WATTS

08-2010

Year 80 + 8m

Monthly newsletter of the Pretoria Amateur Radio Club
Maandelikse nuusbrief van die Pretoria Amateur Radio Klub.

PARC, PO Box 73696 Lynnwood Ridge 0040, RSA

web http://www.parc.org.za mail: zs6pta@zs6pta.org.za

Bulletins: 145,725 MHz 08:45 Sundays/Sondae
Relays: 1.840, 3.700, 7.066, 10.135, 14.235, 51.400, 438.825, 1297 MHz
Activated frequencies are announced prior to bulletins
Swapshop: 2m and 7.066 MHz Live on-air after bulletins
Bulletin repeats Mondays | herhalings : Maandae 2m 19:45

ZR6FD logo

Drukwerk printing ZS6JPL

Papier / Paper ZS6JPL

PARC Winter fleamarket

despite lower than normal attendance vendors had good turnover

In this issue

In hierdie uitgawe

Next Meeting

---- AGM ----

Date: 14 Aug 2010
Time: 13:30 for 14:00
PARC Clubhouse,
South Campus,
University of Pretoria.
SE cnr University and
Lynnwood roads.

PARC Management team / Bestuurspan Aug. 2009 - Aug. 2010

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SARL liason, fleamarket					
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Minutes of the monthly club meeting of the Pretoria Amateur Radio Club held at the South Campus of the University of Pretoria on 14 July 2010.

Welcome: The chairman welcomed all present.

Present: See register, 10 members, 1 visitor.
Apologies: 5 as per register.

Joys & Sorrows: No further news was received on Bill ZS6KO

Minutes: The minutes of the previous meeting were in Watts, approved by Pieter ZS6PA and seconded by Mark ZS6USA.

Matters Arising: Pieter ZS6PA will not be available in September.

Finances: We have a bank balance of R5430.28.

Membership: There are 60 paid up members of the total of 140 for 2010/11 already..

Web site: The problem accessing the web site, due to the Seacom cable failure, was explained and discussed.

Contests: The youth day sprint took place on Wednesday 16 June and according to the latest HF happening s, 3 logs were received.

Awards: The Arthur Hemsley trophy was presented to Pine ZS6OB, and the JJ Pienaar trophy is waiting for Vince ZS6BTY.

Repeater: The repeater defaulted to high power and the power feed melted. We are running on the back-up repeater at Wonderboom..

Contests: The .VHF/UHF Indaba took place with good representation from PARC. The new proposed rules are available. Digital and phone will take place simultaneously, but will be separate contests. Comments are invited to the new organiser.

DXpedition: Planning is under way for a dx-pedition on VHF/UHF for next year, probably between February and April. A venue search is also under way.

Rallies: The Witbank rally is on Saturday August 7, and the Gauteng rally at Bapsfontein is October 21.

Flea Market: The date of the next flea market is still to be confirmed, but will be either end August or early September..
.
AGM: This will be at the August meeting. There will be a braai afterwards. Motions must be received by end July.

Birthdays Aug Verjaarsdae

01 Sue ZS6SUE
02 Mairilese, LV van Pierre ZS6PJH
03 Paul ZS6BMF
04 Ceciel, LV van Flip ZS6BSO/ZS4GE
05 Hans ZR6HVG
05 Kara, daughter of Rita and Sarel ZS6AC
06 Estelle, LV van Simon ZS6AST
06 Edwin ZR6ESP, son of Molly ZR6MOL and Richard ZS6UK
07 'JB' ZR6YV
17 Peggy, SW of Ed ZS6UT
07 Whitey Zs6JJJ
08 Ray ZS6ALG
08 Marnix ZS6MCM
08 Tobie ZS6ZX
10 Anne ZS6AUL, daughter of Frances ZS6AUT
14 Harry ZS6HRD
15 Roger ZS6RJ
15 Samantha, daughter of Sue ZS6SUE
15 Molly ZR6MOL, SW of Richard ZS6UK
16 Marie, dogter van Poppie ZS6BCP en Hansie ZS6AIK
22 Neville ZRNBA
23 Otto OE6OWV/ZS6OFW
25 Doppies ZS6BAQ
25 Louise, dogter van Martha Louisa en Attie ZS6REY
26 Sinéad, daughter of Heather and Vince ZS6BTY
28 Jean ZS6ARA
30 Jonathan, son of Sue ZS6SUE

Anniversaries Aug Herdenkings

07 Peggy and Ed ZS6UT ( )
18 Zdena and Ivo ZS6AXT (54)
20 Bertha en Hans ZS6KR (44)
27 Anne and Jac ZS6QA ( )

Joys and Sorrows | Lief en Leed

Bill ZS6KO has been taken ill with gall bladder problems
Bertha, lv van Hans ZS6KR is weer tuis na 3 weke in die hosptaal.
Hannes (ex ZU6HDT) het nou opgegradeer na **ZR6U**

† **Ons het met leedwese verneem van die heengaan van Gert ZS6ZB op 10 Julie 2010.**

Diary | Dagboek (UTC times)

Aug	**01**	**SARL HF Phone contest 13:00-16:30**
	02-07	National Science Week at Sci-Bono. ZS6SCI on air 09:00-14:00 CAT
	14	**PARC AGM**
	14-15	WAE DX Contest, CW 00:00-23:59
	28-29	YO DX HF Contest 12:00-12:00
	29	**SARL HF CW Contest 14:00-16:00**
Sept	04	All Asian DX Contest Phone 00:00-24:00

PARC SUBS / LEDEGELD 30-06-2010

Please remit your subs in time to our treasurer or by transfer to:

Betaal asb. u ledegeld betyds aan ons tesourier of per oorplasing aan:

Bank : FNB
Branch : 25 20 45
Account : 546 000 426 73
Your call sign must appear as statement text!

Ordinary members/ gewone lede R70
Spouses, pensioners R50

So far ±65/105 members have renewed

Notice – Kennisgewing

Lede kan nog steeds die sekretaris in kennis te stel van u voorkeur oor watter dae en tye vir u geskik sal wees vir klubvergaderings.
'n Finale besluit sal by ons AJV in Augustus geneem word na gelang van insette ontvang.

Members can still notify the secretary about your preference as to which days and times club meetings should be held.
A final decision will be made at our AGM in August according to inputs received

SARL subs were due 30 June

R360 and R225 for over 65's to:
South African Radio League
ABSA 632005
Account 407 158 8849

Snippets | Brokkies

- **WARNING – never coil up power wires carrying either DC or AC current. This applies especially to transmitter power supply wires. Prolonged or frequent transmissions can heat the copper sufficiently to cause meltdown through the PVC insulation.**

August is AGM month
Please let us have your attendance and support
Prepare any motions you wish to submit
- Only paid-up members can vote -

- **Feb-April 2011** is the timeslot for the next **EME for Africa Dxpedition – this time to Lesotho.** Various improvements and new antennas to accommodate all polarizations and have already been implemented by Pine ZS6OB. 6m EME and MS are also planned. With these system improvements the target is in excess of the recent 3B8 DXpedition's 400 contacts. Apart from Dan HB9Q, no other participants were yet mentioned.

Watch your elbows – buy a good brand name

ZS6BAQ opened a R20.- Taiwan elbow. Note the inductive/variable R coupling! Some stock were even open circuit!

Roger ZS6RJ sacrificed R63.- to inspect this one. Note the solid reliable connection that should not give any trouble.

70cm Bazooka Dipole

Here is a very simple 70cms dipole from Harald PD2HFE, which uses a single piece of RG-213 coaxial cable 34 cms in length.

1cm of the braid is trimmed off at the centre of the coax.
Each leg should be 11.5 cms long, with a further 5cms of the coax **inner** protruding from the end of each leg.

Connect the inner of the coax to outer at each end, keeping the connections as short as possible.

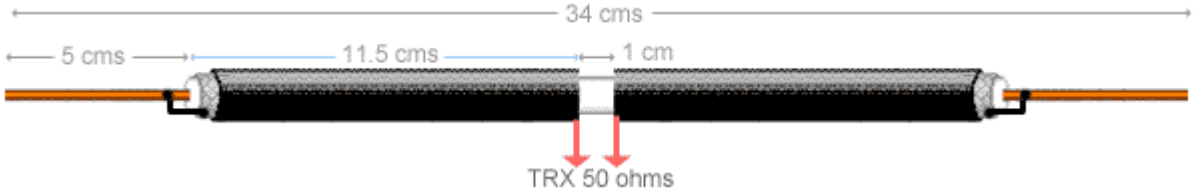


Illustration by G4TUT - Not to scale

For SWR fine-tuning, you can bend the dipole a bit.
Cut 1 or 2 mm off from both ends for MHz fine-tuning

Use a proper SWR meter and start with low power.

Happy building and enjoy the 70cm Bazooka Dipole

de Harald PD2HFE

Propagation to Pretoria

(Surviving the Winter Months with High Tech Tools)

ZS6USA – Mark Lukinovich / 14 July 2010

With the winter months upon us, many of us have noticed that HF propagation isn't what it was just a few weeks ago. Even with some encouraging sunspot numbers, the bands aren't opening all that often. There are some of us who spend hours sending CQ looking to make that special contact when the reality is that the band is simply closed. The bands still do open up for short periods. In order to make the most of the DX experience, try visiting some of the beacon sites on the web, or better yet, become a WSPR (Whisper) site or a Northern California DX Foundation monitoring site.

Joining in the fun is no harder than setting up a sound card PSK-31 Station. The hardware interfacing is the same, you just use different software.

The Northern California DX Foundation has 18 beacons placed around the world that are synchronized down to milliseconds via the GPS system. They transmit in very tightly defined time slots which allow monitoring stations to resolve short and long path on Omni-directional antennas. For monitoring Northern California DX Foundation beacons, there is an excellent software package called FAROS (Faros means 'beacon' in Spanish). ZS1HMO and ZS6USA use FAROS 1.3 to monitor NCDXF beacons and display the results on the Internet in near real-time. Visit these sites at:

http://spaceweather.hmo.ac.za/index.php?action=propagation&site=HER
http://www.kw1o.com/faros/

FAROS requires a good Internet connection for accurate time-sync information. If you are interested in the Faros software it can be downloaded at:

http://www.dxatlas.com/faros/

WSPR is the Weak Signal Propagation Reporter. WSPR is an interactive Beacon and Monitoring Software used for very weak signal reporting, on the order of -28db below the noise floor. The WSPR software can be used to just monitor WSPR Beacons or you can use your station to act as a WSPR beacon. With an Internet connection, you can automatically upload your information to WSPRnet – Weak Signal Propagation Reporter Network. WSPR Beacons are generally QRP stations with maximum transmitter power that is rarely above 10 watts. Most WSPR beacons are 5 watts and it's not unusual to see 100mw (20dBm) WSPR beacons transmitting from Europe or America being heard here in Pretoria. There are actually sub-milliwatt (< 1 dBm) WSPR beacons. I encourage you to visit the WSPRnet Website at:

http://wsprnet.org/drupal/

WSPR only requires your computer clock to be accurate to within one second which is easily done with most any time sync software. The WSPR software can be found at:

http://physics.princeton.edu/pulsar/K1JT/

With theses real-time propagation monitoring tools in hand, finding a band opening is greatly simplified and should increase your chances of making that special QSO without making yourself hoarse calling CQ.

TECHNOLOGY IN AMATEUR RADIO –WHERE ARE OUR INNOVATORS

The SA Amateur Radio Development Trust has thus far received one entry in the Innovation in Amateur Radio Competition from an Amateur in the UK. Where are the South African innovators?

Radio amateurs and technologists are invited to submit projects that will innovate amateur radio whether it is software, amateur radio and the Internet, the development of compact HF antennas for flat and complex dwellers or innovation in Emergency Communications.

Out-of-the box ideas are required to solve some of the problems and challenges faced by the 21st century radio amateurs. The innovation project is in the form of a competition to stimulate the creative side of amateurs to develop those solutions that will make the hobby more enjoyable to amateurs all over the world. Even old ideas improved with modern design techniques and modern components can generate a "wow" factor. Solutions will be judged by their uniqueness, e.g. not having been previously published.

Entry of paper designs are invited by 30 September 2010. The designs must be innovative but also practically implementable. Three entries will be chosen to go to the final stage of the competition which requires the entrant to develop and build a prototype. The three winners of the first stage will be announced at on 31 October 2010. Visit www.amateurradio.org.za for details and an entry form.

Optimum Wire Size for RF Coils

By Charles J. Michaels, W7XC
13431 N 24th Ave
Phoenix, AZ 85029

There are applications for inductors in electronic circuitry where the inductor Q is of little or no importance. In many other applications, the Q is secondary only to the value of the inductance. Among these are tank circuit coils, impedance matching circuit coils, and virtually all coils involved in loading or tuning antennas.

The Q of an inductor is the ratio of its reactance (X_L) to its ac resistance (R_{ac}) at the operating frequency.

$$X_L = 2\pi FL \qquad \text{(Eq 1)}$$

and

$$Q = \frac{X_L}{R_{ac}} \qquad \text{(Eq 2)}$$

then

$$Q = \frac{2\pi FL}{R_{ac}} \qquad \text{(Eq 3)}$$

where
- π = 3.1416
- Q = quality factor
- F = frequency in Hz
- L = inductance in henrys
- R_{ac} = ac resistance of coil

The Q of an inductor is proportional to frequency. Less obvious is that the resistance to alternating current is also a function of frequency and of several other factors we will discuss.

RF In A Conductive Sheet

A sheet of conductive material has a resistance at high frequencies that is higher than the resistance measured with direct current. The difference is caused by *skin effect*. That is, the current is carried not by the entire cross section of the material, as in direct current, but by a thin layer of conductor lying at the surface. For example, in a sheet of copper at 1.8 MHz, the current density at a depth of about 0.001 inch is only 0.37 of that at the surface. The current density continues to decrease exponentially with depth. At 30 MHz, the depth is 0.0005 inch.

The depth at which the current density is down to 0.37 of the surface density is called the *skin depth*. It is a mathematical concept in that the sheet's resistance at RF is equal to the dc resistance of a layer of the skin thickness (0.37 is 1/e, where e is the base of the natural logarithms, 2.718).

The skin depth, and consequently the ac resistance, can be calculated by

$$D_s = \frac{0.3937}{\sqrt{\pi \mu F \sigma}} \qquad \text{(Eq 4)}$$

where
- D_s = skin depth in inches
- F = frequency in Hz
- μ = magnetic permeability ($4\pi \times 10^{-9}$ for non-ferrous materials)
- σ = conductivity in mhos per centimeter cube (5.8×10^5 for copper)

Since F, μ and σ appear under the square root sign in the denominator of Eq 4, the skin depth varies inversely as the square root of their values.

The higher the frequency, and the higher the permeability, the thinner the skin. Therefore, ferromagnetic metals such as iron, steel, and nickel make poor RF conductors. Non-ferrous metals such as copper, silver, aluminum, and gold have a permeability essentially that of free space. These materials make better, but not equally good, RF conductors.

The higher the conductivity, the thinner the skin. The advantage of using silver over copper is not as great as the ratio of their dc conductivities might conclude. The conductivity of silver is 6% better than that of copper, but is only about 3% better at RF.

Q In A Straight Round Wire

If the conductor is not flat, but has a surface curvature (round wire), then all of the direct inverse square root relationships become more complex. In wire of small diameter, the skin depth is greater. And because a larger portion of the wire conducts, the skin effect is not as severe. The *ratio* of ac resistance to dc resistance is smaller. A large straight wire has a smaller ac resistance than a small wire, but again the advantages are less than might first be thought.

For the reasons stated earlier, large copper, silver (or silver plated), and aluminum wires are used as high-frequency conductors. Silver's surface corrosion products are conductive, and it provides for a good contact. It has a slight advantage over copper's less conductive corrosion products. Aluminum is light and sometimes larger-dimensioned materials can compensate for its somewhat poorer conductivity.

Q In A Coil

When a piece of wire is wound into a coil, three additional factors come into play. First, the wires of adjacent turns are in close proximity, and the current is not distributed uniformly over the surface. Therefore, some parts of the skin carry a higher-current density than other parts, and since the power loss is proportional to the square of the current, the effective resistance is increased. This is called the *proximity effect*.

Second, the coil's magnetic field induces eddy currents in the wire material. The loss incurred by these currents are reflected as more loss resistance in the coil. Smaller wires have less material for eddy current induction and (for the same turns per inch) less proximity effect. The combination of these two effects can combine to overcome the lower ac resistance of the larger wire in its straight form.

The third factor occurs when a coil is wound on a form. Loss in the coil form material may occur. This factor is usually of less concern in the HF range unless poor form material is used, particularly if it is subject to water absorption.

Each factor interacts in an extremely complex manner to yield a multiplying factor that is the ratio of the ac resistance of a coil to its dc resistance. If a coil is wound with a specific diameter, length, and number of turns, we have a sort of dilemma. If the wire is too small, the ac resistance is unnecessarily high in spite of a low multiplying factor because of its high dc resistance. If the wire is too large, the ac resistance is unnecessarily high in spite of its low dc resistance because of a high multiplying factor.

As it turns out, for any coil of a given diameter, length, and number of turns, there is an optimum wire size. That wire size is not the largest that can be accommodated. When a coil specification says *closewound* enameled wire, be assured that the coil will have more loss than it could have. Formulas that minimize dc resistance do not apply at radio frequencies.

Butterworth researched this problem.[1] A fairly simple equation yields the optimum wire diameter for a simple single-layer solenoidal coil wound of round wire. All the complexities described went into the calculation of factor A in Table 1.

$$d_o = \frac{LA}{N} \qquad \text{(Eq 5)}$$

where
- d_o = optimum wire diameter
- L = length of coil
- D = diameter of coil
- N = number of turns
- A = from Table 1

(These terms are expressed in the same units.)

[1]Notes appear on page 7.

Table 1
Machine-Wound Coil Specifications

$\frac{L}{D}$	A
0.4	0.702
0.6	0.666
0.8	0.637
1.0	0.615
2.0	0.551
4.0	0.508
6.0	0.478
10.0	0.474
∞	0.450

Let's Try An Example

For a 160-m antenna construction project, we want a coil two inches in diameter and four inches long.[2] It should be closewound with no. 14 enameled wire, with an inductance of 80 μH, and a measured Q of 110. (That dictates a loss resistance of 8.7 Ω at 1.9 MHz.) Now, 60 closewound turns of no. 14 enameled wire should fit in four inches and yield an inductance of approximately 80 μH. But is that the optimum wire size for maximum Q and minimum loss and heat? No! Applying Eq 5, we calculate L/D = 4/2 = 2. From Table 1, A = 0.551 and

$$d_o = \frac{LA}{N} = \frac{4 \times 0.55}{60}$$

$$= 0.0367 \text{ inch} \qquad \text{(Eq 6)}$$

Consulting a wire table, we find that 0.0367 inch in diameter lies between values listed for no. 18 and no. 19 wire. Number 18 wire is used because no. 19 is not commonly available. We space 60 turns of no. 18 wire to occupy the four inches of winding length. Expect the Q to be about 200 or better. This cuts the 1.9 MHz loss resistance from 8.7 Ω to 4.8 Ω or less. You can get less loss with less copper.

Improving Q

It is generally accepted that coils having a length similar to their diameter optimize Q with little difference over the range of lengths of from one half to two times the diameter. With longer lengths the increased coil form loss (if any) also adds to the loss.

If we consider a coil with a specific length-to-diameter ratio, loss can further be reduced by increasing the coil size. If we maintain the same ratio of length to diameter, the Q increases as the square root of the ratio of the diameters, providing that for each coil size we use the optimum wire size for that coil. Larger coils have larger optimum wire sizes. Thus, if the coil in our example were increased to four inches in diameter and eight inches in length, with 44 turns (for the same 80-μH inductance), the optimum wire size would be no. 10 and we'd expect the Q to be 280 or better (4/2 = 2, √2 = 1.414, 200 x 1.414 = 280). The 1.9 MHz loss resistance would be reduced to 3.4 Ω or less.

For those interested in the low-frequency experimental band at 160-190 kHz, Litz wire can be used to increase Q. For most amateurs, however, Litz wire is of no advantage; its effect disappears at frequencies above about 0.8 MHz. Hard drawn copper wire should not be used for high-Q coils—its conductivity is only about 59% of that of soft drawn copper wire.

Some commercial loaded antennas use closewound coils. I can only conjecture that the higher loss is tolerated to provide a tradeoff for wider SWR bandwidth. In fact, the manufacturer of one popular antenna states in his packaged instructions, "Do not be concerned if resonators appear to warm up. Efficiency will not be affected." Wow! Perhaps they meant "efficiency will not be affected"!

Notes

[1] S. Butterworth, Effective Resistance of Inductance Coils at Radio Frequencies, *Exp Wireless and Wireless Eng*, vol 3, Apr 1926, May 1926, Jul 1926, Aug 1926. Eq 5 is adapted from Terman, *Radio Engineers Handbook*, 1943, p 77-83, incorporating his Table 22 data into his Eq 100, all based on S. Butterworth, loc. cit.

[2] D. DeMaw, "How to Build A 160-Meter Shortie," *QST*, Nov 1986, p 26.

Long Term HF Propagation Prediction for Aug 2010

courtesy ZS6BTY

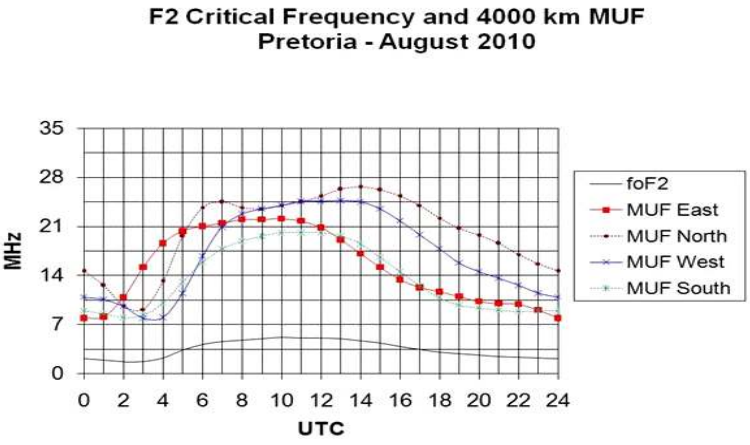
(see also our website propagation tab)

DX Operating

The graph shows the 4000 km maximum useable frequency (MUF) to the East, North, West and South from Pretoria for the first hop using the F2 layer.

Local Operating

The F2 critical frequency (foF2) is the maximum frequency that will reflect when you transmit straight up. E-layer reflection is not shown.



HF Mobile -- detail unknown but at a guess during WW2 due to the muted headlights. Note the antenna feed point.