U.S. Department of Justice
Office of Justice Programs
National Institute of Justice

JULY 2016

NATIONAL INSTITUTE OF JUSTICE

STANDARD

OFFENDER TRACKING SYSTEMS

Offender Tracking Systems NIJ Standard 1004.00

NIJ

U.S. Department of Justice
Office of Justice Programs

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U.S. Department of Justice
Office of Justice Programs
National Institute of Justice

Criminal Justice Offender Tracking System Standard

NIJ Standard-1004.00

JULY 2016

NCJ 249810

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Special Technical Committee

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

Table 1. Practitioners

Type	Name	Organization	Professional Affiliation
Local	Tom Roy	Arrowhead Regional Corrections	American Probation and Parole Association American Correctional Association
Local	Dave Scheppegrell	Charlotte Mecklenburg Police Department	Fraternal Order of Police
Federal	Carlton Butler	Court Services and Offender Supervision Agency	Fraternal Order of Police
Federal	Dean Johnson	U.S. Probation Office, District of New Mexico	Federal Probation and Pretrial Officers Association National Alliance of Mental Illness
State	Denise Milano	California Department of Corrections and Rehabilitation	American Probation and Parole Association American Correctional Association California Correctional Peace Officers Association
State	Lin Miller	Washington State Department of Corrections	American Probation and Parole Association
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Table 2. Technical Experts and Others

Type	Name	Organization	Expertise
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Private	Michael Gbadebo	ITC Engineering Services, Inc.	Test Method Development
Private	Harry Hodes	Acme Testing Co.	Test Method Development
Federal	Axel Rodriguez	U. S. Army Natick Soldier Research, Development, and Engineering Center	Test Method Development
Federal	Jamie Phillips (contractor)	National Law Enforcement and Corrections Technology Center-National	Conformity Assessment
Federal	Joe Russo (contractor)	Corrections Technology Center of Excellence	Offender Tracking
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Advisory Working Group

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

Table 3. AWG Members

Organization
American Jail Association (AJA)
American Probation and Parole Association (APPA)
American Correctional Association (ACA)
National Sheriffs' Association (NSA)
International Association of Chiefs of Police (IACP)
U.S. Department of Homeland Security (DHS)

FOREWORD

This document is a voluntary performance standard for offender tracking systems (OTS) used by the criminal justice community. It defines both performance requirements and the methods used to test performance. In order for a supplier 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. All requirements stated in this standard, including those that explicitly employ mandatory language (e.g., "shall") are those necessary to satisfy the standard. Nothing in this document is intended to require or imply that a commercially available OTS used by criminal justice personnel must satisfy this standard. Agencies should consider that future procurements shall meet, or exceed, the most recent version of this standard.

NIJ standards are subject to continued research, development, and testing, as well as review and modification as appropriate on an ongoing basis. Users of this standard are advised to check the NIJ Standards page (http://www.nij.gov/standards) to determine whether the standard has been revised or superseded.

Please send all written comments and suggestions to the Director, National Institute of Justice, Office of Justice Programs, U.S. Department of Justice, 810 7th 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, suppliers, law enforcement agencies, or others to follow or adopt this voluntary law enforcement technology equipment standard.

CONTENTS

1. SCOPE, PURPOSE, AND APPLICATION....1
1.1 Scope....1
1.2 Purpose....1
1.3 Application....2
2. REFERENCES....4
2.1 Referenced Publications....4
3. DEFINITIONS....8
3.1 General....8
3.2 Standard-Specific Definitions....8
4. FORM AND FIT REQUIREMENTS....13
4.1 Requirements for Offender Tracking System Models....13
5. PERFORMANCE REQUIREMENTS....14
5.1 Performance Requirements for OTS models....14
5.2 Safety....14
5.3 Technical Operation Requirements....15
5.4 Circumvention Requirements....17
5.5 Software Requirements....18
5.6 Robustness Requirements....19
5.7 Requirements for Optional Features....20
6. TEST METHODS....21
6.1 General....21
6.2 Room Temperature Conditioning....22
6.3 Test Conditions....22
6.4 Test Samples....26
6.5 Sharp Edges Test....26
6.6 Emergency Removal Test....26
6.7 Location Signal Acquisition Test....27
6.8 Outdoor Accuracy Test....29
6.9 Indoor Accuracy Test....31
6.10 Location and Status Data Test....33

6.11 Low Battery Alert Test 34
6.12 Zone Violation Alert Test 35
6.13 Multi-Piece OTS Separation Detection and Alert Test.....36
6.14 Participant Alert Test 37
6.15 Data Storage Test.....38
6.16 Charging System Communication Test 40
6.17 Rechargeable Battery Test 40
6.18 Battery Life Expectancy Test.....42
6.19 Attachment Strap Removal (by Cutting) Detection and Alert Test.....43
6.20 Attachment Strap Removal (by Stretching) Detection and Alert Test 45
6.21 Loss of Location Alert Test/Communications Loss Alert Test 48
6.22 Metallic Shielding Detection and Alert Test (Optional).....52
6.23 Cellular Interference/Jamming Detection and Alert Test (Optional) 55
6.24 GPS Interference/Jamming Detection and Alert Test (Optional).....61
6.25 Software Tests.....67
6.26 OTS Functionality Test.....70
6.27 Extreme Temperature Storage Test 71
6.28 Condensing Humidity Test 72
6.29 Water Spray Exposure Test 73
6.30 Immersion Test 74
6.31 Shock by Impact Test.....75
6.32 Dynamic Shock Test 76
6.33 Sinusoidal Vibration Test 77
6.34 Random Vibration Test.....77
6.35 Electromagnetic Compatibility Test 78
7. LABELING AND INFORMATION.....83
7.1 General Product Label Requirements 83
7.2 User Information to Be Provided by the OTS Supplier.....83
APPENDIX A. SECURE LOG-IN CRITERIA 85
APPENDIX B. BUILDING SPECIFICATIONS FOR INDOOR ACCURACY TESTING..86
APPENDIX C. OTS STRAP STRETCH FIXTURE ASSEMBLY…….87

ABBREVIATIONS, SYMBOLS, PREFIXES, and CONVERSIONS

Standard-Specific Abbreviations and Acronyms

AFLT	Advanced forward link trilateration
AGL	Above ground level
Ah	Ampere-hour
AM	Amplitude modulation
ANSI	American National Standards Institute
AWG	Advisory Working Group
BTS	Base transceiver station
C	Centigrade
CDMA	Code division multiple access
CFR	Code of Federal Regulations
cm	Centimeter
dB	Decibel
dBA	A-weighted (environmental noise measure)
dBm	The power ratio in decibels (dB) of the measured power referenced to one milliwatt (mW)
DOC	Declaration of Conformity
EMC	Electromagnetic compatibility
EMS/EMT	Emergency medical service/emergency medical technician
ESD	Electrostatic discharge
EUT	Equipment under test
FCC	Federal Communications Commission
FDA	Food and Drug Administration
FM	Frequency modulation
g	Gram
GHz	Gigahertz
GPS	Global positioning system
GSM	Global System for Mobile Communications
Hz	Hertz
I	Electric current
I_c	Cumulative current consumed
IEC	International Electrotechnical Commission
in	Inch
IP Code	Ingress protection code
J_c	Jamming cellular signal
KDB	Knowledge database
kg	Kilogram
kHz	Kilohertz
Kp	Planetary K values that define a geomagnetic storm

kts	Nautical miles
kV	Kilovolts
LTE	Long term evolution (a 4G standard for wireless communication of high-speed data for mobile phones and data terminals)
m	Meter
mAH	Milliampere-hour
Mbits/s	Megabits per second
Mbytes/s	Megabytes per second
MHz	Megahertz
MIL-STD	Military Standard
mm	Millimeter
mph	Miles per hour
ms	Millisecond
N	Newton
NCJ	National Criminal Justice [Reference Service] (This usually appears only on the cover or title page and indicates the publication number, as referenced by NCJRS.)
NEMA	National Electrical Manufacturers Association
NIJ	National Institute of Justice
OET	Federal Communications Commission, Office of Engineering and Technology
OTS	Offender Tracking System
PCB	Printed circuit board
PCS	Personal Communications Service
PM	Phase modulation
ppv	Peak particle velocity
PROM	Programmable read-only memory
PVC	Polyvinyl chloride
RBW	Resolution bandwidth
RF	Radio frequency
RH	Relative humidity
ROM	Read-only memory
s	Second
S_c	Cellular signal
T	Time
TIA	Telecommunications Industry Association
UL	Underwriters Laboratories
UMTS	Universal Mobile Telecommunications Service
UTC	Coordinated Universal Time
VAC	Volts alternating current
VBW	Video bandwidth

Commonly Used Symbols and Abbreviations

A	ampere	lbf	pound force
ac	alternating current	lbf·in	pound force inch
cd	candela	lm	lumen
cm	centimeter	ln	logarithm (base e)
dB	decibel	log	logarithm (base 10)
dc	direct current	m	meter
°C	degree Celsius	min	minute
°F	degree Fahrenheit	mm	millimeter
ft	foot	mph	miles per hour
ft/s	foot per second	mphe	miles per hour equivalent
h	hour	m/s	meter per second
Hz	hertz	rh	relative humidity
in	inch	V	volt
Lb	pound	W	watt

area = unit^2 (e.g., ft^2, in^2, etc.); volume = unit^3 (e.g., ft^3, m^3, etc.)

Prefixes

d	deci (10^{-1})		da	deka (10)
c	centi (10^{-2})		h	hecto (10^2)
m	milli (10^{-3})		k	kilo (10^3)
µ	micro (10^{-6})		M	mega (10^6)
n	nano (10^{-9})		G	giga (10^9)
p	pico (10^{-12})		T	tera (10^{12})

Common Conversions

0.30480 m = 1 ft	4.448222 N = 1 lbf
2.54 cm = 1 in	1.355818 J = 1 ft·lbf
0.4535924 kg = 1 lb	0.1129848 Nm = 1 lbf·in
0.06479891 g = 1 gr	14.59390 N/m = 1 lbf/ft
0.9463529 L = 1 qt	6894.757 Pa = 1 lbf/in^2
3,600,000 J = 1 kW·h	1.609344 km/h = 1 mph

1. SCOPE, PURPOSE, AND APPLICATION

1.1 Scope

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

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

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

1.1.4 This standard shall not be understood as addressing all of the safety risks associated with testing OTS. The user of this document is responsible for following appropriate safety practices when handling or operating OTS.

1.1.5 No supplier, manufacturer, or other entity shall claim compliance with only selected portions of this standard. The OTS model shall meet all applicable stated requirements, with the exception of those specifically indicated as pertaining to "optional features."

1.1.6 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.

1.1.7 Nothing herein shall be understood to restrict any OTS supplier 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 OTS.

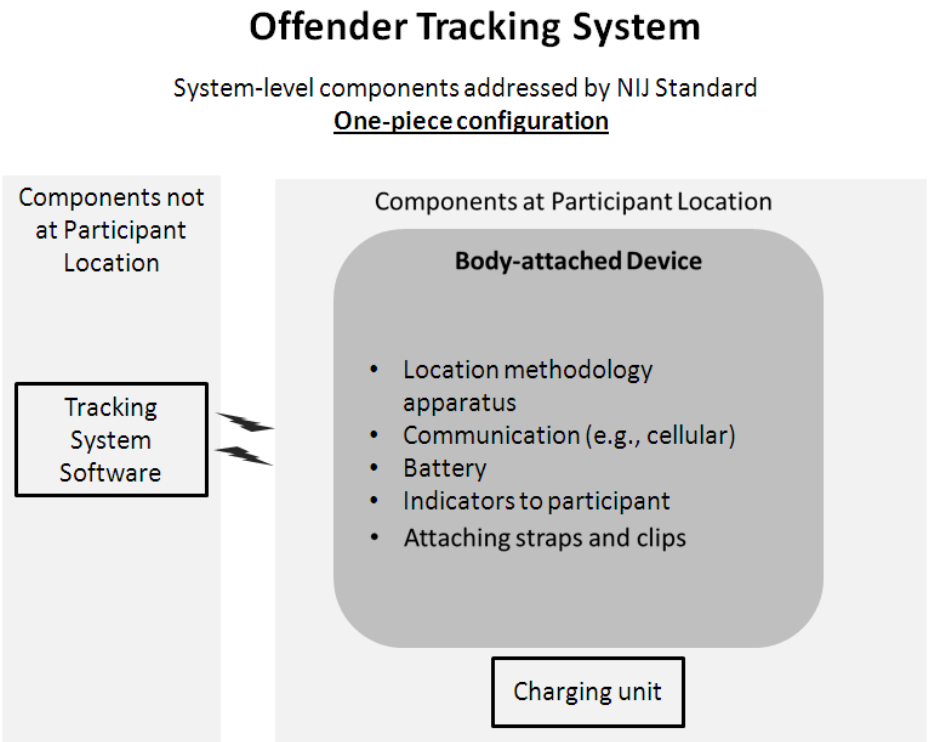
1.2.2 The purpose of the test methods in this standard is to assess performance and should not be understood to specify performance levels for all situations and hazards to which the participant may be exposed.

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.

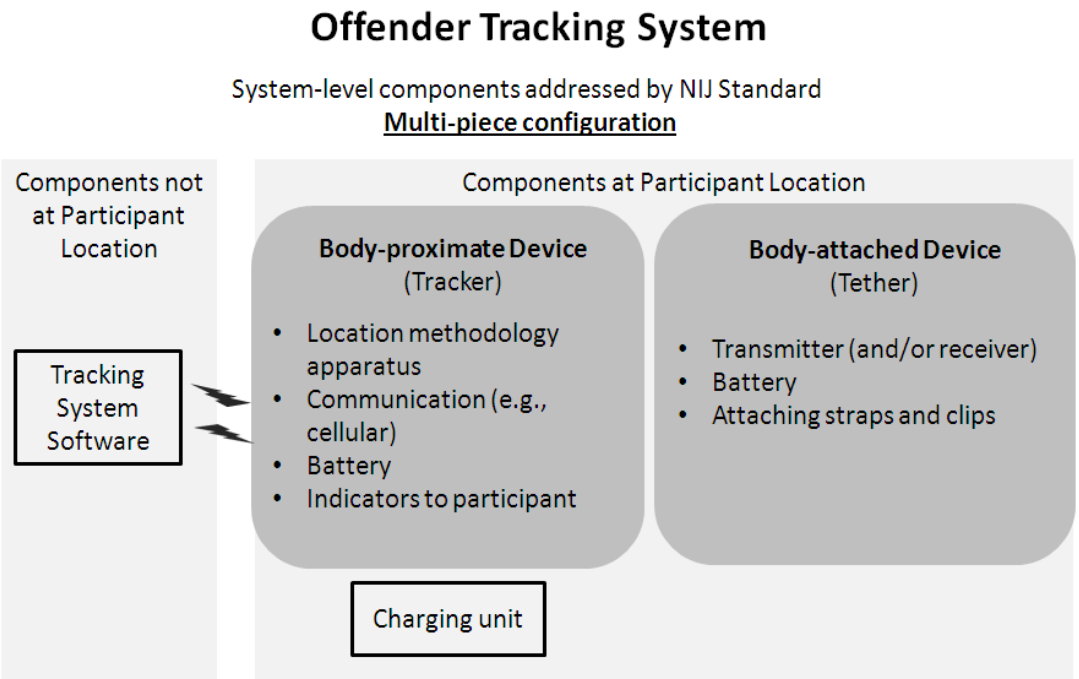
Figure 1. System-level Components for a One-piece Configuration



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

1.3.1.2 In a multi-piece configuration, there are two separate units. One unit is body-attached, and the other, body-proximate (see Figure 2). Components of the body-proximate unit typically include the location methodology apparatus, communication device, battery, indicators to the participant, and casing. Components of the body-attached device typically include the transmitter/receiver, battery, attaching straps and clips, and casing.

Figure 2. System-level Components for a 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)

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.* New York, NY: American National Standards Institute.

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.* New York, NY: American National Standards Institute.

ANSI C63.10. 2009. *American National Standard for Wireless Testing Unlicensed Wireless Devices.* New York, NY: American National Standards Institute.

2.1.2 ASTM International

ASTM Standard B117. 2007a. *Standard Practice for Operating Salt Spray (Fog) Apparatus*. West Conshohocken, PA: ASTM International.

2.1.3 Code of Federal Regulations (CFR)

Food and Drugs

21 CFR Part 880.6820. *Medical disposable scissors*. Washington, DC: Food and Drug Administration.

Telecommunication

47 CFR Part 2. *Frequency allocations and radio treaty matters; general rules and regulations.* Washington, DC: Federal Communications Commission.

47 CFR Part 15. *Radiofrequency devices.* Washington, DC: Federal Communications Commission.

47 CFR Part 22. *Public mobile services.* Washington, DC: Federal Communications Commission.

47 CFR Part 24. *Personal communications services*. Washington, DC: Federal Communications Commission.

47 CFR Part 27. *Miscellaneous wireless communications services*. Washington, DC: Federal Communications Commission.

47 CFR Part 68. *Connection of terminal equipment to the telephone network*. Washington, DC: Federal Communications Commission.

2.1.4 Federal Communications Commission (FCC) - Additional

Office of Engineering and Technology (OET) Bulletin Number 6.5, 1997. "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields," and supplements. Washington, DC: Federal Communications Commission.

2.1.5 International Electrotechnical Commission (IEC)

IEC 60068-2-6. 2007. *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal).* Geneva, Switzerland: International Electrotechnical Commission.

IEC 60068-2-64. 2008. *Environmental testing – Part 2-64: Tests – Test Fh: Vibration, Broadband Random and Guidance*. Geneva, Switzerland: International Electrotechnical Commission.

IEC 60529. 2004. *Degrees of Protection Provided by Enclosures (IP Code).* Geneva, Switzerland: International Electrotechnical Commission.

IEC 61000-4-2. 2008. *Electromagnetic Compatibility (EMC), Part 4-2: Testing and Measurement Techniques – Electrostatic Discharge Immunity Test – Edition 2.0.* Geneva, Switzerland: International Electrotechnical Commission.

IEC 61000-4-3. 2008. *Electromagnetic Compatibility (EMC), Part 4-3: Testing and Measurement Techniques – Radiated, Radio-Frequency, Electromagnetic Field Immunity Test.* Geneva, Switzerland: International Electrotechnical Commission.

IEC 61000-4-4. 2004. *Electromagnetic Compatibility (EMC), Part 4-4: Electrical Fast Transient/Burst Immunity Test - Edition 2.0*. Geneva, Switzerland: International Electrotechnical Commission.

IEC 61000-4-5. 2004. *Electromagnetic Compatibility (EMC), Part 4-5: Testing and Measurement Techniques – Surge Immunity Test.* Geneva, Switzerland: International Electrotechnical Commission.

IEC 61000-4-6. 2008. *Electromagnetic compatibility (EMC), Part 4-6: Testing and Measurement Techniques – Immunity to Conducted Disturbances, Induced by Radio-frequency Fields - Edition 3.0.* Geneva, Switzerland: International Electrotechnical Commission.

IEC 61000-4-8. 2009. *Electromagnetic Compatibility (EMC), Part 4-8: Testing and Measurement Techniques – Power Frequency Magnetic Field Immunity Test – Edition 2.0.* Geneva, Switzerland: International Electrotechnical Commission.

IEC 61000-4-11. 2004. *Electromagnetic Compatibility (EMC), Part 4-11: Testing and Measurement Techniques – Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests*. Geneva, Switzerland: International Electrotechnical Commission.

IEC 61960. 2011. *Secondary cells and batteries containing alkaline or other non-acid electrolytes- Secondary lithium cells and batteries for portable applications.* Geneva, Switzerland: International Electrotechnical Commission.

IEC 62133. 2002. *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*. Geneva, Switzerland: International Electrotechnical Commission.

2.1.6 National Institute of Justice (NIJ)

NIJ CR-1004.00. *Criminal Justice Offender Tracking Systems Certification Program Requirements*. Washington, DC: U.S. Department of Justice, National Institute of Justice.

NIJ Guide-1004.00. *Criminal Justice Offender Tracking System Selection and Application Guide.* Washington, DC: U.S. Department of Justice, National Institute of Justice.

NIJ RP-1004.00. *Criminal Justice Offender Tracking System Refurbishment Service Program Requirements.* Washington, DC: U.S. Department of Justice, National Institute of Justice.

2.1.7 Telecommunications Industry Association (TIA)

TIA-603-C. 2010. *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*. Arlington, VA: Telecommunications Industry Association.

2.1.8 Underwriters Laboratories Inc. (UL)

UL Standard 1439. 1998 (w/revisions through 2013). *Tests for Sharpness of Edges on Equipment*. Camas, WA: Underwriters Laboratories Inc.

UL Standard 1642. 2012 (w/revisions through 2013). *Lithium Batteries*. Camas, WA: Underwriters Laboratories Inc.

UL Standard 2054. 2004 (w/revisions through 2011). *Household and Commercial Batteries*. Camas, WA: Underwriters Laboratories Inc.

UL Standard 60950-1. 2007 (w/revisions through 2011). *Information Technology Equipment – Safety – Part 1: General Requirements*. Camas, WA: Underwriters Laboratories Inc.

UL Standard 61010-1. 2012. *Standard for Safety – Electrical Equipment for Measurement, Control, and Laboratory Use; Part 1: General Requirements*. Camas, WA: Underwriters Laboratories Inc.

2.1.9 U.S. Military

MIL-STD-810G. 2008. *Test Method Standard – Environmental Engineering Considerations and Laboratory Tests*. Washington, DC: U.S. Department of Defense.

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 must be capable of providing on-demand location and status information to an agency within 3 minutes, and provide zone and status alerts to an agency within 4 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 "charged battery" within the past 6 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 5.3.5).

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

3.2.8 **Body-proximate:** The quality of being near the participant. As it relates to an OTS, the tracking device must be close enough to the participant to ensure the participant's location is being tracked.

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

3.2.10 **Certification body:** An entity that operates a product certification system.

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

3.2.12 **Charged battery:** The quantity of electricity in Ah (ampere-hours) that a battery can deliver after being charged, from a discharged state, for a 2-hour period for one-piece devices or a 4-hour period for multi-piece devices.

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

3.2.14 **Communications loss:** 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 **Incident:** A condition or occurrence that affects the capability to track a participant.

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 supplier’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-proximate and body-attached components.

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

3.2.29 **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.

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

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

3.2.32 **Operational Mode:** A condition of the OTS in which the battery is installed in the device and the device is turned on.

3.2.33 **Pairing:** The process of assigning a body-attached tether to a body-proximate tracking device when using a multi-piece OTS configuration, using a procedure that is specified by the OTS manufacturer. This is usually accomplished by entering the designated tether ID and tracking device ID in the participant enrollment section of the supplier's software.

3.2.34 **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.

3.2.35 **Passive tracking:** An approach to offender tracking in which device location and status data are stored in device memory and 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.

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

3.2.37 **Portable communication 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).

3.2.38 **Precision algorithm:** Mathematical rectification model used to improve the positioning accuracy of an OTS device.

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

3.2.39.1 **New product:** An OTS that contains all new parts and has never been shipped from the manufacturing location to an agency.

3.2.40 **Product label:** A marking affixed by an OTS supplier to each piece (i.e., body-proximate and body-attached) of a compliant model that contains required product and model information.

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

3.2.42 **Serial number:** A unique designation applied to a single offender tracking system product that distinguishes it from every other offender tracking system product.

3.2.43 **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.

3.2.44 **Supplier:** The party that is responsible for ensuring that products meet and, if applicable, continue to meet, the requirements on which certification is based.

3.2.45 **System-level components:** Key parts of an OTS model that, when certified, cannot be changed or modified without first receiving authorization from 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 user interface. These programs may exist within the tracking devices themselves (firmware), within the supplier's computer systems, or resident on computers controlled by users.

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 **User:** An agency employee who interacts with OTS-related hardware and software in the course of his or her duties.

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

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

3.2.52.2 **Free-form zone:** A user-defined irregular polygon that permits introduction of up to at least 40 nodes to produce a highly customizable, asymmetrical shape.

3.2.52.3 **Inclusion zone:** A user-defined area within which a tracked participant must remain during specified periods.

3.2.53 **Zone template:** An 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 (.6 inch) 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).

Section 5.7 contains optional circumvention requirements that the OTS supplier may also choose to meet. These requirements are not necessary to declare conformity with this standard unless the supplier chooses to declare that the OTS provides those associated capabilities.

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 OTS, except as noted.

5.1.3 OTS time-stamps shall be based on the UTC time standard. Furthermore, all on-board processing (e.g., micro-processor clock timing) shall be accomplished as delineated in IEEE Standard 1588.

5.1.4 OTS 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.

5.1.5 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.

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

5.2 Safety

5.2.1 The OTS shall comply with applicable Federal Communications Commission (FCC) rules and regulations. The OTS supplier shall submit the FCC certification grant of approval, a Class 2 Permissive Change certification grant of approval, or declaration of conformity, whichever is appropriate, for the OTS.

5.2.2 The OTS, including associated power charger, shall comply with the product 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 rechargeable and backup battery shall be tested (or shall have been tested) to the requirements as specified in any one of the following: 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*; or UL 2054, *Household and Commercial Batteries*.

5.2.4 The body-attached and body-proximate devices shall be tested as specified in Section 6.5, 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 6.6, Emergency Removal Test, and 1) the attachment strap shall be successfully severed during the test; and 2) it shall be severed within a period of 1 minute or less.

5.3 Technical Operation Requirements

5.3.1 If the OTS uses GPS, the OTS shall be tested as specified in Section 6.7, Location Signal Acquisition Test, and shall determine a position in 2 minutes or less.

5.3.2 The OTS shall be tested as specified in Section 6.8, Outdoor Accuracy Test, and shall be demonstrated at the accuracy levels as follows:

- 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 for each sample tested and for each test replicate.
- After the participant location components have been stationary for a minimum of 1 hour in an open air environment, the OTS shall register a sudden change of location. The participant location components shall be moved 75 meters to another open air environment within 1 minute. In the next 30 minutes, tracking points captured will provide a location that is accurate within 10 meters 90% of the time for each sample tested and for each test replicate.

5.3.3 The OTS shall be tested as specified in Section 6.9, Indoor Accuracy Test, and shall be demonstrated at the accuracy level as follows:

- With the participant location components placed in a structure designed to approximate residential shielding (see Appendix B), the OTS shall provide a location that is accurate within 30 meters 90% of the time for each sample tested.

5.3.4 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.

5.3.5 The OTS shall provide alerts as follows:

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

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

5.3.5.3 Unless otherwise stated in the test method, an active tracking OTS shall be capable of providing alerts to the agency within 4 minutes of the occurrence of an event (as defined by the agency or supplier) under the communications environment described within the specific test method.

5.3.5.4 Unless otherwise stated in the test method, a passive tracking OTS shall be capable of providing alerts to the agency of the occurrence of an event (as defined by the agency or supplier) within 15 minutes of uploading/transmission of the data at the prescribed, predetermined time intervals.

5.3.6 The OTS shall be tested as specified in Section 6.11, Low Battery Alert Test, and shall generate both a local alert and an alert to the data center prior to complete battery discharge. The local alert shall be generated prior to, or at the same time, as the alert to the data center. The alerts shall also meet the requirements of Section 5.3.5, with the following exception:

- An active tracking OTS shall be capable of providing alerts to the agency within *three* minutes of the occurrence of an event.

5.3.7 The OTS shall be tested as specified in Section 6.12, Zone Violation Alert Test, and shall generate a zone violation alert for each test condition. The alerts shall also meet the requirements of Section 5.3.5.

5.3.8 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 5 minutes of separation, and an agency alert within 4 minutes of the local alert. The alerts shall also meet the requirements of Section 5.3.5.

5.3.9 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:

5.3.9.1 Audible alert: Shall be at least 40 dBA at a distance of one meter from the OTS.

5.3.9.2 Vibratory alert: Shall be at least 5 mm/second peak particle velocity (ppv).

5.3.10 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; 2) successful collection of at least 90% of the total location points over the 10-day period; and 3) successful collection of no less than 85% of each day's location points. Additionally, this data shall be recoverable even after the OTS battery has been completely discharged.

5.3.11 The OTS shall be tested as specified in Section 6.16, Charging System Communication Test, and shall: 1) provide indication when the battery is being charged; 2) provide indication when the battery charging process is complete.

5.3.12 The OTS shall be tested as specified in Section 6.17, Rechargeable Battery Test, and shall: 1) remain operational during and after each portion of the test; and 2) successfully collect 95% of the possible 1,440 location data points (1,368 points) at each of the three test temperatures.

5.3.13 The OTS shall be tested as specified in Section 6.18, Battery Life Expectancy Test, and the batteries shall be capable of 365 cycles of charging/discharging. Additionally, when tested as specified in Section 6.18.5.6, the OTS shall: 1) remain operational during the prescribed steps; and 2) successfully collect 95% of the possible 1,440 location data points (1,368 points).

5.4 Circumvention Requirements

5.4.1 The OTS shall be tested as specified in Section 6.19, Attachment Strap Removal (by Cutting) Detection and Alert Test, and the attachment strap shall: 1) generate a time-stamped tamper event after no longer than 5 seconds of being cut; and 2) provide a report to the data center within 3 minutes of the time stamp concerning the tamper event.

5.4.2 The OTS shall be tested as specified in Section 6.20, Attachment Strap Removal (by Stretching) Detection and Alert Test, and 1) the attachment strap shall not separate from the body-attached device; and 2) the circumference/perimeter of the OTS shall not stretch more than 5% (for a strap that adjusts incrementally) or 10% (for a strap that is non-incremental in its adjustment) on application of a 245 N (± 5 N) force. On application of a force (greater than 245 N) sufficient to cause either the strap to separate from the body-attached device or the circumference/perimeter of the OTS to stretch in excess of 5% (or 10%, if applicable), an alert shall be generated that meets the requirements of Section 5.3.5, with the following exception:

- An active tracking OTS shall be capable of providing alerts to the agency within 3 minutes of the occurrence of an event.

5.4.3 The OTS shall be tested as specified in Section 6.21, Loss of Location Alert Test/Communications Loss 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 of 1 hour). The alerts shall also meet the requirements of Section 5.3.5.

5.4.4 All multi-piece OTS with communications between the tether and the tracking device shall incorporate 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.[1] Evidence of a certificate of compliance for the validation of encryption algorithms and authentication of the data to and from the data center shall also be provided.[2]

5.5 Software Requirements

5.5.1 The OTS software and firmware shall be tested as specified in Section 6.25, Software Tests, and shall demonstrate the following capabilities:

- 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 at a minimum of once every 15 minutes (for active tracking devices only).
- Capability for configuring zones in the shapes of circles, rectangles, and arbitrary-shaped polygons (i.e., free-form zones), 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.

[1] The rules for the specific bands of operation and service requirements should be consulted to determinate whether appropriate regulatory authorities, such as the FCC or NTIA, prohibit the use of encryption in the anticipated bands of operation for an OTS.

[2] 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.

- Capability of a secure method of agency access to software as described in Appendix A.

5.6 Robustness Requirements

5.6.1 Unless otherwise specified within the test method, tests specified within this section shall be performed with the OTS in "operational" mode (i.e., the battery shall be installed in the device and the device shall be turned on).

5.6.2 The tests specified within this section incorporate the performance of the OTS Functionality Test provided in Section 6.26.

5.6.3 The OTS shall be tested as specified in Section 6.27, Extreme Temperature Storage Test, and shall function properly following exposure to extreme temperatures (+50°C [122°F] and -20°C [-4°F]).

5.6.4 The OTS shall be tested as specified in Section 6.28, Condensing Humidity Test, and shall function properly and show no signs of moisture ingress following exposure to condensing humidity.

5.6.5 The OTS shall be tested as specified in Section 6.29, Water Spray Exposure Test, and: 1) shall not demonstrate insulation breakdown during post-exposure electric strength (dielectric) testing; and 2) shall function properly following exposure to water spray, and after a latency period of one week following this exposure.

5.6.6 The OTS shall be tested as specified in Section 6.30, Immersion Test, and: 1) shall not demonstrate insulation breakdown during post-immersion electric strength (dielectric) testing; and 2) shall function properly following immersion, and after a latency period of one week following this immersion.

5.6.7 The OTS shall be tested as specified in Section 6.31, Shock by Impact Test, and shall function properly and show no signs of breach of the casing following exposure.

5.6.8 The OTS shall be tested as specified in Section 6.32, Dynamic Shock Test, and shall function properly and show no signs of breach of the casing following exposure.

5.6.9 The OTS shall be tested as specified in Section 6.33, Sinusoidal Vibration Test, and shall function properly following exposure.

5.6.10 The OTS shall be tested as specified in Section 6.34, Random Vibration Test, and shall function properly following exposure.

5.6.11 The OTS shall be tested as specified in Section 6.35, Electromagnetic Compatibility Test, and shall function properly during and following exposure.

5.7 Requirements for Optional Features

5.7.1 The OTS supplier shall declare whether or not the OTS provides each of the following capabilities: 1) metallic shielding detection; 2) cellular interference/jamming detection; 3) GPS interference/jamming detection. These features are optional.

5.7.2 If the OTS is claimed to provide any of the capabilities in section 5.7.1, the applicable requirement below shall be met (section 5.7.3 for metallic shielding detection; section 5.7.4 for cellular interference/jamming detection; section 5.7.5 for GPS interference/jamming detection).

5.7.3 The OTS shall be tested as specified in Section 6.22, Metallic Shielding Detection and Alert Test, and shall demonstrate detection and alerting in those cases when an object or material shields the OTS for a period of 5 minutes (± 1 minute). The OTS shall provide an alert to the agency as soon as cellular communication is restored (if interrupted). The OTS shall not generate a “Loss of Location/Possible Shielding” (or similar) alert for solely a loss of GPS when no metallic shielding is present. The alerts shall also meet the requirements of Section 5.3.5.

5.7.4 The OTS shall be tested as specified in Section 6.23, Cellular Interference/Jamming Detection and Alert Test, and shall detect interference or jamming of the cellular communications. The OTS shall generate a “Cellular Jamming” alert in those cases when the OTS cellular signal is jammed for a period of 5 minutes (± 1 minute). The OTS shall not generate a “Cellular Jamming” alert for solely a loss of cellular signal when no jamming signal is present. The alert shall also meet the requirements of Section 5.3.5. For clarification, it is recognized that a jamming event will interrupt cellular communication. In this case, the 4 minute period specified for active tracking OTS in Section 5.3.5.3 shall begin on removal of the OTS from the shielded/anechoic room.

5.7.5 The OTS shall be tested as specified in Section 6.24, GPS Interference/Jamming Detection and Alert Test, and shall detect interference or jamming of the GPS signal. The OTS shall generate a “GPS Jamming” alert in those cases when the OTS GPS signal is jammed for a period of 5 minutes (± 1 minute). The OTS shall not generate a “GPS Jamming” alert for solely a loss of GPS signal when no jamming signal is present. The alert shall also meet the requirements of Section 5.3.5.

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 supplier shall submit test samples in accordance with Section 6.4.

6.1.4 Unless indicated otherwise, the test laboratory shall use a working sample for each test 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 devices.

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

6.1.8 Unless the performance requirement is specifically stated as an average result, if any individual sample result does not meet the performance requirement, the overall result 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 a “charged battery”, the battery shall be charged for a period of 2 hours for a one-piece system or 4 hours for multi-piece systems. The multi-piece system is allowed a longer charging period since the component containing the battery is not attached to the participant.

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

6.1.12 Unless otherwise specified within a test method, discharging of the OTS battery is to be accomplished in accordance with: 1) manufacturer recommendations; or 2) IEC 61960.

6.1.13 With respect to passive tracking OTS, test methods requiring the transmission of data from the OTS, the tracking devices shall be placed in their charging/communications cradles (or allowed to communicate using some other methodology as specified by the supplier) to upload data to the data center that was collected and stored during the testing period.

6.2 Room Temperature Conditioning

6.2.1 Each sample shall be conditioned prior to testing at a temperature of 21°C ± 3°C (70°F ± 5°F) and 65% ± 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 4. Note that not all test conditions apply to every test.

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

6.3.2.2 The test 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. The collection rate shall be at least one location point per minute. The upload frequency shall be at least once every 15 minutes. 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 (not obstructed by trees, vegetation, topography, or buildings) starting at 15 º above horizontal.

6.3.2.5 In order to prevent the OTS from going into an “at rest” status during the test, it shall be placed on a device that subjects it to a continuous cyclical motion. The motion of the device shall be such that it continuously alternates speed. The device shall start at 10 cycles per minute for a period of 30 seconds. The speed of the device shall then immediately be changed to 20 cycles per minute for 30 seconds. This cycle shall continue to be repeated until the testing is completed.

6.3.2.6 The OTS shall be tested with a charged battery if so specified in the test method.

6.3.2.7 The OTS shall be tested with an adequately charged battery if so specified in the test method.

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:"

- Fog (with horizontal visibility < 4.8 km [3 miles]).
- Stratus (i.e., solid overcast cloud cover, with cloud base 152 m [500 ft] AGL or lower).
- Sustained surface wind speed < 3 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 20 cm (± 2 cm) above the ground. It shall be mounted on a vertically oriented 3-inch diameter piece of PVC Schedule 40 pipe.

6.3.2.11 The body-proximate device, if applicable, shall be tested at a distance of 1 meter (± 10 cm) from the ground.

6.3.2.12 The test shall be conducted with the OTS set at its minimum loss of communication (or similar) time setting.

6.3.2.13 The test shall be conducted in an area with grades of no more than 5 º within 25 meters of where the OTS will be situated.

6.3.2.14 Test platforms shall be flat, dry, non-conductive surfaces (i.e., wood or concrete). They shall be a minimum of 1.2 meters (4 ft.) x 1.2 meters (4 ft.) in size.

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.

6.3.2.16 The following website shall be consulted prior to testing to determine if there are any planned military testing activities that could affect GPS in the area:

Federal Aviation Administration PilotWeb .

6.3.2.17 For multi-piece OTS, the tether shall be paired with the tracking device.

Table 4. Test Condition Summary

	Test Condition																
[redacted]	Limited or no Cloud Cover (6.3.2.1)	100 kb/s Cellular Upload/Download speed(6.3.2.2)	Use Max Collection/Upload Rates Unless Otherwise Specified (6.3.2.3)	Clear View of the Sky; 15 Degree above Horizontal; No Trees (6.3.2.4)	10-20 Cycles/Minute to Avoid Sleeping (6.3.2.5)	Charged Battery (6.3.2.6)	Adequately Charged Battery (6.3.2.7)	Enable Precision Alogorithm if Used by Software (6.3.2.8)	Well-Mixed Atmosphere (6.3.2.9)	20 cm Above Ground on 3" PVC Pipe (6.3.2.10)	Body-Proximate Device 1m Above Ground (6.3.2.11)	Loss of Communication set at minimum (6.3.2.12)	No Grades Greater Than 5 Degrees Within 25m of OTS (6.3.2.13)	Test Platforms -Flat, Dry, Non-Conductive Surfaces (6.3.2.14)	Collect Data for 30 Minutes Prior to Start of Test (6.3.2.15)	Planned military testing activities that could affect GPS (6.3.2.16)	Pair the Tether with the Tracking Device (6.3.2.17)
Sharp Edges Test (6.5)																	
Emergency Removal Test (6.6)										✓							
Location Signal Acquisition Test (6.7)		✓	✓	✓	✓		✓		✓	✓	✓				✓		✓
Outdoor Accuracy Test (6.8)	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓
Indoor Accuracy Test (6.9)	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓
Location and Status Data Test (6.10)		✓	✓		✓		✓			✓	✓				✓		✓
Low Battery Alert Test (6.11)		✓	✓		✓		✓	✓							✓		✓
Zone Violation Alert Test (6.12)	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		✓
Multi-Piece OTS Separation Detection and Alert Test (6.13)		✓	✓				✓			✓	✓				✓		✓
Participant Alert Test (6.14)							✓			✓	✓						✓
Data Storage Test (6.15)		✓	✓	✓	✓	✓									✓		✓
Charging System Communication Test (6.16)																	
Rechargeable Battery Test (6.17)		✓		✓	✓	✓											✓
Battery Life Expectancy Test (6.18)						✓											✓
Attachment Strap Removal (by Cutting) Detection and Alert Test (6.19)		✓	✓				✓								✓		✓
Attachment Strap Removal (by Stretching) Detection and Alert Test (6.20)		✓	✓				✓								✓		✓
Loss of Location/Communications Failure Alert Test (6.21)		✓	✓				✓					✓			✓		✓
Metallic Shielding Detection and Alert Test (6.22)		✓	✓				✓								✓		✓
Cellular Interference/Jamming Detection and Alert Test (6.23)		✓	✓				✓					✓			✓		✓
GPS Interference/Jamming Detection and Alert Test (6.24)		✓	✓				✓								✓		✓
Software Test (6.25)																	
OTS Functionality Test (6.26)		✓	✓	✓	✓		✓			✓	✓				✓		✓
Extreme Temperature Storage Test (6.27)																	
Condensing Humidity Test (6.28)																	
Water Spray Exposure Test (6.29)																	
Immersion Test (6.30)																	
Shock by Impact Test (6.31)																	
Dynamic Shock Test (6.32)																	
Sinusoidal Vibration Test (6.33)																	
Random Vibration Test (6.34)																	
Electromagnetic Compatibility Test (6.35)		✓	✓	✓	✓		✓								✓		✓

Table 5. Test Sample Summary

		Sample Number													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Test Method	Electrical Safety - UL 60950-1 (5.2.2)	✓													
	Sharp Edges Test (6.5)			✓	✓	✓	✓	✓	✓	✓					
	Emergency Removal Test (6.6)			✓*	✓*	✓*	✓*	✓*	✓*	✓*					
	Location Signal Acquisition Test (6.7)			✓	✓	✓	✓	✓	✓	✓					
	Outdoor Accuracy Test (6.8)			✓	✓	✓	✓	✓	✓	✓					
	Indoor Accuracy Test (6.9)			✓	✓	✓	✓	✓	✓	✓					
	Location and Status Data Test (6.10)			✓	✓	✓	✓	✓	✓	✓					
	Low Battery Alert Test (6.11)			✓	✓	✓	✓	✓	✓	✓					
	Zone Violation Alert Test (6.12)			✓	✓	✓	✓	✓	✓	✓					
	Multi-Piece OTS Separation Detection and Alert Test (6.13)			✓	✓	✓	✓	✓	✓	✓					
	Participant Alert Test (6.14)			✓	✓	✓	✓	✓	✓	✓					
	Data Storage Test (6.15)			✓**	✓**	✓**	✓**	✓**	✓**	✓**					
	Charging System Communication Test (6.16)			✓	✓	✓	✓	✓	✓	✓					
	Rechargeable Battery Test (6.17)			✓	✓	✓	✓	✓	✓	✓					
	Battery Life Expectancy Test (6.18)			✓	✓	✓	✓	✓	✓	✓					
	Attachment Strap Removal (by Cutting) Detection and Alert Test (6.19)			✓*	✓*	✓*	✓*	✓*	✓*	✓*					
	Attachment Strap Removal (by Sretching) Detection and Alert Test (6.20)			✓*	✓*	✓*	✓*	✓*	✓*	✓*					
	Loss of Location/Communications Failure Alert Test (6.21)			✓	✓	✓	✓	✓	✓	✓					
	Metallic Shielding Detection and Alert Test (6.22)			✓	✓	✓	✓	✓	✓	✓					
	Cellular Interference/Jamming Detection and Alert Test (6.23)			✓	✓	✓	✓	✓	✓	✓					
	GPS Interference/Jamming Detection and Alert Test (6.24)			✓	✓	✓	✓	✓	✓	✓					
	Software Test (6.25)			✓	✓	✓	✓	✓	✓	✓					
	OTS Functionality Test (6.26)										✓	✓	✓	✓	✓
	Extreme Temperature Storage Test (6.27)										✓	✓	✓	✓	✓
	Condensing Humidity Test (6.28)										✓	✓	✓	✓	✓
	Water Spray Exposure Test (6.29)										✓	✓	✓	✓	✓
	Immersion Test (6.30)										✓	✓	✓	✓	✓
	Shock by Impact Test (6.31)										✓	✓	✓	✓	✓
	Dynamic Shock Test (6.32)										✓	✓	✓	✓	✓
	Sinusoidal Vibration Test (6.33)										✓	✓	✓	✓	✓
	Random Vibration Test (6.34)										✓	✓	✓	✓	✓
	Electromagnetic Compatibility Test (6.35)		✓												

* - 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 readily disconnected and/or removed without damaging the rest of the sample (e.g., case is unsealed)

6.4 Test Samples

6.4.1 The supplier shall provide a total of 14 complete OTS for testing. A table summarizing the specific allocation of samples to each of the test methods in the chapter can be found in Table 5.

6.4.2 The supplier shall provide 10 spare OTS straps for use during testing.

6.4.3 The supplier shall provide five separate OTS batteries for use during Battery Life Expectancy Testing (section 6.18).

6.4.4 OTS sample Nos. 3-9 are to be used for a majority of the tests and can be reused among these tests as required except as noted for one of the strap-related tests. Only the specified number of samples (as indicated in the specific test method) is required to be used for each of the tests indicated (e.g., for the accuracy tests, only three of the samples are to be used, **not** all seven).

6.5 Sharp Edges Test

Note: This test method corresponds to the performance requirement in Section 5.2.4.

6.5.1 Application

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

6.5.2 Samples

6.5.2.1 One complete OTS per Table 5. The sample being tested does not need to function, per se, but the exterior must not have been damaged by any prior tests.

6.5.3 Test Conditions

6.5.3.1 No specific test conditions from Section 6.3 apply.

6.5.4 Procedure

6.5.4.1 The OTS shall be tested in accordance with UL 1439, *Tests for Sharpness of Edges on Equipment.*

6.5.5 Report

6.5.5.1 Test results and observations shall be reported and documented.

6.6 Emergency Removal Test

Note: This test method corresponds to the performance requirement in Section 5.2.5.

6.6.1 Application

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

6.6.2 Samples

6.6.2.1 One complete OTS per Table 5.

6.6.2.2 Sample shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.6.3 Test Conditions

6.6.3.1 The test condition from the following section applies to this test. This information is also represented in Table 4.

(a) 6.3.2.10

6.6.4 Procedure

6.6.4.1 Secure the body-attached device per the OTS supplier instructions to a vertically oriented 3-inch diameter piece of PVC Schedule 40 pipe.

6.6.4.2 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.*

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

6.6.5 Report

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

- The amount of time that it took to cut through the attachment strap.
- Any relevant observations.

6.6.6 Interpretation

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

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

6.7 Location Signal Acquisition Test

Note: This test method corresponds to the performance requirement in Section 5.3.1.

6.7.1 Samples

6.7.1.1 One complete OTS per Table 5.

6.7.1.2 Sample shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.7.2 Test Conditions

6.7.2.1 The test conditions from the following sections apply to this test. This information is also represented in Table 4.

(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
(j) 6.3.2.17

6.7.3 Procedure

6.7.3.1 With the OTS powered and operating, set the upload frequency to a minimum of once every 15 minutes, and allow it to successfully acquire its location.

6.7.3.2 Place an electrically grounded Faraday Cage a distance of 3 m ±10 cm (9.8 ft ± 3.9 in) from the device. The Faraday Cage shall have a removable or hinged lid and be of a size suitable to accommodate the device.

6.7.3.3 Move the device into the Faraday Cage and replace/close the lid.

6.7.3.4 Keep the device in the Faraday Cage for 30 minutes (± 2 minutes).

6.7.3.5 Open the Faraday Cage, immediately remove the device, and place it in its original location.

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

6.7.3.7 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.

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

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

6.7.4 Report

6.7.4.1 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.

6.7.4.2 The elapsed time, T_E, shall be calculated as follows:

$$T_E = T_2 - T_1$$

6.7.5 Interpretation

6.7.5.1 The elapsed time, T_E, shall be used as one of the pass/fail criteria.

6.7.5.2 Failure to reacquire a signal shall also be considered a failing result.

6.8 Outdoor Accuracy Test

Note: This test method corresponds to the performance requirement in Section 5.3.2.

6.8.1 Samples

6.8.1.1 Three complete OTS per Table 5.

6.8.2 Purpose

6.8.2.1 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.

6.8.3 Test Conditions

6.8.3.1 All test conditions from Section 6.3 apply to this test with the **exception** of Sections 6.3.2.7 and 6.3.2.12. This information is also represented in Table 4.

6.8.3.2 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 a minimum of once every 15 minutes.

6.8.3.3 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 (± 10 cm) of each of these locations must be known using commercial surveying services.

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

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

6.8.4 Procedure

6.8.4.1 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, unless the criteria of Section 6.3.2.9 are exceeded. However, if the OTS fails any portion of the accuracy testing, the testing shall be repeated at a time when better weather conditions exist.

6.8.4.2 Evaluate the cellular coverage of the services used by the OTS and proceed with the testing if the system 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 shall be tested at a different location.

6.8.4.3 If GPS is the primary location technology being used, use a separate GPS receiver to continually monitor for reception of four or more GPS satellites for a period of 15 minutes prior to and during the duration of this test. This data will be used for instances when the OTS fails this accuracy test.

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

6.8.4.5 Start the test.

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

6.8.4.7 Immediately at the conclusion of the 60-minute period, the OTS shall be moved from Location A to Location B within a 1 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.

6.8.4.8 Repeat sections 6.8.4.1 through 6.8.4.7 four additional times for each sample.

6.8.5 Report

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

6.8.5.2 For those points generated while the OTS samples were at Location A, the distance between each of those points and the actual position (longitude/latitude) of Location A shall be calculated using the "haversine formula" and reported. The Movable Type Scripts website to calculate distance, bearing and more between latitude/longitude points, uses the "haversine formula" and shall be used for this calculation.

6.8.5.3 For those points generated while the OTS samples were at Location B, the distance between each of those points and the actual position (longitude/latitude) of Location B shall be calculated using the "haversine formula" and reported. The Movable Type

Scripts website to calculate distance, bearing and more between latitude/longitude points, uses the "haversine formula" and shall be used for this calculation.

6.8.6 Interpretation

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

6.8.6.2 To pass, a minimum of 90% of those location points generated each time each OTS sample was at Location A (90% x 60 points = 54) must fall within 10 meters of the precise location (longitude/latitude) of Location A.

6.8.6.3 To pass, a minimum of 90% of those location points generated each time each OTS sample was at Location B (90% x 30 points = 27) must fall within 10 meters of the precise location (longitude/latitude) of Location B.

6.8.6.4 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 NOAA Space Weather Prediction Center Satellite Environment Plot chart shall be reviewed. All Kp values during the time of the test must be < 4. 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 < 4, testing of a failed OTS shall be repeated.

6.9 Indoor Accuracy Test

Note: This test method corresponds to the performance requirement in Section 5.3.3.

6.9.1 Samples

6.9.1.1 Three complete OTS per Table 5.

6.9.2 Purpose

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

6.9.3 Test Conditions

6.9.3.1 All test conditions from Section 6.3 apply to this test with the **exception** of Sections 6.3.2.7 and 6.3.2.12. This information is also represented in Table 4.

6.9.3.2 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

6.9.3.3 Figure 6 (Appendix B) and shall not contain any metallic insulation or other metal sheet material.

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

6.9.3.5 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.

6.9.4 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 testing, the test administrator may choose to continue testing, unless the criteria of Section 6.3.2.9 are exceeded. 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 From inside the structure, evaluate the cellular coverage of the services used by the OTS and proceed with the testing if the system 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 If GPS is the primary location technology being used, use a separate GPS receiver to continually monitor for reception of four or more GPS satellites for a period of 15 minutes prior to and during the duration of this test. This data will be used for instances when the OTS fails this accuracy test. During this verification process, the commercial GPS receiver shall be located outside the structure referenced in section 6.9.3.2.

6.9.4.4 The OTS shall be placed in the center of the room at the pre-described height for a minimum of 5 minutes before the start of test.

6.9.4.5 Start the test.

6.9.4.6 The OTS shall remain in this location for a period of 12 hours.

6.9.5 Report

6.9.5.1 Record and report all data (i.e., location points), known position of the center of the test structure, and confirmatory documentation that test conditions were met.

6.9.5.2 The distance between each of the location points generated and the precise position (longitude/latitude) of the test platform shall be calculated using the “haversine formula” and reported. The Movable Type Scripts website to calculate distance, bearing and more between latitude/longitude points, uses the “haversine formula” and shall be used for this calculation.

6.9.6 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 (90% x 720 points = 648) by each OTS sample must fall within 30 meters of the precise location (longitude/latitude).

6.9.6.3 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 NOAA Space Weather Prediction Center Satellite Environment Plot chart shall be reviewed. All Kp values during the time of the test must be < 4. 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 < 4, testing of a failed OTS shall be repeated.

6.10 Location and Status Data Test

Note: This test method corresponds to the performance requirement in Section 5.3.4.

6.10.1 Application

6.10.1.1 This test shall apply only to active tracking OTS.

6.10.2 Samples

6.10.2.1 One complete OTS per Table 5.

6.10.2.2 Sample shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.10.3 Test Conditions

6.10.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 4.

(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) 6.3.2.14
(h) 6.3.2.17

6.10.4 Procedure

6.10.4.1 Execute the on-demand location and status update (i.e., "locate device") function from the user interface.

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

6.10.4.3 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.)

6.10.4.4 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.

6.10.5 Report

6.10.5.1 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.

6.10.6 Interpretation

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

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

6.11 Low Battery Alert Test

Note: This test method corresponds to the performance requirement in Section 5.3.6.

6.11.1 Samples

6.11.1.1 One complete OTS per Table 5.

6.11.1.2 Sample 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 4.

(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
(g) 6.3.2.17

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” event to the data center are generated. Record the time at which both are generated. Also record the time of the receipt of the subsequent low battery alert received by the agency.

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 events and alerts, and the time stamping of these events and alerts.

6.11.5 Interpretation

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

6.12 Zone Violation Alert Test

Note: This test method corresponds to the performance requirement in Section 5.3.7.

6.12.1 Samples

6.12.1.1 One complete OTS per Table 5.

6.12.2 Test Conditions

6.12.2.1 All test conditions from Section 6.3 apply to this test with the **exception** of Sections 6.3.2.6, 6.3.2.12, and 6.3.2.16. This information is also represented in Table 4.

6.12.3 Procedure

6.12.3.1 Using supplier software, create a circular inclusion zone 150 m (492.1 ft) ± 5m (16.4 ft) in diameter.

6.12.3.2 Place the OTS at the approximate center of the inclusion zone. This shall be verified by observing tracking points mapped by the system software for a period of at least five minutes.

6.12.3.3 Once the location is verified as indicated in the previous step, allow the system to collect location data for approximately 30 minutes.

6.12.3.4 Move the OTS 150 m (492.1 ft) ± 5m (16.4 ft) 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. Ensure this exclusion zone has been received and/or accepted by the OTS prior to proceeding.

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 event was generated.

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 zone boundaries were crossed, and “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 OTS Separation Detection and Alert Test

Note: This test method corresponds to the performance requirement in Section 5.3.8.

6.13.1 Samples

6.13.1.1 One complete OTS per Table 5.

6.13.2 Test Conditions

6.13.2.1 The test conditions from the following sections apply to this test. This information is also represented in Table 4.

(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
(g) 6.3.2.17

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

6.13.2.3 The test shall be conducted with the OTS set to its most restrictive separation (alert range) setting, as applicable. This setting represents the smallest separation distance between the tracking unit and the tether that creates an alert.

6.13.3 Procedure

6.13.3.1 With the multi-piece OTS device powered and operating, keep the tracking unit and the tether together (within 1 meter of each other).

6.13.3.2 Move the tether away from the tracking unit until there is a distance of 45 m (±2 m) between the two.

6.13.3.3 Start timing with a stopwatch.

6.13.3.4 Note whether a tether gone or similar local event has been documented by the system.

6.13.3.5 Note whether a tether gone or similar alert has been received by the agency.

6.13.4 Report

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

6.13.5 Interpretation

6.13.5.1 The elapsed time until the appropriate local alert is documented by the system, and 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.

6.13.5.2 Failure of the system to document an alert shall also be considered a failing result.

6.14 Participant Alert Test

Note: This test method corresponds to the performance requirement in Section 5.3.9.

6.14.1 Samples

6.14.1.1 One complete OTS per Table 5.

6.14.1.2 Sample 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 4.

(a) 6.3.2.7
(b) 6.3.2.10
(c) 6.3.2.11
(d) 6.3.2.17

6.14.2.2 When replicating an incident that creates a local alert (see section 6.14.3.1), any additional test conditions associated with that particular incident/alert condition (e.g., zone violation) also apply. This information can be found in Table 4.

6.14.3 Procedure

6.14.3.1 Create an incident that will generate a local alert (zone violation, low battery, etc.).

6.14.3.2 For audible alerts, measure the sound pressure level at a distance of one meter above the uppermost surface of the OTS (as attached) 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. Measurements shall be taken at the center of the body-attached device surface that makes contact with the participant's skin.

6.14.3.4 For OTS 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, then 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 the capability to generate either a vibratory or an audible local alert shall also result in a failure.

6.15 Data Storage Test

Note: This test method corresponds to the performance requirement in Section 5.3.10.

6.15.1 Samples

6.15.1.1 One complete OTS per Table 5.

6.15.1.2 Sample 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 4.

(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
(g) 6.3.2.17

6.15.3 Procedure

6.15.3.1 If the OTS is of one-piece configuration, then it shall be completely discharged before being subjected to recharge for up to 2 hours (or less if the device indicates that the charging process is complete). If the OTS is of multi-piece configuration, then it shall be discharged before being subjected to recharge for up to 4 hours (or less if the device indicates that the charging process is complete).

6.15.3.2 Turn off the upload transmission function of the OTS or ensure that no cell communication is available by placing the device in an anechoic chamber with the GPS signal piped-in or rebroadcast.

6.15.3.3 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).

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

6.15.3.5 Following the 10-day period, to ensure that data can be retained under a fully depleted battery, remove the rechargeable battery (the supplier shall make provisions for battery removal if the battery is enclosed and not normally removable). Leave it in this condition for approximately 30 minutes.

6.15.3.6 Put the rechargeable battery back into the OTS.

6.15.3.7 Recharge the OTS.

6.15.3.8 Re-establish cell communication/data upload function or remove the device from the anechoic chamber (if applicable) and allow the OTS to upload the previous 10 days of data to the data center.

6.15.3.9 Verify that at least 90% of the 10 days of data was properly uploaded (90% x 10 days x 60 points/hour x 24 hours/day = 12,960 points), and that a minimum of 85% of each

day's data was properly uploaded (85% x 60 points/hour x 24 hours/day = 1,224 points).

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 days of location data (as defined in section 6.15.3.9) shall be used as the pass/fail criterion.

6.16 Charging System Communication Test

Note: This test method corresponds to the performance requirement in Section 5.3.11.

6.16.1 Samples

6.16.1.1 One complete OTS per Table 5.

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

6.16.2 Test Conditions

6.16.2.1 No specific test conditions from Section 6.3 apply.

6.16.3 Procedure

6.16.3.1 The OTS shall be discharged before being subjected to recharge following the supplier's instructions.

6.16.3.2 Note the type of indication to the wearer that the OTS is being charged.

6.16.3.3 Note the type of indication provided to the wearer by the OTS when the charging process is complete. Also note the time that it took for this charging process to be completed.

6.16.4 Report

6.16.4.1 Test results and observations shall be reported and documented.

6.16.5 Interpretation

6.16.5.1 The capability to provide an indication that the OTS is charging, and a separate indication that the OTS has completed its charging process, shall be used as the pass/fail criterion.

6.17 Rechargeable Battery Test

Note: This test method corresponds to the performance requirement in Section 5.3.12.

6.17.1 Samples

6.17.1.1 One complete OTS per Table 5.

6.17.1.2 Sample shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.17.2 Test Conditions

6.17.2.1 The test conditions from the following sections apply to this test. This information is also represented in Table 4.

(a) 6.3.2.2
(b) 6.3.2.4
(c) 6.3.2.5
(d) 6.3.2.6
(e) 6.3.2.17

6.17.2.2 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 cells and batteries for portable applications*, Section 7.2, Charging procedure for test purposes, and with Section 7.3.1, Discharge performance at 20 °C (rated capacity) Step 3, respectively.

6.17.3 Procedure

6.17.3.1 If the OTS is of one-piece configuration, then it shall be discharged before being subjected to recharge for up to 2 hours (or less if the device indicates that the charging process is complete). If the OTS is of multi-piece configuration, then it shall be discharged before being subjected to recharge for up to 4 hours (or less if the device indicates that the charging process is complete).

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

6.17.3.3 The OTS shall be configured to collect location data at a nominal rate of one point per minute and an upload interval of at least once every 15 minutes for a period of 22 hours (or 20 hours for a multi-piece OTS). These times (22 and 20 hours) correspond to the amount of time during a 24-hour day that the OTS battery is not actively being charged (see section 6.17.3.1)

6.17.3.4 Steps 6.17.3.2 through 1.1.1.1 shall be repeated at temperatures within the environmental chamber of -20°C (-4°F) and 50°C (122°F). Prior to each of these iterations, the sample shall be conditioned per Section 6.2, Room Temperature Conditioning and Step 6.17.3.1 shall be performed.

6.17.4 Report

6.17.4.1 All results shall be recorded and reported. This includes the number of location data points that are successfully collected at each of the three test temperatures, and verification that the battery did not completely discharge during the testing.

6.17.5 Interpretation

6.17.5.1 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.

6.18 Battery Life Expectancy Test

Note: This test method corresponds to the performance requirement in Section 5.3.13.

6.18.1 Safety

6.18.1.1 At no time shall the battery's maximum charging current or voltage be exceeded.

6.18.2 Application

6.18.2.1 This test is applicable to all OTS batteries that are Lithium ion (Li-ion) batteries.

6.18.2.2 This test shall be performed on each battery make/model provided by the OTS supplier.

6.18.3 Samples

6.18.3.1 Five new (unused) batteries shall be provided for testing (per Section 6.4.3).

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

6.18.4 Test Conditions

6.18.4.1 The test conditions from the following sections apply to this test. This information is also represented in Table 4.

(a) 6.3.2.6
(b) 6.3.2.17

6.18.5 Procedure

6.18.5.1 Using the battery manufacturer's specifications, discharge each battery down to the discharge cut-off voltage using the maximum discharge current.

6.18.5.2 Rest for a minimum of 10 minutes.

6.18.5.3 Using the battery manufacturer's specifications, charge each battery to the maximum charge voltage using the maximum charge current.

6.18.5.4 Rest for a minimum of 10 minutes.

6.18.5.5 Repeat the discharge/charge cycle until 365 cycles have been reached.

6.18.5.6 Following the 365 cycles, place each of the batteries in an OTS and perform the steps in Sections 6.17.3.1 through 6.17.3.3 of the Rechargeable Battery Test.

6.18.6 Report

6.18.6.1 Document all test results and observations, including the ability of the batteries to survive 365 charge/discharge cycles and the results of the subsequent testing from the Rechargeable Battery Test.

6.18.7 Interpretation

6.18.7.1 The ability of the batteries to continue to operate/function (as demonstrated by their performance in Section 6.18.5.6) following the applied charge/discharge cycles shall be used as the pass/fail criterion.

6.19 Attachment Strap Removal (by Cutting) Detection and Alert Test

Note: This test method corresponds to the performance requirement in Section 5.4.1.

6.19.1 Application

6.19.1.1 This test method shall apply to the body-attached device.

6.19.2 Samples

6.19.2.1 One complete OTS per Table 5 and five replacement straps

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

6.19.2.3 OTS samples shall be verified as operational and placed into their normal operating state.

6.19.3 Purpose

6.19.3.1 The purpose of this test is to verify that the OTS is capable of time stamping an attachment strap-cutting event within a maximum of 5 seconds of its occurrence and reporting that event to the data center within 3 minutes after that.

6.19.4 Conditions

6.19.4.1 The test conditions from the following sections apply to this test. This information is also represented in Table 4.

(a) 6.3.2.2
(b) 6.3.2.3

(c) 6.3.2.7
(d) 6.3.2.15
(e) 6.3.2.17

6.19.4.2 In order to ensure consistent and accurate time recordings, prior to testing the device it must be determined on what time scale the OTS, tracking system software, and monitoring center operate (i.e., GPS time, UTC, adjusted for locality).

6.19.5 Apparatus

6.19.5.1 The following equipment is required for the execution of this test method:

- Guillotine paper cutter (with a cutting arm) capable of cutting through the attachment strap of an OTS with a single stroke of the cutting arm;
- Digital clock that:
  - Displays time in hours:minutes:seconds.
  - Is verified the day of, and prior to, testing to be within 2 seconds of the selected time scale.
  - Is verified the day of, and following, testing to be within 2 seconds of the selected time scale.

6.19.5.2 Alternatively, the following equipment may be used:

- Guillotine paper cutter (with a cutting arm) capable of cutting through the attachment strap of an OTS with a single stroke of the cutting arm.
- GPS time data logger with a trigger input (typically a computer with a specialized interface board and external antenna to receive GPS signals) that:
  - Displays time in hours:minutes:seconds.
  - Is verified the day of, and prior to, testing to be within 2 seconds of the selected time scale.
  - Is verified the day of, and following, testing to be within 2 seconds of the selected time scale.
- Insulated 30 AWG wire (often used for wire wrap applications).
- Masking tape.

6.19.6 Procedure

6.19.6.1 Allow the OTS device under test to establish communications with the data center.

6.19.6.2 Raise the cutting arm of the paper cutter.

6.19.6.3 Place the fully assembled body-attached device over the cutting arm of the guillotine paper cutter so that the device and its attachment strap encircle the arm. Position the device nearer the pivot point of the cutter (at a distance from the pivot point of about a quarter of the total length of the cutting arm), with the attachment strap oriented such that it will be severed when the arm is brought down.

6.19.6.4 Observing the digital clock, bring the arm down rapidly until it comes to a complete stop such that the attachment strap is cleanly severed.

6.19.6.5 Record the time when the strap was cut.

6.19.7 Alternate Procedure

6.19.7.1 Set up the GPS time data logger according to manufacturer's recommendations such that severing or opening a loop of wire will trigger the data logger to record the time of the triggering event.

6.19.7.2 Using masking tape, tape a 30 AWG wire onto the OTS strap to be severed by this test. The wire should be approximately parallel with, and centered on, the strap. Using appropriate conductors, attach the 30 AWG wire to the GPS time data logger in order to form the triggering loop.

6.19.7.3 Allow the OTS device under test to establish communications with the data center.

6.19.7.4 Raise the cutting arm of the paper cutter.

6.19.7.5 Place the fully assembled body-attached device over the cutting arm of the guillotine paper cutter so that the device and its attachment strap encircle the arm. Position the device nearer the pivot point of the cutter (at a distance from the pivot point of about a quarter of the total length of the cutting arm), with the attachment strap oriented such that it will be severed when the arm is brought down.

6.19.7.6 Bring the arm down rapidly until it comes to a complete stop such that the attachment strap is cleanly severed.

6.19.7.7 Record the time the GPS time data logger indicates the triggering loop was cut with the strap.

Note: Perform the selected procedure using each of the five new straps.

6.19.8 Report

6.19.8.1 In addition to recording the time the attachment straps were cut, also record the time the OTS indicates that the "tamper/cut strap" event occurred and the time when the event was reported to the data center. (This data will be provided by the data center through the OTS user interface).

6.19.9 Interpretation

6.19.9.1 For each of the cut straps, the OTS must have recorded a strap cutting event within five seconds of its occurrence, and the data center must have received notice of the strap-cutting event within three minutes after that.

6.20 Attachment Strap Removal (by Stretching) Detection and Alert Test

Note: This test method corresponds to the performance requirement in Section 5.4.2.

6.20.1 Application

6.20.1.1 This test method shall apply to the body-attached device.

6.20.2 Samples

6.20.2.1 One complete OTS per Table 5.

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

6.20.3 Test Conditions

6.20.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 4.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.7
(d) 6.3.2.15
(e) 6.3.2.17

6.20.4 Procedure

6.20.4.1 Remove the top mounting plate from the stretch test fixture (see Appendix C, *OTS Strap Stretch Fixture Assembly Document*, for details of the fixture and test setup).

6.20.4.2 Mount the OTS strap on the large cylinder with the OTS facing away from the front of the stretch test fixture.

6.20.4.3 Ensure that the strap is adjusted so that it is as snug around the large cylinder as possible. If the strap is adjustable in discrete increments, this may result in a small amount of slack (up to as much as 1.5 cm) between the strap and the outside of the large cylinder.

6.20.4.4 Replace the top mounting plate on the stretch test fixture.

6.20.4.5 Actuate the stretch test fixture pulling mechanism just enough to remove any slack from the OTS strap.

6.20.4.6 At this point, set the linear caliper to zero.

6.20.4.7 Using a cloth measuring tape, measure the circumference/perimeter of the OTS. This will include measuring the outside length of the OTS strap PLUS the width of the OTS device itself that is in contact with the participant. Record this measurement.

6.20.4.8 For a strap that adjusts in discrete increments, calculate 105% of the measurement recorded above (i.e., distance equal to a 5% stretch in the original OTS circumference/perimeter measurement). For a strap that is non-incremental in its adjustments, calculate 110% of the measurement recorded above (i.e., distance equal to a 10% stretch in the original OTS circumference/perimeter measurement).

6.20.4.9 From the measurement calculated in step 6.20.4.8 above, subtract the width of the OTS device that is in contact with the participant. The result will be the allowable stretch of the OTS strap itself.

6.20.4.10 Remove the top mounting plate from the stretch test fixture.

6.20.4.11 Situate the cloth measuring tape around the outside circumference/perimeter of the OTS as if measuring only the strap. With the measuring tape wrapped around the strap, simulate a strap length equal to the length calculated in step 6.20.4.9.

6.20.4.12 Replace the top mounting plate on the stretch test fixture.

6.20.4.13 Actuate the stretch test fixture slowly (e.g., 1-2 mm/sec), and stretch the strap until a 245 N force is reached.

6.20.4.14 Maintain the 245 N force for a period of 5 minutes. As the strap is likely to relax during this 5 minute period, continue to monitor the force and adjust the stretch test fixture as needed to maintain the prescribed force.

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

6.20.4.16 During performance of the test, verify that the OTS strap does not stretch beyond the length calculated in step 6.20.4.9. This will be indicated by the OTS strap contacting the cloth tape “strap” (section 6.20.4.11).

6.20.4.17 Following the 5 minute exposure to the 245 N force, if the stretch has not either exceeded the value calculated in section 6.20.4.9 or separated from the rest of the body-attached device, slowly increase the force on the strap until it does actually separate or exceed the length/perimeter of the cloth tape “strap”.

6.20.5 Report

6.20.5.1 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 245 N force.

- Verification that the circumference/perimeter of the OTS did not stretch more than 5% during application of the 245 N force (or 10% for a strap that is non-incremental in its adjustment).
- Verification that an event is generated when the attachment strap separated from the body-attached device or when the circumference/perimeter of the OTS stretched more than 5% (or 10% for a strap that is non-incremental in its adjustment).
- Verification that an alert is received by the agency - within 3 minutes of the generated event for active tracking OTS, or in accordance with section 5.3.5.4 for passive tracking OTS.
- Verification that an event is not generated unless the attachment strap separated from the body-attached device or the circumference/perimeter of the OTS is stretched more than 5% (or 10% for a strap that is non-incremental in its adjustment).
- Any relevant observations.

6.20.6 Interpretation

6.20.6.1 The ability of the attachment strap to withstand the application of a 245 N force without separating from the body-attached device or stretching excessively shall be one of the pass/fail criteria.

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

6.21 Loss of Location Alert Test/Communications Loss Alert Test

Note: This test method corresponds to the performance requirement in Section 5.4.3.

6.21.1 Samples

6.21.1.1 One complete OTS per Table 5.

6.21.1.2 Sample shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.21.2 Test Conditions

6.21.2.1 The test conditions from the following sections apply to this test. This information is also represented in Table 4.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.7
(d) 6.3.2.12

(e) 6.3.2.15
(f) 6.3.2.17

6.21.3 Procedure

6.21.3.1 The OTS sample shall be placed in an RF-shielded semi-anechoic room. The sample shall be allowed to run for 10 minutes. Following this 10-minute period, the sample shall be temporarily removed from the shielded/semi-anechoic room, and allowed to re-establish cellular communication. It shall be verified that during this 10-minute period, the OTS sample did not communicate with the data center and no GPS location points were collected.

6.21.3.2 The OTS sample shall be placed back into the shielded/semi-anechoic room. This room shall now be configured such that GPS communication location points and cellular communication signals are received, and out of which cellular communication signals are rebroadcast. The following equipment is required for the execution of this test method (see Figure 3 for a schematic of the equipment setup):

- RF-shielded semi-anechoic room.
- Table.
- Piece of 3-inch diameter PVC pipe.
- GPS variable gain line amplifier.
- Two GPS patch antennas, or equivalent.
- FCC-certified bi-directional cellular amplifier (booster) module with two cellular antennas, or equivalent.
- Four low-loss coaxial cables.

6.21.3.3 To receive GPS location points inside the shielded/semi-anechoic room, configure the equipment (as shown in Figure 3) as follows:

(a) Outside the shielded/semi-anechoic room, install one GPS patch antenna (in clear view of the sky) and the GPS variable gain line amplifier. Inside the room, place the OTS (mounted as shown in the figure) and install the second GPS patch antenna away from both the OTS and the GPS patch antenna installed outside the room.

(b) Connect a low-loss coaxial cable from the antenna port of the GPS patch antenna installed inside the shielded/semi-anechoic room through the room's "bulkhead" connector to the RF output port of the GPS variable gain line amplifier located outside the room.

(c) Connect another low-loss cable from the GPS patch antenna installed outside the room to the RF input port of the GPS variable gain line amplifier located outside the room. Once the GPS variable line amplifier is switched on, the OTS inside the shielded/semi-anechoic room will be able receive GPS location points.

6.21.3.4 To enable the OTS in the shielded/semi-anechoic room to receive and send cellular data from/to the outside world, place the FCC-certified bi-directional cellular amplifier (booster) module outside the shielded/semi-anechoic room in clear view of the sky and configure the equipment as follows:

(a) Install one cellular antenna outside the shielded/semi-anechoic room in clear view of the sky and install the second cellular antenna inside the shielded/semi-anechoic room away from both the OTS inside the room and the cellular antenna installed outside the room.

(b) Connect a low-loss coaxial cable from the antenna port of the cellular antenna inside the shielded/semi-anechoic room through the room's "bulkhead" connector to the RF user's port of the FCC-certified bi-directional cellular amplifier (booster) module.

(c) Connect another low-loss coaxial cable from the cellular antenna located outside the room to the base transceiver station (BTS) input of the FCC-certified bi-directional cellular amplifier (booster) module. Once the FCC-certified bi-directional cellular amplifier (booster) module is switched on, the OTS inside the shielded/semi-anechoic room will be able to receive and rebroadcast cellular data.

6.21.3.5 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.

6.21.3.6 Allow the system to run as configured for 30 minutes (± 2 minutes).

6.21.3.7 Remove/disable both the GPS signal and the cellular signal. Record the time at which this was done. Leave it in this condition for 90 minutes (± 5 minutes).

6.21.3.8 Restore both the GPS signal and the cellular signal.

6.21.3.9 Verify that a "loss of communications" (or similar) event and subsequent alert was generated by the data center following the removal of the cellular signal.

6.21.3.10 Verify that a "loss of location" (or similar) event and subsequent alert was generated by the OTS and received by the data center. Record these times.

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

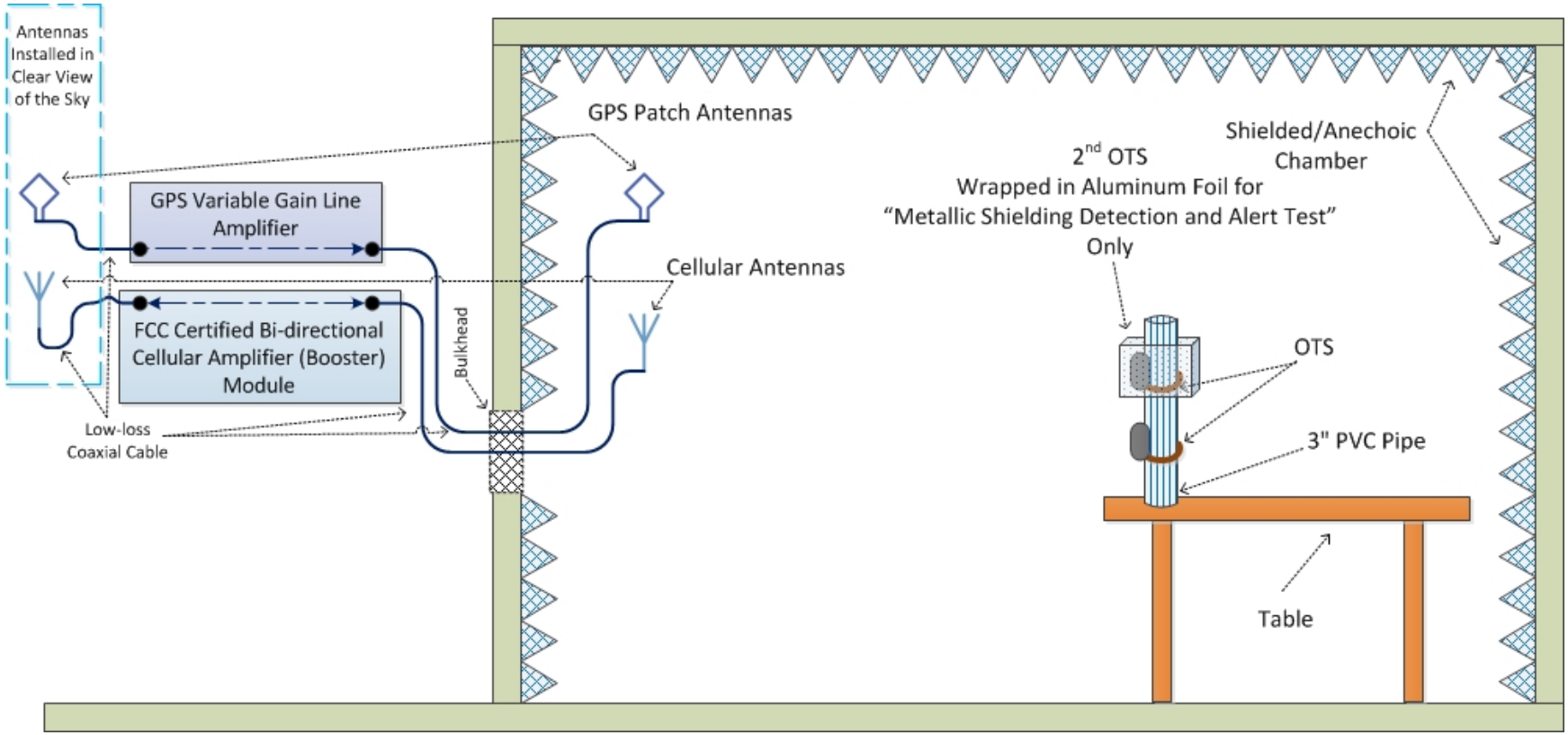


Figure 3 - Equipment Configuration I – GPS and Cellular Signal Transmission

6.21.4 Report

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

6.21.5 Interpretation

6.21.5.1 The generation and receipt of a loss of location alert (or similar) shall be used as one of the pass/fail criterion.

6.21.5.2 The generation and receipt of a loss of communications alert (or similar) shall be used as another pass/fail criterion.

6.22 Metallic Shielding Detection and Alert Test (Optional)

Note: This test method corresponds to the performance requirement in Section 5.7.3.

6.22.1 Application

6.22.1.1 This test is applicable to OTS that use GPS to determine location.

6.22.2 Samples

6.22.2.1 Two complete OTS per Table 5, including power chargers.

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

6.22.3 Test conditions

6.22.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 4.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.7
(d) 6.3.2.15
(e) 6.3.2.17

6.22.4 Procedure

6.22.4.1 Adjust the OTS settings such that a Loss of Location alert (or similar) is generated within 5 minutes (i.e., 5 minutes or less) after detection of a Loss of Location event.

6.22.4.2 Adjust the OTS settings such that the system generates a No GPS/Possible Shielding alert (or similar) within 5 minutes (i.e., 5 minutes or less) after detection of a shielding event.

6.22.4.3 One of the OTS samples shall be placed in an RF-shielded semi-anechoic room. The sample shall be allowed to run for 10 minutes. Following this 10-minute period, the sample shall be temporarily removed from the shielded/semi-anechoic room and allowed to re-establish cellular communication. It shall be verified that during this 10-minute period that the OTS sample did not communicate with the data center and that no GPS location points were collected. If this step has already been performed in conjunction with one of the test methods associated with the other "optional" performance requirements (Section 6.23.4.3 or Section 6.24.4.3) within the past 24 hours, it does not need to be repeated.

6.22.4.4 The two OTS samples shall be placed back into the shielded/semi-anechoic room. This room shall now be configured such that GPS communication location points and cellular communication signals are received, and out of which cellular communication signals are rebroadcast. The following equipment is required for the execution of this test method (see Figure 3 for a schematic of the equipment setup):

- RF-shielded semi-anechoic room.
- Table.
- Piece of 3-inch diameter PVC pipe.
- GPS variable gain line amplifier.
- Two GPS patch antennas, or equivalent.
- FCC-certified bi-directional cellular amplifier (booster) module with two cellular antennas, or equivalent.
- Four low-loss coaxial cables.

6.22.4.5 To receive GPS location points inside the shielded/semi-anechoic room, configure the equipment (as shown in Figure 3) as follows:

(a) Outside the shielded/semi-anechoic room, install one GPS patch antenna (in clear view of the sky) and the GPS variable gain line amplifier. Inside the room, place the OTS (mounted as shown in the figure) and install the second GPS patch antenna away from both the OTS and the GPS patch antenna installed outside the room.

(b) Connect a low-loss coaxial cable from the antenna port of the GPS patch antenna installed inside the shielded/semi-anechoic room through the room's bulkhead connector to the RF output port of the GPS variable gain line amplifier located outside the room.

(c) Connect another low-loss cable from the GPS patch antenna installed outside the room to the RF input port of the GPS variable gain line amplifier located outside the room. Once the GPS variable line amplifier is switched on, the OTS inside the shielded/semi-anechoic room will be able receive GPS location points.

6.22.4.6 To enable the OTS in the shielded/semi-anechoic room to receive and send cellular data from/to the outside world, place the FCC-certified bi-directional cellular

amplifier (booster) module outside the shielded/semi-anechoic room in clear view of the sky and configure the equipment as follows:

(a) Install one cellular antenna outside the shielded/semi-anechoic room in clear view of the sky and install the second cellular antenna inside the shielded/semi-anechoic room, away from both the OTS inside the room and the cellular antenna installed outside the room.

(b) Connect a low-loss coaxial cable from the antenna port of the cellular antenna inside the shielded/semi-anechoic room through the room's bulkhead connector to the RF user's port of the FCC-certified bi-directional cellular amplifier (booster) module.

(c) Connect another low-loss coaxial cable from the cellular antenna located outside the room to the base transceiver station (BTS) input of the FCC-certified bi-directional cellular amplifier (booster) module. Once the FCC-certified bi-directional cellular amplifier (booster) module is switched on, the OTS inside the shielded/semi-anechoic room will be able to receive and rebroadcast cellular data.

6.22.4.7 Record the test start time and allow the system to run as configured for 10 minutes. Verify or confirm that the time-tagged location data points for each OTS appear on the data center computer screen.

6.22.4.8 After verification of the time-tagged location data points for both OTS, one OTS tracking device only shall be completely wrapped in no less than a single layer of 20-micrometer thick aluminum foil. The aluminum foil is to be grounded.

6.22.4.9 A second 10-minute test shall be conducted with the aluminum-wrapped OTS and the OTS without foil as follows:

(a) Remove the GPS antenna and disable GPS communications.

(b) Keep cellular communications established.

(c) Place the devices into the shielded/anechoic room and start the test. A new test start time shall be recorded, and the system shall run as configured.

(d) At the end of 10 minutes, remove the aluminum foil from the wrapped tracking device, and after allowing sufficient time for the OTS device to communicate with the data center, verify or confirm the time-tagged location data at the data center for the aluminum-wrapped OTS and the OTS without foil. The aluminum-wrapped OTS shall generate a No GPS/Possible Shielding (or similar) alert within 5 minutes (i.e., 5 minutes or less) after the start of the test, and the OTS without foil shall generate a Loss of Location (or similar) alert within 5 minutes (i.e., 5 minutes or less) after the start of the test.

6.22.5 Report

6.22.5.1 Document and record all test results, including verification (and including timing) that a No GPS/Possible Shielding event (or similar) was received at the data center for the aluminum foil-wrapped OTS and that a Loss of Location event (or similar) was received at the data center for the OTS without foil. Confirm the subsequent alerts arrived in a timely manner (i.e., 5 minutes or less). Also document any observations made during the testing.

6.22.6 Interpretation

6.22.6.1 The timely generation and receipt of a No GPS/Possible Shielding alert (or similar) for the aluminum foil-wrapped OTS and an accompanying Loss of Location alert (or similar) for the OTS without foil shall be used as one of the pass/fail criterion.

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

6.23 Cellular Interference/Jamming Detection and Alert Test (Optional)

Note: This test method corresponds to the performance requirement in Section 5.7.4.

6.23.1 Application

6.23.1.1 This test is applicable only to active tracking OTS.

6.23.2 Samples

6.23.2.1 One complete OTS per Table 5, including peripherals.

6.23.2.2 Sample shall be conditioned per Section 6.2, Room Temperature Conditioning.

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 4.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.7
(d) 6.3.2.12
(e) 6.3.2.15
(f) 6.3.2.17

6.23.4 Procedure

6.23.4.1 Adjust the OTS settings such that the system generates a Cellular Jamming alert (or similar) within 5 minutes (i.e., 5 minutes or less) after detection of a jamming incident.

6.23.4.2 Adjust the OTS settings such that the system generates a Loss of Communication alert (or similar) within 5 minutes (i.e., 5 minutes or less) after detection of a loss of cellular communication incident.

6.23.4.3 The OTS sample shall be placed in an RF-shielded semi-anechoic room. The sample shall be allowed to run for 10 minutes. Following this 10-minute period, the sample shall be temporarily removed from the shielded/semi-anechoic room and allowed to re-establish cellular communication. It shall be verified that during this 10-minute period, the OTS sample did not communicate with the data center and that no GPS location points were collected. If this step has already been performed in conjunction with one of the other test methods associated with the other optional performance requirements (Section 6.22.4.3 or Section 6.24.4.3) within the past 24 hours, it does not need to be repeated.

6.23.4.4 The OTS sample shall be placed back into the shielded/semi-anechoic room. This room shall be configured such that GPS communication location points and cellular communication signals are received, and out of which cellular communication signals are rebroadcast. See Figure 3 for a schematic of the equipment setup. The following equipment is required for the execution of this test method:

- RF-shielded semi-anechoic room.
- Non-conductive table.
- Piece of 3-inch diameter PVC pipe.
- GPS variable gain line amplifier.
- Two GPS patch antennas, or equivalent.
- FCC-certified bi-directional cellular amplifier (booster) module with two cellular antennas, or equivalent.
- Four low-loss coaxial cables.
- Signal generator.
- RF amplifier with 3 GHz minimum bandwidth.
- 50Ω coaxial cable.
- Spectrum analyzer.
- RF pre-amplifier.
- Control computer.
- Cellular capable band antenna (GSM/CDMA/UMTS/LTE).

6.23.4.5 To receive GPS location points inside the shielded/semi-anechoic room, configure the equipment as follows:

(a) Outside the shielded/semi-anechoic room, install one GPS patch antenna in clear view of the sky and the GPS variable gain line amplifier. Inside the room, place the OTS and install the second GPS patch antenna away from both the OTS and the GPS patch antenna installed outside the room.

(b) Connect a low-loss coaxial cable from the antenna port of the GPS patch antenna installed inside the shielded/semi-anechoic room through the room's

bulkhead connector to the RF output port of the GPS variable gain line amplifier located outside the room.

(c) Connect another low-loss cable from the GPS patch antenna installed outside the room to the RF input port of the GPS variable gain line amplifier located outside the room. Once the GPS variable line amplifier is switched on, the OTS inside the shielded/semi-anechoic room will be able receive GPS location points.

6.23.4.6 To enable the OTS in the shielded/semi-anechoic room to receive and send cellular data from/to the outside world, place the FCC-certified bi-directional cellular amplifier (booster) module outside the shielded/semi-anechoic room in clear view of the sky and configure the equipment as follows:

(a) Install one cellular antenna outside the shielded/semi-anechoic room in clear view of the sky and install the second cellular antenna inside the shielded/semi-anechoic room, away from both the OTS inside the room and the cellular antenna installed outside the room.

(b) Connect a low-loss coaxial cable from the antenna port of the cellular antenna inside the shielded/semi-anechoic room through the room's bulkhead connector to the RF user's port of the FCC-certified bi-directional cellular amplifier (booster) module.

(c) Connect another low-loss coaxial cable from the cellular antenna located outside the room to the base transceiver station (BTS) input of the FCC-certified bi-directional cellular amplifier (booster) module. Once the FCC-certified bi-directional cellular amplifier (booster) module is switched on, the OTS inside the shielded/semi-anechoic room will be able to receive cellular data.

6.23.4.7 Measurement of Cellular Signal (S_c)

(a) The cellular signal to which the OTS shall have access, herein referred to as the cellular signal (S_c), shall be provided by the GSM/CDMA/UMTS/LTE FCC-certified bi-directional cellular amplifier (booster) module. (S_c is the ambient wireless cellular signal from cellular network operators being transmitted into the shielded/semi-anechoic room.)

(b) The OTS shall be configured to operate to collect location data at a nominal rate of one point per minute while receiving S_c (GSM/CDMA/UMTS/ LTE). Measure and record the S_c uncorrected field strength that the OTS is receiving by placing the cellular capable band antenna exactly next to where the OTS is placed in the shielded/semi-anechoic room as shown in Figure 4. The height of the antenna and the OTS shall be the same. Connect this antenna to the input port of the spectrum analyzer via a low-loss coaxial cable and RF pre-amplifier.

(c) In order to correct the S_c field strength level the OTS is receiving, adjust the spectrum analyzer's measurement result recorded in step (b) above to correct for measurement system losses/gains by adding the low-loss coaxial cable losses and subtracting the RF amplifier gain. During this adjustment, the spectrum analyzer's resolution bandwidth/video bandwidth (RBW/VBW) shall be set to 100 kHz, and its center frequency set to receive the appropriate (GSM/CDMA/UMTS/LTE) S_c uncorrected field strength. Record the corrected S_c field strength.

6.23.4.8 Cellular Jamming

(a) Using the signal generator with a minimum bandwidth of 3GHz, connect its output port to the RF amplifier's input port and connect the RF amplifier's output port to the cellular-capable band antenna using the 50Ω coaxial cable. The height of the antenna and the OTS shall be the same (see Figure 5). The cellular capable band antenna shall be utilized 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, herein referred to as the Jamming Cellular signal (J_c).

(b) The bandwidth of the J_c shall be set greater than the bandwidth of the S_c.

(c) Amplitude Modulation (AM) shall be used to modulate the J_c.

Note: Although this test method for jamming the OTS enlists the use of a signal generator, other GPS/cellular generating broadband-sources capable of producing "no GPS" and/or "no cellular" events may be used.

(d) Set the J_c such that the ratio from it to the S_c field strength recorded in (b) is 6dB (6dB J_c/S_c ratio) and expose the OTS to the J_c for 10 minutes.

(e) After the 10-minute exposure, remove the J_c to allow the OTS to achieve cellular communication.

(f) Verify that local Cellular Jamming alerts (or similar) from the OTS are active, and confirm that the data center and the agency receive the Cellular Jamming events (or similar) as a result of the 6dB J_c/S_c ratio. Record the times and date of the OTS Cellular Jamming events and the J_c/S_c ratio. The events shall be generated within 5 minutes (i.e., 5 minutes or less) after the start of the exposure. Also record the time that the subsequent alerts were received by the data center and the agency. For the purpose of configuring this test, all discussions of J_c/S_c ratios should be in dBm units.

(g) If the Cellular Jamming events were not received by the data center and the agency but it is confirmed that the OTS is still communicating with the data center and the agency, increase the Jc/Sc ratio by 6dB increments until the

OTS stops communicating with the data center and the agency. Expose the OTS to the Jc/Sc level that stopped the OTS communication for 10 minutes.

(h) After the 10-minute exposure, remove the J_c to allow the OTS cellular communication.

(i) Confirm with the data center and the agency that the Cellular Jamming events (or similar) were received. Record the date and times of the OTS Cellular Jamming (or similar) events and subsequent alerts, the J_c/S_c ratio, and the times that the events were received by the data center and the subsequent alerts by the agency. The alert shall be generated within 5 minutes (i.e., 5 minutes or less) after the start of the exposure.

(j) If the Cellular Jamming alerts (or similar) were not generated by the data center and the agency after the subsequent 6dB increases that stopped OTS communication, the OTS device fails the test. Record the date and times of the Cellular Jamming alerts and the Jc/Sc ratios.

(k) Repeat all steps within Section 6.23.4.7 for all cellular frequency operating bands supported by the OTS.

6.23.4.9 Run another 10-minute test as follows:

(a) Place the OTS back into the shielded/anechoic room. Turn off the signal generator so that $J_c = 0$.

(b) Disconnect the cellular antenna inside the shielded/anechoic room (see Figure 3) so that the OTS can no longer receive cellular communication.

(c) Allow the OTS to run for 10 minutes.

(d) Re-connect the cellular antenna inside the shielded/anechoic room to allow for the restoration of cellular communication.

(e) Verify that the OTS generated a Loss of Communication alert (or similar), but did not generate a Cellular Jamming” alert (or similar) under these conditions.

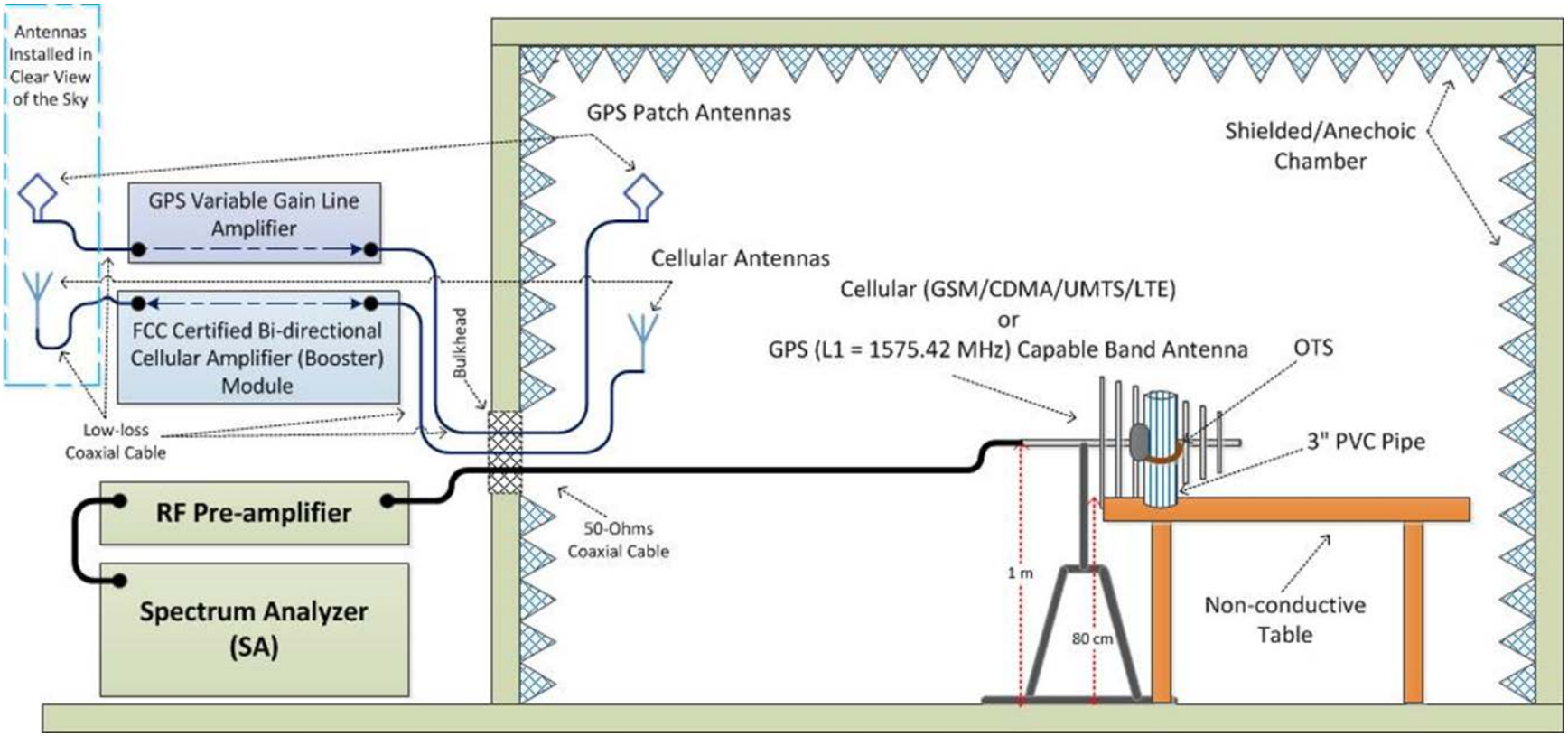


Figure 4 - Equipment Configuration II – Measure Cellular Signal

6.23.5 Report

6.23.5.1 Document and record all test results, including the J_c/S_c ratios used, the date and times of the OTS jamming alerts, the method of confirmation that the jamming alerts were generated by the data center and the alerts were received by the agency, and the times that the alerts were received by the agency. Also, document any observations made during the testing.

6.23.6 Interpretation

6.23.6.1 The observation of local cellular alerts from the OTS and the timely generation and receipt of Cellular Jamming alerts shall be used as one of the pass/fall criterion.

6.23.6.2 The generation and receipt of a Cellular Jamming alert as a result of the test in Section 6.23.4.9 shall result in a failure.

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

6.24 GPS Interference/Jamming Detection and Alert Test (Optional)

Note: This test method corresponds to the performance requirement in Section 5.7.5.

6.24.1 Application

6.24.1.1 This test is applicable to OTS that use GPS as one of their location technologies.

6.24.2 Samples

6.24.2.1 One complete OTS per Table 5, including peripherals.

6.24.2.2 Sample shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.24.3 Test conditions

6.24.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 4.

(a) 6.3.2.2
(b) 6.3.2.3
(c) 6.3.2.7
(d) 6.3.2.15
(e) 6.3.2.17

6.24.4 Procedure

6.24.4.1 Adjust OTS settings such that a Loss of Location alert (or similar) is generated within 5 minutes (i.e., 5 minutes or less) after detection of a Loss of Location incident.

6.24.4.2 Adjust the OTS settings such that the system generates a GPS Jamming alert 5 minutes (± 1 minute) after detection of a jamming incident.

6.24.4.3 The OTS sample shall be placed in an RF shielded semi-anechoic room. The sample shall be allowed to run for 10 minutes. Following this 10-minute period, the sample shall be temporarily removed from the shielded/semi-anechoic room and allowed to re-establish cellular communication. It shall be verified that during this 10-minute period, the OTS sample did not communicate with the data center and that no GPS location points were collected. If this step has already been performed in conjunction with one of the other test methods associated with the other optional performance requirements (Section 6.22.4.3 or Section 6.23.4.3) within the past 24 hours, it does not need to be repeated.

6.24.4.4 The OTS sample shall be placed again in the shielded/semi-anechoic room. This room shall be configured such that GPS communication location points and cellular communication signals are received, and out of which cellular communication signals are rebroadcast. See Figure 3 for a schematic of the equipment setup. The following equipment is required for the execution of this test method:

- RF-shielded semi-anechoic room.
- Non-conductive table.
- Piece of 3-inch diameter PVC pipe.
- GPS variable gain line amplifier.
- Two GPS patch antennas, or equivalent.
- FCC-certified bi-directional cellular amplifier (booster) module with two cellular antennas, or equivalent.
- Four low-loss coaxial cables.
- Signal generator
- RF amplifier with 3 GHz minimum bandwidth.
- 50Ω coaxial cable.
- Spectrum analyzer.
- RF pre-amplifier.
- Control computer.
- GPS capable band antenna.

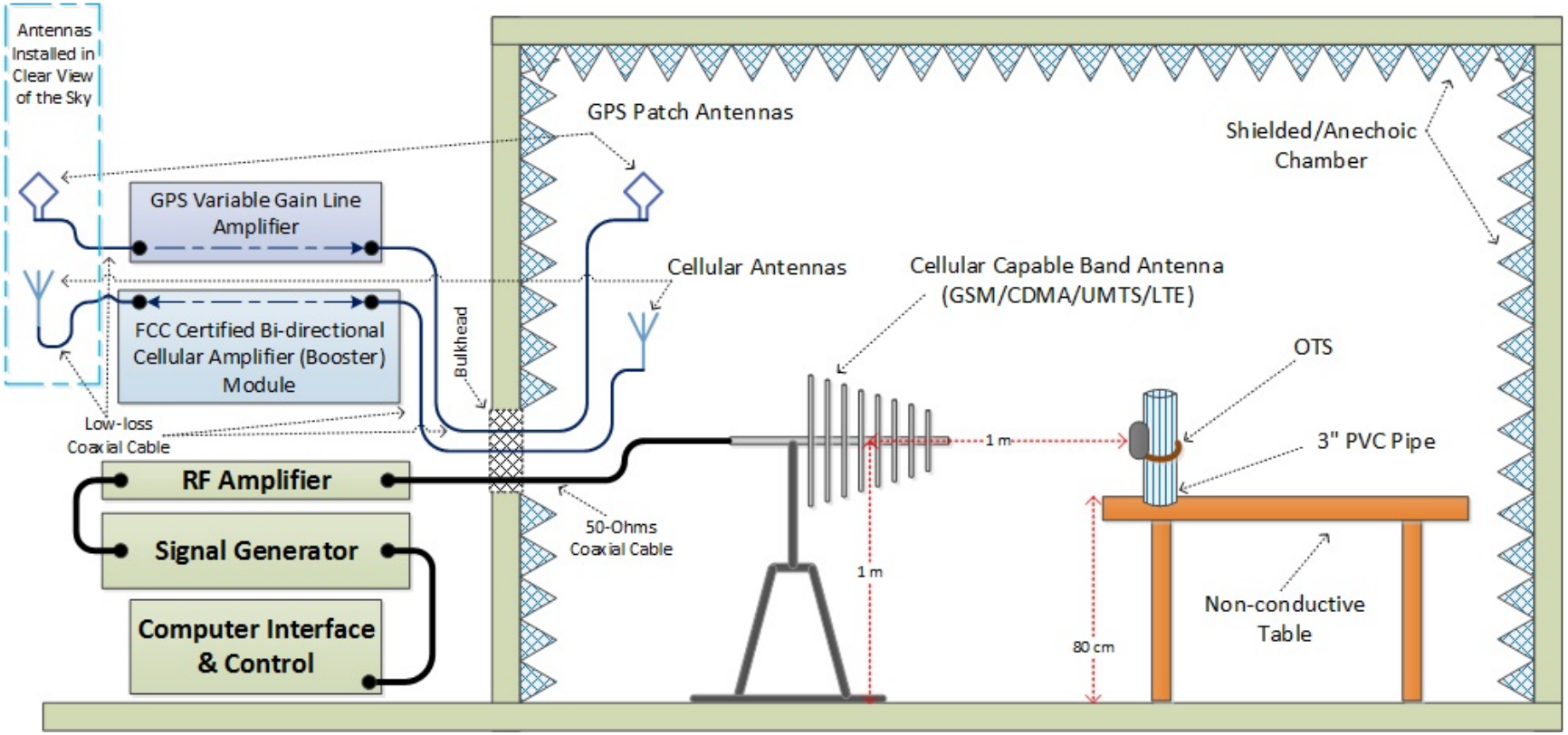


Figure 5 - Equipment Configuration III – Jamming Configuration

6.24.4.5 To receive GPS location points inside the shielded/semi-anechoic room, configure the equipment as follows:

(a) Outside the shielded/semi-anechoic room, install one GPS patch antenna in clear view of the sky and the GPS variable gain line amplifier. Inside the room, place the OTS and install the second GPS patch antenna away from both the OTS and the GPS patch antenna installed outside the room.

(b) Connect a low-loss coaxial cable from the antenna port of the GPS patch antenna installed inside the shielded/semi-anechoic room through the room's "bulkhead" connector to the RF output port of the GPS variable gain line amplifier located outside the room.

(c) Connect another low-loss cable from the GPS patch antenna installed outside the room to the RF input port of the GPS variable gain line amplifier located outside the room. Once the GPS variable line amplifier is switched on, the OTS inside the shielded/semi-anechoic room will be able receive GPS location points.

6.24.4.6 To enable the OTS in the shielded/semi-anechoic room to receive and send cellular data from/to the outside world, place the FCC-certified bi-directional cellular amplifier (booster) module outside the shielded/semi-anechoic room in clear view of the sky and configure the equipment as follows:

(a) Install one cellular antenna outside the shielded/semi-anechoic room in clear view of the sky and install the second cellular antenna inside the shielded/semi-anechoic room, away from both the OTS inside the room and the cellular antenna installed outside the room.

(b) Connect a low-loss coaxial cable from the antenna port of the cellular antenna inside the shielded/semi-anechoic room through the room's bulkhead connector to the RF user's port of the FCC-certified bi-directional cellular amplifier (booster) module.

(c) Connect another low-loss coaxial cable from the cellular antenna located outside the room to the base transceiver station (BTS) input of the FCC-certified bi-directional cellular amplifier (booster) module. Once the FCC-certified bi-directional cellular amplifier (booster) module is switched on, the OTS inside the shielded/semi-anechoic room will be able to receive cellular data.

6.24.4.7 Measurement of GPS Signal (S_{GPS})

(a) The GPS signal to which the OTS shall have access, herein referred to as the GPS signal (S_{GPS}), shall be provided by the GPS variable gain line amplifier.

(S_{GPS} is the ambient wireless GPS signal from GPS satellites being transmitted into the shielded/semi-anechoic room.)

(b) The OTS shall be configured to operate to collect location data at a nominal rate of one point per minute while receiving cellular signal and S_{GPS}. Measure and record the S_{GPS} uncorrected field strength that the OTS is receiving by placing the GPS capable band antenna exactly next to where the OTS is placed in the shielded/semi-anechoic room, as shown in Figure 4. The height of the antenna and the OTS shall be the same. Connect this antenna to the input port of the spectrum analyzer via a low-loss coaxial cable and RF pre-amplifier.

(c) In order to correct the S_{GPS} field strength level the OTS is receiving, adjust the spectrum analyzer's measurement result recorded in (b) above to correct for measurement system losses/gains by adding the low-loss coaxial cable losses and subtracting the RF amplifier gain. During this adjustment, the spectrum analyzer's resolution bandwidth/video bandwidth (RBW/VBW) shall be set to 100 kHz, and its center frequency set to receive the S_{GPS} uncorrected field strength. Record the corrected S_{GPS} field strength.

6.24.4.8 GPS Jamming

(a) Using the signal generator with a minimum bandwidth of 3GHz, connect its output port to the RF amplifier's input port and connect the RF amplifier's output port to the GPS capable band antenna using the 50Ω coaxial cable. The height of the antenna and the OTS shall be the same (see Figure 5). The GPS capable band antenna shall be used to transmit GPS frequency, 1575.42 MHz (L1 signal = 10.23 MHz * 154), herein referred to as the Jamming GPS signal (J_{GPS}).

(b) The bandwidth of the J_{GPS} shall be set greater than the bandwidth of the S_{GPS}.

(c) Amplitude Modulation (AM) shall be used to modulate the J_{GPS}.

Note: Although this test method for jamming the OTS enlists the use of a signal generator, other GPS/cellular generating broadband-sources capable of producing GPS and/or cellular events may be used.

(d) Set the J_{GPS} such that the ratio from it to the S_{GPS} field strength recorded in (b) is 6dB (6dB J_{GPS}/S_{GPS} ratio) and expose the OTS to the J_{GPS} for 10 minutes.

(e) After the 10-minute exposure, remove the J_{GPS} to allow the OTS to receive location data points.

(f) Verify that local GPS Jamming alerts (or similar) from the OTS are active, and confirm that the data center and the agency receive the GPS Jamming events (or similar) as a result of the 6dB J_{GPS}/S_{GPS} ratio. Record the times and date of the OTS GPS Jamming (or similar) events, and subsequent alerts and

the J_{GPS}/S_{GPS} ratio. The alert shall be generated within 5 minutes (i.e., 5 minutes or less) after the start of the exposure. Also record the time that the events were received by the data center, and the subsequent alert by the agency. For the purpose of configuring this test, all discussions of J_{GPS}/S_{GPS} ratios should be in dBm units.

(g) If the GPS Jamming events were not received by the data center and the agency but it is confirmed that the OTS is still communicating with the data center and the agency, increase the J_{GPS}/S_{GPS} ratio by 6dB increments until the OTS stops communicating with the data center and the agency. Expose the OTS to the J_{GPS}/S_{GPS} level that stopped the OTS communication for 10 minutes.

(h) After the 10-minute exposure, remove the J_{GPS} to allow the OTS to receive location data points.

(i) Confirm with the data center and the agency that the GPS Jamming events (or similar) were received. Record the date and times of the OTS GPS Jamming events, the J_{GPS}/S_{GPS} ratio, and the times that the events were received by the data center and the subsequent alert received by the agency. The alert shall be generated within 5 minutes (i.e., 5 minutes or less) after the start of the exposure.

(j) If the GPS Jamming alerts (or similar) were not generated by the data center and the agency after the subsequent 6dB increases that stopped OTS communication, the OTS device fails the test. Record the date and times of the GPS Jamming alerts and the J_{GPS}/S_{GPS} ratios.

6.24.4.9 Run another 10-minute test as follows:

(a) Place the OTS back into the shielded/anechoic room. Turn off the signal generator so that $J_{GPS} = 0$.

(b) Disconnect the GPS patch antenna inside the shielded/anechoic room (see Figure 3) so that the OTS can no longer receive GPS signals.

(c) Allow the OTS to run for 10 minutes.

(d) Re-connect the GPS patch antenna inside the shielded/anechoic room to allow for the restoration of GPS signals.

(e) Verify that the OTS generated a “Loss of Location” alert (or similar), but did not generate a “GPS Jamming” alert (or similar) under these conditions.

6.24.5 Report

6.24.5.1 Document and record all test results, including the J_{GPS}/S_{GPS} ratios used, the date and times of the OTS jamming events, the method of confirmation that the jamming

events were received by the data center and the alerts were received by the agency, and the times that the alerts were received by the agency. Also, document any observations made during the testing.

6.24.6 Interpretation

6.24.6.1 The observation of local GPS alerts from the OTS and the timely receipt of "GPS Jamming" alerts (or similar) shall be used as one of the pass/fall criterion.

6.24.6.2 The generation and receipt of a GPS Jamming alert (or similar) as a result of the test in Section 6.24.4.9 shall result in a failure.

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

6.25 Software Tests

Note: This test method corresponds to the performance requirement in Section 5.5.1.

6.25.1 Use supplier-provided operational instructions to aid in performing the manipulations below.

6.25.2 Samples

6.25.2.1 One complete OTS per Table 5.

6.25.2.2 Sample shall be conditioned per Section 6.2, Room Temperature Conditioning.

6.25.3 Test Conditions

6.25.3.1 No specific test conditions from Section 6.3 apply.

6.25.4 Data Export Procedure

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

6.25.4.2 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.

6.25.5 Collection Rate Adjustment Procedure

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

6.25.5.2 To verify the capability to adjust the rate at which data points are collected, adjust the OTS collection rate to a rate of 1 data point per minute.

6.25.5.3 Collect a minimum of 3 data points at this setting.

6.25.5.4 Adjust the OTS collection rate to a rate of 1 date point per every 5 minutes.

6.25.5.5 Collect a minimum of 3 data points at this setting.

6.25.5.6 Adjust the OTS collection rate to a rate of 1 data point per every 15 minutes.

6.25.5.7 Collect a minimum of 3 data points at this setting.

6.25.5.8 Verify that each data point is received at the user interface and that the time increment between each point is appropriate for the data collection rate used.

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

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

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

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

6.25.6.3 Adjust the OTS collection rate to 1 data point per minute.

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

6.25.6.5 Verify each data point is received at the 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.

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

6.25.7 Zone/Zone Template Creation Procedure

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

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

6.25.7.3 Create 20 arbitrarily shaped polygon zones (i.e., free-form zones) with at least one of the 20 contained within one of the other 19, and with one of the 20 comprised of at least 40 nodes.

6.25.7.4 Using all of the zones created in sections 6.25.7.1, 6.25.7.2, and 6.25.7.3, create and store a zone template.

6.25.7.5 Document the results and record any observations.

6.25.8 Change Control Verification Procedure

6.25.8.1 Attempt to change the following information in existing data/files:

- Schedules
- Zones
- Demographics
- Addresses

6.25.8.2 Verify that the changes have been successfully executed.

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

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

6.25.8.5 Document the results and record any observations.

6.25.9 Administrative Privilege Setting Verification Procedure

6.25.9.1 Attempt to assign differing levels of administrative privileges to several agency employees who are representative of different ranks/levels.

6.25.9.2 Access the system as one of the employees with limited or lesser administrative privileges.

6.25.9.3 Ensure that actual privileges are commensurate with the privileges set in 6.25.9.1. 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.

6.25.9.4 Access the system as one of the employees with greater administrative privileges.

6.25.9.5 Ensure that actual privileges are commensurate with the privileges set in 6.25.9.1. This shall be accomplished by verifying the ability to access those functions/menus to which the individual should have access.

6.25.9.6 Document the results and record any observations.

6.25.10 Secure Access Verification Procedure

6.25.10.1 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.

6.25.10.2 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.

6.25.10.3 Using the password created in 6.25.10.1, change the password 5 times to a different, acceptable password. Each time the option is chosen to change the password, attempt to use the password created in 6.25.10.1. Verify that the system will not allow that password to be reused.

6.25.10.4 Log in to 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.

6.25.10.5 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 5th unsuccessful login attempt and that system access must be reset manually (i.e., not reset automatically after a designated waiting period).

6.25.10.6 While performing steps 6.25.10.1 through 6.25.10.5, verify that the system for account access does not contain/allow auto-fill, auto-type, or auto-complete functions.

6.25.10.7 Document the results and record any observations.

6.25.11 Report

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

6.25.12 Interpretation

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

Note: Even though it is required that the OTS software and firmware demonstrate the capabilities in this section, this does not preclude OTS suppliers from offering the agency the flexibility to turn the capability on/off or select a different setting.

6.26 OTS Functionality Test

6.26.1 Application

6.26.1.1 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.

6.26.2 Sample

6.26.2.1 One complete OTS per Table 5.

6.26.2.2 The sample used during this test shall be the same one being used for the other test methods that invoke this OTS Functionality Test.

6.26.3 Test Conditions

6.26.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 4.

(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
(i) 6.3.2.17

6.26.4 Procedure

6.26.4.1 Turn the OTS on.

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

6.26.4.3 Allow the system to upload/transmit this data.

6.26.5 Report

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

6.27 Extreme Temperature Storage Test

Note: This test method corresponds to the performance requirement in Section 5.6.3.

6.27.1 Test Conditions

6.27.1.1 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.

6.27.2 Samples

6.27.2.1 Three complete OTS per Table 5.

6.27.3 Procedure

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

6.27.3.2 Perform the OTS Functionality Test specified in Section 6.26.

6.27.3.3 Place the OTS in an environmental chamber.

6.27.3.4 Increase the temperature within the chamber at a rate of 2°C (+/-10%) per minute until the chamber reaches the test temperature of 50°C.

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

6.27.3.6 Return the chamber to 20°C (room temperature) by decreasing the temperature at a rate of 2°C (+/-10%) per minute.

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

6.27.3.8 Remove the OTS from the environmental chamber.

6.27.3.9 Perform the OTS Functionality Test specified in Section 6.26.

6.27.3.10 Return the OTS to the environmental chamber.

6.27.3.11 Decrease the temperature within the chamber at a rate of 2°C (+/-10%) per minute until the chamber reaches the test temperature of -20°C.

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

6.27.3.13 Return the chamber to 20°C (room temperature) by increasing the temperature at a rate of 2°C (+/-10%) per minute.

6.27.3.14 Normalize the system in the temperature chamber at a temperature of 20°C (room temperature) for 1 hour.

6.27.3.15 Remove the OTS from the environmental chamber.

6.27.3.16 Perform the OTS Functionality Test specified in Section 6.26.

6.27.4 Report

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

6.28 Condensing Humidity Test

Note: This test method corresponds to the performance requirement in Section 5.6.4.

6.28.1 Application

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

6.28.2 Samples

6.28.2.1 Three complete OTS per Table 5.

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 Place the OTS in an environmental chamber.

6.28.4.2 Normalize the system in the chamber at a temperature of 20ºC (room temperature) for 1 hour.

6.28.4.3 Expose the samples to humidity with condensation under conditions of relative humidity ≥ 99%. Exposure time shall be 7 days.

6.28.4.4 Remove the OTS from the environmental chamber.

6.28.4.5 Perform the OTS Functionality Test specified in Section 6.26 following the above exposure.

6.28.5 Report

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

6.29 Water Spray Exposure Test

Note: This test method corresponds to the performance requirement in Section 5.6.5.

6.29.1 Application

6.29.1.1 This test method shall apply to the body-proximate device of the OTS only.

6.29.2 Samples

6.29.2.1 Three complete OTS per Table 5.

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 As a baseline, perform the electric strength test procedure found in Section 5.2.2 of UL Standard 60950-1. This procedure shall be conducted at room temperature conditions (temperature and humidity) as specified in Section 6.2.1.

6.29.4.3 The body-proximate device of each of the samples shall be water spray-tested in accordance with the conditions in IEC 60529 Section 14.2.5.

6.29.4.4 Following the water spray exposure in the previous step, remove the device from the water and perform the electric strength test procedure found in Section 5.2.2 of UL Standard 60950-1. This procedure shall be conducted at room temperature conditions (temperature and humidity) as specified in Section 6.2.1.

6.29.4.5 Perform the OTS Functionality Test specified in Section 6.26 following the above exposure.

6.29.4.6 Store the body-proximate device in a location at the environmental conditions (temperature and humidity) found in Section 6.2.1 for a period of 1 week.

6.29.4.7 After the one-week period in the previous step, perform the OTS Functionality Test specified in Section 6.26.

6.29.5 Report

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

6.30 Immersion Test

Note: This test method corresponds to the performance requirement in Section 5.6.6.

6.30.1 Application

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

6.30.2 Samples

6.30.2.1 Three complete OTS per Table 5.

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 As a baseline, perform the electric strength test procedure found in Section 5.2.2 of UL Standard 60950-1. This procedure shall be conducted at room temperature conditions (temperature and humidity) as specified in Section 6.2.1.

6.30.4.3 Immerse the body-attached device of each of the samples in salt water at a depth of 2 meters (i.e., the highest point of the body-attached device shall be located 2 meters below the surface of the water) for 1 hour. The salt solution shall be as specified in ASTM B117 Section 8. During immersion, the water shall be at a temperature of 21°C ± 3°C (70°F ± 5°F).

6.30.4.4 Following the immersion in the previous step, remove the device from the water and perform the electric strength test procedure found in Section 5.2.2 of UL Standard 60950-1. This procedure shall be conducted at room temperature conditions (temperature and humidity) as specified in Section 6.2.1.

6.30.4.5 Perform the OTS Functionality Test specified in Section 6.26 following the above immersion.

6.30.4.6 Store the body-attached device in a location at the environmental conditions (temperature and humidity) found in Section 6.2.1 for a period of 1 week.

6.30.4.7 After the one-week period in the previous step, perform the OTS Functionality Test specified in Section 6.26.

6.30.5 Report

6.30.5.1 Document all test results and observations, including the results of the electric strength and both functionality tests.

6.31 Shock by Impact Test

Note: This test method corresponds to the performance requirement in Section 5.6.7.

6.31.1 Application

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

6.31.2 Samples

6.31.2.1 Three complete OTS per Table 5.

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 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,* Section 8.1.2 – Dynamic Test, using a height (x) of 1 meter per Figure 4.

6.31.4.3 Perform the OTS Functionality Test specified in Section 6.26.

6.31.5 Report

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

6.32 Dynamic Shock Test

Note: This test method corresponds to the performance requirement in Section 5.6.8.

6.32.1 Application

6.32.1.1 This test method shall apply to body-proximate and body-attached devices.

6.32.2 Samples

6.32.2.1 Three complete OTS per Table 5.

6.32.3 Test Conditions

6.32.3.1 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.

6.32.4 Procedure

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

6.32.4.2 The OTS shall be subjected to mechanical shock (ref: Mil Std 810G, Test Method 516.6, Procedure I) of the following magnitude and shape: – 20 g peak, half sine, 11 ms pulse on all three axes, in both positive and negative orientation.

6.32.4.3 Perform the OTS Functionality Test specified in Section 6.26 following the above exposure.

6.32.5 Report

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

6.33 Sinusoidal Vibration Test

Note: This test method corresponds to the performance requirement in Section 5.6.9.

6.33.1 Application

6.33.1.1 This test method shall apply to body-proximate and body-attached devices.

6.33.2 Samples

6.33.2.1 Three complete OTS per Table 5.

6.33.3 Test Conditions

6.33.3.1 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.

6.33.4 Procedure

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

6.33.4.2 Expose the samples to 15 g of sinusoidal vibration along each of its three axes over the frequency range of 5 Hz through 500 Hz for a duration of 3 minutes. (Refer to IEC 60068-2-6.)

6.33.4.3 Perform the OTS Functionality Test specified in Section 6.26 during and following the above exposure.

6.33.5 Report

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

6.34 Random Vibration Test

Note: This test method corresponds to the performance requirement in Section 5.6.10.

6.34.1 Application

6.34.1.1 This test method shall apply to body-proximate and body-attached devices.

6.34.2 Samples

6.34.2.1 Three complete OTS per Table 5.

6.34.3 Test Conditions

6.34.3.1 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.

6.34.4 Procedure

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

6.34.4.2 Expose the samples to .3 g_{rms} (root-mean-square acceleration) of random vibration along each of its three axes over the frequency range of 5 Hz through 500 Hz for a duration of 30 minutes. (Refer to IEC 60068-2-64.)

6.34.4.3 Perform the OTS Functionality Test specified in Section 6.26 during and following the above exposure.

6.34.4.4 Expose the samples to 2.4 g_{rms} of random vibration along each of its three axes over the frequency range of 5 Hz through 500 Hz for a duration of 30 minutes. (Refer to IEC 60068-2-64.)

6.34.4.5 Perform the OTS Functionality Test specified in Section 6.26 during and following the above exposure.

6.34.5 Report

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

6.35 Electromagnetic Compatibility Test

Note: This test method corresponds to the performance requirement in Section 5.6.11.

6.35.1 Application

6.35.1.1 This test method shall apply to body-proximate and body-attached OTS.

6.35.2 Samples

6.35.2.1 One complete OTS per Table 5.

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

6.35.3 Test Conditions

6.35.3.1 The test conditions from the following sections apply to this test. This information is also represented in Table 4.

(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
(g) 6.3.2.17

6.35.3.2 A table (Table 6) summarizing this test method can be found at the end of section 6.35.

6.35.4 Procedure (body-proximate OTS not being charged)

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

(a) 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.

(b) 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 1 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.)

(c) 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 5 minutes of exposure (per axis position) is required.)

6.35.5 Procedure

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

6.35.5.2 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.

(a) 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.

(b) 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.

(c) Electrical Fast Transients/Burst Immunity

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

(d) Surge Immunity

All testing shall be performed in accordance with IEC 61000-4-5.

The limits applied shall be +/- 1 kV Level as well as all lower test limit levels. The Performance Criterion shall be B.

(e) 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 V_{rms} with 80% AM Modulation. The Performance Criterion shall be A.

(f) 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 5 minutes of exposure (per axis position) is required.)

(g) 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.

6.35.6 Report

6.35.6.1 Document all test results and observations.

Table 6. Immunity Test Requirements

Port	Phenomenon	Basic Standard	Test Value	Performance Criteria
OTS Enclosure Only	Electrostatic Discharge (ESD)	IEC 61000-4-2	±8 kV/±15 kV Contact/Air	B
	RF Field	IEC 61000-4-3	10 V/m, 80% 1KHz AM (26 MHz to 1GHz) 3 V/m, 80% 1KHz AM (1.0 GHz to 3 GHz) Antenna Polarization: Horizontal & Vertical EUT Orientation: Each Orthogonal Axis (X, Y Z)	A
	Rated Power Frequency Magnetic Field	IEC 61000-4-8	30 A/m @ 60Hz EUT Orientation: Each Orthogonal Axis (X, Y Z)	A
OTS with Fully Discharged Battery with Charger operating @ 120 Vac, 60Hz	Electrostatic Discharge (ESD)	IEC 61000-4-2	±8 kV/±15 kV Contact/Air	B
	RF Field (RI)	IEC 61000-4-3	10 V/m, 80% 1KHz AM (26 MHz to 1GHz) 3 V/m, 80% 1KHz AM (1.0 GHz to 3 GHz) Antenna Polarization: Horizontal & Vertical EUT Orientation: Each Orthogonal Axis (X, Y Z)[c]	A
	Rated Power Frequency Magnetic Field (MI)	IEC 61000-4-8	30A/m @ 60Hz EUT Orientation: Each Orthogonal Axis (X, Y Z)[c]	A
	Electrical Fast Transient (EFT)	IEC 61000-4-4	±1 kV[a)] ; ±1 kV[b)]	B
	Surge (S)	IEC 61000-4-5	±1 kV[a)] ; ±1 kV[b)]	B
	RF Common Mode (CI)	IEC 61000-4-6	3 V; 150 kHz to 80 MHz; 80% 1KHz AM	A
	Voltage Dips	IEC 61000-4-11	30%, 500ms	B
	Voltage Interruptions	IEC 61000-4-11	>95% @ 0° & 180° for 10ms each	B
	Voltage Interruptions	IEC 61000-4-11	>95% @ 270° for 5000ms each	B

a) Line to line.
b) Line to earth (ground).
c) Minimum of 5 minutes' exposure per axis
d) Minimum of 15 minutes' exposure per axis

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 the body-attached and body-proximate (for multi-piece configurations) components. Permanently attached (e.g., chemically bonded) plastic labels that are permanently and visibly stamped, etched, engraved, or printed are acceptable. Product labels shall not be stick-on paper labels.

7.1.2 All worded portions of a required product label shall appear in English, but other languages may be added provided that they state the same information.

7.1.3 At least the following information shall be printed legibly on the product label(s) using Arial font of at least the size indicated below:

- Legal name of the OTS supplier. (8-point font [.111 in])
- Model and serial number. (12-point font [.166 in])
- FCC ID. (8-point font [.111 in])

7.2 User Information to Be Provided by the OTS Supplier

7.2.1 The OTS supplier 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 supplier, 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.
    - Battery charging instructions.
- Field test and performance verification procedures.
- Warranty information.
- OTS supplier contact information, including address of manufacturing

location (city, state/province, country) and phone number.

- Care and maintenance instructions (see definitions for care and maintenance in Chapter 3), 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 supplier to not damage the unit nor degrade its performance.

7.2.2 The OTS supplier shall keep a maintenance history of body-attached and body-proximate components (as applicable) of the OTS (by serial number), including component replacement and repair. Field-replaceable system level components need not be included. This history shall be made available to the agency on request.

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

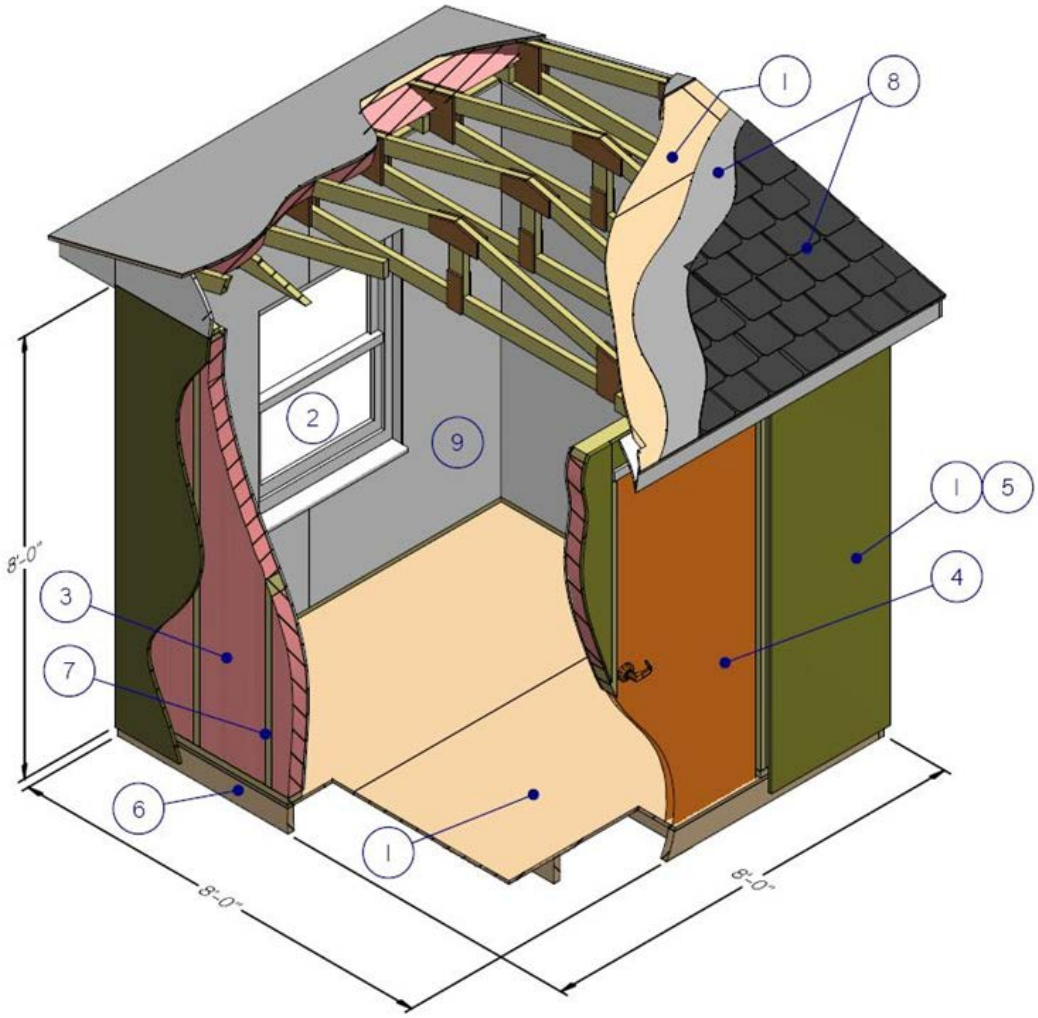
APPENDIX A. SECURE LOG-IN CRITERIA

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 6 passwords.
3) The maximum length of use for use of any one password must not exceed 120 days.
4) The system for the 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 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 manually (i.e., not reset automatically after a designated waiting period).
7) Passwords must be a minimum of 6 characters and contain characters from at least 3 of the following 4 categories:
    - Uppercase character.
    - Lowercase character.
    - Numeral 0-9.
    - Non-alphanumeric characters: ~!@#$%^&*_-+=`|\(){}[]:;"'<>,.?/.

APPENDIX B. BUILDING SPECIFICATIONS FOR INDOOR ACCURACY TESTING

1	Exterior wall, roof, and floor shall be ¾ in plywood.
2	Window shall be 3 ft x 4 ft standard hung, with single-pane glass. No screen. Install directly opposite from door entrance.
3	Exterior walls and roof shall be covered in R-13 insulation. Metallic-faced insulation is not permitted.
4	Entrance door shall be 36 in x 82 in and located at the center of the wall.
5	Building exterior shall be painted with typical household latex paint.
6	Floor joists shall be constructed with 2 in x 6 in lumber, 24 in centers.
7	Wall framing and roof trusses shall be constructed with 2 in x 4 in lumber, 18 in centers.
8	Typical residential roofing shingles with underlayment.
9	Interior walls and ceiling of ½ in drywall.



Note: The bottom of this building shall be no greater than 8 in off the ground.

Figure 6. Sample Building Diagram (not to scale)

APPENDIX C. OTS Strap Stretch Fixture Assembly Document – Rev. 1

Content

1. Description 88

2. Illustrative Assembly Parts 89

3. Mounting 2-D Instruction 94

4. Parts List 116

1. Description:

OTS Strap Stretch Fixture assembly drawings and photos shown below are intended to serve as a guide in building similar devices by test laboratories assigned to perform similar tests.

2. Illustrative Assembly Parts

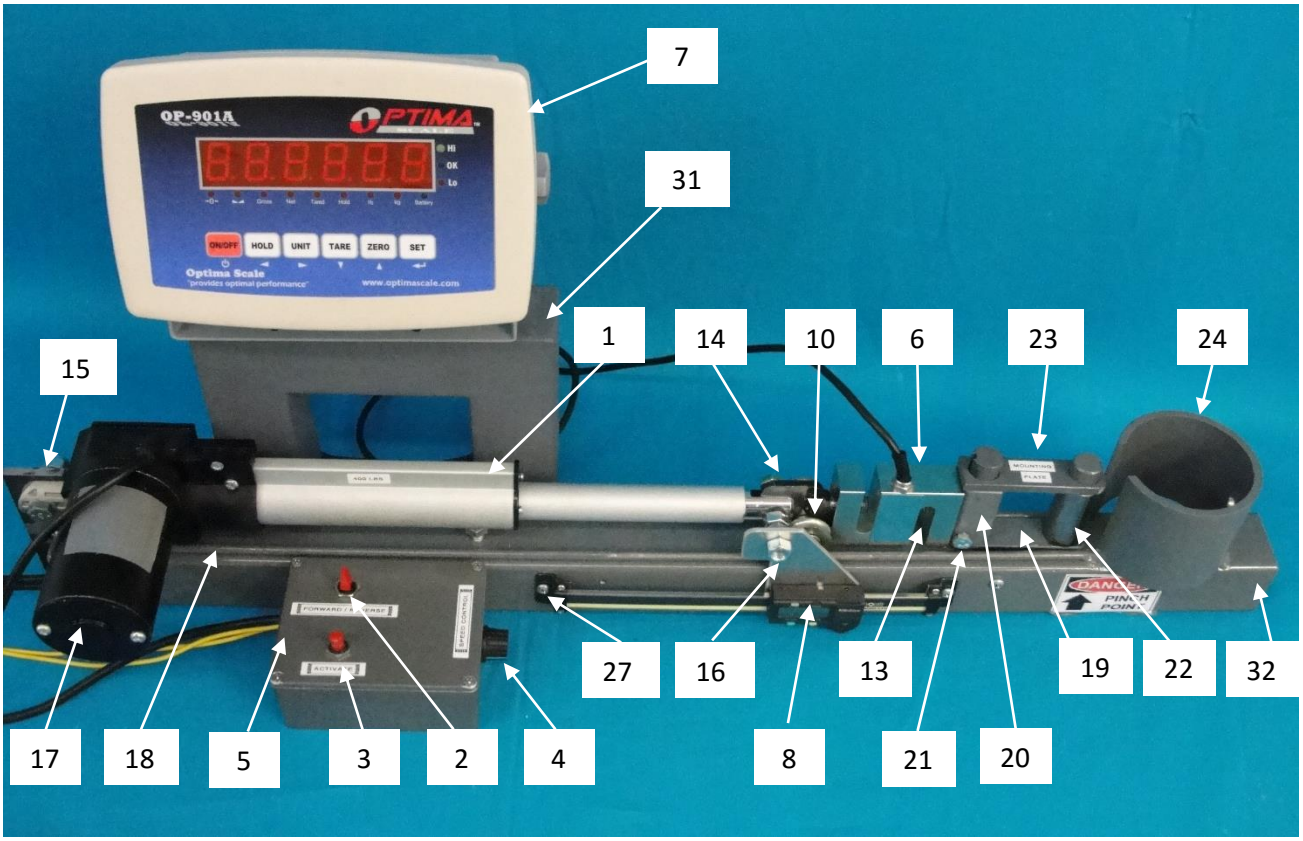


FIGURE 1. Assembled Fixture

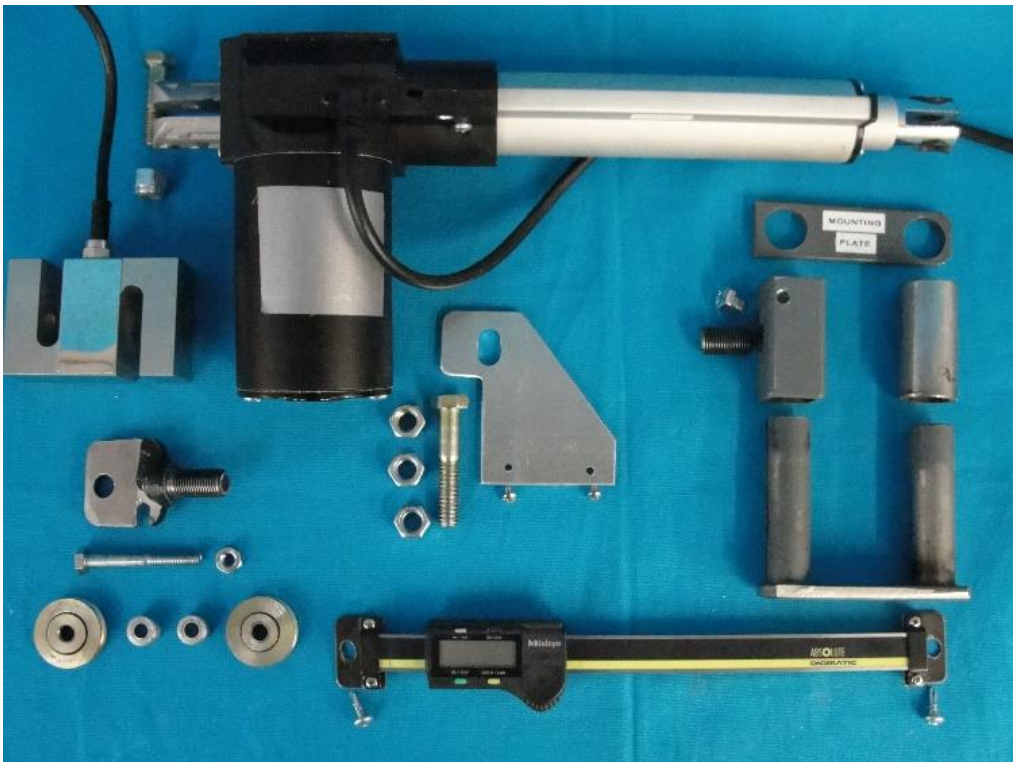


FIGURE 2. Assembly Parts without base & Force Gage Support assembly

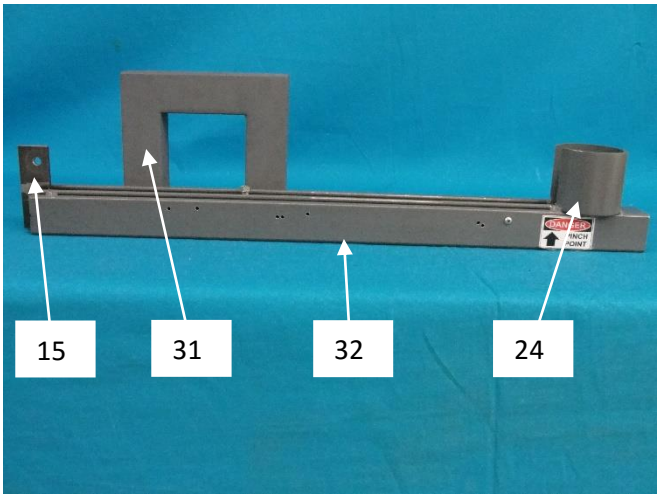


FIGURE 3. Main Support Front View

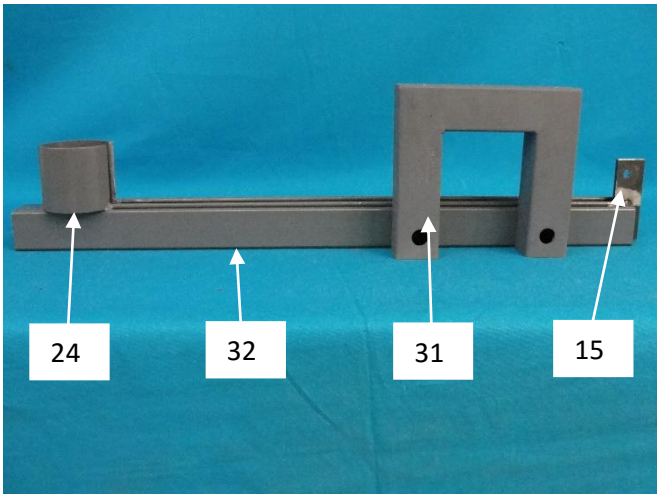


FIGURE 4. Main Support Back View

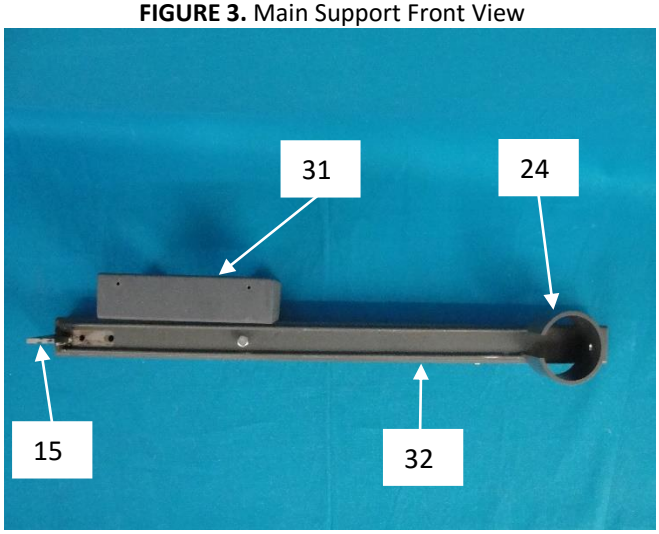


FIGURE 5. Main Support Top View

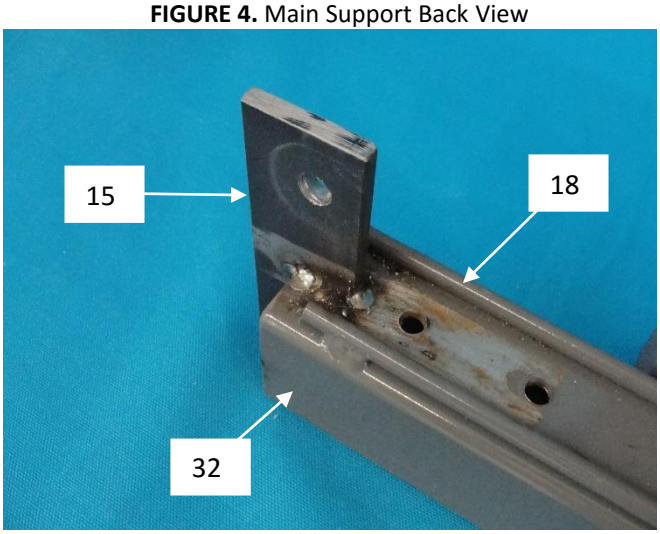


FIGURE 6. Main Support Top Left Side View

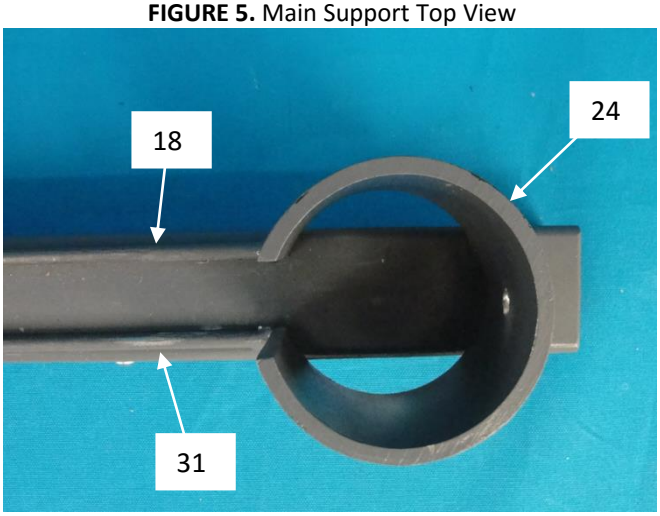


FIGURE 7. Strap Support Top View

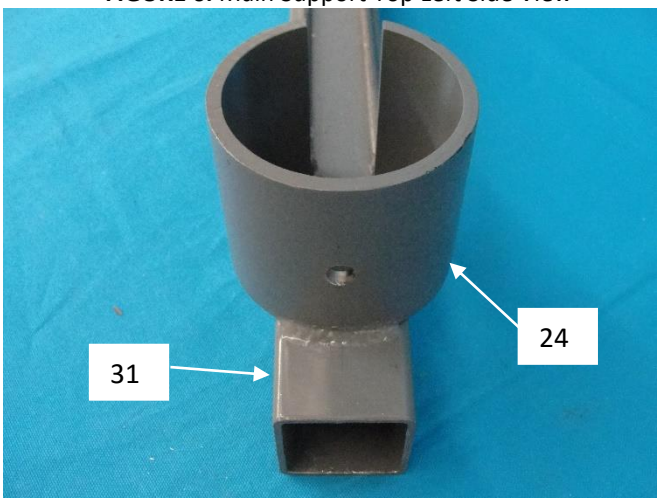


FIGURE 8. Connection Strap Support to Main Support

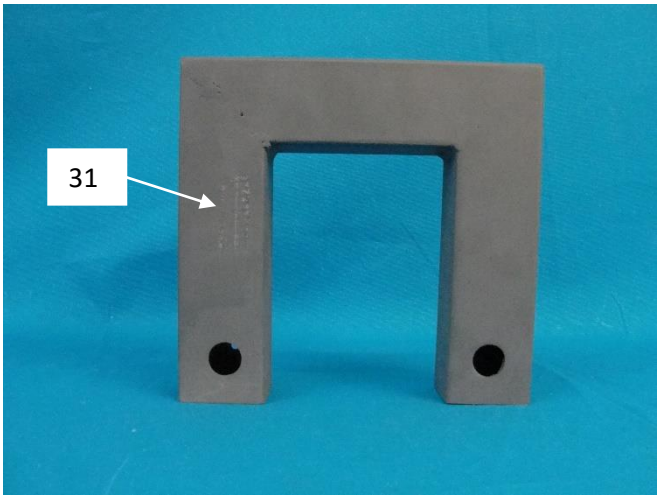


FIGURE 9. Force Gauge Support Side View

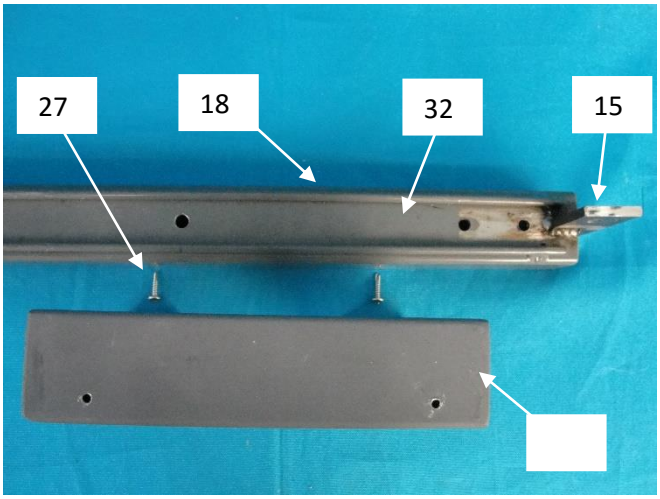


FIGURE 10. Assembled of Force Gauge Support View

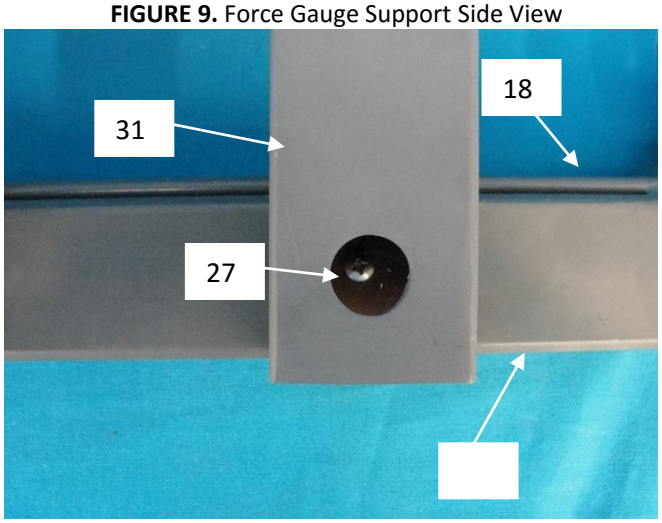


FIGURE 11. Assembled Gage Support

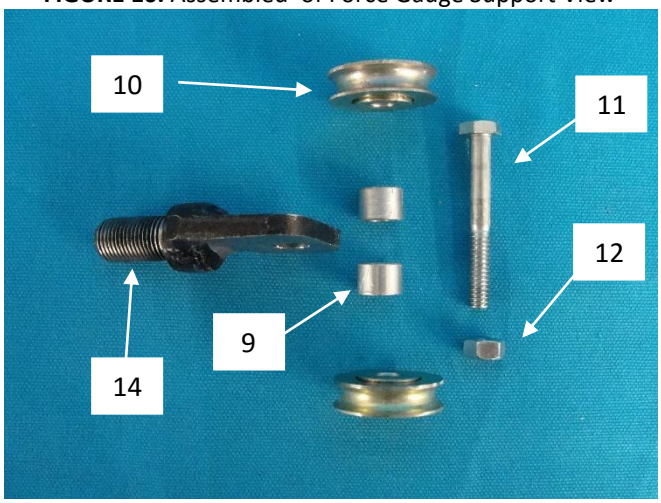


FIGURE 12. Assembly Parts for Wheels

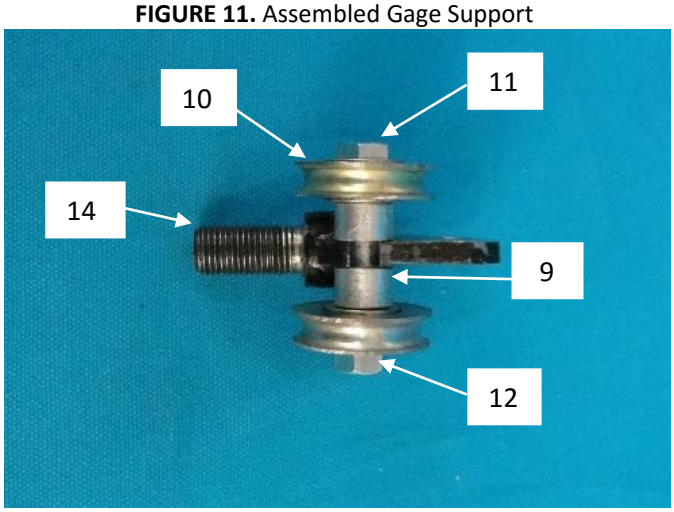


FIGURE 13. Assembled Wheels

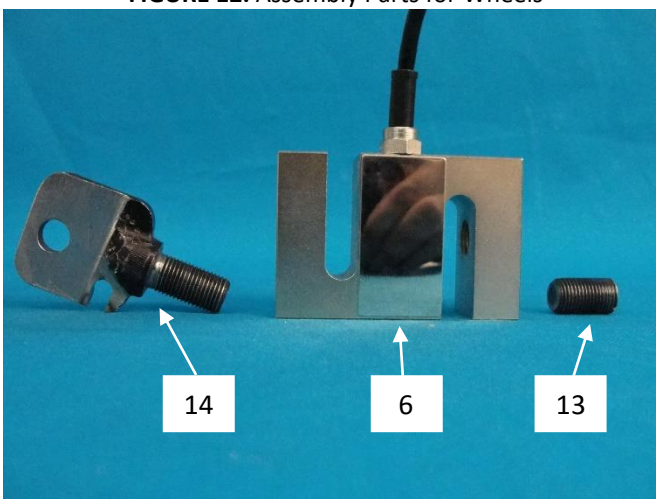


FIGURE 14

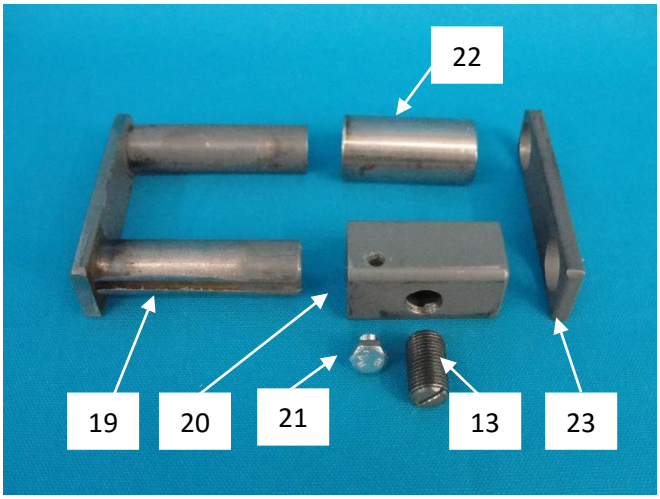


FIGURE 15. Custom Load Cell Connectors

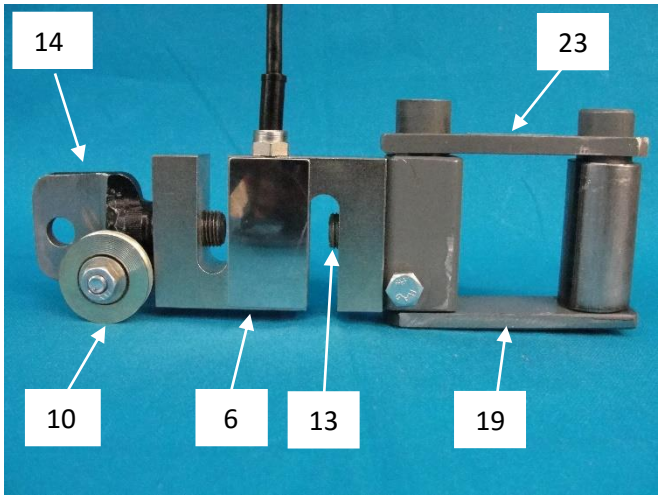


FIGURE 16

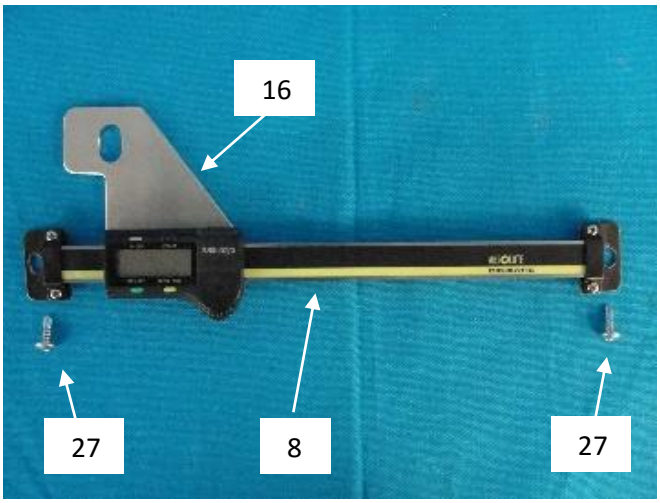


FIGURE 17. Custom Actuator to Caliber Connector (Front View)

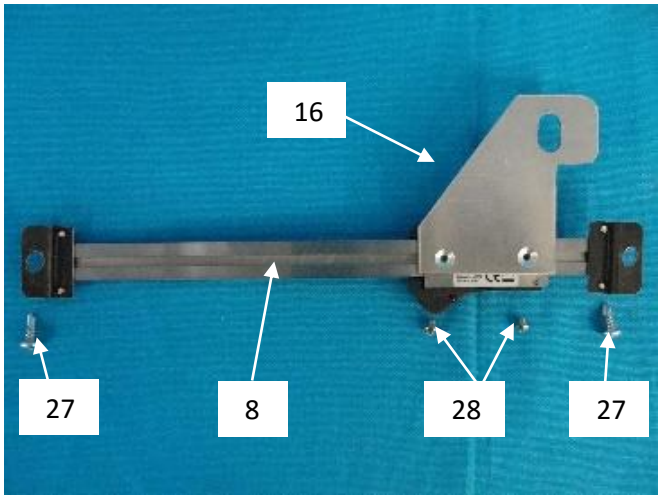


FIGURE 18. Custom Actuator to Caliber Connector (Back View)

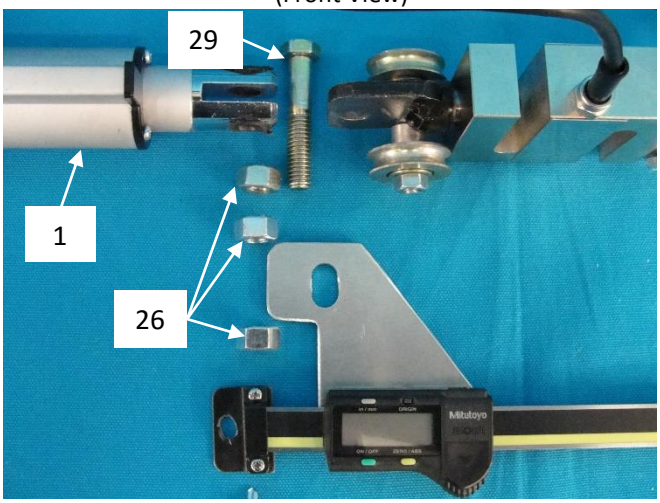


FIGURE 19

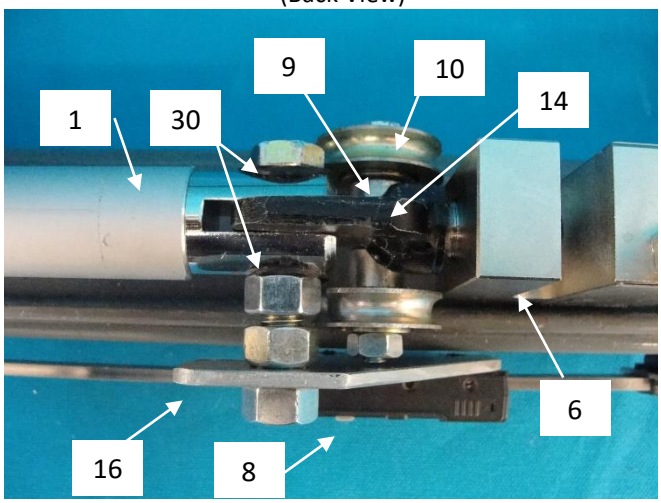


FIGURE 20

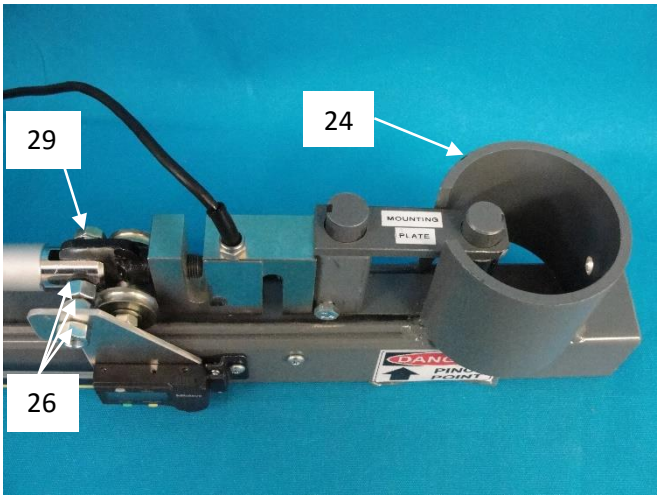


FIGURE 21

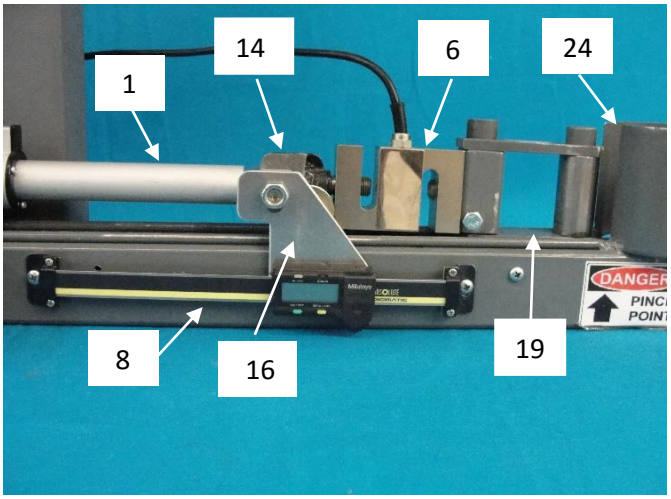


FIGURE 22

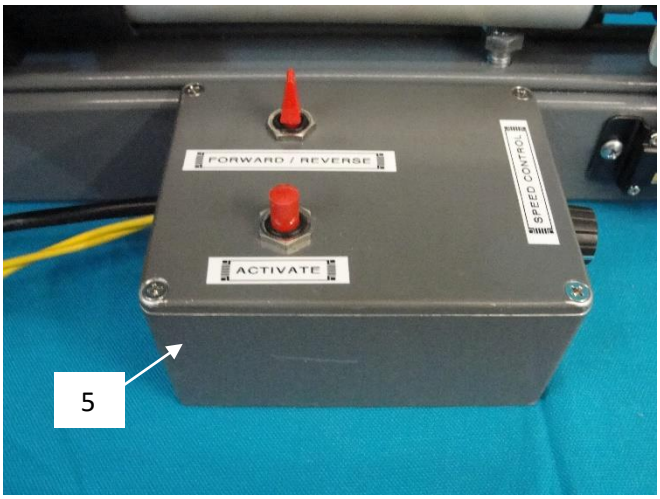


FIGURE 23. Speed Control Box

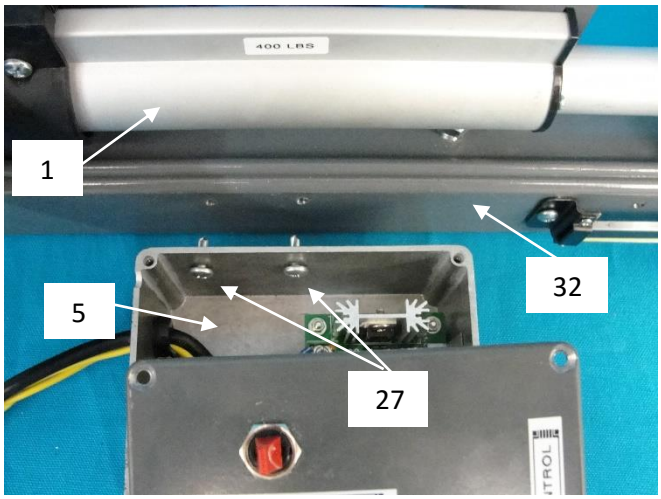


FIGURE 24. Control Box Connection to Main Support

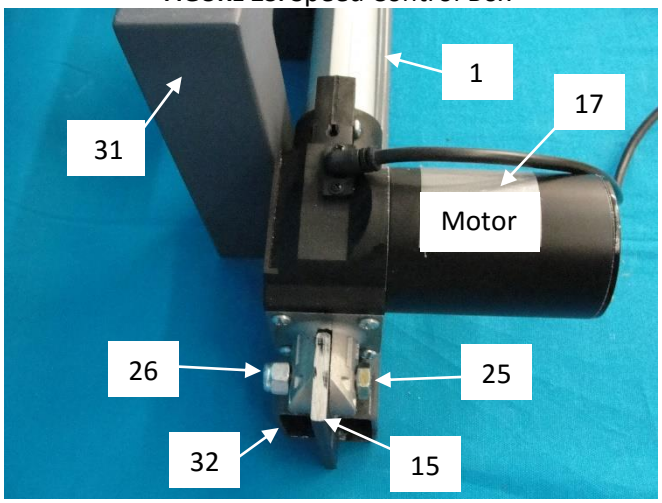


FIGURE 25. Motor and Actuator Connection to Base

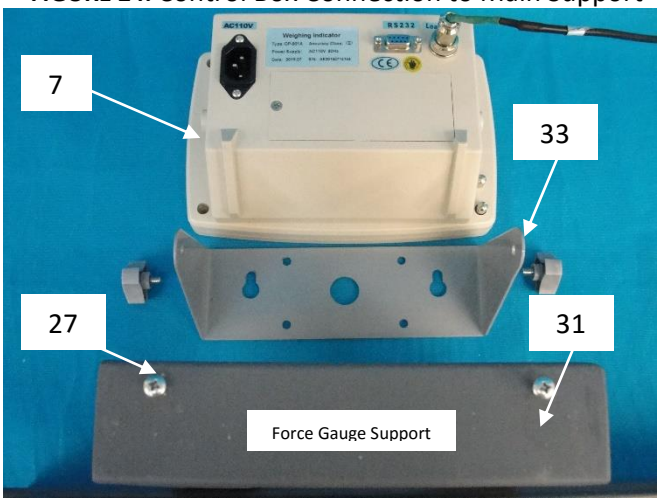


FIGURE 26. Force Gage Support Parts

3. Mounting 2-D Instruction

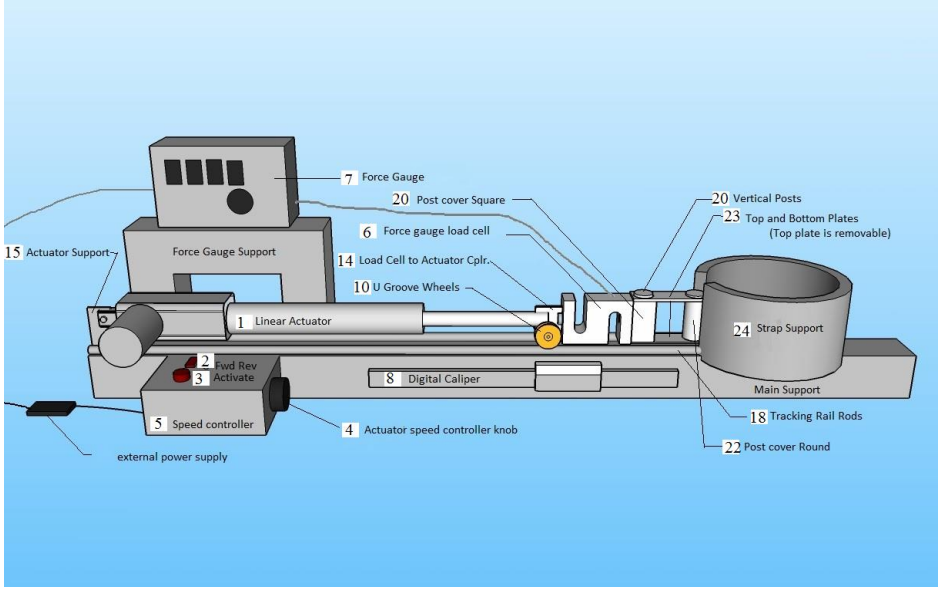


FIGURE 27

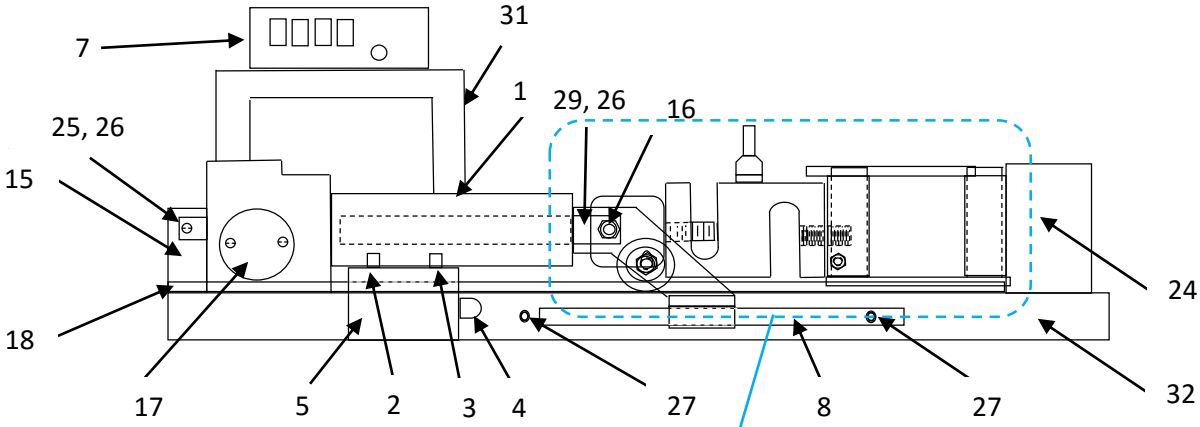


FIGURE 28. Main Support Side View

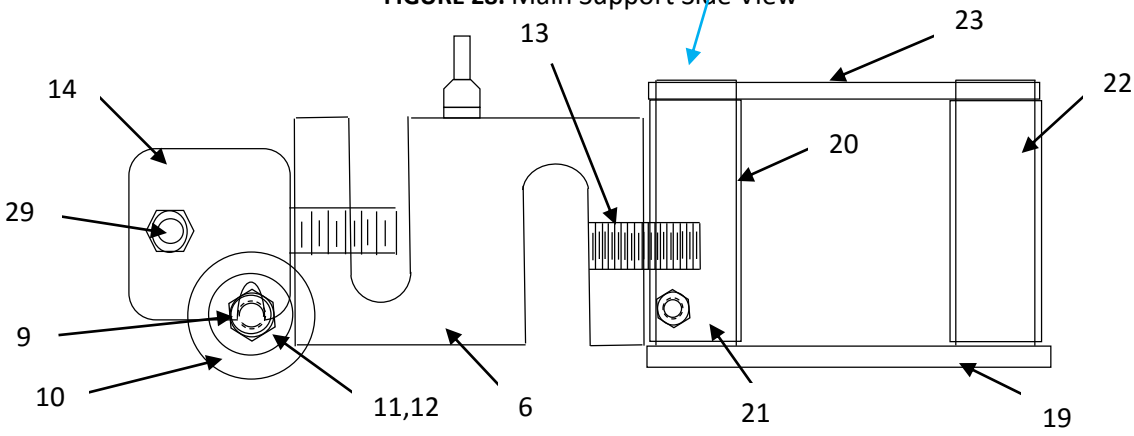
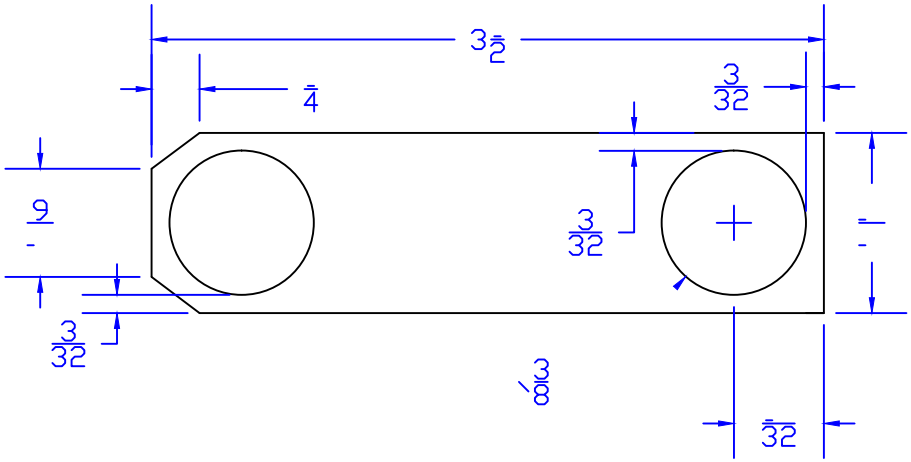


FIGURE 29

3. Mounting 2-D Drawing



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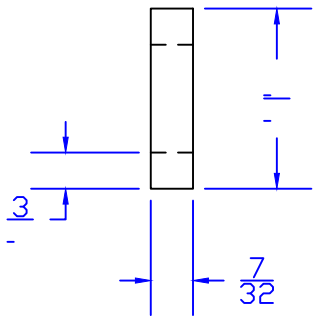

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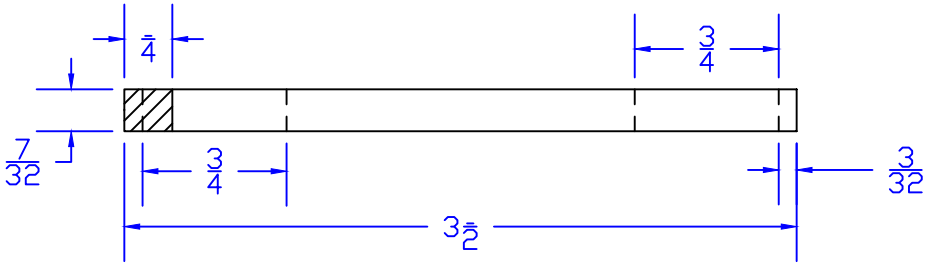

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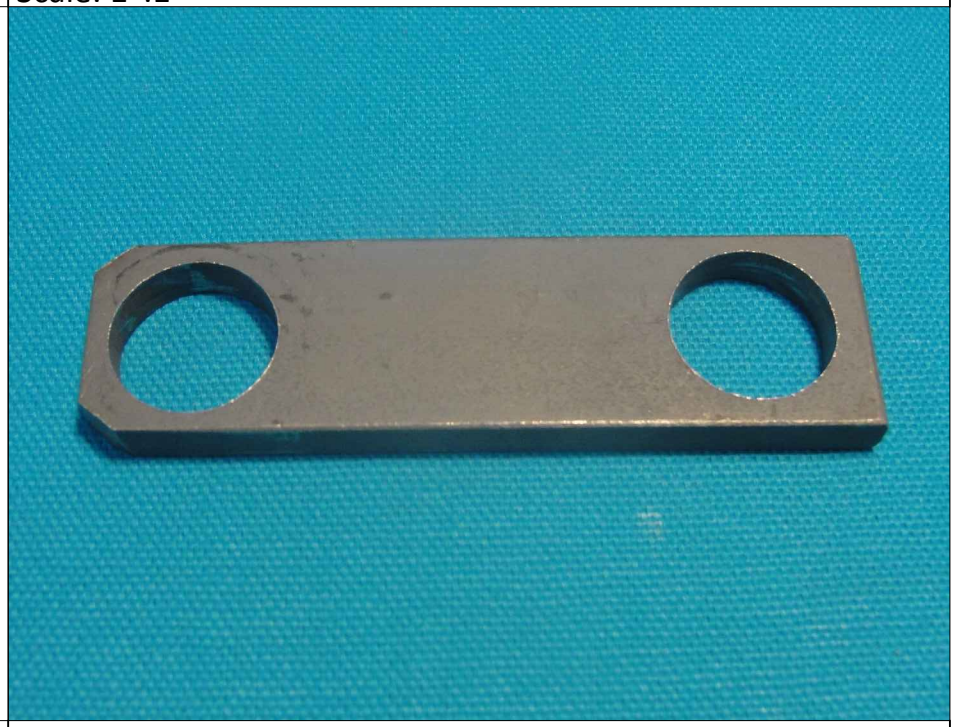

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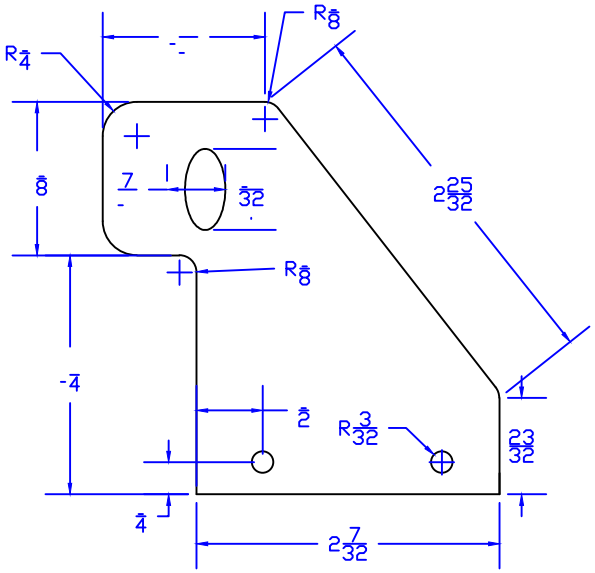

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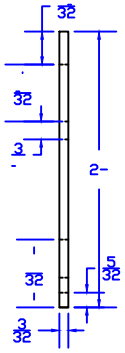

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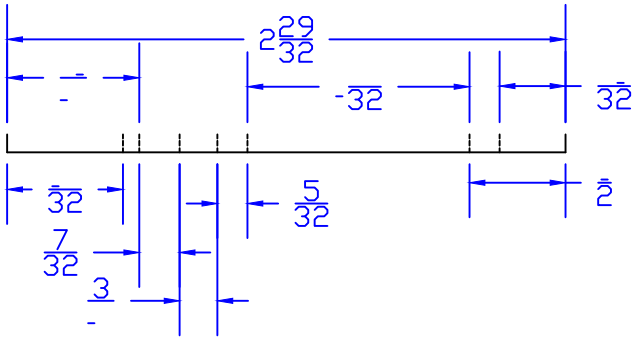

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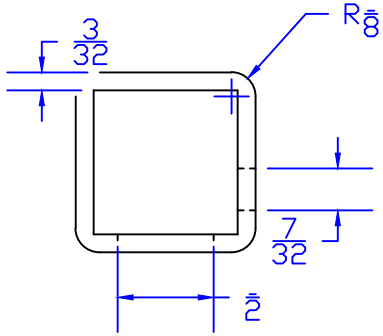

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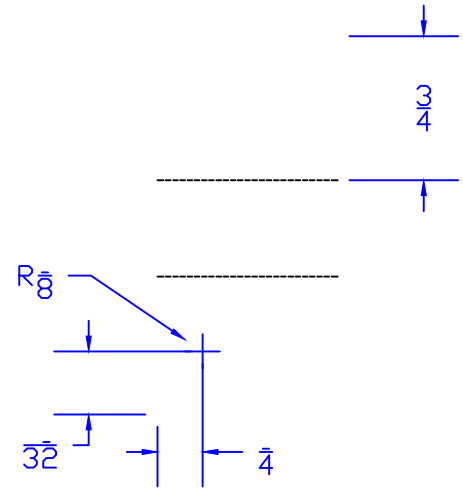

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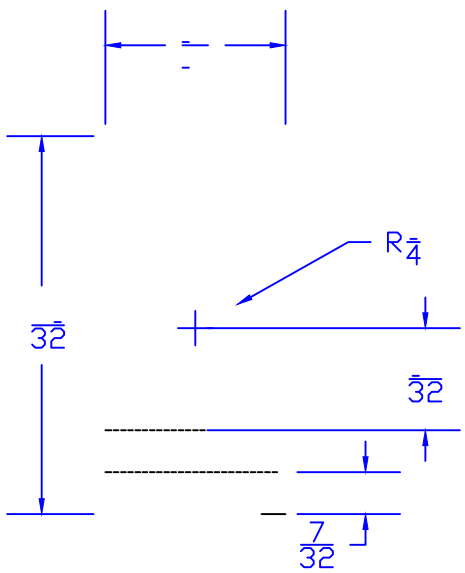

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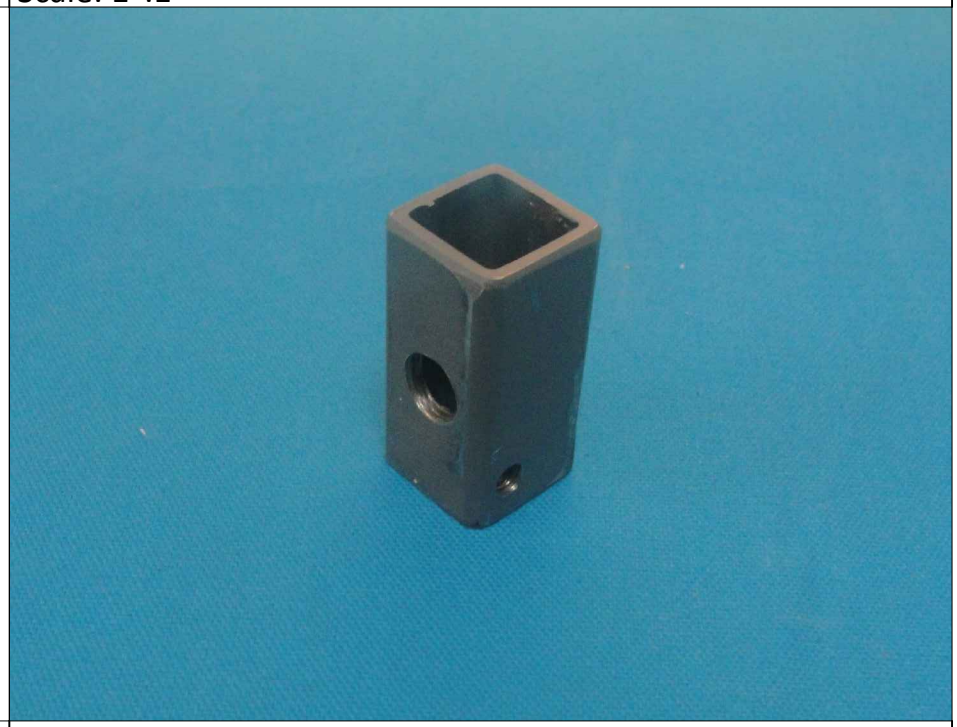

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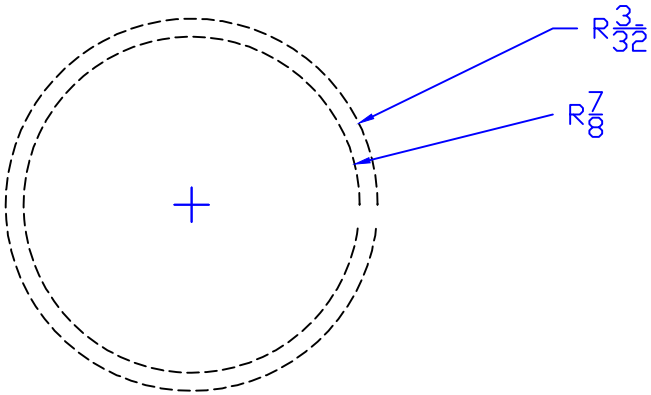

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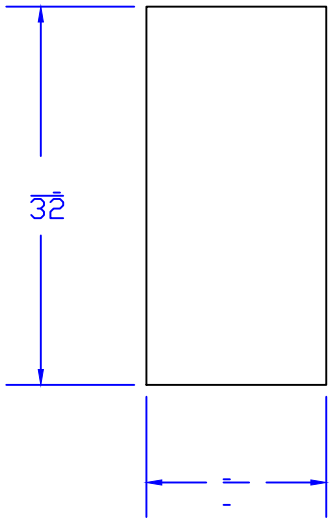

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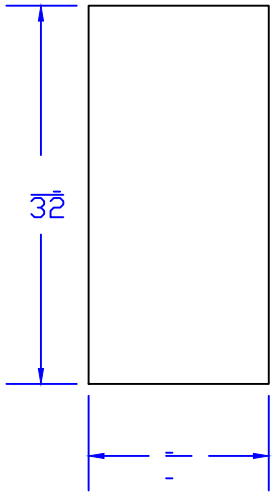

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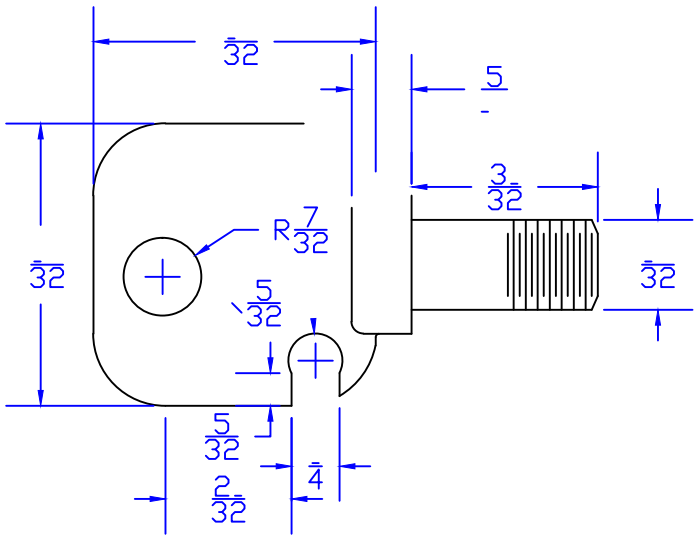

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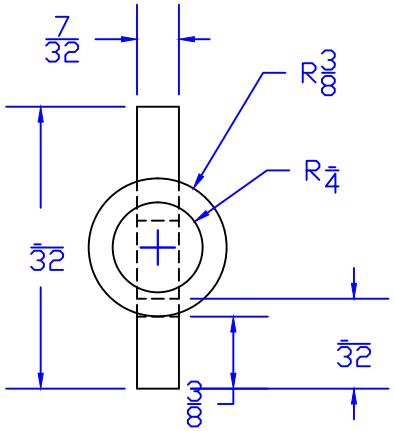

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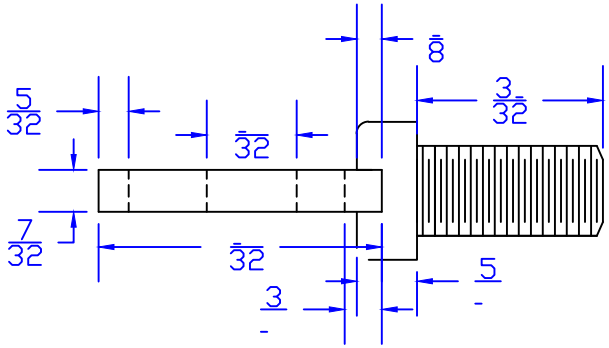

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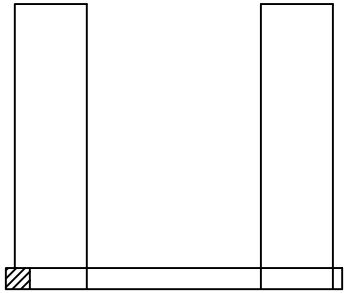

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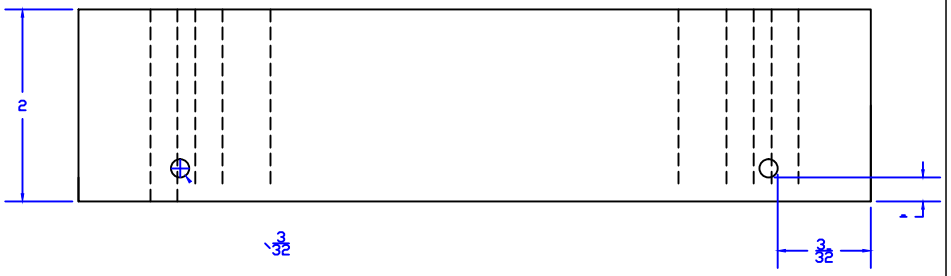

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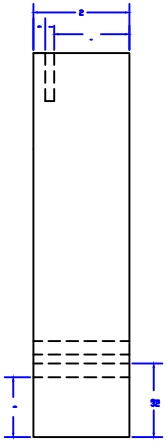

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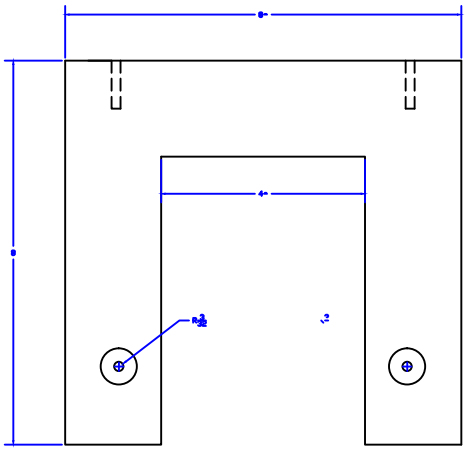

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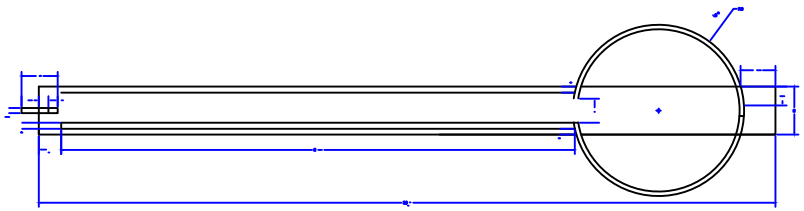

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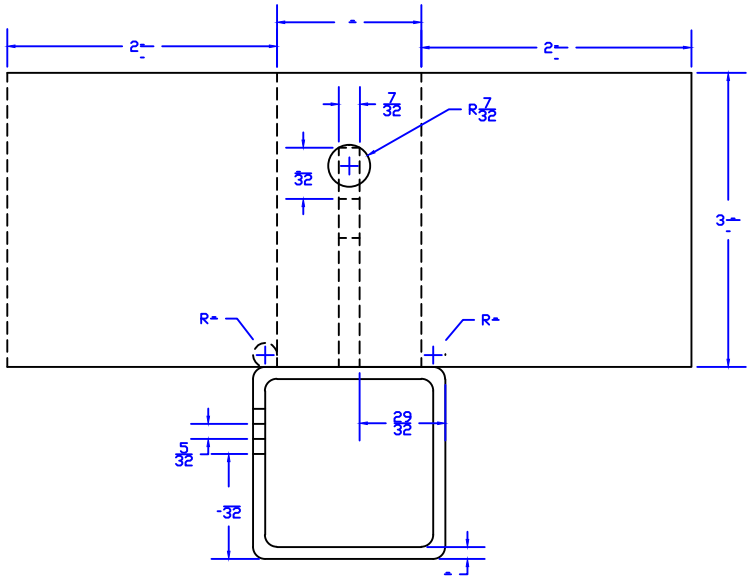

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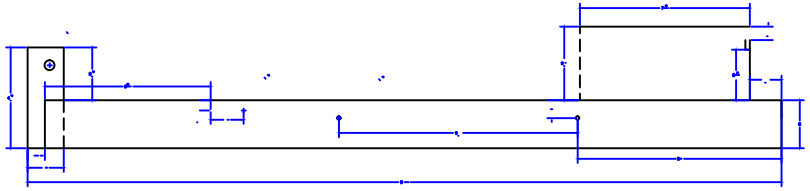

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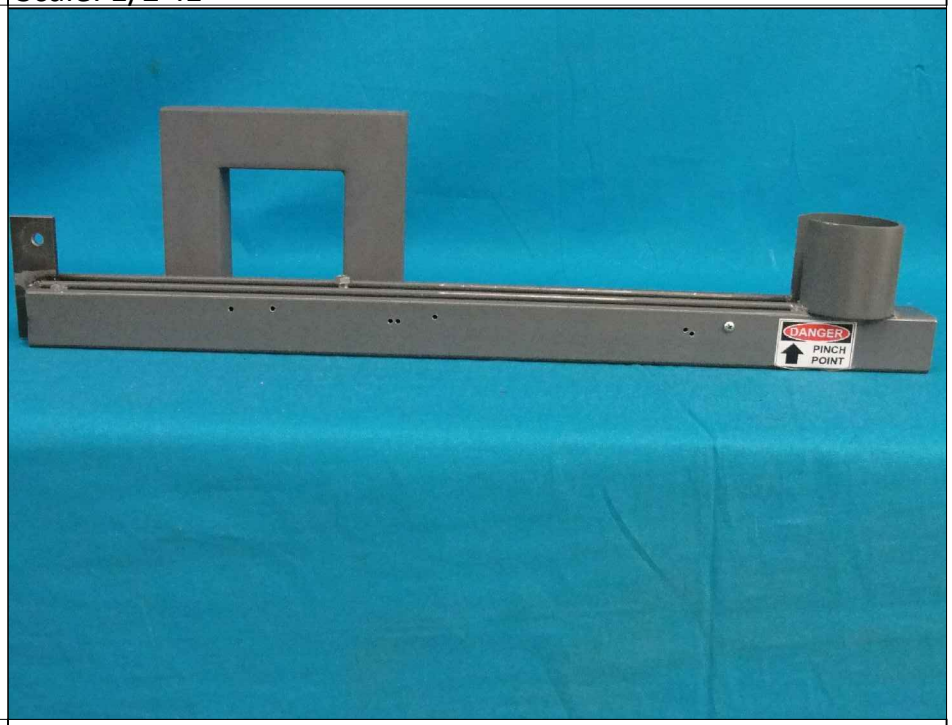

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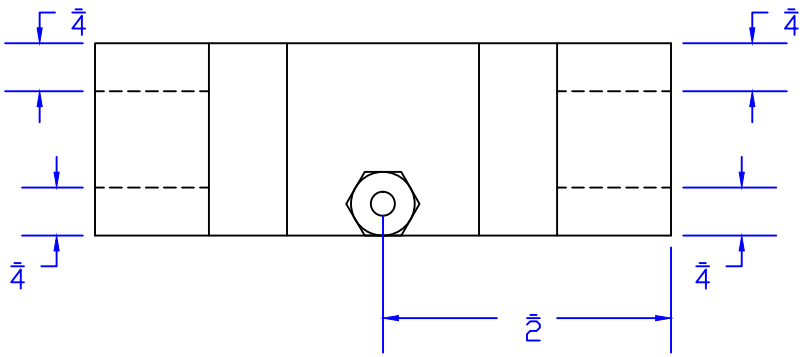

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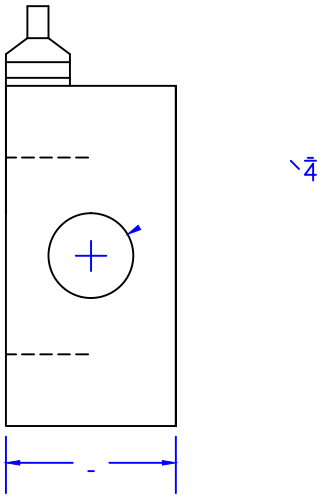

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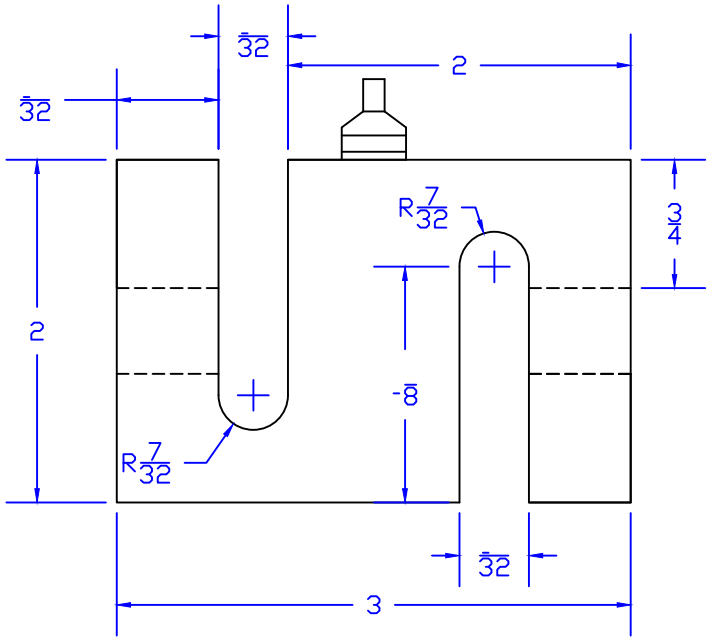

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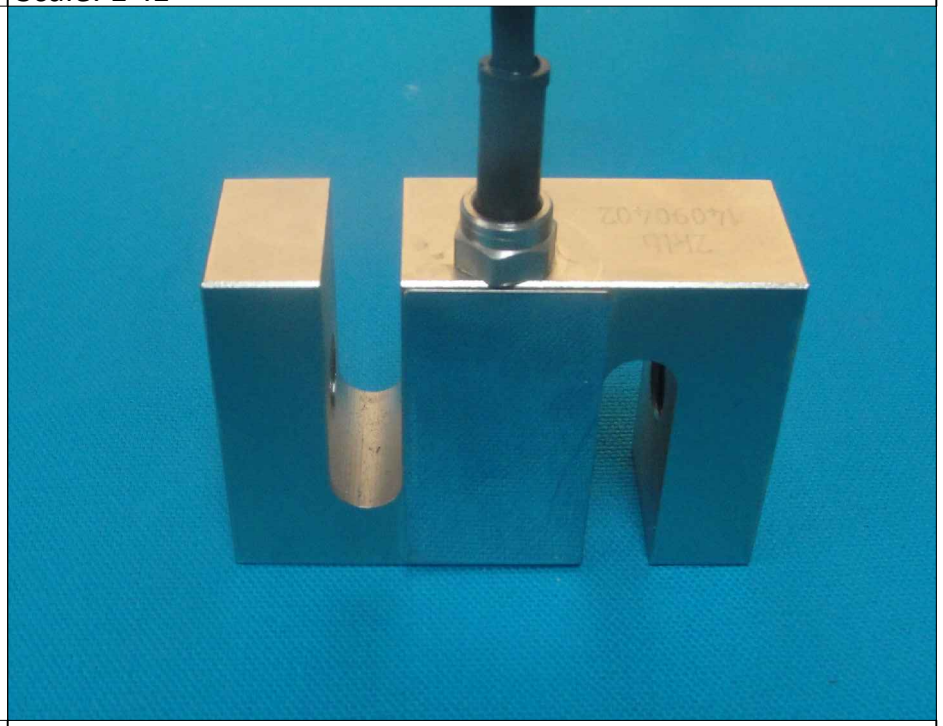

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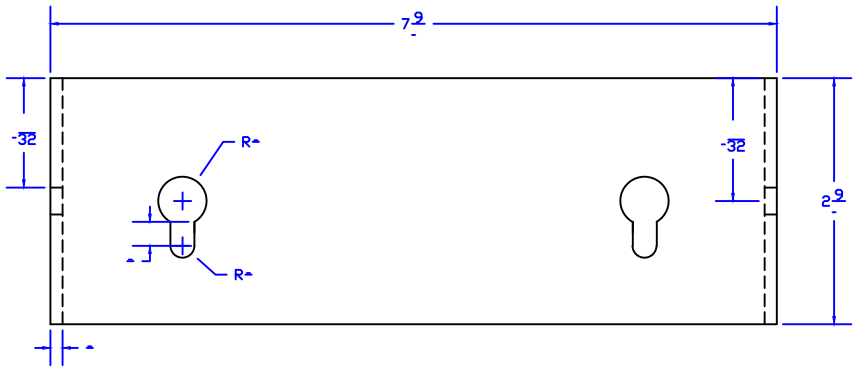

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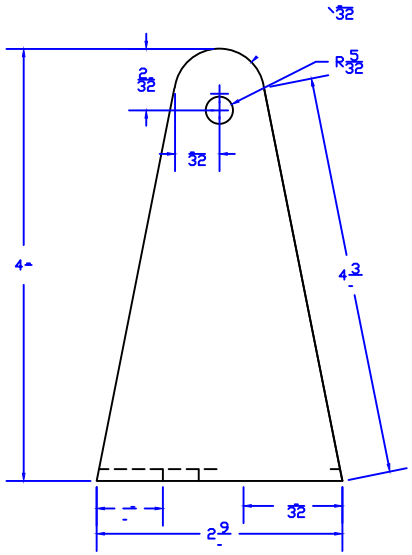

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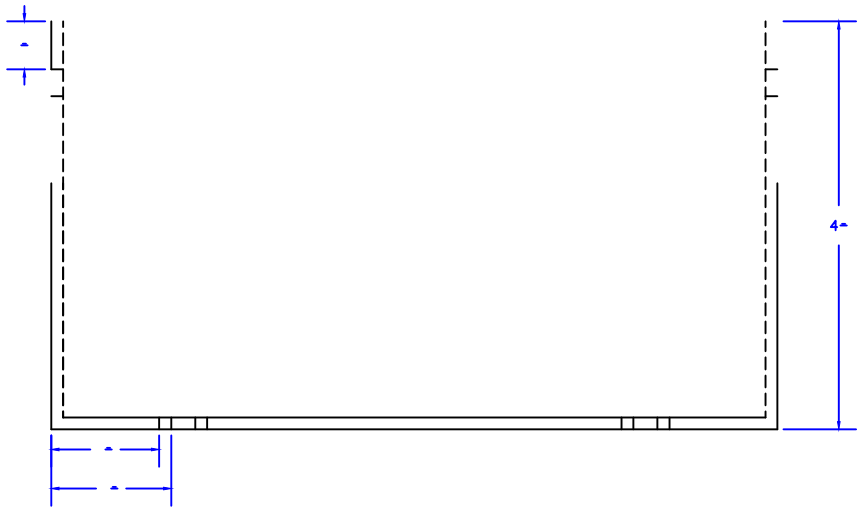

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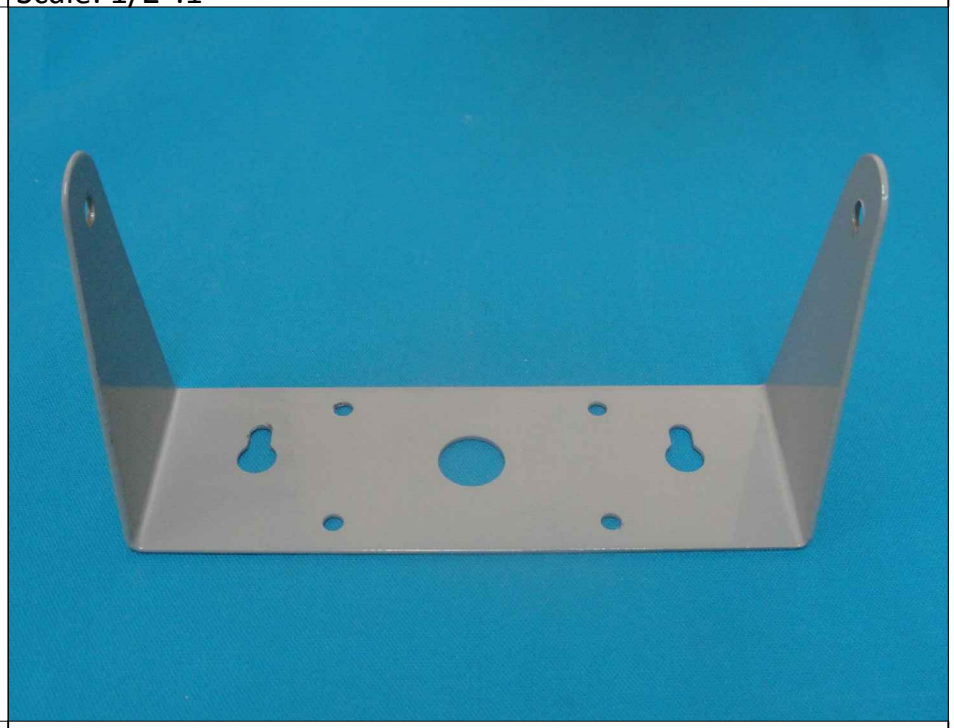

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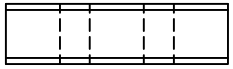

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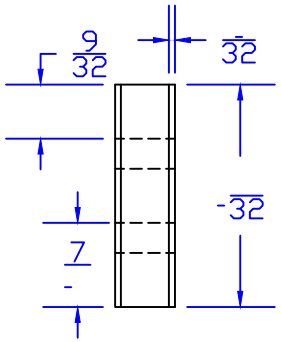

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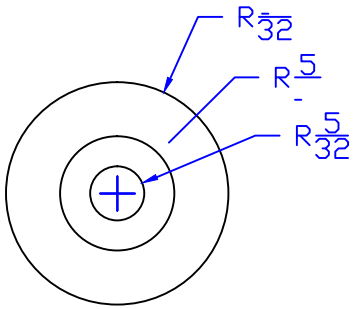

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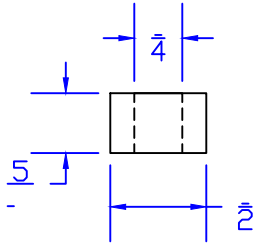

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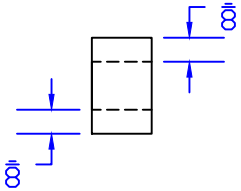

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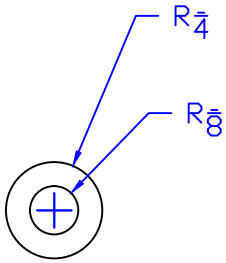

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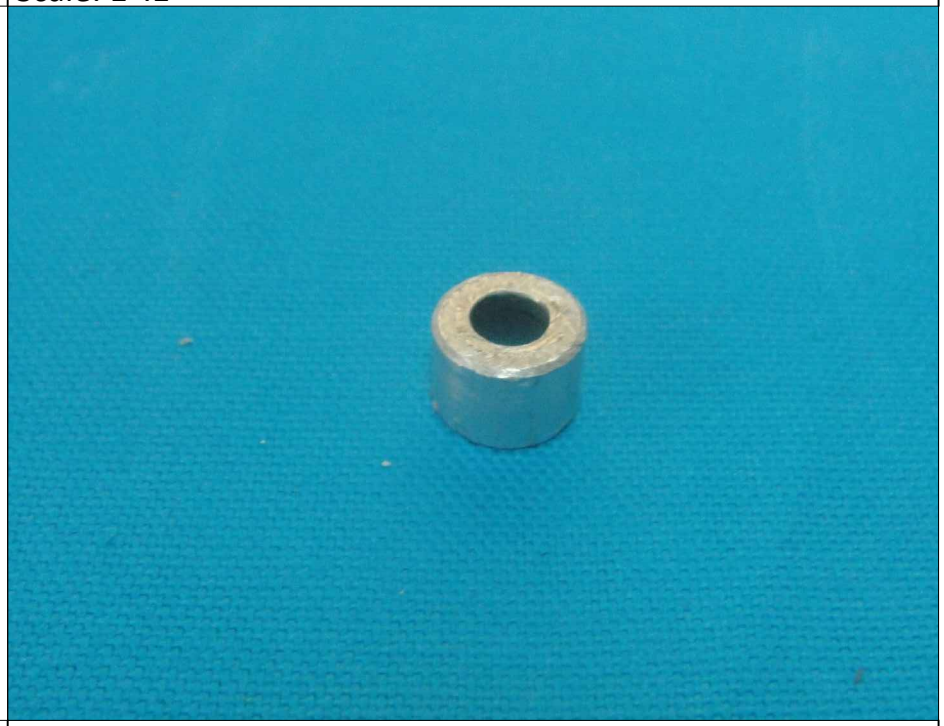

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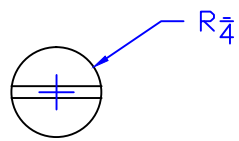

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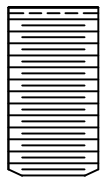

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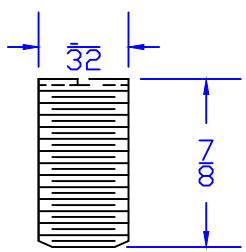

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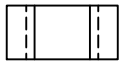

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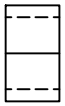

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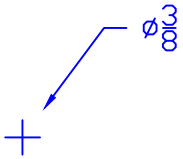

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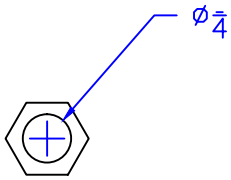

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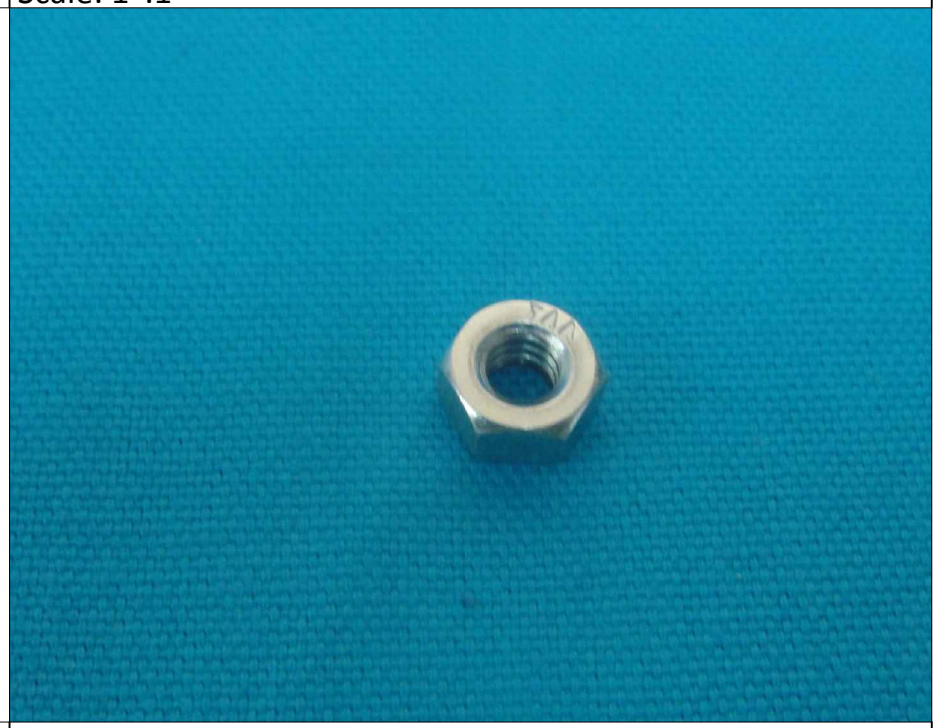

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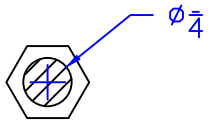

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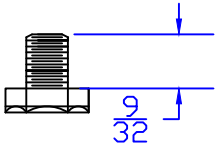

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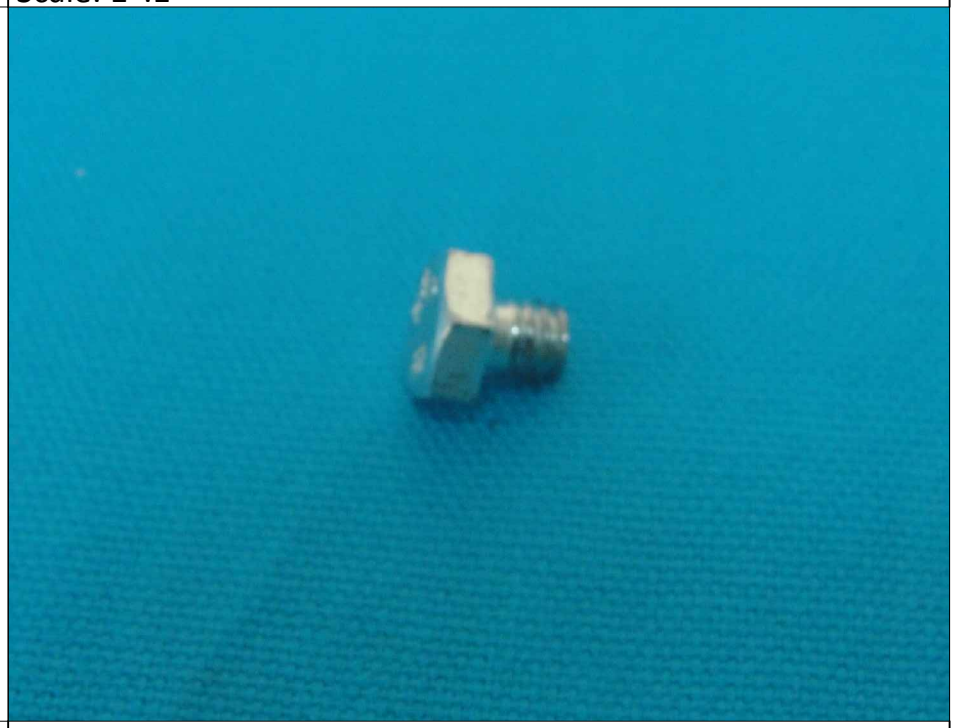

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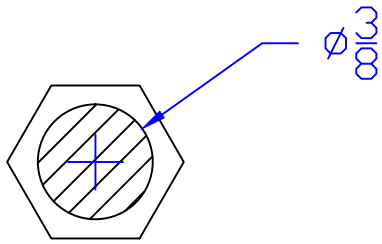

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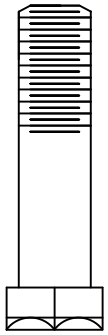

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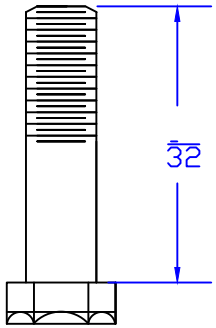

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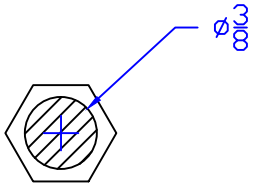

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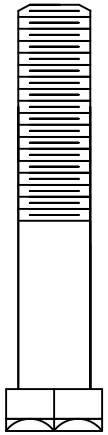

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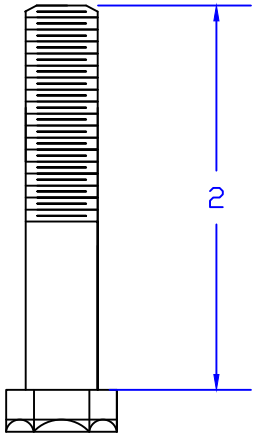

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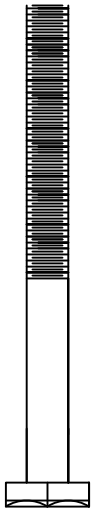

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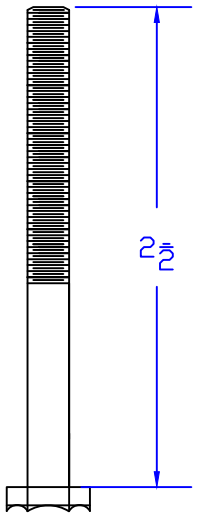

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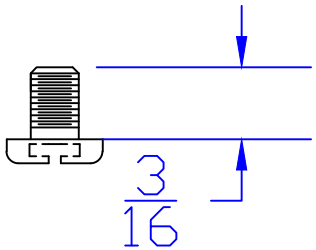

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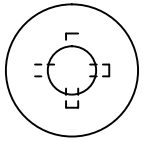

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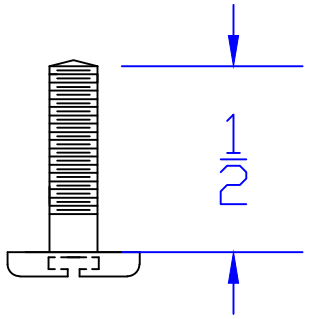

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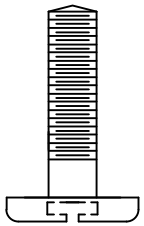

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4. Parts List

Purchased Parts				
	Description	Model		Note:
1	Linear Actuator with Motor	Firgelli FA-400-L-12-6 (or any with 6” Displacement& 400LBF min)	or equivalent	12 Vdc., 400lbF, 15.4cm travel, 2mm/sec travel speed
2	SPDT Switch	12 Vdc, 10A	Generic	Single pole double throw, (to reverse actuator direction)
3	Pushbutton switch	12 Vdc, 10A	Generic	Normally open, (to energies actuator)
4	Speed controller enclosure	Generic 4” X 5” X 2”	or equivalent	For speed controller, reversing switch and energizing button
5	Actuator speed controller & knob	Progressive Automations 12 Vdc	or equivalent	High torque, low heat generating
6	Load Cell	TD-112 (or any with 500Lb min.)	or equivalent	
7	Electronic Gage indicator	To match Load cell industrial commercial scales CCS-2K	or equivalent	Support as necessary
8	Digital Caliper	Mfg. Mitutoyo, 8”	or equivalent	Position on main support to measure actuator travel
9	Spacer	Material - Aluminum	2 each	
10	1/4" U grooved wheels	Material - Steel	or equivalent	Mount as required to support load cell
11	Bolt 1/4"-20 x2”	Material - Steel	1 each	To mount U grove wheels
12	Nut 1/4"-20	Material - Steel	1 each	To mount U grove wheels
13	Headless Bolt 3/8”-16 X 2"	Material - Steel	1 each	Linear actuator at load cell end
14	Actuator to Wheel Connector	Material - Steel	1 each	
15	Actuator Support	Material - Steel	1 each	1-3/4” width and 4-1/4” Length
16	Actuator to Caliper Connector	Material - Steel	1 each	
17	Motor integral with Actuator	See Item #1 above	1 each	
18	Tracking Rail Rods	Material - Steel	2 each	
19	U Shaped Puller	Material - Steel	1 each	
20	Vertical Post Cover - Square	Material - Steel	1 each	
21	Tapping Screw	Material - Steel	1 each	
22	Vertical Post Cover - Round	Material - Steel	1 each	
23	Top Mounting Plate	Material - Steel	1 each	
24	Strap Support	3-1/2" Dia. Round Steel Tubing 1/4" Wall; 3” Height	1 each	
25	Bolt 3/8”-16 X 2"	Material - Steel	1 each	Linear actuator at support end
26	Nut 3/8”-16	Material - Steel	4 each	
27	#6 X 1/4" Self Tapping screws	Material - Steel	2 each	To mount calipers
28	Machine Screw	Material - Steel	2 each	To connect the Part Item No.16 to Caliber
29	Bolt 3/8”-16 X 2-1/2"	Material - Steel	1 each	Linear actuator at support connecting to caliber
30	Nylon Washer 3/8”-16	Material - Steel	2 each	Linear actuator
31	Force Gauge Support		1 each	
32	Main Support		1 each	

About the Law Enforcement and Corrections Standards and Testing Program

The National Institute of Justice (NIJ) Standards and Testing Program is sponsored by the NIJ Office of Science and Technology within the U.S. Department of Justice, Office of Justice Programs. The program responds to provisions in the Homeland Security Act of 2002 that authorize the NIJ Office of Science and Technology to establish and maintain performance standards (in accordance with the National Technology Transfer and Advancement Act of 1995) for law enforcement technologies that may be used by federal, state and local law enforcement agencies, and to test and evaluate those technologies. The Homeland Security Act of 2002 also authorizes the NIJ Office of Science and Technology to establish and maintain a program to certify, validate and mark or otherwise recognize law enforcement technology products that conform to the standards mentioned above.

The NIJ Standards and Testing Program works to identify the needs of state and local criminal justice system practitioners for equipment standards and test protocols, develops voluntary performance standards for specific criminal justice tools and technologies, establishes conformity assessment requirements for demonstrating that commercially available equipment conforms to those standards, and publishes listings of product models that have been tested through one or more specified organizations and found to comply with the standards. The standards development process begins with the operational needs and requirements of practitioners in the field being defined, and, based on those needs, the standards are developed principally by a special technical committee led by criminal justice practitioners and including testing and conformity assessment experts, other technical experts, federal partners and members from practitioner stakeholder organizations. Manufacturers, vendors and other interested parties are provided with an opportunity to review and comment on draft standards prior to their publication.

As indicated above, all NIJ standards developed through the Standards and Testing Program are voluntary standards. There is no requirement or obligation for manufacturers, law enforcement agencies or others to follow or adopt these voluntary law enforcement technology equipment standards. The primary intent of these standards is to provide the end user of a model of equipment found to be compliant with a particular standard with performance information on key equipment characteristics, provide a level of confidence in that particular model's fitness for use in specified circumstances and allow comparison of product models based on standardized testing methods and performance requirements. These standards do not specify a particular solution but rather define what a potential solution must accomplish. The ultimate goal is to help ensure to the degree possible that law enforcement technology equipment is safe, reliable and effective.

Publications related to the Standards and Testing Program, including the voluntary standards and associated documents, are available at no charge through the National Law Enforcement and Corrections Technology Center-National (NLECTC-National) and also are available online at http://www.NIJ.gov/standards and http://www.justnet.org. To request a document or additional information, please call (800) 248-2742 or send an e-mail to asknlectc@justnet.org.

Users of NIJ standards are advised to check with http://www.NIJ.gov/standards on a regular basis to determine whether a particular law enforcement technology equipment standard has been revised or superseded, or the compliance status of a particular model has changed.

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