The Pye SSB130

Colin Guy G4DDI

First introduced around 1970, the Pye SSB130 is an all-solid state except for the transmitter final (2x 6883B) ssb/cw transceiver providing 100W pep output on any one of up to six preset frequencies between 2 and 15MHz. The general design bears a remarkable resemblance to the Westminster pmr radios of the period, and indeed uses the same audio pcb as these sets. Not a military or marine design, rather a general purpose pmr set, it had no UK land mobile market as far as I am aware, most units going for export. It is said that they were individually assembled to order, though the individual pcb's are obviously mass produced, so no two are exactly the same. They do, however turn up from time to time in junk sales, and I got one for all of £5, including the pa valves but with no power supply. More recently I have seen them go for much higher prices on Ebay so maybe their usefulness is now being recognised.

Being crystal controlled they are not very attractive for amateur use, though brief details for making one into a single amateur band rig using a commercial VFO kit are given in Chris Lorek's PMR Conversion Handbook. So the unit sat in the shed until the amateur 5MHz fixed frequencies became available, and, not having a convertible 'black box', my thoughts turned to using the SSB130 for this. I obtained a manual from Martin Swift and it is from this that the following description was gleaned.

General

The transmitter and receiver are incorporated into one unit and consist of a number of printed circuit modules, interconnected by a fixed wiring loom. Power may be obtained from a separate AC power unit, or for mobile use a 12 volt or 24 volt power unit may be fitted into a compartment in the rear of the casing. Channel and mode selection is mostly carried out by a system of diode switching, USB, LSB and CW modes being provided. For compatibility with AM services provision is made to reinsert the carrier to give pseudo-AM on transmit, but there is no separate AM receive provision.
A carrier squelch system is incorporated to enable silent monitoring and a fine tune control provides around +/-100Hz frequency adjustment in receive only. A facilities socket on the rear provides for remote control of the transceiver, and of a remote ATU if needed. The frequency coverage is split into three sub-bands, 2-4MHz (low), 4-8MHz (mid) and 8-15MHz (high) and an intermediate frequency of 1.4 MHz is used. Any position of the six channel switch can be hard-wired into any of these bands provided the appropriate tuned circuit boards are fitted. Each tuned circuit board carries a pair of tuned circuits which may be in any combination of low, mid, or high band. Up to three boards may be fitted to give up to six channels. The part number on the board indicates its frequency coverage, see Table 1. The 5 pin type B DIN microphone socket is wired the same as the Westminster, see table 2. There are six separate aerial sockets on the rear panel, one for each channel. If a single aerial is going to be used, there can be simply strapped in parallel across the back of the sockets, and any one used.

Circuit Summary (Fig.1)

Transmit

When the press-to-talk button on the microphone is operated or, when c.w. operation is employed, the Tx/Rx switch on the front panel is set to TX, contacts of the aerial changeover relay connect the aerial to the output of the Power Amplifier and also apply an appropriate switching potential to the gating diodes in those units which are used in both transmit and receive modes.
An audio signal from the mic. amp. and facility board is applied to the balanced modulator where the audio signal is mixed with the output of a 1.4 MHz oscillator. The output of the balanced modulator, consisting of upper and lower sideband signals with the 1.4 MHz component suppressed by approximately 40db, is taken to the sideband filter board which affords further attenuation of the 1.4 MHz carrier component and 50db rejection of the unwanted sideband. The selected sideband is passed, together with an output

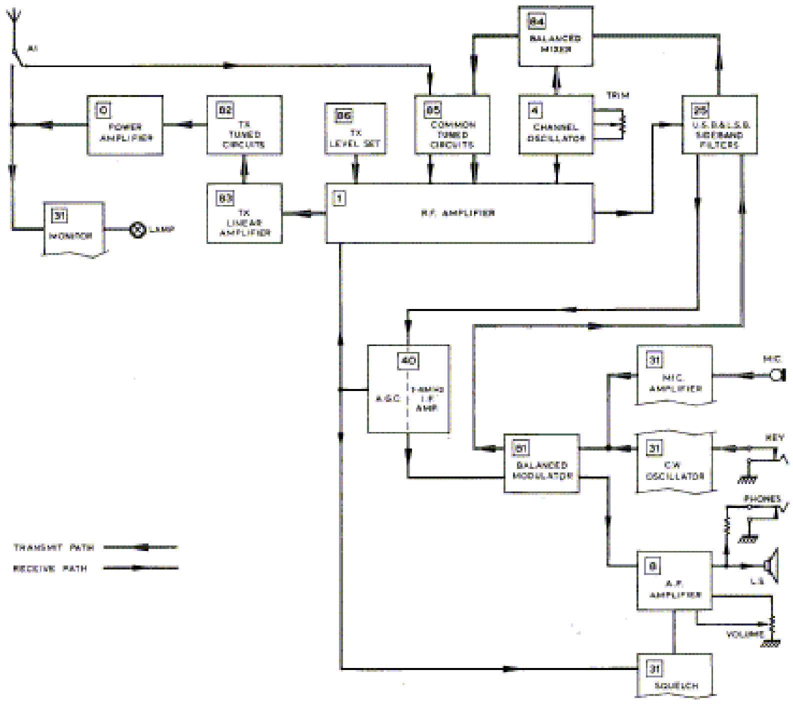


Fig.1. SSB130 transceiver block diagram

from the channel oscillator, to the balanced mixer the output of which consists of sum and difference frequency signals. The difference frequency signal is selected by the common tuned circuit and applied to the RF amplifier. The gain of this amplifier is controlled from the transmitter level set unit to provide an output at a level suitable for application to the

transmitter linear amplifier which provides a 500mW r.f. input to the transmitter tuned circuit. The RF signal from this tuned circuit is applied to the power amplifier at approximately 100V peak to peak.
Two 6883 power tetrodes in parallel, operating in Class AB, provide power amplification and supply 100W pep at the aerial socket. A power monitor circuit provides visual indication of an output from the p .a. stage.
The 6883 valves are equivalent to the more common 6146, but have a 12 volt heater. In the SSB130 the 6883 is used so that the heaters can be used in parallel for 12 volt DC operation, and in series for 24 volt operation. They can be substituted for 6146's if necessary and the heaters used in series for 12 volts, or in parallel on 6.3 volts from a homebrew psu as described below.

Range	Transmitter tuned Circuit	Common tuned Circuit
Low+Low	AT27111/01	AT27112/01
Mid+Mid	AT27111/02	AT27112/02
Low+Mid	AT27111/03	AT27112/03
Mid+High	AT27111/04	AT27112/04
High+High	AT27111/06	AT27112/06

Table 1 – Part Numbers to aid identification of Transmitter and Common Tuned circuit boards

Receive

In the receive condition, contacts of the aerial changeover relay connect the aerial to the RF amplifier and apply switching potentials of appropriate polarity to the gating diodes in those units which are used in both transmit and receive modes. The received signal is passed from the aerial to the tuned RF amplifier where it is amplified and mixed with a signal from the cannel oscillator. The difference frequency, centred on 1.4 MHz, is selected by a bandpass filter and applied via the sideband filter board to the IF amplifier. An agc circuit ensures that the I F amplifier output is held at a constant level, the amplified IF signal being demodulated by heterodyning it with the output of a 1.4 MHz crystal oscillator on the balanced modulator board. The resulting audio signal is fed to the Receiver AF unit where, provided that the incoming r .f. signal exceeds the squelch level, an audio amplifier provides an output of up to 2.5W to the loudspeaker. The squelch circuit mutes the output of the AF unit under 'no signal' conditions or when the transceiver is operating in the transmit mode.

Power Requirements

All of the 'solid state' electronics runs from a 12 volt supply which only needs to be roughly stabilised if derived from the mains; the more critical circuits run from an internally stabilised 10 volt rail. In addition, the following supplies are required: +200V for the PA screen, +700V for the PA anode and –100V for the PA bias and relay switching. The 12V DC supply is isolated from the chassis to allow for negative or positive earth mobile operation. A separate 12VAC supply is used for the valve heaters when on an AC supply. All voltages, and the connections to the off-on-standby switch are made via an 18 pin Jones connector, which, fortunately if you haven't got a psu, is the same type used for the bootmount Cambridge, and therefore should be easy to obtain. Connection details are given in Table 2.

Getting it going.

The HC25u crystals are mounted in a six channel oven unit. You will need to order a crystal for each channel, the frequency is simply f_c + 1.4MHz, see Table 3 . If ordering from Quartslab you just need to specify the frequency and the equipment type. There is no need to use the oven for normal use: oven spec crystals are 50% dearer!

If some crystals are already fitted when you get your set, make a note of their frequencies and position in the oven, Fig 4, you will then know then which channels are in which band. Ensure that the 'local-remote' switch on the rear panel is in the 'local' position and apply a 12 volt supply to pin 5 (+) and 4(-) of the power connector. If you are lucky the set will immediately burst into life and be receiving on all channels that are fitted with crystals. If not it would be a good idea to find out why and rectify the problem at this stage. If you have one of the correct power supplies you can also test the transmitter into a dummy load at this stage, if not, apply a supply of 100 volts, negative to pin 3, positive to chassis to allow the relay to operate. You can then check that approximately 35 volts peak is present on the PA grids (pin 5 of either valveholder) at the signal frequency on CW or when whistling into the mic. on ssb.

1	+700V PA HT
2	+200V screen
3	-100V bias and relay
4	12 V DC supply neg
5	+12V DC
6	xtal oven supply
7	power switch
8	power switch
9	standby switch
10	Heaters top (chassis in homebrew psu)
11	standby switch
12	Heater CT (6.3 volts in homebrew psu)
13	chassis
14	join to 15 - ptt
15	join to 14 - ptt
16	not used
17	not used
18	chassis

Table 2 – Power connections

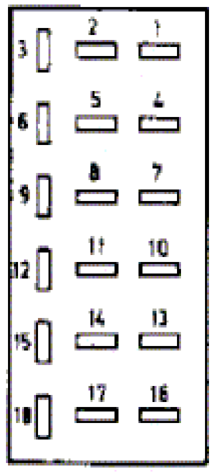


Fig. 2. Power connector pin layout, viewed from solder tags

The 5MHz band

The five frequencies in the Amateur 5MHz allocation are close enough for one mid band tuned circuit board to be used for all five, but if you have two mid band boards, one could be used for the lower three frequencies and the other for the upper two. This is in fact what I did. For the transmitter tuned circuit, it is simply necessary to disconnect the switch poles from the unwanted tuned circuits and parallel them to the wanted one.
The mod for the common tuned circuit is a little more difficult though, as there is an additional wafer which shorts the diode switching supply pin on the unused tuned circuits to earth. If the wanted one were paralleled to all of the switch contacts as for the transmitter tuned circuit it would be earthed by the shorting wafer. The solution is simply to add a diode in series with each terminal of SB1F, anode to the switch terminal. A diode will be needed for each channel. Hopefully, Fig.3, which shows the arrangement with one midband tuned circuit used for the lower three channels and one for the upper two will make this clearer.

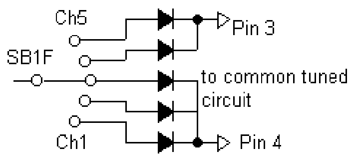


Fig.3. Diode connections needed to use one common tuned board for five channels

Alignment

Once you have figured out the above, alignment is relatively straightforward. Apply a signal generator tuned to the signal frequency to the aerial socket, set initially to 100mV output, and peak the relevant common tuned circuits for maximum output, reducing the signal input as necessary. Peak 1L3 and 1L4 on the RF amplifier and adjust 1RV1 for maximum. These last adjustments should be very close to optimum if the set is already working.

Transmitter

Before applying power, set all of the PA coil taps to a position approximately 14 turns down from the top of the coil, then locate 0R6, which is connected between pin 1 / 4 of each PA valve and earth (cathode connection) and connect a multimeter set to 10 volts fsd between this point and chassis. With all power supplies connected, allow 5 minutes for the valves to heat up. Connect a 50Ω dummy load and power meter to the aerial socket and set all of the ‘transmitter set level’ controls fully clockwise. In USB mode key the transmitter and set the bias control 0RV4 for a reading of 0.8 volts on the multimeter. (Short circuit the microphone or ensure a quiet background whilst doing this.) Set the transmitter to CW, key up and peak the relevant transmitter tuned circuit to obtain a reading of 1.5 volts on the multimeter. Adjust the relevant PA tuning capacitor for a dip in the reading. By this time you should have RF output, peak up the PA tuning and loading for maximum. Repeat for each channel. The transmitter set level control for each channel should then be backed off to ensure that the multimeter reading doesn’t exceed 3 volts in any circumstances.

Frequency Trimming

Each channel can be set onto frequency by adjusting the appropriate crystal frequency trimmer with the mode switch in the AM position using a frequency counter loosely coupled to the PA output, or alternatively on receive by netting to a known signal, with the Trim control set to mid position.

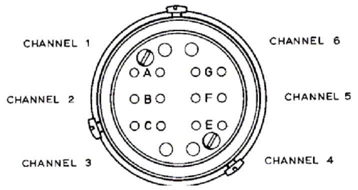


Fig.4. Position of crystals in the oven.

AM and CW

There is no provision for AM reception as such, but provided the AM station is exactly netted it can be received in either upper or lower sideband mode. AM transmission is provided by reinserting carrier. RV1 on the balanced modulator board adjusts the level of carrier insertion in AM mode.

CW is generated by keying an 800Hz oscillator which is located on the mic amp board.

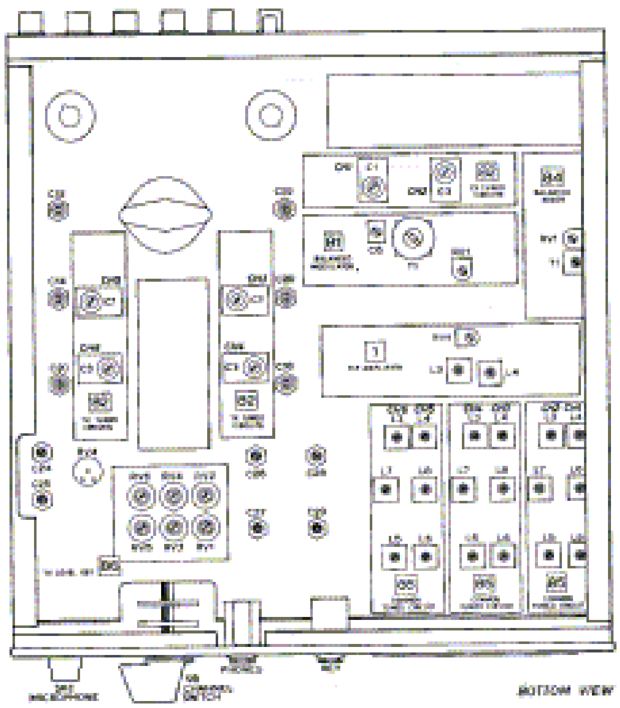
Power Supply

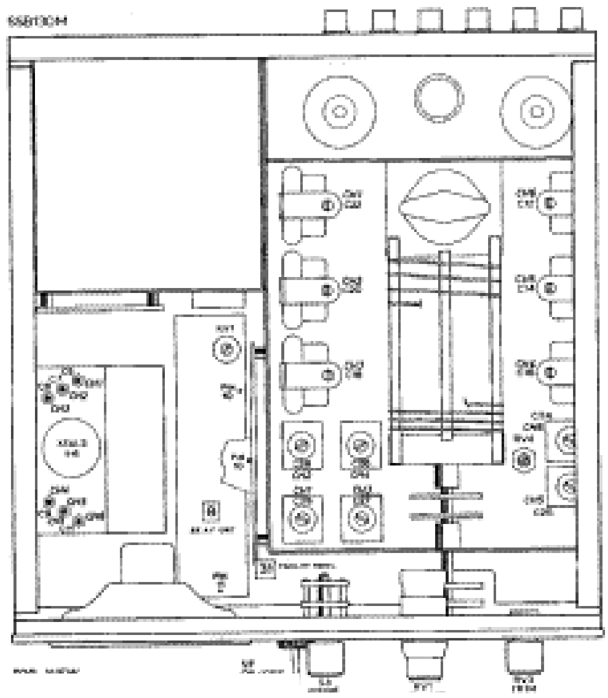
If you are lucky enough to get a power supply with your unit you will not need to read this bit, but if not, or if you only have a DC power unit and want to operate the set from the mains, this is how I went about it. Only brief details are given as it will depend, in true amateur style, on what you have available in the junkbox.

A mains transformer relieved from a Pye F27 AM base station, together with its associated rectifier unit, provides the HT, heater (6.3 volts, use 6146’s in parallel in the PA) and The bias supply is supplied by a fullwave rectifier from the 65 volt winding originally used to provide the 50 volt remote supply in the F27, a separate 12 volt 20VA transformer provides the DC supply via a bridge rectifier and a simple regulator, and a 12 volt 6VA transformer used in reverse, with its “secondary” supplied by the 6.3 volt heater winding of the F27 transformer, and a full wave rectifier provides the 200 volt screen supply from the “primary”. The PA HT with this arrangement is around 570 volts rather than the 700 volts from the original unit, but apart from a slightly reduced output (70w pep) this doesn’t seem to make much difference.

On Air

I have been using this on 5MHz for some months now as those of you who have worked me will know. Audio reports have been good, and the receiver is reasonable, though has a higher background noise level than the PRC320 which I also use, and the agc recovery is a little too fast for my liking. The ability to flick round all five frequencies at the turn of a switch is extremely useful, (OK – if you are clever enough to programme the memories of a modern black box you can do that anyway, but so far such skills have eluded me!) and the squelch is useful for silent monitoring, though it does tend to open at the slightest excuse. All in all a very worthwhile rig to have in the shack. If anyone needs further information, an e-copy of the manual is available from the author.





Above and below chassis layout