This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 644039.

Newsletter / May 2018- Issue 6

M3TERA

MICROMACHINED TERAHERTZ SYSTEMS

A new heterogeneous integration platform enabling the commercialization of the THz frequency spectrum

Project Reference
644039

Start Date
1st of February 2015

End Date
31st October 2018

Duration
48 months

Project Total Costs
€ 4.255.743,75

EU Contribution
€ 3.742.961,25

Project webseite
www.m3tera.eu

Consortium
7 partners (4 countries)

Project Coordinator
Dr. Klaus-Michael Koch
coordination@m3tera.eu

Technical Leader
Dr. Franz Dielacher
franz.dielacher@infineon.com

Scientific Leader
Dr. Joachim Oberhammer
joachim.oberhammer@ee.kth.se

Highlights of results in M3TERA

Micromachined waveguides

World's lowest loss waveguides 110 -170 GHz

World's lowest loss filters/diplexers 110 -170 GHz band

D-band SiGe MMICs

Unique combination of wide-bandwidth / power level / Q-factors

Record power/area efficiency for PA

Data-rate expected to be state-of-the-art or beyond

Interfaces

3 SiGe chip to waveguide interfaces

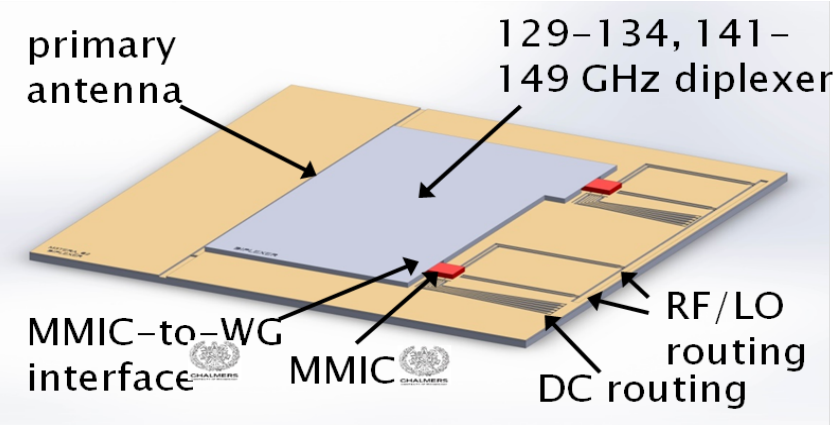
New, air-gap tolerant, micromachined-waveguide to flange interface with design (patent pending)

Antennas

Two different antenna interfaces (reflector + lens)

This work is supported (also) by the Swiss State Secretariat for Education, Research and Innovation (SERI) under contract number 15.0059. The opinions expressed and arguments employed herein do not necessarily reflect the official views of the Swiss Government.

Europe`s first micromachined THz system



The figure shows an overview of the micromachined THz system platform of this deliverable. The prototype is tailor-made for the industrial end-user Ericsson. All elements are designed and fabricated at KTH except explicitly mentioned.

The prototype contains the following elements:

(1) diplexer for 130-134 GHz (lower band) and 141-148.5 GHz (upper band), with 60 dB rejection of the other band

(2) micromachined waveguides in double-H-plane split technology, as described in deliverable D2.2 "Final Version of Report on Overall THz Microsystem and System Packaging Concept"

(3) end-firing antenna: for this first platform prototype, for simplicity the antenna interface is only implemented as an open-ended waveguide

(4) sockets for MMIC mounting in the waveguides (designed by Chalmers)

(5) RF transmission lines to the MMICs with contact pads, for routing the RF and LO signals from the platform edge to the MMICs. Since no actual MMIC designs are available at this stage in the project, these transmission lines do not fulfil any function for this first platform prototype, but are implemented to show the technology capability and also for RF characterization of transmission lines implemented in this platform technology.

(6) DC biasing routing lines with contact pads, for routing biasing lines to the MMICs. Since no actual MMIC designs are available at this stage in the project, these lines are not functional for this first platform prototype.

(7) MMICs (designed by Chalmers, fabricated by Infineon): the MMICs used for this first prototype are not functional, since at this stage in the project, the final MMIC designs are not available yet. The chips used for this prototype contain passive structures with the intention to characterize the wave launching into the micromachined waveguides. It should be noted that at this stage the original project proposal only comprised a micromachined platform without assembled MMICs. However, this deliverable already includes assembled dummy-MMICs into the platform.

Project meeting & Advisory Board workshop in Pamplona

The meeting started on 19th April with an official General Assembly meeting. The consortium discussed the main results and achievements and the plans for the upcoming months. Afterwards there was a Technical Meeting.
Joachim Oberhammer, the scientific leader, started the Advisory Board meeting with an overview presentation. The main purpose was to summarize the motivation for M3TERA, the background and state of the art on micromachined THz systems, the summary of the project`s objectives and the highlights, followed by individual presentations given by the different WP leaders.
Details about the intermediate results will be illustrated in an upcoming project newsletter.

On 20th April, there was an Advisory Board workshop. The Advisory Board members (Antti Räisänen, Gerd Hechtfischer, and Roberto Sorrentino) participated in this workshop and provided valuable feedback and advice and there were a lot of interesting discussions (e.g. planning of a M3TERA workshop at the IEEE Asia-Pacific Conference 2018, M3TERA platform development and costs, tuneability of the filters, and the very well cooperation of the consortium) .

Publications

(1) A 100-145 GHz Area-Efficient Power Amplifier in a 130 nm SiGe Technology (October 2017)
Bao Mingquan, He Zhongxia Simon, Zirath Herbert

(2) A Direct Carrier I/Q Modulator for High-Speed Communication at D-Band Using 130 nm SiGe BiCMOS Technology (October 2017)
Carpenter Sona, He Zhongxia Simon, Zirath Herbert

(3) A SiGe High Gain and Highly Linear F-Band Single-Balanced Subharmonic Mixer (October 2017)
Seyedhosseinzadeh Neda, Nabavi Abdolreza, Carpenter Sona, He Zhongxia Simon, Bao Mingquan, Zirath Herbert

(4) Silicon Taper Based D-band Chip to Waveguide Interconnect for Millimeter-wave Systems (December 2017)
Hassona Ahmed, Vassilev Vessen, He Zhongxia Simon, Mariotti Chiara, Dielacher Franz, Zirath Herbert

Secondary application measurement setup

The consortium, especially partner CSEM is working on the development of the secondary prototype with sensor-specific interfaces, platform components and control /IF/baseband ICs.

Antenna System Prototype

The final antenna system comprises a reflector antenna and a feed horn antenna.
The feeding horn antenna is in charge of transmitting the signal emitted by the microchip and directing it towards the reflector antenna.
The reflector collects the signal coming from its focal point and sends it to the receiver system.
Partner Anteral also worked on a lens horn antenna system.
The antenna system directivity is higher than 41 dB and S11 parameter of the feed horn antenna is below -20 dB and the complete system around -15 dB.