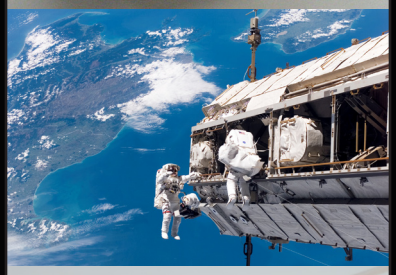

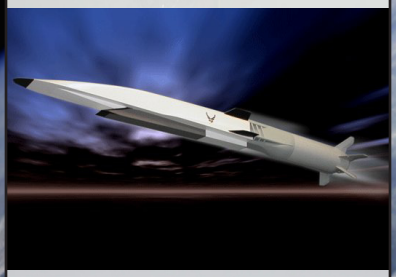

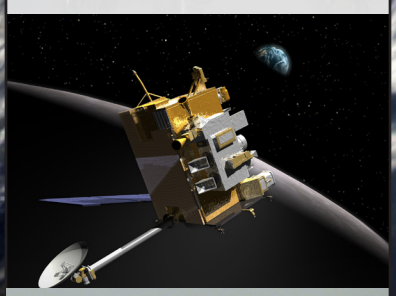

PHOENIX LOGISTICS INC.

Space Level Screening Services

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Phoenix Logistics, Inc.

1553 Data Bus

Test Plan Suite

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PHYSICAL CHARACTERISTICS

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify the coupler meets design requirements utilizing manufacturing documentation and inspection to ensure the highest quality attainable with sound engineering and design practices. When measured per the below procedure, each assembly shall meet all requirements as specified by the Data Bus Coupler Specification.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.2

2.2 Data Bus Coupler Specification for coupler under test

3.0 **TEST EQUIPMENT:**

3.1 Microscope

3.2 Mechanical measuring equipment; as required for type of measurement

4.0 **PROCEDURE:**

4.1 DIMENSIONS:

4.1.1 Measure all dimensions on 100% of each lot to verify they are as specified by the coupler assembly specification and document results.

4.2 WEIGHT:

4.2.1 Weigh each coupler and document to verify weight is as specified by the coupler assembly specification drawing requirements.

4.3 ENCLOSURE:

4.3.1 Inspect the coupler enclosure(s) on 100% of each lot at a minimum of 5X magnification and document to ensure each provides EMI/RFI sealing of the coupler case and to ensure physical, environmental and contamination protection is provided by the coupler case covering.

4.3.2 Examine the enclosure(s) and document to verify sufficient mechanical strength to withstand normal handling in transit, test, storage, and use as specified without causing malfunction or distortion of parts.

4.4 CABLE REQUIREMENTS:

4.4.1 Verify the data bus coupler is designed for use with the customer specified cable; specifically coupler cable entry points must be of the correct size and weight of cable must be managed to avoid distortion of coupler case.

4.5 MOUNTING ATTITUDE:

4.5.1 Verify the data bus coupler assembly is designed to function as specified when mounted in any position.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

VACUUM STABILITY

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify polymeric materials used within the completed assembly shall not exceed NASA Outgassing requirements.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.1.3.1.1

2.2 NASA Reference Publication 1124 at http://outgassing.nasa.gov/

3.0 **TEST EQUIPMENT:**

3.1 Analysis only

4.0 **PROCEDURE:**

4.1 Perform Outgassing analysis during coupler design phase inclusive of all materials to be used in design of couplers; utilizing the above referenced NASA website, to ensure the following:

4.1.1 No material shall exceed a Total Mass Loss (TML) of 1.0 %.

4.1.2 No material shall exceed a Collected Volatile Condensable Material (CVCM) of 0.1%.

4.2 Outgassing vacuum bake-out has been proven to bring materials within the required range. If the customer approves use of any materials within the coupler design that exceed the NASA Reference Publication 1124 criteria the coupler manufacturing process must include a vacuum bake-out.

4.2.1 Perform Vacuum Outgas Bake-Out per the Test Plan following completion of all manufacturing processes and just prior to Final Test of assembly.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

OUTGASSING / TOXICITY

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify the type and quantity of volatile offgas and toxicity properties of a component or assembly are compatible with the environment that the component or assembly will be exposed to in use. Materials shall meet MAC (Maximum Allowable Concentration) levels defined by NASA-STD-6001.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.1.3.1.2

2.2 NASA-STD-6001 (Previously published as NHB 8060.1C), paragraph 4.7, Test 7

3.0 **TEST EQUIPMENT:** Dependent upon component type and environment to which the component will be exposed

4.0 **PROCEDURE:**

4.1 Perform testing in accordance with NASA-STD-6001.

4.2 Define the operational environment and component type to determine which test procedure within NASA-STD-6001 to select and execute.

4.2.1 Materials within a hermetically sealed container do not require Offgas/Toxicity testing.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

ODOR

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify the nature and quantity of odor properties of a component or assembly are not objectionable or revolting. The nature and quantity of odor products from coupler materials shall have a rating of 2.5 maximum as defined in NASA-STD-6001.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.1.3.1.3

2.2 NASA-STD-6001 (Previously published as NHB 8060.1C), paragraph 4.6, Test 6

3.0 **TEST EQUIPMENT:** Dependant upon component type and environment to which the component will be exposed in use.

4.0 **PROCEDURE:** Perform testing in accordance with NASA-STD-6001.

4.1 Define the operational environment and component type to determine which test procedure within NASA-STD-6001 to select and execute.

4.1.1 Materials within a hermetically sealed container do not require Odor testing.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

FLAMMABILITY

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify the flammability and/or self extinguishing properties of the components of coupler assembly are compatible with the environment in which the component or assembly will be operating. Materials used in the Couplers shall be non combustible or self-extinguishing (Flammability rating A as listed in MSFC-HDBK-527/JSC09604), six inch maximum burn length and ten minutes maximum burn time. During testing there shall be no sparking, sputtering or dripping of flaming particles from the test specimen.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.1.3.1.4

2.2 NASA-STD-6001 (Previously published as NHB 8060.1C), paragraph 4.1, test 1 and paragraph 4.4, test 4

3.0 **TEST EQUIPMENT:**

3.1 Dependent upon component type and environment in which the component will be exposed in use.

3.1.1 Test chamber large enough so that complete combustion of the test specimen can occur with no more than a 5% relative depletion of oxygen concentration and it must not interfere chemically or physically with the test

3.1.2 Measuring devices, such as pressure gauges and oxygen measuring devices

3.1.3 Test gases

3.1.4 Chemical ignition source

3.1.5 Test sample holder

4.0 **PROCEDURE:**

4.1 Perform testing in accordance with NASA-STD-6001 with the following test conditions:

4.1.1 Perform tests in a 14.7 PSIA test atmosphere of 20%, 25%, and 30% O_2 partial pressure.

4.1.2 Gases – 30% oxygen and 70% nitrogen

4.1.3 Pressure – 10 PSIA

4.2 Examine test specimen for sparking, sputtering or dripping of flaming particles, record findings.

4.3 Time how long the test specimen burns after removal of test flame, record findings.

4.4 Measure the distance of flame travel up the test specimen, record findings.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

FUNGUS

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify all materials of a component or assembly are fungus inert. Analysis or testing shall prove all materials are fungus inert

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.1.3.2

2.2 MIL-STD-810, Method 508.6

3.0 **TEST EQUIPMENT:**

3.1 Refer to MIL-STD-810, Method 508.6 to determine equipment needs.

4.0 **PROCEDURE:**

4.1 Through analysis of materials, determine if any materials within a component or assembly need testing.

4.1.1 Materials listed in MIL-STD-810, Method 508.6, Annex B, Table 508.6B-1, Group 1 are considered Fungus Inert and do not require testing.

4.1.2 Test in accordance with MIL-STD-810, Method 508.6 all materials not listed nor previously tested.

4.1.3 Materials within a hermetically sealed enclosure do not require Fungus testing.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

OZONE EXPOSURE

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify the materials of the coupler/coupler harness can withstand exposure to ozone without degradation. After exposure there shall be no degradation of elastomer materials, excessive swelling of resilient material or loosening or breakage of part.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.1.3.3

3.0 **TEST EQUIPMENT:**

3.1 Suitable chamber

3.2 Mercury vapor lamp

WARNING: OZONE IS A TOXIC GAS, EXERCISE APPROPRIATE CAUTION

4.0 **PROCEDURE:**

4.1 Place component in chamber and expose to an ozone concentration of 100 – 150 PPM by volume of the chamber, at standard ambient temperature for 2 hours.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

FLUIDS RESISTANCE

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To determine if materials of the coupler and the coupler itself are affected by temporary exposure to contaminating fluids (liquids) such as may be encountered and applied during its life cycle, either occasionally, intermittently, or over extended periods. As a result of testing there shall be no functional damage or electrical shorts or discontinuities of greater than one micro-second.

2.0 **TEST SPECIFICATIONS:**

2.1 5PTV5207, paragraph 3.4.9

2.2 MIL-STD-810, Method 504

3.0 **TEST EQUIPMENT:**

3.1 Environmental Chamber of sufficient thermal capacity to meet temperature and test condition requirements

3.2 Test Fluids

3.3 Soak Vessels for each fluid

4.0 **PROCEDURE:**

4.1 Manufacture one test coupler specimen for each type of fluid listed in TABLE 1

4.2 Perform all normal final acceptance tests and inspections and record data.

4.3 Perform one of the two test sequences as prescribed in TABLE 1; one test specimen per fluid:

4.3.1 TEST SEQUENCE 1:

4.3.1.1 Bake test specimen at 135˚ C for 30 minutes.

4.3.1.2 Immerse test specimen in test fluid for 5 minutes at room temperature.

4.3.1.3 Drain the test specimen for 1 hour.

4.3.1.4 Perform post-testing

4.3.1.5 Repeat all steps two more times.

4.3.2 TEST SEQUENCE 2:

4.3.2.1 Bake test specimen at 39˚ C for 30 minutes.

4.3.2.2 Immerse test specimen in test fluid for 5 minutes at room temperature.

4.3.2.3 Drain the test specimen for 1 hour.

4.3.2.4 Perform post-testing

4.3.2.5 Repeat all steps two more times.

4.4 POST-TESTING: Perform the following tests and record results:

4.4.1 Electrical Performance

4.4.2 Dielectric Withstanding Voltage

4.4.3 Examination of test specimen for visual damage and swelling, to include two dimensional measurements; height and width, of coupler.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

TABLE 1		
TEST	**TEST FLUID**	**TEST SEQUENCE**
1	MIL-PRF-87252, Coolant	1
2	MIL-DTL-5624, JP-4 Turbine Fuel	2
3	MIL-PRF-5606	1
4	MIL-DTL-5624, JP-5 Turbine Fuel	2
5	MIL-PRF-7808, Lubricating Oil	1
OPTIONAL 1	TT-I-735, Isopropyl Alcohol	1
OPTIONAL 2	AMS 1424 (Previously MIL-A-8243), Anti-Icing Fluid	1
6	MIL-PRF-83282, Hydraulic Fluid	1
7	MIL-PRF-23699, Lubricating Oil	1
OPTIONAL 3	ASTM-D1153, M1BK, Methyl Isobutyl Keytone	1
OPTIONAL 4	AMS 1432 (Previously MIL-D-83411), Deicing Fluid CL1 for taxiways and runways	1

TURNS RATIO & POLARITY

TRANSFORMERS

1.0 **PURPOSE:** To verify the transformer turns ratio of 1:1.41 +/- 3% and the polarity of the transformer. During testing the output shall be between 0.6880 and 0.7300, with 0.7090 being nominal and the output voltage shall have the same instantaneous polarity as the input voltage, be in phase.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.3.1.1

2.2 NASA EEE-INST-002, Section M1, Table 2, Test 2

3.0 **TEST EQUIPMENT:**

3.1 Sine Wave Generator

3.2 Oscilloscope

4.0 **PROCEDURE;**

4.1 Apply a 1 VRMS, 10.0 kHz signal to terminals 3 and 4.

4.2 Measure output at terminals 1 and 2

4.3 Polarity is tested at the same time in the same set up by monitoring the output voltage.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

OPEN CIRCUIT IMPEDANCE

TRANSFORMERS

1.0 **PURPOSE:** To verify the transformer input impedance is greater than 3000 Ohms.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.3.1.2

3.0 **TEST EQUIPMENT:**

3.1 Signal Generator

3.2 Impedance Meter 252, or equivalent

3.3 Test Box # 3 Input Impedance, or equivalent

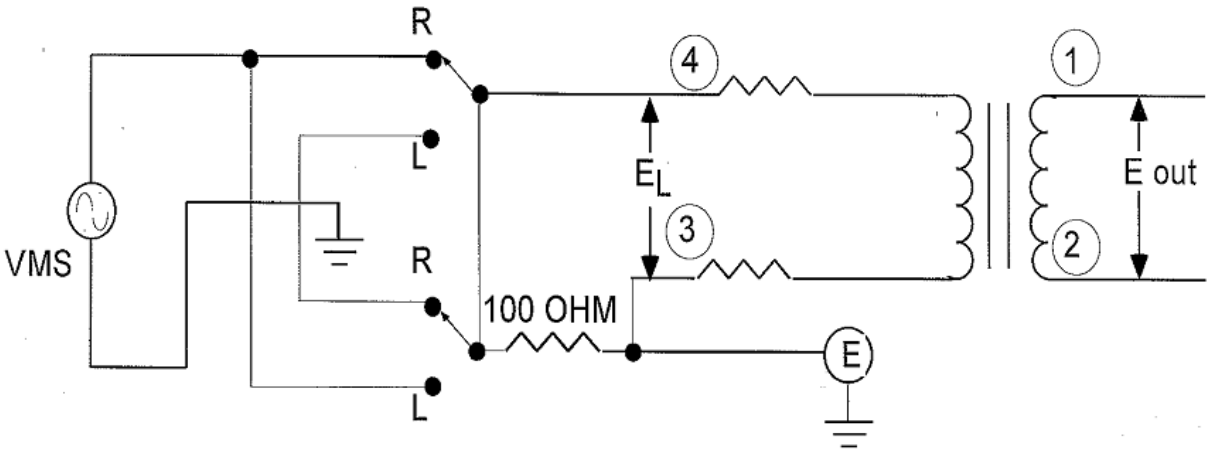
4.0 **PROCEDURE;**

4.1 Apply a 1 VRMS signal over the frequency range of 75 kHz to 1MHz (E in) to terminals 3 & 4 at the "IN' connection on test box # 3.

4.2 Measure inductance (EL) across terminals 3 and 4 at the red test points marked "3" and "4" of test box # 3.

4.3 Measure resistance (E out) across terminals 1 and 2 at the "OUT" connection of test box # 3.

4.4 Calculate Input Impedance with the following formula:



$$\text{Input Impedance } Z = \frac{E_L}{E_R} \times 100\%$$

Where:

Z = Input Impedance

EL = Inductance across terminals 3 and 4, in micro henries

ER = Resistance (E out) across terminals 1 and 2, in Ohms

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

FREQUENCY RANGE

TRANSFORMERS

1.0 **PURPOSE:** To verify the transformer will respond from 75 kHz – 1 MHz per MIL-STD-1553.

2.0 **TEST SPECIFICATIONS:**

2.1 MIL-STD-1553

2.2 Q40010-001 Test Requirements

3.0 **TEST EQUIPMENT:**

3.1 Signal Generator

3.2 Oscilloscope

4.0 **PROCEDURE:**

4.1 Frequency range is verified as part of the OPEN CIRCUIT IMPEDANCE test.

WAVEFORM INTEGRITY

TRANSFORMERS

1.0 **PURPOSE:** To verify the output waveform integrity of the transformer to include waveform droop, overshoot and ringing. Droop shall be 20% max and Overshoot/Ringing shall be less than +/-1.0 V.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.3.1.3

3.0 **TEST EQUIPMENT:**

3.1 Signal Generator

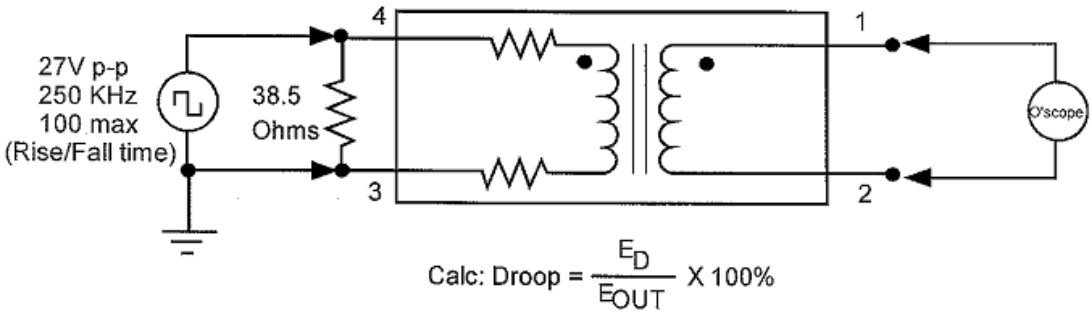
3.2 Oscilloscope

4.0 **PROCEDURE;**

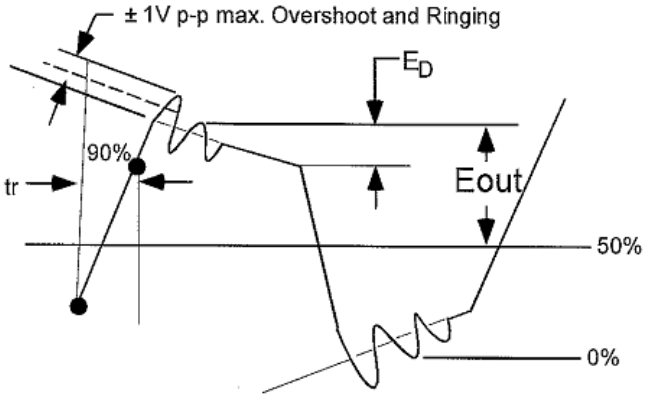
4.1 Apply a 27 VPP, 250 kHz signal across a 38.5 Ohm resistor to terminals 3 & 4 at a rise time 100 nanoseconds.

4.2 Measure output at terminals 1 and 2

4.3 Test Set Up:



4.4 Output Waveform:



5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached report.

COMMON MODE REJECTION

TRANSFORMERS

1.0 **PURPOSE:** To verify the transformer common mode rejection ratio is greater than 45 dB at 1 MHz.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.3.1.4

3.0 **TEST EQUIPMENT:**

3.1 Data Bus Network Tester T10013, Model S2471 or S2475

4.0 **PROCEDURE;**

4.1 Push the Shield Test button to engage.

4.2 Terminate all open Bus leads with 77 Ohms.

4.3 Connect the Network Tester output leads between both conductors of Stub 1 tied together and the shield.

4.4 Connect the Network Tester input leads between the conductors of another Stub.

4.5 Read the Common Mode Rejection ratio on the Network Tester readout.

4.6 Repeat test on each Stub of the assembly.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

PRE-POT INSPECTION
TRANSFORMERS

1.0 **PURPOSE:** To ensure conformance to construction and workmanship criteria prior to potting. There shall be no evidence of defects, as defined in MIL-STD-981.

2.0 **TEST SPECIFICATIONS:**

2.1 MIL-STD-981, paragraph 5.5.12

2.2 Transformer specification

2.3 J-STD-001

3.0 **TEST EQUIPMENT:**

3.1 Microscope

4.0 **PROCEDURE:**

4.1 Perform pre-pot inspection in accordance with MIL-STD-981, paragraph 5.5.12 under magnification of 3-10 X for the criteria listed.

4.1.1 An additional criterion for the Q40010-001 transformer is to inspect the internal isolation resistors' silicone conformal coating for cracks in accordance with J-STD-001.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

ELECTRICAL PERFORMANCE
1553 DATA BUS COUPLER

1.0 **PURPOSE:** The Data Bus Tester is used to ensure the 1553 Harness under test can receive and transmit data. Performance testing includes normal transmission testing using simulated 1553 data bus signals, testing for phase throughout the network, measuring insertion loss, testing for continuity on bus and stubs, detecting shorts between conductors, conductors and shields, or bus terminating resistors.

2.0 **TEST SPECIFICATONS:**

2.1 MIL-STD-1553

2.2 S2471/S2475 Data Bus Network Tester Operating Manual

3.0 **TEST EQUIPMENT:**

3.1 Data Bus Network Tester T10013, Model S2471 or S2475

3.2 Test Coupler(s)

4.0 **PROCEDURE**:

4.1 At the start of each day: Perform the Daily Calibration Procedure per the Network Tester Operating Manual.

4.2 Connect the Network Tester input lead to the stub conductors of the unit under test (UUT).

4.3 Connect the Network Tester output lead to one lead of a Test Coupler and connect the other lead of the Test Coupler to the Bus conductors of the UUT.

4.3.1 Harnesses/couplers with a dual terminated Bus Line: Do not use any Test Couplers. Connect both Network Tester leads directly to the Stub legs of the harness/coupler under test.

4.3.2 Harnesses/couplers with an unterminated Bus Line: Connect a second Test Coupler to the other end of the Bus line.

4.4 The display on the Network Tester shall read -12.0 +/- 1dB loss and the green pass indicator shall be ignited.

4.4.1 If the UUT passes with borderline insertion loss readings (higher than normal for the configuration), perform further troubleshooting to ensure the borderline reading is not being caused by a failing transformer. EX: If readings have been in the range of -12.0 to -12.3; a -12.5 reading would be above the norm (borderline).

4.4.2 A red fail light with a correct dB loss indication (-12.0 +/- 1dB) on the Network Tester indicates a failure due to an out-of-phase condition.

4.5 Repeat the test for each Stub conductor.

4.6 Harnesses/couplers with an unterminated Bus Line - Perform the following steps to verify polarity at both ends of bus line:

4.6.1 Disconnect the Test Coupler with the Network Tester output lead connected to it from the UUT and switch it with Test Coupler at the other end of the Bus line.

4.6.2 Connect the Network Tester input lead to any of the Stub leads and repeat the test; only to the one Stub to verify that the Stub has maintained a passing condition.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

BUS/STUB RETURN LOSS
1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify the coupler under test can receive and transmit data utilizing simulated 1553 data bus signals. Insertion Loss shall be -12.0 +/- 1dB.

2.0 **TEST SPECIFICATIONS:**

2.1 S2471/S2475 Data Bus Network Tester Operating Manual

3.0 **TEST EQUIPMENT:**

3.1 Data Bus Network Tester T10013; Model S2471 or S2475

3.2 Test Coupler(s)

4.0 **PROCEDURE:**

4.1 The Bus and Stub return loss test is performed and recorded as part of the DATA BUS ELECTRICAL PERFORMANCE test.

PHASE

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify the phase of each Bus and Stub network according to the schematic of each coupler/harness assembly configuration.

2.0 **TEST SPECIFICATIONS:**

2.1 S2471/S2475 Data Bus Network Tester Operating Manual

2.2 Coupler Specification Drawing

3.0 **TEST EQUIPMENT:**

3.1 Data Bus Network Tester T10013; Model S2471 or S2475.

3.2 Test Coupler(s)

4.0 **PROCEDURE:**

4.1 The phase test of the Bus and Stub networks is performed and recorded as part of the DATA BUS ELECTRICAL PERFORMANCE test.

CONTINUITY

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify the continuity of each Bus and Stub cable including shields according to the schematic of each coupler/harness assembly configuration.

2.0 **TEST SPECIFICATIONS:**

2.1 S2471/S2475 Data Bus Network Tester Operating Manual

3.0 **TEST EQUIPMENT:**

3.1 Data Bus Network Tester T10013; Model S2471 or S2475

3.2 Test Coupler(s)

4.0 **PROCEDURE:**

4.1 The continuity test of the Bus, Stub and shield is performed and recorded as part of the DATA BUS ELECTRICAL PERFORMANCE test.

INSULATION RESISTANCE
1553 DATA BUS COUPLER

1.0 **PURPOSE:** To measure the resistance offered by the insulating members throughout the coupler assembly using DC voltage. Resistance shall be greater than 1000 M Ohms @ 500 VDC (Shield to conductor) or 250 VDC (Conductor to conductor).

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.3.2.3

2.2 MIL-STD-202, Method 302, Test Condition B

3.0 **TEST EQUIPMENT:** Megohm-meter; Beckman L-8 or equivalent

WARNING: HIGH VOLTAGE EXISTS DURING PROCEDURE THAT CAN CAUSE SHOCK. DO NOT COME INTO CONTACT WITH SHIELD OR CONDUCTORS DURING TEST.

4.0 **PROCEDURE:**

4.1 TEST 1; shield to conductor:

4.1.1 Connect one lead of the Megohm-meter to the Bus shield. Connect the other lead to both conductors at once of a Bus leg.

4.1.2 Set Megohm-meter to 500 VDC.

4.1.3 Depress the meter “TEST” button. The Megohm-meter will indicate an initial low reading, then go up and indicate a steady reading.

4.1.4 Repeat the test between the shield and conductor pairs for each Stub leg.

4.2 TEST 2; conductor to conductor:

4.2.1 Disconnect all Megohm-meter leads from assembly. Connect one Megohm-meter lead to a Bus conductor. Connect the other lead to a Stub conductor.

4.2.2 Set Megohm-meter to 250 VDC.

4.2.3 Depress the meter “TEST” button. The Megohm-meter will indicate an initial low reading, then go up and indicate a steady reading.

4.2.4 Repeat the test for each Stub conductor until all Stubs have been tested.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

DIELECTRIC WITHSTANDING VOLTAGE

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To ensure assembly can operate safely at its rated voltage and withstand momentary over potentials due to switching, surges and other similar phenomena. During voltage application there shall be no arcing or breakdown between terminal points and leakage current shall not exceed 2.0 mA.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.3.2.4

2.2 MIL-STD-202, Method 301

3.0 **TEST EQUIPMENT:** Biddle AC Hypot Tester, Model #230315 or equivalent

WARNING: HIGH VOLTAGE EXISTS DURING PROCEDURE THAT CAN CAUSE SHOCK. DO NOT COME INTO CONTACT WITH SHIELD OR CONDUCTORS DURING TEST.

4.0 **PROCEDURE:**

4.1 TEST 1; shield to conductor:

4.1.1 Connect one lead of the Hypot to the Bus shield. Connect the other lead to both conductors at once of a Bus leg.

4.1.2 Rotate “Voltage Control” clockwise to 500 VAC, 60 Hz signal slowly and at a uniform rate and maintain for 60 seconds; then return to zero.

4.1.3 Repeat the test between the shield and conductors pairs for each Stub leg.

4.2 TEST 2; conductor to conductor:

4.2.1 Disconnect all Hypot leads from assembly. Connect one Hypot lead to a Bus conductor. Connect the other lead to a Stub conductor.

4.2.2 Rotate “Voltage Control” clockwise to 100 VAC, 60 Hz voltage signal slowly and at a uniform rate and maintain for 60 seconds; then return to zero.

4.2.3 Repeat test for each Stub conductor until all Stubs have been tested.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

BUS DC RESISTANCE

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To ensure the measured DC Resistance across the Bus network; to include conductors, resistors and transformers, meets the specified requirements of the Bus network configuration. The measured resistance shall meet the computed design Bus DC resistance within a tolerance of +/- 5%.

2.0 **TEST SPECIFICATONS:**

2.1 MIL-STD-202, Method 303

3.0 **TEST EQUIPMENT:**

3.1 Fluke 77 Multi-Meter; or equivalent.

4.0 **PROCEDURE**:

4.1 Compute the coupler design DC Resistance of the Bus network using the following formula:

$$Ro = \left(\frac{1}{\frac{1}{R1} + \frac{1}{R2} + \underset{\cdot\cdot\cdot\cdot\cdot}{\text{etc}} + \frac{1}{Rn}} \right) + \frac{1.5}{250} \text{ X Bus network length}$$

Where:

Ro = Bus DCR

R1, R2, R3 (etc) = Resistance value for each transformer in the assembly and all isolation resistors.

Rn = Resistance value of any termination resistors within the assembly; when applicable.

4.2 Measure the DC resistance of the Bus network of the coupler under test and compare the readings to the computed design Bus DC resistance:

4.2.1 Connect multi-meter leads across the two center conductors at one end of the Bus network and measure the resistance

4.2.2 Repeat at the other end of the Bus network to ensure the resistance reads the same

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

BUS DC RESISTANCE
1553 DATA BUS COUPLER

1.0 **PURPOSE:** To ensure the measured DC Resistance across each Stub network; to include conductors, resistors and transformers, meets the specified requirements of the Stub network configuration. The measured DC resistance of each Stub network shall meet the computed design Stub DC resistance within a tolerance of +/- 5%.

2.0 **TEST SPECIFICATONS:**

2.1 MIL-STD-202, Method 303

3.0 **TEST EQUIPMENT:**

3.1 Fluke 77 Multi-Meter; or equivalent.

4.0 **PROCEDURE**:

4.1 Compute the coupler design DC Resistance of the each Stub network using the following formula:

$$\mathbf{Ro} = \left(\frac{1}{\frac{1}{R1} + \frac{1}{R2} + \text{etc.} \ldots\ldots} \right) + \frac{1.5}{250} \times \text{Stub network length}$$

Where:

Ro = Stub DCR

R1, R2, R3 (etc) = Resistance value for the transformer and all isolation resistors.

4.2 Measure the DC resistance of each Stub network of the coupler under test and compare the readings to the computed design Stub DC resistance:

4.2.1 Connect multi-meter leads across the two center conductors of the furthermost left and top Stub network and measure the resistance.

4.2.2 Repeat test for each Stub network in a consecutive flow through the assembly; left → right, top → bottom

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

CHARACTERISTIC IMPEDANCE

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify the capability of the transformer to provide impedance matching between the main Bus and Stubs. Characteristic impedance is controlled by the impedance of the data bus cable used to interconnect the couplers in the couple/harness assembly. The characteristic impedance shall be within the limits of the specified cable impedance.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.3.3.2.1

3.0 **TEST EQUIPMENT:**

3.1 N/A; verification by analysis

4.0 **PROCEDURE;**

4.1 Determine the Characteristic Impedance of the coupler and cable junction using the resistance in parallel formula below to calculate:

$$\text{Total Resistance} = \frac{R1 \times R2}{R1 + R2}$$

Where:

R1 = Cable nominal impedance (per cable manufacture specification)

R2 = Transformer average input impedance; which is 3200 Ω

Characteristic Impedance (Zo) = Total Resistance

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

FAULT ISOLATION RESISTANCE

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify the fault isolation resistance value of the Data Bus Coupler assembly. The calculated Fault Isolation Resistance and the Bus DC resistance measurement shall match and be within 0.75 of Zo +/- 2%, where Zo is the cable impedance.

2.0 **TEST SPECIFICATONS:**

2.1 SSQ 21676, paragraph 3.3.3.2.2

3.0 **TEST EQUIPMENT:**

3.1 N/A; Verification by analysis

4.0 **PROCEDURE**:

4.1 Calculate the Fault Isolation Resistance value of the coupler assembly configuration using the following formula:

$$R = \frac{Zo \times 1.5}{N}$$

Where:

R = Fault Isolation Resistance

Zo = The Characteristic Impedance of the cable

N = The number of stubs in the assembly

4.2 Perform or review BUS DC RESISTANCE testing per the Test Plan.

4.3 Compare the calculated Fault Isolation Resistance value to the measured resistance value of the Bus DC Resistance test data.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

WORKMANSHIP

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To verify workmanship is of the highest quality attainable with sound engineering and design practices.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.6 and 4.5

2.2 Customer Specification

3.0 **TEST EQUIPMENT:**

3.1 Microscope

4.0 **PROCEDURE:**

4.1 Inspect the following for workmanship at 5X magnification to assure the coupler assembly is free from mechanical defects that would prevent it from performing it's intended function:

4.1.1 Identification marking; shall meet customer specification

4.1.2 Condition of finish; shall be of good quality with no exposed flash or contaminants

4.1.3 Condition of enclosure seals; all corners shall be broken and smooth

4.1.4 Soldering; shall be performed in accordance with IPC/WHMA-A-620 and ANSI/J-STD-001 requirements

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

X-RAY FLUORESCENCE

PLATED COMPONENTS

1.0 **PURPOSE:** To verify the composition and thickness of the component's finish meet the component specification requirements.

2.0 **TEST SPECIFICATIONS:**

2.1 Component specification

3.0 **TEST EQUIPMENT:**

3.1 X-Ray Fluorescence Spectrometer System

4.0 **PROCEDURE:**

4.1 Subject a sample of (2) per lot, or as specified, to X-Ray Fluorescence Spectroscopy.

4.2 Compare the XRF readings to the component's specification to verify the plating metal type is as specified by the component specification.

4.3 Compare the XRF readings to the component's specification to verify the plating thickness is as specified by the component specification.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

THERMAL RATING

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To determine the stability of a component when exposed to long periods at high temperature. Component shall be able to withstand a minimum of 888 hours at 135˚ C with no degradation.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.4.6

3.0 **TEST EQUIPMENT:**

3.1 Environmental Chamber of sufficient thermal capacity to meet temperature and test condition requirements

3.2 Signal Generator

4.0 **PROCEDURE:**

4.1 Place specimen into the chamber so there is no obstruction to the flow of air across and around the specimen. Direct heat conduction to the specimen shall be minimized.

4.2 Energize Stub 1 with a 14 V peak to peak square wave at 250 Hz for the first 3 weeks, and then switch to Stub 2 for the remaining 3 weeks.

4.3 Terminate Bus leads with 78.7 Ohm resistors.

4.4 Program Chamber to perform five cycles a week for six weeks; as follows:

4.4.1 Four cycles each week – 20 hours at 135˚C followed by 4 hours at 20˚C

4.4.2 Fifth cycle of each week – 68 hours at 135˚C followed by 4 hours at 20˚C

4.5 Upon completion of cycling perform the following tests according to their Test Plans and attach test data:

4.5.1 Electrical Performance

4.5.2 Dielectric Withstanding Voltage (sea level)

4.5.3 Insulation Resistance

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

THERMAL CYCLING, VACUUM

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To determine the stability of a coupler when exposed to extremes of high and low temperature and low pressure. Permanent changes in a coupler's operating characteristics and physical damage produced during testing usually result from variations in dimensions and other physical properties such as mechanical displacement or rupture of conductors or insulating materials. The coupler shall pass electric performance testing at each temperature extreme of each cycle and there shall be no electrical discontinuities during cycling.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.4.7.1

2.2 S2471/S2475 Data Bus Network Tester Operating Manual

3.0 **TEST EQUIPMENT:**

3.1 Environmental Chamber of sufficient thermal and vacuum capacity to meet temperature, vacuum and test condition requirements

3.2 Torr Indicator Gauge

3.3 Data Bus Network Tester T10013; Model S2471 or S2475

3.4 Test Coupler(s)

3.5 Oscilloscope

4.0 **PROCEDURE:**

4.1 Place specimens into the chamber such that there is no obstruction to the flow of air across and around the specimen. Minimize direct heat conduction to the specimen.

4.2 Apply a vacuum of 10-6 Torr maximum within the chamber.

4.3 Simultaneously cycle test temperature between the extremes for 48 hours as detailed:

4.3.1 Temperature extremes: -55˚ C (or minimum design temperature) and 135˚ C (or maximum design temperature)

4.3.2 Cycle time: 90 minutes minimum, plus sufficient time at each temperature extreme to achieve thermal stabilization and conduct an Electrical Performance test

4.4 Perform Electrical Performance testing per the associated Test Plan, with test data recorded, at each temperature extreme of each cycle.

4.5 Monitor the specimens throughout cycling for electrical shorts and opens.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

TEMPERATURE SHOCK

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To determine the effects on a component of sudden changes in temperature of the surrounding atmosphere. These effects may include cracking or rupture of materials due to sudden dimensional changes caused by expansion or contraction. Upon completion of cycling there shall be no evidence of functional damage, no short circuits and no electrical discontinuities greater than 1 microsecond.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.4.8

2.2 MIL-STD-810, Method 503.5, Procedure I-C (Previously Method 503.1)

3.0 **TEST EQUIPMENT:**

3.1 Environmental Chamber of sufficient thermal capacity to meet temperature and test condition requirements

3.2 Oscilloscope

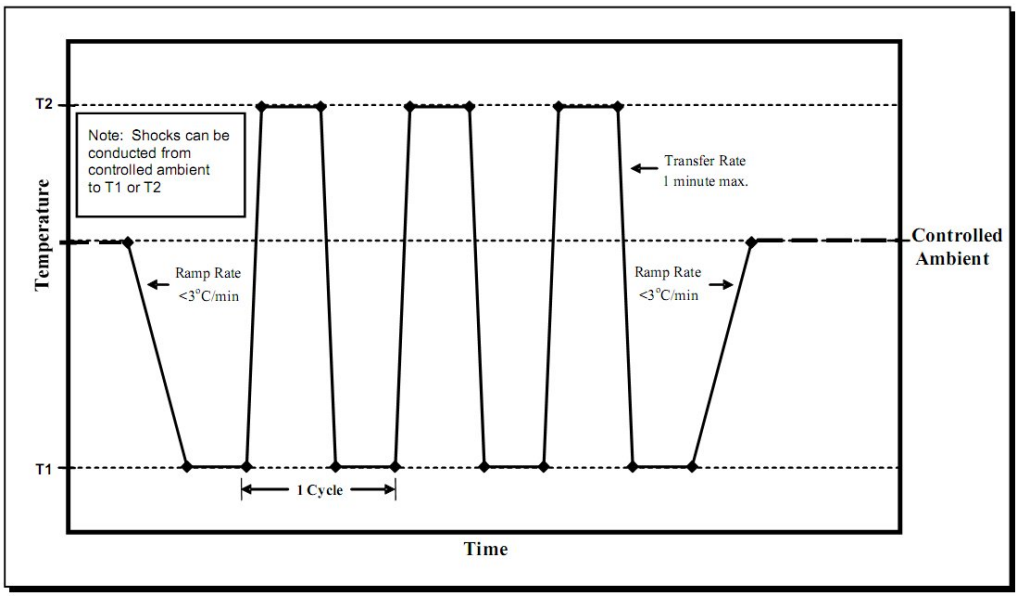
4.0 **PROCEDURE:**

4.1 Perform testing in accordance with MIL-STD-810, Method 503.5, Procedure I-C except the following:

4.1.1 Cycle test specimen five times between the temperature extremes of -94˚ C (-137˚ F) and +135˚ C (+275˚ F), with a stabilization period at temperature of four hours minimum.

4.1.2 Monitor test specimens throughout test for short circuits or electrical discontinuities.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.



RANDOM VIBRATION

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To determine the ability of the assembly to withstand the dynamic stress exerted by random vibration applied between upper and lower frequency limits to simulate operating environments. There shall be no electrical shorts or electrical discontinuities greater than 1 microsecond throughout the test.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.4.9

2.2 MIL-STD-202, Method 214, Condition II, Letter H

3.0 **TEST EQUIPMENT:**

3.1 Vibration System

3.2 Oscilloscope, or equivalent

4.0 **PROCEDURE:**

4.1 Mount test specimens to the vibration shaker in each of the three perpendicular axes.

4.2 Subject test specimens to a random vibration spectrum of + 6 dB per octave from 20 Hz to 100 Hz and 1.0 g2/Hz from 100 Hz to 2000 Hz in each of the three perpendicular axes for a duration of 7 minutes minimum per axis.

4.2.1 Test Condition, Test Letter, and duration time per axis is defined by the customer specification.

4.2.1.1 Nominal duration time per axis variations:

4.2.1.1.1 Space: 1-3 minutes

4.2.1.1.2 Military: 8 hours

4.3 Monitor test specimens throughout test for electrical shorts and discontinuities.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

MECHANICAL SHOCK

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To determine the ability of the assembly to withstand applied mechanical shocks to simulate field environments. There shall be no evidence of functional damage and no electrical discontinuities greater than 1 microsecond throughout testing.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.4.10

2.2 MIL-STD-202, Method 213

3.0 **TEST EQUIPMENT:**

3.1 Shock Machine

3.2 Transducers; one for each assembly

3.3 Oscilloscope

4.0 **PROCEDURE:**

4.1 Perform testing in accordance with MIL-STD-202, Method 213, paragraph 3.1 Half Sine Shock Pulse per Figure 213.1 and test condition B of Table 213-1 except the following:

4.1.1 Subject test specimen to three half sine wave mechanical shocks of 75 G's, 11 + 1 millisecond half sine, in each direction in three mutually perpendicular axes.

4.2 Monitor test specimen throughout testing for electrical shorts and discontinuities.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

SALT ATMOSPHERE (CORROSION)

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To evaluate the uniformity of protective coatings, metallic and nonmetallic, specifically for thickness and degree of porosity.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.4.11

2.2 MIL-STD-202, Method 101, Test condition B

3.0 **TEST EQUIPMENT:**

3.1 Salt chamber and chamber-heating means and controls

3.2 Salt solution delivery system

3.3 Means for humidifying the heated air within the chamber

3.4 Microscope

4.0 **PROCEDURE:**

4.1 Perform testing in accordance with MIL-STD-202, Method 101, Test Condition B with the following details:

4.1.1 Immediately following the test, wash the test specimens under running water as detailed in MIL-STD-202.

4.1.2 Following the washing, dry the test specimens in a circulating air oven at 38 +/- 3˚ C for a period of 12 hours.

4.1.3 Following the drying, inspect the test specimens at 4X magnification minimum to ensure there is no exposed base metal or corrosion, discoloration is acceptable and not a cause for failure.

4.1.4 Perform Electrical Performance testing per the Test Plan, record data and attach.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

MOISTURE RESISTANCE

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To evaluate, in an accelerated manner, the resistance to the absorption of moisture and deteriorative effects of high humidity and heat moisture vapor resulting in degraded performance from 10 years of exposure to a pressurized habitat environment. Couplers shall pass all tests and there shall be no evidence of moisture absorption or damage that may result in degradation of performance.

2.0 **TEST SPECIFICATIONS:**

2.1 SSQ 21676, paragraph 3.4.4

2.2 MIL-STD-202, Method 106

3.0 **TEST EQUIPMENT:**

3.1 Environmental Chamber of sufficient thermal and humidity capacity to meet temperature and test condition requirements. Materials used within the chamber shall be nonreactive in high humidity and shall not be wood or plywood nor shall it contain formaldehyde or phenol. Provisions shall be made to prevent condensate from the chamber ceiling dripping onto the specimens.

3.2 Steam, or distilled and demineralized, or deionized water, having a pH level between 6.0 and 7.2 at 23˚ C (77˚ F) shall be used, no rust or corrosive contaminants shall be imposed on the specimens.

4.0 **PROCEDURE:** Perform testing in accordance with MIL-STD-202, Method 106 with the following details:

4.1 Initial measurements: Prior to beginning the moisture resistance cycling; Electrical Performance, Dielectric Withstanding Voltage and Insulation Resistance testing shall be performed per their Test Plans.

4.2 After drying period: Following step 6 of the 10^{th} cycle; Perform Electrical Performance, Dielectric Withstanding Voltage and Insulation Resistance testing per their Test Plans.

4.3 After completion of all cycles: Repeat the same tests and inspect the couplers for moisture absorption and damage caused by cycling.

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.

RADIOGRAPHIC INSPECTION

1553 DATA BUS COUPLER

1.0 **PURPOSE:** To detect internal physical defects which are not otherwise visible. These defects include but are not limited to improper positioning of elements, damaged or broken elements, poor workmanship, voids in potting compounds, and presence of foreign or extraneous materials.

2.0 **TEST SPECIFICATIONS:**

2.1 MIL-STD-202, Method 209

3.0 **TEST EQUIPMENT:**

3.1 Radiographic Equipment

4.0 **PROCEDURE:**

4.1 Record radiographic images in each of the three axes; X, Y and Z.

4.1.1 Identify radiographic image records with the part number, lot number and serial number of specimen.

4.2 Examine the final images with suitable viewing equipment, which may include magnification, for any defects that may be present, such as but not limited to:

4.2.1 Improper positioning of elements that may allow inadequate internal electrical and mechanical clearances

4.2.2 Damaged or broken elements

4.2.3 Foreign or extraneous materials that can cause damage to insulation or electrical short circuit between elements

4.2.4 Poor workmanship such as incomplete solder or crimp connections, excess lengths of unsupported wires or raveled, frayed or broken wires or terminals

4.2.5 Voids in potting compound that would allow movement of elements that may cause shorts or damage by vibration or thermal expansion

5.0 **RECORD DATA:** Document test results on the following data sheet or within an attached test report.