



**Tait Orca Calibration
Application
User's Manual**

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Tait Electronics Ltd has made every effort to ensure the accuracy of the information in this manual. However, Tait Electronics Ltd reserves the right to update the software and/or this manual without notice.

Part 1: Using the Calibration Application

This part describes the basic operation of the Calibration Application.

Topics

- [Getting Started](#)
- [Calibration Application Basics](#)

Getting Started

The Tait Orca series of radios has been designed to be totally electronically tuned. The calibration process uses a PC running the Calibration Application, which is connected to a radio via a calibration test unit. The application leads the operator through a series of tests and uses the information from these tests to calibrate and program the radio.

This manual is intended as an installation guide and reference for the Calibration Application. It provides the following information:

- installation instructions and hardware setup
- an overview of the Calibration Application
- reference guide to all parameters and settings

Minimum System Requirements

The application requires the following minimum configuration:

- an IBM compatible PC with an 80486 microprocessor (or better)
- Windows® 95, Windows 98, Windows 2000 or Windows NT® 4
- 16 MB of RAM
- a VGA colour graphics display
- a hard disk drive with 8 MB of free space (20 MB Recommended)
- CD-ROM drive
- a printer (if you intend to keep a hard copy of data)
- a Microsoft or compatible mouse and driver (if you wish to use the program with a mouse)

Equipment Supplied

- application CD-ROM
- radio programming lead with an RJ-11 telephone-style socket at one end and an accessory connector at the other (TOPA-SV-007)
- radio programming cable with a 9-pin or 25-pin serial connector at one end and an RJ-11 telephone-style plug at the other
- calibration test unit (TOPA-SV-004)
- DC service adaptor (TOPA-SV-005)
- SMA N-type RF test lead (TOPA-SV-006)

Other Equipment Required

- RF communications test set (e.g. HP8920, MI2945/55, CMS52)
- digital current meter capable of measuring current up to 3 A accurate to two decimal places
- DC power supply, 7.5 V, 3 A

Application Installation

To install the application:

1. Insert the CD-ROM into your CD drive.
2. If the autorun does not automatically start, double-click on My Computer.
3. Double-click on the CD-ROM drive to view the CD's contents.
4. Double-click on the file setup.exe.

The installation program will guide you through the installation process. Read the information presented on the screen carefully.

Connecting a Radio to the PC

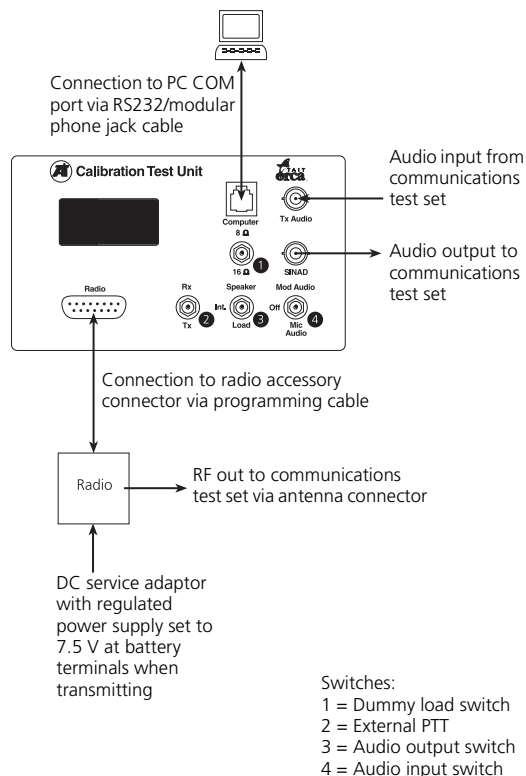
The calibration test unit provides an interface between the test equipment and the radio being calibrated. The diagram at right shows the connections that must be made.

1. Connect the radio programming lead to the calibration test unit at the Radio connection and to the radio at the accessory connector.
2. Connect the radio programming cable to the calibration test unit via the Computer connection and to the PC via one of the COM ports.
3. Connect the radio to the test set via the RF test lead using the antenna connector.
4. Connect the calibration test unit's audio input and output to the test set.

If the PA Bias Calibration test is to be done, connect a digital current meter in series with the power supply to the radio. Connect the radio's antenna connector to a 50Ω load/ input.

There are four switches on the calibration test unit.

- The external PTT (R_x/T_x) switches the radio between receive and transmit modes.



- The audio output switch (calibration test unit's speaker) switches between the speaker (Speaker), a dummy load (Load) and the radio's internal speaker (Int.).
- The audio input switch (Mod Audio/Off/Mic Audio) switches between the radio's MOD-AUDIO input (Mod Audio/MOD-AUDIO), Off (no audio input) and the external microphone audio input (Mic Audio/EXT-MIC).
- The dummy load switch ($8\Omega/16\Omega$) switches between dummy loads of 8Ω and 16Ω . This should be set to 16Ω for Tait Orca portables.

The external PTT should be set to Rx for all calibration tests. Instructions on other settings and connections for different calibration tests are given in the instructions for each test.

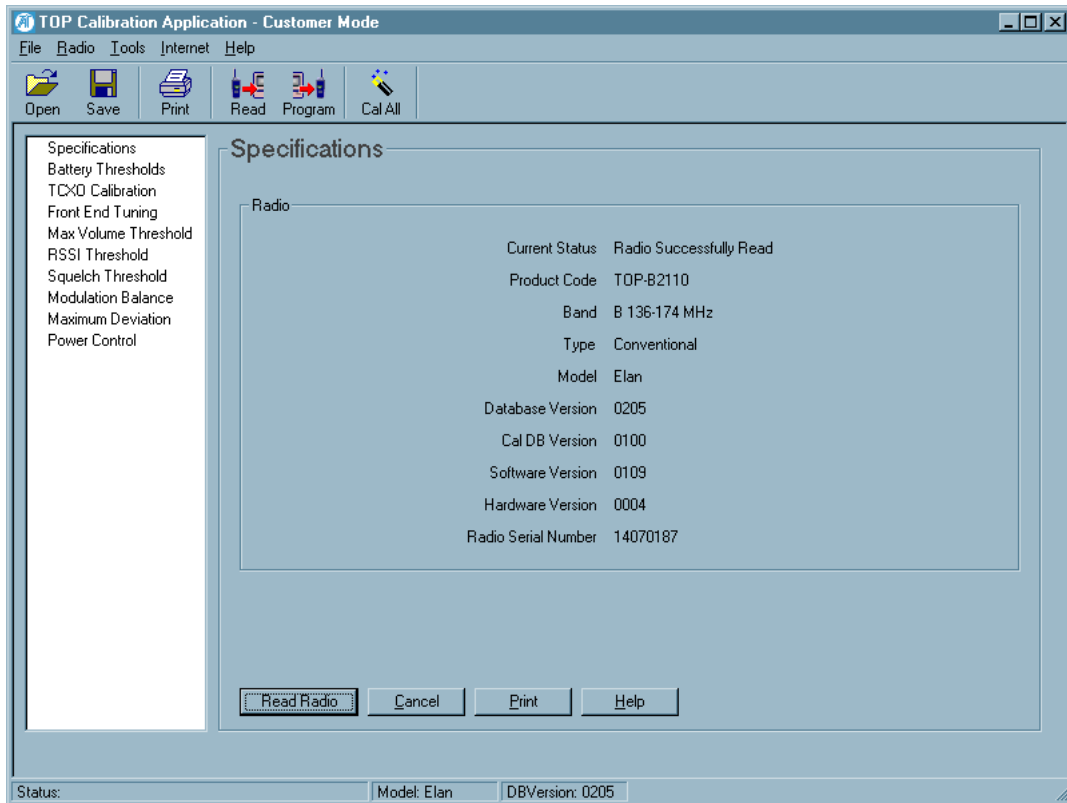
Set the regulated power supply to 7.5 V at the battery terminals when transmitting. Confirm that 7.5 V is delivered to the radio when transmitting by first connecting the radio's antenna port to the test set's high power input. Then set the calibration test unit's external PTT to Tx and monitor voltage on the bottom contacts of the DC service adaptor. Be sure to switch the external PTT to Rx before beginning the calibration tests.

Once connected, the radio must be switched on before it can be calibrated. To ensure the radio does not switch itself off during the session, use a fully-charged battery or a DC service adaptor (TOPA-SV-005).

Calibration Application Basics

When you first start the Calibration Application, the main window appears showing:

- **Menus:** A series of menus along the top of the window. See “[Menu Commands](#)” on page 10.
- **Toolbar:** A toolbar with a series of buttons. See “[The Toolbar](#)” on page 14.
- **Forms tree:** A list of forms. See “[The Forms Tree](#)” on page 14.



Press the F1 key for context-sensitive help.

Menu Commands

The bar along the top of the main window shows the following menus:

- [File](#)
- [Radio](#)
- [Tools](#)
- [Internet](#)
- [Help](#)

Keyboard: Select a menu by pressing the Alt key, then the first letter of the menu's name. Use the up and down arrow keys to scroll through the list of commands, and press the Enter key to select a command. Select another menu using the left and right arrow keys. Press the Esc key to close a menu; the menu bar remains selected. Press the Esc key again to return to the main window.

Mouse: Select a menu by clicking on it, then clicking on the required command.

File Menu

The commands available from the File menu are:

- [New](#)
- [Open](#)
- [Save](#)
- [Printer Settings](#)
- [Print](#)
- [Preferences](#)
- [Exit](#)

New

Selecting the File>New command loads the application's default data. Warning: default data should not be programmed to a radio.

Open

Selecting the File>Open command opens an existing file.

If a file was saved with comments, the comments will be displayed in the Comments window and the radio information will be displayed in the Radio Information window.

Save

Selecting the File>Save command opens the Save file window. If the file has not previously been saved, the application uses the radio's serial number to suggest a file name.

Any comments you enter in the Comments window will be saved with the file, together with the information displayed in the Radio Information window.

Printer Settings

Selecting the File>Printer Settings command opens the Print Setup dialog in which you can select the printer you wish to print to.

Print

Selecting the File>Print command opens the Print View window, where you can preview a summary of calibration data in all forms. You can then send this data to a printer

using the Print button, or to a text file using the Print to File button.

Preferences

Selecting the File>Preferences command opens the Preferences form. The options are:

- [Select Application Language](#)
- [Communication Port](#)
- [WWW Addresses](#)

Select Application Language

Select the language the application will be displayed in.

Communication Port

Select the port used for communicating with radios.

WWW Addresses

If you wish to change the URL used when the options in the [Internet](#) menu are selected, enter the new information in the appropriate WWW Address field.

- Tait World Address: The address used when the Internet>[TaitWorld](#) command is selected
- Tait Support Address: The address used when the Internet>[Tait Support](#) command is selected
- Tait Application Upgrade Address: The address used when the Internet>[Tait Update](#) command is selected

Exit

Selecting the File>Exit command exits the application. You will be asked to confirm your decision.

Radio Menu

The commands available from the Read menu are:

- [Read](#)
- [Program](#)

Read

Selecting the Radio>Read command reads the radio's calibration database, which is then used for calibrating the radio.

Program

Selecting the Radio>Program command programs the radio's calibration database using the information collecting during the calibration process.

Tools Menu

Selecting another Tait application from the Tools menu launches the application. If the application cannot be found,

you will be prompted to locate the executable (*.exe) file. If you browse for and select a new executable file, the path for that application will be updated and the application will be launched. Next time you select that application from the Tools menu the new path for the executable file will be used.

Internet Menu

The commands available from the Internet menu are:

- [TaitWorld](#)
- [Tait Support](#)
- [Tait Update](#)

TaitWorld

Selecting the Internet>TaitWorld command launches your default browser and loads the TaitWorld web page. Enter the address used in the [Preferences](#) form (File>Preferences).

Tait Support

Selecting the Internet>Tait Support command launches your default browser and loads the Tait support request web page. Enter the address used in the [Preferences](#) form (File>Preferences).

Tait Update

Selecting the Internet>Tait Update command launches your default browser and loads the Tait technical issues web page. Enter the address used in the [Preferences](#) form (File>Preferences).

If you do not have a Username and Password, contact your local Tait office.

Help Menu

The commands available from the Help menu are:

- [Contents](#)
- [Search For Help On...](#)
- [About](#)

For context-sensitive help, press the F1 key.

Contents

Selecting the Help>Contents command launches the online help, open at the Contents tab.

Search For Help On...

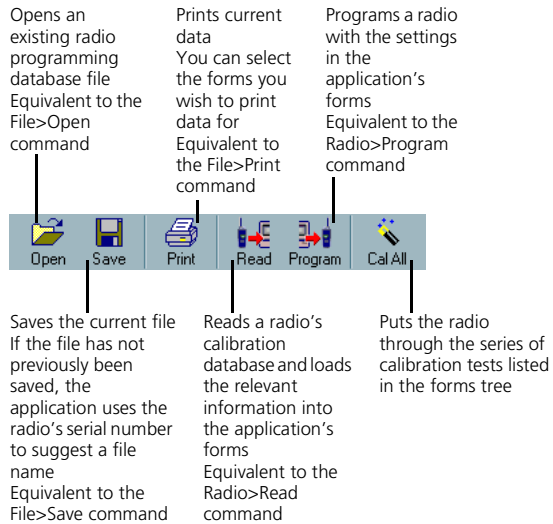
Selecting the Help>Search For Help On... command launches the online help, open at the Search tab.

About

Selecting the Help>About command displays information about the application.

The Toolbar

The toolbar commands are as follows.



The Forms Tree

The forms tree on the lefthand side of the main window lists the forms available.

Keyboard: Scroll through the forms using the up and down arrow keys. Press the Enter key or the spacebar to open the form.

Mouse: Click on the name of a form to open it and begin changing data.

The buttons along the bottom of each form are as follows.

- **OK:** Saves the form data and exits the form. Pressing the Esc key or Alt-O also saves data and exits the form.
- **Cancel:** Discards any changes made and exits the form. Pressing Alt-C also discards changes and exits the form.
- **Print:** Opens the Print View window, where you can preview a summary of calibration data in all forms. You can then send this data to a printer using the Print button, or to a text file using the Print to File button.
- **Help:** Displays online help for the form. Pressing F1 or Alt-H also displays online help for the form.

Changing Data

Keyboard: Use the Tab key to move between fields.

Mouse: Click on a field.

How you change the data for each field depends on how that data is displayed. There are three options:

- text box
- combo box
- slider

Text Box

A text box is used for numeric and alphanumeric data.



Keyboard: Select a text box using the Tab key. Enter the required data.

Mouse: Select a text box by clicking on it with the mouse. Enter the required data.

Combo Box

A combo box is used for fields that have a range of possible values and appears as a box with an arrow at the righthand side.



Keyboard: Select a combo box using the Tab key. You can then display the options available by pressing the Alt key and the down arrow key at the same time. Use the up and down arrow keys to scroll through the options until the required value is displayed, then press the Enter key.

Mouse: Select a combo box by clicking on it, which displays the list of values. Select the required value from the combo box.

Slider

A slider is used for fields that have a range of values. The current value is indicated on the right.



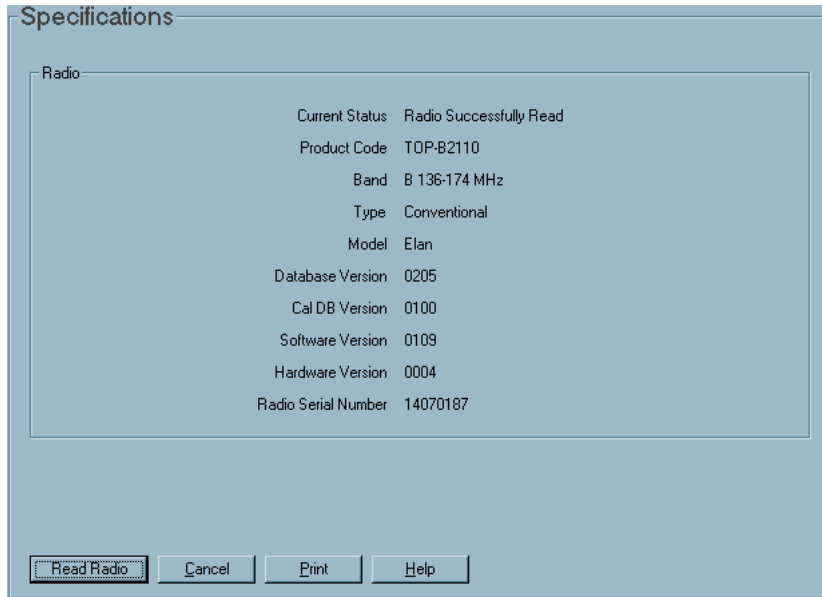
Keyboard: Select a slider using the Tab key. Use the left and right arrow keys to decrease and increase the value.

Mouse: Select a slider and change its value by either clicking on and dragging the tab or by clicking on the arrow buttons at either end of the slider.

Specifications Form

In the Specifications form, you can read a radio's Product Code, Band, Type, Model, Database Version, Calibration Database Version, Software Version, Hardware Version and Serial Number.

From the forms tree, select Specifications. The Specifications form appears, which is shown below.



The image shows a software window titled "Specifications". Inside the window, there is a section labeled "Radio" containing a list of attributes and their values. At the bottom of the window, there are four buttons: "Read Radio", "Cancel", "Print", and "Help".

Attribute	Value
Current Status	Radio Successfully Read
Product Code	TOP-B2110
Band	B 136-174 MHz
Type	Conventional
Model	Elan
Database Version	0205
Cal DB Version	0100
Software Version	0109
Hardware Version	0004
Radio Serial Number	14070187

Select the Read Radio button to read a radio's information. While not essential, it is recommended that you read a radio before beginning the calibration tests.

Part 2: Calibration Tests

This part contains detailed information carrying out the radio calibration tests.

Instructions for carrying out each test are provided on the form.

Tests

- [Battery Thresholds](#)
- [TCXO Calibration](#)
- [2.5 kHz Offset](#)
- [Front End Tuning](#)
- [Maximum Volume Threshold](#)
- [RSSI Thresholds](#)
- [Squelch Threshold](#)
- [Modulation Balance](#)
- [Maximum Deviation](#)
- [Power Control](#)
- [Diagnostics](#)

Calibration Tests

Each calibration test form includes step-by-step instructions on how to carry out the test. Once an instruction has been carried out, select the Next Instruction button.

Forms in which a number of steps must be repeated have an additional button that loops back to the first instruction that must be repeated. These buttons are not active until a particular step in the test has been reached. For example, the [Squelch Threshold](#) test requires that steps 5 to 10 be repeated at all Test Deviations. Once at step 11, the Loop to Instruction 5 button will be selectable and you can select it to view instructions 5 to 10 again.

The calibration test unit's external PTT should be set to Rx for all tests. Some tests are frequency dependent and so must be carried out across a range of test frequencies.

For each test, follow the instructions provided on the form. Once a test is finished, select OK to exit the form and save the data, or Cancel to exit the form without saving the data.

Battery Thresholds

Battery Thresholds

1. Ensure the calibration test unit's external PTT is set to Rx.

Previous Instruction Next Instruction

Measure Voltage 7.5 volts
Digital Voltage Reading 160

OK Cancel Print Help

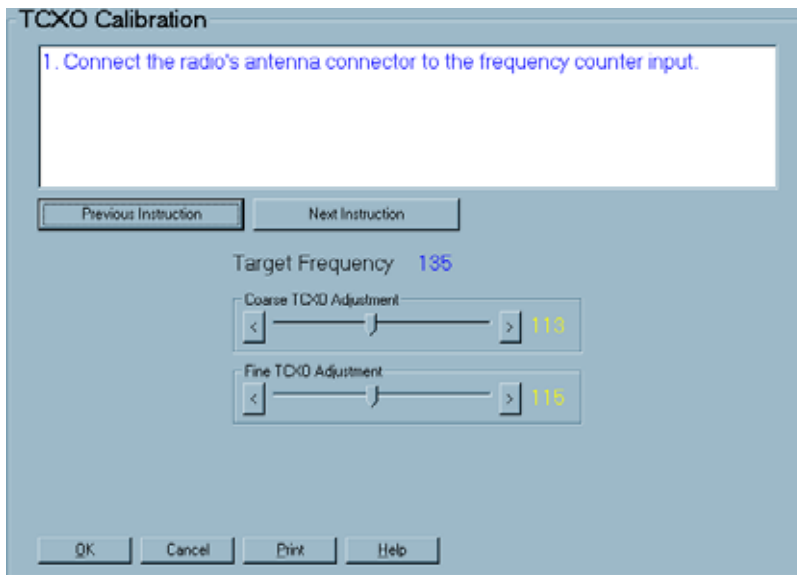
The Battery Thresholds test measures the voltage into the radio, which must be accurately measured so that the radio can calculate low battery states.

Instructions

1. Ensure the calibration test unit's external PTT is set to Rx.

2. With a power supply connected to the DC service adaptor, adjust the voltage to give an output between 6 and 9 volts.
3. Use the digital multimeter to accurately measure the voltage across the two points at the base of the DC service adaptor.
4. Enter the voltage reading in the Measure Voltage box.
5. Select OK to exit and accept the calibrated information, or Cancel to exit without saving the calibrated information.

TCXO Calibration



The TCXO (temperature compensated crystal oscillator) provides the reference frequency from which all other RF frequencies are derived. The TCXO requires careful alignment to ensure that the transmitter and receiver are on frequency.

The TCXO Calibration test must be carried out at a room temperature of 25 degrees Celsius (± 5 degrees), and should be completed as rapidly as possible since extended transmission times increase temperature, thereby making the calibration test less reliable.

Instructions

1. Connect the radio's antenna connector to the frequency counter input.
2. Set the calibration test unit's audio input switch to Off.
3. If the Fine TCXO Adjustment slider is outside the range 115 to 140, set it to 127.

4. Adjust the Coarse TCXO Adjustment slider so that the frequency displayed is as close as possible to the Target Frequency indicated on the form.
5. Adjust the Fine TCXO Adjustment slider so that the frequency displayed is as close as possible to the Target Frequency indicated on the form.
6. Select OK to exit and accept the calibrated information, or Cancel to exit without saving the calibrated information.

2.5 kHz Offset

2.5 kHz Offset Calibration

1. Connect the radio's antenna connector to the frequency counter input

NOTE: Ensure that the TCXO Calibration has been completed before doing this test.

Previous Instruction Next Instruction

Target Frequency 162002500 Hz

Frequency Offset Adjustment

< ————— | ————— > 148

OK Cancel Print Help

This test sets the 2.5 kHz offset, so that 2.5 kHz channel increments can be selected on VHF narrowband radios operating in the frequency range 150 to 174 MHz. The TCXO must be correctly calibrated ([TCXO Calibration](#) test) before the 2.5 kHz offset can be set.

Instructions

1. Connect the radio's antenna to the frequency counter input.
2. Set the calibration test unit's audio input switch to Off.
3. The frequency displayed on the frequency counter should be close to 162.000000 MHz.
4. Adjust the Frequency Offset Adjustment slider so that the frequency displayed is as close as possible to the Target Frequency (162002500 Hz) indicated on the form.
5. Select OK to exit and accept the calibrated information or Cancel to exit without saving the calibrated information.

Front End Tuning

Front End Tuning

1. Ensure the calibration test unit's external PTT is set to Rx.

Previous Instruction Loop to Instruction 4 Next Instruction

Test Deviation 1.6 KHz Auto-Tune

Test Frequency:

- 145.1 MHz
- 155.1 MHz
- 164.1 MHz
- 174.1 MHz

Maximum RSSI Finder 102 Maximum RSSI 68

Upper End RSSI Finder 102 Upper RSSI 68

Lower End RSSI Finder 102 Lower RSSI 68

OK Cancel Print Help

The front end tuning voltage sets the centre of the bandpass filter in the receiver section of the radio. The TCXO must be correctly calibrated ([TCXO Calibration](#) test) before the front end can be tuned. The front end for 800 MHz and 900 MHz radios does not need tuning.

Instructions

1. Ensure the calibration test unit's external PTT is set to Rx.
2. Connect the radio's antenna connector to the RF signal output.
3. Set the RF signal power to -100 dBm, the Test Deviation indicated on the form and modulate a 1 kHz signal.
4. For all radios except the Orca Eclipse, ensure that the radio's volume control is set approximately half way.
5. Set the RF signal frequency to the frequency indicated by the currently selected Test Frequency.
6. Adjust the Maximum RSSI Finder slider until the Maximum RSSI indicated on the form is at its highest value. You can also adjust all RSSI levels automatically by selecting the AutoTune button.
7. Adjust the Upper RSSI Finder slider and the Lower RSSI Finder slider until each RSSI value is three settings less than the value of Maximum RSSI. This step is not necessary if you selected the AutoTune button in step 6.
8. Repeat steps 5 to 7 for each Test Frequency indicated on the form.

9. Select OK to exit and accept the calibrated information, or Cancel to exit without saving the calibrated information.

Maximum Volume Threshold

The screenshot shows a software window titled "Maximum Volume Threshold". At the top, there is a text box containing the instruction: "1. Connect the oscilloscope across the calibration test unit's SINAD output." Below this are two buttons: "Previous Instruction" and "Next Instruction". The main area displays test parameters: "Test Frequency 135.1 MHz", "Test Deviation 1.5 KHz", "Test Load 16 ohms", and "Target Amplitude 8 Vpp". A "Volume Adjustment" slider is positioned to the right of these parameters, with a numerical value of "20" displayed on the right side. At the bottom of the window are four buttons: "OK", "Cancel", "Print", and "Help".

The maximum volume threshold is set to ensure that the radio's speaker is not overdriven.

Instructions

1. Connect the oscilloscope across the calibration test unit's SINAD output.
2. On the calibration test unit, ensure the external PTT is set to Rx, the audio output switch is set to load and the dummy load switch is set to the Test Load specified on the form.
3. Connect the radio's antenna connector to the RF signal output.
4. Set the RF signal to the Test Frequency and Test Deviation indicated on the form at a power of -47 dBm and modulate a 1 kHz signal.
5. Ensure that the radio's volume control is set to its maximum position.
6. Change the Volume Adjustment slider to the Target Amplitude indicated on the form.
7. Select OK to exit and accept the calibrated information, or Cancel to exit without saving the calibrated information.

RSSI Thresholds

The screenshot shows a software window titled "RSSI Thresholds". At the top, there is a text box containing the instruction: "1. Ensure the external PTT on the calibration test unit is set to Rx." Below this are two buttons: "Previous Instruction" and "Next Instruction". The main area displays two columns of data: "Test Frequency" (135.1 MHz) and "Test Deviation" (1.5 KHz). Below this is a table with two rows of calibration data. The first row shows "RF Power In for L0" (-116 dBm) and "L0 RSSI" (70), with a "Calibrate L0" button to the right. The second row shows "RF Power In for L2" (-100 dBm) and "L2 RSSI" (88), with a "Calibrate L2" button to the right. At the bottom of the window are four buttons: "OK", "Cancel", "Print", and "Help".

Test Frequency	Test Deviation
135.1 MHz	1.5 KHz

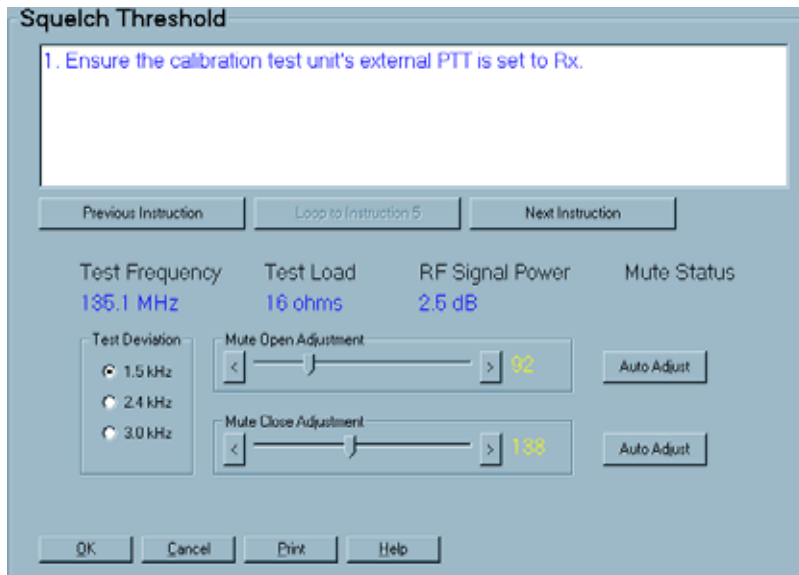
RF Power In for L0 -116 dBm	L0 RSSI 70	Calibrate L0
RF Power In for L2 -100 dBm	L2 RSSI 88	Calibrate L2

The received signal strength indicator (RSSI) must be calibrated to give an accurate measurement of received signal strength. The correct calibration of RSSI thresholds is critical for the proper operation of trunked radios.

Instructions

1. Ensure the external PTT on the calibration test unit is set to Rx.
2. Connect the radio's antenna connector to the RF signal output.
3. Set the RF signal to the Test Frequency and Test Deviation indicated on the form and modulate a 1 kHz signal.
4. Set the RF signal power to -116 dBm and select the Calibrate L0 button. Note: -116 dBm is a standard RSSI levels; your locality may require a different level.
5. Set the RF signal power to -100 dBm and select the Calibrate L2 button. Note: -100 dBm is a standard RSSI levels; your locality may require a different level.
6. Select OK to exit and accept the calibrated information, or Cancel to exit without saving the calibrated information.

Squelch Threshold



Squelch opening and closing levels are defined by independent values in the calibration database.

There are two programmable squelch settings for Tait Orca radios since different operating environments contain different amounts of RF noise. These settings are country and city and correspond to nominal settings of 12 dB and 16 dB SINAD respectively. Squelch is bandwidth dependent and so the test must be carried out for each bandwidth at which the radio operates.

Instructions

1. Ensure the calibration test unit's external PTT is set to Rx.
2. Connect the SINAD metering input to the calibration test unit's SINAD output.
3. Set the calibration test unit's dummy load switch to Load.
4. Connect the radio's antenna connector to the RF signal output.
5. Set the RF signal to the Test Frequency indicated on the form.
6. Set the RF signal to the Test Deviation indicated on the form and modulate a 1 kHz signal.
7. For the opening level, adjust the signal power so that the SINAD reads 12 dB.

Note: Steps 8 and 10 can automatically be carried out by pressing the appropriate AutoAdjust button; however, you must still adjust the signal power for the appropriate SINAD.

8. Adjust the Mute Open Adjustment slider until a single increment causes Mute Status to change from Closed to Open. If this changes over an increment greater than one, adjust the Mute Open Adjustment slider until Mute Status reads Closed and repeat this step.
9. For the closing level, decrease the RF signal power to the value indicated on the form.
10. Adjust the Mute Close Adjustment slider until a single increment causes Mute Status to change from Open to Closed. If this changes over an increment greater than one, adjust the Mute Closed Adjustment slider until Mute Status reads Open and repeat this step.
11. Repeat steps 5 to 10 for all Test Deviations indicated on the form.
12. Select OK to exit and accept the calibrated information, or Cancel to exit without saving the calibrated information.

Modulation Balance

Modulation Balance

1. Connect the radio's antenna connector to the modulation measuring input.

Previous Instruction Loop to Instruction 3 Next Instruction

Target Deviation 2.50 KHz

VCO Modulation Adjustment: [Slider] 56

Measured Deviations	
2.7	at 145 MHz
2.99	at 155 MHz
3.25	at 164 MHz
0.26	at 174 MHz

OK Cancel Print Help

Tait Orca radios modulate the signal into both the TCXO and VCO sections of the synthesiser in an attempt to get a flat response made up of the two modulation inputs.

Instructions

1. Connect the radio's antenna connector to the modulation measuring input.
2. Set audio filtering to <20 Hz HPF and >15 kHz LPF. Turn off de-emphasis and set IF filtering to >50 kHz.

3. Connect the audio signal output to the calibration test unit's Tx Audio input and set the audio input switch to Mod Audio.
4. Set the frequency of generated audio signal to 70 Hz and adjust the amplitude to give a deviation as close as possible to the Target Base Deviation indicated on the form.
5. Set the signal frequency to 7 kHz and adjust the VCO Modulation Adjustment slider to reset the deviation as close as possible to the Target Base Deviation indicated on the form. (Note: Ensure that the frequency generator is DC coupled if using an 8920 test set.)
6. Recheck the deviation at 70 Hz, and repeat Steps 4 and 5 until the deviation at both 70 Hz and 7 kHz is as close to the Target Base Deviation indicated on the form as possible.
7. Set the audio signal to 7 kHz.
8. In each box under Measured Deviations, record the signal deviation by first clicking in the box and then recording the value shown on the modulation measuring input.
9. Select OK to exit and accept the calibrated information, or Cancel to exit without saving the calibrated information.

Maximum Deviation

Maximum Deviation

1. Connect the radio's antenna connector to the modulation measuring input.

Previous Instruction Loop to Instruction B Next Instruction

Target Deviation 2.375 KHz

Test Deviation
 1.5 KHz
 3.0 KHz

Deviation Adjustment
 < ————— | ————— > 71

OK Cancel Print Help

Maximum deviation must be set to ensure that the maximum modulation deviation from the centre frequency does not exceed statutory limits.

The Modulation Balance test must be carried out before the Maximum Deviation test. For Maximum Deviation to be

accurate for all bandwidths, the test must be carried out at each of the stated Test Deviations.

Instructions

1. Connect the radio's antenna connector to the modulation measuring input.
2. Set audio filtering to <50 Hz HPF and >=15 kHz LPF. Turn off de-emphasis and set IF filtering to >50 kHz.
3. Connect the audio signal output to the calibration test unit's Tx Audio input and set the audio input switch to Mic Audio.
4. Set the audio generator to give a 1 kHz sinusoidal signal.
5. Observe the modulated waveform on an oscilloscope and adjust the amplitude of the audio signal to give a maximum response without clipping.
6. Increase the audio level by 20 dB.
7. Adjust the frequency of the audio generator from 300 Hz to 3 kHz to find the maximum deviation.
8. Adjust the Deviation Adjustment slider so that the deviation on the modulation measuring input equals the Target Deviation indicated on the form.
9. Repeat Step 8 for all Test Deviations listed on the form.
10. Select OK to exit and accept the calibrated information, or Cancel to exit without saving the calibrated information.

Power Control

Power Control

1. Connect the radio's antenna connector directly to the RF power measuring input.

Previous Instruction Loop to Instruction 4 Next Instruction

Test Frequency

- 135 MHz
- 145 MHz
- 155 MHz
- 164 MHz
- 174 MHz

Low Power Adjustment Low Power 1 Watt

Mid Power Adjustment Mid Power 2.5 Watts

High Power Adjustment High Power 5 Watts

OK Cancel Print Help

Power control must be calibrated for high, mid and low power at five points across the radios frequency band to ensure a flat power output across the operating band.

The PA Bias test must be carried out before this test.

The Power Control test requires a total of 15 adjustments, three at each test frequency, and must be carried out with 7.5 V at the radio terminals for handportable radios.

Instructions

1. Connect the radio's antenna connector directly to the RF power measuring input.
2. Set the calibration test unit's audio input switch to Off.
3. Make sure the input voltage while transmitting is 7.5 V at the radio terminals.
4. For the selected frequency, adjust the three power level sliders so the measured power is as close to the target power output indicated on the form (Low Power, Mid Power and High Power) as possible.
5. Select the next frequency in the Test Frequency list and repeat step 4.
6. Select OK to exit and accept the calibrated information, or Cancel to exit without saving the calibrated information.

Diagnostics

The Diagnostics form is used for sending test commands to a radio. Select the required test command from the Command Description dropdown list, then select the Send button to send the command to the radio. The string sent will be displayed in the Sent String box. The radio's reply will be displayed in the Response String box.

Some test commands require additional parameters. If so, what information is required will be displayed in a new box below the Command Number field. Enter the required information and select the Send Button.

Diagnostics Form Error Codes

Code	Description
C01	An invalid command code has been received. Try sending the command again.
C02	A (valid) command code has been received but with invalid parameters. Check the parameters and try sending the command again.

Code	Description
C03	A (valid) command code has been received but it cannot be processed at this time. Try sending the command again. If the error persists, turn the radio off, then on again and resend the command. If the error still persists, contact your Tait dealer.
C04	An error occurred during the initialisation of test mode. Turn the radio off, then on again and put the radio into test mode. If the error persists, contact your Tait dealer.
X01	EPROM checksum error. The software code in the flash has been corrupted. Re-download the radio software. If the error persists, the flash needs to be replaced. Contact your Tait dealer.
X02	Internal RAM failed. The RAM in the microprocessor is faulty and the microprocessor needs to be replaced. Contact your Tait dealer.
X03	External RAM failed. The RAM in the ASIC is faulty and the ASIC needs to be replaced. Contact your Tait dealer.
X04	The DSP is not responding. Check the DSP for pin connections. If the error persists, the DSP needs to be replaced. Contact your Tait dealer.
X05	The DSP version number is incorrect. The radio software and DSP software are incompatible. The DSP needs to be replaced with a later version. Contact your Tait dealer.
X06	The MCU internal configuration is incorrect. Contact your Tait dealer.
X09	The prototype timer has expired. This error will only occur on prototype software releases when the radio usage time has expired. New radio software must be downloaded into the radio and the new software must have a different software version number.
X31	Model configuration checksum error. This error indicates that the radio's model configuration checksum is incorrect. Contact your Tait dealer.
X32	Database checksum error. This error indicates that the radio's database checksum is incorrect. Contact your Tait dealer.
X33	ESN error. The radio's electronic serial number is incorrect. Contact your Tait dealer.
X35	Temperature is above the T1 threshold and turn down of transmit power is impending. To avoid damaging the transmit circuitry, stop transmitting and allow the radio to cool down before continuing.
X36	Temperature is above the T2 threshold and turn off of the transmitter is impending. To avoid damaging the transmit circuitry, stop transmitting and allow the radio to cool down before continuing.
X37	Voltage is less than the V1 threshold; the radio will give a low battery warning. Replace the battery or use a DC service adaptor.
X38	Voltage is less than the V2 threshold. The radio turns itself off after indicating this error and so will be unable to respond to the reset command character. Replace the battery or use a DC service adaptor.

Diagnostics Form Test Commands

Signalling

Description	Command Number	Parameter	Response String
Set modem to send zeros	10	no	OK
Set modem to send ones	11	no	OK
Set modem to send pre-amble	12	no	OK
Disable modem signalling	13	no	OK
Read modem receive string (continuous)	14	no	OK
Disable all signalling	15	no	OK
Enable subaudible signalling	16	no	OK
Read subaudible signalling decode status	17	no	0 = signal not detected, 1 = signal detected

Mute

Description	Command Number	Parameter	Response String
Force Rx audio muted	20	no	OK
Force Rx audio unmuted	21	no	OK
Mute DSP input	22	no	OK
Unmute DSP input	23	no	OK
Let squelch control Rx audio	24	no	OK
Read RX_BUSY status	25	no	0 = busy inactive, 1 = busy active

Rx/Tx

Description	Command Number	Parameter	Response String
Relax Rx mute control	26	no	OK
Inhibit PA (transmit mode)	30	no	OK

Description	Command Number	Parameter	Response String
Enable PA (transmit mode)	31	no	OK
Set radio to Rx	32	no	OK
Set radio to Tx	33	no	OK
Set transmit to low power	34	no	OK
Set transmit to mid power	135	no	OK
Set transmit to high power	35	no	OK
Set transmit to max power	36	no	OK
Set transmit to no power	137	no	OK
Activate economy mode	42	no	OK
Deactivate economy mode	43	no	OK
Read battery level	46	no	0 to 255
Read temperature level	47	no	0 to 255
Set keypad test on	50	no	OK
Set keypad test off	51	no	OK
Set display test on	52	0, 1, 2 or 3	OK
Set display test off	53	no	OK
Read averaged RSSI level	63	no	0 to 255
Read L1 threshold	64	no	0 to 255
Read L2 threshold	65	no	0 to 255

Miscellaneous

Description	Command Number	Parameter	Response String
Select normal micro clock	70	no	OK
Select birdie micro clock	71	no	OK
Read synth lock status	72	no	0 = not in lock, 1 = in lock
Disable internal speaker	74	no	OK

Description	Command Number	Parameter	Response String
Enable internal speaker	75	no	OK
Stop the MCU clock	79	no	OK
Select wide band	84	no	OK
Select medium band	85	no	OK
Select narrow band	86	no	OK
Select city squelch	88	no	OK
Select country squelch	89	no	OK

Radio information

Description	Command Number	Parameter	Response String
Read radio serial number	94/131	no	6 digit number (hex)
Read DSP software version number	132	no	4 digit number (hex)
Read radio software version number	96	no	4 digit number
Read radio type	130	no	radio type (P or M) frequency band (B, H, I or K), channel spacing(1 or 2)
Read radio hardware version number	133	no	4 digit number

Synthesiser

Description	Command Number	Parameter	Response String
Load absolute synth frequency	101	ttttt T rrrrr R F	OK
Load synth reference divider	102	8 to 16383	OK
Load synth prescaler	103	0 = 64/65 1 = 128/129	OK

Configuration

Description	Command Number	Parameter	Response String
Set volume pot	110	0 to 255	OK
Set transistor gate bias	111	0 to 255	OK
Set TCXO mod	112	0 to 255	OK
Set VCO mod	113	0 to 255	OK
Set Tx power level	114	0 to 255	OK
Set TCXO coarse frequency	115	0 to 255	OK
Set TCXO fine frequency	116	0 to 255	OK
Set Rx front end tuning	117	0 to 255	OK
Set squelch threshold	118	0 to 255	OK
Set CTCSS modulation	120	0 to 32767	OK
Set DCS modulation	121	0 to 32767	OK
Set FFSK modulation	122	0 to 32767	OK
Set Selcall modulation	123	0 to 32767	OK
Set DTMF modulation	124	0 to 32767	OK
Set voice modulation	125	0 to 32767	OK
Force DCS signalling (023 tone)	126	no	OK
Force CTCSS signalling (67.0 Hz)	127	no	OK
Force Selcall signalling (2000 Hz for 2 seconds)	128	no	OK
Force DTMF signalling (tone A)	129	1 = start encoding, 0 = stop encoding	OK
Read calibrated volume setting	136	no	0 to 255

Calculating Parameters for Test Command 101

Enter the parameters in the format ttttt T rrrrr R F, where:

■ ttttt represents the transmit frequency (see Example 1)

■ T and R represent channel spacing:

0 = 5 kHz

1 = 6.25 kHz

- rrrrrr represents the receive frequency (See Example 2)
- F indicates whether the test command changes the calibration values:

0 = do not change calibrated values

1 = recalculate the calibrated values based on new frequencies

Note that tttttt and rrrrrr may be up to 6 digits long.

Example 1: Calculating tttttt for an H band radio

$$\begin{aligned}
 \text{tttttt} &= \frac{\text{transmit frequency (MHz)}}{\text{channel spacing (MHz)}} \\
 &= \frac{461.025 \text{ MHz}}{6.25 \text{ kHz}} \\
 &= \frac{461.025 \times 10^6 \text{ Hz}}{6.25 \times 10^3 \text{ Hz}} \\
 &= 73764
 \end{aligned}$$

Example 2: Calculating rrrrrr for an H band radio

$$\begin{aligned}
 \text{rrrrrr} &= \frac{\text{receive frequency (MHz)} - \text{IF (MHz)}}{\text{channel spacing (MHz)}} \\
 &= \frac{461.025 \text{ MHz} - 45.1 \text{ MHz}}{6.25 \text{ kHz}} \\
 &= \frac{415.925 \times 10^6 \text{ Hz}}{6.25 \times 10^3 \text{ Hz}} \\
 &= 66548
 \end{aligned}$$

Note: IF depends on the radio's switching band.

For A, B, C and D bands radios, the IF is 21.4 MHz.

- For A band, add the IF (MHz) in the formula (radio uses high side injection.)
- For E, F, G, H, I, J and K band radios, the IF is 45.1 MHz.