650 MHz Solid State RF Power development at RRCAT

Indian Institutions and Fermi lab Interaction Meeting

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Solid State Amplifier Experience

- At 650 MHz design studies are in progress for active device selection, energy efficient impedance matching circuit for 400-500 W solid state amplifier module.
- With commissioning of 50 kW and 30 kW solid state amplifiers in Indus-2 SRS, technology is well established for Power Divider, combiner, Amplifier modules, Directional couplers, FPGA based control/interlock and RF dummy loads - all needed for making a complete system.
- With this experience of 505.8 MHz RF system for Indus-2, eengineering design and prototyping of key components at 650 MHz has been completed.

505.8 MHz 500W RF Amplifier module

RF PA module, operating at 500 W, with 50V DC bias, is workhorse for 50 kW amplifier. specifications are listed below.

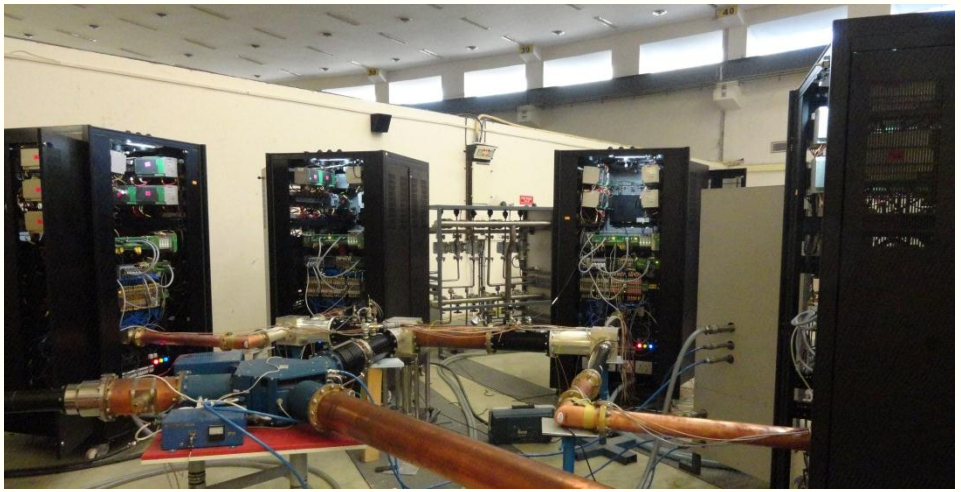
Sr.	Parameter	Value
1	Rated RF Power Output	520 W
2	Operating frequency and 1 dB Bandwidth	505.8 MHz, ± 5 MHz
3	Power Output @ 1db Compression	500 W
4	Operating Mode/ Class of operation	CW/ AB
5	Power Gain	18 dB
6	Input and output Impedance	50 Ω
7	Power Added Efficiency	58 %
8	Harmonic Distortion	-30 dBc
9	Spurious Output	-35 dBc
10	Input VSWR	1.15
11	Cooling	Water Cooled

500 W (CW) water cooled amplifier module

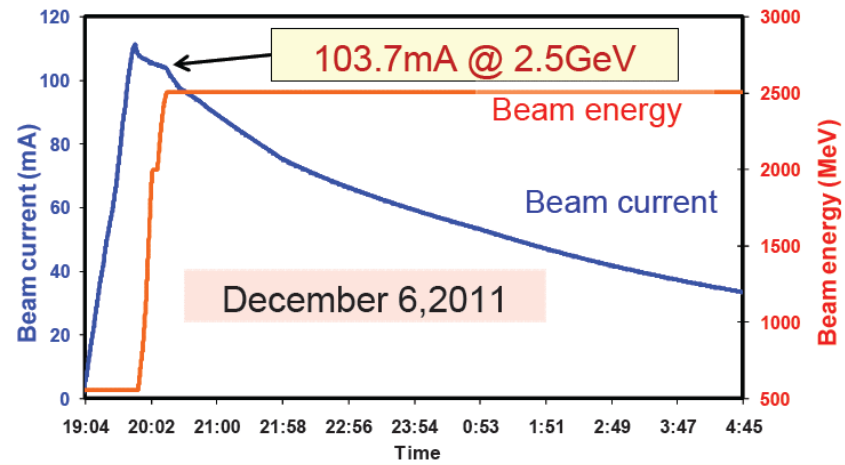
Deployment of Solid State RF Amplifiers in Indus-2

RF station # 1 and # 3 now use 50 kW and 30 kW solid state amplifiers.

RF station # 3 at 30 kW



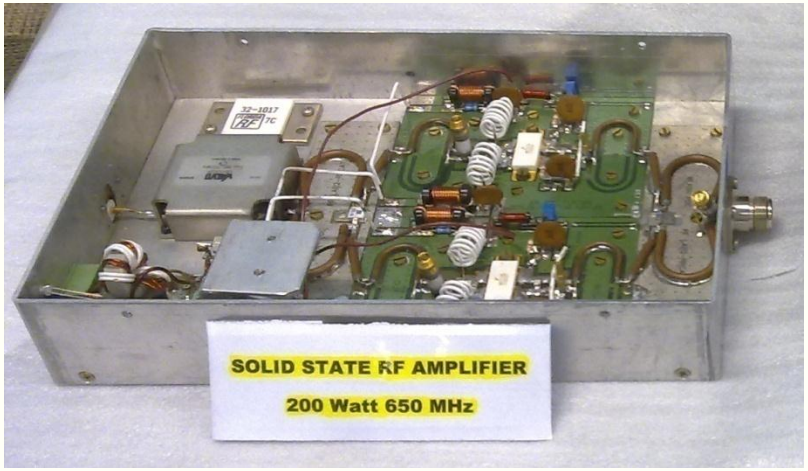
RF station # 1 at 50 kW

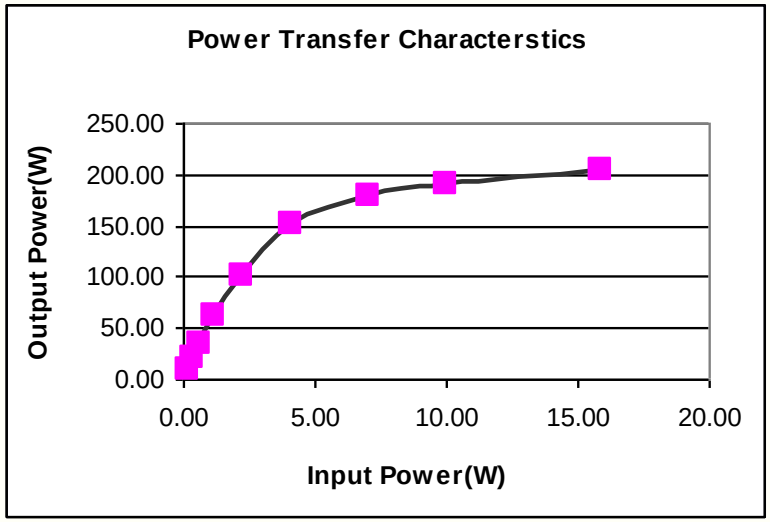


2.5 GeV operation of Indus-2 SRS using solid state amplifiers and Klystrons

200 W module at 650 MHz

- At 650 MHz, 200W module is developed.
- Design studies and simulation have been carried out using Newer LDMOS device, operating at 50V to obtain 350 W. Its PCB layout design and prototyping is under progress.





200 W solid state amplifier with measured power

650 MHz RF Components Developed at RRCAT

20W Low Power Driver

200 W Amplifier Module

Gain: 13 dB

VSWR: 1.1

P_{1dB}: 200W

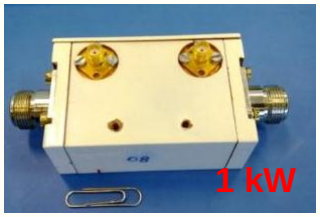
2-way 8 kW and 18kW Power combiners

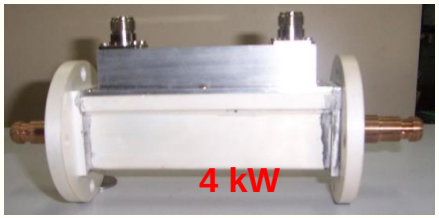
Output : 3-1/8” EIA

Coaxial Transitions

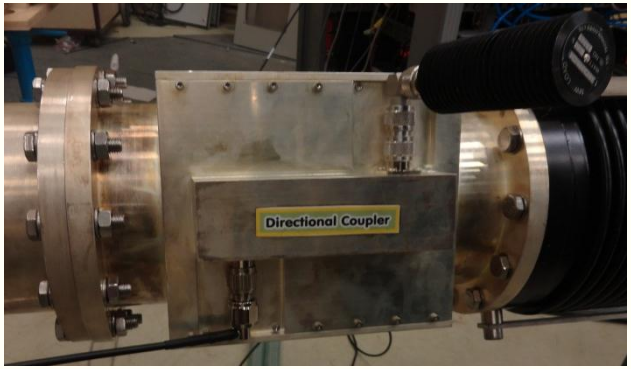
3-1/8” EIA to 1-5/8” EIA

1-5/8” EIA to N Type





Wide-Band Directional Couplers



60 kW Directional Coupler using 6-1/8” EIA flange

16-way 4kW Power combiner

Output : 1-5/8” EIA

Thanks