

# DIRECT CONVERSION - A FASCINATING TECHNIQUE

ATANU DASGUPTA, VU2ATN

We reproduce below from our archives, this articles published by ARSI in the then News letter Indian Radio Amateur. This interesting article was written by VU2ATN about 20 years ago. It has still got an appeal for the beginners / experimenters.

Since this circuit is very old, please use modern readily available transistors like BF 549 or 2N2222A etc. and also replace the Audio Amplifier by modern transistors/ICs like 810. The basic circuit with BFW-11 and CA 3028 A however, remain same.

- Editor

Eversince an article on direct conversion receivers had appeared in August 1974 issue of the Indian Radio Amateur, I had been toying with the idea of homebrewing one for me. The result is a little all solid state receiver which utilizes the existing VFO in the shack, thereby enabling me to use the rig along with my existing CW Tx in the transceiver mode. The machine is surprisingly sensitive & usable for its simplicity & physical size & once its limitations are appreciated, you will enjoy using it. However, there is little or no ingenuity in the project described here and this is rather a collection of ideas found in different Amateur Radio magazines etc. The project will be extremely interesting & rewarding to a homebrewer whether he is a novice or an old timer. Not a single component is an imported one & that is why a prospective constructor will find no difficulty in locating parts in the local market. I have used seven bipolar transistors, one FET & one IC in the receiver & all are readily available in the electronics market.

**THE CIRCUIT :** The block diagram & the receiver are shown in the Figs 1 & 2 respectively. At the heart of the Rx there is a CA 3028A product detector. A coil-capacitor combination forms the front end & the idea of adding a RF amplifier is rejected for fear of non-linearity & cross-modulation. The VFO is a FET oscillator followed by two buffer stages, the construction of which has been described in an earlier article in the IRA. The 3.5 MHz signal from the VFO is quadrupled in a 2N706 quadrupler stage & the same along with the incoming 20M signals are applied simultaneously to the detector. The output is a beat note for CW & speech or audio for SSB which is passed through a low pass filter for selectivity & then highly amplified to loudspeaker level. A four-transistor conventional transformer- coupled audio amplifier has been chosen for the job. Since I have only a 3 ohms speaker in the shack & this time I avoided experimenting with transformerless audio amp which usually requires speakers with higher impedances, this circuit has been the final choice. All fine tuning is done simply by controlling the VFO & there is no

problem of tracking & hence no ganged tuning. Besides no RF or AF gain control has been found necessary :

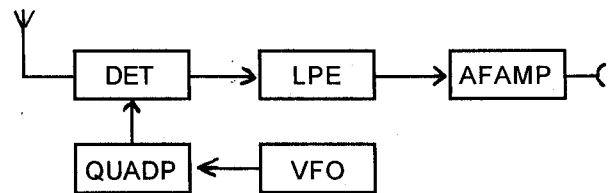


Fig. 1 The Block diagram

**CONSTRUCTION :** Veroboards are used for all the circuits. The VFO is built inside an aluminium box with usual care required for VFO construction. A prospective constructor will find a lot of articles on this subject in the Handbooks & elsewhere & so I would not elaborate. The quadrupler & detector stages along with the front end coil-capacitor combination are built on a piece of veroboard measuring 2" x 2.5". The audio end & the low pass filter are built on another piece of veroboard measuring 5" x 2". The VFO box & remaining two pieces of veroboard have been mounted in my case on an experimental U-shaped aluminium chassis measuring 7" x 6.5" x 2".

**INITIAL TESTING :** The tuning capacitor 25 pf is so chosen or adjusted (in my case, I modified a 60 pf variable capacitor by removing rotor & stator plates one by one experimentally) that the fourth harmonic of 3.5 MHz signal of the VFO falls between 14000 to 143.50 KHz., the permitted range in the OM band. Therefore a calibrated RS is required at this stage for this purpose. Once you are certain that you are not violating the frequency limit, you may go ahead with the rest of the job.

The quadrupler is now peaked utilising a VTVM in case you are lucky enough to possess one otherwise it is not a difficult job using a diode probe for this purpose in conjunction with a VOM. While doing this the fourth harmonic of the 3.5 MHz VFO signal must be tuned in the calibrated Rx & you are to be absolutely certain that you are not peaking the wrong harmonic. When the fourth harmonic is peaked by adjusting the slug tuned coil, the 2nd, 3rd & other harmonic output will be found minimum in the calibrated Rx. However, it is always advisable to check the tuned circuits with a G.D.O. at the very beginning. An antenna is now connected to the input & the VFO is tuned slowly. If all the connections are O.K. in the detector & audio stages, no further adjustment is necessary & your 20m direct conversion receiver is ready for use.

**FINAL COMMENTS :** The low pass filter has been an experimental one & has been constructed after some tinkering with different combinations. The same may be

VU<sub>2</sub>ATN'S D.C. Rx  
(SUMMARY 1976)

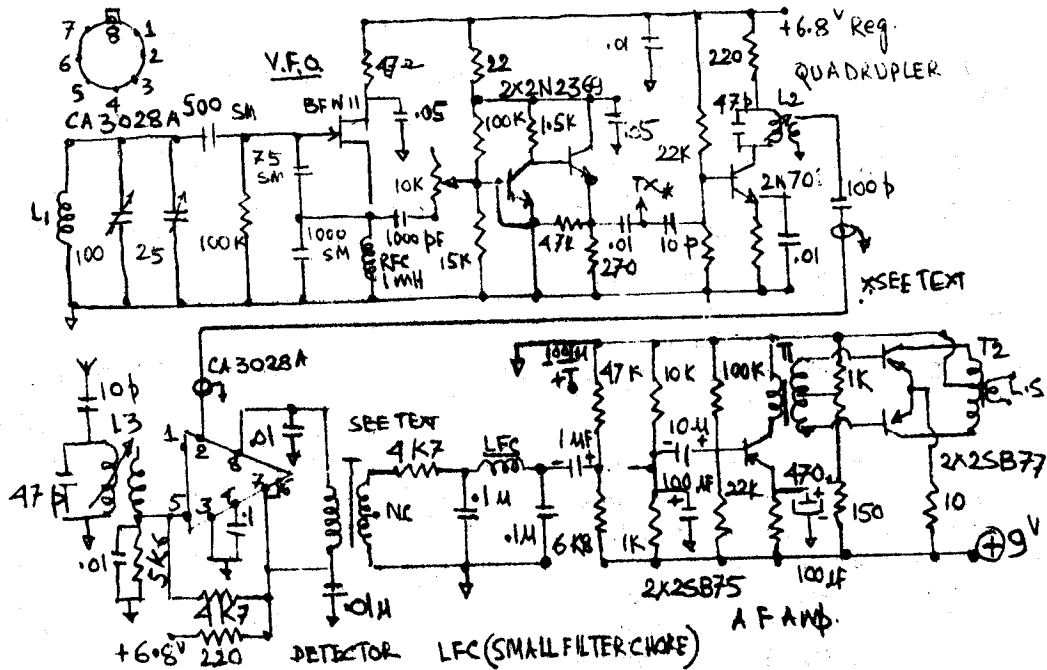


Fig. 2 The Circuit daigram.

3.5 MHz output can be taken out, if desired, from the arrow-mark, after 2 x 2N2369 transistors. LFC used is 300mA type, VOICE Master IF Choke as used in battery eliminator as ripple filter choke. L-2 the quadrupler coil is broad-tuned and set at the middle of 14MHz amateur band. The 100pf variable capacitor in VFO is for 'Band-setting' VFO tuning is by 25pf capacitor as stated in the text.

replaced with an active filter & in that case impressive selectivity is expected. The overall gain will probably be even better if the transformer T is replaced with a 10K : 2K type. Since such a transformer is not readily available, an ordinary input T type as required in a transformer-coupled AF amp, is used have with pretty good result. The VFO may be utilized to drive a chain of multipliers either transistorised or tube type & thus a C.W. transceiver can easily be constructed. However, during transmission the detector stage is to be put off & if you like to monitor your own keying, a separate tone oscillator may be incorporated.

Best of luck & happy construction.

REFERENCES:

1. Direct Conversion Receivers, Indian Radio Amateur, August 1974.
2. Post Script to Jayaraman's FET VFO. Indian Radio Amateur, Summer 1975.

3. The Micromountaineer, QST, August, 1973.
4. Receiver Topics. Amateur Radio Techniques by G3VA.

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COIL DATA :

COIL	No. of turns or Winding Length	Size of Former	Wire Gauge
L1	3/4 1 close wound	0.3" dia with iron core	32 s.w.g.
L2	12t close wound with link 2 turns over cold end	do	24 s.w.g.
L3	12t close wound with link 2 turns over cold end	do	do