

# The Preliminary Result of External Calibration for the Precipitation Measurement Radar onboard FengYun-3G Satellite

The FengYun-3G (FY-3G) satellite was launched on 16 April 2023. The nominal orbital altitude of the FY-3G satellite is 407 km, and the nominal orbital inclination is 50°. As the core instrument of the FY-3G satellite, Precipitation Measurement Radar (PMR) can provide the three-dimensional structure of typhoon, rainstorm, snowstorm and other precipitation, and retrieve accurate precipitation intensity, precipitation type and other information. PMR is a dual-frequency phased array radar, which is composed of a Ku-band radar and a Ka-band radar. Compared to the Tropical Rainfall Measuring Mission (TRMM) Precipitation Radar (PR) and Global Precipitation Measurement (GPM) mission Dual-frequency Precipitation Radar (DPR), PMR has wider observation swath and lower antenna peak sidelobe level. Another difference is that the two frequency-band radars of the PMR always observe same area synchronously.

Calibration of the PMR in orbit consists of internal and external calibrations. The internal calibration is carried out one time every 15 orbits to monitor the in-orbit status of the PMR. Since the internal calibration can't obtain information of the parameter changes of the whole radar, the external calibration is designed to calibrate the PMR absolutely. A radar active calibrator (ARC) is deployed under the satellite track during the external calibration. The angle between the radar boresight and the line from the radar to the ARC is constantly changing during the satellite moving, so the radar antenna pattern can be measured.

More than 30 external calibration experiments were conducted in the last 2 years. These experiments showed that, the PMR transmitting beamwidth and receiving beamwidth in both frequency bands on orbit changed by less than 3% compared to the ground test results. The maximum difference in transmitted/received beam direction between two bands is less than 0.02 degrees. Therefore, it can be concluded that the PMR's performance is very stable since its entry into orbit.