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Miniaturization and Optimization of Multiband Antenna Arrays By Co-Design

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Wireless electronic systems need to be highly integrated and have to respond, at the same time, to an increasing demand for flexibility. The simultaneous improvement of functionality and compactness requires an approach known as "more than Moore" which corresponds to the development of new integration technologies and new circuit and system architectures.
The new circuit and system integration technology must be 3D for minimizing the footprint and reducing connection stages and be compatible with a heterogeneous assembly. On the other hand, for rationalizing the architecture of the system, it is interesting to consider its design in a global way. In particular, this system-wide design approach involves the combination of elementary functions, which makes possible simplification of interconnection stages or even of elementary functions by taking into account their interactions [1]-[2].

The objective in this work was to develop a joint design methodology for the antenna and its associated circuits in order to achieve optimal performance (radiation, efficiency, ...) with an integrated and compact device. The demonstration has been carried out by the design of a circularly polarized tri-band (GPS / GALILEO) network of 4 active elements, for the satellite radionavigation systems (GNSS).
The approach is applied to the receiver stage combining the antenna, the filter and the low noise amplifier (LNA). The functions are thus associated to miniaturize this subsystem and benefit from the combination of functions, which, by offering additional degrees of freedom, allows optimized performance. In particular, this approach has shown that, by distributing the filtering function over the subsystem assembly, a consequent improvement in the overall efficiency of the system and a great reduction of its footprint could be obtained.

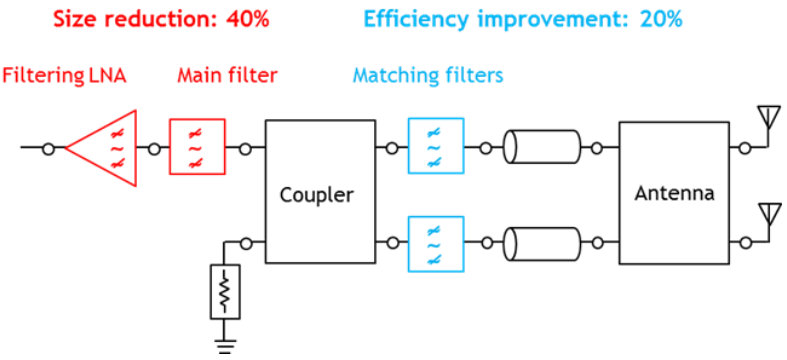

Figure 1. Mutual design for the optimization of a compact receiver for satellite radionavigation

1. H. Chreim, et al., "An Enhanced Ka-band Reflector Focal-plane Array Using a Multifeed EBG Structure," *IEEE Antennas and Wireless Propagation Letters*, art. no. 5658104, vol. 9, pp. 1152-1156, 2010

2. H. Chreim et al., "Analysis of Capabilities to Achieve Overlapped Radiating Apertures by Using a Multi-feed EBG Structure Loaded by Passive Filtering Functions," *European Conference on Antennas and Propagation*, art. no. 5505489, 2010