

## TERAHERTZ NON LINEAR METAMATERIALS

M.F. Foulon<sup>1</sup>, D. Yarekha<sup>1</sup>, T. Crépin and D. Lippens<sup>1</sup>

<sup>1</sup>Institut d'Electronique, de Microélectronique et de Nanotechnologie( IEMN)  
 Université des Sciences et Technologies de Lille  
 Avenue Poincaré, BP 69, 69652 Villeneuve d'Ascq Cedex, France  
[Michel.foulon@IEMN.univ-lille1.fr](mailto:Michel.foulon@IEMN.univ-lille1.fr)

Metamaterial Tehnology is now attracted an increasing interest with the prospect to achieve new functionalities afforded by the synthesis of an effective negative refractive index . So far however the main effort has been paid to the study of linear electromagnetic properties while a number of novel effects can be foreseen if non linear discrete devices are integrated in such left handed media. Basically a double approach can be used for the synthesis of negative refractive Index materials (NRIM) either by using particles as the so-called split ring resonator [1] or the phase advance scheme which is obtained by periodically loaded a transmission by series capacitance and self inductance. For the latter, a first paper on numerical modelling and expected effects was published in the literature. Recently, the first experimental demonstration of wave propagation phenomena in non linear left handed media was reported also using a one dimensional system. The originality of this communication stems mainly for the use of a transmission lines periodically loaded by an Heterostructure Barrier Varactor [3]. This kind of device show symmetric C-V characteristics. Main emphasis was also focused on harmonic multiplication whereas also parametric effects are expected in such systems.

When a transmission line is periodically loaded by a varactor in shunt (see fig. 1(a) where the devices interconnects here the two strips of a Co-Planar Strip line) the line becomes frequency selective with a low-pass filter type [4]. The propagation is forward up to a corner frequency called the Bragg frequency[2]. By integrating now the devices in series namely to the place where fixed parallel plate capacitance are apparent in the layout, the propagation becomes backward with a high-pass filter frequency behaviour. Therefore depending on the balance between parallel and series element a composite electromagnetic behaviour can be achieved [3]. At the present stage, we are modelling the non-linear behaviour either in the time domain or the frequency one by means of the commercial code ADS by Agilent. Enhancement in the up-conversion efficiency over a broad band can be pointed out in the left handed propagation regime. Further advantage can also be foreseen with the use of MIRM's from the frequency filtering effect and from the radiation guided regimes [4].

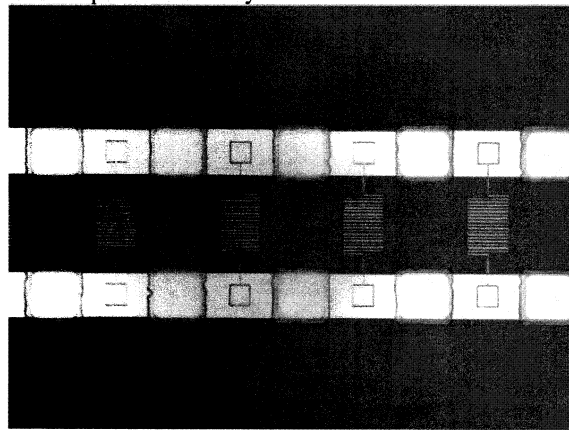


Fig. 1 (a) Left handed transmission lines in a CPS technology

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