

ASICを用いた小型周波数掃引型スペクトル受信器の開発

Development of Miniaturized Sweep Frequency Analyzer using ASIC

福原 始^{1*}, 小嶋 浩嗣², 池田 博一³, 山川 宏²

Hajime Fukuhara^{1*}, Hirotosugu Kojima², Hirokazu Ikeda³, Hiroshi Yamakawa²

¹京都大学大学院工学研究科, ²京都大学生存圏研究所, ³宇宙航空研究開発機構 宇宙研究科学本部

¹Kyoto Univ. EE, ²Kyoto Univ. RISH, ³JAXA/ISAS

A sweep frequency analyzer (SFA) is a part of plasma wave receivers to observe plasma waves in wide frequencies. The SFA is basically a heterodyne receiving system with low noises and high frequency resolution. The SFA has a PLL, which is frequency synthesizer. It takes several seconds to sweep all range. Since the total time to lock in all frequencies is not short enough in PLL, the SFA generally has disadvantage in temporal resolution. We propose a new kind of the SFA combined with FFT in FPGA (Field Programmable Gate Array). To improve the temporal resolution, sweep steps are widened and number of the steps is decreased. The bandwidth brought out of the heterodyne receiver is also widened. Observed signals are converted into digital signals and input to the FPGA. The FPGA has logic FFT blocks and apply the FFT to the digital signals. Thus, we can obtain the frequency resolution which is equals to the widened bandwidth divided by the FFT points. For example, we assume the sweep steps become ten times and the number of steps becomes tenth. Applying 64-point FFT in the FPGA, the temporal and frequency resolutions are respectively improved up to ten times and six times. We achieve high temporal resolution in the SFA without frequency resolution dropping. We have developed several analog circuits in the new SFA, such as PLL, and band pass filters using ASIC (Application Specific Integrated Circuit) technology. The ASIC technology enables extreme miniaturization of analog circuits. There is possibility to realize the analog circuits of the SFA in a chip of 5 mm x 5mm. We introduce the new SFA and development of the required circuits.

キーワード:プラズマ波動,周波数掃引型スペクトル受信器, ASIC,小型化

Keywords: Plasma Wave Receiver, Sweep Frequency Analyzer, ASIC, Miniaturization