

November 5, 2004

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Sgt. M<sup>c</sup>Nall,

The Ontario Provincial Police asked Decatur Electronics whether a tuning fork test was necessary to test our products. Before directly answering the question it will be helpful to review the history of the tuning fork test and defining exactly what the tuning fork test actually tests.

The use of a tuning fork to test law enforcement radar is almost as old as the use of law enforcement radar itself. Early radars had primitive electronics that caused the radar's accuracy to change significantly over temperature and time. The operator had to calibrate the radar using tuning forks before use to ensure that it was suitable for enforcement purposes. As the state of the art advanced, the need for the operator to calibrate the radar was eliminated. Many departments, both locally and abroad, continued using tuning forks as an independent means of speed verification because the tuning fork test remained familiar, quick, convenient and low-cost.

The accuracy of a law enforcement Doppler radar is dependent on two parameters. First the radar assumes that it is transmitting at or very close to its design frequency. Any error in transmitter frequency directly affects speed measurement accuracy. Second is the accuracy of the electronic circuitry that measures the Doppler shift from a moving object. The tuning fork test verifies that the radar can measure the Doppler shift accurately but does not test the transmitter frequency at all.

All radars manufactured by Decatur Electronics since the mid 1980s have included independent timebase circuitry that verifies that the radar can measure Doppler shifts accurately. The timebase circuitry uses a precision high-frequency crystal oscillator that is further divided down to form a test signal. The radar processes this test signal and compares it to the expected result. The advantage of this internal timebase is that it is easily 100 times more accurate



than a signal from a tuning fork. For a Genesis I series radar this circuitry is active when the device is first turned on, after the locked button is pressed and when the operator initiates a self-test. In the Genesis II and GVP series of radar this test is performed continuously many times a second. Should one of our radars detect an error, it automatically displays an error code and suspends all speed measurement activity.

Another method of independent speed verification is for the operator to correlate the reading of the radar to the vehicle's speedometer. This test is superior to the tuning fork test since it does verify accuracy of the entire radar as a system – that is, the operator can directly see any errors from both parameters combined.

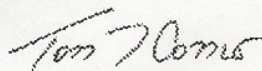
It is important for public confidence reasons that the radar be routinely and independently verified. In the US the testing requirements vary from state to state and department to department. The state of Michigan has used the speedometer verification test exclusively for many years. Dr. David Fisher of Michigan State University has been intimately involved in the radar testing programs in Michigan and can provide you with his testing experiences. He can be reached via e-mail at [fisher@egr.msu.edu](mailto:fisher@egr.msu.edu) or at 517-355-5341.

Decatur Electronics position is that a tuning fork is unnecessary to test any of its products, new or already in the field, because the radar's internal timebase circuitry independently verifies the accuracy of the speed measurement circuitry automatically and more precisely than a tuning fork. Decatur Electronics does provide tuning forks to any customers who request them. While there is no advantage in performing a tuning fork test there is no harm done either. Decatur Electronics also endorses the speedometer test as the best in-field test to ensure that the radar's accuracy is suitable for traffic safety use.

Decatur Electronics has recently revised its operator manual for the Canadian market. Significant changes include a maple leaf watermark on each page, inclusion of Canadian case law, and elimination of specifications in Imperial units. Additional emphasis was added to the speedometer test section and the section on the tuning fork test was deleted. Since you will likely need to familiarize your officers with the new manual, I recommend that it be deployed when the training is complete.

Please feel free to contact me if you have additional questions.

Cordially,



Todd Cottle  
Staff Advisor, Technology





Certified ISO 9001  
GSA Contract GS-07F-0231L

To: Whom It May Concern

From: Kevin M. Morrison  
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Public Safety Product Specialist

Subject: Radar Accuracy – Background

Within the concept discussed on the accuracy of radar there may be a need for some additional background. To that end, I wish to offer the following;

In any court the standard attacks on a scientific device used to aid law enforcement will be to attack the scientific principle first, then to attack the device itself, and finally to attack the user. Isolating the device attack, the question is whether or not the device reports information accurately. With radar devices designed to report the speed of a moving vehicle, the court will want to know if the reported speed matches the actual speed. To understand what the radar is reporting one must define the acceptable accuracy.

Radars can be made to read in different levels of precision, as evident with fluid velocity radar that may read in centimeters of accuracy. Motor vehicles in Canada, as in many other countries relate their speeds in kilometers over a period of an hour. But radars are very fast measuring as much as 100 times each second. The standard is a measurement of 1 kilometer per hour.

Due to the speed at which radars reads motion, the reported speed is a decimal number. Decimal numbers such as 90.762 are used in situations which call for more precision than whole numbers provide. In police traffic radar, the radar is designed to report speeds as whole numbers only. But in the processor, the decimal number may exist. In mathematics any number ending in a decimal of 5 or greater is rounded up. To prevent this from happening, the radar truncates the decimal, allowing only the whole number to show.

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From inception to the time when digital technology took over (about 1972), radar needed to be checked by a tuning fork. The problem was that tuning forks could have an amount of drift in its assigned frequency due to environmental conditions. Because of this, a range of tolerance – one to two km/hr – was allowed in this testing. This was not due to radar inaccuracy, but due to the tuning fork. This tolerance made its way into radar operation manuals and was carried that way for years in one form or another.

In 2008 the question of these tolerances was raised at Decatur Electronics, Inc, and we viewed that the tuning fork test is not the most precise method of determining the radar readout. The result was the decision to state that the radar manufactured by Decatur Electronics, Inc is a highly precise instrument. Because of the effect of truncation these radars read in whole numbers. The resulting readout is accurate to within 1 unit of measure.

A speed reading on Decatur Electronics, Inc radar will read the nearest lower whole number regardless of the decimal value. For example, ninety kilometers per hours is read, even if the resulting speed is determined by the radar to be anywhere from 90.0 to 90.9 km/hr.

To determine the accuracy of the radar, the self test will generate a tone, at a frequency to give a specific whole number reading. A readout that gives any other number is considered to fail the test. To determine if the radar can read a signal from an external source it is recommended that the operator conduct a road test before and after enforcement activity. By driving the patrol vehicle with the radar at a steady speed and observing the radar readout the operator can confirm the correlation between the patrol vehicle speedometer and the patrol speed displayed on the radar. Accuracy is already confirmed with the internal test; however the police car should have a certified speedometer as a double check. Remember in this test the objective is to verify reception of external signals. Any difference that may be observed is an outcome of the speedometer and not an indication of radar inaccuracy.



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Radars are accurate to within one unit of measure, based on the unit of measure being used (km/hr, mph, fps, etc.). From 12/22/2008 our manuals reflect this level of accuracy.

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