Law Enforcement Vehicular Digital Multimedia Evidence Recording System Standard

NIJ Standard–1003.00

July 18, 2012

NCJ xxxxxx
NATIONAL INSTITUTE OF JUSTICE

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The National Institute of Justice is a component of the Office of Justice Programs, which also includes the Bureau of Justice Assistance; the Bureau of Justice Statistics; the Office for Victims of Crime; the Office of Juvenile Justice and Delinquency Prevention; and the Office of Sex Offender Sentencing, Monitoring, Apprehending, Registering, and Tracking (SMART).
Special Technical Committee

This standard was developed by a Special Technical Committee of practitioners, technical experts and others with experience in standards development and conformity assessment. Committee members, their organizations and their professional affiliations are listed in Table 1 and Table 2.

Table 1. Practitioners

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<tr>
<th>Type</th>
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Table 2. Technical Experts and Others

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Advisory Working Group

The work of the Special Technical Committee was reviewed by an Advisory Working Group (AWG) made up of senior-level representatives from stakeholder organizations and individuals with experience in standards development and conformity assessment. Organizations represented on the AWG are listed in Table 3 below.

Table 3. AWG Members

<table>
<thead>
<tr>
<th>Organizations</th>
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<tr>
<td>Fraternal Order of Police</td>
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<td>International Association of Chiefs of Police</td>
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<tr>
<td>Law Enforcement and Emergency Services Video Association</td>
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<tr>
<td>National Sheriffs’ Association</td>
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<tr>
<td>Scientific Working Group on Imaging Technology</td>
</tr>
<tr>
<td>U.S. Department of Commerce, National Institute of Standards and Technology</td>
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<tr>
<td>U.S. Department of Homeland Security, Customs and Border Protection</td>
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<tr>
<td>U.S. Department of Justice, Federal Bureau of Investigation (FBI)</td>
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</table>

Steering Committee

The Steering Committee generally directed the effort and helped to ensure coordination among relevant federal programs. The following were the members of the Steering Committee (shown in Table 4 with their respective organizations during the development of this document).

Table 4. Steering Committee Members

<table>
<thead>
<tr>
<th>Member</th>
<th>Organization</th>
<th>Title</th>
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<tbody>
<tr>
<td>Kristina Rose</td>
<td>U.S. Department of Justice, Office of Justice Programs, National Institute of Justice</td>
<td>Deputy Director</td>
</tr>
<tr>
<td>Bert Coursey</td>
<td>U.S. Department of Homeland Security, Science and Technology Directorate, Office of Standards</td>
<td>Director</td>
</tr>
<tr>
<td>Mark Stolorow</td>
<td>U.S. Department of Commerce, National Institute of Standards and Technology, Office of Law Enforcement Standards</td>
<td>Director</td>
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Foreword

This document is a voluntary performance standard for vehicular digital multimedia evidence recording systems (VDMERSs) used by law enforcement. It defines both performance requirements and the methods used to test performance. In order for a manufacturer, supplier, or other entity to claim that a particular VDMERS model satisfies this National Institute of Justice (NIJ) standard, the model must be in compliance with this standard as determined in accordance with this document and the associated document, *Law Enforcement Vehicular Digital Multimedia Evidence Recording Systems Certification Program Requirements*, NIJ CR-1003.00. Both this standard and the associated certification program requirements document are produced as a part of the Standards and Testing Program of the U.S. Department of Justice, Office of Justice Programs, NIJ, as is a third associated document, the *Law Enforcement Vehicular Digital Multimedia Evidence Recording Systems Selection and Application Guide*, NIJ Guide–1003.00.

All requirements stated in this standard, including those that explicitly employ mandatory language (e.g., “shall”) are those necessary to satisfy the standard. Nothing in this document is intended to require or imply that commercially available VDMERS models for use by law enforcement must satisfy this standard.

This standard is based in part on a performance specification produced by the International Association of Chiefs of Police. Portions of the document are used in this standard, and references to the document are cited using the letter symbol indicated below:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Cited Document</th>
</tr>
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Requirements for manufacturers, suppliers, or other entities seeking to demonstrate conformity with this standard are provided in a separate document, *Law Enforcement Vehicular Digital Multimedia Evidence Recording Systems Certification Program Requirements*, NIJ CR-1003.00. Those seeking guidance concerning the selection and application of certified VDMERSs should refer to the most recent version of the *Law Enforcement Vehicular Digital Multimedia Evidence Recording Systems Selection and Application Guide*, NIJ Guide–1003.00, which explains the standard in nontechnical language and provides guidance into selecting, procuring, using, and maintaining hand-held metal detectors.

Although agencies are advised always to require their procurements to meet or exceed the most recent and up-to-date version of this standard, this does not necessarily mean that agencies should remove VMDERSs that they currently have in use from service.

NIJ standards are subject to continued research, development and testing, review, and modification as appropriate on an ongoing basis. Users of this standard are advised to consult the NIJ Standards and Testing Program webpage, accessed from [www.nij.gov/standards](http://www.nij.gov/standards), on a regular basis to determine whether the documents have been revised or superseded.
Technical comments and recommended revisions are welcome. Please send all written comments and suggestions to Director, National Institute of Justice, Office of Justice Programs, U.S. Department of Justice, Washington, DC, 20531, ATTN: NIJ Standards and Testing Program.

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Nothing in this document is intended to create any legal or procedural rights enforceable against the United States. Moreover, nothing in this document creates any obligation for manufacturers, law enforcement agencies, or others to follow or adopt NIJ Standard-1003.00, which is a voluntary standard.
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## ACRONYMS, ABBREVIATIONS, AND SYMBOLS

### Acronyms

<table>
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<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>CD</td>
<td>Compact Disc</td>
</tr>
<tr>
<td>CIE</td>
<td>Commission Internationale de L’Eclairage (International Commission on Illumination)</td>
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<tr>
<td>CPU</td>
<td>Central Processing Unit</td>
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<tr>
<td>DME</td>
<td>Digital Multimedia Evidence</td>
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<tr>
<td>DVR</td>
<td>Digital Video Recorder</td>
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<tr>
<td>EMC</td>
<td>Electromagnetic Compatibility</td>
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<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
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<tr>
<td>FIPS</td>
<td>Federal Information Processing Standard</td>
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<tr>
<td>FOV</td>
<td>Field of View</td>
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<td>FPS</td>
<td>Frames Per Second</td>
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<tr>
<td>GPS</td>
<td>Global Positioning System</td>
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<tr>
<td>IACP</td>
<td>International Association of Chiefs of Police</td>
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<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
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<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronic Engineers</td>
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<td>ISO</td>
<td>International Standards Organization</td>
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<td>LEVA</td>
<td>Law Enforcement and Emergency Services Video Association International</td>
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<td>NIEM</td>
<td>National Information Exchange Model</td>
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<td>NTSC</td>
<td>National Television System Committee</td>
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<td>RF</td>
<td>Radio Frequency</td>
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<tr>
<td>RMS</td>
<td>Root Mean Square</td>
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<tr>
<td>SAE</td>
<td>Society of Automotive Engineers</td>
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<td>SI</td>
<td>System Internationale</td>
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<td>SIA</td>
<td>Security Industry Association</td>
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<tr>
<td>SMPTE</td>
<td>Society of Motion Picture and Television Engineers</td>
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<tr>
<td>UL</td>
<td>Underwriters Laboratories Inc.</td>
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<tr>
<td>U.S.</td>
<td>United States</td>
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<tr>
<td>V-A</td>
<td>Volt-Amp</td>
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<tr>
<td>VDMERS</td>
<td>Vehicular Digital Multimedia Evidence Recording System</td>
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<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
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Technical Symbols and Abbreviations

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Unit</th>
<th>Unit Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Ampere(s)</td>
<td>lm</td>
<td>lumen(s)</td>
</tr>
<tr>
<td>ac</td>
<td>alternating current</td>
<td>lm/W</td>
<td>lumens per watt</td>
</tr>
<tr>
<td>cd</td>
<td>candela</td>
<td>ln</td>
<td>logarithm (base e)</td>
</tr>
<tr>
<td>cd/m²</td>
<td>candela(s) per meter²</td>
<td>log</td>
<td>logarithm (base 10)</td>
</tr>
<tr>
<td>cm</td>
<td>Centimeter(s)</td>
<td>lux</td>
<td>lumens per meter²</td>
</tr>
<tr>
<td>dB</td>
<td>Decibel(s)</td>
<td>lux·s</td>
<td>lux-seconds</td>
</tr>
<tr>
<td>dc</td>
<td>direct current</td>
<td>m</td>
<td>meter(s)</td>
</tr>
<tr>
<td>°C</td>
<td>degree Celsius</td>
<td>mm</td>
<td>millimeter(s)</td>
</tr>
<tr>
<td>°F</td>
<td>degree Fahrenheit</td>
<td>mph</td>
<td>miles per hour</td>
</tr>
<tr>
<td>ft</td>
<td>foot or feet</td>
<td>mphe</td>
<td>miles per hour equivalent</td>
</tr>
<tr>
<td>ft/s</td>
<td>feet per second</td>
<td>m/s</td>
<td>meters per second</td>
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<tr>
<td>Hz</td>
<td>hertz</td>
<td>rh</td>
<td>relative humidity</td>
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<tr>
<td>K</td>
<td>Kelvin</td>
<td>RMS</td>
<td>root mean square</td>
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<tr>
<td>lb</td>
<td>pound(s)</td>
<td>V</td>
<td>volt(s)</td>
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<tr>
<td>lbf</td>
<td>pounds force</td>
<td>W</td>
<td>watt(s)</td>
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<tr>
<td>lbf·in</td>
<td>pounds force inches</td>
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viii
1. **Scope, Purpose and Application**

1.1 **Scope**

1.1.1 This document is a voluntary standard. All requirements stated in this standard, including those that explicitly employ mandatory language (e.g., “shall”) are those necessary to satisfy the standard. Nothing in this document is intended to require or imply that a commercially available vehicular digital multimedia evidence recording system (VDMERS) for use by law enforcement must satisfy this standard. In order for a supplier, manufacturer or other entity to claim that a particular VDMERS model satisfies this NIJ standard, however, the model must be found to comply with this standard as determined in accordance with this document and the associated document, *Law Enforcement Vehicular Digital Multimedia Evidence Recording System Certification Program Requirements*, NIJ CR-1003.00.

1.1.2 This standard specifies the minimum requirements for form and fit, performance, testing, documentation and labeling of VDMERS models used by law enforcement officers for recording events occurring in and around an enclosed law enforcement vehicle. (A VDMERS may also be referred to as a system within this document.)

1.1.3 The form and fit requirements and performance requirements of this standard shall be met for a complete base unit (see Section 3.2.10). Accessories are not required to meet the form and fit requirements and performance requirements of this standard.

1.1.4 This standard does not address requirements for active or archival storage.

1.1.5 This standard shall not be understood as addressing all safety concerns associated with the use of systems. Users of this standard should be aware of all safety issues associated with their use. User information related to these issues is provided in the *Law Enforcement VDMERS Selection and Application Guide*, NIJ Guide-1003.00.

1.1.6 This standard shall not be understood as addressing the safety concerns (if any) associated with its use by testing facilities.

1.1.7 No supplier, manufacturer or other entity shall claim compliance with only selected portions of this standard. The VDMERS model shall meet all applicable stated requirements.

1.1.8 Nothing herein shall be understood to restrict any supplier from exceeding the requirements of this standard.
1.1.9 As appropriate (e.g., for models that employ materials or forms of construction not anticipated when this standard was developed or are not addressed by this standard), NIJ may modify the test methods of the standard or establish new ones.

1.2 Purpose

1.2.1 The purpose of this NIJ standard is to specify minimum requirements for VDMERSs used to record events occurring in and around an enclosed law enforcement vehicle and enhance the effectiveness and integrity of audio/video evidence.

1.2.2 The standard identifies test methods for verifying the minimum performance requirements are met.

1.2.3 The purpose of the test methods in this standard is to assess performance, and the test methods shall not be understood to specify performance levels for all situations in which systems may be used.

1.3 Application

1.3.1 This standard applies to systems that record video from at least one camera and audio from at least one microphone.

1.3.2 This standard does not address performance classifications or levels of systems.

1.4 Units

1.4.1 All measurement units used in this document are metric. Where useful, English units are indicated in parentheses immediately following the metric units, such as “2.54 cm (1 inch).”
2. References

2.1 Associated Publications


2.2 Referenced Publications

The following publications are referenced in this document. For publications listed immediately below with a date, only the edition cited applies. For undated publications, the latest edition of the referenced publication applies, including any amendments.

2.2.1 International Association of Chiefs of Police


2.2.2 International Electrotechnical Commission

IEC 60065, Audio, Video and Similar Electronic Apparatus – Safety Requirements.


IEC 62133, Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications.


2.2.3 International Organization for Standardization (ISO)


2.2.4 National Institute of Justice

2.2.5 National Institute of Standards and Technology


2.2.6 Society of Automotive Engineers (SAE)

SAE J1113-1. Electromagnetic Compatibility Procedures and Limits for Components of Vehicles, Boats (up to 15 m) and Machines, Except Aircraft. Warrendale, PA: Society of Automotive Engineers.


2.2.7 Underwriters Laboratories Inc. (UL)


UL 1642, Lithium Batteries and/or UL 2054, Household and Commercial Batteries. Camas, WA: Underwriters Laboratories Inc.

2.2.8 Other Publications

3. **Definitions**

3.1 **General**

3.1.1 The definitions contained in this chapter shall apply to these terms as used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings, unless the context unmistakably indicates otherwise.

3.2 **Standard-Specific Definitions**

3.2.1 **Accessories**: Any supplier-recommended or aftermarket items (including software) that can be attached to or interfaced with the base unit.

3.2.2 **Accuracy**: How close a measured value is to the true value or established standard.

3.2.3 **Active Mode**: An operating condition of the remote wireless microphone and transmitter when it is transmitting audio data.

3.2.4 **Active Storage**: A location or device (e.g., server) to which Digital Multimedia Evidence (DME) is located in a local area network environment.

3.2.5 **Administrator level**: An unrestricted level of system access and privileges, including but not limited to, assigning all authorized user levels, user-defined fields, and DME export and distribution.

3.2.6 **Archival Storage**: A location or device to which DME is moved after a designated amount of time and where it resides for an extended period of time.\(^A\)

3.2.7 **Audio Monitor**: Device for listening to live and recorded audio.

3.2.8 **Authorized user level**: A limited level of system access as defined by the administrator. There may be more than one such level.

3.2.9 **Attestation**: Issue of a statement, based on a decision following review, that fulfillment of specified requirements has been demonstrated. (ISO/IEC 17000, 5.2)

3.2.10 **Base unit**: The set of system-level hardware components and software components available for use with a model. (See Section 3.2.703.2.74, System-level Components)

3.2.11 **Bit**: The smallest amount of digital information. A bit is restricted to being either a one or a zero.

3.2.12 **Camera**: The image acquisition device comprised of at minimum a lens and an image sensor.

3.2.13 **Capture**: The process of producing or recording the DME from a natural event.\(^A\)
3.2.14 **Certification body**: Any body operating a product certification system. (ISO/IEC Guide 65, 1.1, 1.2)

3.2.15 **Circle of Blur**: A grayish circle formed at the center of a star-type test target when it is photographed or recorded using a camera; the center portion of the star where the details are not resolved but are blurred together.

3.2.16 **Codec**: A device/program capable of encoding and/or decoding digital data. Codecs encode a stream or signal for transmission, storage or encryption, and decode it for viewing and listening. A

3.2.17 **Compliant**: The condition of a VDMERS model meeting or exceeding all applicable requirements of this standard, as determined pursuant and subject to the Law Enforcement VDMERS Certification Program Requirements (NIJ CR-1003.00).

3.2.18 **Component**: Any material, part or subassembly used in construction of a VDMERS.

3.2.19 **Compression**: The reduction of data used to represent DME.

3.2.20 **Correlated Color Temperature**: Characterization of a light source in terms of the temperature of a theoretical blackbody radiator that would have a color (spectral energy density) that most closely resembles that of the illuminating source.

3.2.21 **Data File**: A set of binary information representing DME. A

3.2.22 **Date/Time Stamping**: A software feature that automatically inserts the current date/time into the data file. A

3.2.23 **Default Settings**: Controls and settings established by the supplier prior to delivery of a VDMERS (e.g., factory settings).

3.2.24 **Digital Image**: A picture represented by discrete numerical values organized in a two-dimensional array or video stream.

3.2.25 **Digital Multimedia Evidence (DME)**: Data representing audio essence, video essence, metadata and any other information attached to a digital file. A DME may be classified as follows:

3.2.25.1 **Compressed DME**: Data that has been transcoded from the original DME resulting in a reduced amount of data required to represent the original data set.

3.2.25.2 **Original DME**: Data recorded and retrieved to media in its native file format (i.e., first usable form).

3.2.25.3 **Uncompressed DME Copy**: A transcoded version of the original DME that is interoperable as a Material eXchange Format (MXF) file and where no loss of video information occurs.

3.2.26 **DME Audit Log**: A National Information Exchange Model (NIEM)-compliant list of all import/export activities, including dates and times, type, affected files and hash
functions of affected files, which is used to provide integrity of files and detect tampering of said files.

3.2.27 **Digital Recording:** The storage of a stream of information as discrete bits.

3.2.28 **Digital Video Recorder:** Any device used to encode and record DME.

3.2.29 **Display:** Synonymous with *video monitor*.

3.2.30 **Download:** The process of receiving data from another digital source.\(^A\)

3.2.31 **Duplicate:** An exact reproduction of the original data validated through a hash function.

3.2.32 **Encryption:** The process of coding data so that a specific code or key is required to restore the original data.\(^A\)

3.2.33 **Essence:** Sound and/or picture information, not including metadata.

3.2.34 **Export:** To copy, duplicate, or move information from within a device or system to a physical or logical location outside that device or system.

3.2.35 **Field of View (FOV):** The horizontal angular extent of a scene imaged by the video camera. FOV depends on the focal length of the camera lens and the size of the camera’s imager chip.

3.2.36 **Format:** The specific structure for the data in a file.\(^A\)

3.2.37 **Hash function:** A mathematical formula that generates a unique number based on the data in a file and is used to verify the data’s integrity.\(^A\)

3.2.38 **Illuminance:** A photometric quantity that expresses the luminous flux (i.e., the light level in lumens per unit area) and is measured in lumens per m\(^2\) (also called lux.)

3.2.39 **Indicator:** A visible or audible device on the VDMERS used to provide awareness of a state change, status, or condition.

3.2.40 **Industry Standard File Formats:** Formats that are viewable and playable without the need for proprietary codecs, players or viewers available only from the supplier.

3.2.41 **Import:** To bring information from one system or program into another.\(^A\)

3.2.42 **Integrity:** (1) The reliability and accuracy of DME throughout its lifecycle. (2) The degree to which a system or component prevents degradation of, unauthorized access to or modification of DME.\(^A\)

3.2.43 **Interoperable:** Able to be shared among law enforcement agencies in an industry standard file format; specifically referring to uncompressed and compressed DME.
3.2.44 **Interoperability:** The ability to be shared among law enforcement agencies in an industry standard file format; specifically refers to uncompressed and compressed DME.

3.2.45 **Manufacturer:** A commercial enterprise engaged in fabricating a product.

3.2.46 **Metadata:** Data embedded within or associated with a file that describes information about, or related to, the file or its directory. This may include, but is not limited to, locations where the content is stored, dates, times, application-specific information and permissions.\(^\text{A}\) It is data about data.

3.2.47 **Model:** The supplier’s design, with unique specifications and characteristics, of a particular item.

3.2.48 **National Information Exchange Model (NIEM):** A federal, state, local and tribal interagency initiative providing a foundation for seamless information exchange;\(^1\) an Extensible Markup Language (XML)-based information exchange framework and reference model designed as a core set of building blocks used as a consistent baseline for creating exchange documents and transactions across government.

3.2.49 **Native File Format:** The original form of a file. This usually refers to a file format associated with, and unique to, a specific software application program.\(^\text{A}\)

3.2.50 **Passive Mode:** An operating condition of the remote wireless microphone and transmitter when paired with the rest of the base unit but not transmitting audio data.

3.2.51 **Pixel:** A picture element.\(^\text{A}\)

3.2.52 **Primary Camera:** Camera and lens assembly intended to be forward facing when installed.

3.2.53 **Primary Microphone:** Wireless microphone, transmitter, battery and accessories (e.g., cords) intended to be worn by an officer.

3.2.54 **Product:** One unit of a particular model.

3.2.55 **Product Label:** A marking affixed by a supplier to each unit of a compliant model or to the compliant model package that contains required model information and the mark of conformity.

3.2.56 **Proprietary:** A characteristic of a technique, technology or device owned and controlled by a company or other party and thereby only usable or adaptable as allowed by that party.\(^\text{A}\)

3.2.57 **Record:** Process of writing DME to recording media.

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\(^1\) Refer to [http://www.NIEM.gov](http://www.NIEM.gov).
3.2.58   **Recording Media:** Any object to which DME is written and can be retrieved.

3.2.58.1 **Non-Removable Recording Media:** Any data storage housed within a device that cannot be removed from said device without its disassembly.

3.2.58.2 **Removable Recording Media:** Any portable data storage device designed for removal from a system without disassembly of the system or the storage device.

3.2.59 **Reference Frame:** A digital video image not dependent on any other images within a group of pictures for its value. A reference frame is often used as a source for values of other images within a group of pictures, such as bi-directional and predictive frames.

3.2.60 **Reliability:** The extent to which a process can repeatedly produce the same effective output, with a central tendency and an acceptable dispersion, for consistent input settings. Information from such a system is said to be **reliable.**

3.2.61 **Resolution:** Measure of the output quality of an image; capability of distinguishing between two adjacent elements of an image such as lines (referred to as **spatial resolution**) or pixels (referred to as **pixel resolution**).

3.2.62 **Sample:** A complete base unit to be tested (following conditioning as specified in this standard). A sample is representative of a model.

3.2.63 **Secondary Camera:** An expression commonly used to refer to the camera and lens assembly intended to be rear facing (i.e., to capture activities within the interior of an enclosed law enforcement vehicle) when installed. It is not necessarily the second camera in a multi camera system.

3.2.64 **Secondary Microphone:** A microphone intended to be installed within the passenger compartment of an enclosed law enforcement vehicle.

3.2.65 **Shall:** Indicates a mandatory requirement for the purposes of this voluntary standard.

3.2.66 **Should:** Indicates a recommendation that is advised, but not required, for the purposes of this voluntary standard.

3.2.67 **Siemens Star Test Target:** A pattern consisting of a series of thin triangles arranged in a circle, something like an asterisk. Alternating triangles are a dark color, usually black. Adjacent to these triangles are congruent triangles that are lighter in color, usually white. The dark and light triangles are arranged in a circle with the points all meeting in the center.

3.2.68 **Supplier:** The party that is responsible for ensuring that products meet and, if applicable, continue to meet, the requirements on which the certification is based (ISO/IEC Guide 65, 3.1).
3.2.69 **System Audit Log:** A list used to track system events, such as bootup, diagnostic failures or status changes.

3.2.70 **System-level Components:** Cameras, microphones, digital video recorder, recording media, software, video monitor, and audio monitor that make up the VDMERS. Figure 1 of Appendix A provides a diagram of the VDMERS.

3.2.71 **Transcoding:** The conversion of DME from one data file format to another.

3.2.72 **Vehicular DME Recording System (VDMERS):** System for recording DME to document events in and around an enclosed law enforcement vehicle. The system consists of a base unit and may or may not include accessories.

3.2.73 **Verification:** The process of confirming the accuracy of any duplicate of the DME compared to the original DME. This process normally includes the application of a type of hash function.

3.2.74 **Video Monitor:** Device for viewing live and recorded video.
4. **Form and Fit Requirements**

To be tested under the performance requirements of this standard, VDMERS models shall satisfy the requirements of this chapter.

4.1 **VDMERS Model Requirements**

4.1.1 VDMERS models shall meet or exceed the applicable requirements specified in this section.

4.1.2 The system shall consist of at a minimum one primary camera, one primary microphone (wireless), a digital video recorder, recording media, software, a video monitor, and an audio monitor. The video monitor and audio monitor may be combined into a single video/audio monitor.

4.1.3 The system may incorporate a secondary camera which shall meet the applicable requirements of Sections 5.2 and 5.3. If the system incorporates a secondary camera, the system shall also include one secondary microphone (wired).

4.1.4 The system may incorporate cameras in addition to the primary and secondary cameras, which are considered part of the base unit and shall be tested.

4.1.5 The system shall have the option to incorporate at least one additional wireless microphone. Such additional wireless microphones shall meet the requirements of the primary microphone.

4.1.6 Compressed DME shall be interoperable.

4.1.7 The system shall be capable of allowing a user to input specific information, at the administrator level or the authorized user level, required for the DME Audit Log and System Audit Log (refer to Sections 5.5.1.18 and 5.5.1.20).

4.1.8 The system recording media shall be secured using a mechanism that prevents unauthorized removal of the media from the recorder.

4.1.9 If non-removable recording media is being used in the system, it shall be housed inside the recorder in a manner which prevents tampering with, and/or destruction of, the media.
4.1.10 For systems incorporating encrypted line wired and wireless security, evidence of a
certificate of compliance for the validation of encryption algorithms (e.g., FIPS 197
or 46-3) or validation of security requirements for cryptographic modules (e.g., FIPS
140-3) shall be provided.²

4.1.11 All export of the original DME shall have an automated verification mechanism.
Using a 256-bit or greater Federal Information Processing Standards (FIPS) 180-4
approved hash function, the resulting hash function value shall be attached to the
original DME. Evidence of a certificate of compliance for the hash function with
FIPS 180-4 shall be provided. The automated mechanism shall not introduce any
visible or audible artifacts into the DME.

4.2 Microphone Requirements for VDMERS Models

4.2.1 Microphones shall meet or exceed the applicable requirements specified in this
section.

4.2.2 The system shall incorporate as the primary microphone a remote wireless
microphone and transmitter in a device to be worn by an officer.

4.2.3 The primary microphone’s transmitter shall contain an integrated antenna.²

4.2.4 The primary microphone shall contain a memory-free rechargeable battery that may
be replaced by the end user with commonly accessible tools.

4.3 Video and Audio Monitor Requirements for VDMERS Models

4.3.1 Video and audio monitors shall meet or exceed the applicable requirements specified
in this section.

4.3.2 The video monitor shall have a viewing screen that has a diagonal measurement of at
least 7.6 cm (3.0 inches) and shall be able to display color.²

² The transmission stream that contains the DME shall also contain a separate hash (as described above) so that once
the file is written to a storage medium such as a hard disk, tampering can be detected. This means that the
transmission of the DME will also contain a DME audit record that contains the source and target hashes when
possible. In cases where the camera provides a video feed directly to a PC, the program that encodes and stores
the video must provide an algorithm that can be used to detect missing and/or tampered frames of video and the
detection of disruption within any of the audio streams.
5. Performance Requirements

5.1 Performance Requirements for VDMERS Models

5.1.1 To declare conformity of a VDMERS model against this standard, all performance requirements defined in the following sections shall be met for each of the categories listed below:

- Camera features (See Section 5.2).
- System Image Quality (See Section 5.3).
- Microphone (See Section 5.4).
- System operations (See Section 5.5).
- Interoperability (See Section 5.6).
- System Function Access and Permissions (See Section 5.7).
- Mechanical safety (See Section 5.8).
- Electrical safety (See Section 5.9).
- Electromagnetic compatibility (See Section 5.10).
- Environment (See Section 5.11).

5.1.2 All performance requirements are system-level requirements for a base unit of a model. The supplier shall identify the system-level components of the base unit by supplier and part number and provide installation instructions for all system-level components.

5.1.3 If the VDMERS digital video recorder and/or recording media is an external computing device (e.g., laptop, tablet, smart phone, or mobile data terminal), then for all tests specified within Chapter 5, 20 to 25% of computer device’s processing resources (e.g. random access memory and (central processing unit) capacity) shall be consumed by a testing process independent of the VDMERS tests, to simulate the computing device as a shared resource.

5.1.4 The system performance shall be evaluated by the test methods referenced within this section and as described in Chapter 6. All tests identified in Chapter 6 shall include the requirements of Section 6.1.

5.2 Camera Feature Requirements for VDMERS Models

5.2.1 The system shall be tested as specified in Section 6.2, Camera Features Tests, and shall meet the requirements below:

5.2.1.1 The primary camera shall demonstrate the capability to be switchable between autofocus and manual focus when tested as specified in Section 6.2.3. The camera shall default to autofocus on system startup. When the recorded video is played back,
the circle of blur around the center of the test pattern shall be nominally the same for both the autofocus setting and the best setting of the manual focus adjustment series.

5.2.1.2 The primary camera shall demonstrate the capability to provide a focused image with an FOV of 40 degrees horizontally at object distances of 10.7 m (35 ft) and 76.0 cm (30 inches) when tested as specified in Section 6.2.4. This represents a viewing angle of 40 degrees.

5.2.1.3 The secondary camera shall demonstrate the capability to operate in low light at 0.1 lux when tested as specified in Section 6.2.5.

5.2.1.4 The secondary camera shall demonstrate the capability to provide a focused image with an FOV of 127.0 cm (50 inches) at an object distance of 76.0 cm (30 inches) when tested as specified in Section 6.2.6.

5.2.1.5 If the system does not incorporate a secondary camera, the primary camera shall demonstrate the capability to be rotated 180 degrees on its mount in a horizontal plane using only one hand when tested as specified in Section 6.2.7. The camera position shall not shift without intentional manipulation by the operator.

5.2.1.6 If the system does not incorporate a primary camera capable of being rotated 180 degrees, the system shall incorporate a secondary camera.

5.3 System Image Quality Requirements for VDMERS Models

5.3.1 The system shall demonstrate the following system image quality requirements when tested as specified below. These system image quality requirements shall not apply if the camera is operating in the near-infrared portion of the electromagnetic spectrum.

5.3.1.1 The system shall be tested as specified in Section 6.3, Color Fidelity Test, and the red-green-blue (RGB) values shall not be shifted off axis by more than 5%.

5.3.1.2 The system shall be tested as specified in Section 6.4, Spatial Resolution Test, and shall have a minimum of 452 horizontal lines of resolution. A

5.3.1.3 The system shall be tested as specified in Section 6.5, Aspect Ratio Test, and shall have an aspect ratio that is within 100:100 ± 2:100. A

5.4 Microphone Requirements for VDMERS Models

5.4.1 The system shall be tested as specified in Section 6.6, Microphone Test, and each wireless microphone and transmitter assembly shall meet the requirements below:
5.4.1.1 The wireless microphone and transmitter assembly shall transmit within FCC-approved frequency bands. The manufacturer must provide documentation.

5.4.1.2 The average from the three observers for each test subject shall be at least 55 out of 60 words correctly documented.

5.4.1.3 The remote wireless microphone and transmitter assembly shall be able to activate audio and video recording from the remote transmitter.

5.4.1.4 All microphones shall be capable of capturing sounds greater than or equal to 50 dB sound pressure level at a distance of 1.0 m (39 inches), and the values within the frequency range of 300 Hz and at 3,000 Hz shall be no more than 6.0 dB below the average output value.

5.4.2 The system shall be tested as specified in Section 6.7, *Wireless Microphone Battery Life Test*, and shall demonstrate a minimum battery life of 15 hours in the passive mode and 3.5 hours in active mode.

5.5 **System Operational Requirements for VDMERS Models**

5.5.1 The system shall demonstrate the following operational requirements when tested according to Section 6.8, *System Operational Test*.

5.5.1.1 The system shall demonstrate proper operation of the controls listed in Table 5 and shall demonstrate that the indicators and displayed information (on the video monitor) listed in Table 5 are provided appropriately.

5.5.1.2 Video and audio essence shall continue to be presented on the video and audio monitors during periods when the record function may not be initiated.

5.5.1.3 The video monitor viewing screen light level shall be user adjustable and shall be capable of being turned off independently from the rest of the system.

5.5.1.4 The system controls shall be capable of being illuminated for ready identification during periods of darkness. The illumination level shall be capable of being controlled over a range from bright to dim.

5.5.1.5 The system shall have an illuminated record indicator for the purpose of indicating to the operator that the system is actively recording while the operator is outside the vehicle. This indicator light shall be able to be disabled by the operator.

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5.5.1.6 The system shall be capable of monitoring audio transmissions from the wireless microphone(s). The system shall also be capable of playing back previously recorded audio. The system shall contain control(s) to adjust the volume and enable and disable monitoring of audio.

5.5.1.7 The recording device shall indicate when media is not inserted into the recorder.

Table 5. Controls, Indicators, and Displays

<table>
<thead>
<tr>
<th>Controls</th>
<th>Indicator (I) or Displayed Information (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power On</td>
<td>Power On (I)</td>
</tr>
<tr>
<td></td>
<td>Diagnostic showing system level events (i.e., system audit log) (D)</td>
</tr>
<tr>
<td></td>
<td>Media not inserted or not operational (if removable media) (D)</td>
</tr>
<tr>
<td>Power Off</td>
<td>None</td>
</tr>
<tr>
<td>Microphone Activated</td>
<td>Microphone On (I or D)</td>
</tr>
<tr>
<td></td>
<td>Recording (I and D)</td>
</tr>
<tr>
<td></td>
<td>Time Remaining (D)</td>
</tr>
<tr>
<td></td>
<td>Low record time remaining at ≤one hour remaining (I)</td>
</tr>
<tr>
<td>Record</td>
<td>Recording (I and D)</td>
</tr>
<tr>
<td></td>
<td>Time Remaining (D)</td>
</tr>
<tr>
<td></td>
<td>Low record time remaining at ≤one hour remaining (I)</td>
</tr>
<tr>
<td>Play</td>
<td>Playing (D)</td>
</tr>
<tr>
<td>Fast Forward</td>
<td>Fast Forwarding (D)</td>
</tr>
<tr>
<td>Rewind</td>
<td>Rewinding (D)</td>
</tr>
<tr>
<td>Pause</td>
<td>Paused (D)</td>
</tr>
<tr>
<td>Stop</td>
<td>None</td>
</tr>
<tr>
<td>Volume Control</td>
<td>None</td>
</tr>
<tr>
<td>Brightness Control</td>
<td>None</td>
</tr>
</tbody>
</table>

5.5.1.8 The system shall not have the capability to overwrite currently recorded DME prior to its export from the system.

5.5.1.9 The system’s recording functions shall demonstrate activation by any of the following methods:\textsuperscript{A}:

a) User pushes the “record” button.

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b) Activation of the emergency lights and/or sirens.

c) Activation upon vehicle impact or crash.

d) User activates the “record” button on the primary microphone.

5.5.1.10 The system shall be capable of capturing and recording at a minimum frame rate of 29.97 FPS. The system shall have the ability of pre-event and post-event video and metadata recording for a minimum of 30 seconds at a minimum frame rate of 29.97 FPS. Pre-event and post-event recording shall not include audio.

5.5.1.11 The system shall be capable of recording events uninterrupted for a minimum of 3.5 hours at the lowest compression setting offered by the system (i.e., highest quality) while encoding all cameras and microphones when removable media is used.

5.5.1.12 The system recorder clock and active storage system clock shall either maintain synchronization to, or be synchronized periodically with, a known external reference (e.g., U.S. Standard of Time). If synchronization is continually maintained to an external reference, it shall be maintained to that reference within 33 milliseconds. If time clock synchronization is initiated periodically (such as via interface with an archival storage device), the system recorder clock and active storage system clock shall not demonstrate a drift from the external time reference in excess of one second over a 24-hour time period.

5.5.1.13 The system shall have the ability to record and selectively display on the video monitor during playback at least the following data: date/time of DME creation, user identification information, emergency light indication, siren indication, and system status indicators (e.g., video recording on/off, microphone(s) on/off). This data shall be encoded at least once per second in the metadata and shall not overwrite image information.

5.5.1.14 Time stamping of DME elements (i.e., video essence, audio essence and metadata) shall be consistent within all system-level components.

5.5.1.15 The system shall be capable of recording video from all system cameras simultaneously, audio from all system microphones simultaneously, and the associated metadata. Synchronization error shall be less than 1/30-second when tested as specified in Section 6.6.7, Microphone Test.

5.5.1.16 If the system uses removable recording media, hash function or other industry standard integrity check shall be used to validate that the DME in the active storage is an exact duplicate of any data on the removable media.
5.5.1.17 The system shall have the capability of recording all DME in digital file format to recording media and electronically exporting all DME (i.e., original DME, compressed DME, and uncompressed DME copy). If the digital file format is proprietary, the supplier shall provide in the software the capability for an authorized user to redact a copy of the original DME.

5.5.1.18 The DME Audit Log shall contain the following items when the DME is exported:
   a. Identification of officer and vehicle.
   b. Identification of location receiving the exported DME.
   c. Time and date of export.
   d. The Frame Rate Verification Procedure specified in Section 6.8.6 shall be performed and logged to validate the DME immediately prior to the export.
   e. Hash function or other industry standard verification shall be computed for the exported DME using an industry-standard method and shall be defined and provided with the exported DME.
   f. The calculated hash function of the exported DME should be recorded as part of the audit log, as well as the hash function of the original file.
   g. Identification of the source of the DME, including the vehicle identification, CPU, hardware identification, etc.
   h. Frame rate and size.

5.5.1.19 The system shall poll all system-level components and automatically record into the System Audit Log system-level details and events, including the following, at least each time status changes:
   a. Date and time of event.
   b. Global positioning system (GPS) location of event.
   c. Product label information per Section 7.1 of this standard.
   d. Hardware identification, including supplier and model number.
   e. Software version.
   f. Recording device identification, including supplier and model number.
   g. Removable media identification.
   h. System status change (e.g., bootup, power on).
   i. System-level component status change indicators (e.g., DVR full, camera failure, component ready).

5.5.1.20 The System Audit Log shall provide the ability to manually record at least the following:
b. Officer identification.

5.5.1.21 The system shall be capable of exporting the System Audit Log and the DME Audit Log in a NIEM-compliant format, and a NIEM-based field mapping table is provided in Appendix B.

5.5.1.22 The system shall perform a diagnostic to detect any malfunction (i.e., dropped frames, loss of time stamp, or loss of any external references normally recorded by the system) or loss of functionality of the recorder, camera, displays and microphones. The diagnostic shall be performed on system startup and at least every 60 seconds. Any malfunction or loss of functionality shall be documented in the System Audit Log and indicated to the user within one second of diagnostic completion.

5.5.1.23 The system shall automatically set the correct time and date following a 5-minute interruption of power.

5.6 Interoperability Requirements for VDMERS Models

5.6.1 The following system interoperability requirements shall be demonstrated when tested according to Section 6.9, Interoperability Test.

5.6.2 The system shall provide the original DME files, which shall include all metadata in a read-only NIEM-conforming format.

5.6.3 The system shall provide two interoperable formats for export of the DME: (1) uncompressed DME copy and (2) compressed DME, both of which must display date/time information.

5.6.4 A verification report shall be included with the original DME export stating the calculated value of the DME hash function.

5.7 System Function Access and Permissions for VDMERS Models

5.7.1 The system shall be tested as specified in Section 6.10, Security Test to Demonstrate Access and Permissions for System Functions, and shall demonstrate the following:

(1) the capability to perform the following at the administrator access level:
   - Change system configuration.
   - Assign authorized user access permissions to groups or to individuals.
   - Manage audit log information.
(2) that the original DME cannot be altered or destroyed without at any access level.

5.8 Mechanical Safety Requirements for VDMERS Models

5.8.1 The system shall be designed such that exposed edges and corners accessible to the test finger per figure 2A of IEC 60950-1, second edition, have a minimum 3.2 mm (0.13 inches) radius or chamfer or be padded with an energy-absorbing material to minimize the risk of injury.

5.9 Electrical Safety Requirements for VDMERS Models

5.9.1 The system shall comply with safety requirements as specified in IEC 60065, Audio, Video and Similar Electronic Apparatus – Safety Requirements, and/or as specified in IEC 60950-1, Information Technology Equipment – Safety – Part 1: General Requirements.

5.9.2 Each system primary and secondary battery shall be tested in accordance with, or shall demonstrate compliance with\(^4\), UL 1642, Lithium Batteries, IEC 62133, Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications, and/or UL 2054, Household and Commercial Batteries.

5.9.3 The system shall be tested as specified in Section 6.11, Electrical System Safety Tests, and shall meet the requirements identified within the test method.

5.10 Electromagnetic Compatibility Requirements for VDMERS Models

5.10.1 The systems shall be tested as specified in Section 6.12, EMC Tests, and shall meet the requirements of SAE J1113-1, Electromagnetic Compatibility Procedures and Limits for Components of Vehicles, Boats (up to 15 m) and Machines, Except Aircraft.

5.11 Environmental Requirements for VDMERS Models

5.11.1 The system shall be tested as specified in Section 6.13, Environmental Tests, and shall meet the requirements below.

5.11.1.1 When subjected to the high and low temperature exposures, the system’s video monitor shall function properly, there shall be no missing DME data capture and no external system damage.

5.11.1.2 When subjected to the humidity exposure, the system’s video monitor shall function properly, and there shall be no missing DME data capture.

\(^4\) Demonstration of compliance shall be via attestation by an accredited certification body.
5.11.1.3 When subjected to the mechanical vibration exposure, the system’s video monitor shall function properly, there shall be no missing DME data capture and no change in frame width greater than 10%.

5.11.1.4 When subjected to the mechanical shock exposure, the system’s video monitor shall function properly, and there shall be no missing DME data capture.

5.11.2 The system shall comply with environmental requirements as specified in SAE J1455, *Recommended Environmental Practices for Electronic Equipment Designed in Heavy Duty Vehicle Applications*, June 2006.
6. **Test Methods**

6.1 **General**

6.1.1 Typically, the performance requirement pass/fail criteria shall be as stated in Chapter 5, *Performance Requirements*; however, in some cases, the pass/fail criteria are stated within the test method.

6.1.1.1 Unless otherwise specified within a test method, testing shall be conducted at ambient conditions within the temperature range of 16° C to 27° C (60° F to 80° F) and 20% to 60% rh.\(^A\)

6.1.1.2 Each test shall be performed on a single sample representative of the model unless otherwise specified within the individual test procedure.

6.1.1.3 Unless otherwise stated within a test method, all tests shall be conducted with the DVR set at a recording rate of 29.97 FPS at the highest compression setting specified by the supplier for that model. Unless otherwise stated within a test method, settings shall not be adjusted between tests for a single sample.

6.1.2 Unless specified otherwise within a test procedure, the primary camera shall be used in test methods requiring that video be recorded.

6.1.3 All test data and observations shall be documented and reported, including supplier, model number, identification of all system-level components, settings, and accessories tested.

6.1.4 All tests related to image quality shall be performed on both uncompressed DME copy and original DME.

6.1.5 The system shall be set up and operated according to the supplier’s instructions. All default factory settings for the sample shall be documented.

6.1.6 For any tests requiring an observer to view and assess a recorded image, the individual shall have 20/20 or better vision (corrected or uncorrected).

6.2 **Camera Features Tests**

6.2.1 Test Equipment

6.2.1.1 Test target: Siemens star test target.

6.2.1.2 Light source: Illumination source of 500 to 2,000 lux and at a color correlated temperature of 2,800 to 3,200 K.
6.2.2 Initial Conditions

6.2.2.1 The system shall have an empty DME storage device prior to the beginning of this test. The nominal operating power, as described in the system manual, shall be applied to the system.

6.2.3 Primary Camera Auto/Manual Focus Procedure

6.2.3.1 Connect the VDMERS per supplier instructions.

6.2.3.2 Affix the camera(s) to a stable mount.

6.2.3.3 Power up the VDMERS and other test equipment.

6.2.3.4 Position the test target approximately 6.0 m (20 ft) from the camera.

6.2.3.5 The test target shall be illuminated by the light source.

6.2.3.6 Verify that the system defaults to autofocus at start up, and verify proper operation by viewing an image on the video display of the scene being captured.

6.2.3.7 Initiate recording for 5 to 10 seconds and then stop recording. Set the focus to manual focus. Initiate recording and continue recording while the focus is manually and slowly adjusted to the point at which the image appears to be in focus. Stop recording. Repeat this process at a distance of 2.0 m (6.6 ft) between the camera and the test target.

6.2.3.8 During the manual focus testing, the size of the circle of blur should change as the focus is changed. Best focus corresponds to the smallest circle of blur. When the recorded video is played back on a monitor with a viewing screen that has a diagonal measurement of at least 22.9 cm (9.0 inches), the circle of blur around the center of the test pattern shall be nominally the same for both the autofocus setting and the best setting of the manual focus adjustment series. The circle of blur will not be the same for both distance settings.

6.2.3.9 Document the results and observations.

6.2.4 Primary Camera FOV Procedure

6.2.4.1 The camera shall be tested to ensure that the FOV and the focus ranges are capable of both proper operation at (1) an object distance of 10.7 m (35 ft) and frame width of

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5 Adjusting the focus slowly eliminates any potential difference in how an interlaced or a progressive image reacts to the star-type test target.
7.3 m (24 ft) and (2) an object distance of 76.0 cm (30 inches) and frame width of 127.0 cm (50 inches).

6.2.4.2 Connect the VDMERS per supplier instructions.

6.2.4.3 Affix the camera(s) to a stable mount.

6.2.4.4 Power up the VDMERS and other test equipment.

6.2.4.5 Verify proper operation by viewing an image on the video display of the scene being captured.

6.2.4.6 Place the test target, identified as the primary test target, at approximately 10.7 m (35 ft) from the camera such that the optical axis of the camera is nominally perpendicular to the surface of the primary test target. Place two additional and identical test targets, one on either side of the primary test target and each separated an equal distance from the primary target, parallel to and in the plane of the primary test target. The separation distance between the farthest edges of the pattern on the two additional targets shall be 7.3 m ± 7.6 cm (24 ft ± 3 inches).

6.2.4.7 All test targets shall be illuminated by the light source.

6.2.4.8 Adjust the lens to the normal frame width setting, 7.3 m ± 0.3 m (24 ft ± 12 inches). Attempt to capture all three targets in the field of view, and record at least 10 seconds of video, and stop recording.

6.2.4.9 Change the primary test target distance to approximately 76.0 cm (30 inches) from the camera and place the additional test targets, one on either side of the primary test target and each separated an equal distance from the primary test target. The separation distance between the farthest edges of the two additional targets shall be 127.0 cm ± 2.5 cm (50 inches ± 1.0 inch). Initiate recording, and record at least 10 seconds of video, and stop recording.

6.2.4.10 Evaluate the recorded video to determine if all three test targets, in their entirety, are visible in both video clips.

6.2.4.11 Document the results and observations.

6.2.5 Secondary Camera Low-Light Operation Procedure

6.2.5.1 The camera shall be tested to ensure that the camera is capable of low-light operation as available light decreases.
6.2.5.2 Connect the VDMERS per supplier instructions.

6.2.5.3 Affix the camera(s) to a stable mount.

6.2.5.4 Power up the VDMERS and other test equipment.

6.2.5.5 Verify proper operation by viewing an image on the video display of the scene being captured.

6.2.5.6 Place the test target in the view of the camera at a distance of 76.0 cm (30 inches), and adjust the lens so that the image is in focus (if necessary). The test target shall be illuminated by the light source. Initiate recording, and record at least 10 seconds of video.

6.2.5.7 Adjust illumination of the test target to 0.1 lux. Initiate recording, and record at least 10 seconds of video.

6.2.5.8 Evaluate the recorded image and note whether the image of the test target was obtained with a sufficient level of detail (as determined by the observer) at the low light level.

6.2.5.9 Document the results and observations.

6.2.6 Secondary Camera FOV Procedure

6.2.6.1 Connect the VDMERS per supplier instructions.

6.2.6.2 Affix the camera(s) to a stable mount.

6.2.6.3 Power up the VDMERS and other test equipment.

6.2.6.4 Verify proper operation by viewing an image on the video display of the scene being captured.

6.2.6.5 Position the primary test target approximately 76.0 cm (30 inches) from the camera and place two additional and identical test targets, one on either side of the primary test target and each separated an equal distance from the primary test target. The separation distance between the farthest edges of the two additional targets shall be 127.0 cm ± 2.5 cm (50 inches ± 1.0 inch).

6.2.6.6 All test targets shall be illuminated by the light source.

6.2.6.7 Initiate recording, and record at least 10 seconds of video, and stop recording.

6.2.6.8 Evaluate the recorded video to determine if all three test targets, in their entirety, are visible in both video clips.
6.2.6.9 Document the results and observations.

6.2.7 Test for Primary Camera Rotation Procedure

6.2.7.1 The camera on its mount shall be tested to ensure that it can be rotated at least 180° to both the left and the right sides of forward.

6.2.7.2 Using a test platform that emulates the mounting location and procedures for a vehicle, attach the camera to the test platform so that when the camera rotation angle is nominally at 0°, the camera is facing forward. Using one hand, rotate the camera approximately 180° from this position and document any restrictions to this motion. Return the camera to the nominally 0° position. Using one hand, rotate the camera 180° in the opposite direction.

6.2.7.3 Document any restrictions to motion and any observations.

6.2.8 Report

6.2.8.1 Each trial result and observations shall be documented and reported. The report shall document the camera make and model and all system settings at the time of testing.

6.3 Color Fidelity Test

6.3.1 The purpose of this test is to determine the degree to which the system can capture colors accurately so that color can be reliably used to track activity of objects and persons during analyses of recorded video.\textsuperscript{A}

6.3.2 Initial Conditions

6.3.2.1 The system shall have an empty DME storage device prior to the beginning of this test. The nominal operating power, as described in the system manual, shall be applied to the system.

6.3.3 Test Equipment

6.3.3.1 Test Target: Society of Motion Picture and Television Engineers (SMPTE) color bar chart.

6.3.3.2 Light source: An illumination source of 500 to 2,000 lux and at a color correlated temperature of 2,800 to 3,200 K.

6.3.3.3 Digital vectorscope, such as a Tektronix.
6.3.4  Procedure

6.3.4.1  Connect the VDMERS per supplier instructions.

6.3.4.2  Power up the VDMERS and other test equipment.

6.3.4.3  Affix the camera(s) to a stable mount and verify proper operation by viewing an image on the video display of the scene being captured.

6.3.4.4  Position the test target so that the target fills the camera’s view.

6.3.4.5  The test target shall be illuminated by the light source.

6.3.4.6  Position the test target relative to the camera such that the target is in the center with all edges in view and so that the target encompasses approximately 75% of the horizontal samples of the field of view.

6.3.4.7  Record 30 to 60 frames of video of the test target.

6.3.4.8  Extract an uncompressed DME copy of the video, and input the file into the digital vectorscope.

6.3.5  Report

6.3.5.1  Each trial result and observations shall be documented and reported.

6.3.5.2  Observations regarding functioning per supplier specifications shall be documented and reported.

6.4  Spatial Resolution Test

6.4.1  The purpose of this test is to determine if the system is able to capture images of small items of importance in the typical scenes likely to be encountered in practice. A

6.4.2  Initial Conditions

6.4.2.1  The system shall have an empty DME storage device prior to the beginning of this test. The nominal operating power, as described in the system manual, shall be applied to the system.

6.4.3  Test Equipment

6.4.3.1  Test Target: NTSC line test chart.
6.4.3.2 Light source: An illumination source of 500 to 2,000 lux and at a color correlated temperature of 2,800 to 3,200 K.

6.4.4 Procedure

6.4.4.1 Connect the VDMERS per supplier instructions.

6.4.4.2 Power up the VDMERS and other test equipment.

6.4.4.3 Affix the camera(s) to a stable mount and verify proper operation by viewing an image on the video display of the scene being captured.

6.4.4.4 Position the test target relative to the camera such that the target is in the center with all edges in view and so that the target encompasses approximately 75% of the horizontal samples of the field of view.

6.4.4.5 The test target shall be illuminated by the light source.

6.4.4.6 Record enough video to capture a single frame.

6.4.4.7 Take a frame from each type of DME output by the system. Open each image in a suitable image processing software (such as Photoshop).

6.4.5 Report

6.4.5.1 Each trial result shall be documented and reported.

6.5 Aspect Ratio Test

6.5.1 The purpose of this test is to determine if the system presents images to the user that have the correct aspect ratio (i.e., width to height) so that valid measurements can be made from recorded video.

6.5.2 Initial Conditions

6.5.2.1 The system shall have an empty DME storage device prior to the beginning of this test. The nominal operating power, as described in the system manual, shall be applied.

6.5.3 Test Equipment

6.5.3.1 Test target: 3” to 10” diameter sphere having a smooth surface, of solid dark color, such as black.
6.5.3.2 Light source: An illumination source of 500 to 2,000 lux and at a color correlated temperature of 2,800 to 3,200 K.

6.5.4 Procedure

6.5.4.1 Connect the VDMERS per supplier instructions.

6.5.4.2 Power up the VDMERS and other test equipment.

6.5.4.3 Affix the camera(s) to a stable mount and verify proper operation by viewing an image on the video display of the scene being captured.

6.5.4.4 The test target shall be illuminated by the light source.

6.5.4.5 Suspend the sphere in front of a background having contrasting color from the sphere that allows the sphere to be distinguished from the background. The sphere shall be positioned relative to the camera such that the sphere is in the center with all edges of the sphere in view and so that the sphere encompasses approximately 75% of the horizontal samples of the field of view.

6.5.4.6 Record enough video to capture a single frame.

6.5.4.7 Take a frame from each type of DME output by the system. Open each image in a suitable image processing software (such as Photoshop).

6.5.5 Report

6.5.5.1 Each trial result and observations shall be documented and reported.

6.6 **Microphone Test**

6.6.1 The purpose of this test is to assess the following:

- Remote wireless microphone and transmitter assembly ability to activate audio and video recording.
- Audio, video, and metadata synchronization.
- Audio system ability to deliver intelligible audio when the wireless microphone is transmitting to the receiver at a distance of 1,000 feet.\(^A\)
- Capability of all microphones of a base unit to capture sounds of a minimum level or greater.

6.6.2 Test Equipment
6.6.2.1 Test target: Clapboard with a SMPTE time code generator (for determining audio, video and metadata synchronization).

6.6.2.2 Phrase list from Appendix C.

6.6.2.3 High-quality over-ear headphones, minimum frequency range of 20 to 20,000 Hz.

6.6.2.4 ANSI and IEC 651 Type 2 digital sound level meter.

6.6.3 Test Subjects and Personnel

6.6.3.1 Two test subjects are required, one male and one female.6
   • The male subject shall be between 5’10” and 6’0” in height and shall weigh between 158 lbs and 188 lbs.
   • The female subject shall be between 5’3” and 5’5” in height and shall weigh between 131 lbs and 155 lbs.
   • Each test subject shall be clothed in a tee shirt and pants or shorts, with no metallic jewelry or belt buckles.

6.6.3.2 Three individuals are required as observers to listen to the recorded audio as it is played back. Each observer shall demonstrate the ability to hear frequencies from at least 2 kHz to 5 kHz.

6.6.3.3 One test assistant is required to listen to live audio as the test subjects speak to verify that live audio can be heard. The test assistant shall demonstrate the ability to hear frequencies from at least 2 kHz to 5 kHz.

6.6.4 Initial Conditions and Set Up

6.6.4.1 The wireless microphone shall have installed fully charged (new and/or rechargeable) batteries of the type specified by the supplier.

6.6.4.2 Each test subject shall be instructed to maintain a constant sound output volume at 75 dBA to 85 dBA for all presented phrases. The sound meter needs to be located within close proximity to the microphone.

6.6.4.3 The test subject shall don the wireless microphone and transmitter assembly according to supplier instructions, positioning the microphone approximately 10

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inches directly below the mouth, and shall be positioned approximately 305 m (1,000 ft) from the other VDMERS components.

6.6.4.4 The background noise level at the location of the test subject shall be measured and documented and shall be less than 50 dB in order to perform this test.

6.6.4.5 Affix the camera to a stable mount. All components, besides the camera and wireless microphone and transmitter assembly, shall be placed on a nonferrous platform 76 to 91 cm (30 to 36 inches) above the ground. Place a sound pressure meter within 15.0 cm (6 inches) of the test subject. Set it to measure A-filtration and at least one second integration time sound levels.

6.6.4.6 The base unit shall have an empty DME storage device. The nominal operating power, as described in the system manual, shall be applied to the system, and the system shall be turned on.

6.6.4.7 The test target shall be placed in the view of the camera, and proper operation of the camera shall be verified by viewing an image on the video display of the scene being captured.

6.6.5 Wireless Microphone (primary) Test Procedure

The test subject shall don the wireless microphone

6.6.5.1 The test subject shall place the wireless microphone in active mode. It shall be documented whether activation of the wireless microphone activates the digital recorder.

6.6.5.2 Perform the following steps sequentially. The speaker shall speak slowly, enunciating each phrase clearly and distinctly and shall pause for approximately 5 seconds between phrases. The speaker output levels shall be monitored while speaking.

- Standing at an angle of ~ 0 degrees with respect to the camera, speak 2 phrases from the list provided in Appendix C.
- Turn ~ 180 degrees from the original position, and speak 2 additional phrases from the list provided in Appendix C.

6.6.5.3 The test subject shall doff the wireless microphone. It will then be turned off.

Wired Microphone Test

6.6.5.4 The test subject shall stand at a distance of 1 m (39 inches) from the wired microphone and speak 15 words from the modified rhyme test into the microphone.
6.6.5.5 The test assistant shall monitor the live audio as the test subject speaks to assess whether live audio can be heard.

6.6.5.6 The test assistant shall record the measured sound pressure measurements as a function of input frequency. The values shall be averaged between 350 Hz and 2,500 Hz. This is the average output value.

6.6.5.7 When the above steps are completed, recording shall be stopped.

6.6.5.8 Three observers shall independently don the headphones and listen to a playback of the recorded audio and document the words that are heard.

6.6.5.9 The procedure shall be repeated with the second test subject.

6.6.5.10 The appropriate steps of this procedure shall be performed for each and every system microphone.

6.6.6 Report

6.6.6.1 Each observer’s results shall be documented and reported.

6.6.6.2 The average of the 3 observer results for each test subject shall be documented and reported.

6.6.6.3 The sound pressure measurements shall be documented.

6.7 Wireless Microphone Battery Life Test

6.7.1 This test shall be performed with all microphones installed and operating per the instructions below. Each wireless microphone and transmitter assembly shall be tested while all microphones are operational.

6.7.2 It is recommended that this test follow the Microphone Test of Section 6.6.

6.7.3 Test Equipment

6.7.3.1 Test equipment shall be as specified in Section 6.6.2.

6.7.4 Test Subjects and Personnel

6.7.4.1 Test subjects and personnel shall be as specified in Section 6.6.3, except that only one test subject is required and may be either male or female.

6.7.5 Initial Conditions
6.7.5.1 Initial conditions shall be as specified in Section 6.6.4, except that the test subject shall not don the wireless microphone initially as stated in Section 6.6.4.3.

6.7.6 Procedure

6.7.6.1 Turn the microphone on in the passive mode\textsuperscript{7} and allow it to remain on for a continuous period of 15 hours ± 10 minutes at a temperature between 19 °C and 23 °C (66 °F and 73 °F).

6.7.6.2 Within the last 30 minutes of this period and without changing the batteries, the test subject shall don the wireless microphone and transmitter assembly according to supplier instructions, positioning the microphone approximately 10 inches directly below the mouth, and speak 2 phrases from the list provided in Appendix C. The speaker shall speak slowly, enunciating each phrase clearly and distinctly and shall pause for approximately 5 seconds between phrases. The speaker output levels shall be monitored while speaking.

6.7.6.3 The test subject shall doff the wireless microphone.

6.7.6.4 The test assistant shall monitor the live audio as the test subject speaks to assess whether live audio can be heard.

6.7.6.5 The test assistant shall record the measured sound pressure measurements as a function of input frequency. The values shall be averaged between 350 Hz and 2,500 Hz. This is the average output value.

6.7.6.6 When the above steps are completed, recording shall be stopped.

6.7.6.7 Three observers shall independently don the headphones and listen to a playback of the recorded audio and document the words that are heard.

6.7.6.8 Install in the wireless microphone and transmitter assembly fully charged (new and/or rechargeable) batteries of the type specified by the supplier. Turn the microphone on in the active mode and allow it to remain on in the active mode for a continuous period of 3.5 hours ± 10 minutes at a temperature between 19 °C and 23 °C (66 °F and 73 °F).

6.7.6.9 Perform steps 6.7.6.2 through 6.7.6.7.

\textsuperscript{7} If the transition from passive to active mode is triggered automatically based on sound level, then the sound level in the test environment shall be controlled appropriately such that the microphone remains in passive mode throughout this portion of the test.
6.7.7 Report

6.7.7.1 Each observer’s results shall be documented and reported.

6.7.7.2 The average of the 3 observer results for each test subject shall be documented and reported.

6.7.7.3 The sound pressure measurements shall be documented.

6.8 System Operational Test

6.8.1 The purpose of this test is to assess the system operations, controls, indicators and displays, and audit logs.

6.8.2 Initial Conditions

6.8.2.1 The system shall have an empty DME storage device prior to the beginning of this test. The nominal operating power, as described in the system manual, shall be applied to the system.

6.8.3 Test Equipment:

- Computer with professional editing software.
- Test Target: SMPTE NTSC time code generator clock readable in digital form displaying hours, minutes, seconds, and frames.
- Light Source: An illumination source of 500 to 2,000 lux and at a color correlated temperature of 2,800 to 3,200 K.

6.8.4 Controls, Indicators and Displays Procedure

6.8.4.1 Connect the VDMERS per supplier instructions.

6.8.4.2 Power up the VDMERS and other test equipment.

6.8.4.3 Affix the camera(s) to a stable mount and verify proper operation by viewing an image on the video display of the scene being captured.

6.8.4.4 Position the test target so that the target fills the camera’s view.

6.8.4.5 The test target shall be illuminated by the light source.

6.8.4.6 While performing the following steps, assess whether the controls, indicators and displays function properly, and where indicated, assess the Audit Log:
• Observe that video and audio essences are presented on monitors when not recording.

• Adjust the viewing screen light level and observe that the light level is adjustable and can be turned off independently of the rest of the system.

• Adjust the illumination of system indicators, and observe that the illumination is adjustable from bright to dim.

• If the recording media is removable, remove it and verify that the “Media not inserted or not operational” display functions properly.

• Record DME until the media capacity is expended and verify that recording stops.

• Press the record button, and record DME for at least five minutes, verifying that the record display and indicator are on. Verify that the indicator is visible at a distance of 10.7 m (35 ft). Follow supplier instructions for disabling the record indicator and verify whether the indicator is disabled or not. Verify live audio during recording. Stop recording, rewind, and playback DME. Verify playback of DME and display of date/time, user identification, and system status.

• Activate the wireless microphone, and verify that record indicator is on. Record DME for 10 seconds. Play back video to verify that activation of the wireless microphone initiated recording and to verify that the record indicator was activated. Adjust the volume control, and verify that the volume level changes appropriately. Download the System Audit Log, and verify that the activation of recording by the wireless microphone is included.

• Using a 5-minute video recorded in a previous testing step, operate the Play, Fast Forward, Rewind, Pause, and Stop controls. Record results and observations.

6.8.5 Minimum Recording Time Procedure

6.8.5.1 Position the camera to view the test target. Starting with empty recording media, record DME uninterrupted from all microphones and from all cameras (at 29.97 FPS) simultaneously for at least 3.5 hours at the lowest compression setting offered by the system (i.e., highest quality) supported by the system. At 3 hours and 29 minutes, initiate a visual event in the view of the primary camera (e.g., flash) lasting at least 33 ms for the purpose of verifying synchronization (as required in Section 5.5.1.12). This event shall be recorded as part of the System Audit Log.

6.8.5.2 Perform synchronization of the VDMERS internal clock with a known external time reference per the supplier instructions. Assess whether an entry is written to the System Audit Log, and the system time is synchronized to match the external source
6.8.5.3 Download the System Audit Log and verify that all required elements (Appendix B) are present in the XML file and represent the content of the event.

6.8.6 Frame Rate Verification Procedure

6.8.6.1 The frame rate shall be verified per the following steps:

- Position camera to view the test target. Record video of the test target for at least six 30-second intervals.
- Import the recording into professional editing software capable of displaying frame count.
- Identify a frame near the start of the recording, and note the time code and frame number.
- Move to a frame exactly six minutes further into the recording, and note the time code and frame number.
- Subtract the starting frame number from the ending frame number. The difference is the number of frames recorded in six minutes.

- The number of frames should be at least 10,788. This is 29.97 FPS times 60 seconds per minute times six minutes, plus or minus an allowance of 0.2 seconds for the normal “one fifth least count” on the test target for each reading.

6.8.7 Pre-event and Post-event Recording Procedure

6.8.7.1 Position the camera to view the test target. Enable pre-event and post-event recording. Set up switches to simulate inputs for activation of emergency lights, siren, and vehicle crash actuator\(^8\) and connect to system wiring harness. Activate each switch separately, and verify for each switch activation that recording is initiated and that the record indicator is activated. Record for at least one minute and stop recording.

6.8.7.2 Play back DME and verify that (1) pre-event recording was performed for 30 seconds prior to activation of the record function and (2) post-event recording was performed for 30 seconds after recording was stopped. Verify that no audio was recorded during the pre-event and post-event recordings.

6.8.7.3 Play back the DME on the video monitor and selectively display the following on the video monitor: date/time, user identification information, emergency light indication, siren indication, and system status indicators (i.e., video recording on/off, microphone(s) on/off). Verify the recorded audio playback. Verify that the user can select between live audio and recorded audio during playback. Adjust volume control

\(^8\) If the vehicle crash actuator is not an external device accessible via the wiring harness, then the supplier shall provide instructions to be followed for testing this function.
and verify correct operation. Verify that time stamping is consistent within all system-level components.

6.8.7.4 Download the Audit Logs and verify that events and all required information are included.

6.8.8 Metadata Verification Procedure

6.8.8.1 Using a 5-minute video recorded in a previous testing step and an XML viewer, open the associated metadata file and verify its contents include the required information.

6.8.9 Diagnostics Procedure

6.8.9.1 Initiate recording and sequentially introduce the following malfunctions to the system: loss of an external reference and loss of functionality of the recorder, camera, displays, and microphones. The system shall indicate any malfunction within 60 seconds of diagnostic completion.

6.8.9.2 Download the System Audit Log, and verify that the diagnostic check is documented as being performed upon system startup, at least every 60 seconds, and for every simulated malfunction listed above.

6.8.10 Automatic Date/Time Set Procedure

6.8.10.1 Disconnect system power for a minimum of five minutes. Reconnect power and turn the system on. Allow one minute for the system to automatically set the correct time and date. Document whether the time and date are set within one minute.

6.8.11 Report

6.8.11.1 Each trial result and observations shall be documented and reported.

6.9 \textbf{Interoperability Test}

6.9.1 The purpose of this test is to confirm that the uncompressed DME copy is an accurate representation of the original DME with no loss of video information and confirm that the compressed DME is interoperable.

6.9.2 Test video

6.9.2.1 Original DME and uncompressed DME copy having at least 30 frames of video from any previous test within this standard may be used as the test video for interoperability.

6.9.3 Procedure
6.9.3.1 Import the recording into professional editing software capable of displaying frame count.

6.9.3.2 Select and compare corresponding frames from original DME and uncompressed DME copy. A minimum of 1% of the total frames selected from the beginning, middle, and end shall be compared.

6.9.3.3 The frame rate shall be tested to ensure the videos are identical in FPS.

6.9.3.4 Frames shall be compared at the pixel level to ensure the following attributes are identical:

- Luminance.
- Pixel resolution.
- Compression artifacts, including compression block and macroblock structure and/or frequency based artifacts.
- Color fidelity.

6.9.4 Using appropriate software, calculate a hash function value on the original DME and compare that value with the hash function value taken prior to export of original DME (i.e., during the automatic verification check).

6.9.5 Verify that the compressed DME is playable with no-cost, readily-available (non-proprietary) media players (e.g., Quicktime or Windows Media Player) without installing any additional proprietary software.

6.9.6 Report

6.9.6.1 The results and observations shall be documented and reported.

6.9.7 Interpretation

6.9.7.1 This task is evaluated on a pass/fail basis. The test result shall be considered a pass if the values of the attributes are determined to be identical between frames.

6.10 Security Test to Demonstrate Access and Permissions for System Functions

6.10.1 The purpose of this test is to assess the capability to configure system functions and set permissions.

6.10.2 Initial Conditions

6.10.2.1 The system shall have an empty DME storage device prior to the beginning of this test. The nominal operating power, as described in the system manual, shall be applied to the system, and the system shall be turned on.

6.10.3 Procedure
6.10.3.1 The supplier shall provide a list of available system functions configurable at the administrator access level. A representative subset of those system functions shall be selected for evaluation.

6.10.3.2 Attempt to configure system functions at the administrator access level, and assess whether those system functions can be configured at the administrator access level. Attempt to configure those same system functions at the authorized user access level, and assess whether those system functions can be configured at the authorized user access level.

6.10.3.3 Assign permission for the same subset of system functions to the authorized user access level, and assess whether those permissions are successfully assigned and configurable at the authorized user access level.

6.10.3.4 For a different subset of system functions other than those for which permissions were assigned above, attempt to configure those system functions at the authorized user access level, and assess whether those system functions are configurable at the authorized user access level.

6.10.3.5 Attempt to erase, modify, or overwrite previously recorded original DME at the administrator access level and the authorized user access level.

6.10.4 Report

6.10.4.1 Each trial result and observations shall be documented and reported.

6.11 Electrical System Safety Tests

6.11.1 Test Conditions

6.11.1.1 Unless otherwise specified within a given test method, the following conditions shall be established within the test environment and maintained throughout the test:

a) Ambient temperature at 23° C ± 3° C (73.4 ° F ± 5°F).

b) Relative humidity at 50% ± 20%.

c) Supply voltage, if applicable, adjusted to 100% of rated input voltage.

6.11.2 Current Protection Test

6.11.2.1 This test is based on UL 639, Standard for Safety for Intrusion-Detection Units, Section 24, and the following clarifications apply:

- This test is not required if proper polarity is identified on the device.

- Internal damage to circuitry shall not result when field wiring terminals are unintentionally shorted or jumped to power supply terminals (see also below.)
6.11.2.2 A power source of rated voltage shall be connected to the power terminals.

6.11.2.3 All connections to power terminals and input and output lines shall be reversed as pairs or individually connected to any terminal adjacent to the correct one.

6.11.2.4 If damage results from the incorrect connection specified above, then markings clearly visible to the installer during installation shall be placed on the terminals to warn of consequences of unintended connection. When correct polarity is required, then polarity markings shall appear immediately adjacent to wiring terminals.

6.11.3 Current Input Test

6.11.3.1 This test is based on UL 639, Standard for Safety for Intrusion-Detection Units, Section 25.

6.11.3.2 The input current of the system shall not exceed 110% of the unit’s marked input current, power or V-A rating while connected to a source of supply in accordance with the requirements below and operated under all conditions of intended use.

6.11.3.3 The test voltage for this test is to be the maximum rated voltage for the product. For a product having a single voltage rating, such as 115 V, maximum rated voltage is to be that single voltage. When the voltage is given in terms of a range of voltages, such as 110-120 V, the maximum rated voltage is the highest value of the range.

6.11.3.4 Power shall be applied to the system as specified above, and the input current shall be measured.

6.11.4 Overvoltage Test

6.11.4.1 This test is based on UL 639, Standard for Safety for Intrusion-Detection Units, Section 29, with modifications as indicated below:

- One sample shall be subjected to this test.
- The system shall operate as fully intended when connected to a supply source of 110% of the rated value. When the rated value is a voltage range, the overvoltage level shall be 110% of the higher limit of the range.

6.11.4.2 The system shall be energized in standby condition at the overvoltage level for a minimum of 16 hours and then tested as specified in Section 6.4, Spatial Resolution Test.

6.11.5 Undervoltage Test

6.11.5.1 This test is based on UL 983, Standard for Surveillance Camera Units, Section 29 with modifications as indicated below:

- One sample shall be subjected to this test.
• The system shall operate as fully intended when energized from a supply source of 85% of the test voltage specified by the supplier.

• For devices provided with a standby battery, the test is to be conducted at 85% of the charged battery voltage. When the standby battery provides a trouble signal requiring replacement at higher than 85% of the charged battery voltage, the test is to be conducted at the battery trouble signal voltage level.

6.11.5.2 The system shall be energized at the rated voltage. After that, the voltage is to be reduced to 85% of this level and battery-operated devices are to be operated at the trouble level voltage. The systems shall then be tested for proper operation as specified in Section 6.4, Spatial Resolution Test.

6.11.6 Report

6.11.6.1 Each trial result shall be documented and reported.

6.12 EMC Tests

6.12.1 Initial Conditions

6.12.1.1 The system shall have an empty DME storage device prior to the beginning of this test. There shall be sufficient light for the system to capture an image. The nominal operating power, as described in the system manual, shall be applied to the system, and the system shall be turned on.

6.12.2 Conducted Emissions Procedure

6.12.2.1 This section details the procedure for measuring the electrical emissions applied back into the input power system.

6.12.2.2 SAE J1113-41 details the method and limits for this test. The Class 3 limits defined in Paragraph 6.2, Table 4 shall be applied.

6.12.3 Conducted Immunity Procedure

6.12.3.1 This section details the procedure for evaluating the ability of the system to reject signals that might be present on the input power system.

6.12.3.2 SAE J1113-11 details the method and limits for this test.

6.12.4 Radiated Susceptibility Procedure

6.12.4.1 This section details the procedure for evaluating the ability of the system to be operated while being exposed to radiated electrical signals.
6.12.4.2 SAE J1113-21 details the method and limits for this test. The Level 3 limits defined in Table B1 shall be applied.

6.12.5 Radiated Emissions Procedure

6.12.5.1 This section details the procedure for evaluating the amount of radiated electrical emissions that is generated by system.

6.12.5.2 CISPR 25 details the method and limits for this test.

6.12.6 Report

6.12.6.1 All results and observations shall be documented and reported.

6.13 Environmental Tests

6.13.1 Initial Conditions

6.13.1.1 Initial conditions shall be as specified within individual tests of this section.

6.13.2 Test Targets and Equipment

6.13.2.1 The high temperature, low temperature, and humidity chamber test target shall be an SMPTE clock with a size chosen in combination with the camera lens focal length and the distance to the clock such that the clock face fills at least 33% of the video frame’s area.

6.13.2.2 The mechanical vibration and mechanical shock test target shall be set up as follows. Place numbered vertical black lines on a background as wide as indicated in Table 6 or on a linear interpolation of the chart. The sheet height should be 75% of the width. The lines should be centered vertically and on a white background. From 5.1 cm (2 inches) above and 5.1 cm (2 inches) below the lines, the background of the sheet should be gray with a reflectance between 15% and 25%.

Table 6. Dimensions for Test Target

<table>
<thead>
<tr>
<th>Distance from camera</th>
<th>Width of sheet</th>
<th>White Space between lines</th>
<th>Width of lines</th>
<th>Height of lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.7 m (35.0 ft)</td>
<td>4.6 m (15.0 ft)</td>
<td>91.4 cm (3.0 ft)</td>
<td>5.1 cm (2 inches)</td>
<td>40.6 cm (16 inches)</td>
</tr>
<tr>
<td>5.3 m (17.5 ft)</td>
<td>2.3 m (7.50 ft)</td>
<td>45.7 cm (1.5 ft)</td>
<td>2.5 cm (1 inch)</td>
<td>20.3 cm (8 inches)</td>
</tr>
<tr>
<td>2.7 m (8.75 ft)</td>
<td>1.1 m (3.75 ft)</td>
<td>22.9 cm (0.75 ft)</td>
<td>1.3 cm (0.5 ft)</td>
<td>10.2 cm (4 ft)</td>
</tr>
</tbody>
</table>
6.13.2.3 An environmental chamber capable of adjusting temperature and humidity over the ranges specified in the test procedures shall be used.

6.13.2.4 A vibration plate capable of creating the vibration specified in the test procedures shall be used.

6.13.3 High Temperature Exposure Procedure

6.13.3.1 The system shall have an empty DME storage device and a fully charged battery for the primary microphone prior to the beginning of this test. The system shall be placed inside a chamber such that the camera is viewing the test target outside the chamber through a clear window. The system’s video monitor shall either be visible to the system camera through the window or shall be recorded via separate video camera during this test. The test target shall have sufficient illumination to allow the system to capture an image. Power shall be applied to the system, and the system shall be placed in the record mode.

6.13.3.2 The chamber temperature shall be increased from 23° C ± 3° C (73.4 ° F ± 5°F) to 49° C ± 3° C (120° F ± 5° F) over a one-hour (-0 minutes +5 minutes) period and be held at that temperature for a period of one hour -0 minutes +5 minutes. During this period, the system shall continue to record. After 30 minutes – 0 seconds + 30 seconds, obscure the window for one minute -0 seconds + 5 seconds. The functionality of the video monitor shall be observed- and documented at the end of the one-hour period by viewing an image on the video display of the scene being captured.

6.13.3.3 The chamber temperature shall be decreased to the initial temperature over one hour -0 minutes +5 minutes. During this period, the system shall continue to record.

6.13.3.4 The stored data shall be examined for any missing DME data capture by performing the Frame Rate Verification Test specified in Section 6.8.6. The exterior of the system shall be inspected for any damage. The functionality of the video monitor shall be observed and documented by viewing an image on the video display of the scene being captured.

6.13.3.5 All results and observations shall be documented and reported.

6.13.4 Low Temperature Exposure Procedure

6.13.4.1 The system shall have an empty DME storage device and a fully charged battery for the primary microphone prior to the beginning of this test. The system shall be placed inside a chamber such that the camera is viewing the test target outside the chamber through a clear window. The system’s video monitor shall either be visible through the window or shall be recorded via video camera during this test. The test target shall have sufficient illumination to allow the system to capture an image. Power shall be applied to the system, and the system shall be placed in the record mode.
6.13.4.2 The chamber temperature shall be decreased from 23° C ± 3° C (73.4 ° F ± 5°F) to 0° C ± 3° C (32° F ± 5° F) over a one-hour (-0 minutes +5 minutes) period and be held at that temperature for a period of one hour. During this period, the system shall continue to record. After 30 minutes– 0 seconds + 30 seconds, obscure the window for one minute– 0 seconds + 5 seconds. The functionality of the video monitor shall be observed and documented at the end of the one-hour period by viewing an image on the video display of the scene being captured.

6.13.4.3 The chamber temperature shall be increased to the initial temperature over a one-hour period. During this period, the system shall continue to record.

6.13.4.4 The stored data shall be examined for any missing DME data capture by performing the Frame Rate Verification Test specified in Section 6.8.6. The exterior of the system shall be inspected for any damage. The functionality of the video monitor shall be observed and documented by viewing an image on the video display of the scene being captured.

6.13.4.5 All results and observations shall be documented and reported.

6.13.5 Humidity Exposure Procedure

6.13.5.1 The system shall have an empty DME storage device and a fully charged battery for the primary microphone prior to the beginning of this test. The system shall be placed inside a chamber such that the camera is viewing the test target outside the chamber through a clear window. The system’s video monitor shall either be visible through the window or shall be recorded via video camera during this test. The test target shall have sufficient illumination to allow the system to capture an image. Power shall be applied to the system, and the system shall be placed in the record mode.

6.13.5.2 The chamber temperature shall be increased from 23° C ± 3° C (73.4 ° F ± 5°F) to 38° C ± 3° C (100°F ± 5° F) over a one-hour (-0 minutes +5 minutes ) period, and the chamber humidity shall be increased to 90% rh over that same one-hour period. The chamber shall remain at these conditions for a period of one hour -0 minutes +5 minutes. During this period, the system shall continue to record. The functionality of the video monitor shall be observed and recorded at the end of the one-hour period.

6.13.5.3 The chamber temperature shall then be decreased to the initial temperature and humidity conditions over a one-hour (-0 minutes +5 minutes) period. During this period, the system shall continue to record.

6.13.5.4 The stored data shall be examined for any missing DME data capture by performing the Frame Rate Verification Test specified in Section 6.8.6. The functionality of the video monitor shall be observed and documented by viewing an image on the video display of the scene being captured.

6.13.5.5 All results and observations shall be documented and reported.
6.13.6 Mechanical Vibration Exposure Procedure

6.13.6.1 The system shall have an empty DME storage device and a fully charged battery for the primary microphone prior to the beginning of this test. The system shall be mounted on a vibration plate using the system’s provided mounting hardware and the camera shall be aimed at the test target. If multiple mounting kits are provided with the unit, the test shall be performed with each mounting kit. The test target shall have sufficient illumination to allow the system to capture an image. Power shall be applied to the system, and the system shall be placed in the record mode.

6.13.6.2 Prior to running the test, set the camera zoom to its longest focal length. Focus on the test target. Make sure that at least three vertical lines of the test target are in the frame. The system should be recording at least a few seconds prior to, during the test, and a few seconds after the vibration is applied. Extract a frame from before the application of vibration (“before frame”).

6.13.6.3 The system shall be subjected to a random vibration test detailed in SAEJ1455 as outlined in Paragraph 4.10. The vibration profiles depicted in figures 6, 7 and 8 of SAEJ1455 will be used. The system shall be exposed to these levels for a period of 15 minutes -0 seconds + 30 seconds for each of the profiles for a total exposure time of 45 minutes -0 seconds + 90 seconds. During the exposure to vibration, the system shall continue to capture DME data.

6.13.6.4 At the conclusion, the stored data shall be examined for any missing DME data capture by performing the Frame Rate Verification Test specified in Section 6.8.6. The functionality of the video monitor shall be observed and documented by viewing an image on the video display of the scene being captured.

6.13.6.5 Extract a frame after the vibration is turned off (“after frame”). Count the number of pixels across the displayed frames for the system. Count the number of pixels between lines from both the before and after frames. Any change over 3% indicates an unacceptable change in the zoom setting due to vibration.

6.13.6.6 Compare the edges of the lines on both the before and after frames. Visually different sharpness indicates an unacceptable change in focus.

6.13.6.7 Count the number of pixels from the left edge of the before frame to the closest (to the left edge) vertical line and note the line’s number. Repeat this count for the after frame. Subtract the pixel count for the after frame from that of the before frame and divide this by the number of pixels across the frame to get the percent frame movement. The percent frame movement should be less than 10% in either direction (in magnitude).

6.13.7 Mechanical Shock Exposure Procedure

6.13.7.1 The system shall have an empty DME storage device and a fully charged battery for the primary microphone prior to the beginning of this test. The system shall be
mounted on a vibration plate using the system’s provided mounting hardware, and the camera shall be aimed at the test target. If multiple mounting kits are provided with the unit, the test shall be performed with each mounting kit. The test target shall have sufficient illumination to allow the system to capture an image. Power shall be applied to the system, and the system shall be placed in the record mode.

6.13.7.2 Prior to running the test, set the camera zoom to its longest focal length. Focus on the test target. Make sure that at least three vertical lines of the test target are in the frame. The system should be recording at least a few seconds prior to, during the test and a few seconds after the mechanical shock is applied. Extract a frame from before the application of shock (“before frame”).

6.13.7.3 The system shall be subjected to random tests detailed in SAEJ1455 as outlined in Paragraph 4.11.3.4. The mechanical shock profile is depicted in Figure 12 of SAE J1455. The mechanical shock shall be applied to each of the three mutually perpendicular axes. Each axis will subjected to three mechanical shock pulses. During the exposure to the mechanical shock pulses, the system shall continue to capture DME data. Following each of the exposures, the stored data shall be examined for any missing DME data capture by performing the Frame Rate Verification Test specified in Section 6.8.6. The functionality of the video monitor shall be observed and documented by viewing an image on the video display of the scene being captured.

6.13.7.4 Extract a frame from after the exposure to shock (“after frame”).

6.13.7.5 Measure the number of pixels across the displayed frames for the system.

6.13.7.6 Measure the number of pixels between lines of the test target from both the before and after frames. Any change over 3% indicates an unacceptable change in the zoom setting due to shock.

6.13.7.7 Compare the edges of the test target lines on both the before and after frames. Visually different sharpness indicates an unacceptable change in focus.

6.13.7.8 Measure the number of pixels from the left edge of the before frame to the closest (to the left edge) vertical line and note the line’s number. Repeat this measurement for the after frame. Subtract the pixel count for the after frame from that of the before frame and divide this by the number of pixels across the frame to get the percent frame movement. The percent frame movement should be less than 10% in either direction (in magnitude).

6.13.7.9 Report

6.13.7.10 Each trial result and observations shall be documented and reported.
7. Labeling and Information

7.1 General Product Label Requirements for VDMERS Models

7.1.1 For each compliant VDMERS model, the requirements of this section shall be met.

7.1.2 The system shall have a product label permanently and visibly attached to, stamped on, or printed on the main housing of the recording unit of the system.

7.1.3 All text on the required product label shall be at least in English.

7.1.4 Symbols and other graphical information shall be permitted to be used to supplement text on the product label(s) and shall be explained in the user information.

7.1.5 The housing of the recording unit of the system shall have at least the following information printed legibly on the label(s) in letters at least 3.2 mm (1/8 inch) high:

- Legal name and legal address of the supplier.
- Manufacturing location address (city, state/province, country).
- Date of manufacture (i.e., month and year).
- VDMERS model number.
- Serial number.

7.2 Compliance Statement for Each Certified Product of a Compliant VDMERS Model

7.2.1 A certified product shall have the following compliance statement included in the user information required in Section 7.3.

“PURSUANT TO NIJ CR-1003.00, THIS VDMERS MODEL HAS BEEN TESTED AND FOUND TO BE COMPLIANT WITH THE REQUIREMENTS OF NIJ STANDARD-1003.00 (LAW ENFORCEMENT VDMERS STANDARD).”

7.3 User Information to Be Provided by Supplier of VDMERS Model

7.3.1 In order for a supplier to have a VDMERS model tested under this standard, the supplier must agree that, if the model is found to be compliant, it will provide written user information including, but not limited to, warnings, information and instructions with each complete system (and with each system-level component that may be acquired or provided separately).

7.3.2 The supplier shall provide the required user information in such a manner as to make such information clear, prominent, and immediately available to any individual opening the package.
7.3.3 The supplier shall provide at least the following instructions and information with each certified product:

- Information from Section 7.1.5.
- System-level components tested with the system. System-level components shall be identified by model number with allowable substitutions (including model numbers and specifications).
- Instructions for proper installation and use as intended by the supplier, including safety considerations, configurable system functions, and user-definable settings.
- Warranty information.
- Proper care and maintenance instructions, including cleaning, inspection guidelines and frequency, recommended operating temperature range, recommended storage practices and storage life, and cautions.
- If any of the system-level components of the base unit are not dedicated exclusively to supporting system functionality, it shall be noted that system ability to share resources is not addressed under the scope of this standard. It is recommended that a risk analysis be conducted by the end user to ensure that the system is interoperable with other equipment.
- Guidelines on lifecycle and storage of removable media, if applicable.

7.4 Technical Documentation to Be Provided by Supplier

7.4.1 In order for a supplier to have a VDMERS model tested under this standard, the supplier must agree that, if the model is found to be compliant, it will provide technical documentation as set forth in this section for the system on request by the purchaser or prospective purchaser.

7.4.2 The technical data package shall contain all data showing compliance of the model with this standard.

7.4.3 The technical documentation shall include the supplier name, model number, supplier-replaceable system-level components, and available options and accessories. Frequency response of microphone shall also be specified.

7.4.4 The technical documentation shall address accessories available for use with the system.
Appendix A. Figure

Figure 1. Diagram of the VDMERS

Representation of System-level Components of the VDMERS

- Primary wireless microphone
- Primary Camera
- Wired microphone (optional)
- Secondary Camera (optional)
- Additional primary microphone (optional)
- Additional Cameras (optional)

Digital Video Recorder

Software

- Audio Monitor
- Recording Media
- Video Monitor

These system-level components could be laptop.

External to VDMERS: Physical, wired, or wireless DME transfer from VDMERS to Active Storage
## Appendix B. NIEM-based Field Mapping

<table>
<thead>
<tr>
<th>Data Element</th>
<th>Description</th>
<th>Niem Schema Mapping</th>
<th>Inherits/Instantiates</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DME AUDIT LOG</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity Type</td>
<td>Export or Import</td>
<td>j:activitytype</td>
<td>nc:activitytype</td>
<td></td>
</tr>
<tr>
<td>Date/Time of export</td>
<td>Date/Time of export</td>
<td>nc:DateTime</td>
<td>niem-xsd:dateTime</td>
<td></td>
</tr>
<tr>
<td>Affected File</td>
<td>File being sent</td>
<td>nc:documentfilename</td>
<td></td>
<td></td>
</tr>
<tr>
<td>File Hash</td>
<td>Hash function Value for sent file</td>
<td>scr:ImageHashValue</td>
<td>scr:ScreeningDocumentPhotoAugmentationType</td>
<td></td>
</tr>
<tr>
<td>Compressed File Hash</td>
<td>Hash function Value after compressed</td>
<td>scr:ImageHashValue</td>
<td>scr:ScreeningDocumentPhotoAugmentationType</td>
<td></td>
</tr>
<tr>
<td>Source DME id</td>
<td>Vehicle Id, CPU, Hardware Id</td>
<td>cbrn:DataFileSubjectCode</td>
<td>cbrn:DataFileType</td>
<td></td>
</tr>
<tr>
<td>Storage Transfer Name</td>
<td>Name of Submitter</td>
<td>nc:PersonName</td>
<td>nc:PersonType</td>
<td>Need the Name or the Badge or the ID number of the sender</td>
</tr>
<tr>
<td>Storage Transfer Badge Number</td>
<td>BadgeNumber of Submitter</td>
<td>nc:EmployeeBadgeNumber</td>
<td>nc:PersonType</td>
<td>Need the Name or the Badge or the ID number of the sender</td>
</tr>
<tr>
<td>Storage Transfer Employee Number</td>
<td>EmpNumber of Submitter</td>
<td>nc:EmployeeNumber</td>
<td>nc:PersonType</td>
<td>Need the Name or the Badge or the ID number of the sender</td>
</tr>
<tr>
<td>Person/System Receiving</td>
<td>name of person/system receiving file</td>
<td>nc:DocumentRecipient</td>
<td>nc:EntityType</td>
<td></td>
</tr>
<tr>
<td><strong>SYSTEM AUDIT LOG</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date/Time</td>
<td>Date/Time of event</td>
<td>nc:DateTime</td>
<td>niem-xsd:dateTime</td>
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</tr>
<tr>
<td>Equipment</td>
<td>Equipment reporting event</td>
<td>it:EquipmentIdentifier</td>
<td>niem-xsd:string</td>
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</tr>
<tr>
<td>AuditMessage</td>
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<td>em:AlarmdetailsText</td>
<td>em:AlarmType</td>
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<tr>
<td>AlarmEvent</td>
<td>Cause of Event</td>
<td>em:AlertEventDetailsSeverityCode</td>
<td>em:AlertEventDetailsType</td>
<td></td>
</tr>
<tr>
<td>Verification Results</td>
<td>Verification Check of</td>
<td>cbrn:CredentialsAuthenticatedCode</td>
<td>cbrn:AcknowledgementDataType</td>
<td></td>
</tr>
</tbody>
</table>
Appendix C: Phrases for Microphone Test

1. Mr. Roberts, please step out of your vehicle.
2. Miss Johnson, may I see your vehicle registration and your driver’s license?
3. Dr. Edwards, where are you headed this evening?
4. Mr. Hutchinson, May I see your student identification?
5. Miss Arnold, do you have a current passport?
6. Mr. Baker, do you know what the speed limit is on this road?
7. Miss Rodriguez, are you the owner of this vehicle?
8. Mr. Greene, please sign here. Your court date is March 3.
9. Miss Perkins, do you realize you are out past your curfew?
10. Mr. Carlson, do you realize your registration is expired?
11. Dr. James, you were driving 55 in a 35 zone.
12. Miss Thomas, please pull forward to the shopping center parking lot.
13. Mr. Davis, how are you this evening?
14. Mr. Ford, you have the right to remain silent.
15. Miss Williamson, your left tail light is out.
16. Mr. Hamilton, please place your hands on the steering wheel?