Development of Wideband Digital Radio Wave Receiver onboard Spacecraft to Jupiter

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Recently, many scientists pay attention for problems about the generation mechanism of radio emission from Jupiter such as QP-burst in Kilometoric radio frequency range (KOM), L-burst (Long-burst) in Decametoric radio frequency range that contains sometimes a group of S-burst (Short-burst). However, due to the effects of terrestrial ionosphere disturbance and inter planetary scintillation (IPS), it is difficult to observe the fine structure of these burst phenomena from the ground and satellite observatories around the earth.

To solve these problems, an in-situ observation of the Jovian magnetosphere is needed. To realize the installation of the radio wave receiver onboard in future Jovian mission, we are now developing a receiver with ultra light weight and low electric power consumption.

The receiver has a capability of down conversion from RF signal (1kHz˜40MHz) to low frequency signal (below 10kHz) using ISL5416 digital down converter IC. RF frequency is set to observe the Jovian radio emission frequency range. On the other hand, parameters of down converter are tunable depending on the telemeter transmission rate from the spacecraft. Since ISL5416 device has 4channel digital down converters and filters, we are planning to use 2 tips to measure 5 components of electro-magnetic fields, that make it possible to identify the direction of Jovian radio emission from the spacecraft.

The function of the down conversion from 24MHz RF signal to below 10kHz by using ISL5416 evaluation board has been confirmed. We are now planning to make observation of Solar, Jovian, and Galactic radio emissions at Iitate observatory of Tohoku University for the purpose of testing S/N sensitivity and performance of receiver. 14Bit A/D converter of 80MSPS AD9245 is used for the present test. The previous laboratory works has confirmed that 13dB of additional is enough to receive Galactic radio noise.

After this basic development test, we will make a breadboard model, which is possible to apply to the observation of solar, Jovian, Galactic radio emission from the ground.