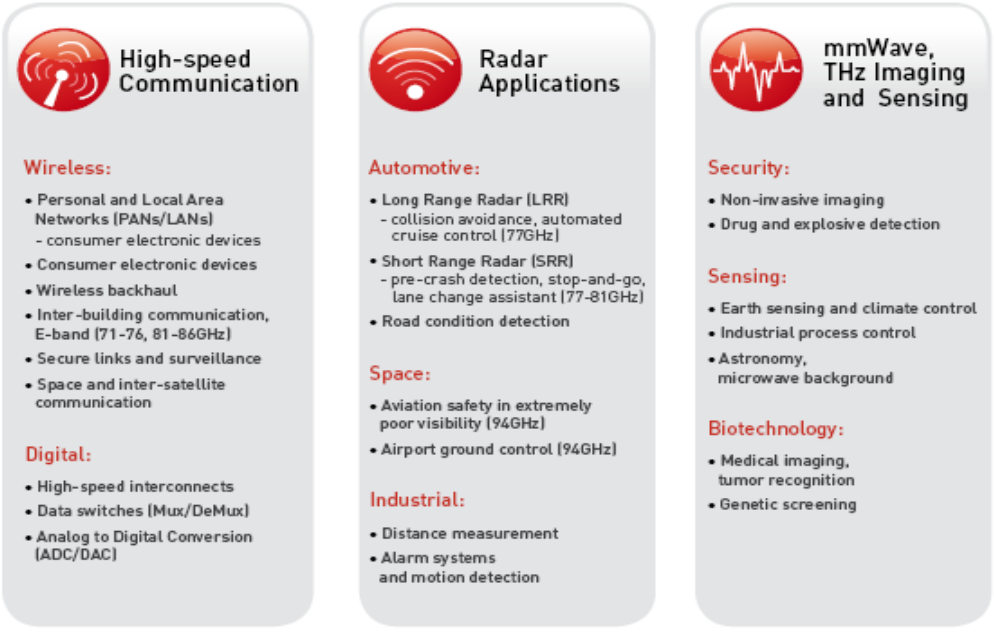
Supported by the European Commission through the Seventh Framework Programme (FP7) for Research and Technology Development with funding of 9,7M€ out of a total budget of 14,75M€, the DOTFIVE project addresses the area of "More than Moore" technologies targeting heterogeneous Systems-on-Chip (SoC) solutions for the Information Society Technologies.

The project runs from February 1st, 2008 to January 31st, 2011.

DOTFIVE is an ambitious three-year European project focused on advanced RTD activities necessary to move the **Silicon-Germanium (SiGe) Heterojunction Bipolar Transistor** (HBT) into the frequency range of **0.5THz** (500 GHz) at room temperature and evaluate the achievable performance of integrated mmWave circuits (operating frequency around 160 GHz) using those HBTs.

The project aims at the fabrication of individual devices and integrated circuits with higher operating speed allowing to realize new applications in the lower THz portion of the electromagnetic spectrum. In 2010 the targeted results at transistor level should reach a maximum oscillation frequency **f_{max} = 500GHz and/or a delay time td=2.5ps for a ring oscillator.**
This high frequency performance is currently only possible with more expensive technology based on III-V semiconductor compound making the high level of integration needed for complex functions costly for large volume consumer applications.

The new transistors developed within DOTFIVE will be used for designing circuits enabling power efficient millimetre-wave applications such as anti-collision **automotive radar or** Wireless Local Area Network **communications systems** In addition, DOTFIVE technology will be a key enabler for silicon based millimetre-wave circuits with applications in **the security, medical and scientific areas;** the high operating speed can open up new application areas at very high frequencies, or can be traded in for lower power dissipation.



Potential to Transform Modern Information Society

After two years, important progress towards the main objective has been achieved by the technology providers (2 companies and 2 research institutes). For this second year, 3 partners have achieved the 2nd year goal of **fmax ≥ 400GHz**. Latest experimental results demonstrate wafer average values of **425GHz** for fmax and suggest that the 500GHz goal will be reached before year's end..

Concerning DOTFIVE's applications, the expected final targeted performance of **160GHz operating frequency on key functional circuit blocks** has already been achieved one year ahead of schedule. The performance is already sufficient for some active imaging applications but further gain/NF improvements are useful to increase detection range to prove and demonstrate the complete system integration. Process development and circuit design are supported by a strong effort from almost all partners on high-frequency characterization, compact, device and process modeling, parameter extraction, and design kits.

The DOTFIVE consortium is currently leading the race for the world's highest frequency SiGe HBTs.

In order to share their results, DOTFIVE's partners will participate to the Europe's Premier Microwave, RF, Wireless and Radar Event.

The European Microwave Week consists of four conferences:

- The European Microwave Conference (EuMC)
- The European Wireless Technology Conference (EuWiT)
- The European Radar Conference (EuRAD)
- The European Microwave Integrated Circuits Conference (EuMIC)

DOTFIVE partners will participate at the EuMIC and the EuMC with the presentation of the following papers:

The European Microwave Integrated Circuits Conference (EuMIC)

***"Pushing Conventional SiGe HBT technology towards "DOTFIVE" Terahertz"*,**
Participants: STMicroelectronics
This paper presents an overview of the millimetre-wave dedicated 130nm SiGe BiCMOS technology used by STMicroelectronics as a platform for DOTFIVE Project developments. The achievements during the first two years of the project culminate in the demonstration of an intermediate 400GHz fMAX SiGe HBT process with good device control and reproducibility.

***"Modeling and parameter extraction of SiGe:C HBT with HICUM" for the emerging Terahertz era"*,**
Participants: XMOD, University of Technology Dresden, STMicroeletronics, Infineon, University of Bordeaux
Recent advances in SiGe:C HBT process fabrication as those achieved within the DOTFIVE project allow circuit designers to address the so called Terahertz gap, opening a completely new field of applications and unforeseen market opportunities. In order to allow successful circuit design close to the very limits of device operation capabilities and to avoid costly redesigns, an efficient and accurate compact modeling infrastructure has to be employed.
This paper presents a status of the HICUM model development activities (within the DOTFIVE project) for future technologies. Physics based scalable model libraries are realized for two of the most advanced SiGe:C HBT processes currently available. The parameter extraction methodology is described via two meaningful examples.

***"TCAD simulation and development within the European DOTFIVE project on 500 GHz SiGe:C HBTs"*,**
Participants University of Napoli, University of Bordeaux, *University of Technology Dresden*,, STMicroeletronics, IMEC, Bundeswehr University Munich.
The TCAD infrastructure developed within the DOTFIVE project [1] is described. The hierarchical TCAD platform includes different Boltzmann equation solvers as well as simulators based on the widely used drift-diffusion and hydrodynamic transport models. In the latter case, accurate physical models developed within DOTFIVE are presented. The TCAD platform is used to explore the physics of extremely scaled devices and to investigate new device concepts and architectures.

The European Microwave Conference (EuMC) - Low-Noise Receiver Components

A 160-GHz Low-Noise Downconverter in a SiGe HBT Technology
Participants: University of Wuppertal, STMicroelectronics
A 160-GHz downconversion front-end for imaging arrays fabricated in a SiGe HBT technology is presented. The front-end features a fully differential architecture compatible with balanced on or off-chip antennas consisting of a three-stage LNA with 24 dB gain and Gilbert-cell mixer operating from -7dBm fundamental LO signal. The downconverter consumes 50 mA from a 3.3V supply and requires 0.1 mm2 die area (excl. pads) per channel, which is more compact than comparable III-V MMICs. With a 160-GHz input signal and an IF frequency of 150 MHz, the implemented front-end yields a 27-dB conversion gain and a 7.4-dB/9.5-dB system noise figure (without/with auxiliary on chip input balun)

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Further information about the project, publications and seminars are available at the project public web site: http://www.dotfive.eu

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