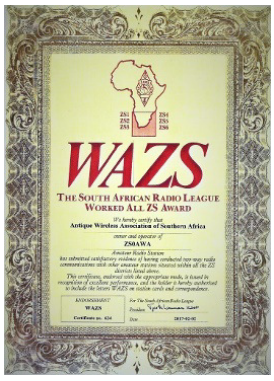
Newsletter

The Antique Wireless Association of Southern Africa

 # 167 **June 2020**



Inside this issue:

AWA Committee:

* President—Renato ZS6REN
* Acting VicePresident—John ZS1WJ
* Technical Advisor—Rad ZS6RAD
* Secretary/PRO—Andy ZS6ADY
* KZN—Don ZS5DR
* WC—John ZS1WJ
* Historian—Oliver ZS6OG

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Reflections:

My apologies for the late Newsletter this month after a crash on my Office programme set me back a while.

Only a short while more and we will have reached the midpoint of the year.

With all that has been going on during this year so far, it seems that we have really been put on a turbo based daily routine as the time has certainly not taken its time this time.

I don't know how many other people feel like I do, but it would seem that the older I get, the faster time flies by. How is it that when we were youngsters in school, time really dragged by and it took forever for weekends to arrive.

So many things to do and still so little time left to do it.

Projects ? Well I seem to have given up on those now and really just do things as I remember them, which is also becoming a lot more difficult these days. I know there are things that I should be doing and only really remember them when the weekend is over and its time to be heading back to work.

I think I must be one of the few pensioners who are still working, but then it does help to keep me going. It's a good excuse when I forget to do things...I was so busy at work….

I'm not going to get caught up in the Covid19 thing because I think too much is being said about it already. All I can say that it really got people back on to radio. I think I have heard people that have really had to blow the dust off their radios before getting them going.

The results of the AWA Valve QSO party bear witness to this very thing. See them further on in this Newsletter.

I must say though that I am starting to miss some of the Flea markets. I think the first one that is allowed to happen will be so well attended that there wont be enough room for everyone. Wouldn't that be great ?

It will be good to see all the old faces again and its really going to seem like we haven't seen each for ages. Amazing what a bit of a break can do for one.

A good chance to renew old acquaintances and some of us may even have forgotten about the ones we wanted to forget about.

Lets face it, radio hams are definitely a breed on their own and anyone who is not one will find it very difficult to slot in with those who are. People just don't understand what we are about . "You do what, sit and talk to people you don't know on the other side of the earth ? Why ?"

I've had that a few times already, but it doesn't seem to bother me anymore. Maybe I've just been around the block too many times now.

Get out there and call CQ, You will be surprised at who is waiting for that call….

Best 73

DE Andy ZS6ADY

Wikipedia

Radio Propagation:

Tropospheric ducting

Sudden changes in the atmosphere's vertical moisture content and temperature profiles can on random occasions make UHF, VHF and microwave signals propagate hundreds of kilometers up to about 2,000 kilometers (1,200 miles)—and for ducting mode even farther—beyond the normal radio-horizon. The inversion layer is mostly observed over high pressure regions, but there are several tropospheric weather conditions which create these randomly occurring propagation modes. Inversion layer's altitude for non-ducting is typically found between 100 and 1,000 meters (330 and 3,280 feet) and for ducting about 500 to 3,000 meters (1,600 to 9,800 feet), and the duration of the events are typically from several hours up to several days. Higher frequencies experience the most dramatic increase of signal strengths, while on low-VHF and HF the effect is negligible. Propagation path attenuation may be below free-space loss. Some of the lesser inversion types related to warm ground and cooler air moisture content occur regularly at certain times of the year and time of day. A typical example could be the late summer, early morning tropospheric enhancements that bring in signals from distances up to few hundred kilometers for a couple of hours, until undone by the Sun's warming effect.

HF Happenings:

Global Stay-At-Home Radio Event set for 6 and 7 June Stations bearing call signs that promote the "stay-athome" message and the value of social distancing and isolation have sprung up during the COVID-19 pandemic, with some 150 000 messages of support shared around the world. An on-air gathering over the 6 and 7 June weekend will offer a further opportunity for stay-at-home stations and radio amateurs to share greetings in a contest-like framework, looking toward the day that restrictions will ease, eventually making the stay-at-home injunction obsolete. The patron of the STAYHOME radio campaign is Finland's Foreign Minister Pekka Haavisto and the worldwide activity has the endorsement of International Amateur Radio Union President Tim Ellam, VE6SH/G4HUA and the United Nations Amateur Radio Club. "Amateur radio operators across the world are experiencing something we have never seen before, with the current COVID-19 pandemic," Tim Ellam said. "In times like this, on-the-air activities can benefit our communities and ourselves. Events such as this are important to improve operating skills. It is also encouraging us to get on the air and keep active, as well as promoting social distancing." Tim, VE6SH expressed thanks to the national regulators in more than three dozen countries that made special stay-at-home-suffix call signs available for amateur use. Sponsoring the event and campaign are the Finnish Amateur Radio League (SRAL), in cooperation with Araucaria DX Group (ADXG) of Brazil and Radio Arcala (OH8X) in Finland. The 4U1UN station will be on the air to support of the global STAY HOME movement, as will sister stations 4U1GSC (operating as 4U9STAYHOME) and 4U1A (operating as 4U2STAYHOME). The STAYHOME event gets under way at 10:00 UTC on Saturday 6 June and ending 24 hours later. Bands will include 80, 40, 20, 15 and 10 meters using CW, SSB and FT12 only. The exchange is a signal report and operator age. Complete information about the associated award and certificate programme can be found on http://ko8sca.com/awards.pdf.

Calendar:

Some of these events may not take place due to the restrictions put in place by the dreaded Lurgi-20!

June:

5 - World Environmental Day
6 - SARL VHF/UHF QSO Party; West Rand Flea Market
7 - World Ocean's Day
14 - Comrades Marathon; Hammies Sprint
16 – Public Holiday; SARL Youth Sprint; Highway ARC meeting
17 - World QRP Day
18 to 22 - SARL Top Band QSO Party
20 - Winter Solstice (23:44); SARL 95 40 m Club Sprint
21 - Father's Day
26 to 28 – Ham Radio, Friedrichshafen
27 - CTARC meeting
30 - End of the SARL Financial Year; World Asteroid Day

The Provisional Results of the SARL Wednesday 80 m Club Sprint

I had hoped to have the results out earlier, BUT on Wednesday morning 27 May I opened Publisher to complete the June Radio ZS and I got the message "*the file is corrupted and cannot be opened!*" I may have spoken various languages at that moment, but I had to start from scratch on Radio ZS.

Fifty-eight (58) logs were received showing 693 QSOs. One log was received as a PDF – naughty! Band conditions were down compared to January and March.

1st West Rand ARC – 741 points (23 logs)
2nd Boland ARC – 595 points (16 logs)
3rd Bo-Karoo ARC – 244 points (7 logs)
4th Hibiscus ARC – 195 points (4 logs)
5th Magalies ARC – 105 points (4 logs)
6th Sandton ARC – 84 points (1 log)
7th Vrystaat ARC – 64 points (1 log)
8th Lichtenburg ARC – 37 points (1 log)
9th Northern Cape ARC – 33 points (1 log)
10th Cape Town ARC – 28 points (1 log)

Totals after the third leg

1st West Rand ARC – 2 723 points
2nd Boland ARC – 2 575 points
3rd Bo-Karoo ARC 704 points
4th Hibiscus ARC – 427 points
5th Magalies ARC – 387 points

6th Bloemfontein ARC – 232 points
7th Cape Town ARC – 170 points
8th Sandton ARC – 152 points
9th Northern Cape ARC – 81 points
10th Rustenburg Branch and the Vrystaat ARC – 64 points
12th Lichtenburg ARC – 37 points
13th Highway ARC – 32 points
14th Secunda ARC – 18 points

TQSL: New Version.
A new version (v2.5.4) of LoTW's Trusted QSL (TQSL) has been released: http://www.arrl.org/tqsl-download. This version has new features as well as corrections for defects found since TQSL 2.5.3 was released. This release also includes an update to the most recent TQSL configuration file. TQSL 2.5.4 can be installed to upgrade any older version. On all three supported platforms (Windows, MacOS and Linux), installing TQSL 2.5.4 will replace older versions of Trusted QSL while preserving your Callsign Certificates, Station Locations and preferences.

IOTA and LOTW QSO Matching.
Islands on The Air (IOTA) Ltd has announced "the implementation of the ARRL application which allows the use of QSO matching via LoTW. This will allow IOTA chasers to obtain credits by matching their logs with those at LoTW in addition to those at Club Log. We have a lot of work ahead of us to identify the time windows of past IOTA operations and this will be phased in over the next few months. An initial list of operations arising from the link-up with LoTW has been added to the database and these will become available for QSO matching from 21 May. Further additions will be made on an ongoing basis". Instructions for LoTW QSO Matching are on https://iota-world.org/info/lotw_qso_matching-en.pdf, and notes on "Accepted Activations for QSO Matching" can be found on https://iota-world.org/info/accepted_activations-en.pdf.

African DX
Contacts with stations on the African continent count towards the SARL's All Africa Award (www.sarl.org.za/public/awards/awards.asp)
South Africa, ZS. ZS1820S celebrates the 200th anniversary of the arrival of the 1820 British Settlers in the Eastern Cape area of South Africa. The call sign will be active during 2020 on various bands and modes. QSL is via the bureau to ZS2EC, also via LoTW, Club Log and QRZ.
South Africa, ZS. Look for ZS95SARL during 2020. This to celebrate the 95th anniversary of the South African Radio League, founded on 20 May 1925 as South African Radio Relay League. Activity on HF, VHF, UHF and via satellites. QSL via bureau.

African Islands
IOTA Frequencies
CW: 28 040 24 920 21 040 18 098 14 040 10 114 7 030 3 530 kHz
SSB: 28 560 28 460 24 950 21 260 18 128 14 260 7 055 3 760 kHz
Canary Islands, EA8. The Radio Club Laurilsiva (EA8RKL) from Gran Canaria (AF-004) will be active again as EH8DDC between 24 and 31 May. QSL via eQSL and log search on Club Log. Celebrating the anniversary of the local autonomous Parliament's first session back in 1983, the Canary Islands Day (Dia de Canarias) is held annually on 30 May.

CQ Amateur Radio Hall of Fame
The CQ Amateur Radio Hall of Fame was established in January 2001 to recognize individuals - radio amateurs or not - who significantly affected the course of Amateur Radio, as well as radio amateurs who have made significant contributions either to amateur radio, to their professional careers or to some other aspect of life on our planet. This year's inductees, which bring the total number of members of the CQ Amateur Radio Hall of Fame to 333, are:
* Chet Atkins, W4CGP (SK), legendary musician known as "Mister Guitar," and music producer; ushered in "the Nashville sound" on RCA Records. (Note: Chet's call has subsequently been re-issued).
* Les Barclay, G3HTF (SK), propagation expert, leader of International Telecommunication Union propagation

study groups and Chairman of the ITU's first Radiocommunication Assembly in 1993; top official in the UK's telecommunication regulatory agency.
* George Laurer, K4HZE (SK), developer of the UPC (Universal Product Code) or "bar code" on merchandise, permitting items purchased at stores to be scanned on checkout rather than manually rung up.
* Yasuo "Zorro" Miyazawa, JH1AJT, whose Foundation for Global Children helps fund educational and medical programs for children around the world; FGC also works with several countries to help them organize and train teams for the Olympic Games and Paralympic Games.
* Champ Muangamphun, E21EIC, is a DXer and DXpeditioner who has been a sparkplug for growing interest in ham radio in Thailand and throughout Southeast Asia; Champ also accompanies JH1AJT on many of his humanitarian missions and operates DXpedition-style ham stations while Zorro works with government officials and non-governmental organizations on behalf of the Foundation for Global Children. * Sultan Qaboos bin Said, A41AA (SK), Sultan of Oman from 1970-2020; transformed impoverished country into a modern and prosperous state with influence throughout the Middle East.
* Tom Roscoe, K8CX, a champion of amateur radio history who collects and makes available online his "Ham Gallery" of old QSL cards and other historic photos.

CQ DX Hall of Fame
Established in 1967, the CQ DX Hall of Fame honours those DXers who not only excel in personal performance, but who also "give back" to the hobby in outstanding ways. CQ DX Editor Bob Schenck, N2OO, made a virtual presentation on the Ham Nation podcast on 20 May. The 2020 inductees to the CQ DX Hall of Fame are:
*Tony Gonzalez, EA5RM - has been an active DXpeditioner for 20 years, often organizing and leading teams to operate from difficult and challenging locations. Tony and his teams have also helped establish or re-establish amateur radio activities in several countries, including Rwanda (where it had been banned for a decade due to civil war) and the newly-independent country of South Sudan. In addition, Tony has made ten trips to Bolivia to establish and maintain HF communication links between medical facilities and remote villages in the Amazon rain forest and has operated as CP1XRM during his free time. Tony's work in South America earned him the ARRL International Humanitarian Award in 2015.
Edward "Ned" Stearns, AA7A - is an accomplished DXer, DXpeditioner (he is been on 32 of them and led 8) and technical innovator. He introduced the use of switchable vertical dipole array antennas on island DXpeditions and designed "dual-band discone" antennas for use with the Northern California DX Foundation's worldwide beacon network. Ned also worked with 2019 DX Hall of Fame inductee Joe Taylor, K1JT, on developing the "Fox/Hound" mode for FT8 used by DXpeditions. Ned also maintains two remote stations in Arizona, has made presentations at many technical conferences and has served in a variety of leadership roles in the hobby. On the air, he is at the Top of the Honour Roll for DXCC Phone and Mixed, was the first recipient of 11-band DXCC and has worked over 160 countries via EME (Earth-Moon-Earth).

Antique Wireless Association Valve QSO Party

The first AWA Valve QSO Party was held in October of 2007 and attracted a fairly good amount of contesters to try and get the first of the certificates that would be issued. Finely contested there really not a lot of valve radios that took part, but from the beginning it was proved that even by using a Hybrid rig, one could double the points count and set the solid state radios back a step.

This was the whole idea of the QSO party, to encourage people using older valve equipment to come up on air and use them.

There were a few of the QSO Parties in between where attendance dropped right down and very few logs were submitted from a few contesters.

And Then came Covid 19 and lockdown.

This year is probably the best attended QSO party in the history of it. 117 different call signs were recorded in the SSB section and 33 in the AM section. The highest that we have ever had. A total of 13 logs submitted on SSB and 7 logs on AM.

Listed below are the scores of all the participants, and once again, it can be seen that the valve radios have proved popular and the highest scores have been attained using them.

Our thanks to all who participated and made this QSO party the success it was.

AM May 2020

Thanie ZS4AZ	40	FT101
Johan ZS4DZ	36	FT101
Helge ZS6HB	12	FT101
Barry ZS2NF	7	
Mario ZS6MAR	4	
Renato ZS6REN	3	
Eric ZS5EL	3	
ZS0AWA	32	FT102

SSB May

Henry ZS6MC	132	Collins S line
Helge ZS6HB	112	TS830S
Johan ZS4DZ	110	FT101
Thanie ZS4AZ	92	FT101
Aldo ZS4AL	86	TS 820
Mario ZS6MAR	72	FTDX400
Theunis ZS2EC	60	
Barry ZS2NF	24	
Hellmar ZS1H	23	
Andre ZS2ACP	22	
Roy ZS3RW	17	
Dylan ZS2MAC	16	
ZS0AWA	54	FT102

Hybrid

All Valve

Solid State

Working Together in Vintage Radio

I (Editor) was recently approached by the CVRS whether we would like to enter into a exchange basis with them regarding our Newsletter and below is the email sent to me by their Editor/Chairman concerning this.

I have accepted Gerry's invitation and we now have a reciprocal agreement with them, and Gerry has since become a member of the AWASA. We appreciate the fact that someone has seen us and would want to be in cahoots with us and we look forward to a long and happy relationship with them.

My name is Gerry O'Hara, and I am the Editor of 'Canadian Vintage Radios' (CVR), the Newsletter of the Canadian Vintage Radio Society (CVRS). CVR is issued five times a year to CVRS Members and contains 20 pages, largely packed with CVRS members articles on a wide variety of vintage radio topics. A searchable index of the contents of all issues of CVR dating back to 1995 can be accessed on the CVRS website.

The CVRS has been sending complimentary copies of CVR to several like-minded organizations for many years on an exchange basis. In a recent review of international exchanges, your organization was identified as not receiving CVR, so, I am writing to ask whether you would like to receive an electronic (pdf) copy of each issue *gratis* in future?

The CVRS have a Policy in place for such exchanges, a copy of which is attached to this email. The Policy allows limited distribution of the full (pdf) version of each issue of CVR to a non-Member organization representative, eg. their newsletter editor. This is for information only and so they may request reprinting of any article(s) that may be of interest to their membership, however, this full version must not be distributed to their members. To allow for a wider distribution of CVR content information, a front page and table of contents document is being made available that may be distributed freely to your members - a sample is attached to this email.

If you would like to receive a *gratis* copy of CVR on this basis, please confirm to myself, agreeing to adhere to the Policy. A sample copy of the latest issue of CVR (April 2020) is attached to this email, along with the cover page and table of contents version as noted above. Should any of your members be interested in joining the CVRS to have full access to all issues of CVR, a membership discount is available, details here.

Regards

Gerry O'Hara, CVRS President and Editor 'Canadian Vintage Radios'

A Graphic Short Story: Restuffing 'Domino' Style Paper (or Mica) Capacitors— *Ivan E.Geleye*

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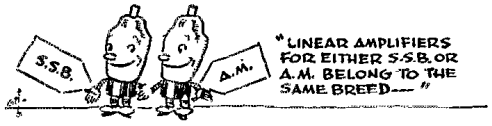
• Technical Topics —

Linear Amplifiers for A.M.

ONE of the by-products of single sideband is a revival of interest in linear amplifiers for amplitude modulation, particularly on the part of a.m. users who don't understand the limitations of the linear. Linear amplifiers for either s.s.b. or a.m. belong to the same breed and operate in exactly the same way. The difference between



the two is in the kind of signal they have to handle, not in the amplifiers themselves.

A single-sideband signal is essentially one whose amplitude is proportional to the instantaneous amplitude of the modulating waveform, so when there is no modulation there is no signal. Usually, this means that there is comparatively little d.c. input to the amplifier during those periods when there is no modulation or low-amplitude modulation — periods that represent a large percentage of the total time in voice communication. This is quite similar to the operation of a Class B modulator — which in fact is simply a linear amplifier operated at audio rather than radio frequencies.

In contrast, in a proper a.m. signal the *average* amplitude stays the same whether or not there is modulation. Merely generating an unmodulated carrier demands just as much d.c. input as generating a fully-modulated signal. This is the key to the difference in ratings on a linear amplifier for a.m. as compared with s.s.b.

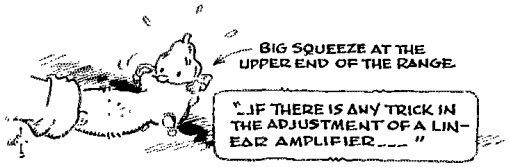
What Is Linearity?

The word "linear" in this connection implies that there is a fixed ratio between the amplitude of the r.f. signal applied to the grid and the amplitude of the r.f. output voltage in the plate circuit. In other words, any change in the r.f. voltage applied to the grid is accompanied by a proportionate change in the amplifier's r.f. output voltage. So long as this simple relationship holds true the amplifier's output faithfully reproduces the variations in — that is, the modulation on — the signal applied to the grid.

One operating requirement that will be recognized immediately is that any r.f. voltage, no matter how small, applied to the grid must cause *some* output to be delivered by the plate, and this in turn requires that some plate current must flow even with the smallest possible grid signal. That is, the grid bias cannot be greater than the plate-current cut-off value (although smaller bias is permissible); any larger value would "clip" the signal. This bias requirement establishes a ceiling on the tube plate efficiency.

At the other extreme, the r.f. grid voltage must not be allowed to become so large that a further increase in it will not be accompanied by a corresponding increase in the r.f. output amplitude. If increasing the r.f. grid voltage does not increase the output the amplifier is said to be "saturating," and the modulation is clipped on the up-peak in much the same way that biasing beyond cut-off would clip it on the down-peak. Both types of clipping distort the output signal and the amplifier is no longer linear. The no-saturation requirement establishes the operating range.

What you can get out of a linear amplifier depends principally on how much power can be squeezed out at the upper (large-signal) end of the



linear range. If there is any trick in the adjustment of a linear amplifier, this is it.

Plate Efficiency

What makes a linear amplifier linear? With the plate modulation customarily used in a.m., the plate voltage on the Class C amplifier is varied above and below the d.c. supply voltage at the modulation rate. The amplifier's plate current varies right along with the plate voltage, and so when the plate voltage is instantaneously doubled at the modulation up-peak the plate current likewise is doubled. Similarly, when the plate voltage is instantaneously zero the plate current likewise is zero. (These variations occur at audio frequency and so do not register on d.c. meters.) Since the plate voltage and plate current vary together, the Class C plate circuit "acts like" an ordinary resistor, in which the current is proportional to the applied voltage and the power is proportional to the square of the voltage.

In a linear amplifier the supply voltage does not vary with the modulation. The only thing in the plate circuit that can be varied is the plate current. The modulated r.f. grid voltage can cause corresponding variations in the plate current, and without attempting to dig into the technicalities of tube operation, it can be said that these plate-current variations can, within the operating limits mentioned above, be responsible for a fundamental-frequency r.f. output current whose modulated amplitude faithfully follows the amplitude variations in the modulated r.f. grid voltage. To a fair approximation, as most tubes are operated, the *d.c.* plate current

is proportional to the amplitude of the r.f. grid voltage. Thus we have a circuit in which the plate voltage does not vary at an audio-frequency rate during modulation but the plate current does. This means that at a modulation up-peak the plate current is twice the carrier-only value while the plate voltage remains the same; that is, the power input is doubled. Compare this with plate modulation where the voltage and current are both doubled and the power is four times.

Now it is *necessary* to reach four times the carrier power on a modulation up-peak if the amplifier is to operate without distortion. The fact that the r.f. output current and r.f. grid voltage go hand in hand does guarantee that the output power will meet this condition, because on the modulation up-peak the r.f. output current is doubled as compared with the carrier value. Twice as much current in a constant value of resistance — and the load resistance for the tube, as represented by the load coupled to the plate through the tank circuit, *is* constant — means four times as much power, by Ohm's Law. Thus even though the power input is only twice as great at the peak, the power output is four times as great. How is the difference accounted for?

This can be made clear by citing an example. Suppose that at the up-peak the instantaneous plate current is 200 ma. and the plate voltage is 1000, an input of 200 watts. If the plate efficiency is 70 per cent, a not-unreasonable value, the output will be 140 watts. If the r.f. grid voltage is now dropped to one half its former value, corresponding to the unmodulated carrier figure, the plate current will drop to 100 ma., and since the plate voltage remains the same the input is 100 watts. The r.f. output current also drops to

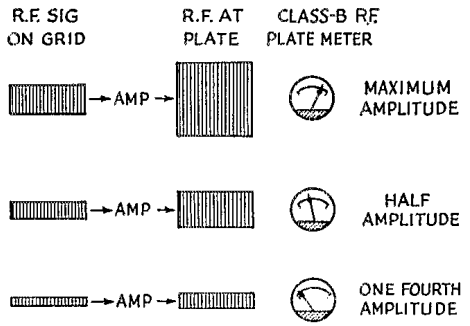


Fig. 1 — Three levels of operation in a linear amplifier when the grid is driven by a steady (unmodulated) signal whose amplitude can be adjusted within the limits of linear operation.

If the maximum amplitude within the linear range is as shown at the top, a half-amplitude signal on the grid will be followed by a drop to one-half in the output amplitude. The d.c. plate current likewise will drop to one-half the value it had with the maximum-amplitude signal. Similarly, decreasing the grid drive to one-fourth amplitude will be followed by corresponding decreases in output amplitude and plate current.

Strictly speaking, the plate meter will behave as shown only when the amplifier is operated true Class B; that is, biased to cut-off. With Class AB operation, where the no-signal plate current is appreciable, the d.c. plate current will not follow the grid driving voltage amplitude at low levels. Class AB operation is usually preferable to straight Class B because the AB amplifier is more truly linear at low levels.

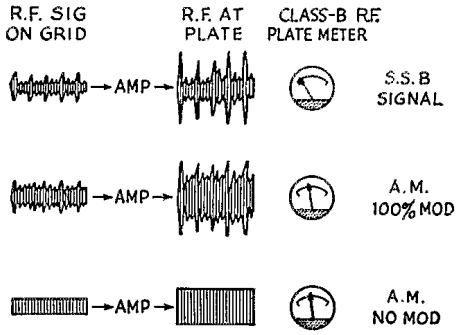


Fig. 2 — Behavior of the linear amplifier with a modulated signal. These drawings are to the same scale as Fig. 1, so the peaks in the s.s.b. and 100 per cent a.m. cases have the same height as the maximum-signal condition in Fig. 1.

With s.s.b., the plate current will vary at a syllabic rate according to the signal amplitude, as suggested in the upper drawing. In most cases, the d.c. meter will just "kick," on peaks, to about half the value shown in the maximum-signal drawing of Fig. 1. The a.m. signal will show the same plate-current reading whether or not the carrier is modulated, as shown by the two lower drawings above. The carrier amplitude and plate-meter reading are just half the maximum value shown in Fig. 1.

Note that the a.m. modulation drawings show a greater area than the s.s.b. drawing even though both signals have the same instantaneous amplitude on modulation peaks. This means that the a.m. signal has more average power than the s.s.b. signal, and since the power is handled by the amplifier at about half its maximum possible efficiency, the power used in heating the plate is considerably greater. Of the greater average power put out in the a.m. signal, over two-thirds is carrier and less than one-third is voice modulation.

half its peak value and so the output is one-fourth its peak value, or 35 watts. The plate efficiency is now 35/100 or 35 per cent instead of its peak value of 70 per cent.

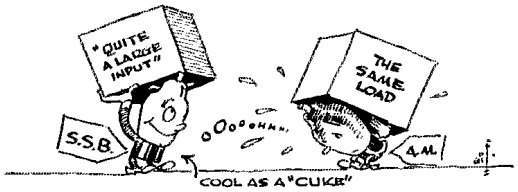
At other values of r.f. grid voltage the plate current and plate efficiency are proportional. The smaller the r.f. grid voltage, the smaller the plate current, plate power input, and efficiency. This is simply a consequence of the fact that while the d.c. input is directly proportional to the r.f. grid voltage, because the plate voltage is constant, the r.f. output is proportional to the *square* of the r.f. grid voltage.

Handling the Carrier

These relationships hold regardless of the type of signal being amplified — i.e., whether it is a.m. or s.s.b. In either case the power output, power input, and plate efficiency vary with the amplitude of the modulated grid signal. The loss in the plate of the tube, which is what determines how much power the tube can handle, likewise varies with the modulation. Thus in the example above, where the input on a modulation peak is 200 watts and the output is 140 watts, the power left on the plate is the difference, 60 watts. At the half-amplitude point the power input is 100 watts and the output is 35 watts, leaving 65 watts on the plate. Note that although the input is halved, the plate loss actually is a little higher than under peak output conditions. The fact is that the plate loss does not vary much with the grid signal level

except at low levels where the input likewise is low.

Now in both s.s.b. and a.m. the grid signal amplitude, the plate input and the power output all are varying at an audio-frequency rate. The s.s.b. signal starts from zero with no modulation, just like the Class B modulator, and when the amplifier is biased near cut-off the power input and plate loss are substantial only when the modulation is fairly high. This means that the plate of the tube is heating only part of the time. Add to this the fact that voice waveforms commonly have only about half the energy content of a sine wave and you have the condition where the amplifier is delivering its full output on modulation peaks with an *average* input of only about half the power that would be required to sustain the peak. Both these things mean that the *average* power loss in the plate is fairly low with an s.s.b. signal — in the neighborhood of one-fourth the loss under peak conditions. The tube can handle quite a large peak input without getting hot.



The a.m. signal, however, does not start from zero with no modulation. It works up and down about the carrier level, which is just one-half the modulation up-peak level. When there is no modulation the tube is still called upon to deliver the unmodulated carrier, and since the carrier is at half level the output is one-fourth the modulation-peak output and the plate efficiency is one-half the modulation-peak efficiency. Actually, the efficiency increases with modulation, but since there are times when a speaker has to stop to catch his breath, the amplifier has to be designed to handle the unmodulated carrier safely. The tube gets hotter with no modulation than with it — quite in contrast with the s.s.b. case.

To resume the example above, on a.m. the tube would have to be able to dissipate 65 watts safely on its plate in order to give a carrier output of 35 watts. On s.s.b. the same tube with the same output on the modulation peak would have an average plate loss of around one-fourth the peak loss, or about 15 watts. Putting it another way, if the rated plate dissipation of the tube is the limiting factor in design, the a.m. amplifier would require a tube having a rated plate dissipation of 65 watts, but the same tube as an s.s.b. amplifier could give a peak output 65/15 or about four times as great as the peak output on a.m., the plate heating being the same in both cases.

Actually, the 70 per cent modulation-peak efficiency assumed in the example is a little optimistic in many cases, and for estimating purposes it is convenient to assume that the maximum efficiency will be 66⅔ per cent. This leads to the rule of thumb that on a.m. the carrier power output that can be obtained from a linear amplifier is equal to half the rated plate dissipation of the tube. It is easy to see why a linear amplifier is not worth while unless it uses a fairly big tube.

Where the Linear Might Be Useful

Altogether, it would seem as though the linear for a.m. would offer few attractions. This is especially so where it is being considered for following a plate-modulated transmitter running 75 to 150 watts input. The possible power gain, in most cases, is too small to be interesting.

It is possible to visualize cases, however, where there might be some advantages in the linear amplifier. Most such amplifiers need very little driving power for fairly substantial power output. By using any of several tetrodes in Class AB_1, or zero-bias triodes such as the 811A, there is no need to provide extra driving power simply for the sake of throwing it away to get good regulation — i.e., low distortion — in the amplifier's grid circuit. Hence the driver need supply — only a few watts of modulated output. Also — and this is a point seldom appreciated — the *total* d.c. power required by the complete transmitter is just about the same, when a low-power driver followed by a linear amplifier is compared with a plate-modulated amplifier with its higher-power driver, Class B modulator, and more elaborate speech amplifier. The total amount of equipment is considerably less, for the same carrier output, with the linear amplifier, and in most cases the total cost is lower. The catch is, of course, that the most carrier output that can be hoped for with a kilowatt input is around 350 watts as against 700 or 750 with plate modulation. But if your requirements are not for more than 300 to 350 watts carrier and you're starting the complete transmitter from scratch, it might be interesting to work up the comparative costs of the two systems.

One of the nice features of such a rig is the ease with which an s.s.b. exciter can be substituted when you reach that stage. — *G.G.*

Strays

"For sustaining service to amateur radio, and administrative leadership," the Institute of Radio Engineers conferred the grade of Fellow upon George H. Bailey, W2KH, its executive secretary.

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The Association for Applied Solar Energy is retaining permanently in Phoenix, Arizona, the Solar Powered Amateur Radio Station (September *QST*). The exhibit will be kept in a group for display with appropriate credit to ARRL and W1CUT, the exhibitor. In connection with the exhibit a new $700,000 solar research laboratory will be opened by the Stanford Research Institute, also in Phoenix.

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Net Times and Frequencies (SAST):
Saturday 06:00 (04:00 UTC) —AM Net—3615
Saturday 07:00 (05:00 UTC) —Western Cape SSB Net— 3640
Saturday 08:30 (06:30 UTC)— National SSB Net— 7140; Sandton repeater 145.700
Echolink—ZS0AWA-L; ZS6STN-R
Relay on 3615 for those having difficulty with local skip conditions.
Saturday 14:00 (12:00 UTC)— CW Net—7020; (3550 after 15 min if band conditions not good on 40)
Wednesday 19:00 (17:00 UTC) — AM Net—3615, band conditions permitting.