Newsletter

July 2016 - Issue 3

Message from the Coordinator

Since the last newsletter in December 2015, major attention was drawn to the diplexer design, the antenna design and the SiGe tapeout. Many conference calls and face-2-face meetings were dedicated to the project development and to discuss and identify suitable solutions and detailed concepts. During the review meeting, valuable comments and feedback were provided, which helped to guide the partners' future project work. In addition, the next Advisory Board meeting has been organised and will take place in November at CSEM in Switzerland. All Advisory Board members confirmed their participation.

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M3TERA

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Technical Review Meeting in Brussels / Belgium



The first intermediate Review Meeting of M3TERA took place on **28th January 2016** at the premises of the European Commission in Brussels, Belgium.

All beneficiaries were represented and contributed to valuable discussions on the project progress and future developments. The aim of the Review Meeting was to present the overall progress of each work package to the official reviewers (Mr Martyn Chamberlain, Durham University, UK; and Mrs Marijke Vandewal, Royal Military Academy, Belgium) and the Project Officer (Mr Henri Rajbenbach).

The meeting was a great success, as the feedback from the reviewers was very positive and proved that M3TERA is on the right track, is very ambitious and has a great team.

M3TERA Technical Meeting in Pamplona / Spain

From **13th to 14th April 2016**, the M3TERA consortium executed a technical meeting in Pamplona, Spain. The meeting, hosted by ANTERAL, started with an overview about the project progress and the recommendations resulting from the Review Meeting.

The main part of the meeting was dedicated to synchronizations and discussions on WP level and the creation of a timeline for the first demonstrator. Furthermore, the consortium was planning the upcoming deliverables as well as project internal meetings and the participation in workshops/conferences.

Upcoming Project Meetings

- 2nd M3TERA Technical Review Meeting 29th September 2016, Brussels/Belgium
- M3TERA General Assembly, Technical Meeting & Advisory Board Meeting 8th- 9th November 2016, Neuchâtel/Switzerland

KEY Data: Start Date: End Date: Duration: Project Reference: Project Total Costs: EC Contribution:

Project Website

1 February 2015 31 January 2018 36 months 644039 € 4.255.743,75 € 3.742.961,25



Consortium: Project Coordinator: Technical Leader: Scientific Leader:

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Research Highlights of the previous months

The scientific leader, KTH, successfully completed the diplexer design according to the specifications and was able to almost complete the technology development for the fabrication of the microsystem platform. In addition the feasibility of the MEMS-reconfigurable micromachined-waveguide components up to 750 GHz has been experimentally proven and recently published by KTH. ANTERAL worked on the reflector antenna design obtaining a high performance antenna with more than 40 dB gain and reduced dimensions. Now, the system is ready for fabrication. Also CSEM focused on the design and prototyping compatible with M3TERA platform antennas. Different plastic antennas, like rod, flat lens and 3D lens have been prototyped with their 3D printer.

In May 2016, partner Chalmers finished one SiGe tape-out including active circuits and transition design and in June they finished one eWLB design run with Infineon. Currently they are working on the design of the test fixture for the measurements and on the fabrication of the prototypes for testing. In parallel Chalmers is transferring the design dimension to KTH, needed for the platform fabrication. Ericsson worked on a mechanical solution for the interface between the Si carrier and the external antenna and proposed together with KTH a test structure for early manufacturing test. Furthermore, Ericsson worked on SiGe circuit designs and submitted more than 10 designs such as mixers, frequency multipliers and amplifiers to the tape-out that was scheduled at the beginning of June.

Last but not least, Chalmers is working with Infineon on a patent application in order to protect one of the concepts proposed for the IC-to-MEMS interface.

Past Conferences

- <u>MEMSWAVE 2016</u> Annual RF-MST Cluster Meeting (4th July 2016, Bucharest/Romania): Joachim Oberhammer (KTH, scientific lead) participated in the RF Cluster Meeting and represented M3TERA.
- Opportunities for dual-use technologies: Components (18th June 2016, Brussels/Belgium): Franz Dielacher (Infineon, technical lead) presented "A Micromachined Heterogeneous Integration Platform for THz Systems (M3TERA)" at this occasion.
- International Microwave Symposium "IMS2016" (22nd 27th May 2016, San Francisco/USA): KTH presented the following paper: "500-750 GHz Submillimeter-Wave MEMS Waveguide Switch":

This paper presents a 500-750 GHz waveguide based single-pole single-throw (SPST) switch achieving a 40% bandwidth. The switch is based on a MEMS reconfigurable surface which can block the wave propagation in the waveguide by short-circuiting the electrical field lines of the TE10 mode. The switch is designed for optimized isolation in the blocking state and for optimized insertion loss in the non-blocking state. The measurement results of the first prototypes show better than 15 dB isolation in the blocking state and better than 3 dB insertion loss in the non-blocking state for 500-750 GHz. The higher insertion loss is mainly attributed to the insufficient metal thickness and surface roughness on the waveguide sidewalls. Two switch designs with different number of blocking elements are fabricated and compared. The switch bandwidth is limited by the waveguide only and not by the switch technology.

Participation in upcoming Conferences:

- 38th Annual International Conference of the IEEE Engineering in medicine and Biology Society (EMBS)
 - 16th 20th August 2016, Orlando/USA

CSEM got paper accepted "Human Physical Condition RF Sensing at THz range":

The skin response to high radio frequency has been associated with the human physical condition and most prominently with the stress. The objective of this study is to investigate the possibility to detect mental and light physical stress through the measurement of skin reflectance in the mm-wave/sub-THz band. Two frequency bands have been considered, 75-110 GHz (Band-I) and 325-500 GHz (Band-II), while the measurements have been performed in the three different locations, the arm, the dorsal side of the hand and the fingertip. The measurement setup is discussed in detail and the reflectance spectrum is demonstrated. The results illustrate a difference in skin reflectance under rest and stress in Band-II which ranges from 3.5 dB at the finger to 7 dB at the hand. The outcomes of this study indicate the feasibility of stress detection through skin reflectance measurement and serve as a suggestion for deeper exploration of higher frequency bands.

- European Microwave Week (EuMW 2016)
 - 3rd- 7th October 2016, London/UK

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