4 T889 Fault Finding

Caution: **This equipment contains CMOS devices which are susceptible to damage from static charges. Refer to Section 1.2 in Part A for more information on anti-static procedures when handling these devices.**

The following test procedures and fault finding flow charts may be used to help locate a hardware problem, however they are by no means a complete fault finding procedure. If you still cannot trace the fault after progressing through them in a logical manner, contact your nearest Tait Dealer or Customer Service Organisation. If necessary, you can get additional technical help from Customer Support, Radio Systems Division, Tait Electronics Ltd, Christchurch, New Zealand (full contact details are on page 2).

Refer to Section 5 where the parts lists, grid reference index and diagrams will provide detailed information on identifying and locating components.

The following topics are covered in this section.

4.1 Visual Checks

Remove the side cover from the T889 and inspect the PCB for damaged or broken components, paying particular attention to the surface mounted devices (SMDs). Also check for defective solder joints.

Refer to Section 4.7, Section 4.8 and Section 3 of Part A for more details on repair and replacement of components.

4.2 UNC Thread Screws

All black finish Pozidriv screws used in the T889 are 4-40 UNC thread and cannot be interchanged with M3 screws. Note that different lengths are used in different applications.

4.3 Component Checks

If you suspect a transistor is faulty, you can assess its performance by measuring the forward and reverse resistance of the junctions. Unless the device is completely desoldered, first make sure that the transistor is not shunted by some circuit resistance. Use a good quality EVM (e.g. Fluke 75) for taking the measurements (or a 20k ohm/V or better multimeter, using only the medium or low resistance ranges). The collector current drawn by multi-junction transistors is a further guide to their performance.

Note: Q1 (2SC2933) and Q2-Q6 (SD1414) are common base transistors.

If an IC is suspect, the most reliable check is to measure the DC operating voltages. Due to the catastrophic nature of most IC failures, the pin voltages will usually be markedly different from the recommended values in the presence of a fault. The recommended values can be obtained from either the circuit diagram or the component data catalogue.

4.4 DC Checks

Note: No RF power is to be applied during these checks.

Check that +13.8V is present on the collectors of Q2, Q3, Q4, Q5 and Q6. Make this measurement when the transmitter is not keyed.

Check that approximately 8-13.8V is present on the collector of Q1 (the level is dependent on RV115 being set to maximum).

Check that +13.8V is present at pin 4 of IC103 and pin 4 of IC101.

Check that approximately 8-13.8V is present at pin 8 of IC105 (the level is dependent on RV115 being set to maximum).

Check that +7.0V is present at the output of regulator IC109 (pin 7).

4.5 RF Checks

The PA Fault Finding Chart (Section 4.6.1) provides a systematic approach for locating a fault in the RF circuitry. Use this chart in conjunction with Figure 4.1, which shows the locations of the 50Ω input and output test points for RF transistors Q1-Q6.

Transistor	Input Transmission Line	Output Transmission Line
Q1-Q2	L16 (Q1)	L21 (Q2)
Q3	L24	L23
Q4	L26	L32
Q5	L33	L39
Q6	L43	L49

Note 1: ***Always*** test individual PA stages at the 50Ω test points, located at the ends of the semi-rigid transmission lines furthest away from the RF transistors.

Note 2: ***Always*** test Q1 and Q2 as a pair.

Note 3: Use 50Ω semi-rigid coax for the flying test leads. Ensure each output is terminated in a 50Ω load of the correct power rating.

For problems with the power control circuitry, refer to the Power Control Fault Finding Chart (Section 4.6.2).

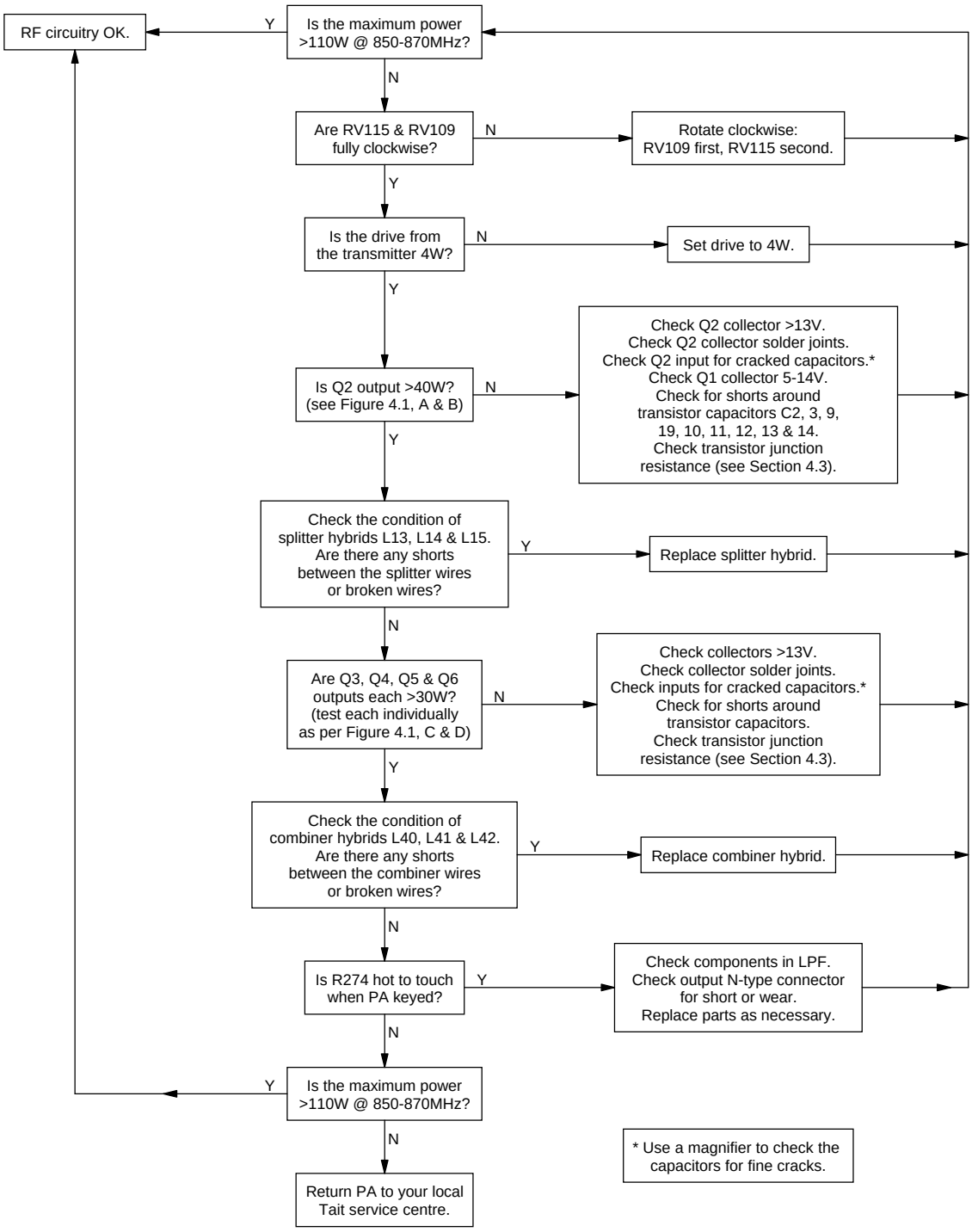
replace A4 pages D4.5/D4.6 with A3 pages D4.5/D4.6

Figure 4.1 T889 Test Break Point Location

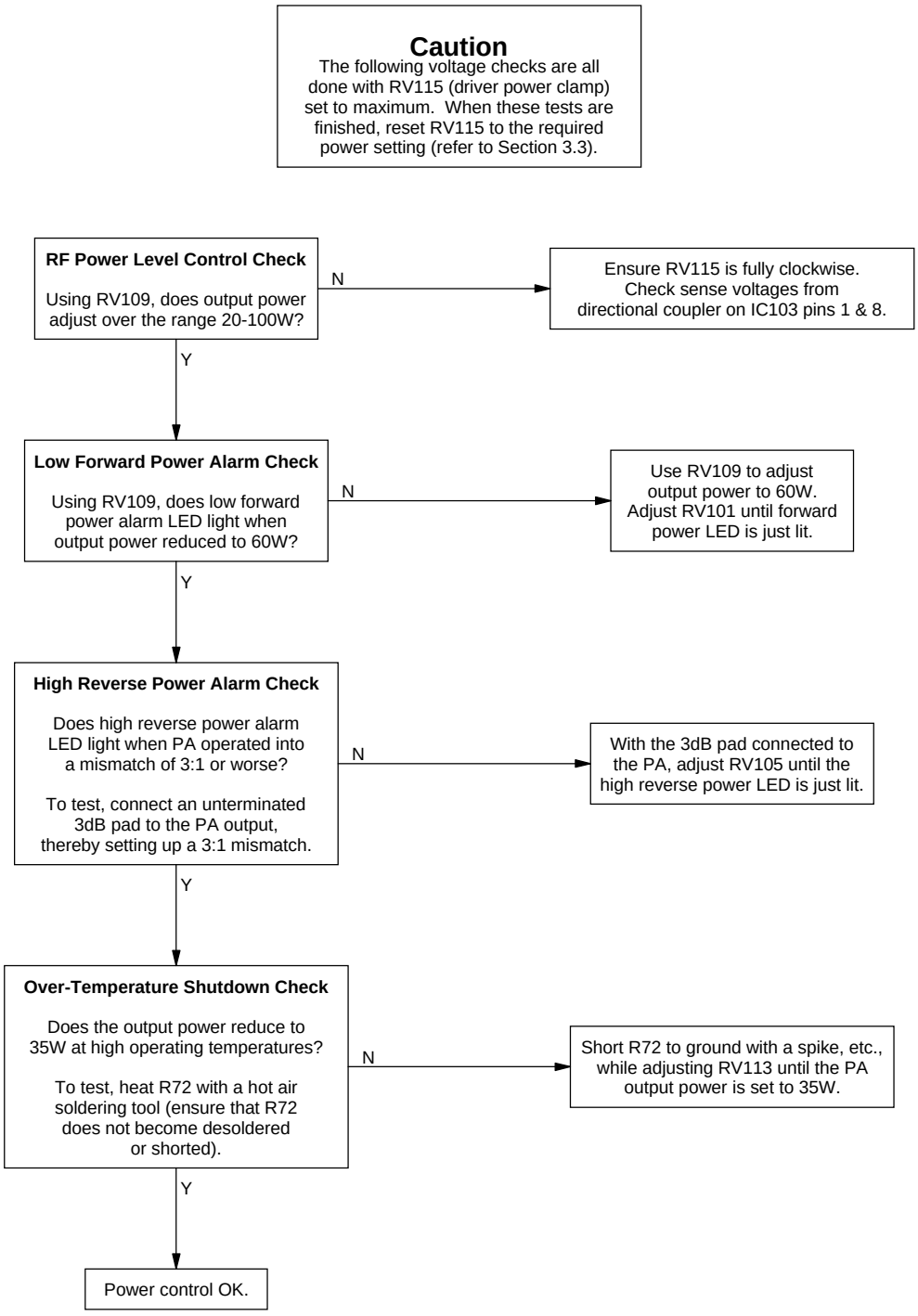
replace A4 pages D4.5/D4.6 with A3 pages D4.5/D4.6

4.6 Fault Finding Charts

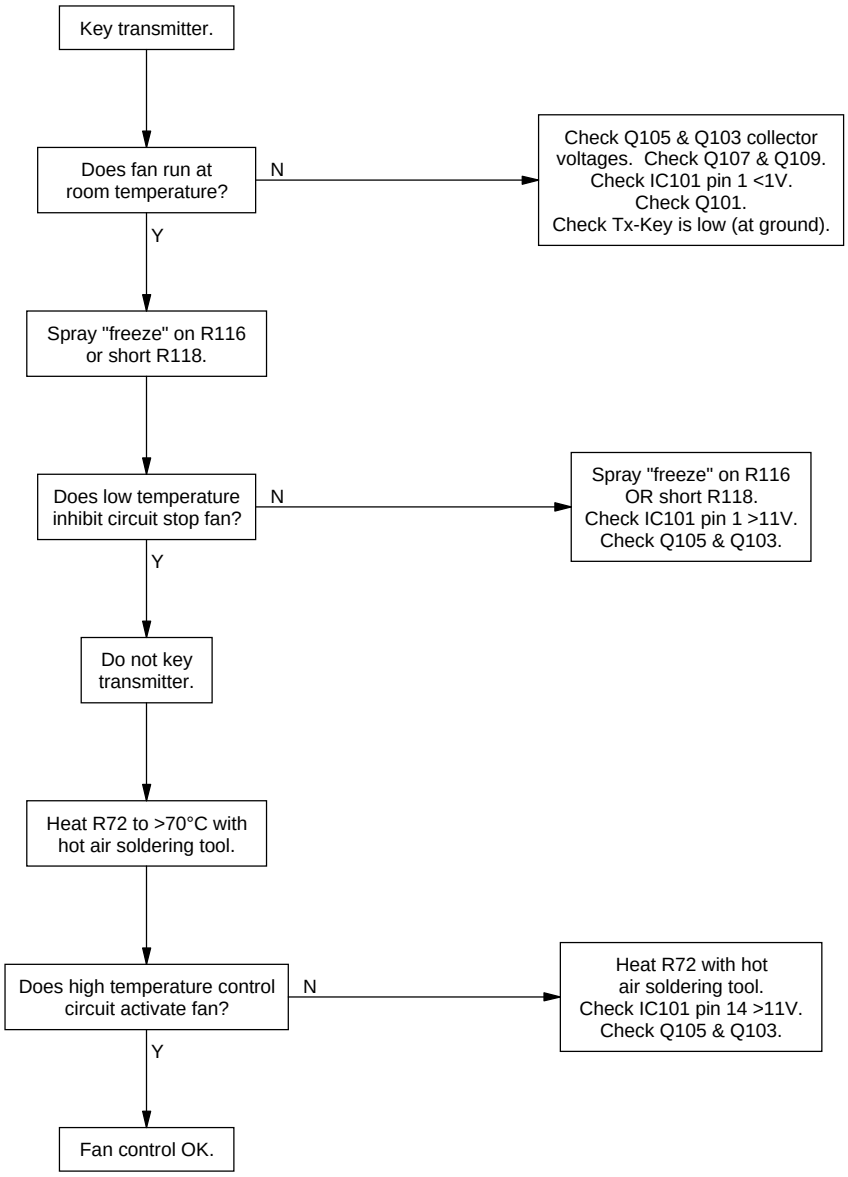
4.6.1 PA



4.6.2 Power Control



4.6.3 Fan Control Circuitry



4.7 Replacing RF Power Transistors

Caution: **Failure to comply with the following procedure can result in failure of the device due to poor heatsinking, or worse, can endanger the health of the assembler if the beryllium oxide die carrier is smashed during assembly.**

Caution: **As the location of certain components in the PA is critical to performance, it is important that any components removed or disturbed are refitted in *exactly* the same position.**

Caution: **Do not apply too much heat or pressure to the PCB pads and tracks as you may damage them or lift them from the PCB, causing permanent damage to the PA.**

4.7.1 Transistor/Capacitor Spacing

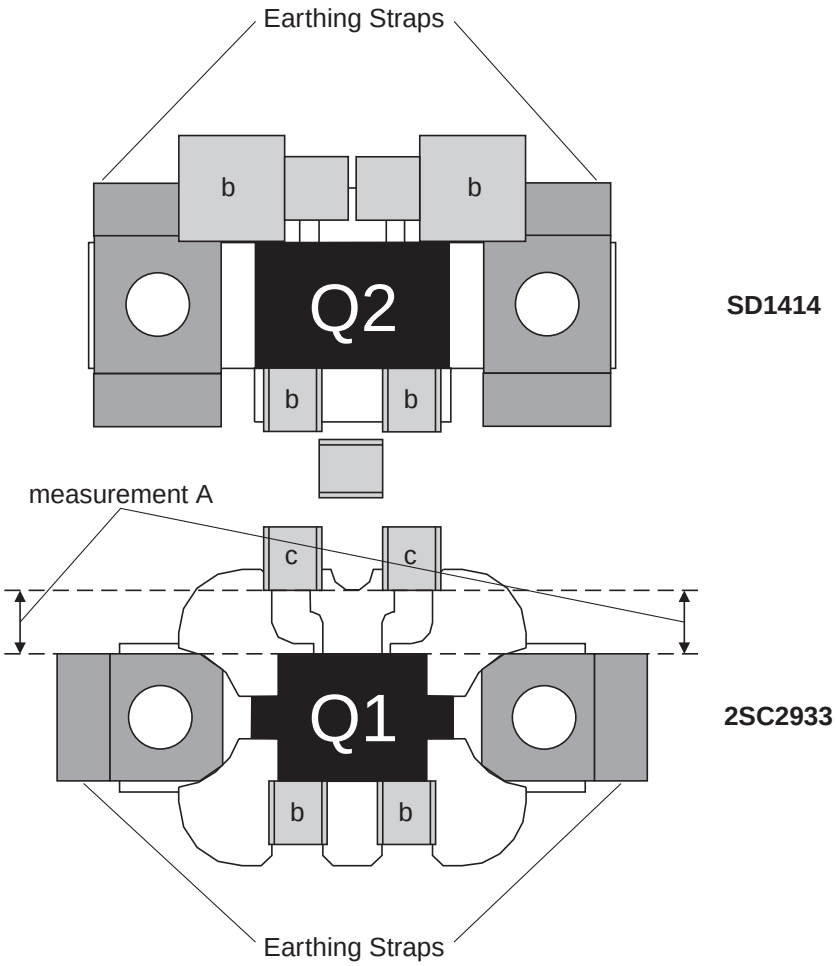


Figure 4.2 T889 Typical Transistor/Capacitor Spacing (Q1 & Q2 Shown)

4.7.1.1 Q1 (2SC2933 Pre-Driver)

Refer to Figure 4.2.

Position the capacitors labelled “b” hard up against the transistor body.

The exact positioning of the capacitors labelled "c" is important in order to achieve at least 40W output power from Q2. You may need to readjust their positioning after replacing Q1 to achieve the required output power level. We therefore suggest the following procedure:

- before removing Q1, measure the distance between the capacitors labelled “c” and the transistor body (measurement “A”);
- after you have replaced Q1, replace these capacitors in the same position, using measurement "A" as a reference;
- measure the output power from Q2 and adjust the exact positioning of these capacitors to achieve at least 40W.

4.7.1.2 Q2, Q3, Q4, Q5 & Q6 (SD1414)

Refer to Figure 4.2.

Position all capacitors labelled “b” hard up against the transistor body.

4.7.2 Replacement Procedure

Note: This procedure requires high quality solder joints. We strongly recommend that you use a 100W soldering iron and low melting point solder (62% tin, 36% lead, 2% silver).

Desolder and remove the components from around the transistor.

Desolder the transistor tabs and earthing straps by heating with a soldering iron and lifting away from the PCB with a screwdriver or thin stainless steel spike.

Remove the transistor retaining screws and remove the transistor.

Remove any excess solder from the PCB pads with solder wick.

Lightly tin the underside of the tabs on the replacement transistor and earthing straps. Remove any excess solder to leave a thin, even layer on the tabs.

Apply a small amount of heatsink compound (Dow-Corning 340 or equivalent) to the transistor mounting surface. Sufficient compound should be used to ensure an even film over the entire mounting surface.

Place the transistor on the PCB in the correct orientation (ensuring the tabs are flush to the surface), fit the new earthing straps and torque down the retaining screws to the correct torque (0.7Nm/6in.lbf.).

Solder all transistor tabs and earthing straps to the PCB.

Caution: **Do not solder the transistor tabs before torquing down otherwise the device may be broken.**

Replace all other components in exactly the same positions as noted previously.

4.8 Removing The PCB From The Heatsink

Note 1: This is a lengthy procedure and should be considered only after all other checks have been carried out. There are no components on the bottom of the PCB.

Note 2: T889 PAs manufactured after August 25th 2000 will have a heatspreader fitted between the main PCB and the heatsink to help dissipate the heat generated by transistors Q2-Q6. Refer to TN-632 for more details.

Remove the harmonic filter shield lid.

Desolder the power feed to the fan from the PCB.

Remove the 50 ohm output N-type connector by unscrewing it from the heatsink casting and desoldering it from the PCB.

Unplug the 50 ohm input coaxial cable from the PCB, unscrew the BNC connector from the heatsink, and remove the connector and cable (cutting cable ties as required).

Desolder the positive and negative power feed wires from the PCB.

Disconnect the ribbon cable from the D-range PCB.

Remove the 2 screws securing the D-range connector and PCB to the heatsink and withdraw the assembly and wires from the heatsink.

Remove the mounting screws for the following transistors:

Q1, Q2, Q3, Q4, Q5, Q6 and Q137.

Remove the mounting screws for the termination resistors:

R276, R277, R278, R272, R274 and R275.

Remove the retaining screws for the wireline couplers:

L13, L14, L15, L40, L41 and L42.

Remove the 13 PCB retaining screws.

Push the three LEDs out of their front panel grommets.

Lift the PCB gently from the heatsink to gain access to the underside of the board.

Note: R272-278 and Q1-Q6 may be stuck down with heatsink compound. You may need to carefully prise them away from the heatsink with a small screwdriver.

Caution: **Keep the heatsink compound clean while the PCB is detached. Any objects caught in the heatsink compound underneath the device which prevent effective earthing and/or heatsinking may cause the device to fail.**

Caution: **Do not operate the PA with the PCB detached as the heatsink is used for earthing and heat dissipation.**

To replace the PCB, reverse the order of removal, taking care that the wiring is correctly positioned and not 'pinched'.

Note: Torque down the transistor and termination resistor mounting screws to the correct torque (90N.cm/8in.lbf.).

Make sure that the heatsink compound has stayed clean, and that the insulating pad for Q137 is not damaged.

If you have difficulty refitting the LEDs, try pushing the body of the LED back into the grommet with a thin screwdriver or spike.

