18-40GHz Phased Array Antenna using Printed Circuit Board Fabrication and Surface-mount MEMS Phase Shifters

Anas J. Abumunshar*[1], Niru K. Nahar[1], Daniel J. Hyman[2], and Kubilay Sertel[1].
[1]ElectroScience Laboratory, The Ohio State University
1320 Kinnear Rd. 43212 Columbus, OH, USA
[2]XCOM Wireless Inc.
2815 Junipero Ave., Suite 110, Signal Hill, CA 90755

We present a K-to-Ka-band (18~40 GHz) tightly coupled dipole array using MEMS-based phase shifter elements directly integrated into each antenna element's feed structure. Such low-profile, ultra-wideband array designs have already been realized at RF frequency bands (e.g. Doane, J.P.; Sertel, K.; Volakis, J.L., "A 6.3:1 bandwidth scanning Tightly Coupled Dipole Array with co-designed compact balun," *Antennas and Propagation Society International Symposium (APSURSI), 2012 IEEE* , 8-14 July 2012), however, for mmW band applications several fabrication challenges need to be addressed due to much reduced element sizes as well as increased material losses. In particular, MEMS-based phase shifters are attractive for millimeter wave integrated systems due to their low insertion loss and very low power consumption (Maximilian C. Scardelletti, George E. Ponchak, Afroz J. Zaman, and Richard Q. Lee, "RF MEMS Phase Shifters and Their Application in Phase Array Antenna," *IEEE WAMICON*, 2005). Moreover, for ultra-wideband tightly-coupled phased arrays consisting of many densely-packed elements, the integration of MEMS-based phase-shifters are perhaps the best option for real-time beamforming.

The array topology proposed here is designed using a commercial electromagnetic simulator (Ansoft HFSS v15) and consists of closely-packed, partially overlapping dipole elements. Two 4x4-element prototypes were fabricated using standard multilayer printed circuit board technology and tested in the Ohio State University, ElectroScience Laboratory anechoic chamber. An impedance bandwidth of 17-42GHz at VSWR<2.5 is demonstrated for broadside operation. The pattern measurement results for the fabricated prototypes were well-behaved over the entire band. We will present the design details and measured results at the conference.