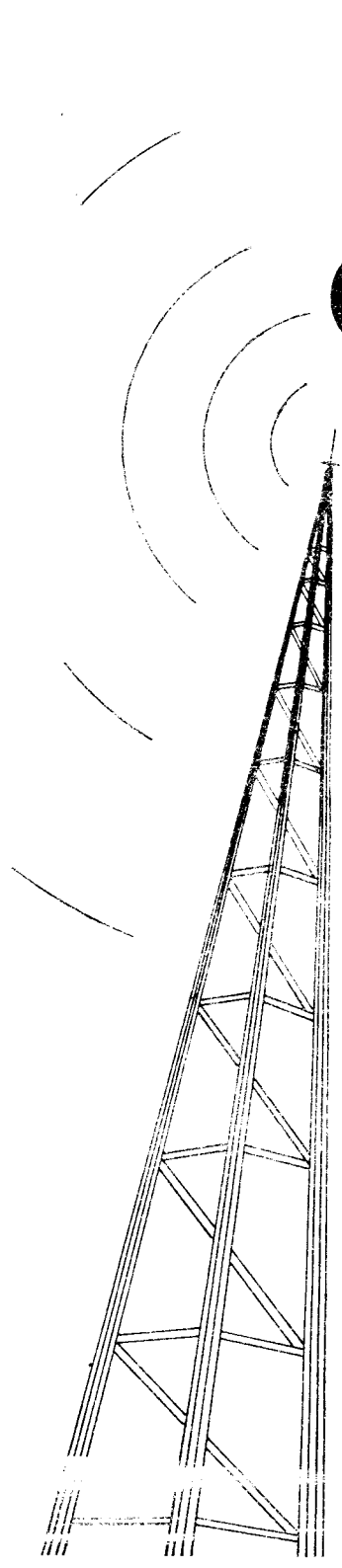
Q S X
P E



ZS2PE

FREQUENCIES:

Bulletin	3640 Khz
	7098 Khz
National Call	145.5 Mhz
P.E. Repeater	145.05/65
Grahamstown	145.15/75
Lady's Slipper	145.10/70

Port Elizabeth Branch of the

South African Radio League

P.O.Box 462, Port Elizabeth. 6000.

Port Elizabeth Branch

›NOTICE OF MONTHLY MEETING‹

THE MONTHLY MEETING OF THE PORT ELIZABETH BRANCH OF THE SOUTH AFRICAN RADIO LEAGUE WILL BE HELD AT THE SCOUT HALL, BROADWAY AVENUE, SUNRIDGE PARK ON FRIDAY 15TH JUNE, 1984 at 8P.M.

Committee

CHAIRMAN:	Dick ZS2RS (32111)	VICE CHAIRMAN:	Trevor ZS2AE(321746)
SECRETARY:	Marge ZS2OB (303498)	TREASURER:	Brian ZS2AB (303498)
PROJECTS:	Lionel ZS2DD(321770)	SPECIAL EVENTS:	Colin ZS2AO (312471)
P.R.O.	Pete ZS2PJ (301493)	AWARDS:	Attie ZR2DY (611318)

QSX-PE - ZS2OB and ZS2AB.

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NEWS

CONGRATULATIONS to Jan ZS2JW and Wanda van Ree on the birth of their daughter Joelene on 1st June. May she bring you much happiness and not too many sleepless nights. Perhaps you can work some DX, Jan?

WELCOME back to Hugh Robb ZS2RB and Annamarie after their holiday in Italy. By all accounts it was a good holiday, with lots of pasta and warm welcomes.

Among many members who took off in different directions for the long week-end, were Basil ZS2PG and Ros Gibson and family who flew up to Margate for an Air Rally. Thank heavens their plane didn't do a "Spitfire" on them and they got back safely.

Andre van Deventer ex ZS6UF was very pleased to get back his old call of ZS2BK and he and family have settled into a brand new house just opposite Basil ZS2PG. Is that why you are moving, Basil?!!

A recent visitor in town was Ken Biggs who was a member of the Branch for a few years. Ken is back in ZS on business from G land and will be doing the rounds of the country.

Not so lucky about getting his old call back was Brian Gruss Ex ZS2TY ex ZS6AEB who has now acquired the call of ZS2BG and can be heard mobiling around the countryside again.

Another visitor to town was Sel ZS6AXC and Rietjie Staples who were doing some visiting in various towns in the Eastern Cape. It was good to see them again.

SUBSCRIPTIONS

The end of June is the time when subscriptions are once again due and by now Headquarters should have posted reminder cards to all members. PLEASE REMEMBER TO SEND YOUR MONEY TO THE BRANCH TREASURER AND NOT TO HEADQUARTERS. Enclosed some members will find envelopes already addressed to the Branch. Unfortunately there were not enough of these to go round so we are sending them to members out of town and to those whom we unfortunately do not see at monthly meetings. Perhaps you could give us all a lovely surprise and bring them in person!

MINUTES OF THE GENERAL MEETING OF THE PORT ELIZABETH BRANCH OF THE SOUTH AFRICAN RADIO LEAGUE HELD AT THE SCOUT HALL, SUNRIDGE PARK ON 18th MAY, 1984.

PRESENT: 20 members and visitors.

APOLOGIES: Lynn Crothall, Gordon Knapp, Colette Rundle.

The Chairman welcomed all very warmly to the meeting in spite of the cold weather. A special welcome back to Andre ZS6UF ex ZS2BK and his family and also to Malcolm Harwood ZR2ET who was attending a meeting for the first time.

MINUTES: The minutes of the meeting held 16th March, 1984, having been published and circulated in QSX PE were taken as read, proposed by Trevor ZS2TJ and seconded by Mitch ZS2DK.

ARISING: -

FINANCE: The Chairman referred to the balance sheet for AGM '84 which had been handed to members attending the meeting and said that it revolved around various facets thereof. He explained various points such as "School Bus" which referred to the use of a Kombi used to transport delegates and which had clocked up 500km over the weekend. A donation would be given to the school to cover this. Referring to transport, Dick said he would like to thank Mitch ZS2DK and Jan ZS2JW for their sterling work with the transport. Members did not realize that their day had started on Thursday at a very early hour and continued until late on Monday when all the delegates had finally left.
The Secretary was asked to write to John Chamen thanking him for the donation of fruit which had been given to delegates in the form of fruit baskets in their hotel rooms.
A further donation of R50 had been received from Mitch ZS2DK and this had been as a result of his setting up a P.A. system at his saltmine.
Two donations had been received from other branches i.e. R100 from Algoa Branch and R50 from Randburg Branch. These had been discussed in Committee and the matter was now being raised at the General Meeting. In view of the fact that our excess of income of expenditure was R900, it was felt that we could not justify keeping these donations, in view of the fact also that branch money was hard to come by in these days and letters would be written to the Branches concerned, thanking them sincerely for their kind thought and hoping that it would be received back in the spirit in which it was returned.

CORRES: Various letters from the President, Councillors and Branch delegates were read thanking the Branch for the well-organised and pleasant AGM. Many thanks were extended to the ladies for their catering efforts and especially for the wonderful team work by all concerned.
Trevor ZS2AE extended thanks from all Branch members to Dick ZS2RS the Chairman for being the guiding light and for all his hard work. Dick thanked Trevor for his kind words but again emphasized that it was a team effort.
Dick also read portion of the Highveld Branch newsletter in which it was stated that it seemed that the branch was fading out from lack of interest on the part of the members and said he was very thankful that it did not appear to be the same with P.E. Branch.
A letter from ZD9CC on Tristan da Cunha together with postcards showing various aspects of the island was tabled. Dick explained that Mitch ZS2DK was QSL manager for John and he and Mitch had made up several dipoles, fly-leads, etc and sent them to Tristan by boat, together with a selection of S.A. wine, chocolates,

sweets and comics. These had been most gratefully received.

GENERAL: Still in connection with Tristan, Dick said that Piet Fourie had donated a second-hand Tribander beam and it was suggested that this be overhauled and shipped to Tristan. It would be a nice idea to adopt Tristan as a Branch project. Members considered this a good idea. The beam was not considered to be in good enough condition to send.
In two months time the Hobbies Fair would be held. Discussion on this had been held in Committee and it was put to the meeting as to whether an HF station should be set up in view of the difficulty of erecting an antenna. The general passer-by was not used to SSB but a two-metre station would be set up, together with slow-scan TV and a weather satellite station and various other facets of Ham radio, such as RTTY and the use of computers. Some of the money left over from the AGM would be used to set up a more professional stand. Help would be needed with all of this together with manning the stand, and it would be nice to see some new faces.
The question of the Technical Handbook had arisen at the A.G.M. and Dick said that he had reported on the difficulties that had arisen with the compiling of this and the matter was therefore being left in abeyance.

At this stage, Brian ZS2AB made a presentation to the winner of the Div. 2 phone section and this once again was Dick ZS2RS. The award took the form of a book and was named the "Frank Burrell ZS2CY Memorial Award". The Secretary mentioned that the new rules for the 1984 Contests had been received and that there were many more sections under which members could take part, such as multi-operator stations and Branch stations which would count towards the Branch participation award. The rules were to be published in Radio ZS.

There being no further business, the meeting was closed and tea was taken. Pete ZS2PJ was thanked for the eats.

sgd:
R.W. Schönborn ZS2RS
Chairman

sgd:
M.T. Weller ZS2OB
Secretary

THE MARKET PLACE

for sale

Complete station for sale.
FT 101 ZD Brand new with cw filter, fan and mike.R1000.
FT 902 Antenna Tuning Unit. R90.
Brand new unopened Yaesu desk mike. R50.
12 AVQ trap antenna. R100.
All above - Or nearest offer.
2 aluminium masts + 16 metres.
Brandnew books as follows:
Amateur Radio Techniques. H.F. Antennas.
Test Equipment for the Radio Amateur. All R.S.G.B.
A.R.R.L. Antenna book. R10 each. All brand new.

Contact Jimmy Levay at 721532.

BRANCH TROPHIES

Only about three months left in which to catch up on lots of DX or to complete your building project or work that rare VHF DX to be able to qualify for the three branch Trophies to be awarded at the AGM. If you need any details, phone Brian or Marge at 303498.

Wise Words

A TIP FOR THOSE WHO USE FLOPPY DISKS WITH THEIR COMPUTERS. BY Brian ZS2AB.

The use of the 5.25 inch floppy disk is something which most micro-computer users graduate to eventually, and these come in "single-sided" and"double-sided" versions from the suppliers, who charge accordingly for the two types. The curiosity which is said to have done the proverbial cat no good, led me to have a closer look at the disk material, and , as I could see no difference between the coating on one side of my "single-sided" disks and the other, I decided to try using the "flip-side" to see what would happen. I have two types of disk, and they both responded to the test. It is necessary to reproduce the "write-protect notch" on one edge of the disk sleeve, and also the index hole just alongside the centre drive hole, on the opposite sides of the disk jacket in order to be able to use the flip-side. Having done this on one of the disks, I proceeded to attempt to record on it. BINGO!!! I now have box full of double-sided disks!

In order to locate the index hole correctly, I made a paper template of the disk sleeve by laying a sheet of paper over the sleeve and pressing the paper into the holes and the notch as well as imprinting the four corners of the sleeve. I then marked the various impressions on both sidesof the sheet of paper. This paper now gives you a template of both sides of the disk jacket and, by positioning it correctly, you can mark the positions of the new holes on the disk sleeve. Now comes the bit where care is the watchword. You will need a small strip of hard plastic or similar about 20 mm wide and perhaps 50 mm long so that you can hold it easily. The strip has to be hard so that it will not be cut by the blade used to modify the disk sleeve, but it must not have sharp edges which may damage the surface of the disk itself. Slip the strip inbetween the disk and the sleeve so that it lies under the place where the new index hole is to be cut, and cut a hole about 6 mm square in the marked position with a sharp, rigid blade. Turn the sleeve over and cut another hole in the sleeve in the corresponding position on the opposite side. Cut out the write-protect notch and you will have double-sided disk. Take care to hold the plastic strip firmly whilst you cut the sleeve, to prevent it moving under the blade pressure and so damaging the disk coating. There may be some makes of disk which ARE only coated on one surface, but an inspection of the disk will usually reveal a different "look" to the disk surface on a side which is not coated, as with most recording tapes, where the back surface is almost always different to the coated surface.

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bulletin roster

17th June	Pete ZS2PJ
24th June	John ZS2AO
1st July	Attie ZR2DV
8th July	Dick ZS2RS
15th July	Trevor ZS2AT

technical

RADIO FREQUENCY INTERFERENCE.

This address by Brian Austin ZS6BKW originated on the Central Nits Repeater and was relayed onto other repeaters countrywide in the first TTCC repeater link net on 26th February, 1984.

We all dread the day when a neighbour might inform us that we, the Radio amateurs are causing interference on his TV, Hi-Fi, telephone, tape-recorder, etc. Whenever Radio Frequency Interference occurs the blame more often than not is laid at the door of the Radio Amateur. Let us try to put the records straight.

Frequently in attempting to pinpoint the actual source of the problem the inevitable scapegoat is 'A high standing wave ratio'. It is the intention in this talk to present the facts regarding the relationship between R.F.I. and the antenna system so that the real cause of the great majority of R.F.I. incidents may be identified.

First of all then - "What are standing waves?"
Standing waves of voltage and current exist on any transmission line when it is not terminated in its characteristic impedance. These waves are simply the result of the interaction between the forward and reflected components of voltage and current on the transmission line and their magnitude is a measure of the amount of mismatch which exists between the load, which in most cases is an antenna, and the line itself.

If, for example, the load is a resistance R_L of 1000 Ohms and the characteristic impedance Z_o of the line is 50 ohms then the standing wave ratio or SWR is simply their ratio. In other words SWR is equal to R_L divided by Z_o. In other words 1000 divided by 50 which is 20 to 1. That is a severe mismatch. This ratio of 20 : 1 means that the peak or maximum value of voltage on the line is twenty times larger than the trough or minimum value. Likewise the maximum and minimum current values will differ by the same amount. If the line were matched then the load R_L equals the characteristic impedance Z_o of the transmission line.

So from the previous definition the SWR would be equal to 1 on the ratio 1 to 1. In other words a perfect match or a so called "flat line" because it has no waves on it. Having established this, one must now ask the question "Why should standing waves cause RFI?" The answer is quite simple. "On their own, they simply do not". The next question must then surely be "Why then is SWR of so much concern to the average radio amateur? The answer to this is far less specific because of the myths, almost folk lore which have grown up around this term. Don't be persuaded however, to think now that SWR may be dismissed for ever. There are a number of points which are vitally important and should be appreciated.

Firstly if a transmission line is not completely without loss - in other words, not lossless - (and none is) then standing waves on the line means that more power will be lost in the conductors or dielectric of the line than would be the case if the SWR were 1 to 1.

Power is lost in three ways in a transmission line:
(a)by radiation or leakage from the line
(b)by heating of the conductors, by the well known I^2R mechanism, and
(c)by heating of the dielectric of the line - the $\frac{E^2}{R}$ mechanism from Ohms Law.

Radiation or leakage losses will not be considered because they are minimal under normal circumstances if the line is of good quality and is correctly installed. However heating losses are due simply to the fact that any current in the line will generate heat when flowing through any resistive path - thus I^2R losses occur. A high SWR means that the

current peaks are much greater than those in a matched case and so these I^2R losses increase very rapidly because of the squaring of the current. Similarly the high voltage peaks due to high SWR will cause the dielectric to heat up with similar resulting loss of power.

A bit now about Impedance which the transmitter would see under high SWR conditions and what is the effect of this on its performance. Standing waves on the line mean that the impedance is constantly changing along its length, unlike the case where the characteristic impedance of the line Z_o and that of the load Z_L are matched. Then of course the impedance along the line at all points, in fact at any point, is simply Z_o. Let's take a simple example: If we take a piece of 50 ohm coax and we connect to its end a 50 ohm resistor, that line is matched. If we were to measure the impedance at any point along the line we would measure 50 Ohms regardless of the length of the line. The voltage and the current ratio which by definition is then the impedance will always be the same. The SWR in other words is 1 to 1. If, however the load resistor is any value other than 50 Ohms then the line is mismatched and there must be a standing wave of voltage and likewise a standing wave of current existing on the line and so if you measure the impedance, that ratio of voltage to current at any point, the impedance along the line will change depending on the position where you make the measurement depending on the length of the line.

What happens to your transmitter connected to the end of the line which is not correctly terminated? Depending on the length of the line, the transmitter may see a high impedance or a low impedance, which is either resistive or reactive. None of these conditions will allow your transmitter to deliver its rated output.

Worse!! and this is the important point when we talk about RFI, the mismatch, if severe could lead to serious distortions, both in-band which would degrade the quality of your signal, or out-of-band which could lead to interference.

Let's look at some of the basics. The transmitter normally has a fairly well defined output impedance known as its Source Impedance. That transmitter will only deliver maximum power if the load is conjugately matched. What we mean is simply this: That a conjugately matched source and load have equal resistive components and equal yet opposite reactive components.

In other words, if the load consisted of a 50 Ohm resistor in series with a capacitor whose reactance was 100 Ohms, then to conjugately match that load to the source we would have to tune out the capacitive reactance. The way to do that would be to include an inductive component whose reactance was 100 Ohms but of course whose sign was opposite to that of the capacitor - they would resonate and cancel one another out. Now if the source had a resistive component of 50 Ohms we would have a 50 Ohm source connected to a 50 Ohm load which would be a perfectly conjugately matched system. Only then can the source deliver its maximum rated power to the load.

The key word to emerge from all this is that the <u>system is now matched</u>. In practice this will seldom be the case. So to ensure maximum power transfer from source to load requires that some impedance matching must take place in the system. This then is the role of the <u>so-called</u> Antenna Tuning Unit or ATU which has assumed great prominence in the amateur world these days. Unfortunately this commonly used term is most misleading. In fact, it is basically incorrect. The unit referred to as an ATU does not in any way tune the antenna. What it does is transform the impedance presented to the input terminals to some other value at their output. So a far more acceptable description is IMPEDANCE MATCHING NETWORK or if you like the good old fashioned "Z match" will do admirably.

From here on we will talk of this device as a "Z match". Let us visualise the following system:- An antenna which has some feed point impedance Z_L is the load. A transmission line of characteristic impedance Z_o. A transmitter with an output impedance R_s. If they are not all the same, then we cannot just interconnect them. So ideally we then have to make use of some Z match network, suitably positioned between the source on the transmitter and the load or antenna, in order to effect an impedance match. Ideally we need two Z matches. Firstly we have to convert the impedance of the antenna Z_L into a value which matches that of the transmission line Z_o so that there will be no standing waves on the transmission line. Secondly we may need another matching network at the transmitter end of the system to convert whatever impedance is now presented at the input end of the line to the value which the transmitter requires in order to deliver maximum power. To recap - we have a Z match at the transmitter end and another Z match at the antenna end. Between the two we have the transmission line.

The operation of the system is as follows:
The load would normally be the feedpoint impedance of the antenna and in general this would not be equal to the characteristic impedance of the transmission line. In many practical situations however, antennas are used which have impedances fairly close to that of the line. Consider the halfwave dipole, erected about a half-wavelength above the ground. It would have an input impedance of around 65 to 70 Ohms. Feed that with 70 Ohm coax and the SWR will be extremely close to 1 to 1. There would not be a need in this case for an impedance matching network. In mobile installations though, the feedpoint impedance of the antenna is normally very different from that of the feedline. Here some form of Z match would be required. Likewise, in antenna arrays, particularly the beam of the yagi type, these can present impedances very different to Z_o and here again some suitable impedance transformer or Z match would be required. Once such impedance matching has taken place we have a flat line from antenna to transmitter.

What happens at the input end? The function of the impedance matching network at the input end will now transform any impedance which it sees into a value which will suit the transmitter. If a single multiband antenna is to be used, then it is highly unlikely that its impedance will always match the characteristic impedance of the transmission line on all frequencies. Standing waves then exist and so the Z match network will have to be adjusted to convert the resulting value of impedance as seen by the transmitter into the required value at <u>each frequency</u>. In this context, what one really means is in each band of frequencies. Normally the bandwidth of the systems are wide enough to accommodate frequency changes within any of the bands. The moment one changes from band to band clearly an adjustment is necessary.

Now the following comments are most important. Because the SWR on the transmission line is related to the relationship between the impedance of the load and the characteristic impedance of the line, there is absolutely nothing which can be done at the transmitter end which will change the prevailing SWR. This unfortunately is something which most people seem not to have grasped. The ATU at the transmitter end will in no way affect the prevailing SWR on the transmission line to the antenna. That Z match only provides an impedance which the transmitter is happy to deliver power into. No amount of adjusting of the Z match at the transmitter can then alter the SWR on the line. If an SWR meter is connected between the transmitter and the Z match it will then show the SWR on whatever short length of cable is connected between the transmitter and the Z match, NOT the SWR on the long length of cable between the Z match and the antenna. That is the important point.

A reading of 1 to 1 indicating a perfect match really implies that that short length of cable between the transmitter and Z match has no standing wave on it. We, therefore, have a perfect match and all the power from the transmitter then goes into the line, even though there are standing waves beyond the Z match. This does not matter because as long as the inherent losses in the main transmission line are low, and the line itself is not too long then the existence of those standing waves will not cause any significant power loss.

A most important point to appreciate is that power may be lost in the resistance of the line and is not lost merely because of reflections from the load. In a perfectly lossless line all the power is eventually dissipated in the loads regardless of the S/R. Standing waves on their own do not imply loss of power. Reflected power is not lost. It is ultimately radiated by the antenna. Some of the power is obviously consumed as I^2r or $\frac{V^2}{R}$ loss as discussed earlier.

If the line is of good quality, in other words, it is a low loss line, that power loss is minimal, as long as the S/R is small. If the S/R is large, the high voltage and current peaks, of course, will lead to an increased power consumption.

To be continued.

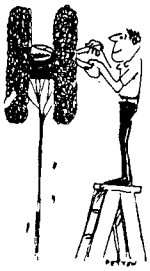
Acknowledgments to QRX Newsletter. Southern Transvaal Branch.

AGM'84

A.G.M. '84 BALANCE SHEET.

Total Income from donations and registration fees:		R4146
Expenditure:	Catering Friday evening	R615.50
	Catering - Edward Hotel	1726.85
	Photographs - Bob Binnell	187.25
	Printing	118.77
	Cabaret - Gary Bryden	200.00
	Silkscreening	100.00
	Corsages	80.00
	Cake	16.50
	Drill Hall	25.00
	Petrol	50.00
	Name Tags	23.00
	Name tags (printers)	25.00
	Fruit baskets	10.00
	Postage and photocopies	35.80
	Miscellaneous	15.20
	School bus	100.00
	Total	R3328.87
Excess of Income over expenditure		R900.77

India cables TV to tree aerials



Green vegetation can act as aerials and receivers according to Dr. S. P. Kosta, deputy director of the satellite [illegible] at the Indian Space Research Organisation.

In a series of field demonstrations, he has shown that tall healthy trees such as cypress, coconut, eucalyptus and mango can substitute for conventional metallic rooftop TV antennas and for transmitting and receiving voice signals.

The "green revolution" in TV signals reception started in the summer of 1980. Kosta thought that certain geometrically shaped plants, trees and vegetation could act as receptors of audio and visual signals. He made a bundle of freshly cut cypress leaves and put them in a conically shaped polythene bag. As expected, the leaves could sustain, propagate and radiate electromagnetic waves. Emboldened, Kosta began experimenting with coconut, date-palm and casaurina trees. Using all these species, he was able to obtain high-quality TV pictures; the taller and greener the vegetation, the better the reception.

According to Kosta, an easy to handle inexpensive cable can link a TV set to the vegetation. "All that one has got to do is to pierce the cable so that it touches the moist part of the tree or plant." The cable can be connected either to the leaf or to the stem.

Kosta feels that once he is able to evolve a technique to neutralise the impact of hostile natural elements, such as wind, rain and snow, that the TV antenna can be replaced by green vegetation. He hopes that his findings will pave the way for television to penetrate India's heartland.

Field studies carried out by Kosta have established that TV signals, radiating 1 kW, can be received clearly by healthy date-palm, coconut and papaya trees. He says that the signal is transmitted via the Xylem and phloem which carry a plant's food and water. The pictures were found to be better quality than those received in TV sets using conventional metallic antennas.

In October 1983, Kosta transmitted and received voice signals over distances up to 30 kilometres through trees such as eucalyptus, cypress, mango and jack-fruit.

In the future, he plans to study whether or not creepers and climbers are suitable for transmitting telephone signals. The BBC is very sceptical about the idea. It does no doubt that the Indian Space Centre can receive and transmit radio waves with living plants. The phenomenon is wholly predictable, but BBC engineers have serious doubts about its practical value for tele-communications.

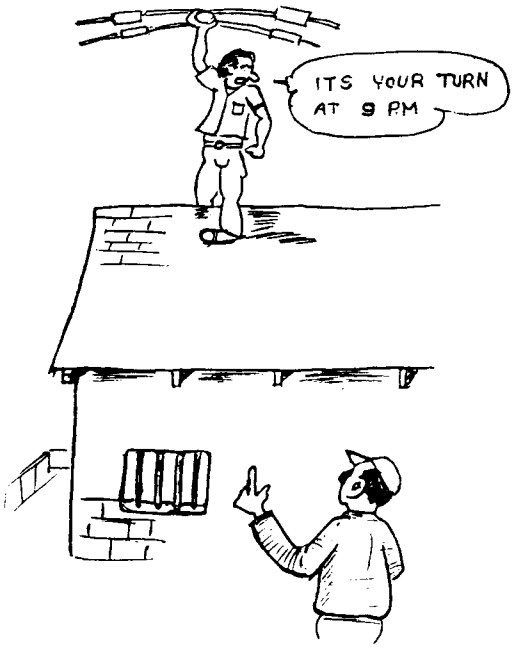
If a signal is strong, and the transmitter is close, a radio or TV will work with a piece of wet string connected to the aerial socket. Some sets will work without any aerial at all. Often they pick up enough signal from the screened coaxial cable which connects an aerial to a receiver or transmitter.

It is not surprising that a living plant, full of impure, electrically conductive fluid, will work like a large wet-string aerial. The problem is to match the electrical impedance of the connecting cable to that of the aerial. (What about a Z match? See other article. Ed.) If both have the same impedance, often 75 ohms, then received energy will transfer efficiently to the cable. A transformer could easily match a cable to the impedance of a plant. But if the plant grows, or the weather turns wet, the impedance will change and mis-match will reduce the received signal strength.

For high efficiency an aerial must also be tuned in size to a multiple or fraction of the wavelength. A fast growing plant could go out of tune over the weekend and again received signal strength would drop. So it would be foolish to rely on a plant as a transmission aerial.

An aerial engineer at the BBC says: "You can use anything as an aerial, old bed springs or a dead sheep, provided you pump in enough transmission power to compensate for its inefficiency. If you push kilowatts of radio frequency energy into a tree, you will make it get so hot that it dies and bursts into flames. You would then have a burning bush as an aerial."

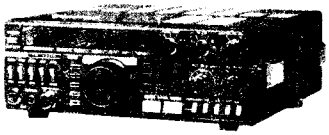
From "The New Scientist 19 April 1984.
Thanks to Colin ZS2AO



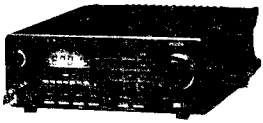
From

KENWOOD

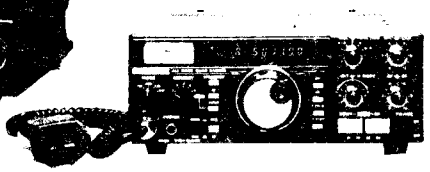
THE WORLD'S LEADER IN AMATEUR RADIO EQUIPMENT



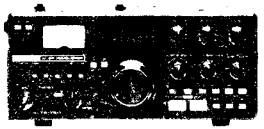
Kenwood TS-430S
H.F. Transceiver



Kenwood TR-7950
2m F.M. Transceiver

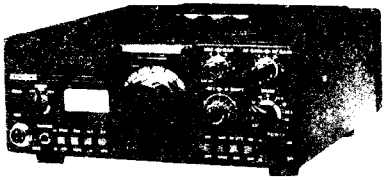


Kenwood TS-660 All Mode
6m • 10m • 12m • 15m • Quad Bander



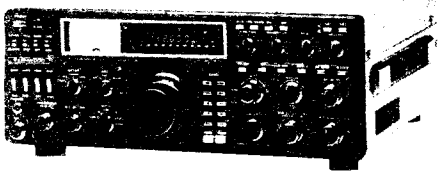
Kenwood 2M TS-780 70cm
All Mode Duo Bander

Kenwood TR-9130 2m
All Mode Transceiver



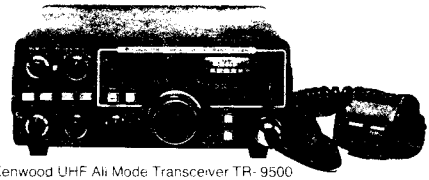
Kenwood TS-130S
H.F. Transceiver

Accessories
- Desk Top Misc
- World Clock
- Filters
- Dummy Loads
- Antennas
- Ext. VFO S



Kenwood TS-930S HF Transceiver

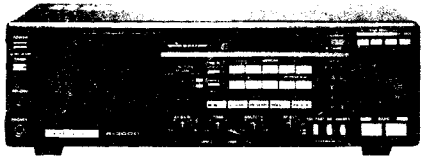
Accessories
- Linear Amps
- Antenna Tuners
- External Speakers
- Power Supplies
- Dip Meters
- Head Phones



Kenwood UHF All Mode Transceiver TR-9500

Kenwood R-600 Communications
Receiver

Kenwood TR-7730 – 2m FM



Kenwood R-2000 Communications
Receiver

KENWOOD
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