



Wide band compound magnetometer : a new instrument to investigate magnetic field components of plasma waves

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Measurement of magnetic fields from DC up to several kHz is of major importance to investigate plasma waves and their role in magnetospheric dynamics. Usually this broad frequency range is covered by two different instruments: the fluxgate (FG) and the search coil (SC) magnetometers. Typically SC covers the frequency band from a few Hz to a few kHz. We describe a new generation of compound magnetometer that covers the whole frequency range and therefore ensures the redundancy with the FG. In addition to enable redundancy with fluxgate magnetometer it should be of interest for scientific spacecraft. This new compound magnetometer is based upon especially tailored magnetic concentrators to intensify the magnetic field in the active region where a Hall sensor is implemented to measure from mHz to few Hz, while a coil is wound around the magnetic core to measure magnetic fluctuations from a few Hz to a few kHz. We have used an especially designed Hall effect sensor thinned down to $70\mu\text{m}$. The magnetic concentrator have been designed to provide magnetic gain up to 250. Thus, the sensitivity of Hall sensors can be improved by at least two orders of magnitude. An electronic conditioning, using spinning current method, permits to remove low frequency noise and the offsets. With this new design a Noise Equivalent Magnetic Induction down to $100\text{pT}\sqrt{\text{Hz}}$ at 1Hz can be reached. On the other hand, an high turn number winding around the core is used to measure ac magnetic fluctuations. This winding is connected with a very low noise preamplifier. A feedback loop is used to remove the natural resonances of the sensor and to ensure a constant gain over 2 frequency decades. This wide band magnetometer will fly, for the first time, in January 2007 on a NASA rocket (CHARM).