Commonwealth of Virginia
Department of General Services
Division of Consolidated Laboratory Services
Richmond, Virginia

Protocol for the Certification of Laboratories Performing Certification of Tuning Forks

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I. PURPOSE

The Department of General Services (DGS) Division of Consolidated Laboratory Services (DCLS) administers the program for the certification of laboratories performing tuning fork certification testing on behalf of DGS Division of Purchases & Supply which has statutory authority for the specification of traffic speed detection devices used by Virginia Police Chiefs, Sheriffs, and law enforcement authorities. The purpose of this certification program is to ensure that laboratories certifying tuning forks used for the calibration of traffic radar develop and maintain the necessary quality systems and procedures to produce legally defensible data.

The purpose of this protocol is to prescribe certification criteria for stationary and mobile laboratories performing tuning fork certification testing under the Code of Virginia Sections 2.2-1112 and 46.2-882.

II. SCOPE

The requirements of the program are applicable to all commercial and non-commercial laboratories and/or radio shops (hereafter, “laboratories”) that certify tuning forks employed by law enforcement personnel to calibrate traffic speed detection devices used for the enforcement of speed limits.

Tuning forks must be certified at least once every six months. Certification may be performed by a laboratory certified by the Division of Consolidated Laboratory Services (DCLS) to evaluate and certify tuning forks used for testing the accuracy of radar equipment used in the Commonwealth of Virginia according to the Code of Virginia Section 46.2-882 and the International Association of Chiefs of Police [IACP] standards. Specifically, DCLS evaluates tuning fork certification

laboratories to ensure testing and certification of tuning forks is performed in accordance with Section 1221.71 of the National Highway Traffic Safety Administration (NHTSA) document "Model Minimum Performance Specifications for Police Traffic Radar and Lidar Devices" [NHTSA DOT HS 808-069, hereafter NHTSA Model Minimum Performance or NHTSA MMP]. An additional NHTSA document, "Speed Measuring Device Performance Specifications: Across-the-Road Radar Module" [NHTSA DOT HS 810-845] also provides a comparable description of the tuning fork calibration procedure. Tuning forks may also be returned to the manufacturer for certification.

Stationary and mobile tuning fork laboratories operating in Virginia must be certified by DCLS through a process requiring an on-site evaluation of the facility at least once every three years. Mobile operations are considered separate stand-alone laboratories and are subject to separate inspections.

This document describes the DCLS protocols for the utilization of on-site laboratory assessments to certify, continue certification, and recertify those laboratories performing tuning fork certification testing in Virginia.

III. DEFINITIONS

"Tuning Fork" means a mechanical self-resonant device, which when excited, produces free oscillations that may be used to generate a pseudo Doppler frequency reference when placed in the radar antenna beam. [NHTSA MMP §1221.4]

"Standard Test Conditions" means the ambient temperature shall be between 20°C (68°F) and 30°C (86°F) and the relative humidity shall be between 10 and 85 percent. [NHTSA MMP §1221.31]

"Nominal value" means the numerical value of a device characteristic as specified by the manufacturer. [NHTSA MMP §1221.4]

Nominal Ka microwave frequencies by manufacturer:

1) Decatur / KSI: 35.5 GHz
2) MPH: 33.8 GHz
3) Stalker: 34.7 GHz

"K-band radar" means a speed measuring radar device designed to operate in the 24 050 to 24 250 MHz frequency band. [NHTSA MMP §1221.4]

"Ka-band radar" means a speed measuring radar device designed to operate in the 33 400 to 36 000 MHz frequency band. [NHTSA MMP §1221.4]

"X-band radar" means a speed measuring radar device designed to operate in the frequency band of 10 500 to 10 550 MHz. [NHTSA MMP §1221.4]

"Type I radar device" means a radar device that transmits microwave energy in the 10 500 to 10 550 MHz frequency band (in the X-band) and operates only in the stationary mode. [NHTSA MMP §1221.4]

"Type II radar device" means a radar device that transmits microwave energy in the 10 500 to 10 550 MHz frequency band (in the X-band) and operates in both the stationary and moving modes. [NHTSA MMP §1221.4]

"Type III radar device" means a radar device that transmits microwave energy in the 24 050 to 24 250 MHz frequency band (in the K-band) and operates only in the stationary mode. [NHTSA MMP §1221.4]

"Type IV radar device" means a radar device that transmits microwave energy in the 24 050 to 24 250 MHz frequency band (in the K-band) and operates in both the stationary and moving modes. [NHTSA MMP §1221.4]

"Type V radar device" means a radar device that transmits microwave energy in the 33 400 to 36 000 MHz frequency band (in the Ka-band) and operates only in the stationary mode. [NHTSA MMP §1221.4]

"Type VI radar device" means a radar device that transmits microwave energy in the 33 400 to 36 000 MHz frequency band (in the Ka-band) and operates in both the stationary and moving modes. [NHTSA MMP §1221.4]

IV. BACKGROUND INFORMATION

A. The Virginia Department of General Services Division of Purchases and Supply (DPS) has authorized for use by law enforcement authorities in the Commonwealth of Virginia the current Conforming Product List (CPL) on the website of the International Association of Chiefs of Police (IACP). (http://www.theiacp.org/Radar-Lidar-Testing) Equipment on this list conforms to NHTSA's Model Minimum Performance document.

B. The NHTSA Model Minimum Performance document describes the expectation that each tuning fork will be accompanied by a calibration certificate including as a minimum the serial number of the tuning fork, the nominal design speed, a frequency calibration at 21˚C (70˚F), the microwave frequency band for which it is to be used (X, K, or Ka), the calibrated frequency and associated radar speed in mph or km/h, and any correction factor that must be applied to the 21˚C (70˚F) calibration speed when used at another temperature. [NHTSA MMP §1221.12 (b).]

C. The NHTSA Model Minimum Performance document describes the expectation that each tuning fork manufacturer shall permanently mark each tuning fork with a serial number, the radar frequency band that is to be used with (X, K, or

Ka), and a nominal stationary model radar speed specification including units (km/h or mph). Each Ka-band tuning fork shall also be permanently marked with the nominal microwave frequency of its radar device, or marked with a code representing the same. [NHTSA MMP §1221.13 (a)]

D. The use of the appropriate frequency calculation is the responsibility of the laboratory performing tuning fork certification.

E. Ka-band radar devices approved for use in the Commonwealth of Virginia may operate at 33.8 GHz, 34.7 GHz, or 35.5 GHz. Tuning fork certification laboratories should ensure either that all appropriate Ka-band reference tuning forks are available prior to performing certification testing, or define in the Quality Manual the scope of testing available to Virginia customers.

V. REQUIREMENTS FOR CERTIFICATION

A. Initial Application - Requests for certification shall be made to DCLS using the current application, Tuning Fork Laboratory Application for Certification (Qualtrax ID # 6958). DCLS will send an application to each requesting laboratory. The application may also be downloaded from the DCLS web site at http://dgs.virginia.gov/DCLS.

B. The laboratory must submit a Quality Manual with the completed application. At a minimum, the following information must be included or referenced in the Quality Manual:

1. Company name and address,

2. Statements affirming the laboratory's commitments to quality assurance and data integrity.

3. Minimum qualifications for personnel performing tuning fork calibrations, including education and any specialized training in communications electronics, radar calibration and repair, or frequency measurement.

4. Log of printed names, handwritten initials and signatures of all laboratory personnel authorized to perform tuning fork testing, data review, and/or certificate notarization.

5. List of all testing equipment by manufacturer, model number, and serial number used in the certification procedure.

6. Information describing the accuracy, range, and reproducibility for each instrument and item of support equipment used for the testing and certification of tuning forks. An excerpt from the instrument manual with

this information will satisfy this requirement.

7. Corrective Action Policy for response when instrumentation fails to meet fitness for use acceptance criteria.

8. Schedules for instrument calibration and maintenance including requirements for documentation of calibration and maintenance.

9. Description of circumstances that would require recertification of reference tuning forks, such as in the event that trauma or damage to the fork is observed, or when the reference fork evaluation criteria cannot be met or demonstrates a trend of change in performance.

10. Description of processes and procedures for ensuring traceability of measurements to nationally recognized standards.

    This description may include the calibration tone source by name, address, and telephone number or other means of documenting traceability.

    Processes and procedures may include daily evaluation of equipment against a standard signal from WWV but are not limited to that mode, provided that traceability of measurements can be otherwise demonstrated to the satisfaction of DCLS. [WWV is the call sign of the National Institute of Standards and Technology (NIST) radio station located in Fort Collins, Colorado. The station operates in the high frequency (HF, also known as shortwave) portion of the radio spectrum and broadcasts time and frequency information 24 hours per day, 7 days per week.]

11. Description of procedures being performed, equipment being used, calculations, and examples, adjustments (if any), and references. This information may be included in the Quality Manual or may be a separate Standard Operating Procedure (SOP). At a minimum, the information shall include the following:
    a. Sample receiving and tracking procedures;
    b. Sample Rejection Policy describing the circumstances under which a tuning fork would not be accepted for testing.
    c. Procedures for labeling and disposition of tuning forks that are rejected before testing.
    d. Step-by-step instruction for instrument setup, instrument fitness for use testing and documentation and acceptance criteria;
        Note: The instruction for instrument fitness for use testing will be evaluated to be in accordance with the tuning fork calibration test procedure [NHTSA MMP §1221.71] to include striking the tuning fork on a nonmetallic object and waiting for a stable output

(approximately 3 seconds) before recording the observed frequency.

e. The procedure and criteria for testing tuning forks submitted by law enforcement agencies for certification and documenting test results, to include:
   i. reference tuning forks tested prior to beginning testing and at the conclusion of each day on which testing occurred;
   ii. at a minimum, the frequency of oscillation of each reference tuning fork shall be within ±0.5% of that specified by the manufacturer or the most recent independent certification [NHTSA MMP §1221.14];
   iii. temperature of the test environment recorded prior to testing each sample set and at the end of the sample set;
   iv. temperature of the test environment not less than 20° C and not greater than 30° C; [see NOTE below]
   v. a minimum of 2 frequency observations recorded and averaged for the calculation of MPH (miles per hour);
   vi. a description of calculations used, with sufficient detail to ensure the report produced by the analyst can be verified by reconstructing the calculation

      Operating frequencies and calculations:
      K band: 24,050 MHz:
      K band speed, mph = Average observed frequency (Hz) / 72.0301

      Ka band: 33,400 MHz to 36,000 MHz
      Ka band speed, mph = Average observed frequency (Hz) / (2.983135 x nominal microwave frequency, GHz) [NHTSA MMP §1221.71]

      [NOTE: mph x 1.609344 = kph]

      Nominal Ka Microwave frequencies by manufacturer:
      Decatur / KSI: 35.5 GHz
      MPH: 33.8 GHz
      Stalker: 34.7 GHz

   vii. each page of test documentation dated and initialed by the analyst.

   NOTE: "Standard Test Conditions" as defined by NHTSA MMP §1221.31 includes specification of both temperature (between 20°C and 30°C) and relative humidity (RH) (between 10% and 85%). Indoor, air-conditioned or heated laboratory environments which meet the required temperature range generally address humidity extremes that would exceed the range specified. A laboratory should consider monitoring humidity at the testing site if the possibility of exceeding the specified range is suspected.

f. Processes for reviewing and reporting test data and calculations, to

include:
   i. data review documented with date and initials of reviewer;
   ii. final reports notarized;
g. Processes for customer notification as well as labeling and disposition of tuning forks that fail the certification testing.

12. A training procedure that clearly describes the complete training process and supporting documentation. Elements of such a procedure shall include:
   a. Training Goal - a concise statement identifying the overall training goal and results expected.
   b. Learning Objectives - a clear statement of the capabilities expected of the technician upon completion of the training.
   c. Learning Methods and/or Activities - specific actions facilitating the achievement of the learning objectives.
   d. Documentation - evidence, with signatures and dates, that the learning activities were performed and evaluated.
   e. Criteria - specific measures and criteria indicating the effectiveness of the training.
   f. Evaluation - an assessment of the documentation against the criteria to determine whether the learning objectives were achieved, or whether additional training may be necessary.

13. A Demonstration of Capability (DOC) procedure that outlines a procedure for establishing technician competence in testing and establishes acceptance criteria for the evaluation of analyst capability.
   a. Each technician employed by a commercial facility shall perform a demonstration of capability as follows:
      i. Perform a minimum of 20 consecutive frequency observations of each reference tuning fork.
      ii. Calculate the mean and standard deviation of each data set.
   b. At a minimum, the frequency of oscillation of each reference tuning fork shall be within ±0.5% of that specified by the manufacturer or the most recent independent certification.

14. Recordkeeping Policies and Practices
   a. Record Retention Policy
      i. Maintenance logs retained for a minimum of three years;
      ii. Calibration records retained for a minimum of three years;
      iii. Sample observation records retained for a minimum of three years;
      iv. Training records and Demonstrations of Capability retained for a minimum of three years.
   b. Documentation practices
      i. All handwritten data shall be recorded in ink;

ii. Changes to laboratory records shall be made with a single strike-out line leaving the original entry visible;
iii. Changes shall be documented with date and initials of person making the correction.

c. Electronic Records
The laboratory shall describe procedures for ensuring the security and integrity of electronic records.

15. A sample copy of a certificate issued to customers as it relates to tuning fork certification, which shall include the following information:
a. Serial number or other unique identifier of the tuning fork;
b. The frequency at which the tuning fork was found to oscillate and the corresponding MPH (miles per hour);
c. The designation of the radar frequency band within which the tuning fork is to be used;
d. Date of certification testing;
e. Signature of the analyst who performed the testing;
f. Date, seal and signature of notarization;
g. Any additional information required by the court system(s) of the jurisdictions in which the laboratory's clients are located.

16. Change sheet to allow historic reconstruction of changes to the Quality Manual.

17. Annual Review and signature sheet.

C. Fee

1. For the purpose of laboratory certification, separate applications and fees are required for each mobile laboratory as well as each stationary laboratory.

2. The application fee of three hundred twenty dollars ($320.00), payable to the Treasurer of Virginia, must accompany each application and is non-refundable and not pro-rated. The application fee is subject to change.

3. A certification renewal fee of three hundred twenty dollars ($320.00) is payable annually for each mobile laboratory and each stationary laboratory. The annual fee is payable upon receipt of the invoice.
a. The annual renewal fee is subject to change if needed to cover program costs.
b. In addition to annual renewal fees, a tuning fork laboratory located outside of Virginia will be responsible for reasonable travel costs associated with conducting an on-site assessment of the laboratory. Reasonable travel costs include assessor labor for time spent in travel and costs associated with transportation, lodging, and per diem.

c. All Tuning Fork Laboratory Certificates will expire September 30 of each year. New certificates will not be issued unless payment has been received.

D. The completed application, including the Quality Manual and applicable fee payable to the Treasurer of Virginia, may be mailed to

Laboratory Certification Group
Division of Consolidated Laboratory Services
600 North 5th Street
Richmond, VA 23219

The application form and Quality Manual may also be submitted electronically to lab_cert@dgs.virginia.gov.

E. Application Review

1. Electronically submitted documents and/or hard copy application submissions will be collected for review by the Certification Officer.

2. After all necessary documents have been received, the completed application packet and the Quality Manual will be reviewed by the DCLS Certification Officer within 60 days.

3. Based on the review of the application, one of the following responses will be initiated within 60 days of application receipt:
   a. The laboratory will be contacted by telephone or e-mail to schedule the on-site inspection and complete the certification process.
   b. The laboratory will be contacted by telephone or e-mail to correct minor problems or obtain clarification. Changes in the application agreed upon by the laboratory will be dated and initialed. Minor changes may be submitted by fax or e-mail during the review process.
   c. The submitting laboratory will receive a letter or email identifying the additional information and/or corrections that are required. Additions and/or corrections must be submitted to DCLS within 60 days to complete the application.
4. Failure to complete the application within the specified time will delay the review process and may result in denial of certification.

VI. ON-SITE INSPECTION AND REPORT

A. Initial On-Site Inspection

1. Upon arrival at the facility, the Certification Officer will conduct an Opening Conference with the responsible laboratory official(s) or his/her designee. The laboratory official(s) may invite additional staff members to attend.

2. The laboratory operations, quality system, equipment, personnel, standard operating procedures and record keeping practices will be inspected in accordance with Tuning Fork Laboratory Inspection Checklist (Qualtrax ID # 6954). The checklist can be accessed on the DCLS website at www.dgs.virginia.gov/DCLS.

3. At each triennial inspection, the laboratory's corrective actions from the previous inspection will be evaluated. A laboratory demonstrating repeat finding(s), i.e., finding(s) from a previous inspection that were not corrected in accordance with the corrective action plan for that inspection, may be recommended for decertification. Failure to implement and maintain corrective actions to satisfy certification program requirements jeopardizes a laboratory's certification status.

4. At each triennial inspection, the Certification Officer will review all documentation associated with one or more certification data set(s) selected during the inspection.

5. Laboratory personnel will be asked to demonstrate equipment fitness for use and tuning fork certification tests during the on-site inspection. The assessor will evaluate the demonstrated testing to be in accordance with the NHTSA MMP Procedure, as follows:

> "Strike the tuning fork on a nonmetallic object, wait 3 s, then hold it in front of the microphone while adjusting the synthesizer frequency to obtain a stationary, circular, Lissajous pattern on the oscilloscope." [NHTSA MMP §1221.71]

6. The Certification Officer will meet with the responsible laboratory official(s) or his/her designee following the assessment for an informal debriefing and discussion of potential findings. The laboratory leadership may invite additional staff members to attend.

7. Following the on-site inspection a comprehensive report will be prepared by the DCLS Certification Officer and reviewed and issued by the Group Manager or Director of Laboratory Operations. The inspection report will be issued within 30 days of the on-site inspection and will document the Certification Officer's findings and may offer recommendations for improvements to the laboratory's quality system and the legal defensibility of the laboratory's data.

8. The laboratory seeking certification must respond to findings noted in the report within sixty (60) days. The response must describe the corrective action taken and include documentation demonstrating that corrective action has been implemented to satisfactorily address the finding(s).

9. Within thirty (30) days of receiving documentation demonstrating that all

corrective action requirements have been satisfied, a certificate will be issued to the laboratory seeking initial certification. The certificate will be effective until the date of the next annual certificate renewal date (October 1 of each year).

B. Each laboratory that desires to maintain uninterrupted certification shall be inspected triennially.

1. An on-site inspection, as described in section VI. A, will be conducted at each laboratory at least once every three years. A notice of the triennial inspection, scheduled for a mutually agreed-upon date, will be sent to the laboratory approximately 30 days before the inspection date and will include a request for the information listed in VI. B. 2.

2. Prior to the on-site inspection, the laboratory shall provide DCLS with the following documentation:

a. A copy of the laboratory's current Quality Manual, and any/all documents referenced by the Quality Manual.

b. A copy of Tuning Fork Laboratory Quality Manual Checklist (Qualtrax ID # 6957), filled out by the laboratory, designating the location of each required item in the laboratory's quality documentation.

c. A current list of laboratory personnel;

d. A current list of laboratory equipment used for the testing of tuning forks.

e. A current Standard Operating Procedure (SOP) for the testing of tuning forks, if the test procedure is maintained separately from the Quality Manual.

3. The laboratory's quality manual will be evaluated prior to the site visit using Tuning Fork Laboratory Quality Manual Checklist (Qualtrax ID # 6957).

4. Following each on-site inspection a comprehensive report will be prepared by the DCLS Certification Officer within thirty (30) days.

5. The laboratory must respond to findings noted in the report within sixty (60) days.

6. Upon demonstration of satisfactory corrective action, DCLS will acknowledge receipt of satisfactory corrective action responses and the inspection will be closed. The laboratory will then be eligible for renewal of certification.

C. DCLS reserves the right to perform announced or unannounced interim inspections.

D. If on-site inspections are refused, DCLS may revoke certification.

E. Refer to Laboratory Assessment Procedures, 1VAC30-45 and 1VAC30-46

(Qualtrax ID # 6857). Sections titled, “Assessment Issue: Improper or Potentially Illegal Activities”, “Assessment Issue: Termination of On-Site Assessment”, “Assessment Issue: Confidential Business Information”, “Assessment Issue: National Security Considerations”, and “Assessment Issue: Safety and Health Considerations” may be deemed applicable to site visits done under this protocol.

VII. CERTIFICATE

A certificate, valid for a period of one year, will be issued to each certified laboratory in good standing on or by October 1 of each year.

VIII. MAINTENANCE OF CERTIFICATION

A. The laboratory must notify DCLS within thirty (30) days of changes in personnel, procedures, equipment or laboratory location.

B. A certification renewal fee, as described in Section V.C.3, is payable annually for each mobile laboratory and each stationary laboratory.

C. An on-site inspection, as described in Section VI, will be conducted at each laboratory at least once every three years.

IX. RENEWAL OF CERTIFICATION

A. Renewal invoices will be sent out on or before August 1 of each year.

B. Annual certificate re-issuance is based on timely receipt of payment and satisfactorily completing an on-site inspection on a triennial basis.

X. REFERENCES

A. Tuning Fork Laboratory Inspection Checklist (Qualtrax ID # 6954)
B. Tuning Fork Laboratory Application for Certification (Qualtrax ID # 6958)
C. DOT HS 810 845, “Speed Measuring Device Performance Specifications: Across-the-Road Module,” U. S. Department of Transportation, National Highway Traffic Safety Administration, October 2007
D. DOT HS 809 812 266, “Speed Measuring Device Performance Specifications: Down-the-Road Module,” U. S. Department of Transportation, National Highway Traffic Safety Administration, April 2016
E. DOT HS 808-069, “Model Minimum Performance Specifications for Police Traffic Radar and Lidar Devices”, U. S. Department of Transportation, National Highway Traffic Safety Administration, January 1994
F. Tuning Fork Laboratory Quality Manual Checklist (Qualtrax ID # 6957)
G. Virginia Division of Purchases and Supply (DPS) Directive re: VA Standard

680-77 (current revision; maintained on DPS website, https://dgs.virginia.gov/procurement/resources/standards--specifications/)

H. Conforming Products List published by the International Association of Chiefs of Police (IACP) (current revision; referenced from IACP website, http://www.theiacp.org/Radar-Lidar-Testing)