

V. CONCLUSIONS

This paper presents several solutions adopting the partial removal of the dielectric substrate for the implementation of bandpass SIW filters. The perforation of the substrate with air holes is investigated for its superior strength to the fabrication tolerances, compared to the iris-type filter (able to realize a similar filtering function). In addition, the half mode and the folded half mode have been studied in order to reduce the dimensions and compensate the radiation losses, respectively. A different approach, that can be used to increase the out of band rejection of the previous topologies whilst reducing the dimensions, is related to the use of dual-mode air filled SIW cavities. The removal of the dielectric in the center of the cavity realizes a doublet able to generate two poles and two transmission zeros. Two different examples are presented to show the control on the filter characteristics related to the geometrical parameters. Conversely, the excavation of the lateral portions of the cavity leads to the full control on the position of the transmission zeros. All the filters have been realized and measured confirming the theoretical studies.

REFERENCES

- [1] L. Silvestri, E. Massoni, C. Tomassoni, A. Coves, M. Bozzi, and L. Perregrini, "Substrate Integrated Waveguide Filters Based on a Dielectric Layer with Periodic Perforations," *IEEE Transactions on Microwave Theory and Techniques*, Vol. 65, No. 8, pp. 2687–2697, Aug. 2017.
- [2] L. Silvestri, E. Massoni, C. Tomassoni, A. Coves, M. Bozzi, L. Perregrini, "Modeling and Implementation of Perforated SIW Filters," *IEEE MTT-S International Conference on Numerical Electromagnetic and Multiphysics Modeling and Optimization (NEMO2016)*, Beijing, China, July 27-29, 2016.
- [3] L. Silvestri, E. Massoni, C. Tomassoni, A. Coves, M. Bozzi, and L. Perregrini, "A New Class of SIW Filters Based on Periodically Perforated Dielectric Substrate," *46th European Microwave Conference (EuMC2016)*, London, UK, Oct. 3–7, 2016.
- [4] C. Tomassoni, L. Silvestri, A. Ghiotto, M. Bozzi, and L. Perregrini, "A Novel Filter Based on a Dual-Mode Air-Filled Substrate Integrated Waveguide Cavity Resonator," *2017 IEEE MTT-S International Conference on Numerical Electromagnetic and Multiphysics Modeling and Optimization for RF, Microwave, and Terahertz Applications (NEMO2017)*, Sevilla, Spain, May 17-19, 2017.
- [5] C. Tomassoni, L. Silvestri, A. Ghiotto, M. Bozzi, and L. Perregrini, "Substrate Integrated Waveguide Filters Based on Dual-Mode Air-Filled Resonant Cavities," *IEEE Transactions on Microwave Theory and Techniques*, Vol. 66, No. 2, pp. 726-736, Feb. 2018.
- [6] L. Silvestri, A. Ghiotto, C. Tomassoni, M. Bozzi, and L. Perregrini, "Partially Air-Filled Substrate Integrated Waveguide Filters with Full Control of Transmission Zeros," *IEEE Transactions on Microwave Theory and Techniques (in print)*.