BK KNG Series Auto-Test and Alignment

3920B Radio Test Platform

VIAVI

This guide describes how to setup and use the BK KNG Series Auto-Test application on the 8800SX.

Supported Models

P150	M150
P400	M400
P500	M500
P800	M800

Equipment Requirements

3920B with options
- Option 061 – Tracking Generator
- Option 200 – P25 Conventional Operation
- Option 218 – Auto-Test II for P25
- Option 627 – BK KNG Series Auto-Test and Alignment

Test Hardware
- VIAVI 82556 – 6 dB / 150-Watt 1.5 GHz Attenuator or VIAVI 82557 – 10 dB / 150-Watt 1.5 GHz Attenuator – For testing High Power mobiles and Squelch Alignment
- Radio programming cable
    - Relm KAA0608A for portables
    - Relm KAA0609A for mobiles
- Variable Power Supply (30 Amp rating for High Power mobiles)
- Battery Eliminator (for portables) – Relm 1100-31002-500
- Test Cable (Double Shielded RG-223 recommended) BNC (M) – BNC (M)
- Reference Cable (Short 6") BNC (M) – BNC (M)
- 3 or 6 dB Attenuator BNC (M) – BNC (F) (Optional but recommended for best accuracy)
- Connector Adapters
    - BNC (F) – dual banana plug (M) (Included with radio programming cable)
    - BNC (M) – banana jack (F) x 2 (Included with radio programming cable)
    - BNC (F) – BNC (F)
    - BNC (F) – SMA (F)
    - TNC (M) – BNC (F)
    - N (M) – BNC (F)
- For best accuracy, the 3920B should be connected and configured to use an external 10 MHz Standard.

Before you Begin

- Before testing begins, be sure to check the system software version of your 3920. Press the UTILS key (twice) to access the Utilities menu. Choose Software Settings>Software Upgrade to see the installed software versions.

- The system software version is indicated next the "BASE_CONFIG". The BK KNG application version is indicated to the right of OPTION_627.
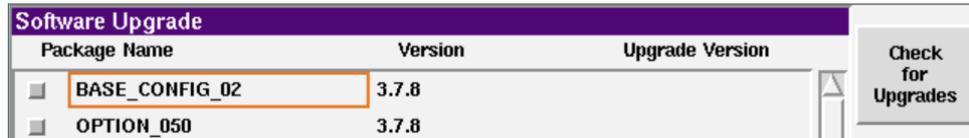

- Check for software updates on the VIAVI 3920 Series Software webpage at www.viavisolutions.com/en-us/software-download/3920-series-software. The current system software version is displayed next to 3920 Series Software Update.

- If the system software version is older than the version listed on this site, download the software, release notes, and installation instructions and update your system software. The system software download includes the latest Auto-Test Software Update.

- If the system software version is current, check your Auto-Test application version, as the test scripts are updated more frequently than system software. The Auto-Test Release Notes will list current versions in order of most recently updated.

- The Auto-Test Software Update includes all currently released test scripts.

KNG Portable Interconnect

1. Connect 10.4 VDC power supply to battery eliminator.

2. Connect radio ANT to 3920 T/R port, with 6 dB or 10 dB attenuator in-line if performing squelch alignment.

3. Connect radio programming cable to 3920 USB port.

4. Connect radio programming cable audio connectors to 3920 if performing audio tests:

   • Connect audio out cable to the BNC to dual banana plug adapter.
   • Connect BNC to banana jack adapters to 3920 Audio In 1 and 2 ports.
   • Connect dual banana plug adapter to 3920 Audio In 1 and 2 ports.
   • Connect "MIC IN" to 3920 Function Gen port.

5. Set the radio Zone and Channel selector to the pre-programmed the P25 Test Channel and Zone.
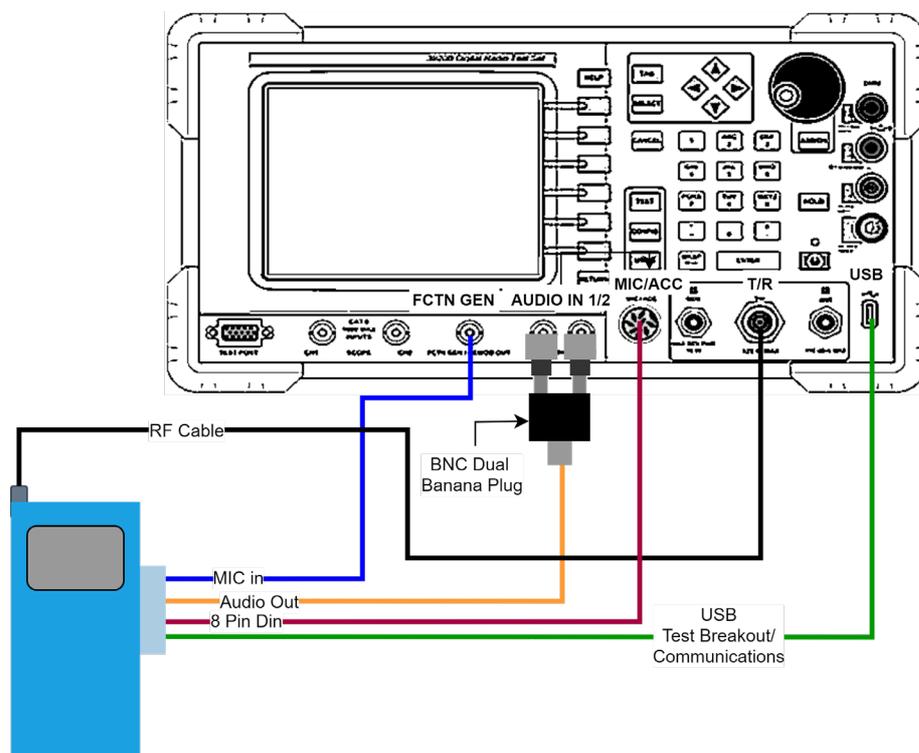
KNG Mobile Interconnect

1. Connect 12 VDC power supply to radio.

2. Connect radio ANT to 3920 T/R port, with 6 dB or 10 dB attenuator in-line for high power (110 W) radios or if performing squelch alignment.

3. Connect radio programming cable to 3920 USB port.

4. Connect radio programming cable audio connectors to 3920 if performing audio tests:

   • Connect audio out cable to the BNC to dual banana plug adapter.
   • Connect BNC to banana jack adapters to 3920 Audio In 1 and 2 ports.
   • Connect dual banana plug adapter to 3920 Audio In 1 and 2 ports.
   • Connect "MIC IN" to 3920 Function Gen port.

5. Set the radio Zone and Channel selector to the pre-programmed the P25 Test Channel and Zone.
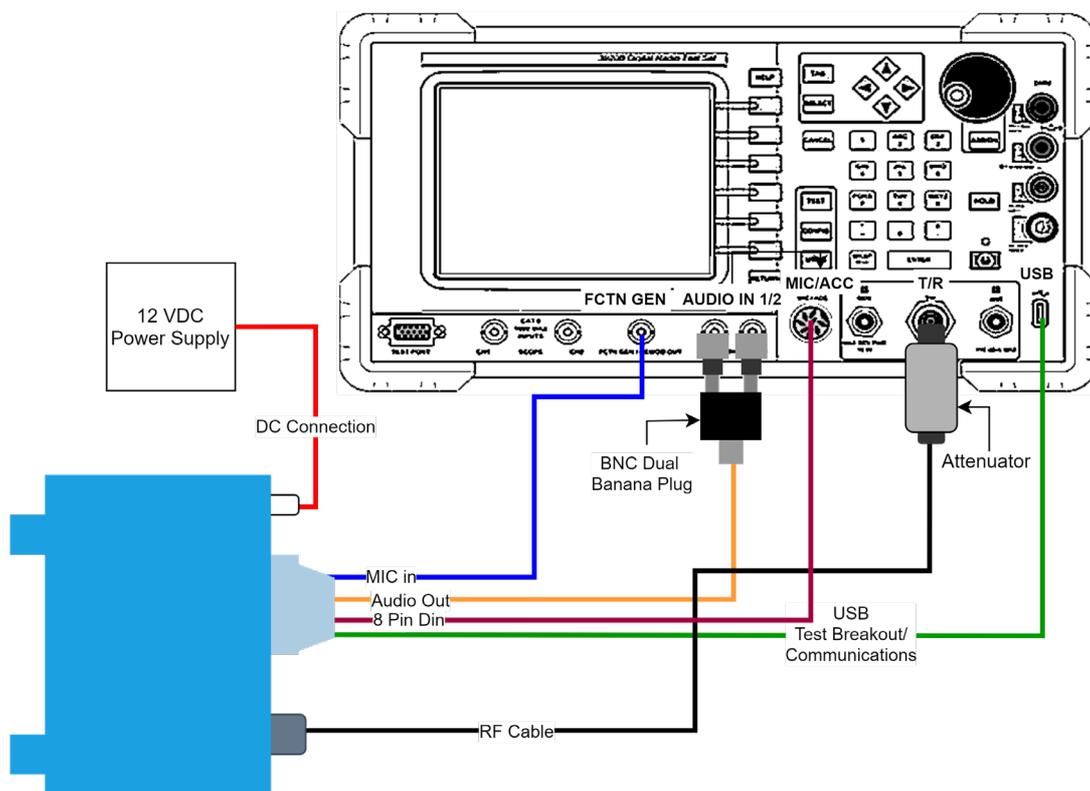
Access to the Application through Auto-Test II

1. On the 3920, press the CONFIG key (twice) to gain access to the System menu and select Auto-Test II. This can also be accomplished by right clicking with a mouse and selecting Auto-Test II.

2. Select the BK KNG Auto-Test from the Auto-Test II menu.

Test Screen - Test Selections

The selections on this screen allow any combination of tests or alignments to be performed. The application will not attempt to perform invalid operations on the radio if the test or alignment is not supported by the radio that is connected.

Radio IP - Enter the radio IP address here.

Radio Type and Test Selection – Select the radio type (portable or mobile), test type (Test or Align & Test), and whether audio tests are skipped (No Audio).

Select All - This will enable all tests.

Reset Test All - This will disable all tests.
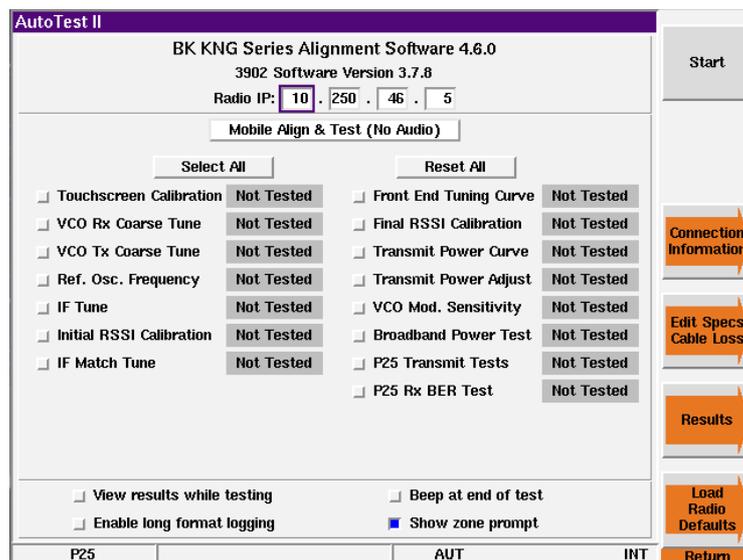
View Results while testing

- When selected and the test or alignment function has been executed, the screen will change and will display all tests and alignments as they occur. If not selected, the application will stay on this screen and show only the current status, Testing / Passed / Failed / Skipped.

Enable long format logging

- Diagnostic mode that shows all adjustments to soft pot values.

Beep at end of test

- The 3920 will produce an audible beep at the completion of all tests and alignments to notify the operator that the test or alignment is complete.

Show zone prompt

- The test will prompt the user to set the radio to the P25 Test Channel and Zone for P25 tests.

Test Screen - Function keys

F1 – **Start**
- Starts the selected test type (Test or Align & Test)

F3 – **Connection Information**
- All selected items that are capable of being aligned will be aligned. Performance tests will also be performed to validate the alignment.

F4 – **Edit Specs Cable Loss**
- Allows editing of test parameters as well as entry of the P25 Test Channel and Test Zone. 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 – **Results**
- Views results of the last test performed. Also allows test results to be copied to a USB drive.

F6 – **Load Radio Defaults**
- Resets the radio's calibration data. Used for troubleshooting alignment failures; a complete alignment will need to be performed afterwards.

Edit Specs Screen

Info lines
- Allows three lines of user text to be entered that will be visible at the beginning of the printout in the Test Results file. These could be used to identify a Technician ID, Company Name or anything that might be useful at the beginning 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 saved specification file from memory.

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 specifications to the factory defaults. Note, these values are not permanently stored unless you answer yes when prompted or press the Save Key. This does not impact Radio selection, Info lines, Offset or cable selections.
- ** This operation should be performed after updating the application to a new version.

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

Copy (continued)

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

Note: This will automatically save to the currently selected specification file.

Offset / Cable Loss

- These values are used to correct the power meter for TX Tests and RF Generator for RX Tests. If you are using an external 6 dB or 10 dB attenuator, you can enter a *negative* value as an offset. You can additionally use a cable sweep plot to compensate for a test cable. This feature is primarily needed for testing or aligning Transmitter power levels.

Note: If it is not possible to perform the cable sweep, enter a fixed negative value in the offset field to compensate for the connecting cable. This value will be used at all frequencies to compensate the power meter. A higher loss value entry would cause the Power meter to read higher values.

- The offset entry will be applied in addition to a cable loss selection.

Cable Loss Screen

Cable 1 - 3

- Choose up to 3 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.

Delete Data

- Deletes cable data.
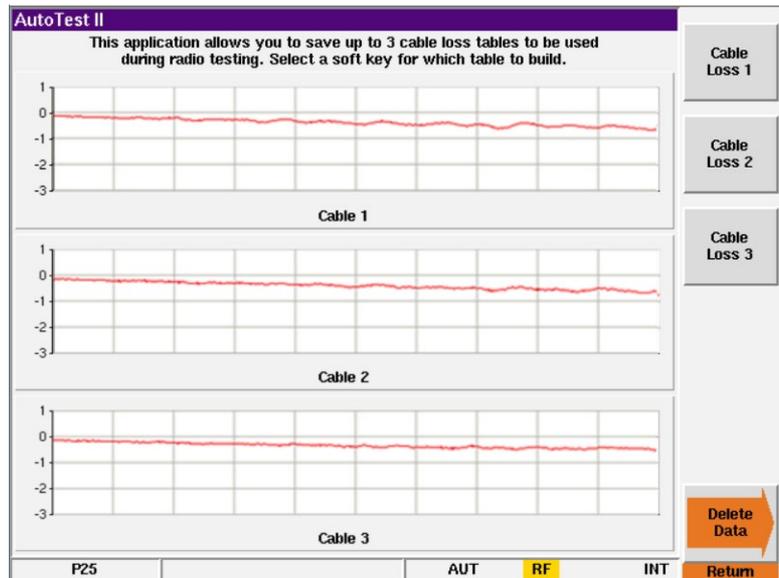
## Test Cable Calibration

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 attenuator at the end of the reference cable that is connected to the T/R port of the 3920. This will improve the VSWR of the cable when it is connected to the Radio Testing Cable.

Reference Cable Sweep

- Gen port -> Reference Cable -> 3 or 6 dB Attenuator (optional) ->TR port
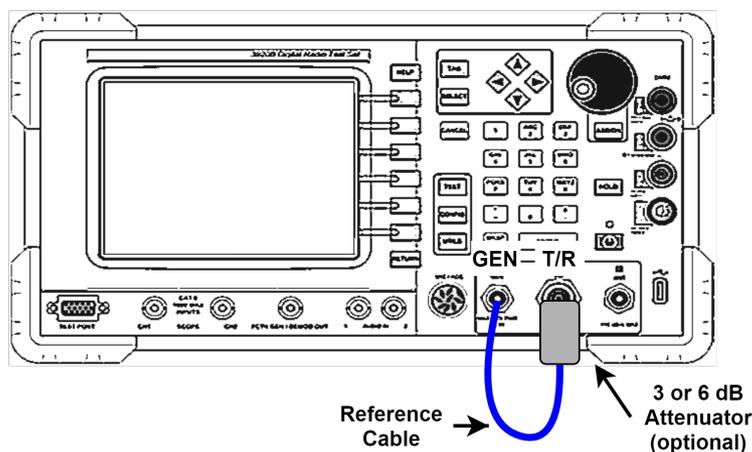
Radio Testing Cable Sweep

- 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 or 6 dB Attenuator (optional) -> Adapter -> Radio Testing Cable -> TR port

NOTE: The on-screen instructions make no mention of the use of an external attenuator for this calibration.
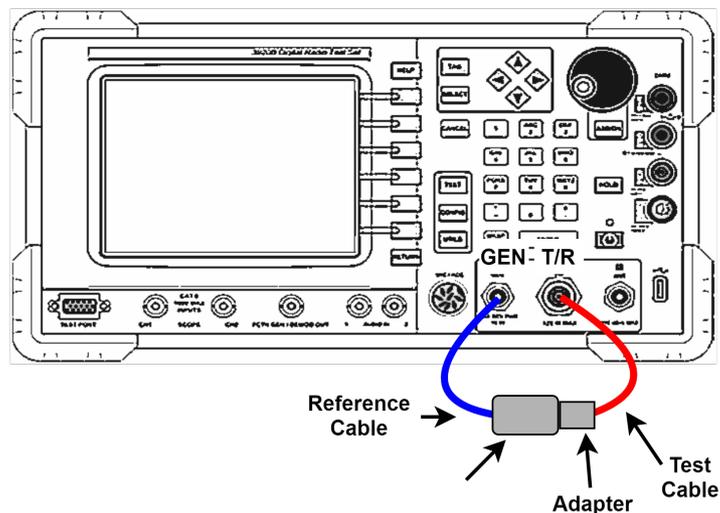

Results of Cable Calibration

Cable 1

- This calibration was performed as directed without the use of the 6 dB external attenuator.

Cable 2

- This calibration was performed with the same Radio Test Cable but a 6 dB attenuator was used as explained above.

Cable 3

- This calibration was performed with the external 6 dB attenuator and a high quality, low loss, double shielded Radio Test Cable.
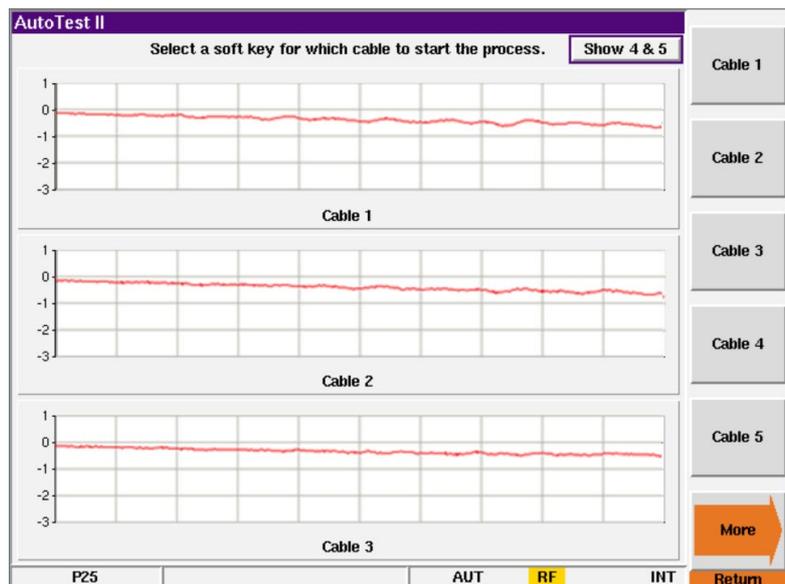
The Difference

- Results will vary depending on the quality and length of the test cable. This test was done with a 3ft RG-58 test cable.

- Notice that Cable 1 response is not as smooth as the Cable 2 response. These waves are caused by a VSWR mismatch at the point where the cables are connected together. Use of the 6 dB attenuator 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.

- With Dual Band radios, it is important to note that the insertion loss at low frequencies is less than the insertion loss at higher frequencies so one fixed entry for cable loss will not correct the power meter in both bands correctly.

View Results

Displays the most recent test result.

- 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.

Load File

- Allows a different test results file to be loaded and displayed.

Clear

- Clears the currently displayed results from the screen.

Copy Results to USB

- Copies ALL test result files from the 3920's hard drive to a connected USB flash drive.

Clear Results Data

- Deletes all test results files from the 3920's hard drive.

Running the Auto-Test, Step by Step

1. Select the Auto-Test II system and select the BK KNG Auto-Test.

2. Connect the Portable or Mobile radio to be tested.

3. 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 access 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. Confirm the P25 Test Channel and Zone are configured correctly for the radio.

   6. Press Return.

4. Main Test Screen

   1. Select the radio type and test type.

   2. Select the tests or alignments to be performed.

   3. Press the Start softkey.

5. Failed tests should be confirmed by re-testing.