QUA

Januarie 2015 January

Antenna Matching Networks

Yet another Dipole Feed Point Enclosure

HF Mobiele Antenna wenke

The Big Pineapple at Bathurst in the Eastern Cape

Bloemfontein Amateur Radio Club
Bloemfontein Amateurradioklub

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Happy New Year to you and your family. I hoped you had a great holiday and spent quality time with loved ones. I know Brendon, ZS4BM, and his family spent time in Botswana (A22BM) and in Zimbabwe at the Victoria Falls. Almost 5 000 km return journey!

'n Voorspoedige Nuwe Jaar aan jou en jou familie. Ek en Carina is af Oos-Kaap toe, daar na die mond van die Groot Visrivier. Ons beplanning was vir 5 dae, toe bly ons 12 dae! Party dae rond gery na Bathurst, Port Alfred, Kleinemonde en Kenton-on-Sea. En as ons die word "BOOKS" sien, dan word geparkeer en gesnuffel (en gekoop)! En groot pynappels kos tussen R6 en R7 by die padstalle.

It took us 9 hours to drive back to Bloemfontein - we stopped in Bathurst to buy hand cream and herb salt, in Grahamstown for 50 diesel and a geocache, on the R350 for two geocaches, at Bedford for a geocache, at Daggaboer Farm Stall for ginger beer (to be recommended) and a geocache about 2 km for there, in Cradock for cappuccino (first in 2015), in Hofmeyer at the Karoobos Farm Stall for a geocache (we can recommend their home made pies) and at Kuilfontein Farm Stall for ice cream (did the cache there in 2012 and we can recommend the breakfast and coffee) and then home. The X-Trail averaged 12,36 km/l.

Ek weet Martin, ZS4MS en sy familie was daar in die Baviaanskloof gewees, lekker uitgekamp.

Op 1 Julie 1980 is Tak Bloemfontein van die Suid-Afrikaanse Radioliga gestig. Op 1 Julie 2015 vier die Bloemfontein ARK sy 35ste verjaarsdag (in 1996 het die Tak verander na die BARK). Ek praat onder voorbehoud, Hennie, ZS4HG, Sarie, ZS4SG en Niel, ZS4NN, is van die stigterslede. Ek is vanaf 1 Julie 1984 in lid.

Wat is 'n PIC en 'n AVR? En 'n Arduino?? Ek het n artikel gekry wat so bietjie meer vertel en dit is in Afrikaans. Dit sal in die Februarie 2015 uitgawe van QUA wees.

Has anybody been busy on WSPR? WSPR = Weak Signal Propagation Research. I have downloaded the manual and have the software on the PC. But, I think this is a case of reading the manual first. I have an app on my iPad called WSPR watch and it is interesting to look at what can be achieved - even on 2 metres. There are a number of ZS stations active on WSPR and we have the ZS6SRL and ZS6KTS beacons on 60 metres.

What are you planning for 2015? I am thinking about SOTA (Thaba Nchu, Thaba Patchwa, etc.) maybe activating a lighthouse in August, visiting 7P8 again, helping getting the Springfontein repeater on the air and a few other things. Enjoy what you are going to do!!

Klub Bulletins
Maandag 19:30 op 145,600 MHz FM via die Naval Hill herhaler

Club Meetings
Last Saturday of each month at 14:00 (winter) or 16:00 (summer) at the Club House at CBC School

Club meeting 16:00 on Saturday 31 January 2015
Klubvergadering 16:00 op Saterdag 31 Januarie 2015

More information in the Club bulletin on Monday evenings at 19:30 on 145,600 MHz FM

Meer inligting in die Klubbulletin op Maandae-aande om 19:30 op 145,600 MHz FM

www.zs4bfn.co.za

https://www.facebook.com/groups/zs4bfn/

Antenna Matching Networks: why do we need them?

Richard G3CWI

Transmitters and receivers are designed to work into a specific load impedance. In most cases this is 50 Ohms. We spend a lot of time optimising our antenna systems to make them "look like" 50 Ohm loads. In the case of some antennas, they are, by design, roughly 50 Ohm loads. A half-wave centre-fed dipole is a good example of this where, depending on its environment and how the wires are arranged; it will present a 50 Ohm load. It would be possible to only use antenna like this and thus avoid using antenna matching networks but to do so would severely limit the antenna options available.

Many antennas have different load impedances, For example wire loops of various sorts (quads, delta-loops, etc.) often have a feed-point impedance of around 120 Ohms. Such antennas are usually matched at their feed point to 50 Ohms to allow them to be fed with 50 Ohm co-axial cable. Perhaps the most widely used multi-band antenna is a doublet fed with open wire line. This type of antenna often has both a very high VSWR at its feed point and a presents widely differing impedances across the HF spectrum at the end of the open wire line. To use any of these antenna types, antenna matching networks are essential.

It would be wrong to assume that antenna matching networks necessarily introduce excessive losses into systems; indeed sometimes that are used to reduce losses. How so? Imagine a radio system with a dipole antenna that is remote from the transmitter; if it is many wavelengths away as is often the case in professional radio systems, it may be more efficient to match it to the impedance of open wire line (450 – 600 ohms), use that for the long feeder run and then match back to 50 Ohms; two antenna matching networks being used to reduce losses as the losses due to a long length of open wire line are much less than those of an equivalent length of co-axial cable.

Simple antenna matching networks

For temporary or portable working a simple "long wire" is often a great way to get on the air. Some lengths of wires have been gifted with almost magical qualities in amateur radio circles. These lengths have often been chosen to allow relatively easy matching using simple matching networks. An antenna matching network consists of components that have been

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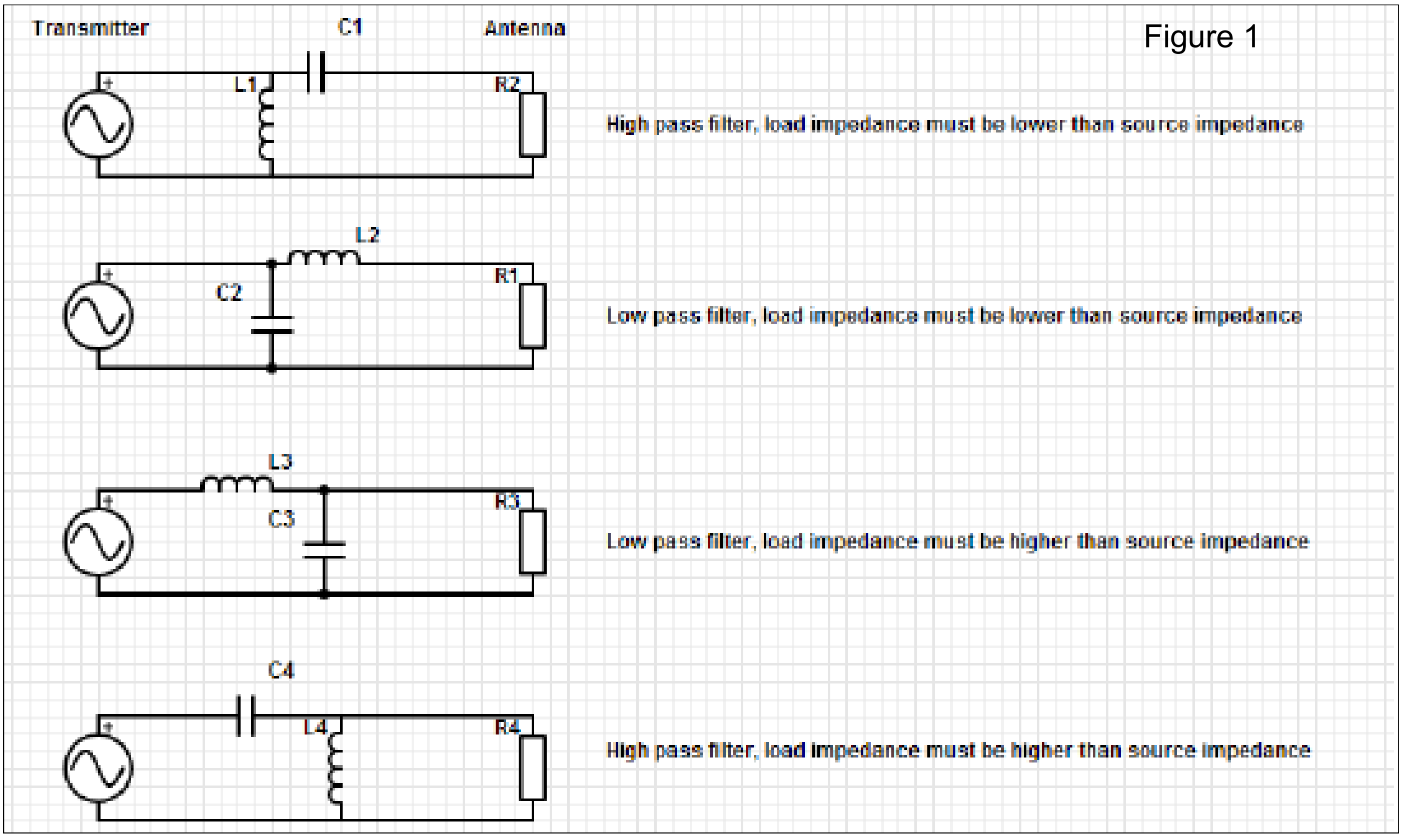

(Go fly a kite from page 3)

selected to transform the impedance presented at the end of the antenna to 50 Ohms. If the impedance at the end of an antenna was resistive a simple impedance matching transformer of some sort could be used. However, the impedance at the end of a long wire is usually reactive, that's to say it has a complex impedance that can be described as having a resistive component and some capacitance or inductance.

In some (special) cases it may be possible to match an antenna using just an inductance or a capacitance but in most cases a combination of inductance and capacitance will be needed to provide the necessary impedance transformation in an antenna matching network.

The simplest and most widely used antenna matching network is the L network. In this case we are considering L networks that consist of a capacitor and an inductor. There are four ways in which these components can be configured and each of the four ways has slightly different characteristics.

They can:

- be low-pass or high pass networks
- provide a DC block between the source and load or not
- match impedances higher or lower than the source impedance.

(refer to figure 1)

Deciding which is most useful depends on what you are doing, but in most cases:

- the load impedance of an antenna will be higher than the source impedance (i.e. greater than 50 ohms);
- the provision of a DC block is not an important consideration; and
- a low pass filtering action is preferable to a high pass filter as it provides some small level of attenuation of harmonics.

So this is generally the most useful of the L networks. There are actually four other L networks, two consisting of two capacitors and two consisting of two inductors. These are less commonly use as they provide a smaller matching range than the L networks discussed above.

Different antenna matching networks

The L network will theoretically match any impedance. However, in some cases the component values become impractical. It is for this reason that antenna tuners sometimes use more complex networks to achieve a wider matching range. These more complex networks can be harder to adjust.

The Tee network provides matching for impedances that are higher or lower than the source impedance but tends to be configured as a high pass filter. In theory this type of network can match any load impedance although to match more extreme load impedances requires unrealistic L and C values. In this respect it has the same limitations as the L network. the T network usually has three controls to adjust making it a little more complicated to use.

The Z match is a version of the L match that does not require a tapped inductor. Again, the matching range is limited by the component values. The Z match usually has just one control to adjust so if it's suitable for your antenna it's easiest to use.

Extending the matching range of a network

All practical antenna matching networks have a limited matching range. They have a finite range of inductance and capacitance and usually have a fixed network topology. The matching range of antenna tuners can be extended by attaching an external network that will transform the impedance of an antenna system into the matching range of a simple antenna tuner. One way of doing this is by adding a 4:1 matching transformer between the antenna and the tuner. This reduces the range of impedances seem by the tuner and will allow matching over a wide bandwidth. Of course there is an additional loss associated with the matching transformer and this tends to be higher in high impedance systems.

Losses in antenna matching networks

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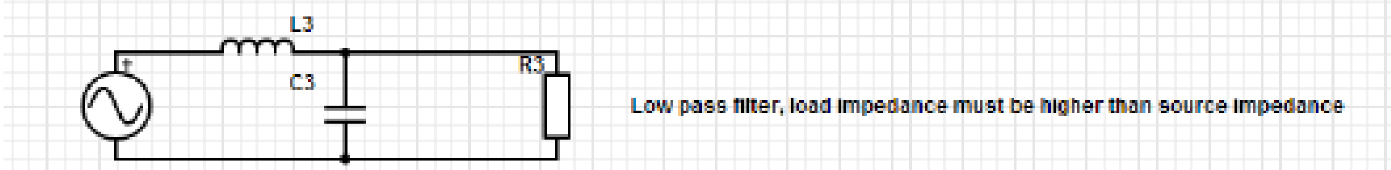
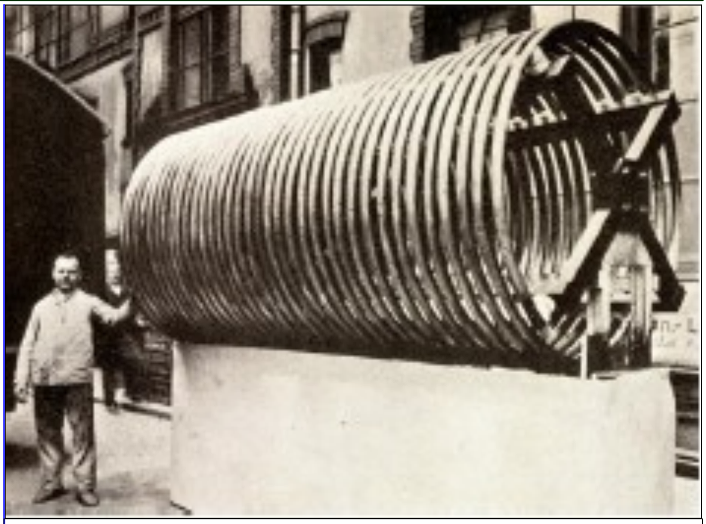


(Go fly a kite from page 4)

There are a number of potential areas of loss in antenna matching networks. Capacitors tend not to be very lossy provided any sliding connections (found in most variable capacitors) have a low resistance. Inductors will have resistive losses. These are accentuated by the fact that RF flows only on the surface of the conductors (it penetrates only slightly), thus coils in high power antenna tuners are frequently silver plated. The actual loss of an antenna matching network tends to depending on the impedance of the load to be matched. It is easily measure by matching the load impedance with one network and then connecting another identical network. Commercial antenna tuners are often in metal boxes. These boxes can reduce the Q of the tuning inductor and can even increases losses.



Some antenna tuners have large loading coils

Where to put the antenna matching network?

The best place for an antenna matching network is usually at the feed-point of the antenna. This allows the use of a defined-impedance transmission line between the antenna and the transmitter. There are exceptions though: in the case of a doublet fed with open wire line, the line losses are so low that the high VSWR at the feed-point of the antenna does not give rise to excessive feed-line losses and so the tuner can be at the end of the open wire line. Another exception is when an antenna tuner is used to increase the bandwidth of an antenna so that the band edges can be used. The most common example of this is when a coax fed 80 m dipole is being used and coverage across the whole band is required. In such a case it's fine to have the matching network at the end of the coax because:

- the VSWR is moderate
- the excess line loss will be low due to the low radio frequency.

For these reasons, internal "antenna-tuners" in radios intended to be used in the shack are not as flexible for use as external tuners.

SOTABEAMS makes a range of antenna tuners for portable use, visit
www.sotabeams.co.uk

References:

Electronic Applications: Smith Chart, Philip Smith, Noble Publications

Yet another Dipole Feed Point Enclosure

Greg Ordy, W8WWV

Using plastic pipe parts to build a feed point enclosure for a centre-fed dipole is hardly unique or original. This article looks at yet another variation on the old theme.

Introduction

I was working on building parts for an 80 meter Moxon Rectangle. The overall antenna design is described in another article. The elements were made of wire, and the centre feed point was the typical two wires coming to a single point where the feed line attaches design - a dipole. In this case, the feed point of each of the elements was slightly more complicated. I knew that I needed room for a current choke, in order to attempt to keep unbalanced current from flowing on the feed line, and disturbing the desired radiation pattern. In addition, I wanted to locate a DPDT relay at the feed point that could control the insertion of inductance for shifting the antenna resonance from the SSB (3,790 MHz) DX window to the CW (3,525 MHz) DX window. What I needed, therefore, was an enclosure to hold the current choke, the relay, and two powdered iron toroidal core inductors. In addition, the enclosure

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(Dipole Feed Point Enclosure from page 5)

should be as light and small as possible, while providing enough strength to stand up against the tension of the wire elements and the feed line. Resistance from weather damage is also important.

I always seem to think about metal boxes before plastic. Three key issues to consider are the need for electrical shielding, box strength, and weatherproofing. Cost is also always an issue. I did realise one interesting key point, which really made metal undesirable. For the current choke, I wanted to use a W2DU-style design, available from The Wireman (their product #833). This design consists of 50 ferrite beads over a length of thin but high quality and high power Teflon coax. One end of the Teflon coax (RG-303) connects to the female SO-239 panel connector, while the other end connects to the SSB/CW relay. After thinking about it for a bit, the light bulb went on. I realised that it defeats the entire purpose of the choke if you ground the two ends of the RG-303 together. The ferrite section is effectively shorted out. No wonder plastic pipe is often used to enclose chokes and baluns!

Since electrical shielding was not important for this application and given the shorting out the choke issue, plastic seemed like a better choice. In most cases I find plastic to be more weatherproof, it certainly can't rust. At most, certain plastic can degrade due to UV exposure.

I still had some concerns about strength. An 80 metre dipole can put quite a bit of strain on its centre support. Plastic would only make sense if it could stand up to the tension of the wire elements and the weight of the transmission line.

Certain plastic boxes are specifically made for holding electrical wiring in outdoor environments.

While I always search the electrical aisle at the hardware store for some new solution, these boxes and enclosures usually don't provide a satisfying result. They are often expensive, and are never quite the right size. As always seems to be the case, I found myself heading for the plastic pipe aisle.

Design and Construction

When considering using plastic pipe in such a project, two important questions arise. The first is the pipe diameter, and the second is the pipe thickness. Common plastic pipe diameters range from ½ to 4 inches (12,7 to 100 mm). Even larger diameters are available, although they may be more difficult to find. I knew that my toroidal inductor would be wound on a 2 to 3 inch (50 to 75 mm) diameter core, so the 4 inch (100 mm) plastic pipe size looked very good.

Sealed cylindrical enclosures are made by adding plastic end caps to a section of plastic pipe. Plastic pipe wall thickness is usually either the thinner Schedule 20, or the thicker Schedule 40.

Looking ahead, I assumed that I would use stainless steel U-bolts to provide attachment points for the wire elements. These U-bolts would be located at the top of the cylinder, where they would go through both the pipe and the end cap. In effect, the pipe is nearly twice as thick in this area because of the addition of the end cap. Because of the added thickness in this region, I decided upon the thinner wall pipe. The thicker pipe is simply overkill, and is quite a bit heavier.

I left the plastic pipe aisle with a length of pipe, and four end caps (two wire elements

Components of the basic cylinder

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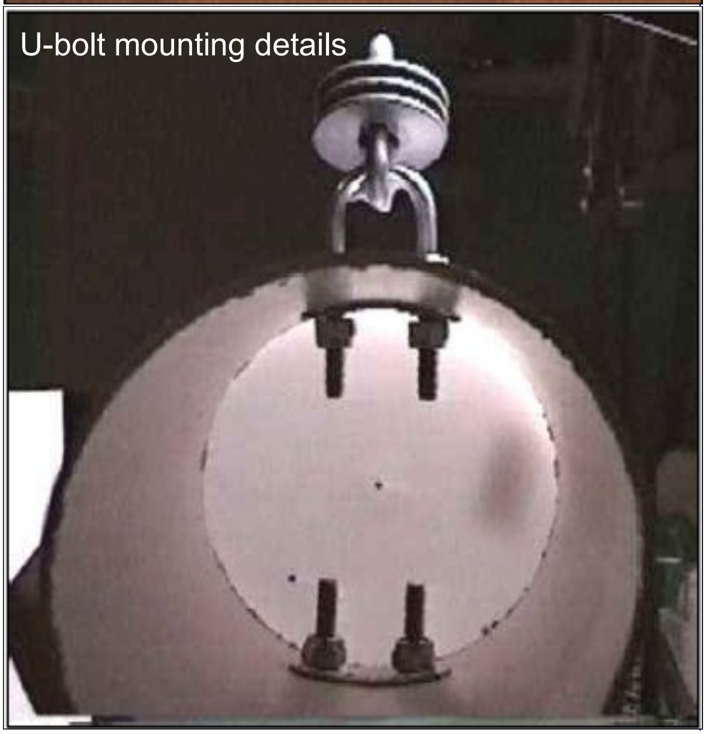
(Dipole Feed Point Enclosure from page 6)

times' two caps per cylinder).

The Wireman also sells some sturdy plastic insulators (their #810) which I wanted to use as the attachment points for the wire elements. I then picked up some ¼ x ¾ x 2¼ inch (6,35 x 19,05 x 57,15 mm) stainless steel U-bolts, which would connect the insulators to the plastic pipe end caps. The following picture shows the basic elements of the plastic cylinder, U-bolts, and insulators. The picture also includes the ferrite core current choke, and the SO-239 jack. All plastic parts are 4 inch (100 mm), Schedule 20, in size.

Assembled basic cylinder



U-bolt mounting details

The length of the cylinder was set at 8 inches (203,8 mm). I glued the top end cap to the pipe. I drilled mounting holes for the SO-239 connector on the centre of the bottom cap. I mounted the U-bolts on opposite sides of the top end cap, half way down the length of the end cap. The following picture shows the parts assembled as described.

The holes on the plastic insulators were slightly enlarged so that the U-bolt could pass through them. The normal U-bolt plate is flat. Since the cylinder walls are curved, I bent the U-bolt plates to match the radius of the inside of the cylinder. I added extra nuts and washers on the outside portion of the U-bolts in order to make a firm sandwich of metal around the plastic.

The external shell of the enclosure was complete. What I needed now was a scheme to mount the relay and inductors firmly inside the cylinder.

A number of different ideas were considered. I wanted a solution that provided a firm mount, but was also maintainable. In other words, parts could be accessed and replaced. Since the space in the cylinder was not very large, and it was 8 inches (203,8 mm) deep, it would be necessary to assemble the components outside of the cylinder. The cylinder itself could not directly be part of the mounting system.

In the end, I went with what I called the toilet paper tube dispenser design. I attached the relay and inductors to a ½ inch (12,7 mm) diameter plastic pipe that is held in place by 3/4 inch end caps. On the top end of the cylinder, I simply glued a ¾ inch (19 mm) end cap to the inside of the 4 inch (100 mm) cap. The bottom support was complicated by the SO-239 jack which was already attached to the centre of the bottom 4 inch (100 mm) end cap. I created a mounting surface for the ¾ inch (19 mm) bottom end cap by gluing it to a 2 inch (50 mm) end cap which was placed around the SO-239 connector and itself glued to the 4 inch (100 mm) end cap. A slit was cut in the 2 inch (50 mm) end cap to allow the current choke to pass from the SO-239 into the 4 inch (100 mm) cylinder. The next figure is a simple cross section of the mounting system.

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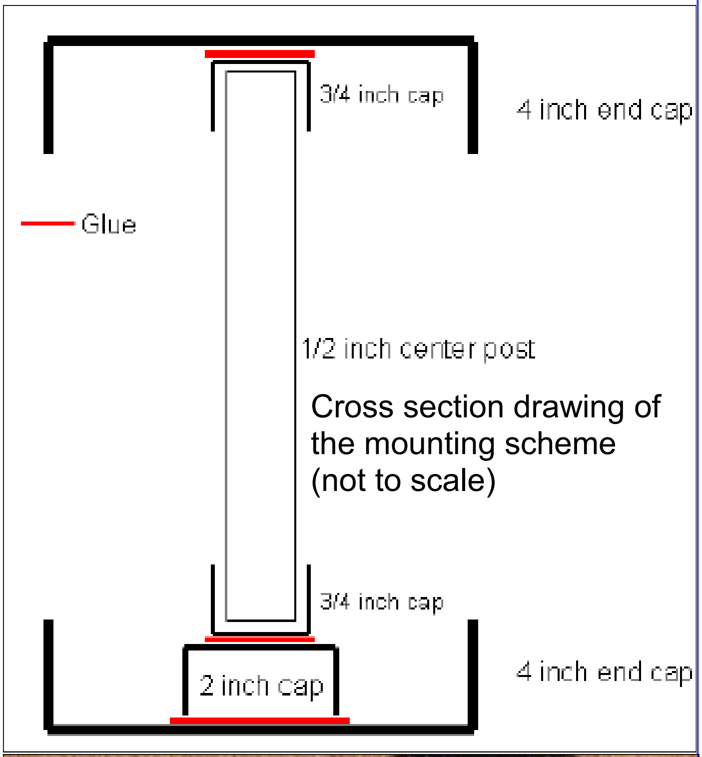
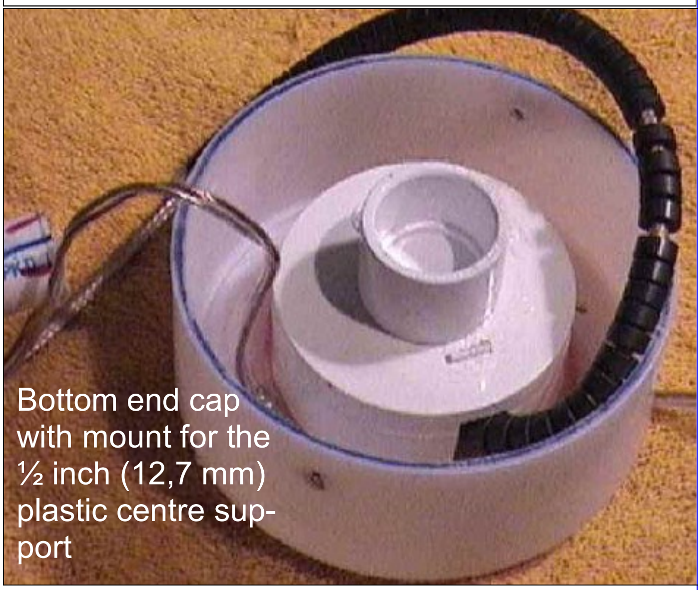
(Dipole Feed Point Enclosure from page 7)



Cross section drawing of the mounting scheme (not to scale)



Bottom end cap with mount for the ½ inch (12,7 mm) plastic centre support

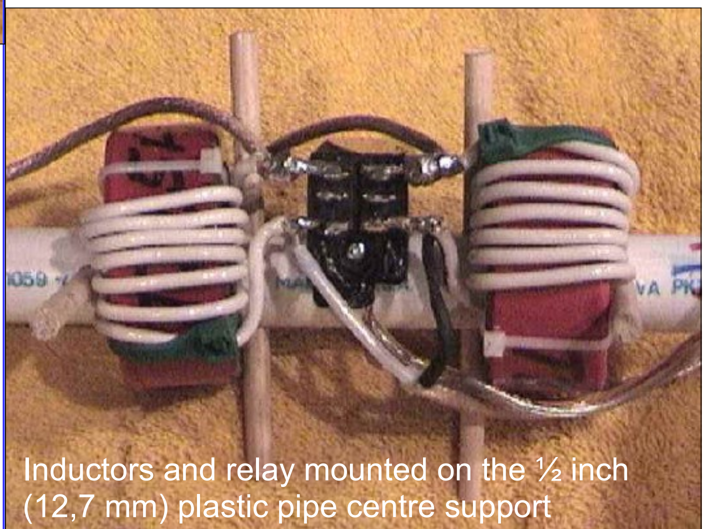
The ferrite cores are clearly visible around the RG-303 coming out of the slit in the 2-inch (50 mm) end cap. The ¾ inch (19 mm) end cap on the top centre matches up with a second ¾ inch (19 mm) cap on the top of the cylinder.

These two caps hold captive a length of ½ inch (12,7 mm) pipe, which will serve as the mounting base for the internal components. The two-wire cable coming through the bottom cap on the left side is the relay control cable. I drilled 4 holes around the perimeter of the bottom cap to accept #10 X ½ inch (12,7 mm) stainless steel machine screws that hold the bottom onto the cylinder. I also drilled a weep hole in the bottom cap, to drain any moisture that might accumulate. Water always seems to find a way to get to where it doesn't belong.

I used a hacksaw and file to create a notch in the ½ inch (12,7 mm) pipe for the relay. Since the relay, a 10 amp Potter and Brumfield unit, came in a sealed plastic case, I simply glued it into the notch. If ever the relay fails, it will be necessary to replace the ½ inch (12,7 mm) pipe as well. All that was left was to mount the toroids.

Given the expected power levels, and required inductance, I selected the Amidon T225-A2 powdered iron core for the toroids. According to the EZNEC model, each toroid needed to supply 62 ohms of inductive reactance in order to lower the resonance point from 3,790 to 3,525 MHZ. With the wire I used, and my winding technique, each coil required approximately 7 turns. I adjusted each coil for the desired reactance with the aid of an MFJ-269 antenna analyser. The ½ inch (12,7 mm) plastic pipe fits inside the core centre. While the stiffness of the solid copper wire I used would probably hold the coils in place next to the relay and around the centre support, I chose to pin the cores in place with ¼ inch (6,35 mm) wooden dowels. These dowels provided a second function, which turned out to be quite important. I cut the dowel length to be the inside diameter of the 4 inch (100 mm) cylinder. The dowels then acted as centring guides that keep the ½ inch (12,7 mm) pipe centred in the 4 inch (100 mm) tube while the parts are assembled.

The following picture shows the inductors, relay and dowels, all attached to the ½ inch (50 mm) pipe.



Inductors and relay mounted on the ½ inch (12,7 mm) plastic pipe centre support

(Continued on page 9)

(Dipole Feed Point Enclosure from page 8)

In this picture, the RG-303 from the current choke, and the relay control wire, dress to the right. The antenna wires dress to the left. Two holes were drilled in the 4 inch (100 mm) cylinder near the U-bolts so that the antenna wires could leave the cylinder and attach to the wire elements near the plastic insulators. All internal connections are made right on the relay pins.

The antenna wires are fed through the holes in the top of the cylinder. The ½ inch (12,7 mm) pipe is placed in the 4 inch (100 mm) cylinder. The dowels keep the smaller pipe centred in the larger pipe. The current choke, which is approximately 12 inches (304, 8 mm) long, winds around the inside of the bottom cap. The bottom cap is placed over the cylinder and then held fast with four screws.

Conclusion

I doubt if plastic pipe was designed with amateur radio in mind, but, it can be quite useful in many situations. In this case, I used it to make a strong and weatherproof case for the centre support of an 80 metre Moxon Rectangle.

In this installation, the feed line runs a very short distance before it is supported. This reduces the weight of the feed line connected to the bottom cap. In the case of any significant feed line weight, I would strongly recommend that a strain relief rope that connects to the U-bolts support the feed line. I would not allow significant weight to hang down from the bottom cap. In the extreme, it could crack and fail. I would also use the U-bolts as a mounting point for any upper support rope that would raise the cylinder in the air.

http://www.seed-solutions/gregordy/amateur radio/experimentation

HF Mobiele Antenna wenke om ‘n mobiele HF antenna op ‘n voertuig te installeer

A. **Aanbieding van AD5X**. Die onderwerp word redelik in detail behandel met heelwat wiskundige formules, moenie daarvoor skrik nie. Die volgende programmetjie doen al die huiswerk vir jou!

B. Programmetjie van die ARRL Antenna Book 19th Edition. **Mobile.exe**, is gebasseer op die formules soos in die Antenna handboek beskryf. Ongelukkig is dit nog 'n DOS program en moet dit in 'n DOS gesimuleerde venster op die 64 bit Windows bedryfstelsels loop.

C. ARRL artikel: 'n Praktiese antenna wat self gebou kan word **A $20 HF Mobile Antenna**

Die drie items kan op die klub webwerf afgelaai word, kyk onder ‘Downloads’

Opsommend

1. Gebruik die langste moontlike antenna - veral vir 14 MHz en laer
2. Monteer dit so hoog as moontlik en verkieslik in die middel van die voertuig.
3. Totale maksimum hoog moet laer as 4,3 m wees
4. Kyk na die beaarding van panele, radio, antenna en die uitlaatpyp!
5. Installeer die radio sodat dit nie jou bestuursvermoë belemmer nie
6. Spoelverliese moet so min as moontlik wees (gebruik dik geleiers)
7. Stem eers die antenna in dat dit resoneer (X = 0)
8. Doen hierna die aanpassing op die aanpasspoel onderaan die antenna.
9. OPPAS: Vandag se voertuie het baie elektriese harnasse, lugsakke en veselpanele. Wees gewaarsku!

Met dank aan die Nov/Des Teenspanning van die Magalies Amateurradioklub

The South African Maritime Net operates 7 days a week and provides weather reports from around the coast and maintains contact with boats off the coast of South Africa and up into the Mozambique channel. There are two regular schedule times as follows:
06:30 UTC: Starts on 14 316 kHz for 5 - 10 minutes and then moves to 7 120 kHz
11:30 UTC: Starts on 14 316 kHz for about 30 minutes and then moves down to 7 120 kHz

Participation is more important than the victory and friendship is worth more than prizes

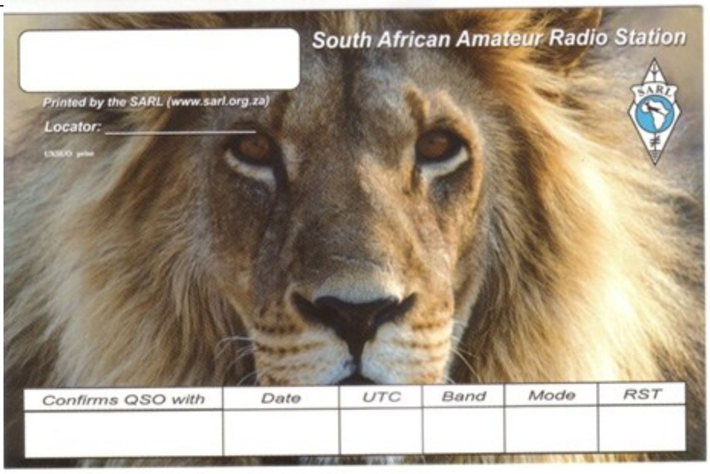
Bloemfontein Amateur Radio Club
Bloemfontein Amateurradioklub

PO Box / Posbus 33211, Fichardt Park, 9317
e-mail: zs4bfn@gmail.com Web: http://www.zs4bfn.co.za

Birthdays and Anniversaries

2 - Ruan, seun van Nico, ZS4N
2 - Teresa en Dries, ZS4AJ
3 - Sarie, ZS4SG, en Hennie, ZS4HG
4 - Warren, ZS4W
5 - Victor, ZS4VR
13 - Martin, ZS4MC
15 - Shane, ZS4TW
22 - Frans, ZS4FP
23 - Daniel, ZS4DL

QSLing is the final courtesy of a QSO



The South African Radio League has produced a generic QSL card, which you can personalise by writing in your own call sign. The cards are available in batches of 100 at R50 per batch, including postage. To order, pay in the amount for the required number of QSL cards into the SARL account.

Account details: ABSA account no 407 158 8849, branch code 632 005. Send details of the delivery address and proof of payment to zs6wwj@gmail.com

Die Suid-Afrikaanse Radioliga se Nasionale Velddag word gehou oor die naweek van 14 en 15 Februarie 2014.

16 to 18 January - PEARS National VHF/UHF Contest
24 January – Summer QRP Contest
31 January, 16:00 - ZS4BFN Club Meeting
7 and 8 February – AWA CW Day
14 and 15 February – SARL National Field Day
21 February – SARL Youth Contest
22 February – SARL Digital Contest
28 February, 16:00 - ZS4BFN Club Meeting

Hierdie maand se uitdaging

I am not what happened to me. I am what I choose to become. – C.G. Jung

Jou verlede is nie jou hede nie. Niks wat in jou lewe gebeur het, bepaal wie en wat jy vandag is nie. Jy kies self wie jy wil wees. Ja, natuurlik is daar dinge uit ons verlede wat ons nie ongedaan kan maak nie, maar ons kan steeds kies hoe om daarop te reageer. Verkeerde keuses in die verlede bepaal nie my huidige keuses nie. Nikodemus was 'n fariseër – 'n groep wat vyandig was teenoor Jesus – en tog keer dit hom nie om Jesus op te soek nie (Joh 3). Kyk ook na Paulus, Matteus (Levi die tollenaar) en soveel ander.

Hoe lank gaan jy nog toelaat dat jou verlede jou hede bepaal?

© Leon M Foot (ZS4Y)

Onthou om jou GRATIS boek '*Lewenshulp vir 'n nuwe begin*' af te laai by www.lifecoachleon.co.za