AWA Newsletter

88

May 2013

Affiliated to the SARL

Antique Wireless Association of Southern Africa

Inside this issue:

AWA Committee:

* President—Richard ZS6TF
* Technical Advisor—Rad ZS6RAD
* Secretary/PRO—Andy ZS6ADY
* Western Cape—John ZS1WJ

Reflections:

Being an ardent Collins fan, some might say "ag shame", I get regular communication in the form of a Collins Reflector via the internet.

During this week, one of the guys posted a link to some photo's of Dayton Hamvention.

My mouth absolutely hung open at the stalls and rigs that were there for sale. It was absolutely gobsmacking.

The boat anchors that were on sale there, and probably many of them still went home with their owners, was amazing. The majority of them still in absolutely beautiful condition.

I wonder if we could ever get to a quarter of the attendance (well that would mean every registered ham in SA attending) at one of our flea markets. Any of them ?

Of course there are more than just boat anchors on display at the Hamvention and the top manufacturers also have their latest and greatest on very elaborate displays.

What is it that makes many of us go to Hamventions/ Fleamarkets ?

Is it the allure of just seeing what is out there and what is available, or is it just to catch up with old friends ? Is it looking for something in particular to add to the junk box for later builds, or is it looking for something newer to add to the shack or mobile ?

Most times, I believe, we are looking for things that will improve the quality of our signals or enhance the shack/mobile in some way.

In my case, I must admit, its really to go and catch up with as many of the friends I have made in the course of operating ham radio, as I can. There is always the allure of finding a transmitter or receiver that I may be specifically looking for, but the camaraderie and interesting conversations that one can get involved in, are to me much more important.

Of course, we do not have anywhere near the amount of hams in SA as the US does probably in one state, but I am sure we could do more to attract many more of those who do not go to fleamarkets, to actually attend.

What ? I really do not know. But there must be some gap that can be filled by attending these outings.

Now, anyone going to sponsor my trip to Dayton next year ?

Best 73

DE Andy ZS6ADY

AWA OPEN DAY

Our Annual open Day has been postponed this year from April, to fall in with an invitation to the Kempton Park Club Flea Market on the 1st of June at the :

Impala Voortrekker Centre,
46 Rooibos Ave,
Allen Grove,
Kempton Park.

Tables will be available for fleamarket goodies and there will be the usual display of antique radios and associated equipment. Should you want a table, please contact Selwyn ZS6SEL and let him know your requirements. You can also go to :

http://www.zs6kts.co.za/

Please diarise this date on your calendar and come along and join us.

CW Net:

For some reason or another, it has been a fairly active month on CW.

Every weekend there have been a good few rag chewers going from 12 wpm to 25 wpm who have been willing to get in the saddle and pump out some CW, which to me has been very exciting.

In the QRP contest, I only managed a few CW contacts, but in the ZS3 contest, I managed to get 12 CW contacts.

The band has been fairly active and even with the AWA net on a Saturday afternoon, there are the regulars, plus one or two more calling in.

On the Dx scene, well you can tune in to the Dx bands almost any time and hear a fair amount of CW taking place. There is always someone out there playing with their paddle, bug or straight key.

We have been encouraging <or trying to at least, ardent CW'ers to come up on frequency for some time now. At least a year or two, but to no avail.

I know there are those who listen to our nets and often to the frequency just to try their ear at picking up what they can.

About a week ago, I was asked by one of the net members, why we kept the speed at which we send so low. My answer to him was, in case anyone decided to join who was still a novice at CW. He then asked me when last a novice joined the net ?

Unfortunately, my response had to be not for a good few years. Which was a little disconcerting, to say the least.

A valid point from my colleague who is trying to entice me to get up to 20 wpm and faster, where mistakes abound.

So I wonder. Where are those novices who have been talking about joining the CW net ? When are you going to stop talking about it, and join us ?

Looking forward to hearing you on key.

DE ZS0AWA/CW …-.-

SSB activity:

The bands have been good to us through out this last month and conditions have been pretty good country wide.

There have been a regular 18-20 at times more, calling in on the SSB net to join in with the topic of discussion. We believe this has proved to be fairly popular and normally, the topic of conversation has to do with operation or has reference in some way to our antique radios.

We look forward to hearing what Richard has dreamed up for topics and hopefully they haven't reached the nightmare stage yet.

With the Valve QSO party now a thing of the past, we were pleasantly surprised at the turnout. With no official figures available yet, ZS0AWA loged 60 contacts on the SSb section, which is the best we have ever done.

Admittedly, that was on both 40 and 80m and some of them were duplicated, but still, very rewarding to hear all the activity.

What was of interest, was how many more valve radios, either pure valve or hybrid, there were on the band. I noted, one of the more popular rigs of choice being the FT101/2 in various models. The Yaesu Hybrids were very much in the majority of rigs being used.

There were also a few Kenwoods and of course then the pure valve technology from Hallicrafters and Collins, much in the minority, but of course scoring the points for using valves.

Thanks to all who took the time to participate

Heathkit HW 101

AM:

The AM sessions on a Wednesday evening and Saturday morning continue with the ardent AM crew pounding out MF's to their hearts content.

We have seen an increase in people joining the net on the odd occasion, and usually with some exotic AM rig that has been restored or dragged out of storage. Most encouraging to hear these old beauties being used again.

The AM section of the Valve QSO party also astounded us. Conditions were really not great for AM with QRN running in at S7 -8, but there was still a large amount of activity taking place.

ZS0AWA logged over 30 stations on 40 and 80m which was quite remarkable. Of course Div 1 stations were very thin and I only heard Matt ZS1MJJ, but could not get through with the noise on the band.

It was so encouraging to hear so many stations working on AM and of course with the broad receivers that some of have, it was quite hair raising trying to hear all the stations calling.

As Eddie, ZS6BNE put it to me with his log submission, this was the most AM stations he had ever heard on 40m at one time.

I believe there were some complaints from to the Western Cape stations about how wide some of the transmissions were, but its not as if our bands are so busy that the complainants could not move to the top end of 40m. Besides, it only happens twice a year.

The next QSO party will take place in October. So start getting those AM rigs sorted out for the next one.

Collins 51J-4

Neutralization

BY W8JI

While there may be exceptions, neutralization of a high frequency PA (power amplifier) vacuum tube amplifier has little to do with VHF or UHF stability. VHF instability is almost always caused by a high impedance (or even parallel resonant) path from grid-to-ground. The high grid path impedance prevents the grid from being held at ground-potential for RF over some range of frequencies. If the high grid-path impedance occurs at or near a frequency range where the anode path to ground is parallel resonant, the tube can act like a tuned-plate tuned-grid oscillator.

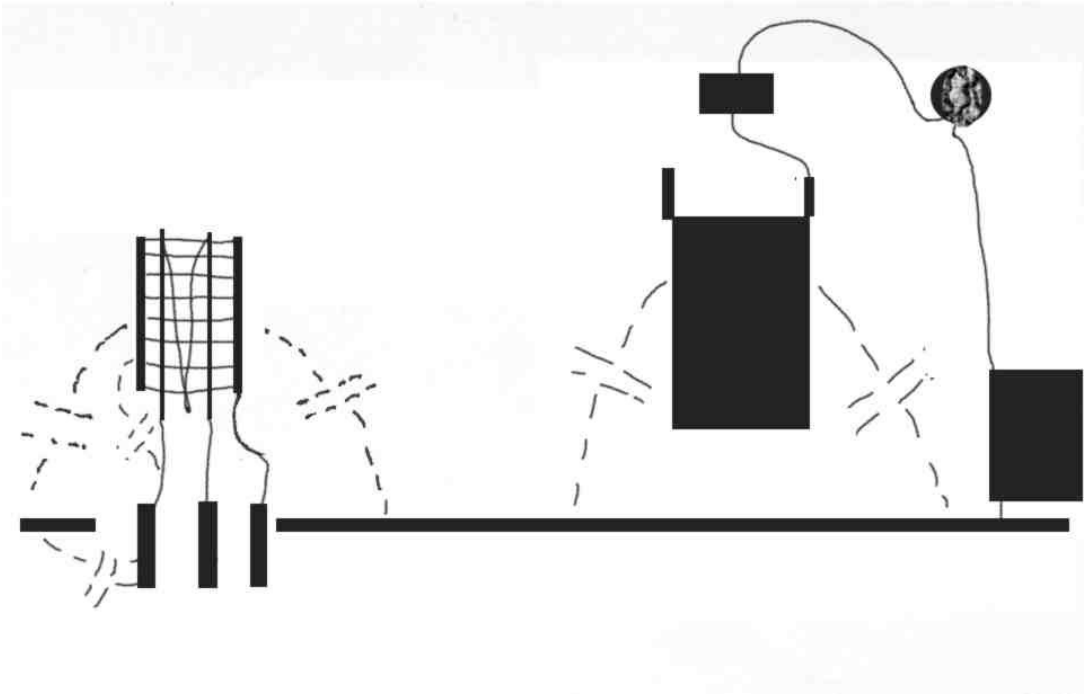
Neutralization is primarily concerned with normal expected anode-cathode feedback in a grounded grid amplifier. Anode-cathode feedback is caused by imperfect shielding from anode to cathode inside the tube, as well as additional feedback outside the tube. In reasonable layouts the in-tube capacitance dominates, especially if multiple parallel tubes are used.

As in other amplifier stages, excessive feedback causes the plate current dip and maximum power output to be out-of-sync. This can add positive feedback, increasing intermodulation distortion. In severe cases, the amplifier becomes unstable and oscillates under some tuning conditions at or near the operating frequency. The Yaesu FL2100 series, the Dentron Clipperton L, and the Collins 30L1 are particularly unstable.

In the FL2100, rumors are some tubes oscillate because they have higher mu or gain. This is actually the opposite of the truth. The FL2100 will oscillate, on standby, with any 572B tube if the bias is reduced enough to allow conduction with the antenna and exciter disconnected. The reason some tubes oscillate in the FL2100 while others do not, while on standby, is some tubes have slightly lower mu and draw current at idle while in standby. If bias is reduced on any brand tube, the FL2100 series will break into oscillation. The HF instability has little to nothing to do with gain, the instability is rooted in the lack of neutralization in early FL2100's, and a terrible neutralization system in the later FL2100Z.

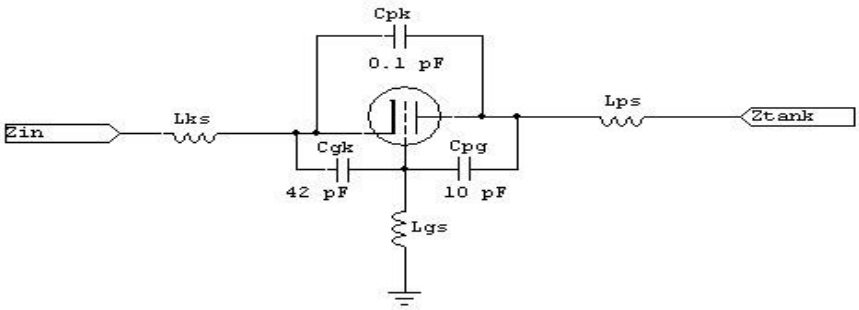
The worse thing about the incorrect mu rumors is the rumors mislead people into thinking certain tube brands cause problems from gain changes. The real problem is Yaesu used a terrible biasing system that barely cuts the tubes off on standby, they failed to swamp or load the tubes, or properly neutralize them. When Yaesu finally added a neutralization system, they used a terrible system. They added feedback from the antenna side of the tank circuit back to the filament. This creates variable phase and level feedback, with feedback depending on band, tank capacitor settings, and load impedance. This is as bad as the RF feedback in some Collins transmitters that wraps back around two tuned stages that are user adjustable.

In cases like this, where the design is flawed, blame is shifted to the tube type, even though the real problem is in the equipment design. In some Collins exciters, certain 6146's are blamed for a poor feedback system that destabilizes the stages. In the FL2100, Svetlana 572B's are blamed for Yaesu bias and feedback design problems. The result of this is certain tube brands get a bad rap, often in well-written white papers that, unfortunately, are based on speculation rather than logical verification.



Long grid path of 572B tube and poor shielding from anode to cathode (filament) structure:

The VHF parasitic circuit, unrelated to neutralization, heavily involves the grid's path to ground.



Neutralization can only cancel Cpk, and generally has minimal effect on VHF stability of HF power amplifiers. Lack of neutralization, when required, causes upper HF instability. Upper HF instability can easily damage band switches and other tank components.

Cathode Driven Power Amplifier

Many people think grounded grid HF PA's never require neutralization. In many cases this is true, but in some cases it is not true. Tubes with low impedance compact grid structures and grid connections that come out of the envelope with very short leads, like the 8877, have very little feedthrough capacitance. The 8877 is unconditionally stable all the way up to UHF. With the 8877 grid ring grounded directly to the chassis with a very low impedance connection, the 8877 will not require neutralization or parasitic suppression.

Some tubes are much different. Tubes like the 3CX1200A7 or D7 have significant feedthrough capacitance, and exhibit "out of neutralization" behavior above 20 MHz. This behavior is characterized by maximum RF output occurring well off the plate current dip, and in some cases (i.e. open circuit input terminations) by actual HF instability.

*Tubes generally **not** requiring neutralization in GG HF amps are the:*

8877/3CX1500A7 8873 8874 8875 3-500Z 3CX800A7 3CX1200Z7 3CX3000 series 3CX5000 series 3CX10000 series

Tubes generally benefiting from neutralization in HF GG amps are the:

810, 811A, 833, 572B, 100TH, 304TH, 8005, 3CX1200A7, and 3CX1200D7.

Tetrodes and pentodes generally have very low feedback when their grids operate at RF ground potential. Connecting a beam forming plate, screen grid, or control grid to the cathode changes things. With a grid or beam forming plate tied back to the cathode, feedback can increase to the point of instability. Some amplifiers, such as the Amp Supply LA1000 or Dentron sweep tube amps, were unstable on ten meters because the control grid was tied back to the cathode. While these amplifiers could have been stabilized through neutralization, the customer was left to simply load them heavily enough to stabilize them.

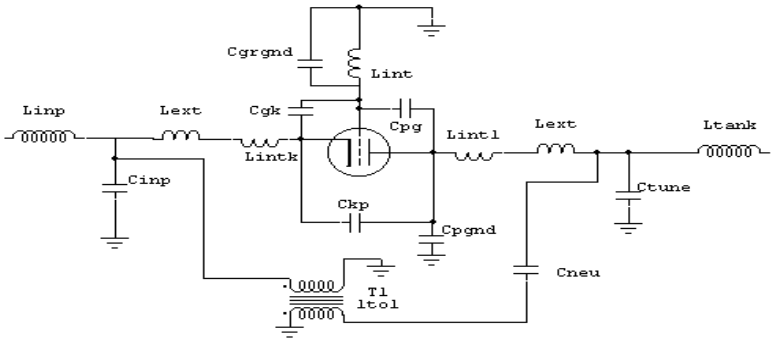
Tubes not requiring neutralization in GG circuits are generally those with conical grid supports and grid connections made via a very short wide internal grid lead or leads. Stable tubes (tubes with low internal feedback) often have compact control grid structures inside the tube.

Tubes benefiting from neutralization are those with long thin (often single) grid leads to single pins, widely-spaced grid wires, and poor or no internal shielding from anode-to-cathode.

Tubes with better internal shielding, short wide grid leads, compact grid structures, and close spacings not only work better at upper high frequencies, they are also significantly more stable at VHF. Such tubes rarely require neutralization or parasitic suppression! The most stable tubes are designed to work at VHF and higher, the least stable tubes generally make poor VHF amplifiers.

How Do We Neutralize a Grounded Grid Amplifier?

Electrical Equivalent Grounded Grid Amplifier

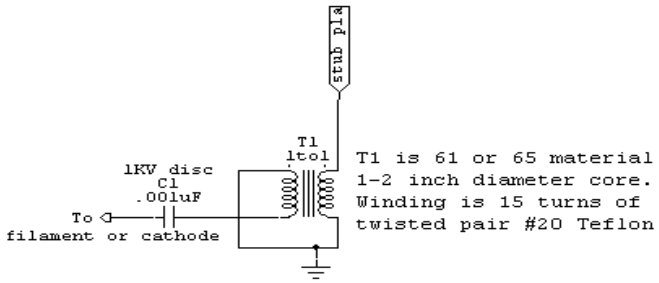


In the circuit above, T1 inverts phase 180 degrees. Cneu approximately equals Ckp, the cathode plate capacitance (or feed-through capacitance) of the tube. Unwanted feedthrough capacitance, Ckp, varies widely with frequency. This capacitance is not frequency linear. It has less reactance at higher frequencies, and higher reactance at lower frequencies. The absolute equivalent value of Ckp varies more than a pure capacitor would with frequency because all stray inductances, including Lint (internal lead inductance) and Lext (external lead inductance), cause Ckp to have a reactance vs. frequency slope much more rapid than a normal fixed capacitor. This means we can really only neutralize a PA perfectly over a small range of frequencies.

In the Ameritron 811H amplifier, neutralization is almost perfect on fifteen through ten meters. The typical feedthrough null is 35 to 45 dB. The 811H neutralization does a good job from 7 to 45 MHz, where feedthrough is less than -20 dB. Feedthrough capacitance is so low perfect neutralization is not required below 10 MHz. Above 45 MHz the parasitic suppressors load the circuit enough to greatly decrease gain and stabilize the stage.

The AL-811H is perfectly stable and will not break into oscillation on any band if we remove the antenna or exciter, key the PA without drive, and rotate the tuning and loading controls throughout their range.

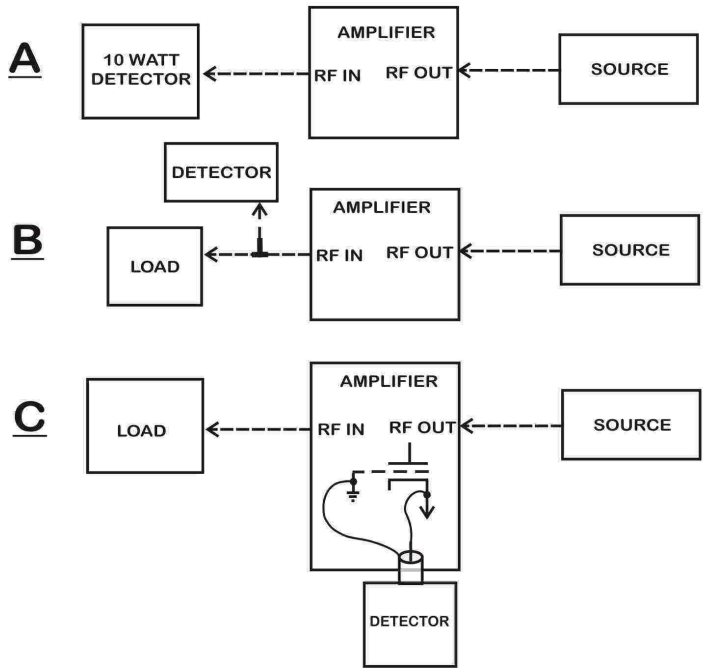
If we repeat this test with a Clipperton L, Yaesu FL2100, or a Collins 30L1 (all un-neutralized amplifiers) most amplifiers (if not all) will break into self-oscillation on 15 and 10 meters. This instability occurs because 811 and 572 tubes have similar poor construction. The tubes have very poor shielding from anode-to-cathode. Both tube types exhibit very high amounts of feedthrough capacitance, enough feedthrough capacitance to make un-neutralized amplifiers unstable near the operating frequency on higher bands, such as 15 and 10 meters.



The circuit above is a typical neutralization system for a grounded grid amplifier. The ferrite core is a 1 to 2 inch diameter, 1/2 inch thick, using a higher Q (low loss tangent) 61 or 65 material.

Test Setups

Neutralization adjustments are best done on a cold amplifier. To adjust neutralization, three basic test configurations can be used:

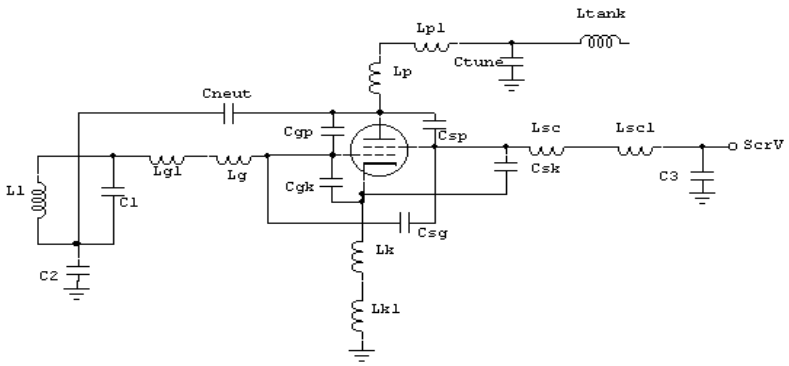


In all configurations except "C", input and output ports can be reversed. The source should be variable, and capable of supplying a few watts. Many transceivers will work OK.

The detector should respond to very low levels, but be capable of withstanding some reasonable power in the event of a circuit or component defect that accidentally allows full source power to couple through.

Grid Driven Tetrodes

Grid driven tetrodes like 6146, 807, or 4CX250's have high power gain. High gain systems require very little feedback to become unstable, so they are generally neutralized. The also often require some form of grid loading resistor to reduce or stabilize gain. The following circuit shows a commonly used tetrode grid-driven amplifier with neutralization:



L1/C1 is the normal input tuning coil. Being resonant on the operating frequency, it inverts phase 180-degrees from end-to-end. C2 is a voltage divider to control the feedback voltage ratio and provide a return path for grid excitation. Cneut is adjusted so its voltage feedback equals the voltage fed through Cgp from plate to control grid inside the tube.

Note that this system depends heavily on L1/C1 being resonant at the operating frequency. This proves the tube is only neutralized at the frequency where C1/L1 is set. It does not stabilize the tube on any frequency except where L1/C1 is resonant.
Lp,Lsc,Lk, and Lg are inductances of leads inside the tube. Lp1,Lg1,Lk1, and Lsc1 are lead and component inductances that occur outside the tube.

While the feedback adjustment setting of Cneut holds true for multiple bands near the initial adjustment frequency, it only actually neutralizes the tube on the band in use at any moment of time!

In a 160-10 meter PA, Cneut generally only works properly over two or three bands. It is usually set near 15 meters so it has the most effect where it is needed most. By the time we get down to 40 meters and lower, feedback voltage through Cgp is generally through such a high reactance that the lack of proper balancing is meaningless.

Additional stability can be added by loading the grid with a broadband termination resistance. This makes neutralization much less critical, and may at times even eliminate the need to neutralize. This resistor would go from the control grid to ground and ideally be added right at the tube. Unless the resistor is an integral part of the bias system, it must be "dc blocked" with a low impedance series capacitance so it does not affect grid bias.

Neutralization:

Neutralization generally only affects operation near or at the desired operating frequencies. Neutralization is normally optimized near the upper frequency end of operation, perhaps between 15 and 30 MHz in a 1.8-30 MHz transmitter or amplifier.

Neutralization is sometimes needed because tubes have unwanted internal capacitances. The capacitance between the output element and the input element inside the tube will cause the output circuit to couple back to the input. If large enough, this regenerative feedback could cause a loss of efficiency. It might cause the output maximum to occur off the plate current dip, reducing efficiency. It might increase IM distortion or in rare severe cases may cause the amplifier to oscillate someplace the operating frequency. (This problem is common with grounded grid amplifiers using 572B's like the Dentron Clipperton L, or quads of 811A's, like the Collins 30L1. Yaesu has this problem is some FL2100's.)
While a need to neutralize does occur in some HF grounded grid amplifiers, it is more common in very high gain grid-driven amplifiers.

Neutralization Adjustment Methods:

Neutralization is generally accomplished by adding an external capacitance that is excited exactly 180 degrees out-of-phase with the feedthrough capacitance. One typical adjust procedure is to disable the PA stage by removing anode and screen or filament voltage. A sensitive RF detector is connected to the transmitter output. Neutralizing a totally cold tube is perfectly fine, because there is very little capacitance shift in a tube with temperature changes.
Normal drive is applied, and the neutralizing capacitor is adjusted until feedthrough power is minimum. The tuning controls are continually peaked for maximum power on the sensitive detector throughout the process.

A second less accurate method is to watch the plate current dip in a properly tuned normally operating transmitter. The neutralization capacitor is adjusted until ***maximum power output and minimum plate current*** occur simultaneously as the plate capacitor is tuned.

The best method varies with the PA design, but in general the most accurate method is by applying drive to a cold PA stage (generally either screen and plate or filament power is removed) and feedthrough power is measured with a sensitive detector.
What Happens If We Don't Neutralize a New Tube?

Many times nothing noticeable occurs if we don't neutralize a PA. The results really depend on how much different the internal capacitance is in the new tube(s) when compared to the capacitance of the tube(s) being replaced.
If the PA requires neutralization and we don't neutralize or re-neutralize it, we could find IM distortion higher. We would probably find maximum output power occurs well-off the plate current dip. The un-neutralized stage, in severe cases, might oscillate somewhere near the operating frequency under certain conditions of tuning and loading.

Neutralization is generally only accurate over a limited range of frequencies, but fortunately it is almost always at the higher frequency end of the operating range where the PA needs neutralized. The manufacturer probably knows the optimum adjustment point. In the AL1200 and AL811H, the optimum null frequency is 21.5 MHz.

Unrelated Problems are sometimes Blamed on Neutralization

Since neutralization is the canceling of feedthrough capacitance, and since capacitance doesn't change over the life of a tube (or even much from a hot tube to a cold tube), neutralization won't "drift out" with certain tube types.

A tube will either neutralize right from the start, or it won't. If it appears to drift out of adjustment something other than the neutralization is at fault. Tubes in HF PA's cannot drift in and out of neutralization because the capacitance is set by the tube's physical construction... not by emission, age, or any other time-variable parameter.

People sometimes blame neutralization for problems when they really have gassy or defective emission. Gassy tubes can go into current runaway or even flash over inside. Doing this for 35 years for a living, I've never yet seen a tube in a HF or lower VHF amplifier "drift" or age out of neutralization.

The capacitance is for the most part related only to the physical characteristics of the tube, like internal lead length, size of the elements, and spacing of the elements. That's why it is perfectly acceptable to neutralize a cold tube (no filament voltage). The change in feedthrough is very small when the tube is operating compared to when it is cold.

Visit : www.W8JI.com

President's Corner

By Richard ZS6TF

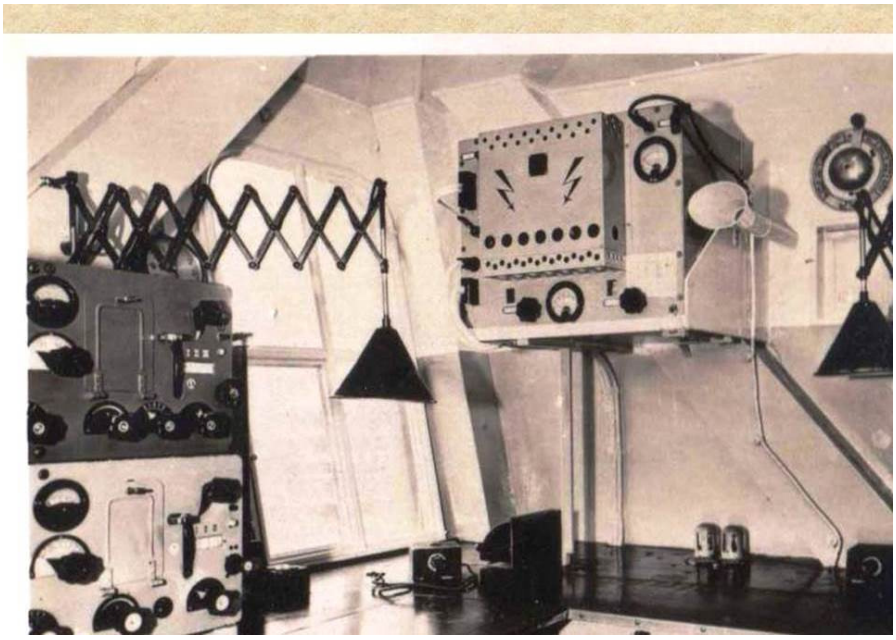
Objectivity is in the ear of the beholder.

This strange title came to me as I pondered the influences on amateur radio through the decades. As a de-tribalised Pohm, I confess to a certain fascination in de-bunking my own pre-conceived ideas, drummed into me by a post WW2 upbringing in England where everything German was suppressed and "The Dam Busters March" composed by Eric Coates' for the 1955 film, was my favorite music at the time.

Recently I renewed my quest for truth in this subject and discovered that Heinrich Hertz got into the act early on, upstaging Marconi by not only being the first person to conclusively prove the existence of electromagnetic radio waves by receiving them, but also by proving that their velocity of propagation equals the speed of light. This he did in 1885 while newly appointed as Professor at the University of Karlsruhe at the age of 27, 9 years before his death, clearly an exceptionally talented German.

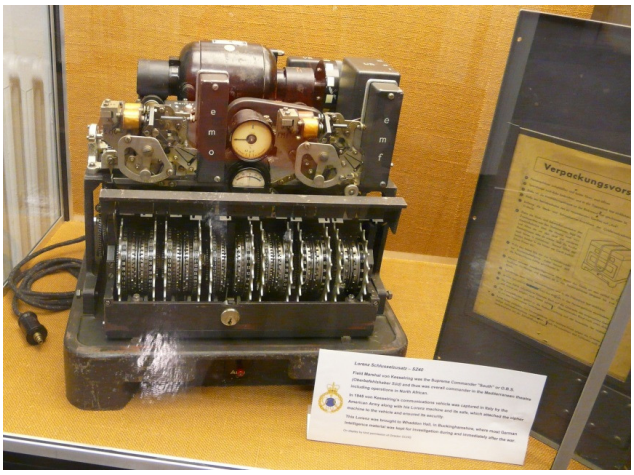
In 1930 the International Electro-technical commission adopted the name in his honour for the unit of frequency, but with the advent of the third Reich he was discredited due to "tainted ethnicity" It was not until 1960 that the General Conference on Weights and Measures (CGPM) in 1960, replaced the previous name for the unit, *cycles per second* (cps), along with its related multiples with Hertz as the unit. My Racal RA17 produced in the 1960's proclaims Mega-cycles and Kilocycles engraved on its front panel. My personal tribute to Heinrich is that I take care in my corre-spondence and emails to use a capital H and lower case letters for the multiple and the z.

The Germans have been synonymous with technical excellence and innovation for generations and radio was often a supporting technology for greater enterprises. The Graf Zeppelin began trans-Atlantic air services in 1928 which would not have been possible without reliable HF radio communication.



"Der Zeppelin Funk Raum"

Undoubtedly the urgency of World war 2 caused the accelerated development of new radio based technologies. The British airborne radios could justly be described as a collection of BA screws flying in close formation whereas the German radios made use of superb die cast compartments for RF isolation and their synthetic rubber insulation was far superior to the natural rubber to which the allies had access. The Germans definitely began the war with the ad-vantages of Enigma, superior HF and VHF radios, they developed radars (Freya and Würzburg) and radio navigation aids (Knickbein) forcing the British to accelerate their program of countermeasures and more advanced technologies to advance the defence of Britain and the eventual successful outcome of the war.



The German High command latterly switched to teleprinter communications over HF radio encoded by the Lorentz machine.

It took the Brits 14 months to design and build a machine called Colossus to routinely decode these messages. These machines were all destroyed after the war and it took 15 years to build a working replica, now displayed and operated at Bletchley park.

Whatever the moral standpoint, the destruction of Dresden in the closing stages of the war is a good example of technology leapfrogging. The clarity of the images on the 3cm H2S ground imaging radar realisable by the invention of the magnetron, kept secret from the Germans, and used by the British Bomber command, enabled deadly accuracy of the positioning of the bomber force to create the firestorm that engulfed the city.

Some technology arrived too late to affect the course of the war but provided a spring board for future developments. Notably the Americans set foot on the moon in 1969 in the “Analogue era” thanks to a leg up by Dr Werner von Braun and they haven’t been back since.

Amateur radio has undoubtedly been a major beneficiary of the post war liberation of vast amounts of military surplus equipment and components, sparking several decades of the greatest homebrew activity of all time with conversion and construction projects becoming a most important aspect of our amateur radio heritage, worthy of documentation and preservation.

Night fighter radar antennae on the nose of the Messerschmitt 262 jet fighter in the museum of military history, Saxonwold.

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Antique Wireless Association of Southern Africa

Mission Statement

Our aim is to facilitate, generate and maintain an interest in the location, acquisition, repair and use of yesterdays radio's and associated equipment. To encourage all like minded amateurs to do the same thus ensuring the maintenance and preservation of our amateur heritage.

Membership of this group is free and by association.

Notices:

I have a Yaesu FT901 DM with Transverter for 6m, 2m and 70cm and an FTDX400 that will be on sale at the fleamarket. If you are interested, come and see us there.

AWA 10th Birthday.

For those of you who have been with us from the beginning, you may just remember that it was in March 2003 that the first meeting on air of the AWA of Southern Africa was took place.

Now it is 10 years later and we are celebrating 10 years of being on the air and many various activities that take place on air. In celebration of this, we have designed a special QSL card.

In order for you to get this celebratory QSL card, you need to contact ZS0AWA during one of the QSO parties, or activity days that take place during the year. That would be the CW activity day on the 3rd and 4th of February. The AWA QSO party on AM and SSB on the 11th and 12th May and the QSO party on the 12th and 13th October. Should you have a QSO with ZS0AWA on any of these dates, send us a QSL with a SASE and we will send you the QSL