

# 太空天氣與福爾摩沙衛星七號星系商用 GPS 接收器之單事件效應

## The space weather and single event effect on commercial off-the-shelf bus GPS receivers onboard FORMOSAT-7/COSMIC-2 constellation

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### Abstract

The FORMOSAT-7/COSMIC-2 (F7/C2) is a six-satellite constellation with onboard commercial off-the-shelf bus global positioning system receivers (bus GPSR), providing positioning, navigation, and time functions. The bus GPSR, however, often generates the “GPS receiver warm start request (WSR)” to onboard computer logs. There are more than 7,000 WSRs recorded in 3 years after launching. The massive messages catch our attention, but they only happen on this component. According to the user manual provided by the manufactory, the WSR occurs when the data inside the memory is inverted, which could be further interpreted as the single event effect (SEE). The SEEs result from radiations and energetic particles in the space environment, which may sometimes lead to the failure of the mission. By means of the orbital transfer from 720 km to 550 km altitude of F7/C2, it gives a great opportunity to investigate the SEE/WSR at different altitudes through one constellation in low-Earth orbit. Moreover, investigations of cumulative rate, distribution of WSRs, and their relationships with the geomagnetic field and space weather are also discussed. The high-probability warning area for SEE is also reported based on the geomagnetic field, with corresponding strength around 21,200/20,550 nT at both orbits, which can be regarded as the border of the South Atlantic Anomaly area. Furthermore, the weighting center and drift of this area in the longitudinal direction are simultaneously interpreted.

Key words: FORMOSAT-7/COSMIC-2 (F7/C2), Single Event Effect (SEE), Warm Start Request (WSR), South Atlantic Anomaly (SAA), Commercial off-the-shelf (COTS)

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