Specification and Observation plan of the plasma wave experiment (PWE) on board ERG

\# Yoshiya Kasahara[1]; Yasumasa Kasaba[2]; Hirotsugu Kojima[3]; Satoshi Yagitani[1]; Shoya Matsuda[4]; Fuminori Tsuchiya[5]; Keigo Ishisaka[6]; Mitsunori Ozaki[7]; Tomohiko Imachi[1]; Atsushi Kumamoto[8]; Yoshizumi Miyoshi[4]; Mamoru Ota[1]; Satoshi Kurita[4]; Naoko Takahashi[2]; Kazushi Asamura[9]; Iku Shinohara[10]
[1] Kanazawa Univ.; [2] Tohoku Univ.; [3] RISH, Kyoto Univ.; [4] ISEE, Nagoya Univ.; [5] Planet. Plasma Atmos. Res. Cent., Tohoku Univ.; [6] Toyama Pref. Univ.; [7] Electrical and Computer Eng., Kanazawa Univ.; [8] Dept. Geophys, Tohoku Univ.; [9] ISAS/JAXA; [10] ISAS/JAXA

The ERG (Exploration of energization and Radiation in Geospace) project is a mission to study acceleration and loss mechanisms of relativistic electrons around the Earth. In order to achieve comprehensive observations of the inner magnetosphere, electrons and ion detectors, magnetic field sensors, and electric sensors are equipped on the spacecraft. The Plasma Wave Experiment (PWE) is one of scientific instruments on the ERG satellite. It measures electric field in the frequency range from DC to 10 MHz, and magnetic field in the frequency range from a few Hz to 100 kHz. Three kinds of receivers are implemented in the PWE; EFD (Electric Field Detector), OFA/WFC (Onboard Frequency Analyzer and Waveform Capture), and HFA (High Frequency Analyzer).

The measured data are processed and edited by onboard software implemented in the CPUs in order to realize varieties of operational modes. We produce continuous spectra below ~200 Hz and waveforms below 64 Hz (256 Hz) at L-values larger (less) than 4 as EFD double probe data. Spacecraft potential is also provided by the EFD by single probe measurement. As for the data from OFA and WFC, raw waveforms are once stored in the onboard memory and we calculate wave spectra and spectral matrix using FFT. They are continuously processed and all data are sent to the ground. On the other hand, waveforms are intermittently stored as 'PWE burst' data in the mission data recorder (MDR). Two kinds of PWE-burst mode are implemented; one is 'chorus burst' and another is 'EMIC-burst'. Several seconds of continuous VLF waveforms sampled at 65 kHz are produced after lossy compression in the 'chorus burst' mode, while a few minutes of continuous ELF waveforms down-sampled at 1024 Hz are generated in the 'EMIC burst' mode. These two modes are exclusively operated. Due to the limitation of telemetry resource, the PWE burst data stored in the MDR are partially selected and downloaded to the ground. In addition, a triggering logic is implemented for the PWE-burst to capture significant plasma waveforms such as 'large-amplitude whistlers'. The HFA measures high frequency spectra from 10 kHz to 10 MHz for electric field and 10 kHz to 100 kHz for magnetic field. Electron density along the spacecraft trajectory can be determined from upper-hybrid resonance (UHR) frequency measured by the HFA.

Development of the PWE has finished and passed its product quality review (PQR) in August, 2016. In parallel, we are now constructing a pipeline data processing scheme on the ground to provide excellent science data and to perform smooth and effective data analyses. In the present paper, we introduce a final design of the PWE and its observation plan to meet the scientific objects of the ERG mission.