Develop1nent of 81na11 and high power amplifiers for an active integrated phased array antenna

Shigeaki Kawai
Research Institute for Sustainable Humanosphere, Kyoto University

An AIPAA (Active Integrated Phased Array Antenna) is a wireless transceiver with feature of small in size, light in weight and beam control. For its compactness and functionality, development of AIPAA system is expected in fields of a mobile communication system and a wireless power transmission system. For practical use of the AIPAA, cost reduction and size reduction of components are necessary. In these reasons, small high power and low-cost microwave circuits for the AIPAA are needed. The AIPAA consists of antennas, amplifier, phase shifter and other circuits. The objective of the present study is development of small and high power amplifiers for the AIPAA.

Small and high power 5.8GHz band amplifier circuit for the AIPAA were designed and fabricated. A driver amplifier is designed with GaAs HEMT. Its P_{1dB} (output power at 1dB gain compression point) was 7dBm with gain of 13dB. A high power two-stage amplifier circuit was designed and fabricated with high power GaAs FET. Its maximum output power is 31dBm (1.3W) at 5.8GHz with gain of 13dB. For compactness of amplifiers, a creased circuit substrate was considered. The loss in the creased circuit substrate was smaller than 0.4dB at 5.8GHz. The high power two-stage amplifier was bended with creased circuit substrate technology. It is proved that the creased circuit substrate is applicable to amplifier circuits. This method is applied to size reduction of high power AIA transmitter. In terms of downsizing amplifier circuits and cost reduction, MMIC (Microwave Monolithic Integrated Circuit) technology is effective. Two-stage amplifier was designed with FET chip for consideration of high power MMIC amplifiers. Its P_{1dB} was 27dBm with gain of 23dB. MMIC amplifier for 5.8GHz band was designed and computed its characteristics. Its P_{1dB} is 27.5dBm with gain of 31.5dB. The size of MMIC is 3mm x 3.5mm. MMIC amplifiers for 14GHz band were also designed and fabricated for high frequency AIPAA. With these circuits, a structure of small AIPAA was considered. Its thickness became smaller than 2.5cm.