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About the calibration system

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

The calibration system:

- reads information from the radio, such as the radio's calibration database;

- guides the operator through a series of calibration tests;

- calculates calibration database items from information obtained in the calibration tests; and

- programs the radio's calibration database.

These tasks will typically be performed in sequential order, although there may be times when some tests will not be performed.

System requirements

The Tait Orca calibration system requires:

- an IBM compatible PC with an 80386 microprocessor (or better);

- MS-DOS version 5.0 or higher;

- 2 MB of RAM;

- a VGA colour graphics display;

- a hard disk drive with 2 MB free space;

- a single 3.5 inch floppy disk drive (1.44 MB capacity);

- a printer (if you intend to keep a hard copy of calibration data); and

- a Microsoft or compatible mouse and driver (if you wish to use the program with a mouse).

Equipment supplied

The calibration system is supplied as part of the Tait Orca Service Kit (OPA-SV-001); see the *Tait Orca Handportable Service Manual* (IPN 449-51000-xx) for a list of equipment supplied.

NOTE: The calibration system includes online help that is updated at each software release. If information in this manual conflicts with that in online help, the information in the online help can be considered the most up-to-date.

Equipment required

Other items required for calibration but not included as part of the service kit are:

- 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 for handportable radios; and

- DC power supply, 13.8 V, 7 A for mobile radios.

Warning!

Instructions in this manual and the calibration system assume you are calibrating a radio using a test set. If you are calibrating using discrete test equipment, adequate protection must be provided on all inputs and outputs.

What radios does the calibration system apply to?

This manual describes the calibration of Tait Orca series handportable and mobile radios. The calibration system cannot be used to calibrate Tait T2000 or T3000 series radios.

Conventions

Throughout this manual, the following conventions are used:

- screen names, field names, screen buttons and computer keys are shown in **bold sans serif**;

- commands you must type are shown in bold;

- information you must provide is shown <in brackets>;

- specific entries and available settings for screen fields are shown 'in single quotes'; and

- names of computer directories and files are shown in ALLCAPS.

These conventions are illustrated on page 5.

Adjust **Mute Open Adjustment** until a single increment causes <u>**Mute Status**</u> to change from '<u>Closed</u>' to '<u>Open</u>'.

Mute Open Adjustment and **Mute Status** are the names of fields.

'Closed' and 'Open' are the values **Mute Status** can be set to.

Insert the supplied disk in the floppy drive and at the DOS prompt, type a:install (if the disk is in drive A) or <u>b:install</u> (if the disk is in drive B). Press **Enter**.

The b:install is the command to type in.

Press the **Enter** key to initiate the command.

To start the calibration system, type <u>c:\<pathname>\orcacale</u>, then press **Enter**.

Press the **Enter** key to initiate the command.

Type in the command c:\<pathname>\orcacale, substituting the directory in which the calibration system was installed for <pathname>.

ORCA.ICO is the name of a file.

■ Select the file <u>ORCA.ICO</u>, then select **Open**.

Open is the name of a screen button.

Installing the calibration system

The Tait Orca calibration system cannot be run directly from the distribution disk. It must be installed on your hard disk, which requires up to 2 MB of free disk space.

If you are installing from DOS, insert the supplied disk in the floppy drive and at the DOS prompt, type a:install or b:install, then select **Enter**.

If you are installing from Windows 3.x, in **Program Manager**, select **Run** from the **File** menu. Type a:install or b:install, then select **Enter**.

If you are installing from Windows 95, select **Start** from the taskbar. Select **Run** and type a:install or b:install, then select **Enter**.

The installation program will guide you through the installation process. Read the information presented on the screen carefully. After installing the software, place the original distribution disk in a safe place.

Drive and path options

You will be asked to enter the drive and path to which you want the software installed. If you do not change the default directory, then the files will be copied to the \TAITORCA\CALIB directory on the target drive. It is recommended you use the default directory setting, especially if you have already installed or intend to install other Tait programming and support software packages.

You may wish to include the \TAITORCA\CALIB directory in the DOS search path so that you can start the calibration system from any directory. Consult your DOS manual for information on how to add the directory to the search path.

Installing a mouse

To use this program with a mouse, your mouse driver software must first be loaded. Usually a command such as c:\<pathname>\mouse.exe can be added to your AUTOEXEC.BAT file to load the mouse driver automatically when your computer starts up. See the instruction manual for your mouse software for more details.

If a mouse is connected to a serial port on your computer, you must have a second serial port available to connect to the radio you wish to read or program.

Setting up a program item (Windows 3.x)

If you are running the calibration system from Windows 3.x, you can set up a program item for the calibration system. You can then double-click on the program item to start the calibration system.

To set up a program item:

■ Open the group in which you wish to set up the program item.

■ From the **File** menu, select **New**.

■ Choose **Program Item**, then select **OK**.

- A **Program Item Properties** window will appear. Select **Browse**, then move to the directory the calibration system was installed in.

- Select ORCACALE, then select **OK**.

- You will then be returned to the **Program Item Properties** window. In the **Description** field, type a name for the program item, then select **Change Icon...**

- A message will appear saying there are no icons available for the specified file. Select **OK** to choose an icon.

- The **Change Icon** window will appear displaying a selection of icons. Select **Browse**, then move to the directory the calibration system was installed in.

- Select ORCA.ICO, then **OK**.

- You will be returned to the **Change Icon** window. Select **OK**.

- You will be returned to the **Program Item Properties** window. Select **OK** to close the **Program Item Properties** window; the program item will appear.

Setting up a shortcut (Windows 95)

If you are running the calibration system from Windows 95, you can set up shortcut to the calibration system. You can then double-click on the shortcut to start the calibration system.

To set up a shortcut:

- Right-click on the desktop, and choose **New**, then **Shortcut** from the pop-up menu.

- A **Create Shortcut** dialog box will appear. Select **Browse**, then move to the directory the calibration system was installed in.

- Select ORCACALE, then **Open**.

- You will then be returned to the **Create Shortcut** window. Select **Next>**.

- Type in a name for the shortcut, then select **Next>**.

- You will then be prompted to choose an icon. When you have done so, select **Finish** and the shortcut will appear on the desktop.

You can change the icon for the shortcut to the Tait Orca icon. To change the icon:

- Right-click on the shortcut and select **Properties** from the pop-up menu that appears.

- A **Properties** window will appear. Select the **Program** tab at the top of the window, then select **Change Icon**.

- The **Change Icon** window will appear. Select **Browse**, then move to the directory the calibration system was installed in.

- Select the file ORCA.ICO, then select **Open**.

- You will then be returned to the **Change Icon** window, in which the selected icon will be displayed. Select **OK**.

- You will then be returned to the **Properties** window. Select **OK** to close the **Properties** window and apply the changes.

Setting up the test equipment

The calibration test unit provides an interface between the test equipment and the radio being calibrated. The calibration test unit is compatible with Tait T3000 series radios; however, the calibration system itself can only be used with Tait Orca series radios. The calibration test unit and setup are shown in Figure 1.

Connect the supplied calibration cable to the calibration test unit at the **Radio** connection and to the radio at the accessory connector.

For handportable radios, you may need to remove the rear accessory cover. Remove the battery, then insert the end of a key underneath the bottom edge of the accessory cover and lift to remove the cover. When attaching the accessory connector, ensure that the lever is in the upright position. Once the connector is in position, rotate the lever 90 degrees counterclockwise to lock it in place.

The RS232 to modular phone jack cable supplied connects to the calibration test unit via the **Computer** connection and to the PC via one of the COM ports. If a

Figure 1: The calibration test unit and setup
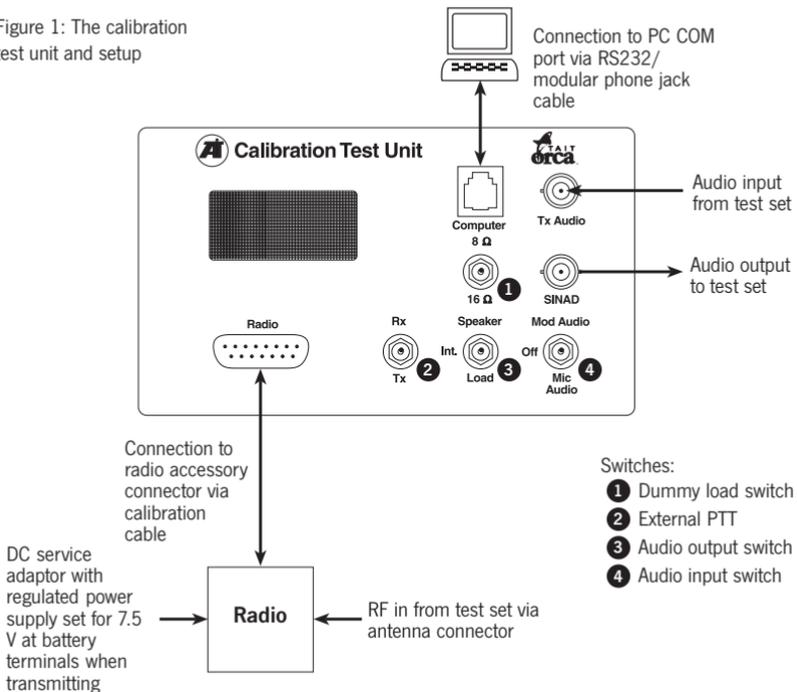
mouse is connected to COM1 or COM2, the calibration system will detect it and automatically assign the test unit to whichever of COM1 or COM2 is not being used by the mouse. However, the calibration system will not detect other serial devices, such as a modem, and if you wish to connect the test unit to COM3 or COM4, you will need to change the COM port setting in the **Defaults** window (**Utility** menu). Be sure you use the correct COM port setting; otherwise you may have problems communicating with the radio.

There are four switches on the calibration test unit.

■ The external PTT (**Rx/Tx**) 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 internal speaker position only applies to Tait Orca handportable radios.

■ 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 (**8Ω/16Ω**) switches between dummy loads of 8Ω and 16Ω. **8Ω** applies to Tait Orca mobiles radios and T3000 series radios; **16Ω** applies to Tait Orca handportable radios.

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.

If the **PA Bias Calibration** test is to be done (handportable radios only), 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.

Power supply during calibration

Once connected, the radio must be turned on before it can be calibrated. To ensure the radio does not turn itself off during calibration, use the supplied DC service adaptor.

For handportable radios, 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.

For mobile radios, set the regulated power supply to 13.8 V at the DC service lead test terminals when transmitting. Confirm that 13.8 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 at the DC service lead test terminals. Be sure to switch the external PTT to **Rx** before beginning calibration tests.

Using the calibration system

The calibration system can be run from DOS or from Windows.

To start the calibration system from DOS, change to the directory the programming system was installed in and type orcacale, then select **Enter**. Changing directories is not necessary if you have included the target directory in the search path.

To start the calibration system from Windows 3.x, in **Program Manager**, select **Run** from the **File** menu. Type c:\<pathname>\orcacale then select **Enter**. If you have set up a program item, you can start the calibration system by double-clicking on the program item.

In Windows 95, select **Start** from the taskbar. Select **Run** and type c:\<pathname>\orcacale then select **Enter**. If you have set up a shortcut, you can start the calibration system by double-clicking on the shortcut.
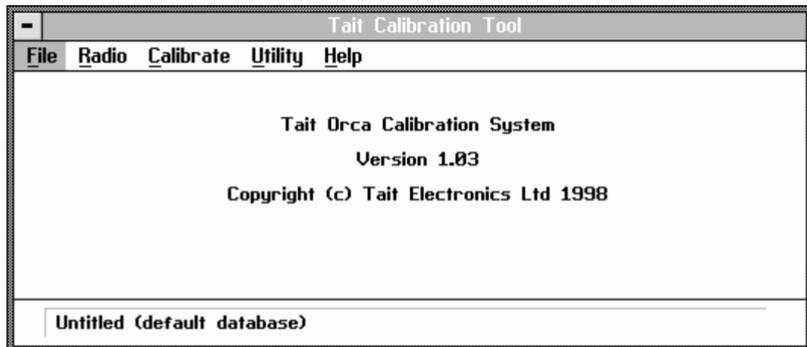
The main window

The main window for the calibration system is shown in Figure 2. This is the window that appears when you first start the calibration system. Whenever you finish working in another window, you will return to the main window.

The menu bar shows the titles of five menus:

- use the **File** menu to create, save and load calibration databases, and exit the calibration system;

- use the **Radio** menu to read a calibration database from a radio and program a radio;

- use the **Calibrate** menu to carry out calibrations tests;

- use the **Utility** menu to set defaults, print data and send test commands to a radio; and

- use the **Help** menu to access the **Navigation Guide** and information about the calibration system.

Figure 2: Calibration system main window

Tait Calibration Tool

File   Radio   Calibrate   Utility   Help

Tait Orca Calibration System

Version 1.03

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Untitled (default database)

The keywords on the main menu bar are selected either by clicking on them with the mouse or by holding down the **Alt** key and selecting the underlined letter.

The bar at the bottom of the window tells you the name of the calibration database currently loaded. If you have just started the calibration system or created a new file, this will read 'Default Database'.

You can exit the program and return to the DOS prompt or Windows by selecting **Exit** from the **File** menu.

Online help

Online help is available throughout the calibration system. Pressing the **F1** key displays online help specific to the screen you are currently working in. Some windows have a **Help** button, which displays help for that window.

The **Navigation Guide** option in the **Help** menu provides general information on using the calibration system.

Navigating

The calibration system can be used with or without a mouse. The keystrokes and key descriptions shown in Table 1 are common to all calibration system windows and menus.

Scroll bars

A scroll bar appears as:

The value to the right of the scroll bar reflects the current setting.

Using the keyboard, move onto the scroll bar using the **Tab** key; once selected, the slider button will be highlighted. Change

the value in steps of one with the left and right arrow keys, in steps of five with the up and down arrow keys, and in steps of ten with the **PageUp** and **PageDown** keys. Change the value to its lowest possible value with the **Home** key and to its highest possible value with the **End** key.

Using the mouse, change this value in steps of one by clicking on the arrow keys, in steps of 10 by clicking on either side of the slider button, and in large steps by clicking on and dragging the button.

List boxes

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

Longer lists will also have a scroll bar down the side.

Using the keyboard, select the desired value by using the **Tab** key to select the field, then select **Enter** to open the drop-down menu. Use the arrow keys to scroll to the desired value, then select **Enter**.

Using the mouse, click on the arrow to the right of the field to open the drop-down menu, then click on the desired value.

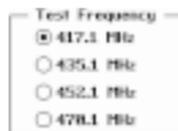### Radio buttons

Radio buttons appear as:

Table 1: Calibration system keystrokes and key descriptions

Keystroke	Function
F1	Online help for the current window.
F3	Exit window and return to the main menu.
F5	Refresh screen.
Alt	Select the window menu bar. The Alt key can be used together with a hot key to select a specific item. For example, pressing Alt-F-X in the main window exits the program, and pressing Alt-H in one of the test windows brings up the help screen.
Enter	End edit and validate new value.
Tab	Move to next window object.
Shift-Tab	Move to previous window object.
Up arrow	Increase the currently selected value by 5.
Down arrow	Decrease the currently selected value by 5.

Keystroke	Function
Right arrow	Increase the currently selected value by 1.
Left arrow	Decrease the currently selected value by 1.
PageUp	Increase the currently selected value by 10.
PageDown	Decrease the currently selected value by 10.
Home	Changes the currently selected value to its lowest possible value.
End	Changes the currently selected value to its highest possible value.

Key	Description
OK	Exit the window and save the data.
Cancel	Exit the window without saving the data.
Help	Accesses context-sensitive help.

Radio buttons are used where only one value in a set of values is possible; the filled-in button is the current value and selecting any of the other buttons makes that the current value.

Using the keyboard, select the desired value by moving on to the field using the **Tab** key. Then use the arrow keys or the **Home** and **End** keys to select the desired value.

Using the mouse, select the desired value by clicking on it.

Screen buttons

A screen button appears as a box and contains a command, such as **OK**.

Using the keyboard, use the **Tab** key to select the button, then select **Enter** to carry out the command. You can also

select the button by pressing the **Alt** key and the underlined letter on the button; for example, pressing **Alt-o** will select the **OK** button.

Using the mouse, click on the button to carry out the command.

Edit boxes

Edit boxes appear as a box, sometimes with default text entered.

Select the box using the **Tab** key or by clicking on it with the mouse. A text cursor will appear in the box. Type in the data and select **Enter** to set the new value.

Utilities

The **Utility** menu contains three options: **Defaults**, **Print** and **Test Commands**.

Setting defaults

Select **Defaults** from the **Utility** menu and the **Defaults** window (Figure 3) will appear. In this window, set the COM port that will be used to connect the calibration test unit to the PC, the default file extension and the default directory.

If you have a mouse on COM1, the calibration system will automatically detect it and will assign the calibration test unit to COM2. If you wish to attach the test unit to another port, choose the desired port in this screen.

The file location and extension can help you organise your calibration data. **Data file path** determines the default directory on your hard drive that will be used for storing radio data files. The default is 'c:\taitorca\calib\ocsfiles'. **Data file extension** determines the filename extension for all data files. The default is 'ocs'.

COM port settings and problems communicating with a radio

If you are having problems reading from or programming the radio, there could be a problem with the connection between the radio and the computer. Check that:

- the correct serial port is specified in the **Defaults** window (**Utility** menu);

- the calibration test unit is properly connected to the correct serial port connector;

- the radio is properly connected to the calibration test unit;

- the radio type matches the software being used; and

- the radio is turned on.

If you still have problems reading from or programming the radio and are running the calibration system from Windows, check that only one copy of the calibration system is running and that no other applications that use serial ports are running. Such applications may prevent access to the port even if they are not actively using it.

Figure 3: Defaults window
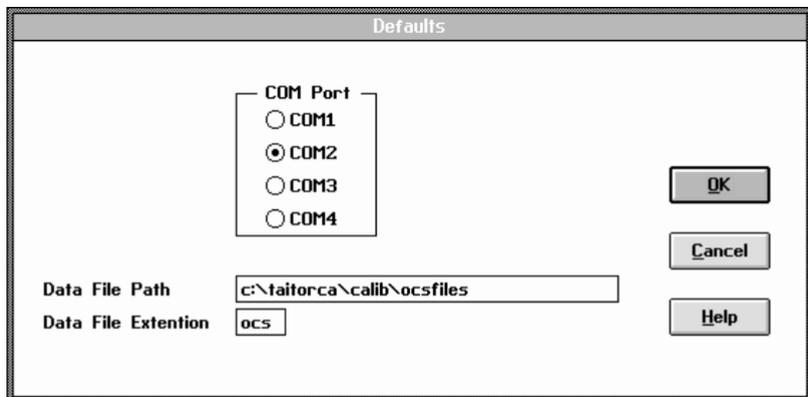
Make sure no other serial hardware device, such as a modem, is trying to use the same COM port as the calibration system. In addition, another COM port cannot be using the same interrupt at the same time as the calibration system. For example, a mouse and the calibration system cannot be on COM ports that share the same interrupt; however, a modem and the calibration system can be on ports that share an interrupt if the modem is not used while the calibration system is being used. Typically COM1 and COM3 use the same interrupts, as do COM2 and COM4. If you need to modify these settings, refer to your DOS manual or online help.

If you still have problems, refer to your DOS manual for information on configuring hardware and troubleshooting serial communications.

Printing data

Select **Print** from the **Utility** menu and the **Print** window appears (Figure 4). The preview box shows the information that will be printed; use the scroll bars to see all the information. Choose the printer port the data will be sent to from the drop-down list in the upper righthand corner, and print by selecting the **Print** button.

Sending test commands to a radio

Select **Test Commands** from the **Utility** menu and the **Test Commands** window (Figure 5) will appear. Use this screen to send test commands to an attached radio.

Scroll through the list of commands. Click on the command and select **Send** to send the test command to the radio. Returned information will be displayed, together with any error messages.

A full list of test commands is shown in Appendix A.

Reading, loading and creating calibration databases

When calibrating a radio, you must first read the radio for:

- radio variant information, such as trunked/conventional and handportable/mobile, frequency band and IF bandwidth;

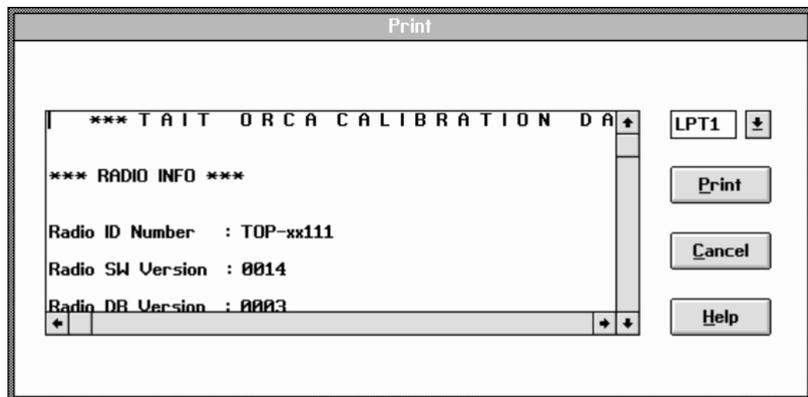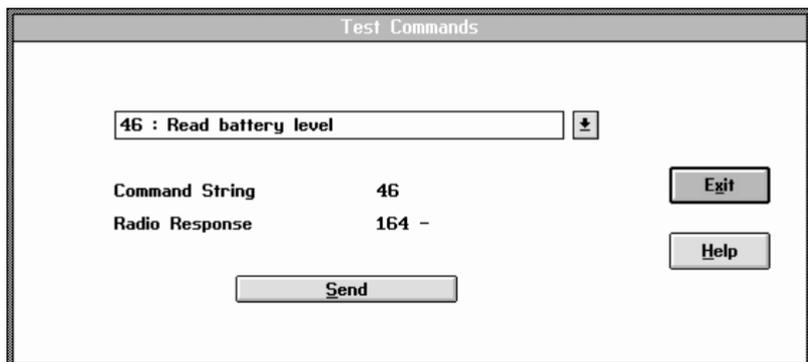- radio software version;

Figure 4: Print window

Figure 5: Test Commands window

radio database version; and

calibration database version.

Select **Read** from the **Radio** menu and the **Radio Read** window (Figure 6) will appear.

The field **Current Status** should say 'Radio successfully read'. If you select **OK** when exiting the window, the calibration database read from the radio will be used in the calibration tests.

Radio ID Number indicates the radio's model number. If no radio is detected, then this field will remain blank.

Frequency Band shows the frequency band the radio operates at.

Band Type shows the radio's receiver bandwidth. Wideband radios are designed to operate on 20 and 25 kHz channels, and narrowband radios are designed to operate on 12.5, 20 and 25 kHz channels.

Figure 6: Radio Read window
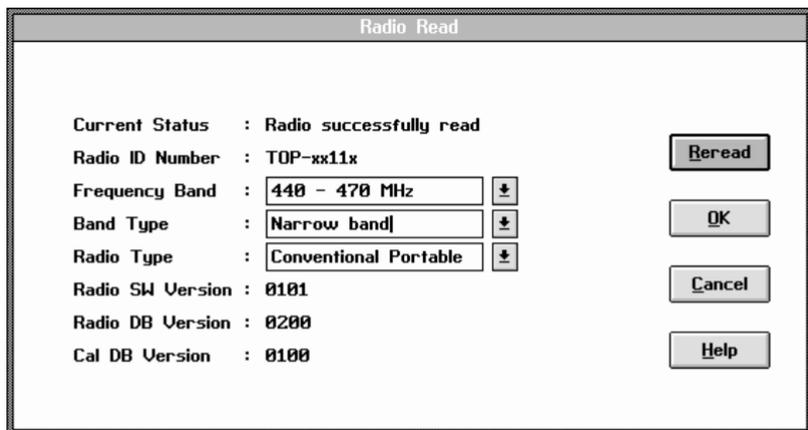
Radio Type shows whether the radio is a conventional or trunked handportable radio or a conventional or trunked mobile radio.

Radio SW Version shows the radio software version, **Radio DB Version** shows the radio database version, and **Cal DB version** shows the radio's calibration database version.

For the fields **Frequency Band**, **Band Type** and **Radio Type**, you can change the information displayed if you are going to use calibration information from one type of radio to calibrate another type. This information can be read from the radio's serial number on the back of the radio, e.g. TOP-B1211 (see Figure 7).

Problems reading a radio

If you have a read a radio and the **Current Status** field shows a message other than 'Radio successfully read', you may not be able to use that radio's calibration database for calibrating the radio. The options available depend on the message displayed.

If **Current Status** says 'Radio not detected', make sure the radio is properly connected to the calibration test unit and that it is turned on, then select **ReRead**. If the calibration system still will not read the radio, check in the **Defaults** window (**Utility** menu) that the correct COM port is specified. The calibration system will not detect Tait T3000 series radios.

If **Current Status** says:

■ 'Error - incompatible calibration database' or

■ 'Error - incompatible radio database'

check that you have the latest version of the calibration system. You will still be able to carry out the calibration tests, but

Figure 7: The Tait Orca naming convention
Note that the naming convention is not intended to imply that any particular combination of radio features is at present available or planned for later release.

Tait Orca

P handportable
M mobile

Frequency
B 136-174 MHz
C 174-225 MHz
D 220-270 MHz
E 270-310 MHz
F 290-340 MHz
G 336-400 MHz
H*400-470 MHz
I   450-530 MHz

Channel spacing
1 20/25 kHz
2 12.5/20/25 kHz

1 Elan
2 Excel
3 Eclipse

1 conventional
2 trunked

Custom product
0 Default
1 Special

*H band may be split into TOP-HxxxL (Rx 400-450 MHz, Tx 400-440 MHz) and TOP-HxxxH (440-470 MHz)
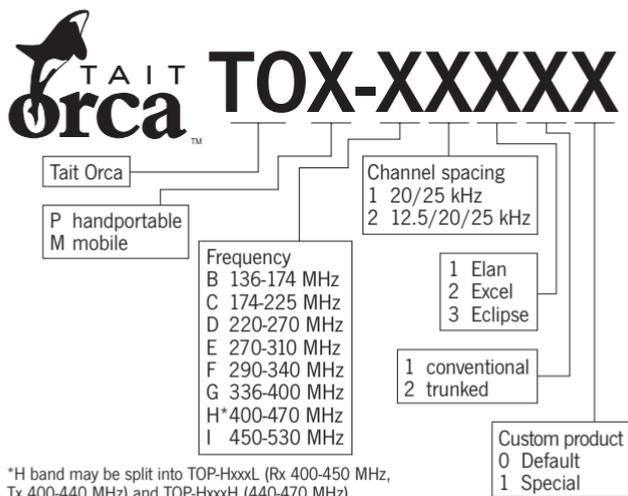
you will not be able to program the radio. In addition, the calibration will be carried out using the default database.

If **Current Status** says:

- 'Error - failed to read item 00' or
- 'Error - failed to read freq\band item' or
- 'Error -failed to read database item'

check that the radio is properly connected and then attempt to read it again. If the same error is reported, read the radio using the programming system for Tait Orca conventional or trunked radios and check that the information in the **Radio Model** fields (**Specifications** screen) is correct. If this information is incorrect, reprogram the radio with the correct information. If the calibration system still will not read the radio, contact your Tait dealer.

If **Current Status** says 'Error - bad data in freq\band item', use the programming system for Tait Orca conventional or trunked radios and check that the

frequency band information in the **Radio Model** fields (**Specifications** screen) is correct.

If **Current Status** says 'Calibration database checksum corrupt', the database read from the radio cannot be used for calibrating the radio. You can use the default database or a previously saved database. You should perform a full calibration to avoid damaging the radio.

Using the default database

The default database is automatically loaded when you start the calibration system, and if you have not been able to successfully read a radio, this is the database that will be used. You can also open a copy of the default database by selecting **New** from the **File** menu.

Using a previously saved database

The **Load** option in the **File** menu retrieves a calibration database from a disk. When you select **Load**, the **Load Database** window appears (Figure 8).

The **Drives** list shows all the drives associated with your computer.

Figure 8: Load Database window
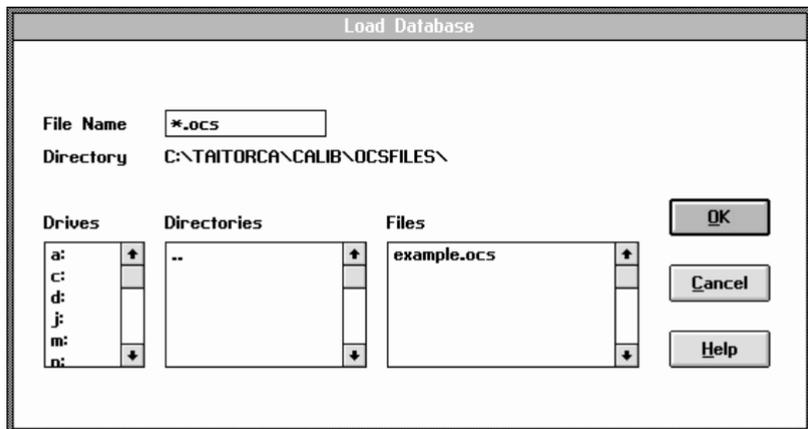
The **Directories** list shows all the directories immediately available on the selected drive. When you select a directory, the next level of directories appears. The previous level of directories is indicated by the '..' symbol.

The **Files** list shows all files in the current directory with the properties shown in the **File Name** box. The default is '*.ocs'. You can search for files using the DOS wildcards '*' and '?'.

Select the database you wish to load by clicking on the file name displayed in the **Files** list, or use **Tab** to select the file name and then press **Enter**. Select **OK** to load the file.

Select **OK** to load the database indicated in the **File Name** field.

Saving a calibration database on disk

The **Save As** option in the **File** menu saves the current calibration database on disk. When you select **Save As**, the **Save Database** window (Figure 9) appears and prompts you to specify a path and name for the file. Enter the name of the file in the **File Name** box, then select the drive and directory where you wish to save the file.

The **Files** list shows all files in the current directory with the properties shown in the **File Name** box. The default is '*.ocs'.

The **Directories** list shows all the directories immediately available on the selected drive. When you select a directory, the next level of directories appears. The previous level of directories is indicated by the '..' symbol.

The **Drives** list shows all the drives associated with your computer.

Select **OK** to save the database.

The **Save** option in the **File** menu saves the current calibration database on disk and is only available when a file has been loaded or has already been saved using the **Save As** command.

Figure 9: Save Database window
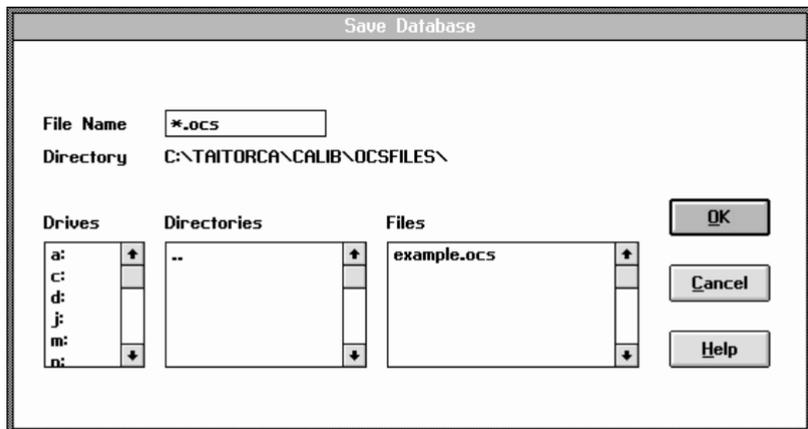
Calibration tests

The **Calibrate** menu contains options that put the radio through a series of calibration tests. It is divided into three sections (see Figure 10).

The first section contains one option, **Calibrate All**, which takes you through each of the calibration tests in sequence. If you do not need to do a full calibration, each of the tests can be selected individually from the second section of the **Calibrate** menu.

The tests are:

- PA Bias Calibration

- TCXO Calibration

- Front End Tuning

- Squelch Thresholds

- Power Control

- Modulation Balance

- Maximum Deviation

- Maximum Volume Threshold

- RSSI Thresholds

- Battery Thresholds.

The last section of the **Calibrate** menu contains one option, **Advanced Settings**, which is not a calibration test but allows you to change CTCSS and DCS signalling deviations. Changes to these settings should only be made under special circumstances.

Each calibration test window includes step-by-step instructions on how to carry out the test. The calibration test unit's external PTT should be set to **Rx** for all tests.

Figure 10: The Calibrate menu
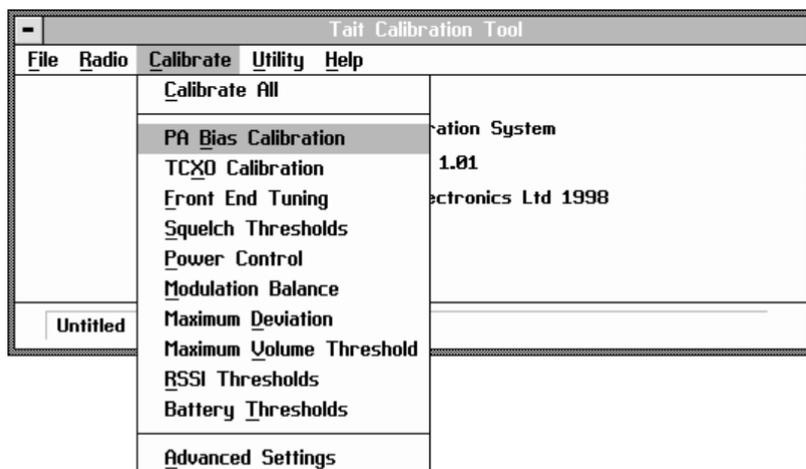
Some tests are frequency dependent and so must be carried out across the range of test frequencies.

Once a test is finished, select **OK** to exit the window and save the data, or **Cancel** to exit the window without saving the data.

PA Bias Calibration

This test only applies to handportable radios.

The final transistor in the Tait Orca handportable radio must be biased at a constant current. Each transistor is different and so requires a different voltage to obtain the same current.

This test should be carried out with no RF power transmitted (calibration test unit set to **Rx**), and requires a digital current meter capable of measuring current up to 3 A accurate to two decimal places.

The current meter should be connected in series with the power supply to the radio before the radio is turned on. If it has not been connected, you must turn off the radio and connect the current meter as described on page 8. Then turn the radio back on.

Select **PA Bias Calibration** from the **Calibrate** menu and the window shown in Figure 11 will appear.

Set **PA Bias Adjustment** to 0, then note the DC current consumed by the radio. Slowly increase **PA Bias Adjustment** until the current consumed by the radio increases by the amount shown in **Target Current Increase**.

Select **OK** to exit the **PA Bias Calibration** window.

Figure 11: PA Bias Calibration window
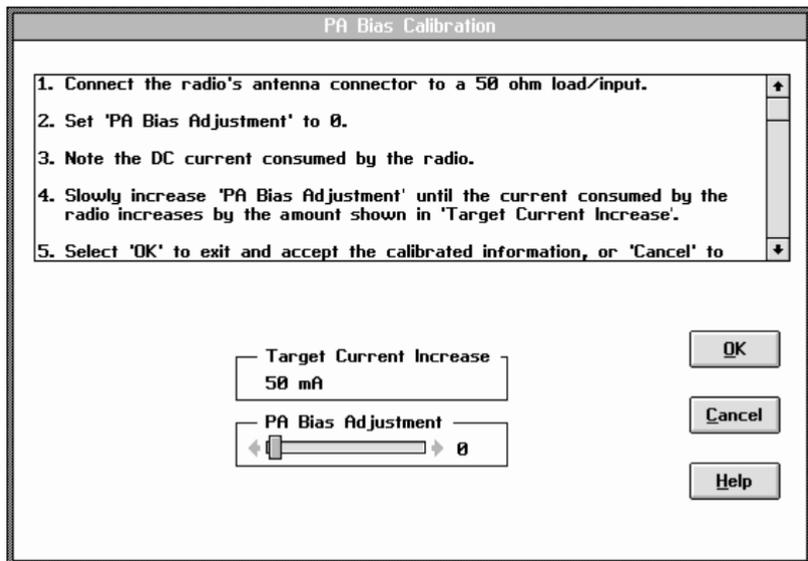
TCXO Calibration

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.

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

Select **TCXO Calibration** from the **Calibrate** menu and the window shown in Figure 12 will appear.

Connect the radio's antenna connector to the frequency measuring input, and set the calibration test unit's audio input switch to

Off. If **Fine TCXO Adjustment** is outside the range 115 to 140, set it to 127.

Adjust **Coarse TCXO Adjustment** so that the frequency displayed is as close as possible to **Target Frequency**. Then adjust **Fine TCXO Adjustment** so that the frequency displayed is as close as possible to **Target Frequency**.

Select **OK** to exit the **TCXO Calibration** window and save the coarse and fine values.

Front End Tuning

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 before the front end can be tuned.

Select **Front End Tuning** from the **Calibrate** menu and the window shown in Figure 13 will appear.
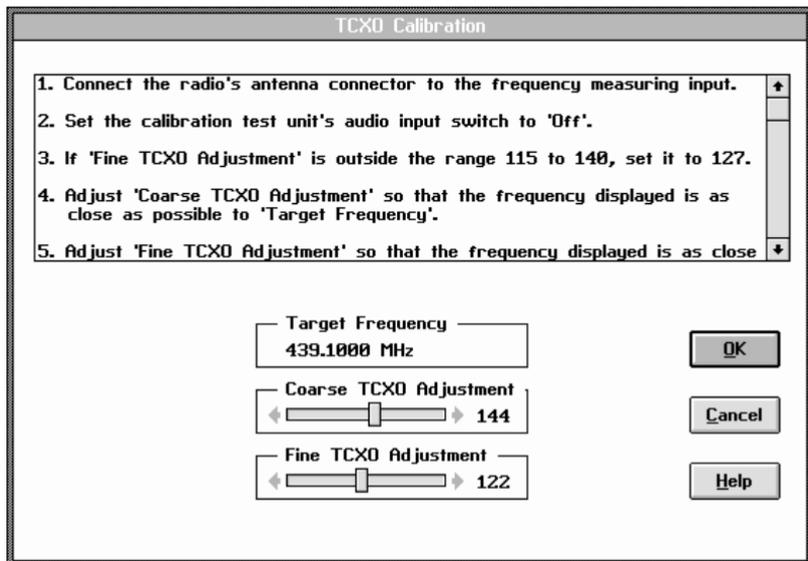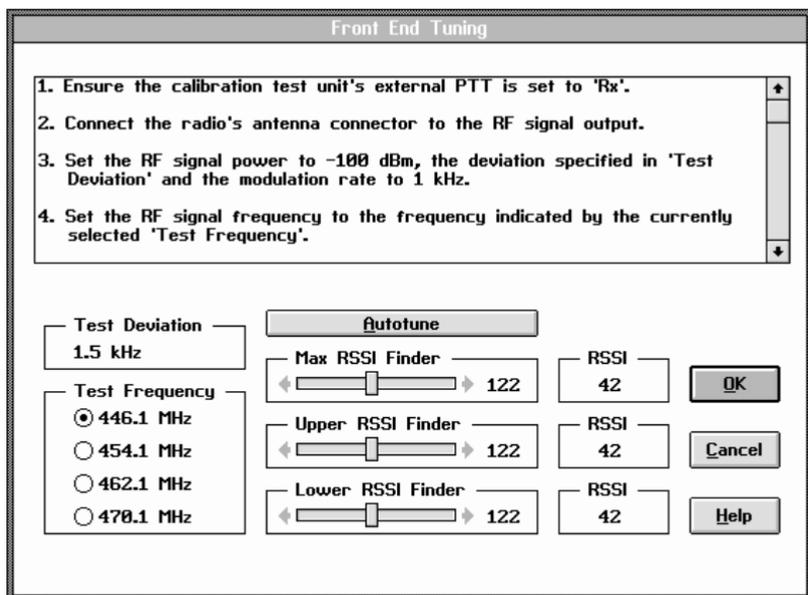
Figure 12: TCXO Calibration window

Figure 13: Front End Tuning window

Connect the radio's antenna connector to the RF signal output, and set the RF signal to -100 dBm, the deviation specified in **Test Deviation** and the modulation rate to 1 kHz.

For each **Test Frequency**, set the RF frequency to the currently selected **Test Frequency**. Select **AutoTune** to automatically adjust **Max RSSI Finder**, **Upper RSSI Finder** and **Lower RSSI Finder**.

If **AutoTune** fails, the signal strength may be too weak or the radio may be faulty. Check the test setup and make sure all connections are secure. If **AutoTune** fails again, contact your Tait dealer.

Select **OK** to exit the window and save the values of **Upper RSSI** and **Lower RSSI** for each of the test frequencies.

Squelch Thresholds

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.

Select **Squelch Thresholds** from the **Calibrate** menu and the window shown in Figure 14 will appear.

Connect the SINAD metering input to the calibration test unit's **SINAD** output. Set the calibration test unit's dummy load

Figure 14: Squelch Thresholds window
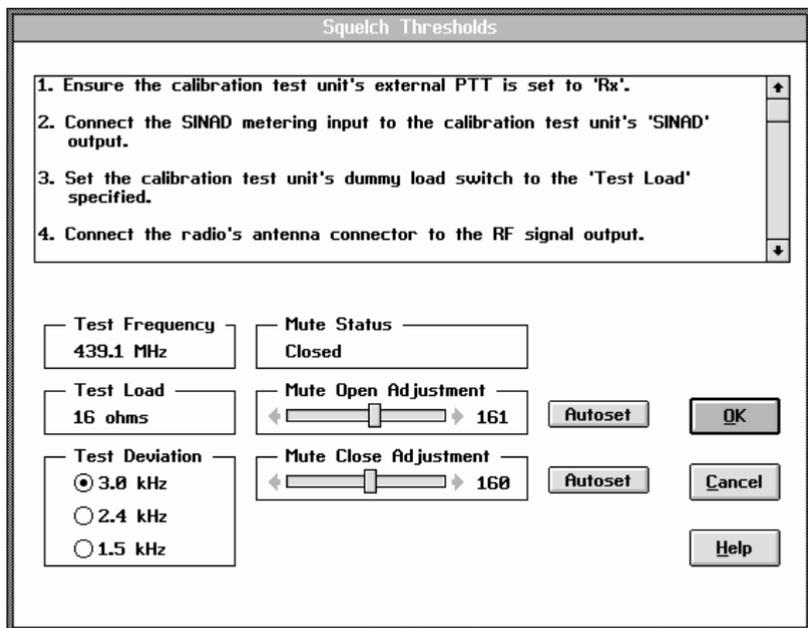
switch to the **Test Load** specified. Connect the radio's antenna connector to the RF signal output, and set the RF signal to the frequency specified by **Test Frequency**.

For each **Test Deviation**, set the RF signal to the deviation specified by **Test Deviation** with a modulation rate of 1 kHz.

For the opening level, adjust the signal power so that the SINAD reads 12 dB. Adjust **Mute Open Adjustment** 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** until **Mute Status** reads 'Closed' and repeat this step. This step can be carried out automatically by selecting the **Autoset** button; however, you must still adjust the signal power for the appropriate SINAD.

For the closing level, decrease the RF signal power by 2.5 dBm. Adjust **Mute Close Adjustment** until a single increment causes **Mute Status** to change from 'Open' to 'Closed'. If this changes over an increment greater than one, adjust **Mute Close Adjustment** until **Mute Status** reads 'Open' and repeat this step. This step can be carried out automatically by selecting the **Autoset** button; however, you must still adjust the signal power for the appropriate SINAD.

Once the test has been carried out at all **Test Deviations**, select **OK** to exit the window and save the squelch opening and closing values.

Power Control

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

The **PA Bias Calibration** test must be carried out before the **Power Control** test.

This 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 and 13.8 V at the DC service lead test terminals for mobile radios.

Select **Power Control** from the **Calibrate** menu and the window shown in Figure 15 will appear.

Connect the radio's antenna connector directly to the RF power measuring input. If using a cable other than that provided in the service kit, make sure it is as short as possible and of high quality.

Set the calibration test unit's audio input switch to **Off** and make sure the input voltage at the radio terminals while transmitting is 7.5 V at the radio terminals for handportable radios and 13.8 V at the DC service lead test terminals for mobile radios.

At each **Frequency**, adjust the three power levels so the measured power is as close to the target power output (**Low Power**, **Mid Power** and **High Power**) as possible.

Select **OK** to exit and save the power adjustments, which are used to calculate the correction factor for all frequencies in the radio's operating band.

Figure 15: Power Control window
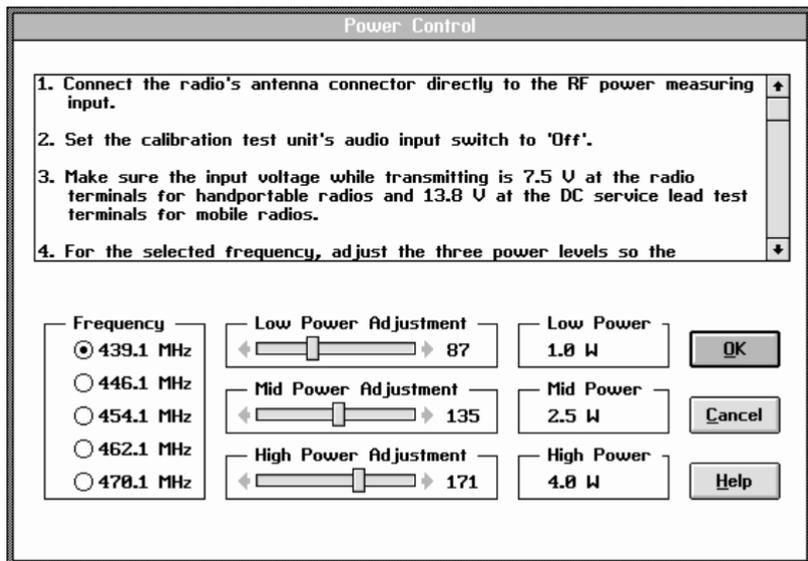
Modulation Balance

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.

Select **Modulation Balance** from the **Calibrate** menu and the window shown in Figure 16 will appear.

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

Connect the audio signal output to the calibration test unit's **Tx Audio** input and set the audio input switch to **Mod Audio**.

Set the frequency of the generated audio signal to 70 Hz and adjust the amplitude

to give a deviation as close as possible to the **Target Base Deviation**.

Set the signal frequency to 7 kHz and adjust **VCO Modulation Adjust** to reset the deviation as close as possible to the **Target Base Deviation**.

Check the deviation at 70 Hz is still the **Target Base Deviation**; if not so, readjust the audio signal output, then set the frequency of the audio signal to 7 kHz and adjust **VCO Modulation Adjust** until it is.

Set the audio signal to 7 kHz. 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.

Select **OK** to exit the window and save the values of **Measured Deviations**.

Figure 16: Modulation Balance window
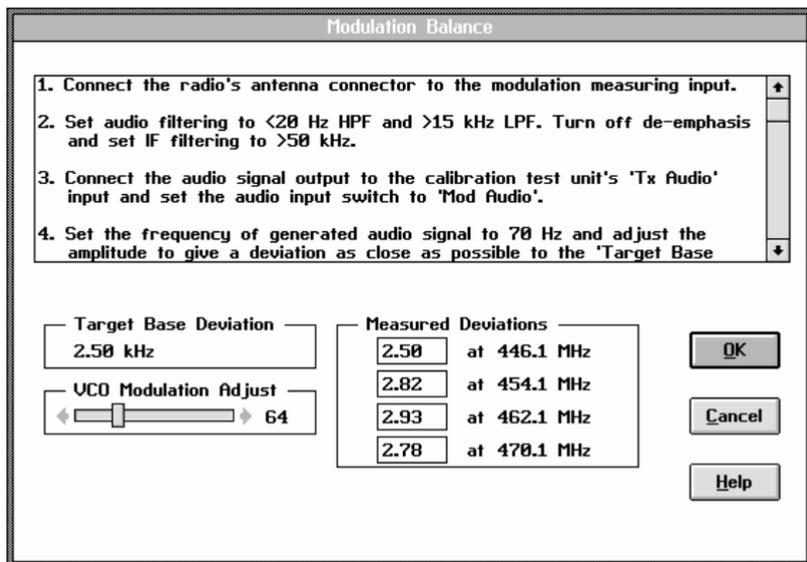
Maximum Deviation

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.

Select **Maximum Deviation** from the **Calibrate** menu and the window shown in Figure 17 will appear.

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

Connect the audio signal output to the calibration test unit's **Tx Audio** input and set the audio input switch to **Mic Audio**.

Set the audio generator to give a 1 kHz sinusoidal signal. Observe the modulated waveform on the oscilloscope, and adjust the amplitude of the audio signal to give a maximum response without clipping, then increase the audio level by 20 dB.

Adjust the frequency of the audio generator from 300 Hz to 3 kHz to find the maximum deviation. Adjust **TCXO Modulation Adjust** so that the deviation on the modulation measuring input equals the **Target Deviation**.

If the value of **TXCO Modulation Adjust** change by more than 20 percent, you will need to recheck the **TCXO Calibration**.

Select **OK** to exit the window and save the value of **TCXO Modulation Adjust**.

Maximum Volume Threshold

The maximum volume threshold is set to ensure that the radio's speaker is not overdriven. Select **Maximum Volume Threshold** from the **Calibrate** menu and the window shown in Figure 18 will appear.
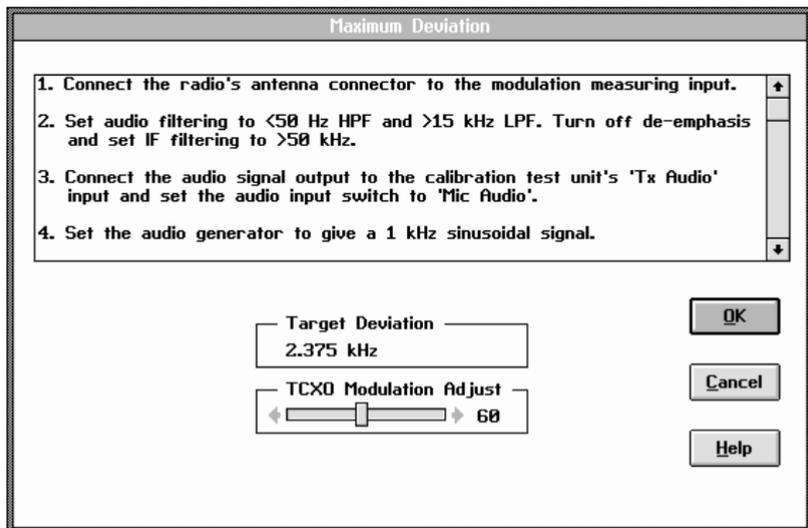
Figure 17: Maximum Deviation window

Figure 18: Maximum Volume Threshold window
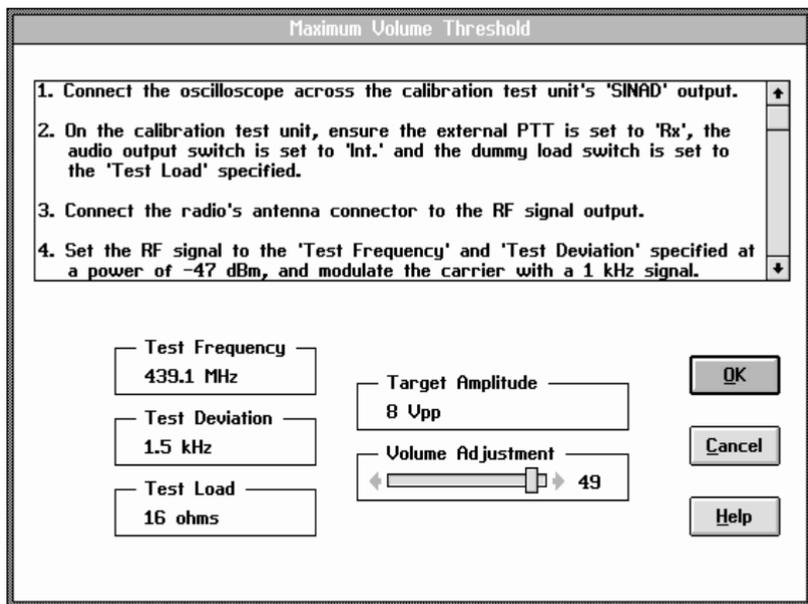
Connect the oscilloscope across the calibration test unit's **SINAD** output. On the calibration test unit, ensure the external PTT is set to **Rx** and the audio output switch is set to **Int**. Set the load switch to the **Test Load** specified.

Connect the radio's antenna connector to the RF signal output. Set the RF signal to the **Test Frequency** and **Test Deviation** specified at a power of -47 dBm, and modulate the carrier with a 1 kHz signal.

Ensure that the radio's volume control is set to its maximum position. Change **Volume Adjustment** so the oscilloscope shows the **Target Amplitude**.

Select **OK** to exit the window and save the value of **Volume Adjustment**.

RSSI Thresholds

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.

Select **RSSI Thresholds** from the **Calibrate** menu and the window shown in Figure 19 will appear.

Connect the radio's antenna connector to the RF signal output. Set the RF signal to the **Test Frequency** and **Test Deviation** specified, modulated with a 1 kHz sinusoid. Set the RF signal power to -116 dBm and select the **Set L0** button. Then set the RF signal power to -100 dBm and select the **Set L2** button. -116 dBm and -100 dBm are standard RSSI levels; your trunking system may require different levels.

Figure 19: RSSI Thresholds window
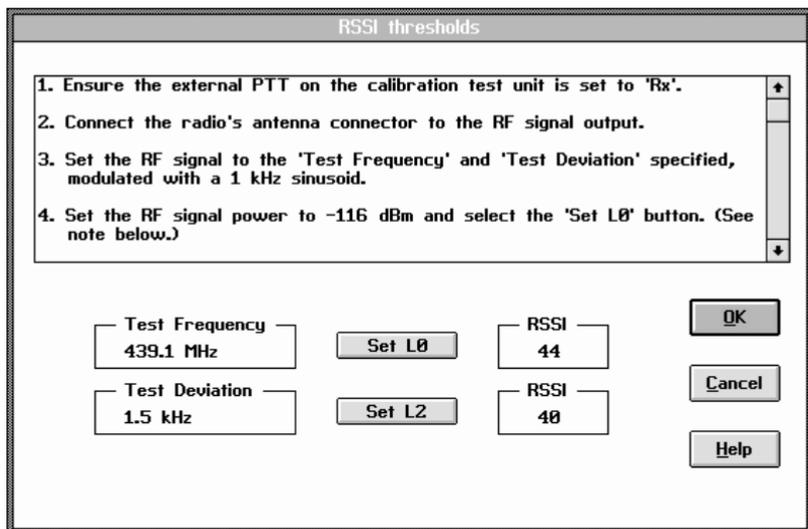
Select **OK** to exit and save the displayed **RSSI** values.

Battery Thresholds

This test only applies to handportable radios.

The voltage into the radio must be accurately measured so that the radio can calculate low battery states. Select **Battery Thresholds** from the **Calibrate** menu and the window shown in Figure 20 will appear.

With a power supply connected to the DC service adaptor, adjust the voltage to give an output between 6 and 9 volts, then use the digital multimeter to accurately measure the voltage across the two points at the base of the DC service adaptor.

Enter the voltage reading in **Measured Voltage**, then select **OK** to exit the window and save **Measured Voltage**.

Advanced Settings

The **Advanced Settings** window is used to change settings relevant to DSP signalling deviations. Select **Advanced Settings** from the **Calibrate** menu and the window shown in Figure 21 will appear.

These settings should only be adjusted for special system requirements.

The CTCSS and DCS settings are the deviations applied when subaudible signalling is used. The voice deviation is adjusted to keep the overall deviation within statutory limits. When subaudible signalling is not enabled on a channel, voice deviation will not be affected.

Enter the required signalling deviations, then select **OK** to exit the window and save the settings.

Figure 20: Battery Thresholds window

Battery Thresholds

1. Ensure 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 'Measured Voltage'.

Voltage ADC Reading
158

Measured Voltage
7.50   (6.00...9.00)

OK   Cancel   Help

Figure 21: Advanced Settings window

Advanced Settings

1. Enter the required signalling deviations.

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

Note: This window contains advanced settings. These should only be altered under special circumstances.

DSP Signalling Deviations
CTCSS   14%   (10..50%)
DCS   14%   (10..50%)

OK   Cancel   Help
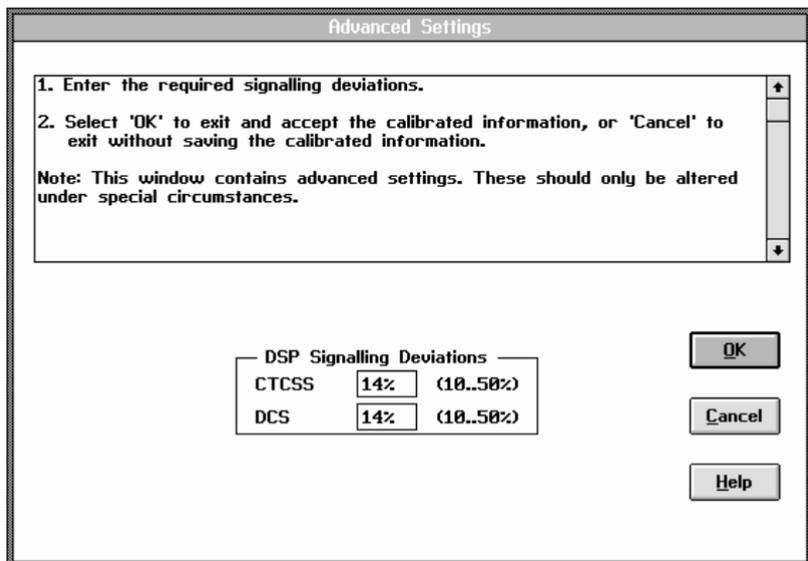
Programming a radio

Once the calibration tests are complete, the information obtained is used to program the radio's calibration database.

When the **Program** option is selected from the **Radio** menu, a message will appear telling you that the radio is being programmed. Once programming is complete, the **Radio Program** window (Figure 22) appears.

The field **Current Status** shows the current status of the radio and database, and should read 'Radio successfully programmed'.

Problems programming a radio

If when you program a radio, **Current Status** reports 'Error - failed to program dbase item' or any other type of error, check that the connections between the radio and the calibration test unit and between the calibration test unit and the PC are intact and select the **ReProg** button.

If the calibration system still returns an error, save the calibration database to disk, exit the calibration system and restart the computer. Load the saved calibration database and again try to program the radio.

If you still cannot program the radio, contact your Tait dealer.

Figure 22: Radio Program window
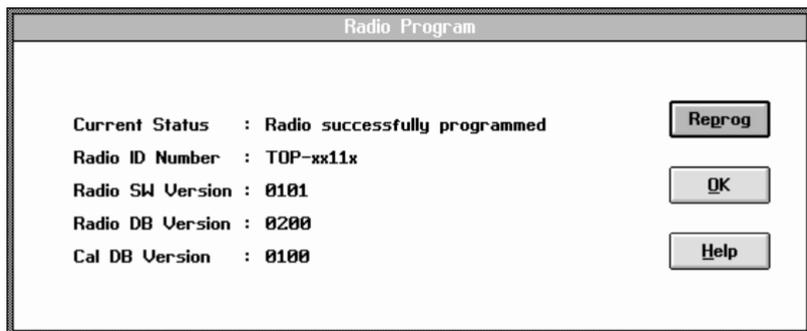
Appendix: Test commands

Below are listed the test commands available through the **Test Commands** option of the **Utility** menu. Select the command, then **Send** to send the command to the radio. Returned information will be displayed, together with any error messages. Where a test command requires additional parameters, these will appear when the command is selected from the list.

A description of error codes is also included.

Function	Description	CCTM code	Parameters
Signalling	Set modem to send zeros	10	None
	Set modem to send ones	11	None
	Set modem to send preamble	12	None
	Disable modem signalling	13	None
	Read modem receive string (continuous)	14	None
	Disable all signalling	15	None
	Enable subaudible signalling	16	None
	Read subaudible signalling decode status	17	Returns: 0 = signal not detected, 1 = signal detected
Mute	Force Rx audio muted	20	None
	Force Rx audio unmuted	21	None
	Mute DSP input	22	None
	Unmute DSP input	23	None
	Let squelch control Rx audio	24	None
	Read RX_BUSY status	25	Returns: 0 = busy inactive, 1 = busy active
	Relax Rx mute control	26	None
Rx/Tx	Inhibit PA (transmit mode)	30	None
	Enable PA (transmit mode)	31	None
	Set radio to Rx	32	None
	Set radio to Tx	33	None
	Set transmit to low power	34	None
	Set transmit to mid power	135	None
	Set transmit to high power	35	None
	Set transmit to max power	36	None
	Set transmit to no power	137	None
	Activate economy mode	42	None
	Deactivate economy mode	43	None
	Read battery level	46	Returns: 0 to 255
(continued on next page)	Read temperature level	47	Returns: 0 to 255

Function	Description	CCTM code	Parameters
Rx/Tx (cont'd)	Set keypad test on	50	None
	Set keypad test off	51	None
	Set display test on	52	IN: 0, 1, 2 or 3
	Set display test off	53	None
	Read averaged RSSI level	63	Returns: 0 to 255
	Read L1 threshold	64	Returns: 0 to 255
	Read L2 threshold	65	Returns: 0 to 255
Miscellaneous	Select normal micro clock	70	None
	Select birdie micro clock	71	None
	Read synth lock status	72	Returns: 0 = not in lock, 1 = in lock
	Select external speaker/microphone	74	
	Select internal speaker/microphone	75	
	Stop the MCU clock	79	None
	Select wide band	84	None
	Select medium band	85	None
	Select narrow band	86	None
	Select city squelch	88	None
	Select country squelch	89	None
Radio info	Read radio serial number	94/131	Returns: 6 digit number (hex)
	Read DSP software version number	132	Returns: 4 digit number (hex)
	Read radio software version number	96	Returns: 4 digit number
	Read radio type	130	Returns: radio type (P or M), frequency band (B-J), channel spacing (1 or 2)
Synth	Load absolute synth frequency	101	tttttt T rrrrrr R F
	Load synth reference divider	102	8 to 16383
Config	Set volume pot	110	0 to 255
	Set transistor gate bias	111	0 to 255
	Set TCXO mod	112	0 to 255
	Set VCO mod	113	0 to 255
	Set Tx power level	114	0 to 255
	Set TCXO coarse frequency	115	0 to 255
	Set TCXO fine frequency	116	0 to 255
	Set Rx front end tuning	117	0 to 255
	Set squelch threshold	118	0 to 255
	Set CTCSS modulation	120	0 to 32767
	Set DCS modulation	121	0 to 32767
	Set FFSK modulation	122	0 to 32767
	Set Selcall modulation	123	0 to 32767
(continued on next page)	Set DTMF modulation	124	0 to 32767

Function	Description	CCTM code	Parameters
Config (continued)	Set voice modulation	125	0 to 32767
	Force DCS signalling (023 tone)	126	None
	Force CTCSS signalling (67.0 Hz)	127	None
	Force Selcall signalling (2000 Hz for 2 seconds)	128	None
	Force DTMF signalling (tone A)	129	IN: 1 = start encoding, 0 = stop encoding
	Read calibrated volume setting	136	Returns: 0 to 255

Error codes

The errors you may receive while the radio is in test mode are outlined below.

{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.

{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 put the radio into test mode. 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 micro-processor 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.

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