The Old Radio Shop - by Grant Manning
"DIRECT DIGITAL READOUT"

Some thoughts on receiver electronic frequency readout, for the NOVICE.

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Everyone ought to have a radio that can be accurately tuned to within a kilohertz or so!

There are a few problems associated with hooking up a frequency counter to your favorite radio that you should be aware of.

Resolution - "the act of resolving something."

Just how closely do you want to read frequency? A readout of 1 kHz requires the receiver to be able to determine which station you are tuned to within 1 kHz before you measure it! If you tune onto a strong SW signal, and you are using the "peak the 'S' meter" method of being "on frequency" - you probably won't be close enough to be within 1 kHz, unless you have a good sharp IF bandpass.

Most readout schemes measure the "L.O." (local oscillator) or "V.F.O." (variable frequency oscillator) frequency. and then add, or subtract, the output of these with a local crystal oscillator to glean the correct frequency.

If, say, we hang a counter (a counter "counts" frequency, and displays the frequency digitally on a visible readout) on the "V.F.O." of say an FRG-7, you would read the "V.F.O." frequency, which would change as you tune the set. It would count, however, from 3455 to 2455 kHz as you tune from 0-1000 on the dial. So then if you were on 100, you'd read 3355 on the counter. Accurate, except somewhat tacky, and difficult to read. Impossible for those of us who can't add & subtract!

So, what if you have a different receiver, say a DX-160? They are "single conversion" radios, and their "L.O." is 455 kHz above their received frequency. If, say, you were tuned to a station on 1000 kHz, the "L.O." would be at 1455 kHz, which, if measured, would accurately display 1455 kHz! Subtract the 455 kHz IF frequency, and you are in business! You are, until the last band, that is! On band 4, they change the "L.O." to work below the received frequency, so now you get to subtract. WWV on 15.000 MHz would be read 14.545. Not too convenient on the 19-meter band!

So far we've examined a few possible problems - and can grasp that it isn't all that simple.

Another method of measuring frequency is to use an external RF oscillator and counter. Measurement this way works fairly well to within 500 Hz or so (depending on your equipment, etc.), but takes another step. You tune your DX-160 to CHU-3330 kHz. Then, with the counter connected to read the output frequency of the RF generator, and enough antenna (a foot or so of wire) to radiate into the DX-160, you slowly tune the generator, and "zero beat" it to your receiver. This will then read your frequency.

Digital frequency displays are becoming available for some of the popular SWL receivers now. A digital frequency display is a device that "reads" the "L.O." or "V.F.O." frequency, then mixes this frequency with the correct IF offset, and displays the result on an LED readout.

The problem with the display units is one of having the DXer correctly locate and extract the "V.F.O." signal so that it can be counted. On any external output of an "L.O." or "V.F.O.," there should be some sort of "buffer" circuit which "isolates" the output of the "V.F.O." or "L.O." Without a buffer circuit, you stand the chance of "pulling" the "L.O." (changing its frequency, by loading it with external equipment), or introducing external noise into the receiver at this point. Any equipment noise introduced by not "buffering" the VFO/LO output will ride right on through the IF, and show up as hash, or other undesirable noise in your speaker!

Another problem encountered if you don't "buffer" the VFO/LO output is that the co-ax used to bring the signal out has enough capacity to possibly decrease the VFO/LO output, or kill the VFO/LO entirely.

In the case of the DX-160, for $169.95 they don't even give you selectivity specifications - however, DX-160 owners will readily admit that the IF response is broader than the proverbial "barn door." This isn't really a problem until you count it, and then you realize that even though the 'S' meter has long since pegged, you still are not "right on" frequency. Inexpensive ceramic filters do not always end up "right on" their specific frequency either, and so state in their specifications. This is again no problem, except when tuning in a station with an inaccurate or wide filter it blows your resolution of 1 kHz!

There are two ways to eliminate this problem to some degree: (1) Use your BFO to zero-beat all signals, and offset the BFO to compensate for the lack of selectivity/poor filter as necessary; or, (2) Construct an internal oscillator "right on" 455 kHz, or whatever IF frequency your set uses, and zero-beat with that, to give you a true frequency reading, despite your meter, and IF filter deficiencies.

In summary, to read out to 1 kHz is expensive, but a very desirable feature. It is most expensive for those DXers who have inexpensive equipment to begin with. One must consider the worth (to themselves) of their receiver before investing $100+ in an electronic frequency counting scheme. Plus, for different receiver formats, the cost would vary. For a good counter, you can easily spend $200 to $500, and a generator, kit form, about $80 up.

As of this writing, the following devices are available for DXers: Digital displays for the FRG-7, SSR-1, and BW-XCR-30 receivers, and at least one for the DX-160 that was in Popular Electronics (I think). Available also is a counter-generator, in one small package that sits on the rx. This can be used with 1 kHz accuracy on any rx from 440 kHz to 30 MHz. Most of these devices are available in the $100-to-$250 price range.

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