Tore Supra LH transmitter upgrade, a new RF driver for the power spectrum

G. Berger-By, J. Achard, A. Armitano, F. Bouquey, E. Corbel, A. Ekedahl, L. Delpech, G. Lombard, R. Magne, P. Mollard, M. Pagano, M. Prou, F. Samaille, D. Volpe and Tore supra Team.
CEA, IRFM, F-13108 Saint-Paul-lez-Durance, France

New real time tools have been developed for testing new 700kW/3.7GHz/CW klystrons and the operations on very long plasma shots. After the commissioning of the 18 series tubes on the high power test bed facility, the installation of the first 8 klystrons in the Tore Supra transmitter and the adjustment tests on load, this upgrade work has been materialized during the last 2010 campaign by a successful operation on the Full Active Multijunction (FAM) C3 antenna, with new performances: 3MW/48s on plasma.

The RF output power control in amplitude and phase was improved for better control of the wave spectrum launched into the plasma. The new klystrons have no modulating anode and the high cathode voltage must be adjusted with the RF input power in order to optimize the RF output power with a minimization of the thermal power losses in the collector. A new phase correction, which is function of the 3 RF output power ranges used, has been introduced. The improvements made in 2009 and 2010 on the generic phase loop and the procedures used during the real time tests of the RF transfer functions in amplitude and phase are detailed.

All RF measurements systems, RF safety systems and the RF calibration procedures have been revised in order to have the best coherence, reproducibility and with a measurement error against the calorimetry measurement lower than 10%.