

# ANODE

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## Editor's Comments

This last week I was in Durban for a client. It was cloudy and rained heavily in the early evening. Not the sort of weather I expected in Durban. More like the UK.

The weather here in Gauteng has been cool and sunny with no great thunderstorms yet. Remember to unplug antennae and phone lines when surrounded by rumbling storm clouds.

There's more from the

SARL this month with the 2m band plan. This was sent to me by Dave (ZR6AOC the Chairman) in portable document format. Unfortunately this also meant me retyping the table and missing the self-imposed deadline for inclusion in the Anode. I shall put it next month's issue.

This Adobe invention allows text, pictures and now multimedia in a readable document. The latest version, 5.5, has some new features and fixes

version five's tendency to crash. In the recent film 'Minority Report', Tom Cruise empties a cereal box into a bowl and sets off the animated cartoon displayed on the side of the packet. These cartoon characters then sing a cheery morning song and won't shut up. Even when thrown to the other side of the room. Your Anode could be doing just that soon! They have discovered that they can

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## The cross field antenna in practice

Can the CFA really work? Bypassing the complex theory of the controversial March article\*, C. Bryan Wells has produced practical versions which suggest that it does.

Mainly because James Clerk Maxwell is my scientist hero of days gone by I carefully read the March article and became almost hooked when I came across the words quoted here from the final paragraph. For some time I had been thinking along the lines that an antenna is really a coupling device coupling electromagnetic energy to space and that

there ought to be ways of achieving this process as alternatives to monopoles, dipoles and loops. Was this one of those appealing concepts with seemingly great initial promise whose claimed potential is never realized in practice? Indeed, could it possibly be a hoax?

There seemed to be only one thing to do - to see if the cross-field antenna (CFA) could be made to work. The first step was to extract as much information as possible from the diagrams and photograph on page 218 by scaling to the one dimension quoted - 70cm overall height (see Fig.1). The fol-

lowing dimensions are estimates: E.) cylinder height; D plate overall diameters. and the diameter of the feeder access holes in the D plates (because of the obscuring effect of the eight supporting and insulating rings in the middle of the "barrel").

I started by making a half size version. winding aluminium foil around powdered milk drums and cutting off the tin plate ends to form the D plates and then forming seven annular support members from polystyrene

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## Special points of interest:

- Contact details on back page

## The cross field antenna in practice

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packing material. The 50% power split and phasing were arranged as in Fig.2. Perched on an easterly-facing window ledge, this unit yielded a number of successful contacts with British, Irish and European stations on 7MHz, at 100W.

Since then I have engineered a second half-size version, this time using coffee tins, and a further version properly fabricated from aluminium to the dimensions in Fig. 1. This full size CFA shows considerable promise. At night the results are almost as good as both my double zepp and an 82m circumference vertical loop, both at about 10m. The full-size CFA is mounted against the peak of the roof space in the house at about 8m above

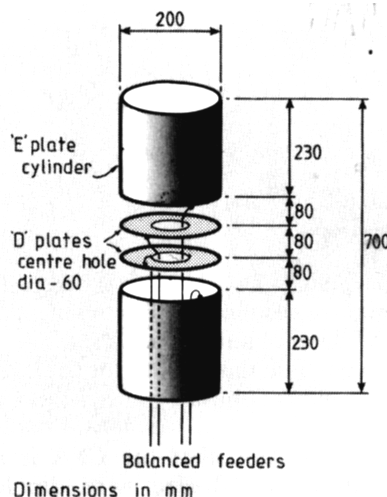


Fig. 1. Barrel shaped cross field antenna. Dimensions are estimated by the author from the photograph and Fig. 1 of the article by Abbacy, Hatley and Stewart (March issue).

ground.

### Precautions

I have taken precautions such as earthing other antennas, in case coupling to them was responsible for the results achieved, and checking that the feeders were not doing most of the radiating with an efficient antenna matching unit it is possible to make any piece of conducting material into some kind of RF radiator.

These checks were threefold. First I removed the quarter-wave lines and directly fed the device through 45cm lengths of 300Ohm ribbon with a balanced L-network phasing circuit interposed between the feeder and matching unit on one side and the CFA then mounted about 30cm above the matching unit. This arrangement worked satis-

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## Microprocessor Inductance - Capacitance Meter

Inductance and capacitance are at the best of times, a pain in the butt to measure accurately, and for those of you that are in the DIY radio frequency and or other electronic persuasions, projects or QRP building, this is a "must" have test instrument!

Well I have found the answer to your prayers! Neil Hecht, of "Almost All Digital Electronics USA" (can't remember his call sign off hand) has designed such a gadget, using the ubiquitous PIC 16F622 microprocessor chip and a handful of other parts. I have made a small change here and there, otherwise I cannot claim any credit unfortunately.



Just look at these specs!

Range: 1nH to about 150mH  
0.01pF to about 1.5uF  
(Note: Cannot measure electrolytic capacitors)  
Automatic ranging: no range

switch required.

Typical accuracy: 1%, compared against an HP4275A LCR bridge and a B & K Digital LCR bridge.

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## Editors Comments

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'print' transistors and components onto paper or cardboard.

### This issue

The first article features a small hf antenna ideal for flat-dwelling hams. The article was taken from the November 1989 issue of *Wireless World*.

OM Bob (ZS6RZ) has been busy assembling a very compact inductance/capacitance meter. Its relatively low cost and high accuracy should make it a "must have" for most amateur constructors.

It uses a small programmed microprocessor for the measure-

ment and display. Having seen and tested this baby I can honestly say its well worth the construction.

### Exchanging data through touch

Two Japanese telecoms giants have developed technology that turns the human body into a broadband-paced link that allows email addresses to be exchanged through a simple handshake, a report has said.

The technology, developed by Nippon Telegraph and Telephone Corp. and its subsidiary NTT DoCoMo Inc., uses the body's conductivity and adds the smarts of a personal digital

assistant (PDA), the *Nihon Keizai Shimbun* said.

A device attached to a PDA can send and receive weak electrical signals through people, with human bodies as communications circuits, the paper said, citing sources close to the companies.

Apparel and handbags have their own conductivity, allowing an electrical connection to a PDA that can remain in one's pocket, the paper said. In this way, people can exchange email addresses, names and phone numbers while shaking hands, with the data automatically written into both their PDAs, the paper said. The

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## Microprocessor Inductance - Capacitance Meter

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Self calibrating: against 1% capacitors within the circuit.

Displays in direct engineering units, i.e. uH, mH, uF, and pF

One can also "zero" the display reading to take care of "stray" capacitance and inductance of the circuit board and the test leads.

Percentage comparison measurements i.e. should you need to measure a bunch of the same value components, it will indicate by % how much they differ from one another.

Display is on an intelligent alpha-numerical liquid crystal

device (this is the most expensive component - I have found an economical source for these!)

This is an excellent piece of equipment, and I fully endorse it. A good project to tackle.

Disclaimer - apart from being a very happy chappy user, I have no connection or interest in Neil's business "Almost All Digital Electronics USA"

I must just say - "Thank you Neil, for a great design, and simple at that!"

This project apparently appeared in the (American) July 1998, *Electronics Now* maga-

zine. (I found it on the web)

His claims for this circuit and its specifications were unbelievable, but all proved to be true.

He does market a kit, however in Rand terms, this comes in at about R1,100.00 plus postage, packing, VAT and import duty, settle on about R1,300.00 by the time you have it in your hands.

But do not despair, I have done lots of homework, have actually built a unit, and can vouch for the results. It can be built much, much cheaper, sourcing all the parts in South

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## The cross field antenna in practice

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factorily if slightly down. Next I reintroduced the quarter feeders and Moved the CFA to the peak of the roof space. I reasoned that if the feeders were doing most of the work, elevating the CFA so that the feeders had a 6m vertical run should bring about a very significant improvement. This did not occur. The reception improvement was just noticeable by ear.

The third check was to compare 300Ohm feeder radiation with a double zepp as load, at 80W, with that of both the CFA feeders taken separately, each taking approximately 50W. The detector was a 6V flash lamp bulb to which was connected 25cm of 300Ohm ribbon, shorted at the open end. This check showed that radiation from the CFA feeders was much less than that from the double zepp feeders or from a well matched twin-lead dipole.

To detect the CFA feeder radiation it was necessary to clip the 25cm of detector ribbon to the CFA feeder. There was no bulb glow with a 12mm separation.

To check radiation from the CFA itself I used a 240V neon bulb. again with 25cm of shorted 300fl ribbon attached. This insensitive probe was incapable of detecting feeder radiation, but showed a distinct glow when positioned within 8-10cm of the CFA excited with 100W (2 X 50W).

It is still possible that all the CFA does is to provide a useful metallic radiator "tuned" by the antenna matching unit. However, in a great deal of experience with extended coils, loaded whips, helicals etc., I

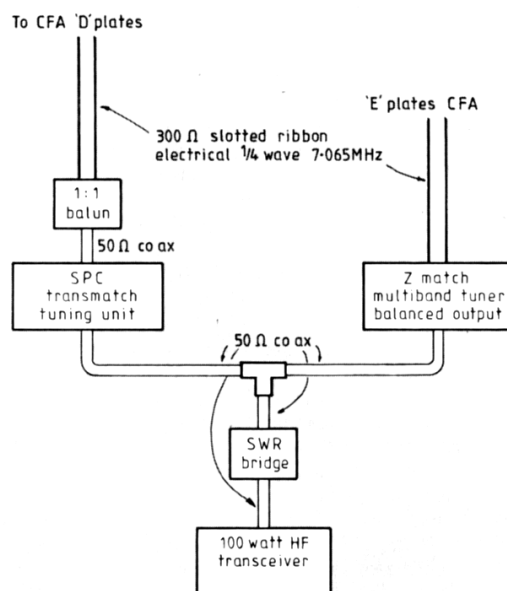


Fig.2. Feed arrangements, showing a quadrature feed for the E and D plates. In practice, a balanced L network was used to give a 90° shift while eliminating the need for a second quarter wave phasing section.

have not been able to produce

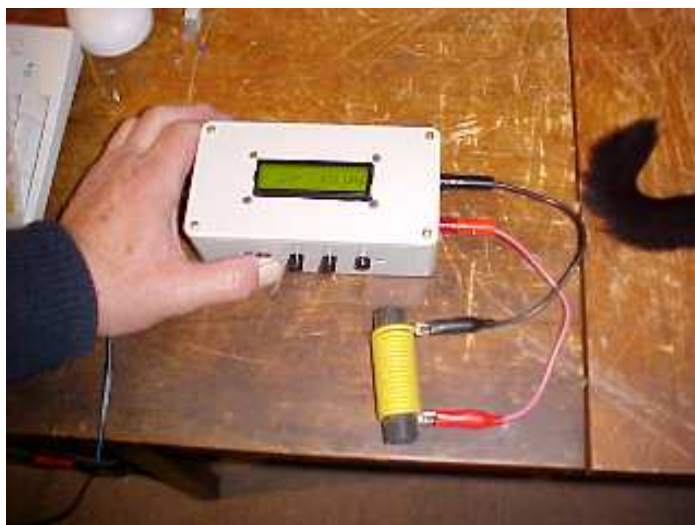
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## Microprocessor Inductance - Capacitance Meter

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Africa. I have got a huge amount of junk-box bit's and pieces, and as such I managed to build this unit for about R100.00! I have done a few rough sums, and if you buy everything new, it would probably cost about R250.00 - R300.00, depending on your junk-box. I still need to do an accurate costing though. I have the software HEX code and can program the PIC processor for you.

A PC board is also available from myself. Should you not feel confident about building



this unit or you do not have the time, I can do this for you, for a small consideration.

Commercial units run into the thousands of Rands, the cheap-

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## Editors Comments

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companies have confirmed in an experiment that data can be transmitted at 10 megabits per second, comparable to the speed of a broadband Internet connection, it said.

The technology could allow data communications through door knobs, switches, desks and chairs, the paper said. It could pave the way to one day being able to pass through railway ticket gates or entering secure buildings with a simple touch.

It could also get a computer to start up with the proper settings as soon as the user sat down, the paper said.

From AFP

### **The Pentium III is dead, Long live the Pentium IV**

There will be no 'cheap' Pentium's for xmas this year. The Pentium III is no longer in production and the local suppliers are running out of stock.

Windows 98SE is also running out and making many corporate buyers move to a later operating system. Unfortunately for Bill, not all are looking at Windows as their new platform. MS announced that their latest office suite will only run on XP and Win2k when it is released has brought howls of dismay from others. This will definitely kill off Win9x in the long run. It

remains to be seen if the majority of users will migrate to another operating system. It certainly will give a boost to the developers of "Lindows".

73

JB 2002-11-10

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## Microprocessor Inductance - Capacitance Meter

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est good unit I know of, is about R3000.00 odd.

Just take a 30 cm piece of 16 gauge straight piece of wire and measure it, you will be knocked out, or twist two pieces 10cm long insulated wire together and measure the capacitance, you'll be amazed!!

Should there be enough interest, and money "up-front" (I burnt my fingers before with hobbyists not putting their money where their mouths are!) I will organize kits for interested persons.

Incidentally I also have info and PC boards for PIC frequency

counters, timers, VFO stabilizers, PSU's and many other bits and pieces of interest.

73's,

Bob.....ZS6RZ

Mobile phone: 083-675-3951  
or home: 011-672-7475

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(for OM Henk)

## The cross field antenna in practice

(Continued from page 4)

results which compare with those I have obtained with the CFA. It is also possible that I have not achieved the optimum in phasing, power split and matching.

I cannot claim that the CFA is as efficient as a full-size wire dipole, although it is only very slightly down on a 40m twin lead dipole, also up in the roof space, which I have used as a reference.

### How does it work?

If I have come to believe that the CFA concept has some real

sion of a device analogous to our normally understood antennas.

The power carried by an electromagnetic wave is proportional to the product of the electric field  $E$  and the magnetic field  $M$ . If some way can be found of augmenting either  $E$  or  $H$  then this will result in a greater overall field intensity.

In the original CFA article it is emphasized, and the authors claim to have demonstrated, that "the  $H$  field may at any time be the combination of two

trying 180' (on 7.065 MHz.), with an extra electrical half wave to one of the elements, I found greater success in terms of transmit reports and reception with a 90' quarter-wavelength addition. I eventually replaced this additional quarter-wave line with a balanced  $L$  network at one side of the origin of the two power-splitting quarter-wave lines, with no apparent change in performance.

Using a twin variable capacitor in this network gave the possibility of fine adjustment. As previously stated, this arrangement

The important features of these antennas are (i) that they are extremely small, excellent receivers, powerful, efficient radiators and (ii) that their physical size is independent of the radiated wavelength -an unprecedented concept in antenna theory and design.

merit, I ought to be able to put together a practical explanation of how it works, without recourse to rigorous mathematical analysis. I start with two simple propositions:

\*An antenna is a means of coupling electromagnetic energy to space and usually comprises widely distributed inductance and capacitance. Most, but not all, antenna ideas involve resonant half-wave elements in some way.

\* Half-wave resonance can be produced in very small antenna designs (small compared to a wavelength) usually by using lumped constant inductors and or capacitors.

If the CFA concept is in fact a new and reasonably effective way of achieving "space coupling" then it might be considered as a lumped constant  $C$  ver-

separately induced fields from independent types of sources, i.e. charge motion and capacitor displacement current".

If the "displacement current field" in a normal system has been under-used or not really used at all until now, then the CFA is a means of exploiting it and thereby augmenting  $E \times H$ .

The device is relatively small and so its coupling to space in comparison to a normal, well distributed, antenna is less efficient; but the higher field intensity compensates to some degree. Just to what degree compensation can be achieved is, I suppose, the underlying purpose of the experiments.

### The CFA in action

Perhaps the most important problem is the question of the required phase relationships between the 50% power split to  $D$  plates and  $E$  cylinders. After

follows the preferred amateur radio method of splitting power between two phased verticals and achieving quadrature phasing. (The network values were calculated after making approximate measurements of plate and cylinder impedance using a noise bridge).

It seems that, whatever phasing method is used, it becomes difficult to maintain the 50 - 50 power split between plates and cylinders. RF voltage measurements are extremely difficult to make with balanced lines for this purpose. However, splitting the power in co-ax. and then feeding the quarter wave lines through baluns with RF voltmeters placed immediately before the baluns can also be misleading. Any slight difference in the standing wave on the quarter-wave feeders in the unmatched, or poorly matched system, shows up as RF

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## The cross field antenna in practice

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voltage differences, which may, or may not mean an asymmetric power distribution; the only answer so far to these problems is as shown in the attached diagram. Split the power in co-ax. between two matching units, feed the quarter-wave lines through baluns, tune both matching units for best reception and finally trim for a flat line to the transceiver. Do not worry too much about the accuracy of the power split or the exact phasing relationship.

Using two matching units has also facilitated excursions onto the 80m and 20m amateur bands. This has raised another puzzle: whereas on 40m the results from the CFA come close to the normal wire antennas at distance of 500 miles plus, particularly in darkness hours with the possibility of lower angle propagation, the experience on 20m does not show anything like such dramatic improvement.

However, on 80 the CFA results are always close to the wire antennas and during darkness pretty nearly equal. The only explanation that I can produce for this experience is the question of compromise.

The CFA is obviously a compact antenna, with the associated limitations. Mostly if not all, amateur radio antennas on both 40 and 80 are compromises so far as height is concerned. In the trade off between the compact CFA and the "low-height relatively low-frequency" wire antennas the CFA does not fare too badly. At 20m, where many amateurs can

erect beams and dipoles at a height of half a wavelength, the CFA suffers in comparison. I have to add the note here that band conditions on 20m, 15m and 10m have been relatively poor with a lot of short-term variation during the experi-



mental period and that has made comparison difficult. I must mention that the experiments on 20m and 80m have been made with the feed arrangements as shown for 40m and all band change adjustments being made with the matching units.

It has occurred to us that the employment of delay lines especially designed for that purpose might be another approach to phasing experiments, if they can be obtained at reasonable cost, although having to provide separate lines of this kind for all nine

amateur HF bands does seem a little bit uneconomic.

So far as the CFA's element spacing and phasing arrangements are concerned it is difficult to find any critical adjustment points that affect receiving performance. This leads me to suspect that the feed and phasing arrangements I have used are not ideal.

The CFA shares a roof space with a UHF television antenna, also vertically polarized, and an outdoor television antenna is only about 1m above it. So far no television interference has been apparent. This seems to confirm one of the qualities claimed for the CFA, that it does not easily couple to conventional antennas in its vicinity.

Earthing the main antennas gives an improvement, small but detectable by ear, in reception using the CFA.

\*R. M. Kabbary, M. C. Hatley and B. G. Stewart, Maxwell's equations and the cross-field antenna. *Electronics & Wireless World* March 1989, pages 216-218. For a rebuttal, see also *Letters*, July, page 682.

**The West Rand Amateur Radio Club**  
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**Bulletins** (Sundays at ...)  
11h15 Start call in of stations  
11h30 Main bulletin start

**Frequencies**  
145,625 MHz (West Rand Repeater)  
10,135 MHz (HF Relay)

**Radio Amateurs do it with more frequency!**



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

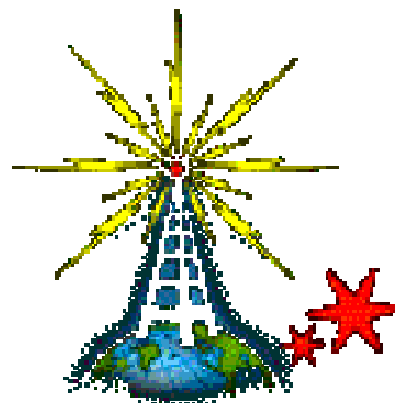
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**West Rand members input - we need your input!**

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 2001, 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. It is soon to be updated, check with the vice-chairman for details.



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