

S Band and UHF Band Communication Systems for Kanazawa-SAT3 Microsatellite

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Kanazawa University is developing the first Kanazawa University's microsatellite, named as Kanazawa-SAT3(Study and Training in Space and Technology for Kanazawa Cube-Satellite). Kanazawa University satellite's mission object is to identify the source of gravitational waves by detecting the occurrence time and arrival direction of X-rays and gamma rays observed simultaneously with gravitational waves.

In this research, we are developing communication system for Kanazawa University satellite. Kanazawa University satellite has three communication systems, S band communication, UHF band communication and Iridium communication. These systems are composed of each antennas and transceivers. We summarize S band communication system and UHF communication system in detail as the following.

About the S band communication system, Kanazawa University satellite are equipped with two types of antennas: S band patch antennas and S beacon antennas. On the satellite side, the S band patch antennas for both transmission and reception are mounted on the front panel and the rear panel of the satellite. The S beacon antennas are also mounted on the front panel and the rear panel of the satellite. On the ground station side, we use a parabolic antenna of 2.4 m in diameter at Kanazawa University. S band system is a main communication system between the satellite and the ground station, and plays a role of high speed data communication and beacon transmission. We tested transceivers to be mounted on the satellite and communicator for the ground station by wired connection. And we developed satellite tracking system for the S band antenna. We evaluated the tracking system by performing tracking experiments for a satellite which passes over Kanazawa and receiving the S band signal. As a result of tracking experiments using the satellite tracking system, we confirmed that we could continuously receive signals from the satellite. As future work, we have to test communication system using the S band antenna. And also, it is necessary to develop the communication software for transceiver.

About the UHF communication system, Kanazawa University satellite are equipped with antennas we are developing. On the satellite side, the antennas are mounted for receiving and transmitting independently on the front panel and the rear panel of the satellite. On the ground station side, we use the Yagi antenna with 14 crossed elements at Kanazawa University. This system plays a role of transmitting commands from the ground station to the satellite and transmitting telemetry information from the satellite to the ground station. We adopt PIFA(planar inverted-F antenna) as UHF band antennas on the satellite. In this antenna, a dielectric is inserted into the gap between the patch plane and the ground plane to shorten the wavelength and miniaturization. This antenna body is made of aluminum, and the dielectric is made of polycarbonate. We measured the developed antenna and compared it with the simulation results to evaluate the characteristics. Also, like S band communication system, we developed satellite tracking system for the UHF band. As future work, we have to test transceiver to be mounted on the satellite and communicator for the ground station by wired connection. After that, we test communication system using the PIFA. Also, it is necessary to develop the communication software for transceiver.

Keywords: Microsatellite, Communications system, Kanazawa SAT3