Development status of EarthCARE Cloud Profiling Radar

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EarthCARE (Earth Clouds, Aerosols and Radiation Explorer) is a satellite mission to observe clouds and aerosols with active and passive sensors for researching cloud and aerosol’s role to earth radiation transfer. It is cooperation mission between Europe and Japan. W-band Cloud Profiling Radar (CPR) for EarthCARE has been developed by Japanese Aerospace Exploration Agency (JAXA) and National Institute of Information and Communications Technology (NICT) taking advantage of legacy of TRMM/PR and GPM/DPR development. European Space Agency (ESA) has been developed Atmospheric Lidar (ATLID), Multi Spectral Imager (MSI), Broad Band Radiometer (BBR), and satellite bus. EarthCARE/CPR is important sensor for EarthCARE mission because it can measure the vertical profile of cloud, which is sometimes difficult to observe using optical sensor only. EarthCARE/CPR is similar radar to CloudSat/CPR. It adopts the same radio frequency of 94 GHz. Extended Interaction Klystron (EIK) is used for high power amplifier and transmitting power is around 1.5 kW. However, EarthCARE/CPR adopts deployment antenna and its size is larger than CloudSat/CPR. Since the EarthCARE satellite orbit is lower than CloudSat/CPR, EarthCARE/CPR’s radar sensitivity will be more than 6 dB better than CloudSat/CPR. Unique feature of EarthCARE/CPR is Doppler velocity measurement using pulse-pair method. In order to get good accuracy of Doppler velocity measurement, the pulse repetition frequency (PRF) of EarthCARE/CPR is much higher than CloudSat/CPR and the duty ratio of transmitting is also higher. Since Doppler measurement from a space-borne radar is the first attempt, so various considerations are needed for getting good Doppler measurement, such as fine beam pointing control and knowledge, small distortion of antenna, good phase stability of transmitter and receiver, etc.

Once, flight model of EarthCARE/CPR were assembled and various flight tests started, such as mechanical test, electrical test, thermal vacuum test, and so on. Unfortunately, malfunction of high voltage power supply for EIK was found in redundant side and it is still repairing until now. We are hoping to complete the CPR as soon as possible and to realize the EarthCARE mission in orbit.

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