



**Tait Orca 5000 Handportable Radios
Service Manual**

**Issue 03
April 2001**

IPN: 449-51000-03

Contents

Part A: Introduction

Servicing Tait Orca 5000 handportables	A-3
WWW technical support	A-3
What does this manual contain?	A-3
What is included in the calibration service kit?	A-3
Programming kit	A-4
Conventions	A-4
The Tait Orca 5000 series of handportables	A-5
Product codes	A-5
The Tait Orca Product Naming Convention	A-5
Operating Instructions	A-6
Accessories	A-6
Important information	A-11
Basic servicing precautions	A-11
Programming	A-11
Calibrating	A-11
Test facilities	A-11

Part B: Radio specifications and circuit descriptions

Radio specifications	B-3
General specifications	B-3
Receiver performance	B-3
Transmitter performance	B-4
Tait Orca 5000 66-88MHz. Conventional and Trunked Radio Specifications	B-5
Tait Orca 5000 136-174MHz. Conventional and Trunked Radio Specifications	B-6
Tait Orca 5000 174-225MHz. Conventional and Trunked Radio Specifications	B-7
Tait Orca 5000 336-400MHz. Conventional and Trunked Radio Specifications	B-8
Tait Orca 5000 400-470MHz. Conventional and Trunked Radio Specifications	B-9
Tait Orca 5000 450-530MHz. Conventional and Trunked Radio Specifications	B-10
Tait Orca 5000 806-870MHz. Conventional and Trunked Radio Specifications	B-11
Tait Orca 5000 896-941MHz. Conventional and Trunked Radio Specifications	B-12
Circuit descriptions	B-14
Transmitter	B-14
Transmit (Tx) audio	B-14

Receiver	B-14
Receive (Rx) audio	B-15
Synthesiser and VCO	B-15
Power supplies	B-15
Accessory connector interface	B-16
Implications of universal band versus wideband IF filtering	B-16

Part C: Diagnostics and fault finding

Test facilities	C-3
Error codes	C-3
Test commands.....	C-5
Calculating the parameters required for test command 101.....	C-7
Fault finding charts	C-8
Fault finding – Radio cannot be switched on	C-9
Fault finding – Cannot change channel	C-10
Fault finding – No serial communication	C-11
Fault finding – Receive faults	C-12
Fault finding – Cannot transmit	C-13
Fault finding – No transmit audio	C-14

Part D: Servicing the radio

Servicing the radio	D-3
Screw head types	D-3
Disassembling the radio	D-4
Removing the front panel from the chassis	D-4
Removing the shield sub-assembly from the chassis	D-5
Removing the PCB from the chassis	D-6
Removing the rear panel	D-7
Replacing key mechanical and ancillary devices	D-8
Replacing the lens (Orca 5020, Orca 5035 and Orca 5040)	D-8
Replacing the PTT keypad	D-8
Replacing the speaker	D-9
Replacing the LCD display (Orca 5020, Orca 5035 and Orca 5040)	D-9
Replacing the shield, user interface PCB assembly and polyester dome (Orca 5020, Orca 5035 and Orca 5040)	D-12
Replacing the antenna connector, channel selector switch and volume control switch	D-12
Replacing the microphone	D-12

Replacing the battery and speaker contacts	D-12
Replacing the tact switch	D-12
Reassembling the radio	D-13
Rear panel reassembly and replacing the auxiliary flexible PCB	D-13
Fitting the PCB to the chassis and replacing the RF out assembly	D-14
Fitting the shield to the chassis	D-14
Fitting the front panel to the chassis	D-15
Spares kits	D-16
Orca 5010/5030 spares kit (TOPA-SP-401)	D-17
Orca 5035 spares kit (TOPA-SP-402)	D-18
Orca 5020/5040 spares kit (TOPA-SP-403)	D-19
Orca 5010/5030 Re-skinning kit (TOPA-SP-404)	D-20
Orca 5035 Re-skinning kit (TOPA-SP-405)	D-20
Orca 5020/5040 Re-skinning kit (TOPA-SP-406)	D-20
Orca 5020/5035/5040 User Interface PCB and Shield (TOPA-SP-407)	D-20

Part E: Battery packs and chargers

Battery packs	E-3
Battery shift life	E-3
Disposing of used nickel-cadmium batteries	E-4
Battery chargers	E-5
Desktop fast charger	E-6
Fast charger operation	E-6
Using the fast charger	E-9
Repairing the fast charger	E-11
Desktop trickle charger	E-13
Trickle charger operation	E-13
Using the trickle charger	E-14
Repairing the trickle charger	E-14
Troubleshooting	E-15
Basic Maintenance	E-16
General Care	E-16
Troubleshooting	E-16
Multi-charger	E-17
Multi-charger operation	E-17
Repairing the multi-charger	E-17

Fuse replacement	E-18
------------------------	------

Part F: Accessories

Tait Orca 5000 Accessory Connector	F-3
Connecting an Accessory	F-3
Connecting a Headset	F-5
Accessory Connector Signal Descriptions	F-6
7.5 mm Accessory Adaptor	F-8
Tait Orca Vehicle Kit	F-10
Product Codes	F-10
Installing a Vehicle Kit	F-10
Vehicle Kit Operation	F-10
Vehicle Kit Specifications	F-12
Servicing the Vehicle Kit	F-13
Spares Kits	F-14
Vehicle kit spares kit (TOPA-SP-301).....	F-15
Vehicle kit reskinning kit (TOPA-SP-302).....	F-16
Custom Modifications	F-17
Vehicle Kit Circuit Descriptions	F-19

Part G: Additional information

Glossary	G-3
Tait Electronics Limited	
Software Licence Agreement	G-7

PART **A** Introduction

This part provides an introduction to servicing Tait Orca 5000 handportables. It includes an outline of the Tait Orca 5000 handportable range of products and precautions that should be taken before servicing Tait Orca 5000 handportables.

Detailed servicing instructions and information about spare parts are found in *Part D: Servicing the radio*.

Contents

Servicing Tait Orca handportables	A-3
WWW technical support	A-3
What does this manual contain?	A-3
What is included in the calibration service kit?	A-3
Programming service kits	A-4
Conventions	A-4
The Tait Orca series of handportables	A-5
Product codes	A-5
Operating Instructions	A-5
Accessories	A-5
Important information	A-8
Basic servicing precautions	A-8
Programming	A-8
Calibrating	A-9
Test facilities	A-9

Servicing Tait Orca 5000 handportables

The Tait Orca 5000 series of handportables is a range of high performance, microprocessor-controlled radios manufactured using an RF-shielded PCB and high-density SMD componentry.

The manufacturing process does not allow direct servicing access to components on the main PCB, although replacement PCBs are available on an exchange basis. Service repairs of Tait Orca 5000 handportables are therefore limited to key mechanical and ancillary devices associated with the main PCB. These include:

- the front panel assembly;
- the lens (Orca 5020, Orca 5035 and Orca 5040);
- the PTT keypad;
- the speaker;
- the keypad;
- the LCD display (Orca 5020, Orca 5035 and Orca 5040);
- the shield, complete with user interface PCB assembly and polyester dome (Orca 5020, Orca 5035 and Orca 5040);
- the main PCB assembly;
- the antenna connector;
- the channel selector switch;
- the volume control switch;
- the microphone;
- the speaker contacts;
- the battery contacts;
- the PTT tact switch;
- the RF out assembly; and
- the auxiliary flexible PCB.

The repair of PCB-related faults is the responsibility of the Customer Services Division of

Tait Electronics Ltd. Detailed schematics and component location information for the main PCB may also be obtained from the Customer Services Division. Contact your Tait dealer for more information.

WWW technical support

Tait Electronics Ltd provides product support at the following address:

<http://www.taitworld.com/support>

At this site, you can send a request for support.

What does this manual contain?

This manual is supplied as part of the Tait Orca 5000 handportable service kit (TOPA-SV-117), and provides the following:

- general information and specifications on the Tait Orca 5000 series of handportables;
- basic circuit descriptions;
- information on finding and servicing of non-PCB-related faults;
- information on Tait Orca 5000 battery packs and chargers;
- information on interfacing accessories to Tait Orca 5000 handportables; and
- a glossary of key terms.

What is included in the calibration service kit?

The TOPA-SV-117 service kit contains:

- calibration test unit (TOPA-SV-004);
- radio calibration cable for connecting the radio to the calibration test unit (TOPA-SV-007);
- 25 pin RS232 to modular phone jack

programming lead for connecting the calibration test unit to a PC (TOPA-SV-012);

- DC service adaptor (TOPA-SV-005);
- SMA to N-type RF test lead for connecting to the radio's antenna connector (TOPA-SV-006);
- T6 driver bit and 8 mm socket (TOPA-SV-011);
- this manual; and
- TOP Programming Utilities (TPU) CD-ROM (IPN 406-00003-xx).

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 handportables; and
- TOPA-SV-A07 if calibrating TOP-Axxxx-xx 66 -88MHz product.

Programming kit

The TOPA-SV-116 kit for programming Tait Orca 5000 radios contains:

- accessory connector to modular phone socket programming cable for connecting the radio to the programming lead (TOPA-SV-003); and
- 25 pin RS232 to modular phone jack programming lead for connecting the programming cable to a PC (TOPA-SV-012); and
- TOP Programming Utilities (TPU) CD-ROM (IPN 406-00003-xx).

Conventions

Throughout this manual, the names of software screen, field and menu names are referred to in **bold sans serif font**. For example:

Check that the information in the **Radio Model** fields (**Specifications** screen) is correct.

The Tait Orca 5000 series of handportables

There are five Tait Orca 5000 series handportables:

- Orca 5010 - low tier conventional
- Orca 5020 - high tier conventional
- Orca 5030 - low tier trunked
- Orca 5035 - mid tier trunked
- Orca 5035 - high tier trunked

This manual includes information specific to all the Orca 5000 handportables. As new features and enhancements occur, new revisions of this manual will be released.

The new text (without folder) is available as

IPN 410-51000-xx, where 'xx' refers to the revision status of the new manual.

Product codes

The digits in the Tait Orca 5000 product code provide information about the radio's model number and various hardware options, according to the convention outlined in Figure A-. The naming convention is not intended to imply that any particular combination of radio features is at present available or planned for later release. For more information on what features and variants are available, contact your nearest Tait dealer.

Figure A-1: The Tait Orca naming convention

TOP-abcde-mn	
Compliance Code (see note 9)	
TOP – Family designator	c – User interface:
a – Frequency band:	1 Elan
A 66–88 MHz	2 Excel
B 136–174 MHz	3 Eclipse
C 174–225 MHz (see note 1)	4 5010,5030 (see notes 1 & 6)
D reserved	5 5035 (see notes 1 & 6)
E reserved	6 5020, 5040 (see notes 1 & 6)
F reserved	d – Air interface:
G 336–400 MHz	1 Conventional PMR
H 400–470 MHz	2 MPT 1327 trunked
I 450–530 MHz	3 LTR trunked (see note 1)
J 806–870 MHz Tx	e – Reserved for compliance-relevant changes:
851–870 MHz Rx	0 Initial default
K 896–941 MHz Tx	m – Badging:
935–941 MHz Rx	G Reserved
b – Channel space/IFBW:	T Tait
1 12 kHz Medium IFBW (MB) –	V TEL (Argentina, see note 7)
20/25/30 kHz Channel spacing	U Unbadged (see note 8)
(see note 1)	Z Reserved
2 10 kHz Universal IFBW (UB) –	n – Custom variations not affecting compliance:
12.5/15/20/25/30 kHz Channel spacing	0 Initial default

The Tait Orca Product Naming Convention

1. The Tait Orca Product Naming Convention is intended to describe the meaning if the various characters used in Tait Orca Product Codes. It is not a design-a-product menu. Tait CSOs

must not enter new items on Baan or make commitments to customers without first confirming availability, compliance in intended market, etc. with Tait Electronics Ltd. Information in italics refers either to obsolescent or planned new items which are not avail-

able at the issue date of this document.

2. The offer of any product in any market is subject to adequate regulatory compliance.
3. Care must be taken not to enter alpha O instead of numeral 0, or alpha I instead of numeral 1. With the exception of I as a band designator, alphas I & O will not be used in this scheme.

4. This document does not address coding for packed ensembles of radio, battery, charger, antenna etc. These must be negotiated with TOP Logistics (refer to TMS document CS0003, TOP Package Code Scheme).

5. Lower-case alpha character-location designation can be used as a convenient shorthand when listing products, compliances etc., eg TOP-B2xy0, where x = 1~6, y = 1 or 2.

6. The 50xx numbers assigned to SlimTOP products are the name of each product, analogous to Elan, Excel and Eclipse. They are based on T2k/3k Product Codes for guidance as to what they do, but the functions are not identical to the T2k or T3k product.

5020 will only have 1 as an air interface code, and 5040 will only have 2 as an air interface code.

7. V identifies TEL badged products are for sale in Argentina, where the name 'Tait' is registered to another Company.

8. U identifies accessories which are generally Tait-badged, but an unbadged version has been produced for use with radios carrying a non-Tait badge.

9. The Compliance Code underline addresses regulator concerns that the full (3-group) code appearing on the product is not the same as the 2-group code under which Compliance was obtained. It appears only on the product label and some regulatory declarations.

This also permits the same Compliances to apply regardless of badging or minor custom variations expressed in the 3rd group. However, note that the first 2 groups of the Product Code may not necessarily be the same as the

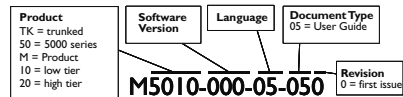
Compliance Code. This allows Compliance of TOP 50xx products to be extrapolated from Elan/Excel/Eclipse for some regulators. See the following label illustrations for an example. The product is a TOP-H2510-T0, but the Compliance Code is TOP-H2110.

Operating Instructions

A user's guide is available for each radio.

Figure A-2 shows the naming convention for Tait Orca 5000 radio user's guides.

Figure A-2: Naming convention for Tait Orca hand-portable user's manuals



BATTERY CHARGER USER GUIDE

MBAT1-207-03-050

Multiple Languages. One User guide per Orca Charger or Orca Multi-Charger.

USER GUIDES

ENGLISH	GERMAN	FRENCH	EURO SPANISH
M5010-000-00-050	M5010-000-01-050	M5010-000-02-050	M5010-000-04-050
M5020-000-00-050	M5020-000-01-050	M5020-000-02-050	M5020-000-04-050
M50TK-000-00-050	M50TK-000-01-050	M50TK-000-02-050	M50TK-000-04-050

SOUTH AMERICAN SPANISH	BRAZILIAN PORTUGUESE	SIMPLIFIED CHINESE	TRADITIONAL CHINESE
M5010-000-05-050	M5010-000-08-050	M5010-000-09-050	M5010-000-10-050
M5020-000-05-050	M5020-000-08-050	M5020-000-09-050	M5020-000-10-050
M50TK-000-05-050	M50TK-000-08-050	M50TK-000-09-050	M50TK-000-10-050

Accessories

Table A-1 shows the accessories available for Tait Orca 5000 handportables. Of these accessories, only the chargers are serviceable.

For more information on chargers, see *Part E: Battery packs and chargers*. The three battery packs available for Tait Orca 5000 handportables are also described in Part E.

Fitting an accessory (without D-clip)

To fit some accessories to the radio, you will 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. Lift to remove the cover.

When attaching or removing an accessory, ensure that the lever is in the upright position. Engage the two posts at the base of the connector with the rear panel. Once the accessory is in position, rotate the lever 90

degrees counterclockwise to lock it in place.

Fitting an accessory (with D-clip)

When removing an accessory with a D-clip, press the lock spring tab before rotating the D-clip clockwise. (To fit and remove a D-clip, see Figure A-3.)

Fitting a non-Tait accessory

See *Part F: Interfacing non-Tait accessories* for information on using non-Tait accessories with Tait Orca 5000 handportables.

Figure A-3: Fitting and removing a D-clip to a Tait Orca 5000 handportable

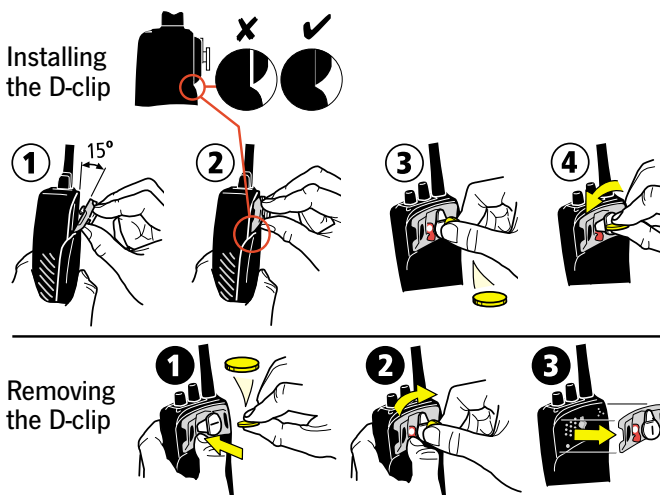







Table A-1: Tait Orca 5000 handportable accessories

Type of accessory	Product code	Description
Antennas	TOPA-AN-101	130-230 MHz 3" helical
	TOPA-AN-102	336-540 MHz 3" helical
	TOPA-AN-201	136-340 MHz 6" helical
	TOPA-AN-202	400-940 MHz 6" wave whip
	TOPA-AN-203	896-941MHz 7" gain
	TOPA-AN-204	806-870M 1/2 wave gain
	TOPA-AN-205	896-941M 1/2 wave gain
	TOPA-AN-301	66-88MHz 10" helical
Audio accessories	TOPA-AA-001	Speaker microphone -10 °C, two function buttons
	TOPA-AA-002	Speaker microphone -30 °C heavy duty, two function buttons
	TOPA-AA-003	Speaker microphone -30 °C MIL spec
	TOPA-AA-004	Speaker microphone -30 °C MIL spec RF
	TOPA-AA-005	7.5 mm accessory adaptor
	TOPA-AA-006	Tait Orca accessory connector kit
	TOPA-AA-007	Tait Orca RF accessory connector kit
	TOPA-AA-008	Speaker microphone, -30 C MIL spec, no function buttons, high/low volume*
	TOPA-AA-009	2-wire palm microphone and earphone*
	TOPA-AA-010	3-wire lapel microphone and earphone*
	TOPA-AA-011	Light weight single speaker headset with in-line PTT*
	TOPA-AA-012	Over-the-head headset with noise cancelling boom microphone*
	TOPA-AA-013	Behind-the-head headset with noise cancelling boom microphone*
	TOPA-AA-101	Speaker microphone -10 °C, two function buttons (with D-clip)
	TOPA-AA-102	Speaker microphone -30 °C heavy duty, two function buttons (with D-clip)
	TOPA-AA-103	Speaker microphone -30 °C MIL spec (with D-clip)
	TOPA-AA-104	Speaker microphone -30 °C MIL spec RF (with D-clip)
	TOPA-AA-105	7.5 mm accessory adaptor (with D-clip)
	TOPA-AA-106	Tait Orca 5000 accessory connector kit (with D-clip)
	TOPA-AA-107	Tait Orca 5000 RF accessory connector kit (with D-clip)
T952-051	Earphone kit with coil corn and 2.5 mm plug (for use with TOPA-AA-003, TOPA-AA-004, TOPA-AA-008, TOPA-AA-103 & TOPA-AA-104)	
Batteries	TOPB100	1100 mAh NiCd battery pack
	TOPB200	1500 mAh NiCd battery pack
	TOPB400	1500 mAh NiMH battery pack
	TOPB500	2000 mAh NiMH battery pack
	TOPB600	1100mAh NiCd battery pack (slim)
	TOPB700	1500 mAh NiMH battery pack (slim)
	Battery chargers	TOPA-CH-100
TOPA-CH-200		Desktop fast charger

* For use with
TOPA-AA-005 &
TOPA-AA-105

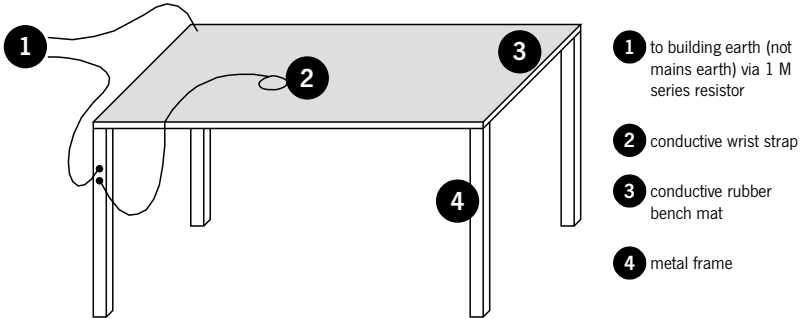
Type of accessory	Product code	Description
	TOPA-CH-300	Six-way multi-charger
Plug packs (for TOPA-CH-200)	T952-012	Australia, New Zealand and China (230 V 50 Hz input; plug configuration: )
	T952-022	Singapore and Middle East (230 V 50 Hz input; plug configuration: )
	T952-032	Mainland Europe (230 V 50 Hz input; plug configuration: )
	T952-042	USA and Canada (115 V 60 Hz input; plug configuration: )
	T952-052	UK and Hong Kong (230 V 50 Hz input; plug configuration: )
Carrying accessories	TOPA-CA-001	Heavy duty carry case
	TOPA-CA-002	Heavy duty holster
	TOPA-CA-003	38 mm belt clip x 10
	TOPA-CA-004	Accessory port cover x 10
	TOPA-CA-005	55 mm belt clip
	TOPA-CA-006	55 mm belt clip x 10
	TOPA-CA-101	Heavy duty carry case (with D-clip)
	TOPA-CA-102	Holster carry case (with D-clip)
	TOPA-CA-103	Belt loop
	TOPA-CA-104	D clip
	TOPA-CA-105	Handstrap

Important information

Basic servicing precautions

Tait Orca 5000 handportables require specialised servicing techniques and should only be serviced at an approved Tait service centre equipped with the necessary facilities.

Figure A-1: Typical anti-static bench setup



Warning!!!

Repairs attempted with incorrect equipment or by untrained personnel may result in permanent damage.

Caution: CMOS devices

This equipment contains CMOS devices, which are susceptible to damage from static charges. Care when handling these devices is essential. For correct handling procedures, refer to manufacturers' data books covering CMOS devices, such as *Philips Data Handbook Covering CMOS Devices* or *Motorola CMOS Data Book Section 5 (Handling Procedures)*.

Standard anti-static procedures should be followed; a typical setup is shown in Figure A-1.

If in doubt, contact Tait Electronics Ltd or your nearest Tait dealer.

Screw head types

Torx recess head screws and Pozidriv recess head screws require the correct sized driver to achieve best performance. Most of the screws in Tait Orca 5000 handportables are Torx head screws, and so a Torx T6 driver bit is supplied as part of the service kit. Some earlier radios have Pozidriv screws.

Torx head 1.8*5 mm screws should be removed using the supplied Torx T6 driver. When replacing these screws, set the driver to 2 inch pounds.

Pan Pozi M2*8 mm and M2*5 mm screws should be removed using a Pozi 1 driver. When replacing these screws, set the driver to 2 inch pounds.

Programming

For information on programming Tait Orca 5000 handportables, refer to:

- the *Tait Orca Trunked Programming Application User's Manual* or the online help;

PART **B** Radio specifications and circuit descriptions

This part outlines the radio specifications and circuit descriptions for Tait Orca handportables.

Contents

Radio specifications	B-3
General specifications	B-3
Receiver performance	B-3
Transmitter performance.....	B-4
Tait Orca 5000 66-88MHz. Conventional and Trunked Radio Specifications	B-5
Tait Orca 5000 136-174MHz. Conventional and Trunked Radio Specifications ...	B-6
Tait Orca 5000 174-225MHz. Conventional and Trunked Radio Specifications ...	B-7
Tait Orca 5000 336-400MHz. Convnetional and Trunked Radio Specifications ...	B-8
Tait Orca 5000 400-470MHz. Conventional and Trunked Radio Specifications ...	B-9
Tait Orca 5000 450-530MHz. Conventional and Trunked Radio Specifications .	B-10
Tait Orca 5000 806-870MHz. Conventional and Trunked Radio Specifications .	B-11
Tait Orca 5000 896-941MHz. Conventional and Trunked Radio Specifications .	B-12
Circuit descriptions	B-14
Transmitter	B-14
Transmit (Tx) audio	B-14
Receiver	B-14
Receive (Rx) audio	B-15
Synthesiser and VCO	B-15
Power supplies	B-15
Accessory connector interface	B-16
Implications of universal band versus wideband IF filtering	B-16

Radio specifications

Tables B-1, B-2 and B-3 show information common to all the radios. For detailed information on each band, refer to the performance figures outlined in Tables B-4 to B-9.

The performance figures are typical figures, unless otherwise stated, for equipment operating at standard room temperature.

The test methods used to obtain these figures are those described in the European Telecommunication Standard ETS 300-086. Where applicable, the EIA figure is also given.

Details of test methods and the conditions that apply for type approval testing in all countries can be obtained from Tait Electronics Ltd.

Important Note: With regard to the typical performance figures, specifications are subject to change without notice and shall not form part of any contract. They are issued for guidance purposes only. For further information please check with your nearest Tait office or authorised dealer. The radio meets applicable regulatory requirements.

Notes for Tables B-4 to B-11:

* The “x” in the part number allows one specifications page to cover Orca 5010 and Orca 5020 models. For Orca 5010 x=4 and for Orca 5020 x =6.

** The “y” in the part number allows one specifications page to cover Orca 5035 and Orca 5040 models. For Orca 5035 y=5 and for Orca 5040 y=6.

Table B-1: General specifications

Supply voltage	6.0-9.0 V
----------------	-----------

Standard test voltage	7.5 V
-----------------------	-------

Table B-2: Receiver performance

Audio	
Minimum load impedance	13 Ω
Rated power	500 mW (1kHz, 60% deviation into 16 Ω)
Distortion	<5% (1kHz, 60% deviation at rated power into 16 Ω)
Response	-6 dB/oct +1, -3 dB (cf 1 kHz), 300-2550 Hz (narrowband) 300-3000 Hz (wideband)

Spurious emissions	
to 1 GHz	-57 dBm (conducted and radiated)
1 to 4 GHz (136-470 MHz)	-47 dBm (conducted and radiated)
1 to 12.75 GHz (>470 MHz)	-47 dBm (conducted only)

Group delay variation	$\pm 50 \mu\text{s}$ (at detected audio output) bandwidth 300-3000 Hz
-----------------------	--

RSSI	
range	-120 to -40 dBm
slope	28.65 mV/dB (typical)

Table B-3: Transmitter performance

Duty cycle	20% (1 minute Tx, 4 minutes Rx at maximum temperature and voltage)
Group delay variation	$\pm 50 \mu\text{s}$ (at mod audio output)
bandwidth	300-3000 Hz
Trunking data deviation (as per MPT1327)	
narrowband	1.5 kHz
mediumband	2.4 kHz
wideband	3 kHz
Audio response	
below limiting	6 dB/oct +1, -3 dB (cf 1 kHz) 300-3000 Hz
in limiting	0 dB +0, -4 dB (cf maximum system deviation) 450-2550 Hz
above 3 kHz	-35 dB/oct min
input for 60% deviation	5 mV _{rms}
distortion	<5% at 1 kHz
Ruggedness	2 minutes (into infinite VSWR)
Stability	5:1 VSWR (all phase angles, <-60 dBc)

Table B-4: Tait Orca 5000 66-88MHz. Conventional and Trunked Radio Specifications

Model	TOP-A2x10*	TOP-A2y20**	
Frequency Range	66-88MHz		
Channel Spacing	12.5 / 20 / 25 kHz		
Frequency Increments	5 or 6.25kHz		
IF Bandwidth	Universal Bandwidth (UB) 10kHz		
Frequency Stability	+/-10ppm (-10 to +60°C); +/-15ppm (-10 to -20°C)		
Current Consumption (Receiver Squelched)	80mA	100mA	
Current Consumption (Standby with high economy duty cycle)	40mA	N/A	
Current Consumption (Receiver Rated Audio)	300mA		
Transmitter current	1.6A		
Size, incl. 1500mAh NiMH battery (WxHxD)	66 x 154 x 41mm		
Weight	Orca 5010	Orca 5035	Orca 5020/5040
With TOPB200 1500mAh NiCd	525g	545g	550g
With TOPB700 1500mAh NiMH	510g	530g	535g
With TOPB500 2000mAh NiMH	550g	570g	575g
Receiver*			
Measurements as per:	ETS 300-086		
Intermediate frequencies	21.4MHz and 455kHz		
Sensitivity 12dB SINAD	< -119dBm		
Sensitivity 20dB SINAD	< -114dBm		
Fixed Squelch Sensitivity	12dB SINAD or 16dB SINAD Nominal		
Selectivity	70dB (NB), 75dB (WB)		
Spurious Response	70dB		
Intermodulation	65dB		
Blocking	94dB		
Ultimate Signal to Noise Ratio (EIA)	37dB (NB), 42dB (WB)		
Audio Response	Within +1 / -3dB of 6dB / Octave De-emphasis		
Distortion (EIA)	<5% @ 1kHz, 60% Deviation		
Rated Audio Output	> 500mW		
Transmitter*			
Measurements as per:	ETS 300-086		
Power Output (Low/Mid/High)	1 / 2.5 / 5W		
Spurious Emissions (Cond. & Rad.)	< -36dBm (0-1GHz), < -30dBm (1-4GHz)		
Hum and Noise (EIA)	43dB (NB), 48dB (WB)		
Modulation Type	Direct FM		
Deviation Limiting	Adjustable up to +/- 5kHz		
Audio Response Bandwidth	300Hz to 2.55kHz		
Audio Response	Within +1 / -3dB of 6dB / Octave Pre-emphasis		
Distortion (EIA)	<5% @ 1kHz, 60% Deviation		

Table B-5: Tait Orca 5000 136-174MHz. Conventional and Trunked Radio Specifications

Model	TOP-B2x10*	TOP-B2y20**	
Frequency Range	136-174MHz		
Channel Spacing	12.5 / 20 / 25 kHz		
Frequency Increments	5 or 6.25kHz		
IF Bandwidth	Universal Bandwidth (UB) 10kHz		
Frequency Stability	+/-2.5ppm (-30 to +60°C)		
Current Consumption (Receiver Squelched)	80mA	100mA	
Current Consumption (Standby with high economy duty cycle)	40mA	N/A	
Current Consumption (Receiver Rated Audio)	300mA		
Transmitter current	1.9A		
Size, incl. 1500mAh NiMH battery (WxHxD)	66 x 154 x 41mm		
Weight	Orca 5010	Orca 5035	Orca 5020/5040
With TOPB200 1500mAh NiCd	525g	545g	550g
With TOPB700 1500mAh NiMH	510g	530g	535g
With TOPB500 2000mAh NiMH	550g	570g	575g
Receiver*			
Measurements as per:	ETS 300-086		
Intermediate frequencies	21.4MHz and 455kHz		
Sensitivity 12dB SINAD	< -119dBm		
Sensitivity 20dB SINAD	< -114dBm		
Fixed Squelch Sensitivity	12dB SINAD or 16dB SINAD Nominal		
Selectivity	70dB (NB), 75dB (WB)		
Spurious Response	70dB		
Intermodulation	65dB		
Blocking	94dB		
Ultimate Signal to Noise Ratio (EIA)	37dB (NB), 42dB (WB)		
Audio Response	Within +1 / -3dB of 6dB / Octave De-emphasis		
Distortion (EIA)	<5% @ 1kHz, 60% Deviation		
Rated Audio Output	> 500mW		
Transmitter*			
Measurements as per:	ETS 300-086		
Power Output (Low/Mid/High)	1 / 2.5 / 5W		
Spurious Emissions (Cond. & Rad.)	< -36dBm (0-1GHz), < -30dBm (1-4GHz)		
Hum and Noise (EIA)	36dB (NB), 42dB (WB)		
Modulation Type	Direct FM		
Deviation Limiting	Adjustable up to +/- 5kHz		
Audio Response Bandwidth	300Hz to 2.55kHz		
Audio Response	Within +1 / -3dB of 6dB / Octave Pre-emphasis		
Distortion (EIA)	<5% @ 1kHz, 60% Deviation		

Table B-6: Tait Orca 5000 174-225MHz. Conventional and Trunked Radio Specifications

Model	TOP-C2x10*	TOP-C2y20**	
Frequency Range	174-225MHz		
Channel Spacing	12.5 / 20 / 25 kHz		
Frequency Increments	5 or 6.25kHz		
IF Bandwidth	Universal Bandwidth (UB) 10kHz		
Frequency Stability	+/-2.5ppm (-30 to +60°C)		
Current Consumption (Receiver Squelched)	80mA	100mA	
Current Consumption (Standby with high economy duty cycle)	40mA	N/A	
Current Consumption (Receiver Rated Audio)	300mA		
Transmitter current	1.5A		
Size, incl. 1500mAh NiMH battery (WxHxD)	66 x 154 x 41mm		
Weight	Orca 5010	Orca 5035	Orca 5020/5040
With TOPB200 1500mAh NiCd	525g	545g	550g
With TOPB700 1500mAh NiMH	510g	530g	535g
With TOPB500 2000mAh NiMH	550g	570g	575g
Receiver*			
Measurements as per:	ETS 300-086		
Intermediate frequencies	21.4MHz and 455kHz		
Sensitivity 12dB SINAD	< -119dBm		
Sensitivity 20dB SINAD	< -114dBm		
Fixed Squelch Sensitivity	12dB SINAD or 16dB SINAD Nominal		
Selectivity	70dB (NB), 75dB (WB)		
Spurious Response	70dB		
Intermodulation	65dB		
Blocking	94dB		
Ultimate Signal to Noise Ratio (EIA)	37dB (NB), 42dB (WB)		
Audio Response	Within +1 / -3dB of 6dB / Octave De-emphasis		
Distortion (EIA)	<5% @ 1kHz, 60% Deviation		
Rated Audio Output	> 500mW		
Transmitter*			
Measurements as per:	ETS 300-086		
Power Output (Low/Mid/High)	1 / 2.5 / 4W		
Spurious Emissions (Cond. & Rad.)	< -36dBm (0-1GHz), < -30dBm (1-4GHz)		
Hum and Noise (EIA)	36dB (NB), 42dB (WB)		
Modulation Type	Direct FM		
Deviation Limiting	Adjustable up to +/- 5kHz		
Audio Response Bandwidth	300Hz to 2.55kHz		
Audio Response	Within +1 / -3dB of 6dB / Octave Pre-emphasis		
Distortion (EIA)	<5% @ 1kHz, 60% Deviation		

Table B-7: Tait Orca 5000 336-400MHz. Convnetional and Trunked Radio Specifications

Model	TOP-G2x10*		TOP-G2y20**
Frequency Range	336-400MHz		
Channel Spacing	12.5 / 20 / 25 kHz		
Frequency Increments	5 or 6.25kHz		
IF Bandwidth	Universal Bandwidth (UB) 10kHz		
Frequency Stability	+/-2.5ppm (-30 to +60°C)		
Current Consumption (Receiver Squelched)	85mA	100mA	
Current Consumption (Standby with high economy duty cycle)	40mA	N/A	
Current Consumption (Receiver Rated Audio)	300mA		
Transmitter current	1.7A		
Size, incl. 1500mAh NiMH battery (WxHxD)	66 x 154 x 41mm		
Weight	Orca 5010/5030	Orca 5035	Orca 5020/5040
With TOPB200 1500mAh NiCd	525g	545g	550g
With TOPB700 1500mAh NiMH	510g	530g	535g
With TOPB500 2000mAh NiMH	550g	570g	575g
Receiver*			
Measurements as per:	ETS 300-086		
Intermediate frequencies	21.4MHz and 455kHz		
Sensitivity 12dB SINAD	< -119dBm		
Sensitivity 20dB SINAD	< -114dBm		
Fixed Squelch Sensitivity	12dB SINAD or 16dB SINAD Nominal		
Selectivity	66dB (NB), 72dB (WB)		
Spurious Response	70dB		
Intermodulation	65dB		
Blocking	94dB		
Ultimate Signal to Noise Ratio (EIA)	36dB (NB), 42dB (WB)		
Audio Response	Within +1 / -3dB of 6dB / Octave De-emphasis		
Distortion (EIA)	<5% @ 1kHz, 60% Deviation		
Rated Audio Output	> 500mW		
Transmitter*			
Measurements as per:	ETS 300-086		
Power Output (Low/Mid/High)	1 / 2.5 / 4W		
Adjacent Channel Power	65dB (NB), 75dB (WB)		
Spurious Emissions (Cond. & Rad.)	< -36dBm (0-1GHz), < -30dBm (1-4GHz)		
Hum and Noise (EIA)	37dB (NB), 43dB (WB)		
Modulation Type	Direct FM		
Deviation Limiting	Adjustable up to +/- 5kHz		
Audio Response Bandwidth	300Hz to 2.55kHz		
Audio Response	Within +1 / -3dB of 6dB / Octave Pre-emphasis		
Distortion (EIA)	<5% @ 1kHz, 60% Deviation		

Table B-8: Tait Orca 5000 400-470MHz. Conventional and Trunked Radio Specifications

Model	TOP-H2x10*	TOP-H2y20**	
Frequency Range	400-470MHz		
Channel Spacing	12.5 / 20 / 25 kHz		
Frequency Increments	5 or 6.25kHz		
IF Bandwidth	Universal Bandwidth (UB) 10kHz		
Frequency Stability	+/-2.5ppm (-30 to +60°C)		
Current Consumption (Receiver Squelched)	80mA	100mA	
Current Consumption (Standby with high economy duty cycle)	40mA	N/A	
Current Consumption (Receiver Rated Audio)	300mA		
Transmitter current	1.5A		
Size, incl. 1500mAh NiMH battery (WxHxD)	66 x 154 x 41mm		
Weight	Orca 5030	Orca 5035	Orca 5040
With TOPB200 1500mAh NiCd	525g	545g	550g
With TOPB700 1500mAh NiMH	510g	530g	535g
With TOPB500 2000mAh NiMH	550g	570g	575g
Receiver*			
Measurements as per:	ETS 300-086		
Intermediate Frequencies	45.1MHz and 455kHz		
Sensitivity 12dB SINAD	< -119dBm		
Sensitivity 20dB SINAD	< -114dBm		
Fixed Squelch Sensitivity	12dB SINAD or 16dB SINAD Nominal		
Selectivity	66dB (NB), 72dB (WB)		
Spurious Response	70dB		
Intermodulation	65dB		
Blocking	94dB		
Ultimate Signal to Noise Ratio (EIA)	34dB (NB), 40dB (WB)		
Audio Response	Within +1 / -3dB of 6dB / Octave De-emphasis		
Distortion (EIA)	<5% @ 1kHz, 60% Deviation		
Rated Audio Output	> 500mW		
Transmitter*			
Measurements as per:	ETS 300-086		
Power Output (Low/Mid/High)	1 / 2.5 / 4W		
Spurious Emissions (Cond. & Rad.)	< -36dBm (0-1GHz), < -30dBm (1-4GHz)		
Hum and Noise (EIA)	35dB (NB), 41dB (WB)		
Modulation Type	Direct FM		
Deviation Limiting	Adjustable up to +/- 5kHz		
Audio Response Bandwidth	300Hz to 2.55kHz		
Audio Response	Within +1 / -3dB of 6dB / Octave Pre-emphasis		
Distortion (EIA)	<5% @ 1kHz, 60% Deviation		

Table B-9: Tait Orca 5000 450-530MHz. Conventional and Trunked Radio Specifications

Model	TOP-I2x10*	TOP-I2y20**	
Frequency Range	450-530MHz		
Channel Spacing	12.5 / 20 / 25 kHz		
Frequency Increments	5 or 6.25kHz		
IF Bandwidth	Universal Bandwidth (UB) 10kHz		
Frequency Stability	+/-2.5ppm (-30 to +60°C)		
Current Consumption (Receiver Squelched)	80mA	100mA	
Current Consumption (Standby with high economy duty cycle)	40mA	N/A	
Current Consumption (Receiver Rated Audio)	300mA		
Transmitter current	1.6A		
Size, incl. 1500mAh NiMH battery (WxHxD)	66 x 154 x 41mm		
Weight	Orca 5030	Orca 5035	Orca 5040
With TOPB200 1500mAh NiCd	525g	545g	550g
With TOPB700 1500mAh NiMH	510g	530g	535g
With TOPB500 2000mAh NiMH	550g	570g	575g
Receiver*			
Measurements as per:	ETS 300-086		
Intermediate frequencies	45.1MHz and 455kHz		
Sensitivity 12dB SINAD	< -119dBm		
Sensitivity 20dB SINAD	< -114dBm		
Fixed Squelch Sensitivity	12dB SINAD or 16dB SINAD Nominal		
Selectivity	66dB (NB), 72dB (WB)		
Spurious Response	70dB		
Intermodulation	65dB		
Blocking	94dB		
Ultimate Signal to Noise Ratio (EIA)	34dB (NB), 40dB (WB)		
Audio Response	Within +1 / -3dB of 6dB / Octave De-emphasis		
Distortion (EIA)	<5% @ 1kHz, 60% Deviation		
Rated Audio Output	> 500mW		
Transmitter*			
Measurements as per:	ETS 300-086		
Power Output (Low/Mid/High)	1 / 2.5 / 4W		
Spurious Emissions (Cond. & Rad.)	< -36dBm (0-1GHz), < -30dBm (1-4GHz)		
Hum and Noise (EIA)	34dB (NB), 40dB (WB)		
Modulation Type	Direct FM		
Deviation Limiting	Adjustable up to +/- 5kHz		
Audio Response Bandwidth	300Hz to 2.55kHz		
Audio Response	Within +1 / -3dB of 6dB / Octave Pre-emphasis		
Distortion	<5% @ 1kHz, 60% Deviation		

Table B-10: Tait Orca 5000 806-870MHz. Conventional and Trunked Radio Specifications

Model	TOP-J2x10*	TOP-J2y20**	
Frequency Range	806-870MHz Transmit 851-870MHz Receive		
Channel Spacing	12.5 / 20 / 25 kHz		
Frequency Increments	5 or 6.25kHz		
IF Bandwidth	Universal Bandwidth (UB) 10kHz		
Frequency Stability	+/-1.5ppm (-30 to +60°C)		
Current Consumption (Receiver Squelched)	85 mA	100mA	
Current Consumption (Standby with high economy duty cycle)	40 mA	N/A	
Current Consumption (Receiver Rated Audio)	300mA		
Transmitter current	1.3A		
Size, incl. 1500mAh NiMH battery (WxHxD)	66 x 154 x 41mm		
Weight	Orca 5030	Orca 5035	Orca 5040
With TOPB200 1500mAh NiCd	525g	545g	550g
With TOPB700 1500mAh NiMH	510g	530g	535g
With TOPB500 2000mAh NiMH	550g	570g	575g
Receiver*			
Measurements as per:	EIA		
Intermediate frequencies	45.1MHz and 455kHz		
Sensitivity 12dB SINAD	< 0.25µV (-119dBm)		
Sensitivity 20dB SINAD	< 0.40 µV (-114dBm)		
Fixed Squelch Sensitivity	12dB SINAD or 16dB SINAD Nominal		
Selectivity	60dB (NB), 65dB (WB)		
Spurious Response	65dB		
Intermodulation	65dB		
Hum and Noise	32dB (NB), 38dB (WB)		
Audio Response	Within +1 / -3dB of 6dB / Octave De-emphasis		
Rated Audio Output	> 500mW		
Transmitter*			
Measurements as per:	EIA		
Power Output (Low/Mid/High)	1 / 2 / 3W		
Spurious Emissions (Cond. & Rad.)	- 65dB		
Hum and Noise	38dB (NB), 42dB (WB)		
Modulation Type	Direct FM		
Deviation Limiting	Adjustable up to +/- 5kHz		
Audio Response Bandwidth	300Hz to 2.55kHz		
Audio Response	Within +1 / -3dB of 6dB / Octave Pre-emphasis		
Distortion	<5% @ 1kHz, 60% Deviation		

Table B-11: Tait Orca 5000 896-941MHz. Conventional and Trunked Radio Specifications

Model	TOP-K2x10*	TOP-K2y20**	
Frequency Range	896-941MHz Transmit 935-941MHz Receive		
Channel Spacing	12.5 / 20 / 25 kHz		
Frequency Increments	5 or 6.25kHz		
IF Bandwidth	Universal Bandwidth (UB) 10kHz		
Frequency Stability	+/-1.5ppm (-30 to +60°C)		
Current Consumption (Receiver Squelched)	85 mA	100mA	
Current Consumption (Standby with high economy duty cycle)	40 mA	N/A	
Current Consumption (Receiver Rated Audio)	300mA		
Transmitter current	1.3A		
Size, incl. 1500mAh NiMH battery (WxHxD)	66 x 154 x 41mm		
Weight	Orca 5030	Orca 5035	Orca 5040
With TOPB200 1500mAh NiCd	525g	545g	550g
With TOPB700 1500mAh NiMH	510g	530g	535g
With TOPB500 2000mAh NiMH	550g	570g	575g
Receiver*			
Measurements as per:	EIA		
Intermediate frequencies	45.1MHz and 455kHz		
Sensitivity 12dB SINAD	<0.25µV (-119dBm)		
Sensitivity 20dB SINAD	<0.40µV (-114dBm)		
Fixed Squelch Sensitivity	12dB SINAD or 16dB SINAD Nominal		
Selectivity	60dB (NB), 65dB (WB)		
Spurious Response	70dB		
Intermodulation	65dB		
Hum and Noise	32dB (NB), 38dB (WB)		
Audio Response	Within +1 / -3dB of 6dB / Octave De-emphasis		
Rated Audio Output	> 500mW		
Transmitter*			
Measurements as per:	EIA		
Power Output (Low/Mid/High)	1 / 2 / 3W		
Spurious Emissions (Cond. & Rad.)	-65dB		
Hum and Noise (EIA)	38dB (NB), 42dB (WB)		
Modulation Type	Direct FM		
Deviation Limiting	Adjustable up to +/- 5kHz		
Audio Response Bandwidth	300Hz to 2.55kHz		
Audio Response	Within +1 / -3dB of 6dB / Octave Pre-emphasis		
Distortion	<5% @ 1kHz, 60% Deviation		

Circuit descriptions

Circuit interface diagrams for the Tait Orca handportable radios are shown in Figure B-1 (TOP B, C, G, H, I, J and K) and Figure B-2 (TOP A only).

The Tait Orca handportable has been designed to be totally electronically tuned using the *Calibration System for Tait Orca Radios*. The titles of tests referred to below are tests available in the calibration system, e.g. **Power Level** test refers to the **Power Level** screen in the calibration system. Consult the calibration system *User's Manual* for more information on specific calibration tests.

Transmitter

The RF power amplifier amplifies transmit RF from the VCO to the output power level (3W 800/900 MHz, 4W UHF/5W VHF). The PA output is fed to the PIN switch, which provides isolation between the transmit and receive paths.

An LPF follows the PIN switch and provides attenuation of unwanted high frequency signals.

Following the LPF, the signal is fed to the antenna.

The output power level is controlled by the microprocessor and associated circuitry, and is initially set by calibrating the radio (**Power Level** test).

Transmit (Tx) audio

Tx audio from the microphone is processed by the DSP and associated circuitry into two modulation signals, one required by the TCXO in the synthesiser and the other by the VCO.

A digital pot is used to set the overall deviation and modulation balance; these are controlled by calibration (**Maximum Deviation** and **Modulation Balance** tests).

Receiver

RF from the antenna is fed via the LPF and PIN switch into the receiver. The RF passes through the front end tuning circuit, which rejects unwanted frequencies. The front end is electronically tuned, and the front end tuning voltage that sets the centre of the bandpass filter is determined during calibration (**Front End Tuning** test).

The output of the front end tuning stage is fed to the first mixer, and the VCO provides the local oscillator input. The output of the mixer is at the first IF frequency (45.1 MHz UHF/21.4 MHz VHF).

The IF signal passes through two crystal filters, separated by the IF amplifier.

In the Demod IC, the signal passes through the second mixer, producing the second IF (455 kHz). The second IF passes through a ceramic band pass filter and IF amp, which are external to the IC. The second IF is then fed back into the Demod IC for another amplification stage, then through another ceramic band pass filter. The final stage is the phase lock loop (PLL) discriminator in the Demod IC, which produces detected audio.

A squelch detect circuit detects high frequency audio noise and compares it with a threshold, which is set up by the microprocessor and can be set during calibration (**Squelch Thresholds** test).

The RSSI output of the detector circuit provides an analogue indication of the received signal strength. RSSI thresholds are set during calibration (**RSSI Thresholds** test).

TOP-x2xxx radios have 9 kHz ceramic filters and can operate on wide / medium or narrow band (refer to page 16 for explanation), whereas TOP-x1xxx radios have 20kHz ceramic filters and can operate on wide or medium

band. This is programmable on a per channel basis.

Receive (Rx) audio

The detected audio is processed by the DSP, amplified and fed to an internal speaker, whose selection is controlled by a line from the microprocessor. The speaker output is always available on the accessory connector, to drive an external speaker.

The unprocessed audio from the output of the Demod IC (RX-DET-AF) is also available at the accessory connector.

All signalling, such as Selcall, CTCSS, DCS, DTMF and FFSK, and all confidence tones are generated by the DSP.

The DSP operates in half-duplex mode. That is, its CODEC input and output is switched between the Tx and Rx audio paths, according to whether the radio is transmitting or receiving.

Synthesiser and VCO

The synthesiser receives channel frequency information from the microprocessor. It then sets the VCO to the required frequency and maintains its stability using a phase-locked loop. There are one or two VCOs, depending on the radio type. Some bands have one VCO that covers the whole tuning range of the radio plus the IF offset, with its output switched to Tx or Rx. Other bands have a dedicated Tx and Rx VCO.

A lock detect output from the synthesiser (LCK-DET) indicates whether the VCO is producing the correct frequency (the radio is in lock). If the frequency is incorrect, the lock detect status prevents the transmitter from operating, and informs the control microprocessor.

The reference frequency for the synthesiser is provided by the TCXO (temperature compensated crystal oscillator), which is initially set on frequency using a DC voltage at calibration (**TCXO Calibration** test).

Power supplies

+5V-DIG

The +5V-DIG supply provides regulated 5 V to the microprocessor and its associated circuitry. It is controlled by the on/off switch and a line from the microprocessor.

It provides 5 V to all circuitry that requires power when the radio is in economy mode.

+5V-AN

The +5V-AN supply provides the power to all circuitry that requires 5 V when the radio is not in economy mode, mainly all analog circuitry in the receiver, synthesiser and audio modules. It is controlled by a line from the microprocessor and is a regulated supply.

+5V-TX

The +5V TX supply provides power for the exciter stage of the transmitter when the radio is in transmit mode. It is controlled by a line from the microprocessor and is a regulated supply.

+7V5-BATT

The +7V5-BATT supply is the unregulated voltage supplied to the radio from the battery.

+7V5-ACC

The +7V5-ACC supply is supplied to the accessory connector from the battery through a switch and with some current limiting.

+7V5-SW

The +7V5-SW switched supply is unregulated voltage supplied to the radio from the battery through a switch.

+14V

The +14V regulated supply provides the 14 V required by the loop filter in the synthesiser.

A switch mode regulator produces this voltage from the +7V5-SW and +5V-AN supplies.

+4V3-DEC

The +4V3V-DEC supply is derived from the +5V-AN voltage. It is used to power the transmit and receive VCOs in conjunction with the transmit control line from the processor. It also provides the loop filter reference in the synthesiser.

Accessory connector interface

The accessory connector interface is described in *Part F: Interfacing non-Tait accessories*.

Implications of universal band versus wideband IF filtering

The two physical variants of bandwidth in the Tait Orca handportable series differ in the bandwidth of the second IF ceramic filtering, and in the squelch circuit design. TOP-x2xxx radios are universal band and TOP-x1xxx radios are wideband.

The IF filtering for the universal band is designed in a way such that it functionally meets specifications for both narrowband as well as wideband systems.

The Deviation and Receive Audio Processing are selectable per channel, which enables the radio to inter-operate between narrowband and wideband channels.

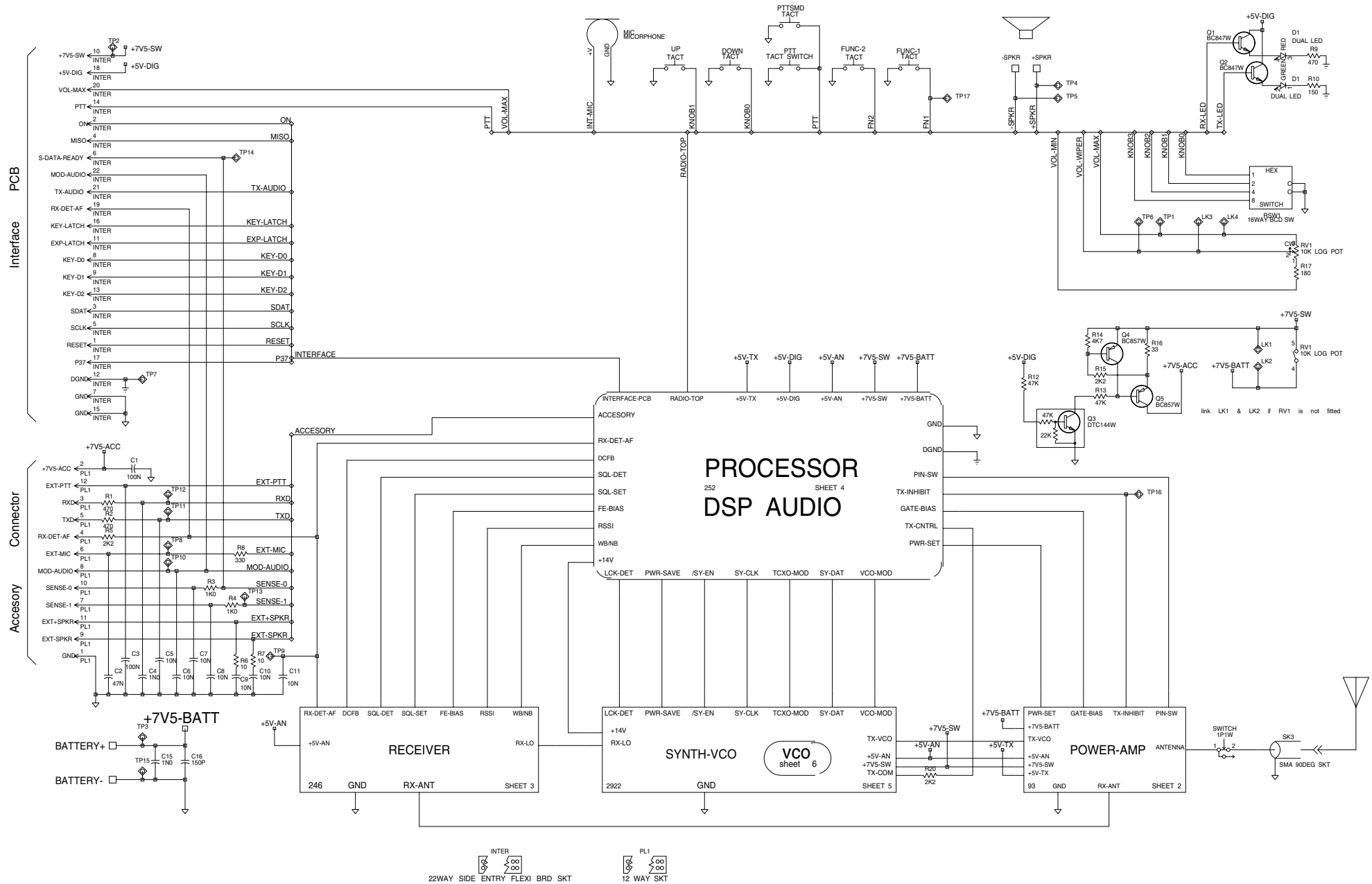


Figure B-1: Circuit interface diagram for Tait Orca handportable radios (TOP B, C, G, H, I, J and K)

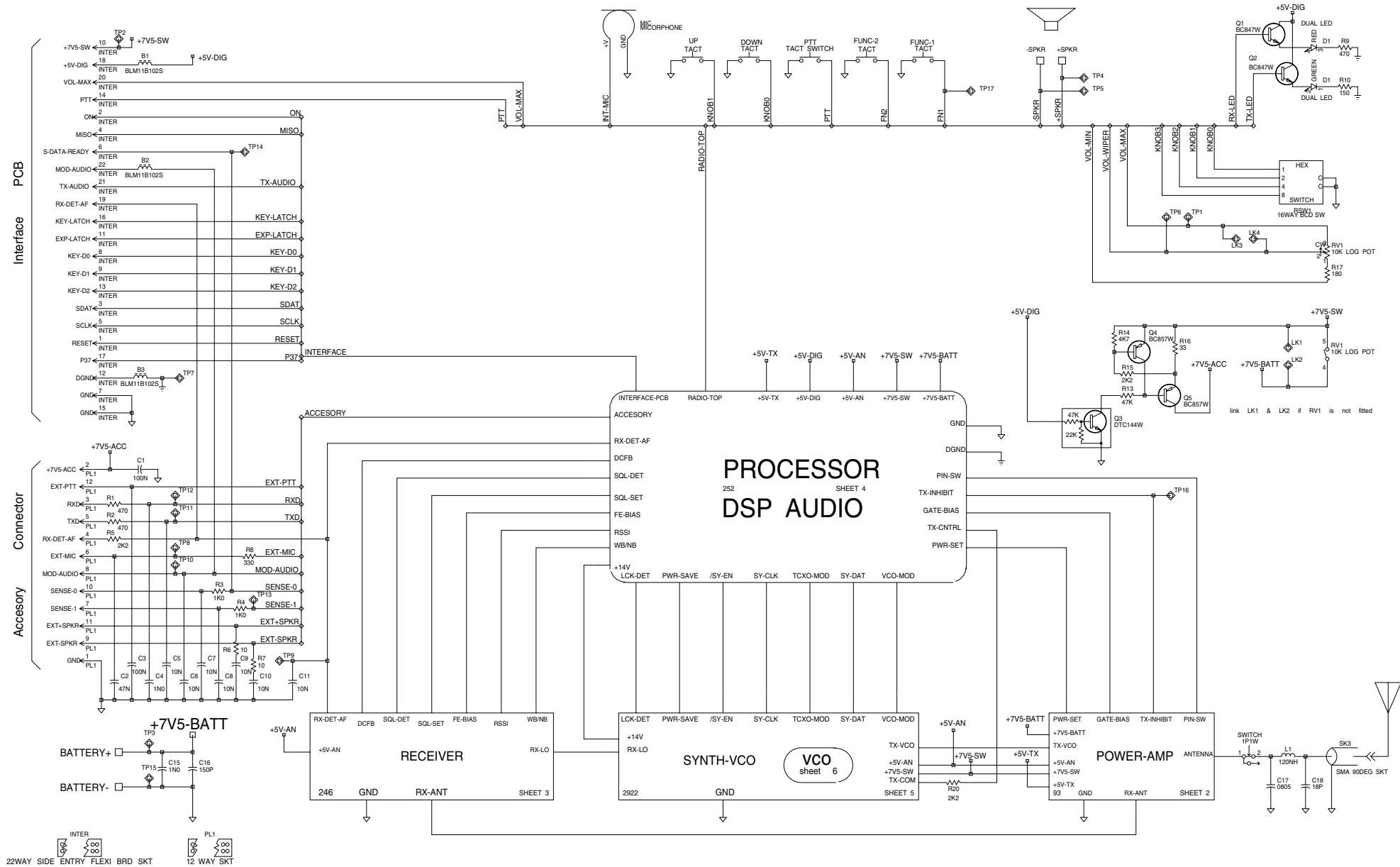


Figure B-2: Circuit interface diagram for Tait Orca handportable radios (TOP A only)

PART C Diagnostics and fault finding

This part provides information on diagnosing faults in Tait Orca 5000 handportables.

The information in the fault finding charts should be used in combination with the test facilities, and it may also be helpful to examine the radio programming software data using the programming system for Tait Orca 5000 conventional or trunked radios.

Contents

Test facilities	C-3
Error codes	C-3
Test commands	C-5
Calculating the parameters required for test command 101	C-7
Fault finding charts	C-8
Radio cannot be switched on	C-9
Cannot change channel.....	C-10
No serial communication	C-11
Receive faults	C-12
Cannot transmit	C-13
No transmit audio	C-14

Test facilities

Standard test facilities provide a way of testing the radio's functions independently of normal radio operation. A series of test commands can be sent to a radio in two ways:

- using the TOP calibration application; or
- using a terminal program.

See the *Tait Orca Calibration Application: User's Manual* or the program's online help for information on using the calibration system to send test commands to a radio.

When using a terminal program, use the following settings:

- baud rate: 9600
- number of data bits: 8
- number of stop bits: 1
- parity: none
- flow control: none.

To put the radio into computer-controlled test mode, send ^ (**Shift-6**), wait for a return prompt (v), then immediately send % (**Shift-5**). A (-) appears. You can then begin sending test commands to the radio.

A full list of test commands is given in Table C-1. Table C-2 shows how to calculate the parameters necessary for test command 101.

If using the calibration system to send test commands to a radio, the parameters for command 101 are automatically calculated from the frequency value entered.

Error codes

The errors you may receive while the radio is in test mode are outlined below. If the radio must be returned for repair (e.g. the DSP needs to be replaced), contact your Tait dealer for more information.

{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 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. All the radio to cool down before continuing.

{X36}

Temperature is above the T2 threshold and turn off of the transmitter is impending. 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.

Table C-1: Test commands

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	
	Read temperature level	47	Returns: 0 to 255	
	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	
	Disable internal speaker	74		
	Enable internal speaker	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	
	(continued on next page)	Select country squelch	89	None

Table C-1: Test commands (continued)

Function	Description	CCTM code	Parameters
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)
	Read radio hardware version number	133	Returns: 4 digit number
Synth	Load absolute synth frequency	101	ttttt T rrrrr R F (see Table C-2)
	Load synth reference divider	102	8 to 16383
	Load synth prescaler	103	0 = 64/65 1 = 128/129
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
	Set DTMF modulation	124	0 to 32767
	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
Select bottom microphone	138	None	
Select top microphone	139	None	
Disable both microphones	140	None	
Enable both microphones	141	None	

Table C-2: Calculating the parameters required for test command 101

Calculating parameters for test command 101

Enter the parameters in the format ttttt T rrrrr R F

- ttttt represents the transmit frequency
See Example 1
- T and R represent channel spacing
0 = 5 kHz
1 = 6.25 kHz
- rrrrr 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: ttttt and rrrrr may be up to 6 digits long.

Example 1: Calculating ttttt for an H band radio

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

Example 2: Calculating rrrrr for an H band radio

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

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.

Fault finding charts

The fault finding charts in Figures C-1 to C-6 address the faults you are most likely to find.

If you experience other faults that do not fall into these categories, contact your Tait dealer.

They are:

- radio cannot be switched on;
- cannot change channel;
- no serial communications;
- receive faults;
- cannot transmit; and
- no transmit audio.

Figure C-1: Fault finding – Radio cannot be switched on

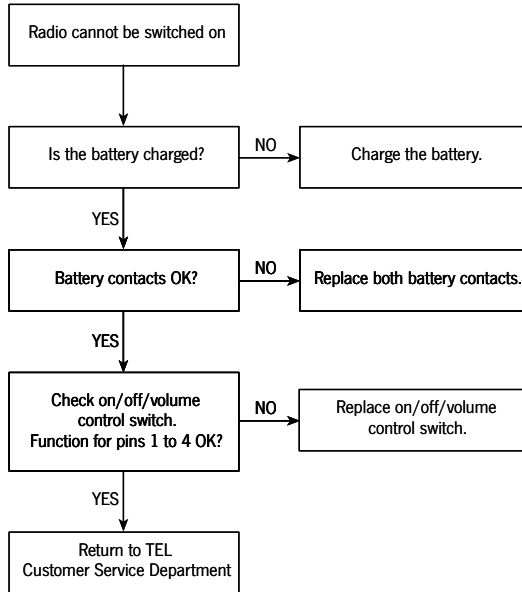
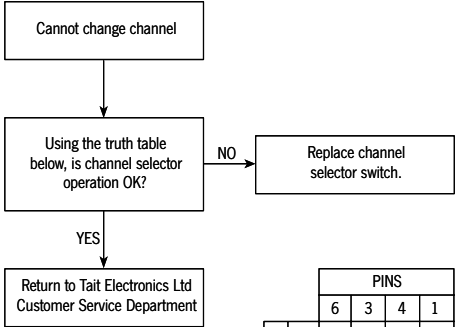


Figure C-2: Fault finding – Cannot change channel



		PINS			
		6	3	4	1
CHANNELS	2	0	0	0	1
	3	0	0	1	0
	5	0	1	0	0
	9	1	0	0	0

1 = S/C to GND
0 = O/C to GND

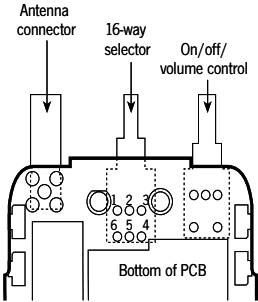


Figure C-3: Fault finding – No serial communication

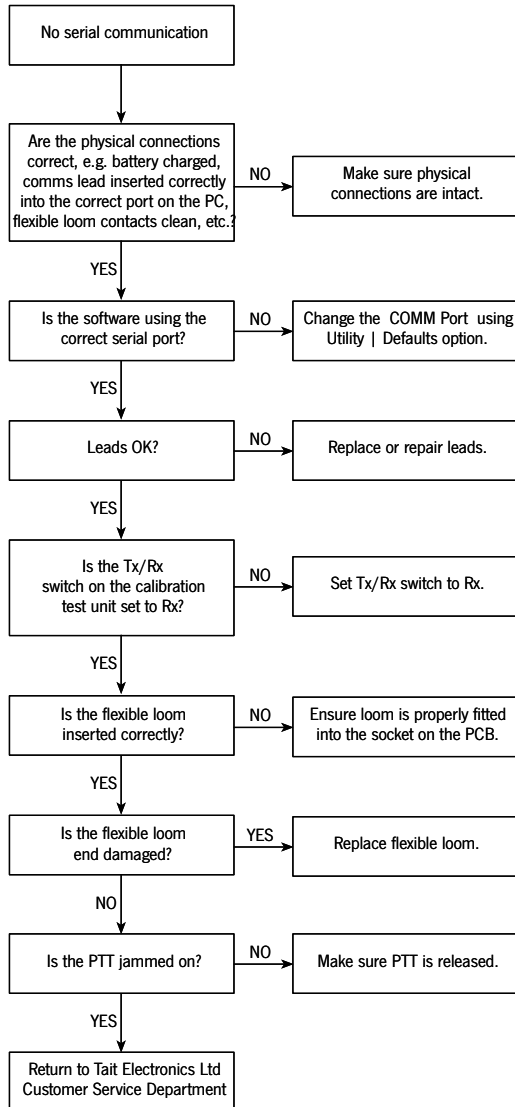


Figure C-4: Fault finding – Receive faults

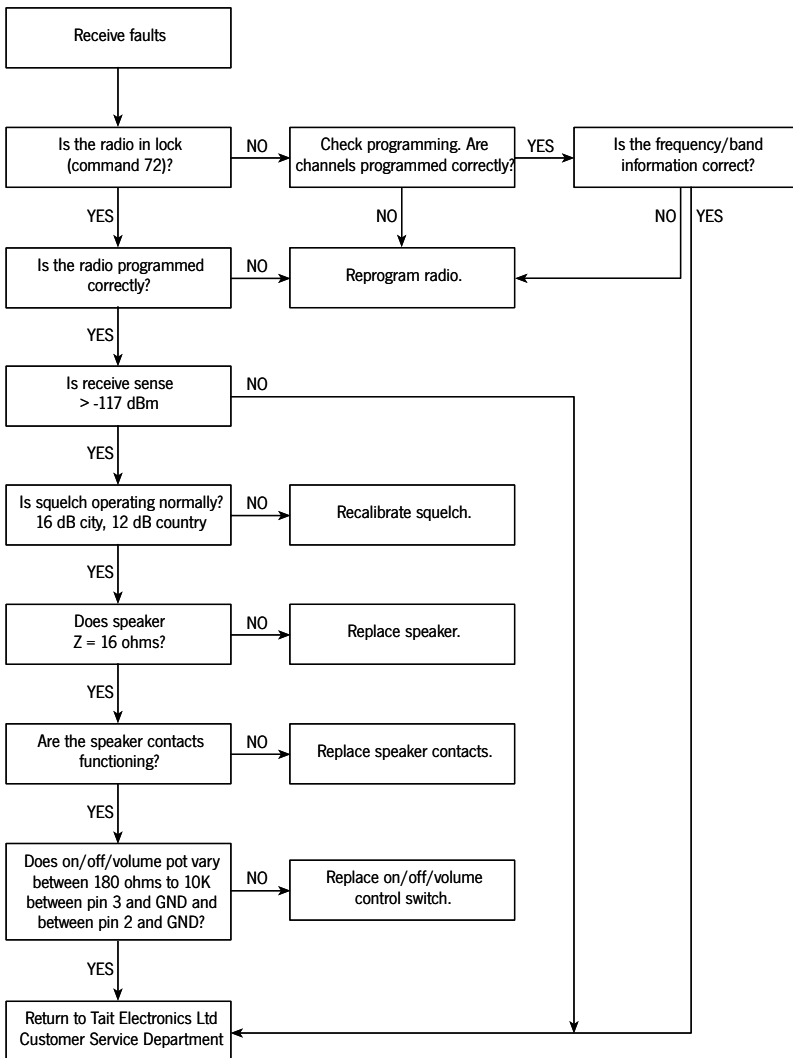


Figure C-5: Fault finding – Cannot transmit

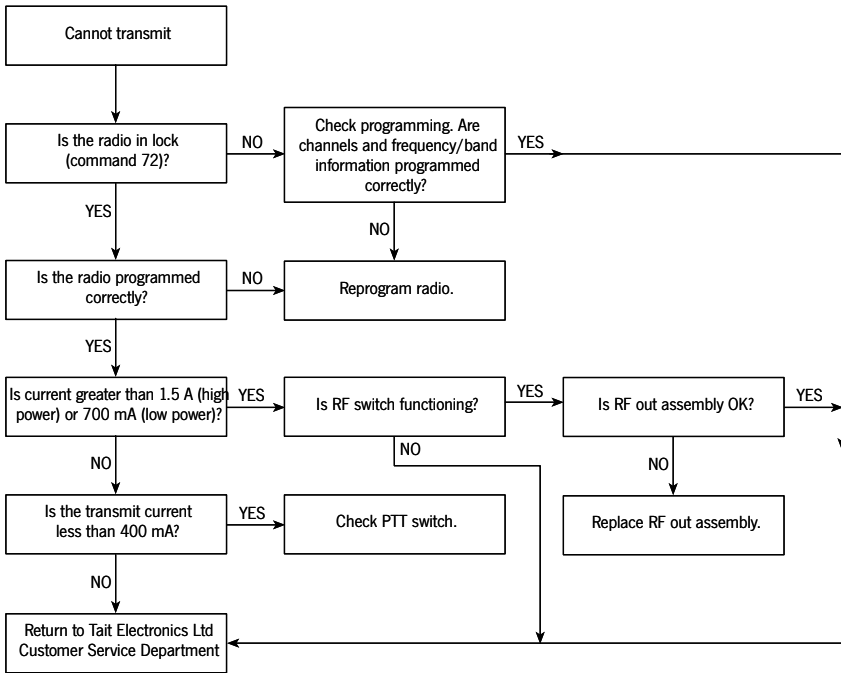


Figure C-6: Fault finding – No transmit audio

