

Abstract: Detecting Removal of the Authenticatable Container Tracking System (ACTS) from a Container or Conveyance

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The Authenticatable Container Tracking System (ACTS) is an extensible, secure container tag that can be used to optimize chain-of-custody monitoring for packaged nuclear materials as they are being stored, processed, and transported. Based on the ultra-low-power TI MSP430 mixed-signal microcontroller, ACTS is an active device that uses an almost-universal core platform that can be appropriately configured with expansion modules to provide the application specific data acquisition, data logging, container sealing, and communications functions needed for 21st century material accountancy, monitoring, and tracking applications. This core architecture enables appropriately designed modules to be easily interfaced with the basic system, thus providing an integration path for current and new technologies. ACTS contains a built-in set of sensors and supports an expansion bus for up to six additional communications, tracking, authentication, encryption, sealing, location, or sensing modules that may enhance the monitoring and tracking of particular containers for specific applications. ACTS uses an anomaly detection approach common to machine learning, as well as data from an internal three-axis magnetometer to determine if the tag has been removed from a metal container. The approach discussed here uses principal component analysis to reduce the dimensionality of the magnetometer data before applying a T^2 statistic to monitor for anomalies, but in principle, any anomaly detection approach that can be coded in C or C++ for an MSP430 can be used. This approach is covered by US Patent No. 10,147,289B2 as of December 4, 2018.