working properly. Fit the 2@LM324s. If you don't have a scope, correct operation of the oscillator and buffer amplifier will be indicated by around 1.4VDC appearing at IC1 pin 14 at all frequencies (the peak value of the rectified ac at the input to the test circuit).

With the "TRIM FREQUENCY" pot set centrally, the main tuning capacitor set to minimum capacitance, and the 12.5 to 30MHz range selected, monitor the "hot" test circuit terminal with a frequency counter and use the trimmer on the main tuning capacitor to set the output frequency to 31MHz. Now check the frequency coverage on all ranges. Finally, set the oscillator frequency to 2MHz. Switch off.

Plug in the 74LSO4, 74LS93, and 4040. Switch on. Your scope should show around 2KHz of 5V p-p square wave at pin 14 of the PICAXE if the pre-scaler is working correctly. Check prescaler operation (divide by 1024) on all other frequency ranges and then re-set the frequency to around 2MHz. Without a scope you will have to wait until the Picaxe is plugged in to check prescaler operation. This will be shown by the LCD indicating the correct frequency.

Connect two 100 ohm 1% 1/4watt metal film resistors across the test terminals (50 ohms). Monitor TP2 with a DVM and adjust P1 until a DC voltage of exactly 4.500 volts appears. Then adjust P2 and P3 until exactly 2.250 volts appears at TP3 and TP4 when checked with the DVM. This completes initial calibration. Switch off and plug in the Picaxe. Switch on.

Your analyser should now be alive! For the first 1.5 seconds the battery voltage should be indicated with an accuracy of around +/- 5%, and then the display should show a frequency of around 2MHz, R=050ohms, X=000ohms, and SWR=1.00. Recheck the voltages at TP2, 3 and 4 if this is not the case, and also measure the battery drain (around 100mA total). Also check that the fast and slow frequency gating intervals are correct (4 or 5 digit mode). If the frequency indicated is around 8MHz and the gating is very slow, the Picaxe is using its internal RC default clock of 4MHz instead of the external 16MHz crystal, and you have a fault in the crystal circuit connected to pins 9 and 10 of the Picaxe. This is also possible if you have decided not to use the preprogrammed Picaxe supplied, but instead have loaded the Picaxe yourself with an early version of the software written for the Picaxe 28X rather than the Picaxe 28X1 supplied with the kit. See the VK5JST homepage for a fix.

Remove the 2 @100 ohm load resistors and replace them with a single 330 ohm 0.25 watt metal film resistor with short leads. The analyzer should now indicate a resistance of 330 ohms+/- 10% together with an SWR of around 6.6 and a reactance of zero. If the reactance X is not zero, very slightly adjust P2 or P3 until it is. Recheck the analyzer with the 50 ohm load again.

Depending on the circuit conditions for which your crystal was made, you may wish to slightly change the count periods specified in the "count" statements in the software so that the analyser shows an exactly correct frequency. You can also modify the battery voltage indicated at switch on, and this can be adjusted in two ways. The value of one of the resistors which form the voltage divider connected to Picaxe pin 5 (16K and 3K9) can be adjusted, or you can modify a constant provided in the battery measuring routine within the Picaxe software. If you wish to modify the analyser software, please see the procedure detailed on the VK5JST homepage. Connect a 300mm length of hook up wire between the test terminals and select a frequency of around 30MHz. Depending on the wire diameter and the shape of the single turn coil you have made, the skin effect resistance will be around 4-10 ohms and the inductive reactance around 80 ohms. When the wire is disconnected the instrument will display the reactance and loss resistance of the few pF of stray capacitance in the test circuit and will not indicate an open circuit until the frequency falls below about 15MHz. Another way of looking at this is to say that the instrument is displaying the characteristics of a very short length of transmission line connected to the test circuit (the terminals etc). There are typically around 4 pf of strays in the test circuit and standard coaxial cable has a capacitance of 100 pf/metre and so the strays equate to an unterminated length of coax of around 40mm. In any practical HF measurement, this will be absorbed into the antenna and feed line being measured and is so short it is negligible.

Congratulations, and enjoy using your analyser. SCARC November 2008