

ONCORE™ Software Enhancements for Timing Applications

This preliminary report summarizes the operational features of Motorola's new software enhancements designed to provide additional support to GPS customers with timing applications. These enhancements add a layer of integrity to the GPS timing solution through the use of a Receiver Autonomous Integrity Monitoring (RAIM) Algorithm. In addition, the enhancements provide increased functionality to the GPS receiver for higher accuracy timing markets.

Background - One limitation of the GPS system is that it can take up to 40 minutes to remove a failed satellite from service. During this period, the failed satellite may broadcast data that causes the GPS time and position solutions to be corrupted. Motorola has developed a class of algorithms that exploit redundancy in the GPS measurements in order to detect and isolate faulty satellites; a derivative algorithm called TIME RAIM (T-RAIM) has been developed by Motorola and is being applied to 1PPS timing solutions. Previous firmware versions made the 1PPS output pulse available all the time, and the user had to interpret the output message stream to determine when it was valid.

Based upon an operator-specified timing alarm, the T-RAIM algorithm will maintain the 1PPS accuracy to the specified level or inform the user when it is no longer possible to do so. Satellites which have failed are automatically detected by the algorithm and removed from the solution. In addition to this protection from satellite anomalies, the user is provided with an accuracy estimate for the 1PPS pulse. The following new features have been added to the Motorola ONCORE™ GPS Receiver 1PPS option with the T-RAIM algorithm, including the control parameters needed to use them. The features are implemented in all 6-channel and 8-channel ONCORE™ products.

Features - New ONCORE™ I/O messages accommodate the T-RAIM function described above as well as other features requested by our time customers. These include:

- a) 3 new options for 1PPS Output: - ONCORE™ receivers can generate the pulse...
 - i) All the time;
 - ii) Only when tracking at least 1 satellite; or
 - iii) Only when the time solution is confirmed by the T-RAIM algorithm.
- b) Negative Sawtooth Residual Output: - A 9.5MHz clock is used to generate the 1PPS signal inside the receiver. The underlying noise due to the granularity of this clock is deterministic on every 1PPS pulse. Motorola's receiver's internal software computes the residual and outputs the value on the serial port.
- c) Timing Accuracy Quality Measure - The new T-RAIM software outputs an estimate of the overall accuracy of the time solution in nanoseconds (1 sigma error value). Additional synchronization options, accuracy enhancements and alarms are planned.

User Controllable Inputs - Various alarms and toggles can be set by the user to make automated use of Motorola's T-RAIM features.

User Observable Outputs - ONCORE™ message outputs provide indications of T-RAIM status according to user-selected alarm limits and satellite constellation geometry, as well as accuracy estimates and negative sawtooth residual offset values.

For configuration assistance, order placement and technical support call:

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