AWA Newsletter

#69

October 2011

A Member of the SARL

Antique Wireless Association of Southern Africa

Inside this issue:

CW Net	2
SSB Activity	2
AM	2
The Receiving Tube Story	3-5
AGM Notification	6
Notices	7

AWA Committee:

* President—Don ZS5DR
* Technical Advisor—Rad ZS6RAD
* Secretary/PRO—Andy ZS6ADY
* Western Cape—John ZS1WJ

Reflections:

Well, thanks to all for your understanding and commiserations with the loss of my data bank (laptop). I must tell you it has been an extremely frustrating period trying to recoup a lot of the data lost, some of which will never be seen again.

Anyway, that is now a thing of the past and we are on a new heading. I now make sure I have more than one backup copy in more than one place at a time.

All I can say is, it makes no difference how many plans you make, there will always be someone or something to screw them up for you, so try to minimise the damage as much as you can.

I guess the same applies to all of our Ham equipment and other things we have. One can never say "never" as there are just too many variables that we have to deal with. We can only try to minimise the damage we will incur.

So the Americans have tornados and hurricanes, the Japanese have earthquakes and waves. Europe has snow and floods. Brazil has mudslides and floods.

I read the other day that the British tube trains were brought to a stand still because of cable theft. Guess we know all about that one then ?

But we are tough and I guess I will always try to see the silver lining somewhere. I would much rather live my life being optimistic than continually looking at the bad side of life. So shrug these things off and carry on with life.

I know there are people out there who have been through a lot worse than I have, and I will always remember that too.

Things that happen in life are not sent to test us, they are sent to keep us from falling off the tracks and forgetting about others, because we always think the worst things happen to us only.

I will never forget a little statuette given to me by my late Mom. The caption on the front read, "Keep smiling, it makes everyone wonder what you've been up to."

Wonderful words of wisdom, and I've never forgotten them.

Best 73

De Andy ZS6ADY

Wikipedia—The Resistor

Electromagnetic Spectrum

The **electromagnetic spectrum** is the range of all possible frequencies of electromagnetic radiation. The "electromagnetic spectrum" of an object is the characteristic distribution of electromagnetic radiation emitted or absorbed by that particular object.

The electromagnetic spectrum extends from low frequencies used for modern radio communication to gamma radiation at the short-wavelength (high-frequency) end, thereby covering wavelengths from thousands of kilometers' down to a fraction of the size of an atom. It is for this reason that the electromagnetic spectrum is highly studied for spectroscopic purposes to characterize matter. The limit for long wavelength is the size of the universe itself, while it is thought that the short wavelength limit is in the vicinity of the Planck length, although in principle the spectrum is infinite and continuous.

CW Net:

The CW net continues to run under the very capable fist of Barrie ZS6AJY every Saturday afternoon on 7020 at 14:00 SAST.

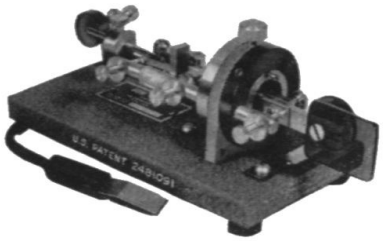
Barrie tells me the net is still well attended and a few new call signs have appeared on the net, adding to the numbers. We hope there will be even more new joiners as time goes on. I consistently read of some getting involved again n CW on the SARL Forum and hope that some of these guys will migrate to the Awa net some day and join in there.

It never ceases to amaze me the amount of CW one can hear on DX bands and on special event stations in Europe and the US. CW is still very much an active part of ham radio in those parts of the world and there are some extremely dedicated ham operators using only CW as their choice of modes.

Of course here in SA, we have a lot fewer operators on air than in those parts of the world and I suppose if one had to do a little exercise, percentage wise, I am sure we would not turn out too badly.

Let us remember, the AWA net is only one of a few CW nets taking place as well as those who just operate singly using CW for fun. I do believe there are many active CW operators still in SA. Of course it would be nice to hear more of them on the AWA net, but then it's also not everyone's cup of tea.

CW on the DX bands. Still quite a bit of activity out there from Europe and the US. I do not have any of the WARC bands



available, but have heard quite a few stations active on 15 and 20m. Maybe someone who operates on 17, 10 and even 6m can let us know about activity there.

So keep the brass shined and the fingers nimble, until next time.

Best 73,
De ZS0AWA … -.-

SSB activity:

Conditions on 40m never cease to amaze me. One week we can have fantastic comms on 40, with conditions on 80 being fair to poor, and the next week the roles are reversed. In general, band conditions have been pretty good and the SSB nets have been well attended with an average of 18 to 20 people calling in on a Saturday morning.

Its also good to hear some of the old stalwarts returning to the net, who we have not been heard for some time. Looks like when band conditions improve, people start to come back again.

DX bands are also sounding good these days and conditions are really working well on 15 and 20m.

As a side line, congratulations are in order to Dudley Z22JE for another DXCC award, this time on 6m. Another one to add to the collection.

With the coming of the Highveld summer thunderstorms, one can expect a lot more noise on the bands these days and this will get even worse as the storms increase.

Remember to plug out your antennas and earth all your systems otherwise you could be looking at some costly repairs and lots of lost smoke, which as you all know, is very difficult to get back in once it has escaped.

Looking forward to hearing more of you on the SSB net.

Collins 75A4 Rx with CE100es600L

AM:

AM has been pretty dismal these last few weeks with 80m certainly not being what it used to be. Band conditions tend to fade very quickly after the band opening in the early morning with the further stations suffering the most.

Locally conditions are not too bad and the AM stations in and around Gauteng seem to work quite well.

I note with interest, the Collins Association are starting their Wednesday evening Am nets again with the approach of their winter in the US. It will be interesting to hear how, if at all, conditions have changed over there.

At times there are a fairly large group of interested parties on the Am net, particularly the Saturday morning net. Wednesday evenings are never well attended, but at times conditions are as good as they are on a Saturday morning.

Don and I have often had extremely good comms on a Wednesday evening, but at the same time, have often had pretty bad conditions. The problem is of coursethere are never really enough stations on a Wednesday to actually evaluate the band conditions fairly.

The Valve QSO party is supposed to be taking place this coming weekend with AM starting off on Saturday afternoon, but with the SARL website being the way it is, it has been terribly frustrating to try and get the weekend advertised in the events calendar of the Forum. I have had as much difficulty trying to get a news item posted for inclusion in the SARL bulletin. We will try activating the ZS0AWA Am station on Saturday afternoon,

Yaesu FR50B Rx

with the hopes there may some interested

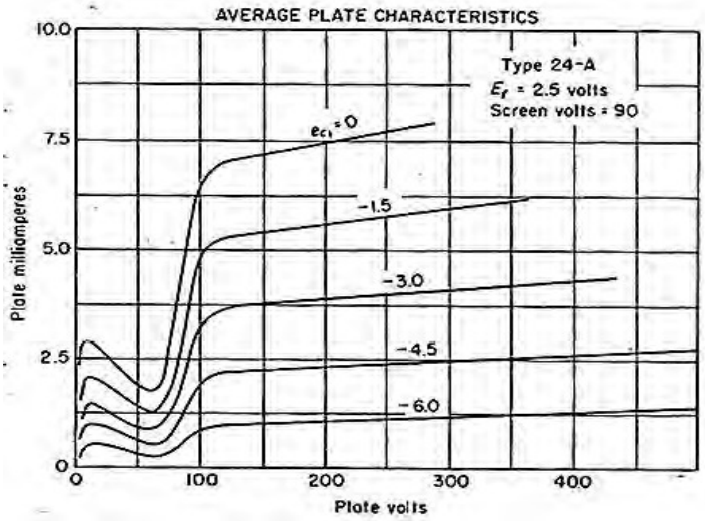
The Receiving Tube Story

Part 3: The Power of the Pentode; The Format Wars

By Marc F. Ellis, N9EWJ

PENTODE TUBES

The last installment of "The Receiving Tube Story" dealt with the development of the screen-grid tube.
As you'll recall, this four-element (tetrode) design permitted a much higher degree of radio frequency amplification than did the triode (3-element) tube. Its extra grid, placed between the control grid and the plate and maintained at a positive potential, helped isolate the grid and plate circuits of the tube from each other, minimizing feedback and instability.
The screen-grid design was a remarkable breakthrough in vacuum tube technology, significantly improving the performance of the TRF receivers then in common use.
However, there was a catch. The negatively-charged electron stream emitted by the cathode, accelerated to even higher velocity by the attraction of the positively-charged screen grid, impacted strongly on the plate. This knocked loose additional electrons from the surface of the plate (a phenomenon known as "secondary emission").
Many of these electrons were attracted to the screen grid, which reduced the current (electron flow) in the plate circuit, limiting the amplification that could be achieved. Secondary emission is also responsible for introducing nonlinearity into the plate voltage vs plate current curve of the tube (see graph). In fact, the plate current actually begins to decrease with increasing plate voltage in the region where the plate and screen voltages are similar—causing a pronounced dip in the curve. That phenomenon introduced distortion that made the tetrode unsuitable for use as a power amplifier (audio output) tube.
The pentode (five-element) tube was developed to overcome this deficiency. Born in the research laboratories of the Holland-based Phillips Company, the concept behind the pentode tube is elegant in its simplicity.
An additional grid, known as the suppressor grid, is located between the screen grid and the plate and connected (usually internally) to the cathode or filament.



Dip in tetrode's plate current vs. plate voltage curves (shown here for type 24-A) made the tube unsatisfactory as an audio power amplifier

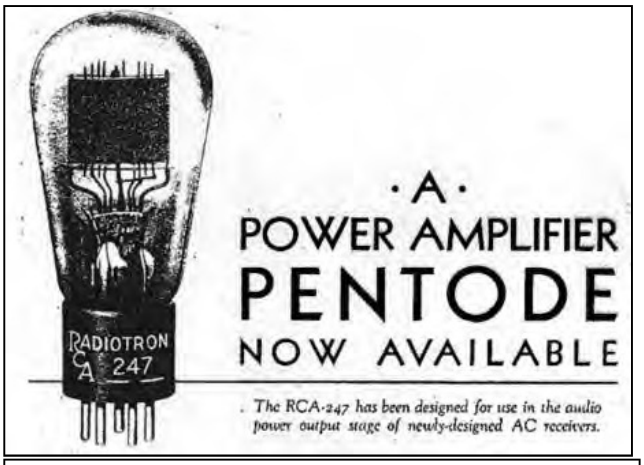
Since the suppressor grid is at the same potential as the cathode, it has no effect on the electrons emitted by the cathode, neither impeding nor accelerating them on their journey to the plate.
However, by virtue of being connected to the cathode, the suppressor grid is negative with respect to the plate. Because of that, it repels the electrons knocked out of the plate—sending them back towards that element, where they are re-attracted and become part of the plate current. The result: improvement in linearity and significant gains in efficiency and power handling capability.

THE EARLIEST PENTODES

The first power pentode type generally available in this country was the type 33 which, like the pioneering type 22 tetrode (see the previous installment of this story), was a battery tube released at the dawn of the AC tube revolution. Like the 22, this tube saw very little use and is on the rare side. If you have any in your collection, don't let them go!
Following the 22 was the type 47 (released in 1931), which did see wide usage. The 47 was a directly heated (no cathode) tube with the 2.5-volt filament that had become standard for tubes operating on AC power. Like the 71A (see previous installment), which was actually a battery tube, its lack of a cathode did not prevent it from operating as a hum-free power amplifier when lit from an AC source.
In his *Radio Physics Course* (second edition, 1933), Alfred Ghirardi provides an insight into the quantum performance leap made possible by the introduction of the pentode as a power amplifier. He reports that the type 45 triode, then in wide use as a power amplifier, consumed 8 watts of power in its plate circuit while delivering 1.6 watts to a speaker with a 50-volt signal applied to its grid. The type 47 power pentode drew about 10 watts in its plate circuit, but delivered 2.5 watts of undistorted power to a speaker with a signal voltage of only 16.5 volts applied to its grid.
The net result: the type 47 provided almost as much power as two push-pull 45s (a common configuration). And since the 47 required only about one-third of the signal input voltage as the 45, the "first audio" stage required in front of the 45s could be eliminated along with its contribution to hum and distortion.

TYPES AND FUNCTIONS MULTIPLY.

In 1931, soon after the release of the 47, the first indirectly-heated power pentode appeared. The type 38 was designed for auto radios; its filament operated from the 6.3 volts DC supplied by the vehicular electrical systems of the day. However, being equipped with a cathode, it could also be AC powered. And the 38's .3-ampere heater current rating matched the standard being developed for the series string AC-DC sets that were beginning to appear on the depression-era market.
The 38, and its companion the type 39, (a pentode RF amplifier released a year later) were perfect for the lowcost AC-DCs because they could deliver high performance with a low tube count. The International Kadette *Universal*, one of the first of these minimal radios, used a 38 and a 39 in addition to a type 35 screen grid tetrode.
The year 1932 also saw the release of other indirectly heated power pentodes, including the first 2.5-volt AC filament design (type 59) and the first 6.3-volt filament design intended specifically for AC sets (type 42).



Detail from a 1931 RCA ad introducing the type 47.

Additional pentode RF amplifiers appeared about the same time, including the 2.5-volt indirectly heated types 57 and 58. These were the first tubes to depart from the old pear-shaped envelope design, being equipped with the new type ST ("double dome") bulb.

The pentode RF amplifier tube, with its more efficient performance and superior inter-electrode shielding, would soon supplant tetrodes such as the 24A, just as the pentode power amplifier had outclassed the earlier triode designs.

Just one quick disclaimer before the triode-loving hifi aficionados climb all over me! Even in those days, triodes were noted for their purer tone and were still frequently preferred over pentodes in high-end sets.

THE REMARKABLE 6L6

Though the plate voltage vs. plate current curve of a pentode was quite a bit more linear than that of a tetrode, here was still room for improvement—especially in the critical power amplifier spot. That was achieved with the release, in 1936, of the first beam power output tube-dubbed the 6L6.

In a sense, the 6L6 is a cross between a tetrode and a pentode. It has control and screen grids, but no suppressor grid as such. Instead of the latter it is equipped with a pair of deflector plates (or "beam forming electrodes") that are connected internally to the cathode. These are positioned in such a manner that they concentrate the stream of electrons into an intense beam. It is difficult or impossible for secondary emission electrons to penetrate the beam and reach the screen grid.

Another feature of the beam power tube is the alignment of the control and screen wires so that the former "shade" the latter from the electron stream. This minimizes the number of electrons that would be attracted to the screen and therefore lost to the plate.

To get an idea of the improvement in efficiency made possible by the 6L6, Marcus, Marcus and Horton tell us (*Elements of Radio*, 1943) that the 6L6 delivers 6.5 watts of power with only 14 volts on its grid. Compare this with Ghirardi's numbers for the type 47 quoted earlier.

As it happens, the 6L6 was almost too potent, delivering more power than most receivers required. Accordingly, the beam power tube didn't really threaten the conventional power pentode for use in home receivers until the 6V6, a scaled-down version of the 6L6, was introduced in the following year.

THE FORMAT WARS

With our discussion of the pentode, we have completed our coverage of the four major types of vacuum tubes: diode, triode, tetrode and pentode. The next developments in vacuum tube evolution were not so much technical as mechanical—relating more to packaging than to function. Many of these packaging "innovations" were essentially marketing devices, with various manufacturers vying to outdo each other. which is why I think of these activities as "The Format Wars."

METAL TUBES.

In 1935, RCA announced the release of a group of tubes that were quite different (at least visually) from any heretofore sold in the American market. Developed for GE, apparently as a gimmick for that company's reentry into the receiver market after an absence of several years, the outer shells of these new tubes were made of metal instead of glass.

They were much more compact than previous American designs and sported a brand-new eightprong base (dubbed the "octal" base) equipped with a clever locating key molded onto a center post.

Some of the nine tubes that were released by RCA (and later by various independent manufacturers), were simply metal versions of existing glass tubes. Others, such as the 6H6 dual triode and 6L7 mixer-amplifier, were brand-new types.

Generally speaking, these tubes did not advance the state of the art in receiver performance, but they did offer some handy features. Because of their metal shells, the new tubes did not require the use of separate metal shields. And the octal base, which could be installed in its socket with a "rotate-until-it-drops" action, was a real advance in tube changing convenience. Ask anyone who has ever installed one of the previous, non-keyed, tubes into a tight spot at the back of a chassis!

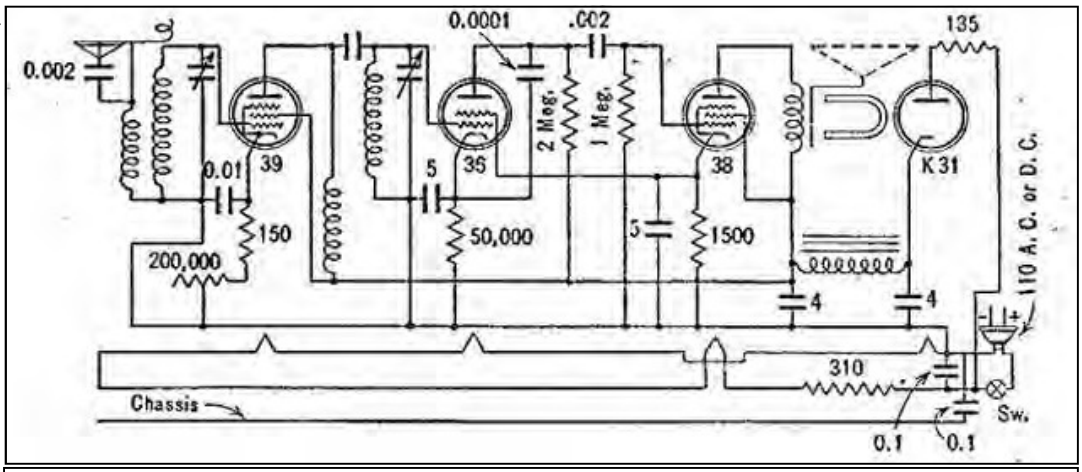
A few years later, RCA pioneered a new manufacturing concept in its line of metal tubes: the "single-ended" design.

Several types originally manufactured with a gridcap connection, including the 6L7, 6K7 and 6Q7, were re-released without the caps, all leads being brought out to the octal base. This reduced hum and unwanted coupling effects, improving efficiency and performance. The new tubes were identified with an "S" (for "single ended") inserted into their type numbers (6SL7, 6SK7, 6SQ7, etc.).

OCTAL-BASED GLASS TUBES.

The GE/RCA advertising campaigns for metal-tube equipped sets tended to put down competitive radios with ordinary tubes. Incensed, Philco refused to have anything to do with the metal tubes—developing, instead, a new line of glass tubes having octal bases. The glass envelopes of these tubes were of the familiar "double-dome" or "ST" design introduced a few years previously to replace the old "pear shaped" style.

The coming of the glass-octal, or "G," tubes (which began to be released just a few months after the introduction of metal tubes) caused a proliferation of "the same but different" types. The first glass-octals to be released were either glass versions of the metal tubes or glass/octal versions of older glass types with traditional bases.



Schematic of the International Kadette Universal *shows type 38 as power amplifier, type 39*

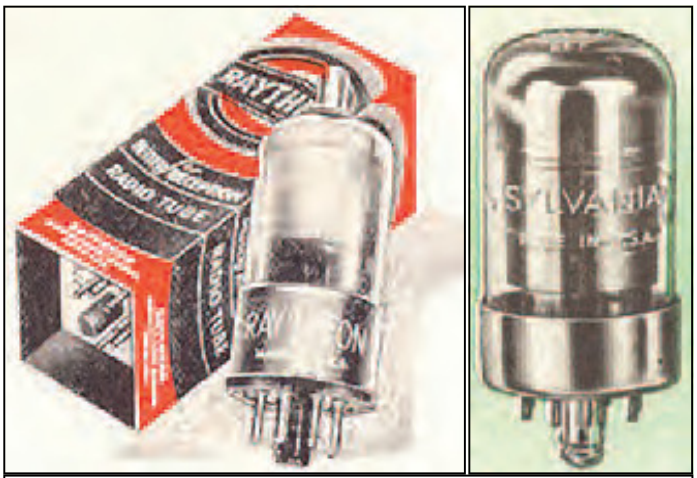
The former carried the same type designation as the metal version with a G suffix to indicate "glass." The latter, of course, were not interchangeable with their parent types because of the basing differences. These required new designations (for example, the octal-based version of the 6D6 was designated 6U7G). Later, of course, completely new types of glass-octal tubes were released.

As soon as metal tubes were released in 1935, radio manufacturers raced to put them in their sets and hype them in the media.

GT AND LOKTAL TUBES.

The vacuum tube envelope went through still another evolution when Hytron announced the "Bantam" or "GT" type tube in 1938. The "GT" tube was a shortened and much more compact version of the "G" tube. It was housed in a tubular (hence the "T" in "GT") envelope instead of the old "double-dome" style. Not much larger than the equivalent metal tube, a "GT" type could easily substitute for it even where space was very limited.

This led to a very confusing and redundant situation in which the same tube could be available in three different styles: metal, G and GT. Eventually, however, the GT design prevailed. While "GT" tubes offered no improvement in performance, set manufacturers favored them over "G" tubes because of their compactness. And for some reason, despite the initial acceptance of metal tubes, glass types came to be preferred in the industry.



Left: The "GT"-style glass tubes had tubular envelopes; were much more compact than their "G" equivalents. Right: The Loktal tube, originated by Sylvania, had a unique locking groove on its locating pin.

Approximately concurrent with the first release of "GT" tubes was the introduction of the "Loktal," a new Philco sponsored threat to the metal tube. Though equipped with a nominal metal shell at the base, Loktals were true all-glass tubes. Instead of being wired into separate base pins, the wires passing through the bottom of the tube were made extra-heavy, to be directly plugged into the tube socket.

Originally manufactured by Sylvania, later by others, the Loktal tubes had a central keyed post somewhat like that used in the octal base. However, the end of the post carried a groove that was engaged by a locking spring built into the tube socket. This arrangement helped lock the tube into its socket; hence the name "Loktal."

Since few set owners that I'm aware of were troubled by tubes creeping out of their sockets—even in auto sets— this Loktal feature had to be of value mostly as a marketing gimmick. In any case, the new tubes were used extensively in Philco radios as soon as they became available.

In order for Loktal tubes to be identified as such by their type designations, a variance was made in the initial numeral of the standard tube designation. Normally "6" for 6-volt tubes and "12" for 12-volt tubes, the numeral
became 7 and 14, respectively, for 6- and 12-volt Loktals.

MINIATURE TUBES.

The all-glass design of the Loktal base paved the way for the introduction of miniature tubes about 1940. The new tubes were tubular, with tip seal, about 3/4" in diameter and 2" long. And—as with the Loctals—the wires passing through the tube base were also the contact pins. There was no metal shell on this tube type, nor was there a locating key. Correct insertion was assured by an asymmetrical arrangement of the seven pins.

The tubes released in 1940 were 1.4-volt filament types for battery portables: the 1R5, 1S5, 1T4 and 3S4. Later, during the war, many cathode-equipped AC types (such as the 6C4 and 6J6) were introduced. These, of course found their way into broadcast receivers during the postwar period. Also available immediately after the war was a range of miniature types designed for the AC-DC sets we know as "baby boomer" radios.

These tubes included the 12BA6, 12BE6, 12AT6, 50B5 and 35W4. There were also 6-volt equivalents of most of these tubes for use in straight AC radios.

The original miniature tubes, designed for use in battery portables, had 1.4-volt filaments. This is the 1R5 pentagrid converter.

NOTICE OF THE AWA ANNUAL GENERAL MEETING

Notice is hereby given of the AGM for the AWA to take place on Saturday 12 November from 10:00 at Rand Airport at the TAC.

Matters will be as follows:

- Report by the Presdient—Don ZS5RK
- Report of Financial Status
- Election of President for the next term
- Election of office bearers

There will also be a display of Radio's as well as a fleamarket for all your needs and to get rid of excess. Please contact Andy ZS6ADY should you require the use of a table or tables for the fleamarket or for display purposes.

There will also be restaurant facilities and a cash bar available throughout the day.

Please come along and join us with your family, who can enjoy the facilities or sit and watch the coming and going of aircraft. There is also the static display of aircraft available as well as the SAA museum on site.

Some of Previous years Displays at the AGM

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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 transmitters and receivers. 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:

NET TIMES AND FREQUENCIES:
The following are times and frequencies for the AWA nets:

AM Net—Wednesday evenings from around 18:30: Saturday mornings from around 06:00 or when band conditions allow. Frequency—3615.

SSB Net—Saturday mornings from 08:30. Frequencies—7070 with a relay on 3615.

CW Net—Saturday afternoon from 14:00. Frequency—7020.
(Times given are CAT or SAST)