

High-directivity terahertz TEM horn antenna based on Silicon

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In the terahertz range, the emission or detection of a signal uses generally planar antennas combined with silicon lenses. However, the planar antenna covers a wide area on the wafer and the positioning of the lens is fastidious. An alternative is the integrated TEM horn antenna (TEM-HA) that has been developed in our group [1]. In order to reduce the size of the chip and to combine the lens with the antenna, we have developed a new design of TEM-HA made on a high permittivity dielectric. This design is drawn from the description of the antenna as a micro-strip line [2] using its opening angles as parameters [3]. Thereafter, we used it to design a $50\ \Omega$ TEM-HA made with silicon. In addition, to reduce the internal reflections of the signal in the antenna, we added an anti-reflecting layer centered at 600 GHz. Simulations show 19 dBi of directivity (fig. 1) and a scattering parameter S_{11} less than -10dB with a bandwidth of 150 GHz. Moreover, the antenna presents a very low dispersion for short pulses (fig. 2). Those promising simulations let us believe that further experiments will show usefulness of this antenna for wide bandwidth THz signals transmission.

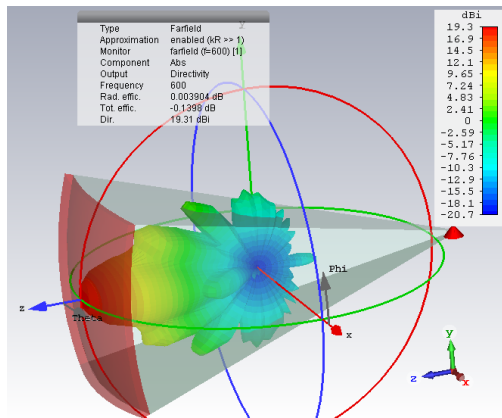


Fig. 1 : Design and directivity of the TEM-HA at 600GHz

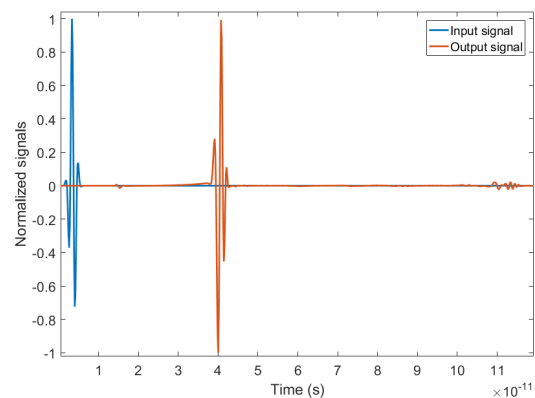


Fig. 2 : Pulse response of the TEM-HA

References :

- [1] E. Peytavit et al., *Appl. Phys. Lett.* **93** (2008) 111108.
- [2] Erik O. Hammerstad, "Equations for microstrip circuit design" 5th European Microwave Conference, Oct. 1975.
- [3] R.T. Lee and G.S. Smith, *IEEE Transactions on Antennas and Propagation* **52** (2004) 315.