pThe approach is better for high frequency because at frequency greater than 100GHz couplers have much lower size can area is lower.a continuous phase variation is achieved by changing the gain of two VGA. The gain variation is 21-25 dB for 94GHz and 16-20 db for 120 GHz.Noise figure is 8-9 dB for 94GHz and 11-12 dB for 120 GHz.Input 1 dB compression point is -23dBm and -21 dBm respectively.the maximum power conxumtion is 110 mW.

In order to reduce chip size, for 94GHz lumped element can be used.in this way quadrature coupler size can be reduced from 254\*407 um2 to 141\*212um2 and for rat race the size is reduced from 340\*478 um2 to 210\*210 um2.thus the size can be half by using lumped element.for higher frequency,distributed elememnts size is much lower so lumped elemnt is not need ed in those cases.thhe bias circuits are not optimized for lower power consumption.By optimization of bias circuits power consumption can be reduced to 70 mW at 94 GHz.

Phase shifter is the most essential element in a phased-array to compensate for the delayed experienced by the incident signal in reaching different antennas. Passive phase shifters have a good linearity, but the loss associated with the MOSFET switches is the main challenge. In addition, their physical sizes make them impractical for integration with multiple arrays in a commercial IC process, especially below K band frequencies (*<* 30 GHz).

Active phase shifters, on the other hand, can achieve a high integration level with decent gain and accuracy along with a fine digital phase control under a constrained power budget. To design an active phase shifter Quadrature generation block is needed to generate two orthogonal phases. Then, VGA varies the amplitudes of two orthogonally-phased input signals to get the desired phase within the selected quadrant. Switch Amplifiers are used to select the appropriate quadrant that the two orthogonally-phased inputs create the desired phase. Single channel and an array of two-elements are designed at 0.13 um SiGe technology for mm-wave 120 GHz front-end phased arrays.