A 44/60-GHz 4-Bit Step Phase Shifter

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Diverse range of modern wireless applications necessitates development of communication systems with more bandwidth and flexibility. Dual-band transceivers have been developed to improve the functionality of communication systems. Typical dual-band transceivers are realized by switching between two different bands to transmit/receive one band at a time, which is not sufficient for a multifunctional transceiver where more than one band needs to be transmitted and received simultaneously. A concurrent dual-band system has been introduced to full-fill this need. A concurrent dual-band system is capable of simultaneous operation at two different frequencies without consuming twice as much power as a switching dual-band system or a significant increase in cost. The advantages of the concurrent dual-band concept are applicable to phased array implementation. A concurrent dual-band phased array system can form beams at two different frequency bands simultaneously. By separately adjusting the phase at different frequency bands, it can steer the direction of the beams independently without interference between the frequency bands. To that end, concurrent dual-band phase shifters are needed.

We present a 4-bit step phase shifter for a concurrent dual-band phased array transceiver operating concurrently at two different bands centered at 44 and 60 GHz. Fig. 1 shows the concurrent dual-band 44/60-GHz phase shifter that consists of two single-band phase shifters operating individually at 60 and 44 GHz and two diplexers working at both 60 and 44 GHz. The concurrent dual-band phase shifter is designed using a 0.18µm BiCMOS technology. The phase shifter has 4.2±1.3 dB and 5.4±1.8 dB insertion loss at 44 and 60 GHz over all phase shift states, respectively. The RMS phase errors at 44 and 60 GHz are 2.5 and 4 deg., respectively.

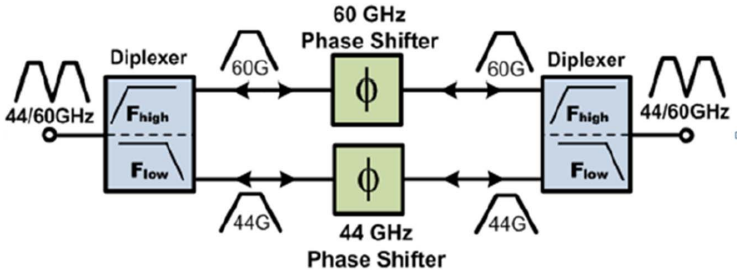

Fig. 1. A concurrent 44/60-GHz dual-band phase shifter.