Metamaterial-inspired Chipless RFID encoding exploiting phase response

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Radio Frequency Identification (RFID) is a widespread tool used in a large spectrum of application spanning from the remote identification of goods, animals tracking and people localization. The vast majority of RFID tags operating in the radiofrequency and microwave bands present today in the market is passive (i.e. without an internal power source) and comprises an antenna tuned to a semiconductor chip that allows the storing of information. Although the cost of this kind of RFID tag is low, it cannot beat the barcode especially for low-price items. Therefore a great effort has recently been put in the development of the so called *chipless* RFID in order to further reduce the cost of a single tag.

Chipless tags are a good trade-off in terms of low cost and operational potential if compared to the barcode and also to the tag equipped with a chip. In the absence of a modulating chip that processes the information, the data is encoded in the reflection coefficient of the tag. More in detail, an amplitude shift keying can be exploited where the absence /presence of one or more absorption peaks in the amplitude of the reflection coefficient represents a string of "1" or "0" bits information. These kind of chipless RFID tags offer a quite good bit-capacity but they may suffer of a large footprint. Other encoding techniques are based on the phase response or may involve time-domain techniques for the recovering of the information embedded in the the backscattered field.

Their chipless RFID are easy to fabricate and since they do not employ damageable IC they are promising to be used in harsh environments or in extreme conditions. These features come at a price of an increased reader complexity and challenges in defining a standard procedure for recovering the information in real scenarios.

The design of a metamaterial-inspired chipless RFID tag is addressed in order to exploit the polarization of the probing wave in order to mitigate the above mentioned drawbacks. In particular, the properties of periodic surfaces such as Frequency Selective Surfaces (FSSs) and High-Impedance Surfaces (HISs) will be used to tailor the frequency response of the proposed RFID chipless tags.