§ 11. Construction of New High Power and Steady-State Amplifier

Saito, K., Kumazawa, R.

Two lines of steady-state amplifiers were constructed. Each line has two final power amplifiers (FPA). One was FPA with 4CM2500KG tetrode tube and another was that with TH525A tetrode tube as shown in Fig.1.

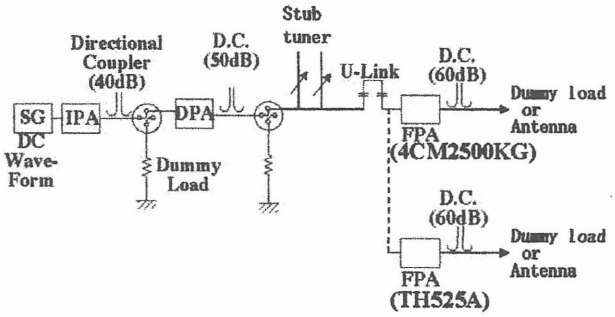

Fig. 1 One line of amplifier

Each FPA has only one input matching stub, therefore external stub tuners and U-link were necessary. Two FPAs were alternately used by changing a coaxial line shown by dashed line in Fig. 1. Cathode was grounded in each FPA. 4CW150KE tetrode tubes were used for driver power amplifier (DPA). 4CM2500KG and TH525A have the potential of driving power of 1.5MW/5sec and 1MW/CW per one tetrode tube. Ferrite was attached between the control grid and screen grid to prevent parasitic oscillation, and it was water cooled for steady state operation. FPA with 4CM2500KG has the same design with existing steady-state amplifiers except for cathode-grounding.

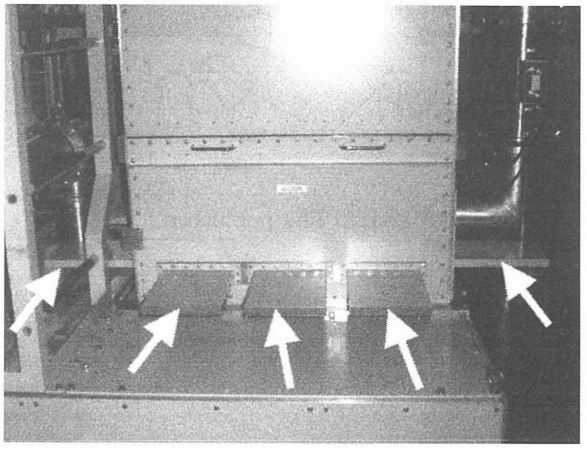

Fig. 2 Wave-guides attached around output cavity

FPA with TH525A has wave-guides with ferrite absorbers around output cavity as shown in Fig. 2. It was attached to prevent parasitic oscillation of 1.6GHz which is large in use of TH525A tetrode tube. Before attaching the wave-guides, parasitic oscillation of 1.6GHz was observed and the control grid current I_{CG} and the screen grid current I_{SG} were 3A and 2.5A, respectively at the output power of 940kW. But after attaching the wave-guides they reduced to 2A and 1A, respectively at the power of 990kW. The capacitance between the ground and the control grid of 4CM2500KG tetrode tube was increased by changing two Teflon sheet (total 200μm) to one Kapton sheet (125μm), and the output power was increased from 540kW to 680kW at the same control grid current of 3A. The achieved parameter of FPA up to now was shown in Table 1.

Table 1 Achieved parameters

	4CM2500KG	TH525A
P	930kW	990kW
T	1.0sec	1.0sec
I_{CG}	4.1A	2.0A
I_{SG}	2.9A	1.0A
I_K	75A	95A
η	54%	48%

where, P is output power, T is duration time, I_K is cathode current, and η is efficiency defined using anode voltage V_A as $\eta=P/I_K V_A$. Duration time was only 1sec because long pulse operation test was yet to be done.

In the plasma experiment FPA with TH525A was used in both lines because low I_{CG} and I_{SG} were achieved. ICRF power of over 1MW was launched from 4.5U,L antennas. Plasma heating using new amplifiers was recognized by the change of slope of stored energy W_p before and after ICRF turn-off (2sec) as shown in Fig. 3.

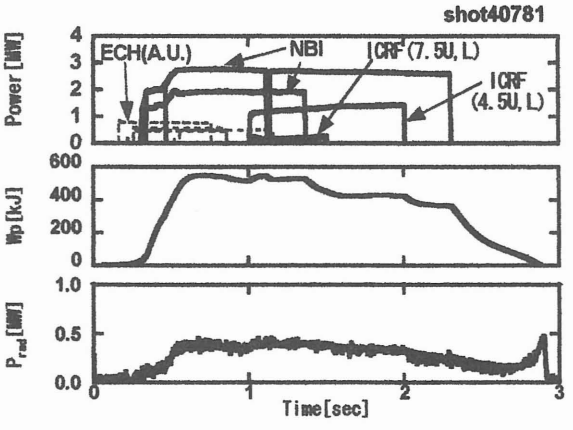

Fig. 3 First trial using new amplifiers