

Performance evaluation and enhancement in kW level SSAs

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The Bhabha Atomic Research Centre (BARC) of Department of Atomic Energy (DAE) has indigenously designed, developed and tested high efficiency compact 7 kW and 20 kW solid state amplifier (SSA) systems at 325 MHz. These SSAs will be used for both Indian accelerators and Proton Improvement Plan II (PIP-II) project of Fermilab, USA. The PIP-II accelerator requires two levels of RF power at 325 MHz for its single spoke resonator (SSR) section with 7 kW SSA for SSR1 with β of 0.22 and 20 kW SSA for SSR2 with β of 0.47. Based on BARC design, eight 7 kW SSA systems were produced by Electronic Corporation of India (ECIL), DAE and deployed at PIP II injector test (PIP2IT) facility of Fermilab for beam acceleration. Performance evaluation of the 7 and 20 kW SSAs included, a detailed measurement survey of non-ionizing radiation at 325 MHz around SSA, validation of graceful degradation, measurement of mean time to replace etc. Enhancement accomplished in the SSA sub systems comprises of incorporation of inbuilt directional coupler in each 1 kW power amplifier (PA) module, a balanced input power divider, a 100W driver amplifier with heat pipe-heatsink and arrangement of three PA modules on single water cooled aluminum heat sink etc. This paper discusses all these performance evaluations and performance enhancements in detail for both 7 and 20 kW SSAs, which will be highly beneficial for reliable accelerator operation.

Footnotes

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