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A new alternate way to T-junctions in balanced diplexers

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In recent years, the development of wireless communications, satellite navigation systems and many other radio applications of a multi-band nature have shifted the design focus from single-band to multi-band microwave devices to meet these new requirements, dependent on the needs of a constantly growing and changing industry. This shift in focus has not only affected single-band devices, but also single-ended devices, which are being replaced in many applications by their differential counterparts due to their inherent advantages, such as intrinsic resistance to electromagnetic interference and better signal-to-noise ratio for low-voltage operations, leading to higher switching speed and better overall performance [1]. One of the main multi-band balanced devices are the diplexers, frequency selective one-to-two frequency multiplexers that are commonly used to separate two frequencies of interest. These diplexers are usually presented in the literature [1] by linking two output filters by the means of a T-junction. However, this approach presents some drawbacks such as the inherent dependence between output filters at the design stage, which increases the complexity. In this contribution, a new technique for designing balanced diplexers is presented. This new technique consists of replacing the T-junction by an input filter that will pre-filter all the passbands of the diplexers that will be individually filtered in the output filtering stage. This approach brings out some advantages such as the complete individualization of the output filters design, which will facilitate the process. The inclusion of this pre-filter stage will improve the selectivity of the diplexer when compared to the original T-junction based one. There are two ways to implement this new input filtering stage and it will depend on the proximity of the pass bands to the one selected. The first form is based on a pair of resonators purposely overcoupled, so that the resonant frequency is split giving rise to two resonances very close to each other. The second way, for more widely spaced passbands, is based on the use of a dual-band input filter, each of the resonant frequencies centred on the operating frequencies of the output filters. The main characteristics of the proposed new technique are: 1) output filters completely independent of each other in the design process; 2) increase in the order of the output filter improving the selectivity without increasing the size; 3) Easily adaptable to different frequencies and bandwidths of the passbands. Two examples, for the two scenarios commented above, have been manufactured to validate this new design technique. The 2D views of the structures are shown in Figure 1. The obtained results will be presented in the conference.

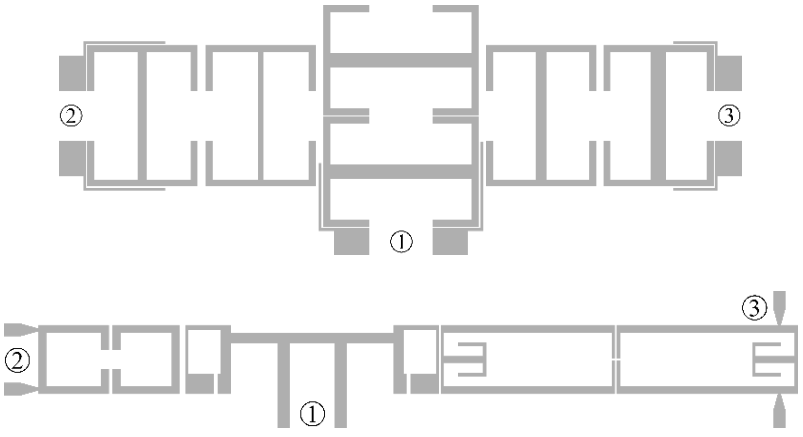

Figure 1. Design examples of the proposed new technique based on input filters.

1. Martín, L. Zhu, J. S. Hong, and F. Medina, Balanced Microwave Filters, Hoboken, NJ, USA: Wiley, 2018. doi:10.1002/9781119238386.