Criminal Justice Offender Tracking System Standard

NIJ Standard-1004.00

June 2012

NCJ xxxxx
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 Community Capacity Development Office; 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).
Contributors:
STC members (To be listed upon completion)
NIJ (To be listed upon completion)

Advisory Working Group:
AWG members (To be listed upon completion)
FOREWORD

This document is a voluntary performance standard for offender tracking systems (OTSs) used by the criminal justice community. It defines both performance requirements and the methods used to test performance. In order for a manufacturer or other entity to claim that a particular OTS 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, Criminal Justice Offender Tracking System Certification Program Requirements, NIJ CR-1004.00. Both this standard and the associated certification program requirements document are produced as a part of the NIJ Standards and Testing Program, as is a third associated document, Criminal Justice Offender Tracking System Selection and Application Guide, NIJ Guide-1004.00.

Publication of NIJ Standard-1004.00 does not render unsuitable or obsolete any OTSs currently in use by criminal justice agencies. Although NIJ is not suggesting the removal of any existing OTSs from service, agencies are advised to require that future procurements specify that equipment shall meet or exceed the most recent version of this standard.

NIJ standards are subject to continued research, development and testing, and to review and modification as appropriate on an ongoing basis. Users of this standard are advised to check www.justnet.org on a regular basis to determine whether it has been revised or superseded.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, 810 Seventh St., N.W., Washington, DC 20531.

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 this voluntary law enforcement technology equipment standard.
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<th>Description</th>
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<td>AFLT</td>
<td>Advanced forward link trilateration</td>
</tr>
<tr>
<td>AGL</td>
<td>Above ground level</td>
</tr>
<tr>
<td>Ah</td>
<td>Ampere-hour</td>
</tr>
<tr>
<td>AM</td>
<td>Amplitude modulation</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>AWG</td>
<td>Advisory Working Group</td>
</tr>
<tr>
<td>C</td>
<td>Centigrade</td>
</tr>
<tr>
<td>CDMA</td>
<td>Code division multiple access</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>cm</td>
<td>Centimeter</td>
</tr>
<tr>
<td>dB</td>
<td>Decibel</td>
</tr>
<tr>
<td>dBA</td>
<td>A-weighted (environmental noise measure)</td>
</tr>
<tr>
<td>dBm</td>
<td>The power ratio in decibels (dB) of the measured power referenced to one milliwatt (mW)</td>
</tr>
<tr>
<td>DOC</td>
<td>Declaration of Conformity</td>
</tr>
<tr>
<td>EIA/TIA</td>
<td>Electronic Industries Alliance/Telecommunications Industry Association</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic compatibility</td>
</tr>
<tr>
<td>EMS/EMT</td>
<td>Emergency medical service/emergency medical technician</td>
</tr>
<tr>
<td>ESD</td>
<td>Electrostatic discharge</td>
</tr>
<tr>
<td>EUT</td>
<td>Equipment under test</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
</tr>
<tr>
<td>FDA</td>
<td>Food and Drug Administration</td>
</tr>
<tr>
<td>FM</td>
<td>Frequency modulation</td>
</tr>
<tr>
<td>g</td>
<td>Gram</td>
</tr>
<tr>
<td>GHz</td>
<td>Gigahertz</td>
</tr>
<tr>
<td>GPS</td>
<td>Global positioning system</td>
</tr>
<tr>
<td>GSM</td>
<td>Global System for Mobile Communications</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz</td>
</tr>
<tr>
<td>I</td>
<td>Electric current</td>
</tr>
<tr>
<td>Ic</td>
<td>Cumulative current consumed</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>in</td>
<td>Inch</td>
</tr>
<tr>
<td>IP Code</td>
<td>Ingress protection code</td>
</tr>
<tr>
<td>KDB</td>
<td>Knowledge database</td>
</tr>
<tr>
<td>kg</td>
<td>Kilogram</td>
</tr>
<tr>
<td>kHz</td>
<td>Kilohertz</td>
</tr>
<tr>
<td>Kp</td>
<td>Planetary K values that define a geomagnetic storm</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>kts</td>
<td>Nautical miles</td>
</tr>
<tr>
<td>kV</td>
<td>Kilovolts</td>
</tr>
<tr>
<td>LTE</td>
<td>Long term evolution (a 4G standard for wireless communication of high-speed data for mobile phones and data terminals)</td>
</tr>
<tr>
<td>m</td>
<td>Meter</td>
</tr>
<tr>
<td>mAH</td>
<td>Milliampere-hour</td>
</tr>
<tr>
<td>Mbits/s</td>
<td>Megabits per second</td>
</tr>
<tr>
<td>Mbytes/s</td>
<td>Megabytes per second</td>
</tr>
<tr>
<td>MHz</td>
<td>Megahertz</td>
</tr>
<tr>
<td>MIL-STD</td>
<td>Military Standard</td>
</tr>
<tr>
<td>mm</td>
<td>Millimeter</td>
</tr>
<tr>
<td>mph</td>
<td>Miles per hour</td>
</tr>
<tr>
<td>ms</td>
<td>Millisecond</td>
</tr>
<tr>
<td>NCJ</td>
<td>National Criminal Justice (Reference Service) [This usually appears only on the cover or title page and indicates the publication number, as referenced by NCJRS.]</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
</tr>
<tr>
<td>NIJ</td>
<td>National Institute of Justice</td>
</tr>
<tr>
<td>OET</td>
<td>Federal Communications Commission, Office of Engineering and Technology</td>
</tr>
<tr>
<td>OTS</td>
<td>Offender Tracking System</td>
</tr>
<tr>
<td>PCB</td>
<td>Printed circuit board</td>
</tr>
<tr>
<td>PCS</td>
<td>Personal Communications Service</td>
</tr>
<tr>
<td>PM</td>
<td>Phase modulation</td>
</tr>
<tr>
<td>ppv</td>
<td>Peak particle velocity</td>
</tr>
<tr>
<td>PROM</td>
<td>Programmable read-only memory</td>
</tr>
<tr>
<td>PVC</td>
<td>Polyvinyl chloride</td>
</tr>
<tr>
<td>RBW</td>
<td>Resolution bandwidth</td>
</tr>
<tr>
<td>RF</td>
<td>Radio frequency</td>
</tr>
<tr>
<td>RH</td>
<td>Relative humidity</td>
</tr>
<tr>
<td>ROM</td>
<td>Read-only memory</td>
</tr>
<tr>
<td>s</td>
<td>Second</td>
</tr>
<tr>
<td>T</td>
<td>Time</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters Laboratories</td>
</tr>
<tr>
<td>UMTS</td>
<td>Universal Mobile Telecommunications Service</td>
</tr>
<tr>
<td>VAC</td>
<td>Volts alternating current</td>
</tr>
<tr>
<td>VBW</td>
<td>Video bandwidth</td>
</tr>
<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
</tr>
</tbody>
</table>
## Commonly Used 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</td>
<td>lbf</td>
<td>pound force</td>
</tr>
<tr>
<td>ac</td>
<td>alternating current</td>
<td>lbf-in</td>
<td>pound force inch</td>
</tr>
<tr>
<td>cd</td>
<td>candela</td>
<td>lm</td>
<td>lumen</td>
</tr>
<tr>
<td>cm</td>
<td>centimeter</td>
<td>ln</td>
<td>logarithm (base e)</td>
</tr>
<tr>
<td>dB</td>
<td>decibel</td>
<td>log</td>
<td>logarithm (base 10)</td>
</tr>
<tr>
<td>dc</td>
<td>direct current</td>
<td>m</td>
<td>meter</td>
</tr>
<tr>
<td>°C</td>
<td>degree Celsius</td>
<td>min</td>
<td>minute</td>
</tr>
<tr>
<td>°F</td>
<td>degree Fahrenheit</td>
<td>mm</td>
<td>millimeter</td>
</tr>
<tr>
<td>ft</td>
<td>foot</td>
<td>mph</td>
<td>miles per hour</td>
</tr>
<tr>
<td>ft/s</td>
<td>foot per second</td>
<td>mphe</td>
<td>miles per hour equivalent</td>
</tr>
<tr>
<td>h</td>
<td>hour</td>
<td>m/s</td>
<td>meter per second</td>
</tr>
<tr>
<td>Hz</td>
<td>hertz</td>
<td>rh</td>
<td>relative humidity</td>
</tr>
<tr>
<td>in</td>
<td>inch</td>
<td>V</td>
<td>volt</td>
</tr>
<tr>
<td>Lb</td>
<td>pound</td>
<td>W</td>
<td>watt</td>
</tr>
</tbody>
</table>

area = unit² (e.g., ft², in², etc.); volume = unit³ (e.g., ft³, m³, etc.)

### Prefixes

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Multiple</th>
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<tbody>
<tr>
<td>d</td>
<td>deci (10⁻¹)</td>
</tr>
<tr>
<td>c</td>
<td>centi (10⁻²)</td>
</tr>
<tr>
<td>m</td>
<td>milli (10⁻³)</td>
</tr>
<tr>
<td>µ</td>
<td>micro (10⁻⁶)</td>
</tr>
<tr>
<td>n</td>
<td>nano (10⁻⁹)</td>
</tr>
<tr>
<td>p</td>
<td>pico (10⁻¹²)</td>
</tr>
<tr>
<td>da</td>
<td>deka (10)</td>
</tr>
<tr>
<td>h</td>
<td>hecto (10²)</td>
</tr>
<tr>
<td>k</td>
<td>kilo (10³)</td>
</tr>
<tr>
<td>M</td>
<td>mega (10⁶)</td>
</tr>
<tr>
<td>G</td>
<td>giga (10⁹)</td>
</tr>
<tr>
<td>T</td>
<td>tera (10¹²)</td>
</tr>
</tbody>
</table>

### Common Conversions

<table>
<thead>
<tr>
<th>Conversion</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.30480 m = 1 ft</td>
<td>4.448222 N = 1 lbf</td>
</tr>
<tr>
<td>2.54 cm = 1 in</td>
<td>1.355818 J = 1 ft-lbf</td>
</tr>
<tr>
<td>0.4535924 kg = 1 lb</td>
<td>0.1129848 Nm = 1 lbf-in</td>
</tr>
<tr>
<td>0.06479891 g = 1 gr</td>
<td>14.59390 N/m = 1 lbf/ft</td>
</tr>
<tr>
<td>0.9463529 L = 1 qt</td>
<td>6894.757 Pa = 1 lbf/in²</td>
</tr>
<tr>
<td>3,600,000 J = 1 kW·h</td>
<td>1.609344 km/h = 1 mph</td>
</tr>
</tbody>
</table>
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 commercially available offender tracking systems (OTSs) used by criminal justice personnel must satisfy this standard. In order for a manufacturer or other entity to claim that a particular OTS 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, Criminal Justice Offender Tracking Systems Certification Program Requirements, NIJ CR-1004.00.

1.1.2 This standard specifies the minimum requirements for form and fit, performance, testing, documentation, and labeling of OTSs.

1.1.3 This standard addresses only system-level components of an OTS model (i.e., does not address individual parts such as electrical resistors).

1.1.4 This standard shall not be understood as addressing all of the safety concerns associated with the use of OTSs used by criminal justice professionals.

1.1.5 This standard shall not be understood as addressing the safety concerns, if any, associated with the use of this standard by testing facilities.

1.1.6 No manufacturer or other entity shall claim compliance with only selected portions of this standard. The OTS model shall meet all applicable stated requirements.

1.1.7 As appropriate (e.g., for models that employ technologies, materials, configurations, or forms of construction that were 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.

1.1.8 Nothing herein shall be understood to restrict any OTS manufacturer from exceeding the requirements of this standard.

1.2 Purpose

1.2.1 The purpose of this standard is to specify minimum performance requirements and methods for testing OTSs with the intention of providing criminal justice personnel with improved information to make better decisions regarding offender management.
1.2.2 The purpose of the test methods in this standard is to assess performance and should not be understood to specify performance levels for all situations and hazards to which the participant may be exposed.

1.2.3 This standard is not intended to be used as a detailed manufacturing or purchase specification but may be referenced in purchase specifications as minimum requirements.

1.3 Application

1.3.1 This standard addresses two configurations of OTS models: one-piece configuration and multi-piece configuration.

In the one-piece configuration, the body-attached device contains the location methodology apparatus, communication device, battery, attaching straps and clips, indicators to the participant, and the casing (See Figure 1).

**Figure 1. System-level Components for a One-piece Configuration**

**Offender Tracking System**

System-level components addressed by NIJ Standard

**One-piece configuration**

- **Components Not at Participant Location**
  - Tracking System Software

- **Components at Participant Location**
  - **Body-attached Device**
    - Location methodology apparatus
    - Communication (e.g., cellular)
    - Battery
    - Indicators to participant
    - Attaching straps and clips
  - Charging unit
1.3.1.1 In the multi-piece configuration, there are two separate units. One unit is body-attached, and the other unit is body-worn (See Figure 2). The components of the body-worn unit typically include the location methodology apparatus, communication device, battery, indicators to the participant, and the casing. The components of the body-attached device typically include the transmitter/receiver, battery, attaching straps and clips, and the casing.

Figure 2. System-level Components for a Multi-piece Configuration

Offender Tracking System

System-level components addressed by NIJ Standard
Multi-piece configuration

1.3.2 All measurement units used in this document are metric except in cases where English units are the accepted convention. Length units are abbreviated as meter (m), centimeter (cm), and millimeter (mm). Where useful, English units are indicated in parentheses immediately following the metric units, such as “2.54 cm (1 in).”
2. REFERENCES

2.1 Referenced Publications

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

2.1.1 American National Standards Institute (ANSI)


2.1.3 International Electrotechnical Commission (IEC)


2.1.4 National Electrical Manufacturers Association (NEMA)


2.1.5 National Institute of Justice (NIJ)


2.1.6 Telecommunications Industry Association (TIA)


2.1.7 Underwriters Laboratories Inc. (UL)


2.1.8 U.S. Military


3. DEFINITIONS

3.1 General

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 within the context in which they are used.

3.2 Standard-Specific Definitions

3.2.1 Accuracy: The measure or characterization of difference between a participant’s location as determined and reported by the OTS and the participant’s actual location.

3.2.2 Active tracking: An offender tracking approach that uses a location system and a communications infrastructure to accomplish near real-time collection and transmission of device location and status data. An active offender tracking system receiving NIJ certification must be capable of providing on-demand location and status information to an agency within three minutes, and provide zone and status alerts to an agency within four minutes (assuming the location system and communication infrastructure relied on are working properly).

3.2.3 Adequately charged battery: A unit charged to meet the definition of a “fully charged battery” within the past six hours.

3.2.4 Administrative privileges: OTS software security permissions that permit agency-level administration of employee access to automated OTS data and reporting.

3.2.5 Agency: An organization authorized to install and/or monitor the application of OTS technology to participants within a specific jurisdiction.

3.2.6 Alert: (1) A notification that an offender wearing a tracking device has engaged in activity of interest to the supervising entity (e.g., zone breach, tamper) or that a device parameter of interest has changed (e.g., low battery power); or (2) An event generated or recorded by an offender tracking system that requires notification to the subscribing agency for possible enforcement action. (See Section 5.3.4)

3.2.7 Body-attached: The quality of being physically secured to a participant’s body.

3.2.8 Body-worn: The quality of being fastened, typically, to an article of the participant’s clothing.
3.2.9 **Bracelet:** The body-attached portion of an OTS, usually affixed to a participant’s wrist or ankle.

3.2.10 **Care:** Cleaning, sanitization, and storage of an OTS.

3.2.11 **Certification body:** Any body operating a product certification system.

3.2.12 **Certified model:** A model that has been determined, through third party attestation, to meet or exceed all applicable requirements of NIJ Standard-1004.00.

3.2.13 **Circumvention:** An action intended to frustrate or defeat proper OTS function.

3.2.14 **Communications failure:** The OTS is unable to establish communications with the monitoring center or data center to upload data for a designated period of time.

3.2.15 **Data center:** A facility equipped with, or connected to, one or more computers, used for receiving, processing, or maintaining OTS data.

3.2.16 **Encryption:** Protecting data in transit from unauthorized use by applying a mathematical algorithm to render the data unreadable without the use of a decryption key.

3.2.17 **Event:** Any incident recorded by an offender tracking system that is time-stamped, logged, and reportable.

3.2.18 **Firmware:** (1) Fixed, usually rather small programs and/or data structures that internally control various electronic devices; (2) Software stored in read-only memory (ROM) or programmable ROM (PROM) that often is responsible for the behavior of a system when it is first switched on.

3.2.19 **Fully charged battery:** The quantity of electricity in Ah (ampere-hours) declared by the manufacturer that a single-cell battery can deliver after being charged for a two-hour period for one-piece devices or a four-hour period for multi-piece devices.

3.2.20 **Jamming:** Use of an electronic device to disrupt communications by overriding incoming transmissions at the receiver.

3.2.21 **Location methodology:** An approach, or a combination of approaches, used to track objects (e.g., GPS, AFLT, inertial navigation).

3.2.22 **Low battery:** A reportable OTS device power status that indicates an impending loss of power.
3.2.23 **Maintenance:** Inspection, repair, and retirement of a system.

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

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

3.2.26 **Monitoring center:** A designated location where offender tracking data are received and alerts are responded to in accordance with a protocol established by an agency.

3.2.27 **Multi-piece system:** An OTS configuration that consists of, at a minimum, both body-worn and body-attached components.

3.2.28 **National Information Exchange Model:** A collaborative (public/private), XML-based information exchange framework designed to develop, disseminate, and support enterprise-wide information exchange standards and processes that will enable jurisdictions to automate information sharing.

3.2.29 **Near real time:** Refers to the delay introduced, for electronic communication and automated data processing, between the occurrence of an event and the delivery of the processed data, and implies that there are no significant delays.

3.2.30 **New unit:** An OTS unit that contains all new parts and has not previously been shipped from the manufacturing location to a user agency.

3.2.31 **Notification:** The process of advising the subscribing agency of selected events.

3.2.32 **Offender tracking:** The process of continuously monitoring the location of an individual using a location-based service.

3.2.33 **Offender Tracking System (OTS):** A technology, consisting of hardware and software segments, designed to determine and report at programmed intervals the geographic location of a person (participant) who is subject to criminal justice system supervision.

3.2.34 **One-piece system:** An OTS configuration in which the tracking component(s) reside within the body-attached device.

3.2.35 **Open air environment:** Taking place in, or characteristic of, a setting in which there are no obstructions that extend higher than 15 degrees above the horizon.

3.2.36 **Participant:** A person subject to criminal justice system supervision who is wearing, or is assigned to wear, an OTS hardware unit in connection with that supervision.
3.2.37 **Passive tracking:** An approach to offender tracking in which device location and status data are stored in device memory, and are transmitted retrospectively. The data may be transmitted at fixed intervals using cellular capability, or may be transmitted when the device is connected to a telephone line.

3.2.38 **Point:** A single geographic location derived by a location-based service.

3.2.39 **Portable communications modality:** A handheld or wearable device that provides the user with mobile communication and/or computing capability (e.g., cellular telephone, personal digital assistant, pager, smart phone, tablet).

3.2.40 **Product:** One unit of a specific OTS model.

3.2.40.1 **New product:** An OTS containing all new parts and that has not ever been shipped from the manufacturing location to a user agency.

3.2.40.2 **Refurbished product:** (1) Provided by the OTS manufacturer to a user agency after modification by replacement of system-level components, including the casing and excluding straps and field-replaceable batteries, with identical components and assignment of a modified serial number, or (2) Manufactured from used system-level components and assigned a unique serial number with the intent to provide it to a user agency.

3.2.40.3 **Repaired product:** An OTS submitted to the OTS manufacturer for correction of a defect, failure, or functional issue that the OTS manufacturer corrects and returns back to the submitting user agency with the same original serial number.

3.2.40.4 **Used product:** An OTS containing all original system-level components, excluding field-replaceable batteries and straps, and that was previously shipped from the manufacturing location to a user agency. A used OTS maintains its original serial number with no modifications required.

3.2.41 **Product label:** A marking affixed by an OTS manufacturer to each piece (i.e., body-worn and body-attached) of a compliant model that contains required product and model information and the mark of conformity.

3.2.42 **Removal:** Detachment of a body-attached OTS unit from a participant.

3.2.43 **Serial number:** A unique alphanumeric identifier applied by an OTS manufacturer to each unit of a particular product model that distinguishes it from every other unit of that product model produced by the OTS manufacturer.
3.2.44 **Shielding**: Intentional application of an object or substance, usually metallic, to the exterior of an OTS device for the purpose of blocking incoming and/or outgoing radio signals.

3.2.45 **System-level components**: Key parts of an OTS model that, when certified, cannot be changed or modified without first receiving the authorization of the certification body. These items include casings, location methodology apparatus, antennas, communication devices, batteries, straps/attachment pins or devices, transmitters/receivers, and indicators to the participant.

3.2.45.1 **Field-replaceable system-level components**: OTS hardware elements that can be replaced by the agency without destructively opening the hardware component casing (e.g., some batteries, straps).

3.2.46 **Tether or tethering device**: The body-attached component of a multi-piece OTS.

3.2.47 **Tether-gone**: Event in which the tether and tracking device of a multi-piece OTS are separated by a specified distance for a predetermined length of time.

3.2.48 **Tracking system software**: The various computer programs used to direct the operation of an OTS, especially as it relates to the interface with the end user. These programs may exist within the tracking devices themselves (firmware), within the manufacturer’s computer systems, or resident on computers controlled by the end user.

3.2.49 **Two-piece system**: See *multi-piece system*.

3.2.50 **Unit**: One instance of a particular OTS hardware product model.

3.2.51 **Zone**: A user-defined geographic area typically intended to restrict the movement of a participant during specified periods and to trigger notification to the user agency if the area boundaries are traversed by a participant to whom the zone applies.

3.2.51.1 **Exclusion zone**: A user-defined area outside of which a tracked participant must remain during specified periods.

3.2.51.2 **Free-form zone**: A user-defined irregular polygon that permits introduction of an unlimited number of nodes to produce a highly customizable, asymmetrical shape.

3.2.51.3 **Inclusion zone**: A user-defined area within which a tracked participant must remain during specified periods. Inclusion zones are usually defined using product-specific software, and participant noncompliance generally results in delivery of an alert to the supervising agency.
3.2.52 **Zone template:** Overlay, or pattern, containing multiple areas of specified types that an agency may create once and apply as needed to multiple participants.
4. FORM AND FIT REQUIREMENTS

To be tested under the performance requirements of this standard, an OTS model must satisfy the requirements of this chapter.

4.1 Requirements for Offender Tracking System Models

4.1.1 The OTS shall meet or exceed the applicable requirements specified in this section.

4.1.2 The OTS may be of either one-piece or multiple-piece configuration.

4.1.3 The OTS may use either active tracking or passive tracking.

4.1.4 The body-attached device attachment strap shall be adjustable in increments of 1.5 cm or less.
5. PERFORMANCE REQUIREMENTS

5.1 Performance Requirements for OTS models

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

- Safety (see Section 5.2).
- Technical Operation (see Section 5.3).
- Circumvention (see Section 5.4).
- Software (see Section 5.5).
- Robustness (see Section 5.6).

5.1.1 The OTS shall meet the performance requirements for either a one-piece or a multi-piece configuration.

5.1.2 Performance requirements in this chapter apply to both active and passive OTSs, except as noted.

5.1.3 OTSs 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.

5.1.4 The safety tests shall be performed first, followed by the technical operation tests. Environmental (e.g., extreme temperature, condensing humidity, water spray, immersion) tests shall follow mechanical tests. No other specific test sequence is required.

5.1.5 Section 6.4 provides a summary of the test samples to be used.

5.2 Safety

5.2.1 The OTS shall be tested as specified in Section 6.5, Radio Frequency Emissions Test, for unintentional, intentional, and harmful radio frequency emissions to comply with applicable FCC rules and regulations. If the OTS integrates previously tested and certified modular transceivers/transmitters shown to comply with FCC rules and regulations, the manufacturer may submit the FCC certification grant of approval, a Class 2 Permissive Change certification grant of approval, or declaration of conformity (DOC), whichever is appropriate, in lieu of this testing.
5.2.2 The OTS shall comply with safety requirements as specified in UL 60950-1, *Information Technology Equipment – Safety – Part 1: General Requirements*. See section 6.4 for information about test samples.

5.2.3 Each OTS primary and secondary battery shall be tested (or shall have been tested) in accordance with 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*.

5.2.4 The body-attached and body-worn devices shall be tested as specified in Section 6.6, Sharp Edges Test, and shall not cut through the two outer layers of the sensing tapes on the test apparatus.

5.2.5 The body-attached device shall be tested as specified in Section 6.7, Emergency Removal/Cut Strap Test, and the attachment strap shall be severed during the test within a period of one minute or less. Cutting through the strap shall also cause an alert to be generated. The alert generated shall be received by the agency within four minutes of the violation. The alert shall also meet the requirements of Section 5.3.4.

5.3 Technical Operation Requirements

5.3.1 If the OTS uses a GPS, the OTS shall be tested as specified in Section 6.8, Signal Acquisition Test, and shall reacquire a GPS signal in two minutes or less.

5.3.2 The OTS shall be tested as specified in Section 6.9, Accuracy Test, and shall be demonstrated at the accuracy levels indicated within the scenarios below:

- With the participant location components in an open air environment with no obstructions, the OTS shall provide a location that is accurate within 10 meters 90% of the time.

- After the participant location components have been stationary for a minimum of one hour in an open air environment, the OTS shall promptly and accurately register a sudden change of location. The participant location components shall be moved 75 meters to another open air environment within one minute. In the next 30 minutes, tracking points captured will provide a location that is accurate within 10 meters 90% of the time.

- With the participant location components placed in a structure designed to approximate typical residential shielding, the OTS shall provide a location that is accurate within 30 meters 90% of the time.
5.3.3 For active tracking systems only, the OTS shall be tested as specified in Section 6.10, Location and Status Data Test, and shall be demonstrated to provide an on-demand location and status update delivered within three minutes of real time.

5.3.4 The OTS shall provide alerts as follows:

5.3.4.1 The OTS shall record alerts at the data center and this information shall be available to the agency.

5.3.4.2 The OTS shall have the ability to provide alerts through a portable communication modality (e.g., cell phones, PDAs, pagers, tablets, laptops).

5.3.4.3 An active OTS shall be capable of providing alerts to the agency within four minutes of the occurrence of an event (as defined by the agency or manufacturer) under the communications environment described within the specific test method.

5.3.5 The OTS shall be tested as specified in Section 6.11, Low Battery Alert Test, and shall generate a local alert and an alert to the data center prior to complete battery discharge. The alerts shall also meet the requirements of Section 5.3.4.

5.3.6 The OTS shall be tested as specified in Section 6.12, Zone Violation Alert Test, and shall generate a “zone violation” alert received by the agency within four minutes of the violation. The alert shall also meet the requirements of Section 5.3.4.

5.3.7 If the OTS is of multi-piece configuration, the OTS shall be tested as specified in Section 6.13, Multi-Piece OTS Separation Detection and Alert Test, and shall provide a local “tether gone” alert within five minutes of separation and an agency alert within four minutes following the local alert. The alerts shall also meet the requirements of Section 5.3.4.

5.3.8 The OTS shall be tested as specified in Section 6.14, Participant Alert Test, and shall provide, at a minimum, audible and/or vibratory alerts to the participant as follows:

5.3.8.1 Audible alert – shall be at least 40 dBA at a distance of one meter from the OTS.

5.3.8.2 Vibratory alert – shall be at least five mm/second peak particle velocity (ppv).

5.3.9 The OTS shall be tested as specified in Section 6.15, Data Storage Test, and shall demonstrate the capability to store no less than 10 days of unreported data, assuming 1) a minimum collection rate of one location point per minute; and 2) successful collection of at least 90% of the location points per day. Additionally, this data shall be recoverable even after the OTS battery has been completely discharged.
5.3.10 The OTS shall be tested as specified in Section 6.16, Rechargeable Battery and Charging System Communication Test, and shall: 1) remain operational during and after each portion of the test; 2) successfully collect 95% of the possible 1,440 location data points (1,368 points) at each of the three test temperatures; and 3) provide indication when the battery is being charged and when the battery charging process is complete.

5.3.11 The OTS shall be tested as specified in Section 6.17, Battery Life Expectancy Test, and the batteries shall be capable of 365 cycles of charging/discharging.

5.4 Circumvention Requirements

5.4.1 The OTS shall be tested as specified in Section 6.18, Attachment Strap Removal Detection and Alert Test, and the attachment strap shall: 1) not separate from the body-attached device or stretch more than 5% (without generating an alert) on application of a 25 kg “inside out” force; and 2) cause an alert to be generated if the strap is separated from the body-attached device or stretched in excess of 5%. The alert generated shall be received by the agency within four minutes of the violation. The alert shall also meet the requirements of Section 5.3.4.

5.4.2 The OTS shall be tested as specified in Section 6.19, Loss of Location/Communications Failure Alert Test, and shall demonstrate detection and alerting for 1) loss of location incidents and 2) loss of communications incidents (i.e., those incidents for which communications have been lost for a period of at least one hour). The alerts shall also meet the requirements of Section 5.3.4.

5.4.3 For multi-piece OTSs with communications between the tether and the tracking device incorporating encrypted 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 140-2) shall be provided. Evidence of a certificate of compliance for the validation of encryption algorithms and authentication of the data to and from the data center shall be provided. ¹

5.4.4 The OTS shall be tested as specified in Section 6.20, Metallic Shielding Detection and Alert Test, and shall demonstrate detection and alerting in the event that an object

¹ The transmission stream that contains the Dynamic Mobile Exchange (DME) shall also contain a separate hash (as described above) so that once the file is written to a storage medium such as a non-volatile memory, solid state disk, or 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 OTS stores location data points on its onboard memory, the program that encodes and stores the location data points must provide an algorithm that can be used to detect missing and/or tampered location data points. The transmission of data to and from the monitoring center shall be encrypted and authenticated.
or material shields the OTS for a minimum of five minutes. The OTS shall provide an alert to the agency as soon as cellular communication is restored (if interrupted). The OTS shall not generate a “No GPS/Possible Shielding” alert for solely a loss of GPS when no metallic shielding is present. The alerts shall also meet the requirements of Section 5.3.4.

5.4.5 The OTS shall be tested as specified in Section 6.21, Interference/Jamming Detection and Alert Test, and shall detect interference or jamming of the cellular communications. The OTS shall provide a “potential jamming violation” alert to the agency within four minutes. The alerts shall also meet the requirements of Section 5.3.4.

5.5 Software Requirements

5.5.1 The OTS software and firmware shall be tested as specified in Section 6.22, Software Test, and shall demonstrate that the following requirements are met:

- Capability of exporting, at a minimum, all historical offender location data (longitude, latitude, time, and date), status of all alerts, offender identifiers, originating agency identifier, and agency contact information into defined comma delimited text files.
- Capability to adjust the rate at which data points are collected.
- Capability to record one location point per minute.
- Capability to upload data points once every 15 minutes (for active devices only).
- Capability for configuring of zones in the shapes of circles, rectangles, and arbitrary-shaped polygons, including zones within zones.
- Capability to generate zone templates and create and store a minimum of 50 zones per template.
- Agency access to make and to track changes to information, including, but not limited to, schedules, zones, demographics, and addresses. The information changes shall be auditable and include identification of the agency employee making the changes.
- Capability to provide configurable levels of administrative privileges (i.e., role-based security) that will allow changes to be made by the agency at the appropriate privilege level.
- Capability of a secure method of agency access to software as described in Appendix A.
5.6 **Robustness Requirements**

5.6.1 The tests specified within this section include the OTS Functionality Test provided in Section 6.23.

5.6.2 The OTS shall be tested as specified in Section 6.24, Extreme Temperature Test, and shall function properly following exposure to extreme temperatures (+50°C and -20°C).

5.6.3 The OTS shall be tested as specified in Section 6.25, Condensing Humidity Test, and shall function properly and show no signs of moisture ingress following exposure to condensing humidity.

5.6.4 The OTS shall be tested as specified in Section 6.26, Water Spray Exposure Test, and shall function properly and show no signs of moisture ingress following exposure to water spray.

5.6.5 The OTS shall be tested as specified in Section 6.27, Immersion Test, and shall function properly and show no signs of moisture ingress following immersion. The OTS shall meet the requirements of IEC 60529 IP 67 or NEMA 6P.

5.6.6 The OTS shall be tested as specified in Section 6.28, Shock by Impact Test, and shall function properly and show no signs of breach of the casing following exposure.

5.6.7 The OTS shall be tested as specified in Section 6.29, Mechanical Shock Test, and shall function properly following exposure.

5.6.8 The OTS shall be tested as specified in Section 6.30, Sinusoidal Vibration Test, and shall function properly following exposure.

5.6.9 The OTS shall be tested as specified in Section 6.31, Random Vibration Test, and shall function properly following exposure.

5.6.10 The OTS shall be tested as specified in Section 6.32, Electromagnetic Compatibility Test, and shall function properly during and following exposure.
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.

6.1.2 All test data and observations shall be recorded and reported, including OTS supplier name and OTS model tested.

6.1.3 Unless specified otherwise, each test shall be performed on a sample representative of the model being tested. The manufacturer shall submit test samples in accordance with Section 6.4.

6.1.4 The test laboratory shall use a working sample for each test unless indicated otherwise within the test method.

6.1.5 Unless specified otherwise, all test methods apply to both active and passive tracking devices.

6.1.6 Unless specified otherwise, all test methods apply to both one-piece and multi-piece OTSs.

6.1.7 Unless specified otherwise, all test methods apply to the entire OTS, including both body-attached and body-worn devices.

6.1.8 Unless the performance requirement is specifically stated as an average result, any individual sample results not meeting the performance requirement shall be considered a failure.

6.1.9 In order to declare conformity for a particular model, the sample(s) must successfully complete all applicable tests within Chapter 6.

6.1.10 For those tests requiring only an “adequately charged battery” (instead of a “fully charged battery”), if the sample does not meet the definition of an adequately charged battery, the battery must be recharged.

6.1.11 Unless otherwise specified within a test method, when charging the OTS battery, the battery shall be charged for a period not to exceed two hours for a one-piece system or four hours for multi-piece systems.
6.2 Room Temperature Conditioning

6.2.1 Each sample shall be conditioned prior to testing at a temperature of $21^\circ C \pm 3^\circ C$ ($70^\circ F \pm 5^\circ F$) and $65\% \pm 5\%$ relative humidity (RH) for at least two hours. Samples shall be tested within 15 minutes following removal from conditioning.

6.3 Test Conditions

6.3.1 Each of the test methods within Chapter 6 requires that the test be conducted under a set of specific test conditions. These conditions vary between test methods.

6.3.2 Each test method shall invoke a subset of the test conditions below. A table summarizing the test conditions applicable to each test method can be found in Table 1.

6.3.2.1 The test shall be conducted during a time with limited or no cloud cover.

6.3.2.2 All tests shall be conducted in a location where a minimum upload/download speed of 100 kilobits/s of cellular data can be achieved.

6.3.2.3 Unless otherwise specified, the test shall be conducted with the OTS set at its maximum location point collection and upload frequencies. A minimum collection rate of one location point per minute is required. A minimum upload frequency of once every 15 minutes is required. The actual settings used during the test shall be documented in the test report.

6.3.2.4 The test shall be conducted in a location that has a clear view of the sky starting at 15 degrees above horizontal, which is not obstructed by trees, vegetation, topography, or buildings.

6.3.2.5 The OTS shall be placed on a moving device with a minimum cycle motion of 10 cycles per minute to prevent the OTS from going into an “at rest” status during the test.

6.3.2.6 The OTS shall be tested with a fully charged battery.

6.3.2.7 The OTS shall be tested with an adequately charged battery.

6.3.2.8 If the OTS or its tracking system software uses any type of precision algorithm, the test shall be conducted with the precision algorithm activated.
6.3.2.9 The test shall be conducted ONLY under turbulent, well-mixed, atmospheric conditions. For the purposes of this section, if ANY of the following atmospheric conditions exist, the atmosphere is NOT considered “turbulent, well-mixed:”

(a) fog (with horizontal visibility < 4.8 km [three miles]).

(b) stratus (i.e., solid overcast cloud cover, with cloud base 152 m [500 ft] AGL or lower).

(c) sustained surface wind speed < three knots.

6.3.2.10 The body-attached device shall be tested in a position such that the centerline of the device is a distance of 15 cm above the ground. It shall be mounted on a vertically oriented 3 in diameter piece of PVC Schedule 40 pipe.

6.3.2.11 The body-worn device, if applicable, shall be tested at a distance of one meter from the ground.

6.3.2.12 The test shall not be conducted within 1.6 km (one mile) of any body of water greater than approximately 8 hectares (20 acres) in size.

6.3.2.13 The test location shall be in an area with grades of no more than five degrees within 25 meters of where the OTS will be situated.

6.3.2.14 Test sites shall be flat, dry, non-conductive surfaces (i.e., wood or concrete).

6.3.2.15 Prior to the start of the test, an OTS using GPS technology shall have acquired location and shall have been outputting tracking data for a minimum of 30 minutes.

6.4 Test Samples

6.4.1 The manufacturer shall provide a total of 10 complete OTSs for initial certification testing. A table summarizing the specific allocation of samples to each of the test methods in the chapter can be found in Table 2.

6.4.2 The manufacturer shall provide five spare OTS straps for use during testing.

6.4.3 The manufacturer shall provide 10 separate OTS batteries for use during Battery Life Expectancy Testing (section 6.17).

6.4.4 OTS sample Nos. 3-5 are to be used for a majority of the tests and can be reused among these tests as required except as noted for the strap-related tests. Unless otherwise indicated, only one of these three samples is required to be used for each of
the tests indicated (e.g., for the accuracy test, either sample No. 3 OR sample No. 4 OR sample No. 5 is to be used – NOT all three).

6.4.5 For sample No. 2, Radiofrequency Emissions Testing (section 6.5) shall be performed before Radiofrequency Exposure Testing (section 6.32).

6.5 **Radio Frequency Emissions Test**

6.5.1 Application

6.5.1.1 This test method shall apply to all OTSs.

6.5.2 Samples

6.5.2.1 One complete OTS per Table 2 and the accompanying power charger.

6.5.2.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.5.3 Test Conditions

6.5.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.5
(d) 6.3.2.6
(e) 6.3.2.15

6.5.3.2 For passive tracking systems, use a 15-minute data upload interval for the entire test if available. If not, use the shortest interval available.

6.5.4 Procedure

6.5.4.1 If the OTS is of one-piece configuration, then it shall be fully discharged before being subjected to recharge for up to two hours. If the OTS is of multi-piece configuration, then it shall be fully discharged before being subjected to recharge for up to four hours. Before the start of the test, verify or confirm that the time-tagged location data points appear on the data center computer screen.
## Table 1 - Test Condition Summary

<table>
<thead>
<tr>
<th>Test Method</th>
<th>Test Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Frequency Emissions Test (6.5)</td>
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<tr>
<td>Sharp Edges Test (6.6)</td>
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<tr>
<td>Emergency Removal/Cut Strap Alert Test (6.7)</td>
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<td>Signal Acquisition Test (6.8)</td>
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<td>Accuracy Test (6.9)</td>
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<td>Location and Status Data Test (6.10)</td>
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<td>Low Battery Alert Test (6.11)</td>
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<td>Zone Violation Alert Test (6.12)</td>
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<td>Multi-Piece Separation Detection and Alert Test (6.13)</td>
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<td>Participant Alert Test (6.14)</td>
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<td>Data Storage Test (6.15)</td>
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<td>Rechargeable Battery and Charging System Communication Test (6.16)</td>
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<td>Attachment Strap Removal Detection and Alert Test (6.18)</td>
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<td>Loss of Location/Communications Failure Alert Test (6.19)</td>
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<td>Extreme Temperature Storage Test (6.24)</td>
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## Table 2 – Test Sample Summary

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<td>Sharp Edges Test (6.6)</td>
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<tr>
<td>Emergency Removal/Cut Strap Alert Test (6.7)</td>
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<tr>
<td>Signal Acquisition Test (6.8)</td>
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<td>Accuracy Test (6.9)</td>
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<td>Location and Status Data Test (6.10)</td>
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<td>Low Battery Alert Test (6.11)</td>
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<td>Zone Violation Alert Test (6.12)</td>
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<td>Multi-Piece Separation Detection and Alert Test (6.13)</td>
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<tr>
<td>Participant Alert Test (6.14)</td>
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<td>Radio Frequency Energy Exposure Test (6.32)</td>
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* - This test is considered destructive, and should be the last test conducted on a given sample

** - This test requires a sample in which the battery may be disconnected without damaging the rest of the sample (i.e., case)
6.5.4.2 When testing the OTS as an unintentional radiator for FCC DOC procedure approval, the above test conditions apply. If the OTS employs a landline to upload tracking data, it shall comply with 47CFR Part 68, which governs the direct connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN) and to wireline carrier-owned facilities used to provide private line services.

6.5.4.3 When testing the OTS as an unlicensed or licensed intentional radiator for FCC certification, the requirements for configuring and exercising the OTS during testing shall be determined by the applicable FCC rule parts and policies, and the need to use appropriate software and interconnect to other hardware, base station simulators, and/or other appropriate engineering means for purposes of ensuring worst case transmitter emissions are present during the testing.

6.5.4.4 The OTS shall be tested for unintentional radiated emissions to comply with FCC 47CFR Part 15, Subparts A and B (Class B) and/or any other rules and regulations when applicable. The referenced standard shall be ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. The FCC will accept applications for certification of equipment tested either to the revised ANSI C63.4-2009 or ANSI C63.10-2009 procedures until its current policy on the validity of procedures is amended.

6.5.4.5 The OTS shall be tested to comply with intentional radiated emissions in accordance with 47CFR Part 15 Subpart C, 15, 47CFR Part 22, Part 24, Part 27 and any other applicable FCC rules and regulations resulting from new progress in mobile communications technology. The referenced standards shall be ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz or both ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz and ANSI C63.10-2009, American National Standard for Wireless Testing Unlicensed Wireless Devices and EIA/TIA 603-C–2004 Land Mobile FM or PM Communications Equipment – Measurement and Performance. The FCC will accept applications for certification of equipment tested either to the ANSI C63.4-2003 procedure or the revised ANSI C63.4-2009 and ANSI C63.10-2009 procedures until its current policy on the validity of the referenced procedures is amended.

6.5.4.6 The OTS shall be tested to determine compliance with the limits of 47CFR Part 2.1093 for Radiofrequency radiation exposure evaluation for portable devices.
Specifically, one-piece and multi-piece body-worn or extremity-worn OTS shall be evaluated using Specific Absorption Rate measurement methods to the FCC’s Radiofrequency radiation exposure limits using OET Bulletin Number 65, “Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation,” its related FCC-referenced supplements including FCC KDB 447498 Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies, and any other associated KDB that would apply.

6.5.4.7 If the OTS incorporates FCC certified unlicensed or licensed wireless modular or limited modular transmitters, transceivers, and/or receivers, the FCC’s grant notes shall govern the use of these devices with respect to OTS FCC certification.

6.5.4.8 Any modifications to a FCC-certified OTS, or modifications to an FCC certified integrated modular or limited modular transmitter, transceiver, and/or receiver on an OTS, or any deviation from its grant notes, shall be subject to the FCC’s Permissive Change rules and policies 47CFR Part 2.1043. These changes may include, but are not limited to, changes in antenna, Printed Circuit Board (PCB) and hardware, enclosure, software, and miscellaneous.

6.5.5 Report

6.5.5.1 Record and document all test results and observations.

6.6 Sharp Edges Test

6.6.1 Application

6.6.1.1 This test method shall apply to all accessible (as worn) edges of the body-attached device and the body-worn device (if applicable).

6.6.2 Samples

6.6.2.1 One complete OTS per Table 2. The sample being tested does not need to function, per se, but the exterior must not have been damaged by any prior tests.

6.6.3 Test Conditions

6.6.3.1 No specific test conditions from Section 6.3 apply.

6.6.4 Procedure

6.6.4.1 The OTS shall be tested in accordance with UL 1439, Tests for Sharpness of Edges on Equipment.
6.6.5 Report

6.6.5.1 Test results and observations shall be reported and documented.

6.7 Emergency Removal/Cut Strap Alert Test

6.7.1 Application

6.7.1.1 This test method shall apply to the body-attached device attachment strap.

6.7.2 Samples

6.7.2.1 One complete OTS per Table 2.

6.7.2.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.7.3 Test Conditions

6.7.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.7
(d) 6.3.2.10
(e) 6.3.2.11

6.7.4 Procedure

6.7.4.1 Secure the body-attached device per the OTS manufacturer instructions to a vertically oriented 3 in diameter piece of PVC Schedule 40 pipe.

6.7.4.2 Starting a stopwatch, attempt to cut the attachment strap completely and remove it from the piece of pipe with 18.4 cm (7.25 in) EMS/EMT shears, as defined by 21 CFR 880.6820 (FDA), Medical Disposable Scissors.

6.7.4.3 Record the amount of time it takes to accomplish this process.

6.7.4.4 Verify that an alert is generated on cutting the strap and that the alert is received by the agency within four minutes once the alert is generated.
6.7.5 Report

6.7.5.1 Record the results of the test, including the following information:

- The amount of time that it took to cut through the attachment strap.
- Verification that an alert was generated on cutting of the attachment strap.
- Verification that an alert was received by the agency within four minutes of when the attachment strap was cut.
- Any relevant observations.

6.7.6 Interpretation

6.7.6.1 The elapsed time shall be used as one of the pass/fail criteria.

6.7.6.2 The failure to successfully cut and remove the OTS from the pipe shall result be considered a failure of the test.

6.7.6.3 The generation and timely receipt of an alert due to cutting of the attachment strap shall be another pass/fail criterion.

6.8 Signal Acquisition Test

6.8.1 Samples

6.8.1.1 One complete OTS per Table 2.

6.8.1.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.8.2 Test Conditions

6.8.2.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.4
(d) 6.3.2.5
(e) 6.3.2.7
(f) 6.3.2.9
(g) 6.3.2.10
(h) 6.3.2.11
(i) 6.3.2.15

6.8.3 Procedure

6.8.3.1 Place the device in a suitably sized metal box (e.g., Faraday Cage) with a removable or hinged lid. The box shall be located 3 meters (±10 cm) from the original position of the device.

6.8.3.2 Keep it in the box for approximately 30 minutes.

6.8.3.3 Open the box, immediately remove the device, and place it in its original location.

6.8.3.4 Timing for this test shall start on removal of the device from the box. The starting time shall be coordinated with the current time at the data center (i.e., when the device is removed from the box, record the time at the data center).

6.8.3.5 Allow the device to successfully reacquire its location. This will be considered to have occurred when the next time-stamped location point is successfully uploaded to, and received by, the data center.

6.8.3.6 Obtain the timestamp generated by the system for the first reacquired location point.

6.8.3.7 Compare this timestamp with the starting time to determine the elapsed time it took the device to re-acquire a location signal.

6.8.4 Report

6.8.4.1 The starting time (hr:min:sec), designated as $T_1$, and the time associated with first reacquired location point (hr:min:sec), designated as $T_2$ shall be recorded and reported.

6.8.4.2 The elapsed time, $T_E$, shall be calculated as follows:

$$T_E = T_2 - T_1$$

6.8.5 Interpretation

6.8.5.1 The elapsed time, $T_E$, shall be used as the pass/fail criterion.

6.8.5.2 Failure to reacquire a signal shall be considered failing results.
6.9 Accuracy Test

6.9.1 Samples

6.9.1.1 One complete OTS per Table 2.

6.9.2 Outdoor Accuracy Test Purpose

6.9.2.1 The outdoor accuracy test has two main purposes. First, it determines the accuracy of the offender tracking technology in an outdoor environment (the device is held stationary in a single outdoor location). Secondly, it evaluates the ability to track a device that has suddenly moved from an anchored location to another location a short distance away.

6.9.3 Outdoor Accuracy Test Conditions

6.9.3.1 All test conditions from Section 6.3 apply to this test with the exception of Section 6.3.2.7. This information is also represented in Table 1.

6.9.3.2 Section 6.3.2.3 applies with the following modification: the data point collection rate shall be set at one point/minute. The data location point upload frequency shall be set at once every 15 minutes.

6.9.3.3 There shall be two locations used for the outdoor test. Location A shall be approximately 75 meters from Location B. The precise longitude and latitude of each of these locations must be known.

6.9.3.4 Locations A and B shall be accurately discernible from the aerial views of the tracking system software.

6.9.3.5 The applicable test conditions in Section 6.3 apply at both Locations A and B.

6.9.4 Outdoor Accuracy Test Procedure

6.9.4.1 Evaluate weather conditions and proceed if the forecast for the testing period predicts clear to partly cloudy conditions. If precipitation occurs during the testing, the test administrator may choose to continue testing. However, if the OTS fails any portion of the accuracy testing, the testing shall be repeated at a time when better weather conditions exist.

6.9.4.2 Test the cellular coverage of the services used by the OTS by measuring the signal strength of cell phones using those services. Proceed with the testing if the cell phones can achieve a minimum upload/download speed of 100 kilobits/s of cellular...
data. If the OTS is using a service that lacks sufficient cellular coverage, the OTS should be tested at a different location.

6.9.4.3 Initiate a test with a commercial GPS receiver to ensure that there is a sufficient view of the sky. The receiver should indicate the reception of four or more satellites for a period of 15 consecutive minutes.

6.9.4.4 The OTS shall be placed at Location A for a minimum of five minutes prior to the start of the testing at the pre-described height.

6.9.4.5 Start the test.

6.9.4.6 The OTS shall remain at Location A for 60 minutes.

6.9.4.7 Immediately at the conclusion of one hour, the OTS shall be moved from Location A to Location B within a one-minute period (i.e., the OTS shall be located at Location B, at the pre-described height, by 61 minutes following the start of the test). The OTS shall remain at Location B for a period of 30 minutes.

6.9.4.8 Repeat sections 6.9.4.1 through 6.9.4.7 four additional times.

6.9.5 Outdoor Accuracy Test Report

6.9.5.1 Record and report all observations and data (confirmation of weather conditions, confirmation of minimum cellular transmission rate, number of GPS satellites, location data, etc.).

6.9.5.2 For those points generated while the OTS was at Location A, the distance between each of those points and the actual position (longitude/latitude) of Location A shall be calculated and reported. Websites such as http://www.movable-type.co.uk/scripts/latlong.html are available to help with this calculation.

6.9.5.3 For those points generated while the OTS was at Location B, the distance between each of those points and the actual position (longitude/latitude) of Location B shall be calculated and reported. Websites like http://www.movable-type.co.uk/scripts/latlong.html are available to help with this calculation.

6.9.6 Outdoor Accuracy Test Interpretation

6.9.6.1 The accuracy of the location points shall be used as the pass/fail criterion.
6.9.6.2 To pass, a minimum of 90% of those location points generated while the OTS was at Location A (90% x 60 points = 54) must fall within 10 meters of the precise location (longitude/latitude) of Location A.

6.9.6.3 To pass, a minimum of 90% of those location points generated while the OTS was at Location B (90% x 30 points = 54) must fall within 10 meters of the precise location (longitude/latitude) of Location B.

6.9.6.4 If an OTS using GPS fails to pass any portion of the accuracy testing, the solar weather conditions at the time must be checked. The “Estimated Kp” readings found on the Satellite Environment Plot chart at http://www.swpc.noaa.gov/today.html shall be reviewed. All Kp values during the time of the test must be <-four. Values greater than or equal to four indicate that increased solar activity was occurring that could have adversely impacted the testing. If the Kp values for the times of the testing period were not all <four, testing of a failed OTS shall be repeated.

6.9.7 Indoor Accuracy Test Purpose

6.9.7.1 The purpose of the indoor accuracy test is to determine the ability of OTS to provide accurate locations in an environment meant to approximate a typical residential environment.

6.9.8 Indoor Accuracy Test Conditions

6.9.8.1 All test conditions from Section 6.3 apply to this test with the exception of Section 6.3.2.7. This information is also represented in Table 1.

6.9.8.2 The indoor accuracy test will be conducted with the OTS in a structure meant to approximate a single story residence. The structure will be constructed according to the specifications provided in Figure 4 (Appendix B).

6.9.8.3 The test location shall be accurately discernible from the aerial views of the tracking system software. The precise position (longitude and latitude) of this location shall be known.

6.9.8.4 For multi-piece devices, the test will be conducted with the tracking device out of the home charger and without the use of any beacon system.

6.9.9 Indoor Accuracy Test Procedure

6.9.9.1 Evaluate weather conditions and proceed if the forecast for the testing period predicts clear to partly cloudy conditions. If precipitation occurs during testing, the test...
administrator may choose to continue testing. However, if the OTS fails any portion of the accuracy testing, the testing should be repeated at a time when better weather conditions exist.

6.9.9.2 Test the cellular coverage of the services used by the OTS by measuring the signal strength of cell phones using those services. Proceed with the testing if the cell phones can achieve a minimum upload/download speed of 100 kilobits/s of cellular data. If the OTS is using a service with insufficient cellular coverage, the OTS should be tested at a different location.

6.9.9.3 Initiate a test with a commercial GPS receiver to ensure that there is a sufficient view of the sky. The receiver should indicate the reception of four or more satellites for a period of 15 consecutive minutes.

6.9.9.4 The OTS shall be placed in the center of the room at the pre-described height and be no more than 2.5 meters from a window for a minimum of five minutes before the start of test.

6.9.9.5 Start the test.

6.9.9.6 The OTS shall remain in this location at the test site for a period of 12 hours.

6.9.10 Indoor Accuracy Test Report

6.9.10.1 Record and report all observations and data (confirmation of weather conditions, confirmation of minimum cellular transmission rate, number of GPS satellites, location data, etc.).

6.9.10.2 The distance between each of the location points generated and the precise position (longitude/latitude) of the test site shall be calculated and reported. Websites like http://www.movable-type.co.uk/scripts/latlong.html are available to help with this calculation.

6.9.11 Indoor Accuracy Test Interpretation

6.9.11.1 The accuracy of the location points shall be used as the pass/fail criterion.

6.9.11.2 To pass, a minimum of 90% of those location points generated (90% x 720 points = 648) must fall within 30 meters of the precise location (longitude/latitude).

6.9.11.3 If an OTS using GPS fails to pass any portion of the accuracy testing, the solar weather conditions that were occurring must be checked. The “Estimated Kp”
readings found on the Satellite Environment Plot chart at http://www.swpc.noaa.gov/today.html shall be reviewed. All Kp values during the time of the test must be <four. Values greater than or equal to four indicate that increased solar activity was occurring that could have adversely impacted the testing. If the Kp values for the times of the testing period were not all <four, testing of a failed OTS shall be repeated.

6.10 **Location and Status Data Test**

6.10.1 **Samples**

6.10.1.1 One complete OTS per Table 2.

6.10.1.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.10.2 **Test Conditions**

6.10.2.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.2  
(b) 6.3.2.3  
(c) 6.3.2.5  
(d) 6.3.2.7  
(e) 6.3.2.10  
(f) 6.3.2.11  
(g) 6.3.2.15

6.10.3 **Procedure**

6.10.3.1 Execute the on-demand location and status update (i.e., “locate device”) function from a device representative of the agency user interface.

6.10.3.2 Timing shall start when the location and status update function is executed.

6.10.3.3 Timing shall stop when the location/status data point is received at the user interface. (Note the user interface screen may need to be refreshed to see this data point.)

6.10.3.4 Record the elapsed time between execution time of the on-demand location and status update function, and receipt of the location point at the user interface.
6.10.4 Report

6.10.4.1 The elapsed time between execution of the on-demand location and status update function and receipt of the location point at the user interface shall be recorded and reported.

6.10.5 Interpretation

6.10.5.1 The elapsed time shall be used as the pass/fail criterion.

6.10.5.2 The failure to receive a data point at the user interface shall be considered failing results.

6.11 Low Battery Alert Test

6.11.1 Samples

6.11.1.1 One complete OTS per Table 2.

6.11.1.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.11.2 Test Conditions

6.11.2.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.5
(d) 6.3.2.7
(e) 6.3.2.8
(f) 6.3.2.15

6.11.3 Procedure

6.11.3.1 Allow the OTS to collect/upload data as it would in the field.

6.11.3.2 Allow the battery to naturally discharge (i.e., do not recharge the battery).
6.11.3.3 Ensure that prior to complete battery discharge, both a local “low battery” alert and a system “low battery” alert to the data center are generated. Record the time at which both of these alerts are generated.

6.11.3.4 Once the battery has discharged, keep it in the discharged state for approximately one hour.

6.11.3.5 Recharge the battery and allow the OTS to upload its stored location data.

6.11.3.6 Record the time of the last location point collected prior to the complete discharge of the battery above.

6.11.4 Report

6.11.4.1 Document all test results and observations, including verification of low battery alerts and the timing of these alerts.

6.11.5 Interpretation

6.11.5.1 The generation of “low battery” alerts, both local and to the data center, shall be used as the pass/fail criterion.

6.12 Zone Violation Alert Test

6.12.1 Samples

6.12.1.1 One complete OTS per Table 2.

6.12.2 Test Conditions

6.12.2.1 All test conditions from Section 6.3 apply to this test with the exception of Section 6.3.2.6. This information is also represented in Table 1.

6.12.3 Procedure

6.12.3.1 Create a circular inclusion zone approximately 150 m in diameter.

6.12.3.2 Place the OTS at the approximate center of the inclusion zone.

6.12.3.3 Allow the system to collect location data for approximately 30 minutes.

6.12.3.4 Move the OTS approximately 150 m in any one direction.

6.12.3.5 Record the time at which the approximate boundary of the inclusion zone is crossed.
6.12.3.6 Keep the OTS at this new location for approximately 30 minutes.

6.12.3.7 Verify that a zone violation alert was generated and record the time at which the system generated the alert.

6.12.3.8 Record the time at which the agency received the zone violation alert.

6.12.3.9 Make the zone created in Section 6.12.3.1 an exclusion zone.

6.12.3.10 Move the OTS back to its original location (in the center of newly created exclusion zone).

6.12.3.11 Record the time at which the approximate boundary of the exclusion zone is crossed.

6.12.3.12 Keep the OTS at this location for approximately 30 minutes.

6.12.3.13 Verify that a zone violation alert was generated and record the time at which the system generated the alert.

6.12.3.14 Record the time at which the agency received the zone violation alert.

6.12.4 Report

6.12.4.1 Record all test results, including the times at which the zone boundaries were crossed and the “zone violations” were generated and received.

6.12.5 Interpretation

6.12.5.1 The generation of and the timeliness of the receipt of “zone violation” alerts shall be used as the pass/fail criteria.

6.13 Multi-Piece Separation Detection and Alert Test

6.13.1 Application

6.13.1.1 This test shall apply only to active, multi-piece OTSs.

6.13.2 Samples

6.13.2.1 One complete OTS per Table 2.
6.13.3 Test Conditions

6.13.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.7
(d) 6.3.2.10
(e) 6.3.2.11
(f) 6.3.2.15

6.13.3.2 The test shall be conducted in an open area, where there are no obstacles between the tracking unit and the tether.

6.13.3.3 The test shall be conducted with the OTS set to the most restrictive separation (alert range) setting, as applicable.

6.13.4 Procedure

6.13.4.1 Turn on the multi-piece OTS, keeping the tracking unit and the tether together (within one meter of each other).

6.13.4.2 Move the tether away from the tracking unit until there is a distance of 45 m between them.

6.13.4.3 Start timing with a stopwatch.

6.13.4.4 Note whether a “tether gone” or similar local alert has been documented by the system within five minutes.

6.13.4.5 Note whether a “tether gone” or similar alert has been received by the agency within four minutes of the initial “local alert”.

6.13.5 Report

6.13.5.1 Record and document test results and observations, including the time it takes for a “tether gone” or similar local alert to be documented by the system, and the time it takes following this local alert for the agency to receive a similar alert.
6.13.6 Interpretation

6.13.7 The elapsed time 1) until the appropriate local alert is documented by the system; and 2) from the time of the local alert to the time of the alert received by the agency, shall be used as the pass/fail criteria.

6.13.7.1 Failure of the system to document the alert shall also be considered failing results.

6.14 Participant Alert Test

6.14.1 Samples

6.14.1.1 One complete OTS per Table 2.

6.14.1.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.14.2 Test Conditions

6.14.2.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.7
(b) 6.3.2.10
(c) 6.3.2.11

6.14.3 Procedure

6.14.3.1 Replicate an event (zone violation, low battery, etc.) that will create a local alert.

6.14.3.2 For audible alerts, measure the sound pressure level at a distance of one meter from the OTS using a sound pressure level meter.

6.14.3.3 For vibratory alerts, measure the vibration coming from the OTS. Accelerometers or similar devices may be used.

6.14.3.4 For OTSs that produce both audible and vibratory alerts, ensure that if a replicated event creates an alert that causes only an audible or a vibratory response, that another event is replicated that tests the other type of alarm.

6.14.4 Report

6.14.4.1 All test results and observations shall be recorded and documented.
6.14.5 Interpretation

6.14.5.1 The quantitative vibratory and audible output from the OTS for local alerts shall be used as the pass/fail criterion for this test.

6.14.5.2 The lack of both a vibratory and audible local alert capability shall also result in a failure.

6.15 Data Storage Test

6.15.1 Samples

6.15.1.1 One complete OTS per Table 2.

6.15.1.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.15.2 Test Conditions

6.15.2.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.2 (applies at the end of the test)

(b) 6.3.2.3

(c) 6.3.2.4

(d) 6.3.2.5

(e) 6.3.2.6

(f) 6.3.2.15

6.15.3 Procedure

6.15.3.1 Turn off the upload transmission function of the OTS or ensure that no cell communication is available.

6.15.3.2 Allow the OTS to collect data at a rate of at least one point per minute (with no data upload) for a period of 10 days (+6 hrs/-0).

6.15.3.3 The OTS shall be charged as required during this 10-day period.

6.15.3.4 Following the 10-day period, remove the primary battery (the manufacturer shall make provisions for battery removal if the battery is enclosed and not normally removable). Leave it in this condition for approximately 30 minutes.
6.15.3.5 Put the primary battery back into the OTS.

6.15.3.6 Recharge the OTS.

6.15.3.7 Re-establish cell communication/data upload function and allow the OTS to upload the previous 10 days of data to the data center.

6.15.3.8 Verify that at least 90% of each of the 10 days of data was properly uploaded.

6.15.4 Report

6.15.4.1 Record and document all test results and observations, including a description (number of location points, etc.) of the uploaded data.

6.15.5 Interpretation

6.15.5.1 The ability to store, and subsequently upload, 10 complete days of location data shall be used as the pass/fail criterion.

6.16 Rechargeable Battery and Charging System Communication Test

6.16.1 Samples

6.16.1.1 One complete OTS per Table 2.

6.16.1.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.16.2 Test Conditions

6.16.2.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.5
(b) 6.3.2.6

6.16.2.2 Battery charging and discharging procedures shall be in accordance with IEC 61960, Secondary cells and batteries containing alkaline or other non-acid electrolytes-Secondary lithium and batteries for portable applications, Section 7.1 Charging procedure for test purposes, and with Section 7.2.1, Discharge performance at 20 °C (rated capacity) Step 3, respectively.
6.16.3 Procedure

6.16.3.1 If the OTS is of one-piece configuration, then it shall be discharged before being subjected to recharge for up to two hours. If the OTS is of multi-piece configuration, then it shall be discharged before being subjected to recharge for up to four hours.

6.16.3.2 Note the start of the charging cycle time and verify the type of indication to the wearer that the OTS is being charged.

6.16.3.3 Note the indication provided by the OTS that it is charged and the time of the indication to the wearer.

6.16.3.4 The OTS shall be placed in an environmental chamber set at 20°C with simulated GPS and cell communications.

6.16.3.5 The OTS shall be configured to collect location data at a nominal rate of one point per minute with a 15-minute upload interval for 22 hours (or 20 hours for a multi-piece OTS).

6.16.3.6 The OTS battery terminals shall be configured such that the cumulative current consumed (I_c, measured in mAh), can be determined for the 22-hour or 20-hour (for one-piece or multi-piece systems, respectively) test period T (measured in hours). If discrete measurements are used to determine battery current consumed, there shall be at least 60 equally spaced measurements every hour. If the battery capacity consumed (I_c) is to be calculated from multiple discrete measurements of current (I_n), then battery current consumed may be calculated from the following (where T is equal to the total time during which measurements are taking place):

\[ I_c = \frac{(I_1 + I_2 + I_3 + \ldots + I_n)}{n} \times T \]

6.16.3.7 Steps 6.16.3.1 through 6.16.3.6 shall be repeated at temperatures within the environmental chamber of -20°C and 50°C.

6.16.4 Report

6.16.4.1 All results shall be recorded and reported. This includes the cumulative current consumed (I_c) at all three test temperatures, the number of location data points that are successfully collected at each temperature, and verification that the battery did not completely discharge during the testing.
6.16.5 Interpretation

6.16.5.1 The ability of the OTS to successfully capture the required number of location data points during the test without completely discharging shall be used as the pass/fail criterion.

6.17 Battery Life Expectancy Test

6.17.1 Safety

6.17.1.1 At no time shall the battery’s maximum charging current or voltage be exceeded.

6.17.2 Application

6.17.2.1 This test is applicable to all OTS batteries.

6.17.3 Samples

6.17.3.1 Ten new (unused) batteries shall be provided for testing (per Section 6.4.3).

6.17.3.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.17.4 Test Conditions

6.17.4.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.6

6.17.5 Procedure

6.17.5.1 The OTS battery shall be charged at a rate and period determined by the OTS manufacturer, with the period not to exceed two hours for one piece or four hours for multi-piece systems.

6.17.5.2 The OTS battery shall be discharged for a period determined by the OTS manufacturer (Td) not to exceed 22 hours for one piece or 20 hours for multi-piece systems. The largest cumulative current consumed (Ic) during the Rechargeable Battery and Charging System Communication Test in Section 6.16 shall be used to determine the discharge rate. The rate of discharge (Id) shall be determined using the following:
6.17.5.3 Sections 6.17.5.1 and 6.17.5.2 shall be repeated for 365 cycles including any rests determined by the OTS manufacturer (a minimum of 10 minutes) such that each cycle is completed within 24 hours.

6.17.5.4 The charge and discharge rate factor, \( (x) \) shall be derived by taking only the worst-case temperature (20° C, -20° C, and 50° C) current consumption, \( (I_{ccc}) \) A from the Rechargeable Battery Test in Section 6.16 for a one-piece device divided by \( I_{max} \) (A), the maximum battery rated capacity for one-piece device resulting in \( (x) \), the charge and discharge rate, where \( x = \frac{I_{ccc}}{I_{max}} \) (Note: the value of \( (x) \) can be any value from 0.2 to 1). \( (xI_t) \) A, is the charge and discharge current necessary to charge and discharge the OTS one-piece battery to its manufacturer’s rated current capacity and to discharge it to its specified end-of-discharge voltage in Steps 1 and 2 of Section 7.5, Endurance in cycles, IEC 61960; Secondary cells and batteries containing alkaline or other non-acid electrolytes—Secondary lithium and batteries for portable applications.

6.17.5.5 The cycle number in Step 5 of the Endurance in cycles test shall be 365.

6.17.5.6 Following 365 cycles, place each of the batteries in an OTS and perform the OTS Functionality Test specified in Section 6.23.

6.17.6 Report

6.17.6.1 Document all test results and observations, including the ability of the batteries to survive 365 charge/discharge cycles and the results of the OTS functionality test.

6.17.7 Interpretation

6.17.7.1 The ability of the batteries to continue to operate/function following the applied charge/discharge cycles shall be used as the pass/fail criterion.

6.18 Attachment Strap Removal Detection and Alert Test

6.18.1 Application

6.18.1.1 This test method shall apply to the body-attached device.
6.18.2 Samples

6.18.2.1 One complete OTS per Table 2.

6.18.2.2 The sample shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.18.3 Test Conditions

6.18.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.7
(d) 6.3.2.15

6.18.4 Procedure

6.18.4.1 Expose the body-attached device to an “inside-out” force of 25 kg (+/- .5 kg) for a period of five minutes (+15 sec/- 0) using a tensile testing machine and a fixture similar to that in Figure 3.

6.18.4.2 During performance of the test, verify that the attachment strap does not separate from the rest of the body-attached device.

6.18.4.3 During performance of the test, verify that the attachment strap does not stretch more than 5%.

6.18.4.4 If the attachment strap separates from the rest of the body-attached device or the strap stretches more than 5%, verify that an alert is generated on actual separation (or once the strap has stretched more than 5%). If an alert is generated, verify that the alert is received within four minutes of the time that the OTS generated the alert.

6.18.4.5 Following the five-minute exposure to the 25-kg force, if the strap has not stretched 5% or separated from the rest of the body-attached device, slowly increase the load until the strap either stretches 5% or separates from the body-attached device.

6.18.4.6 When the attachment strap either separates from the rest of the body-attached device or the strap stretches more than 5%, verify that an alert is generated. If an alert is generated, verify that the alert is received within four minutes of the time that the OTS generated the alert.
6.18.5 Report

6.18.5.1 Record the results of the test, including the following information:

- Verification that the attachment strap did not separate from the rest of the body-attached device during application of the 25 kg “inside out” force.
- Verification that the attachment strap did not stretch more than 5% during application of the 25 kg “inside out” force. If it did stretch, verification that an alert was generated once it exceeded 5%.
• If the strap did not separate or stretch more than 5% during application of the 25 kg force, the applied force that actually caused the strap to separate or stretch more than 5%.

• Verification that an alert was received by the agency within four minutes of when the attachment strap either separated from the body-attached device or as soon as it stretched more than 5%.

• Any relevant observations.

6.18.6 Interpretation

6.18.6.1 The ability of the attachment strap to withstand the application of a 25 kg “inside out” force without separating from the body-attached device or stretching excessively shall be one of the pass/fail criteria.

6.18.6.2 The generation and timely receipt of an alert due to attachment strap separation or excessive stretching shall be one of the pass/fail criteria.

6.19 Loss of Location Alert Test/Communications Failure Alert Test

6.19.1 Samples

6.19.1.1 One complete OTS per Table 2.

6.19.1.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.19.2 Test Conditions

6.19.2.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.7
(d) 6.3.2.15

6.19.3 Procedure

6.19.3.1 The sample shall be placed in a shielded or anechoic room with simulated GPS and cell communication clear line-of-sight reception.
6.19.3.2 To simulate GPS and cellular communication clear line of sight reception, a GPS receiver pre-amplifier with two GPS patch antennas and a bi-directional cellular amplifier (booster) with two cellular antennas shall be configured as follows. The GPS pre-amplifier and the cellular amplifier (booster) shall be configured outside the anechoic room. Next, one of the GPS pre-amplifier antennas and one of the cellular amplifier antennas shall be installed inside the shielded or anechoic room but away from the OTS.

A low loss coaxial cable shall be used to connect the GPS antenna to the GPS pre-amplifier’s output port. Another low loss cable shall be used to connect the cellular antenna to one of the cellular amplifier bi-directional ports. The output port of the GPS pre-amplifier and the other cellular bi-directional amplifier port shall be connected via low loss coaxial cable through the shielded room’s bulkhead or anechoic room “bulkhead” to the GPS antenna and cellular antenna outside the shielded room or anechoic chamber respectively, where GPS and cellular clear line-of-sight reception is established.

6.19.3.3 Note and record the start time of the test and verify or confirm that the time-tagged location data points appears on the data center computer screen.

6.19.3.4 Allow the system to run as configured for approximately 30 minutes.

6.19.3.5 Remove both the simulated GPS signal and the simulated cellular signal. Record the time at which this was done. Leave it in this condition for 90 minutes (+/- 5 minutes).

6.19.3.6 Restore both the simulated GPS signal and the simulated cellular signal.

6.19.3.7 Verify that a “loss of communications” or similar alert was generated by the data center within one hour (+/- 5 minutes) following the removal of the simulated cellular signal.

6.19.3.8 Verify that a “loss of location” or similar alert was generated by the OTS and received the data center. Record these times.

6.19.3.9 Verify that the agency received these two alerts and record the times.

6.19.4 Report

6.19.4.1 Document the results of the test, including the time that the GPS and cellular signals were removed, the times that the two alerts were generated and received (by the OTS, the data center, or the agency, as applicable).
6.19.5 Interpretation

6.19.5.1 The generation and timely receipt of a “loss of location” alert shall be used as one of the pass/fail criterion.

6.19.5.2 The generation and timely receipt of a “loss of communications” alert (once a period of at least one hour has passed since losing cellular communications) shall be used as another pass/fail criterion.

6.20 Metallic Shielding Detection and Alert Test

6.20.1 Application

6.20.2 This test is applicable to OTSs that use GPS to determine location.

6.20.3 Samples

6.20.3.1 Two complete OTSs per Table 2, including power chargers.

6.20.3.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.20.4 Test conditions

6.20.4.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.7
(d) 6.3.2.15

6.20.5 Procedure

6.20.5.1 If the OTSs are one-piece configurations, then they shall be discharged before being subjected to recharge for up to two hours. If the OTSs are multi-piece configurations, then they shall be discharged before being subjected to recharge for up to four hours.

6.20.5.2 To simulate GPS and cellular communication clear line of sight reception, a GPS receiver pre-amplifier with two GPS patch antennas and a bi-directional cellular amplifier (booster) with two cellular antennas shall be configured as follows. The GPS pre-amplifier and the cellular amplifier (booster) shall be configured outside the anechoic room. Next, one of the GPS pre-amplifier antennas and one of the cellular
amplifier antennas shall be installed inside the shielded or anechoic room, but away from the OTS. A low loss coaxial cable shall be used to connect the GPS antenna to the GPS pre-amplifier’s output port. Another low loss cable shall be used to connect the cellular antenna to one of the cellular amplifier bi-directional ports. The output port of the GPS pre-amplifier and the other cellular bi-directional amplifier port shall be connected via low loss coaxial cable through the shielded or anechoic room’s bulkhead to the GPS antenna and cellular antenna outside the shielded or anechoic chamber respectively, where GPS and cellular clear line-of-sight reception is available.

6.20.5.3 A 45-minute test shall be established by recording the “test start time” and verifying or confirming that the time-tagged location data points for each OTS appear on the data center computer screen.

6.20.5.4 After verification of the time-tagged location data points for both OTSs, one OTS tracking device only shall be completely wrapped in no less than a single layer of 20-micrometer thick aluminum foil. Next, a second 45-minute duration test shall be started with the aluminum-wrapped OTS and the unwrapped OTS by recording a new “test start time” and verifying or confirming that the time-tagged location data points for the aluminum-wrapped OTS and the unwrapped OTS appear on the data center computer screen.

6.20.5.5 A third 45-minute test shall be repeated with the aluminum-wrapped OTS and the unwrapped OTS by removing the GPS antenna and disabling GPS communications while cellular communications is still established in the shielded or anechoic room. At the end of this third 45-minute test, verify or confirm the time-tagged location data at the data center for the aluminum-wrapped OTS and the unwrapped OTS. The aluminum-wrapped OTS and the unwrapped OTS shall generate “No GPS/Possible Shielding” and “No GPS” alerts, respectively.

6.20.5.6 For passive systems, the tracking devices shall be placed in their charging/communications cradles (or allowed to communicate using some other methodology as specified by the manufacturer) to upload data to the data center that was collected and stored during the testing period.

6.20.6 Report

6.20.6.1 Document and record all test results, including verification (and including timing) that “No GPS/Possible Shielding” alerts were received at the data center for the aluminum foil-wrapped OTS and that “No GPS” alerts were received at the data
center for the unwrapped OTS. Also document any observations made during the testing.

6.20.7 Interpretation

6.20.7.1 The timely receipt of a “No GPS/Possible Shielding” alert for the aluminum foil-wrapped OTS and an accompanying “No GPS” alert for the unwrapped OTS shall be used as the pass/fail criteria.

6.20.7.2 The failure of the system to generate any alerts during performance of this test shall also result in a failure.

6.21 Interference/Jamming Detection and Alert Test

6.21.1 Application

6.21.1.1 This test is applicable to active OTS.

6.21.2 Samples

6.21.2.1 One complete OTS per Table 2, including peripherals.

6.21.2.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.21.3 Test conditions

6.21.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.7
(d) 6.3.2.15

6.21.4 Jamming Configuration

6.21.4.1 If the OTS is of one-piece configuration, then it shall be discharged before being subjected to recharge for up to two hours. If the OTS is of multi-piece configuration, then it shall be discharged before being subjected to recharge for up to four hours.

6.21.4.2 The sample shall be placed in a shielded or anechoic room with simulated GPS and clear line-of-sight cell communication reception.
6.21.4.3 To simulate GPS and clear line of sight reception cellular communication, a GPS receiver pre-amplifier with two GPS patch antennas and a bi-directional cellular amplifier (booster) with two cellular antennas shall be configured as follows. The GPS pre-amplifier and the cellular amplifier (booster) shall be configured outside the anechoic room. Next, one of the GPS pre-amplifier antennas and one of the cellular amplifier antennas shall be installed inside the shielded or anechoic room but away from the OTS.

A low loss coaxial cable shall be used to connect the GPS antenna to the GPS pre-amplifier’s output port. Another low loss cable shall be used to connect the cellular antenna to one of the cellular amplifier bi-directional ports. The output port of the GPS pre-amplifier and the other cellular bi-directional amplifier port shall be connected via low loss coaxial cable through the shielded room’s bulkhead or anechoic room “bulkhead” to the GPS antenna and cellular antenna outside the shielded room or anechoic chamber respectively, where GPS and clear line-of-sight cellular reception is established.

6.21.4.4 Note and record the start time of the test and verify or confirm that the time-tagged location data points appear on the data center computer screen.

6.21.4.5 Using a signal generator with a minimum bandwidth of 3GHz, connect the signal generator to a broadband antenna with a similar bandwidth using a 50Ω coax cable for transmitting and receiving in the cellular bands. The height of the antenna as well as the OTS shall be the same. The antenna shall be used to transmit cellular frequencies, namely GSM 850, GSM 1900, UMTS 1700/1900, and/or CDMA Cellular/PCS 800/850/1900; and Universal Mobile Telecommunications System (Advance Wireless Services) 1700/2100, or Jamming Cellular signal (Jc).

6.21.4.6 The OTS cellular signal shall be from the simulated GSM/CDMA/UMTS/LTE being piped into the shielded room or anechoic room or the Cellular signal (Sc).

6.21.4.7 The bandwidth of the Jc shall be set greater than the bandwidth of the Sc.

6.21.4.8 Amplitude Modulation (AM) shall be used to modulate the Jc.

(Note: Although the test procedure described above for jamming the OTS enlists the use of a signal generator, other GPS/cellular generating broadband-sources capable of producing GPS and or cellular alerts may be used.)
6.21.5 Cellular Jamming Procedure

6.21.5.1 With the OTS configured and operated to collect location data at a nominal rate of one point per minute while receiving Sc, measure and record the OTS signal strength exactly where it is placed in the shielded or anechoic room using an appropriate cellular capable band (GSM/CDMA/UMTS/LTE) antenna connected to a spectrum analyzer.

6.21.5.2 Adjust the spectrum analyzer to correct for measurement system losses or gains with the spectrum analyzer’s Resolution Bandwidth/Video Bandwidth (RBW/VBW) set to 100 kHz and its center frequency set to receive the appropriate cellular frequency (GSM/CDMA/UMTS/LTE) in order to establish the Sc that the OTS is receiving.

6.21.5.3 Set the Jc such that the Jc to Sc ratio is 6dB, (6dB Jc/Sc ratio).

6.21.5.4 Verify that local Cellular Jamming alerts from the OTS are active and that the data center received a Cellular Jamming alert as a result of the Jc/Sc ratio’s being set to 6 dB. If Cellular Jamming alerts were confirmed at the data center, record the time and date of the Cellular Jamming alerts and the Jc/Sc ratio. Also record the time that the alert was received by the agency. For the purpose of configuring this test, all discussions of Jc/Sc ratios are with respect to dBm units.

6.21.5.5 If Cellular Jamming alerts were not confirmed at the data center, increase the Jc/Sc ratio by 6 dB until Cellular Jamming alerts are confirmed at the data center, and record the date and time of the Cellular Jamming alerts and the Jc/Sc ratios. Again, also record the time that the alert was received by the agency.

6.21.5.6 Repeat all steps within Section 6.21 for all cellular frequency operating bands that the OTS supports.

6.21.6 Report

6.21.6.1 Document and record all test results, including verification (including timing) that jamming alerts were received at the data center and by the agency, and the Jc/Sc ratios used. Also document any observations made during the testing.

6.21.7 Interpretation

6.21.7.1 The observation of local Cellular alerts from the OTS and the timely receipt of Cellular Jamming alerts shall be used as the pass/fail criterion.
6.21.7.2 The failure of the system to generate any jamming alerts during performance of this test shall also result in a failure.

6.22 **Software Test**

6.22.1 Use manufacturer-provided operational instructions to aid in performing the manipulations below.

6.22.2 Samples

6.22.2.1 One complete OTS per Table 2.

6.22.2.2 Samples shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.22.3 Test Conditions

6.22.3.1 No specific test conditions from Section 6.3 apply

6.22.4 Data Export Procedure

6.22.4.1 Using a pre-existing OTS data file, attempt to export the data into comma delimited text files.

6.22.4.2 Verify that all historical offender location data (longitude, latitude, time, and date), status of all alerts, offender identifiers, originating agency identifier, and agency contact information have been exported into defined comma delimited text files.

6.22.5 Collection Rate Adjustment Procedure

6.22.5.1 Ensure that the OTS has access to communication signals (GPS, cell, etc.)

6.22.5.2 To verify the capability to adjust the rate at which data points are collected, adjust the OTS collection rate to a rate of one data point per minute.

6.22.5.3 Collect a minimum of three data points at this setting.

6.22.5.4 Adjust the OTS collection rate to one of the lowest settings available (i.e., one of the longest times between collection points).

6.22.5.5 Collect a minimum of three data points at this setting.

6.22.5.6 Adjust the OTS collection rate to a setting midway between the two other settings.

6.22.5.7 Collect a minimum of three data points at this setting.
6.22.5.8 Verify that each data point is received at the end user interface and that the time increment between each point is appropriate for the data collection rate used.

6.22.5.9 Document the results (device collection rate settings, data points, time between data points, etc.) and record any observations.

6.22.6 Upload Rate Setting Procedure (for active tracking OTS only)

6.22.6.1 Ensure that the OTS has access to communication signals (GPS, cell, etc.)

6.22.6.2 Set the data upload rate to upload data points once every 15 minutes.

6.22.6.3 Adjust the OTS collection rate to one data point per minute.

6.22.6.4 Allow the system to collect and upload data points such that data is uploaded a minimum of two times.

6.22.6.5 Verify each data point is received at the end user interface and that the time increment between uploads is 15 minutes. For the second upload, an additional 15 location points should have been received.

6.22.6.6 Document the results (device collection rate settings, data points, time between data points, time between uploads, etc.) and record any observations.

6.22.7 Zone/Zone Template Creation Procedure

6.22.7.1 Create 15 circular zones with at least one of the 15 contained within one of the other 14.

6.22.7.2 Create 15 rectangular zones with at least one of the 15 contained within one of the other 14.

6.22.7.3 Create 20 arbitrarily shaped polygon zones with at least one of the 20 contained within one of the other 19.

6.22.7.4 Using all of the zones created in sections 6.22.7.1, 6.22.7.2, and 6.22.7.3, create and store a zone template.

6.22.7.5 Document the results and record any observations.

6.22.8 Change Control Verification Procedure

6.22.8.1 Attempt to change the following information in existing data/files:
- Schedules
- Zones
- Demographics
- Addresses

6.22.8.2 Verify that the changes have been successfully executed.

6.22.8.3 Ensure that a record of these changes is generated and saved by the system, including date and time of the change.

6.22.8.4 Ensure that the record created includes the agency employee who made these changes.

6.22.8.5 Document the results and record any observations.

6.22.9 Administrative Privilege Setting Verification Procedure

6.22.9.1 Attempt to assign differing levels of administrative privileges to several agency employees who would be representative of different ranks/levels.

6.22.9.2 Access the system as one of the employees with “limited” or “lesser” administrative privileges.

6.22.9.3 Ensure that actual privileges are commensurate with the privileges set in 6.22.9.1. This shall be accomplished by verifying the ability to access those functions/menus to which the individual should have access, and verifying that access is denied or not available for those functions/menus to which the individual should not have access.

6.22.9.4 Access the system as one of the employees with “greater” administrative privileges.

6.22.9.5 Ensure that actual privileges are commensurate with the privileges set in 6.22.9.1. This shall be accomplished by verifying the ability to access those functions/menus to which the individual should have access.

6.22.9.6 Document the results and record any observations.

6.22.10 Secure Access Verification Procedure

6.22.10.1 Using Appendix A as a reference, attempt to establish account access (i.e., establish a password) that follows the criteria within the appendix. Verify that this can be successfully accomplished.
6.22.10.2 Using Appendix A as a reference, attempt to establish account access (i.e., establish a password) that violates each of the applicable criteria within the appendix. Verify that the system will not allow a password to be generated that violates the criteria.

6.22.10.3 Using the password created in 6.22.10.1, change the password five times to a different, acceptable password. Each time the option is chosen to change the password, attempt to use the password created in 6.22.10.1. Verify that the system will not allow that password to be reused.

6.22.10.4 Log into the system using an established password. Let the system sit idle for 15 minutes. Verify that the system automatically logs off the user within 15 minutes.

6.22.10.5 Attempt to log into the system through an account using a known invalid password. Repeat this attempt four additional times. Verify that the system locks the user account after the fifth unsuccessful login attempt and that a designated agency administrator is required to reset it.

6.22.10.6 While performing steps 6.22.10.1 through 6.22.10.5, verify that the system for account access does not contain/allow auto-fill, auto-type, or auto-complete functions.

6.22.10.7 Document the results and record any observations.

6.22.11 Report

6.22.11.1 Each of the verification test results are to be recorded and documented.

6.22.12 Interpretation

6.22.12.1 Each of the verification test results shall be used as a pass/fail criterion.

6.23 OTS Functionality Test

6.23.1 Application

6.23.1.1 This test method is intended to be performed in conjunction with other test methods in this chapter. Where applicable, those test methods will invoke the “OTS Functionality Test.”

6.23.2 Sample

6.23.2.1 One complete OTS per Table 2.
6.23.2.2 The sample used during this test shall be the same one being used for the other test methods that invoke this OTS Functionality Test.

6.23.3 Test Conditions

6.23.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.4
(d) 6.3.2.5
(e) 6.3.2.7
(f) 6.3.2.10
(g) 6.3.2.11
(h) 6.3.2.15

6.23.4 Procedure

6.23.4.1 Turn the OTS on.

6.23.4.2 Allow the system to gather location data for a period of 30 minutes.

6.23.4.3 Allow the system to upload/transmit this data.

6.23.5 Report

6.23.5.1 Record and report the performance of the OTS and any relevant observations.

6.24 Extreme Temperature Storage Test

6.24.1 Test Conditions

6.24.1.1 No specific test conditions from Section 6.3 apply to this test, per se. When the OTS function test is invoked later in this test method, test conditions specific to the function test will apply.
6.24.2  Samples

6.24.2.1  Five complete OTSs per Table 2.

6.24.3  Procedure

6.24.3.1  Charge and discharge the battery five times.

6.24.3.2  Perform Room Temperature Conditioning of the samples as specified in Section 6.2.

6.24.3.3  Perform the OTS Functionality Test specified in Section 6.23.

6.24.3.4  Place the OTSs in an environmental chamber.

6.24.3.5  Increase the temperature within the chamber at a rate of \(2^\circ C (\pm 10\%)\) per minute until the chamber reaches the test temperature of \(50^\circ C\).

6.24.3.6  Hold the chamber at this test temperature for 24 hours.

6.24.3.7  Return the chamber to \(20^\circ C\) (room temperature) by decreasing the temperature at a rate of \(2^\circ C (\pm 10\%)\) per minute.

6.24.3.8  Normalize the system in the temperature chamber at a temperature of \(20^\circ C\) (room temperature) for one hour.

6.24.3.9  Remove the OTSs from the environmental chamber.

6.24.3.10  Perform the OTS Functionality Test specified in Section 6.23.

6.24.3.11  Return the OTSs to the environmental chamber.

6.24.3.12  Decrease the temperature within the chamber at a rate of \(2^\circ C (\pm 10\%)\) per minute until the chamber reaches the test temperature of \(-20^\circ C\).

6.24.3.13  Hold the chamber at this test temperature for 24 hours.

6.24.3.14  Return the chamber to \(20^\circ C\) (room temperature) by increasing the temperature at a rate of \(2^\circ C (\pm 10\%)\) per minute.

6.24.3.15  Normalize the system in the temperature chamber at a temperature of \(20^\circ C\) (room temperature) for one hour.

6.24.3.16  Remove the OTSs from the environmental chamber.
6.24.3.17 Perform the OTS Functionality Test specified in Section 6.23.

6.24.4 Report

6.24.4.1 Document all test results and observations, including the results of the functionality tests.

6.25 Condensing Humidity Test

6.25.1 Application

6.25.1.1 This test method shall apply to body-worn and body-attached devices.

6.25.2 Samples

6.25.2.1 Five complete OTSs per Table 2.

6.25.3 Test Conditions

6.25.3.1 No specific test conditions from Section 6.3 apply to this test, per se. When the OTS function test is invoked later in this test method, test conditions specific to the function test will apply.

6.25.4 Procedure

6.25.4.1 Place the OTSs in an environmental chamber.

6.25.4.2 Normalize the system in the chamber at a temperature of 20°C (room temperature) for one hour.

6.25.4.3 Expose the samples to humidity with condensation under conditions of relative humidity \( \geq 99\% \). Exposure time shall be seven days.

6.25.4.4 Remove the OTSs from the environmental chamber.

6.25.4.5 Perform the OTS Functionality Test specified in Section 6.23 following the above exposure.

6.25.5 Report

6.25.5.1 Document all test results and observations, including the results of the functionality tests.
6.26 Water Spray Exposure Test

6.26.1 Application

6.26.1.1 This test method shall apply to the body-worn device of the OTS only.

6.26.2 Samples

6.26.2.1 Five complete OTSs per Table 2.

6.26.3 Test Conditions

6.26.3.1 No specific test conditions from Section 6.3 apply to this test, per se. When the OTS function test is invoked later in this test method, test conditions specific to the function test will apply.

6.26.4 Procedure

6.26.4.1 Perform Room Temperature Conditioning of the samples as specified in Section 6.2.

6.26.4.2 Expose the body-worn device of each of the samples to water spray per the requirements of IEC 60529 IP 55 (or better) or NEMA 4 (or better).

6.26.4.3 Perform the OTS Functionality Test specified in Section 6.23 during and following the above exposure.

6.26.5 Report

6.26.5.1 Document all test results and observations, including the results of the functionality tests.

6.27 Immersion Test

6.27.1 Application

6.27.1.1 This test method shall apply to the body-attached device of the OTS only.

6.27.2 Samples

6.27.2.1 Five complete OTSs per Table 2.
6.27.3  Test Conditions

6.27.3.1  No specific test conditions from Section 6.3 apply to this test, per se. When the OTS function test is invoked later in this test method, test conditions specific to the function test will apply.

6.27.4  Procedure

6.27.4.1  Perform Room Temperature Conditioning of the samples as specified in Section 6.2.

6.27.4.2  Immerse the body attached device of each of the samples in fresh water at a depth of two meters for one hour.

6.27.4.3  Following the immersion period, remove the samples from the water and wipe the exterior surfaces dry (giving special attention to areas around seals).

6.27.4.4  Open the samples and examine the interior and contents for evidence of and quantity of any leakage and, if leakage occurred, for probable areas of entry.

6.27.4.5  Close the samples and perform the OTS Functionality Test specified in Section 6.23.

6.27.5  Report

6.27.5.1  Document all test results and observations, including the results of the functionality tests.

6.28  Shock by Impact Test

6.28.1  Application

6.28.1.1  This test method shall apply to both body-attached devices and body-worn devices.

6.28.2  Samples

6.28.2.1  Five complete OTSs per Table 2.

6.28.3  Test Conditions

6.28.3.1  No specific test conditions from Section 6.3 apply to this test, per se. When the OTS function test is invoked later in this test method, test conditions specific to the function test will apply.
6.28.4 Procedure

6.28.4.1 Perform Room Temperature Conditioning of the samples as specified in Section 6.2.

6.28.4.2 Subject the samples, one time, to impact per UL 61010-1, Standard for Safety - Electrical Equipment for Measurement, Control, and Laboratory Use; Part 1: General Requirements, IEC 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1 – General Requirements, Section 8.2.2 – Dynamic Test, using a height (x) of one meter per Figure 4.

6.28.4.3 Perform the OTS Functionality Test specified in Section 6.23.

6.29 Dynamic Shock Test

6.29.1 Application

6.29.1.1 This test method shall apply to body-worn and body-attached devices.

6.29.2 Samples

6.29.2.1 Five complete OTSs per Table 2.

6.29.3 Test Conditions

6.29.3.1 No specific test conditions from Section 6.3 apply to this test, per se. When the OTS function test is invoked later in this test method, test conditions specific to the function test will apply.

6.29.4 Procedure

6.29.4.1 Perform Room Temperature Conditioning of the samples as specified in Section 6.2.

6.29.4.2 The OTSs shall be in operational mode.

6.29.4.3 The OTSs shall be subjected to mechanical shock (ref: Mil Std 810F, Test Method 516.5, Procedure I) of the following magnitude and shape: – 30 g peak, half sine, 11 ms pulse on all three axes, in both positive and negative orientation.
6.29.4.4 Perform the OTS Functionality Test specified in Section 6.23 following the above exposure.

6.29.5 Report

6.29.5.1 Document all test results and observations, including the results of the functionality tests.

6.30 Sinusoidal Vibration Test

6.30.1 Application

6.30.1.1 This test method shall apply to body-worn and body-attached devices.

6.30.2 Samples

6.30.2.1 Five complete OTSs per Table 2.

6.30.3 Test Conditions

6.30.3.1 No specific test conditions from Section 6.3 apply to this test, per se. When the OTS function test is invoked later in this test method, test conditions specific to the function test will apply.

6.30.4 Procedure

6.30.4.1 Perform Room Temperature Conditioning of the samples as specified in Section 6.2.

6.30.4.2 The OTSs shall be in non-operational mode.

6.30.4.3 Expose the samples to 15 g of sinusoidal vibration along each of its three axes over the frequency range of 10 Hz through 2000 Hz for a duration of 30 minutes. (Refer to IEC 60068-2-6.)

6.30.4.4 Perform the OTS Functionality Test specified in Section 6.23 during and following the above exposure.

6.30.5 Report

6.30.5.1 Document all test results and observations, including the results of the functionality tests.
6.31 Random Vibration Test

6.31.1 Application

6.31.1.1 This test method shall apply to body-worn and body-attached devices.

6.31.2 Samples

6.31.2.1 Five complete OTSs per Table 2.

6.31.3 Test Conditions

6.31.3.1 No specific test conditions from Section 6.3 apply to this test, per se. When the OTS function test is invoked later in this test method, test conditions specific to the function test will apply.

6.31.4 Procedure

6.31.4.1 Perform Room Temperature Conditioning of the samples as specified in Section 6.2.

6.31.4.2 The samples shall be in operational mode. (Refer to IEC 60068-2-64). Expose the samples to \(0.3\, g_{\text{rms}}\) (root-mean-square acceleration) of random vibration along each of its three axes over the frequency range of five Hz through 500 Hz for a duration of 30 minutes.

6.31.4.3 Perform the OTS Functionality Test specified in Section 6.23 during and following the above exposure.

6.31.4.4 The test is to be performed in non-operational mode. (Reference Std. - IEC 60068-2-64). Expose the samples to \(2.4\, g_{\text{rms}}\) of random vibration along each of its three axes over the frequency range of five Hz through 500 Hz for a duration of 30 minutes.

6.31.4.5 Perform the OTS Functionality Test specified in Section 6.23 during and following the above exposure.

6.31.5 Report

6.31.5.1 Document all test results and observations, including the results of the functionality tests.
6.32 **Electromagnetic Compatibility Test**

6.32.1 **Application**

6.32.1.1 This test method shall apply to body-worn and body-attached OTS.

6.32.2 **Samples**

6.32.2.1 One complete OTS per Table 2.

6.32.2.2 Perform Room Temperature Conditioning of the sample as specified in Section 6.2.

6.32.3 **Test Conditions**

6.32.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 1.

   (a) 6.3.2.2
   (b) 6.3.2.3
   (c) 6.3.2.4
   (d) 6.3.2.5
   (e) 6.3.2.7
   (f) 6.3.2.15

6.32.3.2 The body-worn and body-attached devices must be paired during testing.

6.32.4 **Procedure (body-worn OTS not being charged)**

6.32.4.1 The OTS shall be powered from its internal battery during all of the following Electromagnetic Compatibility Tests:

6.32.4.1.1 Electrostatic Discharge (ESD) Immunity:

   All testing shall be performed in accordance with IEC 61000-4-2.

   Contact discharged levels shall be applied from +/- 8 kV to all lower test limits and Air discharged levels shall be applied from +/- 15 kV to all lower test limits respectively. The Performance Criterion shall be B.
6.32.4.1.2 Radiated RF Fields Immunity:

All testing shall be performed in accordance with IEC 61000-4-3. The limit applied shall be 26 MHz to 1000 MHz @ 10 V/m with 80% AM Modulation. From 1.0 GHz to 3.0 GHz the limit shall be 3 V/m with 80% AM Modulation. All testing shall be performed at both H and V Polarizations, with the EUT oriented in each of three orthogonal axis positions (i.e., X, Y, and Z). The Performance Criterion shall be A.

(Note: It shall be permissible to test at a one-meter distance over the frequency range 26 MHz to 80 MHz, using either a “Closed-Loop” Test Method or a “Single-Point” Field Calibration Method.)

6.32.4.1.3 AC Power Frequency Magnetic Fields:

All testing shall be performed in accordance with IEC 61000-4-8. The limit shall be 60 Hz at 30 A/m field strength, testing shall be performed with the EUT oriented successively in each of three orthogonal axis positions (i.e., X, Y, and Z). The Performance Criterion shall be A.

(Note: A minimum of five minutes of exposure (per axis position) is required.)

6.32.5 Procedure

6.32.5.1 The OTS shall be configured to operate with a fully discharged battery connected to its charger, powered from 120 VAC/60 Hz.

6.32.5.2 The OTS shall be configured to collect location data while its internal battery is being charged at a nominal rate of one point per minute with a 15-minute upload interval during the entire time it takes to perform the following Electromagnetic Compatibility Tests.

6.32.5.2.1 Electrostatic Discharge (ESD) Immunity

All testing shall be performed in accordance with IEC 61000-4-2.

Contact discharged levels shall be applied from +/- 8 kV to all lower test limits and Air discharged levels shall be applied from +/- 15 kV to all lower test limits respectively. The Performance Criterion shall be A.

6.32.5.2.2 Radiated RF Fields Immunity

All testing shall be performed in accordance with IEC 61000-4-3.
The limit applied shall be 80 MHz to 3000 MHz @ 3 V/m with 80% AM Modulation. All testing shall be performed at both H and V Polarizations, with both the Charger and the EUT oriented in each of three orthogonal axis positions (i.e., X, Y, and Z). The Performance Criterion shall be A.

6.32.5.2.3 Electrical Fast Transients/Burst Immunity

All testing shall be performed in accordance with IEC 61000-4-4, 2004-07 including the 2 erratum. The limits applied shall be +/- 1 kV Level as well as all lower test limit levels. The Performance Criterion shall be B.

6.32.5.2.4 Surge Immunity

All testing shall be performed in accordance with IEC 61000-4-6. The limits applied shall be +/- 1 kV Level as well as all lower test limit levels. The Performance Criterion shall be B.

6.32.5.2.5 RF Common Mode Immunity

All testing shall be performed in accordance with IEC 61000-4-6. The limits applied shall be from 150 kHz to 80 MHz at 3 Vrms with 80% AM Modulation. The Performance Criterion shall be A. AC

6.32.5.2.6 Power Frequency Magnetic Fields

All testing shall be performed in accordance with IEC 61000-4-8. The limit shall be 60 Hz at 30 A/m field strength, testing shall be performed with the EUT oriented successively in each of three orthogonal axis positions (i.e., X, Y, and Z). The Performance Criterion shall be A.

(Note: A minimum of five minutes of exposure (per axis position) is required.)

6.32.5.2.7 Voltage Dips and Short Interruptions Immunity

All testing shall be performed in accordance with IEC 61000-4-11.
The limit shall be the following:

- 30% Voltage Dip for 500 ms with a Performance Criterion of B.
- >95% Voltage Interruption for 10 ms at 0º phase angle with a Performance Criterion of B.
- >95% Voltage Interruption for 10 ms at 180º phase angle with a Performance Criterion of B.
- >95% Voltage Interruption for 5000 ms at 270º phase angle with a Performance Criterion of B.

6.32.6 Report

6.32.6.1 Document all test results and observations.
7. LABELING AND INFORMATION

7.1 General Product Label Requirements

7.1.1 The OTS shall have product labels permanently and visibly stamped, etched, engraved, or printed on it. The product labels shall not be stick-on paper labels.

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

7.1.3 At least the following information shall also be printed legibly on the product label(s) in letters at least 3.2 mm (1/8 in) high:

- Legal name of the OTS manufacturer.
- Model and serial number.
- FCC ID.
- “If Found, Contact:” information.

7.2 User Information to Be Provided by the OTS Manufacturer

7.2.1 The OTS manufacturer shall provide the agency with information including, but not limited to, warnings, information, and instructions with each OTS.

7.2.2 The OTS manufacturer shall provide at least two sets of documentation to each agency for each OTS model that contain at least the following information:

- Intended operating environment.
- Description of controls and adjustments.
- Description of OTS capabilities.
- List of operating features.
- Instructions for proper use and installation as intended by the OTS manufacturer, including installation and safety considerations.
- Specifications describing the materials of construction for the casing and outer portions of the body-attached device.
- Technical specifications containing, at a minimum, the following information:
  - OTS dimensions and weight.
  - Operating ambient temperature range.
Criminal Justice Offender Tracking System Standard

- Battery operational time.
- Calibration instructions.
- Field test and performance verification procedures.
- Warranty information.
- OTS manufacturer contact information, including address of manufacturing location (city, state/province, country) and phone number.
- Care and maintenance instructions, including guidelines for inspection, proper storage recommendations, and a detailed list of the technical skills and computer hardware and software tools required. The cleaning instructions shall be certified by the OTS manufacturer to not damage the unit nor degrade its performance.
- OTS Product Data Sheet and Supplier Attestation as shown in Appendix C.

7.2.3 The OTS manufacturer shall have available a training package that will provide end users with the information necessary to acquire the technical and operational skills required to set up and install the OTS.

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2 See definitions for care and maintenance in Chapter 3.

3 These sheets need not be initially supplied to the agency, but must be available on request or via a secure supplier website.
APPENDIX A. SECURE LOG-IN CRITERIA

The system must provide for a secure method of logging onto the software. All system passwords must meet the following minimum requirements when they are created or changed.

1) The password must not contain the user’s name.
2) The password must be unique and not have been used in the past six passwords.
3) The maximum length of use for the password must not exceed 120 days.
4) The system for secure method of logging onto the software shall not contain the following functions typically supported by browsers:
   - Auto-fill, a function that automatically fills in forms (found in many software applications and computer programs).
   - Auto-type, a function that automatically fills a field once you have typed in the first few letters (found in many software applications and computer programs).
   - Auto-complete, a function that automatically predicts a word or phrase that the user wants to type in without the user’s actually typing it in completely (found in many software applications and computer programs).
5) After 15 minutes of idle time, the system will automatically log off the current user.
6) The system will lock a user account after five unsuccessful log on attempts. Locked accounts must be reset by a designated agency administrator.
7) Passwords must be a minimum of six characters and contain characters from three of the following four categories:
   - Uppercase character.
   - Lowercase character.
   - Number 0-9.
   - Non-alphanumeric characters: ~!@#$%^&*_-+=`|(){}[]:;"'<>,.?/.
APPENDIX B. BUILDING SPECIFICATIONS FOR INDOOR ACCURACY TESTING

<table>
<thead>
<tr>
<th>TEST HOUSE SHALL BE 8' X 8' WITH FOLLOWING SPECIFICATIONS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. EXTERIOR WALL, ROOF, AND FLOOR SHALL BE 1/2 PLYWOOD</td>
</tr>
<tr>
<td>2. WINDOW SHALL BE 3' X 4' STANDARD HUNG, WITH SINGLE PANE GLASS, NO SCREEN INSTALL DIRECTLY OPPOSITE FROM DOOR ENTRANCE</td>
</tr>
<tr>
<td>3. EXTERIOR WALLS AND ROOF SHALL BE COVERED IN R13 INSULATION AND 1/2&quot; DRY WALL.</td>
</tr>
<tr>
<td>4. ENTRANCE DOOR SHALL BE 36&quot; W X 82&quot; H.</td>
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<tr>
<td>5. BUILDING EXTERIOR SHALL BE PAINTED WITH TYPICAL HOUSEHOLD LATEX PAINT.</td>
</tr>
<tr>
<td>6. FLOOR JOISTS SHALL BE CONSTRUCTED WITH 2&quot; X 6&quot; LUMBER, 24&quot; CENTERS.</td>
</tr>
<tr>
<td>7. WALL FRAMING AND ROOF TRUSSES SHALL BE CONSTRUCTED WITH 2&quot; X 4&quot; LUMBER, 16&quot; CENTERS.</td>
</tr>
<tr>
<td>8. TYPICAL RESIDENTIAL ROOFING SHINGLES WITH UNDERLAYMENT.</td>
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</tbody>
</table>

Figure 4. Sample Building Diagram (not to scale)
## APPENDIX C. OTS PRODUCT DATA SHEET AND SUPPLIER ATTESTATION

<table>
<thead>
<tr>
<th>Supplier Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier Name</td>
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<tr>
<td>Supplier Address</td>
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<tr>
<td>Supplier Telephone</td>
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<tr>
<td>Supplier E-mail Address</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>OTS Model Information</th>
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<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>Configuration</td>
</tr>
<tr>
<td>Software Version at Monitoring Station</td>
</tr>
<tr>
<td>Firmware Version on Body-Attached Device</td>
</tr>
<tr>
<td>Date of Model Certification</td>
</tr>
<tr>
<td>Certification Body (CB) Name</td>
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<tr>
<td>CB Web Address</td>
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</table>

**OTS Model Component Identification (e.g., manufacturer, model number):**
- Location Technology
- Communication Device
- Antenna

<table>
<thead>
<tr>
<th>OTS Certified Product Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial Number</td>
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<tr>
<td>Date of Manufacture</td>
</tr>
<tr>
<td>Location of Manufacture</td>
</tr>
<tr>
<td>Date of Verification Testing</td>
</tr>
<tr>
<td>Software Version at Monitoring Station (and history of revisions since original)</td>
</tr>
<tr>
<td>Firmware Version on Body-Attached Device (and history of revisions since original)</td>
</tr>
</tbody>
</table>

**OTS Certified Product Component Identification (i.e., manufacturer, model number):**
- Location Technology
- Communication Device
- Antenna
### Supplier Attestation

The supplier attests that the information contained in this data sheet is correct, accurate, and complete. At a minimum, the OTS Functionality Test specified in NIJ Standard-1004.00, Section 6.23, was performed for this OTS (by the supplier or organization authorized by the supplier), and this product was verified to function properly.

<table>
<thead>
<tr>
<th>Signature of Legal Representative of Supplier</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Printed Name</td>
<td></td>
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<td>Telephone</td>
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<td>Date</td>
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