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A Significant Increase of the Efficiency at the Operating Point of Very High Power Solid State RF Amplifiers (50 MHz to 1.3 GHz) by Remote P1 Control

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A new technique was developed to increase the efficiency of very high power RF amplifiers (50 MHz to 1.3 GHz) at a freely chosen operating point. This improvement can be achieved for a large range of output power by a remote P1-point control. The choice of the P1-point of an RF amplifier is a compromise between increased efficiency vs. increased harmonics and decreased linearity. Typically, the P1-point power in the operation of particle accelerators is fixed to cover the maximum required output power including a large safety margin and for all operational situations. This safety margin is typically at least 20-30%. As a consequence, the effective efficiency of the amplifier is significantly below the one obtainable with an optimized setting of the P1-point for each required operating power. Using a new modular AC-DC-power supply with a maximum efficiency of 95% and a special amplifier control system, an adjustment of the P1-point over a wide power range can be made possible and thereby an increased effective efficiency of the amplifier at its operating point can be obtained. In addition, the new architecture of the ACDC-distribution results in a very low phase noise level, which is of higher importance for all light sources.
A detailed description of the system and the achieved power savings will be presented.

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