



# TERAhertz integrated systems enabling 6G Terabit-per-second ultra-massive MIMO wireless networks

Prof. Guillermo Carpintero  
Prof. Angela Alexiou

TERA6G project has received funding from the Smart Networks and Services Joint Undertaking (SNS JU) under the European Union's Horizon Europe research and innovation programme under Grant Agreement No 101096949



Co-funded by  
the European Union



# Project Consortium

	Beneficiary	Beneficiary Short name
1.	Universidad Carlos III de Madrid   ES	UC3M
2.	Institute of Communications & Computer Systems   EL	ICCS
3.	Fraunhofer Heinrich-Hertz Institute   DE	FhG-HHI
4.	LioniX International BV   NL	LXI
5.	PHIX BV   NL	PHIX
6.	University of Piraeus Research Center   EL	UPRC
7.	Oulun Yliopisto   FI	UOULU
8.	Cumucore OY   FI	CMC
9.	Intracom Telecom Solutions   EL	ICOM
10.	Telefónica Investigación y Desarrollo	TID



Builds upon previous experience from H2020 projects

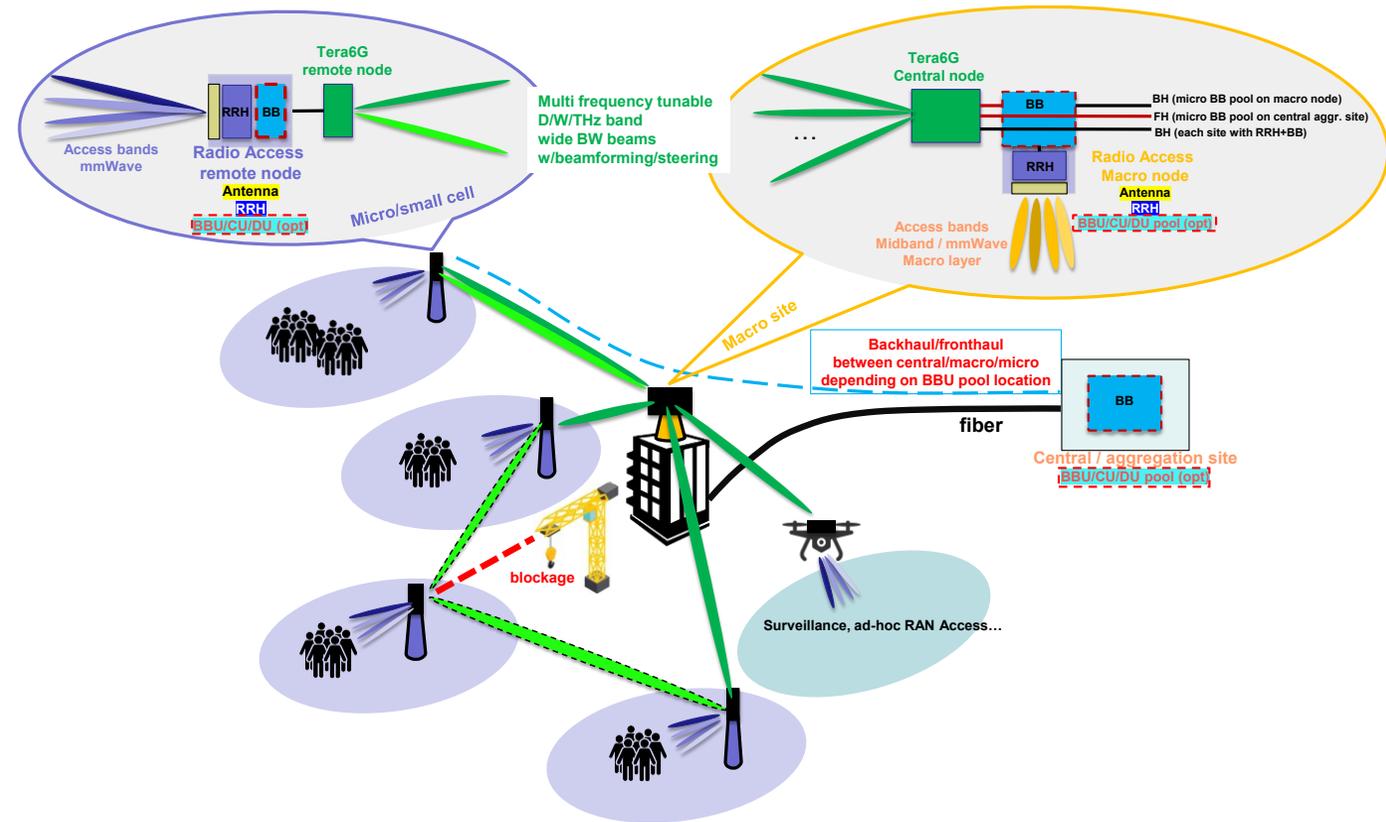
 <p>Grant agreement ID: 871668 From 11/2019 to 10/2022</p> <ul style="list-style-type: none"> <li>Hybrid integrated photonics-based THz generation.</li> <li>Hybrid integrated photonics-based THz detection</li> <li>High-speed photodiode-based mmW/THz transmitter</li> <li>2D transmitter antenna arrays</li> <li>Waveguide-integrated photoconductive-based mmW/THz receiver</li> </ul>	 <p>Grant agreement ID: 871464 From 11/2019 to 10/2022</p> <ul style="list-style-type: none"> <li>D-band propagation and channel modelling</li> <li>Beamforming and tracking</li> <li>Reconfigurable Intelligent Surfaces and beamforming</li> <li>Blockage and misalignment in D band BF</li> <li>Baseband processing</li> </ul>	 <p>Grant agreement ID: 761794 From 06/2017 to 03/2020</p> <ul style="list-style-type: none"> <li>300 GHz regime propagation and channel modelling</li> <li>Pencil Beamforming algorithms and impairments</li> <li>Pencil beamforming MAC and multiple access schemes</li> <li>BF codebook design</li> </ul>	 <p>Grant agreement ID: 871668 From 09/2020 to 02/2023</p> <ul style="list-style-type: none"> <li>5G Core with network slice manager</li> <li>3GPP Service based architecture with 5GLAN and TSN modules</li> <li>SDN controller integrated to network slice manager</li> </ul>
--	---	--	---

# Project Focus

## Enabling the Fiber-over-the-air Concept

TERA6G aims to the development of wireless links with Terabit-per-second data throughput capacity, using hybrid photonic integration technology advances to develop disruptive wireless transceivers providing:

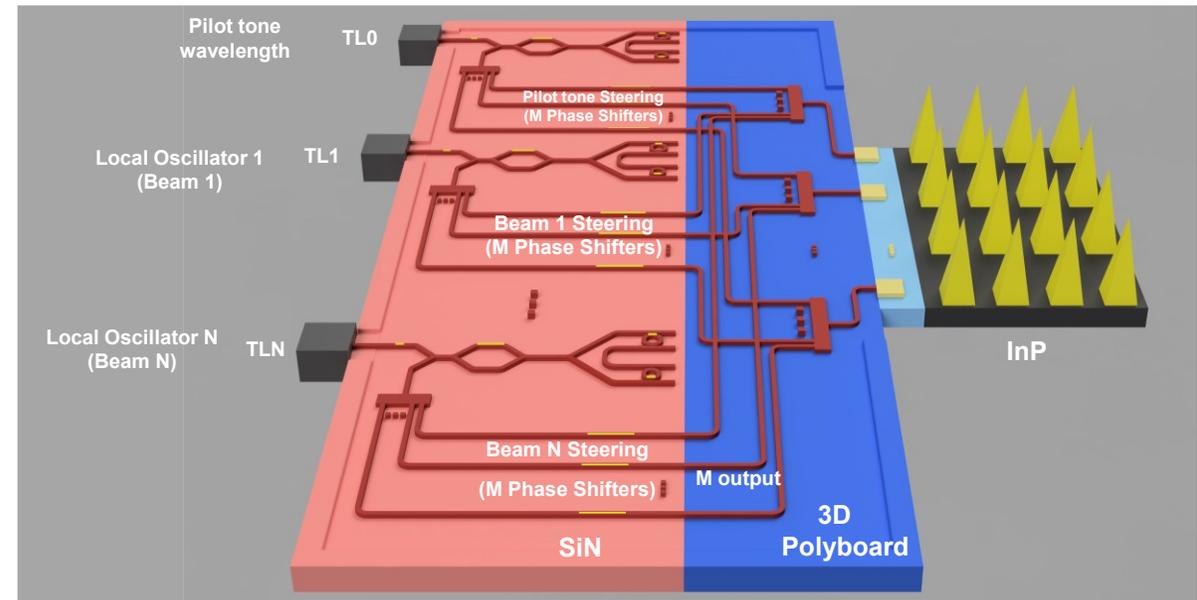
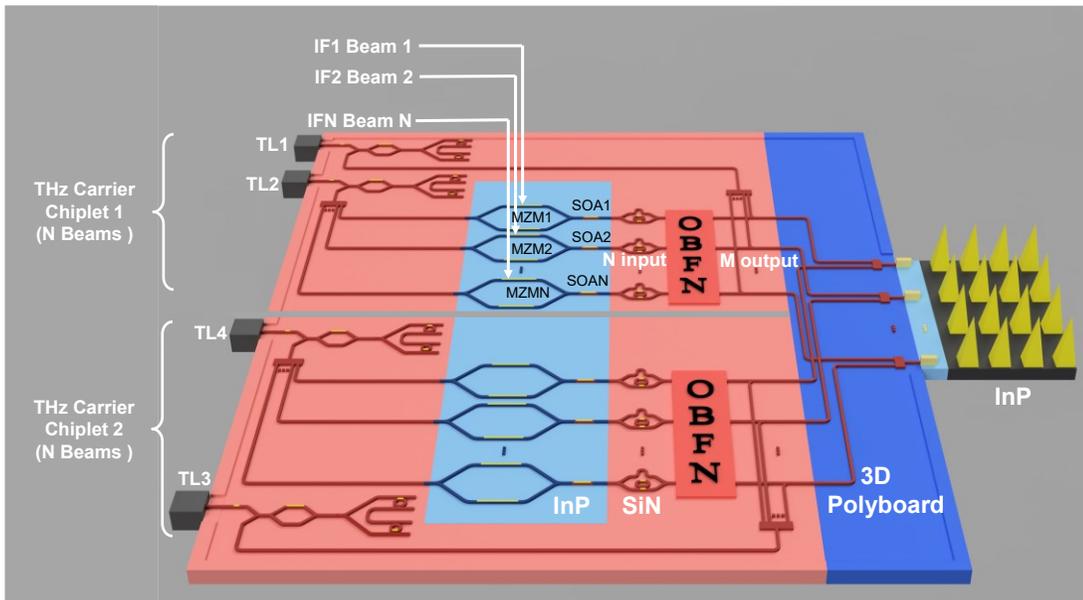
- **Agility:** Ultra-wide bandwidth (up to 30 GHz per channel, handling any modulation scheme) and continuous frequency tuning of the carrier frequency from 30 GHz to 450 GHz, reaching into the Terahertz (THz) range.
- **Scalability:** Development of scalable Multiple-Input/Multiple-Output (MIMO) capable of handling a large number of beams with 2-dimensional antenna arrays with beamforming and beam-steering,
- **Reconfigurability:** TERA6G modules frequency agility and number of available wireless pencil-beams unlock implementing a variety of functions, from wireless data transmission to channel sounding and radar ranging.



# Project Objectives

- Scalable **multi-MIMO** **Blas** **Matrix** **Transmitter** module handling up to 4 beams transmitted from a 2D array with 16 antenna elements in a 4x4 array.

- Scalable **multi-MIMO** **incoherent** **multi-band** **Receiver** module handling 4 beams with 4 different LO oscillators received at a 4x4 antenna array.



- **Reconfigurable transceiver modules**, capable of implementing different independent functionalities on each beam.

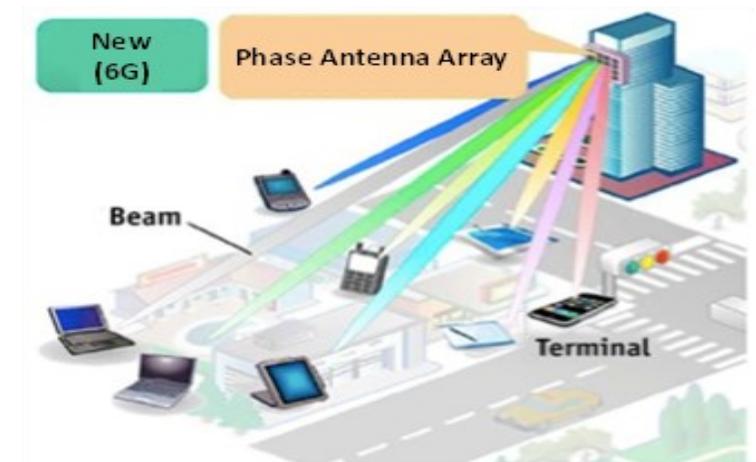


# Project Objectives

Hotspots at Champs-Élysées, Paris



- **“Fiber over the air” and THz smart management**, integrating THz wireless technologies and systems, and designing Network Functions allowing their management as part of network slicing functionality aiming at dynamic automated management of multi-beam wireless system resources, fully programmable end-to-end orchestrated communication networks.
- Dynamic networks based on **adaptive, energy-efficient, multi-beam nodes**, developing methods and algorithms to maximize system energy efficiency adapting dynamically physical layer resources.



# Project Summary

**Call identifier:** HORIZON-JU-SNS-2022-STREAM-B-01-02

**Grant Agreement No.:** 101096949

**Timeline:** 1 January 2023 – 30 June 2026

**Overall budget:** € 6,114,000

**EC contribution:** € 5,892,962

**Contact information:**

*Project Coordinator:* [Prof. Guillermo Carpintero](mailto:guiller@ing.uc3m.es)  
[guiller@ing.uc3m.es](mailto:guiller@ing.uc3m.es)

*Project website:* [uc3m.es/research/tera6g](https://uc3m.es/research/tera6g)



Co-funded by  
the European Union

