On Possibilities of Real-Time Millimeter/Terahertz Three-Dimensional Imaging of Remote Concealed Objects

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Usage of MMW/THz imaging systems for remote stealth screening of suspect individuals at entries is of growing interest. Passive imaging systems exploiting only natural MMW/THz emission within observable scene are not quite effective for indoor inspections due to low brightness temperature contrast. The authors have proposed two novel active MMW/THz quasi-optical imaging techniques which are taking into account peculiarities of reflections of the MMW/THz radiation with most objects of interest and intensively exploiting possibilities of state-of-the-art transceiver apparatus for the radiation. The first technique [1] is intended for remotely forming two-dimensional (2D) images of enhanced quality and extended information content. It is based on concealed object illumination with encoded multi-parameter radiation, formation of distinct partial images and digital synthesis of resulting images. The technique was experimentally confirmed by the authors and a prototype is currently under development. The second technique [2] allows to remotely form three-dimensional (3D) images of concealed objects with spatial localization/ substitution of strong reflections appearing due to hard/wet clothes and skin. It is based on focusing of object-reflected radiation onto focal plane array (FPA) by means of lens, thereby it is exploited stepped frequency radar approach for illuminating the object and further coherent detection of portions of focused radiation being spatially distinctly sampled with FPA elements in the lens focal plane (Fig.1). Fourier Transformation of complex signal sets each of which is distinctly received with particular FPA element allows to reconstruct 3D (volume) image of objects which is disposed within space layer near sharply focused object surface. The first experiments realizing aforesaid technique in its one-element monostatic realization were performed in [3]. This paper outlines the theory of the 3D imaging system operation and presents analysis of factors limiting possibilities of quasi-optical 3D imaging .

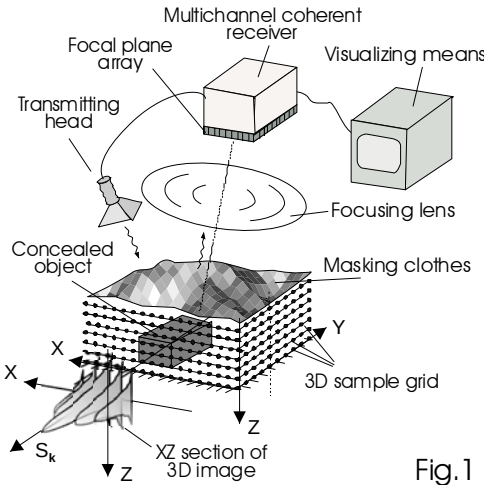

Fig.1

References

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3. J. Detlefsen, etc., Proc. of European Radar Conf.2004, Amsterdam, pp.279-282.