

Development of compact phase shifters with a Low Temperature Co-fired Ceramics substrate for an active integrated phased array antenna

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In recent days, various radio applications are allocated in microwave frequency bands. Furthermore, a wireless power transmission system with microwave is being studied. It is necessary to make the microwave transmission system smaller in size and lighter in weight for low cost. Hence, we propose an AIPAA (Active Integrated Phased Array Antenna) system, which is composed of patch antennas and microwave circuits such as amplifiers, phase shifters and power dividers. In this AIPAA system, the beam direction can be controlled electrically by changing microwave phase with phase shifters. The objective of the present study is to develop compact phase shifters for an AIPAA system.

Digital phase shifters for an AIPAA were designed and fabricated with a LTCC (Low Temperature Co-fired Ceramics) substrate. By using the LTCC technology in the phase shifter, small-sized and thin multi-layered phase shifters were realized. 4-bit switched-line type phase shifters with FET switches in 5.8GHz-band are fabricated. Their size is 10.0mm x 13.0mm x 0.55mm. The insertion loss of 2-bit phase shifters in the fabricated 4-bit phase shifters was measured to be -4.9dB ~ -6.4dB. The phase shifters had phase error of less than 2.7° after changing lengths of open stubs connected to the circuits of phase shifters. Experiment results show that the phase differences between the outputs of two 2-bit phase shifters were $-6.8^\circ \sim +7.0^\circ$.