6GTandem

Unlock new potential of wireless network

A dual-frequency distributed MIMO approach for future 6G applications

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Budget

€ 5.3 Million

€ 5.1 Million EU-funded

Consortium

9 Partners

5 countries

Duration

42 Months

01/2023 - 06/2026

Project Milestone: End of Second Period

As of June 2025, the 6GTandem project successfully concluded its second reporting period, advancing toward sustainable, high-performance 6G connectivity through hybrid sub-10 GHz and sub-THz radio access. In this phase:

- **WP2** has been completed, having defined the demonstrator architecture, use cases, and deployment options.
- **WP3** and **WP4** are fully active, delivering first concrete results on system and hardware modelling, circuit design, and hardware integration.

WP2: Use cases, system requirements

Work Package 2 laid the foundation for the 6GTandem concept by defining future use cases that demand highly reliable coverage with high data rate communication. The team developed a comprehensive catalogue addressing key application scenarios, including indoor industrial environments, smart public transportation systems, and dense deployments of distributed radio units in large venues. These use cases were analysed to extract concrete performance and deployment requirements tailored to dual-band multi-antenna sub-THz systems. Additionally, WP2 offered architectural insights into how future 6G networks can leverage 6GTandem's multi-antenna, hybrid approach for enhanced scalability and flexibility.

WP3: Status Update

WP3 achieved significant progress in both modelling fidelity and the development of intelligent transmission strategies. Building upon earlier deliverables, the simulation framework has been substantially updated, now incorporating real-world measurement data to calibrate hardware-aligned models. These models are essential for accurate system design and are made openly available to ensure reproducibility and encourage community engagement.

A major advancement has been the development of cross-layer strategies for dual-band operations. One such approach enables radio unit and beam selection for sub-THz communications based on channel state information (CSI) extracted from sub-10 GHz bands. This method improves beamforming efficiency by leveraging more reliable lower-band information. In parallel, a dynamic traffic offloading mechanism was introduced, which intelligently allocates application data streams between sub-10 GHz and sub-THz links depending on performance requirements and system load.

Together, these innovations provide the technical foundation for intelligent, adaptive sub-THz systems, enabling flexible and efficient spectrum use in 6G scenarios.

WP4: Status Update

WP4 advanced the development and integration of sub-THz hardware, with notable progress across multiple components. A key milestone was the successful fabrication and verification of the D-band transmitter and reciever modules, covering the 110–170 GHz range and offering a baseband bandwidth of 40 GHz. Functional MMIC components such as phase shifters ,power amplifiers and cross over switches, etc were designed and manufactured to support D-band operations, while testing is ongoing on the component and package level for the first run of the package and MMIC tape-outs. One major achievement is the impressive communication data rate of 100Gbps at D-band through the one meter PMF, linking transmitter and receiver modules.

The second tape-out cycle of the eWLB packages focused on validating a complete radio unit (RU), marking a transition from subsystem evaluation to full-package assessment. The new run of PCBs to support these packages are now being designed and soon will be manufactured.

Significant effort also went into the design of package to Polymer Microwave Fiber (PMF) couplers. Two variants based on Vivaldi antennas were fabricated: one standard broadband configuration and another inverted design suited for single-ended chip interfaces. Initial passive characterization results confirmed insertion losses between 2.5 and 4 dB, closely matching simulation expectations and validating the feasibility of the coupler concept for final demonstrators.

To support the taped out package assembly and testing, thirteen PCB variants featuring flip-chip assembly were produced. These are complemented by custom 3D-printed fixtures and a four-dimensional PMF manipulator, which together enable precise mechanical alignment and high-fidelity measurements.

Lastly, the development of PMF materials raw refinements in geometry and the introduction of suppression layers to minimize signal ripples and reduce attenuation. While new material compounds showed promise in permittivity tests, their performance in fabricated cables fell short of expectations, highlighting the need for continued development and root-cause analysis.

Dissemination activities

As 6GTandem reached the end of its second reporting period, the project significantly stepped up its dissemination and scientific outreach activities. A major highlight was our active presence at EuCNC 2025, where 6GTandem contributed to two high-profile workshops. In the “Integrated Sensing and Communications (ISAC)” workshop, we joined leading European initiatives to explore the role of ISAC in shaping the future of 6G. In the “Third International Workshop on Wireless Communications in Terahertz,” our scientific lead, Liesbet Van der Perre, delivered a keynote titled “6GTandem – Sub-THz Innovation: Enablers or Obstacles for Standardization.” Her talk sparked critical discussion about the practical deployment of sub-THz technologies and their interface with ongoing standardization efforts, underscoring 6GTandem’s thought leadership in the field.

ECTC 2025, Dallas, Texas.

Across the Atlantic, 6GTandem also made an impact at ECTC 2025 in Dallas, Texas. Infineon co-organized a dedicated special session on "Advancements in mmWave and Sub-THz Packaging for Communication and Radar Applications." This session brought together academia and industry to present the latest innovations in high-frequency packaging, with a strong emphasis on co-design techniques, material characterization, and integration strategies for next-generation communication modules.

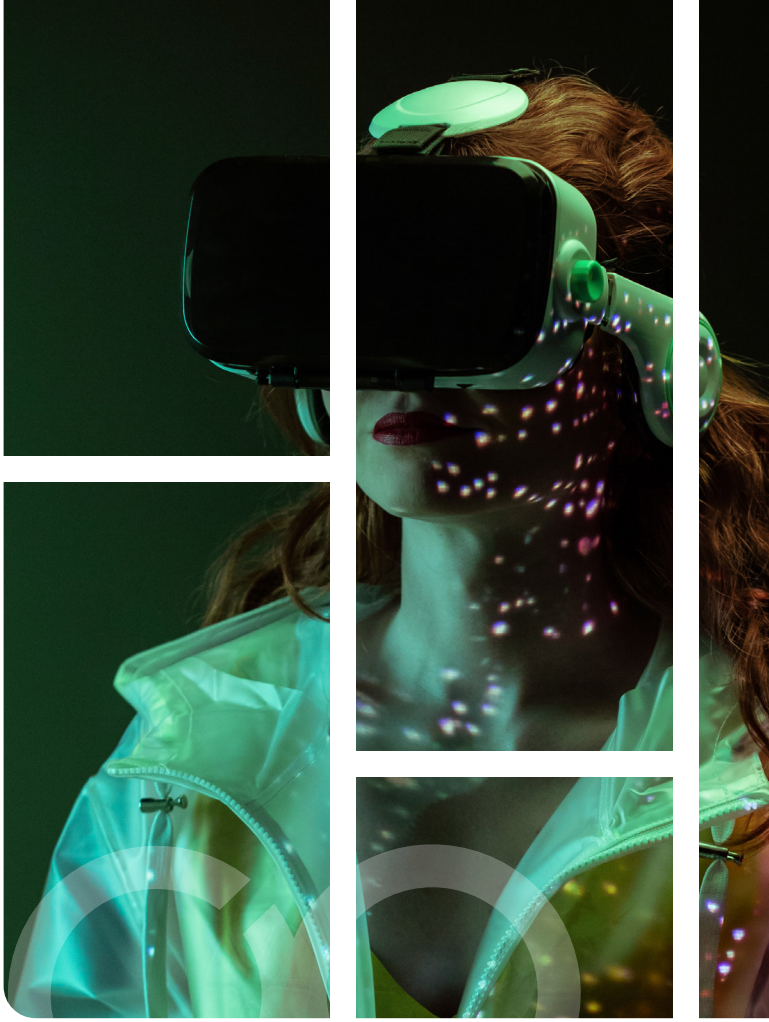
In addition to external events, the consortium continues to foster deep internal collaboration. A key milestone was the technical face-to-face meeting in Gothenburg (May 2025), where experts from across the consortium engaged in intensive sessions on WP3 and WP5. This meeting allowed teams to align system-level modelling with upcoming validation activities and further refine the integration path from circuit-level innovations to practical deployment scenarios.

The scientific progress of 6GTandem is also reflected in its growing body of peer-reviewed publications. Several papers have been accepted and published in leading journals and conference proceedings, covering diverse topics such as system modelling, antenna design, and sub-THz circuit development. These outputs, all publicly accessible on the project website, demonstrate 6GTandem's strong contribution to the European 6G research ecosystem and help shape the academic and industrial discourse around sub-THz technologies.

More information on our scientific publications and ongoing dissemination efforts is available at **horizon-6gtandem.eu.**

What's Next?

As the 6GTandem project enters its final phase, efforts will concentrate on completing the co-integration of the developed sub-THz circuits and progressing toward comprehensive end-to-end system evaluation. Preparations are also underway for public demonstrations that will showcase the project's innovations, accompanied by measurement campaigns focused on validating system key performance indicators (KPIs). With the formal start of Work Package 5, the focus expands to the validation of the tandem approach. This phase introduces a hybrid methodology that combines measurements and simulations to verify system-level performance, integrating outcomes from both WP3 and WP4. WP5 will thus play a central role in confirming the feasibility and impact of the 6GTandem architecture in realistic deployment scenarios.



The 6GTandem Consortium

The 6GTandem Consortium consists of 9 partners from 5 different countries (Austria, Sweden, Belgium, Germany and Switzerland). It consists of a well-balanced mixture between academic and industrial players, from large semiconductors to small SMEs. The team comprises a diversified competence pool with the knowledge and capability to tackle and resolve upcoming challenges.

All past and upcoming events can be found on the 6GTandem official webpage:

horizon-6gtandem.eu/events

1. Technikon Forschungs- und Planungsgesellschaft mbH
AUSTRIA [Villach]

2. Ericsson AB
SWEDEN [Gothenburg]

3. KU Leuven
BELGIUM [Ghent]

4. Infineon Technologies Austria AG
AUSTRIA [Villach]

5. Chalmers University of Technology AB
SWEDEN [Gothenburg]

6. Linköping University
SWEDEN [Linköping]

7. Lund University,
SWEDEN [Lund]

8. Infineon Technologies AG,
GERMANY [Munich]

9. Huber + Suhner AG,
SWITZERLAND [Herisau]

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