Stray RF Power Estimates from EC exploitation during ITER plasma operations

F. Gandini,[1] M. Henderson,[1] C. Nazare,[2] C. Darbos,[1] D. Purohit,[1] T.Omori,[1] G. Thibault,[1] G. Denisov,[3] S.L. Rao,[4] D.A. Rasmussen,[5] G.Saibene,[6] K. Sakamoto[7]

[1]*ITER Organization, 13115 Saint Paul Lez Durance, France*
[2]*Assystem Facilities, 78067 Saint Quentin en Yvelines Cedex, France*
[3]*Institute of Applied Physics, Nizhny Novgorod, 603950 Russia*
[4]*Institute for Plasma Research, Gandhinagar, 382428, India*
[5]*US ITER Project Office, ORNL, Oak Ridge, TN 37831, USA*
[6]*Fusion for Energy, E-08019 Barcelona – Spain*
[7]*Japan Atomic Energy Agency (JAEA), Naka-shi, Ibaraki 311-0193 Japan*

The ITER tokamak is to have the world's largest EC system, which will consist of 24 MW installed at 170 GHz for 3600 seconds generated by 24 gyrotrons. The power is then transmitted via 24 transmission lines (typically 110 m to 160 m in length) to one equatorial and four upper launchers with an injected power of 20 MW. The design of the ITER EC system is guided by experience from existing EC systems, aiming at improved functionality, reliability and availability of ITER EC system. However, the ITER EC system faces new challenges not encountered previously. Long pulse operation requires active cooling of all transmission components to limit strain, deformations and higher order modes generation. The application of high power long pulse operation may also damage in-vessel components, if there is a non-negligible fraction of non-first pass absorbed power. The effective absorption throughout all plasma phases will range from virtually zero (at plasma initiation) to 100%. The stray power radiated in the vacuum chamber is estimated as a first step toward mitigating potential harmful consequence to in-vessel structures and diagnostics. Power loading of the chamber walls (peek power and average power density for straight beam propagation in the empty chamber) and diffuse stray radiation effects are simulated to infer suitable strategies to avoid damages to first wall and to microwave sensitive components.