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Experimental investigation of non-linear wave to plasma interaction in a quasi-flat magnetostatic field

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A detailed characterization of wave-to-plasma interaction in a quasi-flat magnetostatic field at 3.75 GHz has been carried out by using a small-wire movable RF antenna. The plasma-affected RF spectral emission during Electron Bernstein Waves (EBW) heating has been measured by means of a 1kHz-50 GHz spectrum analyzer. EBW are generated by extraordinary waves at the Upper Hybrid Resonance by means of non-linear mechanisms. The coupling between the EM waves and the electrostatic waves lead to a characteristic spectral emission in the low frequency range (ion waves) and around the pumping wave frequency. The EM spectra have been characterized for different values of the microwave power, frequency and pressure in different spatial regions of the plasma. The more relevant results consist in the broadening of the pumping wave spectrum above critical RF power thresholds, and the generation of sidebands at given Δf with respect to the pumping frequency, with corresponding components in the low frequency domain (ion waves around 10-100 kHz). These non-linearities are accompanied by the formation of an overdense plasma and by the emission of intense fluxes of X-rays in the 100 eV-10 keV domain. The results will be discussed and interpreted along the paper.