

TAIT ELECTRONICS

**FCC ID:CASTEL0018
TAIT ORCA TOP-B2110**

EXHIBIT 5

User guide and Service Manual



orca

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excellence in radio communications

user's manual



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

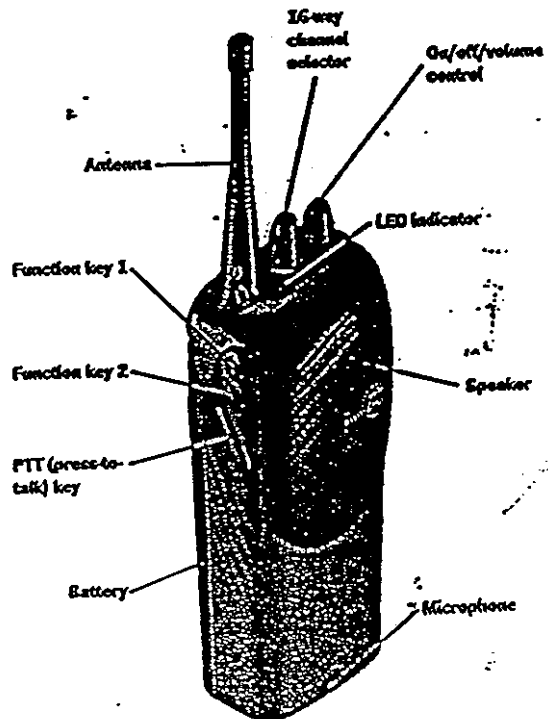
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Congratulations on your purchase of the Tait Orca handportable two-way radio.



Compact, rugged and reliable, your Tait Orca radio offers the latest state-of-the-art technology. Your radio is microprocessor controlled so that it can be customised to suit your communication needs. If you are unsure which of the features described in this manual are available on your radio, consult your system manager or the person who programmed your radio.

The custom features programmed for your radio may be listed on the custom settings page on the inside back cover of this manual.



Safety warnings

- Do not hold the radio with its antenna close to or touching any part of your body, especially your face and eyes, when transmitting.
- Switch the radio off at petrol filling stations.
- Switch the radio off in the vicinity of explosive devices, such as at a quarry that uses blasting techniques.
- Use of a handheld microphone or radio while driving is not permitted in some countries. Check the vehicle regulations in the area where you are driving.
- Use only Tait Orca battery chargers to charge your radio battery.
- If using the radio with an earphone or headset, avoid using unnecessarily high volume levels.
- Do not immerse your Tait Orca radio in water.



Getting started

When you receive your Tait Orca handportable radio, make sure all items you ordered are included. Typically, you should receive the following:

- Tait Orca handportable radio unit
- Battery pack
- Antenna
- Belt clip
- Charger
- Plug pack
- *User's Manual*

If any parts are damaged or missing, report this to your local Tait dealer immediately.

Installing the antenna

Before using the radio, connect the antenna as illustrated. The antenna should screw easily into the socket at the top of the radio.



Installing and removing the battery pack

Before the radio is first used, the battery pack must be fully charged, and putting the battery through a conditioning cycle will maximise the battery's initial capacity. If using the fast charger or multi-charger, the battery will fully charge within two hours. If using the trickle charger, the battery will fully charge within 16 hours. The trickle charger is not recommended for NiMH battery packs. For information on charging and conditioning the battery, see pages 19 to 22.

To fit the battery pack to the radio, insert the bottom edge of the battery pack into the two slots at the back of the

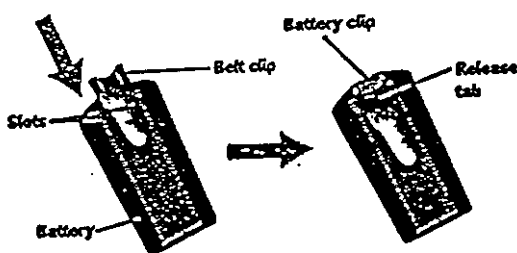
Note: The battery pack must be fully charged before you first use the radio. See pages 19 to 22 for charging instructions.

radio. Push the battery pack towards the radio. It should snap into place.

To remove the pack, push the battery catch down and from the sides, pull the battery away from the radio.

Installing and removing the belt clip

Slide the belt clip into the two slots on the top of the battery. Push down until the clip snaps into place.



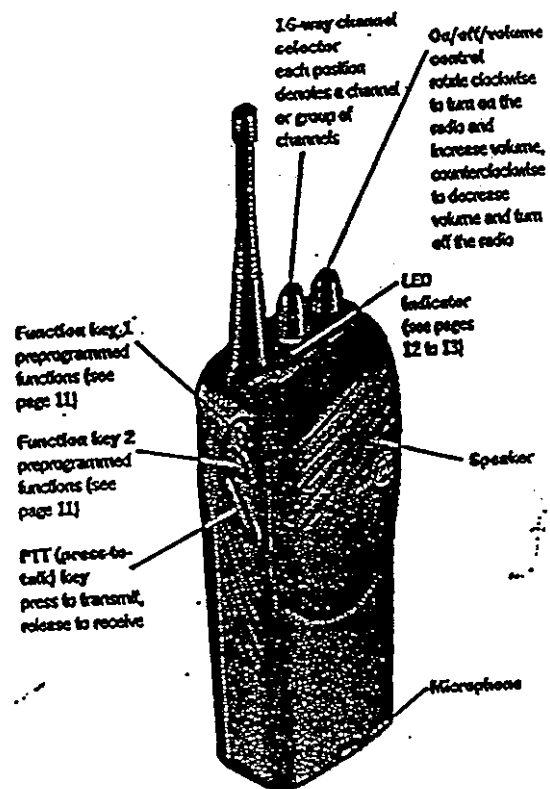
The belt clip has been designed to avoid accidental removal. However, it can be replaced if required.

To remove the belt clip, insert the end of a flat-bladed object (e.g. a butter knife) under the edge of the release tab without forcing it. Gently lift the release tab up, then slide the belt clip away from the battery.

Should the small battery clip come loose while removing the belt clip, it can easily be refitted by sliding it into the slot at the top of the battery until it snaps into place.

Basic operation

Your Tait Orca handportable is preprogrammed to suit your communication needs. If you are unsure which of the features described in this manual are available on your radio, consult your system manager or the person who programmed your radio.



Turning the radio on/off and controlling volume
Rotating the on/off/volume control clockwise turns on the radio and increases volume. Rotating the control counter-clockwise decreases volume and turns off the radio.

To preserve battery life, it is recommended that you turn off the radio when it is unattended.

Selecting a channel

Each position on the 16-way channel selector can be programmed for a channel or group of channels. If the channel selected is busy, the LED will glow green. Wait until the channel is free before transmitting.

Each channel can be programmed with signalling that segregates your group from other users. There are three types of signalling: CTCSS, DCS and Selcall. Each channel can be programmed with no signalling, CTCSS or DCS and/or Selcall.

CTCSS (continuous tone controlled subaudible signalling) and DCS (digitally coded squelch) signalling use subaudible tones to isolate your calls so you only talk with other members of your group, even though the channel may be used by other groups. Selcall (selective calling) uses audible tones to isolate your calls and direct calls to specific individuals within a group.

When CTCSS, DCS and/or Selcall are programmed, your radio will only unmute when activity on a channel is valid; that is, when it matches your group's signalling.

Scanning and voting

When a group of channels is selected, the radio will scan through the group looking for activity. The LED will glow amber while the radio is scanning.

When a busy channel is detected and the signalling is valid, the LED will flash amber and the radio will stop on that channel. You will be able to hear the transmission. Scanning resumes when the channel is no longer busy or the signalling is no longer valid.

One or two priority channels may also be set. These channels are scanned more often than other channels and are scanned periodically when a non-priority channel is busy.

Voting works the same way as scanning, except the group's member channels carry the same traffic and the radio searches for and stops on the channel with the strongest signal.

Monitor

Monitor lets you override the signalling mutes that mean you only hear traffic intended for you and your group. If one of the function keys is programmed for monitor, pressing the key turns on monitor.

Once activated, monitor will automatically turn off after a preprogrammed time period and can also be reset by your dispatcher or when some types of calls are received. You can also turn off monitor by pressing the function key.

Monitor can be preprogrammed to override both the CTCSS/DCS mute and the Selcall mute or only the Selcall mute.

Erasure delete
If a channel is busy, you can temporarily delete it from the scanning regime if one of the function key settings is programmed for erasure delete. Pressing the assigned function key deletes the currently held channel from the regime. When the scan regime is next selected, the deleted channel will again be part of the group of channels.

Channel selection
If no channel or group is programmed for a particular position, the radio will give a series of beeps and the LED will flash red and green (medium). If you change to another position that has no channel or group programmed, the indicator will continue to flash red and green, but the radio will not beep again.

If a particular channel is programmed with Selcall mute, you will only be able to hear traffic that matches your Selcall identity and you will not be able to make calls using the PTT key. Turn on monitor to hear all traffic and make calls using the PTT key.

Your radio may be programmed so that monitor is activated when your radio is turned on or when you send some types of calls.

Squelch override

Squelch allows reception of a call when the signal is above a factory-set threshold so that only intelligible signals are made audible.

If a function key is programmed for squelch override, you can turn off squelch, which can sometimes improve reception in marginal areas. Turn squelch back on by pressing the assigned function key once again.

Squelch override cannot be activated when a scan group is selected, and will automatically be turned off when you change to a scan group.







Programmable function key settings*

When programmed for	Pressing the assigned function key
audible indicators	turns audible indicators on and off
channel's DTMF preset call	sends the DTMF call assigned to the current channel
economy mode	turns economy mode on and off
emergency	activates emergency mode
handset mode	turns handset mode on and off
low power transmit	changes the transmit power from mid or high to low; pressing the key again returns the transmit power to the programmed level
monitor	turns monitor on and off so the user can hear all traffic on a channel
nuisance delete	temporarily deletes the current channel from the scanning regime
one touch preset call	sends a preset Selcall call or DTMF call
repeater access tone	sends the preset Selcall call assigned to the current channel
repeater talk around	sends the repeater access tone to key up the transmitter
squelch override	allows the user to bypass normal repeater operation and communicate directly with another radio; pressing the key again or changing to another channel turns off repeater talk around
volume control	turns the squelch override on and off so the user can hear all activity on a channel, including noise
	controls volume in handset mode

*Note that some features are not permitted in some countries.













Radio indicators

LED:

-  steady red
-  steady green
-  steady amber
-  flashing red
-  flashing green
-  flashing amber



















Sound:

- pitch:  high  medium  low
- duration:  short  long

	LED	Sound	Meaning
Start-up			You have just turned on the radio. The power-up sequence is complete.
		 twice ¹	You have just turned on the radio or changed channels. No channel is set for the currently selected position. Select another channel ² .
Transmitting and receiving			The radio is transmitting.
			A call has been received.
			A call has been received but not answered.
			Activity has been detected on a channel.
			You cannot transmit because the channel is busy or transmission is inhibited by Selcall audio. Wait until it is free to transmit or use a channel that is clear.
			The transmit timer is about to expire. In 30 seconds, the radio will stop transmitting. Release the PTT key before transmitting again.
		 for 1.5 seconds	The radio has stopped transmitting because the transmit timer has expired. Release the PTT key before transmitting again.

Notes:

- 1 If you change to another position that has no channel or group programmed, the LED will continue to flash red and green, but the radio will not beep again.
- 2 If no channels work, your radio may be faulty; contact your Talk dealer.
- 3 The ringing tone is preprogrammed. The radio will give different ringing tones when different types of calls are received.

	LED	Sound	Meaning
Scanning			The radio is scanning a group of channels for activity or greatest signal strength.
			The radio has detected activity on one of a group of channels being scanned.
Functions			A function has been turned on.
			A function has been turned off.
			Repeater talk around is active.
			Low power transmit is active.
			Economy mode is active.
			Handset mode is active.
			Squelch override has been turned on.
			Squelch override has been turned off.
			Monitor or squelch override is active.
			The battery is low. Recharge or replace the battery as soon as possible.
Warnings		 every 5 seconds	The battery is low and the radio has stopped operating. Turn off the radio and recharge or replace the battery.
			The temperature is too high. You should stop transmitting and allow the radio to cool down.
			The radio is stunned. Contact your dispatcher.
		 twice ¹	No channel is set for the currently selected position. Select another channel ² .

Sending and receiving calls

You can make two types of calls on your Tait Orca handportable radio: PTT calls and function key calls.

PTT calls

For PTT (press-to-talk) calls, press the PTT key to initiate the call. If the channel is busy, you will not normally be able to transmit; if so, the radio will sound a low-pitched warning beep if you try to transmit. You may not be able to hear the activity, but the LED indicator will glow green. You can turn on monitor to listen for channel activity.

When the channel is clear, hold down the PTT key and speak clearly into the radio. Identify yourself and the party you are calling using the call signs you have been assigned. The indicator will glow red while you are transmitting. Release the PTT key when you have finished talking.

Your radio will remain quiet until there is valid activity on the channel your radio is currently on. When you hear your own call sign, respond promptly by pressing the PTT key and replying.

If Selcall mute is programmed for a particular channel, you will not be able to make PTT calls on that channel until monitor is turned on and the channel is clear.

Function key calls

A range of preset calls can be programmed for your Tait Orca handportable radio. If programmed, these calls will be assigned to one of the function key settings.

Selcall calls

Selcall (selective calling) allows the radio to direct calls to certain individuals or groups within a channel. Each radio has a unique identity.

When a call is received that contains your identity, the radio will give a ringing tone* and the LED indicator will flash amber. To accept the call, press the PTT key and begin speaking.

Two preset Selcall calls can be assigned to each channel that has Selcall. These calls can be assigned to a function key. To make a preset Selcall call, change to the channel and press the function key.

Group calls

Selcall calls can also be directed to a group of users. When you receive a group call, the radio will give a ringing tone* and the LED indicator will flash amber. The caller will then start speaking.

One of the preset Selcall calls programmed for your radio may be a group call. To send the call, press the assigned function key.

Emergency call

The emergency call is a type of Selcall call. If programmed, the emergency call will be assigned to a function key.

Pressing the function key sends an emergency sequence to a preprogrammed party, usually your dispatcher. The radio can be reset to normal operation remotely by your dispatcher or by turning the radio off then on again.

Emergency operation
When in emergency mode, the radio cycles between receiving and transmitting so that your dispatcher can hear activity near the radio and to decide how to respond. All radio indicators remain unchanged.

*The ringing tone is preprogrammed. The radio will give different ringing tones when different types of calls are received.

Priority calls

Priority calls are another type of Selcall call. When you receive a priority call, your radio will give a ringing tone* and the LED will flash amber. Respond as you would to a normal Selcall call.

DTMF calls

DTMF (dual tone multiple frequency) is the tone-based system used in the world's telephone networks. If your system has access to the public switched telephone network or other networks that make use of DTMF tones, your radio can make a call to a telephone or send control codes to a remote device.

A preset DTMF call can be assigned to one of the function keys. Select the channel the DTMF call is assigned to and press the function key.

One-touch call

A one-touch call can be a Selcall call or a DTMF call. A one-touch call can be assigned to one of the function keys. To make the call, press the assigned function key.

It is not necessary to change channels to send a one-touch call.

*The ringing tone is preprogrammed. The radio will give different ringing tones when different types of calls are received.

Other features*

Normal and handset operation

The radio can be operated as a normal radio where you hold the radio with the microphone about 15 cm away from your mouth. It can also be operated like a telephone handset in noisy environments or when privacy is required.

Press the assigned function key to activate handset mode. Handset mode will automatically turn off after

a preprogrammed period of inactivity. You can also turn off handset mode by pressing the function key.

Volume override :

Your radio may be programmed so that the function keys are used as volume control keys while in handset mode.

Repeater talk around

If the repeater is busy or you are out of range of the repeater, you can communicate directly with another radio by using repeater talk around.

Repeater talk around can be assigned to a function key.

Press the function key to activate repeater talk around. Press the function key again or change to another channel to turn off repeater talk around.

Economy mode

Economy mode can extend battery life when there is little or no activity on the radio. When in economy mode, the radio will cycle between the receive state and a standby state once there has been no activity for a preprogrammed period. Receiving or sending a call returns the radio to the fully active state.

Economy mode may be permanently enabled or can be assigned to a function key. If assigned to a function key, pressing the key toggles economy mode on and off.

*Note that some features are not permitted in some countries.

Low power transmit

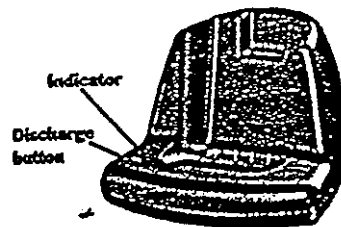
If you are using your radio in conditions where signal strength is high, you can extend battery life by transmitting at low power.

If assigned to a function key, pressing the key toggles low power transmit on and off.

Charging the battery

The battery will last about eight hours under normal usage, although this depends on the time spent transmitting and the type of battery used.

When the battery is low, the radio will emit a low-pitched beep every five seconds and the LED indicator will slowly flash red. Recharge or replace the battery as soon as possible. When the battery gets too low, the radio will emit a long low-pitched beep and stop operating. Turn off the radio immediately.



Your radio comes with a choice of three chargers: a desktop fast charger (left), a desktop trickle charger or a multi-charger. The trickle

charger does not have a discharge button, but is otherwise identical in appearance to the fast charger. The multi-charger is made up of six fast chargers and can be used on a desktop or mounted on a wall. Instructions for using the fast charger also apply to the multi-charger.

The battery can be recharged attached to the radio or as a separate unit.

Charging the battery using the fast charger

The fast charger will charge the battery when the radio is on, but the battery will charge faster if the radio is turned off.

Insert the battery/radio into the charger. The indicator will glow amber for three seconds, then red. If the indicator does not glow red, make sure the battery/radio is seated properly and the charger is properly plugged in. If the battery is too hot or too cold, the indicator will remain amber until the battery temperature is within the safe range for recharging (5°C to 40°C).

Charge times are:

- up to 1 1/2 hours for the standard NiCd battery;
- up to 2 hours for the heavy duty NiCd battery; and
- up to 2 1/2 hours for the NiMH battery.

Once the battery is fully charged, the indicator will change from red to green. Leaving the battery in the charger once it is fully charged does not damage the battery.

Fast charger indicators

Indicator	Meaning
steady red	battery charging
steady green	battery charged
steady amber	charge suspended until battery temperature is within correct range
flashing red	battery not seated properly in the charger, contacts dirty or battery faulty
flashing green	battery being discharged
flashing amber	battery below optimum capacity

Charging the battery using the trickle charger

The trickle charger is not recommended for NiMH battery packs as they can take up to 24 hours to charge fully and the overall lifetime of your battery may be reduced. Use a fast charger instead.

To charge the battery pack using the trickle charger, make sure the radio is turned off. Insert the battery/radio into the charger. Make sure the indicator on the charger glows red. If the indicator does not glow red, make sure the battery/radio is seated properly and the charger is properly plugged in. The indicator will remain red until the radio is removed from the charger.

The battery will be fully charged in about 16 hours. Leave the battery in the charger until you next need to use the

radio; however, leaving the battery in the charger for longer than 24 hours is not recommended.

Preserving battery life

- Condition your battery weekly using the Tait Orca fast charger.
- Avoid storing the battery for extended periods without first fully recharging it. For best results, store the battery detached from the radio.
- Avoid repeatedly recharging the battery when it has only had a small amount of use.
- Turn the radio off when it is unattended for long periods.
- Use only a Tait-recommended charger.
- Maintain an ambient temperature of between 5°C and 40°C during recharging. Optimum battery performance will be obtained between 15°C and 25°C.
- Do not allow the battery pack contacts to become short-circuited.

Conditioning the battery with the fast charger

For best performance, the battery should be conditioned weekly using the fast charger. Conditioning the battery takes about eight hours, depending on how much use it has had.

To condition the battery, turn off the radio. Insert the battery/radio into the fast charger then press the discharge button until the indicator flashes green. The indicator will flash green while the battery is being discharged. Once the battery is discharged, it will charge normally.

Conditioning/analysing the battery with the fast charger

Conditioning/analysing the battery with the fast charger will put the battery through a number of conditioning cycles and will check the battery's capacity on the last cycle.

To condition/analyse the battery, turn off the radio. Press and hold the discharge button while inserting the battery/radio. Continue holding the discharge button; the indicator will glow amber for three seconds, and then will flash green. When the indicator flashes green, release the discharge button.

The condition/analyse cycle will take approximately 16 hours.

Once charged, the charger's indicator will glow green if the battery is in good condition. The indicator will flash amber if the battery is below its optimum capacity; consult your Tait dealer.

Disposing of used nickel-cadmium batteries
NiCd batteries contain a small amount of the metal cadmium, which can produce potentially toxic waste if not disposed of properly. When no longer in use, contact your Tait dealer for recycling details.

Basic maintenance

Your Tait Orca handportable requires no regular maintenance other than ensuring that the battery has sufficient charge and that no damage has occurred to the antenna or the battery pack.

General care

- Wipe the battery contacts and accessory connector contacts with a dry lint-free cloth to remove any dirt, oil or grease.
- Use a cloth dampened with clean water to clean the radio's case, but do not immerse the radio in fluids.
- Do not allow the radio to come into contact with detergents, alcohol, aerosol sprays or petroleum-based products as they may permanently damage the case.
- Avoid high temperatures. If the radio overheats, it will cease to function. You will hear two short high-pitched beeps.

Troubleshooting

If you are experiencing difficulty operating your Tait Orca handportable, review basic operation (pages 7 to 13) and check the following items:

- Is the battery firmly attached to the back of your radio?
- Is the battery sufficiently charged?
- Is the battery charger working properly?
- Is the antenna damaged?

If all appears to be in order but your radio still fails to operate properly, consult your local Tait dealer for assistance.

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However, Tait Electronics Ltd reserves the right to update this manual without notice.

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PART **A** Introduction

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Servicing Tait Orca handportables

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

The manufacturing process does not allow direct servicing access to PCB components. Service repairs of Tait Orca handportables are limited to key mechanical and ancillary devices associated with the main PCB. These include:

- PTT keypad
- speaker
- antenna connector
- channel selector switch
- volume control switch
- microphone
- speaker contacts
- battery contacts
- PTT (internal)
- auxiliary flex
- RF out assembly.

The service repair of PCB-related faults is the sole responsibility of the Customer Services Division of Tait Mobile Radio. See your Tait dealer for information on returning faulty radios to the Customer Services Division.

What does this manual contain?

This manual provides the following:

- general information and specifications on the Tait Orca series of handportable radios;
- basic circuit descriptions;

- information on finding and servicing of non-PCB-related faults;
- information on Tait Orca charging accessories;
- information on interfacing accessories to Tait Orca handportables;
- instructions for uploading radio firmware; and
- a glossary of key terms.

What is included in the service kit?

The service kit contains:

- calibration test unit (TOPA-SV-004);
- radio calibration cable for connecting the radio to the calibration test unit (OPA-SV-007);
- RS232 to modular phone jack cable for connecting the calibration test unit to a PC (OPA-SV-012);
- DC service adaptor (OPA-SV-005);
- SMA N-type RF test lead for connecting to the radio's antenna connector (OPA-SV-006);
- T6 driver bit and 8 mm socket (OPA-SV-011);
- this manual;
- *User's Manual: Calibration System for Tait Orca Radios* (IPN 439-52000-xx);
- a 3.5-inch high density 1.44 MB calibration system install disk (??????); and
- a 3.5-inch high density 1.44 MB radio download program install disk (??????).

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

Important information

Basic servicing precautions

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

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.

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)*.

Screw head types

Pozidriv recess head screws and Torx recess head screws require the correct sized driver to achieve best performance.

The screws that secure the front panel to the chassis are M2*8 mm Pan Pozis screws, and the screw that holds the PCB to the chassis is an M2*5 mm Pan Pozis screw. Use a Pozis 1 driver set to 2 inch pounds to remove and replace them.

The screws that hold the speaker mounting bracket to the inside of the front panel are 1.8*5 mm Torx T6 head screws. Use a Torx T6 driver set to 2 inch pounds to remove and replace them.

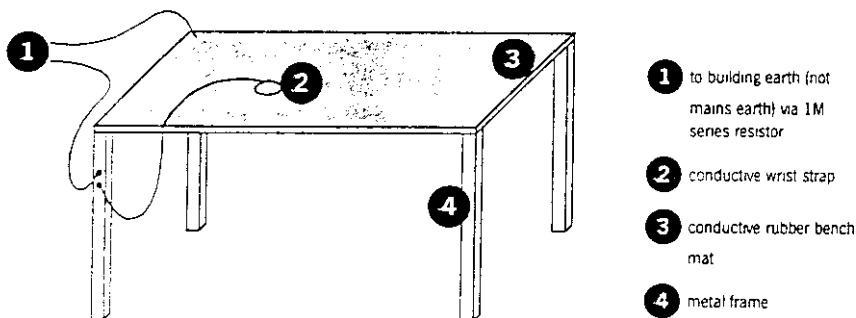
Programming

For information on programming Tait Orca handportable radios, refer to the *User's Manual: Programming System for Tait Orca Conventional Radios* (IPN 439-51100-xx) or the *User's Manual: Programming System for Tait Orca Trunked Radios* (IPN 439-51200-xx).

Calibrating

For information on calibrating Tait Orca handportable radios, refer to the *User's Manual: Calibration System for Tait Orca*

Figure A-1: Typical anti-static bench setup



The Tait Orca series of handportable radios

There are three Tait Orca series handportable radios available:

- the Orca Elan;
- the Orca Excel; and
- the Orca Eclipse.

At the time this manual was published, only the Orca Elan was available. Therefore, this manual does not include information specific to Orca Excel and Orca Eclipse handportable radios. When these radios are released, a revision of this manual will also be released.

Information on the Orca Elan that was not available at the time this manual went to print will be included with this manual as an insert (IPN 410-51000-xx).

Product codes

The digits in the Tait Orca product code provide information about the radio's model number and various hardware options,

according to the convention outlined in Figure A-2. 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 are available, contact your nearest Tait dealer.

Operating instructions

A user's manual is available for each radio. These are available under the following IPNs:

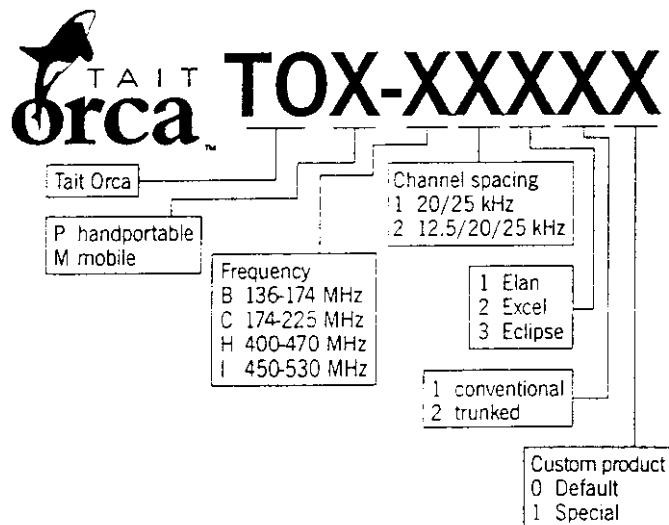
Conventional handportable

- Orca Elan user's manual (IPN 409-00110-0x)
- Orca Excel user's manual (IPN 409-?????-0x)
- Orca Eclipse user's manual (IPN 409-?????-0x)

Trunked handportable

- Orca Elan user's manual (IPN 409-?????-0x)
- Orca Excel user's manual (IPN 409-?????-0x)
- Orca Eclipse user's manual (IPN 409-?????-0x)

Figure A-2: The Tait Orca handportable naming convention



PART **B** Radio specifications and circuit descriptions

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Radio specifications

The performance figures outlined in Tables 1 to 3 are typical figures, unless otherwise stated, for equipment operating at standard room temperature. Where applicable, the test methods used to obtain the performance figures are those described in the European specifications ETS 300-086 (check this).

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

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Table B-2: Receiver performance

Sensitivity		Blocking	-13 dBm
12 dB SINAD	-117 dBm (minimum) -120 dBm (typical)	Spurious emissions	
20 dB psycho	-114 dBm (minimum)	to 1 GHz	-57 dBm (conducted and radiated)
Audio		1 to 4 GHz (136-470)	-47 dBm (conducted and radiated)
Minimum load impedance	13Ω	1 to 12.75 GHz (>470)	-47 dBm (conducted only)
Rated power	500 mW (1 kHz, 60% deviation into 16Ω)	Group delay variation	
Distortion	<5% (1 kHz, 60% deviation at rated power into 16Ω)		-50 μs (at detected audio output) bandwidth 300 Hz to 3 kHz
Response	-6 dB/oct * 1, -3 dB (cf 1 kHz) 300 - 2550	Hum and noise	
Selectivity			40 dB
to 225 MHz	70 dB (narrow) 75 dB (medium) 75 dB (wide)	RSSI	
UHF	56 dB (narrow) 72 dB (medium) 72 dB (wide)	range	-120 to -40 dBm
Spurious responses		slope	28.65 mV/dB (typical)
	70 dB	city	16 dB _{SINAD} fixed
		country	12 dB _{SINAD} fixed
Intermodulation			
	65 dB		

Circuit descriptions

Figure B-1 shows the circuit interface diagram for the Tait Orca handportable radio.

The Tait Orca handportable has been designed to be totally electronically tuned using the *Calibration System for Tait Orca Radios*. The titles in parentheses below refer to tests available 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 (4W UHF/5W VHF). The PA output is fed to the PIN switch, which provides isolation between the transmit and receive paths.

A 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 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 selects the desired frequency. The front end is tuned 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 a crystal filter and onto the IF amplifier. From there it goes through a second crystal filter and into the Demod IC.

In the Demod IC, the first IF passes through the second mixer, producing the second IF (455 kHz). The second IF passes through a 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 external 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 uses high frequency audio noise to control the threshold at which the radio mutes and unmutes. This threshold 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).

The receiver can operate on wide/medium or narrow band (TOP-x2xxx radios), or wide or medium band (TOP-x1xxx radios), which is programmable on a per channel basis.

ACCESSORY CONNECTOR

INTERFACE PCB

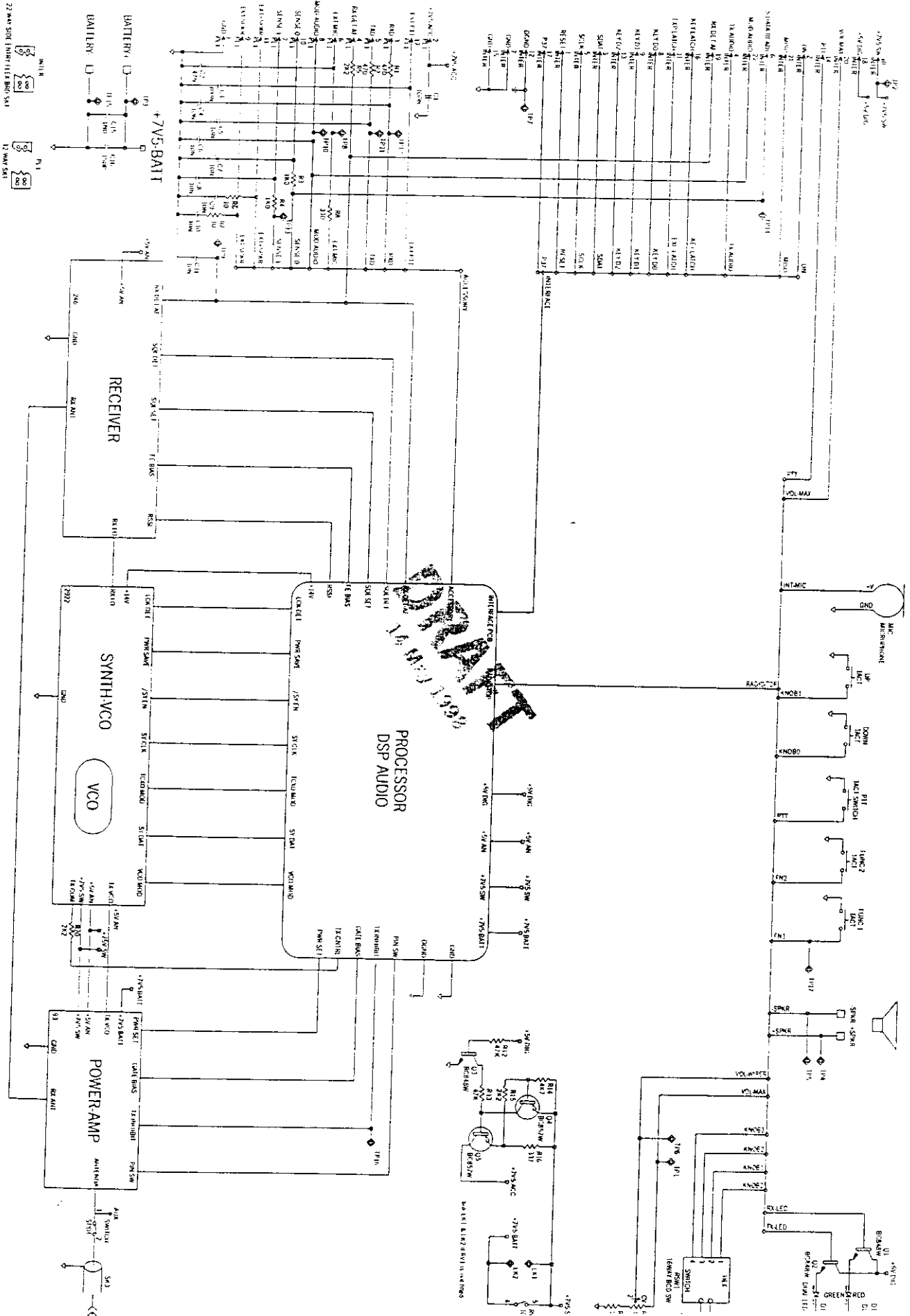


Figure B-1: Circuit interface diagram for Tail Orca hand-portable radios.

Implications of narrowband 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-x211x radios are narrowband and TOP-x111x radios are wideband.

The effect of the wider IF filtering is to allow a higher modulation depth and rate without causing either waveform or group delay distortion problems. This may be critical in high speed data reception applications, but it is recommended that this is confirmed for the actual application.

The difference in the squelch design is to work correctly with the different characteristics of the signal produced by the different IF filtering. At the same time, the squelch circuitry for the 20/25 kHz variant does not have to cope with a large range in the modulation depth, and hence can be optimised for ideal performance. The 12.5/20/25 kHz variant has the compromise that high deviation signals can 'desensitise' the receiver, in that they confuse the squelch circuitry and may cause occasional chopping of the audio in fringe areas. Performance may also be impaired at temperature extremes for high deviation signals through the 12.5/20/25 kHz variant, in that below -20°C and above +55°C, squelch may not operate properly.

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14 May 1998

PART **C**

Diagnostics and fault finding

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Diagnostics and fault finding

This section provides information on diagnosing faults in Tait Orca handportable radios.

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 conventional or trunked radios.

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 calibration system; or
- using a terminal program

See the *User's Manual: Calibration System for Tait Orca Radios* 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: xon/xoff.

To put the radio into computer-controlled test mode, send ^ (Shift-6), wait for a return prompt, then send % (Shift-5). 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.

Error codes

The errors you may receive while the radio is in test mode are:

- {C01} An invalid command code has been received.
- {C02} A (valid) command code has been received but had invalid parameters.
- {C03} A (valid) command code has been received but it cannot be processed at this time.
- {C04} An error occurred during the initialisation of test mode.
- {X04} Front panel test failed. Indicates that a power-on front panel test has failed.
- {X05} MCU internal configuration incorrect. Indicates that MCU's internal configuration is incorrect and the radio is in the wrong operating mode. The radio must be switched off and on again in a mode that allows it to be programmed.
- {X06} MCU internal configuration now programmed. Indicates that the microprocessor's internal configuration has now been set correctly, but the radio must be switched off and on again for the change to take effect.
- {X07} MCU operating mode error. Indicates that the microprocessor has powered up in a mode that provides inadequate security for its internal configuration.
- {X08} Test link error. Indicates that a valid reply to the logon prompt has been received with the test link still connected.

Table C-1: Test commands

Function	Description	CCTM code	Parameters	
Signaling	Set modem to send zeros	10	None	
	Set modem to send ones	11	None	
	Set modem to send preamble	12	None	
	Read modem receive string (continuous)	14	None	
	Disable all signaling	15	None	
	Enable subaudible signaling	16	None	
	Read subaudible signaling 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	None	
	Set display test off	53	None	
	Set L1 threshold	61	0 to 255	
	Set L2 threshold	62	0 to 255	
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	
	(continued on next page)			

Figure C-3: Fault finding – No serial communications

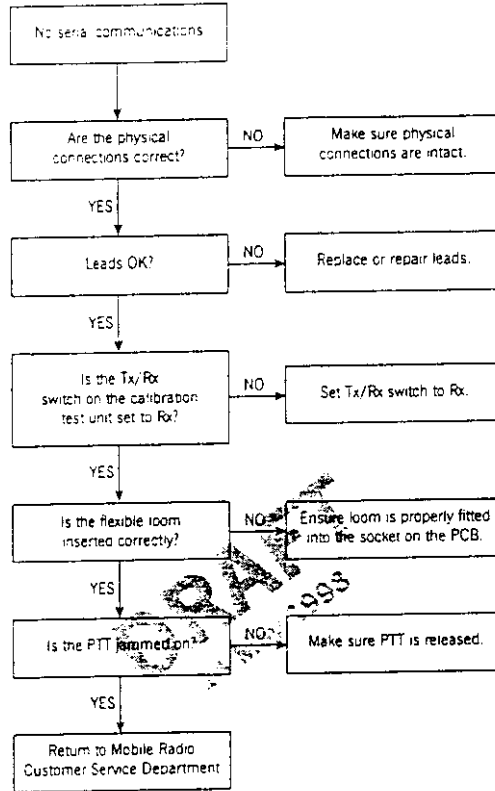


Figure C-5: Fault finding – Cannot transmit

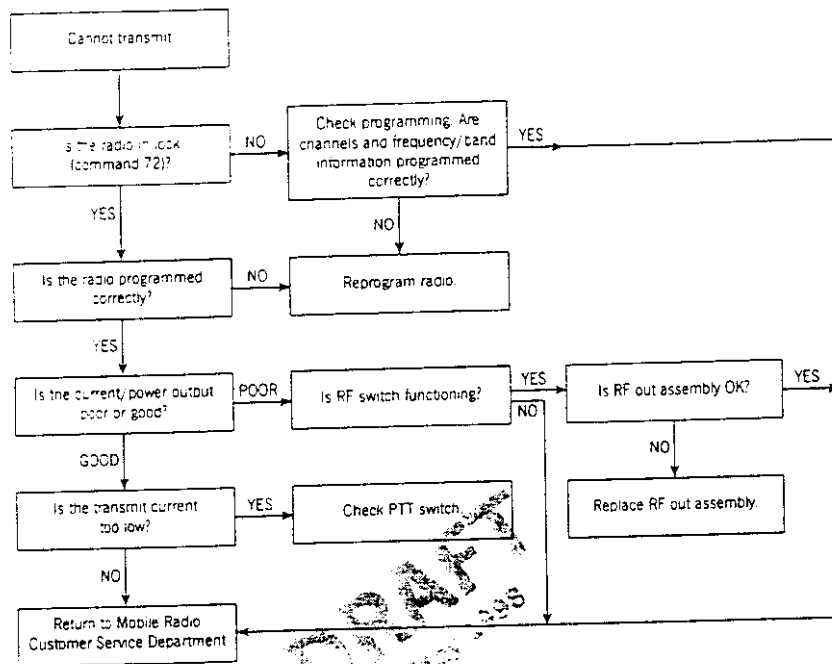
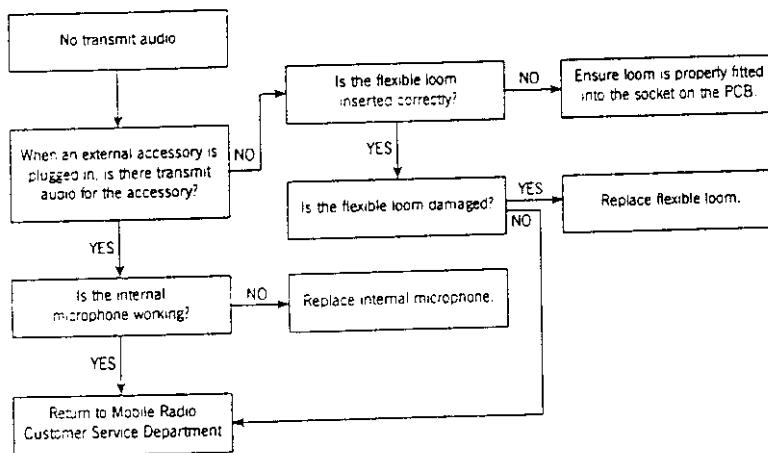


Figure C-6: Fault finding – No transmit audio



PART D Servicing the radio

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Fitting the front panel to the chassis	D-12

Servicing the radio

This chapter describes the disassembly and reassembly of your Tait Orca handportable radio, and the servicing of some key mechanical and ancillary devices. These are:

- PTT keypad
- speaker
- antenna connector
- channel selector switch
- volume control switch
- microphone
- speaker contacts
- battery contacts
- PTT tact switch
- auxiliary flex
- RF out assembly.

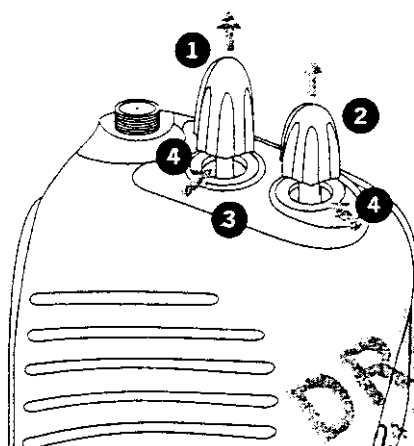
A list of spares for your Tait Orca handportable is shown in Table D-1, together with the devices they are required for. These spares can be ordered from your local Tait dealer.

DRAFT
14 May 1993

Removing the front panel from the chassis

Unscrew the antenna and detach the battery pack. Remove the knobs by inserting a side cutter flat side down at the base of each knob (Figure D-1), making sure not to damage the knob label and the switch shaft. Squeeze lightly; the knobs should pop off. Discard the knobs.

Figure D-1. Removing the knobs



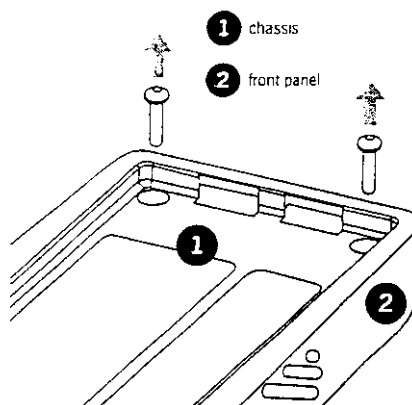
- 1 channel selector
- 2 on/off/volume control
- 3 knob label
- 4 insert side cutters here

Using a Torx T6 driver, remove the two screws at the base of the radio (Figure D-2). Then reattach the battery and hold the base of the radio in one hand. With the other hand, pull the chassis from the front panel using the base of the battery as leverage (Figure D-3).

At this point you can replace:

- the PTT keypad (page D-5); and
- the speaker (page D-5).

Figure D-2. Removing the screws at the base of the radio



Note that the PTT keypad should be removed once the front panel has been removed from the chassis if you wish to avoid damaging the front panel.

Removing the chassis from the shield

To remove the shield, place the radio on a flat surface with the shield side facing up toward you. Press lightly down on the shield above the slot clip detail (Figure D-4), which will slightly bow the shield away from the chassis. Maintain pressure and insert a bladed screwdriver (approx. 4 mm) in the gap between the shield and the chassis. Twist the screwdriver and the shield should rise up over the clip. Repeat this on the other side. Remove the microphone grommet and put it in a safe place.

You can now see the bottom surface of the PCB. The basic layout of the PCB is shown in Figures 15 and 16. Refer to these diagrams for the placement of parts.

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 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

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

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

- For B, C and D bands radios, the IF is 21.4 MHz.
- For E, F, G, H and I band radios, the IF is 45.1 MHz.
- For J band radios, the IF is 70.1 MHz.

DRAFT

Removing the PCB from the chassis

Remove the knob seal, which covers the antenna connector, channel selector switch and volume control switch.

Use a Pozi 1 driver to remove the screw through the PA shield. Remove the three nuts for the antenna connector and knobs using an 8 mm long reach socket driver set to 10 inch pounds, then remove the three ribbed lock washers. Gently lift the PCB up to the angle shown in Figure D-5, then pull it away from the chassis.

At this point you can replace:

- the antenna connector (page D-8);
- the channel selector switch (page D-8);
- the volume control switch (page D-8);
- the microphone (page D-8);
- the speaker contacts (page D-8);
- the battery contacts (page D-8); and
- the PTT tact switch (page D-9).

Once the required devices have been replaced, refer to the reassembly instructions on pages D-9 to D-11. Since replacement of the antenna connector and/or the channel selector and volume control switches requires that the PCB must be replaced on the chassis, the instructions for replacing these is included as part of the reassembly instructions.

Replacing the PTT keypad

Following the disassembly instructions, remove the front panel from the chassis.

To remove the PTT keypad, from the inside of the front panel, gently push the five latches that hold the keypad in place.

To replace the PTT keypad, fit the seal to the keypad, if necessary, making sure not to split or otherwise damage it. Place the three latches on the long edge of the keypad into place, then make sure the pins on the function keys and PTT key fit into the holes on the front panel. Clip the keypad into place.

Replacing the speaker

Following the disassembly instructions, remove the front panel from the chassis. The speaker sits in the mounting bracket on the inside of the front panel (see Figure D-8).

Use a Torx head No. 6 screwdriver to remove the two screws at the base of the mounting bracket. Lift the speaker and mounting bracket out and discard.

Insert the new speaker and mounting bracket in the front panel, making sure the top edge of the mounting bracket goes under the lip in the front panel (Figure D-8). Replace the two screws to secure the speaker in place.

Figure D-5: Removing the PCB from the chassis

- 1 microphone grommet
- 2 PCB
- 3 chassis

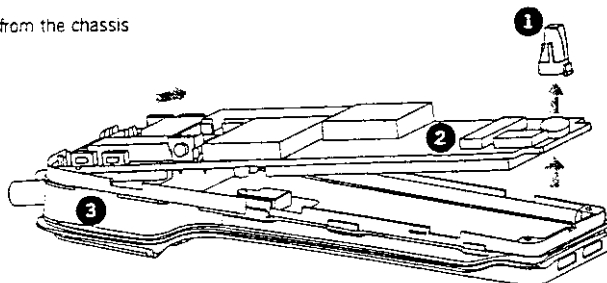
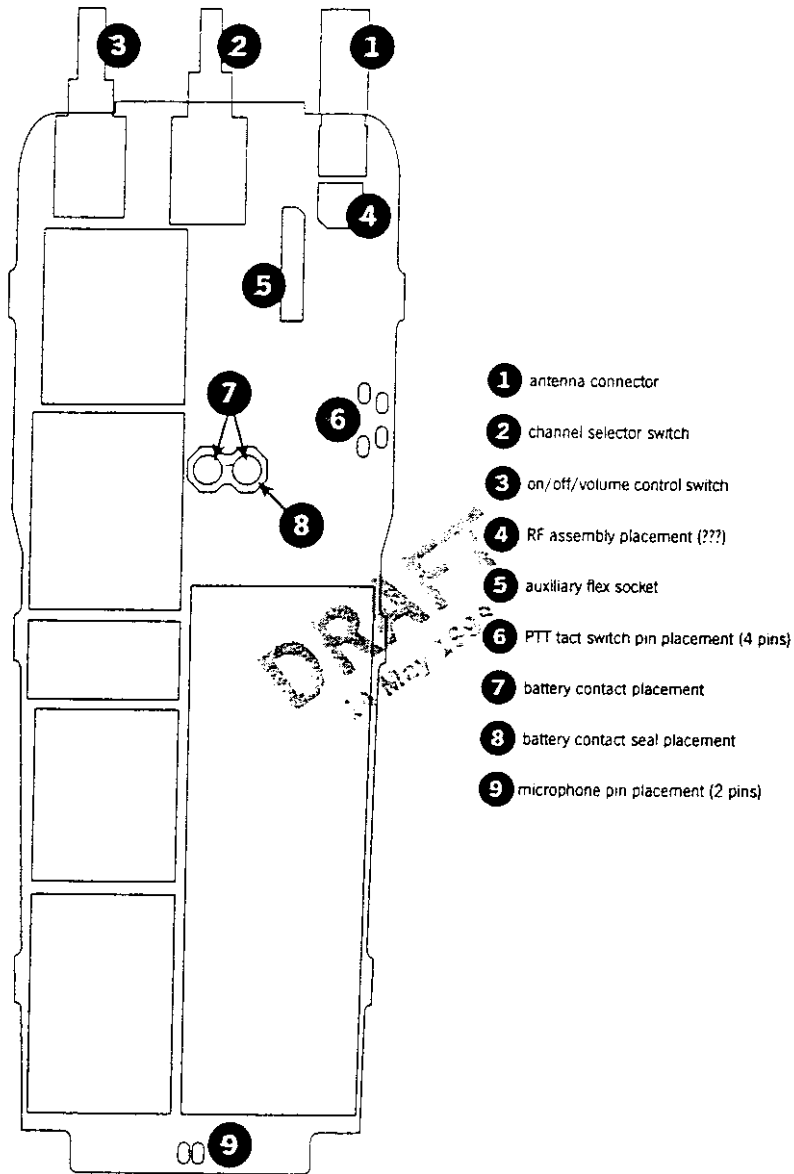


Figure D-7: Top surface of PCB, which is visible only when the PCB has been removed from the chassis



there is a lot of solder on both sides of the board, so be sure to remove it all.

Refer to Figures 15 and 16 for the placement of the PTT tact switch.

Place the new PTT on the board and solder it in place using a heavy-tip soldering iron (e.g. Weller 2PTCC8 tip).

Replacing the auxiliary flex

Should you need to replace the auxiliary flex, you will first need to remove the PCB from the chassis. Following the disassembly instructions, disassemble the radio to the PCB level, then remove the rear panel, as described below.

Removing the rear panel

Refer to Figure D-9 for the details of the rear panel assembly.

To remove the rear panel, either:

- slide the cover forward by pushing at the base with your thumbs; or
- insert a small flat-bladed screwdriver just under the notch in the base and twist.

Remove the auxiliary flex seal. Using a calibrated pin, lift out the rigidiser from the lower lefthand corner. Remove the rigidiser and the seal from the chassis: they should come out as a unit.

Replace the auxiliary flex if it is faulty.

Rear panel reassembly

Insert the end of the rigidiser in the slot in the seal and make sure it is properly lined up (Figure D-9). Push the seal and rigidiser firmly into the chassis aligning the notch in the seal with the locating pin on the chassis. The rubber must sit flush with the back of the chassis or the back panel will not sit properly and the battery will not fit on. On the front of the chassis, use a pin to make sure the four notches on the seal (Figure D-9) sit on the edge of the chassis.

Fit the rigidiser in the chassis; you should feel it snap into place.

Replace the seal by tucking the two notches at the top of the seal under the lip on the chassis and placing it over the rigidiser. Make sure the seal is flush with the chassis.

Slide the rear panel on from the top of the radio (Figure D-9). Force it into place by pressing the top edge of the cover against the edge of a table. Make sure the gap between the cover and the chassis is as small as possible.

Reassembling the radio

This section describes the reassembly of the radio once the required units have been serviced.

Fitting the PCB to the chassis

Put the battery contact seal on the battery contacts rather than on the chassis. If you put the seal on the chassis, the contacts will squash the seal.

Make sure the RF out assembly is fitted properly (see Figure D-10).

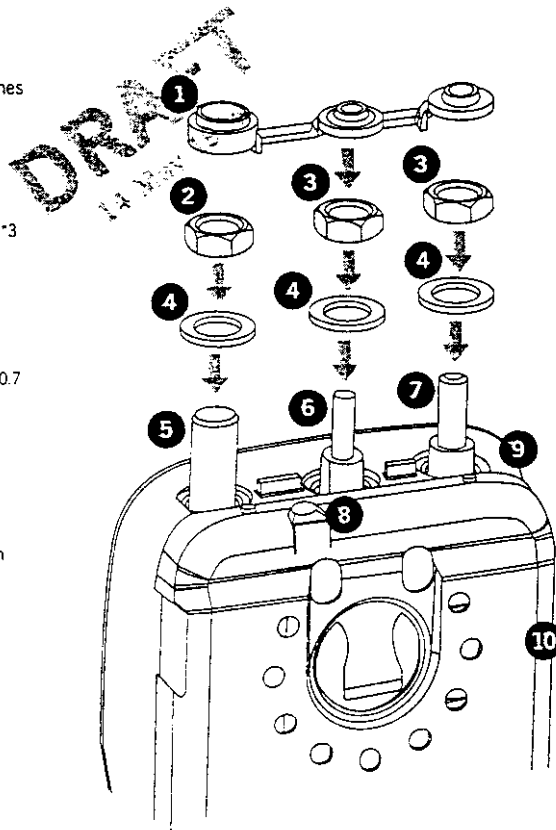
If you have removed the antenna connector or either of the switches, fit them on the PCB (refer to Figures 15 and 16) but do not yet solder them in place. Align them with the holes in the chassis, and as you lower the PCB onto the chassis, make sure the accessory flex protruding from the chassis fits into the socket on the PCB. Lower the PCB onto the chassis, making sure it is firmly seated.

Fit the PA screw loosely in place. Align the switches so they are centered, referring to Figures 15 and 16 for placement. Figure D-11 shows the reassembly of the antenna and switches. Replace the washers, making sure the cone faces up. Replace the nuts, making sure they are threaded correctly before using an 8 mm long reach socket driver set to 10 inch pounds. The nuts for the two switches are black. Then tighten the PA screw using a Pozi 1 driver set to 2 inch pounds.

the top of each knob against a firm surface.
 Choose a surface that will not damage the top
 of the knob.

Figure D-11: Assembly of the switches

- 1 knob seal
- 2 SMA connector nut (1/4"7.9*3 mm)
- 3 channel/volume control nut (M6*7.9*3 mm)
- 4 ribbed lock washer (M6*10*0.7 mm)
- 5 antenna connector
- 6 channel selector switch
- 7 on/off/volume control switch
- 8 indicator pipe
- 9 chassis
- 10 shield



PART **E**

Downloading radio software

Contents

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Installing a mouse	E-3
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Connecting a radio	E-3
Using the <thingee>	E-4
Online help	E-5
Setting up your system	E-5
Changing COM port settings and baud rate	E-5
Changing the default path and <flash????>	E-5
Downloading radio software	E-5
Uploading radio software	E-6
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Downloading radio software

The <thingee> program can be used to download radio software from your PC to a Tait Orca series radio.

The <thingee> 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 [how much??] free space;
- a single 3.5 inch floppy disk drive (1.44 MB capacity); and
- a Microsoft or compatible mouse and driver (if you wish to use the program with a mouse).

The <thingee> cannot be used to download software to Tait T2000 or T3000 series radios.

Installing the software

The <thingee> cannot be run directly from the distribution disk, and so must be installed on your hard disk.

Insert the supplied disk in the floppy drive and at the DOS prompt, type `a:install` (if the disk is in drive A) or `b:install` (if the disk is in drive B). Press 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 placed in the `\ORCA\XXX`

directory on the target drive. It is highly recommended you use the default directory setting, especially if you have already installed or intend to install other Tait programming and support software packages.

Installing a mouse

To use this program with a mouse, your mouse driver software must 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. You can select which serial port is used to communicate with the radio in the **Setup Communications** window (**Setup** menu).

Setting up a program item (Windows 3.x) or shortcut (Windows 95)

If you wish to set up a Windows 3.x program item or Windows 95 shortcut for easier access to the <thingee> see pages 5 to 6 of the *User's Manual: Calibration System for Tait Orca Radios*, which is supplied as part of the service kit.

Connecting a radio

The service kit contains the leads necessary for connecting the radio to be programmed to your PC. Your radio should be turned off before you connect it to the computer.

Connect the radio as follows.

- For mobile radios, connect the programming cable to the radio using the telephone-style plug and to the compu-

Online help

Pressing the F1 key displays online help specific to the screen open when the key is pressed. Pressing the F1 key again displays general help.

Setting up your system

The options in the **Setup** menu allow you to change certain settings to suit your computer setup and operation. These are:

- the COM port to which the radio is attached;
- the baud rate used to communicate with the radio;
- the default directory used for downloading and uploading data files; and
- the radio memory size.

Changing COM port settings and baud rate

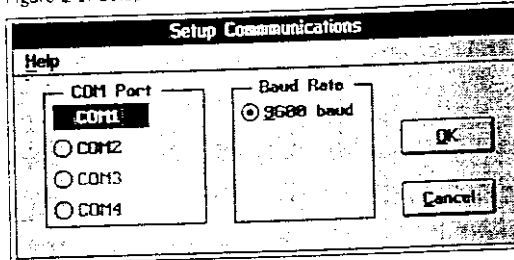
Select **Communications** from the **Setup** menu and the **Setup Communications** window will appear.

[insert setup communications window]

COM Port shows the COM port that is used for communicating with the radio. If you have a mouse on COM1, the program will automatically detect it and assign the radio to COM2. If you wish to attach the radio to another port, choose the desired port in this screen.

Baud Rate shows the rate at which data will be copied to or from a radio. The maximum baud rate for a standard PC is 9600 baud and this is likely the only option that will appear under **Baud Rate**. However, if you have a

Figure E-1: Setup Communications window



125k baud serial card and device driver installed on your computer, a 125k option will appear. Select 125k to maximise the rate of communication.

Changing the default path and <flash????>

Select **Preferences** from the **Setup** menu and the **Setup Preferences** window will appear.

[insert setup preferences window]

Data File Path shows the default directory on your hard drive that will be used for storing radio data files. If you wish to use another directory, enter the full path in **Data File Path**.

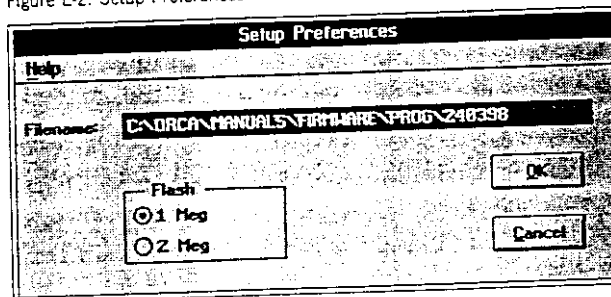
Memory Size shows the amount of memory used on radio -- can it be automatically set depending on binary file size???

Downloading radio software

Choose **Download** from the **Radio** menu and the **Download Radio Software** window will appear:

[insert download window]

Figure E-2: Setup Preferences window



Choose **Upload** from the **Radio** menu and the **Upload Radio Software** window will appear:

[insert Upload window]

Directory shows the default directory. You can change the default directory by selecting **Preferences** from the **Setup** menu.

If the directory shown in **Directory** is the one you wish to copy the radio software to, you can specify the file name in the **Filename** box. If you wish to save the file in another directory, select **Browse**.

When you select **Browse**, the **Browse File** window appears.

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

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.

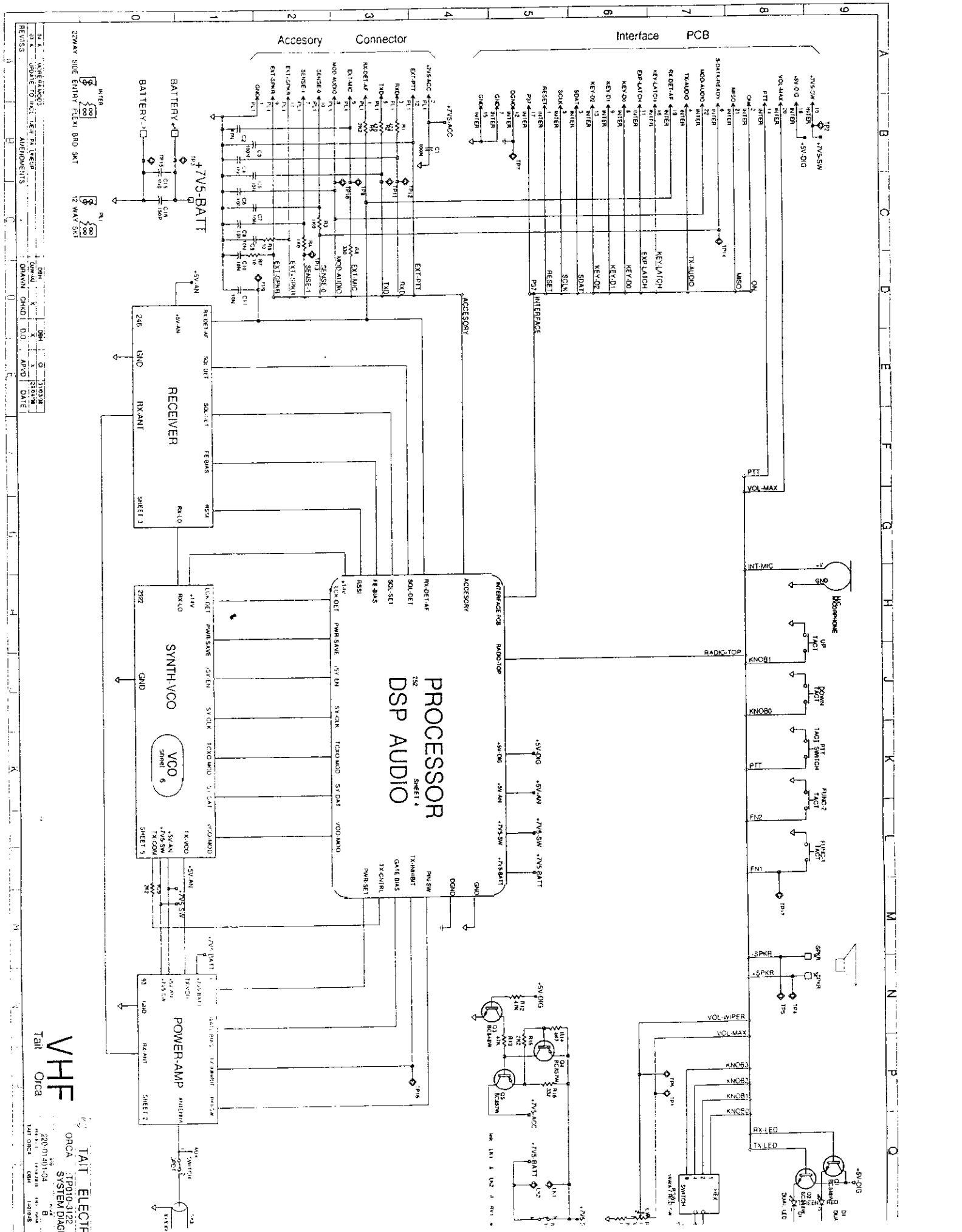
The **Files** list shows all files in the current directory with the properties shown in the **File Name** box. Enter the name you wish to save the file under in the **File Name** box, then select **OK** to return to the **Upload Radio Software** window.

In the **Upload Radio Software** window, select **Upload** to begin the upload process. A window will appear instructing you to ensure that the radio is turned on and connected to the computer. When you are sure that this is so, select **Start**, and the program will begin sucking software from the radio.

[what message when finished?]

Quitting the program

The **Quit** menu allows you to exit the programming system. A window will appear asking whether you wish to quit. Click on **Yes** or press **Enter** to return to the DOS prompt or your operating system.



REVIEWS

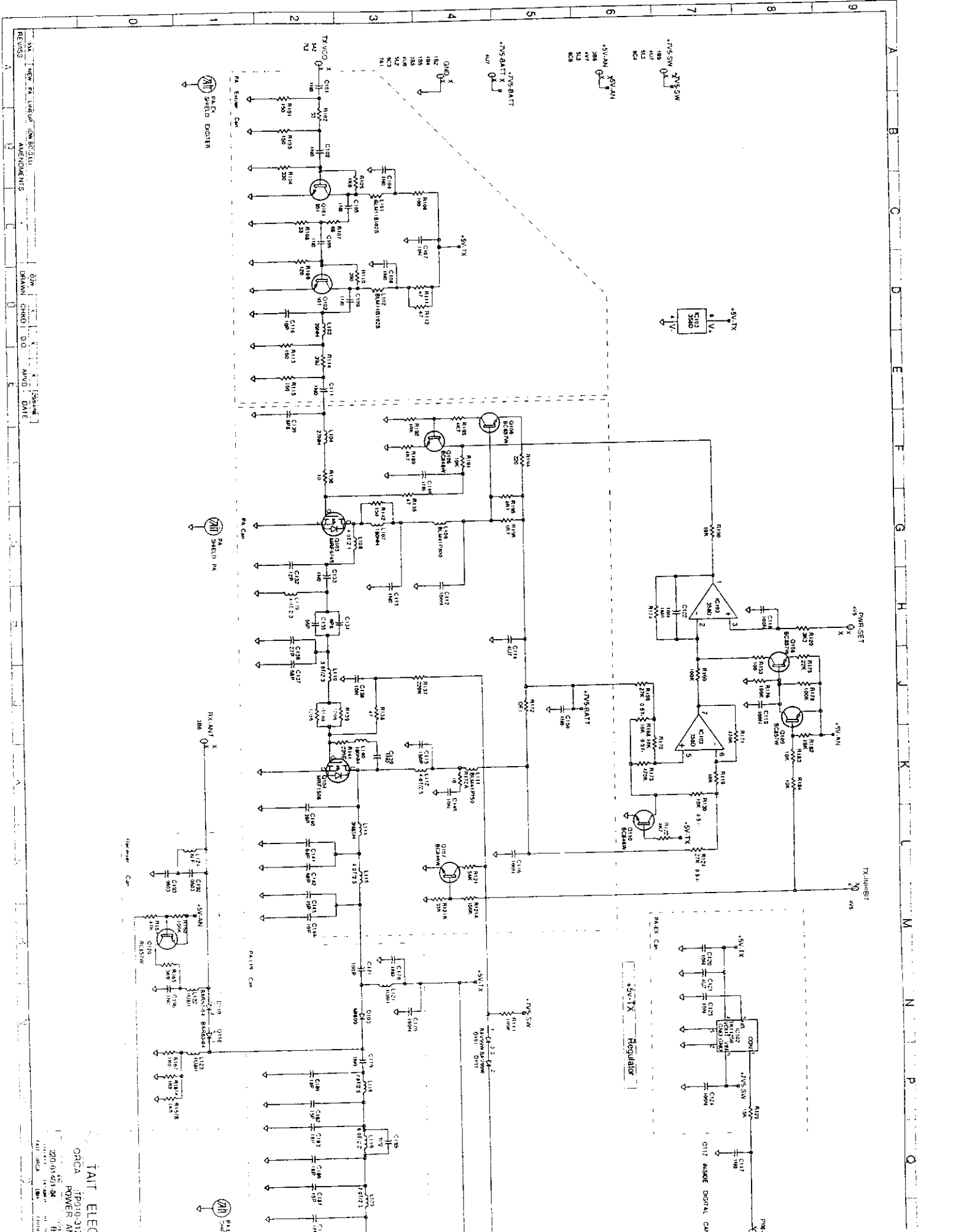
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1	10/10/00	ORCA	INITIAL DESIGN
2	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT
3	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT
4	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT
5	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT
6	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT
7	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT
8	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT
9	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT

AMENDMENTS

NO.	DATE	BY	REVISIONS
1	11/01/00	ORCA	INITIAL DESIGN
2	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT
3	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT
4	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT
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7	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT
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9	11/01/00	ORCA	REVISED TO INCLUDE NEW PCB LAYOUT

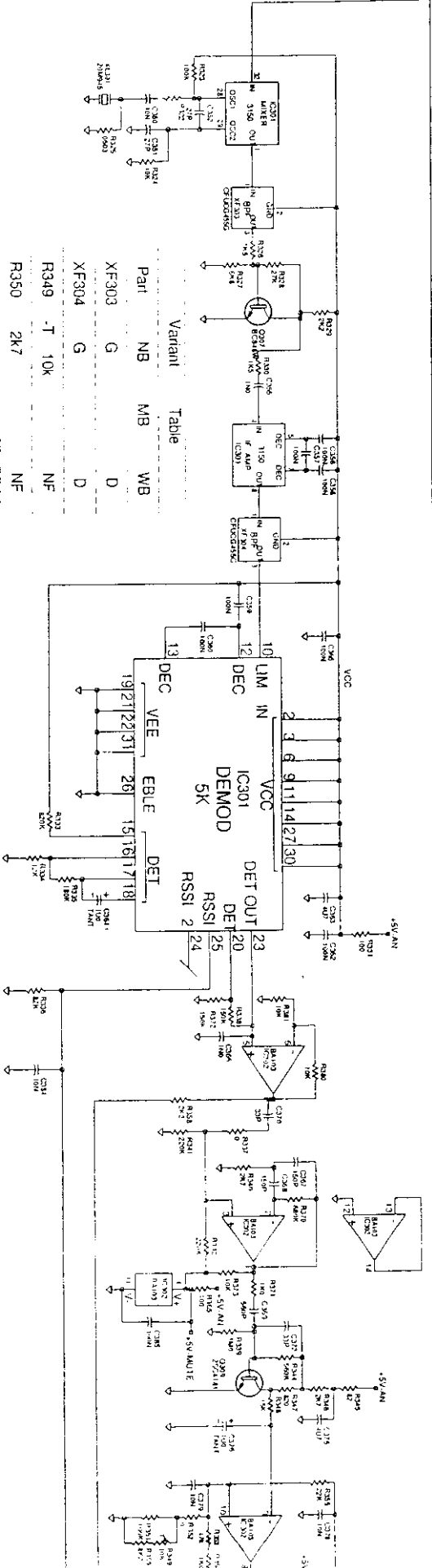
VHF
Tail Orca

TAIT ELECTRONICS
ORCA 17PO10-3122
SYSTEM DIAGR
200-01-01-004
REV B
DATE 11/01/00
ORCA
11/01/00



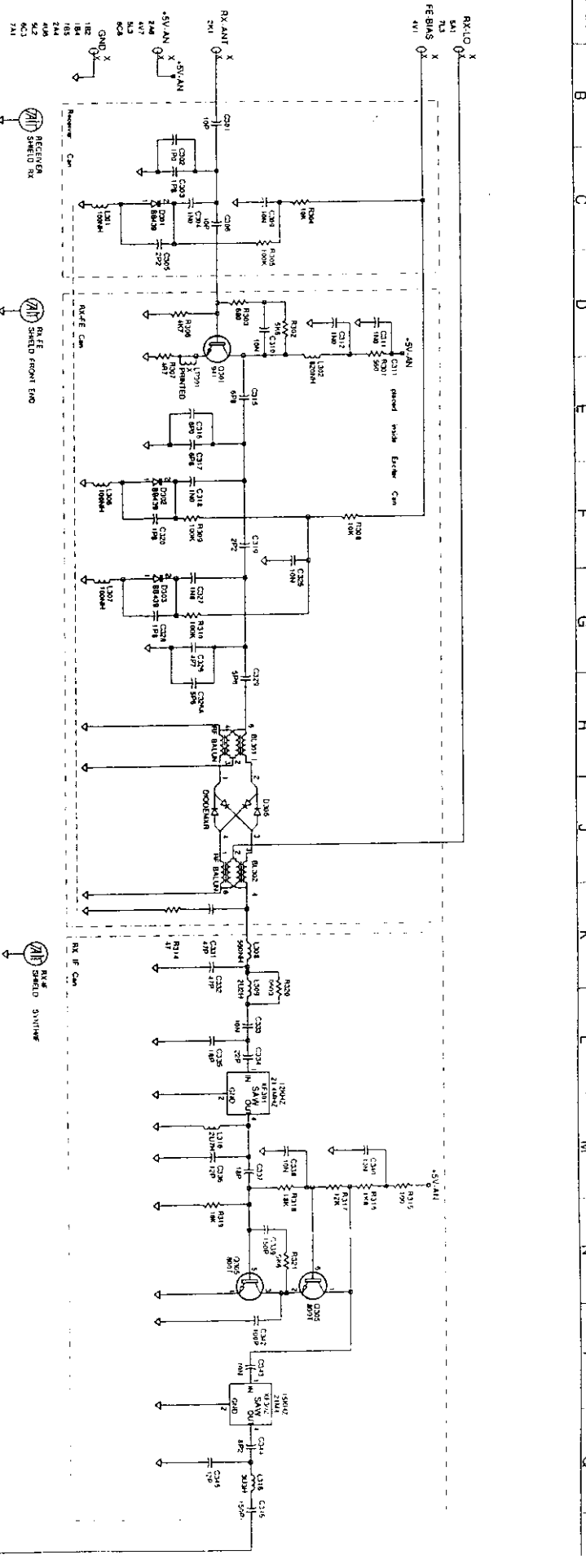
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 DATE: [Date]
 DRAWN: [Signature]
 CHECKED: [Signature]
 APPROVED: [Signature]

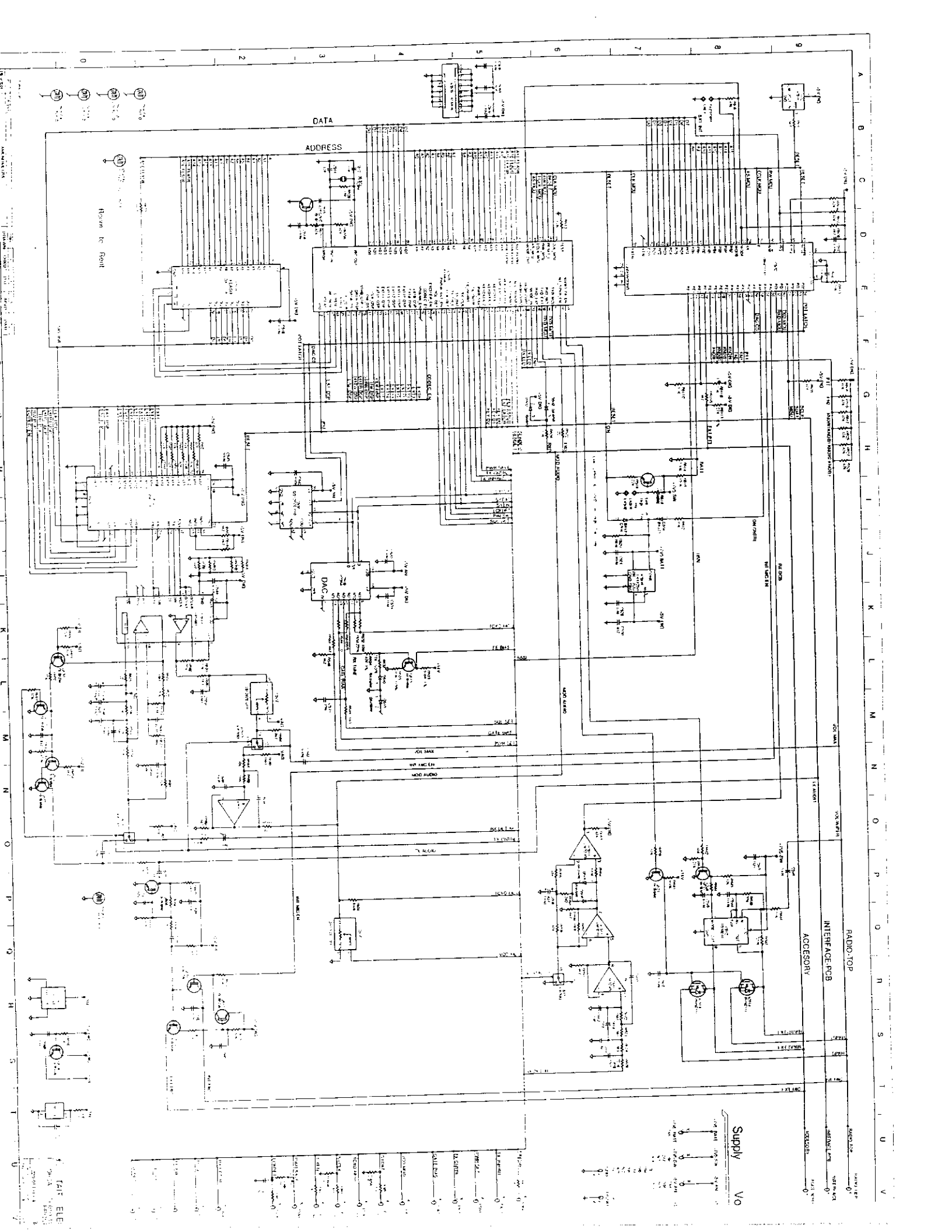
TAIT ELECTRIC
 ORCA
 POWER AMPLIFIER
 220-01-001-00
 10/10/00

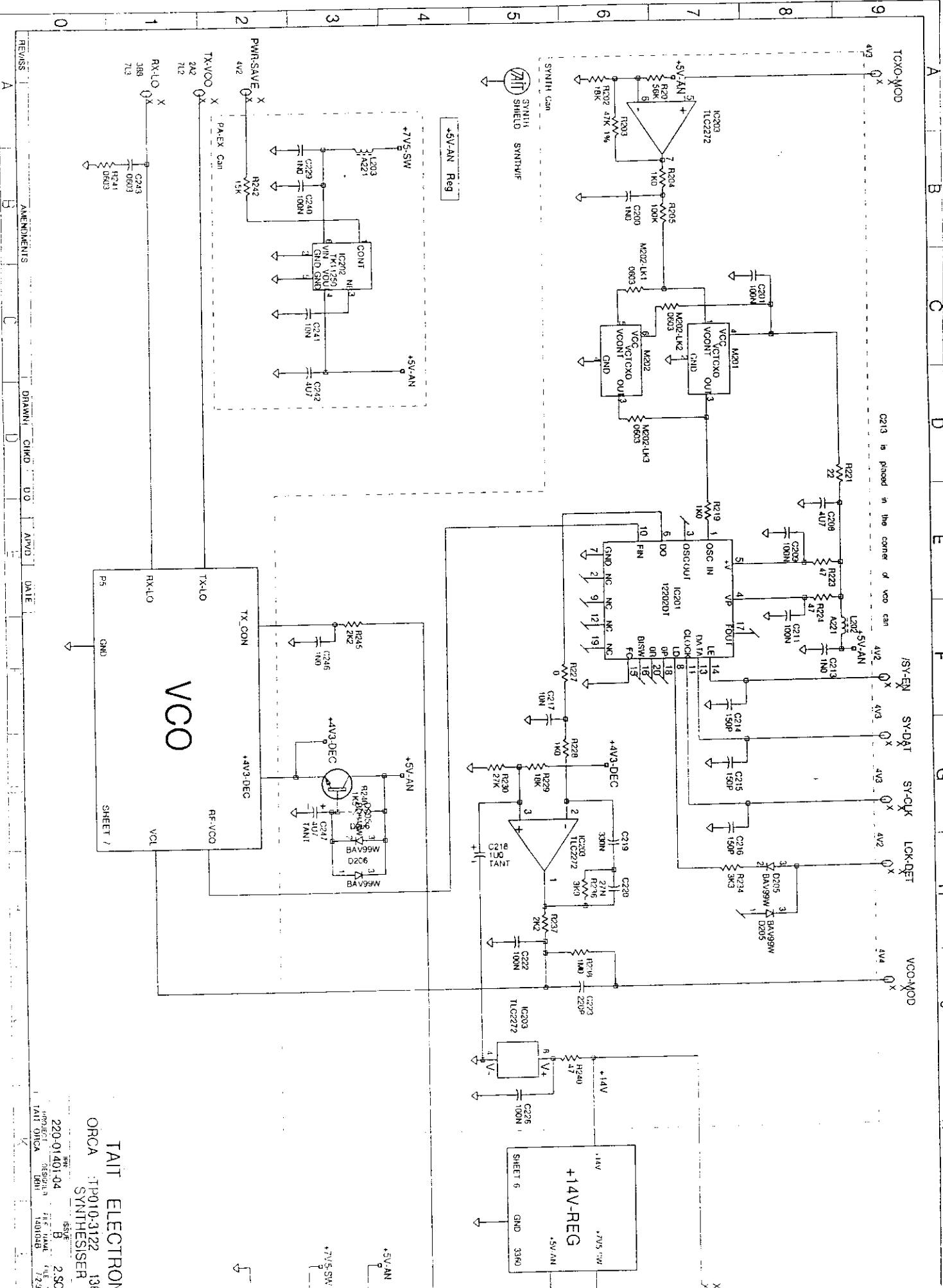


Variant Table

Part	Variant	MB	WB
XF303	G		D
XF304	G		D
R349	JT	10K	NF
R350	2K7		NF
C370	22P		22P
C369	330P		330P

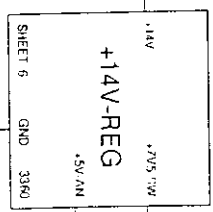
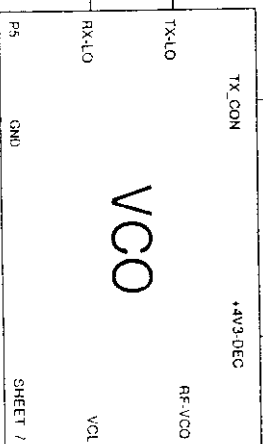






C213 is placed in the center of vco can

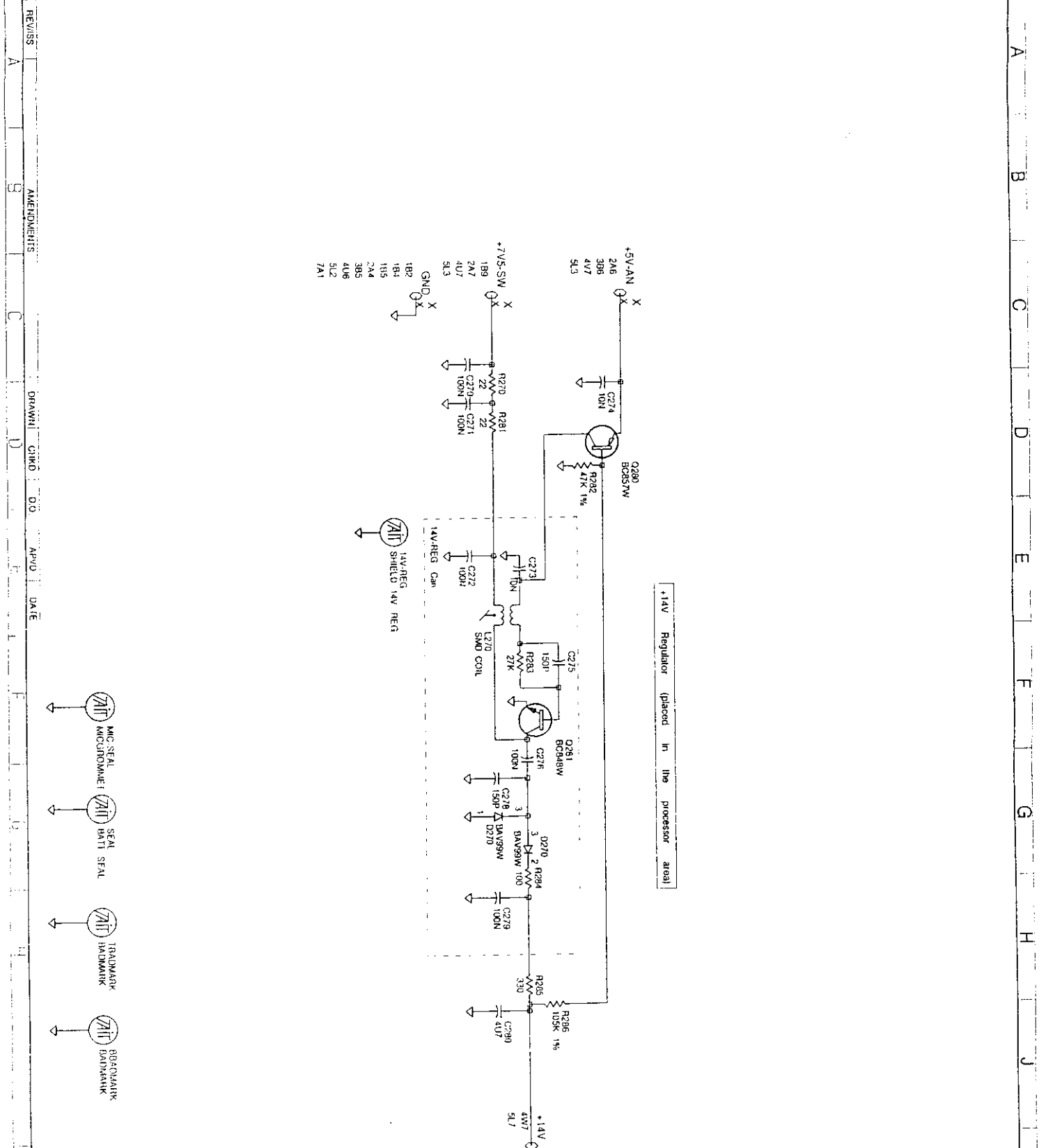
+SV-AN Reg



TAIT ELECTRONI
 ORCA TP010-3122 136-
 SYNTHESISER
 220-01401-04
 PROJECT DESIGNER
 TAIT ORCA DBH
 1401040
 25C
 1729F

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 APVD
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MIC SEAL
 SEAL HATT SEAL
 TRADEMARK
 TRADEMARK

PROJ: 220-01401-04
 ORCA
 +14V REGULATOR
 DATE: 14/01/19

TAIT ELECTRONICS
 TP010-3122
 136-1
 2 SC.

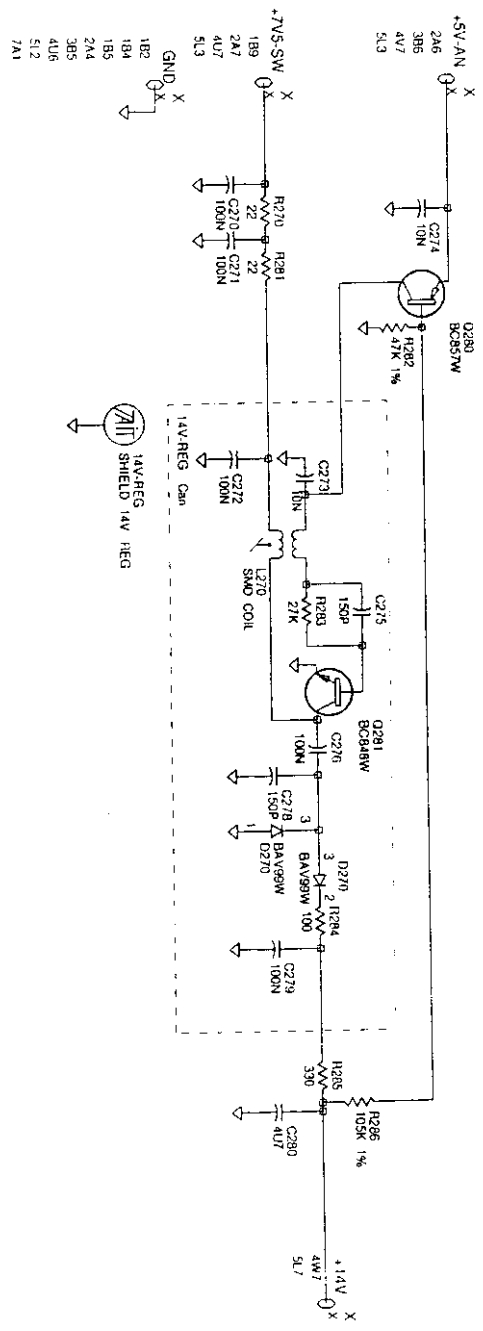
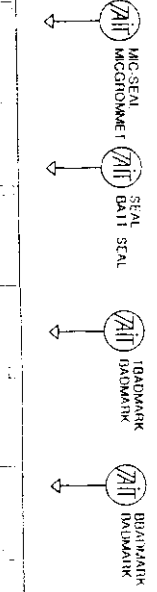
REV: B
 DESIGNED: M. J. JAMES
 CHECKED: M. J. JAMES
 DATE: 14/01/19

0 1 2 3 4 5 6 7 8 9

A B C D E F G H I J K L

REVISED A

AMENDMENTS DRAWN CHKD D.D. APPROV G.A.H.



+14V Regulator (placed in the processor area)

TAIT ELECTRONICS

ORCA TP010-3122 136-174V
 +14V REGULATOR
 220-01401-04
 PROJECT DESIGNER DBR
 DATE 12-79

250 OF 250
 250 OF 250
 250 OF 250

PART F

Battery packs and chargers

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Battery packs and chargers

Three battery packs are available for Tait Orca handportables. The battery packs are not serviceable. Information on their construction and expected life are provided below.

Three chargers are available for Tait Orca handportables:

- desktop fast charger;
- desktop trickle charger; and
- multi-charger.

The trickle charger does not have a discharge button, but is otherwise identical in appearance to the fast charger. The multi-charger is made up of six fast chargers, and charging instructions for the fast charger also apply to the multi-charger.

Note that the trickle charger should not be used for NiMH battery packs as they can take up to 24 hours to charge fully and the overall lifetime of the battery may be reduced. NiMH battery packs should be charged using a fast charger.

Repair of chargers is limited to replacement of the following parts:

- spring contacts;
- Skt DC jack; and
- charge/discharge tact switch.

Refer to the repair information provided below for the fast charger; this information also applies to repair of the multi-charger and the trickle charger.

The contents of the Tait Orca charger spares kit (IPN OPA-SP-202) are shown in Table F-1. Parts for 10 chargers are supplied in the kit.

Battery packs

The battery packs available for Tait Orca handportables are:

- Standard NiCd battery pack (1100 mAh);
- Heavy duty NiCd battery pack (1500 mAh); and
- High capacity NiMH battery pack (1850 mAh).

The battery casing is made of Makroblend and is ultrasonically welded. The casing is

Table F-1: Spares for Tait Orca chargers

IPN Number	Description	Chargers required for
356-01073-00	Spring contact probe	All
240-02020-07	Skt DC jack	All
232-00010-28	Tact switch	Desktop fast charger Multi-charger
302-40054-00	Charge/discharge button	Desktop fast charger Multi-charger
262-00001-00	Charger light pipe	Desktop fast charger Multi-charger
312-01069-00	Charger top	All
312-01070-00	Charger base	All
365-01549-01	Charger logo label	All
365-01522-01	Charger sticker	All
369-00010-11	Rubber charger foot	All
360-01059-00	Trickle charger blanking label	Desktop trickle charger

Table F-3: Typical drain rates for a UHF radio

Mode	Supply voltage (V)	Current (mA)
Standby (no audio)	7.25	70
Economy mode (low duty cycle)	7.25	58
Economy mode (medium duty cycle)	7.25	45
Economy mode (high duty cycle)	7.25	39

Charging the battery using the fast charger

The fast charger will charge the battery when the radio is on, but the battery will charge faster if the radio is turned off. The battery can be recharged attached to the radio or as a separate unit.

Insert the battery/radio into the charger. The indicator will glow amber for three seconds, then red. If the indicator does not glow red, make sure the battery/radio is seated properly and the charger is properly plugged in. If the

battery is too hot or too cold, the indicator will remain amber until the battery temperature is within the safe range for recharging (5°C to 40°C).

Charge times are:

- up to 1 1/2 hours for the standard NiCd battery;
- up to 2 hours for the heavy duty NiCd battery; and
- up to 2 1/2 hours for the NiMH battery.

Once the battery is fully charged, the indicator will change from red to green. Leaving the battery in the charger once it is fully charged does not damage the battery.

Figure F-1: Circuit diagram of the Tait Orca desktop fast charger.

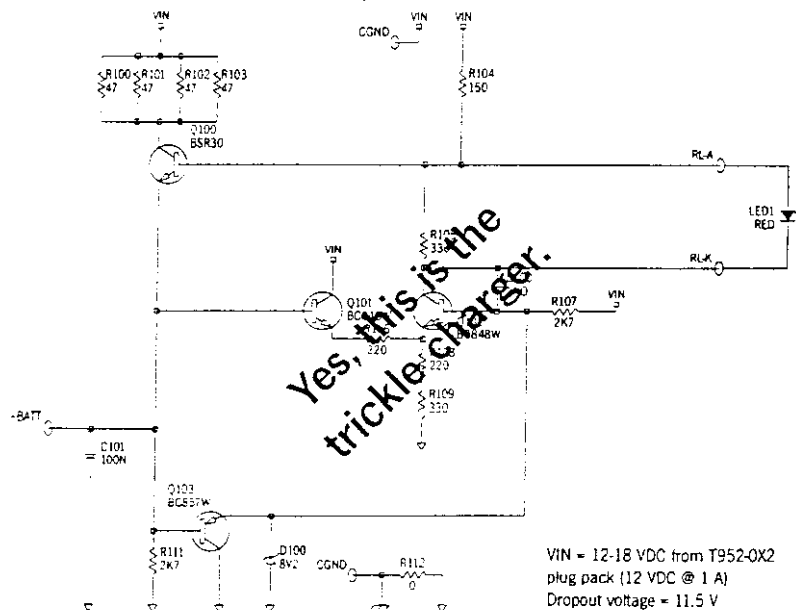
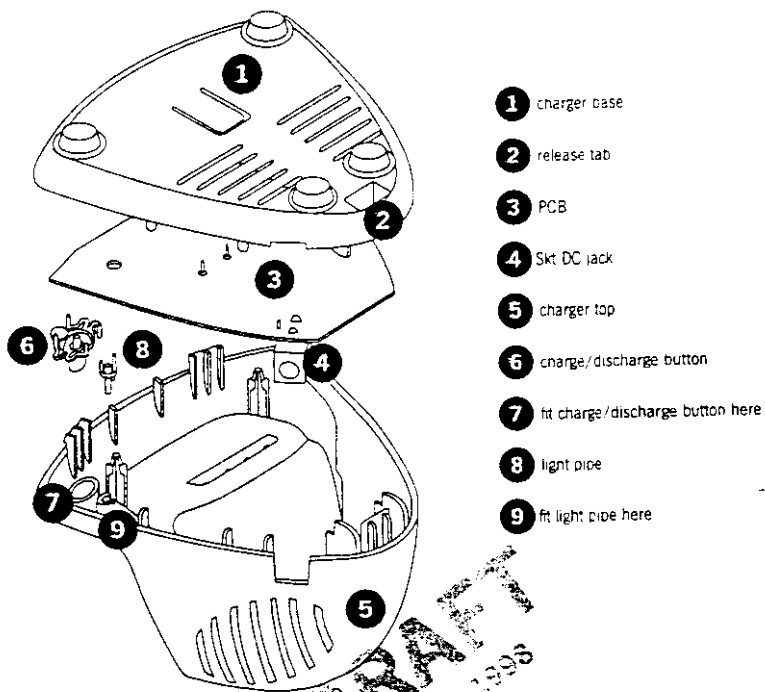


Figure F-2: Assembly of the desktop fast charger



protection of the radio is provided in the form of an open circuit voltage limit as well as short circuit protection.

Figure F-3 shows the schematic diagram for the trickle charger. Figure F-4 shows the charger current profile.

Operation

When the battery voltage is above approximately 8 V the charge current is inversely proportional to the battery voltage. This characteristic is produced by Q100, Q101 and Q102. The charge current is determined by the current through R104, which is set by Q102, its emitter resistors and the reference voltage. The slope of the curve is determined by Q101 and R106. The reference voltage is provided by an 8.2 V Zener diode (D100).

When the battery voltage is below approximately 8 V the charge current is proportional

to the battery voltage. This is accomplished by using Q103 to change the reference voltage in proportion to the battery voltage. This changes the current through R104, which changes the charge current as desired.

R111, in conjunction with Q101, limits the maximum voltage available from the trickle charger to less than 10.5 V so that the radio can not be damaged if the battery goes open circuit. If the battery should go short circuit then Q102 is held off by Q103 and thus Q100 is off and there is negligible charge current.

On startup, the charger is in a state very similar to what happens when the charger output is shorted. When power is applied, V_{in} starts to rise and the emitter voltage of Q103 rises. However, the base of Q103 is still at zero volts, so Q103 starts to turn on. When Q103 is on, it will maintain Q102 off and hence Q100 will also stay off. Thus when V_{in} has risen to

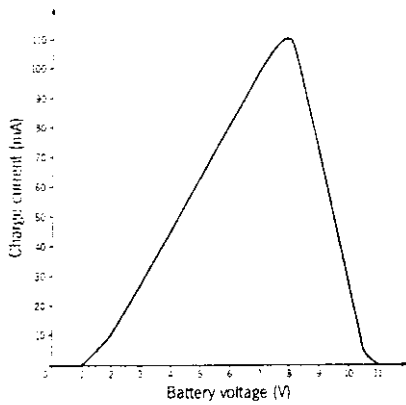


Figure F-4: Tait Orca desktop trickie charger current charge profile.

Multi-charger

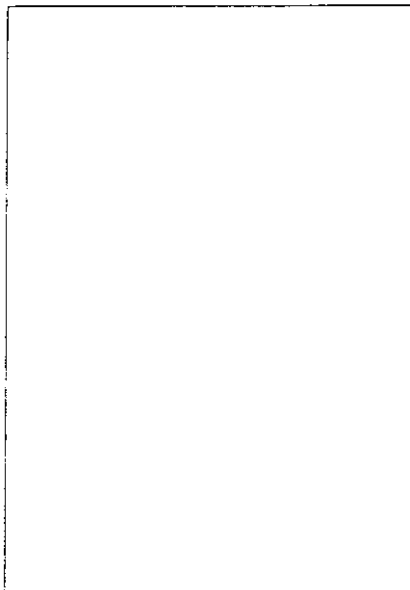
The multi-charger is made up of six desktop fast chargers. The PCB has an additional diode (see Figure F-5), and a tab has been added to the release clip at the base of the charger. Should one of the charger units be faulty, you can repair it according to the instructions for the desktop fast charger or replace the faulty unit with a fast charger unit to which the diode (IN4001 or similar???) has been added.

To remove a faulty charger from the multi-charger:

- Undo the screws at the base of the radio (x 10) using a Pozi 1 driver.
- Do not pull the top off the charger using the housing of the individual chargers. Instead, from the side of the charger, lift the top up and gently fold back.
- Remove the tab from the release clip of the faulty charger.
- Depress the release tab using the end of a flat-bladed screwdriver.
- Gently pull the body away from the base.
- Desolder wires??

- Repair the board or replace it with a new one to which the required diode has been added.
- Pass the wires through the bottom slit of the base of the charger.
- Solder the red wire to the positive terminal on the PCB and the black wire to the negative terminal on the PCB.
- Place the multi-charger unit on its side and make sure the charge/discharge button, the light pipe and the PCB are seated properly.
- Attach the base of the charger at the front edge and clip it in place.
- Replace the tab firmly between the release clip and the charger.
- Close up the multi-charger, replacing the 10 screws using a Pozi 1 driver.

Figure F-5: Placement of the diode for multi-charger PCBs



PART **G**

Interfacing non-Tait accessories

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Interfacing non-Tait accessories

Two types of accessory connectors are available for Tait Orca handportables:

- standard Tait Orca accessory connector; and
- 7.5 mm accessory adaptor.

Tait Orca accessory connector

The Tait Orca handportable has a versatile accessory interface for connecting external accessories, such as speaker microphones, handsets and modems. An accessory kit (IPN OOPA-SSP-xxx) is available for connecting such accessories, and it contains:

- accessory connector PCB (IPN 220-01413-02);
- accessory connector lock (IPN 303-20058-00);
- lock retaining ring (IPN 303-20061-00);
- accessory connector housing (IPN 308-01055-00);
- screw M2*5 mm Pan Pozi (IPN 345-00020-00);
- bush M2 (IPN 354-01044-00);
- probe batt/RF (IPN 356-01070-00(TBD));
- probe accessory x 15 (IPN 356-01072-00);
- clamp (IPN 357-01049-00);
- 6 mm, 5.3 mm and 4.4 mm grommets (IPN 360-02007-00); and
- generic accessory connector seal (IPN 362-01093-00).

Table G-1 shows the signals available at the accessory connector. A circuit diagram of the accessory connector is shown in Figure G-1, and the signals are described below.

Signals

- RX-DET-AF: The RX-DET-AF line carries unprocessed receive audio from the output of the detector IC.
- MOD-AUDIO: The MOD-AUDIO line is used during calibration to set up the modulation balance and by some accessories, such as modems.
- +7.5V-ACC: The +7.5V-ACC line supplies +7.5 V to accessories.
- RXD: The RXD line carries data from the accessory connector to the controller during tasks such as radio programming and calibration.
- TXD: The TXD line is a digital data line from the microprocessor and carries synchronous data from the controller to the accessory connector during tasks such as radio programming and calibration.
- SENSE-0/SENSE-1: SENSE-0 and SENSE-1 lines are used to detect accessories.

SENSE-0 is used to turn off the radio's internal speaker. To turn off the internal speaker, tie SENSE-0 to GND. The external speaker outputs are always active.

SENSE-1 is used to put the radio in VOX mode when an external voice-operated switch is used to control EXT-PTT (e.g. in a hands-free vehicle kit). To do this, tie SENSE-1 (pin 14) to GND. If the radio is being used in VOX mode on a conventional channel, then EXT-PTT will only be sensed when it is not busy. If the radio is being used on a trunking network, then EXT-PTT will only be sensed when it is on a valid traffic channel. A trunking call must be initiated by an internal key on the radio.

This consists of a 27 k Ω pull up to 5 V inside the radio and a pull down resistor on the accessory PCB. The resistor pull downs for BUTTON-1 and BUTTON-2 are as follows:

- PTT function: resistor pull down 0 Ω , voltage level on EXT-PTT 0 V;
- BUTTON-1 function: resistor pull down 12 k Ω , voltage level on EXT-PTT 1.5 V;
- BUTTON-2 function: resistor pull down 27 k Ω , voltage level on EXT-PTT 2.5 V.

These resistors are already soldered onto the accessory PCB.

Connecting an accessory

First determine whether your accessory is compatible with the accessory connector by referring to Table G-1. If it is compatible, determine which pads on the accessory PCB you will need to solder to by referring to Figure G-1.

Short link 1 if it is necessary to turn off the radio's internal speaker. Then carefully follow the mechanical assembly procedure outlined below.

Mechanical assembly procedure

Figure G-2 shows an assembly drawing of the accessory connector. The order of assembly is as follows.

- Fit the lock to the accessory housing.

Figure G-1: Circuit diagram of the Tait Orca accessory connector PCB for handportable radios.

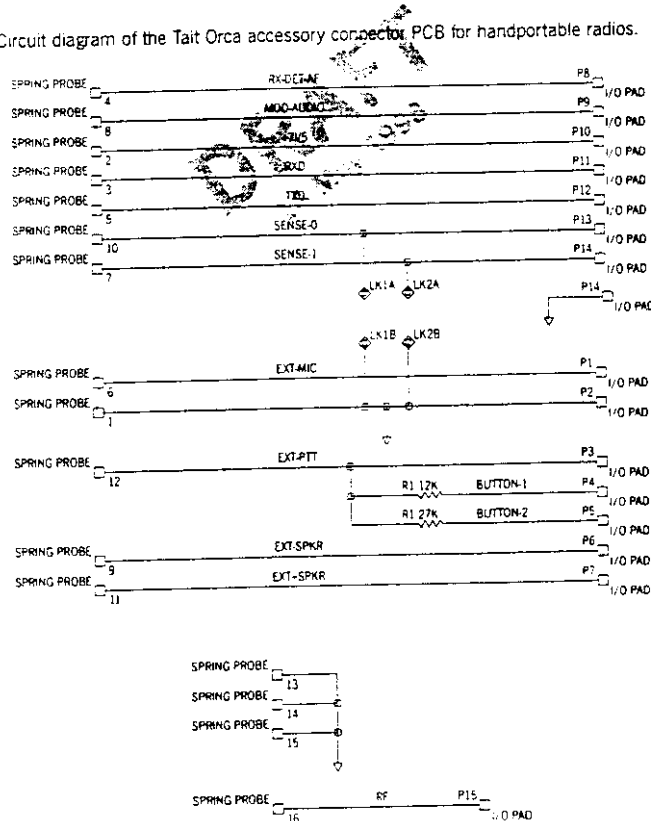
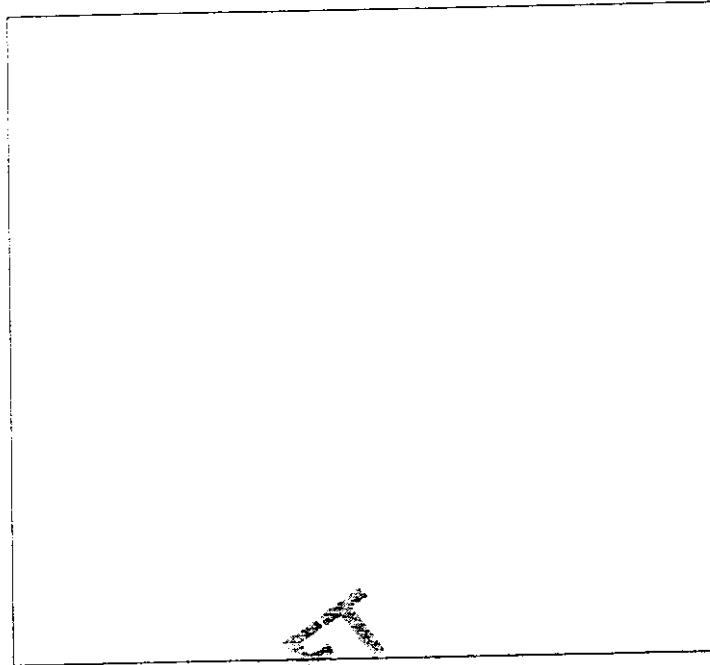


Figure G-2:
Assembly
diagram of the
accessory
connector



modem output is not directly suitable; you must provide filtering to ensure the signal is within this envelope. key-up, and so no data can be sent during this time.

Setting the signal level

The 0 dB reference level shown in Figure G-3 is determined by setting the peak detected modem output signal level so that you get 60 percent full system deviation. The peak point in the spectrum of the modem output must occur at a frequency less than 3 kHz. The MOD-AUDIO input signal can extend down to DC.

To prevent the internal microphone and audio path interfering with the modem's transmit signal, the internal microphone must be disabled. To do this, tie EXT-MIC to ground via a 10 k Ω resistor.

Sending data

When the modem is to send data, the EXT-PTT line must be held low (0 V) to key up the transmitter. The transmitter takes (??) ms to

Connecting the modem input

The modem input is connected to the radio's RX-DET-AF output. The DC bias of RX-DET-AF can vary, and so AC coupling is recommended. The frequency response of RX-DET-AF is shown in Figure G-4.

Group delay

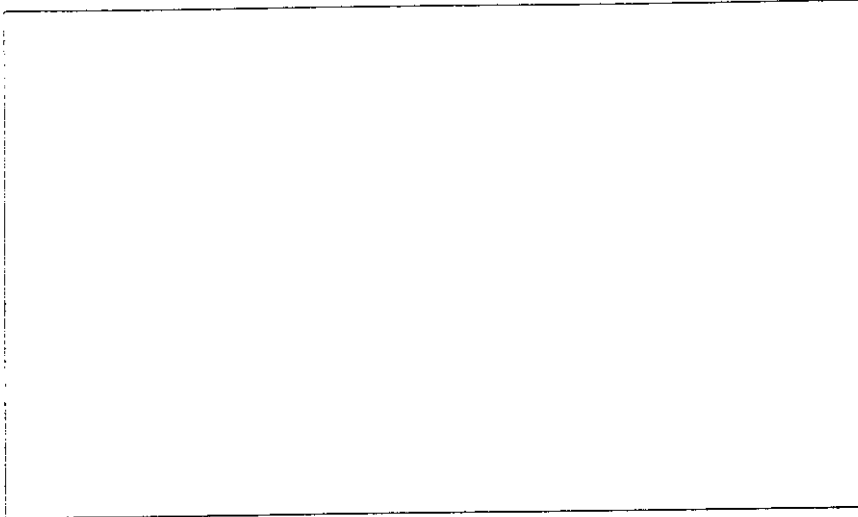
The radio's group delay distortion is less than 150 μ s for both the receive and transmit paths.

7.5 mm accessory adaptor

You can connect non-Tait accessories that require a 7.5 mm adaptor to the Tait Orca handportable using the 7.5 mm accessory adaptor.

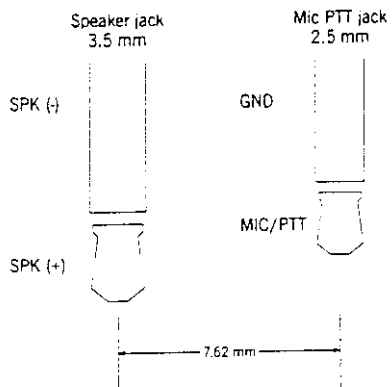
Such accessories use 3.5 mm and 2.5 mm phono plugs with 7.62 mm spacing between them. The speaker and microphone PTT jacks

Figure G-4: two graphs, one wideband, one narrowband



DRAFT
14 May 1998

Figure G-5: Plugs for the 7.5 mm accessory adaptor



PART H Additional information

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Glossary

active

The 'on' (asserted) state of a signal or indicator.

ADC

Analog to digital converter. An electronic device that outputs binary data dependant upon the magnitude of voltage input.

brownout

A dip in the supply voltage sufficient to put the control section into hardware reset.

calibration

The process of determining the **calibration data** for a radio. Calibration is normally only carried out during product manufacture or major service.

calibration data

The set of coefficients for each of the electronic tuning variables, as a function of frequency, which allows the radio to calculate the **configuration data** for any frequency it operates on. The **calibration data** is unique for each radio.

call

A complete exchange of information between two or more parties. In **trunked mode**, this may occur on the **control channel** or on a **traffic channel**.

CCTM

Computer controlled test mode. The operating mode of the radio whereby computer equipment can control various radio functions by sending commands down a serial link to the radio.

channel

A receive/transmit frequency pair.

configuration

The determination and setup of the **configuration data** for a given frequency from the

programmed **calibration data** (i.e. electronic tuning).

configuration data

The data set corresponding to the value of the electronic tuning variables on a given channel. This is calculated for each frequency from the **calibration data**.

control channel

The channel used by a **trunking system** to control the radio.

conventional mode

The mode of operation whereby the radio behaves as a conventional two-way radio (i.e. non-trunked operation).

CSN

Chassis serial number.

CTCSS

Continuous tone controlled subaudible signalling. Continuous, subaudible coding on the channel for the purpose of segregating user groups.

DAC

Digital to analog converter. An electronic device that outputs a voltage dependent upon the value of binary data input.

database

The set of programmable data points that allows the product to be customised for a particular application or mode of operation.

DC

Direct current.

DCS

Digitally coded squelch. Continuous, subaudible coding (repeating digital code sequence) on the **channel** for the purpose of segregating user groups.

PA

Power amplifier.

PABX

Private automatic branch exchange.

PCB

Printed circuit board.

PLL

Phase locked loop.

PLCC

Plastic leaded chip carrier.

PMR

Private mobile radio.

programming mode

The mode of operation of the radio in which computer equipment can read from and write to the radio **database**.

QFP

Quad flat pack.

PSTN

Public service telephone network. [is this right????]

RAM

Random access memory.

receive mode

This is the state wherein the radio is producing a valid busy output, irrespective of whether any audio output is produced at the speaker terminals. The +5V-ECON supply is on, and sufficient time has elapsed for various circuit blocks to settle.

RF

Radio frequency.

RSSI

Received signal strength indicator.

SCI

Serial communications interface. This is the serial interface from the radio to an external device, normally utilising transmit and receive data, signal and ground lines.

Seicall

Selective calling. Sequential tone burst coding on the channel for the purpose of selecting an individual or group with which to communicate.

selecting

The act of picking a **label** from a displayed list using the arrow keys.

signalling

Non-voice coding on the channel for the purpose of identifying parties and/or segregating user groups, e.g. CTCSS, DCS, Seicall.

SMD

Surface mount device.

SOIC

Small outline integrated circuit.

SOT

Small outline transistor.

squelch

The channel busy detection circuitry. The decision to activate/deactivate the audio signal path is based on a signal-to-noise measurement on the received RF signal (the squelch circuitry precedes the mute circuitry).

standby state

This is essentially when the +5V-ECON line is off. That is, when the radio is drawing the minimum current, while still being switched on.

string (simple)

A sequence of the characters 0 to 9, *, #, which instructs the radio to initiate a call or perform some other function.

successful (call)

A call for which a **traffic channel** is assigned.

system restart

The action taken by the radio (e.g. in response to the 'C' character received on the SCI) where it immediately ceases current operation, then behaves as though it has just been switched on.

Tait Electronics Limited

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