THE WEST RAND AMATEUR RADIO CLUB

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Volume 4, Issue 11

ANODE

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Editor's Comments

From our special correspondent in London.....

Well it sounds good. Its a warm sunny day here in London. Really quite hot and with no clouds in the sky. Far too good a time for doing the Anode.

I had a lot of problems getting into the Mweb email system and whilst I could collect my daily ration of spam, I couldn't send anything. Fortunately my daughter has signed me up with nsworld and I can send from there.

[Keith] For Atomic clocks etc go to :-

http://www.sciencemuseum.org.uk/index.asp

[The first atomic clock, Caesium I, was designed by Louis Essen and built at the National Physical Laboratory in Teddington in 1955. Although it was not the first machine to use atoms for timekeeping, it was the first to keep time better than the best pendulum or quartz clocks.]

Take a look at the article on clocks and why they need to be so accurate.

Can't find Amateur Radio?

A search on Google for 'amateur+radio+articles +technical' brought up 103,000 sites devoted to Amateur Radio! Adding 'South Africa' brought up none. There is a subtle change there. If you try just 'Africa', google brings up 20,000+.

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Simple test equipment to build

by Peter Parker VK3YE - first appeared in Amateur Radio, April 1997

This month we plug in our soldering irons and put together some pieces of basic test equipment. Though inexpensive, the projects described will prove useful in the radio shack. Any one of them can be assembled in an afternoon. They are described in order of complexity, so that the reader can find a project suitable for their expertise. Extensive constructional information is not provided; refer to April 1996's Novice Notes for advice on obtaining components, construction techniques and sources of information.

FIELD STRENGTH METER

A field strength meter is perhaps the simplest piece of RF test equipment that can be built. Used for checking transmitters, antenna experimentation, and testing RF oscillators, field strength meters provide an indication of the presence of RF energy. They are not frequency sensitive and are useful where indication of a change in level is more important than the actual strength of the signal indicated.

Figure One shows a schematic of an RF field strength meter. Like a

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Editors Comments

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Our first article is from Peter Parker (wasn't he Spider-man?). See :-

`http://www.alphalink.net.au/~parkerp/gapro.htm`

for more details.

A visit to the Science museum

The new Wellcome section has been open for three years and shows off science in a very new and interesting way. Youngsters visiting the museum are treated to hands on interactive displays which grabs their interest.

The older exhibits are still there, including the amateur radio sets. Some of which are in current use by South African amateurs.

For an interesting article about HF radio in East Africa, check out :-
`www.linuxjournal.com`

Last week end was the commemoration of the 60th anniversary of D-Day. Considerable displays of military might were shown off in Plymouth Sound.

I shall be visiting 'Station X' [Bletchley Park] later this visit and collecting more pictures and information. Persuasion may be used on yours truly to give a talk on this most secret aspect of World War II.

Simple test equipment to build

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crystal set, it requires no power source. However, unlike a crystal set, the meter has no tuned circuit. It responds to signals of any frequency.

The meter works by converting any RF signal present at the antenna to a DC voltage. This voltage drives a meter movement to give an indication of relative RF. The meter includes a control to reduce its sensitivity where required.

Because it uses few parts, a printed circuit board is not necessary; components can simply be soldered to one another. However, a box is desirable for operating convenience. The case and aerial from a discarded toy walkie-talkie was used in the prototype (see photograph), though any small plastic case will suffice. The meter movement need not be large; we are only detecting the presence of RF, and not making precise measurements.

A meter from an old radio or tape recorder should work fine. The diodes can be any germanium type; the actual part number is not important. Germanium diodes can be recognised by their 6mm-long clear glass case with two coloured bands towards the cathode end. None of the component values shown are critical; a 50 percent variation would have little effect on circuit operation.

To test the operation of the meter, a transmitter is required to provide a source of RF. Placing the field strength meter's extended antenna near a handheld VHF rig should produce an indication on the meter, assuming that the sensitivity control has been set to maximum. No indication means that the meter is not working. Common construction errors include connecting the diodes or the meter wrongly and using silicon diodes in place of the germanium diodes specified. In this case, the meter will still work, but with reduced sensitivity.

The earth wire is optional; when working with low-powered oscillators, it is useful to clip it to ground (of the circuit under test) to ensure a better indication on the meter.
Those without a transmitter can use an RF signal generator or crystal oscillator (such as that described later) for testing purposes. In this case, place the meter's antenna directly on the output terminal to verify operation. However,
only attempt this with transistorised circuitry; component ratings and safety considerations make the meter described here unsuitable for poking around valve equipment.

The field strength meter is a useful instrument in its own right, but it can be made more versatile. Modifications include adding an amplifier (for greater sensitivity), including a tuned circuit (so it only detects signals in a particular band), or converting it into an RF wattmeter and dummy load. Circuits for such instruments are found in the standard handbooks.

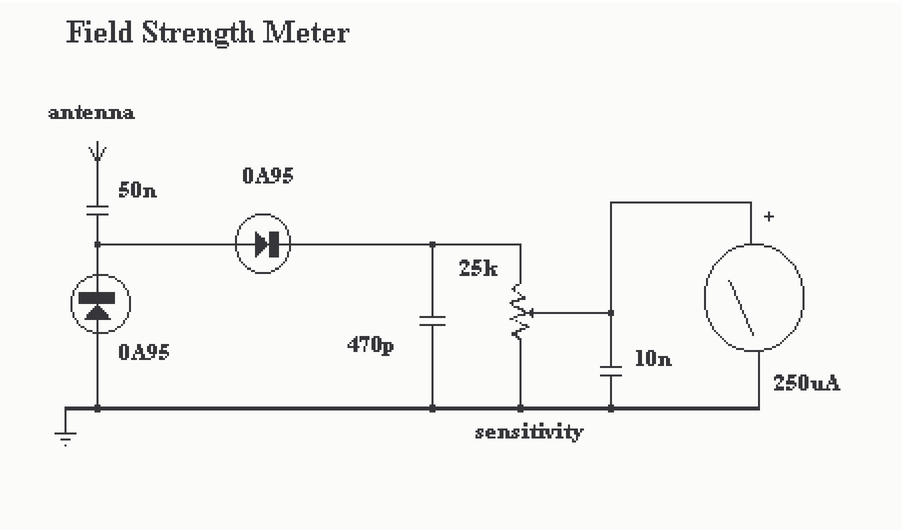

Figure One

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Simple test equipment to build

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CRYSTAL TESTER

Figure Two shows the circuit of a simple crystal tester. It switches on a light emitting diode (LED) if the crystal is working.

The crystal under test is placed in an oscillator circuit. If it is working, an RF voltage will be present at the collector. This is rectified (converted to DC) and made to drive a transistor switch. Applying current to the base causes current to be drawn through the collector, thus lighting the LED.

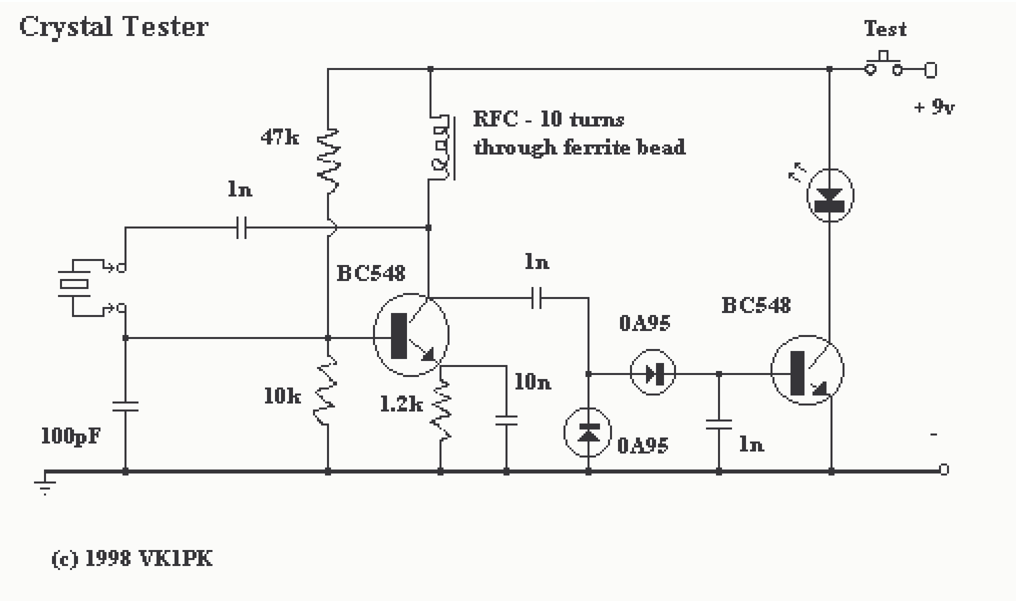

Figure Two

If an indication of frequency is required, simply use a general coverage receiver to locate the crystal oscillator's output. Note however that when testing overtone crystals (mostly those above 20 MHz) the output will be on the crystal's fundamental frequency, and not the frequency marked on the crystal's case. Fundamental frequencies are approximately one-third, one-fifth or one-seventh the overtone frequency, depending on the cut of the crystal.

The circuit may be built on a small piece of matrix board and housed in a plastic box. Alternatively, a case made from scrap printed circuit board material may be used. Either a selection of crystal sockets or two leads with crocodile clips will make it easier to test many crystals quickly. The RF choke is ten turns of very thin insulated wire (such as from receiver IF transformers) passed through a cylindrical ferrite bead. Its value does not seem to be particularly critical, and a commercially-available choke could probably be substituted.

The circuit can be tested by connecting a crystal known to work, and checking for any indication on the LED. A shortwave transistor radio tuned near the crystal's fundamental frequency can be used to verify the oscillator stage's operation. Note however that this circuit may be unreliable for crystals under 3 MHz, and some experimentation with oscillator component values may be required.

The crystal checker also tests ceramic resonators. Other applications include use as a marker generator for homebrew HF receivers (use a 3.58 MHz crystal) and as a test oscillator for aligning equipment.

CAPACITANCE METER

This project is more complex than the others described earlier. However, when finished, you will have an instrument capable of measuring all but the largest capacitors used in radio circuits. Unlike variable resistors, most variable capacitors are not marked with their values. As well, the markings of capacitors from salvaged equipment often rub off. By being able to measure these unmarked components, this project will prove useful to the constructor, vintage radio enthusiast or antenna experimenter.

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Simple test equipment to build

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The common 555 timer IC forms the heart of the circuit (Figure Three). Its function is to charge the unknown capacitor (Cx) to a fixed voltage. The capacitor is then discharged into the meter circuit. The meter measures the current being drawn through the 47 ohm resistor. The 555 repeats the process several times a second, so that the meter needle remains steady.

The deflection on the meter is directly proportional to the value of the unknown capacitor. This means that the scale is linear, like the voltage and current ranges on an analogue multimeter.

The meter has five ranges, from 100pF to 1uF, selected by a five position two pole switch. In addition, there is a x10 switch for measuring higher values and a divide-by-two facility to allow a better indication on the meter where the capacitor being measured is just above 100, 1000pF, 0.01, 0.1 or 1 uF.

Component values are critical. For best accuracy, it is desirable that the nine resistors wired to the Range switch have a 2% tolerance. If 0A47 diodes are not available, try OA91 or OA95 germanium diodes instead. Construct the meter in a plastic box; one that is about the size of your multimeter but deeper is ideal.

The meter movement should as large as your budget allows; you will be using it to indicate exact values. A round 70mm-diameter movement salvaged from a piece of electronic equipment was used in the prototype. The meter you buy will have a scale of 0 to 50 microamps. This scale needs to be converted to read 0 to 100 (ie 20, 40, 60, 80, 100 instead of 10, 20, 30, 40, 50). Use of white correction fluid or small pieces of paper will help here.

The components can be mounted on a piece of matrix board or printed circuit board. Use a socket for the IC should replacement ever be needed. Keep wires short to minimise stray capacitance; stray capacitance reduces accuracy.

Calibrating the completed meter can be done in conjunction with a ready-built capacitance meter. Failing this, a selection of capacitors of known value, as measured on a laboratory meter, could be used. If neither of these options are available, simply buy several capacitors of the same value and use the one which is nearest the average as your standard reference. Use several standards to verify accuracy on all ranges.

To calibrate, disable both the x10 and divide-by-two functions (ie both switches open). Then connect one of your reference capacitors and switch to an appropriate range. Vary the setting of the 47k trimpot until the meter is reading the exact value of the capacitor. Then switch in the divide-by-two function. This should change the reading on the meter. Adjust the 10k trimpot so that the needle shows exactly twice the original reading. For example, if you used a 0.01 uF reference, and the meter read 10 on the 0.1 uF range, it should now read 20. Now switch out the divide-by-two function.

If you are not doing so already, change to a reference with a value equal to one of the ranges (eg 1000pF, 0.01uF, 0.1uF etc). Switch to the range equal to that value (ie the meter reads full-scale (100) when that capacitor is being measured. Switching in the x10 function should cause the meter indication to drop significantly. Adjust the 470 ohm trimpot so that the meter reads 10. Move down one range (eg from 0.01uF to 1000pF). The meter should read 100 again. If it does not, vary the 470 ohm trimpot until it does. That completes the calibration of the capacitance meter. Now try measuring other components to confirm that the measurements are reasonable.

With care, an accuracy of five percent or better should be possible on most ranges.

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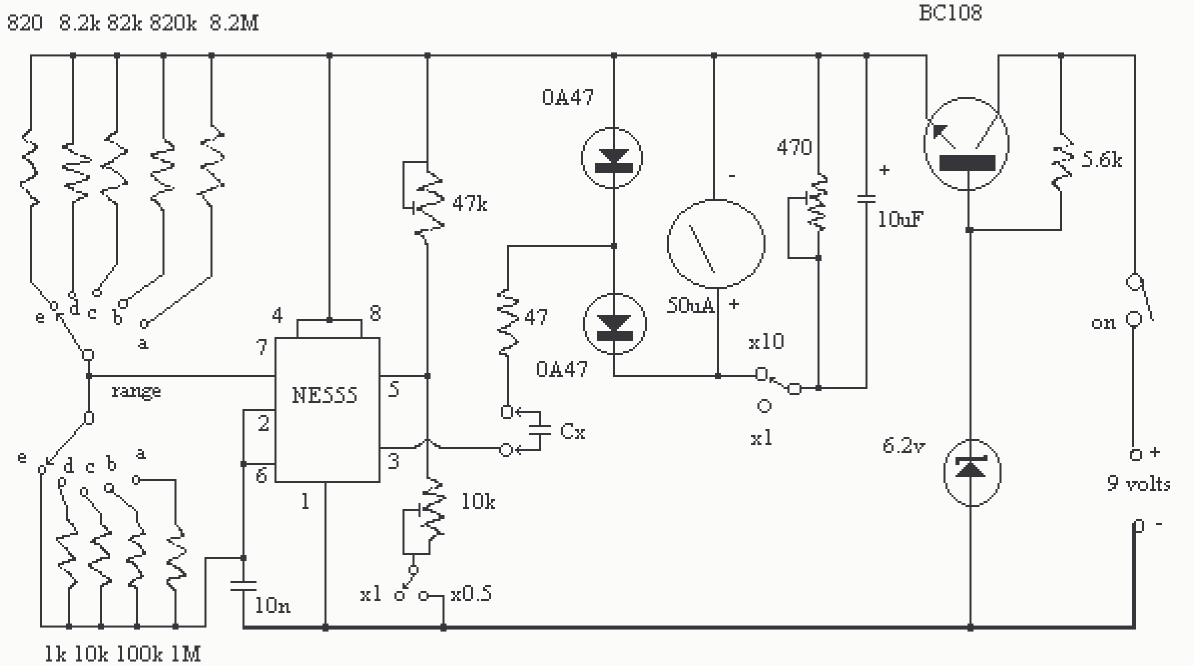
Figure Three

Capacitance Meter



Position	Range
a	1uF
b	100nF
c	10nF
d	1nF
e	100pF

Use x10 switch to measure up to 10uF
Use x0.5 switch for better readings on low values

See text for alignment details

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REFERENCE

Hawker, P Amateur Radio Techniques, Seventh Edition, RSGB, 1980

FURTHER READING

A Guide to Test Equipment – Novice Notes August 2000

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Bulletins (Sundays at …)
11h15 Start call in of stations
11h30 Main bulletin start

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439.000MHz 7.6MHz split
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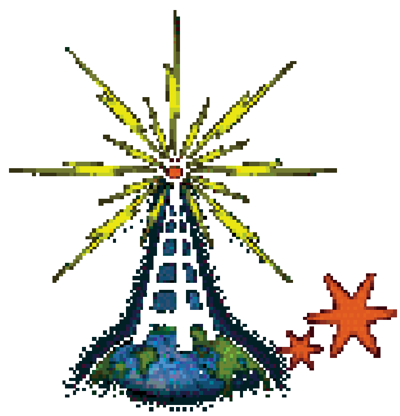
West Rand members - we need your input!

To make this the best ham radio magazine in South Africa we need your input. Please submit articles, comments, suggestions etc.

Please send plain text with no formatting to the email address below.

In July 2003, we re-published an Anode Compendium on CD. It has the issues from July 2000 until June this year. This included the new Adobe reader. It has been updated, check with the chairman for details.



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