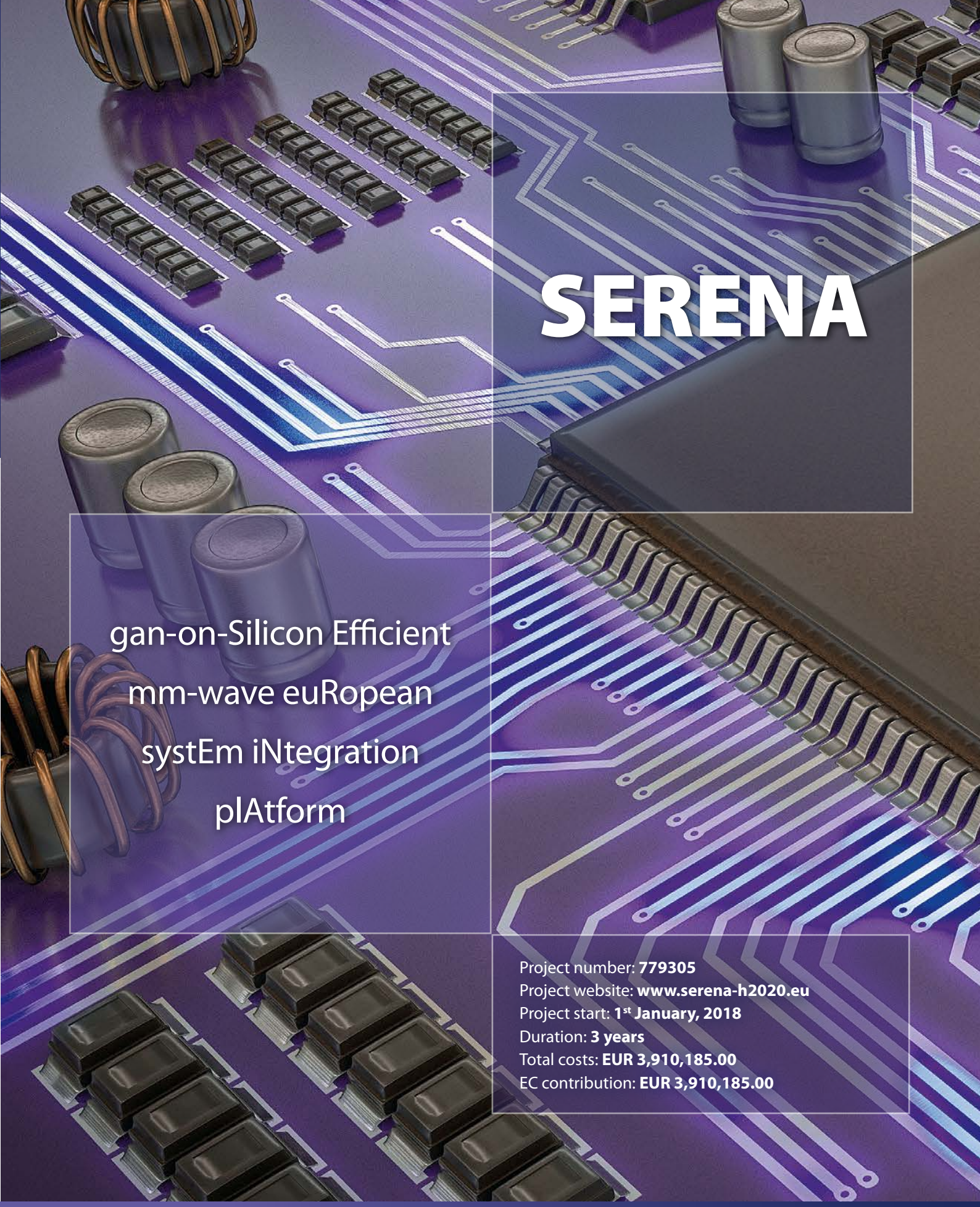


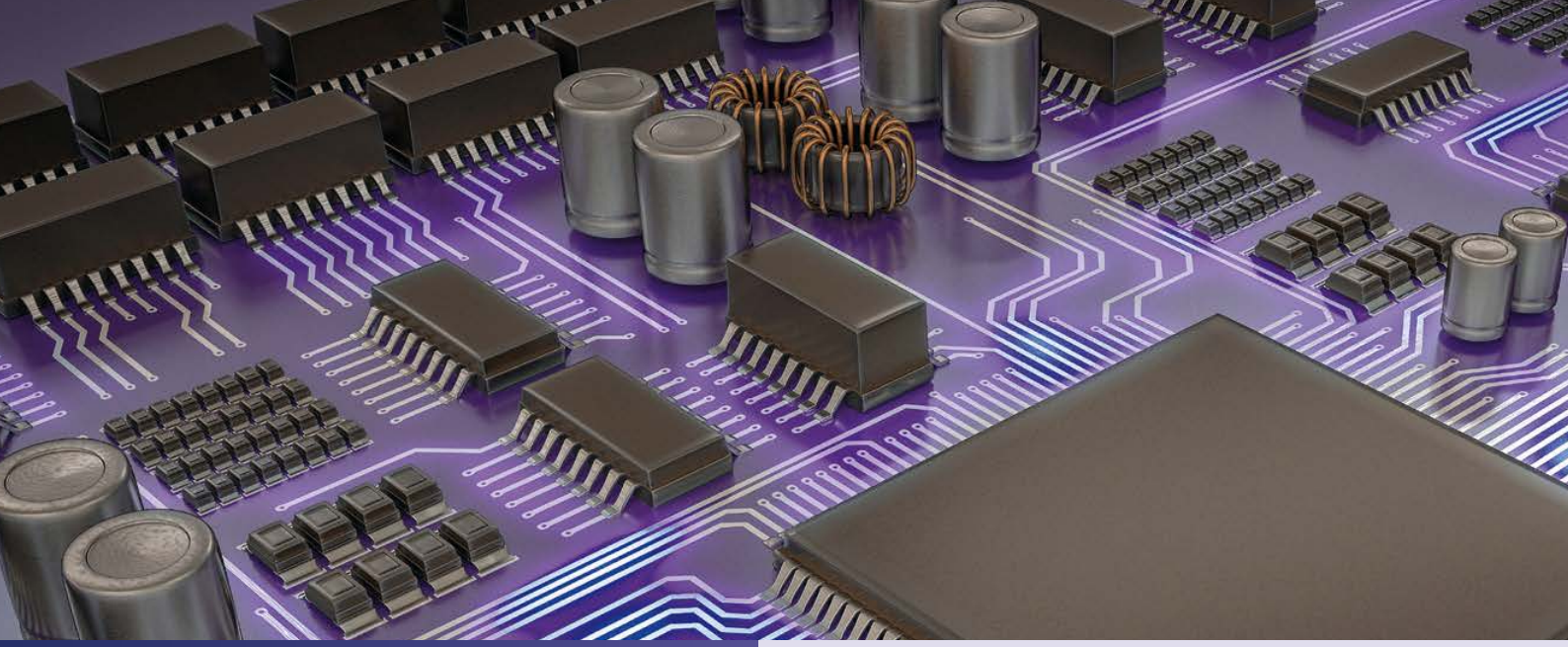
SERENA

gan-on-Silicon Efficient
mm-wave euRopean
systEm iNtegration
plAtform

Project number: **779305**
Project website: **www.serena-h2020.eu**
Project start: **1st January, 2018**
Duration: **3 years**
Total costs: **EUR 3,910,185.00**
EC contribution: **EUR 3,910,185.00**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 779305.

SERENA



Mission of SERENA:

The SERENA project aims to:

1. extend the limits of mainstream semiconductor technologies by developing a **low-cost and high-performance (high-power and high-efficiency)** hybrid **integration platform** for mm-wave systems,
2. develop a GaN-on-Silicon **cost- and power efficient** mm-wave **5G beam-steering system** as a **proof-of-concept** for future key markets (mm-wave 5G wireless **communication systems** and **radars for autonomous vehicles**), and
3. **accept the challenge** to bring into production **high performance** mm-wave active antenna systems, at a **commercially viable price-point** and **low energy consumption.**

Motivation:

The SERENA project proposes an innovative technology enabling **high-power and high-efficiency** through the integration of Gallium Nitride on Silicon (**GaN-on-Si**) semiconductor technology offering unprecedented efficiency and output power 10 times more than SiGe/CMOS.
Compared with state-of-the-art the SERENA architecture and platform will bring the following system level advancements

- **increased energy efficiency**
- **size reduction**
- **cost reduction**
- significant **reduction in design time/ complexity**
- increased **transmitter output power**
- **reduction of power consumption**
- **increased wireless area capacity** (bit/s/km2)

Concept:

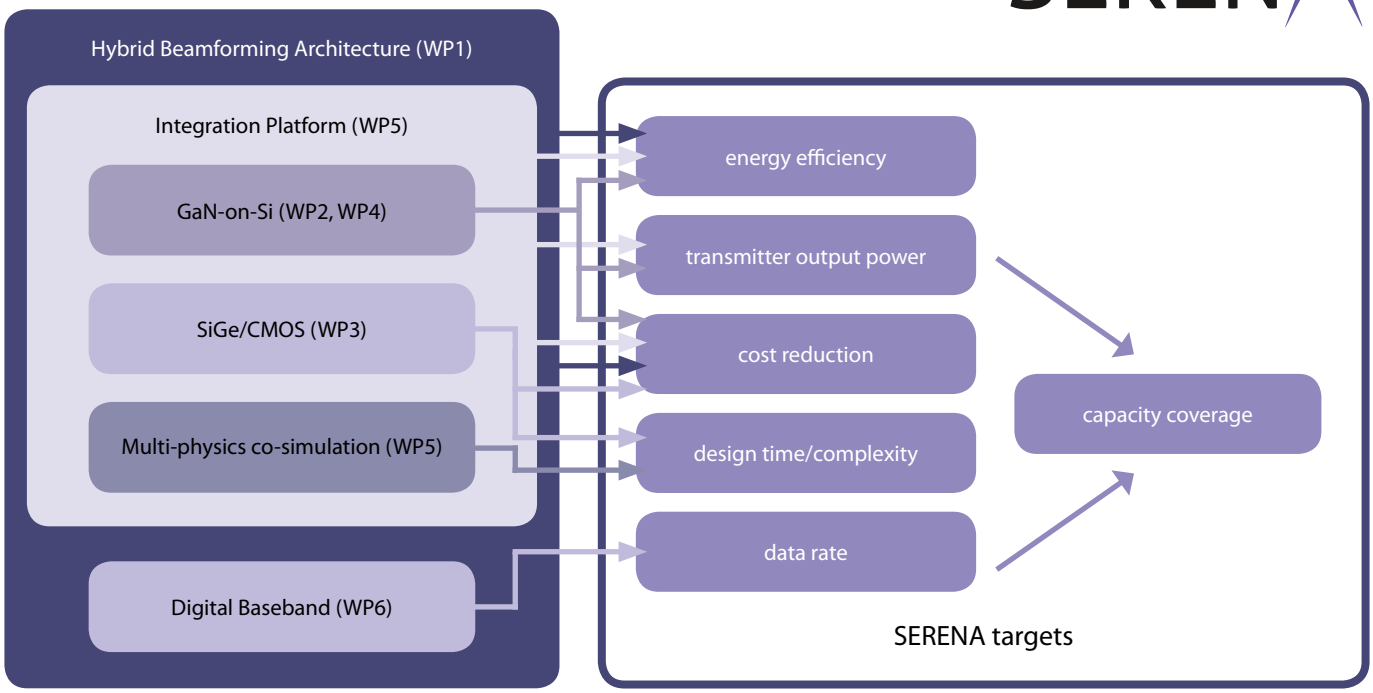
To reach the project goals a system architecture and technology platform will be developed by using an **integrated approach.** Further, SERENA will combine advancements in **hybrid analogue/digital mm-wave beam-steering system architectures** with a completely **European based semiconductor supply chain.** Finally, the project team will foster an inter-disciplinary design approach with a strong emphasis on multi-physics simulations and predictive co-design to show the unique capabilities of the SERENA technology.

Objectives:

The SERENA project aims to reach the following objectives:

- **Objective 1:** Development of a **hybrid analogue/digital beam forming architecture** and integration platform for **high-performance** and **low-cost** mm-wave systems.
- **Objective 2:** Visualization of the SERENA architecture and **integration platform performance** in a proof-of-concept mm-wave electronic beamforming system for 5G mm-wave radio access operating in the 37 GHz to 41 GHz band.
- **Objective 3:** Development of a **hybrid analogue/digital processing architecture** for beamforming systems with the simultaneous benefit **energy efficiency** maximization and **cost minimization.**
- **Objective 4:** Study performances, including applications such as E-band point-to-point high-speed radio links and W-band short-range **radar sensors for autonomous vehicles** to ensure that the SERENA platform is scalable up to 100 GHz.
- **Objective 5:** Development of a predictive design of tightly **integrated mm-wave** and **digital processing systems.**

SERENA structure and work packages



Technical Approach:

The SERENA project is planned to run for 36 months. It is organized into eight work packages (WP) with significant dependencies and expected synergies between them which are described shortly in the following:

WP1: System architecture and specifications

[Partners involved: TEC, EAB, IFAT, OMMIC, FOI, Fraunhofer, CHALMERS, TUB]

WP1 will define the architecture and specifications of the proof-of-concept systems (39 GHz and at E/W-band) and break down the specifications to the sub-system level. A major part of the architecture work is to define the boundaries and signal processing for the hybrid analogue/digital beamforming.

WP2: 39GHz Front-end Circuit: Design and Manufacturing

[Partners involved: EAB, IFAT, EpiGaN, OMMIC, Fraunhofer]

WP2 designs, fabricates and characterizes the 39 GHz front-end chipset (T/R GaN-on-Si MMIC).

WP3: 39GHz Core & Control Circuits: Design and Manufacturing

[Partners involved: EAB, IFAT, Fraunhofer]

WP3 designs, fabricates and characterizes the 39 GHz core-chip in SiGe-BiCMOS and the control chip in a silicon smart-power technology.

WP4: E-/W-band Single chip front-end MMIC: Design and Manufacturing

[Partners involved: EAB, EpiGaN, OMMIC, FOI, CHALMERS]

WP4 explores critical building blocks for implementing the SERENA technology at the upper range of mm-wave frequencies.

WP5: Integration Platform

[Partners involved: EAB, IFAT, Fraunhofer, CHALMERS, TUB]

WP5 designs, fabricates and tests a miniaturized, cost-effective and high performance integration platform with embedded ICs and passive components for the 39 GHz system demonstrator.

WP6: Proof-of-concept Platform

[Partners involved: TEC, EAB, IFAT, OMMIC, FOI, Fraunhofer, TUB]

WP6 implements the proposed hybrid architecture (WP1) by integrating the platform (WP5) and the front-end circuits (WP2) into a proof-of-concept system at 39 GHz. The 39 GHz proof-of-concept will be fully tested with a baseband processing system. An additional proof-of-concept system will be implemented and evaluated at E/W-band using a realised single-chip front-end MMIC (WP4).

WP7: Dissemination, Communication, Exploitation and Training

[All partners contribute to WP7]

WP7 will obtain inputs from all other WPs and ensures the communication and dissemination of results achieved within the individual WPs to the outside parties as well as to participating entities. Further, WP7 will support the partners to exploit the achieved results and impacts on the European and international market.

WP8: Project, Risk, and Innovation Management

[All partners contribute to WP8]

Finally, WP8 will interact with all other WPs in order to ensure a successful project lifetime with respect to risk and innovation management. WP8 shows dependencies to all other WPs as it coordinates and ensures that the tasks are in line with the project work plan and performs scientific coordination as well, in order to reach the common goal of SERENA.

SERENA

Contact:

Project Coordinator:
Dr. Klaus-Michael Koch
TECHNIKON Forschungs- und Planungsgesellschaft mbH
Burgplatz 3a
9500 Villach
Austria
Tel.: +43 4242 233 55
Email: coordination@serena-h2020.eu

Technical Leader:
Dr. Kristoffer Andersson
Ericsson AB
Lindholmspiren 11
417 56 Göteborg
Sweden
Tel.: +46 72 574 68 38
Email: kristoffer.andersson@ericsson.com

Project Partners:

1 TECHNIKON

TEC - Technikon Forschungs- und Planungsgesellschaft mbH, Austria [Villach]

2 ERICSSON

EAB - Ericsson AB, Sweden [Göteborg]

3 infineon

IFAT - Infineon Technologies Austria AG, Austria [Villach]

4 EPIGAN

EPIGAN - EpiGaN nv, Belgium [Hasselt]

5 OMMIC innovating with III-V'S

OMMIC – OMMIC SAS, France [Limeil-Brévannes]

6 FOI

FOI - Totalförsvarets Forskningsinstitut, Sweden [Linköping]

7 Fraunhofer IZM

Fraunhofer - Fraunhofer Gesellschaft zur Förderung der angewandten Forschung E.V., Germany, [Berlin]

8 CHALMERS

CHALMERS - Chalmers Tekniska Högskola AB, Sweden [Göteborg]

9 Technische Universität Berlin

TUB - Technische Universität Berlin, Germany, [Berlin]

Consortium:

The SERENA consortium holds all ingredients for a successful project. Nine partners from five different countries will provide their extensive know-how and long-lasting experience for the development of the targeted design framework. The consortium is a well balanced mix of three SMEs, two research organizations, two industrial partners and two universities. This constellation enables the project to tackle the problem with an exhaustive approach, including researchers, developers and users.