The "Phoenix" —a simple five-valve transceiver for the 3·5MHz band

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Introduction

Several reasons prompted the construction of this piece of equipment, among them:

(a) a desire to "do something with valves" after a lot of dabbling with transistors;

(b) a need for an easily-portable station;

(c) a large amount of, apparently, redundant junk in the shack;

(d) hearing many people expressing the desire to have a go at building a transceiver, but being put off by either cost or complexity.

The result was the "Phoenix", so called because it arose from the "ashes" of the junk box. While not containing anything radical or gimmicky, it did meet one of today's most important criteria—cost effectiveness. The cost was zero, and the effectiveness was well worth the effort required. Ninety per cent of the components came from broken-down old television receivers, and the remainder from an aged domestic broadcast receiver.

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The circuit

It was decided to build a set for the 3·5MHz band because (a) design considerations are less critical than at higher frequencies, and (b) the band always has a high level of cw activity.

Several circuits were tried for the front-end of the receiver; the cascode chosen eventually appearing to give the best gain and selectivity coupled with stability. Coil L1 was found to be broad-banded enough to avoid the necessity of a twin-ganged tuning capacitor, thus obviating the associated tracking problems with two tuned circuits. Capacitor C29 in the anode of V1b compensated more than adequately for any fall-off in gain across the passband. D1, D2 and RV2 comprise a simple balanced modulator, injection being provided by V4a via C18. C6, C7 and R16 tailor the audio by clipping the bass and boosting the treble frequencies. V2a/b is a two-stage audio preamplifier driving V3 to around, in the author's case, half-a-watt output.

The transmitting section is simplicity itself. Valve V4a, a parallel-tuned Colpitts, drives V4b acting as an untuned buffer amplifier. Enough drive is available to run V5 to 5W input. Switching was accomplished by using nothing more than an ordinary dpdt toggle switch. Screen keying was used, as keying the cathode pulled the oscillator too much on transmit.

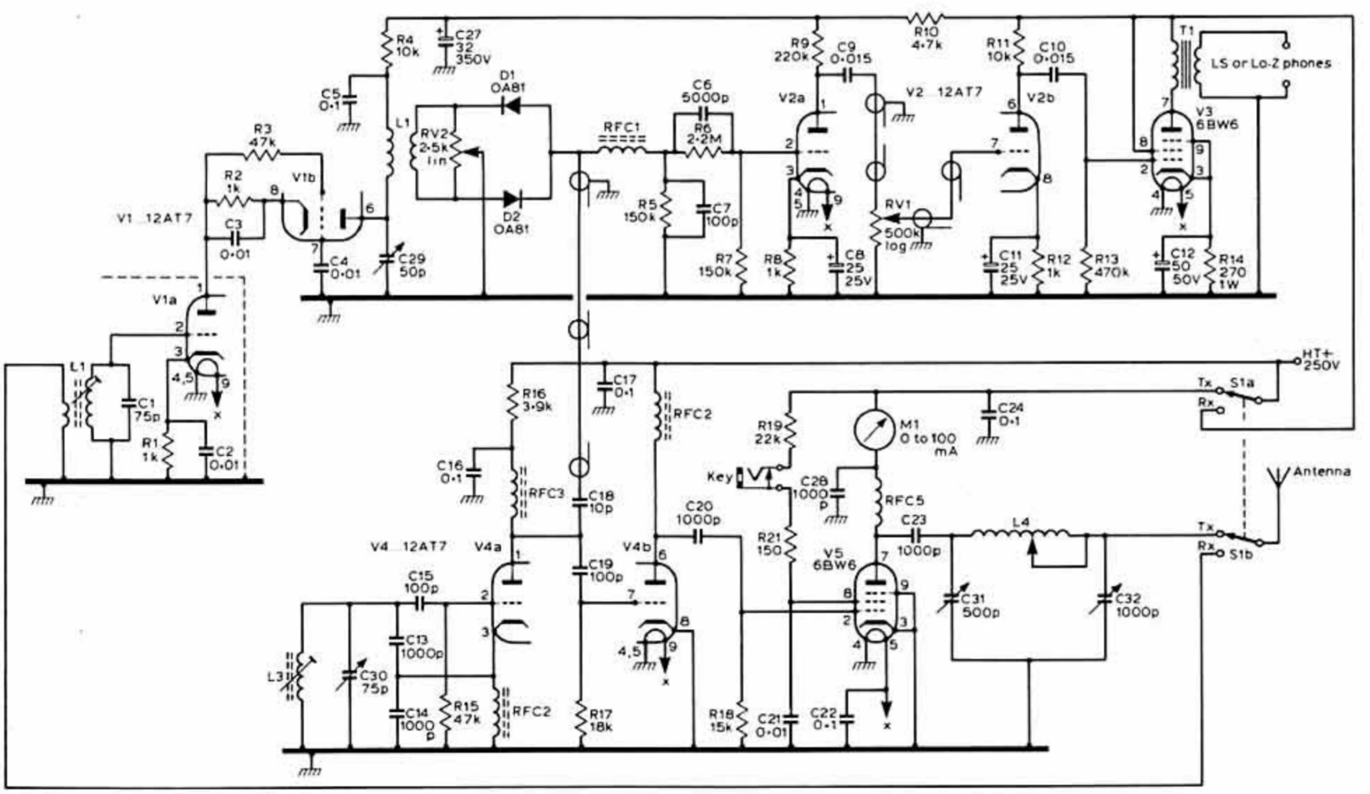


Fig 1. Circuit diagram

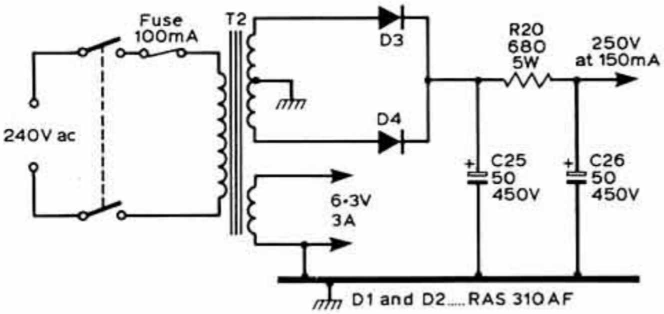
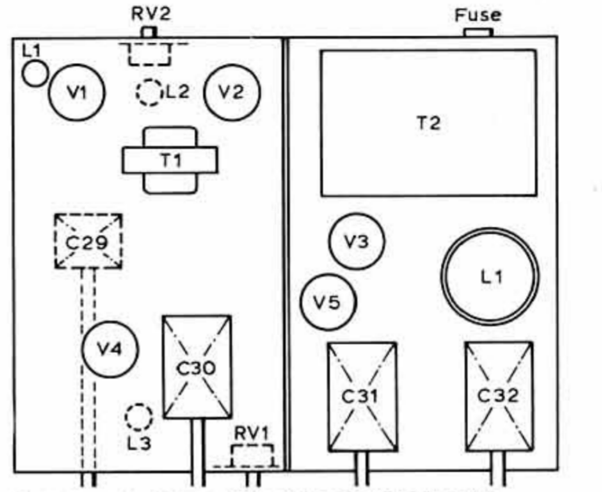


Fig 2. Power supply

Construction and setting up

The unit was constructed on an aluminium chassis (again from the junk box) measuring 10 by 8 by 2½in. The layout, Fig 3, is in no way critical, and can be altered to suit personal taste provided that all rf connections are kept as short and direct as possible.

In setting up, a gdo is useful to pre-align the coils. Check for shorts and circuit errors, switch to receive, set RV2 to mid-travel, connect antenna, and apply mains. With C30 fully meshed, tune L3 to 3·5kHz; a general coverage receiver of known accuracy being the best way to do this. Peak L1 and L2 for maximum signal output at 3·55kHz. If any strong local broadcast signals break through they can be eliminated by RV2. On transmit, set tap on pi-tank to best loading position.



Components shown dotted are mounted on the underside of the chassis

Fig 3. Component layout

Components list

R1, 2	1kΩ	R13	470kΩ
R3, 15	47kΩ	R14	270Ω 1W
R4, 11	10kΩ	R16	3·9kΩ
R5, 7	150kΩ	R17	18kΩ
R6	2·2MΩ	R18	15kΩ
R8, 12	1kΩ	R19	22kΩ
R9	220kΩ	R20	680Ω 5W
R10	4·7kΩ	R21	150Ω
Resistors ¼W unless otherwise stated			
RV1	500kΩ log	RV2	2·5kΩ lin
C1	75pF	C15,19	100pF silvered mica
C2, 3, 4, 21	0·01μF	C18	10pF
C5, 16, 17, 22, 24	0·1μF	C20, 23, 28	1,000pF
C6	5,000pF	C25, 26	50μF 450V wkg
C7	100pF	C27	32μF 350V wkg
C8, 11	25μF 25V wkg	C29	50pF
C9, 10	0·015μF	C30	75pF
C12	50pF 50V wkg	C31	500pF
C13, 14	1,000pF silvered mica	C32	1,000pF (500 + 500 in parallel)
V1a/1b	12AT7	V4a/4b	12AT7
V2a/b	12AT7	V5	6BW6
V3	6BW6		
D1, 2	OA81	D3, 4	RA5 310 AF
T1	3Ω output transformer, primary imp 3,000 – 5,000		
T2	250 – 0 – 250V 150mA 6·3V 3A		
RFC 1, 2, 3, 4	2·5mH on ferrite cores		
RFC 5	2·5mH 100mA rating		
Fuse	100mA cartridge type and holder		

Coil data

L1	50t c/wound 34swg enamelled wire on ⅜in slug tuned former. 5t link on cold end of miniature pvc wire.
L2	60t c/wound 34swg enamelled wire on ½in former. Link 11t c/wound miniature pvc in centre of main coil.
L3	15t c/wound 34swg enamelled wire on ⅜in slug-tuned former.
L4	30t 24swg enamelled wire space wound in 1⅜in dia former tapped at 20 and 25 turns.

Conclusion

Running at 5W dc input, and using a 14MHz dipole with the feeders strapped and fed via an atu, contacts were obtained throughout Europe. On a full-size G5RV antenna it went like a bomb.

This design is a "bare bones" transceiver and offers plenty of scope for improvement for those with the time or inclination. A two- or three-section audio filter would improve selectivity considerably. With suitable adjustment to inductors it could be made usable on the 1·8, 7 or 14MHz bands. Transmitter power could also be stepped up. In these days of the complex high-power ssb black boxes which make transatlantic QSOs routine, it is much more satisfying to do so with one's own equipment on QRP, and good fun too. The author's FTDX560 has been collecting dust for many a month now. □