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# **SERVICE MANUAL**

## **SBX-11A**

SSB Portable  
Radio Telephone

65-5014

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## SECTION 1 - DESCRIPTION

### A. GENERAL DESCRIPTION

The SBX-11A is a portable, solid state, single sideband transceiver, with self contained batteries and microphone.

The entire unit is enclosed in a strong weather resistant aluminum case, with a hinged battery section and removeable cover.

It is capable of operating on four channels in single or crossband simplex, over a range of 1.6 to 8 MHz.

Various battery combinations are available of the non-rechargeable primary or rechargeable secondary types to allow up to 50 hours of operation. Optional battery charger accessories are available to facilitate charging the batteries from any suitable AC or DC source.

The SBX-11A has been designed for the utmost in simplicity of operation and care. All controls, metre, speaker and microphone are accommodated on the front panel. A cover with carrying handle is supplied to protect the entire front panel when the set is not being operated or when in transit.

Internal circuitry is of the utmost simplicity, employing silicon type transistors and the latest silicon integrated circuits. Plug-in tuning coils, numerous test jacks and simple circuit board design ensure easy tuning and maintenance.

Some notable features are: The metre is automatically switched to indicate battery condition or power output. A special ALC control circuit allows efficient operation on VSWR of up to 2:1 or antenna loads of from 25 to 100 Ohms without transmitter adjustments. The set is protected against reversed polarity or excessive voltage from the power source. A tough microphone designed to fit the hand is permanently connected to avoid loss.

Accessories include: Chargers to charge the batteries from 115/230 VAC or 13.6 VDC power sources, portable whip and wire antennas.

## B. SPECIFICATIONS

### 1. General

Mode of Operation:	Single sideband - suppressed carrier (3A3J) USB standard LSB available on special order.	
Number of Channels:	Four.	
Crossband Operation:	Available on all channels.	
Temperature Range:	-30 to +50 Degrees C.	
Frequency Stability:	+/-100 Hz.	
Frequency Range:	1.6 - 8 MHz.	
Battery Drain:	Receiver 30 mA average. Transmit 600 mA average.	
Batteries:	9 size 'D' flashlight cells (See Section III).	
Dimensions (overall):	Height	(8.6 cm) 3-3/8"
	Width	(22.9 cm) 9"
	Length	(32.4 cm) 12-3/4"
	Weight with Batteries	(3.6 kg) 8 lbs

### 2. Transmitter

Power Output:	5 - 10 Watts PEP depending on battery condition. D.O.C. rating 8.7 Watts PEP at 11.75 Volts.	
Spurious Output (Maximum):	43 dB below PEP.	
Carrier Suppression:	50 dB below PEP.	
Intermodulation Distortion:	26 dB below PEP.	

B. SPECIFICATIONS (Cont'd).

AF Response: +/- 3 dB 400 - 2500 Hz.

RF Output  
Impedance: 50 Ohm nominal.

Output Protection: No damage shorted or open antenna.

ALC: Limits power to 10 W PEP maximum.

3. Receiver

Sensitivity: 0.5 uV for 12 dB SINAD.

Selectivity: 2.1 kHz bandwidth at 6 dB down.  
4.5 kHz bandwidth at 60 dB down.

AGC: Input variation from 5 uV to 100 mV produces  
less than 10 dB output change.

Image and  
Spurious Rejection: 44 dB or better.

Clarifier Range: Nominally 0.003% of channel frequency.

AF Response: Same as for transmitter.

AF Output: 250 mW to speaker at 5% distortion.

## SECTION II - OPERATING INSTRUCTIONS

1. Turn the power on by turning the VOLUME control clockwise.
2. Check the metre indicator for battery condition (See Section III-C),
3. Connect the antenna system to the SBX-11A ANT and GND terminals per drawings in antenna section.
4. When using a fixed tuned type of antenna, the CHANNEL and antenna frequency must correspond.
5. To receive, adjust the VOLUME and CLARIFIER controls for the desired volume and maximum speech clarity.
6. To transmit, press the microphone button and talk from a distance of about two inches into the microphone. Do not shout. Power output will be indicated by the metre needle swinging to the right.
7. If the antenna is of the tuneable type it must be tuned to the channel frequency selected. Each time a different channel is selected by the CHANNEL switch the antenna must be retuned to the new frequency.
8. To tune the antenna use the following procedure:
  - a) Select the desired channel.
  - b) Press the TUNE button while quickly tuning the antenna for maximum POWER OUTPUT indication on the metre.

### IMPORTANT

When tuning the antenna the SBX-11A is delivering a continuous high level of power and during this period the consequent battery drain is several times higher than in ordinary SSB operation. To avoid unnecessary battery drain keep the transmitter 'ON' only as long as is absolutely necessary for antenna tuning.

### 9. CAUTION

Always turn the power off at the volume control before replacing the cover of the SBX-11A for transportation. Failure to do so will discharge the batteries.

### SECTION III - BATTERIES (INSTALLATION)

#### A. GENERAL

Nine size 'D' regular flashlight cells connected in series for a nominal value of 12 Volts, supply power to the SBX-11A. These cells are inserted in groups of three into plastic tubes which fit into the battery box on the bottom of the set. The battery box unlatches from the set with two pull down catches. Battery polarity is indicated on the inside of the box.

#### B. SELECTION

1. When selecting a battery type the following points should be considered:
  - a. Type of use
  - b. Temperature of operation
  - c. Rechargeable or non-rechargeable
  - d. Battery life
  - e. Availability

For example: if operation to -22 Deg.F. is required, a nickel cadmium battery will be needed. The temperature range of the various battery types are:

Nickel Cadmium	-22 Deg.F. to 122 Deg.F. - -30 Deg.C. to 50 Deg.C.
Alkaline	14 Deg.F. to 122 Deg.F. - -10 Deg.C. to 50 Deg.C.
Zinc Carbon	32 Deg.F. to 122 Deg.F. - -0 Deg.C. to 50 Deg.C.

If the above is not a consideration then the choice may depend on whether rechargeable or non-rechargeable types are desired. When selecting one of the rechargeable types, read the charging instructions to ensure that proper recharging facilities are available.

The choice of the non-rechargeable type will depend on battery life desired and perhaps on availability. Consult the battery table for more information.

Do NOT use Lithium or lead-acid cells in the battery holder. Their voltage is too high and the internal fuse will blow.

2. Battery Table

The following sets of batteries are recommended:

Battery	Life Hrs.	No. of Recharges	SCL #	Eveready	Burgess	Mallory
Nickel Cad.	50	300	AC-19K	CH4	CD-10	--
Alkaline	50	0	AC-19I	E95	AL-2	MN-1300

NOTE: The SCL number listed above is a complete battery set.  
When ordering by manufacturer's number, nine are required.



C. RECHARGING AND REPLACEMENT

1. When to recharge or replace batteries.

To check for weak batteries, push the TUNE button for five seconds and check the meter indication immediately upon releasing the microphone button.

SBX-11A Meter Scale:

A	B	C
Red	Green	Red

If the meter falls in section:

- A: Replace batteries if non-rechargeable or recharge if rechargeable.
- B: This is the normal operation region.
- C: Do not operate the transceiver in this region while recharging.

NOTES:

- a) New or fully charged batteries may start operation in the C section of the meter, this condition may be ignored as they will quickly discharge to the B or green working section of the scale.
- b) No accurate estimate of the power remaining in the nickel cadmium batteries can be made by reading the meter scale. Charging should be based on the hours of use; generally 2 - 2-1/2 hours of use will require 1 hour of charging. If in doubt as to condition of battery, charge for 14 hours.
- c) With rechargeable batteries, recharge batteries before metre needle falls into Section A or battery life may be affected.

## SECTION 1V - ANTENNAS (INSTALLATION)

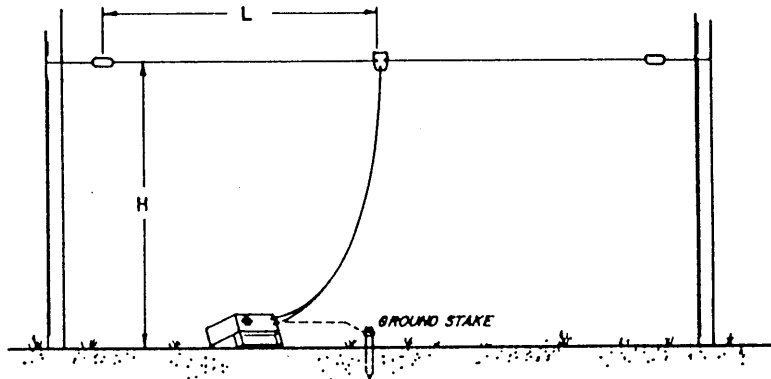


FIGURE 1                      DOUBLET ANTENNA OPERATION

The doublet antenna is a relatively inexpensive and efficient antenna.

1. Be sure antenna used is the correct one for the desired frequency. See #5 below.
2. A ground stake and wire are shown. These are not necessary for doublet operation, but serve only as a static discharge path.
3. The dipole may be supported from any convenient objects such as poles, trees, buildings, etc.
4. The maximum signal is received and transmitted broadside to the antenna.
5. The length (L) of each 1/2 of the antenna is:-

$$L = \frac{234}{\text{freq. (MHz) of channel}}$$

preferably, the antenna height (H) = length (L)

6. TO OPERATE: Set up antenna and connect leads to the SBX-11A, one to each binding post. Connect ground assembly if needed. Antenna is now ready for operation - no tuning is necessary.

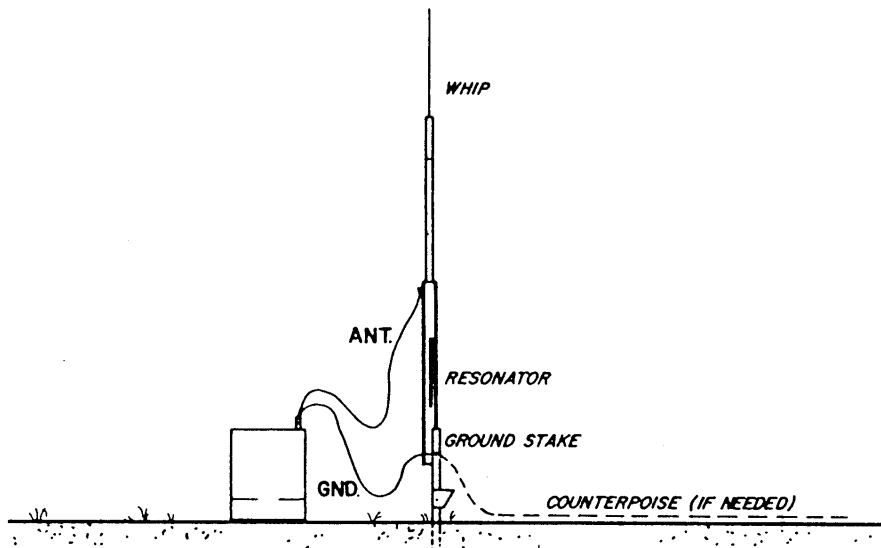


FIGURE 2                      TUNEABLE WHIP ANTENNA OPERATION

The tuneable whip is an easily erected and transportable antenna, which may be easily tuned to any frequency within its range. It is ideally suited where there are no supports for a doublet. The antenna is not directional and needs a good ground for efficient operation. A counterpoise may be needed if the ground is poor. Some notes for tuneable antennas (i.e., Spilsbury Communications Ltd. STA-210 Series) are:

1. Connect wire from resonator unit to antenna (ANT) binding post. Connect wire from ground stake to ground (GND) binding post.
2. Press the TUNE button and quickly adjust antenna for maximum indication on front panel metre.

ADDITIONAL NOTE:

It will be noticed on different frequencies, that the metre will show different maximum indications. This is normal, since the antenna impedance changes with frequency.

## SECTION V - CIRCUIT DESCRIPTION

Refer to SBX-11A schematic while reading the following description. For location of P.C. board components see the component layout diagram of the printed circuit board.

### A. OSCILLATORS

1. The receiver channel oscillator is Q104. Its frequency is varied by the CLARIFIER C501. Trimmer capacitors on each channel permit setting each crystal on frequency while the CLARIFIER is centered.
2. The transmitter channel oscillator is Q106. It is similar to the receiver channel oscillator but does not have a CLARIFIER frequency control. Each crystal has a trimmer capacitor.
3. The LFO operates at 456.5 kHz. C138 is used to adjust the oscillator to the correct frequency.

### B. RECEIVER

1. Q101, a FET emitter follower, couples the signal from the receiver input filter to the mixer U101. In U101 the signal is amplified and mixed with the channel oscillator frequency - producing the I.F. frequency which is fed to U102 through T101.
2. The signal is further amplified by U102, then passes through transformer T102 and sideband filter FL101.
3. U103, which has two outputs (pin 6 and 8) amplifies the signal from FL101. The output from pin 8 is rectified by D106 and D107 and the resultant DC controls the current through Q102 which supplies the forward AGC bias for U101, U102, and U103.
4. The output from pin 6 is fed to T103 then to the balanced modulator/demodulator FL102 through T-R switch diode D102. In FL102 this I.F. signal mixes with the LFO signal from Q107 to produce the audio signals.
5. The audio is fed to volume control R1, to Q103 the audio preamp, and to U104 the audio output, then to the speaker via C125.

## C TRANSMITTER

1. The audio signal from the microphone is fed to Q113 through R.F. decoupling network L110 and C166. The Darlington configuration of Q112 is used to match the impedance of Q113 to the input of balanced modulator FL102.
2. The LFO (456.5 kHz) is fed into the double balanced mixer FL102 and is mixed with the audio input signal from Q112.
3. A double sideband signal (suppressed carrier) results and is fed to the input of the sideband filter FL101 via T-R switch diode D101. Diode D102 is biased off.
4. The upper sideband is removed by the sideband filter and the lower sideband is amplified by U103 and fed to the transmitter balanced channel mixer FL103 through T-R switch diode D108. D102 is biased off.
5. The channel oscillator frequency (H.F.O.) from Q106 is also fed into the balanced mixer FL103 and the two main output frequencies are the channel oscillator frequency +/- the I.F. frequency.
6. The transmitter filter 'TX' is tuned to select the lower of these two frequencies (which is an upper sideband signal) and reject all other frequencies.
7. The desired channel frequency is now amplified by broadband amplifier IC U105, passes through T106, is again amplified by push-pull broadband amplifier Q109 and Q110 and is coupled to the tuned tank circuit 'PA' via T105.
8. Thermistor R150 stabilizes the bias over the temperature range of -30 Deg. C to +50 Deg. C.
9. The output load impedance is nominally 50 Ohms but the SBX-11A will operate into 25 to 100 Ohms with very little reduction of power with no reloading.

10. Current transformer T1204 provides power output indication on the front panel metre and also provides part of the ALC feedback voltage to the gate of the FET microphone amplifier Q113. Part of the ALC is developed from voltage at the output. This advanced ALC circuit senses power and so the output power is almost constant for loads between 25 and 100 Ohms,.

D. METERING

1. On receive the battery voltage is monitored on an expanded scale to permit determination of battery condition.
2. The metre is automatically switched to monitor antenna output current on transmit.

E. MISCELLANEOUS

1. Q108 shorts out receiver B+ when switching from receive to transmit, to prevent feedback from the speaker to the microphone during the switching interval.
2. Operate/Tune Switch

When in tune position a DC current is passed through double balanced mixer FL102 unbalancing it and permitting the LFO frequency to pass through it, through Diodes D101 and D102 (turned on by the Tune Button) into the 2nd double balanced mixer FL103. The LFO input to FL103 produces the suppressed carrier frequency at the output which is used for antenna tuning. The Tune Button can also be used to tune the transmitter into a dummy load resistor.

3. Supply Protection

If the supply voltage exceeds about 18 V the zener diode D1 will conduct and blow the fuse F1. (This should not occur with any of the power options offered for the SBX-11A). If the supply polarity is reversed the zener diode will conduct in the forward direction and blow the fuse.

## SECTION VI - TUNING AND ALIGNMENT

### A. CRYSTAL INFORMATION

#### Low Frequency Oscillator Crystal:

One required per radio.

Spilsbury Communications 85-311, frequency 456.500 kHz.

#### High Frequency Oscillator (H.F.O.) Transmitter and Receiver Crystals

One each required per channel. (Two total of same frequency)

Spilsbury Communications Part No. 85-222, frequency is calculated as follows:

1. Determine Assigned Frequency as per D.O.C. document.
2. Determine Suppressed Carrier Frequency by subtracting:
  - a) 1.5 kHz from the Assigned Frequency for Land Equipment
  - or
  - b) 1.4 kHz from the Assigned Frequency for a Ship Station (Marine Use).
3. Add 456.5 kHz to the Suppressed Carrier Frequency. This is the Actual Crystal Frequency

Crystals may be ordered from Spilsbury Communications Ltd. as follows:

by specifying Suppressed Carrier Frequency with suffix -SCF

or

by specifying Actual Crystal Frequency with suffix -Xtal

## B. CHANNEL FILTER INFORMATION

Frequency Range	Colour Code	'RX' Filter	'TX' Filter	'PA' Filter
1.6 - 2.0 MHz	White	01-214	01-219	01-206]
2.0 - 2.82	Black	01-215	01-220	01-207
2.82 - 4.0	Brown	01-216	01-221	01-208
4.0 - 5.66	Red	01-217	01-222	01-209
5.66 - 8.0	Orange	01-218	01-223	01-210
8.0 - 10.0	Yellow	01-394	01-395	01-396

Order 'RX', 'TX' and 'PA' Filter Kits by frequency colour code. Order individual filters by Part No. A complete 'RX', 'TX' and 'PA' Kit can be ordered by colour code if the two frequencies are within the frequency range.

## C. Main Chassis Removal

1. Unlatch top cover.
2. Unlatch battery box and disconnect battery plug.
3. Loosen the two screws on the back cover about 1/8" and holding onto the outside case, push rear of the chassis with thumbs to break the chassis loose from the rubber seal.
4. Remove screws completely and finish removing chassis carefully.



D. Tuning to Channel Frequencies

1. Minimum test equipment necessary

- (a) Standard signal generator with a calibrated low impedance output (50 Ohms or less)
- (b) A frequency counter with accuracy of 1 part in 10<sup>6</sup> or preferably 10<sup>7</sup> Hz with an input sensitivity of .01 Volts at 1 MegOhm.
- (c) A 50 Ohm non-reactive dummy load resistor.
- (d) A 500 mA R. F. ammetre.
- (e) An audio output metre.
- (f) An oscilloscope useable to 8 MHz or an R.F. VTVM.
- (g) A regulated 12 Volt, 2 Amp power supply.

2. Installation of Channel Components.

- (a) Remove crystal clamp and P.A. tank coil cover can.
- (b) Install TX and RX crystals in the desired channel positions.
- (c) Install TX filters and RX filters in the desired channel positions. The filters are marked on the pin side with T and R and an arrow which corresponds to the arrows on the printed circuit board.
- (d) Install P.A. tank coils in the desired channel positions. Note the coloured stripe on the base of the P.A. coils - the stripe should line up with the stripe of the printed circuit board.
- (e) Replace crystal clamp and P.A. tank coil cover can. The screws and nuts holding these components to the printed circuit board should be tightened firmly but not so that damage to the components occurs.

D. Tuning to Channel Frequencies (Cont'd)

3. Adjustment of Crystal Frequencies

- (a) Adjust the speech clarifier control so the arrow points directly up (toward top of front panel).
- (b) Turn the power on and measure the frequency at the RX H.F.O. test jack (on main printed circuit board). Use a coupling capacitor between the test jack and the counter of not greater than 10 pF capacity.
- (c) Adjust the RX crystal trimmer screw of the channel being tuned until the counter reads the crystal frequency stamped on top of the crystal case.
- (d) Transfer the counter test probe to the TX H.F.O. test jack using the same coupling capacitor.
- (e) Press the P.T.T. button on the microphone and adjust the TX crystal trimmer screw of the channel being tuned until the TX crystals are on their correct frequencies.

4. Receiver Tuning to Channel Frequencies

- (a) Connect the signal generator to the ANT-GND terminals, and the audio metre across the speaker terminals.
- (b) Inject an unmodulated R.F. signal of the channel frequency desired, at a level of 0.1 Volt.
- (c) With the volume turned midway CW tune the signal generator carefully until an audio note of about 1000 Hz is heard.
- (d) Reduce the level of the signal generator until the audio voltage across the speaker is about 1 Volt.
- (e) Tune the slugs of the receiver channel filter being tuned from the 'all out' position (slugs flush with top of coil can) until an increase in sensitivity is noted.

D. Tuning to Channel Frequencies (Cont'd)

- (f) As the sensitivity increases always adjust the signal input level to maintain about 1 Volt across the speaker.
- (g) When nearing maximum sensitivity the volume control may have to be adjusted somewhat to reduce the level across the speaker, thereby avoiding overloading of the audio amplifier.
- (h) Remove the audio meter and signal generator connections before beginning transmitting tuning.

5. Transmitter Tuning to Channel Frequencies

NOTE: Carrier, Bias, Gain and ALC controls for the transmitter have been set correctly at the factory. They should not be adjusted unless the complete alignment instructions are followed. (See Section E Basic Tuning).

- (a) Connect the 50 Ohm dummy load with the R.F. milliammeter in series across the ANT-GND terminals.
- (b) Press the TUNE button while making the following adjustments.
- (c) Tune the slugs of the transmitter channel filter being tuned from the 'all out' position (slugs flush with top of coil can) until the R.F. ammeter begins to indicate. A sensitive oscilloscope or an R.F. VTVM connected across the load will give a better initial indication. It is best to alternately tune each coil of the coil of the filter in small steps until this point is reached.
- (d) Tune the slug in the P.A. tank coil of the channel being tuned from the 'all in' position until the R.F. ammeter indicates a peak.
- (e) Tune the transmitter filter coils, tank coil and loading capacitor alternately of the channel being tuned to get maximum output. Whenever the output exceeds 0.3A detune the input coil of the transmitter filter COUNTER CLOCKWISE for a reading of 0.3A. The input coil of the transmitter filter is adjacent to the crystals. The 0.3A output figure applies only with a power supply voltage of 12 Volts.

(e) (Cont'd)

Supply Voltage    Output Current

10V	.27A
11V	.28A
12V	.29A
13V	.31A

NOTE: These are theoretical values that assume a measurement accuracy of at least 3%. As this is unnecessary the 12V figure is rounded up to 0.3A in the rest of the text.

Do not attempt to tune the transmitter with batteries or a power supply on which the output voltage varies with the amount of load.

NOTE: The loading capacitor tuning is very broad at the lower frequencies. If the peak is not quite reached at minimum capacity, remove the coil can cover and remove from the appropriate tank coil the appropriate capacitor connected to the pins on either side of the coloured strip on the base of the coil. (Do not remove unless necessary).

- (f) Loosely couple a counter to the R.F. output and check that the transmitter output frequency is equal to the crystal frequency 456.5 kHz.
- (g) Release the TUNE button.
- (h) Speak into the microphone. The metre should indicate to the right.
- (i) Return the set to its case and close the battery box. The set is now ready for use following the instructions in the cover.

## E. Basic Tuning and Alignment

NOTE: These adjustments should only be required with component replacement or after long periods of use. Steps should be done in sequence shown.

### 1. Minimum Test Equipment Necessary

- (a) Test equipment specified for tuning to channel frequencies.
- (b) An audio oscillator.
- (c) A milliammeter (V.O.M.)

### 2. Receiver

- (a) LFO (C138). Adjust C138 for an oscillator frequency of 456.5 kHz at the LFO test jack. Do not load with more than 10pF capacity.
- (b) T101, T102 and T103. Connect an R.F. signal generator through a 0.1 uF coupling capacitor to the RX H.F.O. test jack. Adjust the frequency to approximately 455 kHz and increase until a 1000 Hz beat note is heard. Tune T101, T102 and T103 for maximum audio output. Final signal level should be similar to level given in RX stage gain chart.

### 3. Transmitter

- (a) PA Bias (R153). Measure supply current. Turn R153 fully counter clockwise. Advance F153 for increase of about 5 mA (4 mA to 7 mA) while pushing the P.T.T. switch but without modulation.
- (b) TX Gain (R159). For the following steps you should have an orange range TX coil kit and an H.F.O. crystal frequency of about 8.0 MHz to result in an output frequency of about 7.5 MHz. Otherwise use the highest installed frequency.
  - (i) Insert channel components in a channel (see installation of channel components).
  - (ii) Connect the 50 Ohm dummy load with RF ammeter in series across the ANT-GNT terminals.

(b) Cont'd

- (iii) Apply 4 to 6 mV RMS 1000 Hz audio signal at MIC jack to result in exactly 45 mV RMS at AUD jack with P.T.T. switch pressed.
- (iv) Adjust TX filter, tank coil and output loading capacitor for maximum RF output current into the dummy load as per (c), (d) and (e) of Transmitter tuning to channel frequencies but disregard detuning instructions.
- (v) Set R159 for 0.3A output into the dummy load resistor.

(c) ALC R144

With set up as above, double audio input voltage to MIC jack (6 dB increase) and adjust R144 for 0.3A into the dummy load resistor.

(d) Carrier Insertion R137

R137 must be set after R159 (Step B)

- (i) Remove audio input at MIC jack.
- (ii) Push the TUNE button.
- (iii) Adjust R137 for 0.3A into dummy load resistor.

## SECTION VII - MAINTENANCE & REPAIR

### A. TROUBLE-SHOOTING

If the SBX-11A has been working satisfactorily and suddenly fails, check the following items in the order given before proceeding with any further investigation:

1. Are all switches and controls in the correct position?
2. Is the battery voltage adequate?
3. Is there good electrical contact at all antenna and ground connections?
4. Is the antenna wire or feeder broken?

If there is not any indication of battery voltage with the power turned on, and you know the batteries are new or in good charged condition, open the battery case and:

5. Check the polarity of each battery (refer to diagram in battery case).
6. Check the fuse and replace with spare if necessary.
7. Make certain that the battery plug is fully engaged.

NOTE: If the battery voltage is low with good batteries, the temperature may be too low for the battery type in use. See battery section.

If the above points fail to reveal the trouble, technical assistance will be required before the following points can be considered:

8. Remove the set from the case, see Section VI, subsection (c).
9. Make a visual inspection of all components.
10. Check relay operation.
11. Check operation of all three oscillators.

12. Check the main supply voltages (see schematic).
13. If the performance degradation has been gradual, go through all tuning operations step by step.
14. If the set has failed completely or if the above checks do not reveal the trouble, stage gain checks will be required, see the transmitter and receiver stage gain charts.

B. STAGE GAIN CHARTS

1. TX Stage Gain

- ALC control maximum CCW
- Key transmitter
- Measurements made with 1000 Hz audio signal input
- Transmitter tuned to average gain channel with 0.3A R.F. into 50 Ohm.

TEST POINT	VOLTAGE	REMARKS
MIC test jack TP110	4 - 6 mV RMS	This level adjusted to result in correct voltage at AUD test point.
AUD test jack TP109	45 mV RMS	1000 Hz Audio
IF - 2 test jack TP103	120 mV P-P	Scope measurement only DSB minus carrier Two Tone Pattern
Junction D108 & Input of FL103	100 mV RMS	
Junction R159 & FL 103	70 mV RMS	R159 turned max CCW When R159 is set, the voltage on the tap will vary widely with frequency e.g. 10 - 30 mV RMS
C test jack TP106	2.5 V RMS	Channel frequency. R159 turned CCW to result in 0.3A Antenna Current into 50 Ohms with tank tuned.



## B. STAGE GAIN CHARTS

### 2. RX Stage Gain

- Volume Maximum Clockwise
- Connect a signal generator to the test point through a 0.01 uF capacitor (except at RX ANT and AUD connect direct)
- Frequency of signal generator adjusted to result in 1000 Hz audio output
- Input levels should be adjusted for 2.4 V RMS across the speaker or 30 Ohm load 250 mW.

TEST POINT	INPUT LEVEL RMS	INPUT FREQUENCY
ANT binding post	1 uV	Channel Frequency
RX H.F.O. TP101	1 uV	455.5 kHz
1st IF TP102	20 uV	455.5 kHz
2nd IF TP103	18 mV	455.5 kHz
Audio TP109	3 - 6 mV	1000 Hz

### 3. Oscillators

Oscillator levels are given on the schematic.

## C. REPLACEMENT OF PA

The PA module LPA2 - SCL #67-076 may be replaced by following the replacement instructions on the next page.

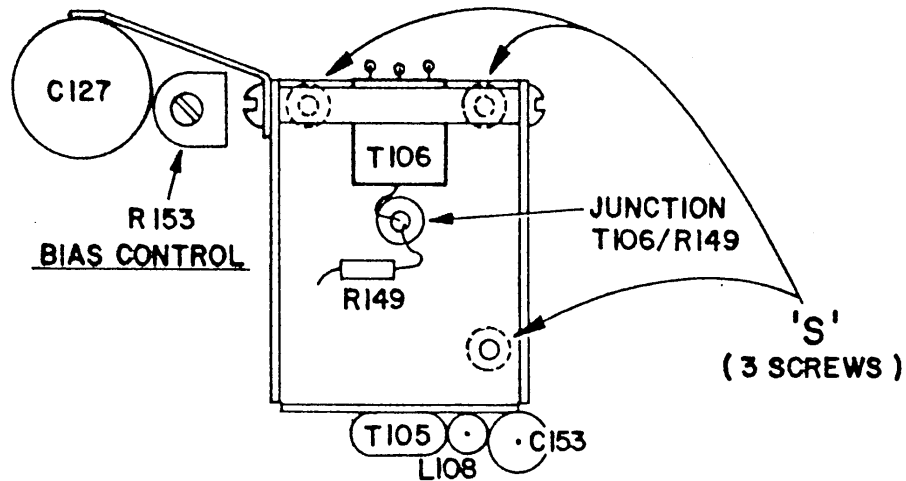


FIGURE 3 MODULE LPA2 - TOP VIEW

1. Removal of Defective PA (See Figure 3 Above)
  - a) Unsolder wires at junction T105/R149
  - b) Unsolder three wires of T106 and clear holes on PCB
  - c) Unsolder two wires of T105 and one of L108 and clear holes
  - d) Remove screw holding C127 support bracket. (If present)
  - e) Remove three screws 'S' under PCB and remove PA module
  
2. Installation of Module LPA2
  - a) Feed leads of T105, T106 and L108 through holes in PCB (outside twisted pair on T106 goes through centre hole of 3)
  - b) Replace 3 screws and solder above leads
  - c) Solder inside twisted pair on T106 and lead of R149 to feed through pin inside module
  - d) Replace C52 support bracket
  - e) Solder bottom lead of C153 to PC board ground

3. Module Adjustment

- a) PA Bias R153. Measure supply current while pushing the PTT switch but without modulation. Turn R153 fully counter clockwise. Advance R153 for increase of about 5 mA (4 mA to 7 mA).
- b) Operate transmitter into dummy load following section VI D5 of the manual. If antenna current falls within 220 to 360 mA RF, retune as described in manual.
- c) If required antenna current cannot be achieved, follow Section VI E3 except instead of step a) in that section, substitute step a) immediately above. Then tune the transmitter again.

SECTION VIII - PARTS LIST

CHASSIS ASSEMBLY

	<u>REF.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
DIODE	D1	Zener 1W 18V	1N4746A
FASTENERS	-	Strikes	45-177
	-	Catch (Swivel) for lid	45-176
	-	Catch (Riveted) for battery box	45-175
	-	Bail Wire (for Lid Catch)	45-182
FREQ. CHART	-	4 Ch. Blank	59-082
	-	Plastic Cover	57-1138
FUSE	F1	2A FB	43-030
	-	Fuseholder	53-009
HANDLE	-	Handle, Plastic	45-181A
	-	End Cap (two required)	45-181B
KNOBS	-	Channel Selector	28-044
	-	Volume, Clarifier	28-087
LOUDSPKR	LS1	30 Ohms 2-3/4 Ins.	23-011
METALWORK	-	Front Panel	57-1676
	-	Lid	57-1682A
	-	Main Case	57-1681A
	-	Battery Box (no inserts)	57-1674A
METRE	M1	500uA 400 Ohms	31-027
MICROPHONE	-	Complete Assembly	32-026
RESISTOR	R1/S1	Vol - On/Off 500 Ohms	13-189

CHASSIS ASSEMBLY (Cont'd)

SOCKETS	J1	3 Pin DIN (Battery	22-113
	-	Antenna Red	13749/001
	-	Ground Black	30-051
SWITCHES	S1	(Part of R1)	—
	S2	Tune/Operate 4PDT Switch Assy.	36-088
	-	Bezel for S2	36-093
		Button for SW	36-156
		Switch for SW	36-204

SECTION VIII - PARTS LIST

BATTERY BOX

	<u>REF.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
CONTACT	-	Kit (Two pieces)	62-169
PAD	-	Rubber	21-105
PLUG	P1	3 Pin DIN	34-062
TUBES	-	Plastic (three required)	21-046

SECTION VIII - PARTS LIST

TX-RX MODULE HTR2

	<u>REF.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
CAPACITORS	C101	Ceramic Disc 0.01uF 10% 100V	24-361
	C102	Ceramic Disc 0.01uF 10% 100V	24-361
	C103	Metalized Foil 0.1uF 10% 250V	24-159
	C104	Ceramic Disc 0.001uF 10% 100V	24-044
	C105	Ceramic Disc 0.01uF 10% 100V	24-361
	C106	Metalized Foil 0.1uF 10% 250V	24-159
	C107	Ceramic Disc 0.01uF 10% 100V	24-361
	C108	Metalized Foil 0.1uF 10% 250V	24-159
	C109	Ceramic Disc 0.001uF 10% 100V	24-044
	C110	Metalized Foil 0.1uF 10% 250V	24-159
	C111	Ceramic Disc 0.01uF 10% 100V	24-361
	C112	Ceramic Disc 0.01uF 10% 100V	24-361
	C113	Ceramic Disc.0.01uF 10% 100V	24-361
	C114	Ceramic Disc .01 uF 10% 50V	24-259
	C115	Ceramic Disc 0.001uF 10% 100V	24-044
	C116	Mica DM10 100pF 5% 500V	15-040
	C117	Metalized Foil 0.1uF 10% 250V	24-159
	C118	Metalized Foil 0.1uF 10% 250V	24-159
	C119	Electrolytic 1uF 15V	19-164
	C120	Metalized Foil 0.1uF 10% 250V	24-159
	C121	Ceramic Disc 0.01uF GMV 100V	24-025
	C122	Ceramic Disc 0.01uF GMV 100V	24-025
	C123	Ceramic Disc 0.003uF 10% 100V	24-175
	C124	Electrolytic 10uF 15V	19-083
	C125	Electrolytic 200uF 15F	19-103
	C126	Ceramic Disc .01uF GMV 100V	24-101
	C127	Electrolytic 2200uF 16V	19-166
	C128	Mica DM10 6.8pF 5% 500V	15-169
	C129	150pF 5% 110V, US (COG)	24-221
	C130	Ceramic Disc 0.01uF 10% 100V	24-361
	C131	Mica DM10 27pF 5% 500V	15-077
	C132	Metalized Foil 0.1uF 10% 250V	24-159
	C133	Mica DM10 5pF 10% 500V	15-032
	C134	Mica DM10 8pF 5% 500V	15-033
	C135	Mica DM10 100pF 5% 500V	15-040
	C136	Ceramic Disc 0.01uF 10% 100V	24-361

PARTS LIST (Cont'd).

	<u>REF</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
CAPACITORS	C137	Mica DM10 390pF 5% 500V	15-106
	C138	Variable 2 - 18.5pF	17-037
	C139	Mica DM10 12pF 5% 500V	15-180
	C140	Mica DM10 100pF 5% 500V	15-040
	C141	Metalized Foil 0.1uF 10% 250V	24-159
	C142	Mica DM10 330pF 5% 100V	15-105
	C143	Mica DM15 500pF 5% 300V	15-012
	C144	Metalized Foil 0.1uF 10% 250V	24-159
	C145	Metalized Foil 0.1uF 10% 250V	24-159
	C146	Metalized Foil 0.1uF 10% 250V	24-159
	C147	Mica DM10 120pF 1% 500V	15-092
	C148	Mica DM10 20pF 1% 500V	15-091
	C149	Ceramic Disc 0.01uF 10% 100V	24-361
	C150	Metalized Paper 0.5 uF 20% 50V	24-129
	* C152	Mica DM19 1000pF	15-051
	* C153	Electrolytic 100uF 25V	19-115
	* C154	Ceramic Disc 0.01uF 10% 100V	24-361
	* C155	Ceramic Disc 0.01uF 10% 100V	24-361
	C156	Metalized Foil 0.1uF 10% 250V	24-159
	C157	Ceramic Disc 0.01uF 10% 100V	24-361
	C158	Ceramic Disc 0.01uF 10% 100V	24-361
	C159	Metalized Foil 0.1uF 10% 250V	24-159
	C160	Electrolytic 10uF 15V	19-083
	C161	Electrolytic 10uF 15V	19-083
	C162	Ceramic Disc 0.01uF 10% 100V	24-361
	C163	Electrolytic 2.2uF 15V	19-165
	C164	Electrolytic 1uF 15V	19-164
	C165	Ceramic Disc 0.01uF 10% 100V	24-361
	C166	Ceramic Disc 470uF 10% 500V	24-160
	C167	Ceramic Disc 0.01uF GMV 100V	24-101
	C168	Ceramic Disc 0.01uF 10% 100V	24-361
	C169	Electrolytic 1uF 15V	19-164
	C170	Ceramic Disc 0.01uF 10% 100V	24-361
C171	Electrolytic 1uF 15V (put part in R158 location)	19-164	

\* Part of Module LPA2 (67-076)



PARTS LIST (Cont'd)

	<u>REF</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
CHOKES	L101	Iron Core 2.5 mH	02-013
	L102	Iron Core 2.5 mH	02-013
	L103	Iron Core 2.5 mH	02-013
	L104	Iron Core 2.5 mH	02-013
	L105	Iron Core 2.5 mH	02-013
	L106	Iron Core 2.5 mH	02-013
	L107	Iron Core 2.5 mH	02-013
	* L108	Iron Core 8.2 uH	02-012
	L109	Iron Core 250 uH	02-037
	L110	Iron Core 2.5 mH	02-013
CRYSTAL	Y101	456.500 kHz	85-311
DIODES	D101	Silicon 1N459A	71-0459
	D102	Silicon 1N459A	71-0459
	D103	Silicon 1N459A	71-0459
	D104	Silicon 1N459A	71-0459
	D105	Silicon 1N459A	71-0459
	D106	Silicon 1N459A	71-0459
	D107	Silicon 1N459A	71-0459
	D108	Silicon 1N459A	71-0459
	D109	Silicon 1N459A	71-0459
	D110	Zener 1N5239B	71-5239
	D111	Silicon 1N459A	71-0459
	D112	Silicon 1N459A	71-0459
	D113	Germanium 1N67A	71-1067
	D114	Silicon 1N459A	71-0459
	D115	Germanium 1N67A	71-1067
	D116	Silicon 1N459A	71-0459
	D117		NOT USED
FILTERS	FL101	LSB Mechanical	01-651
	FL102	Balanced Mixer 50 Ohms	01-202
	FL103	Balanced Mixer 50 Ohms	01-202

\* Part of Module LPA2 (67-076)

PARTS LIST (Cont'd)

	<u>REF</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
INTEGRATED CIRCUITS	U101	HF Differential Amp CA3053	70-201
	U102	HF Differential Amp CA3053	70-201
	U103	DC Differential Amp CA3028B	70-205
	U104	Audio Amp LM386	70-211
	U105	Wideband Amp 1/2W CA3020A	70-206
	-	Heatsink for U105	50-298
	U106	8V Regulator 7808, TO-220 pkg. (put part in Q111 location)	70-043
MODULE	LPA2	Power Amp SSB	67-076
RELAY	K101	12V DPDT	49-082
	-	Socket	22-290
		Clip	50-299
RESISTORS	R101	Carbon Film 1/4W 1.2K 5%	14-006
	R102	Carbon Film 1/4W 10K 5%	14-008
	R103	Carbon Film 1/4W 2.4K 5%	14-079
	R104	Carbon Film 1/4W 10K 5%	14-008
	R105	Carbon Film 1/4W 10K 5%	14-008
	R106	Carbon Film 1/4W 10K 5%	14-008
	R107	Carbon Film 1/4W 100 Ohm 5%	14-002
	R108	Carbon Film 1/4W 470 Ohm 5%	14-050
	R109	Carbon Film 1/4W 82 Ohm 5%	14-093
	R110	Carbon Film 1/4W 10K 5%	14-008
	R111	Carbon Film 1/4W 10K 5%	14-008
	R112	Carbon Film 1/4W 47 Ohm 5%	14-056
	R113	Carbon Film 1/4W 22K 5%	14-010
	R114	Carbon Film 1/4W 1K 5%	14-005
	R115	Carbon Film 2K7 5%	14-063
	R116	Carbon Film 1K 5%	14-005
	R117	Carbon Film 1/4W 10K 5%	14-008
	R118	Carbon Film 1/4W 10K 5%	14-008
	R119	Carbon Film 27K 5%	14-045
	R120	Carbon Film 3K 5%	14-042
	R121	Carbon Film 2.2M 5%	14-068
	R122	Carbon Film 1/4W 10K 5%	14-008
	R123	Carbon Film 560K 5%	14-089
	R124	Carbon Film 120K 5%	14-030
	R125	Carbon Film 39K 5%	14-046
	R126	Carbon Film 750 Ohm	14-004

PARTS LIST (Cont'd)

	<u>REF</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
RESISTORS	R127	Carbon Film 10 Ohm 5%	14-022
	R128	Carbon Film 1M 5%	14-019
	R129	Carbon Film 180 Ohm 5%	14-037
	R130	Carbon Film 1/4W 10K 5%	14-008
	R131	Carbon Film 1M 5%	14-019
	R132	Carbon Film 180 Ohm 5%	14-037
	R133	Carbon Film 1M 5%	14-019
	R134	Carbon Film 180 Ohm 5%	14-037
	R135	Carbon Film 1/4W 10K 5%	14-008
	R136	Carbon Film 1.2K 5%	14-006
	R137	Variable Carbon 1/10W 10K 20%	13-083
	R138	Carbon Film 180 Ohm 5%	14-037
	R139	Carbon Film 6.2K 5%	14-077
	R140	Variable Carbon 1/10W 10K 20%	13-083
	R141	Carbon Film 8.2K 5%	14-082
	R142	Carbon Film 180 Ohm 5%	14-037
	R143	Carbon Film 1/4W 10K 5%	14-008
	R144	Variable Carbon 1/10W 10K 20%	13-083
	R145	Carbon Film 100K 5%	14-013
	R146	Carbon Film 3.3M 5%	14-020
	*R147	Carbon Film 330 Ohm 5%	14-040
	*R148	Carbon Film 20 Ohm 5%	14-076
	*R149	Carbon Film 12 Ohm 5%	14-001
	*R150	Thermistor - 33 Ohm	09-134
	*R151	Carbon Film 330 Ohm 5%	14-040
	R152	Carbon Film 220 Ohm 5%	14-039
	R153	Var. Carbon 1/10W 100 Ohm 20%	13-085
	R154	Carbon Film 1 Ohm 5%	14-078
	R155	Carbon Film 100 Ohm 5%	14-002
	R156		NOT USED
	R157		NOT USED
	R158	(put C171 in this location)	
	R159	Var. Carbon 1/10W 100 Ohm 20%	13-085
	R160	Carbon Film 470 Ohm 5%	14-050
	R161	Carbon Film 330 Ohm 5%	14-040

\*Part of Module LPA2 (67-076)

PARTS LIST (Cont'd)

	<u>REF</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
RESISTORS	R162	Carbon Film 470K 5%	14-017
	R163	Carbon Film 2.2M 5%	14-068
	R164	Carbon Film 2.7K 5%	14-063
	R165	Carbon Film 22K 5%	14-010
	R166	Carbon Film 15K 5%	14-054
	R167	Carbon Film 470K 5%	14-017
	R168	Carbon Film 1/4W 10K 5%	14-008
	R169	Carbon Film 100 Ohm 5%	14-002
	R170	Carbon Film 1K 5%	14-005
	R171	Carbon Film 22K 5%	14-010
TRANSFORMERS	T101	455 kHz I.F.	01-155
	T102	455 kHz I.F.	01-155
	T103	455 kHz 8K: 70 Ohm I.F.	01-200
	T104	ALC Transformer	01-213
	*T105	P.A. Output	01-212
	*T106	P.A. Input	01-211
TRANSISTORS	Q101	Si NCh JFET GP	72-5457
	Q102	Si PCh JFET GP	72-5462
	Q103	Si NPN GP	72-4124
	Q104	Si NCh JFET HF	72-5486
	Q105	Si NPN GP	72-4124
	Q106	Si NCh JFET HF	72-5486
	Q107	Si NCh JFET HF	72-5486
	Q108	Si NPN GP	72-4124
	*Q109	Si NPN Power SSB	}
	*Q110	Si NPN Power SSB	}72-104
	Q111	(see U106)	
	Q112	Si NPN Darlington MPS-A13	72-086
	Q113	Si NCh JFET GP	72-5457

\*Part of Module LPA2 (67-076)

SECTION VIII - PARTS LIST

CHANNEL SELECTOR FCU7

	<u>REF</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
CAPACITORS	C501	Air Variable 1.4-14pF (Clarifier)	18-031
	*C502	Film Variable 2-18.5pF	17-037
	*C503	Film Variable 2-18.5pF	17-037
	C504	Mica Variable 390-1400pF	17-031
PLATE	-	Coil and Crystal Grounding	57-1346
SWITCH	S501	Sections A to E	40-163
	S501	Index	40-125

\*Four per channel

SECTION VIII - PARTS LIST

MISCELLANEOUS

<u>REF</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
CAPACITOR	150 PF 100 V US (COG)	24-221
	Tub, AX 100 UF 25 V	19-115
	.5 MFP 20% 50 V Met. Paper	24-129
DIODE	Diode	71-4746
TRANSISTOR	Transistor Set Matched Pair	72-104
	Washer, Phenolic 2-56	40-019
	Spacer, Ceramic #2 x 1/8"	40-036
	Spacer, Ceramic #2 x 3/32"	40-089
	Spacer, Metal #4 x 1/8"	40-121
	Spacer, Ceramic #2 x 1/2"	40-128
	Spacer, Ceramic #2 x 1/4"	40-129
	Wafer, Switch	40-163
	Handle, Black	45-181A
	Endcap for 45-181A Handle	45-181B
	Battery Block	45-312
	Catch, c/w wire for battery box	45-175
	Catch, less wire for lid	45-176
	Clip - Crystal	50-093
	Socket, PCB Jack	50-137
	Spring Battery Holder	50-233
	Grommet, PVC, 5/16"	51-013
	Guide Plate for Centre Case	57-1197
	Rail Centre	57-1679
	Decal 'Spilsbury C.L.' Logo	59-018
	Decal 'SBX-11A Serial No.'	59-119
	Booklet (plasticized)	
	Operating Instructions	59-120
	Label, Battery Instructions	59-144
	Tubing, Teflon #20	21-017
	Pad, Neoprene 1/8" x 3/4"	21-021

PARTS LIST (Cont'd)

<u>REF</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>
	Tubing, Teflon #10	21-037
	Tape, Double-sided Adhesive	21-103
	Socket, Transistor 4 Pin PA	22-085
	Socket, 8 Pin Dil.	22-193
	Label, Coil	59-145
	Decal 'SBX-11A'	59-239
	Slug-Iron, RX/TX Coils	00-098
	Slug-Iron, PA Coil	00-105
	Button, Black for 36-088 Switch	36-156
	Microphone Assembly	32-026
	Grill Cloth, finished	45-184
	Fibre Pad, Cross, Thick	50-150
	Coupling, Brass (For Clarifier Shaft)	52-173
	Frequency Chart Cover	57-1138
	Cover PA Coil	57-1186
	Chassis, U-Frame	57-2258
	Rod for Clarifier Control	57-2250

1. **DEFINITIONS**

"Company" means Spilsbury Communications, a division of Racal Canada Inc. "Customer" means the other contracting party. "Products" means the goods and services which form the subject of the quote. "Order" means the Order placed by the Customer with the Company for the supply of the Products.
2. **GENERAL**

These Conditions form an integral part of every contract for the supply of the Products by the Company and the acceptance of any quote from the Company shall be deemed to include acceptance by the Customer of these Conditions. Any variation of these Conditions or any document of the Customer is inapplicable unless expressly accepted in writing by the Company.
3. **VALIDITY**

A quote from the Company is valid for a period of 30 days from the date thereon unless otherwise stated on the quote or unless revoked in writing by the Company, but in any event, the Order is subject to written acceptance by the Company.
4. **SPECIFICATIONS**

The Products will be supplied generally in accordance with the Company's proprietary specifications therefore ("the Specification"). The Company will accept no liability for the Products supplied except where there is significant variation from the Specification. Alterations to the specification of the Product requested by the Customer are subject to agreement of the Company and such alteration may render the quoted price subject to variation.
5. **CHANGES IN DESIGN AND MANUFACTURE**

The Company reserves the right at any time to make changes at its discretion in the design or method of manufacture of the Product provided that such changes shall not adversely affect the Products or their prices.
6. **PRICE**

Unless otherwise stated on the quote the prices quoted are strictly nett and f.o.b. Company premises in Vancouver, British Columbia, Canada.
7. **PRICE ADJUSTMENTS**

The Company reserves the right at any time prior to delivery to vary the prices quoted for the Products if following the date of the quotation there is any change in rates of currency exchange, any imposition or alteration of Government taxes, increase in the cost of materials, labour or transport, or if the cost of supplying Products is increased by any other factor beyond the control of the Company.
8. **DELIVERY**
  - a) Unless otherwise specified delivery shall be deemed to take place at the Company's place of business and the times for delivery are calculated from the date of the Company's acceptance of the Order.
  - b) The delivery times indicated in the quote are subject to variation by the Company in its acceptance of the Order. All delivery times quoted are estimates only and whilst the Company will endeavor to meet such delivery times, the Company shall not be liable in any way whatsoever for the consequences of delay.
  - c) Without prejudice to the foregoing no liability whatsoever shall attach to the Company if delivery is affected by circumstances beyond the control of the Company including but not limited to act of God, fire, explosions, tempests, strikes, lockouts, insurrection, war, government imposed regulations or boycotts, inability to procure materials or parts, loss or damage or delay in transit. The Company undertakes to inform the Customer of the occurrence of any such event which may affect delivery. In such circumstances the Company shall have the right to wholly or partially suspend or reschedule deliveries.
9. **PAYMENTS**

All invoices are due for payment on demand but in any case not later than thirty days after delivery as defined in paragraph 8. hereof. For all invoices not paid in full by the due date the Company reserves the right to charge interest on the amount outstanding at the rate of the Bank Rate plus two percent calculated from thirty days after delivery. All prices are strictly nett NO SETTLEMENT DISCOUNT WILL BE ALLOWED UNDER ANY CIRCUMSTANCES WHATSOEVER.
10. **RISKS**

All risks shall pass to the Customer upon delivery as defined in paragraph 8. hereof.
11. **TITLE**

Title to the Products shall remain with the Company as security for the purchase price until payment in full is received. The Company may obtain possession of the goods by any lawful means should the Customer fail to pay the purchase price when due.
12. **DAMAGES OR LOSS IN TRANSIT**

The Company accepts no liability for loss or damage in transit.
13. **FORWARDING INSTRUCTIONS**

Forwarding instructions where required shall be provided by the Customer not later than seven days after being advised that the Products are ready for despatch. If no forwarding instructions are received within this period the Company shall be entitled to charge for storage.
14. **LIMITED WARRANTY**
  - a) Any Products of the Company's manufacture which are found to the Company's satisfaction to be defective in relation to the Specification as a result of faulty manufacture or workmanship on the part of the Company then it shall be at the Company's sole discretion either to repair or replace such Products free of charge and return them to the Customer carriage paid provided that:
    - i) the defective Products (or sample thereof showing the alleged defects) are returned at the Customer's risk and expense to the Company within twelve months from the date of their original delivery as defined in paragraph 8. hereof, and
    - ii) the Products have been properly used.
  - b) In the case of Product not of the Company's manufacture any warranty shall be limited to that given to the Company by the manufacturer thereof.
15. **LIMITATION OF LIABILITY**

In no event shall the Company be liable for any indirect special or consequential damages of the Customer, including without limitation loss of profit or opportunity howsoever caused, including losses caused by negligence of the Company. Should it be determined that the Company is liable for any losses costs or damages of the Customer it is agreed that the Company's liability shall be limited to the purchase price of the Product(s) giving rise to the liability.
16. **PATENT INDEMNITY**

If the Customer is threatened with any action alleging that the products in the form sold infringe any patent or registered design then provided that the Customer promptly informs and co-operates with the Company and in cases where the Company so requests allows the Company to defend any action on the Customer's behalf, then in all cases the Company will indemnify the Customer against any award of damages and costs against the Customer arising from such action. In the case of Product not of the Company's manufacture any such indemnity shall be limited to that given to the Company by the manufacturer thereof. The above indemnity is given by the Company in lieu of any and all other liabilities the Company might have in relation to any action against the Customer for infringement of patent or other proprietary rights and under no circumstances will the Company be liable for any contingent or consequential or any other loss howsoever arising.
17. **PRIOR REPRESENTATIONS AND PRECEDENCE**

These Conditions supersede any earlier sets of Conditions previous understandings commitments agreements or representations whatsoever whether oral or written and shall not be varied except with the Company's written agreement.
18. **SEVERABILITY**

Any contract entered into by the Company shall be regarded as severable in the event of Products being of different kinds or the contract providing for delivery by installments. Each and every delivery of separate items under the contract shall be regarded as being made under a separate contract and damages arising from any legal breach of contract shall be limited accordingly.
19. **LAW**

These Conditions and the contract shall be subject to and construed in accordance with the laws of the Province of British Columbia.
20. **NOTICES**

Any notice or other communication sent to the Customer shall be deemed to be delivered if sent to the Customer's address last known to the Company.
21. **AMENDMENTS OR CANCELLATIONS**

Once accepted by the Company orders cannot be modified or canceled except with the Company's written approval and upon terms which indemnify the Company against losses or additional costs resulting therefrom.
22. **HEADINGS**

The headings in these conditions shall not be deemed to be part thereof or be taken into consideration in the interpretation or construction thereof or of the contract.

### Spilsbury Communications

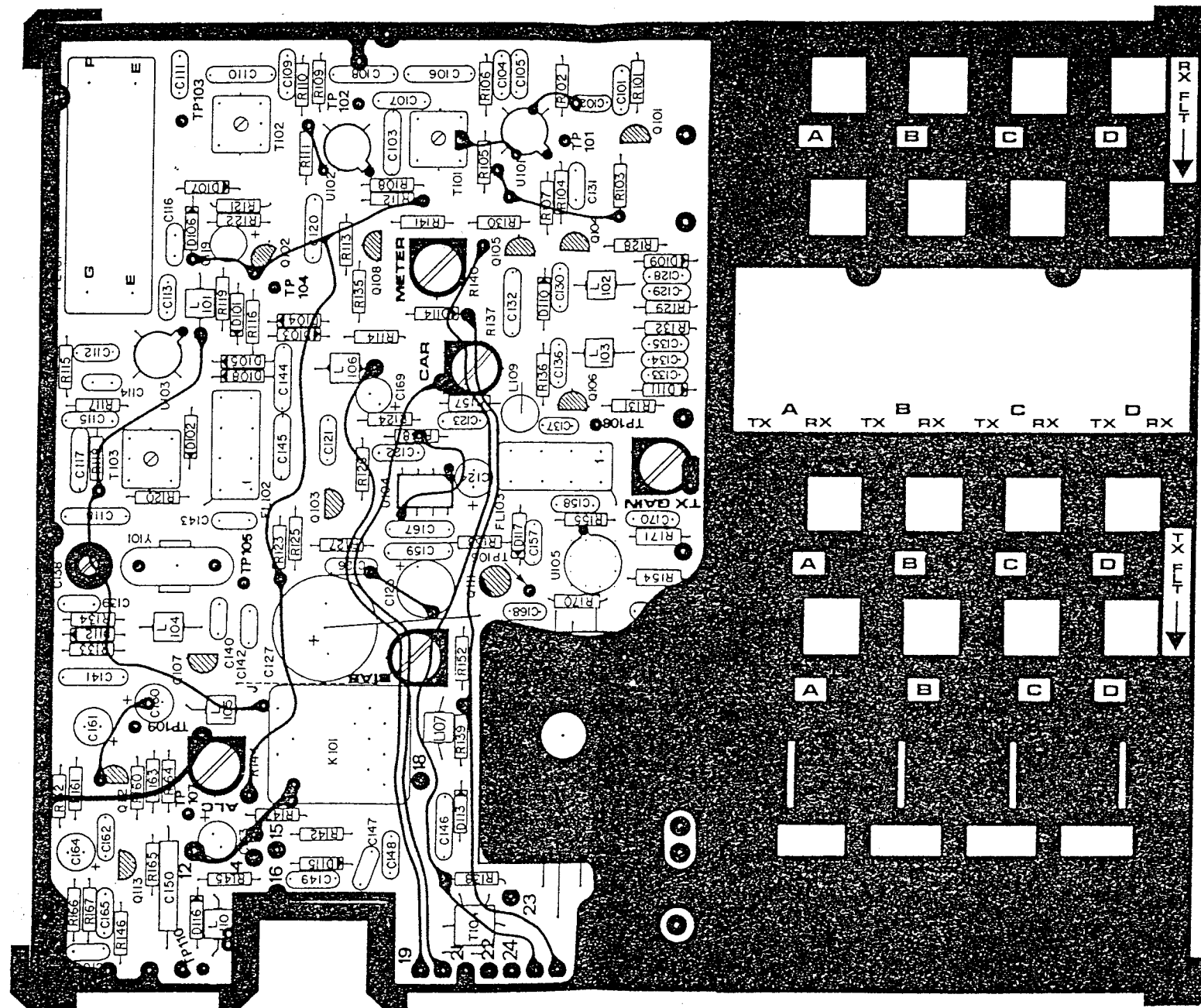
1495 Franklin St., Vancouver, BC, Canada, V5L 5B6

Tel: (604) 254-6474, Fax: (604) 254-2080

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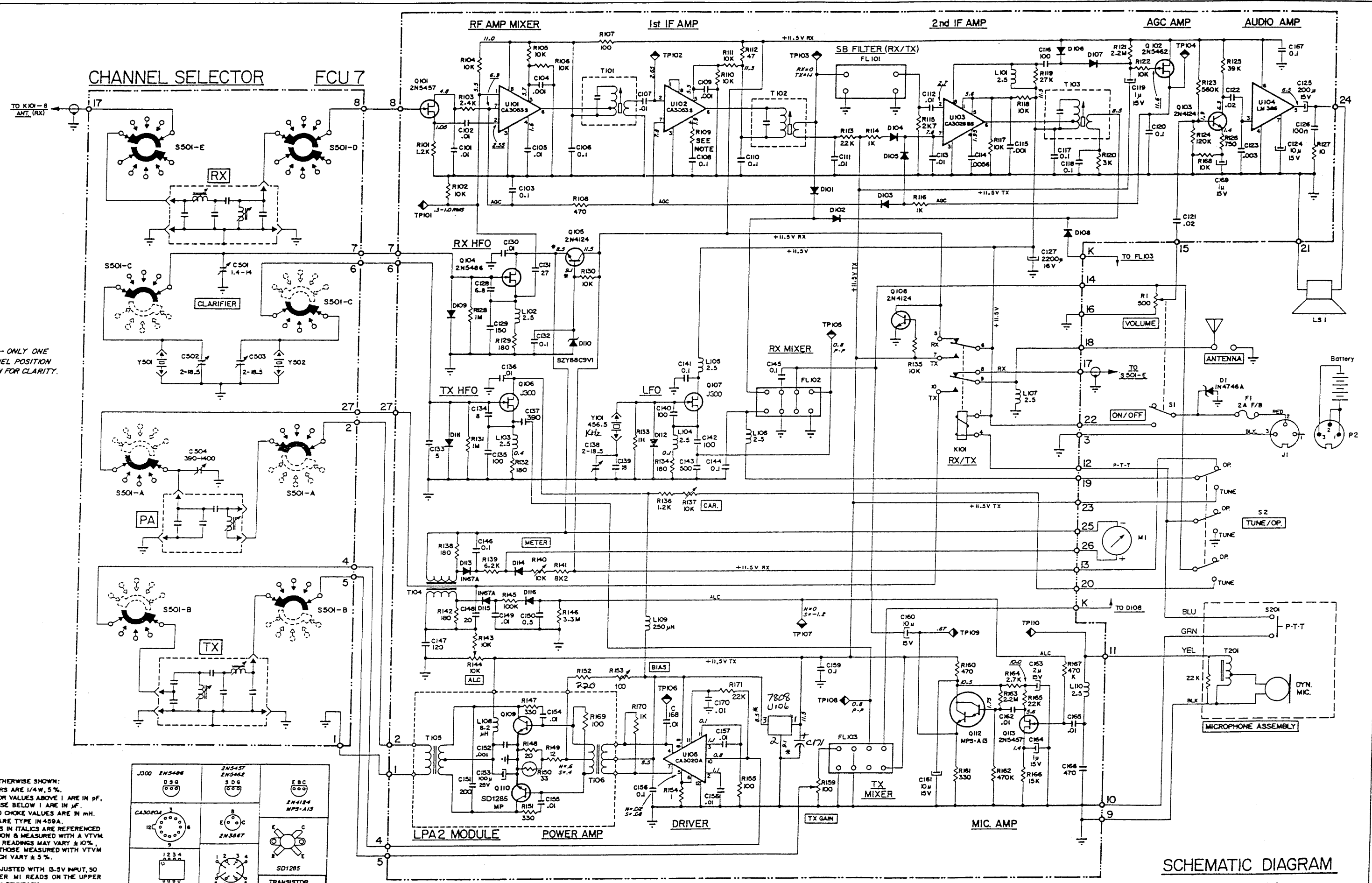


Revision Record			
Date:	ECO #	Description of Change	Approved



LTR	SIZE AND DESCRIPTION	HARDWARE #	QTY

ITEM	PART NUMBER	DESCRIPTION			
	68-4026				
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES, DIMENSIONS IN BRACKETS ( ) ARE IN MILLIMETERS AND APPLY AFTER FINISH		THIS DRAWING IS THE PROPERTY OF RACAL CANADA, AND MAY BE NEITHER USED, COPIED, REPRODUCED OR OTHERWISE DEALT WITH NOR ITS CONTENTS COMMUNICATED TO OTHERS EXCEPT IN ACCORDANCE WITH WRITTEN INSTRUCTIONS RECEIVED FROM RACAL CANADA.			
TOLERANCES		DRAWN BY: K. Greenwood DATE: 03/31/95			
X	XX		XXX	ANGLES	HOLE DIAMETER
+	+	+	+	+	
-	-	-	-	-	
MATERIAL:		CHECKED BY:	DATE:	RACAL CANADA	
FINISH:		APPROVED BY:	DATE:	TITLE SBX 11A Printed Circuit Board Drawing of the Component Placement	
				SIZE B	SCALE n/a
				REF 2504026.001	DRAWING NO. 250-4026-1
				SHEET	1 OF 1

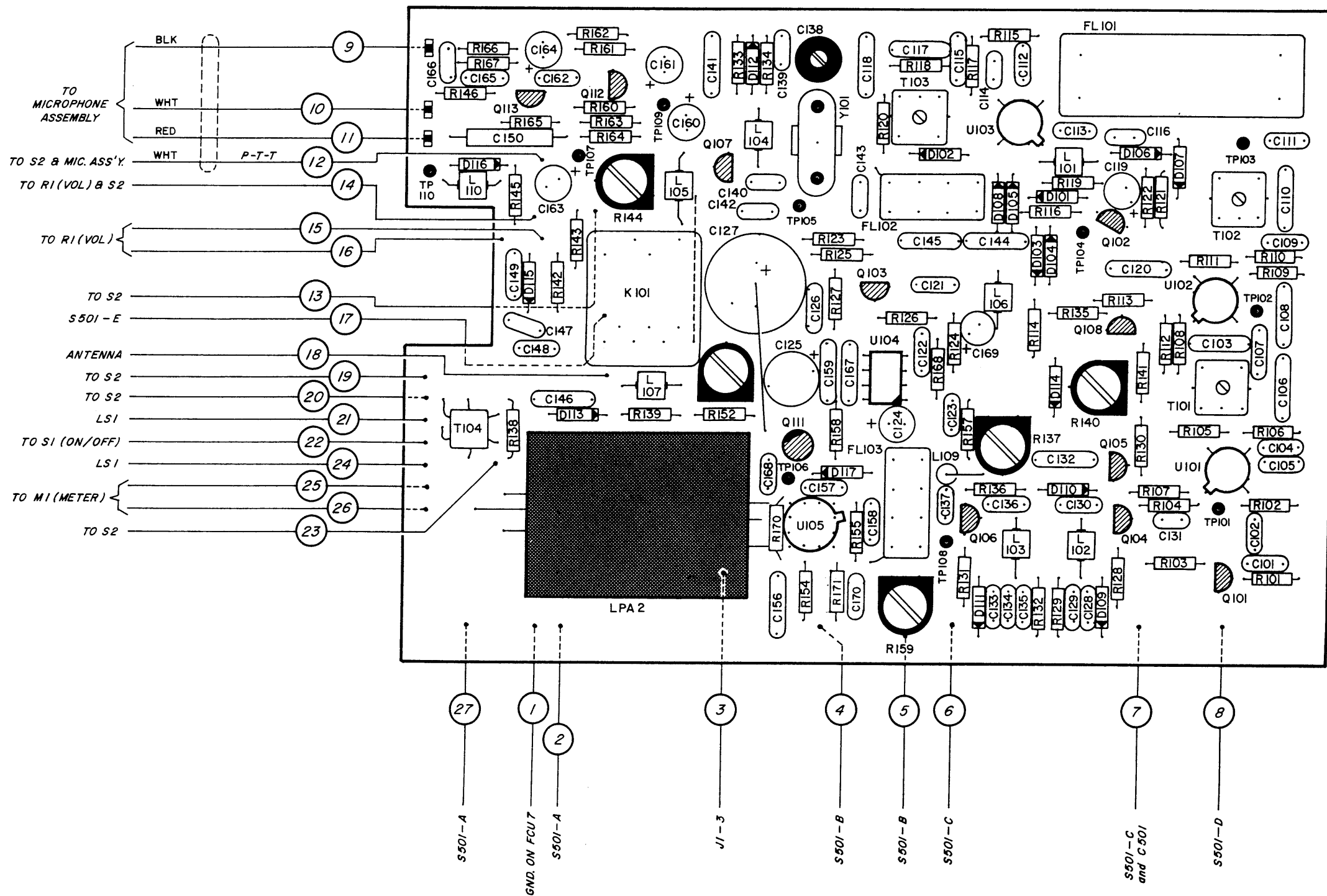


NOTE - ONLY ONE CHANNEL POSITION SHOWN FOR CLARITY.

- NOTES**
- UNLESS OTHERWISE SHOWN:
    - RESISTORS ARE 1/4W, 5%.
    - CAPACITOR VALUES ABOVE 1 ARE IN pF, AND THOSE BELOW 1 ARE IN μF.
    - COIL AND CHOKE VALUES ARE IN mH.
    - DIODES ARE TYPE IN 459A.
    - VOLTAGES IN ITALICS ARE REFERENCED TO COMMON & MEASURED WITH A VTVM.
    - VOLTAGE READINGS MAY VARY ±10%, EXCEPT THOSE MEASURED WITH VTVM (\*) WHICH VARY ±5%.
  - R140 IS ADJUSTED WITH 0.5V INPUT, SO THAT METER M1 READS ON THE UPPER RED/GREEN BOUNDARY.
  - R109 - FACTORY SELECTABLE 82 TO 180 OHMS

J300 2N5406 0 3 0 0 0 0	2N5457 2N5462 3 0 0 0 0 0	EBC 0 0 0 2N4124 MPS-413
CA3020A 1 2 C 0 0 0 0 0 0	B E 0 C 2N3867	SD1285 TRANSISTOR BASING DIAGRAM
1 2 3 4 0 0 0 0 7 6 5 LN386	1 2 3 4 0 0 0 0 7 6 5 CA3020B CA3023	

**SCHEMATIC DIAGRAM**  
**SBX-11A**  
**TRANSCEIVER**



**COMPONENT LAYOUT**  
**TX/RX MODULE**  
**HTR 2**  
 (USED ON SBX-11A)