THE WEST RAND AMATEUR RADIO CLUB

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Volume 2, Issue 6 of 7

ANODE

Inside this issue:

Editor's Comments

With the holiday season upon us, my 'house joblist' has grown to gigantic proportions. I cannot go away, I have too much to do around the house. The Anode had to be deferred from the beginning of December because of too much work. Unlike this time last year, its been a mad rush to get things done before closure on the 21st.

I recently had the opportunity to set up a new Linux machine. This was the latest Slakware version on a 'classic Pentium'. [Pentium is a trademark of Intel and should always be noted as such. Intel is a contraction of Intelligent something and is also a trademark.] It setup very smartly and told me exactly what it was doing (installing). It took a whole 10 minutes and then asked me for the network ip addresses etc. Having done it before, it was but a minute later and it was up and running on my network. Ironically this is a machine to set up Windows 98SE on diskless pc's which generally take around 45 minutes to get to the GUI. Yeah, I know its an unfair comparison as the Linux machine is a server running console only applications. I suppose it takes about the same time as to set up Dos on a pc.

I believe we need a few 'HowTo' type articles in the Anode. These are short explanations on how to do something in Amateur Radio. So far I have been collecting

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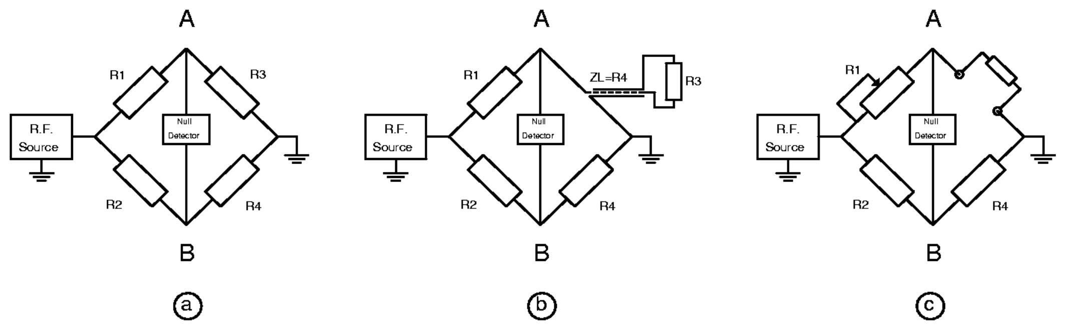
Antennascope

The antennascope is perhaps one of the most practical methods of doing antenna measurements. A true indi-



cation of resonance for the applied frequency can be seen as a direct reading from the calibration scale.

The antennascope is based on the well known Wheatstone Bridge principle. Fig a will be easily recognised as such. In Fig a, when R1= R2 and, R3=R4, then the bridge is in balance and no current will flow through the centre arms. The R1, R2 combinations do not have be equal to R3, R4 combinations for the bridge to remain in balance. In Fig b, R3 is replaced by the antenna under test and R4 is replaced by a variable resistor (non inductive).

Fig - 1 The resistor - bridge SWR measuring

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Special points of interest:

- Contact details on back page

Antennascope

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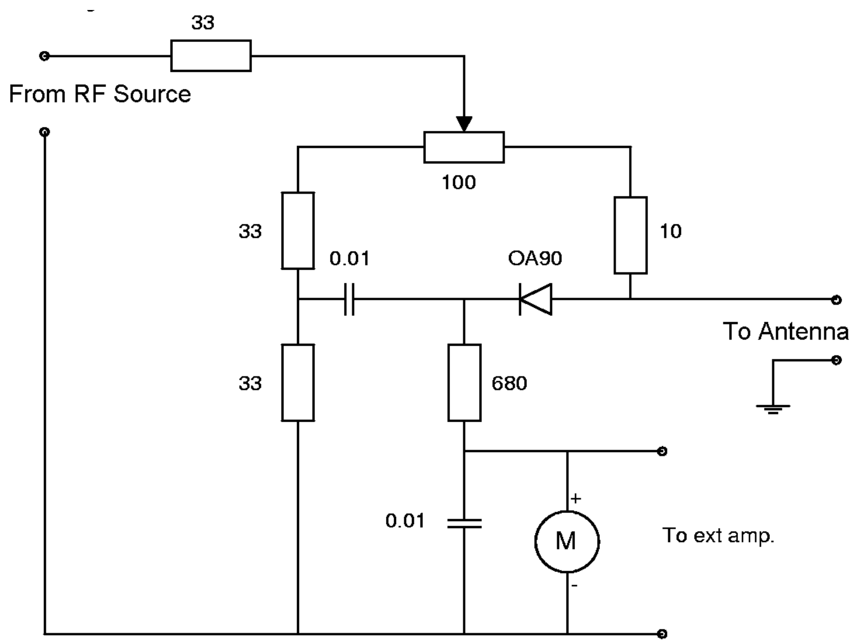
device is an adaptation of the Wheatstone bridge, (a). When the arm ratio is balanced, no voltage is present at the null detector. One arm of the bridge may be removed and replaced with the feedpoint resistance of the antenna, (b). If the opposing arm of the bridge is made variable, measurements may be taken over a wide range of antenna feedpoint values, (c).



The R.F. version of the bridge employs non-inductive resistors in each arm and uses a rf oscillator as the signal source. The principle of operation is exactly the same as the bridge designs. When the arm ratio R1/R2 equals R3/R4, the bridge is in balance and no output voltage is present at the null detector. As one arm of the bridge, (or the ratio of the two arms). changes from the balanced value, the bridge becomes unbalanced and the voltage detected across points A-B increases in proportion to the unbalance.

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An Automatic FM Deviation Meter Part 2

by Roger Ray
[Continued from the November Anode]

In this concluding part of the article we cover the contraction and calibration of the instrument, and include some ideas for its further development. Assembly of the modulation meter is straightforward, especially if the PCB layout (Figure 4) is used. The shape of the PCB allows a 6VA mains transformer to be fitted in the box used. The IC sockets should be soldered in first followed by resistors, capacitors, inductors, diodes and transistors in that order. If IC sockets are not used, then the integrated circuits should be soldered in last. Care must be taken to ensure that transistors are correctly orientated in their relevant positions. Q3 is soldered to the track side of the board. A 5mm hole should first be drilled in the PCB, to accommodate the body of the transistor. Pin 2 of the mixer is underneath the 'M' of 'MCL' stamped on the top, it should be positioned as shown on the layout drawing.

The varactor diode D6 is actually comprised of two diodes in one 'snap apart' package. In this application, the two are mounted separately being snapped apart by applying slight pressure with the fingers.

When viewing the diode from the legended side with pins facing downward the cathode (+) is on the right hand side.

Be careful to fit the rectifier bridge D11, the 1000uF capacitor C31 and the regulator IC5 the correct way round, or severe damage will occur at 'switch on'.

After all components in the VCO section have been assembled, the tap on L3 can be made. A piece of tinned copper wire (approx 22swg) is very

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Editors Comments

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topics such as getting circuit diagrams to the Anode for printing, printing dos apps under Windows 9x and so on. Om John (WL) uses Tango pcb for his diagrams and pcb layouts and as this is a dos program has a problem reproducing the diagram in a graphics format. On closer inspection, Tango has an optional output of printing to a PostScript file. This is a text file containing instructions on how to draw the printed picture. PostScript files usually have the extension .ps. They can be opened with Notepad or any other text editor and you can then see a whole bunch of readable instructions on how to draw the picture. This file can be sent directly to a PostScript printer usually a laser and quite often now a colour laser. It can also be read and understood by other applications one of which we use to reproduce the Anode. This is GhostScript/ GhostView, a pair of free / public domain products which reads in the printing instructions and reproduces the pictures and text on screen. It also allows it to be saved as graphics file or an Adobe .pdf. The pdf type of file has become very popular over the last few years as its readable on pc's and Macs and other machines.

Don't forget though dos programs that use the vga/ega graphics screen for display can be captured in Windows. Simply make the screen as large as possible. Either a full screen or maximised window and press Print Screen. Switch back to Windows with Alt-Tab and paste the clipboard contents into Paint or Wordpad. If the dos app runs as a maximised window and not full screen, then use Alt+Print Screen to capture the active window to the clipboard. It is possible to have the output of a dos program captured straight onto the clipboard using a small utility program. But a simpler way is to capture the printed output to a windows printer driver.

If you have a dos program creating a graphics output that you want to capture then you need to add a 'virtual printer' to your machine. This is where you can enjoy delusions of grandeur and install a printer driver that would normally cost as much as a car. The only thing here is to connect it to a port called 'FILE:'. By the way this is possible in Windows 3.x as well. Go to the Printers folder and Add a printer. Select a printer such as

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An Automatic FM Deviation Meter Part 2

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carefully soldered on to the coil 2 3/4 turns from the earthed end. This operation must be done with great care, or the result will be a molten coil former and the acrid fumes from the plastic dripping from the end of your soldering iron.

Next the screening box surrounding the VCO can be soldered in position.

When all of the components have been soldered into the PCB, the IC's can be fitted into their sockets, again being careful to get them the correct way round.

The box together with front panel is assembled next. The mains transformer is fitted in the extreme rear right hand side of the box. It is fitted to the base cover with 6BA screws through 3mm holes drilled in the base cover.

The primary windings are wired in series (2 x 115v), and the two secondary windings (2 x 6v) are also wired in series.

This gives a primary of 240 volts and a secondary of 12 volts.

The assembled PCB is now fitted from the underside of the box. Note that only the screw nearest to the mixer makes contact with the earth track on the board, this is to prevent a 'hum' loop being formed in the earth track. The same considerations apply to this type of circuit construction as apply to any AC amplifier.

All interconnecting links on the board should be made with insulated wire.

The connection between R4 and R33/R34, together with the connection between R4 and C22, should be made with screened cable to pre-

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An Automatic FM Deviation Meter Part 2

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vent hum pick-up.

With the PCB fitted, the front panel can now be removed to allow the hole for the meter to be cut. The switches LED s and BNC socket all fit in pre-drilled holes, so they can now be assembled. Fit the meter with the scale shown in Figure 5 or alternatively make your own, and fit the meter into the front panel.

Cut 6 inch lengths of insulated wire and solder them into all flying lead positions on the PCB. Now refit the front panel and wire up the meter and other components. Wire the mains transformer secondary to the rectifier bridge D11.

Three core flex should be used for the mains wiring. Connect the earth lead to a good earth position in the box. Wire the 'live' through the fuse F1, and use a maximum fuse rating of 1 amp. Carefully insulate all mains connections with PVC tape and sleeving. Assembly should now be complete.

Errata

A few gremlins crept into the part 1 circuit diagram. R35 should be 4K7 as shown in the parts list. Values of C7 and C8 should be 100n and 10n respectively (reversed on the circuit and in the parts list). Also a 4.7uf (CX) capacitor was missed out entirely. It should go between R21 and pin 2 of IC2, positive end to IC2, the CA3140. IC4 earth should go to pin 11, not pin 8 as shown.

R35 (Next to 'RESET' should be R36 the value of 100R is correct.

D10 is shown reversed, A corrected version of the diagram will be supplied with any kits – or you can get a corrected copy by sending the reader's services department an SAE.

Testing and Alignment

It is preferable not to use the internal mains PSU during initial testing.

Temporarily disconnect the wires to the secondary of the mains transformer, and connect them instead to a 16-18 volt DC power supply (with current limiting if possible). Switch on the external power supply, and check that 12 volts is present on the output of the regulator.

Temporarily short out the reset button to make sure the sweep oscillator is not sweeping. Apply a 10.7MHz carrier signal of about 50mV between pins 3/4 of the mixer and earth. Adjust the core of T2 to give a DC voltage of 5.5 volts on the junction of R33/R34.

Set VR2 fully clockwise, and measure the AGC voltage on pin 5 of ICI. Adjust T1 and T3 for maximum AGC voltage. Reduce the output level of the signal generator as necessary to keep the voltage in the range I □ 4 volts. Now re-adjust T2 for 5.5v on the junction of R33/R34. AM modulate the signal generator with 1KHz 50% and adjust VRI for maximum brilliance of D5.

With the reset button still shorted, adjust L3 to give a VCO output of 27MHz, measured on C19 with a frequency counter or monitored on a nearby receiver: This adjusts the low frequency end of the VCO range. Disconnect the signal generator and make sure it is turned off.

Remove the short from the reset button, and measure the voltage on the Q8 end of R28, using a moving coil meter (AVO etc) or an oscilloscope. Adjust VR5 so that the voltage rises to a maximum of 10.5 volts and repeatedly sweeps up from a lower voltage (level dependent on measuring instrument, oscilloscope approx 2.5v, AVO approx. 5v). If VR5 is set too high the voltage will only sweep up once after the reset button is pressed, if it is set too low the voltage will not reach 10 volts.

With the sweep oscillator running the VCO should be sweeping over the range 30-55MHz. Re-check the AGC voltage, and if necessary back off VR2 until the meter reads less than 0.5 volts. Apply a DC voltage of 3.0 volts to the junction of R33/R34. Measure the voltage on pin 7 of IC4 and adjust VR7 until the voltage just

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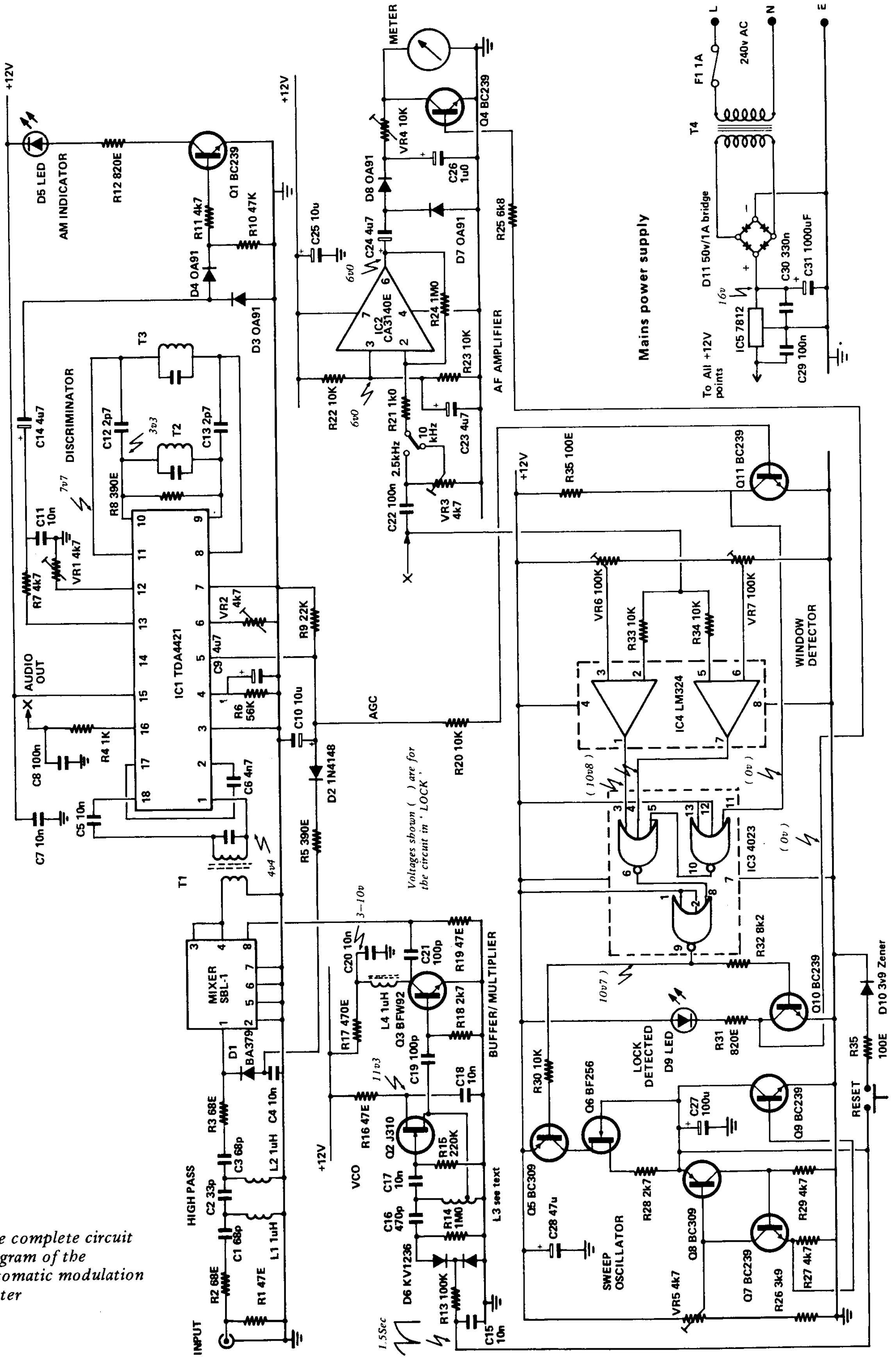

The complete circuit diagram of the automatic modulation meter

TRUTHS ABOUT LIFE

GREAT TRUTHS ABOUT LIFE, THAT LITTLE CHILDREN HAVE LEARNED:

1. No matter how hard you try, you can't baptize cats.
2. When your Mum is mad at your Dad, don't let her brush your hair.
3. If your sister hits you, don't hit her back. They always catch the second person.
4. Never ask your 3-year old brother to hold a tomato.
5. You can't trust dogs to watch your food.
6. Don't sneeze when someone is cutting your hair.
7. Never hold a Dust-Buster and a cat at the same time.
8. You can't hide a piece of broccoli in a glass of milk.
9. Don't wear polka-dot underwear under white shorts.
10. The best place to be when you're sad is Grandpa's lap.

GREAT TRUTHS ABOUT LIFE, THAT ADULTS HAVE LEARNED:

1. Raising teenagers is like nailing Jelly to a tree.
2. Wrinkles don't hurt.
3. Families are like fudge . . . mostly sweet, with a few nuts.
4. Today's mighty oak is just yesterday's nut that held its ground.
5. Laughing is good exercise. It's like jogging on the inside.
6. Middle age is when you choose your cereal for the fibre, not the joy.

GREAT TRUTHS ABOUT GROWING OLD:

1. Growing old is mandatory; growing up is optional.
2. Forget the health food. I need all the preservatives I can get.
3. When you fall down, you wonder what else you can do while you're down there.
4. You're getting old when you get the same sensation from a rocking chair that you once got from a roller coaster.
5. It's frustrating when you know all the answers, but nobody bothers to ask you the right questions.
6. Time may be a great healer, but it's a lousy beautician.
7. Wisdom comes with age, but sometimes age comes alone.

THE FOUR STAGES OF LIFE:

1. You believe in Santa Claus.
2. You don't believe in Santa Claus.
3. You are Santa Claus.
4. You look like Santa Claus.

Editors Comments

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the HP LaserJet 6M Colour and PostScript capable. You can also use Apple Color Postscript types or Tektronix PS types. Connect it to FILE: and make it the default printer for now. You might also want to capture a printer port Lpt1 as well. This will make a dos program think its printing to a super printer. The printing operation is simple, Whenever you decide to print to this printer, it will pop up a box asking for a file name. Type in a file name with the extension .ps and click the ok button. I generally say yes to the question that asks if I want to print a test page and give it a filename test.ps. When you check the file you will see its fairly small and readable in Notepad or Wordpad. You can now open it with GhostView and it will display perfectly on screen as if it had printed there. This file can of course be attached to an email and sent to the Anode for inclusion there!

Did you know the RSGB issues its bulletins as a recording on the Internet? Unfortunately its a Real Audio clip but its size is quite reasonable around 900k bytes.

Measurement of deviation. Its going to become necessary to keep the deviation at reasonable levels in future on 2m. This is because the band planners are quite determined to allocate frequencies according to 12.5kHz channels. This has been coming for a long time, last century in fact. It is a requirement of your amateur radio licence that you should be able to measure the transmission from your station and keep it from interfering with other stations. This to my knowledge has never been enforced by the regulatory bodies here in SA. It

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Antennascope

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The arm resistor R3 may be removed and the feedpoint resistance of an antenna substituted in its place. If the adjacent arm is made variable, the bridge will be balanced when the variable arm equals the resonant feedpoint resistance of the antenna. The variable arm permits measurements to be taken over a wide range of antenna feedpoint values and the exact feedpoint resistance is read from the variable resistor setting when the is adjusted to balance.

Building the Antennascope

The antennascope requires a low power R.F. source to drive the bridge. A practical source is a dip oscillator, (or the output of a hand-held on low power - Ed.). The older valve type dip oscillators sufficient power to drive the bridge and detector directly, but most semiconductor type provide less than 50mW of power output. A DC amplifier added to the antennascope provides a usable meter reading. The circuit of the antennascope is shown in Fig - 2

Fig - 2 Bridge circuit of Fig - 1c is adapted as an antennascope. The instrument is driven by a dip oscillator via a 2 - turn loop placed at "R.F. in" socket. Antenna under test is attached to the "ant" socket Resistors are 5% composition type.

The antennascope has three connectors:- one for the R.F. drive source, one for the indicating meter, and one for the antenna under test. The instrument should be built into a small aluminium or die cast box just large enough to house all the components and provide space for the meter and calibration scale. The bridge is modified slightly in that the variable arm subtracts resistance from one leg and adds it to the other, spreading out the low end of the resistance of the resistance scale for increased accuracy. The small components are supported by their leads and no extra wiring is required in this compact assembly.

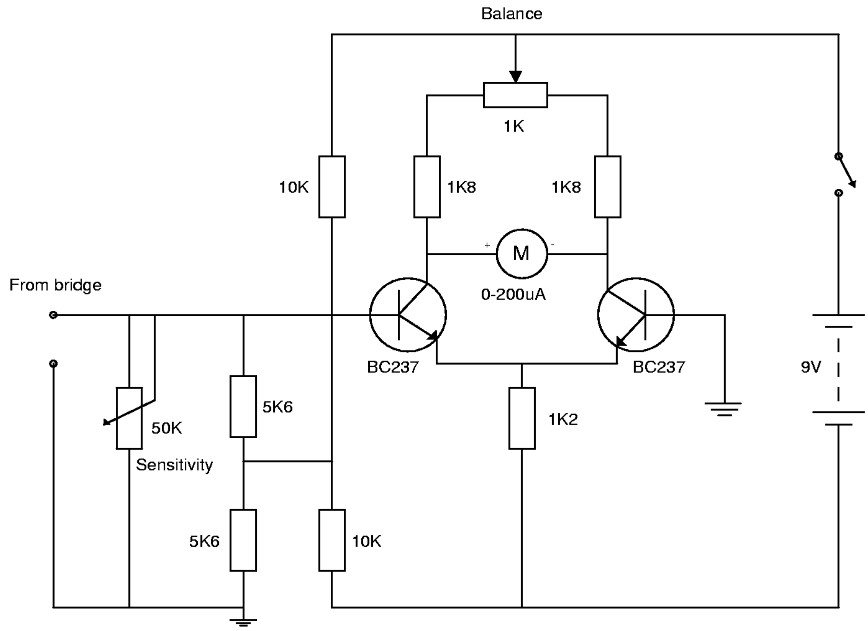

Fig - 3 Meter amplifier for the antennascope when a low power signal source is used. Meter is balanced for zero by the 1K potentiometer.

After the antennascope is assembled is calibrated with use of 1/2 watt composition resistors of known values. The antennascope is coupled to the R.F. drive source and various resistors (4.7, 10, 18, 27, 47, 56, 68, 82) are connected across the "ant" terminals. The resistor leads are kept as short as possible to reduce adding further inductance to the circuit. The variable bridge resistor is adjusted for a meter null for each test resistor and the dial setting is logged. Intermediate points may be obtained by interpolation. Calibration points are now marked on a paper scale for the complete rotation of the dial and the calibration should hold from 2 MHz to 30 MHz.

Using the antennascope.

The antennascope is used in conjunction with a dip oscilla-

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Antennascope

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tor. The amplifier circuit of Fig - 3 may be added as an external driver for the meter. The antennascope is attached to the feedpoint of the antenna under test and sufficient drive power is applied to obtain a usable reading. The frequency of the dip meter, and the resistance of the antennascope are varied until a dip is obtained. The frequency of the driving source, (as picked up on a nearby receiver) corresponds to resonant frequency of the antenna element and the reading from the calibrated dial on the antennascope will give the feedpoint resistance.

Note that the case of the antennascope is common to one side of the input and output circuits. If the antenna terminals are balanced to ground, it may be necessary to place a one - to - one balun between the instrument and the antenna. In this case, the antennascope and driving source must be insulated from the antenna structure.

The antennascope can be used for measurements when coupled to the antenna through an electrical half - wavelength transmission line. Measurements are not quite as accurate as when directly made at the antenna terminals, but the convenience of placing the antennascope at a more convenient spot at, or near ground level may outweigh the possible loss of accuracy. Various handbooks describe the method of trimming a section of co - axial line to the electrical half - wavelength with the aid of a dip oscillator. The line is attached to the antenna terminals and brought down to the antennascope. Measurements are now conducted and, as long as the interconnecting line is an electrical half - wavelength long to at the test frequency, it is "transparent" to the antennascope which only "sees" the antenna load.

Condensed from the Beam Antenna Handbook.

A Suitable Oscillator for the Antennascope

Below is a suitable oscillator for the antennascope described previously. With a little ingenuity, it could be incorporated into the same enclosure. The coil and tuning capacitor would have to be selectable, but I think this a suitable discussion for our technical meetings. I have built this oscillator for 40m when I was tuning my wire antenna and was quite impressed with the stability of the circuit.

The circuit is the venerable Collpits oscillator, which always seem to oscillate, even when it is not suppose to. The component values do have a slight amount of flexibility and the layout is not as critical as some other oscillator types, although good construction sense makes things work better.

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has been left to the amateur to keep an eye on reports from others, who don't know what they are talking about anyway, and to keep his level up or down depending upon reports received. The measuring equipment to do this is usually expensive and way beyond most amateur's budgets. [Its possible to build this equipment for a reasonable amount, see the article in November/ December Anode] Most hams have never checked their rigs deviation or power output levels since purchasing the rig.

It is possible to adapt a standard rig to measure the received signal deviation. Whilst it won't be lab standard accurate it should serve to reduce the over deviation from some stations. You normally adjust the volume control on your rig for comfortable listening which means the loudest always wins. By connecting a peak reading audio meter across the volume control and calibrating the meter with a known signal you can then tell received stations that they are within the limits or over deviating.

Maybe it should be the responsibility of the club to provide such test equipment. What do you think?

An Automatic FM Deviation Meter Part 2

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Jumps 'high (10 12v). Increase the applied DC voltage to 8.0 volts and measure the voltage on pin I of IC4. Adjust VR6 until the voltage on this is just goes 'high'.

Connect a signal source of 100mV in the range 30-100MHz to the input of the instrument. D9 the lock LED – should now illuminate. The LED will occasionally flicker as lock is lost and then re-established. With the instrument in the 'locked' state, the two FM deviation ranges can be calibrated. Set the 2.5/10kHz switch to the 2.5kHz setting, FM modulate the signal source to 2.5kHz and adjust VR4 for near maximum reading on the meter (set to 2.5 if the meter scale of Figure 5 is used). Switch to the 10kHz position apply 10kHz deviation, and adjust VR3 for near maximum reading on the meter (10V on the lower meter scale).

The modulation meter should now be fully operative and the mains transformer can be reconnected, and mains power used. Check the output of the transformer to be absolutely certain all is well.

Using the Modulation meter

The instrument is very easy to use. Simply connect the signal to be measured to the input socket, check the lock LED is illuminated, and read the peak frequency deviation from the meter. If the lock LED does not light, the input level must be too low, or the frequency is below 20MHz. When using input frequencies below 30MHz it may be necessary to use the reset button to establish lock. Care should be taken not to overdrive the modulation meter, maximum input is 1 volt. Direct connection to a transmitter will cause expensive damage.

An aerial should not be connected to the input socket, because the sweeping oscillator may cause interference to nearby receivers.

The normal input frequency range is 20-175MHz. As higher order VCO harmonics are present at the mixer input, the meter can be used up to 500MHz. At frequencies above 175MHz, the modulation meter stays in lock for shorter periods of time. The resulting meter flicker makes accurate readings more difficult to obtain, but nevertheless possible.

AM modulation and AF output

In the basic form of the modulation meter, AM modulation varies the brilliance of the AM LED. The AM output can be switched to the meter, and the meter calibrated in % AM modulation. As long as the circuit is operating within the AGC range of IC1.

The reading will be reasonably accurate (+/- 5% for input levels over 50mV). Greater accuracy could be obtained by comparing the AGC voltage to a reference voltage with a comparator (one of the spare Op amps in IC4 could be utilised), and driving D1 until the AGC equals the reference. The more ambitious designer/ experimenter may like to pursue this approach. Audio output can be taken from a number of points. Low level FM audio is available with 6db/ octave de-emphasis on the junction of R4/C8. A higher level flat response audio output is available on pin 6 of IC2. AM audio output can be taken from the junction of D4/ R10. The complete circuit could form the basis of a scanning monitor receiver. An RF amplifier would be required on the input, to increase sensitivity and reduce oscillator leakage. The circuit would lock onto the first signal encountered on the sweep. The length of time the circuit would remain locked being dependent on the leakage from C27 and the stability of the VCO. With a suitable input attenuator this would make a good 'bug' detector.

From REW NOVEMBER 1981

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Bulletins (Sundays at ...)
11h15 Start call in of stations
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Frequencies
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Radio Amateurs do it with more frequency!

We are going on the Web
www.zs6wr.org.za

Please note this has been just been registered. Our site will be up in the new year.

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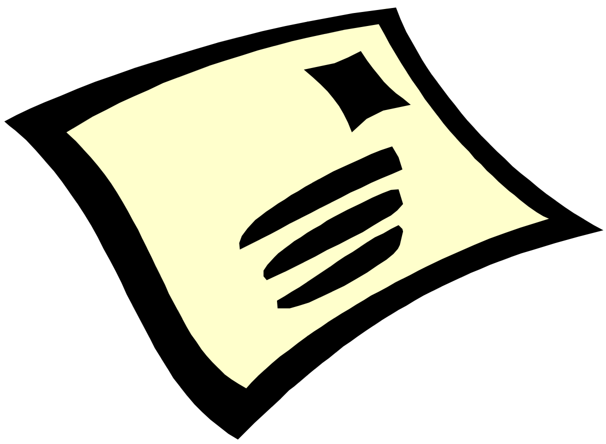
West Rand members input - we need your input!

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 November, we published an Anode Compendium on CD. It has the issues from July 2000 until November this year. This included IE5.5 and the new Adobe reader.



We need your input! Email us articles, comments and suggestions please.
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