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THE ELECTRICAL POWER SYSTEMS DESIGN AND THE PERFORMANCE ANALYSIS FOR THE SECOND KOREAN SAR SATELLITE

Abstract

The Korea Aerospace Research Institute(KARI) has launched the first Korean Synthetic Aperture Radar(SAR) satellite named as the KOrea Multi-Purpose SATellite-5(KOMPSAT-5) successfully in 2013 and has been operating normally in orbit since 2013. The KARI has been developing the next generation SAR satellite required for the national demand of high resolution images. The SAR satellite has the advantages that the imaging operation can be performed at any time of day or night and independent of cloud existence compared with the Electro Optical(EO) satellites, while the SAR satellite requires the high power capability during the imaging mission because of the radar operation with high power consumption. Thus, the robust electrical power systems design for the high power capability and the performance analysis for the system integrity are important during the design phase. This paper provides the results of the electrical power systems design and the performance analysis for the second Korean SAR satellite. The second Korean SAR satellite will orbit the Earth in a Sun-synchronous dawn-dusk orbit with 11 days repeat ground track period at mean altitude of 505 km. The satellite on the dawn-dusk orbit rides the terminator between day and night, so the solar panel can always see the Sun, without being shadowed by the Earth. This allows the satellite to be powered almost entirely by its solar panels except the short period of time in a year. The electrical power systems of the second Korean SAR satellite consist of the ZTJ type solar panels for the generation of spacecraft power, the Li-Ion battery for the storage of spacecraft energy, and the Power Control & Distribution Unit(PCDU) for the power control and distribution. The capability of the solar panel was decided as 2250 Watts at EOL and the capacity of the battery was determined as 90 Ah at BOL to satisfy the systems mission and power requirements. The main function of the PCDU is to provide the 100 Volts bus voltage, the heater power, the high level pulsed command, to distribute the power for the electronics units, and to protect the battery fault by the DNEL(Disconnect Non-Essential Load) and UV(Under Voltage) logic design. The electrical performance analysis was performed with the parameters based on the results of the electrical power systems design. The performance analysis results show that the designed electrical systems are fully able to meet the satellite mission and the power requirements.