PIPE MEDICAL TECHNOLOGY

IMAGING SYSTEMS – THZ-IMAGING

Monolythical chip-integrated, compact, powerful and cost-effective THz-Detector

(070615DE-PT-UNIFRA)

The commercial exploitation of long-wave terahertz (THz) radiation is opening up promising opportunities in the field of medical technology. To date, however, the non-existence of affordable emission sources is hindering further development.

The invention presented here, consists of a compact and cost-effective THz detector, in particular, a monolithically integrated antenna and receiver circuit for detection of THz waves. The field effect transistor and the antenna structure are integrated onto one chip. The THz signal reception of the antenna structure is directly fed into the field effect transistor via a gate source contact, which facilitates the high scale integration of detection elements. By combining several chips, even sheet-like arrays can be realized.

Additionally, the absence of clearances between antenna and field effect transistor reduce the usual losses during THz signal transfer.

IP-Holder: Johann Wolfgang Goethe-University Frankfurt and University of Siegen/Germany

Status: German patent (DE 10 2007 062 562 B4) International Patent application in progress (WO 002009080573 A3).

Resistive blender for detection of THz-frequencies (080655DE-PT-UNIFR)

The lack of compact, efficient and cost-effective emission and detection devices hinders the broad application of THz technology in the medical field. Detector production is too complex for use in common electronic products. The output of a high-frequency signal can be detected by means of common field effect transistors; however, the operations spectrum is limited to a few gigahertzes (Ghz). The present innovation depicts an improved field effect transistor, which works as a resistive blender. It consists of an array of elementary, voltage-dependent ohmic resistance elements and parallel connected capacitors that locally blend a cross-coupled high frequency signal in a resistive way, creating a high frequency-dependent constant current. The ohmic

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resistance elements and capacitators can be integrated into a semiconductor. The blender also works with high GHz and THz frequencies, thereby expanding its field of application, especially to the electromagnetic high frequency THz sector.

IP-Holder: Goethe-University, Frankfurt am Main, Bergische University, Wuppertal/Germany

Status: German and international patent applications are in progress.

(DE 10 20086 047101 A1, WO 002010028966 A2)

3D imaging system for the THz emission spectrum (070450DE-PT-UNIFRA)

This invention describes a system and a procedure for 2D and 3D visualization of objects by THz emission through a radiation source within the range of 300GHz and 1 THz. Dependent on the model, the intensity and frequency of the high-frequency signals can be modified simultaneously or individually. The receiver element, for instance, can be comprised of an assembly of four field-effect transistors that can be utilized as resistive blenders. A matrix-type module arrangement allows radiation detection in an array-type or two-dimensional detection system, similar to a CCD chip to capture 2D-images. At the same time, the depth information of every pixel can be gathered, to implement the creation of a 3D image. This happens by means of a modulation signal, which modulates the intensity and frequency of the THz emission, as well as the transistor sensitivity of the receiving element. The thereby determined phase of THz signal modulation facilitates the calculation of the distance compared to the object.

IP-Holder: Goethe-University Frankfurt am Main, CNRS Montpellier

Status: German and international patent applications are in progress. DE 10 2008 047 103 A1, WO 002010028972 A1

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IMAGING SYSTEMS – ELASTOGRAPHY

Novel imaging technology for diagnosis of liver, heart and brain by means of dynamic elastography (MRE) (06023HPV/CHA)

The examination of tissue elasticity by means of ultra sound or MRI allows an objective and comparable determination of biomechanical properties, and therefore, a non-invasive diagnosis of the examined tissues and organs. This invention improves the determination of the elastic tissue properties. The primary focus of the invention was the development of a non-invasive elastography-based diagnosis for cardiac dysfunctions through magnetic resonance technology (MRI). This novel dynamic MR- elastography allows detection of temporal changing tissue characteristics, in contrast to existing static elastography methods, and stands out by making scanning of bone-covered subjacent tissues possible. The invention encompasses a device for mechanical tissue stimulation that facilitates electronic transmission into underlying or shielded segments of the body. Dynamic elastography significantly improves the determination of the elastic properties of tissues and facilitates computational analysis, resulting in more meaningful elastograms.

IP-Holder: Charité-Universitätsmedizin Berlin

Status: Two patents

- 06023HPV/CHA: A German patent was issued (DE 10 2006 037 160 B4), international patent application is in progress (PCT/EP2007/003417)
- 07023HPV/CHA: German and international patent application are in progress (DE 10 2007 022 469 A1, EP 2150830, National Applications in: US, CA, JP, AUS, CN)

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