

Pro Tech Monitoring, Inc.

PTOP-0064

Production Test Operating Procedure

X-Tech

PCBA Functional Test

Version 1.0 Initial Release
Version 1.1 Added test details

June 16, 2009
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Pro Tech Monitoring, Inc.

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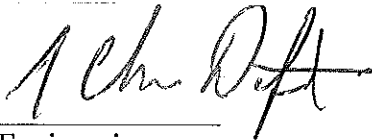
Production Test Operating Procedure

X-Tech

PCBA
Functional Test

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Approved By:



Engineering



Production Test

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Scope

This document describes the Functional test set up and test procedure for the X-Tech PCBA.

Test Configuration:

1. Gather Equipment needed
2. Install software and hardware drivers
3. Set up directories for test software and firmware.
4. Place test exe, ini files and firmware in proper directories
5. Configure hardware (PC, test fixture)
6. Start test program and configure ini files

Equipment Needed:

1. X-Tech Functional test fixture
 - a. ACTiSYS IR Wireless Interface Model ACT-IR220LN57
2. Pro Tech Modular Test Station
 - a. Two - National Instruments USB-6008 DAQ
 - b. One - National Instruments USB-6051 DIO
 - c. Rack Mount Control PC (3 GHz Minimum, 2GB ram, XP Pro)
 - d. LCD Monitor
 - e. LCD Arm
 - f. Agilent N5181A Signal Generator
 - g. BK Precision 9130Triple Output Power Supply (with USB communication Adapter)
 - h. VG Receiver (Everett Charges Technologies)

Software:

NI-DAQ MX:

Install the NI-DAQ MX Drivers

Place disk one in the DVD drive of the PC

Select:

NI-DAQ MX

LabVIEW 8.6 Support

Ni Measurement and Automation Explorer

LabVIEW 8.6 Support

Signal Generator CFG:

Control PC will have a second network card installed and configured to:

IP: 172.16.255.1

Subnet Mask: 255.255.255.0

Gateway Leave blank

Configure Signal Generator LAN (Agilent N5181A)

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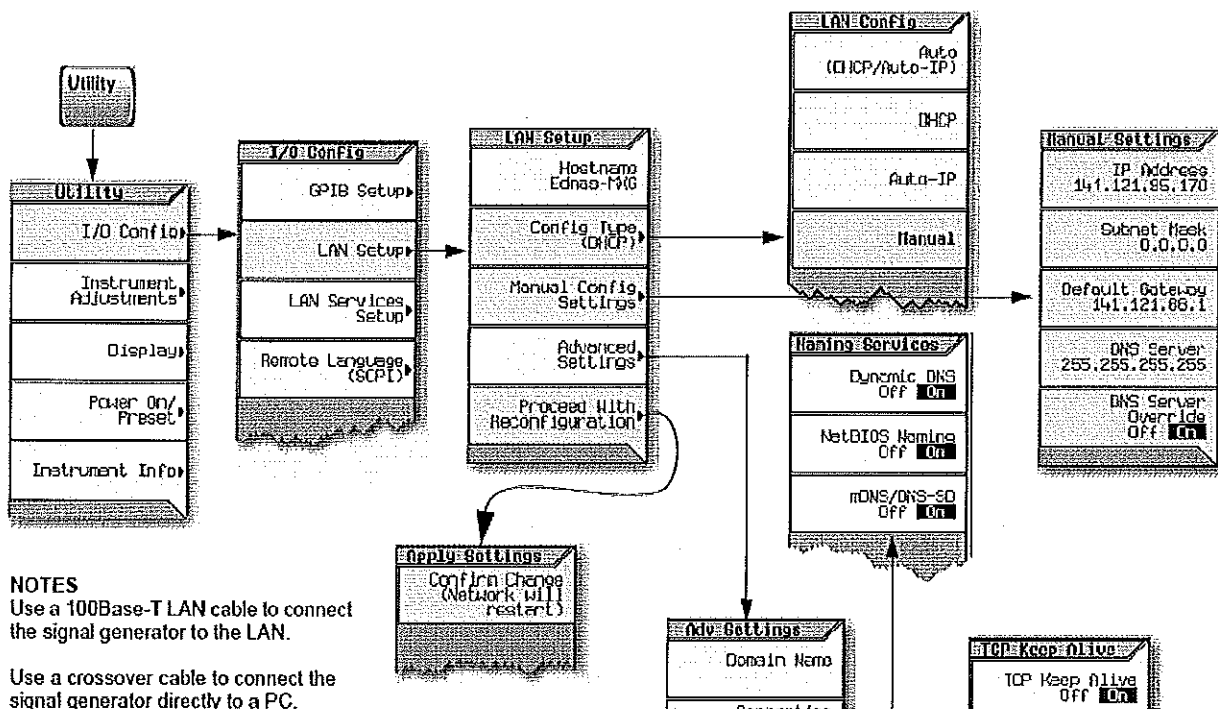
Plug in the network cable

Select "Utility" button, then softkeys:

1. I/O Config - LAN Setup - Config Type (DHCP) – Manual
2. Manual Config Settings –
 - a. IP Address 172.16.255.2
 - b. Subnet 255.255.255.0
 - c. Gateway 0.0.0.0
 - d. DNS Server Blank
 - e. DNS Server Override Off
3. Press the "Return" Key
 - a. Proceed With Configuration
 - b. Confirm Change (Network will restart)

LAN Configuration

Configuring the LAN Interface



Power Supply BK Precision 9130:

Install the USB Driver – PL-2303 (Prolific USB to Serial)

Plug in the TTL to USB adapter supplied with the power supply

MTD_Term

Install MTD_Term

Run the installation for MTD_Term

This must be placed in the Pro Tech directory

Replace the Executable with the latest version

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LabVIEW 8.6 Runtime

Install the LabVIEW 8.6 runtime engine with VISA Support and VISA Configuration Support.

Directory Structure:

Directory for the test program:

C:\Protech\X_Tech_PCBA_VX_X\ (X = current version)

Directory for the test program data:

C:\Protech\Test_Data\X_Tech_PCBA_Data

Directory for the configuration files:

C:\Protech\ini\

Directories for the Firmware:

C:\Protech\X_Tech_ISP\ISP_Utility

C:\Protech\X_Tech_ISP\ROM

Test Station Power-Up Procedure:

1. Initial state
 - a. UPS - ON
 - b. Control PC - OFF
 - c. Digital Power Supply - OFF
 - d. Signal Generator – OFF
 - e. Test Fixture PCBA - OFF
2. Control PC – ON
3. Digital Power Supply – ON
4. Signal Generator – ON
5. Start Test Program
6. Test Fixture – ON
7. GPS Simulator signal available from Final Functional Test station.

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Test Sequence

- ☒ Program
- ☒ X-Tech ID
- ☒ Version
- ☒ Voltage
- ☒ Temperature
- ☒ Current
- ☐ Speaker
- ☒ Modem
- ☒ GPS
- ☒ Vibe_Motor
- ☒ Motion
- ☒ LED
- ☒ Hall_Sensor
- ☒ Ambient
- ☒ Tamper
- ☒ Transceiver
- ☒ Charge

Operator Name

X-Tech ID

Board SN

Application_Version

GPS_Version

Modem_Version

IMEI

Current Test

Tests Completed

UNCHECK **SELECT ALL**

ULIT_PWR_ON **ULIT_PWR_OFF**

cfg.ini **db_cfg.ini**

CFG **CFG**

Password

START TEST **RESET** **EXIT**

ABORT TEST

Figure 1 –PCBA Test Main Test Window.

INI Configuration:

1. Open the “X_Tech_PCBA_VX.vi” software (Figure 1).
2. Click on the check box next to the Password text box.
3. Type in “protech2008”, this will enable the “Config.ini” and “Cfg dB.ini” buttons (Figure 2).
4. Press the “Config.ini” button.
 - a. Ensure the all configuration data is correct for the test station.
 - b. If any changes are made click Write_INI button. All fields will blank out. Click Read_INI and all information with changes will appear.
5. Press the “Cfg dB.ini” button.
 - a. Verify configuration is correct for the test station.

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- b. If any changes are made click Write_INI button. All fields will default to zero or empty. Click Read_INI and all information with changes will appear.

The screenshot shows the 'X-Tech PCBA Test' software interface. The window title is 'X_Tech_PCBA_V1_6.vi'. The interface is divided into several sections. On the left, under 'Test Sequence', there is a list of test items with checkboxes: Program, X-Tech ID, Version, Voltage, Temperature, Current, Speaker, Modem, GPS, Vibe_Motor, Motion, LED, Hall_Sensor, Ambient, Tamper, Transceiver, and Charge. All these checkboxes are checked. To the right of this list are input fields for: Operator Name, X-Tech ID (containing '0'), Board SN, Application_Version, GPS_Version, Modem_Version, and IMEI. Below these fields are two buttons: 'UUT_PWR ON' and 'UUT_PWR OFF', each with a right-pointing arrow. At the bottom left are 'UNCHECK' and 'SELECT ALL' buttons. In the center bottom are 'cfg.ini' and 'dB_cfg.ini' buttons, each with a 'CFG' label below it. To the right of these is a 'Password' field with a checkbox (checked) and a masked password '*****'. On the right side of the window, under 'X-Tech PCBA Test', there is a 'Current Test' section with a 'READY' label. Below that is a 'Tests Completed' section with a large empty box. At the bottom right are 'START TEST', 'RESET', 'EXIT', and 'ABORT TEST' buttons.

Figure 2 – Click on the check box next to the Password text box. Type in “protech2008”, this will enable the “Config.ini” and “Cfg dB.ini” buttons.

Test Configuration ini

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The screenshot shows a software window titled "Config_ini_XT_PCBA_V3.vi". It contains several configuration sections:

- INI path:** A text field containing "C:\Protech\ini\XTECH_PCBA.ini".
- Read and Write Test Configuration File - INI:** A section header.
- DATA DIRECTORY:** A text field containing "C:\Protech\Test_Data\X_Tech_PCBA_Data" with a browse button.
- ISP:** A text field containing "C:\Protech\X_Tech_ISP\ISP_Utility\MTD_ARM_ISP.exe" with a browse button.
- ROM:** A text field containing "C:\Protech\X_Tech_ISP\ROM\XT_V5_0_0_2.hex" with a browse button.
- COM PC:** A dropdown menu showing "COM4".
- COM PS:** A dropdown menu showing "COM9".
- COM SG:** A dropdown menu showing "COM1".
- PRG Baud Rate:** A text field containing "38400".
- INST_ADDRESS:** A dropdown menu showing "TCPIP0::172.16.255.1::inst0".
- DAQ:** A dropdown menu showing "USB_DAO".
- DAQ_DEVICE_1:** A text field containing "1".
- DAQ_DEVICE_2:** A text field containing "2".
- DAQ_DEVICE_3:** A text field containing "3".
- DIO_PORT_0:** A text field containing "0".
- DIO_PORT_1:** A text field containing "0".
- DIO_PORT_2:** A text field containing "1".
- DIO_PORT_3:** A text field containing "2".
- GPS_Sat:** A text field containing "8".
- GPS_C/N:** A text field containing "38".
- VDC Delta:** A text field containing "0.05".
- CHG_Current:** A text field containing "0.35".
- Current_Draw:** A text field containing "0.08".
- Temperature:** A text field containing "85".
- Buttons:** "Read_INI", "Write_INI", and "Exit" buttons are located at the bottom.

Figure 4 – PCBA Test Configuration ini window.

1. Press the "Config.ini" button.
2. The "Config_ini_XT_dB_V1" window will open (Figure 4).
 - a. "Data_Directory" C:\Protech\Test_Data\X_Tech_PCBA_Data
 - b. "ISP" C:\Protech\X_Tech_ISP\ISP_Utility\MTD_ARM_ISP.exe
 - c. "ROM" C:\Protech\X_Tech_ISP\ROM\XT_V5_0_0_2.hex
 - d. "COM_IR" Value should be selected based on the COM port of the control PC connected to the test fixture.

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- | | | |
|----|-----------------|---------------------------------------------------------------------------------------------------------------------------|
| e. | "COM_PS" | Value should be selected based on the COM port of the control PC connected to the "Digital Power Supply". |
| f. | "COM_SG" | Value should be selected based on the COM port of the control PC connected to the test fixture for the transceiver test.. |
| g. | "INST_Address" | Address of Signal Generator |
| h. | "PRG_Baud_Rate" | 38400 |
| i. | "DAQ" | USB_DAQ |
| j. | "DAQ_DEVICE_1" | 1 (Should be checked in NI MAX) |
| k. | "DAQ_DEVICE_2" | 2 (Should be checked in NI MAX) |
| l. | "DAQ_DEVICE_3" | 3 (Should be checked in NI MAX) |
| m. | "DIO_PORT_0" | 0 |
| n. | "DIO_PORT_1" | 0 |
| o. | "DIO_PORT_2" | 1 |
| p. | "DIO_PORT_3" | 2 |
| q. | "GPS_Sat" | Satellite depends on how GPS Sim is Configured |
| r. | "GPS_C/N" | Should be around 38, this needs to be determined based on setup. |
| s. | "VDC_Delta" | 0.050 |
| t. | "CHG_Current" | 0.350 |
| u. | "Current_Draw" | 0.080 |
| v. | "Temperature" | 85 |
3. **Directory paths and file locations should be checked to make sure they exist.**
 4. After updated all the fields, press the "Write_INI" button.
 5. Click Read_INI and all information with changes will appear.
 6. Press "EXIT" to return to the test window.

Database Configuration ini

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The screenshot shows a LabVIEW configuration window titled "Config_ini_dB.vi". It contains several controls for database setup:

- Buttons:** "Save Data" (with a green indicator light), "Save_Data_to_HardwareAdmin", "Read_INI", "Write_INI", and "Exit".
- SQL_Express:** A dropdown menu currently set to "SQL_Express".
- SQL_UserId:** A text field containing "LabviewUser".
- TestType:** A numeric spinner set to "6".
- UserId:** A text field containing "DMATEST".
- SQL_Password:** A text field containing "ptm2549LU".
- HwTypeRecID:** A numeric spinner set to "31".
- Password:** A text field containing "h41971f0".
- ConnectionString:** A text area containing the string: `Server=.\SQLEXPRESS;Database=LabView;Driver={SQL Server};`
- StatusRecId_PASS:** A numeric spinner set to "15".
- StatusRecId_FAIL:** A numeric spinner set to "15".

Figure 5 – Database configuration window.

1. Press the "Cfg dB. ini" button.
2. The "Config_ini_dB" window will open (Figure 5).
 - a. "SQL_UserId" value for is "LabviewUser".
 - b. "SQL_Password" value is "ptm2549LU".
 - c. "WS_UserId" value for Dmatek is "DMATEST".
 - d. "WS_Password" value for Dmatek is "h41971f0".
 - e. "StatusRecId_PASS" should be set to "15".
 - f. "StatusRecId_FAIL" should be set to "15".
 - g. "HwTypeRecID" should be set to "31" (PCBA is hardware type 31).
 - h. "TestType" should be set to "6" (PCBA Test is test type six).
 - i. "Save_Data_to_HardwareAdmin" control should be set to "SQL_Express".
 - j. "Save_Data" should be pressed and showing a green light, this control enables the saving of data to the database.
3. After updated all the fields, press the "Write_INI" button.
4. Click Read_INI and all information with changes will appear.
5. Press "EXIT" to return to the X-Tech PCBA Test Window.

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Functional Test:

1. Start the "XT PCBA_V*_*.vi" software.

The screenshot shows the 'X-Tech PCBA Test' main window. The 'Test Sequence' section on the left contains the following items with checkboxes:

- Program ☒
- X-Tech ID ☒
- Version ☒
- Voltage ☒
- Temperature ☒
- Current ☒
- Speaker ☐
- Modem ☒
- GPS ☒
- Vibe_Motor ☒
- Motion ☒
- LED ☒
- Hall_Sensor ☒
- Ambient ☒
- Temper ☒
- Transceiver ☒
- Charge ☒

The 'Current Test' section on the right displays 'READY'. The 'Tests Completed' section is a large empty box. At the bottom, there are buttons for 'START TEST', 'RESET', 'EXIT', and 'ABORT TEST'. There is also a 'Password' field and a 'Total Test Time' display.

Figure 6 - PCBA Test Main Test Window

2. Verify the following checkboxes are checked:
 - 2.1. "PROGRAM"
 - 2.2. "ID"
 - 2.3. "VERSIONS"
 - 2.4. "VOLTAGE"
 - 2.5. "TEMPERATURE"
 - 2.6. "CURRENT"
 - 2.7. "SPEAKER" - Not Implemented
 - 2.8. "Modem"
 - 2.9. "GPS"
 - 2.10. "VIBE_MOTOR"
 - 2.11. "MOTION"

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- 2.12. "LED"
 - 2.13. "HALL SENSOR"
 - 2.14. "AMBIENT"
 - 2.15. "TAMPER"
 - 2.16. "TRANSCIEVER"
 - 2.17. "CHARGE"
3. Press "START TEST" (The Scan N Chk dialog box will appear - Figure 7).
- 3.1. Type or Scan in the PCBA SN – a "P" prefix is required and it must be eight numeric characters long.
 - 3.2. Type or scan in the ID of the UUT – this is the unique identifier that is to be programmed into the unit and must start with "35" and be eight numeric characters long.
 - 3.3. Type in the operators initials – this must be three characters.
 - 3.4. Press the "Continue" button.

Scan_N_Chk_V3_0_XT.vi

Press SCAN or Continue

Board SN
P1234567

Plastic ID
35000001

Operator Name
jja

Re-Scan Field

Stop Scanning

SCAN Continue

Figure 7 – Scan Window.

4. A dialog window (Figure 8) will open instructing the operator to:
- 4.1. Place the UUT onto the locating pins.
 - 4.2. Plug the battery connector into the UUT.
 - 4.3. Plug in the charge mini power plug.
 - 4.4. Connect the RF cable.
 - 4.5. Close the overclamp lever and select OK.

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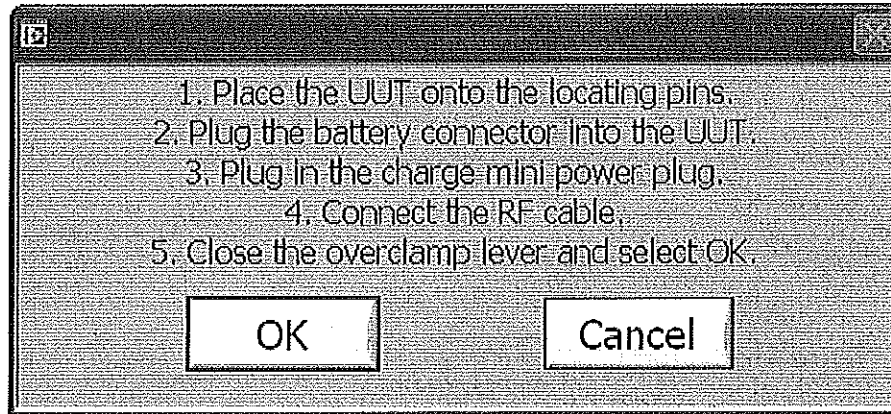


Figure 8 – Dialog Window.

5. Programming window will open.
 - 5.1. If programming is successful press the “EXIT” button to continue on with the test.
 - 5.2. If programming is unsuccessful note the failure and press the “EXIT” button to end the test.

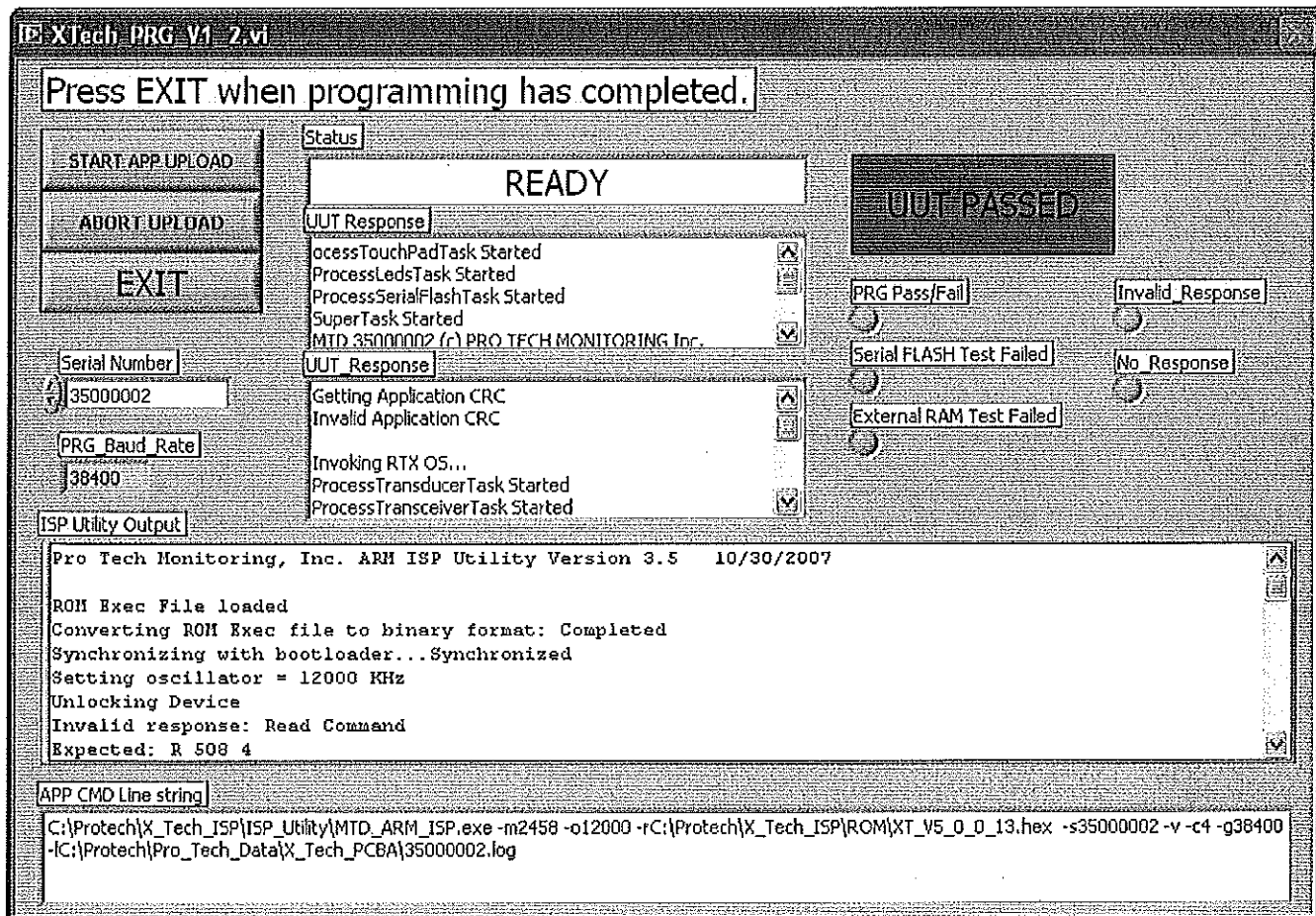


Figure 9 – Programming Window - Passed.

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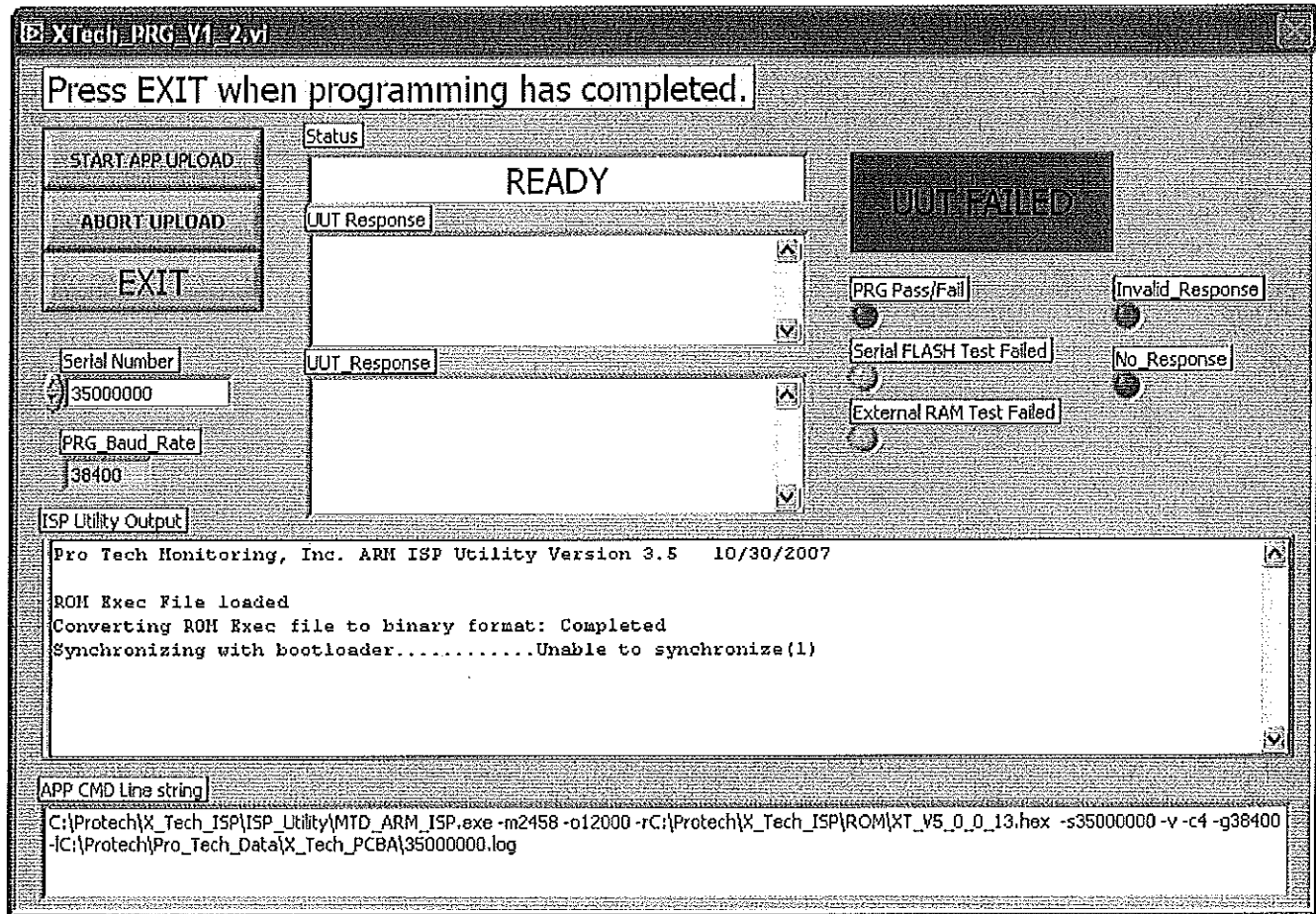


Figure 10 – Programming Window - Failed.

6. X-Tech ID
 - 6.1. This will verify the number entered matches the number reported by the UUT.
 - 6.2. If the device fails you will have the option of rereading the device
7. Version
 - 7.1. The test software will request the application version from the UUT.
 - 7.2. This will be saved to the Log file and reported to the test database.
8. Voltage
 - 8.1. The voltage from the UUT and test fixture are read and compared to limits.
 - 8.2. Will report "PASS" if within test limits.
 - 8.3. If test fails, operator will be prompted to "RETEST" or "FAIL".
9. Temperature
 - 9.1. The Temperature is requested from the UUT and compared to limits.
 - 9.2. Will report "PASS" if within test limits.
 - 9.3. If test fails, operator will be prompted to "RETEST" or "FAIL".
10. Current
 - 10.1. The Current draw from the UUT is measured and compared to the limit.
 - 10.2. Will report "PASS" if within test limit.
 - 10.3. If test fails, operator will be prompted to "RETEST" or "FAIL".

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- 11. Speaker
 - 11.1. Test is not implemented at this time.
- 12. Modem
 - 12.1. The modem of the UUT is turned on and versions are requested.
 - 12.2. Will report "PASS" if communication is established and versions are reported.
 - 12.3. If test fails, operator will be prompted to "RETEST" or "FAIL".
- 13. GPS
 - 13.1. The C/N values are requested from the UUT and compared to limits.
 - 13.2. Will report "PASS" if within test limits.
 - 13.3. If test fails, operator will be prompted to "RETEST" or "FAIL".

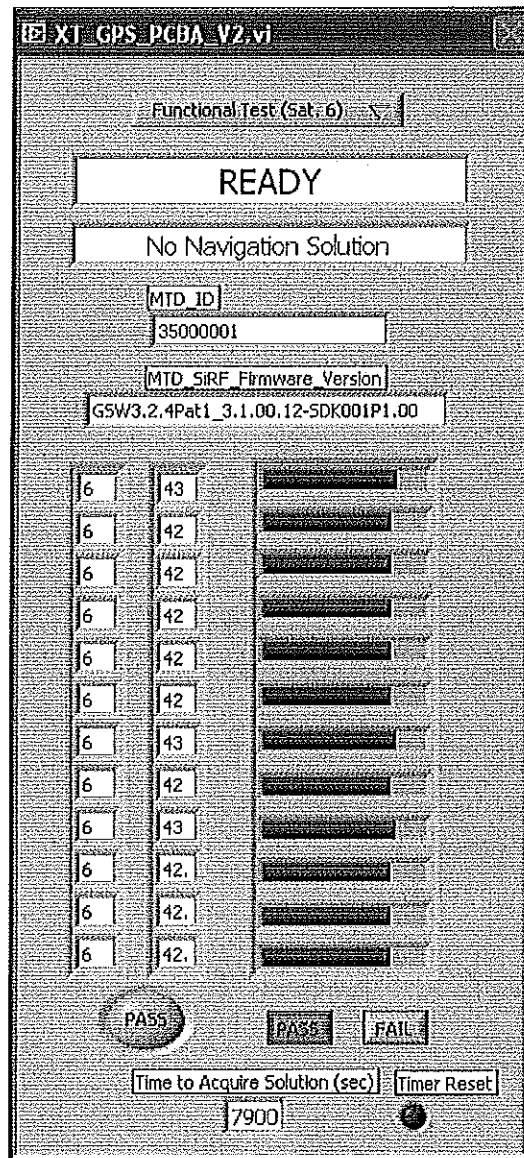


Figure 11 – GPS Test Window - Passed.

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14. Vibe Motor

- 14.1. A test command is sent to the UUT to turn on the vibe motor; voltage is read at the vibe driver and compared to limit.
- 14.2. Will report "PASS" if within test limit.
- 14.3. If test fails, operator will be prompted to "RETEST" or "FAIL".

15. Motion

- 15.1. A test command is sent to the UUT to run the motion test and values compared to limits.
- 15.2. Will report "PASS" if within test limits.
- 15.3. If test fails, operator will be prompted to "RETEST" or "FAIL".

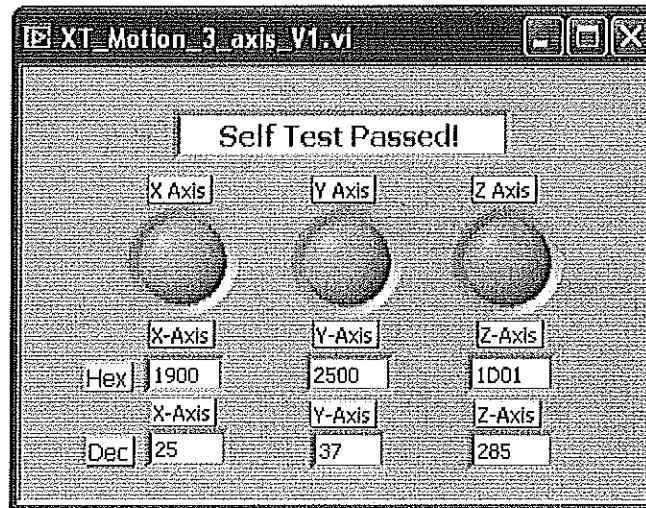


Figure 12 – Motion Test Window.

16. LED

- 16.1. A test command is sent to the UUT turn on the power LED; first red then green and values compared to limits.
- 16.2. Will report "PASS" if within test limits.
- 16.3. If test fails, operator will be prompted to "RETEST" or "FAIL".

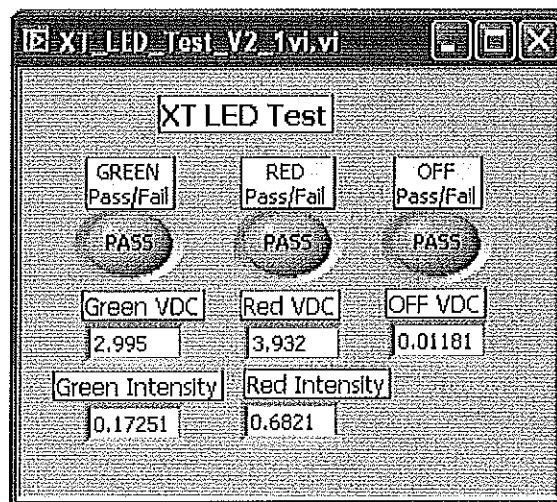


Figure 13 – LED Test Window.

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17. Hall Sensor

- 17.1. Operator is prompted to push magnet down; values are compared to limits.
- 17.2. Operator is prompted to disengage magnet; values are compared to limits.
- 17.3. Will report "PASS" if within test limits.
- 17.4. If test fails, operator will be prompted to "RETEST" or "FAIL".

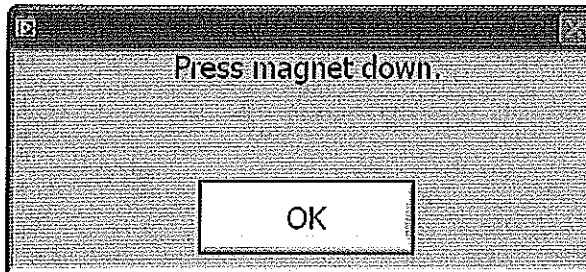


Figure 14 – Hall Test Magnet Down Dialog.

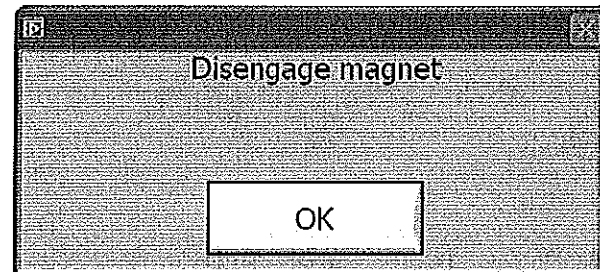


Figure 15 – Hall Test Disengage Dialog.

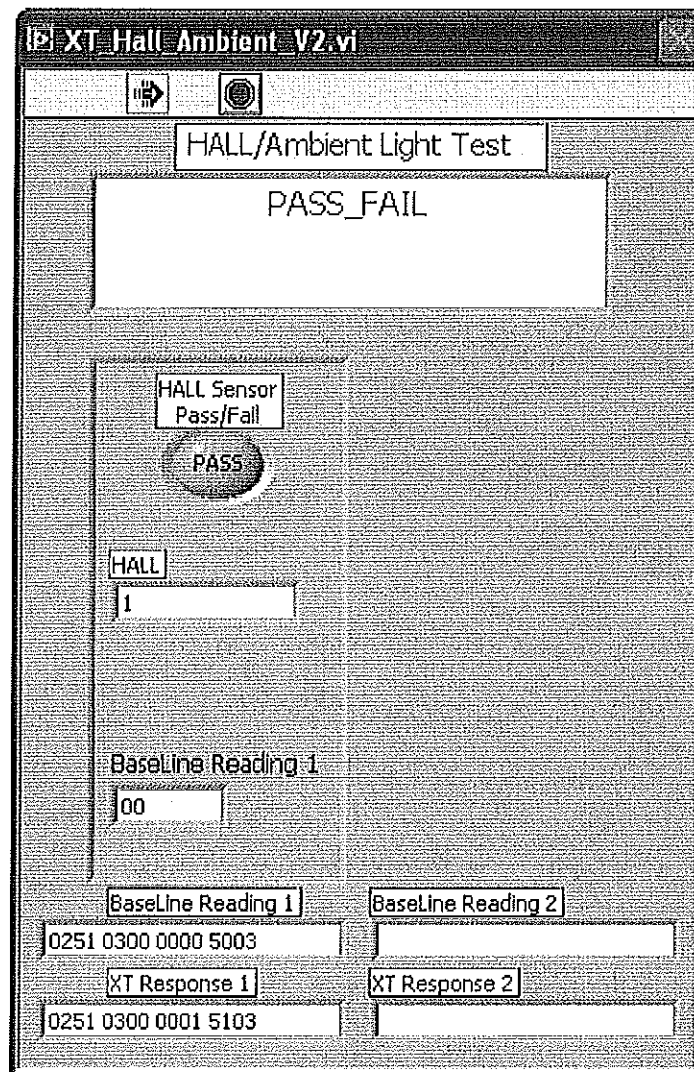


Figure 16 – Hall Test Window - Pass.

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18. Ambient

- 18.1. A test command is sent to the UUT read the values of the ambient light sensor; values compared to limits.
- 18.2. Will report "PASS" if within test limits.
- 18.3. If test fails, operator will be prompted to "RETEST" or "FAIL".

The screenshot shows a LabVIEW interface window titled "XT_Hall_Ambient_V2.vi". The main display area is titled "HALL/Ambient Light Test" and features a large "PASS_FAIL" indicator. Below this, a "PASS" button is visible. To the right, a vertical panel displays the following information: "Ambient Sensor Pass/Fail", "Ambient State" with a value of "2", "Ambient Value Dec" with a value of "595", and "BaseLine Reading 2" with a value of "0000". At the bottom, there are two rows of data: "BaseLine Reading 1" and "BaseLine Reading 2" (values: "0251 0300 0000 5003"), and "XT Response 1" and "XT Response 2" (values: "0251 0353 0200 0103").

Field	Value
BaseLine Reading 1	0251 0300 0000 5003
BaseLine Reading 2	0251 0300 0000 5003
XT Response 1	0251 0353 0200 0103
XT Response 2	0251 0353 0200 0103

Figure 17 – Ambient Test Window - Pass.

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19. Tamper

- 19.1. A test command is sent to the UUT read the values of the Tamper sensors; values compared to limits.
- 19.2. Will report "PASS" if within test limits.
- 19.3. If test fails, operator will be prompted to "RETEST" or "FAIL".

The screenshot shows a software window titled "XT_Tamper_V3_0.vi". Inside the window, there is a "Tamper Test" section with a large text box displaying "PASS_FAIL". Below this, there are two columns for "Tamper 1" and "Tamper 2". Each column has a "Tamper ON Pass/Fail" button, a "Tamper OFF Pass/Fail" button, and a "PASS" button. Below these buttons are several data fields: "Tamper 1 State" (01), "BaseLine 1" (01), "Tamper Value1_DRK" (12), "Tamper Value1_LGT" (863), "BaseLine Reading 1" (0247 0501 0C00 2500 6803), and "XT Response 1" (0247 0501 5F03 6503 7B03). The "Tamper 2" column has similar fields: "Tamper 2 State" (01), "BaseLine 2" (01), "Tamper Value2_DRK" (44), "Tamper Value2_LGT" (872), "BaseLine Reading 2" (0247 0501 0E00 2C00 6303), and "XT Response 2" (0247 0501 5F03 6803 7603).

Figure 18 – Tamper Test Window - Pass.

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20. Transceiver

- 20.1. The Transceiver test window will open and the test will start automatically.
- 20.2. Will report "PASS" if within BER test limit.
- 20.3. If test fails, operator will be prompted to "RETEST" or "FAIL".
- 20.4. After testing is completed the operator must press the "EXIT" button to exit the transceiver test.

The screenshot displays the 'X Tech Chipcon Test V1.3.vi' window. At the top, a status bar shows 'Idle'. Below this, a 'Device_ID' field contains '35000000'. A 'BER (%)' field shows '0'. A 'BER Pass/Fail' indicator shows 'PASS'. A 'PF Out' section has 'PASS' and 'FAIL' buttons, with 'PASS' selected. A 'Stop Test' button is visible. Below these are 'START' and 'EXIT' buttons. A large text box in the center reads: 'After testing is completed Press EXIT to end the Transceiver Test'. The bottom section, titled 'SG CFG', contains various configuration fields: 'Signal Generator' (MXG_NS181A), 'SG_Address' (TCPIP0), 'SG_Frequency (MHz)' (433.920), 'SG_Amplitude (dB)' (-104.0), 'UUT_Type' (MTD), 'Frequency (MHz)' (433 MHz), 'CMD' (0E), 'CMD_Data' (02), 'Length' (01), 'CMD_String' (020E 0102 0F03), 'CMD_Response' (0206 0004 03), 'CMD 2' (0F), 'CMD_Data 2' (3031 3233 3435 3637 3839 3031 3233 3435 3637), 'Length' (1E), 'CMD_String' (020F 1E30 3132 3334 3536 3738 3930 3132 3334 3536 3738 3930 3132 3334 3536 3738 3912 03), 'CMD_Data_ASCII' (012345678901234567890123456789), and 'BER Limit' (0). A 'Returned from MTD' field shows '0206 0004 0302 8902 0000 89'.

Figure 19 – Transceiver Test Window.

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21. Charge

- 21.1. The charge test window will open displaying the current values of the UUT charge draw.
- 21.2. Will report "PASS" if within test limit.
- 21.3. If test fails, operator will be prompted to "RETEST" or "FAIL".

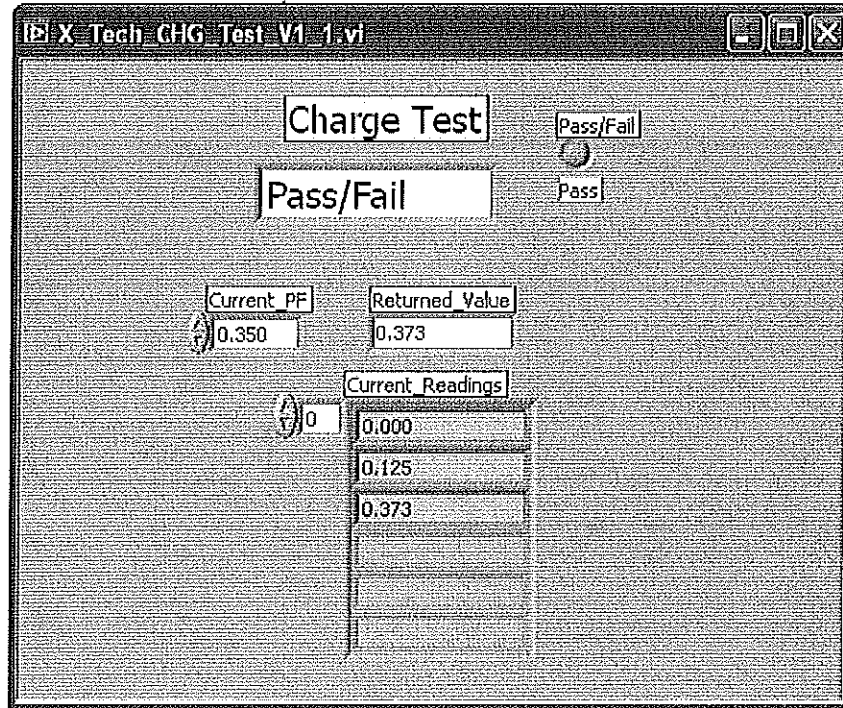


Figure 20 – Charge Test Window.

- 22. The program will display a "Pass" or "Fail" message on test completion.
- 23. Remove Processor Board.
- 24. Repeat steps 3-23 to test additional Processor Boards.