

The development of the one chip new spectrum plasma wave receiver

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The plasma wave receiver is essential instruments for plasma observation. However, the size of the receiver is the important problem, especially for small satellites. We have been attempting the miniaturization of the plasma wave receiver by designing the analog ASIC (Application Specific Integrated Circuit). In this presentation, we introduce the new spectrum receiver which is one kind of plasma wave receivers. Conventional spectrum receivers are categorized into three types: sweep frequency analyzer (SFA), multi channel analyzer (MCA), and fast Fourier transform (FFT) based receiver. The SFA and the MCA have the problem that its time resolution and frequency resolution are incompatible. Although the FFT based receiver can overcome this problem, it has a disadvantage that the receiver amplifies signals with a wide frequency band. To resolve above problems, we propose the new spectrum receiver.

The new spectrum receiver is composed of analog circuits and digital signal processor (DSP). Input signals are band limited and amplified by the analog circuits, and the band-limited signals are analog to digital converted and applied FFT by DSP. The receiver gets whole spectrum by repeating this process in three bands: from 10 Hz to 1 kHz, from 1kHz to 10 kHz, and from 10 kHz to 100 kHz. This method enables to realize the spectrum receiver which has high time and frequency resolution, and this method can avoid wide frequency band amplifying.

We succeeded in developing the analog circuits for the new spectrum receiver and the prototype model of the receiver. The analog circuits are realized in ASIC, and all components of the receiver except for analog to digital converter (ADC) and DSP is included in a 5 mm x 5 mm chip. The prototype model is composed of the ASIC, an ADC board, and a PC. The ADC is controlled by the program running on the PC, and converted data are applied FFT in the same program. The time resolution of the receiver is 0.4 second, and frequency resolution for frequencies from 10 Hz to 1 kHz, from 1 kHz to 10 kHz, and from 10 kHz to 100 kHz are 3.2 Hz, 32 Hz, and 320 Hz respectively. In this presentation, we introduce the design of the new spectrum receiver in detail, and we also introduce the measurement result of the receiver.

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