Abstract: Chlorophyll molecules in their triplet excited state can react with the ground state oxygen, producing oxygen in a singlet excited state, which is very reactive and thus very harmful to the light-harvesting complex. Photosynthetic organisms employ carotenoids to prevent the damage by quenching both excited (singlet) states of oxygen and excited triplet states of chlorophyll. In this work, we use ns transient absorption spectroscopy and global analysis to study the dynamics of carotenoid and chlorophyll triplet states in two light-harvesting complexes of *Amphidinium carterae*, the Peridinin-Chlorophyll *a*-Protein complex (PCP) and the main light-harvesting complex (LHCP). It appears that at room temperature all triplets are transferred from chlorophylls to carotenoids within ~ 5 ns, providing a very efficient protection against formation of singlet oxygen. One carotenoid triplet with a lifetime of ~ 10.2 μs participating in the chlorophyll triplet quenching was observed in the PCP sample, while results from LHCP suggest that two carotenoid triplets with a similar lifetime of ~ 2.5 μs contribute to quenching of chlorophyll triplet states. The two carotenoid triplets are attributed to peridinin placed in a polar environment and peridinin placed in a non-polar environment in the LHCP complex.