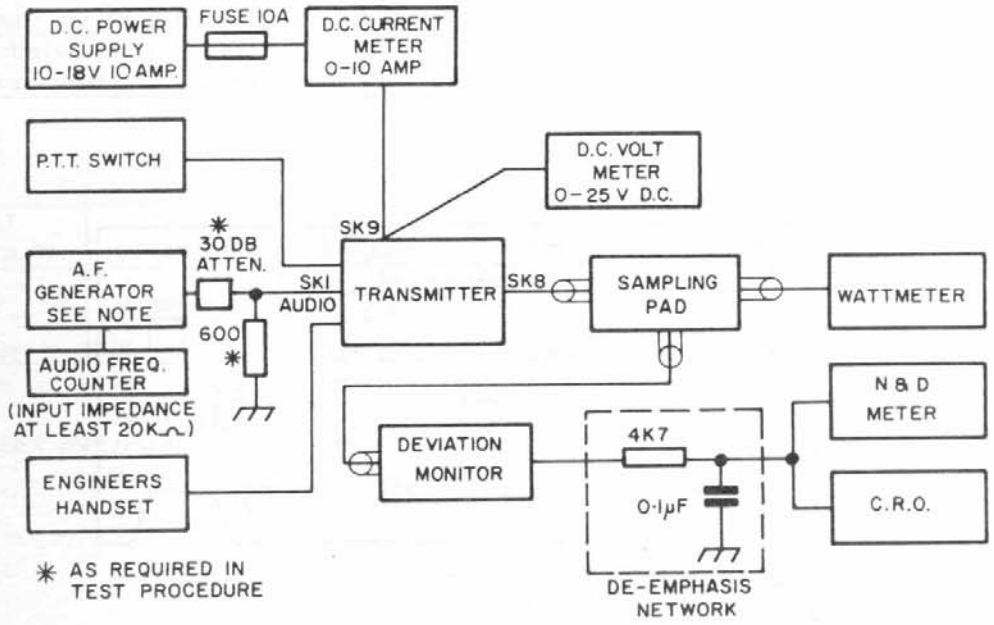
Fm815 UHF

MANUAL
ALIGNMENT SECTION

VK2THE

SECTION 4 ALIGNMENT PROCEDURE

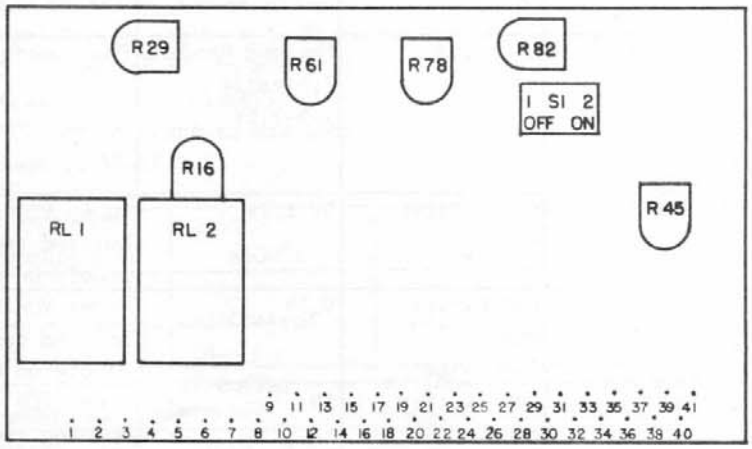
4.1 TRANSMITTER



NOTE:

The AF generator consists of either a standard signal generator or a composite signal source comprising a CU902 together with a signal generator, as required.

4.1.1 +10V REGULATOR

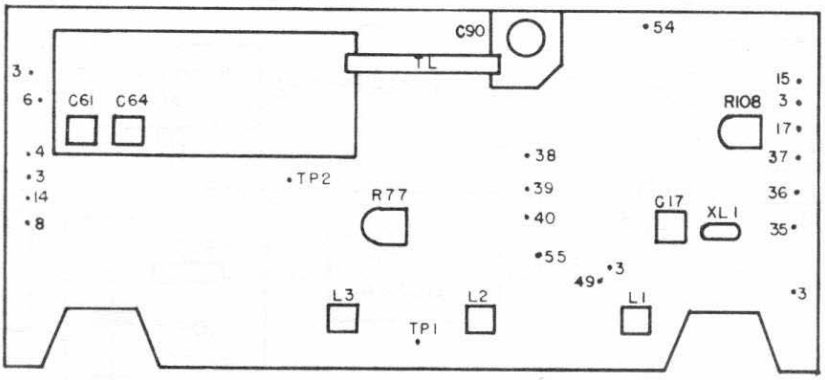


Preliminary Adjustments:
1. R29 Fully Counter Clockwise
2. R16 Fully Clockwise

N.B. Unless otherwise directed -Ve lead of AVO connects to chassis.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 10V Range	Pin 8 Control PCB	R29 Control PCB	10V ± 0.2V	DC Indicator should be on.
6 ohm, 10 Watt	Pin 8 to chassis	R16	Until dc indicator goes out	This sets the current trip to 1.6A and may be reset (after removing load resistor) by switching the supply off then on again.

4.1.2 **EXCITER**



Preliminary Adjustments:

1. Set R82 on control PCB fully counter clockwise.
2. Set SW1 on control PCB in Position 1.
3. Ensure channel crystal is in place and that the correct oscillator has been selected.
4. Set slugs in L1,L2, and L3 flush with the former top and set all trimmers for centre position.

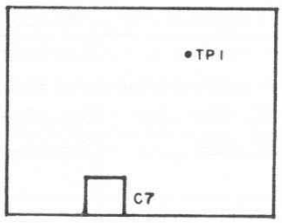
RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 10V Range	Pin 4 Exciter PCB	Operate PTT	10V ± 0.1V	Checks PTT circuit.
AVO 10V Range	-Ve Lead to Chassis +Ve Lead to TP1 on Exciter PCB	L1,L2,L3	Maximum Reading Typically 1.5-2.5V	Phase modulator alignment
AVO 10V Range & CRO 2V/Div.	TP2 Exciter PCB	C90 Exciter PCB	5V ± 1V	Tunes VCO near centre of holding range. No ripple should be observed on CRO.
"	"	C90 Exciter PCB Clockwise	9.5V	Tunes VCO to lower end of holding range. Check for ripple on CRO.
"	"	C90 Exciter PCB counter clockwise	1V	Tunes VCO to higher end of holding range, check for ripple on CRO
"	"	C90 Exciter PCB Clockwise	4.7V ± 0.1V	Tunes VCO to centre of holding range, no ripple should appear on CRO. (For multichannel version tune on centre channel).

NOTE: At some extreme edges of the band, it may not be possible to tune VCO to one end of the holding range.

4.1.3 **BUFFER**

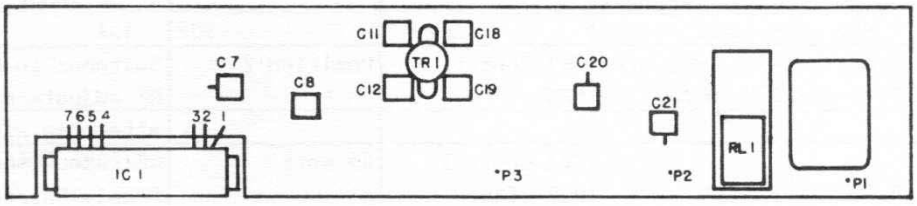
Preliminary Adjustments:

1. Connect wattmeter to aerial socket SK8.
2. Preset C61 and C64 on exciter to mid position.
3. Preset C7 on buffer to mid position.
4. Set R45 on control PCB to mid position.



RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 10V Range	TP1 Buffer PCB	C61 & C64 Exciter	Minimum Reading Typically 9.0V	Must use a plastic tuning tool.

4.1.4 **POWER AMPLIFIER**



Preliminary Adjustments: **NOTE:** RF alignment and test should be carried out using a variable dc supply.

1. Connect wattmeter to aerial socket SK8.
2. Set SW1 on control PCB to position 1. (tune position).
3. Set R78 and R45 on control PCB to mid position.
4. Set R61 on control PCB fully clockwise.
5. Set C7,C20 and C21 on PA board to mid position.
6. Set supply voltage to 14.5V.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 10V Range	Pin 30 Control PCB	R82 Control PCB	3-volt	Operate PTT
Wattmeter 50 watt Range	Aerial socket SK8	C7 Buffer PCB	Maximum Output	Adjust R82 if power rises above 10 watt
Wattmeter 50 watt Range AVO 10A AVO 25V	Aerial socket SK8 Supply lead Supply lead	C20,C21 & C7 PA PCB	Maximum Output	Indication may be slight. Supply current should be 10A.
"	"	C7 Buffer PCB C61 & C64 Exciter PCB	"	Adjust R82 if power rises above 35 watt.

4.1.4 **POWER AMPLIFIER** (Continued)

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
Wattmeter 50 watt Range AVO 10A AVO 25V	Aerial socket SK8 Supply lead Supply lead	R82 Control PCB	35 watt	After 1 minute transmission, check PA transistor case for over heating due to poor heatsink. Case should be warm but not hot. Do not increase R82 above the Point where output stops increasing. Watch current.
"	"	C20 & C21 PA PCB	Maximum Output	Supply current 10A.
"	"	C7 PA PCB C7 Buffer PCB C61 & C64 Exciter PCB	"	Final adjustment
"	"	(After 15 secs) R82 Control PCB	45 watt	Do not increase R82 beyond the point where output stops increasing. Keep watch on current.
"	"	C20 & C21 PA PCB	Best efficiency	Final adjustment of output for 45W output and 13.8-volt at dc input, supply current 10A.
"	"	SW1 Control PCB	Position 2	Switches in ALC. No further RF adjustment to be attempted with ALC on.
"	"	R82 Control PCB after 30 secs. PTT	45 watt	R82 should not be FCW. Supply Current 10A. Supply voltage = 13.8-volt at dc input.

NOTE: If power cannot be set as high in "ALC" mode as in "TUNE" mode, then the voltage from the reflectometer is too high. Reduce R3 in PA PCB so that voltage at P32 on control PCB never exceeds 7-Volts.

4.1.5 **PA CURRENT LIMIT**

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
Wattmeter	Aerial socket SK8	R82 Control PCB	50 Watt See note column	Supply voltage set to 14V. In some cases 50 watt may not be reached.
"	"	R61 Control PCB	Until Power just starts to reduce	Sets current limit point. Do not adjust R61 until output power stable.
"	"	R82 Control PCB after 15 secs.	45 Watt	Ensure power is stable before making final adjustment. Supply = 14-volt dc

4.1.6 **POWER CONTROL TEST**

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
Wattmeter 50 Watt Range AVO 25V	Aerial Socket SK8 DC Input	DC Supply	16V	Power should remain at 45 Watt. If power rises by > 1 Watt adjust R82.
"	"	DC Supply	11V	Power should not drop below 30 Watts.
"	"	DC Supply	14V	Power should return to 45 Watt.
"	"	R82 Control PCB	1 Watt	Power should fall smoothly as R82 adjusted. RF indicator remain on down to at least 5 Watt.
"	"	R82 Control PCB	45 Watts	

4.1.7 **LOW POWER ADJUSTMENT**

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
Wattmeter 50 Watt Range	Aerial Socket SK8	R78 Control PCB	20 Watt	Link P24 Control PCB to chassis. Note that Alarm indicator is on.
"	"	R82	45 Watt	Remove link. N.B. R78 & R82 have some interaction but setting of R78 not critical.

4.1.8 **VSWR ADJUST AND TEST**

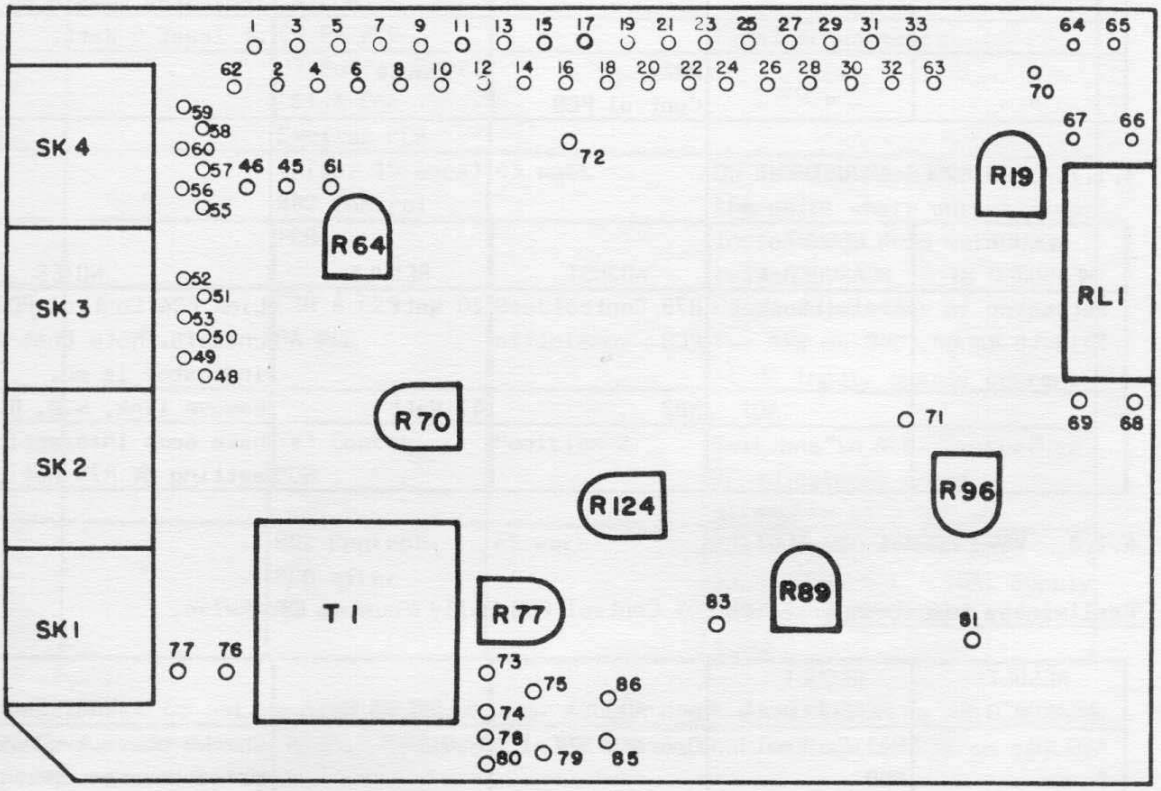
Preliminary Adjustments: Set R45 Control PCB Fully Counter Clockwise.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 10 Range	P41 Control PCB	Operate PTT R6 if necessary (see note)	< 0.5V	Checks correct operation of reflectometer when output properly matched. If > 0.5-Volt, change AIT resistor R6 in PA PCB
	Open circuit at SK8	Operate PTT	Fail Alarm Indicator On	Check that supply current is < 1A. Alarm is reset when PTT is released.
	Short circuit at SK8	Operate PTT	Fail Alarm Indicator On	Check that supply current is < 1A. Alarm reset when PTT released.
Wattmeter 50 Watt Range	Aerial Socket SK8	Operate PTT	45 Watt	Normal operation

4.1.9 OUT-OF-LOCK PROTECTION CHECK

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 10V Range	P30 control PCB	Remove Channel Xtal.	0-Volts	Check that 'Alarm' Ind. is on and that wattmeter reads zero.
		Replace Xtal	Original Value	'Alarm' Ind. is off and wattmeter reads 45 Watt

4.1.10 RX LINE AMPLIFIER (AUDIO FACILITIES T3 BOARD)



Preliminary Adjustments:

1. Set R19 FCW
2. Set R77 exciter, PCB FCCW.
3. Set 'Line Level' control FCW
4. Set 'Mic Level' FCCW.
5. Set R64,R70,R77,R89,R96 and R124 to mid position.
6. Links 11 (73 to 75) and 13 (78 to 79)
7. Connect audio signal generator (600 ohm unterminated to SK2/2&3)
8. Connect 600 ohm resistor between SK1/1 & SK1/2 (2 1K2 resistor in parallel).

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
N & D Meter Set to measure dBm	SK1/1 & SK1/2 (Terminated with 600 ohm)	R64	0dBm at SK/1 & 2	Audio signal generator set to -6dBm at 1kHz. SK2/2 & 3 600 ohm unterminated.
N & D Meter	SK1/1 & SK1/2 (Terminated with 600 ohm)	N & D Meter for 0dB ref.		Audio signal generator set to -6dBm at 1kHz. SK2/2 & 3 600 ohm unterminated.

4.1.11 RX NOTCH FILTER ADJUSTMENT

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
N & D Meter	SK1/1 & SK1/2 (Terminated with 600 ohm)	R70 for minimum level on N & D meter	> 30dB below ref.	Audio signal generator set to -6dBm at 2500Hz ± 1Hz SK2/2 & 3.

4.1.12 HYBRID BALANCE

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
N & D Meter set to measure dBm	Pin 81 Audio Fac. PCB.	R77 for minimum level on N & D meter	Less than -24dBm	Audio signal generator set to -6dBm at 1kHz SK2/2 & 3. this sets the hybrid balance N.B. SK1/1 & 2 must be terminated with 600 ohm to ensure correct adjustment.

4.1.13 TONE DETECTOR (AUDIO FACILITY T3 BOARD)

Preliminary Adjustments:
1. Pots and links as previously set.
2. Ensure that link 15 (85 to 86) is not fitted.
3. Connect high impedance audio counter to P83 via an 820k resistor
4. Remove 600 ohm resistor from SK1/1 & 2.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
Audio Counter	Pin 83 Audio Fac.PCB	R124	2500Hz ± 1Hz.	Fit link 15 (85 to 86) after adjusting R124.
Tx PTT Operation	RF Indicator		Tx should operate	Audio Signal generator set to -30dBm at 2500Hz ± 1Hz SK1/1 & 2 (unterminated)
"	"	Reduce Sig. Gen. Level until Tx turns off.	Sig. Gen. Level -55dBm ±5dB.	Sig. Generator 2500Hz ± 1Hz into SK1/1 & 2 (unterminated)
"	"		Tx should remain off (no decode occurs)	Set. sig. gen. to -30dBm at 2400Hz. Sk1/1 & 2 600 ohm unterminated.
"	"	Increase Sig. Gen. frequency until decode occurs (Tx turns on).	2480Hz ± 5Hz	Sig. Generator at -30dBm
"	"		Tx should remain off (No decode occurs)	Set. Sig. Gen. to -30dBm at 2600Hz.
"	"	Decrease Sig. Gen. frequency until decode occurs (Tx turns on)	2520Hz ± 5Hz	Sig. Gen. at -30dBm

4.1.14 TX NOTCH FILTER ADJUSTMENT (AUDIO FACILITY T3 BOARD)

Preliminary Adjustments:-
1. Pots and links as Rx section.
2. Connect audio signal generator (600 ohm unterminated) to SK1/1 & 2.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
N & D meter set to measure dBm	Pin 71 Audio Fac.PCB	R96 for minimum level N & D meter	Less than -60dBm Typ. -65dBm	Audio signal generator set to -10dBm at 2510Hz ± 1Hz SK1/1 & 2 600 ohm unterminated
"	"	R89 for minimum level on N & D meter	Less than -60dBm Typ. -65dBM	Audio signal generator set to -10dBm at 2490Hz ± 1Hz SK1/1 & 2. 600 ohm unterminated.

4.1.15 COMPRESSOR CHECK

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
N & D Meter	Pin 82 Audio Fac. PCB	N & D meter for 0dB ref.		Audio Sig. Gen. set to -50dBm at 2500Hz ± 1Hz SK1/1 & 2
N & D Meter	Pin 82 Audio Fac. PCB	Increase Sig. Gen. Level by 40dB to -10dBm	Output level at N & D meter should increase by between 10 - 14dB Typ. 11.5dB	

4.1.16 MODULATION ALIGNMENT (AUDIO FACILITY T3 BOARD)

Preliminary Adjustments:
1. Pots and links as previously set.
2. Composite signal source at SK1/1 & 2. SEE NOTE

NOTE: As the transmitter operation depends on the continuous presence of a 2.5kHz PTT tone the modulation alignment must be carried out with this tone plus the audio modulation signal. This is best done by using a CU902 with the 2.5kHz PTT tone set for -10dBm at the CU902 line output and an audio signal generator (600 ohm unterminated) connected to the auxiliary. Tx AF input of the CU902 set to give an output level measured at the CU902 line output of 0dBm at 1kHz. The CU902 must be suitably modified to give a flat response from 300Hz to 2kHz. (The 300Hz response is limited by the CU902 line transformer).

4.1.16 **MODULATION ALIGNMENT (AUDIO FACILITY T3 BOARD)** (Continued)

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 3V	Pin 70 Audio Facility PCB	Audio sig. gen. 1kHz Signal	0.5-Volt	Checks compressor threshold. Generator level for 0.5-Volt should be between -45 and -35dBm. Generator frequency should be 1kHz.
Deviation monitor	Via sampling pad at wattmeter	R77 (Exciter)	±(4.9±0.1)kHz	Set generator to 3kHz to give a composite signal of 0dBm at SK1/1 & 2
Deviation monitor	Via sampling pad at wattmeter	R19	±3kHz	Set generator to 600Hz with a composite signal level of 0dBm at SK1/1 & 2
				Repeat steps 2 & 3 as R77 and R19 interact.
AVO 3V Range	Pin 70	Line level control	0.5	Composite signal of 2.5kHz and 600Hz at 0dBm.
AVO 3V Range	Pin 70 Audio facilities board	Mic level control	0.5-Volt	Must use PTT on handset Voice a constant tone into the mic. held slightly further than normal speaking distance.

4.1.17 **MODULATION RESPONSE CHECK (AUDIO FACILITY T3 BOARD)**

Preliminary Adjustments:

1. Set audio sig. gen. to 1kHz and at a level to produce ±1kHz transmitter deviation.
2. Connect N & D meter to deviation monitor output. No de-emphasis.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
Deviation monitor	Via sampling pad at wattmeter	Audio gen. level (1kHz)	±1kHz	Sets reference deviation. Adjust N & D meter for 0dB reference
N & D Meter	Deviation monitor O/P	Audio gen. freq. to 300Hz	-9.5 to -13.5dB	Ideally -10.5dB (allow for for any losses in CU902 test jig).
N & D Meter	Deviation monitor O/P	Audio gen. freq. to 3kHz	+6.5 to +10.5dB	Ideally +9.5dB

4.1.18 MODULATION DISTORTION CHECK

Preliminary Adjustments:- As for modulation response check except N & D meter connected via de-emphasis network and generator level set to give ±3kHz deviation.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
Deviation monitor	Via sampling pad on wattmeter	Signal gen. level 1kHz	±3kHz	Standard test modulation.
N & D Meter	Deviation monitor O/P after de-emphasis	Distortion meter	Less than 3%	Slight adjustment of L2 and L3 on exciter PCB may improve result but check that deviation not below ±2.9kHz. For multi-channel sets distortion adjusted for centre channel.

4.1.19 RESIDUAL HUM AND NOISE CHECK (AUDIO FACILITY T3 BOARD)

Preliminary Adjustments:- 1. As for modulation response. No de-emphasis.
2. Noise bandwidth 50Hz to 15kHz.
3. PTT switch between SK1/3 & 6.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
N & D Meter	Deviation meter output	N & D Meter Calibrate	0dB ref.	Sig. gen. 1kHz & level adjusted to give ±3kHz dev.
N & D Meter	Deviation meter output	Remove composite signal	More than 40dB below ref.	Aux. PTT switch must be fitted between SK1/3 & 6. Residual noise from dev. monitor must be more than 55dB below ref. mod.
N & D Meter	Deviation meter output	Re-introduce composite sig. Adjust R19	Required dev. (Up to ±4.5KHz)	Only if more speech power required. (At the expense of frequency response and distortion).

4.1.20 AUDIO FACILITIES T3 TEST

Preliminary Adjustments:- 1. Connect handset to front panel socket SK6.
2. Connect PTT switch between SK1/3 & 6.
3. Connect CRO to SK1.
4. Deviation monitor via sampling pad at wattmeter.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 10V Range	Pin 6 Audio PCB	Operate PTT switch between SK1/3 & 6	0.2-Volt	Checks remote PTT operation.
AVO 10V Range	Pin 6 Audio PCB	Operate handset PTT	0.2-Volt	Checks local PTT operation.
Deviation monitor	Via sampling pad	Operate handset PTT	< ±5kHz	Checks local Tx. Speak into microphone with "mic. level" set as before.

4.1.20 **AUDIO FACILITIES T3 TEST** (Continued)

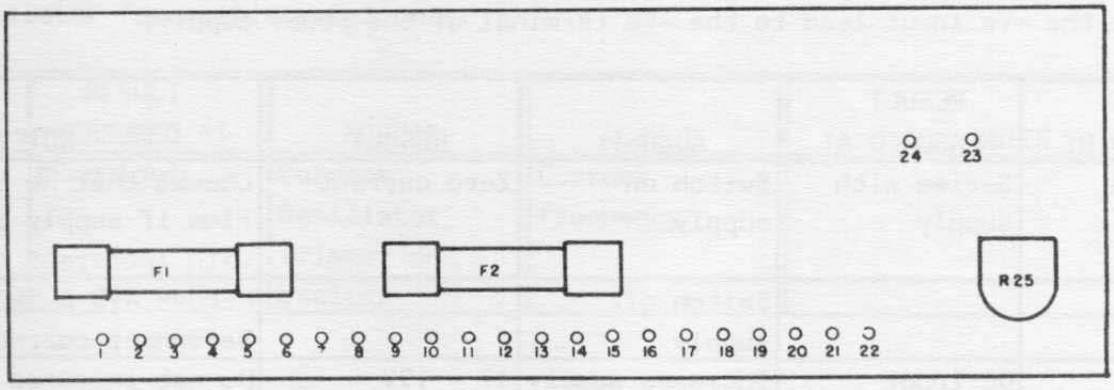
RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
CRO	SK1/1	Operate handset PTT and line intercom together	Monitor mic. audio on CRO	Checks intercom facility microphone to line. Checks that Tx has zero output. N.B. microphone audio should be heard in earpiece as side tone.
Handset earpiece	Handset socket SK6	Switch on sig. gen. at SK1/1 & 2 Operate line intercom	Monitor sig. gen. on ear-piece	Checks intercom facility line to earpiece.
Handset earpiece	Handset socket SK6	Sig. gen. at SK1/1 & 2 Operate Tx monitor	Monitor sig. gen. on earpiece	Checks Tx monitor facility. Tx is not inhibited and microphone not connected.
Handset earpiece & CRO	Handset socket SK6 & CRO at SK1/1 & 2	Connect sig. gen. to SK2/2 SEE NOTE COLUMN	Monitor sig. gen. on earpiece & CRO	Set gen. to -10dBm. Note that input impedance at SK2/2 is 600 ohm unbalanced. This checks receiver to line and receiver to handset interface

N.B. 1. Link 8 (45 to 46) only for when PTT inhibit by Rx required.
2. Link 9 (45 to 61) only required for basic carrier operated talk-through.

4.1.21 **AC SUPPLY & BATTERY CHARGER**

Preliminary Adjustments:-

1. With mains plug removed from power point check transformer taps for correct voltage.
2. Check mains fuses for correct rating i.e. 2A for 240-Volt and 5A for 110-Volt.
3. Place 10A power diode on a heatsink in series with dc supply to ensure current from battery charger cannot damage power supply.



4.1.21 AC SUPPLY & BATTERY CHARGER

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 25V Range	Centre Contact RL2 control PCB	Switch on ac supply	12 ± 1-Volt	Check that mains indicator is on.
AVO 25V Range	Centre Contact RL1 control PCB	Switch on ac supply	14 ± 1-Volt	Checks PA supply. When PTT operated voltage should drop by approximately 1-Volt.
AVO 25V Range	DC Input P42 of RL1	Momentarily short circuit P23 & P24 on ac supply PCB. Adjust R25 on ac supply PCB.	14 ± .2-Volt	DC supply should be switched off and Ext. DC switch should be on. This step sets the battery charger voltage. Shorting P23 and P24 is necessary to start charger in absence of an external dc voltage.
AVO 25V Range	DC Input P42 of RL1	Operate PTT	0-Volt	Checks that battery charger switches off during transmit
AVO ohms Range	-Ve lead to P7 control PCB +Ve lead to chassis	Switch on ac supply	Meter shows low impedance	Checks remote mains indication
AVO ohms Range	-Ve lead to P7 control PCB +Ve lead to chassis	Switch on dc supply, switch off ac supply	Meter shows high impedance	RL1 & RL2 on control change over & transmitter operates from dc supply.
AVO ohms Range	-Ve lead to P7 control PCB +Ve lead to chassis	Switch on ac supply	Meter shows low impedance	RL1 & RL2 turn off and transmitter now operates from ac supply once more.

4.1.22 REVERSE POLARITY AND OVER VOLTAGE PROTECTION

Preliminary Adjustments:

1. Connect a 1k resistor to the -Ve terminal of an AVO on 100mA range.
2. Connect the +Ve terminal of the AVO to the +Ve terminal of the power supply.
3. Connect the other end of the 1k resistor to the -Ve input lead of the transmitter.
4. Connect the +Ve input lead to the -Ve terminal of the power supply.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 100mA Range	Series with supply	Switch on supply	Zero current	Checks that no current will flow if supply connected with incorrect polarity.
		Switch off supply		Remove AVO & 1k resistor. Reconnect correct polarity.
AVO 25V Range	DC Input	Increase supply volts slowly until dc indicator goes off.	17 - 19V	Do not increase supply voltage above 20V. This test checks overvoltage protection.

4.1.23 REMOTE INDICATION AND REMOTE POWER CONTROL

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 10V Range	Pin 36	Operate PTT	5 ± .5V	Checks remote power indication logic level
AVO 10V Range & wattmeter	Pin 40 and RF Output	Operate PTT & connect Pin 22 to ground via 47k pot.	2-5V reducing as 47k pot decreased Output power also	Checks proportional remote power Indication & remote power control.

4.1.24 REMOTE ALARM INDICATION

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO ohms Range	-Ve lead to P26 Control PCB +Ve lead to chassis	Operate alarm by shorting thermal sensor	Low Resistance	Check remote alarm Current sink.

4.1.25 PA SUPPLY FAIL ALARM

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
Alarm Indicator	Front Panel	Remove F1 ac supply PCB switch on ac supply.	Alarm Indicator comes on	Checks alarm protection if PA supply fails.
		Switch off & replace fuse.		

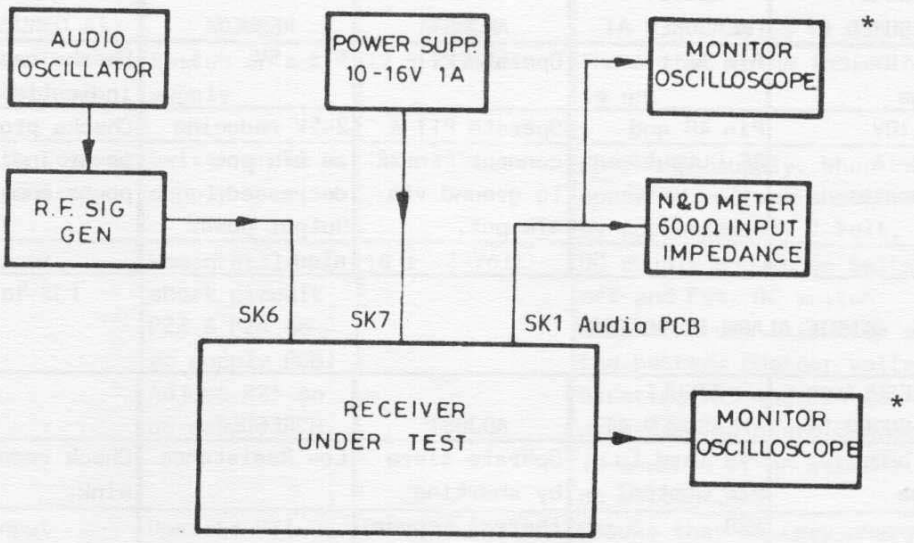
4.1.26 FREQUENCY NETTING

Preliminary Adjustments:

1. Connect sampling pad to RF output.
2. Connect sampled output to UHF frequency counter. Alternatively use a wideband receiver with accurate local oscillator and adjust transmit frequency for zero beat.
3. Select oscillator for multichannel unit.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
Frequency counter or wideband receiver	RF output	Correct Oscillator trimmer on Exciter	Correct frequency	

4.2 RECEIVER



*OSCILLOSCOPE CONNECTED AS REQUIRED

NOTE: The multimeter, marker generator and frequency counter are to be used as directed in the test procedure.

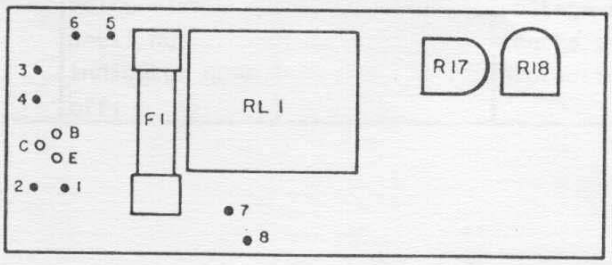
4.2.1 +10V REGULATOR

Preliminary Adjustments:

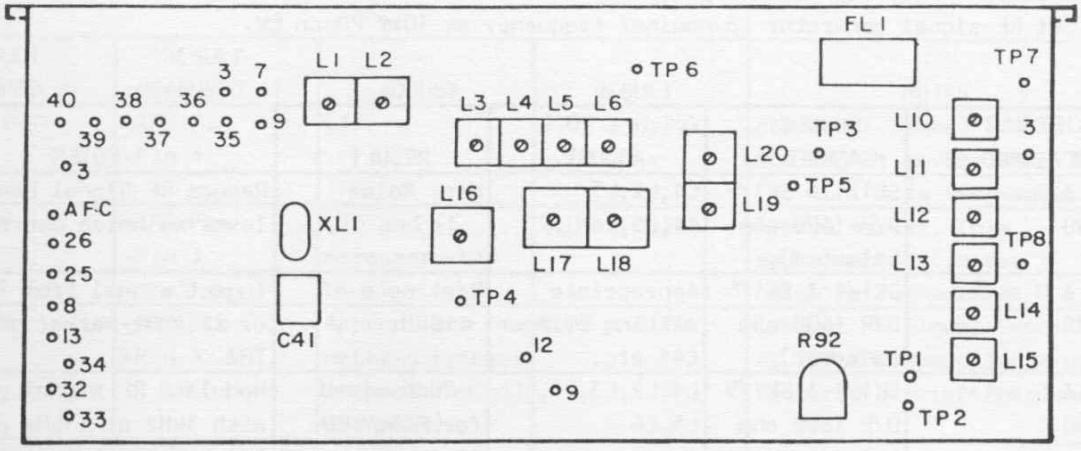
1. Connect dc supply & set to 13.8V
2. R18 FCCW Reg. PCB
3. R17 FCW Reg. PCB
4. Connect link 1 between P28 & P30 Audio PCB

N.B. Unless otherwise directed - VE Lead of AVO connects to chassis.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 10V Range	Pin 4 Regulator PCB	R18 Regulator PCB	+10V ±0.2V	DC Indicator should be on.
DC Indicator	Front Panel	R17 Regulator PCB (see notes)	Until dc indicator goes out	Connect 18 ohm 5W resistor from P4 to chassis before setting R17. This step sets current trip to 0.56A & may be reset by switching supply off then on (after removing load resistor).
AVO 1A Range	In series with +Ve supply lead		<200mA	Volume at minimum & mute defeated. Checks current consumption.



4.2.2 **MULTIPLIER ALIGNMENT**



RECEIVER PCB TEST POINT LOCATION

MULTIPLIER ALIGNMENT

Preliminary Adjustments:

1. Fit crystal.
2. Select channel (Multi.Chan. versions).
3. Disable AFC - link AFC pin to chassis or P3
4. Adjust slugs in L16,L17,L18 and plastic helical resonator slugs in L1,L2,L3,L4,L5,L6,L19 and L20 so that they are flush with the top of the can.
5. Adjust all channel trimmers to 50%.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 2.5V Range	+TP3 -TP4	Remove Crystal	Drop in voltage	Checks that the oscillator is working. Replace crystal.
AVO 2.5V Range	+TP3 -TP4	L16	Max. Volts	
AVO 2.5V Range	+TP3 -TP4	L17	Min. Volts 1V - 1.5V	
AVO 2.5V Range	+TP3 -TP5	L18	Max. Volts	Re-adjust L16,L17,L18,for maximum volts.
AVO 2.5V Range	+TP3 -TP5	L19	Min. Volts 1.2V - 2.7V	
AVO 250uA Range	+TP3 -TP6	L19,L20	Max. current 90uA-150uA	

4.2.3 **RF & IF ALIGNMENT**

Preliminary Adjustments:

1. Connect test equipment as shown.
2. Disable AFC by linking AFC pin to chassis or P3.
3. Set RF signal generator to nominal frequency at 10mV PD on CW.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
N & D meter CRO	SK1/1 & SK1/5 O/P (600 ohm balanced)	L1,L2,L3 L4,L5,L6	Min. Noise	Reduce RF Signal Generator level as noise decreases.
N & D meter CRO	SK1/1 & SK1/5 O/P (600 ohm balanced)	Appropriate netting trimmer C41 etc.	Beat note of <100Hz	Inject signal from 10.7MHz or 21.4MHz marker osc. near TR2.
N & D meter CRO	SK1/1 & SK1/5 O/P (600 ohm balanced)	L1,L2,L3,L4, L5,L6	>20dB sinad for 0.5uV PD RF input	Modulate RF signal generator with 1kHz at ±3kHz deviation Adjust line O/P level for 0dBm. It is assumed that IF alignment has been carried out. If this is not so the following procedure should be carried out.
RFmV meter	+TP8 -TP3	L10, L11, L12, L13	Max. volts	RF signal generator set to 150uV PD unmodulated. Reduce level as required.
RFmV meter	+TP8 -TP3	L10, L11, L12, L13	<10mV RmS	RF signal generator level 1.5uV PD.
AVO 50uA Range	+TP2 -TP1	L15	Zero current	Remove RF signal generator and inject marker near TR2.
N & D meter CRO	SK1/1 & SK1/5	L14	Max. audio O/P	Re-connect Rf signal generator at 1mV PD modulated with 1kHz at ±3kHz deviation.
N & D meter (to measure volts RMS)	Pin 26 RX PCB	R92	190mVRMS	RF signal generator as above.
N & D meter CRO	SK1/1 & SK1/5		<3% THD at 0dBm	RF signal generator as above.

4.2.4 **AFC ALIGNMENT**

Preliminary Adjustments: 1. Enable AFC by Removing earth link to P3.

NOTE: Signal Generator Level during AFC alignment should be 100uVPD.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
AVO 10V Range	+AFC Pin -Pin 3	L15	2.0V ± 0.25V	Remove RF Signal Generator and inject marker near TR2. L15 tuning is very sensitive
AVO 10V Range	+AFC Pin -Pin 3	L13 and if necessary L14	2.0V ± 0.25V	Remove marker. This adjustment optimises IF noise performance.
AVO 10V Range	+AFC PIn -Pin 3	Appropriate netting trimmer (repeat for all channels)	2.0V ± 0.25V	Connect RF Signal Generator at 100uVPD unmodulated on required carrier frequency.
N & D meter CRO	SK1/1 & SK1/5 O/P 600 ohm Balanced		< 3%	Modulate RF Signal Generator with 1kHz at ±3kHz deviation Measure THD.
N & D meter CRO	SK1/1 & SK1/5 O/P 600 ohm Balanced		> 20dB	Reduce RF Signal Generator level to 0.5uVPD & check sinad.
AVO 10V range	+AFC pin -Pin 3	RF Signal generator frequency	5% THD	Increase RF Signal Generator level to 100uVPD ±3kHz/1kHz. Adjust frequency on either side of nominal frequency until THD increases to 5%. Check that offsets are within ±7kHz (±2kHz).
AVO 10V range	+AFC pin -Pin 3	Appropriate netting trimmers (check for all channels)	Within 1kHz	Check symmetry. If not within 1kHz of each other adjust the appropriate netting trimmer until the difference is 1kHz.
AVO 10V range	+AFC pin -Pin 3		4.0V ±0.2V	Check AFC voltage at the negative offset (AFC voltage at positive offset should be 0V).
AVO 10V range	+AFC pin -Pin 3	Increase R130 value	< 3.8V	
AVO 10V range	+AFC pin -Pin 3	Decrease R130 value	> 4.2V	
AVO 10V range	+AFC pin -Pin 3		1.5V to 3.5V	AFC voltage at nominal carrier frequency.

4.2.5 **MUTE RANGE**

Preliminary Adjustments: 1. Signal Generator modulated ±3kHz/1kHz.

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
		Mute Control FCW		
N & D meter	Line O/P	Sig. Gen. Level until Mute opens	⩽18dB Sinad	Mute maximum.
		Mute control FCCW		
Call Rec'd LED	Front panel	Mute control CW	LED goes out	Signal Generator is off.
N & D meter	Line O/P	Increase Sig. Gen. until mute opens	6dB ±3dB Sinad	Mute threshold

4.2.6 **MUTE OVERRIDE CHECK**

RESULT MEASURED BY	ESULT MEASURED AT	ADJUST	RESULT	NOTES
Call Rec'd LED	Front Panel	Mute defeat push button (see notes)	LED comes on	Initially receiver should be muted i.e. no RF input. Check mute defeat switch.
Call Rec'd LED	Front Panel	Link Pin 6 to chassis	LED comes on	Checks remote "mute off"
Call Rec'd LED	Front Panel	Link Pin 5 to chassis	LED goes out	Initially RF signal should present. Checks remote "mute on".

4.2.7 **MODULATION ACCEPTANCE BANDWIDTH**

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
N & D meter	Line O/P	Sig. Gen. level	12dB sinad	
		Increase sig. gen. level by 6dB.		
N & D meter	Line O/P	Increase sig. gen. deviation (see notes)	12dB sinad	Deviation should be ±7.5kHz.

4.2.8 **DEVIATION SENSITIVITY**

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
		Line O/P level control FCW.		
N & D meter set to 1V range	Line O/P terminated by 600 ohm	Sig. Gen. deviation (see notes)	0dBm (0.775V)	Deviation < ±2kHz
N & D meter set to 3V range & oscilloscope	Line O/P terminated by 600 ohm	Sig. Gen. deviation until just before clipping	> +6dBm (1.55V)	Checks max. line level
N & D meter set to 1V range	Line O/P terminated by 600 ohm	Line O/P level control (see notes)	-6dBm (0.39V)	Sig. gen. modulated ±3kHz/ 1kHz sets line O/P level suitable for most installations.

4.2.9 **AUDIO FREQUENCY RESPONSE**

RESULT MEASURED BY	ESULT MEASURED AT	ADJUST	RESULT	NOTES
N & D meter	Line O/P terminated by 600 ohm	Cal. on N & D meter (see notes)	0dBm ref.	Sig. gen. set to 1mV and modulated ±3kHz/1kHz
N & D meter	Line O/P terminated by 600 ohm	Mod. freq. ±3kHz/100Hz	+2 to -2dB	
N & D meter	Line O/P terminated by 600 ohm	±3kHz/300Hz	+8 to +11dB	+10.5dB is ideal
N & D meter	Line O/P terminated by 600 ohm	±3kHz/1kHz	0dB	
N & D meter	Line O/P terminated by 600 ohm	±3kHz/3kHz	-12 to -9dB	-9.5dB is ideal
N & D meter	Line O/P terminated by 600 ohm	±3kHz/6kHz	-24 to -15dB	

4.2.10 **AUDIO POWER AMPLIFIER**

RESULT MEASURED BY	RESULT MEASURED AT	ADJUST	RESULT	NOTES
CRO 1V/Div.	Handset Socket SK5.3	Volume control until just clipping	> 6V p.p.	Sig. gen. modulated ±3kHz. 400Hz check for mechanical vibrations