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Miniaturization of plasma wave instruments and its perspective towards future space missions

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The miniaturization of onboard instruments is essential in executing space plasma observations using microsatellites. In particular, conventional plasma wave instruments have a large size of analogue circuits such as low noise amplifiers and various types of filters. In addition, onboard digital processing such as data compression and FFT calculation requires large budgets of mass and power in using CPU. However, the capability of the onboard CPU does not support the real time onboard processing of plasma wave observation data. We need to convert the processing using software into the processing using hardware such as FPGA and digital ASIC.

We have been attempting the miniaturization of plasma wave instruments using mixed signal ASIC technology. We have already succeeded in realizing six channels of waveform capture receiver inside the chip with the size of 5mm times 5mm. We also realized the preamp chip for magnetic sensors. Furthermore, this ASIC technology leads to the consolidation of the digital part and analogue part of plasma wave receivers. This means that the whole plasma wave receiver system will be installed inside a one chip. In the present paper, we will introduce our attempt of the miniaturization of plasma wave receiver using the ASIC and show you the perspective using the miniaturized plasma wave receiver.

Keywords: Plasma wave, ASIC