Balanced-to-balanced microstrip diplexer based on magnetically coupled open-loop resonators

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1. Extended abstract

In recent years, the use of differential signals has gained increasing attention for both digital high-speed and analog microwave circuits [1]. When compared differential signals with their single-ended counterparts, the former show better signal to noise ratio performance, lower level of electromagnetic interference (EMI), higher immunity to environmental noise as well as better electromagnetic compatibility. Despite all these advantages, differential signals can suffer from the presence of common-mode (CM) noise mainly caused by amplitude unbalance and time skew of the differential signals. Therefore, to ensure the integrity of the differential-signal over the frequency range of interest, strong CM rejection is mandatory. Different type of devices in their differential version can be found in the literature and, in particular, differential-lines [2] and differential-mode balanced bandpass filters (DMBPFs) are undoubtedly the devices accounting for the largest number of publications. However, scarce research has been carried out in the area of microwave balanced-to-balanced diplexers. In particular, very few structures involving simple topologies and an easy and straightforward design process (with no optimization steps required) are available. A couple of examples offering good DM performance, band to band isolation and strong CM rejection (in both differential-ports/channels) can be found in [3]-[4]. Balanced diplexers offer a very interesting solution to increase the compactness and to reduce the cost and size of an RF-module front-end, and for this reason are very attractive devices to be investigated. In this communication, a novel microstrip balanced-to-balanced diplexer based on magnetically coupled open-loop resonators is presented. Each channel/differential-output is composed of a second-order single-band Butterworth balanced bandpass filter. The lower band is centered at 2.5 GHz (WLAN) and the upper band is located at 3.5 GHz (WiMax). For differential-mode, the design procedure is quite straightforward since it is based on the use of the well-known external quality factor and coupling coefficients concepts. On the other hand, common-mode is rejected inherently thanks to the benefits of magnetic coupling which avoids common-mode transmission in a wide frequency range [5]. In addition, the proposed structure also offers high level of channel-to-channel isolation, a critical issue for proper diplexer operation. Compared with previous works, the presented balanced-to-balanced diplexer provides a simple topology, and the performance is competitive in terms of common-mode rejection ratio (CMRR), compactness and isolation level.

2. References

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