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Development of a cavity-type power combiner for 509 MHz solid state amplifier

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Development of a solid state amplifier (SSA) is planned for a 509 MHz accelerator cavity at the SPring-8 storage ring, as an optional plan of the upgrade project. Instead of the present power distribution system using a 1.2 MW klystron, a 100 kW SSA drives each of acceleration cavities. This system enables us to control the power and phase of the cavity, which gives us the redundancy, better stability, and maintainability. In order to obtain a 100 kW rf power, we should combine rf power from 160 LDMOS transistor modules. Therefore a power combiner with low loss is important for better power efficiency and cost reduction. We designed an 80-way power combiner using a TM₀₁₀ mode cavity with 80 input loop couplers attached on the cylinder inner surface of the cavity. The design simulation shows the power loss of the combiner is less than 2% in the ideal case. We made a prototype combiner and measured its rf characteristics. 4-way power combining with 6% loss, which was consistent with our designed value, was confirmed. In addition, we demonstrated the power combining from 4 LDMOS transistor modules with 10% loss. This presentation reports the design and obtained characteristics of the prototype.

Summary

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