

XTL™ / XTS® Mobile and Portable Automated Test and Alignment



Operational Requirements

XTS / XTL Automatic Test and Alignment

- VIAVI Solutions 3920
 - Option 061 – Tracking Generator
 - Option 200 – P25 Conventional Operation
 - Option 218 – Auto-Test II for P25
 - Option 600 – Motorola XTS / XTL Series Auto-Test and Alignment
 - Option 602 – Motorola XTL Power Alignment
 - AC24011 – 10 AMP Current Shunt 0.01 Ohm (for Mobile Power Alignment)
- Power Supply (30 Amp rating for High Power mobiles)
 - Battery Eliminator (for portables)
- Test Cable (Low Loss Phase Stable recommended for best accuracy) BNC (M) – BNC (M)
- Reference Cable (Short 6”) BNC (M) – BNC (M)
 - 6 dB Pad BNC (M) – BNC (F) (Optional but recommended for best accuracy)
- Connector Adapters
 - BNC (F) – BNC (F)
 - BNC (F) – SMA (F)
 - BNC (F) – UHF Mini (M)
 - TNC (M) – BNC (F)
 - N (M) – BNC (F)
- For best accuracy, use an external 10 MHz Reference. This should be a very high stability Rubidium Standard.

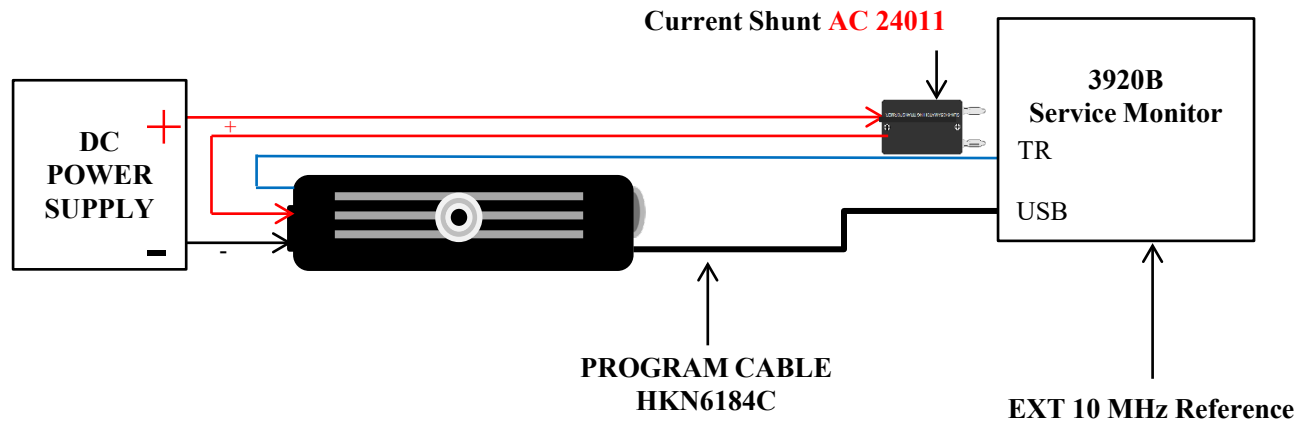
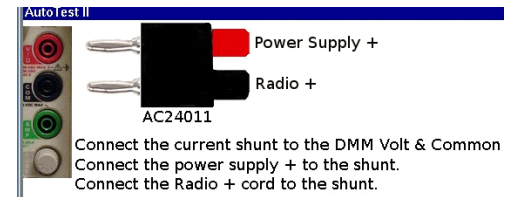
XTS Portable Interconnect

- Connect Radio ANT to 3920 TR Port.
- Connect Radio Programming cable to 3920 USB Port.



APX Mobile Interconnect

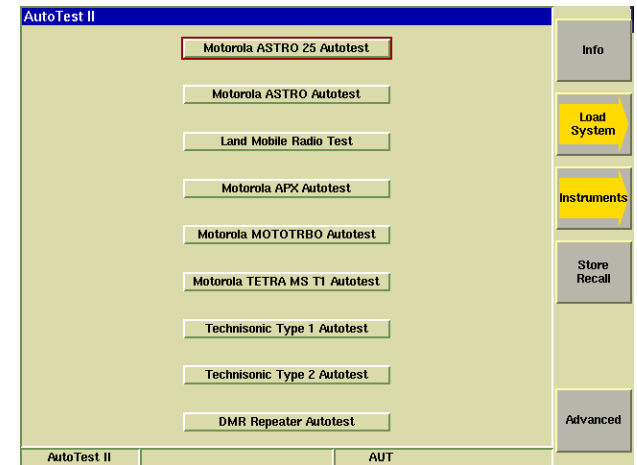
- Connect Mobile TX Out to 3920 TR port.
- Connect Mobile Programming cable to 3920 USB port.
- Connect Power supply to Mobile with Positive lead through the AC 24011 Current shunt if PA BIAS alignment is to be performed.



Auto-Test II Menu

Access to the Application and System through Auto-Test II

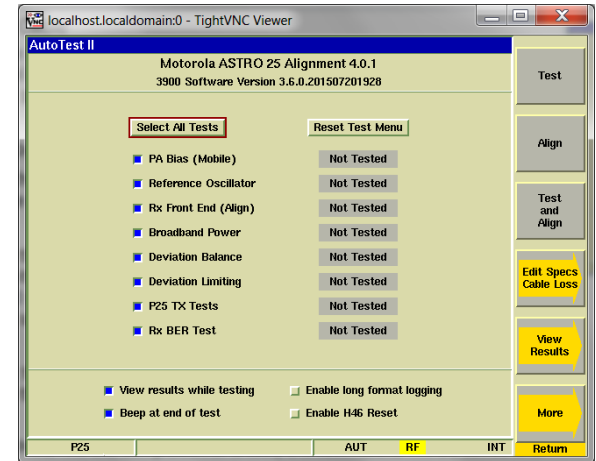
- The Auto-Test II Menu can be accessed by:
 - Right click with mouse and select Auto-Test II.
 - Select Auto-Test II from the system menu. Access to this menu can be accomplished by selecting the CONFIG key twice to access the system menu.
 - Select Motorola ASTRO® Auto-Test from the Auto-Test II menu.



ASTRO 25 Primary Test Screen

Function Keys

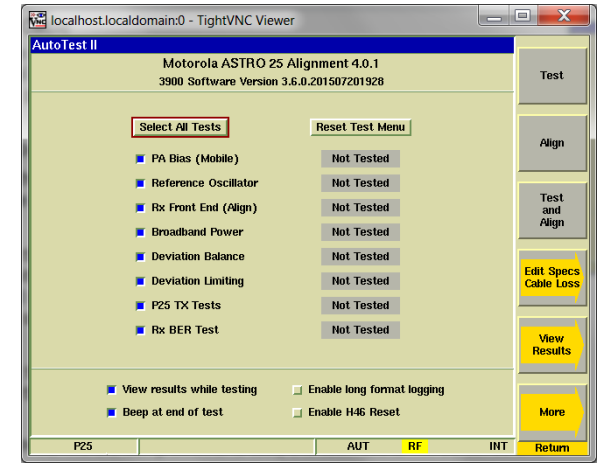
- F1 – Test
 - Start testing the radio. No alignments will be made. Only a test report of pass / fail results. Radio model will be automatically identified and appropriate specification table will be used for testing.
- F2 – Align
 - All selected items that are capable of being aligned will be aligned. Performance tests will also be performed to validate the alignment.
- F3 – Test and Align
 - All selected tests will be tested. Any failed item will be aligned and then re-tested after alignment.
- F4 – Edit Specs / Cable Loss
 - Only required when initially setting up the system for a specific model of radio. Must be reviewed prior to testing a new model of radio or when changing test cables.
- F5 – View Results
 - Allows access to the test results display. Test results may be viewed, recalled or backed up to a USB memory device.
- F6 – More
 - Access to Radio Connect diagrams and special features.



ASTRO 25 Primary Test Screen

Test Selections

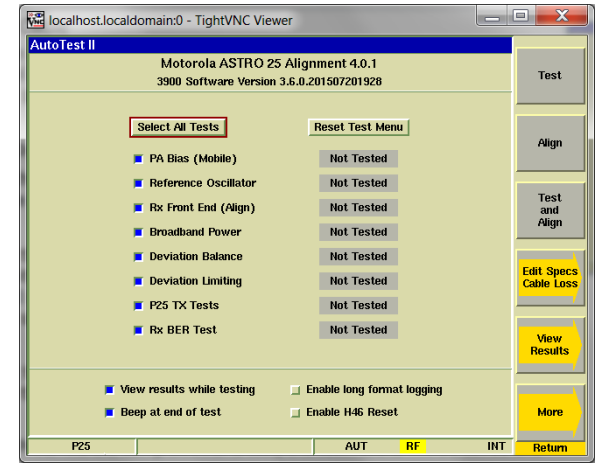
- Allows any combination of tests or alignments to be performed.
- Everything can be selected and the application will not attempt to perform invalid operations on the radio.
- Select All Tests
 - This will enable all tests.
- Reset Test Menu
 - This will disable all tests.
- View Results while testing
 - The application will stay on this screen and show only current status Testing / Passed / Failed if not selected. When selected and the test or alignment function has been executed, the screen will change and all testing can be viewed as it occurs.
- Beep at end of test
 - The 3920 will produce an audible beep at the completion of the test to draw attention to the operator that the test or alignment is done.
- Enable long format logging
 - Diagnostic mode that shows all adjustments to soft pot values.



ASTRO 25 Primary Test Screen

Test Selections

- Enable H46 Reset
 - Some H46 models (2500's) require a reset during the test. If the radio does not complete the power alignment, then enable this feature to resolve the issue.



ASTRO 25 Edit Specs Screen

Function Keys

- Info lines
 - Allows entry of Text that will appear at the top of the printout.
- F1 – Save As
 - Save all modifications to specifications to a user specified file. Information on all models is saved in a single file.
- F2 – Save
 - Save all modifications of specifications to the currently loaded specification configuration file.
- F3 – Recall
 - Recall a different specification file.
- F4 – Recall Current Radio
 - Interrogate the connected radio for model number and show the specifications for that radio.
- F5 – Cable Loss
 - Access to the cable loss measurement application.
 - **Note: This is one of the first things that should be done prior to testing a radio.**
- F6 – Restore Defaults
 - Resets all of the specifications to all of the radios from memory. This the factory default specifications. Note, these values are not permanently stored unless you answer yes when prompted.
 - **** This operation should be performed after updating the application to a new version.**

The screenshot displays the 'AutoTest II' interface for a 'default.cfg' file. It features several input fields for 'Info1' through 'Info6'. Below these are control buttons for 'Copy', 'Offset' (set to 0 dB), 'Manual', and 'Loss'. The main configuration area includes power settings: TX Low Power (10.0 ± 2.0 W), TX Mid Power (0.0 ± 0.0 W), and TX High Power (90.0 ± 3.0 W), with checkboxes for 'Enable XTL Low Power' and 'Enable All Levels & Frequencies (HH only)'. Other parameters include Reference Oscillator (100 Hz), Deviation Balance (2.0 %), Deviation Limiting (2030 ± 50 Hz), Modulation Fidelity (5.00 %), Symbol Deviation (100 Hz), BER (5.0 %), BER Frames (20), and BER Level (-116.0 dBm). A bottom status bar shows 'P25', 'AUT', 'RF', and 'INT'. On the right side, a vertical toolbar contains buttons for 'Save As', 'Save', 'Recall', 'Recall Current Radio', 'Cable Loss', 'Restore Defaults', and 'Return'.

ASTRO 25 Edit Specs Screen

Edit Specification Values

- Model Selection

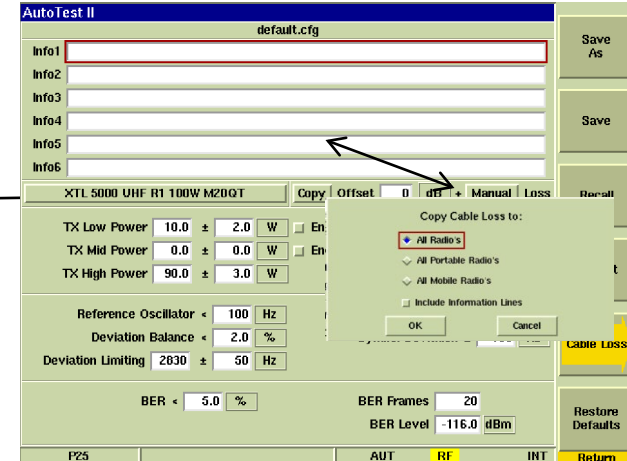
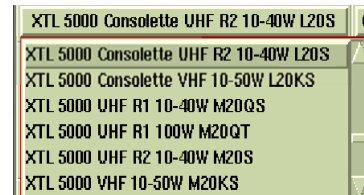
- This is used to access the specifications for supported models. Note that the specifications used when testing a radio are automatically determined after the radio model has been identified at the beginning of a test sequence.

- Copy

- Copies currently selected Cable to:

- All Portables
- All Mobiles
- All Radios

- Additionally allows copying entries in the info lines to the selected list.



ASTRO 25 Edit Specs Screen

Edit Specification Values

- Power Specifications
 - For Portables
These are the power levels that the radio will be tested or aligned to.
 - For Mobiles
The user must enter values that are programmed in the radio. CPS software must be used to obtain this information.
- Enable XTL Low Power
Save time by not testing or aligning Low power if it is not used.
- Enable All Levels and Frequencies (HH only)
This will adjust all three power level settings even if the Mid power setting is not available in user mode.

Specifications are NOT to be used as acceptance tests for new radios as this application is meant to replace the Tuner application. These tolerances are Alignment tolerances which are tighter.

The screenshot displays the 'AutoTest II' software interface for editing test specifications. The window title is 'AutoTest II' and the file name is 'default.cfg'. The interface is organized into several sections:

- Info Fields:** A vertical stack of six text input fields labeled 'Info1' through 'Info6'. The 'Info1' field is currently empty and has a red border.
- XTL 5000 UHF R1 100W M20QT:** A section with a 'Copy' button, an 'Offset' field set to '0 dB', and a 'Manual' button. There are also 'Loss' and 'Recall' buttons on the right side of this section.
- Power Settings:** Three rows of power level settings:
 - TX Low Power: 10.0 ± 2.0 W, with a checkbox for 'Enable XTL Low Power'.
 - TX Mid Power: 0.0 ± 0.0 W, with a checkbox for 'Enable All Levels & Frequencies (HH only)'.
 - TX High Power: 90.0 ± 3.0 W.
- Oscillator and Modulation Settings:** Fields for 'Reference Oscillator' (100 Hz), 'Deviation Balance' (2.0 %), 'Deviation Limiting' (2030 ± 50 Hz), 'Modulation Fidelity' (5.00 %), and 'Symbol Deviation' (100 Hz).
- BER Settings:** Fields for 'BER' (5.0 %), 'BER Frames' (20), and 'BER Level' (-116.0 dBm).
- Navigation:** A bottom bar with buttons for 'P25', 'AUT', 'RF', 'INT', and 'Return'. The 'RF' button is highlighted in yellow.
- Right-Side Panel:** A vertical column of buttons: 'Save As', 'Save', 'Recall', 'Recall Current Radio', 'Cable Loss' (highlighted in yellow), and 'Restore Defaults'.

ASTRO 25 Edit Specs Screen

Edit Specification Values

- Reference Oscillator Specification
 - Default values are for acceptance testing. For test and align mode, alignment will not happen unless the test result exceeds these values. Any time an alignment is made, the alignment adjusts for minimum frequency error.
- Deviation Balance Specification
 - In the Align mode, the alignment balances the modulation contributions of the low and high frequency portions of a baseband signal for minimum difference. In the Test mode, the balance must be less than 2% (this is the Motorola recommended specification).
- Deviation Limiting Specification
 - In the Align mode, the alignment limits the modulation of a baseband signal to 2830 Hz +/- 50 Hz. In the Test mode, the baseband signal must be 2830 Hz +/- 50 Hz (this is the Motorola recommended specification).
- Modulation Fidelity Specification
 - The APCO P25 Standard states that Modulation Fidelity should be less than 5%.
- Symbol Deviation Specification
 - The APCO P25 Standard states that Symbol Deviation should be 1800 Hz +/- 10% (180 Hz).
- BER Specification
 - The BER Frames setting is the number of frames that will be averaged for the reading.
 - The BER Level is the RF Injection level in dBm for the BER Test. The BER must be 5% or less at this test level.

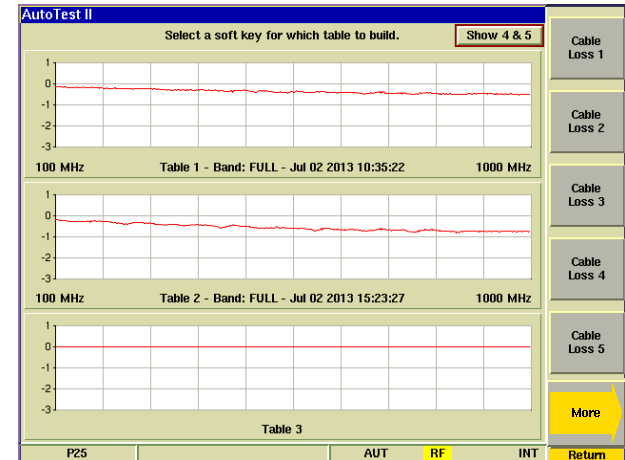
The screenshot displays the 'AutoTest II' software interface with the configuration file 'default.cfg'. The interface is divided into several sections:

- Info Fields:** Six input fields labeled Info1 through Info6, with Info1 currently empty and the others containing faint text.
- Control Buttons:** 'Copy', 'Offset' (set to 0 dB), 'Manual', and 'Loss'.
- Power Settings:**
 - TX Low Power: 10.0 ± 2.0 W, with an 'Enable XTU Low Power' checkbox.
 - TX Mid Power: 0.0 ± 0.0 W, with an 'Enable All Levels & Frequencies (HH only)' checkbox.
 - TX High Power: 90.0 ± 3.0 W.
- Oscillator and Deviation Settings:**
 - Reference Oscillator: 100 Hz.
 - Deviation Balance: 2.0 %.
 - Modulation Fidelity: 5.00 %.
 - Symbol Deviation: ± 180 Hz.
 - Deviation Limiting: 2830 ± 50 Hz.
- BER Settings:**
 - BER: 5.0 %.
 - BER Frames: 20.
 - BER Level: -116.0 dBm.
- Bottom Panel:** A row of buttons labeled P25, AUT, RF (highlighted in yellow), INT, and Return.
- Right Side Panel:** A vertical column of buttons: 'Save As', 'Save', 'Recall', 'Recall Current Radio', 'Cable Loss' (highlighted in yellow), and 'Restore Defaults'.

XTL / XTS Cable Loss

Function Keys

- Cable 1 - 5
 - Choose up to 5 different cable plots. These are initially flat with no calibration. After making a selection, prompts will be provided for cable connection and the cable insertion loss will be measured.
- More
 - Access to Delete cable data or Modify cable data.



XTL / XTS Cable Loss

Test Cable Calibration

- Reference Cable

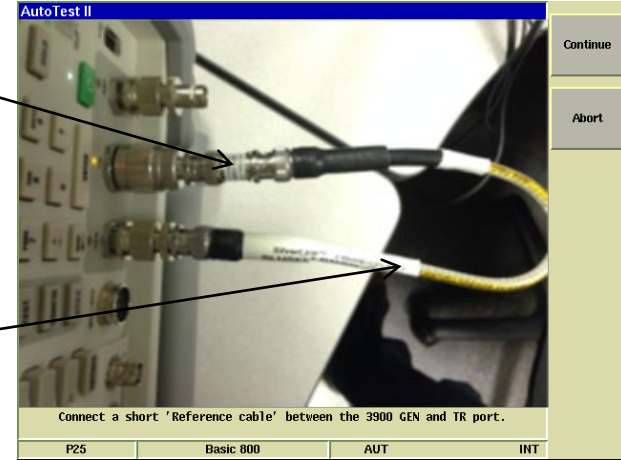
- The 3920 will use its spectrum analyzer and tracking generator to sweep a reference cable and will establish this sweep as a zero reference.
- This cable is used ONLY for calibration purposes and will not be used for testing the radio.

- Getting more accurate results

- To obtain better results from this process, use a 3 or 6 dB pad at the end of the reference cable that is connected to the TR port of the 3920. This will improve the VSWR of the cable for when it is connected to the Radio Testing Cable.
- Reference Sweep
- Gen port -> Reference Cable -> 3 dB Pad -> TR Port

3 or 6 dB Pad

Reference Cable



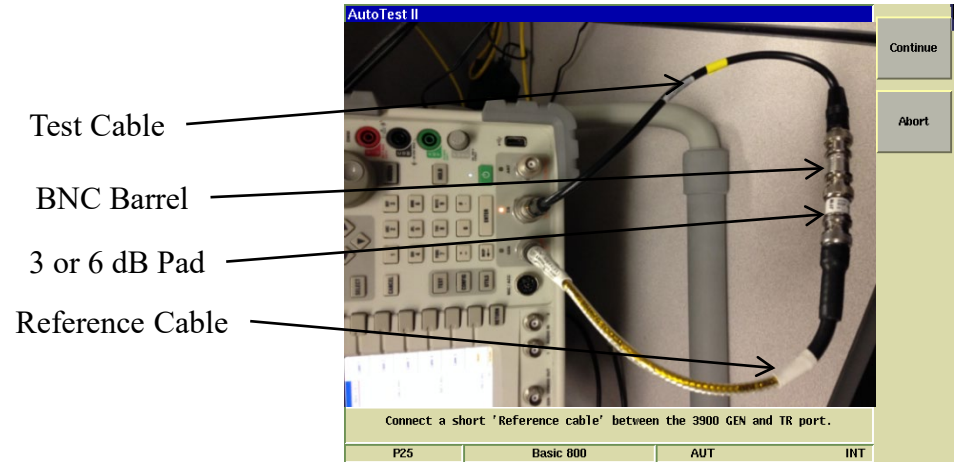
- (1) N (M) – BNC (F) Adapter (TR Port)
- (1) TNC (M) – BNC (F) Adapter (GEN Port)
- (1) BNC (F) – BNC (F) Barrel
- (1) BNC (F) – BNC (M) 6 dB attenuator
- (1) Short BNC (M) – BNC (M) REF cable
- (1) BNC (M) – BNC (M) Test cable
- (1) BNC – SMA Adapter
- (1) BNC – Mini UHF Adapter

XTL / XTS Cable Loss

Test Cable Calibration

- Radio Testing Cable Sweep

- After the Reference cable sweep has been completed, you will be prompted to connect the Radio Testing Cable in line with the Reference cable. The 3920 will again use its spectrum analyzer and tracking generator to sweep the combined cables and will plot the difference between the two sweeps as the insertion loss of the cable that was added.
- Radio Testing Sweep
- Gen port -> Reference Cable -> 3 dB Pad -> Adapter -> Radio Testing Cable -> TR Port
- NOTE: The on screen instructions make no mention of the use of an external pad for this calibration.**

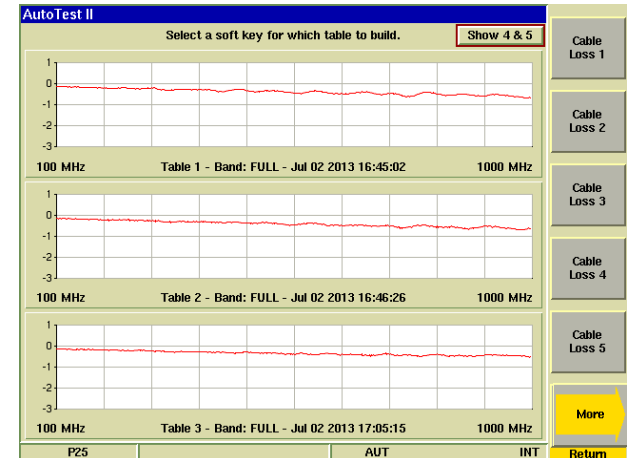


- (1) N (M) – BNC (F) Adapter (TR Port)
- (1) TNC (M) – BNC (F) Adapter (GEN Port)
- (1) BNC (F) – BNC (F) Barrel
- (1) BNC (F) – BNC (M) 6 dB attenuator
- (1) Short BNC (M) – BNC (M) REF cable
- (1) BNC (M) – BNC (M) Test cable
- (1) BNC – SMA Adapter
- (1) BNC – Mini UHF Adapter

XTL / XTS Cable Loss

Results of cable calibration

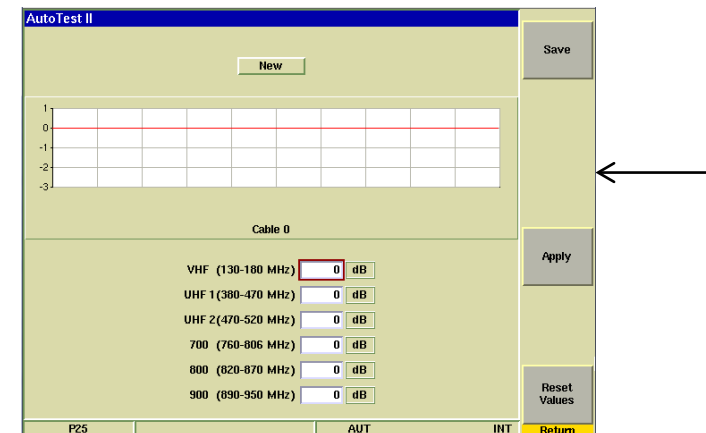
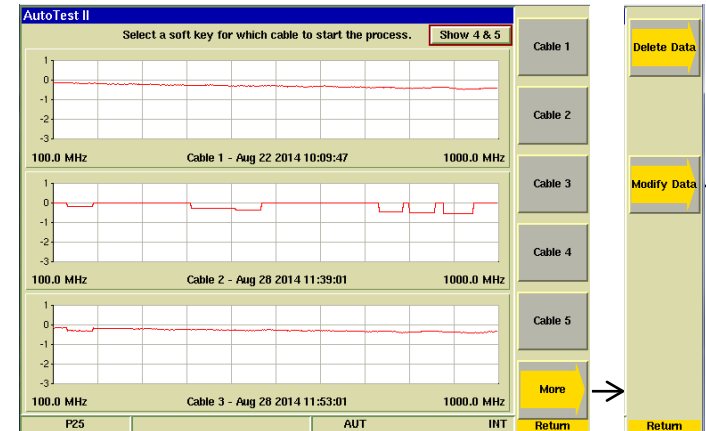
- Trace 1
 - This calibration was done as directed without the use of the 3 dB external attenuator.
- Trace 2
 - This calibration was done with the same Radio Test Cable but a 3 dB attenuator was used when calibrating the Reference cable.
- Trace 3
 - This calibration is done with the external 3 dB attenuator and a high quality, low loss, phase stable cable.
- The Difference
 - Results will vary depending on the quality and length of the test cable. This test was done with a 3 ft RG-58 test cable.
 - Notice that Trace 1 is not as flat as Trace 2. These waves are caused by a VSWR mismatch at the point where the cables are connected together. Use of the 3 dB pad at this junction improves the VSWR and minimizes some of these standing waves.
- The Impact
 - When calibrating the transmitter power, even small amounts of error in the insertion loss measurement can cause the radio to fail the test. An insertion loss of 0.4 dB that is not accounted for can cause up to a 10% error in power measurement.



XTL / XTS Cable Loss

Modify Cable Sweeps


- It is possible to create a trace offset if loss values are already known through the Modify Data feature.
- Allows creation of banded loss factors if loss values are known. Enter negative values to account for loss.
- Allows matching the 3920 Power meter to a higher accuracy Bench power meter.
- Trace 1
 - This is a standard Trace Sweep.
- Trace 2
 - This trace was created by entering band specific offset levels.
 - Use this when:
 - Appropriate adapters are not available.
 - The tracking generator is not installed.
 - When cable loss values are known.
- Trace 3
 - Modified trace allows power meter matching to a Bench Power meter standard.



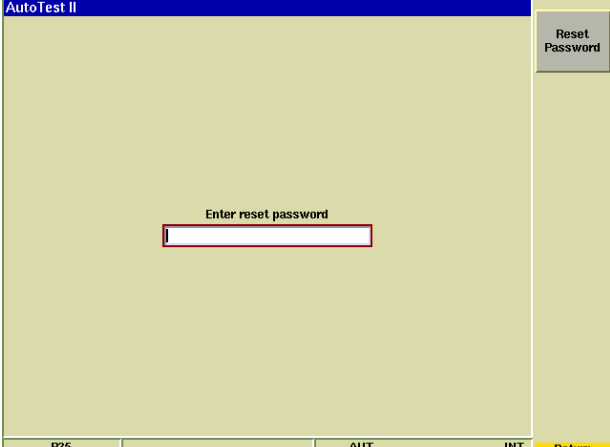
XTL / XTS Administration Page

Administration

- Create a Password
 - Allows entry of password for access to the Edit Specs screen. If users are not allowed to make changes to the radio test specifications, a password may be entered here and must be entered to gain access to the Edit Specs screen.
- Reset Password
 - After a password has been entered, the only way to remove it is to enter the following Reset Password value:
 - 85856767
 - After this value has been entered, press the Reset Password button and the password protection will be removed and a new password may be entered if desired.



The screenshot shows the 'AutoTest II' interface. At the top, there is a blue header bar with the text 'AutoTest II'. Below the header, the main area is light green and contains the text 'Create a password for 'Specifications' screen.' followed by a red-bordered input field. On the right side, there is a vertical grey bar with a 'Save' button. At the bottom, there is a navigation bar with buttons for 'F25', 'AUT', 'INT', and 'Return'.



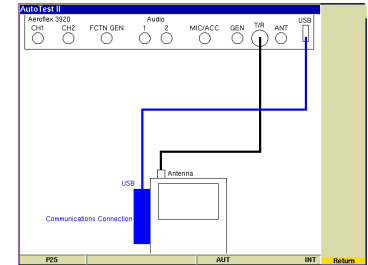
The screenshot shows the 'AutoTest II' interface. At the top, there is a blue header bar with the text 'AutoTest II'. Below the header, the main area is light green and contains the text 'Enter reset password' followed by a red-bordered input field. On the right side, there is a vertical grey bar with a 'Reset Password' button. At the bottom, there is a navigation bar with buttons for 'F25', 'AUT', 'INT', and 'Return'.

XTL / XTS Radio Interconnect Diagrams

Radio Connections to the 3920

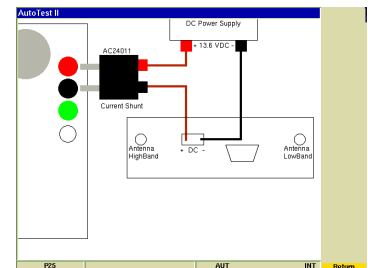
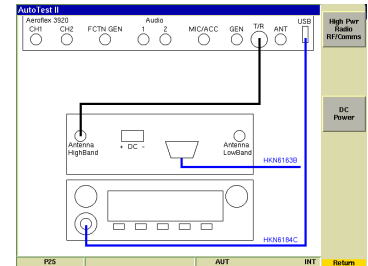
• Interconnect for Portable Radio

1. The Portable radio requires a USB connection from the radio to one of the 3920 USB ports.
2. Requires an RF Cable connection from the 3920 TR port to the radio ANT port.
3. Recommended connection to a battery eliminator and power supply.



• Interconnect for Mobile Radio

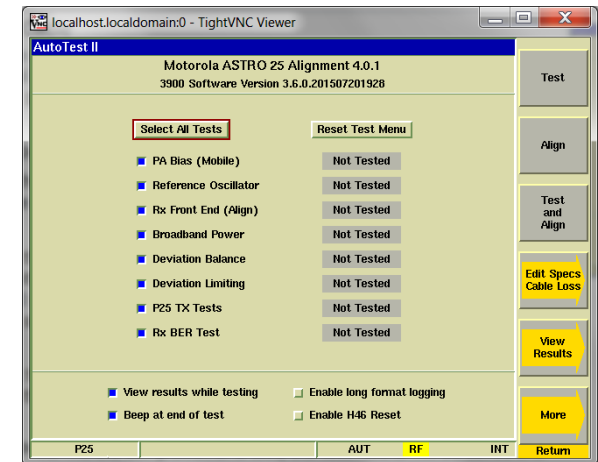
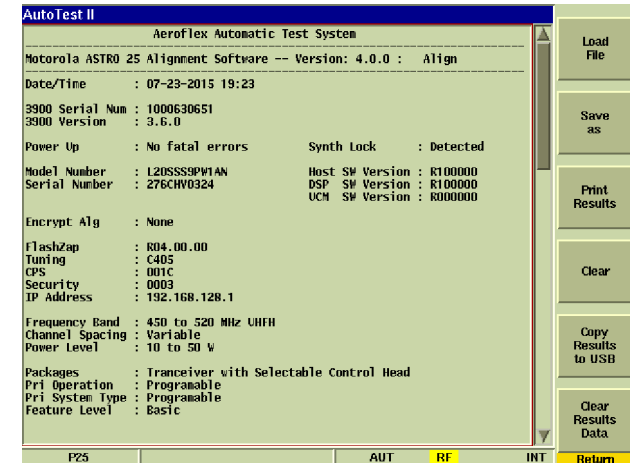
1. The Mobile radio requires a USB connection from the radio to one of the 3920 USB ports. The radio may be connected through the connector on the radios rear section or to the radios control head.
2. The AC24011 current shunt must be used and connected as the diagram indicates only for Power alignment. The current shunt is not required for power testing.
3. The power supply should be capable of supplying the required amount of current and the current limiting should not be set too low. Proper gauge wires should also be used.
4. For connection to the current shunt, the positive wire must be connected to the current shunt as indicated in the drawing. The current shunt is connected to the 3920's V/ohm and COM connectors on the DMM.



XTL / XTS Test Results

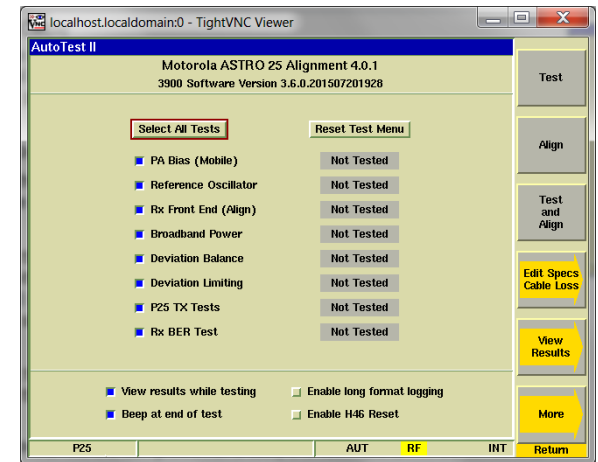
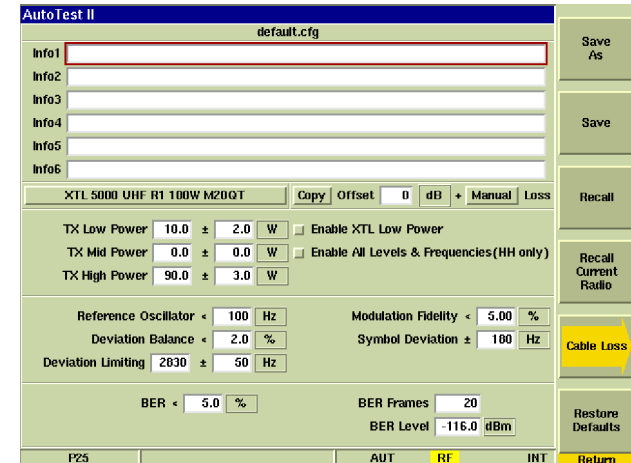
Radio Test Screen

- Test Results Screen
 - Shows Time Date stamp along with the 3920's serial number and version information for both the system and the application.
 - Shows radio model, serial number along with radio software versions and configurations.
 - Shows the Flash Code.
- Load File
 - Allows a different test results file to be loaded and displayed.
- Print Results
 - Prints the test results to a printer that is connected to the 3920 or a network printer if configured for this in the systems printer configuration screen.
- Clear
 - Clears the currently displayed results from the screen.
- Copy Results to USB
 - Copies ALL test results files from the 3920's hard drive to a connected USB memory stick.
- Clear Results Data
 - Deletes all test results files from the 3920's hard drive.
- Test Results
 - As tests are performed, the results along with pass / fail information is provided.



Step by Step Procedure

1. Connect the 3920 to an EXT 10 MHz Reference if available.
2. Select the Auto-Test II system and execute the Astro 25 Auto-Test.
3. Connect the Portable or Mobile radio to be tested.
4. Edit Specs Screen
 1. Connect the radio to be tested and select “Recall Current Radio” button on the Edit Specs screen.
 2. Verify specifications are set appropriately.
 3. If cable loss factors have not been created then go to the Cable Loss screen and either sweep the test cable or enter appropriate correction factors if known.
 4. Select the cable to be used for this radio on the Edit specs screen.
 5. Press Return.
5. Main Test Screen
 1. Select all test items.
 2. Begin the Test or Alignment.
6. Failed tests should be confirmed by re-testing.



Thank You

XTL / XTS Mobile and Portable Automated Test and Alignment

