

Off Air Lock for Ref Osc

By G8MNY

(Updated Jan 15)

(8 Bit ASCII graphics use code page 437 or 850, Terminal Font)

Here was my old method when we had analoge TV, of locking the master oscilator in a PLL signal generator to the 625 line broadcast TV syncs. (The BBC used a Ceasium ref was better than 1/10^9 off air). It was obtained from TV or video Rx with video output. In it time this was much better method I found than other off air sources as there is less fading, no AM or PSK on carrier data etc.

NB. Digital TV sources are NOT accurate as they only use a local xtal timebase.

In the UK I found only the BBC had accurate syncs, CH4 was quite accurate, ITV was poor, & five was no use as it's Tx are fed from their digital sat feed!

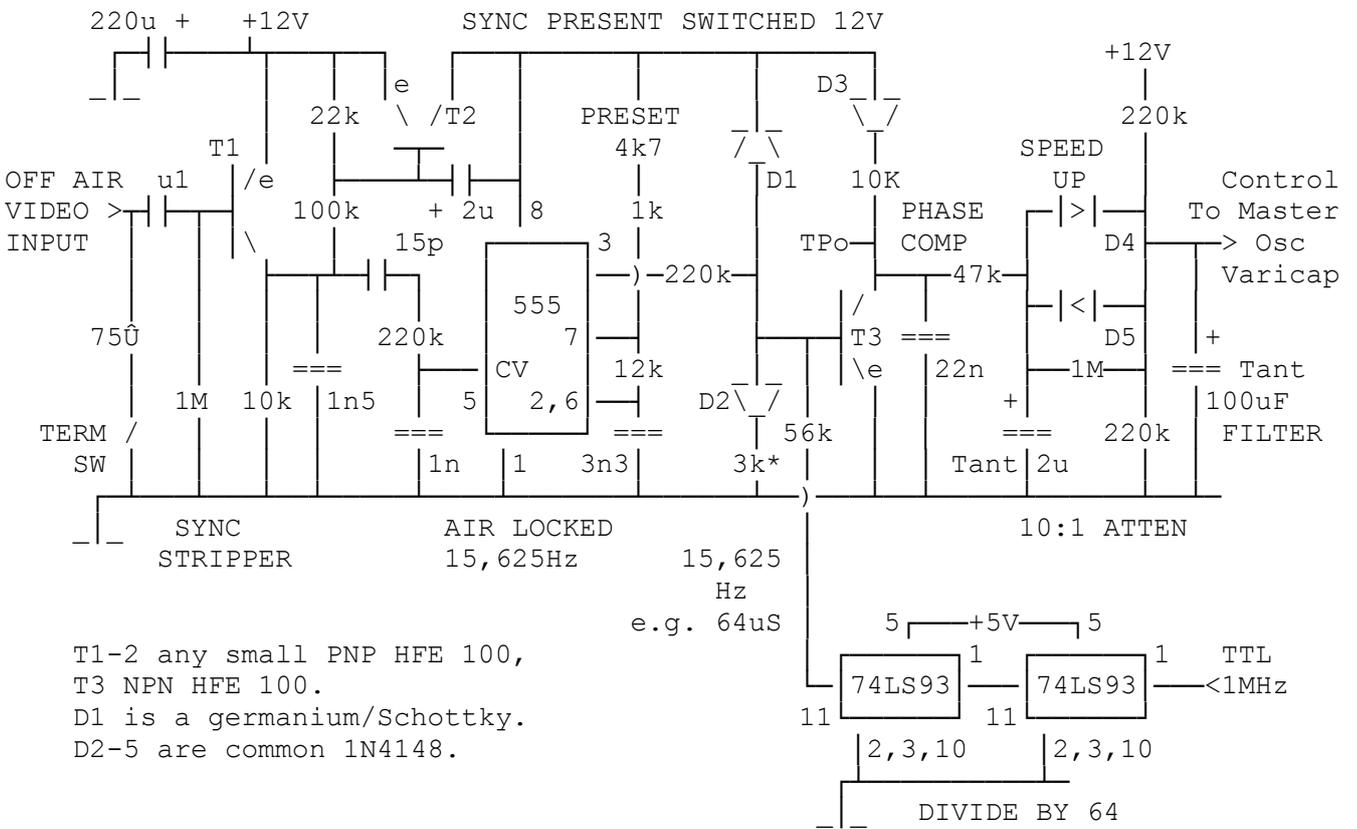
MY DESIGN

This design will work with any 1MHz clock that has (or can have) a varicap to trim its frequency. So it can easily be used on a frequency counter if a 1MHz clock can be derived or extracted. It will greatly improve the accuracy & temperature drift & aging problems of simple Xtal timebases.

FEATURES

- Automatic switching to passive free run mode with no applied Video.
- Reasonable immunity to TV sync noise & ghosts etc.
- Slow PLL Lock up has a "speed up" circuit.

THE CIRCUIT



T1-2 any small PNP HFE 100,
 T3 NPN HFE 100.
 D1 is a germanium/Schottky.
 D2-5 are common 1N4148.

HOW IT WORKS

The input can be terminated or not onto 75R. T1 strips the syncs of the video, which are filtered almost to a saw tooth with the 1n5. The average DC level of T1 collector changes from high to low with the presents of video & this turns on slow acting T2 to power up & enable the rest of the circuit.

The 555 15,625Hz (64uS) astable osc is fed with only a few mV of the recovered syncs on its CV pin 5, this is an unusual way of controlling a 555 & is used to make the astable lock up only over a narrow range, so it free wheels over noisy & missing syncs e.g. during the frame sync pulse.

The 555 output is compared in T3 with the local 1MHz clock after that has been divided by 64 (8x8 to give 64uS) in 2x 74LS93. Diode D2 & 'select on test' 3k* are to temperature compensate T3 so there is no change in phase sensitivity. D1 & D3 isolate the varicap control output when there is no video.

T3 output is lightly filtered on its collector (TP) so that the phase errors can be seen on an oscilloscope for setting up. The final varicap control line is attenuated & heavily filtered to remove all traces of TV variables & clock pulse etc. This would cause long lock up times of several minutes, so an out of lock speed up diodes bypass the filter & attenuator circuit when the control voltage is more than 600mV out.

On applying video, the two 15,625Hz phases will be well out of phase & the control voltage will be $> \pm 0.5V$ off the normal varicap voltage, & diodes D4/5 will conduct & bypass the 10:1 attenuator/filter, speeding up the lock. When in lock the attenuator insures only a small amount of heavily filtered control is applied.

The master oscillator varicap feed has 2 220k Rs across the 12V, (this could be a single 100k from 5V rail) so that when there is no video the osc free runs at the normal frequency. Some accurate osc modules have internal thermistors for thermal tracking the Xtal with a varicap, this circuit is able to drive that load without the need for these Rs.

TESTING

Lock the scope to incoming video "line". Scope the filtered output syncs on T1 collector. Check that T2 is turned on with video being present, & check that it turns off & the varicap voltage returns to the normal setting with no video.

Initially set up the 555 astable preset so that pin 3 output square wave is in line lock with the video.

Check the divider outputs are OK & produce a 15,625Hz square wave. Using a high Z probe (1/10) on T3 collector, check that there is a level somewhere between the power rails (it will have some line & frame sync content on it), this DC level indicates lock up. Now adjust the scope timebase to see a 1/25 Sec & show 2 video frame syncs, & accurately set the 555 preset for minimum disturbance during both odd & even frame syncs.

Use your osc/counter for some accurate work, e.g. listen 70cms SSB carrier (osc harmonic) or is a counter measure 70cms frequency. Remove video & adjust your master osc's trimmer for the same frequency. This should leave the non-locked accuracy as near to the off air as possible, but still with drift etc.

LOCK INDICATION

Not shown here, but I use a couple of transistors to sample the two 15,625Hz phases again, but with slight CR windowing so that they do not turn on when the unit is properly locked. This then has a long time constant to stop indicating lock, until everything has settled down. This feeds a tri-state LED transistor

switch circuit to indicate NORMAL (OFF) TV SYNCS (RED) & TV LOCK (GREEN).

See also my "Calibrating Frequency", "198kHz Off Air Standard", "Comparing Off Air Freq Standards", "Crystal Drift Compensation", "Simple Crystal Oven" & "Locking a Frequency with 555" buls.

Why Don't U send an interesting bul?

73 de G8MNY @ GB7CIP