



AEROSPACE STANDARD

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Validation Methods For MIL-STD-1760D Mission Stores

RATIONALE

AS42701 has been reaffirmed to comply with the SAE five-year review policy.

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1. SCOPE

This document establishes techniques for validating that a mission store complies with the interface requirements contained in MIL-STD-1760 Revision D.

1.1 Purpose

The purpose of this document is to provide methods for validating that a mission store's electrical interface complies with the mission store interface (MSI) requirements of MIL-STD-1760. This document provides a set of modular, independent methods covering each of the requirements placed on the store by MIL-STD-1760. The methods contained herein apply to both the primary and auxiliary interfaces of MIL-STD-1760.

1.2 Application

The methods herein apply to the initial validation of a store design to the requirements of MIL-STD-1760 and are expected to be conducted as part of store design validation as opposed to qualification test, conformance test, flight-line test, etc. The methods contained in this document are sufficient to encompass the Class I interface. Mission stores with Class II MSIs will use the appropriate subset of these Class I methods.

1.3 Tailoring

The methods contained herein are general methods for conducting mission store validation and, as such, do not provide detailed procedures for these methods. It is intended that detailed procedures for validation of a specific mission store will be covered by tailored test plans and procedures prepared specifically for that store. These tailored test procedures would, for example, address those store-specific commands required to step through sufficient operations and states to demonstrate compliance with the particular aircraft/store electrical interconnection system (AEIS) requirement under test.

1.4 Limitations:

The methods contained herein are based on MIL-STD-1760. This AS is based on the assumption that all tests are conducted at the store's MSI connector and measurements of store performance occur only at this MSI connector.

1.5 Identification System:

The test methods contained in this document are designated by an alphanumeric identification scheme. Each method is identified by a three alphabetical character combination followed by a three-digit number. The meaning of the first three characters is:

- a. HBW: High Bandwidth Interface
- b. MUX: Digital Multiplex Data Interface
- c. LBW: Low Bandwidth Interface
- d. REL: Release Consent Interface
- e. INL: Interlock Interface
- f. ADR: Address Interface
- g. GND: Structure Ground
- h. 28V: 28 V DC Power Interface
- i. ACP: 200 V AC Power Interface
- j. HDC: 270 V DC Power Interface
- k. FOC: Fiber Optic Interface
- l. INI: Initialization
- m. INT: Interrupts
- n. CON: MSI Connector
- o. COM: Communication Rules
- p. MSG: Messages on the Digital Multiplex Data Interface
- q. MDT: Mass Data Transfer
- r. GPS: GPS rf

The three numbers following the letter code is a sequentially assigned number such that numbers 101 to 199 are for aircraft station interface (ASI) requirements and 201 to 299 are for mission stores interface (MSI) requirements. When applicable, the letter following this three-digit number is the test method revision letter. For example, HBW201 represents the original version of the first test requirement for the MSI high bandwidth interface while HBW201A represents the first revision of that test requirement.

2. REFERENCES

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of 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 applicable laws and regulations unless a specific exemption has been obtained

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AS4112	Production Test Plan for the Digital Time Division Command/Response Multiplex Data Bus Remote Terminals
AS4114	Production Test Plan for the Digital Time Division Command/Response Multiplex Data Bus Controllers
AS4117	Test Plan for the Digital Time Division Command/Response Multiplex Data Bus Couplers, Terminators, and Data Bus Cables
AS4270	Validation Methods for MIL-STD-1760 Mission Stores
AS15531	Digital Time Division Command/Response Multiplex Data Bus

2.2 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <http://assist.daps.dla.mil/quicksearch/>.

MIL-STD-1553	Aircraft Internal Time Division Command/Response Multiplex Data Bus, Revision B, Notice 4
MIL-HDBK-1553	Multiplex Applications Handbook, Revision A
MIL-HDBK-1760	Aircraft/Store Electrical Interconnection System Handbook
MIL-STD-1760	Aircraft/Store Electrical Interconnection System, Revision D
MIL-DTL-83538	General Specification For Connectors and Accessories, Electrical, Circular, Umbilical, Environment Resistant, Removable Crimp Contacts For MIL-STD-1760 Applications (Metric)
MIL-DTL-38999	General Specification For Connectors, Electrical, Circular, Miniature, High Density, Quick Disconnect (Bayonet, Threaded, and Breech Coupling), Environment Resistant, Removable Crimp and hermetic Solder Contacts
MIL-STD-1560	Insert Arrangements For MIL-C-38999 and MIL-C-27599 and MIL-C-29600 Electrical Circular Connectors
MIL-STD-8591	General Design Criteria for Airborne Stores, Suspension Equipment and Aircraft-Store Interface (Carriage Phase) (Previously identified as MIL-A-8591)

2.3 AMAC Publication

Available from 498 Nuclear Systems Group, 8601 F Avenue Bldg 20203, Kirtland AFB, NM 87117.

AMAC Standard Aircraft Monitor and Control Project Officers Group System 2 Specification: Standard No SYS 2001-01

2.4 Other Publications

ISO-10012-1 Measurement Management Systems - Requirements for Measurement Processes and Measuring Equipment

ANSI-Z540-1 General Requirements For Calibration Laboratories & Measuring & Test Equipment

STANAG 3350 Analogue Video Standard for Aircraft System Applications

STANAG 4291 Pt 1 Navstar Global Positioning System (GPS) System Characteristics

2.5 Abbreviations and Acronyms

AC	Alternating Current
ACP	Alternating Current Power
ADR	Address
AEIS	Aircraft/Store Electrical Interconnection System
AS	Aerospace Standard
ASD	Avionics Systems Division
ASI	Aircraft Station Interface
AUX	Auxiliary
BC	Bus Controller
COM	Communication
CON	Connector
CSSI	Carriage Store Station Interface
dB	Decibel
dBm	Decibels above 1 mW
DC	Direct Current
DCP	Direct Current Power
FOC	Fiber Optic Channel
GHz	Gigahertz
GND	Ground
GPS	Global Positioning System
HB	High Bandwidth
HBW	High Bandwidth
HDBK	Handbook
HDC	High Voltage DC
Hz	Hertz
ICD	Interface Control Document
INI	Interrupts
INL	Interlock
INT	Initialization
kHz	Kilohertz
LB	Low Bandwidth
LBW	Low Bandwidth
mA	Milliamps
MDT	Mass Data Transfer
MHz	Megahertz
MIL	Military
ms	Milliseconds
MSG	Message
MSI	Mission Store Interface

MUX	Multiplex
N/A	Not Applicable
p-p	Peak-to-Peak
REL	Release
RNASP	Routing Network Aircraft System Port
RT	Remote Terminal
RMS	Root Mean Squared
SAE	Society of Automotive Engineers
STANAG	(NATO) Standardization Agreement
STD	Standard
TDP	Technical Data Package
TR	Test Requirement
TRMS	True Root Mean Squared
UUT	Unit Under Test
V	Volts
VSWR	Voltage Standing Wave Ratio

3. DEFINITIONS

3.1 AEIS Terms

Terminology peculiar to the AEIS is defined in MIL-STD-1760.

3.2 Unit Under Test (UUT)

The UUT is defined as the “inert production configuration” of the mission store undergoing validation tests. The test point for all electrical tests is the MSI.

3.3 Validation

Validation of the mission store is defined as the process whereby the final design of a specific mission store is evaluated to determine its compliance with the requirements imposed on mission stores by MIL-STD-1760. This compliance evaluation is accomplished using a combination of techniques including tests, analysis and inspection. The validation is conducted to verify that the design complies with MIL-STD-1760 under nominal ambient conditions. While this validation may be part of a store's qualification test (if specified in the store's system specification), it is not necessarily intended to be conducted under all store environmental and operational conditions and as such, does not specifically “qualify” the store to its system specification/interface control document (ICD) requirements.

4. GENERAL REQUIREMENTS

4.1 Introduction

As part of a store's qualification to its system specification requirements, the mission store design shall be validated against the requirements of MIL-STD-1760. The extent and conditions of this validation will be defined in the store's system specification. The specific validation effort for a given store will be defined in a test plan prepared for that store. The methods defined in this standard provide guidance for the preparation of the test plans by delineating the pertinent requirements in MIL-STD-1760 and validation methods. For those requirements that can be validated by test or analysis, this standard also provides test methods. Section 5 presents validation methods for each requirement in MIL-STD-1760.

4.2 Validation Techniques

Validation of a design to the requirements of MIL-STD-1760 can be accomplished through the use of one or more of the following techniques:

- a. Test
- b. Analysis
- c. Inspection

4.2.1 Test

Tests are those methodologies that measure characteristics or performance under specified conditions. Tests also include techniques that "demonstrate" operation of circuitry or system performance.

4.2.2 Analysis

Analyses are those methodologies that verify design compliance with the designated requirements of MIL-STD-1760 without performance of validation test or inspection. These methodologies will primarily be based on technical evaluation of store technical data package (TDP). The TDP will include all documentation pertinent to the design, manufacture and test of the mission store, including: drawings, parts lists, software listings, source code, internal wiring diagrams, purchase specifications and certification, Interface Control Document, etc.

4.2.3 Inspection

Inspections are visual examinations and other non-destructive investigations of hardware and materials to determine compliance with the physical requirements of MIL-STD-1760.

4.3 Certification of MIL-STD-1553 Components

A MIL-STD-1760 interface normally includes a data bus that is defined by MIL-STD-1553. It is an assumption in this AS42701 that any MIL-STD-1553 components used in the mission store have been previously certified as being compliant with the requirements of that standard. Certification of terminals and components of the data bus may be carried out in accordance with the following SAE documents:

- a. AS4112 Production test plan for Remote Terminals
- b. AS4114 Production test plan for Bus Controllers
- c. AS4117 Test plan for bus couplers, terminators and bus cable

4.4 Tailoring

The specific operation of a store (as observed at the MSI) is to a large extent, unique for each store. Therefore, the test methods presented in this document are written in general terms and described at a "top level" to avoid addressing store-unique operating details that would be required if detailed test methods were presented. As a result, the procedures for validating a specific mission store will need to be defined by a custom "Test Plan" tailored specifically for that mission store. This custom test plan would address specific test setups, test equipment and those operating procedures required to exercise the store under test.

4.5 Test Conditions

Except as specified in the detailed mission store test plan, validation tests are expected to be conducted under the following environmental conditions:

- a. Temperature: Room ambient
- b. Altitude: Normal ground
- c. Vibration: None
- d. Humidity: Room ambient up to 90% relative humidity (non-condensing)
- e. Power supply: AC: 400±7 Hz, 115 ±3.0 V AC RMS phase voltage
- f. Power supply: DC: 27.5±2.0 V DC
- g. Power supply: DC: 270 ±20 V DC

4.6 Measuring Equipment:

This section addresses the test equipment used in the test methods contained in this document.

4.6.1 Equipment Type

The detailed test plan prepared for a specific AEIS will identify the specific test equipment (by manufacturer and part number or by characteristics) that is to be used in each of the tests. The following is a list of generic equipment types required for testing a mission store for each set of interface characteristics

4.6.1.1 High Bandwidth Interfaces

- a. Resistance measuring equipment
- b. Storage oscilloscope
- c. Transient recording equipment
- d. Spectrum analyzer
- e. Peak power meter
- f. Impedance analyzer
- g. Calibrated loads
- h. Store specific test equipment and test cables, as required

4.6.1.2 Digital MUX Data Interface

- a. Oscilloscope
- b. Impedance analyzer
- c. Voltmeter, floating differential input, true RMS
- d. Spectrum analyzer
- e. MIL-STD-1553 Data bus tester
- f. Waveform generator, sinusoidal
- g. Noise generator, transformer coupled to data bus
- h. Continuity measuring instrument
- i. Switching circuit capable of controlling the MSI address lines
- j. Resistor pads
- k. Store power supplies
- l. Store-specific test equipment and test cables, as required.

4.6.1.3 Low Bandwidth Interface

- a. Test loads of 300 Ω and 600 Ω .
- b. Ohmmeter capable of measuring resistances of less than 1 Ω and greater than 600 Ω .
- c. Digital voltmeter with a signal measurement bandwidth of greater than 150 Hz to 8 kHz.
- d. Oscilloscope.
- e. Swept frequency impedance analyzer set with maximum output impedance of 60 Ω , that covers the frequency range of 150 Hz to 8 kHz.
- f. Store power supplies
- g. Store-specific test equipment and test cables, as required.

4.6.1.4 Release Consent Interface

- a. Variable DC power source
- b. Voltage measuring/recording equipment
- c. Current measuring/recording equipment
- d. Resistance measuring equipment
- e. Store power supplies
- f. Store-specific test equipment and test cables, as required.

4.6.1.5 Interlock Interface

- a. Voltage measuring/recording instrument
- b. Current measuring/recording instrument
- c. 28 V DC Power source
- d. Function generator
- e. DC ammeter to read up to a minimum of 100 mA

- f. DC voltmeter to read up to a minimum of 32 V
- g. Test resistors
- h. Store power supplies
- i. Store-specific test equipment and test cables, as required.

4.6.1.6 Data Bus Addressing Interface

- a. MIL-STD-1553 Data bus tester
- b. Switching circuit to control the logical state of the data bus address lines at the MSI, incorporating variable resistances between each address line and the address return
- c. Voltage measuring/recording instrument
- d. Current measuring/recording instrument
- e. Store power supplies
- f. Store-specific test equipment and test cables, as required.

4.6.1.7 Structure Ground Interface

- a. DC power supply, capable of providing an adjustable continuous current of up to 30 A
- b. DC ammeter
- c. DC voltmeter.

4.6.1.8 28 V DC Power Interface

- a. Ohmmeter capable of measuring DC resistances greater than 100 k Ω
- b. Programmable power supplies
- c. DC Voltmeter
- d. Two channel digital storage oscilloscope and current probes
- e. Adjustable current source
- f. Milli-ammeter
- g. Store-specific test equipment and test cables, as required.

4.6.1.9 115/200 V AC Power Interface

- a. Programmable power supplies capable of generating 400 Hz AC voltage levels, transients, and voltage ramps for power application and removal.
- b. Adjustable three phase current source
- c. 3-Phase AC power analyzer
- d. Impedance meter capable of measuring impedances greater than 100 k Ω at 400 Hz
- e. 4-channel digital storage oscilloscope with current probes to measure 80 A (primary interface) or 250 A (auxiliary interface).
- f. AC contactor
- g. Store-specific test equipment and test cables, as required. Equipment to be capable of independently controlling each of the Mission Store's power interfaces

4.6.1.10 270 V DC Power Interface

- a. Ohmmeter capable of measuring DC resistances greater than 100 k Ω
- b. DC Voltmeter
- c. Milli-ammeter
- d. 2 Channel Digital Storage Oscilloscope and compatible current probes
- e. Programmable power supplies
- f. Adjustable current source
- g. DC contactor rated for the current levels required by the Mission Store under test at 280 V DC.
- h. Store-specific test equipment and test cables, as required. Equipment to be capable of independently controlling each of the Mission Store's power interfaces

4.6.1.11 Fiber Optic Interface

None

4.6.1.12 Initialization Interface

- a. MIL-STD-1553 Data bus tester
- b. Store power supplies
- c. Digital Storage Oscilloscope
- d. Store-specific test equipment and cables, as required

4.6.1.13 Interrupts

- a. MIL-STD-1553 bus protocol analyzer
- b. Store-specific test equipment and test cables, as required

4.6.1.14 Connectors

None

4.6.1.15 Communication Rules

- a. MIL-STD-1553 Data bus tester
- b. Store power supplies
- c. Store-specific test equipment and test cables, as required

4.6.1.16 Messages

- a. Data bus tester
- b. Store power supplies
- c. Store-specific test equipment and test cables, as required

4.6.1.17 Mass Data Transfer

- a. Data bus tester
- b. Store power supplies
- c. Store-specific test equipment and test cables, as required

4.6.1.18 GPS RF

- a. Network Analyzer
- b. MSI test connector, 50 Ω test cable and 50 Ω calibrated load
- c. DC Voltmeter
- d. Store power supplies
- e. Store-specific test equipment and test cables, as required.

4.6.2 Equipment Accuracy

The accuracy of instruments and test equipment used to control or monitor the test parameters shall be verified and shall satisfy the requirements of ISO-10012-1 and ANSI-Z540-1 to the satisfaction of the procuring activity. All instruments and test equipment used in conduction the tests specified herein shall:

- a. Have an accuracy tolerance no greater than $\frac{1}{4}$ tolerance on the requirement to be measured. For example, if a variable has a tolerance of $\pm 10\%$, the test equipment shall have a measurement tolerance of 2.5% or better. In the event of conflict between this principle for accuracy and an accuracy requirement stated in any of the test methods of this document, the latter should govern.

- b. Measurements made to satisfy open-ended maximum or minimum requirements shall be accurate to within 5% of the requirement to be satisfied.

4.7 Operation of the Mission Store Under Test

The detailed test plan shall include those store-specific operational requirements necessary to sequence the store through the applicable store states and modes. These store-specific requirements include such items as: timelines, commands to stores and status reports and responses from the store. Actual or simulated signal inputs and loads required to activate, utilize or operate all store functions may be used during testing.

4.8 Test Data

Test data produced during completion of the test validation procedures shall include complete identification of all test equipments and accessories. The data shall include definitions of the actual test setup, the test sequence used and the environmental test conditions. The test record shall contain the test engineer's signature and date for certification of the test data.

5. DETAILED REQUIREMENTS

5.1 Introduction

Detailed validation methods are given in this section. Each of the groups of validation methods is contained in a separate subsection that contains:

- a. An introductory table that relates the requirements contained in MIL-STD-1760 to the individual validation test methods that follow;
- b. Guidance on special considerations that may apply to completion of the validation methods;
- c. Detailed validation methods, including pass/fail criteria.

5.2 High Bandwidth

5.2.1 General Requirement

The High Bandwidth (HBW) interfaces of the mission store will be validated against the requirements of MIL-STD-1760 through a combination of test and analysis methods. The HBW validation matrix is presented in Table 1.

5.2.2 Sequence of tests

The mission store is not required to use any of the HB interfaces. For each HB interface that is not used, the requirements of MIL-STD-1760 for that interface can be satisfied by completion of validation method HBW201 and HBW202 only. If any HB interface is used as either a source or a sink for HB signals, then all other validation methods must be applied to that interface.

TABLE 1 - HIGH BANDWIDTH VALIDATION MATRIX

MIL-STD-1760 Paragraph	Title	Reqt No	Validation Technique 'Test'	Validation Technique 'Analysis'	Validation Technique 'Inspection'	Method Reference
4.3	Primary interface signal set	1		X		HBW201
	Detailed electrical reqts	2	X	X		HBW202 – HBW211
4.3.1	Equipment damage	3	X			HBW211
	HB Support of Type A and B signals	1		X		HBW203
	Type A and B signal passbands	2,3		X		HBW203
	HB Source and sink impedances	4,		X		HBW203
	HB connections	5		X	X	HBW202
	Signal Fidelity	6	X	X		HBW202- HBW211
4.3.1.1 (a)	Type A signal voltages	1,2	X	X		HBW204
4.3.1.1 (b)	Type A signal spectral components	1,2,3	X			HBW205
4.3.1.1 (c)	Type A signal slew rate	1	X	X		HBW204
4.3.1.2	Type B signal requirements	1	X	X		HBW206
4.3.1.3	Signal assignment	1		X		HBW207
4.3.1.3 (a)	Type B signals on HB1 only	1		X		HBW207
4.3.1.3 (b)	Time correlation signals on HB1 or HB2 only	1		X		HBW207
4.3.1.3 (c)	Monochrome composite video on HB3 or HB4 only	1		X		HBW207
	Video compliant with STANAG 3350	2		X		HBW207
5.2	Mission Store requirements (measured at the MSI)	1	X	X		HBW202, HBW208, HBW209
5.2.1	High Bandwidth interface Hierarchy of HB connections	1,2,3	X	X		HBW202
5.2.1.2.1	Return loss	1	X			HBW208
5.2.1.2.2	Dynamic range	1		X		HBW209
5.2.1.4	Ground reference	1,2,3		X		HBW210

5.2.3 Special Considerations

The following special considerations apply to the validation techniques used in this validation method:

5.2.3.1 Test Techniques

The requirements for store operation on the MSI include consideration of the store MSI connector. Care must be taken to ensure that calibration of the test setup prior to conducting the test does not cancel the effects of the connector. Note that the HB1 and HB2 interfaces are 50 Ω systems, whilst the HB3 and HB4 systems are 75 Ω . All test cables and terminations must be selected accordingly.

5.2.3.2 Analysis Techniques

The analysis techniques required for validation of the High Bandwidth requirements on the store is limited to evaluation of the store's TDP. The requirements for store operation on the MSI include consideration of the store MSI connector. Care must therefore be taken to ensure that all analysis includes consideration of the effects of the MSI connector contacts and internal wiring.

5.2.3.3 Inspection Techniques

If a specific mission store does not use any of the High Bandwidth ports, it is permitted to "plug" the connector's contact cavities associated with those unused ports (MIL-STD-1760D, 5.6.4). If the store includes unused High Bandwidth ports, the MSI connector can be inspected for plugged cavities and if the cavities are plugged, the mission store can be considered as complying with all remaining interface requirements for those ports.

METHOD: HBW201

PARAMETER: Primary Interface Signal Set - High Bandwidth Interfaces

MIL-STD-1760 PARAGRAPH: 4.3

PURPOSE: This method verifies the presence on the Mission Store of the High Bandwidth interfaces required for its operation.

PARAMETER TYPE:	☒ ELECTRICAL	☐ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☐ TEST	☒ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if the HB signals required by the Mission Store's interface class are present.

APPARATUS: None

VALIDATION METHOD: Evaluate the Mission Store's TDP to determine the interface class applicable to the Mission Store. Verify that the HB interfaces required by the store are all supported at the MSI.

NOTES: None

METHOD: HBW202

PARAMETER: High Bandwidth - Use of HB Interfaces

MIL-STD-1760D PARAGRAPH: 5.2.1, 4.3 (part) and 4.3.1 (part)

PURPOSE: This method verifies the use made by the Mission Store of each HB interface, and ascertains that the resistance of each unused interface is as specified.

PARAMETER TYPE:	☒ ELECTRICAL	☒ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☒ TEST	☒ ANALYSIS	☒ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if:

- a. Each HB interface comprises a signal connection and a signal return (shield) connection;
- b. The resistance of any unused interface is:
 - 1. Greater than 45 Ω if the unused interface is HB1 or HB2;
 - 2. Greater than 68 Ω if the unused interface is HB3 or HB4.
- c. The hierarchical selection is such that HB1 is selected over HB2, and HB3 is selected over HB4.

APPARATUS: Resistance measuring equipment.

VALIDATION METHOD: Analyze the Mission Store TDP and verify that each HB interface comprises a signal connection and a signal return (shield) connection.

If the HB1 or HB2 interface is not used, inspect the connector to ascertain if seal plugs or dummy contacts are fitted. If any are fitted, then no other HBW validation methods need be applied to that port/contact in order to satisfy the verification requirements. Where contacts are fitted, measure the DC resistance between the centre and outer contacts and verify that it is greater than 45 Ω . If the HB3 or HB4 interface is not used, measure the DC resistance between the centre and outer contacts and verify that it is greater than 68 Ω . Once this verification has been successfully completed on an HB interface that is not used by the Mission Store, then no other HBW validation methods need be applied to that HB connection in order to satisfy the verification requirements.

Analyze the Mission Store TDP to ascertain the hierarchical selection of the use of all HB interfaces. Verify that if HB2 is in use that HB1 is also used. Verify that if HB4 is in use that HB3 is also in use.

NOTES: None

METHOD: HBW203

PARAMETER: High Bandwidth – HB Signal Types and Impedances

MIL-STD-1760D PARAGRAPH: 4.3 (part), 4.3.1 (part)

PURPOSE: This method verifies that if a store uses any HB interface, that the Mission Store supports the transfer of Type A and/or Type B signals that are compatible with the specified passbands and with the connection impedances of the specified values.

PARAMETER TYPE: (X) ELECTRICAL () PROTOCOL () PHYSICAL
VALIDATION TECHNIQUE: () TEST (X) ANALYSIS () INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if the following criteria are satisfied:

- a. HB1, HB2 and HB3, HB4 nominal impedances are 50 Ω and 75 Ω respectively;
- b. Type A signals either sourced or used by the Mission Store are compatible with the frequency band 20 Hz to 20 MHz;
- c. Type B signals either sourced or used by the Mission Store are compatible with the frequency band 20 MHz to 1.6 GHz.

APPARATUS: None

VALIDATION METHOD: Analyze the Mission Store TDP and verify that:

- a. For the HB1 and HB2 interfaces, the source and sink impedances are nominally 50 Ω ;
- b. For the HB3 and HB4 interfaces, the source and sink impedances are nominally 75 Ω .

Analyze the Mission Store TDP and verify that HB Type A signal waveforms that are either sourced by the Mission Store or required by the Mission Store are compatible with a pass band of 20 Hz to 20 MHz. Verify that Type B signals are compatible with a pass band of 20 MHz to 1.6 GHz.

NOTES:

- 1. Type A source signals (such as STANAG 3350 video) may have a DC component that requires restoration at the receiving end because of AC coupling or amplifier DC bias in the signal path. If this DC component exists, the waveform will require features (such as a video back porch) to facilitate DC restoration at the receiving end.
- 2. This validation method is not applicable to any HB interface that is not used by the Mission Store.

METHOD: HBW204

PARAMETER: High Bandwidth – Type A Signal Voltage Requirements

MIL-STD-1760D PARAGRAPH: 4.3 (part), 4.3.1.1 (a), 4.3.1.1 (c)

PURPOSE: This method verifies that any Type A signals associated with operation of the Mission Store meet the steady state, transient and slew rate requirements.

PARAMETER TYPE:	(X) ELECTRICAL	() PROTOCOL	() PHYSICAL
VALIDATION TECHNIQUE:	(X) TEST	(X) ANALYSIS	() INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if any Type A signal generated or required by the Mission Store:

- Is limited to 1.3 Vpp and does not exceed ± 1.55 V under steady state conditions;
- Is limited to 1.3 Vpp and does not exceed ± 2.00 V under transient conditions.
- Returns to within 5% of its steady state limits in less than 250 ms of a transient change;
- Does not exceed a slew rate of 65 V/ μ s.

APPARATUS:

- Storage oscilloscope.
- Transient recording equipment.
- Store-specific test equipment and test cables, as required.

VALIDATION METHOD:

- For Type A signals generated by the Mission Store

- Connect the Mission Store to its test equipment. Connect an oscilloscope and transient recording equipment to the first Type A signal output connection on the primary umbilical connector.
- Switch on the oscilloscope and transient recording equipment. Apply power to the Mission Store and carry out a full test such that the store outputs the Type A signal. Verify that the test recordings indicate that the signal remained within the range of ± 1.55 V and did not exceed 1.3 Vpp. Verify that for any recorded transients of the DC component of the signal, the signal peak voltage returned to within ± 1.6275 V within 250 ms. Verify that the signal remained within ± 2.00 V at all times.
- Verify that the slew rate for all recordings does not exceed 65 V/ μ s.
- Repeat this test process for each HB interface that is used to transmit Type A signals.

- For HB interfaces used to accept Type A signals

Analyze the Mission Store TDP to verify that for each HB interface receiving Type A signals, the Mission Store:

- does not require signals to have a steady state peak-peak voltage in excess of 1.3 V and to extend beyond ± 1.55 V;
- will continue to operate satisfactorily in the event of transients where the input signal extends up to ± 2.0 V;
- will continue to operate satisfactorily in the event of transients in the DC component where the peak voltage falls to within ± 1.6275 V in no longer than 250 ms;
- will continue to operate satisfactorily with input signal slew rates up to 65 V/ μ s.

NOTE: For AC-coupled video signals, transient conditions exist when there is a change from a black scene to a white scene or vice versa.

METHOD: HBW205

PARAMETER: High Bandwidth – Type A Out of Band Signal Spectral Components

MIL-STD-1760D PARAGRAPH: 4.3 (part), 4.3.1.1 (b)

PURPOSE: This method verifies that any Type A signals associated with operation of the Mission Store meet the power spectral requirements.

PARAMETER TYPE:	☒ ELECTRICAL	☐ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☒ TEST	☒ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if the power of any out of band spectral components in the Type A signal generated by the store roll off at a rate greater than 14 dB/octave beginning at 20 MHz and extending to 200 MHz, where the 20 MHz limit is equal to the largest power spectral component over the band 20 Hz to 20 MHz.

APPARATUS:

- a. Spectrum analyzer (20 Hz to 200 MHz).
- b. Store-specific test equipment and test cables, as required.

VALIDATION METHOD: Connect the Mission Store to a spectrum analyser. Under steady state conditions, record the power spectrum of the Type A signal from 20 Hz to 200 MHz, or from the fundamental frequency of the Type A signal to 200 MHz if a measurement from 20 Hz is not practical.

Verify that the power of any spectral components between 20 MHz and 200 MHz do not exceed a limit line starting at 0 dB at 20 MHz and decreasing at 14 dB/octave until 200 MHz. The 0 dB point is defined as the power of the largest spectral component measured between 20 Hz and 20 MHz. Repeat the validation method for each HB interface used to source Type A signals.

NOTES: None

METHOD: HBW206

PARAMETER: High Bandwidth – Type B Signal Power

MIL-STD-1760D PARAGRAPH: 4.3 (part), 4.3.1.2

PURPOSE: This method verifies that Type B signals generated by the Mission Store do not exceed the specified power level.

PARAMETER TYPE:	☒ ELECTRICAL	☐ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☒ TEST	☒ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if

a. The Mission Store does not generate any Type B signals;

or

b. The signal power envelope of the sum of all Type B signal generated simultaneously by the store does not exceed -20 dBm RMS.

APPARATUS:

- a. Peak power meter capable of reading power levels of -20 dBm RMS and lower.
- b. Store-specific test equipment and test cables, as required.

VALIDATION METHOD: Analyze the Mission Store TDP to ascertain whether or not the store transmits any Type B signals. If the store does not transmit any Type B signals, then no further verification is required to satisfy this validation method.

If Type B signals are transmitted, connect the Mission Store to its test equipment and connect the power meter to the HB1 interface – see NOTE. Operate the test equipment so as to cause the Mission Store to generate Type B signals on the HB1 interface. Verify that in all operating modes, the peak power does not exceed -20 dBm RMS. Ensure that the test includes all conditions where the store (if capable) transmits more than one type B signal at the same time.

NOTE: Type B signals may be transferred on the HB1 interface only - see validation method HBW207 for signal assignment verification.

METHOD: HBW207

PARAMETER: High Bandwidth – Signal Assignment

MIL-STD-1760D PARAGRAPH: 4.3 (part), 4.3.1.3

PURPOSE: This method verifies that Mission Store use of the High Bandwidth interfaces is limited to the specified signal types and that they are transferred on the correct interfaces.

PARAMETER TYPE: ☐ ELECTRICAL ☒ PROTOCOL ☐ PHYSICAL
VALIDATION TECHNIQUE: ☐ TEST ☒ ANALYSIS ☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if:

- a. Type B signals are transferred on HB1 only;
- b. That only HB1 and HB2 interfaces are used to transfer time correlation signals that comply with Type A definitions;
- c. That only HB3 and HB4 interfaces are used to transfer monochrome raster composite video;
- d. Raster composite video either sourced or required by the store complies with STANAG 3350;
- e. That no signal types other than those specified above are transferred on High Bandwidth interfaces.

APPARATUS: None

VALIDATION METHOD: Analyze the Mission Store TDP and verify that:

- a. If the store either sources or uses Type B signals, they are transferred using the HB1 interface only;
- b. If the store either sources or uses time correlation signals (see NOTE) that comply with the definition of Type A signals, they are transferred on the HB1 and HB2 interfaces only;
- c. If the store either sources or uses monochrome raster composite video, it is transferred on the HB3 and HB4 interfaces only;
- d. If the store either sources or uses monochrome raster composite video, the signal characteristics comply with STANAG 3350;
- e. None of the HB interfaces are used for the transfer of signals other than those that comply with the definitions for Type A or Type B signals, or monochrome raster composite video.

NOTE: Time correlation signals are defined as those associated with synchronization, clocking and blanking.

METHOD: HBW208

PARAMETER: High Bandwidth – Type A Signals: Return Loss

MIL-STD-1760D PARAGRAPH: 4.3 (part), 5.2.1.2.1

PURPOSE: This method verifies that the return loss introduced by the Mission Store does not exceed the specified limit.

PARAMETER TYPE: ☒ ELECTRICAL ☐ PROTOCOL ☐ PHYSICAL
VALIDATION TECHNIQUE: ☒ TEST ☐ ANALYSIS ☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if the return loss introduced by the store is not less than 25 dB over the frequency range 20 Hz to 20 MHz, when acting as either a source or sink of Type A signals. See NOTE 1.

APPARATUS:

- a. Vector network analyzer, capable of covering the frequency range 20 Hz to 20 MHz.
- b. Adapters cables (50 Ω and 75 Ω) for connecting the test equipment to the MSI.
- c. Calibration loads (50 Ω and 75 Ω) including impedance matching attenuator.

VALIDATION METHOD: See NOTE 2.

Connect the adapter cable to the network analyzer and terminate the line with the correct calibration load. See NOTE 3. Note the system calibration. Remove the calibration load and connect the analyzer to the HB interface under test. Operate the analyzer to ascertain the $20\text{Log}(S_{11})$ return loss over the frequency range 20 Hz to 20 MHz.

Repeat the calibration, measurement and calculation processs for each of the HB interfaces.

Verify that the results of the calculations all show return losses of greater than 25 dB.

NOTES:

1. Return loss is defined as the ratio of transmitted power to the reflected power caused by impedance mismatch, hence a high figure for return loss indicates lower system power loss.
2. The network analyzer will require an adapter cable to enable connection to the MSI connector and it is essential that calibration of the test equipment prior to taking the measurements removes any effect of the adapter cable on the results.
3. The HB1 and HB2 interfaces are of nominal impedance 50 Ω , and the HB3 and HB4 interfaces nominally 75 Ω .

METHOD: HBW209

PARAMETER: High Bandwidth – Type A signals: Dynamic Range

MIL-STD-1760D PARAGRAPH: 4.3 (part), 5.2.1.2.2

PURPOSE: This method verifies that the Mission Store is compatible with input voltages within the range ± 3.0 V. See NOTE 1.

PARAMETER TYPE:	☒ ELECTRICAL	☐ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☐ TEST	☒ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if analysis of the Mission Store indicates that it operates satisfactorily with input signals that may extend up to ± 3.0 V.

APPARATUS: None

VALIDATION METHOD: Analyze the Mission Store TDP and verify that the store is compatible with input voltages within the range ± 3.0 V.

NOTE: This requirement ensures that the mission store is compatible with source signal transient conditions and with signal path gain and DC offset specifications.

METHOD: HBW210

PARAMETER: High Bandwidth – Ground Reference Connections

MIL-STD-1760D PARAGRAPH: 4.3 (part), 5.2.1.4

PURPOSE: This method verifies that the Mission Store ground reference connections for transmission or reception of Type A and Type B signals are as specified in the standard.

PARAMETER TYPE: ☒ ELECTRICAL ☐ PROTOCOL ☐ PHYSICAL
VALIDATION TECHNIQUE: ☐ TEST ☒ ANALYSIS ☐ INSPECTION

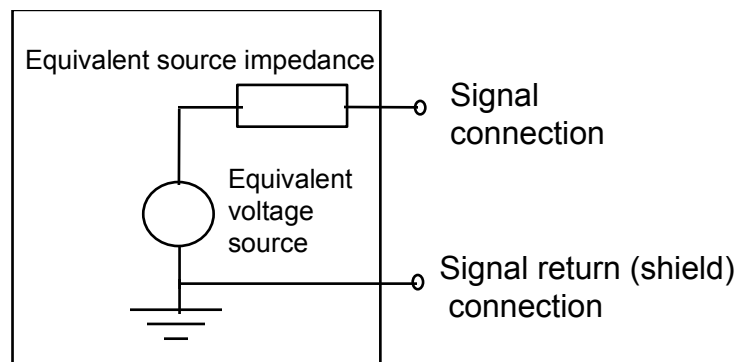
VALIDATION CRITERIA: The Mission Store is considered to have passed if its ground reference connections are as specified in the standard.

APPARATUS: None

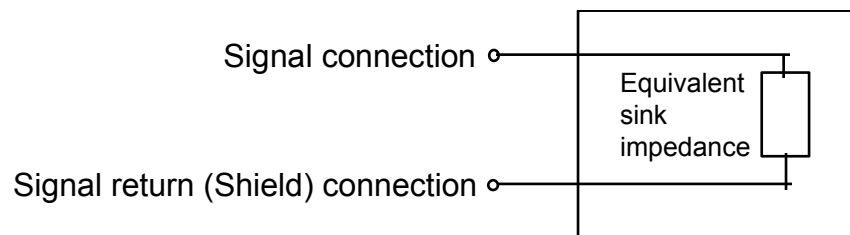
VALIDATION METHOD: Analyze the Mission Store TDP and verify that:

- a. When the store is transmitting either a Type A or Type B signal on any HB interface, the signal return line is connected to the store structure ground as shown in Figure HBW210 (a);
- b. When the store is receiving a Type A signal on any HB interface, the signal return line is isolated from the store structure ground as shown in Figure HBW210 (b);
- c. When the store is receiving a Type B signal, the signal return line is connected to the store structure ground as shown in Figure HBW210 (c).

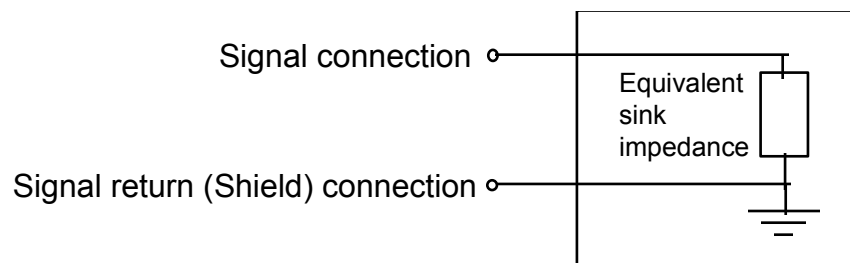
NOTE: None



(a) Equivalent circuit of HB interface when sending a Type A or Type B signal.



(b) Equivalent circuit of HB interface when receiving a Type A signal.



(c) Equivalent circuit of HB interface when receiving a Type B signal.

FIGURE HBW210: EQUIVALENT CIRCUITS FOR GROUND REFERENCE CONNECTIONS

METHOD: HBW211

PARAMETER: Primary Interface Signal Set - Terminations

MIL-STD-1760 PARAGRAPH: 4.3

PURPOSE: This method verifies that the Mission Store is not damaged by the removal of any termination from any HB interface.

PARAMETER TYPE:	☒ ELECTRICAL	☐ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☒ TEST	☒ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if it is able to correctly source or sink its HB signals after removal and reinstatement of interface terminations during previous operations.

APPARATUS:

- a. Store specific test equipment and test cables, as required.
- b. Break-in test capability for each High Bandwidth interface operated by the store.

VALIDATION METHOD: Analyze the Mission Store TDP to verify that terminations are not essential to prevent damage to an HB input or HB output when the store is operating.

Verify by test:

- a. Connect the Mission Store to its test equipment, with a break-in capability introduced for each of the HB interfaces used by the store.
- b. Operate the test equipment so as to transmit to the store any HB signals necessary for store operation. Using the break-in facility, open circuit and then re-connect each HB interface in turn.
- c. Operate the test equipment so as to cause the Mission Store to transmit any HB signals necessary for store operation. Using the break-in facility, open circuit and then reconnect each HB interface in turn.
- d. With all HB interfaces fully connected, carry out a full test of the store and verify its correct operation.

NOTES: None

5.3 Data Bus Interface

5.3.1 General Requirement:

The Mission Store data bus interface will be validated against the requirements of MIL-STD-1760 through a combination of test, analysis and inspection methods. The data bus validation matrix is presented in Table 2.

5.3.2 Applicable Validation Methods

Validation Method MUX201ascertains whether or not the Mission Store uses the data bus interface for the designated purposes. If the Mission Store does not use the data bus interface, then only Validation Method MUX202 need be performed to ensure compliance with the standard. If the analysis shows that the Mission Store uses the data bus interface, then validation methods MUX203 to MUX209 must be carried out.

TABLE 2 – MISSION STORE DATA BUS (MUX) INTERFACE VALIDATION MATRIX

MIL-STD-1760 Paragraph	Title	Req't No	Validation Technique 'Test'	Validation Technique 'Analysis'	Validation Technique 'Inspection'	Method Reference
4.3.2	Implementation of data bus communications	1	-	X	-	MUX201
5.2.2	Input impedance for unused Mux interface	1	X	X	X	MUX202
	Provision of Mux A and B connections	2,3	-	X	-	MUX203, CON101
	Contact connections for Mux A and B	4,5	-	X	-	MUX203
5.2.2.1 (a)	Mission store function as RT	1	X	X	-	MUX204
5.2.2.1 (b)	Mission store to respond to prescribed address and broadcast address	1	X	-	-	MUX204
5.2.2.1 (c)	Use of subaddress 19 and 27	1	-	X	-	MUX205
5.2.2.1 (d)	Mission store to respond to commands iaw Appx B	1	-	-	-	COM
5.2.2.2.1	Mission store output signal characteristics	1,2	X	-	-	MUX206
5.2.2.2.2	Compliance with MIL-STD-1553 for waveform compatibility, common mode rejection and noise rejection	1	X	-	-	MUX207
	Input impedance when not transmitting or unpowered	2,3	X	-	-	MUX208
	Input impedance requirement	4	-	X	-	MUX208
5.2.2.2.3	Mux shields connected to Mission Store structure ground	1,2	X	-	-	MUX209
Appx B.4.1	Mission Store function as RT	1	-	X	-	MUX204

5.3.3 Special Considerations

The following special considerations apply to the three different validation techniques.

5.3.3.1 Test Techniques

The primary consideration during test of the mission store's compliance to the mission store data bus interface requirements concerns the effect of the mating test cable (between the test equipment and the store) on the test results. Some of the critical electrical characteristic measurements (such as input impedance) can be significantly affected by the test cable characteristics. The test cable should use quality components and be as short in length as practical to minimize test cable effects on the test results.

Two additional considerations during mission store validation tests deal with the test sequence. First, some of the tests of the digital MUX data interface of the mission store could require that the store be activated for relatively long durations compared to the store's normal operational time line. If the store was designed for short duration operation, the store's thermal characteristics may require special test sequencing to prevent the store from malfunctioning (e.g. overheating). The second consideration is that the mission store test plan can combine some of these digital MUX data interface tests with other tests, in order to shorten test time. Typically, these other tests may include the Initialization tests, (see 5.13), Communication tests (see 5.16) and Message tests (see 5.17).

5.3.3.2 Analysis Techniques

A number of the mission store's digital MUX data interface characteristic requirements in MIL-STD-1760 are defined as aspects associated with complying with MIL-STD-1553 remote terminal requirements. For example, 5.2.2.2.2 of MIL-STD-1760D requires the mission store to comply with remote terminal input requirements defined in MIL-STD-1553. It is expected that validating compliance to this and certain other requirements will be by analysis based on verification that the RT installed in the mission store has already been "qualified" to MIL-STD-1553. In other words, it should not be necessary to repeat the entire series of MIL-STD-1553 RT validation tests on the store RT. Instead, an analysis would be conducted to verify that the installed store RT is a MIL-STD-1553-compliant RT. Refer to 4.3 for further information.

5.3.3.3 Inspection Techniques

The inspection requirement associated with the mission store data bus interface deals with unused ports. If a specific mission store does not use the data bus ports, it is permitted to "plug" the connector's contact cavities associated with those unused ports. If the store includes unused data bus ports, the MSI connector can be inspected for plugged cavities and if the cavities are plugged, the mission store can be considered as complying with all remaining data bus interface requirements for those ports.

5.3.3.4 It should be noted that all validation tasks associated with requiring the Mission Store operations associated with data bus commands to be in accordance with Appendix B of MIL-STD-1760 are contained in 5.16, COM.

5.3.3.5 Where reference is made to MIL-STD-1553, SAE document AS15531 may be used in its place.

METHOD: MUX201

PARAMETER: Mission Store MUX Interface – Implementation of a dual redundant data bus

MIL-STD-1760D PARAGRAPH: 4.3.2

PURPOSE: This method determines the store use of the data bus interface and placing of subsequent requirements.

PARAMETER TYPE:	☐ ELECTRICAL	☒ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☐ TEST	☒ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: None

This validation method does not in itself place requirements on the Mission Store, but establishes which of the subsequent validation methods are applicable to the store.

APPARATUS: None

VALIDATION METHOD: Analyze the Mission Store TDP to establish the presence of a Mission Store dual redundant data bus interface and its use for store operation.

If the analysis indicates that the Mission Store uses the data bus, then validation methods MUX203 to MUX209 must be carried out, in order to validate data bus interface compliance with MIL-STD-1553 and MIL-STD-1760.

If the analysis indicates that the Mission Store does not use the data bus, only validation method MUX202 needs to be conducted. No further MUX tests are required.

NOTE: None

METHOD: MUX202

PARAMETER: Mission Store MUX Interface – Unused data bus connections

MIL-STD-1760D PARAGRAPH: 5.2.2

PURPOSE: This method validates the Mission Store input impedance for the Mux A and Mux B data bus connections that are not used by the store.

PARAMETER TYPE:	☒ ELECTRICAL	☐ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☒ TEST	☐ ANALYSIS	☒ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if:

Either:

- a. The primary interface connector is fitted with seal plugs/dummy contacts and satisfies requirements defined in Table II of MIL-STD-1760;

or

- b. The input impedance between the centre and intermediate connections for each of the contacts is greater than 1000 Ω between 75 kHz and 1.0 MHz.

APPARATUS:

- a. Impedance analyzer.
- b. Store-specific test equipment and test cables, as required.

VALIDATION METHOD: Carry out the following analysis and test actions, as appropriate:

By inspection of the Mission Store installed parts or by analysis of its TDP, ascertain the types of contacts fitted to insert positions 'H' and 'K' in the primary signal umbilical connector. Verify that the contacts fitted meet the requirements contained in MIL-STD-1760, Table II. If the contacts are found to be electrical contacts, then the test method described below must also be carried out.

Test: Connect the probes of the impedance analyzer between the unused centre and intermediate connections on the contact at insert position 'H'. Using a measurement excitation of between 0 and 17 dBm and with the contact shield connection grounded, verify that the input impedance is greater than 1000 Ω when the analyzer is swept between 75 kHz and 1.0 MHz. The input impedance shall be greater than 1000 Ω . Repeat the test between the equivalent connections on the contact at insert position 'K', with its shield connection grounded.

NOTE: This validation method is applicable only if the results of Validation Method MUX201 show that the store does not use the data bus function.

METHOD: MUX203

PARAMETER: Mission Store MUX Interface – Data bus connections

MIL-STD-1760D PARAGRAPH: 5.2.2

PURPOSE: This method verifies that the Mission Store provides data high, data low and shield connections for the Mux A and Mux B data bus interfaces in the primary signal set.

PARAMETER TYPE:	☐ ELECTRICAL	☐ PROTOCOL	☒ PHYSICAL
VALIDATION TECHNIQUE:	☐ TEST	☒ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if the connections for both data buses use the contacts defined in MIL-STD-1760.

APPARATUS: None

VALIDATION METHOD: Evaluate the Mission Store TDP to verify that:

- a. The Mux A and Mux B data bus connections are made to the primary connector contacts 'K' and 'H' respectively;
- b. For each data bus, data high is connected to the centre contact, data low to the intermediate contact and the shield to the outer contact.

NOTE: Validation Method CON101 verifies that the contact types used in positions 'K' and 'H' are in accordance with Table II of MIL-STD-1760.

METHOD: MUX204

PARAMETER: Mission Store MUX Interface – RT and data bus standby functions

MIL-STD-1760D PARAGRAPH: 5.2.2.1 (a) and (b); B.4.1

PURPOSE: This method validates that the Mission Store:

- a. Operates as a Remote Terminal as defined in MIL-STD-1553;
- b. Provides a dual standby redundant MIL-STD-1553 communications link via Mux A and Mux B;
- c. Responds in accordance with MIL-STD-1553 to those messages with an address corresponding to the encoded RT address and if implemented, broadcast messages.

PARAMETER TYPE: ☐ ELECTRICAL ☒ PROTOCOL ☐ PHYSICAL
VALIDATION TECHNIQUE: ☒ TEST ☒ ANALYSIS ☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to meet the specified requirements of MIL-STD-1760 if the Remote Terminal is qualified to MIL-STD-1553 and responds correctly to messages sent to its encoded address or if implemented, broadcast messages.

APPARATUS:

- a. Data bus tester.
- b. Switching circuit capable of controlling the MSI address lines.
- c. Store power supplies.
- d. Store-specific test equipment and test cables, as required.

VALIDATION METHOD:

- a. Operation as a Remote Terminal
 - 1. Analyze the Mission Store TDP to verify that the Remote Terminals fitted to the store have been certified as being compliant with the requirements contained within MIL-STD-1553.
 - 2. With all Mission Store interface power deactivated, set the address interface input to the store to a valid (correct parity) address 0.
 - 3. Apply store power and verify, via the data bus tester connected to Mux A, that the Mission Store responds only to messages addressed to RT address 0. It is recommended that this be done by causing the bus tester to send the 'transmit status word' mode command or 'transmit store description message' command.
 - 4. Remove store power and repeat steps 2 and 3 with addresses 10 and 21.
 - 5. Remove store power and repeat steps 2 and 3 with the address set to 0 with the incorrect parity and verify that the Mission Store does not respond.
 - 6. Remove store power and repeat steps 2 and 3 with the address set to 6 with the correct parity and verify that the Mission Store does respond.
 - 7. Determine from the Mission Store TDP if the store is required to implement the broadcast communication mode.
 - 8. If the Mission Store design incorporates the broadcast communication mode, the following actions shall be performed:
 - (a.) Determine from the Mission Store TDP a suitable broadcast message and set this up on the bus tester.
 - (b.) With a valid address assigned to the Mission Store address interface, issue the selected broadcast receive command (and data words if applicable). Confirm that the store does not respond with a status word.
 - (c.) With the bus tester, issue a 'transmit status word' mode command to the store's assigned address and confirm that the status word contains the 'broadcast command received' bit set.
 - (d.) With the bus tester, issue a 'transmit store description message' command to the store's assigned address and confirm that the store responds with a status word with the 'broadcast command received' bit cleared.
 - 9. If the Mission Store design does not implement the broadcast communication mode, the following actions shall be performed:

- (a.) Determine from the Mission Store TDP a non-mode command receive message that contains data words and set this up on the data bus tester for broadcast transmission.
 - (b.) With a valid address assigned to the Mission Store address interface, issue the selected broadcast receive command and data words. Confirm that the store does not respond with a status word.
 - (c.) With the bus tester, issue a 'transmit status word' or 'transmit last command' mode command to the store's assigned address and confirm that the status word contains a cleared 'broadcast command received' and a cleared message error bit.
 - (d.) With the bus tester, issue a 'transmit store description message' command to the store's assigned address and confirm that the store responds with a status word with the 'broadcast command received' bit cleared.
- b. Provision of a dual standby redundant communications link
- 1. With all Mission Store interface power deactivated, set the address interface input to the store to a valid (correct parity) address. Connect the data bus tester to both Mux A and Mux B.
 - 2. Apply store power and verify that the Mission Store transmits its status word on Mux A in response to a 'transmit status word' mode command sent on Mux A by the data bus tester.
 - 3. Using the data bus tester, send on Mux B the 'transmit store description message' mode command and verify that the Mission Store transmits its 'store description message' on Mux B.
 - 4. Using the data bus tester, send on Mux A the 'transmit status word' message and verify that the Mission Store transmits its status word on Mux A.

NOTE: None

METHOD: MUX205

PARAMETER: Mission Store MUX Interface – Nuclear store subaddresses

MIL-STD-1760D PARAGRAPH: 5.2.2.1 (c)

PURPOSE: This method validates that nuclear stores use subaddresses 19 and 27(dec) for store control, and that non-nuclear stores do not use these subaddresses for either transmitted or received messages.

PARAMETER TYPE: ☐ ELECTRICAL ☒ PROTOCOL ☐ PHYSICAL
VALIDATION TECHNIQUE: ☐ TEST ☒ ANALYSIS ☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed the validation requirements if use of the messages with the specified subaddresses is appropriate to the nuclear/non-nuclear nature of the store type.

APPARATUS: None

VALIDATION METHOD: Analyze the Mission Store TDP to verify that:

- a. For non-nuclear Mission Stores, subaddresses 19 and 27 are not used for messages either received by or transmitted by the Mission Store;
- b. For nuclear Mission Stores, subaddresses 19 and 27 are used for store control.

NOTE: None

METHOD: MUX206

PARAMETER: Mission Store MUX Interface – Output characteristics

MIL-STD-1760D PARAGRAPH: 5.2.2.2.1

PURPOSE: This method validates that the output characteristics of the Mission Store Mux A and Mux B data buses comply with output characteristics of a MIL-STD-1553 transformer coupled terminal, with the exception that the minimum peak-peak voltage of the output waveform at the MSI shall be 20.0 V.

PARAMETER TYPE:	☒ ELECTRICAL	☐ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☒ TEST	☐ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have met the requirements if it passes the tests defined in MIL-HDBK-1553A, Section 100, 5.1.1, Output Characteristics, with the exception that the results of the output amplitude test in paragraph 5.1.1.1 shall be between 20.0 V and 27.0 V peak-to-peak, line-to-line.

APPARATUS:

- a. Data bus tester.
- b. Resistor pads.
- c. Voltmeter, floating differential input, true RMS.
- d. Noise generator, transformer coupled to data bus.
- e. Oscilloscope.
- f. Spectrum analyzer.
- g. Store power supplies.
- h. Store-specific test equipment and test cables, as required.

VALIDATION METHOD: Carry out the tests defined in MIL-HDBK-1553A, Section 100, RT validation test plan, 5.1.1, output characteristics. The test point identified in the test plan as 'Point A' shall be taken as the MUX connections on the Mission Store MSI primary connector. Verify that the output peak-to-peak, line-to-line voltage is between 20.0 V and 27.0 V. The tests shall be carried out on both Mux A and Mux B.

NOTE: Reference should be made to MIL-HDBK-1553A for suggested test configurations.

METHOD: MUX207

PARAMETER: Mission Store MUX Interface – Input characteristics

MIL-STD-1760D PARAGRAPH: 5.2.2.2.2

PURPOSE: This method verifies that the Mission Store is capable of receiving and operating with input signals at the MSI that comply with the MIL-STD-1553 requirements for waveform compatibility, common mode rejection and noise rejection.

PARAMETER TYPE:	☒ ELECTRICAL	☐ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☒ TEST	☐ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have satisfied the requirements if it passes the tests defined in MIL-HDBK-1553A, Section 100, 5.1.2.1, 5.1.2.2, and 5.3

APPARATUS:

- a. MIL-STD-1553 Data bus tester.
- b. Resistor pad.
- c. Spectrum analyzer.
- d. Oscilloscope.
- e. Waveform generator, sinusoidal.
- f. Noise generator, transformer coupled to data bus.
- g. Voltmeter, floating differential input, true RMS.
- h. Store power supplies.
- i. Store-specific test equipment and test cables, as required.

VALIDATION METHOD:

- a. Waveform compatibility and common mode rejection
 1. Carry out the tests defined in MIL-HDBK-1553A, Section 100, RT validation test plan, 5.1.2, input characteristics, 5.1.2.1 and 5.1.2.2. The test point identified in the test plan as 'Point A' shall be taken as the MUX connections on the Mission Store MSI primary connector.
 2. The tests shall be carried out on both Mux A and Mux B.
- b. Noise rejection
 1. Carry out the tests defined in MIL-HDBK-1553A, Section 100, RT validation test plan, 5.3, noise rejection. The test point identified in the test plan as 'Point A' shall be taken as the MUX connections on the Mission Store MSI primary connector.
 2. The tests shall be carried out on both Mux A and Mux B.

NOTE: Reference should be made to MIL-HDBK-1553A for suggested test configurations.

METHOD: MUX208

PARAMETER: Mission Store MUX Interface – Input impedance

MIL-STD-1760D PARAGRAPH: 5.2.2.2.2

PURPOSE: This method verifies that the input impedances of the data bus connections at the MSI are not less than 300 Ω within the specified frequency range and that the RT input impedances meet the requirements of MIL-STD-1553.

PARAMETER TYPE: (X) ELECTRICAL () PROTOCOL () PHYSICAL
VALIDATION TECHNIQUE: (X) TEST (X) ANALYSIS () INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed the test if the measured impedances are not less than 300 Ω over the frequency range 75 kHz to 1.0 MHz, and analysis of its TDP shows that the RT devices are certified as complying with MIL-STD-1553 in that the input impedance of each RT is not less than 1000 Ω .

APPARATUS:

- a. Impedance analyzer.
- b. Store power supplies.
- c. Store-specific test equipment and test cables, as required.

VALIDATION METHOD: With the Mission Store unpowered, connect the impedance analyzer across the Mux A data high and data low contacts and measure the input impedance over the frequency range 75 kHz to 1.0 MHz. Verify that the impedance is a minimum of 300 Ω . See NOTE. Repeat the test for the Mux B connections. Apply power to the Mission Store and, when the store is not transmitting on Mux B, measure the input impedance over the frequency range 75 kHz to 1.0 MHz. Verify that the impedance is a minimum of 300 Ω . See NOTE. Repeat the test for the Mux A connections when the store is not transmitting on Mux A.

Analyze the Mission Store TDP to verify that the Mux A and Mux B RTs are certified as being compliant with the MIL-STD-1553 requirements for input impedances to be not less than 1000 Ω .

NOTE: The test shall be carried out using a sinusoidal input of between 1.0 V and 2.0 V RMS at the following frequencies: 75 kHz, 100 kHz, 250 kHz, 500 kHz and 1.0 MHz.

METHOD: MUX209

PARAMETER: Mission Store MUX Interface – Shield grounding

MIL-STD-1760D PARAGRAPH: 5.2.2.2.3

PURPOSE: This method verifies that the Mux A and Mux B shield connections are connected to a Mission Store structure ground.

PARAMETER TYPE:	☒ ELECTRICAL	☐ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☒ TEST	☐ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if the measured resistance between each Mux shield connection and contact 'T' in the primary interface connector does not exceed 1.0 Ω . See NOTE 1 and NOTE 2.

APPARATUS: Continuity measuring instrument.

VALIDATION METHOD: Connect the continuity measuring instrument between the shield contact for Mux A and contact 'T' on the Mission Store MSI primary connector and note the instrument reading. Repeat the procedure with the instrument connected between the shield connection for Mux B and contact 'T'. Verify that neither indication exceeded 1.0 Ω .

NOTES:

1. MIL-STD-1760 does not specify a resistance value for 'continuity'. This validation test method assumes that a DC resistance of 1.0 Ω is considered an acceptable maximum value for 'continuity'.
2. Contact 'T' on the Primary interface connector is designated as the Mission Store Structure Ground and is checked for continuity to the store structure in validation method GND201.

5.4 Low Bandwidth

5.4.1 General Requirement

If the Mission Store implements the low bandwidth (LBW) interface of the MSI then it is to be validated against the requirements of MIL-STD-1760D through a combination of test, analysis, and inspection methods. If the Mission Store does not implement the low bandwidth interface then only Validation Method LBW208 need be performed to ensure compliance with the standard. The LBW validation matrix is presented in Table 3.

TABLE 3 - LOW BANDWIDTH VALIDATION MATRIX

MIL-STD-1760 PARAGRAPH	TITLE	Req't No	VALIDATION TECHNIQUE Test	VALIDATION TECHNIQUE Analysis	VALIDATION TECHNIQUE Inspection	METHOD REFERENCE
4.3	Primary Interface Signal Set	1-3	X	-	X	LBW201-LBW208
4.3.3	Low bandwidth interface	1,2,3,4	-	X	-	LBW201
			-	X	-	LBW202
			X	-	-	LBW203
			X	-	-	LBW204
4.3.3.1	LB signal requirements	1,2,3,4	X	-	-	LBW205
			X	-	-	LBW206
4.3.3.2	Signal assignment	1,2	-	X	-	LBW207
			-	-	X	LBW201
5.2.3	Mission Store LB interface	1,2,3	-	-	X	LBW202
			-	-	X	LBW201
			X	-	X	LBW208
5.2.3.1	Input / output impedance	1,2	X	-	-	LBW203
			X	-	-	LBW204
5.2.3.2	Ground reference	1,2,3	-	-	X	LBW202
			X	-	-	LBW209

5.4.2 Special Considerations

The following special considerations apply to the three different validation techniques.

5.4.2.1 Test Techniques

Test of the Mission Store's compliance to the low bandwidth interface requirements concerns signal level, impedance, signal quality and frequency range.

5.4.2.2 Analysis Techniques

None.

5.4.2.3 Inspection Techniques

The inspection effort associated with the LB interface is essentially limited to confirming that if the Mission Store uses the interface for only those applications identified in the standard (i.e., tones or voice grade audio) and that the necessary connections are provided. This compliance can be determined by analysis of the Mission Store's ICD or system specification, as applicable.

METHOD: LBW201

PARAMETER: Mission Store LB Interface

MIL-STD-1760D PARAGRAPH: 4.3, 4.3.3, 4.3.3.2 and 5.2.3

PURPOSE: This method verifies if the Mission Store provides the LB interface.

PARAMETER TYPE:	☐ ELECTRICAL	☐ PROTOCOL	☒ PHYSICAL
VALIDATION TECHNIQUE:	☐ TEST	☒ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if a LB interface is provided.

APPARATUS: None

VALIDATION METHOD: Evaluate the Mission Store TDP to determine if the store provides a LB interface.

NOTE: If this method is “passed”, then the remainder of the LBW validation methods must be performed with the exception of LBW208, in order to validate the LB interface for compliance with MIL-STD-1760D.

METHOD: LBW202

PARAMETER: Mission Store LB Interface

MIL-STD-1760D PARAGRAPH: 4.3, 4.3.3, 5.2.3 and 5.2.3.2

PURPOSE: This method verifies that the Mission Store LB interface provides a non-inverting signal connection, inverting signal connection, and a shield connection and complies with the differential signal interface as defined in Figure 16 (Equivalent circuits for LB interfaces) of the standard.

PARAMETER TYPE:	☐ ELECTRICAL	☐ PROTOCOL	☒ PHYSICAL
VALIDATION TECHNIQUE:	☐ TEST	☒ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if the MSI supplies the required connections and that the signals are referenced to ground as shown in the equivalent circuits of Figure 16 (Equivalent circuits for LB interfaces) of the standard.

APPARATUS: None

VALIDATION METHOD: Evaluate the Mission Store's TDP to determine if the store provides the required connections

NOTE: None

METHOD: LBW203

PARAMETER: Mission Store LB Interface Output Impedance

MIL-STD-1760D PARAGRAPH: 4.3, 4.3.3 and 5.2.3.1

PURPOSE: This method verifies that the output impedance of the Mission Store complies with the requirements of the standard.

PARAMETER TYPE:	☒ ELECTRICAL	☐ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☒ TEST	☐ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if the source impedance (line-to-line) of the low bandwidth interface is less than 60Ω , over the frequency band 150 Hz to 8 kHz.

APPARATUS:

- a. Digital Voltmeter with a signal measurement bandwidth of greater than 150 Hz to 8 kHz.
- b. $600\ \Omega$ load.
- c. Test cabling connecting the test equipment to the MSI.
- d. Other Mission Store particular test equipment, as required.

VALIDATION METHOD: Measure the Mission Store output voltage across a $600\ \Omega$ load using a DVM. The store shall be provided with the necessary stimulus to generate a 12 V peak-to-peak low bandwidth signal. Check that the DVM reads greater than 10.91 V peak-to-peak.

NOTES:

1. The test set up is shown in figure LBW203.
2. Where so designed, the Mission Store shall be set to generate audio signals covering the frequency band 150 Hz to 8 kHz.
3. If the Mission Store design is not capable of producing a 12 V peak-to-peak LB output, then the maximum achievable output shall be used. In this case, the DVM indication shall be not less than 0.909 times that of the store-achieved output.

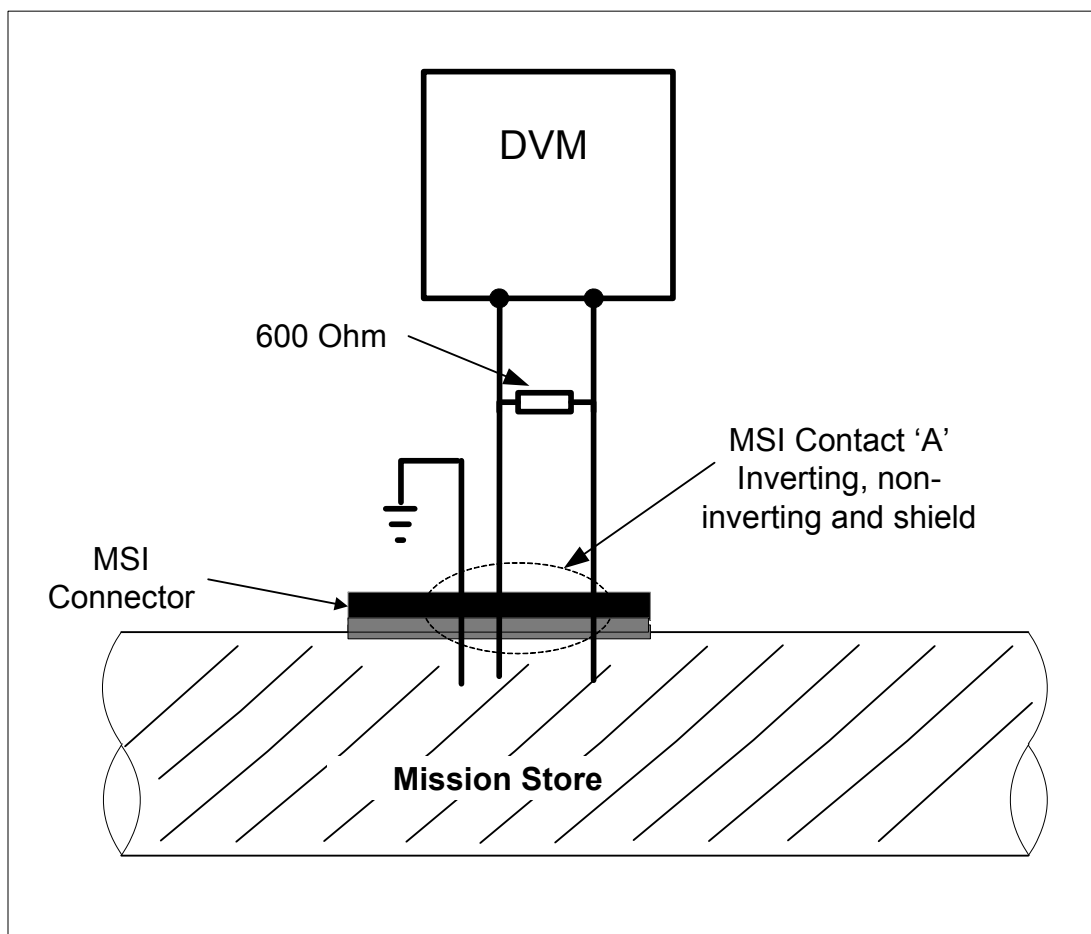


FIGURE LBW203

METHOD: LBW204

PARAMETER: Mission Store LB Interface Input Impedance

MIL-STD-1760D PARAGRAPH: 4.3 and 5.2.3.1

PURPOSE: This method verifies that the input impedance of the Mission Store complies with the requirements of the standard.

PARAMETER TYPE:	☒ ELECTRICAL	☐ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☒ TEST	☐ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if the sink impedance (line-to-line) of the low bandwidth interface is $600\ \Omega \pm 60\ \Omega$.

APPARATUS:

- a. Swept frequency impedance analyzer set with maximum output impedance of $60\ \Omega$, that covers the frequency range of 150 Hz to 8 kHz.
- b. Test cabling connecting the test equipment to the MSI.

VALIDATION METHOD: Connect the impedance analyzer to the Mission Store low bandwidth interface. Sweep the signal frequency from 150 Hz to 8 kHz and ensure that the impedance measured is always $600\ \Omega \pm 60\ \Omega$.

NOTE: The test set-up is shown in Figure LBW204.

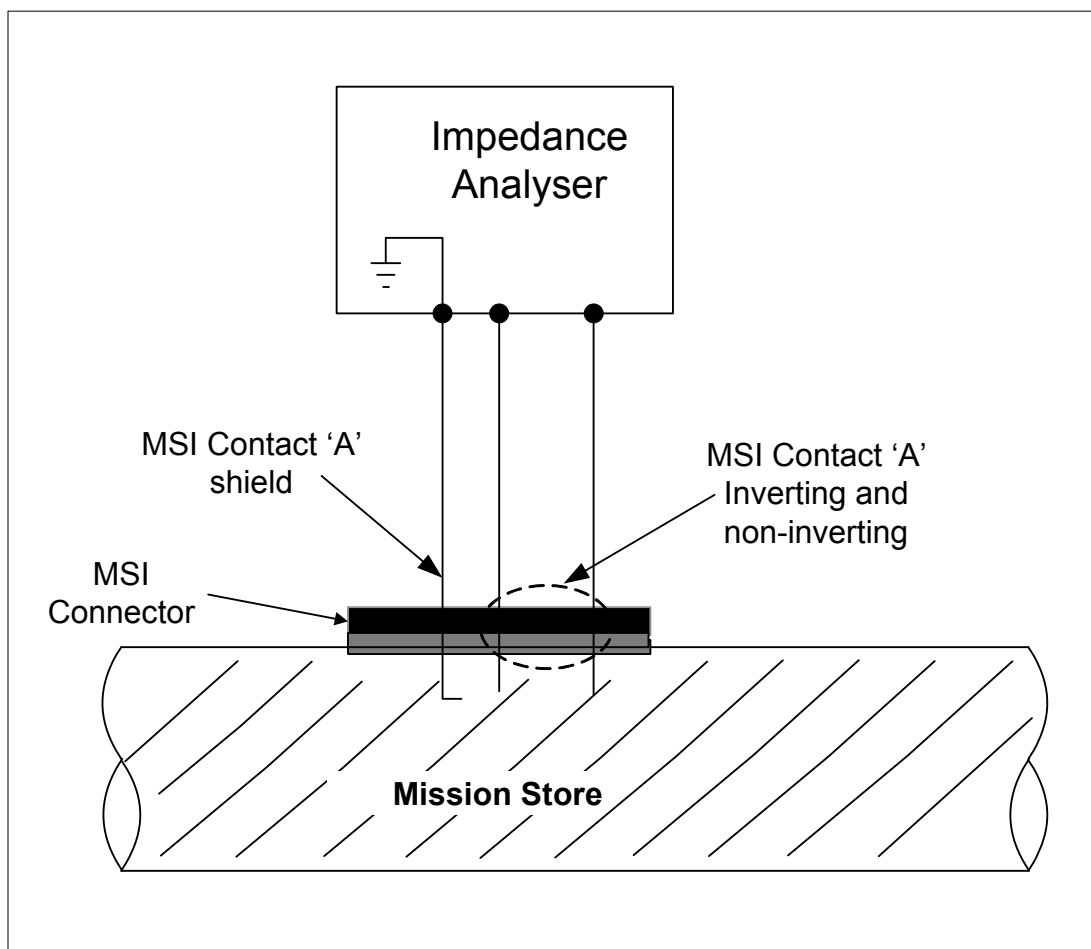


FIGURE LBW204

METHOD: LBW205

PARAMETER: Mission Store LB Interface Pass Band and Signal Voltage

MIL-STD-1760D PARAGRAPH: 4.3, 4.3.3.1

PURPOSE: This method verifies that within the transmission pass band of 300 Hz to 3.4 kHz, the maximum instantaneous signal voltage (between the non-inverting connection and the inverting connection) shall be ± 12 V and that the peak-to-peak signal voltage shall be 12 V maximum.

PARAMETER TYPE: (X) ELECTRICAL () PROTOCOL () PHYSICAL
VALIDATION TECHNIQUE: (X) TEST () ANALYSIS () INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if the LB output voltages measured at the MSI are within the specified ranges of the standard.

APPARATUS:

- a. Oscilloscope.
- b. 600 Ω load.
- c. Test cabling connecting the test equipment to the MSI.
- d. Other Mission Store particular test equipment, as required.

VALIDATION METHOD: Measure the Mission Store output voltage across a 600 Ω load using an oscilloscope. The store shall be provided with the necessary stimulus to generate a maximum output low bandwidth signal. Check the oscilloscope trace for compliance with the standard.

NOTES:

1. The test set up is shown in Figure LBW205.
2. Where so designed, the Mission Store shall be set to generate audio signals covering the transmission pass band of 300 Hz to 3.4 kHz.

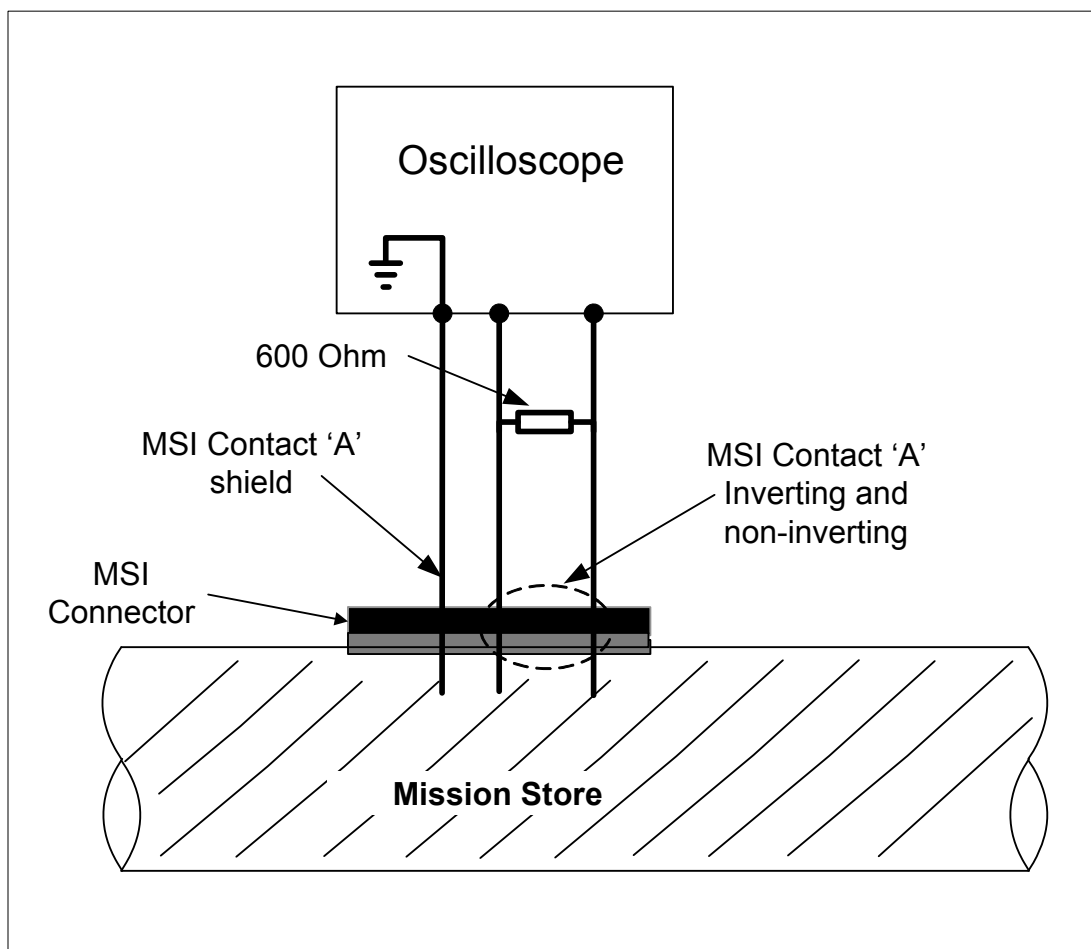


FIGURE LBW205

METHOD: LBW206

PARAMETER: Mission Store LB Interface Instantaneous Common Mode Voltage

MIL-STD-1760D PARAGRAPH: 4.3, 4.3.3.1

PURPOSE: This method verifies that the maximum instantaneous common mode voltage (the voltage between the non-inverting connection and reference ground added to the voltage between the inverting connection and reference ground) is in the range ± 1 V.

PARAMETER TYPE:	☒ ELECTRICAL	☐ PROTOCOL	☐ PHYSICAL
VALIDATION TECHNIQUE:	☒ TEST	☐ ANALYSIS	☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if the measured common mode voltage across the frequency band is ± 1 V.

APPARATUS:

- a. Digital Voltmeter with a signal measurement bandwidth of greater than 300 Hz to 3.4 kHz.
- b. 300 Ω loads.
- c. Test cabling connecting the test equipment to the MSI.
- d. Other Mission Store particular test equipment, as required.

VALIDATION METHOD: Measure the common mode voltage using a DVM. The store shall be provided with the necessary stimulus to generate a 12 V (peak-to-peak) low bandwidth signal. Ensure that the DVM reads between ± 1 V.

NOTES:

1. The test set up is shown in Figure LBW206.
2. Where so designed, the Mission Store shall be set to generate audio signals covering the frequency band 300 Hz to 3.4 kHz.
3. If the Mission Store design is not capable of producing a 12 V peak-to-peak LB output, then the maximum achievable output shall be used.

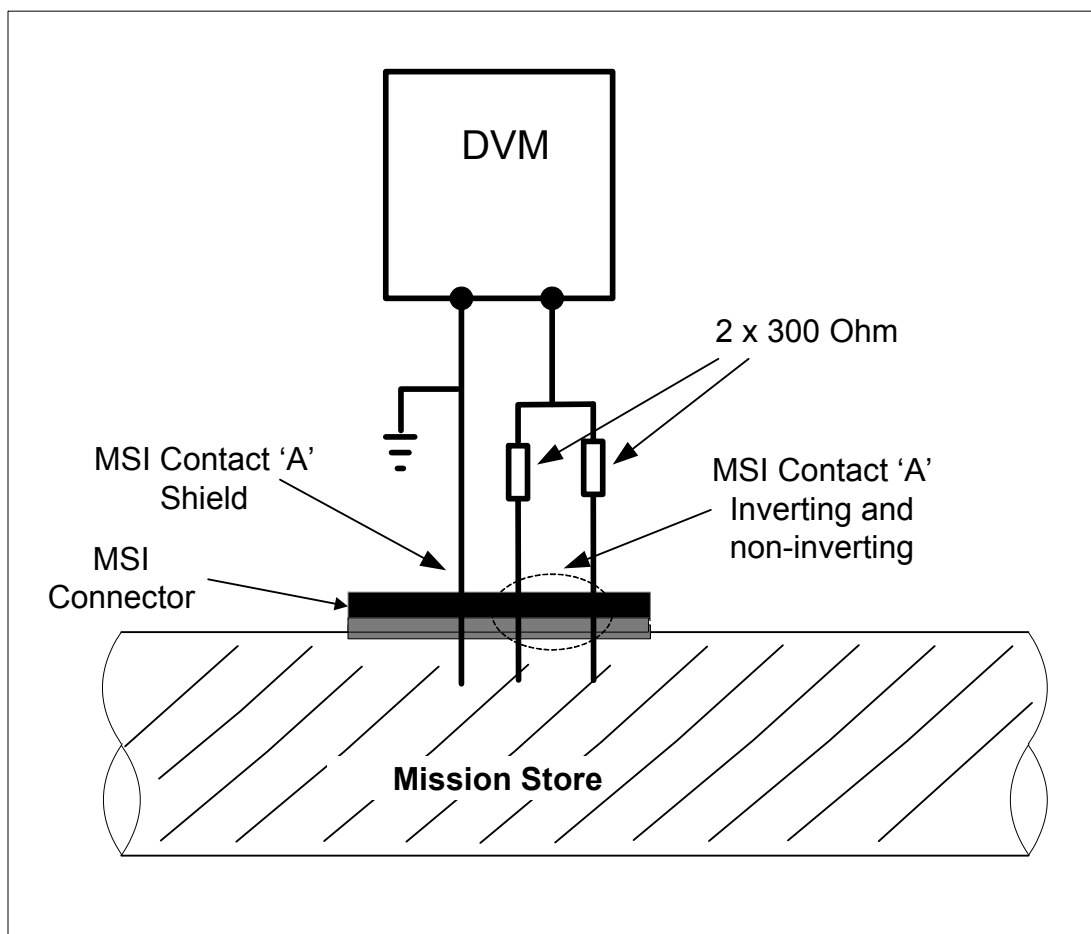


FIGURE LBW206

METHOD: LBW207

PARAMETER: Mission Store LB Interface Signal Assignment

MIL-STD-1760D PARAGRAPH: 4.3, 4.3.3.2

PURPOSE: This method validates that signals on the LB interface are limited to tones and voice grade audio.

PARAMETER TYPE: ☐ ELECTRICAL ☐ PROTOCOL ☒ PHYSICAL
VALIDATION TECHNIQUE: ☐ TEST ☒ ANALYSIS ☐ INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if it can be shown that the LB interface is only used for the transmission and / or receiving of tones and / or voice grade audio.

APPARATUS: None

VALIDATION METHOD: By analysis of the Mission Store TDP, verify that the LB interface is used only for the transmission/reception of tones and/or voice grade audio.

NOTES: None

METHOD: LBW208

PARAMETER: Mission Store LB Unused Interface

MIL-STD-1760D PARAGRAPH: 4.3 and 5.2.3

PURPOSE: This method validates the impedance of the low bandwidth interface that has not been implemented by the Mission Store (see NOTE 2).

PARAMETER TYPE: (X) ELECTRICAL () PROTOCOL () PHYSICAL
VALIDATION TECHNIQUE: (X) TEST () ANALYSIS (X) INSPECTION

VALIDATION CRITERIA: The Mission Store is considered to have passed if, when an electrical contact is installed in the unused interface, it is terminated with an appropriate load.

APPARATUS: Ohmmeter capable of measuring resistances up to at least 600 Ω .

VALIDATION METHOD: Where an electrical contact is installed in the MSI, measure the resistance looking into the MSI using an Ohmmeter. Ensure that the Ohmmeter reads greater than 540 Ω .

NOTES:

1. The test set up is shown in Figure LBW208
2. For those Mission Stores that do not use an electrical contact in the cavity, validation of this requirement may be by inspection of the connector to verify that the contact cavity is plugged.

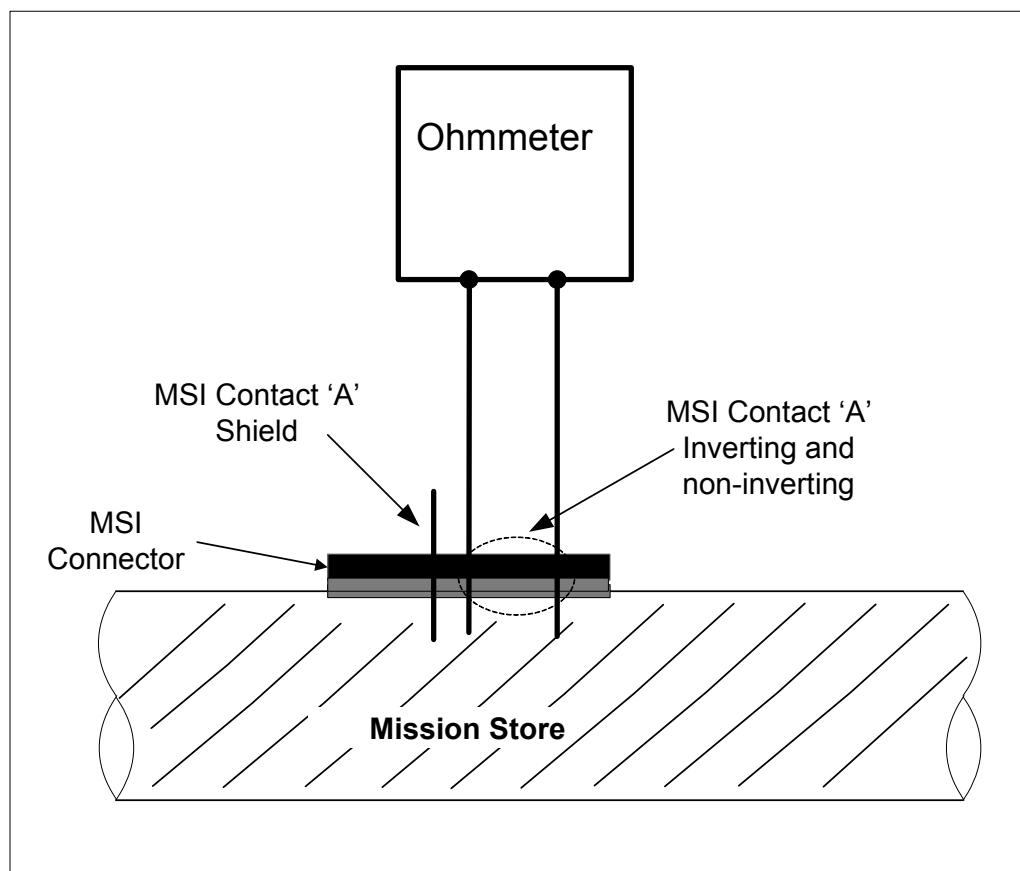


FIGURE LBW208