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OST-ENG-ATR-AIT-FRD-1.1



Transportation Security Administration

OFFICE OF SECURITY TECHNOLOGY

FUNCTIONAL REQUIREMENTS DOCUMENT FOR AN

ADVANCED IMAGING TECHNOLOGY SYSTEM WITH AUTOMATIC TARGET RECOGNITION FOR CHECKPOINT OPERATIONS

U.S. Department of Homeland Security
Transportation Security Administration
TSA Systems Integration Facility
1 West Post Office Road
Ronald Reagan Washington National Airport
Washington, DC 20001

~~BS 49 U.S.C.~~

Version 1.1

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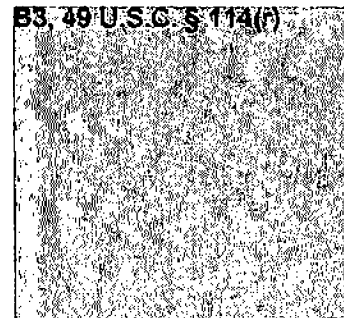
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REVISION HISTORY

Version	Description	Date
0.1	Initial Draft	B3, 49 U.S.C. § 114(f)
0.2	Additional requirements based on TSL CONOPS visit and working group input	
0.3	Additional requirements based on working group input	
0.4	Additional requirements based on working group input	
0.5	Revised requirements based on updates to the classified detection appendix	
0.6	Updates based on document review	
0.7	Updates based on TSL review and comments	
0.8	Updates based on TSL review and comments	
0.8.1	Updates based on document review	
1.0	Initial Release	
1.1	Updates based on stakeholder review and comments	

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~~B3, 49 U.S.C. § 114(r)~~



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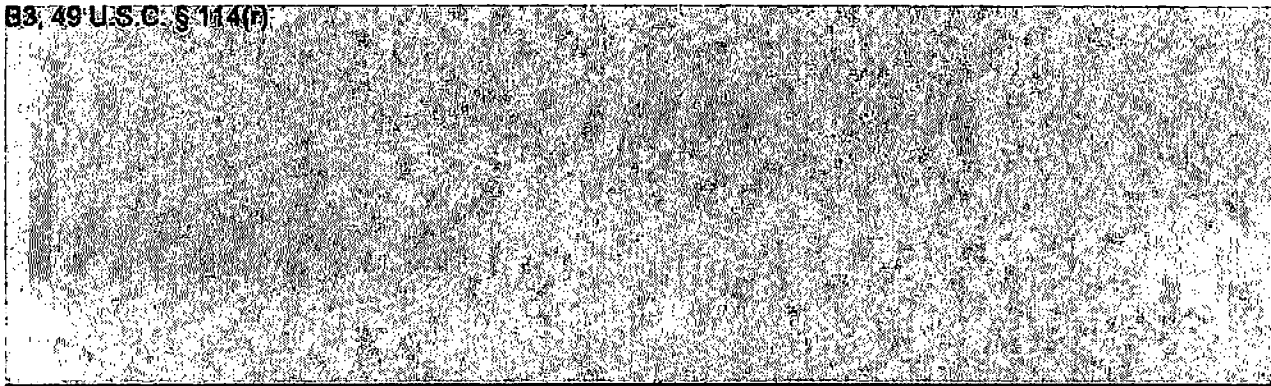
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1.0 INTRODUCTION

1.1 Background

The Department of Homeland Security (DHS) Transportation Security Administration (TSA) has a need for an Advanced Imaging Technology (AIT) system with Automatic Target Recognition (ATR) capabilities that eliminate the need for an Image Operator (IO) station. The system specified in this document is intended to satisfy this need by identifying the requirements existing AIT units, that have already satisfied the requirements of the AIT Procurement Specification, must meet.

1.2 Scope

This Functional Requirements Document (FRD) establishes the additional performance, design, manufacturing, and verification requirements for an AIT system with ATR capabilities to detect

B3, 49 U.S.C. § 114(r)

1.3 System Description

An AIT system with ATR capabilities is a passenger screening technology which uses imaging technology to detect anomalies on a passenger's body or within their clothing. The mission of ATR is for the AIT system

B3, 49 U.S.C. § 114(r)

B3, 49 U.S.C. § 114(r)

Requirements are denoted by the use of a bold italic "*shall*."

This FRD establishes the additional technical requirements for an AIT with ATR. An AIT system is a walk-through sensor that is used at transportation security checkpoints

B3, 49 U.S.C. § 114(r)

Prior to being scanned by the AIT system, passengers will have been requested to fully divest all articles in their possession.

1.4 Definitions

The following terms were used in this document.

Term	Definition
AIT System	The combined performance of the AIT system, including the operator in the loop.
Anomaly	Any undivested objects including

B3, 49 U.S.C. § 114(r)

B3, 49 U.S.C. § 114(r)

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Term	Definition
B3, 49 U.S.C. § 114(r)	
Man-in-the-loop	Method of detection that relies on the Transportation Security Officer to render a decision as opposed to software based algorithm detection.
<i>Shall</i>	Bold italic "shalls" are requirements that the vendors' submitted AIT systems must meet. B3, 49 U.S.C. § 114(r)
Screening Operator (SO)	The Transportation Security Officer responsible for scanning and reviewing the passenger's avatar image during the AIT screening process.
Transportation Security Officer (TSO)	Formerly known as Screeners or Operators, TSOs are TSA personnel who operate the airport security checkpoint and conduct security screening of all persons and objects entering a secure area.

B3, 49 U.S.C. § 114(r)

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2.0 APPLICABLE DOCUMENTS

2.1 General

The documents listed in this section are referenced in this specification. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all requirements of this specification, whether or not the applicable references are listed. The following specifications, standards, handbooks, documents, and drawings of the exact revisions listed below form a part of this specification to the extent noted herein; if a revision is not shown, then the version in effect at the time of contract award shall govern.

2.2 Government Documents

Reference	Title
B3, 49 U.S.C. § 114(n)	
AIT Procurement Specification	<i>PROCUREMENT SPECIFICATION FOR ADVANCED IMAGING TECHNOLOGY (AIT) FOR CHECKPOINT OPERATIONS, Version 2.11.</i>
49 Code of Federal Regulations (CFR), Part CFR 1544.403	<i>TSA: Airport Operator Security: Air Carriers and Commercial Operators: Current Screeners, October 1, 2006.</i>
49 CFR, Part 1544.405	<i>TSA: Airport Operator Security: Air Carriers and Commercial Operators: New Screeners: Qualifications of New Screening Personnel, October 1, 2006.</i>

2.3 Non-Government Documents

There are no non-government documents associated with this FRD.

2.4 Order of Precedence

In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes national and state laws and regulations unless a specific exemption has been obtained.

3.0 REQUIREMENTS

3.1 System

3.1.1 Detection/Imaging

3.1.1.1 System Detection

The Concept of Operations for an AIT system with ATR functionality will remove the IO review from the screening scenario. The AIT with ATR will scan a passenger, analyze the image data obtained from the scan for potential threats, and present possible threat locations on a representative human figure. The AIT with ATR functionality will perform the scanning of passengers divested according to the current TSA divestiture rules, ~~B3, 49 U.S.C. § 114(r)~~

~~B3, 49 U.S.C. § 114(r)~~ The AIT system with ATR functionality *shall* (1) be ~~B3, 49 U.S.C. § 114(r)~~

~~B3, 49 U.S.C. § 114(r)~~ The AIT system with ATR functionality *shall* (2) not require the Screening Operator ~~B3, 49 U.S.C. § 114(r)~~

The AIT system with ATR functionality *shall* (3) meet the Probability of Detection (P_d) as defined in ~~B3, 49 U.S.C. § 114(r)~~
~~B3, 49 U.S.C. § 114(r)~~

~~B3, 49 U.S.C. § 114(r)~~

The AIT system with ATR functionality *shall* (4) detect the presence of the ~~B3, 49 U.S.C. § 114(r)~~
~~B3, 49 U.S.C. § 114(r)~~

~~B3, 49 U.S.C. § 114(r)~~

The AIT system with ATR functionality *shall* (5) detect the presence of ~~B3, 49 U.S.C. § 114(r)~~
~~B3, 49 U.S.C. § 114(r)~~

~~B3, 49 U.S.C. § 114(r)~~

The AIT system with ATR functionality *shall* (6) detect the presence of ~~B3, 49 U.S.C. § 114(r)~~
~~B3, 49 U.S.C. § 114(r)~~

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B3, 49 U.S.C. § 114(r)

The false alarm rate (P_{fa}) for an AIT system with ATR functionality *shall* (9) be in accordance with the value defined in B3, 49 U.S.C. § 114(r)

B3, 49 U.S.C. § 114(r)

3.1.1.1.6 Representative Human Figure

The AIT system with ATR functionality *shall* (10) provide at least the two (2) gray-scale representative human figure images shown in Figure 1. This is in order to present scanning results to the screening operator, one of the "front view" and one of the "back view." The representative human figure image *shall* (11) B3, 49 U.S.C. § 114(r)

B3, 49 U.S.C. § 114(r)

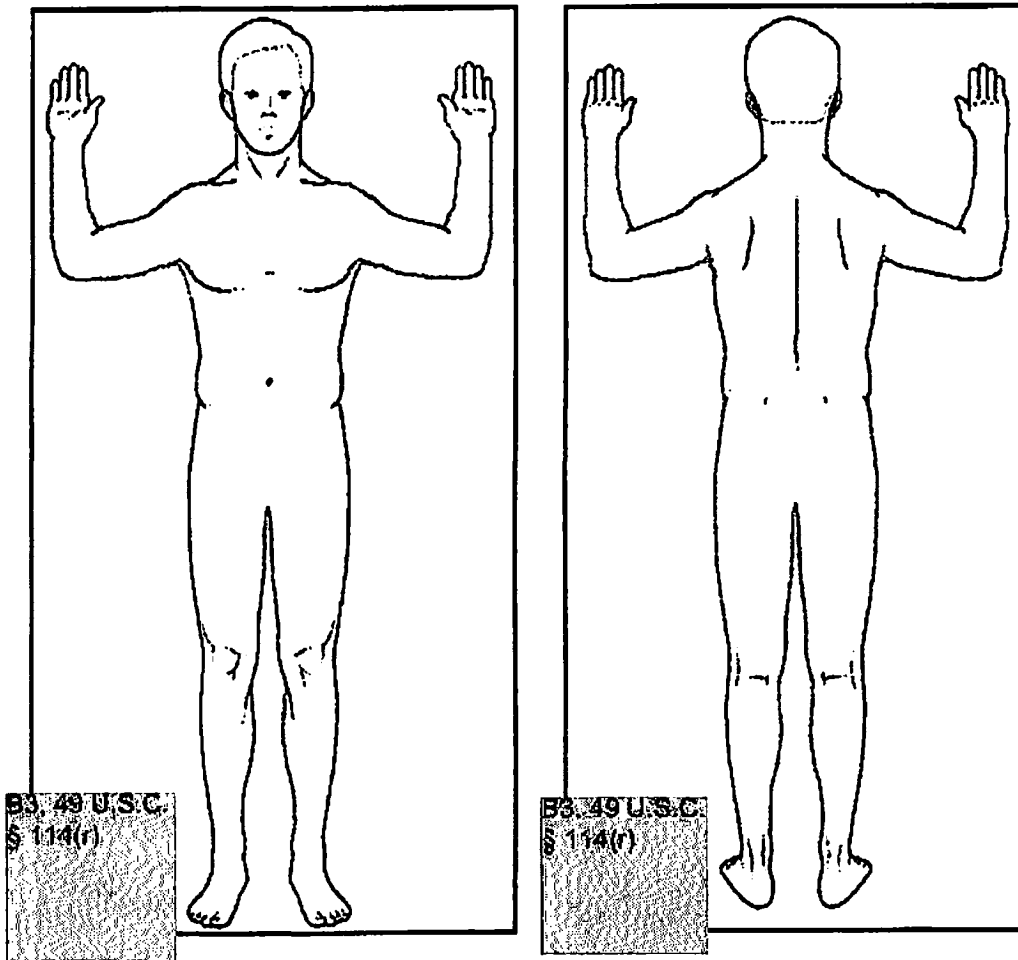


Figure 1: Representative Human Figure

B3, 49 U.S.C. § 114(r)

3.1.1.1.7 Visual Indicators

When an anomaly is detected, the AIT system with ATR functionality *shall* (14) indicate the location of the anomalies with an anomaly location indicator on the representative human figure

B3, 49 U.S.C. § 114(r)

The anomaly location indicator *shall* (15) be at least one yellow filled box with a red border on the representative human figure in the area where each anomaly is located.

B3, 49 U.S.C. § 114(r)

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(b)(3), 49 USC 114(r)

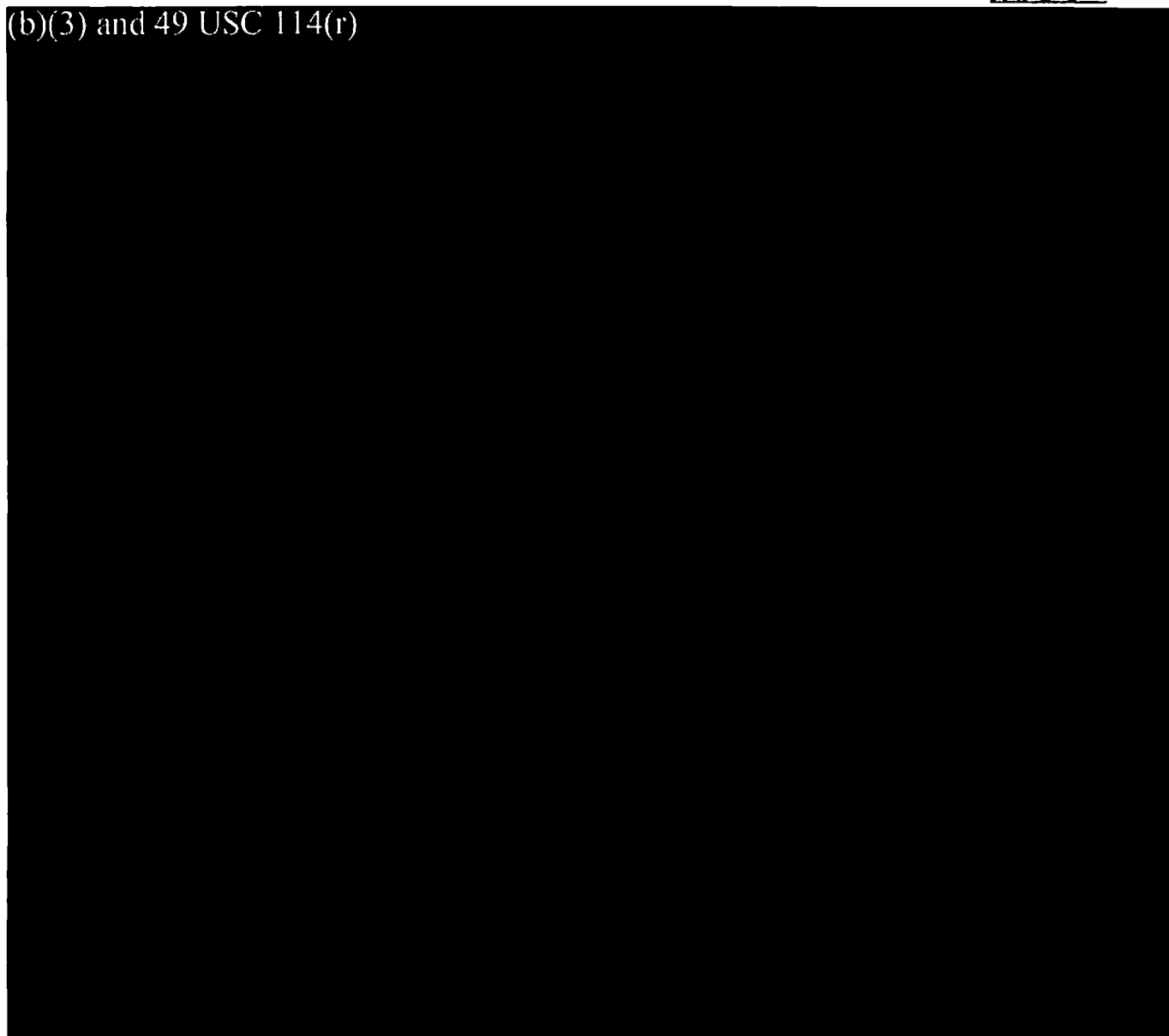
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(b)(3) and 49 USC 114(r)



B3, 49 U.S.C. § 114(r)



B3, 49 U.S.C. § 114(r)



3.1.1.3 System Operator Station Display Monitor

The SO Station *shall* (21) include one or more flat panel color displays for viewing the representative human figure images. The display monitors *shall* (22) be of sufficient size to display the full representative human figure images, defined above in section 3.1.1.1.6,

(b)(3), 49 USC 114(r)

The SO Station *shall* (79) provide a means to clear the scan results from the representative human figure images by pressing a clear button at the SO Station.

B3, 49 U.S.C. § 114(r)



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[Place Holder for removed *shall* (26)]

[Place Holder for removed *shall* (27)]

[Place Holder for removed *shall* (28)]

~~B3, 49 U.S.C. § 114(r)~~



3.1.1.5 System Status Visual and Audible Indicators

The AIT system with ATR functionality *shall* (35) display on the SO monitor, at a minimum, the following:

~~B3, 49 U.S.C. § 114(r)~~



e. Passenger count.

The passenger count *shall* (36) be displayed continuously and clearly while the system is powered on and/or idle. The Passenger Count display *shall* (37) have at least six (6) digits in order to provide a count from 0 to 999999.

The AIT system with ATR functionality *shall* (38) include a means to reset the transit (e.g., passenger, ~~B3, 49~~ counts defined above ~~B3, 49 U.S.C. § 114(r)~~ ~~B3, 49 U.S.C. § 114(r)~~ as defined in Appendix C.

(b)(3), 49 USC 114(r)

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(b)(3), 49 USC 114(r)

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(b)(3), 49 USC 114(r)



4.0 VERIFICATION

To verify production units comply with the requirements in this Procurement Specification, acceptance testing will be performed. Acceptance testing includes three separate test events: First Article Test & Evaluation (FAT&E), Factory Acceptance Test (FAT), and Site Acceptance Test (SAT). Unless otherwise specified within this document, verification within these test events will be accomplished through inspection, test, demonstration, and analysis on an AIT system that is representative of the approved production design that has been placed under configuration control. The OEM is required to provide the necessary support to the Government during FAT&E, FAT and SAT.

4.1 Test and Evaluation

Use of the test and evaluation process will assure that an AIT system has met the requirements of the AIT Procurement Specification, associated interface requirements and control documents, and algorithm description. Requirements verification will be performed in accordance with the Contract Statement of Work (SOW) and this Procurement Specification. All testing will be conducted according to Government-approved test plans, test cases, and test procedures and will be witnessed by an authorized Government representative.

4.1.1 Acceptance Testing

Acceptance testing includes three separate test events: First Article Test & Evaluation (FAT&E), Factory Acceptance Test (FAT), and Site Acceptance Test (SAT). These tests focus on technical conformance.

Configuration Description

Production systems intended for deployment are used in acceptance testing.

Test and Evaluation Objective

AIT system requirements are simply re-verified during acceptance testing, with the goal of ensuring that the systems being delivered by the OEM for deployment meet the same level of performance as systems qualified through DT&E and OT&E.

4.1.1.1 First Article Test and Evaluation

A First Article Test and Evaluation (FAT&E) is performed, as directed by the Government, on the first production model. Hardware components, supporting modules, and functional and performance specifications are verified by a Contractor either by witnessing test conduct or reviewing data from in-house testing at the OEM factory site. A baseline Functional Configuration Audit and Physical Configuration Audit is performed by the TSA Configuration Management group to establish configuration control of the unit under test.

4.1.1.2 Factory Acceptance Test

The Contractor will conduct a Factory Acceptance Test (FAT) at the factory on each system prior to delivery. FAT will verify that each system is manufactured to the Government-approved product baseline, that each system complies with technical contract requirements, and that no

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defects from the manufacturing process exist. FAT generally will test a subset of the requirements tested during FAT&E.

4.1.1.3 Site Acceptance Test

The Contractor will conduct a Site Acceptance Test (SAT) at the site on each system prior to its placement into operation. SAT is performed on all AIT systems once they are installed at their final airport locations to verify that the system is properly installed and configured, and that no defects remain from the transportation and installation processes. SAT follows the same test process used during FAT.

4.1.2 Continuous Assessment

The Government will perform continuous assessment of fielded AIT systems to verify operational effectiveness, suitability, reliability, and availability of the equipment. Continuous assessment will include collection of data from fielded AIT systems for the purpose of assessing field performance over time.

4.2 Verification Methods

All AIT development will undergo test and evaluation to verify that the AIT meets system specification requirements. The verification methods (analysis, demonstration, inspection, and test) described below are mandatory for AIT requirements verification. These sections define the type of verification utilized in the Verification Requirements Traceability Matrix (VRTM).

4.2.1 Analysis

4.2.1.1 Hardware

Hardware analysis will encompass any or all of the following:

B3, 49 U.S.C. § 114(r)



- (b) Similarity analysis is a method applied to end-items or components that are identical in design and manufacturing processes to end-items or components that have previously been qualified to equivalent or more stringent requirements. This method can be applied to Commercial Off-The-Shelf/non-developmental item (COTS/NDI) equipment for the same manufacturer's models, based on the manufacturer's engineering specifications. For COTS/NDI equipment, the use of manufacturer's published materials that contain test conformance information relating to materials construction.

B3, 49 U.S.C. § 114(r)

B3, 49 U.S.C. § 114(r)

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- (c) Validation of records analysis is a method of verification wherein manufacturing records are used to verify the compliance of concealed construction features or processes of manufacturing (e.g., Contractor items). This method will be applied to COTS equipment for the same manufacturer's models based upon the manufacturer's engineering specifications.

4.2.1.2 Software

Software analysis will encompass the processing of accumulated results and conclusions to provide proof that the verification of requirements has been accomplished. The analytical results may be composed of interpretation of existing information or derived from lower level tests, demonstrations, analyses, or examinations.

4.2.2 Demonstration

The demonstration method of verification is used to indicate a general "pass/fail" condition.

4.2.2.1 Hardware

Hardware demonstration will determine, by observation, the qualitative characteristics of end-item or component properties. Demonstration will require no special test equipment or instruction to verify characteristics such as operational performance, human engineering features, service, access features, and transportability.

4.2.2.2 Software

Software demonstration will determine compliance with requirements (e.g., the proper response at a site as a result of a specified interrogation or command to be processed by the program) through observation of functional operation. Demonstration will be used primarily for activities where data gathering is not appropriate, such as display image verification.

4.2.3 Inspection

4.2.3.1 Hardware

Inspection of hardware will comprise verifying physical characteristics to determine compliance with requirements without the use of special laboratory equipment, procedures, items, or services. Inspection will verify workmanship, physical condition, construction features, and document or drawing compliance. For COTS/NDI hardware, use of manufacturer's published materials that contain test conformance information such as commercial reliability test data, safety regulations, or other Government standards and licensing, as applicable, are acceptable.

4.2.3.2 Software

Inspection will consist of an examination that comprises review of software source and object listings to verify compliance with software documentation, technical requirements, coding standards, and verification of the implementation of required algorithms.

4.2.4 Test

4.2.4.1 Hardware

Hardware testing will verify hardware performance during or after the controlled application of functional ~~B3, 49 U.S.C. § 114(f)~~. The test equipment required for verification will be calibrated and kept in proper working condition. Any test hardware or software used will be documented, validated, and kept under configuration control.

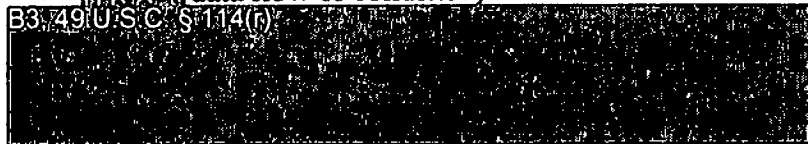
4.2.4.2 Software

Software testing will employ technical means, including evaluation of functional operation by use of special equipment or instrumentation, software and/or simulation techniques, to determine compliance of the system with requirements. Data derived from software testing will be reduced for analysis of software and system performance under the test specified. Test equipment required for verification will be calibrated and in proper working condition. Any test hardware or software will be documented, validated, and under configuration control.

4.3 Verification Requirements Traceability Matrix

The Verification Requirements Traceability Matrix (VRTM) shown in Table I is a subset of the full VRTM used for testing. The VRTM defines the verification method to be used to validate each AIT specification requirement. Table I indicates the verification method for FAT, FAT&E and SAT in order to validate production units comply with each specification requirement. Formal verification tests will encompass the following range of conditions, when applicable:

- ~~B3, 49 U.S.C. § 114(f)~~ data flow or condition,



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Table 1: Verification Requirements Traceability Matrix

Req. #	Paragraph Number	Paragraph Title	FAT&E	FAT	SAT	Remarks
1	3.1.1.1	B3, 49 U.S.C. § 114(f)				
2	3.1.1.1					
3	3.1.1.1					
4	3.1.1.1.1					
5	3.1.1.1.2					
6	3.1.1.1.3					
7	3.1.1.1.4					
8	3.1.1.1.4					
9	3.1.1.1.5					
10	3.1.1.1.6					
11	3.1.1.1.6					
12	3.1.1.1.6					
13	3.1.1.1.6					
14	3.1.1.1.7					

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Req. #	Paragraph Number	Paragraph Title	FAT&E	FAT	SAT	Remarks
15	3.1.1.1.7	B3, 49 U.S.C. § 114 (c)				
16	3.1.1.1.7					
17	3.1.1.1.7					
18	3.1.1.1.7					
19	3.1.1.1.7					
20	3.1.1.2.1					
77	3.1.1.2.1					
78	3.1.1.2.2					
21	3.1.1.3					
22	3.1.1.3					
79	3.1.1.3					
23	3.1.1.3.1					
80	3.1.1.3.1					
24	3.1.1.3.2					
25	3.1.1.3.2					
26	3.1.1.3.2					
27	3.1.1.3.2					
28	3.1.1.3.2					
29	3.1.1.4					

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Req. #	Paragraph Number	Paragraph Title	FAT&E	FAT	SAT	Remarks
30	3.1.1.4	§ 3.49 U.S.C. § 114(c)				
31	3.1.1.4					
32	3.1.1.4					
33	3.1.1.4					
34	3.1.1.4					
35	3.1.1.5					
36	3.1.1.5					
37	3.1.1.5					
38	3.1.1.5					
39	3.1.1.6					
40	3.1.1.6					

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Req. #	Paragraph Number	Paragraph Title	FAT&E	FAT	SAT	Remarks
		83, 49 U.S.C. § 1124				
41	3.1.1.6					
42	3.1.1.6					
43	3.1.1.6					
44	3.1.1.6					
45	3.1.1.6					
46	3.1.1.7					
47	3.1.1.7					
48	3.1.1.7					
49	3.1.1.7					

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Req. #	Paragraph Number	Paragraph Title	FAT&E	FAT	SAT	Remarks
50	3.1.1.7	B3, 49 U.S.C. § 114(f)				
51	3.1.1.7					
52	3.1.1.7					
53	3.1.1.7					
Appendix C						
54	N/A	B3, 49 U.S.C. § 114(f)				
Appendix D						
55	D.1	B3, 49 U.S.C. § 114(f)				
56	D.1					
57	D.1					
58	D.1					
59	D.2					
60	D.2					
61	D.2					

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Req. #	Paragraph Number	Paragraph Title	FAT&E	FAT	SAT	Remarks
		B3, 49 U.S.C. § 114(e)				
62	D.2					
63	D.2					
64	D.2					
65	D.2					
66	D.2					
67	D.2					
68	D.3					
69	D.3					
70	D.3					
71	D.3					
72	D.3					
73	D.3					

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B3, 49
U.S.C.

Req. #	Paragraph Number	Paragraph Title	FAT&E	FAT	SAT	Remarks
74	D.3	B3, 49 U.S.C. § 114(n)				
75	D.3					
76	D.3					

LEGEND 1

Verification Methods	Remarks
B3, 49 U.S.C. § 114(n)	See paragraph 4.2.1
	See paragraph 4.2.2
	See paragraph 4.2.3
	See paragraph 4.2.4

LEGEND 2

Certifications/Qualifications
B3, 49 U.S.C. § 114(n)

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APPENDIX A: ACRONYMS, TERMS, DEFINITIONS, AND ABBREVIATIONS

The following acronyms, terms, definitions, and abbreviations were used in creating this document.

Acronym or Abbreviation	Term or Definition
AIT	Advanced Imaging Technology
ATR	Automatic Target Recognition
CFR	Code of Federal Regulations
COTS	Commercial off-the-Shelf
dB	Decibel
DHS	Department of Homeland Security
DT&E	Developmental Test and Evaluation
FAT	Factory Acceptance Test
FAT&E	First Article Test and Evaluation
FDRS	Field Data Reporting System
FRD	Functional Requirements Document
GED	General Educational Development
IO	Image Operator
NDI	Non-Developmental Item
OT&E	Operational Test and Evaluation
P _d	Probability of Detection
P _{fa}	False Alarm Rate
SAT	Site Acceptance Test
SO	Screening Operator

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Acronym or Abbreviation	Term or Definition
SOW	Statement of Work
T&E	Test and Evaluation
TSA	Transportation Security Administration
TSO	Transportation Security Officer
UL	Underwriters Laboratory
B3, 49 U.S.C. § 114(f)	
VRTM	Verification Requirements Traceability Matrix

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~~B3, 49~~

B3, 49 U.S.C. § 114(r)



B-1

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B3, 49 U.S.C. § 114(r)



B-2

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B3 49
U.S.C.

B3 49 U.S.C. § 114(r)



B-3

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(b)(3), 49 USC 114(r)



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89 49

(b)(3), 49 USC 114(r)



B-5

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B3.49
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(b)(3), 49 USC 114(r)



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BS, 49

(b)(3), 49 USC 114(r)



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83, 49
U.S.C.

(b)(3), 49 USC 114(r)

B-8

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B3, 49
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(b)(3), 49 USC 114(r)



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83, 49

(b)(3), 49 USC 114(r)



C-1

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(b)(3), 49 USC 114(r)

C-2

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B3, 49

B3, 49 U.S.C. § 114(f)

D-1

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(b)(3), 49 USC 114(r)

D-2

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33, 49

(b)(3), 49 USC 114(r)



D-3

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B3, 49 U.S.C. § 114(r)



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OST-ENG-ATR-AIT-FRD-1.1

33, 48

(b)(3), 49 USC 114(r)



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B3, 49 U.S.C. § 114(r)



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OST-ENG-ATR-AIT-FRD-1.1

B3 49
114(r)

(b)(3), 49 USC 114(r)

D-7

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OST-ENG-ATR-AIT-FRD-1.1

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(b)(3), 49 USC 114(r)

D-8

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83, 49

B3 49 U.S.C. § 114(r)



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