

IAF SPACE POWER SYMPOSIUM (C3)
Space Power System for Ambitious Missions (4)

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DEVELOPMENT OF 1KW HIGH POWER X-BAND SAR INSTALLED ON SMALL SATELLITE FOR
ON-DEMAND OBSERVATION**Abstract**

We are developing a X-band synthetic aperture radar (SAR) system that can be used for observations both night and day or whatever the weather installed on a small satellite. We propose an on-demand observation system for the disaster. In this paper, we describe a development of the engineering model (EM) and the prototype model (PM) of the high power system of this X-band SAR. Ground resolutions of the X-band SAR with a single polarization are 1m at 350 km altitude and 3-10m at 600km altitude. A satellite is supposed to be 130kg in mass and the size is 0.7m x 0.7m x 0.7m on a rocket. A size of the deployed antenna is 4.9m x 0.7m. All electronics instruments are installed in a satellite body. The high power system for this SRA system consists of 1kW pulsed amplifier that includes a power combiner with a waveguide resonator, a front-end and a filter. This amplifier adopted the state of art high power GaN HEMT devices. A chirped transmitting signal with frequencies of 9.5-9.8 GHz, with the duty of 25 We designed and manufactured 200 W amplifier modules as an EM adopting the GaN HEMT devices and a novel six input ports power combiner with the waveguide resonator. The output of 1 kW was generated by combining 6 outputs of the amplifier modules. We intend to cut costs by utilizing the commercial-off-the-shelf components. Also, one of the most significant problems was the thermal design of such high power components for the small satellite. We decided the operating temperature of the GaN HEMT device by failure rate prediction, and designed the amplifier modules and the structure panel in order to keep temperature below the operating temperature by heat storage capacity of the aluminum alloy structural panel. We measured the electrical performances under several temperature conditions and evaluated environmental resistance by the thermal vacuum test, the impact and vibration test and the radiation test. Also, we evaluated a tolerance against a discharge from the view point of the on-demand purposes.