Airborne thermal hyperspectral data delivers valuable information about the temperature and emissivity of the Earth’s surface. However, attempting to derive temperature and emissivity from remotely sensed thermal radiation results in an underdetermined system of equations. Several approaches have been suggested to overcome this problem, but the most widespread one is called the Temperature and Emissivity Separation (TES) algorithm. This work focuses on two major topics: 1) improving the TES algorithm and 2) implementing it in a processing chain of image data acquired from the TASI sensor. The improvement of the TES algorithm is achieved by replacing the Normalized Emissivity Module with a new module, which is based on smoothing of spectral radiance signatures. The improved TES algorithm is called Optimized Smoothing for Temperature Emissivity Separation (OSTES). The OSTES algorithm is appended to a pre-processing chain of image data acquired from the TASI sensor. The testing of OSTES with simulated data shows that OSTES produces more accurate and precise temperature and emissivity retrievals. OSTES was further applied on ASTER standard products and on TASI image data. In both cases is not possible to observe significant improvement of the OSTES algorithm due to imperfect atmospheric corrections. However, the OSTES emissivitites are smoother than emissivities delivered as ASTER standard product over homogeneous surfaces.