



Development of Novel Phase Shifter for Beam Wireless Power Transfer

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For an advanced wireless power transfer (WPT) system, we need a novel phase shifter for a beam forming that boosts beam efficiency, received power, and mitigates interference with conventional wireless systems. Conventional phased array can be applied for a wireless communication and a remote sensing, however, it's not suitable for the WPT. We need a novel phase shifter with less loss and higher accuracy, and additionally lower cost. To reduce the loss in the phase shifter, we choose reflection-type hybrid coupler phase shifter with varactor diodes[1]. Frequency in this research is 5.8GHz for the WPT. In the conventional hybrid coupler phase shifter, high impedance line, which is thinner line of a microstrip line, is required to increase variable phase over 180°. The thinner line is not suitable in view point of circuit design. We propose a novel design of the hybrid coupler phase shifter with change of position of the varactor diode (Fig.1(a)). As a result, we can increase the variable phase by thicker line.

Next we apply a PLL feedback loop to the developed phase shifter to minimize the phase error. Figure 1(b) indicates the developed block diagram of the feedback loop phased array. The measured phase error is up to 5°. We also carry out the beam forming experiment with the phased array with developed phase shifter and we can successfully control the beam direction.

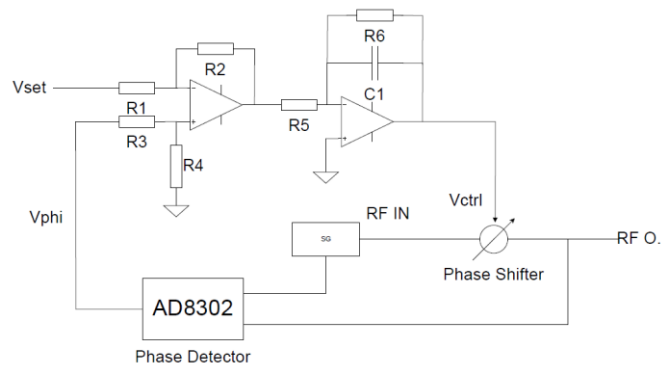
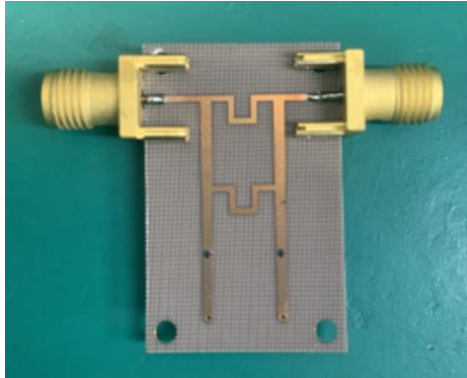


Figure 1. Developed phased array for beam WPT (a) hybrid coupler phase shifter by change of position of varactor diode (b) block diagram of PLL feedback loop phase shifter with developed hybrid coupler phase shifter

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1. N. Shinohara, T. Kajiwara, and B. Yang, "Low Loss and High Accuracy Phase Shifter for Novel Phased Array Antenna for Wireless Power Transfer", *Proc. 2023 Asia-Pacific Microw. Conf. (APMC)*, Dec. 2023, 220048