a unique opportunity in bridging the gap between electronics and photonics applications by enabling the design of silicon-based solutions in the THz region.

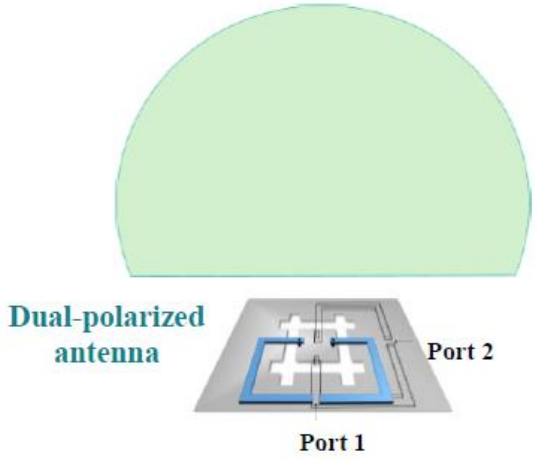
- TeraGreen transceivers will be implemented in Infineon's latest advanced 90nm SiGe process, with copper metallization for analog and mixed signal mm-wave applications, providing high performance at low power consumption.

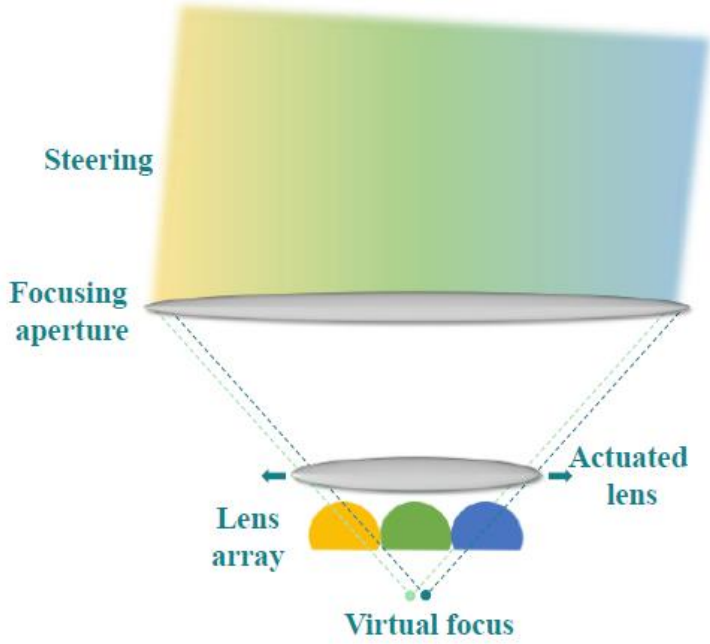
Zero-crossing modulation techniques

- The aim is to provide a complete baseband design for the application of 1-bit quantization in combination with zero-crossing modulation for the quasi-optical MIMO point-to-point link, enabling highly energy-efficient THz communication at high bitrates of >100Gbps per channel.

Quasi-optical antennas with lens arrays

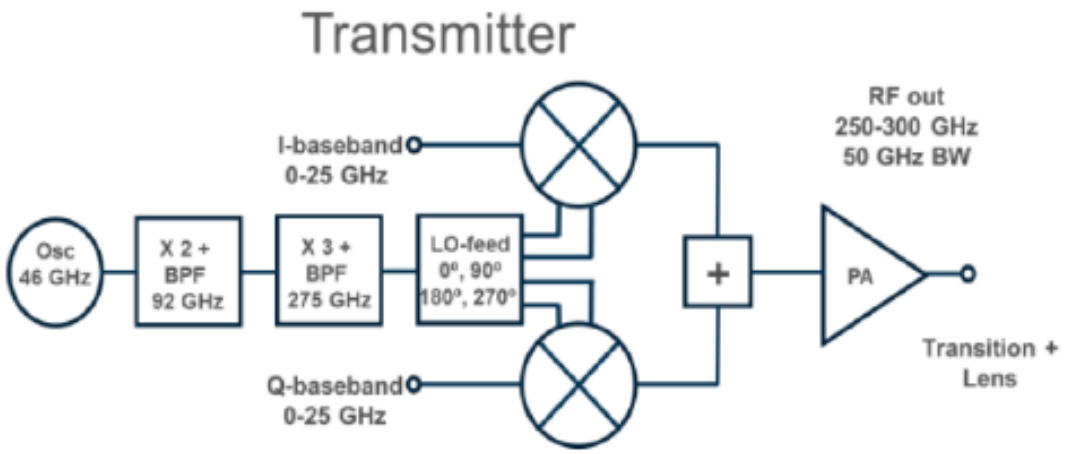
- In TeraGreen, the integration of a planar antenna on a single chip with a silicon lens, as well as an on-package planar antenna with a plastic lens will be optimized to minimize the transmission losses and avoid the use of waveguide costly transitions.
- The goal is to design a 252-325GHz wideband dual-polarized planar antenna with optimal performance and a low-cost solution

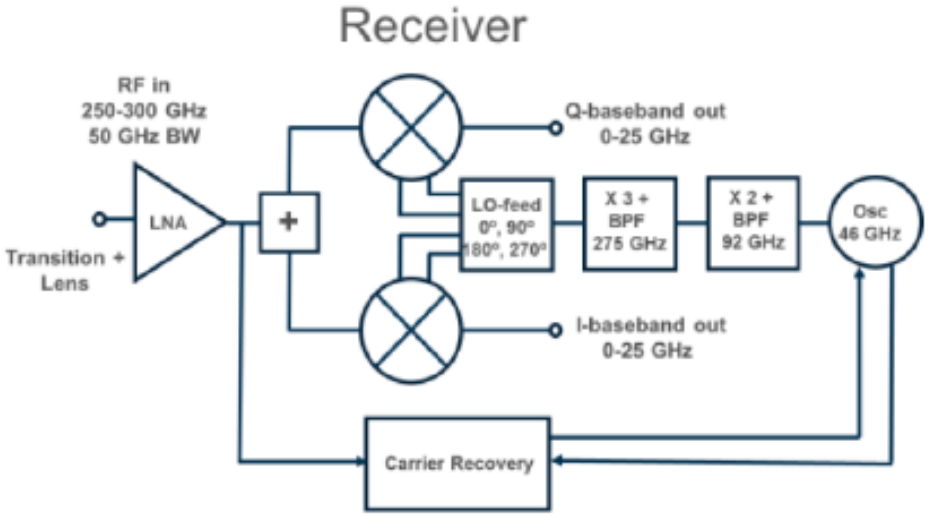




THz SiGe-BiCMOS transmitters and receivers

- TeraGreen will use Infineon's latest-generation SiGe-BiCMOS process, which features a maximum oscillation frequency of 500GHz. The advent of nm-scale SiGe-BiCMOS technologies offers a unique opportunity to bridge the gap between electronic and photonic applications by enabling the design of Si-based highly integrated solutions in this frequency range. To enable ultra-fast future wireless communications, TeraGreen targets a high bitrate of 100Gbps per channel.





TeraGreen objectives

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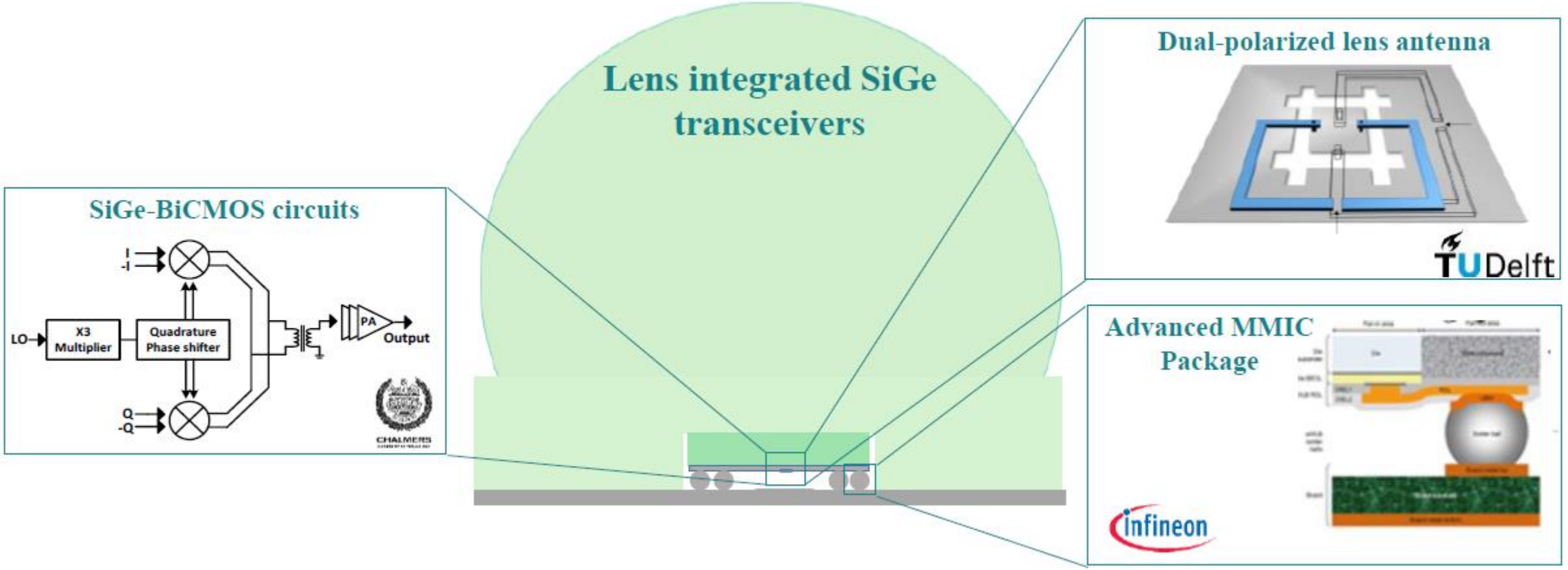
Objective 1: TeraGreen will develop lens integrated SiGe-BiCMOS transceivers in the THz band that can transmit and receive high-speed, energy-efficient pico-second signals able to generate record bitrates (>200Gbps) by exploiting a very high spectral RF bandwidth of 70GHz with zero-crossing modulation schemes and combined with polarization multiplexing.



TeraGreen objectives

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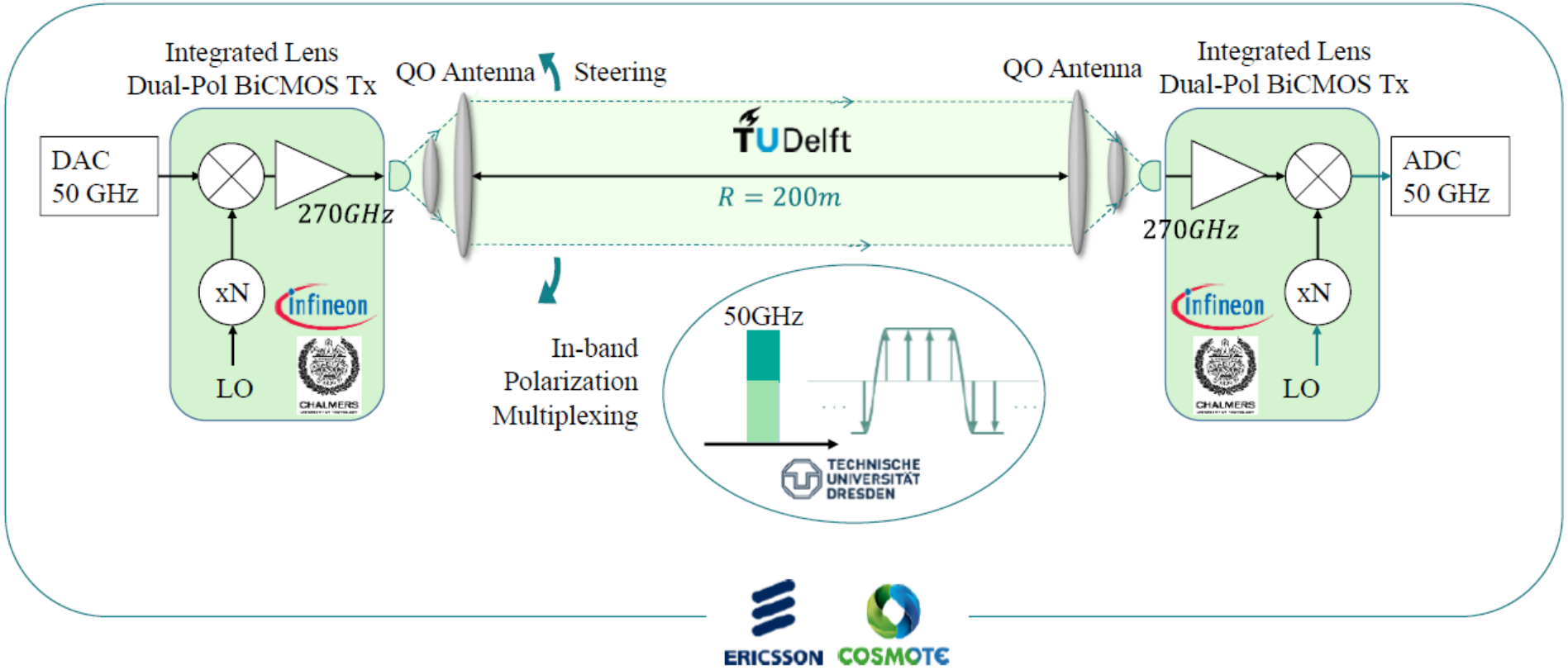
Objective 2: TeraGreen will perform a proof of concept of high-speed high-efficient wireless transmission for a medium range link distance (~200m) at THz using silicon technology for the first time to show the potential of the TeraGreen technology targeting a record demonstration of 200Gbit/sec energy-efficient wireless transmission.



TeraGreen objectives

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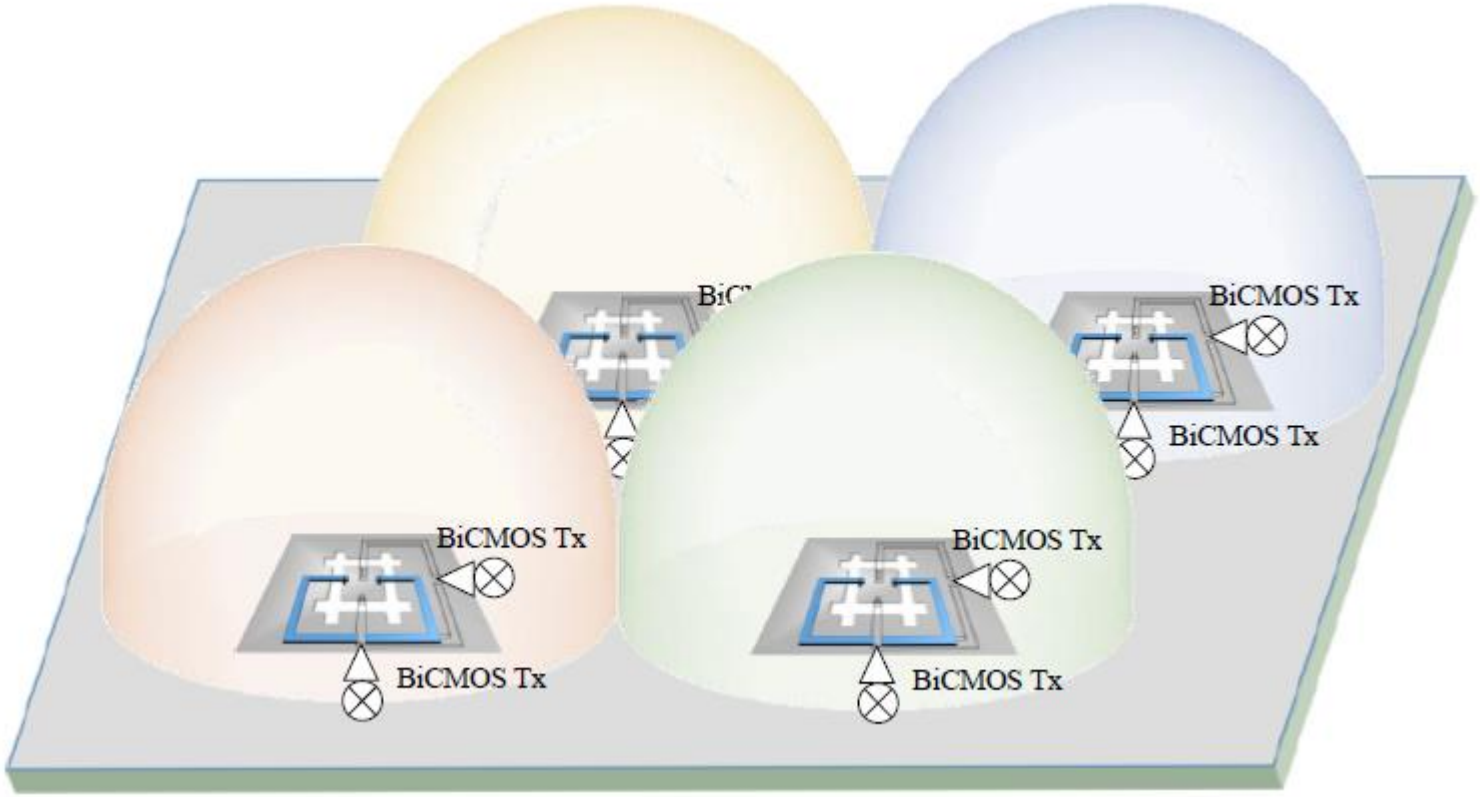
Objective 3: TeraGreen will develop quasi-optical MIMO array architectures to exploit the high degree of spatial multiplexing of the THz spectrum targeting lens array architectures that can generate 10 electromagnetic near field modes towards reaching Tbit/sec link capacities when co-integrated with the wideband THz SiGe-BiCMOS transmitters and receivers from Objective 1.



TeraGreen objectives

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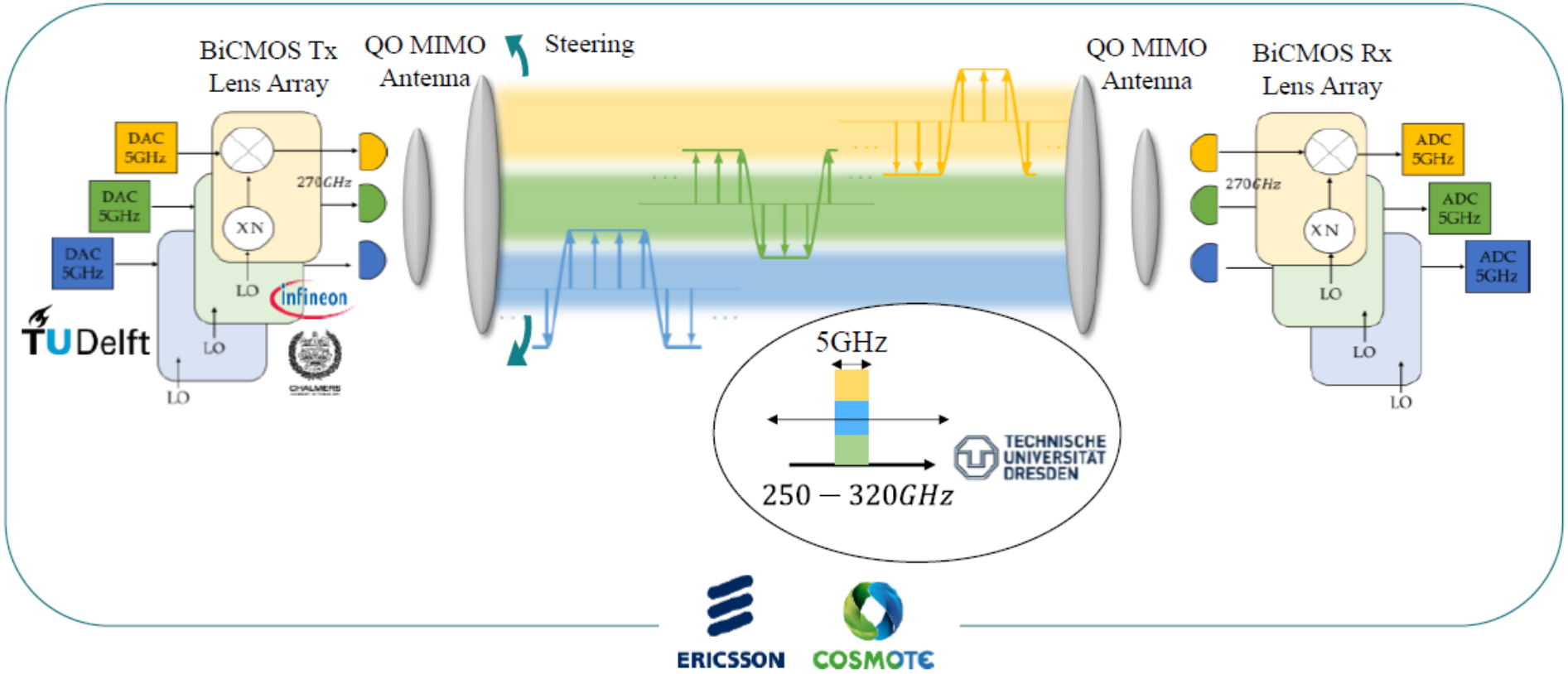
Objective 4: TeraGreen will perform the first proof of concept of Tbit/sec wireless transmission in the THz spectrum using near-field (~10m) spatial multiplexing in an 8x8 MIMO lab demonstration, utilizing 8 parallel channels generated via 2x2 dual-polarized antenna arrays, BiCMOS transceivers and 5GHz current A/D converters.



OTE's role

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- **Leader of WP2 – Use cases, system model and requirements**
- **Definition of use cases, requirements, KPIs and KVIs**
- **Contribution to the demo definition and component specifications**
- **Evaluation of the outcomes of these demonstrations**
- **Contribution to the project communication strategy and planning**
- **Production of dissemination materials and participation in events**
- **Contribution to exploitation, long-term roadmap development, IPR and standardization activities**

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Thanks for your attention!

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