

A.9: Development, installation and performance evaluation of 499.75 MHz, 20 kW SSPA under DAE-CERN collaboration

A 20 kW solid state pulsed power amplifier was developed for CERN CLIC project by PHPMD under DAE-CERN collaboration. The amplifier has been delivered and its installation and performance evaluation was carried out at CERN (see Figure A.9.1). The amplifier is developed to energize the SHB cavity of the drive beam linac of CLIC. The amplifier is developed using 32 LDMOS transistors combined by planar Wilkinson combiner and has the specifications summarized in Table A.9.1.



Fig. A.9.1: Amplifier performance verification with sub harmonic buncher cavity at CERN.

Table A.9.1: Specifications of 20 kW SSPA.

Peak Power @ 499.75 MHz	≥73 dBm
Gain @ peak power	59 dB
3 dB bandwidth	470.75 MHz - 528.75 MHz
Pulse width	up to 140.3 μs
PRR	up to 50 Hz
Pulse to pulse variation in amplitude	< 0.1 dB
Pulse to pulse variation in phase	< 1°
In pulse amplitude variation	< 0.2 dB
In pulse phase variation	~ 3°
AC power consumption at operating parameters	800 W (1050 VA)
Cooling	Air cooled via fans mounted internally

The amplifier consists of a pre-driver, driver and high power stage. The high power stage consists of 32 high power dual LDMOS transistors operating in class AB single ended configuration. The matching circuits have been designed on low loss high dielectric constant flexible PTFE based laminates to reduce size. The planar Wilkinson combiner has been used for combination. The gain and frequency characteristics of the amplifier are shown in Figure A.9.2. The output of amplifier as seen on a peak power analyzer is presented in Figure A.9.3.

The amplifier, after thorough testing for more than 200 hours of heat runs, was shipped to CERN and its installation and performance evaluation was carried out with SHB cavity at CERN. The amplifier performance was verified to be as reported at RRCAT. Its stability and bandwidth have been found as per the given requirements.

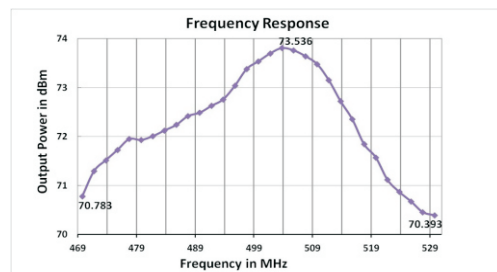
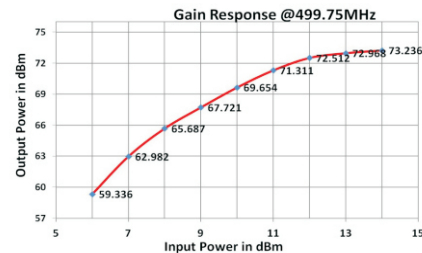


Fig. A.9.2: Gain and frequency characteristics of 499.75 MHz, 20 kW pulsed amplifier.

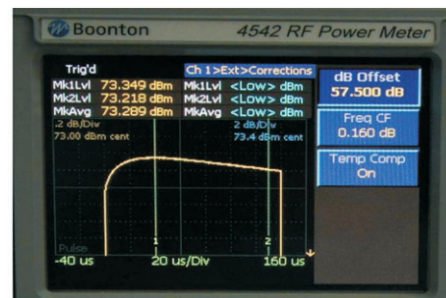


Fig. A.9.3: The output of amplifier as seen on a power analyzer, amplifier output power is in excess of 20 kW.

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