



NXT TRANSPONDER ACCEPTANCE TEST PROCEDURE (ATP)

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Record of Revisions

Rev	Date	Authorization	Description Of Change
-	06-FEB-2014	ECR013945	Initial Release
A	10-APR-2014	ECR015042	CR DB03_00003327: Updated to consolidate EIT on ESS and ESS Testing for both the NXT800 and NXT600
B	28-APR-2014	ECR015095	CR DB03_00003481: Updated for NXT800 BL release and Final Config
C	19-JUN-2014	ECR015208	Update procedure to test multiple LRUs with new Graphical User Interface.

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1 INTRODUCTION

This document is the Acceptance Test Procedure for the NXT-600 and NXT-800 (NXT) Transponder Units.

1.1 Purpose

- To provide the manufacturing flow process for NXT Transponder Unit
- To provide alignment instructions for NXT Transponder CCAs
- To provide instructions on the loading of test software for NXT Transponder Unit testing
- To provide instructions on the calibration of the NXT Transponder Unit
- To provide instructions on the execution of a NXT Transponder EIT and ESS Acceptance Test utilizing automated test equipment with embedded Hardware Test Software (HTS)

1.2 Scope

This Acceptance Test Procedure (ATP) specification establishes the manufacturing and operational requirements that the NXT Transponder Line Replaceable Unit (LRU), part number 9006000-XXYYY and 9008000-XXYYY (where XX is the hardware configuration and YYY is the software configuration), must meet to ensure that the unit is in proper operating condition.

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1.3 Referenced Documents

Table 1-1: ACSS Reference Documents

Document No.	Description
8010002-001	NXT-800 Transponder Hardware Requirements Document (HRD)
8010008-001	NXT-800 Transponder End Item Test (EIT) Test Requirements Document (TRD)
8010040-001	NXT Transponder Hardware Test Software (HTS) Test Requirements Document (TRD)
8010102-001	NXT-600 Transponder Hardware Requirements Document (HRD)
8010118-001	NXT-600 Transponder End Item Test (EIT) Test Requirements Document (TRD)
8010119-001	NXT Transponder Environmental Stress Screening (ESS)
9001080-001	Test Station, Transponder, ESS
9006000-55	Assembly, Hardware NXT-600
9006000-55000	Assembly, EITM NXT-600 Hardware End Item (DC Only)
9006054-001	NXT-600 Transponder Configuration File (SW)
9006056-001	Flash Programming Procedures for NXT Transponder Processor Assembly (TPA)
9008000-10	Assembly, Hardware NXT-800
9008000-55	Assembly, Hardware NXT-800
9008000-10000	Assembly, EITM NXT-800 Hardware End Item (AC/DC)
9008000-55000	Assembly, EITM NXT-800 Hardware End Item (DC Only)
9008047-001	NXT-800 Transponder Configuration File (SW)
9008049-001	NXT Transponder Environmental Stress Screening (ESS) Software (SW)
9001936-001	NXT Transponder Calibration Defaults
9001937-001	NXT Transponder Temp/Vibe Profiles
PL9006000-55	Assembly, Hardware NXT-600 Parts List
PL9006000-55000	Assembly, EITM NXT-600 Hardware End Item (DC Only) Parts List
PL9008000-10	Assembly, Hardware NXT-800 Parts List
PL9008000-55	Assembly, Hardware NXT-800 Parts List
PL9008000-10000	Assembly, EITM NXT-800 Hardware End Item (AC/DC) Parts List
PL9008000-55000	Assembly, EITM NXT-800 Hardware End Item (DC Only) Parts List

Table 1-2: Industry Reference Documents

Source	Document No.	Revision	Description
RTCA	DO-181E	03/17/2011	Minimum Operational Performance Standards for Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/Mode S) Airframe Equipment
RTCA	DO-260B	12/02/2009	Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent

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			Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B).
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1.4 Acronyms and Abbreviations

Table 1-3: Acronyms and Abbreviations

Acronym	Description
ACSS	Aviation Communication and Surveillance Systems
ATP	Acceptance Test Procedures
CCA	Circuit Card Assembly
EIT	End Item Test
ESS	Environment Stress Screening
FPGA	Field Programmable Gate Array
HRD	Hardware Requirements Document
HTS	Hardware Test Software
I/O	Input/Output
JTAG	Joint Test Action Group
LRU	Line Replaceable Unit
MCU	Multifunction Control Unit
MHz	Megahertz
MTL	Minimum Transmit Level
PC	Personal Computer
PCI	Peripheral Components Interconnect
PXI	PCI Extensions for Instrumentation
QA	Quality Assurance
RF	Radio Frequency
RFIU	Radio Frequency (RF) Interface Unit
RTCA	RTCA, Inc.,
SW	Software
TPA	Transponder Processor Assembly
TRD	Test Requirements Document
UUT	Unit Under Test
VSWR	Voltage Standing Wave Ratio
XPDR	Transponder

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2 SYSTEM OVERVIEW

The NXT Transponder Acceptance Test is a fully automated set of tests that is performed using the ACSS Transponder Environmental Stress Screening (ESS) Station (P/N 9001080-001). There are two primary types of software utilized. The first type of software is Hardware Test Software (HTS), which is loaded into FLASH memory of the UUT and executes within the UUT's SDRAM. The second type of software is the End Item Test (EIT) and ESS station program that executes on the station PC.

The HTS program receives high level commands from the station programs via an RS-232 interface. It executes commands and returns a response. The responses returned from HTS may range from acknowledgement of receipt of a command to returning data and/or status of a test that was performed by the embedded software.

The EIT and ESS station program is comprised of a Test Executive, Instrument Drivers, and Test Functions. The Test Executive provides an operator interface, directs test sequencing, determines pass/fail status and generates test reports. The Instrument Drivers communicate with and control the ESS station test equipment via PXI/PCI, IEEE488, and USB interfaces. The Test Functions perform the individual tests that comprise a NXT Transponder Acceptance Test and are described in:

- NXT-600 Transponder End Item Test (EIT) Test Requirements Document (TRD), document number 8010118-001
- NXT-800 Transponder End Item Test (EIT) Test Requirements Document (TRD), document number 8010008-001
- NXT Transponder Environmental Stress Screening (ESS), document number 8010119-001

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3 GENERAL INFORMATION

3.1 General RF Test Requirements

- All antenna ports must be terminated in 50 ohms while power is applied to the UUT.
Note: Do not attempt to transmit with any port unterminated. Damage to UUT may result.
- Any additional test equipment that may be connected to the antenna ports must have a Voltage Standing Wave Ratio (VSWR) of less than 1.5:1.
- Any additional test equipment that may be connected to the antenna ports shall withstand peak power levels of at least 1000 W and average power levels of at least 2 W.

3.2 Power Requirements

- 115 VAC, 60 Hz, 20 A, standard service power for test equipment operation. All power supplied to the UUT is provided by the test equipment via software controlled rack mounted power supplies.

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4 TEST EQUIPMENT REQUIREMENTS

4.1 Test Equipment Hardware

The Transponder ESS Station, P/N 9001080-001, is the test equipment hardware required to perform the tests.

4.1.1 Test Equipment Calibration

The Transponder ESS Station, P/N 9001080-001, must be manually calibrated. The calibration shall be performed at least every six months, and whenever an RF component such as a cable or generator is replaced. The procedure may be performed as often as desired if an equipment or calibration fault is suspected.

4.2 Test Equipment Software

- NXT Transponder End Item Test and Environmental Stress Screening Software – P/N 9008049-001. This program executes on the Environmental Stress Screening station PC and automates the tests that are defined in the NXT Transponder TRD's.
- HTS - This software executes within UUT memory and responds to commands sent by the NXT Transponder PC Test Software. Refer to document number 9006054-001, NXT-600 Transponder Software Configuration File, and 9008047-001, NXT-800 Transponder Software Configuration File, for the proper HTS Master Media Part Number.
- End Item Operational software – This software operates the UUT in a flight configuration. Refer to document number 9006054-001, NXT-600 Transponder Software Configuration File, and 9008047-001, NXT-800 Transponder Software Configuration File, for the proper Operational Software Master Media Part Number.
- NXT-600 Transponder Software Configuration File, 9006054-001. This document specifies the software configurations for the final software load.
- NXT-800 Transponder Software Configuration File, 9008047-001. This document specifies the software configurations for the final software load.
- NXT Transponder Calibration Defaults File, 9001936-001. This document contains the initial calibration values for the NXT-600 and NXT-800 Transponders.
- NXT Transponder Temp/Vibe Profiles File, 9001937-001. This document contains the Temperature and Vibration Profiles used during the ESS testing process.

4.3 Test Equipment / UUT Interconnect

Figure 4-1 shows a diagram of the Transponder ESS Station, P/N 9001080-001.

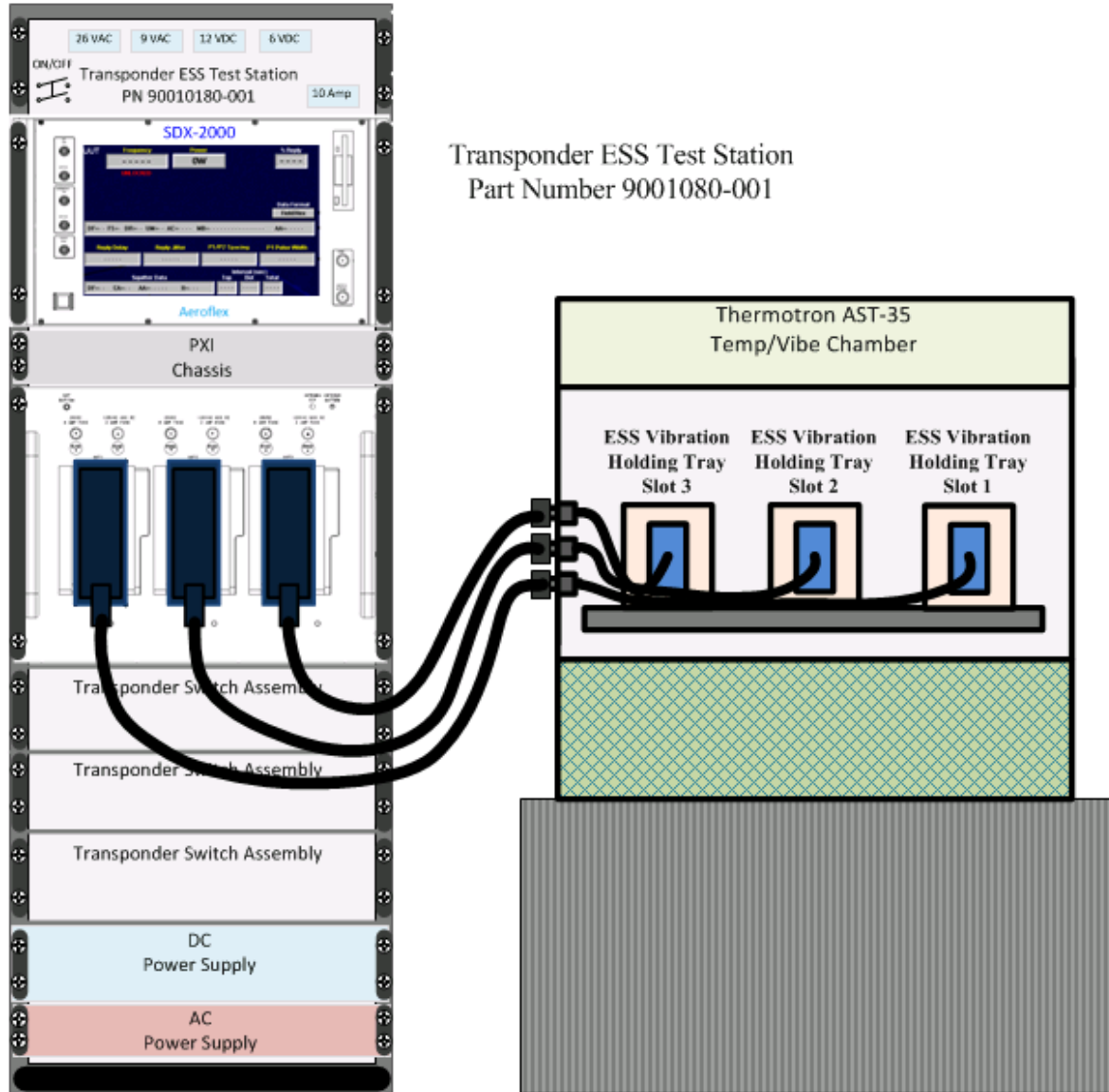


Figure 4-1: Transponder ESS Station Setup

5 MANUFACTURING FLOW PROCESS

This section describes the manufacturing flow for NXT-600 and NXT-800 Transponder units. Refer to Section 5.1 for detail manufacturing steps.

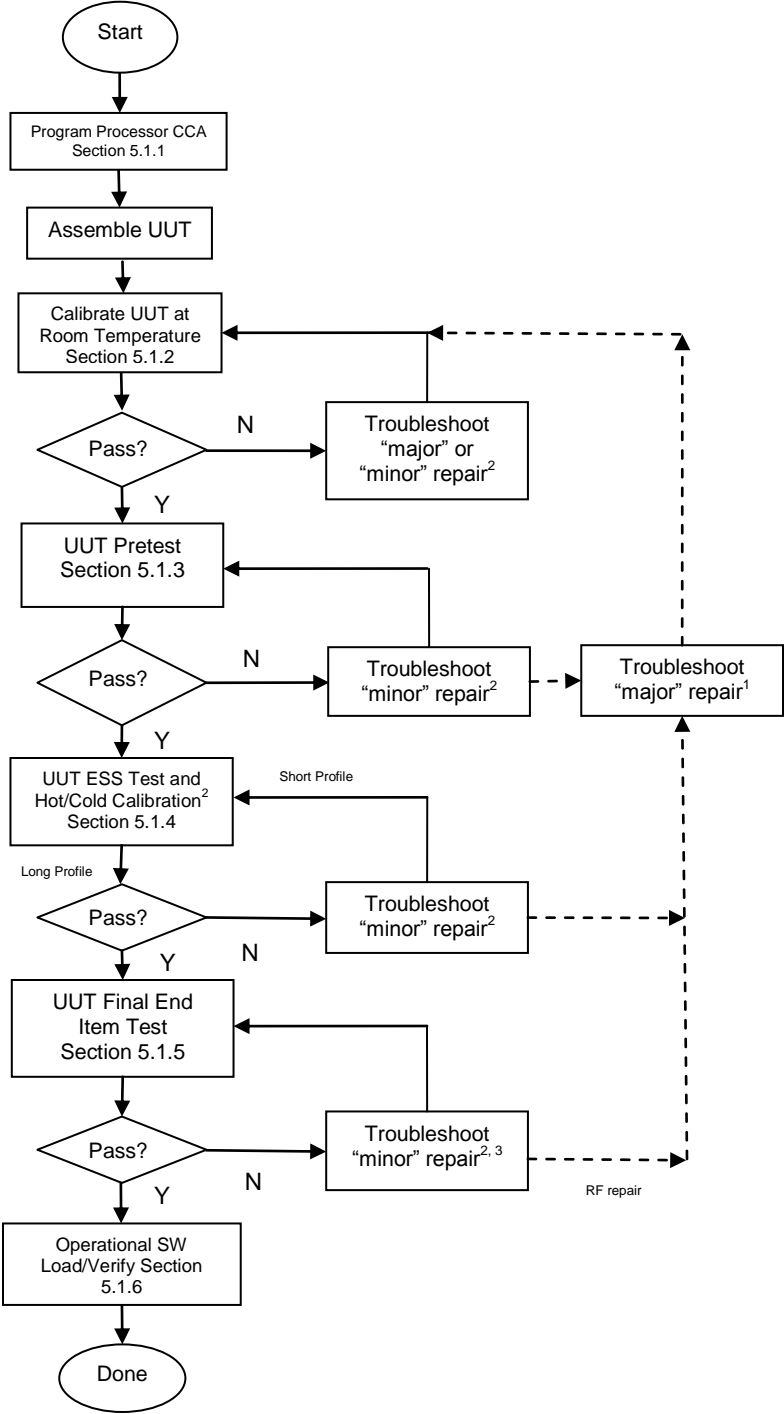


Figure 5-1: NXT Transponder Manufacturing Flow Process

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Note 1: A “major” repair is any repair operation that involves the replacement of an entire CCA. After a major repair, the UUT is returned to the calibration at room temperature step of the manufacturing flow and resumes from that point.

Note 2: A “minor” repair is defined as a repair operation involving the unsoldering or replacement of any electrical components short of replacing an entire CCA, as well as any changes in UUT hardware or software calibration. If a “minor” repair is completed after UUT ESS testing, perform an ESS short profile as described in NXT Transponder Environmental Stress Screening (ESS), document number 8010119-001, and continue with the production flow after UUT ESS testing. Repeat an ESS short profile after each minor repair until the UUT passes regression testing. Once the UUT passes, product flow resumes.

Note 3: If there is a “minor” RF repair after Final End Item Test, complete an ESS short profile and resume product flow.

5.1 Manufacturing Flow

5.1.1 Program Processor CCA with Initial Test Configuration and HTS Software

Prior to installing the Processor CCA in the UUT, program the initial test and HTS software per NXT-600 Transponder Software Configuration File, part number 9006054-001, or NXT-800 Transponder Software Configuration File, part number 9008047-001. For Processor CCA loading instructions, refer to Flash Programming Procedures for NXT Transponder Processor Assembly (TPA), document number 9006056-001.

5.1.2 UUT Calibration

The UUT must be calibrated for the temperatures it is tested over prior to performing those tests. During this ATP the UUT is tested at Room Temperature, about 22°C, at Cold Temperature, about -40°C, and at Hot Temperature, about 70°C. The calibration can be run any time prior to the test using the following test sequences:

- NXTCal_Room.seq
- NXTCal_Cold.seq
- NXTCal_Hot.seq

In the case of manual calibration of the UUT, follow the calibration steps in Appendix E of the NXT-600 or NXT-800 TRD, document numbers 8010118-001, and 8010008-001 respectively.

If calibration of the UUT is unsuccessful, troubleshoot failures and re-run calibration of UUT.

All result files and calibration data is saved on the network drive.

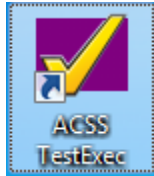
Typically the UUT will be calibrated automatically at the beginning of the current temperature cycle by selecting “RUN” for the “Calibration” option in the “Test Parameters” section of the “Test Information” panel at the beginning of the test software execution. The operator can also select “Yes” for the “Calibration Only” option in the “Test Parameters” to run just the calibration sequence skipping the actual test sequence. The following is an explanation of what the technician is to expect when operating the Test Station to Calibrate a UUT.

See [Section 5.1.3.1](#) for ESS Test/Calibration/Temperature/Vibration Profiles.

5.1.3 Graphic User Interface Test Procedures

Follow the steps below to initiate ESS testing via the GUI.

1. Launch the ESS GUI by clicking the ACSS TestExec icon on the desktop.



2. The TestExec initial screen is displayed with a Login window. Refer to [Figure 5-2](#) for a sample TestStand Login Screen. Select administrator for the User Name and leave Password blank. Click the “OK” button to proceed or Cancel to abort.

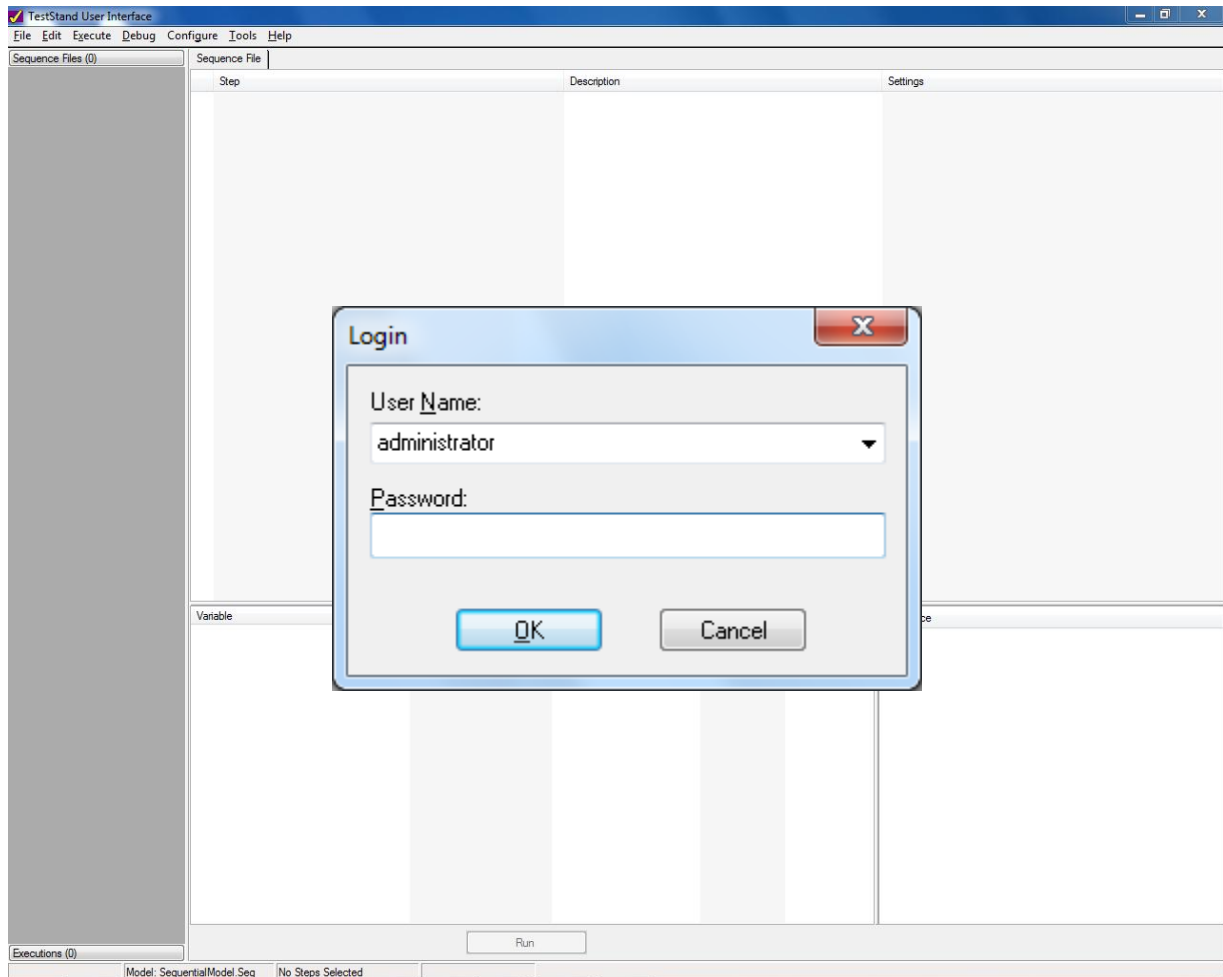


Figure 5-2: TestStand Login Screen

- After Login, the TestStand User Interface screen is displayed, see [Figure 5-3](#). Select the “9008049.seq” test sequence and then click “Test UUTs”. This will bring up the Test Information dialog box, see [Figure 5-4](#).

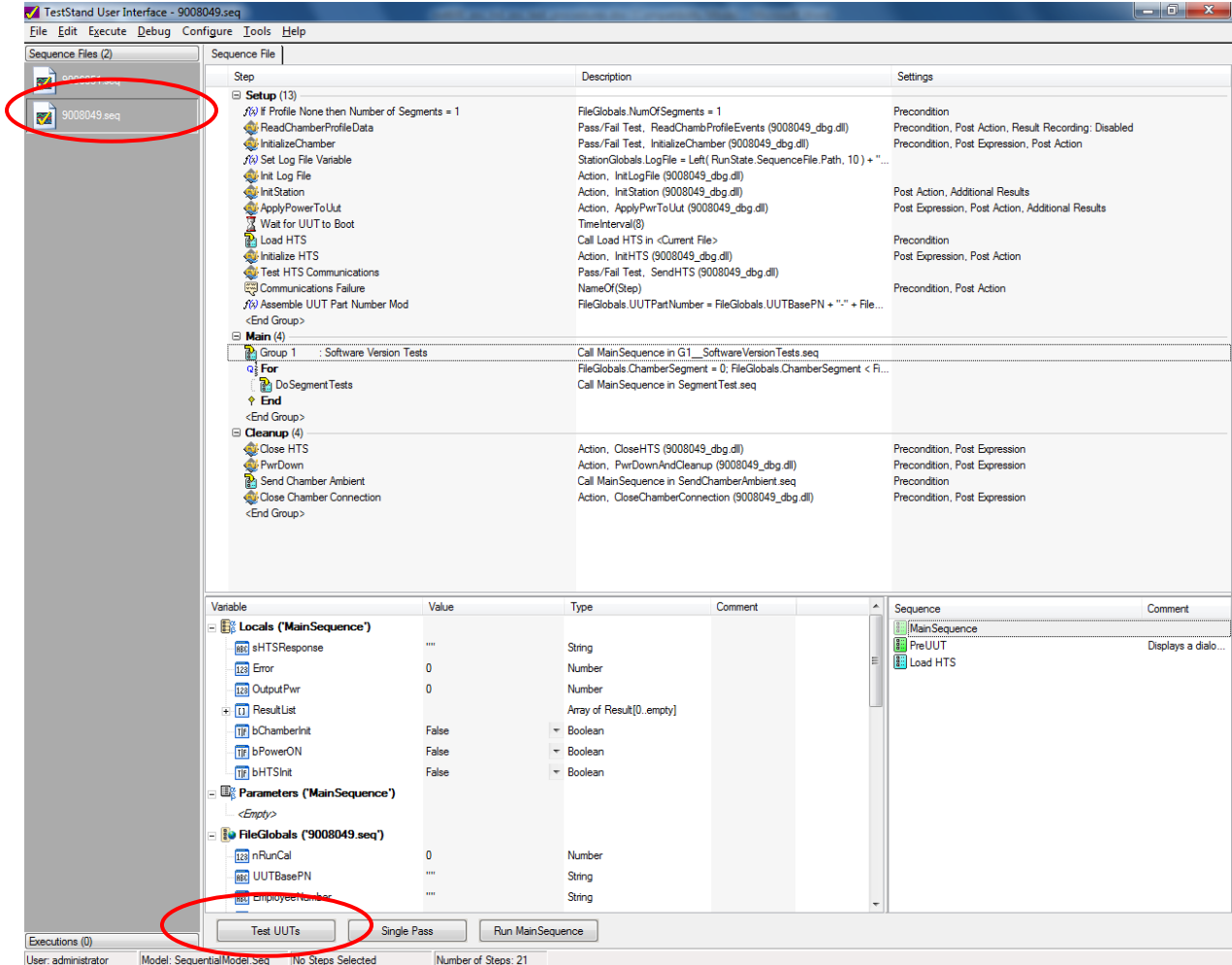


Figure 5-3: TestStand User Interface

- The Test Information dialog box allows the user to enter UUT common information for up to three LRUs, like Part Number and HW Mod Status, as well as select various options, such as Test Type, Profile, and Test Parameters utilized while running the ESS tests. See [Figure 5-4](#).

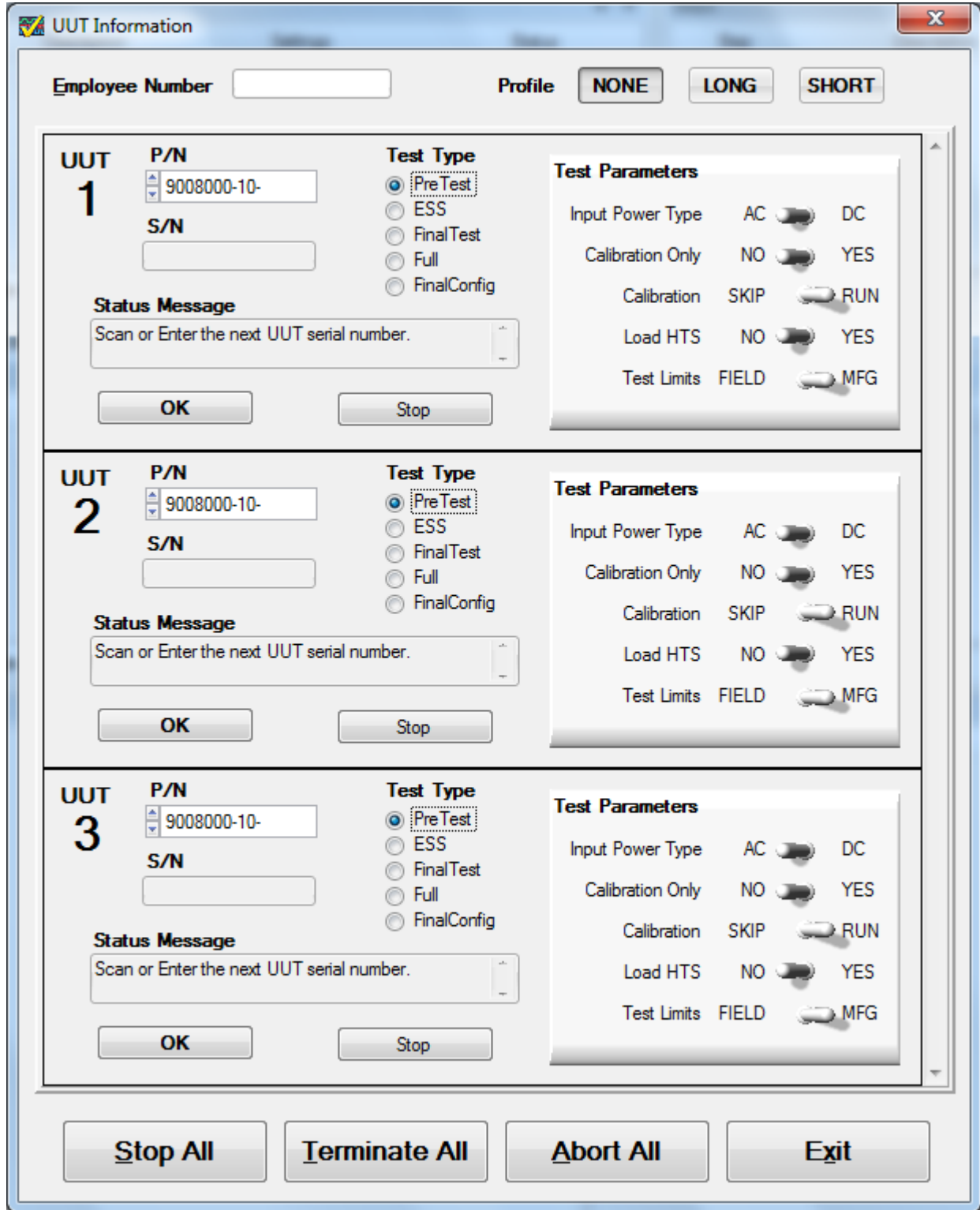


Figure 5-4: ESS\EIT UUT Test Information Dialog

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5. Enter the Common Parameters first. This includes Employee Number and the Temp/Vibe Profile. It will be possible to test different part numbers at the same time, however there will be only One Tem/Vibe Profile for up to Three LRUs.
6. Select and Part Number from the drop-down list, then enter the Serial Number of the UUT installed in the specified Slot. Alternatively, place the cursor in the Serial Number block and use the Scanner on the 2-D icon to enter the Part Number and Serial Number.

NOTE: After scanning the LRU in Slot One, the software will automatically move the cursor to Slot 2 Serial Number where you will be able to immediately scan Slot Two's Part and Serial Number. Slot Three will then be activated for the next LRU scan.

Enter the appropriate Test Type, where:

TestType is **PreTest** *(Preliminary End Item Test, including Room Temp Calibration)*
 ESS *(Environmental Stress Screening Test, including Hot and Cold Calibration)*
 FinalTest *(Final End Item Test, No Calibration Performed)*
 FULL *(Full ESS Test, including Room Temp Calibration and test)*
 FinalConfig *(Change SN, Load Ops SW, and Verify)*

7. Switches in the Test Parameters will be set automatically for the typical test scenario. However, these switches may be modified for custom test profiles, which allow the operator to bypass or force the execution of various pieces of the test program based on where the UUT is in the Manufacturing Process. The option to load HTS and the ability to select Manufacturing or Field Test Limits are also available on the switch panel. If the switch is grayed-out, the option is unavailable, such as selecting an AC Input Power Type for a 9006000-55 LRU.
8. Note: The Operator can stop testing in individual Slots, or abort all ESS test runs by left clicking the "Stop" or "Terminate All" or "Abort All" Buttons. Terminate All will provide an orderly shutdown of the Test Station; if you Abort All, the software shuts down where it is and can leave power connected to the UUTs.

Typically, the UUT is calibrated and tested at room temperature prior to arriving at the ESS Test Station. When the UUT reaches the ESS Test Station, the Long Profile is run: the UUT is calibrated at Cold and Hot temperatures and tested according to specifications in the Long Profile segment definitions listed in Part Number 9001937: NXT Transponder Temp/Vibe Profiles. Use the Short Profile without calibration to retest the UUT after minor repairs. You would retest using the Short Profile with calibration if an RF component was replaced. Check with the Manufacturing Manager to determine which profile parameters should be run.

9. Left click the "OK" buttons on each Slot to begin testing. The Running GUI is shown in [Figure 5.5](#).



Figure 5-5: ESS\EIT UUT Information GUI (Running Tests)

10. When test are complete, the ESS End GUI will show Pass/Fail Status similar to that shown in [Figure 5-6](#).



Figure 5-6: ESS/EIT UUT Information GUI (Tests Completed)

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5.1.3.1 ESS Test/Calibration Profiles

In addition to Performance Testing the LRUs, the ESS station progresses through Calibration Cycles at various temperatures as specified in the selected profile. These profiles are defined in Part Number 9001937: NXT Transponder Temp/Vibe Profiles.

5.1.4 UUT Pretest with Room Temperature Calibration

Perform room temperature calibration and Pretest of the UUT, using NXT Test software, per the following steps:

Note: If the station is powered down, apply power to the Transponder Test Station and allow the test equipment to warm-up for at least 30 minutes. Verify that all of the test equipment is calibrated and is functioning properly.

- Step 1. Remove the UUT cover and insert the UUT into the NXT Transponder Test Station UUT fixture in Slot 1, Slot 2, or Slot 3.
- Step 2. Fully lock all UUT hold-downs.
- Step 3. Run the TestExec application in c:\9008049\TestExec or desktop icon.
Note: Login to the TestStand application as "administrator" with no password.
- Step 4. After Login, the TestStand User Interface screen is displayed, see [Figure 5-3](#). Select the "9008049.seq" test sequence and then click "Test UUTs". This will bring up the UUT Information dialog box, see [Figure 5-4](#).
- Step 5. When the UUT Information dialog box appears:
 - Enter your Employee Number and select NONE for the Profile.
 - Select "PreTest" for "Test Type" in the appropriate UUT/Slot number section of the UUT Information Dialog Box,
 - Select, scan, or enter the UUT Part Number and UUT Serial Number.
 - In the Test Parameters Switch Block, select "RUN" for "Calibration" if you wish to run calibration prior to testing. This is the default for the PreEIT Test and must be run prior to any testing.
 - Select "Mfg" for the "Test Limits"
 - Select "YES" for "Load HTS" if you wish to reload HTS before beginning testing
- Step 6. Click "OK" to begin automated testing or "Stop" to terminate the test run.
- Step 7. Respond to all prompts and instructions that the test program displays during test execution.
- Step 8. A test report will be generated. The test report may be viewed and/or printed at the end of the test sequence from C:\9008049\data.
- Step 9. Verify that all tests have passed. If any tests failed, evaluate the failure and rework the UUT as necessary.
- Step 10. Remove the UUT from the NXT Transponder Test Station UUT Fixture.

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5.1.5 Environmental Stress Screening (ESS) Test with Hot and Cold Temperature Calibration

Perform ESS Test of the UUT, using NXT Test software, per the following steps:

Note: If the station is powered down, apply power to the Transponder Test Station and allow the test equipment to warm-up for at least 30 minutes. Verify that all of the test equipment is calibrated and is functioning properly.

- Step 1. Remove the UUT cover and insert the UUT into the NXT Transponder Test Station UUT fixture in Slot 1, Slot 2, or Slot 3.
- Step 2. Fully lock all UUT hold-downs.
- Step 3. Run the TestExec application in c:\9008049\TestExec or desktop icon.
Note: Login to the TestStand application as “administrator” with no password.
- Step 4. After Login, the TestStand User Interface screen is displayed, see [Figure 5-3](#). Select the “9008049.seq” test sequence and then click “Test UUTs”. This will bring up the UUT Information dialog box, see [Figure 5-4](#).
- Step 5. When the UUT Information dialog box appears:
 - Enter your Employee Number and select LONG or SHORT for the Profile as required
 - Select “ESS” for “Test Type” in the appropriate UUT/Slot number section of the UUT Information Dialog Box,
 - Select, scan, or enter the UUT Part Number and UUT Serial Number.
 - In the Test Parameters Switch Block, select “RUN” for “Calibration” if you wish to run calibration prior to testing. This is the default for the Long Profile and must have been run prior to testing over temperature.
 - Select “Mfg” for the “Test Limits”
 - Select “YES” for “Load HTS” if you wish to reload HTS before beginning testing
- Step 6. Click “OK” to begin automated testing or “Stop” to terminate the test run.
- Step 7. Respond to all prompts and instructions that the test program displays during test execution.
- Step 8. A test report will be generated. The test report may be viewed and/or printed at the end of the test sequence from C:\9008049\data.
- Step 9. Verify that all tests have passed. If any tests failed, evaluate the failure and rework the UUT as necessary.
- Step 10. Remove the UUT from the NXT Transponder Test Station UUT Fixture.

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5.1.6 Final End Item Test UUT

Perform End Item Test of the UUT, using NXT Test software, per the following steps:

Note: If the station is powered down, apply power to the Transponder Test Station and allow the test equipment to warm-up for at least 30 minutes. Verify that all of the test equipment is calibrated and is functioning properly.

- Step 1. Remove the UUT cover and insert the UUT into the NXT Transponder Test Station UUT fixture in Slot 1, Slot 2, or Slot 3.
- Step 2. Fully lock all UUT hold-downs.
- Step 3. Run the TestExec application in c:\9008049\TestExec or desktop icon.
Note: Login to the TestStand application as "administrator" with no password.
- Step 4. After Login, the TestStand User Interface screen is displayed, see [Figure 5-3](#). Select the "9008049.seq" test sequence and then click "Test UUTs". This will bring up the UUT Information dialog box, see [Figure 5-4](#).
- Step 5. When the UUT Information dialog box appears:
 - Enter your Employee Number and select NONE for the Profile.
 - Select "FinalTest" for "Test Type" in the appropriate UUT/Slot number section of the UUT Information Dialog Box,
 - Select, scan, or enter the UUT Part Number and UUT Serial Number.
 - In the Test Parameters Switch Block, select "SKIP" for "Calibration." Re-calibrating the UUT at this time would void any previous calibration and require additional calibration over temperature.
 - Select "Mfg" for the "Test Limits"
 - Select "YES" for "Load HTS" if you wish to reload HTS before beginning testing
- Step 6. Click "OK" to begin automated testing or "Stop" to terminate the test run.
- Step 7. Respond to all prompts and instructions that the test program displays during test execution.
- Step 8. A test report will be generated. The test report may be viewed and/or printed at the end of the test sequence from C:\9008049\data.
- Step 9. Verify that all tests have passed. If any tests failed, evaluate the failure and rework the UUT as necessary.
- Step 10. Remove the UUT from the NXT Transponder Test Station UUT Fixture.

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5.1.7 Operational SW Load and Verify

- Step 1. Remove the UUT cover and insert the UUT into the NXT Transponder Test Station UUT fixture in Slot 1, Slot 2, or Slot 3.
- Step 2. Fully lock all UUT hold-downs.
- Step 3. Run the TestExec application in c:\9008049\TestExec or desktop icon.
Note: Login to the TestStand application as “administrator” with no password.
- Step 4. After Login, the TestStand User Interface screen is displayed, see [Figure 5-3](#). Select the “9008049.seq” test sequence and then click “Test UUTs”. This will bring up the UUT Information dialog box, see [Figure 5-4](#).
- Step 5. When the UUT Information dialog box appears:
 - Enter your Employee Number and select NONE for the Profile.
 - Select “FinalConfig” for “Test Type” in the appropriate UUT/Slot number section of the UUT Information Dialog Box,
 - Select, scan, or enter the UUT Part Number and UUT Serial Number.
 - In the Test Parameters Switch Block, select “SKIP” for “Calibration.” Re-calibrating the UUT at this time would void any previous calibration and require additional calibration over temperature.
 - Select “Mfg” for the “Test Limits”
 - Select “YES” for “Load HTS” if you wish to reload HTS before beginning testing
- Step 6. Click “OK” to begin automated testing or “Stop” to terminate the test run.
- Step 7. Respond to all prompts and instructions that the test program displays during test execution.
- Step 8. A test report will be generated. The test report may be viewed and/or printed at the end of the test sequence from C:\9008049\data.
- Step 9. Verify that all tests have passed. If any tests failed, evaluate the failure and rework the UUT as necessary.
- Step 10. Remove the UUT from the NXT Transponder Test Station UUT Fixture.

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