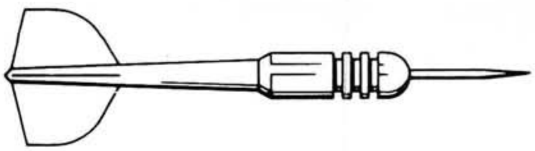
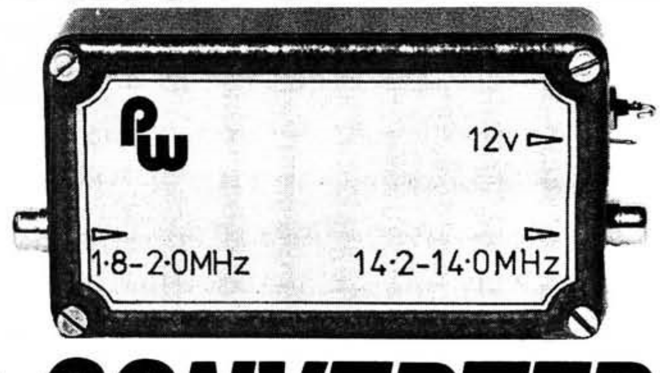


PW DART TOP BAND CONVERTER



by Rev G.C. Dobbs G3RJV & Colin Turner G3VTT

The *PW* Dart d.s.b.s.c./c.w. transmitter described in the November and December 1983 issues provides an ideal way to get onto the 1·81–2·0MHz amateur band at little cost. The circuit is perhaps most appealing to those who do not have facilities for that band. Many recent transceivers have omitted "Top Band" so the *PW* Dart, in conjunction with a suitable receiver, can fill in that gap.

It may be that if Top Band is missing from a station transceiver the station could have no receiving facilities for the band. An obvious way to overcome this problem is to build a receive converter to enable the band to be received on one of the more common amateur bands. What follows in this article is a simple up-converter design which can be bolted onto the back of the *PW* Dart transmitter to enable it to be used in conjunction with a transceiver or receiver which can tune 14MHz, to provide full transceiver facilities for the complete 1·8 to 2·0MHz band. The converter could be built as a small project in its own right to enable Top Band coverage to be added to any station receiver that tunes 14MHz.

Choice of IF

There are a few obvious problems in converting a signal from Top Band to another amateur band. For a start 1·8MHz is uncomfortably near to the medium wave a.m. broadcast band, with a variety of strong stations all waiting to break through on the input. Then there is the problem of breakthrough from existing signals on the amateur band selected as the conversion frequency.

On a dusty back shelf in my shack I have a converter from some years ago built to give me Top Band capability using the 7MHz band as the conversion band. A friendly little unit because if things are quiet on Top Band I can always listen to the local medium wave commercial station or to one of the broadcast stations encroaching into the 7MHz band in the evenings. Plainly a circuit to be avoided!

Another problem is finding a suitable crystal to form the local oscillator (l.o.) frequency for the conversion. Crystals can be etched to order on any suitable frequency but the cost is considerable and rather detracts from the inexpensive approach used in the *PW* Dart transmitter. A prototype was attempted using 27MHz radio control crystals, converting the band up to 29MHz. This works quite well but many receivers can be insensitive at these higher frequencies. The final conversion frequency was decided after noticing an advertisement in the back of *PW* from P. R. Golledge Electronics for "off the shelf" 16MHz fundamental crystals at £3.35 including VAT and postage.

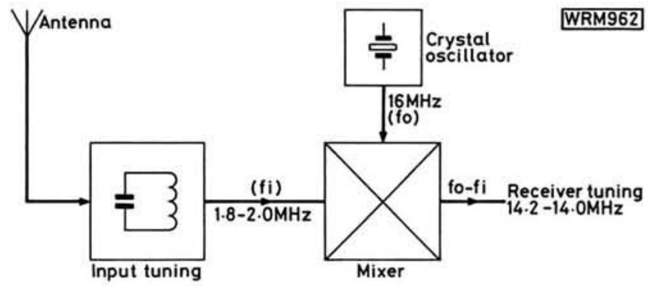


Fig. 1: Block schematic of the *PW* Dart 1·8MHz receive converter

Circuit Design

The approach adopted is shown in block form in Fig. 1. This is the classical simple receive conversion circuit. The required band (1·81 to 2·0MHz in Region 1) is tuned at the input and fed into a mixer stage. A 16MHz crystal provides the frequency for the local oscillator, which is also fed into the mixer. The frequency required at the output is the input frequency (fi) minus the oscillator frequency (fo). This produces the conversion from 1·8 to 2·0MHz as 14·2 to 14·0MHz—reverse tuned on the 14MHz amateur band. The s.s.b. stations on Top Band would normally use the opposite sideband to those on the 14MHz band so the reverse tuning is quite useful in that the sideband switch can be used in its "normal" (u.s.b.) position.

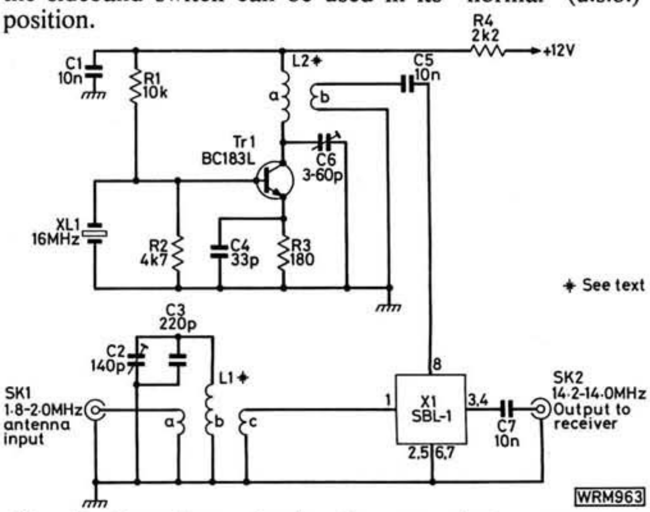


Fig. 2: Complete circuit diagram of the converter which will provide 1·8MHz band coverage when used in conjunction with a 14MHz receiver

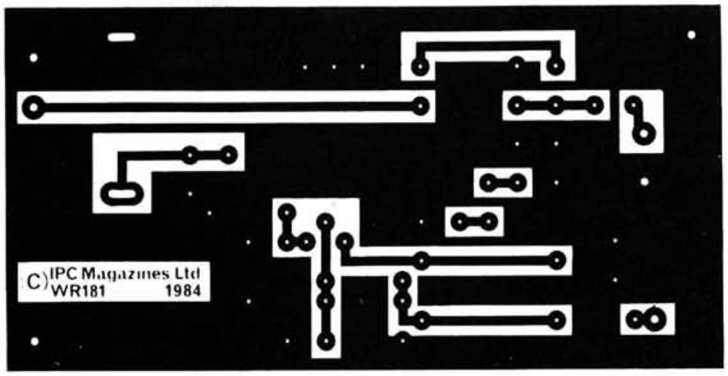
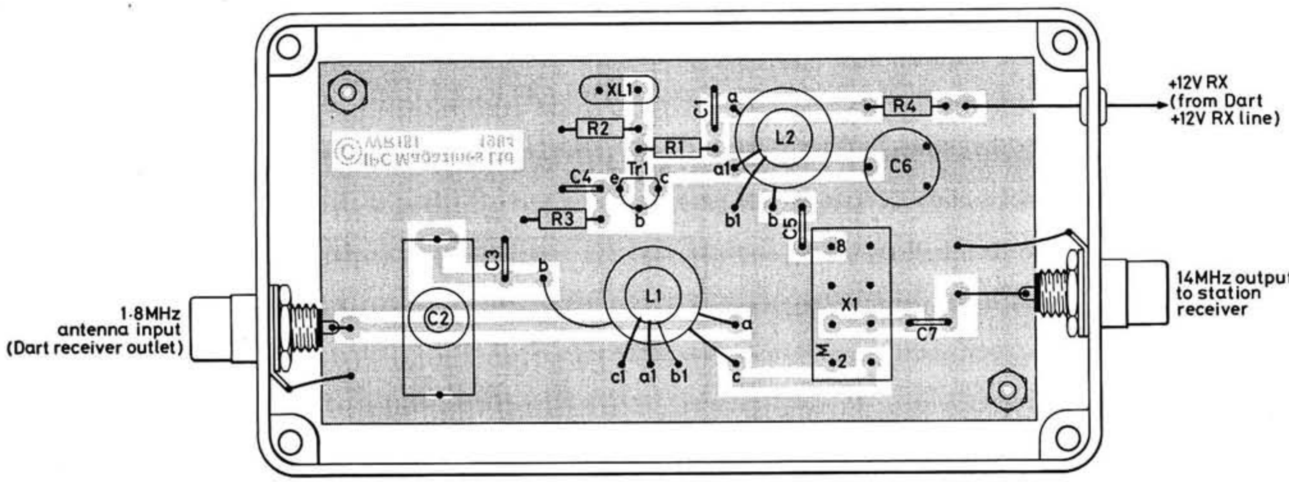


Fig. 3: Full size p.c.b. and component placement details. Pin 2 of the mixer X1 is located beneath the letter M of the part identification



★ components

Resistors
Carbon film ¼W 5%

180Ω	1	R3
2·2kΩ	1	R4
4·7kΩ	1	R2
10kΩ	1	R1

Capacitors
Miniature Plate Ceramic

33pF	1	C4
220pF	1	C3
10nF	1	C5

Miniature Ceramic

10nF	2	C1,C7

Compression Trimmer

140pF	1	C2

Miniature Film Trimmer

3–60pF	1	C6

Semiconductors
Transistors

BC183L	1	Tr1

Miscellaneous
SBL-1, double balanced mixer (1); 16MHz crystal HC18/U; phono sockets (2); feedthrough capacitor (see text); diecast aluminium box 110 × 60 × 30mm (see buying box); p.c.b.; T-50-2 toroid (1); T-50-6 toroid (1)

The full circuit diagram is shown in Fig. 2. Like the *PW* Dart, the circuitry is very simple. The mixing is done using a double balanced mixer type SBL-1. This is not a cheap device but it offers obvious advantages in this simple circuit. Being a high level mixer problems with cross modulation and adjacent channel interference are minimised. So much so that one preset tuned circuit ahead of the mixer was found to be sufficient against the ravages of the evening a.m. stations close to 1·8MHz. The balancing within the device is very "tight" and if adequate screening is used

BUYING GUIDE

Components for this project are readily available. An alternative housing is the Minfford A8 box. The prototype used a 16MHz HC18/U crystal from P.R. Golledge Electronics.

Approximate Cost
£15

Construction Rating
INTERMEDIATE

between the input and output ports and the l.o. the susceptibility to spurious signals is very low. Originally a tuned circuit or filter for the output was considered but in practice this made no difference. The output port is a well matched 50 ohms which can be fed directly, via C7, into the input of a receiver on 14MHz. The SBL-1 is a passive mixer so there is no conversion gain but on Top Band front end gain is of little importance. Who wants to amplify a lot of noise!

The input tuned circuit around L1 was found to be sufficient for the needs of the circuit. A two stage filter was considered, as was an externally adjustable input filter but this simple arrangement works well without problems of adjacent channel breakthrough. Setting C2 to peak signals in the centre of the band serves well for the whole band without need for retrimming. However, the fastidious could make C2 into a variable panel control if they so wish. The winding for L1b, which consists of 63 turns of 32 s.w.g. enamelled copper wire, occupies the whole of the T-50-2 toroid core. Inductors L1a and L1c, both comprising 5 turns of 26 s.w.g., are wound onto the grounded end of L1b. In practice the easiest way to do this is to take two lengths of wire and wind both L1a and L1c side by side onto the core in one action.

The oscillator circuit around Tr1 is very simple and should fire-up first time without problems. A whole range of transistors might be used for Tr1 but the BC183L is as cheap as most commonly available types. Inductor L2a tunes the 16MHz l.o. signal, in conjunction with C6, and L2b provides a low impedance output for the mixer. The two windings are mounted on a T-50-6 toroid, L2a being 16 turns and L2b 3 turns, both of 26 s.w.g. wire. When the oscillator stage is built it is best tested on its own before connection is made through capacitor C5 to the SBL-1.

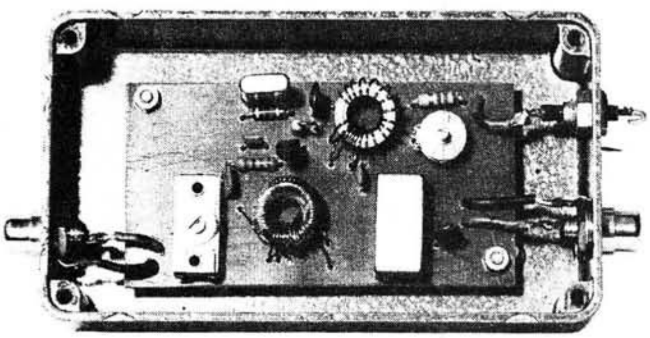


Fig. 4: A photograph of the author's prototype converter

A simple r.f. diode probe may be connected onto the output from L2a and a reading taken on a voltmeter. Passive mixers require quite a bit of drive—over half a volt is advised—so the output from L2a should read in the order of 1 to 1·5 volts (peak r.f.). This will be somewhat less when the output is loaded into the SBL-1. Crystal oscillators are perky little things and capable of much higher outputs than required here. If the output is too high, or under 0·5 volts, adjustment can be made to the value of R4.

A single printed circuit board accommodates the complete converter, as shown in Fig. 3. The board retains a large amount of copper to act as a screen mat which helps the isolation between the ports of the SBL-1. All components are standard types and easy to obtain. The assembled board was mounted into a diecast box measuring 110 × 60 × 30mm. This box happened to be to hand but a much cheaper alternative is the Minffordd A8 Box. Either will bolt directly onto the back of the *PW* Dart transmitter case. The input and output terminations are inexpensive phono sockets and a 1nF leadthrough capacitor takes the 12 volt d.c. supply into the box.

System Connection

The converter is a useful little unit to put ahead of any receiver that lacks Top Band but has 14MHz coverage. If it is to be used with the *PW* Dart, the method of connection is shown in Fig. 3. The Dart changeover board provides for a "receiver" output and a 12 volt d.c. *line on* receive (12VRX). The receiver line already comes out of the back of the case and can be fed into the converter input. The converter output goes to an existing station receiver on 14MHz. A leadthrough added to the back of the Dart case is probably the best way of getting the 12 volt line to the converter. The converter can now be used with the *PW* Dart and a receiver. Antenna changeover functions are provided within the Dart circuitry so once the converter has been peaked up using C2 it is merely left in place on the back of the transmitter case.

Armed with the *PW* Dart transmitter and this converter it is possible to get onto Top Band at little cost and with the added pleasure of making worthwhile contacts with homebuilt equipment. ●

Swap Spot

Have Harrier CBX radio, s.w.r./power meter, Sigma II antenna, halfbreed antennas. Would exchange for linear for Standard C-58 or w.h.y. Jeff Brown. Tel: 01-637 6270 *T574*

Have BSA Bantam D14 motorcycle (non-runner). Would exchange for any 144MHz or 28/29MHz gear, w.h.y. Tel: Basil G6VAN 0642 66869 (Cleveland). *T577*

Have $3\frac{1}{2}$in screw cutting lathe with motor, some change wheels and accessories. Would exchange for 144MHz/432MHz hand held or base equipment, v.h.f. scanner or h.f. w.h.y. Tel: 051-645 5383 after 6.30pm (Birkenhead). *T591*

Have S registration Vee twin 350cc Morini motorcycle. Would exchange for h.f. receiver, FRG-7700, R1000 or w.h.y. Tony G3YSQ. Tel: West Hanney 386. *T592*

Have FT-290R mint condition. Would exchange for TS700G. Tel: G4TBM Lewes (Sussex) 6099. *T598*

Have FT-200 h.f. transceiver, 28MHz–3·5MHz with matching p.s.u.. Would exchange for TS700G. Tel: G8JDF Lewes (Sussex) 78080. *T599*

Have Spectrum 48K computer, plus ZX Printer and Sony cassette recorder. Also programmable joystick and interface and software worth £100. Total cost over £300. Would exchange for Yaesu FT-290R or Standard C-58 or similar. Tel: 041-637 0808 (Glasgow). *T714*

Have amusement arcade Space Invaders machine would exchange for h.f. receiver or FC-902 a.t.u. Karl. Tel: 01-575 0090 (Greenford, Middx.). *T639*

Have Quad f.m. 188MHz Tuner plus 3-waveband tuner all valve sets. Would exchange for w.h.y. J. F. Riley, 51 Leeswood, Ashurst, Skelmersdale. Tel: 33304. *T637*

Have Super 8-Sound Projector and Cine Camera. Would exchange for h.f. receiver 0–30MHz valve or solid state. Tel: 23638 (Coatbridge). *T638*