

HIGH VOLTAGE ANTENNA IN MAGNETOSPHERIC PLASMA

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We present the results of measuring capacity and radiation resistance of a large VLF antenna in magnetospheric plasma. This experiment was performed with the RPI instrument onboard of the IMAGE satellite using a specially developed program, which was run during three orbit passes in the fall of 2004. Measurements were made when the satellite was near its perigee both inside and outside of the plasmasphere. Using the RPI observations in other modes made simultaneously with the antenna experiment, we were also able to measure local plasma and electron gyro frequencies. Results were very successful in showing the dependence of the antenna capacity and radiation resistance on surrounding electron density. It is demonstrated that at high electron density (inside the plasmasphere) antenna capacity increases by about 70

In this experiment we measured the current and voltage on the transmit antenna during the transmissions made with different tuner settings. Because the RPI instrument was not specifically designed for such operation and the actual antenna capacity was not known, the tuning of the antenna was not a trivial task. Namely, in order to change the tuner settings, the operating frequency had to be changed as well. However, dependence of the measured antenna parameters on the operating frequency (between 13 and 20 kHz) was shown to be insignificant when this frequency was small compared to the electron gyro frequency and the plasma frequency. Analysis of the antenna-tuner equivalent circuit showed that the magnitude of antenna current also depends on the parameters of the tuner circuit. Therefore, in order to compare the antenna current values obtained with different tuner settings we had to derive certain normalization factor. When the current in the antenna is corrected by this factor there is still less current in the antenna when the antenna is radiating. The additional correction factor represents the effect of the inductor loss resistor and radiation resistance. Taking into account these corrections we get a rather smooth picture of the amplitude of the antenna current as a function of capacity and time (or location on the orbit). Making use of RPI-measured local plasma and electron gyrofrequencies it was possible to obtain a clear picture of the change of the antenna capacity with the plasma frequency. We are currently studying the dependence of antenna radiation resistance on the electron gyro frequency.

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