AWA Newsletter

86

March 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:

Close encounters of the best kind.

I have come to know some Hams who have made an impression on my life (not that it counts much for anybody else) and all of them have been associated with the AWA funnily enough.

My first encounter with Rod ZS5RK, was through an early morning net I met up with while running mobile 80m. It was through this net that I met up with a few of the other impressionists, but Rod always was one to encourage one to do better in the quality of transmissions. It was he who was responsible for starting the 80m AM net which still runs on a Saturday morning.

Through the starting up of the AWA, previously the Collins group, I met Bushy ZS6M. Bushy was the one who introduced me to Collins radio's and got me up and running on my first S-line, which I still use, and my first KWM2-A. He would sit with me describing the what's and what not's of Collins.

Through Bushy, I met Willem ZS6ALL, and became good friends with Willem. Willem could always talk the hind leg off a donkey on any subject you presented to him.

Cliff ZS6BOX, I have known almost as long as I have been a ham. I happened to meet him on 2m entirely by accident while attending a training course in Vereeniging. Probably one of the longest standing ham friends I have.

Don ZS5DR, I met through the early morning group and developed a friendship with him over a period of time. His tenacity and enthusiasm for playing AM is second only to his Dad ZS5RK.

Rad ZS6RAD, is my longest known acquaintance in ham Radio. We started together while on the mines in the Northern Cape, and did our licences together, I failed the first time round, but was always encouraged by Rad to rewrite.

I could actually write a book about my experiences with these Gentlemen I have mentioned, as well as many others who have come across my path.

This small portion does not give justice to the input in my ham career, but all have played a major part in the history of the AWA too.

Perhaps you too have impressionists in your ham career.

Best 73

DE Andy ZS6ADY

WIKIPEDIA

FREQ	WAVELENGTH	DESIGNATION	ABBR
3 – 30 Hz	10^4 – 10^5 km	Extremely low frequency	ELF
30 – 300 Hz	10^3 – 10^4 km	Super low frequency	SLF
300 – 3000 Hz	100 – 10^3 km	Ultra low frequency	ULF
3 – 30 kHz	10 – 100 km	Very low frequency	VLF
30 – 300 kHz	1 – 10 km	Low frequency	LF
300 kHz – 3 MHz	100 m – 1 km	Medium frequency	MF
3 – 30 MHz	10 – 100 m	High frequency	HF
30 – 300 MHz	1 – 10 m	Very high frequency	VHF
300 MHz – 3 GHz	10 cm – 1 m	Ultra high frequency	UHF
3 – 30 GHz	1 – 10 cm	Super high frequency	SHF
30 – 300 GHz	1 mm – 1 cm	Extremely high frequency	EHF
300 GHz - 3000 GHz	0.1 mm - 1 mm	Tremendously high frequency	THF

CW Net:

Firstly, congratulations to Pierre ZS6A who has achieved his WAZS 200 in CW. This is quite an achievement to get 200 confirmed CW contacts in this day. I hope it can be some kind of inspiration to those of us who are still trying to get 100 confirmed contacts.

Lets face it, CW in South Africa, has always been a bone of contention. I can remember from when I first started out on my ham radio career in the early 80's, there was already this argument about doing 200 CW contacts in order to get your full ZS.

There were those who were fighting the system, wanting to know why this outdated form of communication was still necessary to get your licence, and there were many who remained ZR's because of it. Simply to buck the system.

I did it then, because it was the only way to get to the HF bands, and that was what I wanted.

Not for any greater cause or love for CW, but simply out of necessity.

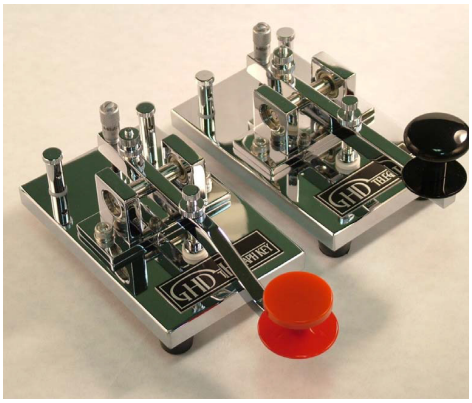
It was only much later in life that I developed a love for CW. I don't know if I can say I am quite passionate about it yet, but I do enjoy it.

In those days, there were many CW operators still around and most of them were active and always willing to QRS, send slower, so as to accommodate the newbies on the bands.

There was a real camaraderie amongst the CW operators in those days and just as we can recognise voices, many of them recognised you just by the way you sent CW. It was almost as if you could hear the tone of the persons voice in the way they sent CW.

Even today, there is still an individuality in each and every CW operators style of sending. Although many of use paddles and keyers, you still hear the difference.

What is it that sets the CW operator apart from others, I think the fact they have learned a new language, a universal language, which cuts across language and border barriers, enabling you to chat with anyone, anywhere.



SSB activity:

The SSB net continues to be well attended with an average of 20 plus calling in on a Saturday morning.

The "Topic for Discussion" has certainly put a new twist on the net and it is so good to hear the contribution being made by many of the participants in the net.

If you are just a listener to the net, then take a call at the end of the net just to let us know you were there.

The bands are still not in great shape and Div 1 stations are really become like rare DX. Fortunately the WC net is running well with a good few participants calling in on the net there.

40m seems to be in the doldrums at the moment, with this constant static rain appearing at different strengths at different times of the day. Very seldom is there a clear band anymore.

Fortunately, the rest of the divisions seems to work through to Div 6 quite well and all are at least a Q5 copy.

The predicted band conditions don't seem to give me much hope for great improvements in local conditions, and I am aware there are a few who are working quite a bit of DX late evenings on 40m.

Early mornings are good for contacts down to Div 1, but seems to fade quite rapidly as the day starts to progress.

80m, long distance communication, anything over 500km seems to fade very rapidly, but is good for local conditions until the D layer starts to fade.

Drake T4X

AM:

AM has been pretty good on the Saturday morning nets and on the few occasions when the band has not been too noisy on a Wednesday evening, communications have worked well.

As we see the summer storms coming to an end, there will be a period when band conditions should be good late evenings, but then the cold fronts will start to move in and things might get noisy again.

The AM net on a Saturday is still well attended and every now and then are surprised with a new call sign joining.

For the majority of the stations, local is lekker, and the band conditions always seem to favour local.

Div 5 come through extremely well early morning before sunrise, but after that they start to fade quite rapidly.

We have an interesting article on AM in this months main article, part one of which has been published and part 2 will follow next month. Do yourself a favour and read the article, comments would be appreciated.

For a long time, we have been talking about the differences between AM and SSB and tuning and power settings etc. Hopefully this article will add to what we have been saying and give more understanding of this great mode.

Please remember, you don't have to be able to transmit music to join the net, there are some who just join in to get on AM and try out their rigs, so don't be shy to call in if you are an ardent AM fan.

We appreciate all who give reports.

Gonset 100

Amplitude Modulation

http://www.w8ji.com/amplitude_modulation.htm

About Power

One of the first things we must understand before discussing characteristics of AM is power measurement. First, there is no such thing as "RMS Power". We find power by multiplying RMS voltage times RMS current, but there is really no such thing as "RMS power".
What does exist is *equivalent* or *heating* power. This is useful power over a defined period of time, even a very short time. It is power that does, or can do, some amount of actual work. Both PEP and average power are based on the heating or work power, even if that heating or work power is taken over a single RF cycle.
The old common method of quantifying RF power was average power. Average power is same as equivalent work power or heating power of each cycle averaged over a significant time compared to the time when power level changes. With an unchanging (during the measurement period) power level, such as a steady unmodulated carrier applied to a constant resistance load, average power and peak envelope power are the same. If we close and hold-closed a manual telegraph key on a good stable CW transmitter, we will see the ***average power*** displayed on a power meter. It will ***not*** be the "RMS power". It is also the peak envelope power, because it is the maximum stable heating power level over some period of time that we hold the key.
As for peak envelope power, peak envelope power is the very maximum short term peak reached of either steady or varying *heating power levels*!
Consider a sine wave with a peak voltage of 100 volts. The RMS voltage is 70.7107 volts, or 100 peak volts. If we placed that voltage across a 50 ohm resistance we would have 70.7107 / 50 = 1.414214 amperes. That would also be 100 watts average power in one complete cycle or any number of equal amplitude cycles that follow. The peak envelope power is also 100 watts because the peaks are the same cycle after cycle.
If we pulsed that power off and on rapidly with a 50% duty cycle the average power would be 50 watts. Half the time it would be 100 watts, and half the time zero watts. The peak envelope power would be 100 watts, because that would be the power at the crest of the envelope! The envelope can be as short as one cycle, although no meters ever respond to that.
Power cannot be RMS power. RMS is calculated by squaring the function's value, taking the average (mean value) of the squared function, and finally converting that mean value back by finding the square root of that mean. If we had a peak power of 100 watts with a 50% duty cycle the RMS power, if there was such a thing, would be SQRT((100^2 + 0)/2) = 70.71 watts. We see that 70.71 watts is not the average power, is not the heating or "work" power, and is not the peak power. It isn't anything at all useful! We can have meters that read RMS voltage, and we can also have RMS current, but we don't read "RMS power" with any of our power measuring instruments. We can't even calculate RMS power to be anything useful or sensible at all.

Characteristics of AM (amplitude modulation)

Let's consider the case of perfect undistorted sine wave modulation of an amplifier stage. The carrier, sidebands, and power levels of the various spectral components making up the signal have a certain ideal relationship. Consider the case below with symmetrical sine wave modulation.
Unmodulated carrier = 100 watts (PEP or) average carrier power.

Average is the same as PEP because, absent amplitude modulation, the carrier level is unchanging over time.
100% steady modulated 100 w carrier = 400 watts PEP or 150 watts average or "heating" power. Of this 150 watts average or "heating" power, 100 watts is in the carrier, and 25 watts average power is in each of the two AM signal's sidebands.
Carrier average power = 2/3 of the total 100% modulated average power
Total of both sidebands, average power = 1/3 of total average power under 100% modulation
Average power one sideband = 1/6th average power with 100% modulation
Peak Envelope Power 100% symmetrical modulation = Four times carrier power

Plate Modulator Requirements
100% sine wave modulation of a 100-watt carrier requires a modulator sine wave power of 50 watts. This audio heating or average power directly adds to the PA's RF power, making the total heating (or average) power 100+50 = 150 watts.
On 100% positive audio peaks the waveform, as seen on an oscilloscope, doubles in voltage. Doubling load voltage on audio peaks also doubles load current on audio peaks. This means any AM signal with symmetrical 100% modulation, when measured using true PEP meters, has four times carrier power.
If we monitor transmitter output current on a typical slow-response RMS current meter, like a typical thermal RF ammeter, we should observe current rising to 1.22475 times steady state current with steady 100% modulation. We should also observe an average RF voltage of 1.22475 times the unmodulated carrier voltage, when steady sine wave modulation of 100% is applied. This is 1.5 times the unmodulated carrier average power, and fully accounts for the carrier power plus the 50% audio power required to modulate that carrier at 100% modulation.

One word of caution, measured values are affected by the type of meter we use, and the modulating waveform! Some metering schemes don't fully respond to peaks, and some don't fully read the average either. This is a metering problem.
We will not see the 100% sine wave modulated average power levels with perfect 100% modulated speech, although PEP will indeed reach four times the carrier on a good sample and hold meter. This is because speech has a larger peak power to average power ratio, when compared to peak-to-average power ratio of steady sine wave modulation. A true peak reading meter with adequate peak-hold time is, by far, the most reliable way to measure positive modulation peaks. A true peak-reading RF power meter, with adequate hold time, is actually a much more accurate indicator of 100% positive peaks than a conventional oscilloscope.
The best overall modulation percentage indicator would be a specialized device that sampled and held negative peaks, and also sampled and held positive peaks. This would not indicate bandwidth of course, only percentage of modulation! Actual bandwidth would only be indicated by using a peak holding spectrum analyzer or, in a pinch, a very narrow bandwidth tunable receiver with a peak responding and slow decay calibrated signal level meter.

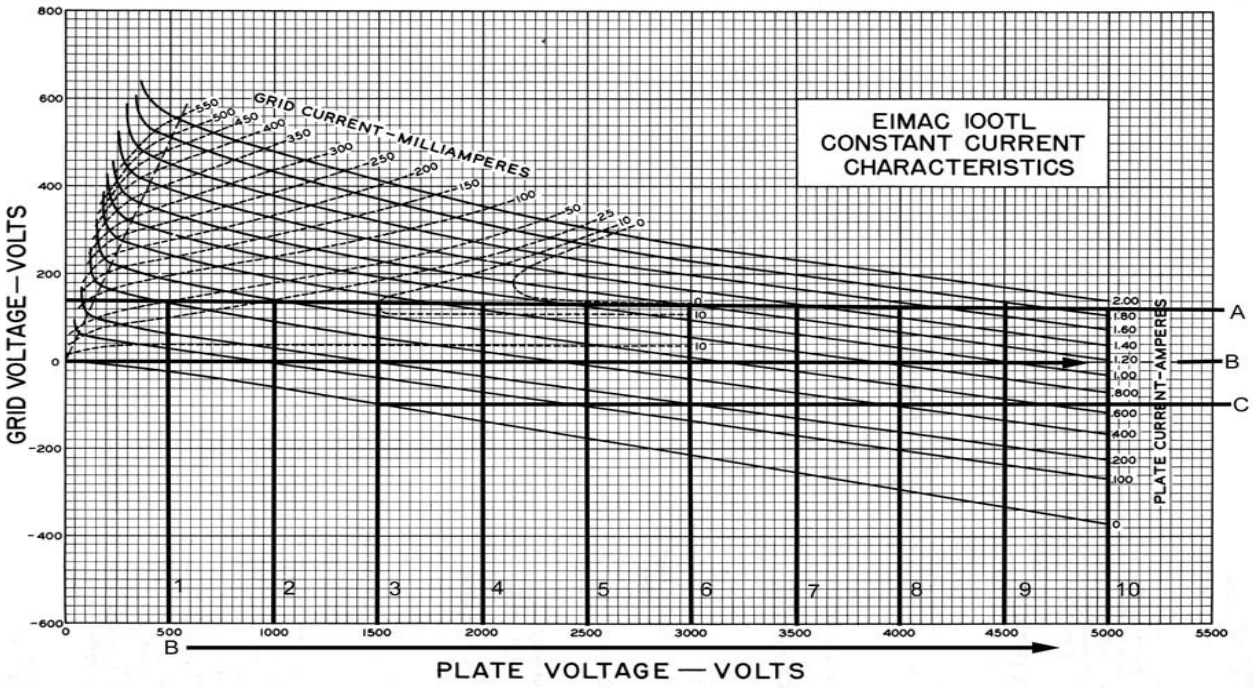
True Plate Modulation

Plate modulation might well be the most common method of obtaining amplitude modulation. Most amateurs consider plate modulation in a very favorable manner, and many of us are capable of building a simple rig we call plate modulated. Most older tube gear uses a system called plate modulation. What isn't often understood is the thing we call plate modulation is almost always not pure plate modulation, but rather a combination of plate and screen modulation!
In order to be ***purely plate modulated*** without distortion, a plate modulated RF power amplifier stage must maintain a ***square law*** power output function with varying plate or anode voltage. As a matter of fact this can actually be called parabolic, or square law, modulation. If peak PA anode voltage increases 50% from modulator power (50% modulation), peak envelope RF output power should increase 225% over the carrier value. If the modulator doubles plate voltage (100% modulation), positive peaks of envelope power output should quadruple (400%) from carrier values.
The reason for this squaring of power is logical and easily understood. With 100% symmetrical modulation, the plate modulator system doubles anode voltage on positive peaks. When tube anode voltage doubles, assuming the tube behaves like a constant average resistance, this also doubles anode current. Doubling current and voltage at the same time obviously means plate input power is four-times initial resting power. Efficiency remains constant at a pretty high value in a class C stage, causing peak RF output power to ideally be four-times the unmodulated carrier value with a 100% modulation and symmetrical modulating waveform signal!
The above assumes real 100% plate modulation. Most amateur rigs and not pure plate modulation, but are a combination of screen and plate modulation. We just call them "plate modulated" rigs.

Methods of "Plate" Modulation

There are several methods of obtaining "plate" modulation. The two most common in amateur use are Heising modulation and standard plate modulation. Heising modulation is also called constant current modulation. There are details of Heising modulation on my Heising Modulation page.
It is very popular among amateurs to call the modulation reactor a Heising choke, and to call a conventional transformer coupled modulator Heising modulation when it has a modulation reactor, but it is NOT Heising modulation. Contrary to what amateurs popularly claim, plate modulation with a transformer and modulation reactor ***is not Heising modulation*** and the modulation reactor is ***not*** a "Heising choke". The reactor serves only to keep steady-state PA current out of the modulation transformer, giving the transformer more headroom before magnetic saturation is reached.
Heising modulation is ***constant current*** modulation, in that the modulator tube and PA tube share the same reasonably-constant power supply current level. The power supply current shifts back and forth between the PA tube and the modulator tube, but the supply load is for all practical purposes constant. Heising modulation never uses a transformer, but rather parallels the PA stage and a modulation with both being fed through a modulation reactor or choke. One of the few rigs to employ Heising Modulation is the Globe Scout.
The modulation choke, when used with transformer coupling from the modulator system, simply serves to keep dc plate current out of the modulation transformer and keep flux levels low in the modulation transformer. The modulation reactor improves performance of the modulation transformer by lowering flux levels cause by dc current flowing through the secondary winding. It serves no Heising function at all.

Plate Modulated Triodes
As a general rule only plate modulated low-mu or medium-mu triodes provide needed square-law power response with modulated anode voltage variation. The ideal response generally occurs only when a triode is operated well into class C with short conduction angles. A triode operating in this manner behaves like a rapidly off-and-on switched resistance (switched at the RF excitation rate). This means the triode presents a nearly constant load resistance to the much lower frequency plate modulator system. Some of the cleanest, least critical to tune, high-level modulated AM transmitters use low-mu triodes.



We can see a low-mu triode, as plate voltage increases, has a substantial increase in plate current. If we pick the correct loadline, the input power will approximately quadruple for every doubling of anode voltage.

For example at A5 we have 1 amperes at 2500 volts, or 2500 watts input power. At A10 we have 1.9 amperes at 5000 volts, or just under 10,000 watts instantaneous plate power.

Remember this is instantaneous power, since the anode current is in very short pulses in class C. The average power is MUCH less. Tube anode heat is an integration of these short pulses of very high dissipation. The thermal mass of the anode averages the heat.

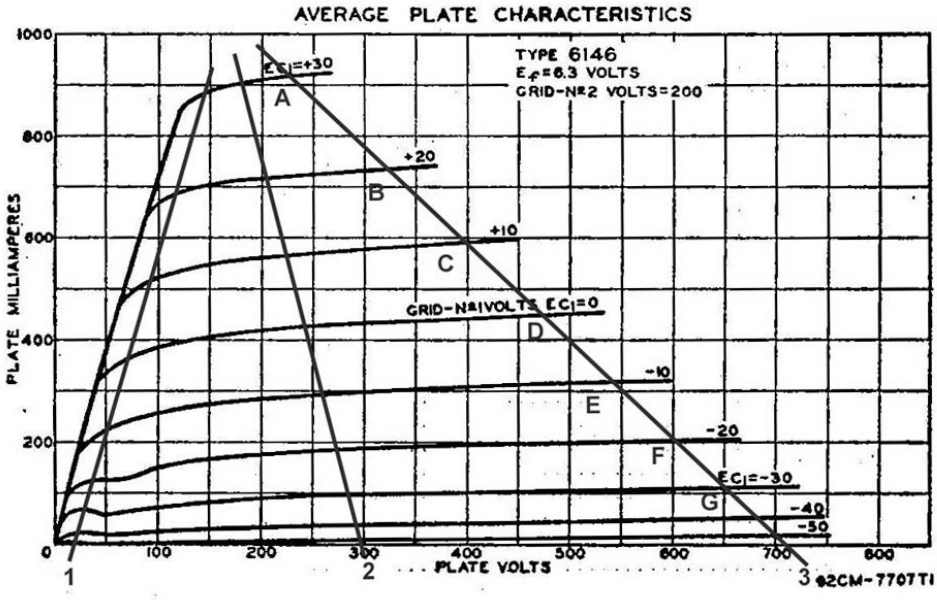
Linearity is not perfect with the 100TL, but if we pick the correct operating loadline, the tube provides very close to square-law response. If the modulator doubles anode voltage, peak power would nearly quadruple.

	A	B	C
1	.4	.05	0
2	.6	.1	0
3	.7	.2	0
4	.83	.3	.05
5	1.0	.42	.1
6	1.2	.58	.2
7	1.4	.7	.3
8	1.5	.8	.4
9	1.7	1.0	.55
10	1.9	1.2	.67

Let's look at a tetrode.

Plate Modulated Tetrodes

A plate modulated tetrode or pentode, without the aid of supplemental screen or control grid modulation, will not follow the desirable square-law power performance. This is because screen grid voltage dominates cathode-to-anode current in a tetrode (or pentode).



Let's look at a commonly used amateur beam power tube, the 6146.

Curves A through G represent anode current as anode voltage is varied with constant bias and screen voltage applied. Notice how flat the plate current curves are as anode voltage is varied.

If the modulator doubles anode voltage in an ***ideal*** tetrode or pentode amplifier, plate current would not change at all! Most tetrodes are not perfect and will do a little better than this, but still have considerable distortion when exclusively plate modulated. If we plate modulated a typical pentode or tetrode like the 6146, the system will only achieve 50-60% positive peaks (200 watts PEP for a 100 W carrier) by the time negative peaks reach 100%. For example at -30 volts bias with 200 volts on the screen (curve G), anode current is about 100 mA whether anode voltage 200 volts or 700 volts. If only the anode was modulated, audio would be highly distorted. **With true plate modulation of a tetrode, it is impossible to obtain 100% positive peaks. Even negative peaks would be grossly distorted.**

The easiest way to properly plate modulate a tetrode is to screen modulate, at the same time the PA stage is anode modulated. By applying the correct proportion of modulating voltages to the screen grid and anode, with neither element actually modulating 100%, the system can come very close to producing the desired square law power response. **The exact ratio of modulation applied to the screen and anode varies with tuning, loading, grid drive, tube type, and operating voltages.** A properly designed plate modulated tetrode is actually not plate modulated, but rather is partially plate and partially screen modulated. We could also modulate the control grid along with the anode, leaving the screen fixed in voltage. We could modulate an earlier exciter stage in combination with the plate of the final amplifier. Still, the most common plate modulation method of tetrodes, and the method that seems to work adequately, is a combination of screen grid and anode modulation.

(*THIS WILL BE CONTINUED IN NEXT MONTHS ISSUE)*

PRESIDENT'S CORNER

By Richard ZS6TF

Whither goes AWA?

As the 10th anniversary of the founding of the association in March is here, I am conscious that the AWA means a great deal to its membership. For some the newsletter is eagerly awaited each month for its pearls of wisdom, for others the nets are important social networks as well as opportunities to use our radios of yesteryear. There are great nostalgic moments when our more senior members recall what ham radio was like 50 years ago. Comments like "time is frozen" and "anti-Alzheimer", "radios you can actually work on", and the "smell of real radios" resonate well with the membership whether you tinker or indulge in full blooded restoration.

The mission statement describes what we do very well in finding, acquiring, fixing and using our boat anchors and door stops, but it doesn't define where we get most satisfaction from doing it. Other special interest clubs are suffering from declining membership yet we see the AWA growing and it makes me ponder what are the reasons so that your committee continue to gently steer the association in the right direction. One of the AWA strengths is that membership is free and by association. We fund the licence fees for ZS0AWA and the snail mail newsletter recipients from sales and raffles of stuff donated to the AWA. No other club that I know of would survive without subscriptions, meetings, politics, and aggravation that goes with them, and our free newsletter, ably produced single-handed by Andy, stands among the best available.

Of course there will always be people who are not so happy in any community for example the dealers. On the one hand with so many antique rigs being restored it has a negative impact on new radio sales. On the other the component suppliers benefit to some extent, and to others perhaps they see a growing market for radios that would have been binned 10 years ago. The point is that they will not get rich on it because most radios within the AWA change hands for other considerations than filthy lucre.

A pivotal AWA activity is clearly the Saturday morning SSB net where we share our projects, experiences and anecdotes. The introduction of the topics since October 2012 has amazed me with its popularity, quality of participation, and pile-ups on the call-in. It has brought a new level of camaraderie and informal help ethic to the association and has even brought back onto the band several newer members whose interest in Amateur radio had waned. The late Willem ZS6ALL would have approved of the good operating standards in evidence on this net in particular.

There is no law that says you have to open a door for a Lady and let her pass through first but we do so because we are gentlemen. Our "netiquette" is not written down but it is understood by most members in the same way and provides a welcoming environment for the perhaps shyer or quieter personality to emerge from the woodwork and participate.

Likewise the AM net presided over by Rad has achieved much improved operational standards, good audio, under his mentorship and the watchful eye of his SDR radio. We hear some good music as well as a bonus.

The CW net and QSO parties bring further opportunities to operate our heritage equipment and modes, and eyeball QSO's, especially at flea markets and our half-yearly gatherings, round off the total AWA experience. I confess to a mild form of eccentricity which stimulates my various projects such as the Lancaster bomber radio and a late 1920's radio and horn loudspeaker for my 3 wheeler Morgan. Without the AWA I would not have started them and would not have been able to get some of the key bits without the help of many members for which I thank them.

AWA members do it with frequency! Long may it continue to grow.

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Get your backdated issues at
http://groups.yahoo.com/group/AWA_SA/

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:

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 Card.