This work presents a digital to RF phase converter (DRFPC) designed specifically for the Asymmetric Multilevel Outphasing (AMO) transmitter architecture [1]. The AMO architecture, shown in Figure 1, has great advantages in efficiency over similar architectures such as Multilevel LINC (linear amplification with non-linear components) without loss of linearity. By allowing the power amplifiers (PA) supplies to vary independently between multiple levels, the DRFPC reduces the burden on outphasing as a way to control output signal amplitude. Instead, outphasing is used primarily for pulse shaping. This use, along with the abrupt phase changes required when the amplitude path steps between discrete levels, translates to a requirement for a high-speed phase path.

The DRFPC presented in this work is designed to perform the phase modulation required for the AMO phase path. Because of the requirement that this phase path be very wideband, a closed loop approach such as a phase locked loop (PLL) is impractical. Instead, a differential current-steering topology is the preferred approach, in which weighted quadrature signals are added to produce an arbitrary output angle [2], [3]. The design choice made in this work exploits its use in the AMO architecture. In particular, the digital predistortion used in the transmitter allows for reduced linearity requirements in the design and therefore creates a topology that is relatively low-area and low-power. For example, by constraining the possible inputs to the DRFPC so that the amplitudes of the quadrature signals always sum to one, it is possible to use only one set of binary weighted current sources. This constraint results in a nonlinearity in the DRFPC but nearly halves its area and reduces matching requirements as compared to a generalized approach. A simplified DRFPC schematic is shown in Figure 2.