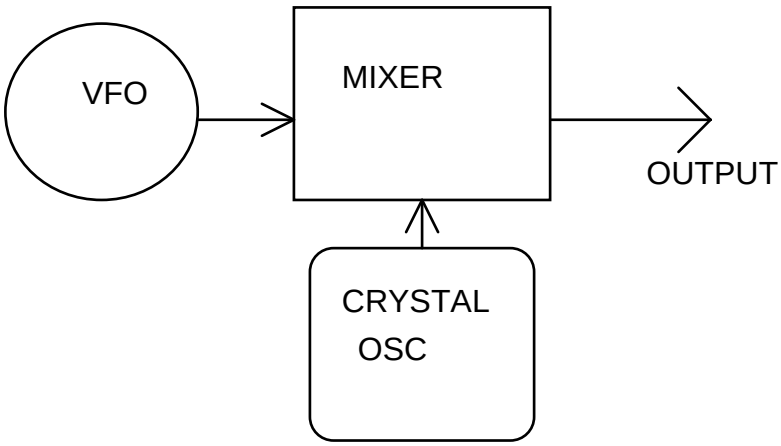
TRANSMITTER OSCILLATORS

The original Amateur Bands (1.8, 3.5, 7, 14, 21, and 28 MHz) were *harmonically related.*
But this is not the case with the later bands, such as 10, 18 and 24 MHz.
Therefore simple transmitters, with a VFO and switched multiplier chain, are no longer practical.
This can be overcome either by using a *mixer VFO system* or by *frequency synthesis*.

MIXER VFO



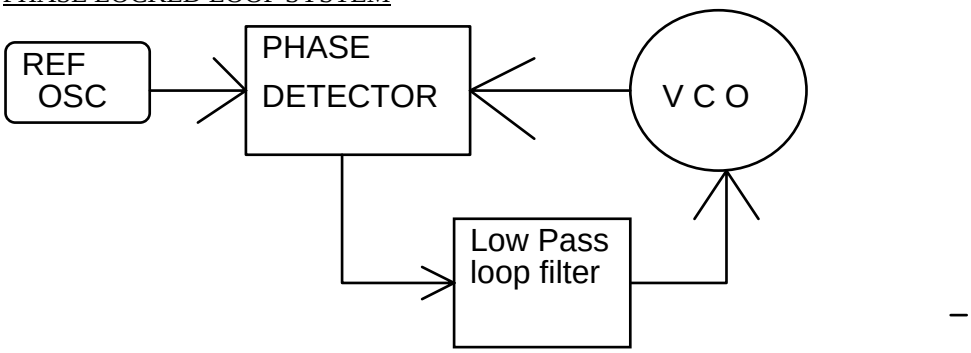
By using a variable frequency oscillator and a crystal oscillator feeding a mixer any frequency can be obtained. For example if a VFO in the range 5 - 5.5 MHz is used in conjunction with a 2.0 MHz crystal to give a mixer output of 7.0 - 7.5 MHz.. If a 23 MHz crystal is used there will be an output in the range 28 to 28.5 MHz.

QUESTION S1
In the above example a 23MHz xtal was used to obtain an output in the range 28 - 28.5 MHz.
What other output will be present when this VFO and crystal are used?
A) 17.5 - 18 B) 28.5 - 29 C) 18 - 17.5 D) 29.5 - 28 MHz

FREQUENCY SYNTHESIS

Frequency synthesis is a means of generating an oscillation that can be set *digitally*.
The basic oscillator is a VCO. - *a Voltage Controlled Oscillator*. As the name suggests, the actual frequency of the oscillator by the voltage on its 'control input'. The VCO forms an important part of a *Phase Locked Loop* (PLL) system.

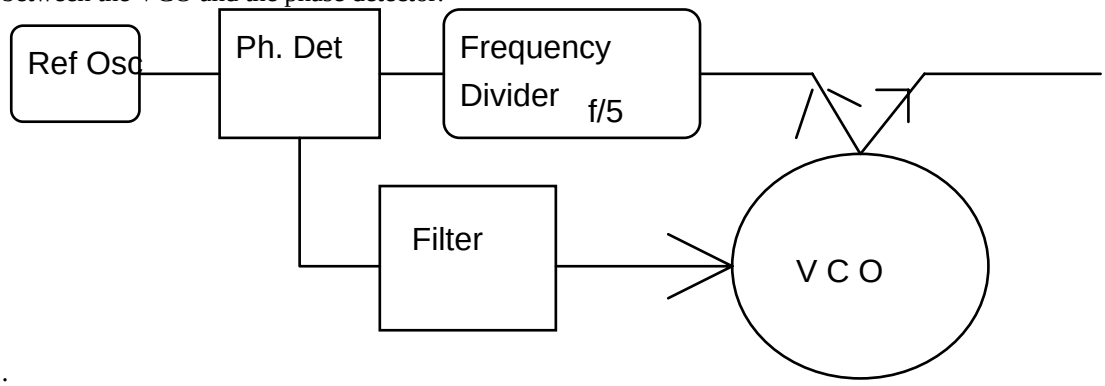
PHASE LOCKED LOOP SYSTEM



The simple phase lock loop circuit enables a Voltage Controlled Oscillator to be exactly locked to the frequency of the crystal controlled *reference oscillator*.
The *phase detector* looks at both the reference frequency and the oscillator frequency. If there is a frequency difference it produces an *error voltage.* This is fed, via a filter, to the VCO to automatically correct its frequency.
This simple example is not very useful as it has purely made the VCO run at the same frequency as the reference. But it shows the principle.

SYNTHESIZED OSCILLATOR

However the circuit begins to show its versatility if, for example, a frequency divider is connected between the VCO and the phase detector.



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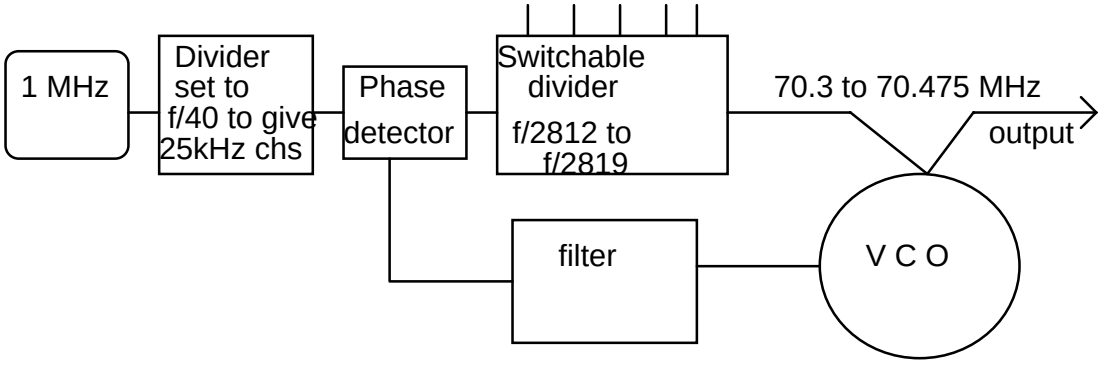
Remember that the *phase detector* will send an tuning voltage to the VCO to adjust both the frequencies fed to it to be the same.

Assume that the *reference oscillator* is a 1MHz crystal. As the *frequency divider*, in this example, is 'divide by 5' the VCO will run up and **lock at 5MHz**

Thus the frequency of the VCO is determined by the *reference frequency* and *the divider*.

SYNTHESISED TRANSMITTER FOR 70 MHz



This shows how a *Phase Lock Loop system* can be used to generate frequencies at the required channel spacing for any Amateur Band. The example taken is 25 kHz channel spacing in a section of the 70 MHz Band. To adopt 12.5 kHz spacing , as suggested by the band plan, the fixed divider would have to be set to *divide by 80,* instead of 40.

If this were to be used in a transceiver, a suitable *frequency shift* would have to be incorporated to take account of the *intermediate frequency,* when on receive.

QUESTION S2

Referring to the block diagram of the “Synthesized transmitter for 70MHz” above.
What will be the output frequency if the divider is set to “f/2815” ?

a) 70.300 MHz b) 70.325 MHz c) 70.330 MHz d) 70.375 MHz

QUESTION S3

What is the main advantage of using “frequency synthesis” ?

a) The frequency can be set digitally b) The oscillator out put will have less noise
c) The circuit uses a phase detector d) The circuit contains a low pass loop filter

('E' SYN.WPS)