

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

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### 1. Kanazawa University

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. In this paper, we summarize S band communication system and UHF communication system in detail as the following.

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. This system, Kanazawa University satellite is equipped with two types of antennas: S band patch antennas and S beacon antennas. On the satellite, 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 for transmission are also mounted on both panels of the satellite. At the ground station, we use a parabolic antenna of 2.4 m in diameter at Kanazawa University. Currently, we have evaluated the characteristics of S-band patch antennas and S beacon antennas by computer simulations and direct measurements. As future work, we have to test wireless communication system using the S band antenna. And also, it is necessary to develop the communication software for transceiver.

About the UHF communication system, it is planned to use about 400 MHz for uplink and 460 MHz for downlink. This system plays a role of transmitting commands from the ground to the satellite and transmitting telemetry information from the satellite to the ground station. On the satellite, the antennas are mounted for receiving and transmitting separately on the front panel and the rear panel of the satellite. We adopt PIFA(planar inverted-F antenna) as UHF band antennas on the satellite. In this antenna, a dielectric medium is inserted between the patch plane and the ground plane to shorten the wavelength to miniaturize the size of the antenna. The plane plates are made of copper, and the dielectric is made of polycarbonate. We have evaluated the characteristics of PIFA by computer simulations and direct measurements. At the ground station, we use a Yagi antenna with 13 crossed elements at Kanazawa University. We designed a BPF to be installed in a ground station and evaluated the characteristics. As future work, we test wireless communication system using the PIFA and the Yagi antenna. Also, it is necessary to develop the communication software for transceiver.

Keywords: Microsatellite, Communication System, Kanazawa SAT3