

Development of transmitter and antenna on board of sounding rocket for the TEC measurement

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A sounding rocket experiment is planned by JAXA in 2021/2022 period for the study of medium-scale traveling ionospheric disturbance (MS-TID). By transmitting two radio beacon with a frequency ratio of 3 : 8 from the rocket and measuring the phase difference between the two signals on the ground, the total electron content (TEC) on the radio wave path from the rocket to the ground can be measured. To realize this observation, we are now developing the observation equipment onboard of this rocket. The instruments are a dual-band beacon transmitter of 150MHz and 400MHz and a set of antennas that are installed on the rocket skin. The transmitter needs to output two phase-coherent radio waves at the same time. As the signal source, we selected Si5338 which is a high-performance, low-jitter clock generator capable of synthesizing at most four signals with different frequencies. The antenna system consists of four elements that can transmit both frequencies. The elements must fit the harsh environment (high temperature, intense vibration, etc.) that is expected at the outside of the sounding rocket at launch. As we transmit a relatively low frequency of 150 MHz / 400 MHz signals, we selected the dual-band Planar Inverted-F Antenna (PIFA) that is useful to reduce the size of the antenna. Selection of high dielectric-constant material is another important issue for antenna-size reduction. This antenna is designed by using electromagnetic-field simulation software called CST. This software can be linked with other antenna design software. With this software, we tried to find the optimized antenna shape by simulating electromagnetic response of the antenna with variety of parameter settings. In the presentation, we report the current status of the transmitter and antenna for the sounding rocket experiment.