

MODERN MILITARY SURPLUS EQUIPMENT



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In the past couple of years some relatively modern military communications equipment has appeared on the local surplus market.

Over the next few issues I will describe this equipment and its adaptation for amateur use.

This instalment should enable you to recognise the various units and the accessories needed for operation. Future instalments will describe individual units and ways of getting them on air.

GENERAL INFORMATION

The equipment to be described is of English origin and was used by the Australian Army in a variety of transport vehicles and Armoured Fighting Vehicles (AFV). It was replaced several years ago by US designed radio equipment and now turns up in disposals throughout Australia.

The sets can be recognised by the dark green colour of the ribbed aluminium cases and the following nomenclature, generally shown on a tag on the front or top of the case:

NAME	FUNCTION	FREQUENCY
Wireless Set B47	low power FM Transceiver	38-56 MHz
Wireless Set C42	high power FM Transceiver	36-60 MHz
Wireless Set C45	high power FM Transceiver	23-38 MHz
Wireless Sender C11	Transmitter	2-16 MHz
Wireless Reception Set R210	AM, CW, FSK Receiver	2-16 MHz
Supply Unit Vibratory No. 12	Power Supply Unit for C42 or C45	
Supply Unit Trans- former Rotary 24V	Power Supply Unit for C11	
Aerial Tuning Unit No. 8	Aerial Tuner	for B47
Aerial Tuning Unit No. 6	Aerial Tuner	for C45 & C42
Aerial Tuning Unit No. 7	Aerial Tuner	for C11

As you can see, this equipment can be quite useful on various amateur bands, particularly 6 metres FM.

The equipment was manufactured in 1959-60 and used miniature 6.3V valves with vibrator or dynamotor power supplies. It is obviously top quality and despite being a bit bulky and power hungry it gives a very reasonable performance even by today's standards.

The condition of the available sets varies from brand new in sealed cartons, to some that must have been in the Yarra! Normally the sets are sealed and could be under slight vacuum, so if you find one that has a small black metal cup covering the head of one of the Allen screws which hold the set in its case, and if, when you open the set, you hear an inrush of

air, you probably have a unit that has not been tampered with.

Because the sets (except C11) are virtually watertight the interiors are generally as new, even if the outer case is pretty grubby. The C11 and its PSU have vents that open for air circulation during operation. If the set has previously been opened, check for missing valves and crystals, particularly as all have 1 MHz/100 kHz crystal calibrators. Any mud, corrosion etc. inside is a big problem as the solder joints are probably affected and will break readily. The front panel knobs are a special collet type and should all be there. The dial scale is a photographic negative film with sprocket holes and is prone to damage and deterioration. Rotate the tuning knob while examining the dial scale and listen for noises which could indicate missing sprocket webs or damage.

The sets use a common connection method and even if you propose to deviate from this it is not a bad idea to acquire the basic connecting harnesses.

Vehicle installation required a two core power lead from a 24 volt battery to the Power Supply Unit PSU where used, or direct to the set. A short harness connected the PSU to the set. A control harness type A or B connected each set to a master control box known as the J1 box, or J2 or JD9. From there cables ran to each operator's station where headphones/microphones or handsets could be attached via individual small control boxes variously called CU30, CU31, CU34, JD8 or B, C, D, or R boxes, depending on facilities provided. Individual audio volume could be adjusted if the box included a low value pot off the audio output bus.

The correct plug and socket connectors and harnesses can be determined by examining the pin layout and shape but check that the threads on the connectors match as there are some harnesses around with non-compatible thread sizes.

The antenna was generally a 2.4 metre rod screwed into a base mounted onto the vehicle. 75 ohm coaxial cable with British Pattern, 4 sockets, not compatible with PL259/SO239, connected to the aerial tuner and to the set. Some vehicles also had a portable 8.7 metre telescopic mast with a variable length whip on top and used rope guys for support. This was fed with about 11 metres of smaller diameter co-ax (RG58/U size).

It is quite feasible to connect up and operate

the sets using the various harnesses and a J box and headset; however in the series I shall consider:

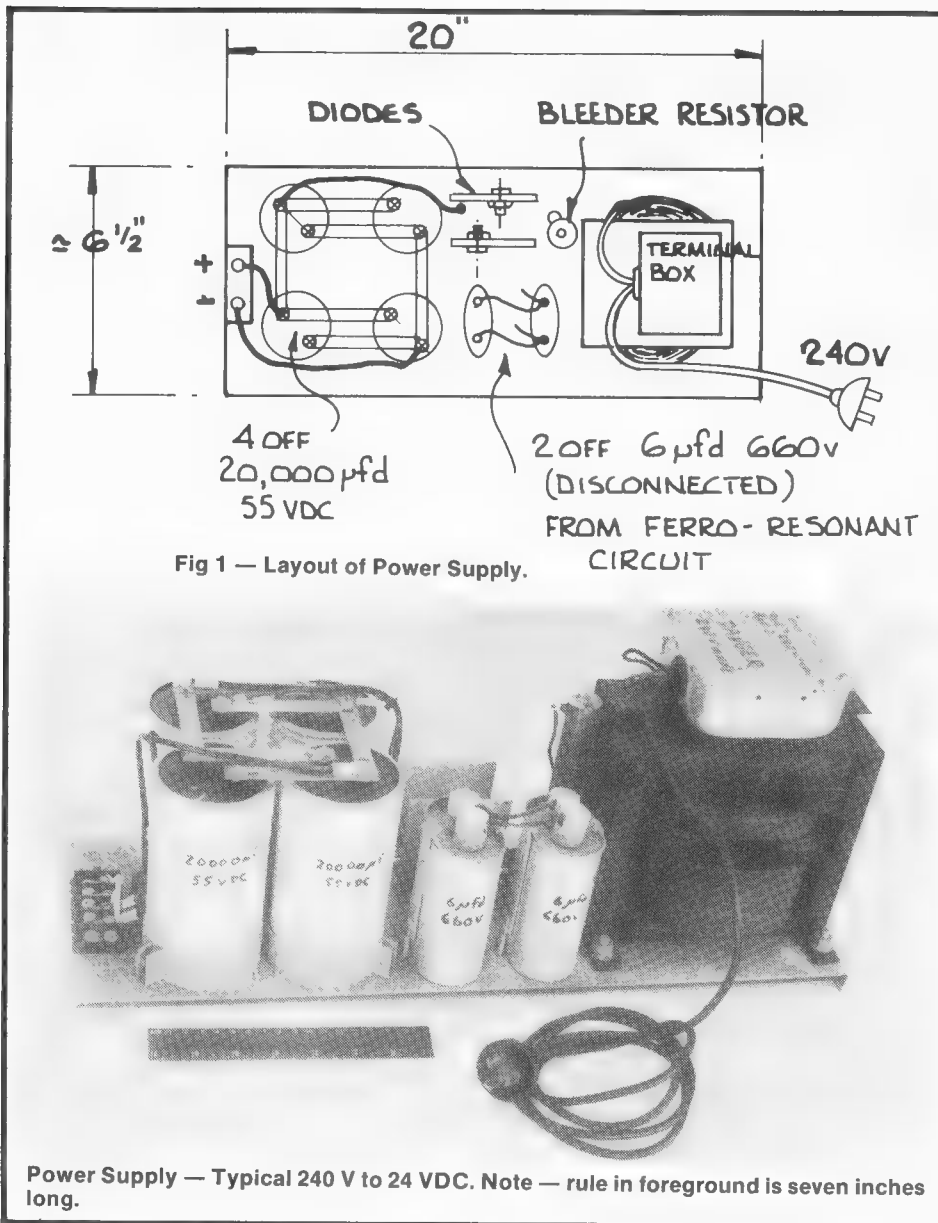
- Alternative power sources.
- A description of the circuitry so that trouble-shooting, alignment or modification can be studied.
- Methods of getting the sets on air without the complexity of the harnesses etc.
- Modifications to improve performance. I will not give step by step details as there is often more than one way of achieving the end result.

POWER SUPPLY ALTERNATIVES

All sets ran on 24V DC at currents ranging from 1.8 amps for the R210 up to a whopping 22 amps for the C11. They are tolerant of wide voltage fluctuations — from 20V to 30V input; although power output drops off at low voltage. All the power supplies have a relay which operates when low voltage is sensed and shorts out a resistance, or changes transformer taps, so increasing voltage into the sets.

There are a number of options for providing the required power:

- Buy an armoured car at a disposals auction. This gives you adequate 24V DC capacity and also commands a certain amount of respect when operating mobile.
- Use a 24V truck battery or connect two 12 volt car batteries in series. This method has the usual problems associated with lead/acid batteries.
- Build a 24V DC supply using commercial or junk box parts. This can be a very simple unit comprising a large transformer, diode rectifiers (perhaps auto alternator diodes?), and a large smoothing capacitor, say 10,000 microfarads at 40V DC. The vibrator or dynamotor are to a large extent self-regulating and will even run off raw unfiltered DC.
- Adapt one of the many ex-computer power supplies that are on the market. There are a few 240V units that give 24V and 32V outputs at adequate amperage but most seem to be 110V input. However, if the transformer is ferro-resonant, as evidenced by a winding connected to two capacitors rated at about 6 microfarads and 600V each, it can probably still be used. Disconnect the capacitors and feed 240V AC into the winding. Hopefully the 32V DC output circuit will show 24 to 28V DC. Take precautions



Power Supply — Typical 240 V to 24 VDC. Note — rule in foreground is seven inches long.

with the primary as it will have 80-90V induced in it. You should also check that the 24V wiring is large enough to carry the current. Some supplies provided 5V at heaps of amps but only low current to the 24 or 32V circuits.

See fig 1 and photo 1

5. Dispense with the existing PSU circuit and build up a power supply for the necessary HT, filament and control voltages. This is more work but gets away from the vibrator noise and hash or the dynamotor's lack of efficiency. A large transformer from a valve type TV set, particularly one that has a valve rectifier would make a good start. Details of the voltages necessary will be given in the description of each set.
6. For the R210 there is another neat alternative which I shall detail later.

MODIFICATIONS IN GENERAL

The circuitry of the sets is very conventional and consequently modifications suggested for other valve circuits will work equally well here. Some of my suggestions for one set will also apply to others in the series.

REMOVING FRONT PANEL KNOBS

The existing knobs are a collet type, called Boot-proof, but the potentiometers and switches have standard shafts. You may wish to fit normal knobs or change the pots or switches. The procedure to remove the knob assembly is:

- (1) Remove the large centre screw and spring washer.
- (2) Remove the knob and replace the centre screw 5-6 turns.
- (3) Tap the screw gently and you will find the collet comes loose.
- (4) Remove the large nut, sleeve, collet and washers, then remove the second large nut.
- (5) You will now be able to get at the control.

DESICCANTS

All the sets have a quick-lime moisture absorber in a red tube of aluminium mesh. It cannot be recycled so can be discarded if you choose. As the coils and IFTS are not impregnated you should try to exclude moisture but do not use silica gel inside the set.

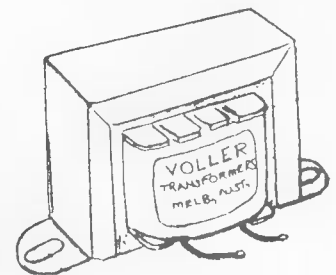
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Reception Set R210

The R210 is a seven band single superheterodyne communications receiver normally used in conjunction with the Wireless Sender C11. It can be used with longwire or coax cable input, and has facilities for AM and CW, a switchable noise limiter and audio filter.

SPECIFICATIONS

Power requirements: 24V DC at 1.8 amps

Frequency coverage:

Band 1	2.0-3.0 MHz
2	3.0-4.5
3	4.5-6.8
4	6.8-9.1
5	9.1-11.4
6	11.4-13.7
7	13.7-16.0

Mode of operation:

Reception of AM, CW and FSK. SSB possible using inbuilt variable BFO.

Sensitivity:

AM-5 microvolts for full audio output

Signal to noise ratio:

AM 6.5 microvolts for 20 dB

Selectivity:

AM-5 kHz-7 kHz at 6 dB

less than 12 kHz at 60 dB

CW-150 Hz at 3 dB

600 to 1000 Hz at 20 dB

Antenna:

1-long wire

2-80 ohm via a BNC socket

IF Frequency:

460 kHz

Stability after 15 minute warm up:

50 Hz per MHz

Dial Calibration:

5 kHz per division, 40:1 reduction ratio of tuning dial.

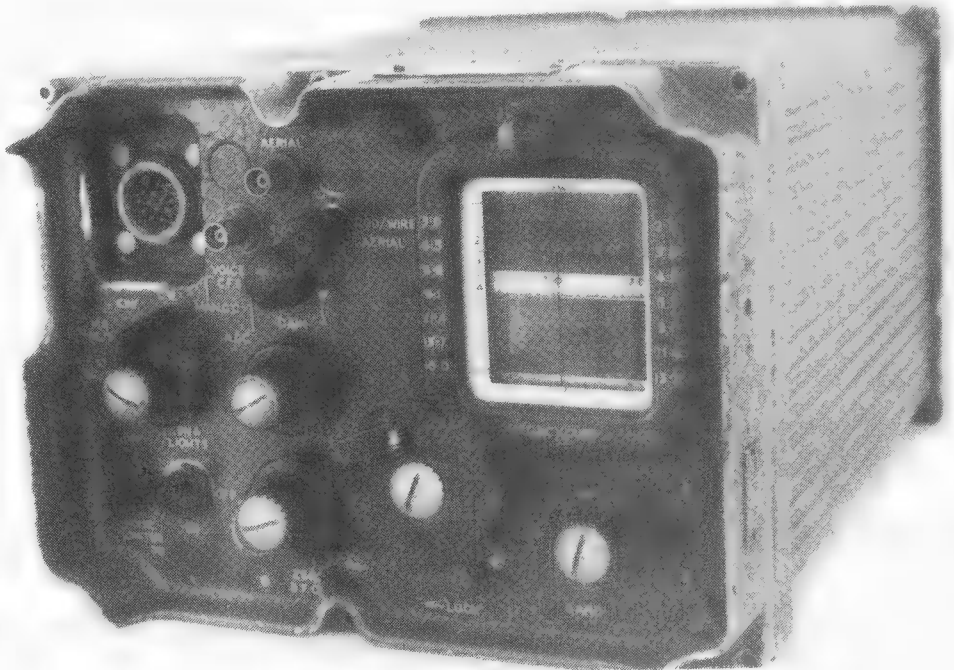
AF output:

150 mW into 50 ohms.

Weight:

approx 17kg

Valve line up:

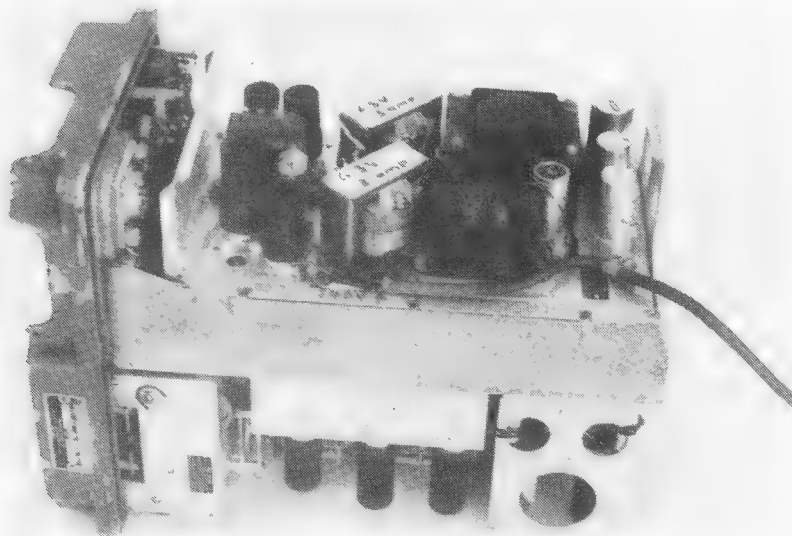


SERIAL NO.	TYPE	FUNCTION	EQUIVALENT
V1	CV4015, CV131	RF amp	6065, EF92
V2	CV4012, CV453	Mixer	6BE6
V3	CV4015, CV131	1st IF amp	6065, EF92
V4	CV4015, CV131	2nd IF amp	6065, EF92
V5	CV4015, CV131	3rd IF amp	6065, EF92
V6	CV4025, CV140	AGC Rectifier/detector	6058, EB91
V7	CV4010, CV 850	1st AF amp	6AK5, EF95
V8	CV4010, CV850	2nd AF amp	6AK5, EF95
V9	CV4003, CV491	10 kHz multivibrator	12AU7, ECC82
V10	CV4010, CV850	100 kHz crystal oscillator	6AK5, EF95
V11	CV4010, CV850	Local Oscillator	6AK5, EF95
V12	CV4010, CV850	BFO	6AK5, EF95
V13	CV4010, CV850	IF cathode follower	6AK5, EF95
V14	CV4025, CV140	Noise Limiter	6058, EB91
V15	CV286	95V Stabiliser	95A1

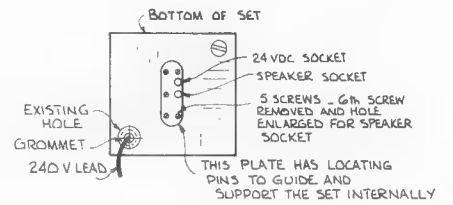
In the above list the valve type numbers are given for the high reliability version e.g. CV4015 and the standard version e.g. CV131. Equivalent numbers are given for US and English commercial valves.

PRINCIPLE OF OPERATION

RF signals are fed through the appropriate aerial circuit via Band Switch SWB to the RF amplifier V1. The signal is mixed in V2 with the local oscillator, V11, output; operating 460kHz above the signal frequency. Three IF stages, V3, V4 and V5, amplify the signal at 460 kHz. V6 detects the audio in one half and acts as the AGC rectifier in the other diode half. V7 and V8 are audio amplifiers.



Internal View Showing Mod 4.



Rear View Showing Mod 3.

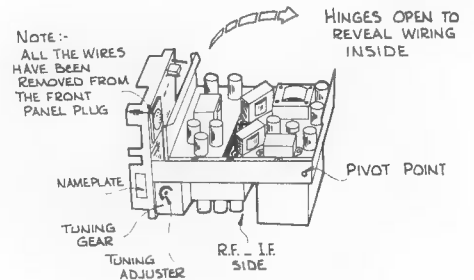


Figure 1 — Rear View.

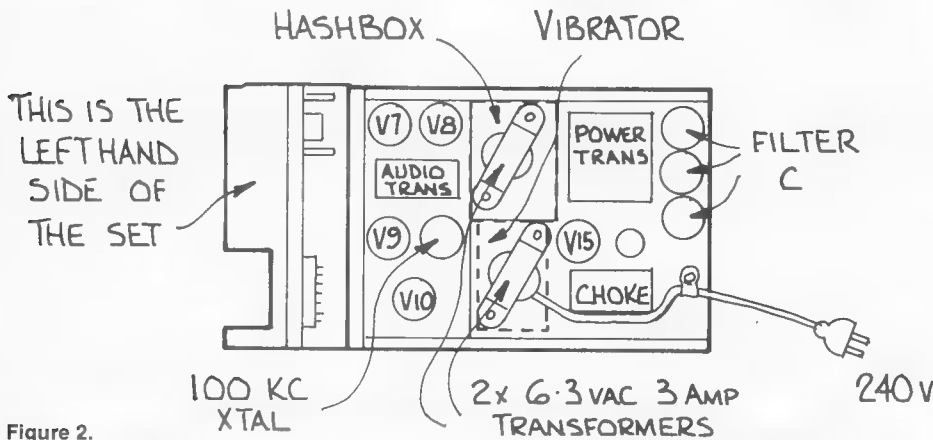


Figure 2.

Output is via a transformer matching to 50 or 150 ohms. The BFO V12 is variable from the front panel about ± 5 kHz. V13 provides an 80 ohm IF output on the front panel for FSK, or as the army call it, CFS, Carrier Frequency Shift. The double diode V14 operates as an audio noise limiter switchable from the front panel.

A 100 kHz crystal oscillator V10 is switched on for calibration and V9, a double triode connected as a multivibrator gives 10 kHz calibration signals. A 1 kHz audio filter, L12 and C99, is switched in on the CWF switch position. AGC is applied to V1, V2 and V3, in the Cal 10 kc/s, Cal 100 kc/s and AGC switch positions but in the CWF, CW and Man GC positions a 1 meg ohm pot ganged with the 0.5 meg ohm audio gain control is brought into the AGC line and supplied with $-30V$. The audio gain pot is then inoperative.

POWER SUPPLY

The power supply uses a self-rectifying vibrator and a transformer, with a choke and capacitor for HT output. Separate windings give filament and bias voltages. V15 is a 95V stabiliser feeding the local oscillator and mixer.

- HT1 + 175VDC at about 150 mA
- HT2 + 95VDC at about 50 mA
- Filaments 6.3VAC at about 2.5 A
- Bias $-30VDC$

An interesting feature of the power supplies for the various units is a relay which switches out resistance, or in the R210, switches transformer tappings to maintain HT voltages when the input voltage drops below 23.5V. In the R210 this is relay RLA/4 which can be permanently energised if the input voltage is less than 30V.

FRONT PANEL INTERCONNECTION PLUG — PLA

If you examine this plug you will see it has a letter beside each pin. The significance of each is:

- A — 24VDC input positive
- B — 24VDC input earth
- C — HT1 (+ 175V) output from PSU
- D — to HT1 input to set
- E — 6.3V heater output from PSU
- F — to valve heaters
- G — earth same as B
- H — 30V input from C11 (in parallel with PSU supplied $-30V$)

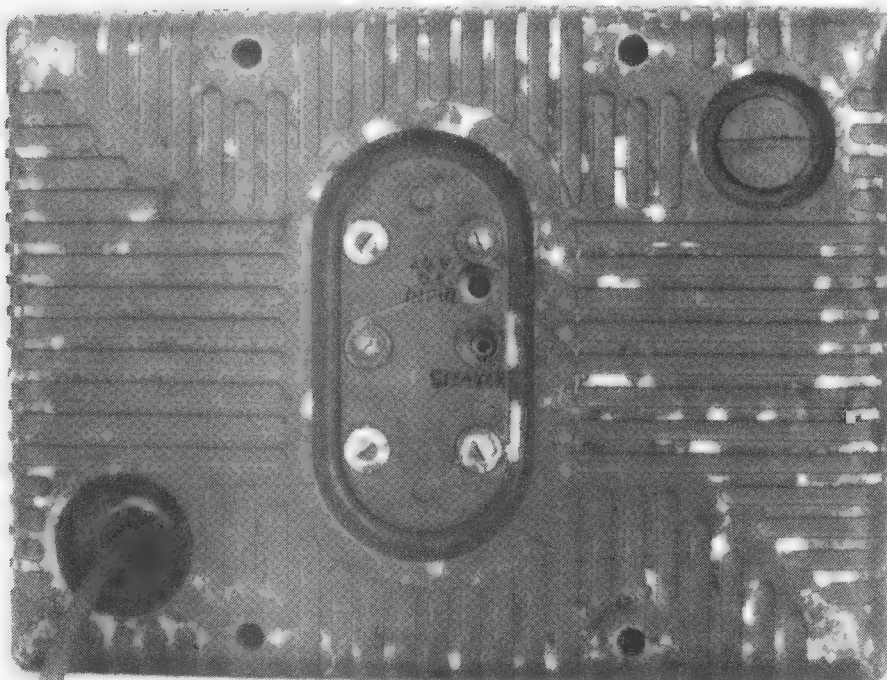


Figure 3.

J — voltage control relay RLA/4
K — Audio Output — 50 to 150 ohm
L — Audio Output — 50 to 150 ohm
M — 24VDC switched output

MODIFICATIONS

- (1) To operate the R210 alone you need to make the following connections:
+ 24VDC to pin A
earth to pin B
pin C to D
pin E to F
pin J to M if input voltage is less than 30V
Headphones, Low impedance, or a speaker to pins K and L. An 8 ohm speaker works OK.
Antenna to front panel.
- (2) One way to accomplish these connections is to remove the front panel connection plug and replace it with an aluminium plate. Onto this plate fit an earphone socket eg Dick Smith P-1231 and a DC power socket eg Dick Smith P-1665.
The other wires can be soldered together as required and taped.
- (3) Another way of making a neat installation is to remove the centre bolt securing an aluminium plate with alignment pins that is bolted to the back of the case. Enlarge the hole to about 12 mm diameter to clear an earphone plug and drill a similar sized hole next to it. Mount a small aluminium plate to the RF/IF sub-assembly chassis and on this, in line with the holes in the case, fit an earphone socket and a DC power

socket. (see photo No. 3) The existing wiring can be left as is and new audio and 24V wiring connected in parallel, or it can be disconnected from the front connector and run to the new sockets. If you choose to leave the existing wiring be aware that there is unguarded 175V on the front connector.

- (4) A worthwhile modification involves fitting a 240V to 6.3V 7 amp transformer onto the power supply chassis and connecting it to the heater wiring. The vibrator is removed and two rectifier diodes connected in the 175V secondary of the set transformer. Note that they are connected in opposite polarity to a conventional full-wave, centre tap circuit. There is room for two transformers on the chassis if you can't find one with sufficient current rating. The mains lead can conveniently be routed through a large plug hole in a rear corner of the case. Do not use the existing ON-OFF switch for the 240 volt input as it's only rated for low voltage.
- (5) If you can find a dual concentric pot with one 1 megohm and one 0.5 megohm values or similar, you can replace the existing gain control and obtain independent control of RF and AF gain. You must move a brown wire from VR₂ terminal with shielded connection to the VR₂ centre terminal. This is helpful when resolving SSB signals.
- (6) Better performance on SSB can be obtained by converting V13 and FSK IF output, to a product detector.
- (7) Although I haven't tried it, it would not be too hard to change the BFO variable capacitor to a switch connecting one of

- (8) two trimmer capacitors for USB or LSB. You can retune the IF to 455 kHz, from the 460 kHz, if you wish to fit a crystal or ceramic filter for better selectivity. Local oscillator frequency will have to be adjusted.
- (9) If you carried out modifications to provide alternative connections to the front panel Interconnection plug PLA then you can remove the front panel connection plug altogether and fit an S-meter in its place. You may have to enlarge the hole to suit. I haven't detailed any circuit as there are plenty of S-meter circuits in the technical literature.
- (10) On the cosmetic side; if you carefully scrape the paint off the raised lettering on the front panel you highlight them in silver on a green background.
- (11) On many sets the tuning is inoperative. I don't know how this came about but invariably a small ball on the end of a worm shaft in the tuning gearing has been dislodged. You usually find the ball somewhere in the case and it only requires infinite patience to replace it. There is supposed to be a ball at each end of the shaft, held under tension by screwed adjusters sealed with red paint. Undo one of the adjusters and fit the missing ball back by whatever means you can. (see fig 3) I have found that a dab of grease on a toothpick will hold the ball whilst you juggle it in. Tighten up the adjuster just enough to eliminate end play and lock it up again. If you choose to fiddle with the rest of the tuning gearing — best of luck!

MODERN MILITARY SURPLUS EQUIPMENT

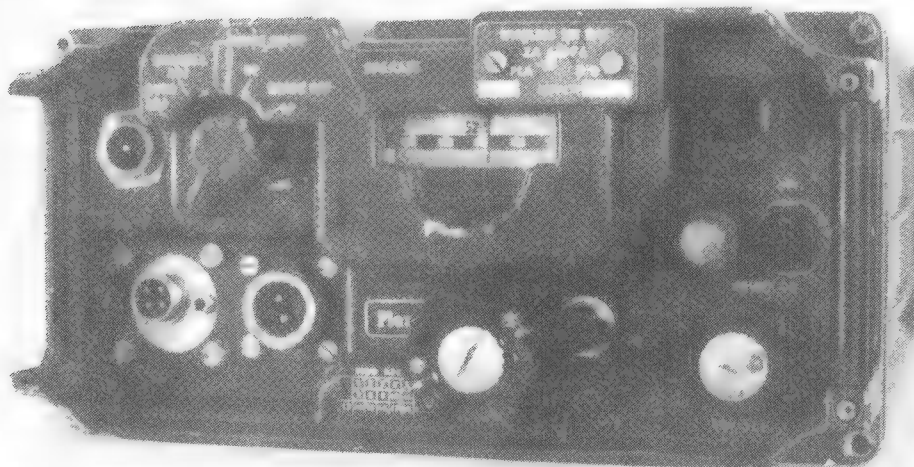


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PO Box 21, Pennant Hills, NSW, 2120

Wireless Set B47

The B47 is a low power FM transceiver, VFO tuned in one range from 38 to 56 MHz. It was intended for short range communications with infantry who would be carrying a man-pack radio such as the AN/PRC10.



SPECIFICATIONS

Power requirements:
24V DC at 2.5 amps
Frequency Coverage:
38 to 56 MHz
Mode of Operation:
Transmission and reception of FM
Transmitter — power output
LP (low power) — approx 20 MW
HP (high power) — approx 600 MW
— Deviation
4.5 kHz for 20mV to mic input
7 kHz for input of 20 mV to 200 mV to mic input
Microphone: 600 ohms
Receiver-Sensitivity:
1.25 microvolts for 10 dB quieting
Selectivity:
— 70 kHz at 3 dB
— 260 kHz at 60 dB
Antenna:
75 ohm via a co-axial plug
IF Frequency: 4.3 MHz
Dial calibration:
100 kHz per division
AF output:
150mW into 50 ohms
Weight: Approx 15 kg

VALVE LINE UP:

Serial No.	Type	Function	Equivalent
V1	CV4010, CV850	1st RF amp	6AK5, EF95
V2	CV4010, CV850	2nd RF amp	6AK5, EF95
V3	CV4015, CV131	Local oscillator	6065, EF92
V4	CV4010, CV850	1st IF amp	6AK5, EF95
V5	CV4010, CV850	Limiter	6AK5, EF95
V6	CV469	Discriminator diode	EA76
V7	CV1833	Neon voltage stabiliser	OB2
V8	CV4010, CV850	Reactor driver	6AK5, EF95
V9	CV4040, CV416	Oscillator/power amp.	6F17
V10	CV469	Discriminator diode	EA76
V201	CV4010, CV850	2nd IF amp	6AK5, EF95
V202	CV4010, CV850	3rd IF amp	6AK5, EF95
V203	CV4010, CV850	Receiver Limiter	6AK5, EF95
V204	CV469	Receiver discriminator	EA76
V205	CV469	Receiver discriminator	EA76
V301	CV4010, CV850	AF amp/squelch driver	6AK5, EF95
V302	CV4010, CV850	AF output	6AK5, EF95
V303	CV4010, CV850	Noise amp and filter	6AK5, EF95
V304	CV469	Squelch rectifier	EA76
V305	CV4015, CV131	Mic amp	6065, EF92
V306	CV469	AMC rectifier	EA76
V401	CV2213	Dial light neon	Not known
V402	CV2213	Dial light neon	Not known
V403	CV4010, CV850	Calibrator oscillator	6AK5, EF95
MR1	CV425	Crystal mixer	OA74

The serial numbers of the valves indicate the chassis sub-unit on which they are fitted and these references are carried through for all components.

1 to 199 RF sub unit eg R113
201 to 299 IF sub unit eg R213
301 to 399 AF sub unit
401 to 499 Calibrator and centre frame unit
501 to 599 Power Supply Unit

PRINCIPLE OF OPERATION

Receive RF signals feed through tuned circuits to two RF stages V1 and V2 and then to the crystal mixer MR1. The local oscillator V3 operating between 42.3 and 60.3 MHz also feeds to MR1. The resultant 4.3MHz frequency goes through three stages of IF amplification V4, V201, and V202 to the limiter V203. The limiter output goes to a discriminator V204, V205, then to a filter network which produces AF, noise at 10 kHz and a DC voltage. The AF is fed to AF amplifiers V301 and V302 then to the output transformer.

The noise output is fed into a noise amp V303 and the output rectified by the squelch rectifier V304. The DC signal from V304 is fed

as bias to V301, the first AF amp, which also acts as a control for the squelch relay RLA/1. A front panel control sets the squelch level.

TRANSMIT

V9 is a master oscillator power amplifier, MOPA, tuned over 38 to 56 MHz and frequency modulated by a ferrite reactor in the plate circuit of the reactor driver V8. A neon stabiliser V7 maintains frequency stability despite variations in supply voltage.

Input to V8 consists of DC from the Automatic Frequency Control, AFC, system, plus AF from the microphone amp V305 and AF negative feedback. The AFC is derived from stray transmit signal which gets into the receiver, and thence to the narrow discriminator V204, V205 and to the sidechain wide discriminator network-V5, the AFC limiter, which receives 4.3 MHz signal from V4 into V6, V10 the discriminator.

Automatic modulation control AMC is obtained by rectifying the sidetone signal from the receiver in V306 and using this as bias to the mic amp V305.

On low power resistance is simply switched into the aerial line to dissipate some of the transmit signal.

The calibration oscillator V403 switches a 1 MHz crystal in the Cursor Adjust switch position and a 100 kHz crystal in the Channel Adjust position.

POWER SUPPLY

The PSU is built into the rear of the case and uses a self-rectifying vibrator and a transformer and thence to a filter network.

Voltagcs required in the set are:

HT: +175 VDC at about 80 mA
 Filaments: 6.3 VAC at about 3.5 A
 Mic Amp: +6.3 VDC at about 200mA
 On/Off Lamp: 12 VDC at about 100 mA
 Relay Supply: 12 VDC at about 140 mA
 AFC diode heaters: 12 VDC at about 140 mA

The DC voltages for the mic amp heater, lamp and relays are obtained by dropping resistors on the 24 VDC input line.

The voltage adjusting relay RLD/2 shorts out series resistance if the input voltage drops.

There is a start up circuit to prevent excessive arcing of vibrator contacts upon first switching on. A starting resistance is shorted out by RLE/2 when the voltage across a capacitor C521 is sufficient after about 1 second.

FRONT PANEL INTERCONNECTION PLUG — SKT405

The pin connections are:

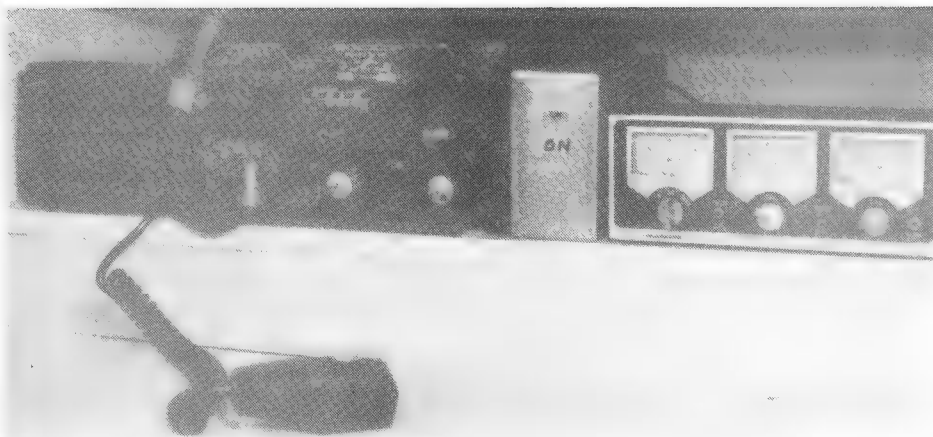
A — microphone input
 B — microphone input shield
 C — no connection
 D — Press to talk switch
 E — Rebroadcast earth
 F — 24V DC switched output
 G — Audio output
 H — Limiter grid current (S-meter output)
 J — No connection
 K — Voltage control relay
 L — No connection
 M — Audio output

FRONT PANEL POWER SOCKET — SKT403

A — + 24 VDC
 B — Earth

MODIFICATIONS

- (1) To operate the B47 make the following connections:
 75 ohm co-ax to the aerial socket
 +24 VDC to pin A of the Power Socket
 Earth to pin B of the Power Socket



The authors B47 with outboard amp and SWR unit.

If you obtained a Power Lead this is simple.

600 ohm microphone to pin A of interconnection plug

600 ohm microphone shield to pin B of interconnection plug

Pin C to earth internally to a convenient earth tag

one side of a PTT switch to C
 the other side of the PTT switch to D
 headphones or a speaker to pins G and M

S — meter to pin H

S — meter return to pin C

Pin K to Pin C if input voltage is less than 30V

- (2) As with the R210 there is room to remove the interconnection plug altogether and fit an aluminium plate across the hole. Into this plate mount a 4 pin microphone socket eg Dick Smith P-1824, and an earphone socket eg P-1231 for your speaker, and a sub-mini socket eg P-1220 for your S-meter connection.

If you don't wish to alter any of the sets described in this series, then obtain an A or B harness and one of the control boxes, such as a J Box. Remove the 12 pin plug from the control box and fit it on to a small box into which you can mount the mike, speaker and S meter sockets and wiring etc. Connect your new control box to the set via the harness. Ensure that you retain the same wire relationship ie Pin A to socket hole A, B to B etc.

- (3) A 0-1 mA meter in an external box with a suitable trimmer pot in series can be connected to pins H and C earth as an S-meter. Adjust the pot so the strongest signal is at FSD and then other signals are just relative.
- (4) Audio output level is set by RV301, a pre-set pot on the rear of the AF chassis. It has a locknut and is sealed with paint and is very fragile so be careful when adjusting it for comfortable speaker volume.
- (5) You will probably find that as the set warms up you have to keep re-adjusting the front panel squelch and if you run out of adjustment you need to re-adjust RV302 next to RV301.
- (6) The Aerial Tuning Unit ATU No 8 was used to match to an 8 foot rod antenna but it is useful to match the 75 ohm output to 50 ohms. Rotate the antenna tuning knob for maximum reading on the tuning meter.
- (7) Power output of 0.5 watts into 50 ohms is adequate for local contacts but for more power you can add an external amplifier with a carrier operated Tx/Rx

relay. The B47 is very compact so the following modifications are difficult. They have all been carried out but you will have to judge whether they are worth the effort in your case.

Para 7B — Connect pin 13 to pin 6 on TS402, or alternatively pin 23 to pin 18 on SKT401. This connects the centre zero tuning meter on receive & transmit as well as during calibration and will allow you to tune in a received signal exactly. One word of caution, if when you transmit the meter needle moves off centre don't change the tuning or you and your contact will be chasing each other up and down the band trying to net. Instead, adjust trimmer capacitor C80 to bring your transmit frequency to centre zero so that it will be the same as the receive frequency.

- (8) The tuning meter is not easy to see as it has a black face and dirty grey pointer. It is possible to remove the front panel and move it forward sufficiently to remove the meter. The meter scale can be removed and painted white and the pointer black. Be very careful with the meter glass as it cracks easily (I found out the hard way!)
- (9) At the same time the HT power to the dial lights can be moved from pin 1 of the calibrator terminal strip TS403 to pin 2 of the terminal strip TS402, so they are on all the time.
- (10) Strip out everything from the power supply, except the choke and smoothing capacitors and the socket that mates with the set. Fit a compact 240V transformer with suitable secondary voltages. Use silicon rectifier diodes for the HT and the mic amp filament voltages. I thought of switching the 240V from the front panel but decided it could create problems and be dangerous.
- (11) Replace the squelch pot with a dual concentric of suitable values and use one section as an audio control. Delete RV301 and run shielded wire to the connecting points.
- (12) Remove the front panel! Remove the ON/OFF switch and the power ON light. Make a rectangular cut-out to fit an edge-reading S-meter. Fit a sub-miniature ON/OFF switch and if you wish, an LED power indicator.
- (13) Whilst the front panel is off, cut off the protruding aluminium surround and handles and file the panel smooth. This gives a bit more access to the controls. Paint in your favourite colour.



MODERN MILITARY SURPLUS EQUIPMENT

Colin MacKinnon, VK2DYM
PO Box 21, Pennant Hills, NSW, 2120

Wireless set C42 & C45.

These sets are identical except for frequency range, and both use the Supply Unit Vibratory No 12 MK2. They were basically mobile to mobile, or mobile to forward base communications units. They include an intercom amplifier for communications within the vehicle.

VALVE LINE UP:

Serial No	Type	Function	Equivalent
V1	CV4010, CV850	RF amp	6AK5, EF95
V2	CV4010, CV850	1st Mixer	6AK5, EF95
V3	CV4010, CV850	100 kHz calibrator	6AK5, EF95
V4	CV4010, CV850	1 MHz calibrator	6AK5, EF95
V5	CV4010, CV850	reactor driver	6AK5, EF95
V6	CV4058, CV133	master oscillator	6C4, EC90
V7	CV2243	driver	
V8	CV220	power amp.	
V9	CV4010, CV850	1st IF amp 6MHz	6AK5, EF95
V10	CV4010, CV850	limiter	6AK5, EF95
V11	CV469	wideband discriminator	EA76
V12	CV469	wideband discriminator	EA76
V13	CV2128	2nd mixer/LO 8.4 MHz	ECH81
V14	CV4010, CV850	2nd IF amp 2.4 MHz	6AK5, EF95
V15	CV4010, CV850	3rd IF amp 2.4 MHz	6AK5, EF95
V16	CV4010, CV850	1st limiter	6AK5, EF95
V17	CV4010, CV850	2nd limiter	6AK5, EF95
V18	CV469	discriminator diode	EA76
V19	CV469	discriminator diode	EA76
V20	CV4010, CV850	1st AF amp	6AK5, EF95
V21	CV4010, CV850	2nd AF amp	6AK5, EF95
V22	CV4010, CV850	1st squelch amp	6AK5, EF95
V23	CV469	rectifier	EA76
V24	CV4010, CV850	squelch amp/switch	6AK5, EF95
V25	CV4010, CV850	intercom amp	6AK5, EF95
V26	CV4010, CV850	intercom amp	6AK5, EF95
V27	CV4015, CV131	mike amp	6065, EF92
V28	CV4010, CV850	AMC amp	6AK5, EF95
V29	CV469	AMC rectifier	EA76
V30	CV4010, CV850	mike amp	6AK5, EF95
V31	CV2209	1st local oscillator	
V32	CV449	voltage stabiliser	85A2
Power Supply Unit			
V1	CV469	time delay diode	EA76
V2	CV469	time delay diode	EA76

PRINCIPLE OF OPERATION

Receive: RF signals are tuned by the RF control and amplified by V1 and fed to the 1st mixer V2. The first local oscillator V31, operates at 6MHz above the signal frequency and is tuned by the CHANNEL tuning control. There is one IF amp V9 at 6MHz — then the signal goes to the 2nd mixer V13a with a crystal oscillator V13b at 8.4 MHz. This is followed by two IF stages at 2.4 MHz V14 and V15 and then into two limiters V16 and V17 which drive the narrow discriminator containing diodes V18 and V19. AF is fed through two AF amps V20 and V21. Noise from the discriminator is amplified in V22, rectified by V23, and used to switch the squelch relay via V24.

Transmit: The master oscillator V6 feeds V7 a driver and thence to the power amp V8 which can be tuned over the frequency range. The Master Oscillator V6 is modulated by the reactor driver V5. V32 maintains voltage to V5 constant to prevent frequency variation. Automatic Frequency Control, AFC, is derived from the limiter V10 and wideband discriminator with diodes V11 and V12.

AF from the microphone goes through two amp stages V27 and V30. Automatic Modulation Control AMC is provided by V28 and V29 to maintain the AF output constant. This AF plus a DC voltage from the AFC circuit frequency modulates V5 but limits deviation to ± 15 kHz.

There is a fan to circulate air and prevent hot spots in the set.

Intercom: This comprises two AF amp stages V25 and V26 switched via the harness to provide talk/listen capability within the vehicle.

Calibrator: Oscillator/harmonic generator V3 with a 100 kHz crystal is switched in at the CHANNEL ADJ position. In the CURSOR ADJ position V4 with a 1 MHz crystal is operative.

Power Supply: The PSU which is common to both the C42 and C45 is a separate unit that connects to the set via a short harness. It provides the necessary voltages and switching for the set and intercom and has overload protection.

Voltages required in the set are:
 HT1 — + 175 VDC at about 150 mA for low power output
 HT2 — + 350 VDC at about 140 mA for high power output
 Filaments — 6.3 VAC at about 1.7 amps — receiver
 Filaments — 6.3 VAC at about 1.0 amps — transmitter

SPECIFICATIONS

Power Requirements:
 24V DC at 8 amps Tx, 3.7 amps Rx

Frequency coverage:
 C42 — 1 band 36 to 60 MHz
 C45 — 1 band 23 to 38 MHz

Mode of Operation:
 Transmission and reception of FM

Transmitter:
 power output —
 low — 0.3-1.0 watts
 high — 15 watts approx.

Deviation — Maximum ± 15 kHz

Microphone — 600 ohms

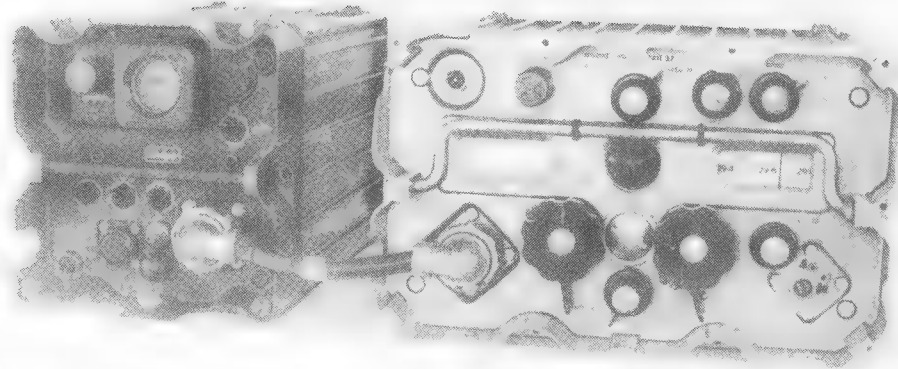
Receiver:
 sensitivity — 1.25 microvolts for 10 dB quieting
 Antenna — 75 ohm via co-axial plug

IF Frequency —
 1st IF — 6 MHz
 2nd IF — 2.4 MHz

Dial Calibration — 100 kHz per division
 AF Output — 150 MW into 50 ohms

Weight —
 Approx 20 kg
 plus Approx 16 kg for PSU

Intercom Amp:
 Output — 250 MW into 30 ohm



Filaments — 12 VAC at about 0.6 amps — transmit PA
 Filaments — 6.3 VAC at about 0.5 amps — intercom
 Filaments — 6.3 VAC balanced to earth 0.8 A — AMC unit
 Fan & Relays — + 24 VDC at about 0.4 amps
 Lamps — 12 VAC at about 0.2 amps
 Diode heaters — + 12.5 VDC at about 0.1 amps

FRONT PANEL POWER INTER-CONNECTION PLUG PL1

The pin connections are:
 A — + 350 VDC HT2 high power
 B — + 175 VDC HT1 low power
 C — Voltage control Relay — connect to earth if less than 30V
 D — + 24 VDC — fan and relays
 E — Push to talk PTT line
 F — 6.3 VAC — receiver filaments
 G — + 24 VDC switched (used with homing loop — not described)
 H — earth
 J — + 12.5 VDC — wide discriminator diode heaters
 K — No connection
 L — 6.3 VAC — receiver filaments (common to F)
 M — 12 VAC — transmitter PA filaments

N — earth — common to H
 O — No connection
 P — No connection
 Q — 6.3 VAC — receiver filaments (common to F)
 R — 12 VAC — lamps
 S — earth common to H
 T — No connection
 U — No connection
 V — 6.3 VAC — receiver filaments (common to F)
 W — 6.3 VAC — intercom filaments
 X — 6.3 VAC — AMC filaments
 Y — 6.3 VAC — AMC filaments
 Z — 6.3 VAC — Transmitter filaments

FRONT PANEL CONTROL INTER-CONNECTION SOCKET SK2

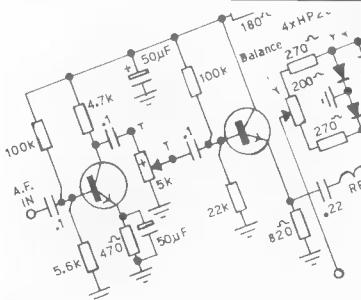
A — Tx microphone input
 B — Intercom and Tx microphone (shield)
 C — Intercom microphone input
 D — PTT switch line
 E — Automatic re-broadcast (not described)
 F — + 24 VDC output (part of homing loop circuit — not described)
 G — intercom and receiver speaker output (shield)
 H — limiter grid current (for an S-meter)
 J — intercom speaker output

K — Voltage Control relay line — connected to PL1 pin C.
 L — + 175 VDC output for rebroadcast
 M — receiver speaker output

MODIFICATIONS

- (1) To operate the set make the following connections:
 Microphone to pins A and B (shield)
 PTT switch to pin D
 PTT return to earth
 S-meter to pin H
 S-meter return to earth
 Speaker to pins G and M
- (2) The PSU provides a suitable box for a 240V power supply. Although there are a number of outputs shown they can be obtained from a fairly common although large valve type transformer with a 350V secondary plus 12V and 6.3V. The 24V for the relays may have to come from a separate transformer.
- (3) There is a little more space on and behind the front panel so sockets for mic, speaker and S-meter can be fitted to the panel. This leaves the space at SK2 socket for fitting an audio volume control. A 1 meg-ohm pot is wired with shielded wire to replace RV1 on the AF sub-unit.
 Para 3A To connect the centre zero tuning meter in line for Rx and Tx connect contact 4 to contacts 1 and 2 on switch bank SWAf (the calibration switch). If your transmit frequency does not match the receive frequency adjust trimmer capacitor C49.
- (4) The C42 is very suitable as it is for the 6 metre band and has been used recently in two cases I know of for contacts with Japan. The C45 can be used on 10m FM provided you narrow the deviation to ± 3 kHz by adjusting RV3 on the AMC unit. Ideally this should be done using a deviation meter but can be achieved by listening to a voice signal from the C45 on a SSB receiver and adjusting RV3 to a point just prior to the signal distorting. The IFs can be adjusted to narrow the response band.
- (5) It should be possible to obtain the 100 kHz transmit shift to suit the FM repeaters by switching capacitance across L10 in the circuit of V6 the Master Oscillator. You may also have to add capacitance across the tuned circuits of L12 and L15 in the V8 circuit. Perhaps varicaps would be the best method of obtaining these capacitances.

AR

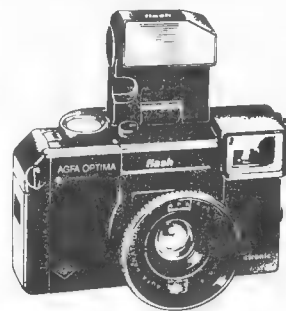


CIRCUITS

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Remember Photo Competition



The AGFA Competition begins this month. Check May AR, page 6, for details.



HELP PREVENT PIRATES

Keep bands for licensed amateurs.

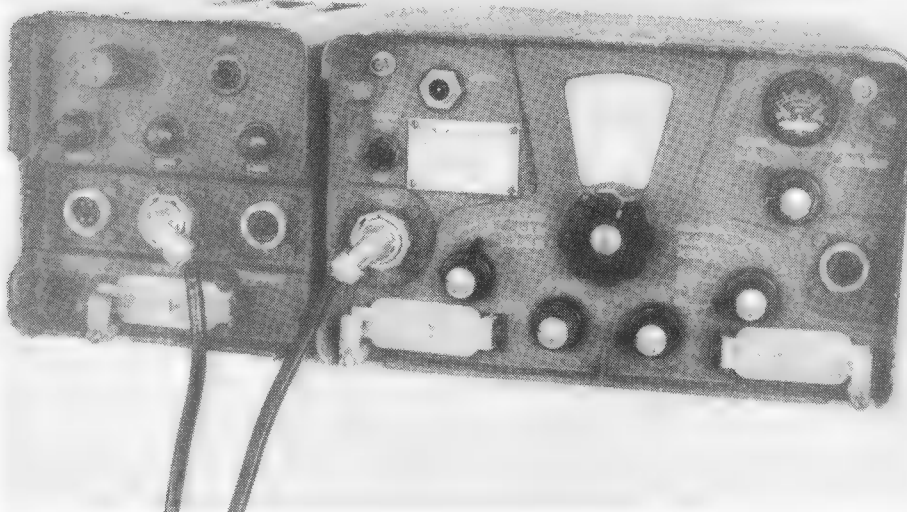
DO NOT sell transmitting equipment to unlicensed operators.

MODERN MILITARY SURPLUS EQUIPMENT

Colin MacKinnon VK2DYM
PO Box 21, Pennant Hills NSW 2120

WIRELESS SENDER — THE C11

The C11 is a transmitter for CW, AM and FSK covering 2-16 MHz. It was used mobile in some AFV's and in command wireless vehicles. The associated receiver is the R210. The power supply was the Supply Unit Transformer Rotary 24V and it had a very nice aerial tuner ATU No 7.



SPECIFICATIONS

Power Requirements:
24V at 20 amps Tx, 3 amps standby.
Frequency coverage:
Band 1 2 to 4 MHz
Band 2 4 to 8 MHz
Band 3 8 to 16 MHz

Mode of Operation:
Transmission of CW, AM and FSK with an adaptor
Power output:
Low — 3 to 10 watts
High — 12 to 50 watts dependent on frequency in use.
Microphone: 600 ohms
Antenna: 75 ohms

Dial Calibration:
Band 1 and 2-2.5 kHz/division
Band 3-5 kHz/division
Weight: C11 31 Kg.
PSU 20 kg.
ATU 9 kg.
Total: 60 kg

Intercom amp:
output — 250 MW into 30 ohms.

PRINCIPLE OF OPERATION

The master oscillator V1 covers a frequency from 2 MHz to 4 MHz. The oscillator unit is housed in a sealed, substantial diecast case. The output is buffered in V2 and fed to the band switch. On band 1 V3 is bypassed but on band 2 V3 a doubler is brought into circuit and V4 is an amplifier. On band 3, V4 becomes a doubler also. V5 & V6 are final amplifiers in parallel.

V11 is a microphone amplifier feeding an AF amp V10 thence to the push pull modulator V8 and V9. Modulation is applied to the screens of V4, V5 and V6 and also to the anodes of V5 and V6. V7 is a detector for Automatic Modulation Control AMC which is fed back to V11 to maintain modulation level constant.

V13 is a sidetone oscillator for CW and amplified by V10.

V14 is a voltage stabiliser for V1 and is housed in the same enclosure.

For calibration a 100 kHz signal from oscillator V12B is mixed in V12A with the master oscillator output from buffer V2. The resultant beat signal is amplified in the AF amp stages.

The intercom AF amp V15 and V16 is powered by voltage from the R210 receiver.

VALVE .LINE UP:

Serial No.	Type	Function	Equivalent
V1	CV4010, CV850	Master oscillator	6AK5, EF95
V2	CV4039, CV2129	Buffer	5763, QV03-12
V3	CV4039, CV2129	Amp/doubler	5763, QV03-12
V4	CV4039, CV2129	Amp/doubler	5763, QV03-12
V5	CV2347	Power amp	
V6	CV2347	Power amp	
V7	CV4007, CV283	AMC Detector	6AL5
V8	CV2347	Modulator	
V9	CV2347	Modulator	
V10	CV4003, CV491	AF amp	12AU7, ECC82
V11	CV4015, CV131	Mic amp	6065, EF92
V12	CV4003, CV491	Mixer/osc.	12AU7, ECC82
V13	CV4010, CV850	CW sidetone Oscillator	6AK5, EF95
V14	CV287	Voltage stabiliser	150B3
V15	CV4010, CV850	Intercom amp.	6AK5, EF95
V16	CV4010, CV850	Intercom amp.	6AK5, EF95
Power Supply Unit			
V101	CV395	Voltage Stabiliser	QS150/45
V102	CV395	Voltage Stabiliser	QS150/45

ANTENNA TUNING UNIT NO 7

This unit matches the 75 ohm transmitter output to various short antennae over the frequency range. It has a variable capacitor controlled by a Match knob and a roller inductor tuned via a Tune control with a digital counter to indicate position. An aerial current metre assists the tuning process. The output connection is a large insulated single wire terminal.

The aerial base used with a rod aerial is specified as a Base No 31. The base for the VHF units is a No 28.

POWER SUPPLY UNIT

The PSU connects to the C11 via a harness and a 12 pin socket. It also has a 12 pin socket for a harness to the R210. The power plug is 4 pin and the power lead has two wires in parallel for +ve and -ve to carry the current. A rotary transformer converts 24V to $\pm 530V$ and a stabilised +300V via dropping resistors and stabilisers V101 and V102.

Voltages required by the C11 are:

HT1 — +300 VDC

HT2 — +530 VDC at about 500 mA.

HT2 — -530 VDC — ie isolated from chassis earth.

Filaments- +19 VDC

Fan & Relays +24 VDC

FRONT PANEL CONTROL INTERCONNECTION SOCKET SKtB

- A — Tx mike input
- B — intercom and Tx microphone shield
- C — intercom microphone input
- D — PTT line
- E — no connection
- F — +24 VDC output via PLA-K
- G — intercom and speaker output
- H — no connection
- J — intercom speaker output
- K — no connection
- L — no connection
- M — speaker output.

MODIFICATIONS

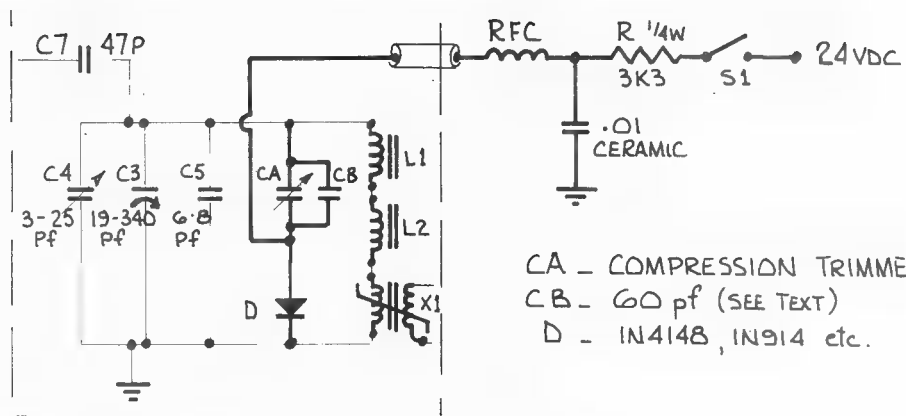
- 1) To operate the set make the following connections:-

Microphone to pins A and B Shield to B.
 PTT switch to pin D
 PTT return to earth
 Speaker to pins G and M
 Receiver to REC AE receiver aerial BNC socket

Note that during operation the vents on the front and rear of both the C11 and PSU must be opened to allow air circulation.

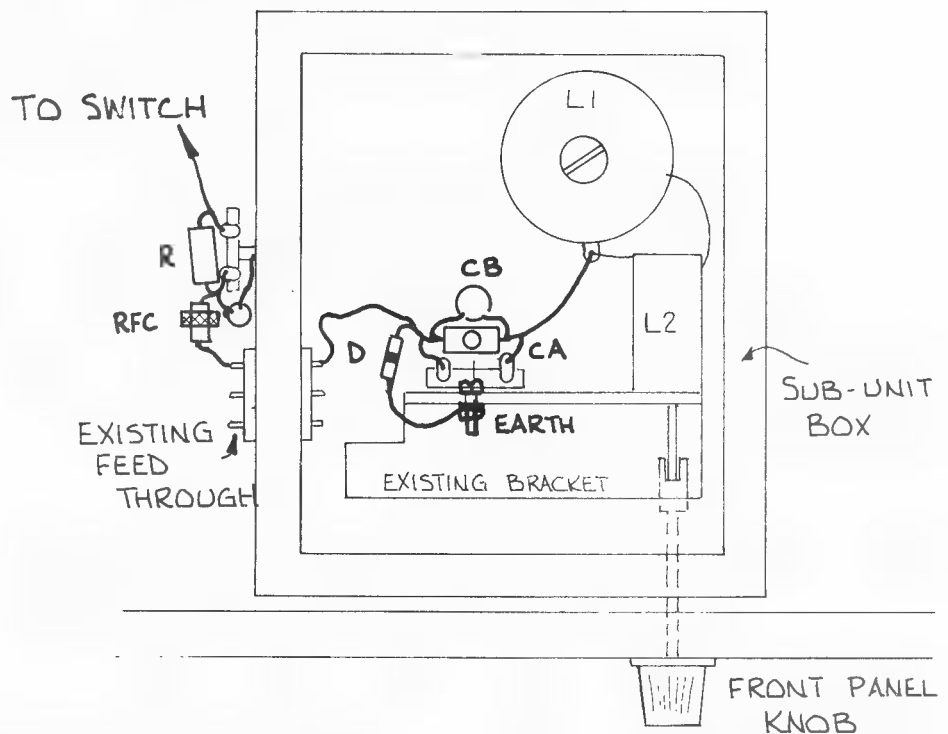
When the C11 control switch is set to CW the PTT line can be keyed and operates semi-break-in.

- 2) The C11 can be operated directly into a dipole using 75 ohm co-ax. For other impedances the ATU No 7 can be used. The large insulator on the rear can be replaced with an SO239 on a metal plate fitted in place of the insulator.



CA — COMPRESSION TRIMMER
 CB — 60 pF (SEE TEXT)
 D — 1N4148, 1N914 etc.

Oscillator Sub-Unit



Layout

160 METRE MODIFICATION

The C11 can be modified to operate on the 1.80-1.86 band by switching in added capacitance across C3, the tuning capacitor in the oscillator sub-unit.

The bottom cover was removed from the oscillator sub-unit to reveal coil L1, and L2 which is adjustable from the front panel for calibration.

The bracket supporting L2 was drilled to mount a small 2 lug tag strip onto which was mounted the compression trimmer and 60 pF capacitor with the diode going from one end to an earth lug. A wire was soldered from the other side of C(A) to the top of L1 (actually the farthest end of L1 looking from the top). Another wire was connected from the junction of the diode and C(A) to an existing unused terminal feed-through on the sub-unit.

Use heavy, rigid connecting wire and ensure the added parts are supported rigidly to prevent vibration and frequency variations.

A second 2 lug tag strip was fitted on an existing bolt on the feed through block on the outside of the sub-unit and the RFC, R, and bypass capacitor mounted there-on.

I found a space on the front panel just to the left of the metre and big enough for a miniature SPST switch. There is a convenient 24V terminal available near the right hand side of the meter.

I used a frequency counter as an aid to calibration but other means of determining the frequency should be satisfactory.

The calibration procedure followed was to set the tuning dial on 2.000 MHz, the front calibration central (L2) at mid travel and the new switch off.

Run the transmitter for at least half an hour to allow temperatures to stabilise.



Bill Blitheringwit

Ted Holmes, VK3DEH
20 Edmond Street, Parkdale, Vic 3195

BILL PREPARES TO GO MOBILE

After the fiasco involving the wrecking of his TV antenna, Bill Blitheringwit was banned from any further radio activities in the house. Bill was not unduly concerned. It had happened before. His wife usually relented in the end, being unable to stand the sight of Bill's woebegone expression as he moped around the place. Bill's face was already adopting the pitiful spaniel look, in preparation for his campaign to resume his normal trail of destruction. It generally worked, but, meantime, he had decided to go mobile.

Bill's somewhat battered Holden station wagon was standing in the driveway, all doors open, and Bill was about to drill a hole in the centre of the roof. He stood on a small cane bottomed chair, purloined from the lounge room, and, as soon as his full weight was deployed upon the fragile cane seat, the cane broke and Bill fell through it. He stood there, wearing the chair like a skirt around his hips, staring with dismay at the power drill he was holding. For in his sudden descent, the drill bit had struck the gutter of the Holden and snapped off. All he had left was a jagged stump.

This was awkward! It would take him hours to find another bit. Never mind. He wrenched himself out of the ruins of the lounge room chair and plunged into the morass of the garage. An hour or so later he discovered another bit — albeit somewhat rusty — but it would do. This one was larger than the first, but it seemed OK. At any rate, it was when he had last used it in 1938.

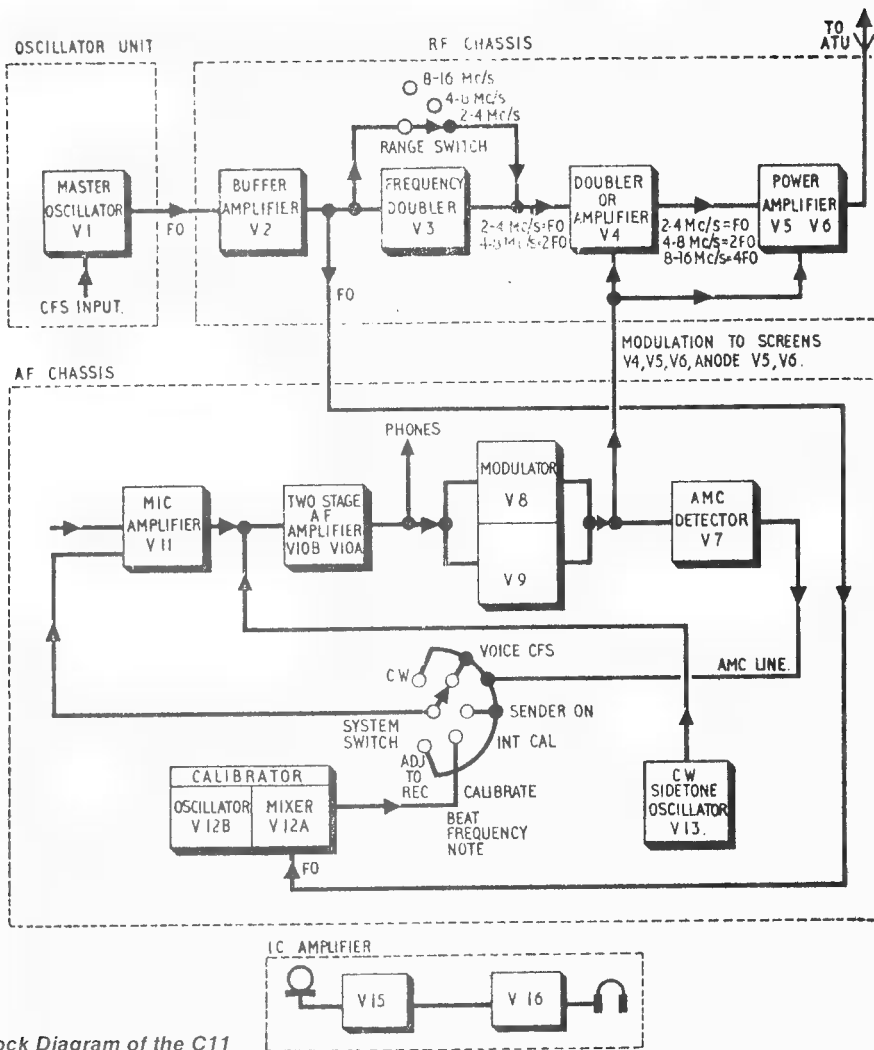
He stood on the car bonnet and aimed the drill in roughly the centre of the roof. Owing to the size of the bit and the fact that Bill had not made a starter hole, the thing skidded a few times before finally biting. This resulted in numerous scratches appearing in the already saddened paintwork, but, in the end, Bill had made a decent sized hole.

His satisfaction was rather diminished when he looked inside the car and discovered that the drill had effectively destroyed the inside roof light. His spirits sank lower still when he looked at the car bonnet, whereon two large dents, size 9, were clearly evident.

True to type, Bill pressed on regardless and finally got his long suffering 22S installed beneath the dashboard. He hooked up the RG58U coax and slammed the car door, thereby neatly severing the coax, which had not been properly guided into the driving compartment.

He sighed and sat down to think about it. What with one thing and another, it just wasn't his day!

AR



Block Diagram of the C11

With the transmitter keyed at low power into a dummy load the frequency was adjusted to exactly 2.000 MHz by adjusting the position of the ferrite slug in L1.

The new switch was then operated and the trimmer C(A) adjusted till the transmit frequency was now exactly 1.800 MHz.

I found some interaction between the adjustments so you may have to go through the procedure a couple of times to get a close calibration. During normal operation the calibration control and internal crystal calibrator can be used for exact frequency setting.

I also found that a 60 pF N750 capacitor for C(B) was best for my set after trying various others. One problem is to get the frequency / temperature variations reasonably correct. At one stage I had the normal 2.00 MHz increasing in frequency with temperature and the 1.8 MHz decreasing.

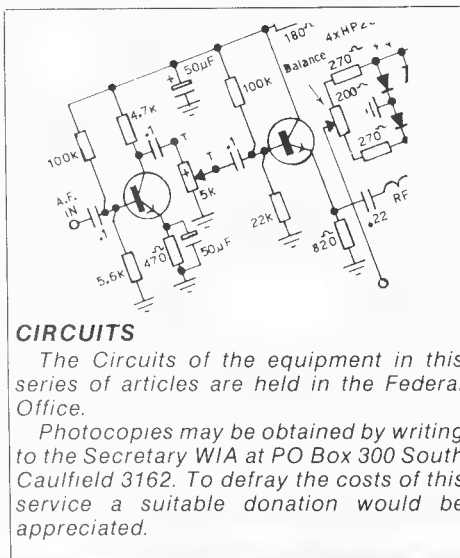
As I was not concerned about operating on the 3.5-3.70 MHz band I didn't try to adjust for correct frequency tracking or power output but did adjust L8 and L12 for maximum output at 1.80 MHz and C28 and C49 for maximum at 1.86 MHz. These adjustments interact so need to be done a couple of times.

Although I had no problem bringing the oscillator sub-unit down to 1.800 MHz it did tend to drop out of oscillation just below 1.8 MHz.

Depending on the gain and feedback of individual sets, some modification may be needed to ensure reliable oscillation at the 1.80 MHz frequency.

ACKNOWLEDGEMENT. These articles could not have been written without the help of Ian VK2ZIO, Ross VK2ZUY, and Tony VK2DKY, who know this equipment far better than I. I just put pen to paper! I must also thank Abe, our friendly disposals proprietor, who let us climb on his mountains of electronic gear, looking for parts.

AR



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