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Author: Mr. Marcello Gambarara
Selex Galileo, Italy

Mr. Marco Cantamessa
Selex Galileo, Italy
Mr. Alberto Battisti
Selex Galileo, Italy

EARTHCARE CLOUD PROFILING RADAR HIGH POWER AMPLIFIER

Abstract

EarthCARE (Earth Clouds, Aerosols and Radiation Explorer) is the 6th Earth Explorer Core Mission of the European Space Agency and a joint undertaking with the Japan Aerospace Exploration Agency (JAXA). It will study and analyze the interaction and impact of clouds and aerosols on the Earth's radiative budget.

The satellite will fly a sun-synchronous orbit 450 km above the ground. Satellite launch is scheduled for 2013 whilst mission duration is 3 years. Along with other instruments the satellite payload will include a 94 GHz Cloud Profiling Radar (CPR) with Doppler capability. The CPR will transmit 1500W peak at 94.05 GHz with a pulse width of 3.3 μs and repetition frequency of approximately 7.5 kHz. Strict phase stability is required to enable Doppler functions.

To address these and many other requirements a High Power Amplifier (HPA) was developed. The HPA comprises of a High Voltage Electronic Power Conditioner (EPC) provided by SELEX Galileo (SG) and a High Power Extended Interaction Klystron (EIK) provided by CPI. SG are responsible of the delivery of the complete High Power Amplifier performing the HPA integration and testing. One EQM and two FMs will be provided for the mission.

The paper presents the main characteristics and the technology related to the main components of the HPA:

EPC

It has been developed by SG, that have a great experience in this field since mid 1970s, having produced EPCs for several space programs for scientific missions, earth observation and telecommunication. The EPC, whose function is to supply high voltages to the EIK, presents several very challenging characteristics/performances; the most important are:

• -17 kV High Voltage Supply for EIK Cathode Electrode

• Focus Electrode Modulator that provides pulsed voltage to the EIK grid, generating 3.3 μs beam current pulses. This voltage shall rise from –3000 to –40 V, w.r.t. cathode, in less than 100 ns

• Efficiency higher than 85%

EIK

The Extended Interaction Klystron is a multi-cavity vacuum electronic amplifier, which provides enhanced power, bandwidth and efficiency at millimeter frequencies. CPI Canada previously developed and qualified the EIK for its first use in space on NASA's CloudSat mission that has been in operation since June 2006. The EIK specification is similar to CloudSat except, the EarthCARE mission requires longer operational life, enhanced duty cycle and improved structural performance to survive more stringent launch environments. The expected lifetime of the EarthCARE EIK is 35,000-40,000 hours.