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PROTO-FLIGHT MODEL TEST RESULTS OF SYNTHETIC APERTURE RADAR FOR 100KG
CLASS SMALL SATELLITE**Abstract**

This paper presents the proto-flight model results of X band synthetic aperture radar for small satellites. The specifications of SAR performance are single polarization SAR with 3m ground resolution for strip map mode. 1 m ground resolution can be achieved with sliding spot light mode under condition of limited value of NESZ at 600km altitude orbit. A satellite has 130kg mass and the size is 0.7m x 0.8m x 0.9m on a rocket. A size of the deployed antenna is 4.9m x 0.7m.

An antenna consists of 7 panels, size of which is 70x70x0.6 cm. The waveguide is embedded at the center of the rear surface in order to feed RF to the antenna panel through coupling slots. The antenna panel consists of a dielectric honeycomb core and metal skins, which work as a parallel plate guide for RF. The front surface with two dimensional arrays of radiation slots works as an antenna radiator for vertical polarization SAR mode.

In order to make antenna instrumentation simpler, TX and RX instruments are in the satellite body. Therefore RF should be fed from the satellite body to each panel with equal electric length. We apply choke flanges of waveguides in order to realize RF feeding with non-contacting waveguide flanges. RF loss can be minimized by the choke connection even though there is a physical gap between two waveguide flanges.

Near field RF measurement of the full antenna configuration has been performed at A-Metlab Facility, Kyoto University. The aperture efficiency of 7-panel full configuration is about 70%.

The RF peak power is selected to 1000 W that is realized by GaN solid state amplifiers, instead of vacuum tube TWTAs. A chirped transmitting signal is amplified in a six GaN HEMT 200W amplifier modules to be combined in a waveguide resonator.

We have performed ground test of SAR observation with a dedicated target signal simulator. Proto-flight model of SAR-Electronics Unit (S-ELU) sends exciter signal with chirp modulation to RF front end (RFE) and High Power Amplifier (HPA). A dedicated target signal generator (TSG) generates echo signals from a single point target under assumption of stop and go model. We have confirmed 0.81m azimuthal resolution and 0.86m ground resolution at off-nadir angle 30deg with sliding spot light mode.

We will launch the first demonstration satellite in late 2019 as collaboration with a private company.