OFFICIAL NEWSLETTER FOR THE WEST AUSTRALIAN VHF GROUP(INC)
P.O. BOX 189, APPLECROSS WA 6153.

MEETINGS ON THE FOURTH MONDAY OF EACH MONTH AT WIRELESS HILL
TELECOMMUNICATIONS MUSEUM, ALMONDBURY RD, ARDROSS

VK6WH VK6WH

PATRON MR. F.W. DAWSON

PRESIDENT	BOB BLINCO	VK6KRC H277 7049	SECRETARY	BOB PINE	VK6ZFY H 339 3273
VICE PRES	PETER TAIT	VK6ZPT	TREASURER	BERT MEUWISSEN	VK6ME H 457 3892
COUNCILLOR	TERRY LEITCH	VK6ZLT H332 7008	BULLETIN ED.	JACK BORTHEN	VK6KDX H 447 5933
COUNCILLOR	BRUCE DOUGLAS	VK6BMD	MUSEUM REP.	BOB PINE	VK6ZFY
COUNCILLOR	FRITZ BERRER	VK6UZ	MUSEUM REP.	TOM BERG	VK6ZAF
ACTIVITIES	TERRY LEITCH	VK6ZLT	PUBLICITY	JACK BORTHEN	VK6KDX
MATERIALS	COLIN MURRAY	VK6ZCR	LIBRARIAN	ILMAR BELTS	VK6AIB

CALENDAR

Jul	19	COMMITTEE MEETING	Aug	16	COMMITTEE MEETING
	24	FOXHUNT		21	FOXHUNT
	26	GENERAL MEETING		23	GENERAL MEETING
Sep	20	COMMITTEE MEETING	Oct	18	COMMITTEE MEETING
	25	FOXHUNT		23	FOXHUNT
	27	GENERAL MEETING		25	ANNUAL GENERAL MEETING

SEPTEMBER 93

March	Two Way Radio Testing
April	Gigahertz Focus on Equipment and Operation
May	Annual Junk Sale
June	Antennas for All Reasons & Dinner
July	Construction Techniques
August	Printed Circuits in Microwave Design
September	Satellite Potpourri
October	Annual General Meeting
November	The Hunt for the Elusive VHF and SHF DX
December	XMAS Function

PROPOGATION ON THE BANDS
50 MHz TO 1296 MHz
by Eric Jamieson VK5LP
Part 1 of 3

This paper is not presented as a lead-in for a technical discussion on the merits or otherwise of equipment which may be utilised on the VHF and UHF bands, that is the province of other speakers. Rather, it is presented in an effort to remove some of the perceived mystiques of the VHF\UHF bands and encourage greater use of any or all the bands comprising 50, 144, 432 and 1296 MHz, each of which has its own interesting facets and capabilities and will be discussed separately.

However, in the allotted time, it will not be possible to give the in-depth coverage of any band, to the degree that I would prefer. What I say may be a "ho-hum" experience for some of you. Sorry about that, but you never know, your memory may be triggered to recall something you had forgotten or you may be stimulated sufficiently to assist someone less experienced than you to become active on another band. However, if as a result of what I say, and together we can finish the day with a few more amateurs prepared to try another band or two, then a suitable objective will have been achieved.

But first let us briefly look at the some of the history of the VHF spectrum. Did you know that in 1884 Heinrich Hertz of Germany built the world's first radio transmitter which transmitted on about 100 MHz? He used a powerful oscillator and a spark coil attached to a dipole antenna. The receiver consisted of a wire loop with a metal ball attached to each end. By adjusting the space between the balls, Hertz was able to improve the sensitivity of his "receiver" to the extent that those original signals were received over a distance of about 9.1 metres or 30 feet.

An improvement to the sensitivity of the original Hertz receiver came with the discovery of the coherer, such a device being demonstrated in 1894 by Lodge of England who recorded the wireless signals on paper tape! The range of the receiver had now been extended in excess of 91 metres or 300 feet.

You might also believe that microwaves are a modern concept, but in 1890 a man by the name of Rhigi was able to generate signals around 1000 MHz by placing steel balls immersed in a bath of oil, within the spark path of a transmitter. The actual transmitted frequencies were more the result of the small resonant circuits used in the spark generators than an actual attempt to use such high frequencies.

In 1895 when Marconi came on the scene, by improvements to the spark and coherer equipment plus the antenna, he was able to increase the transmitted range to several miles, ultimately lowering the frequency to 300 metres so that he was able to span the Atlantic Ocean in 1901. With this incredible achievement, the VHF and UHF areas were soon relegated to the belief of "line of sight" distances and given to the the radio amateur experimenters, who became the real pioneers in the use of the VHF and UHF portion of the spectrum.

Despite the above decision, Marconi continued to experiment to the extent that by 1916 he had provided ship-to-ship short distance communication for the Italian Navy on - wait for it - two metres! His accomplishments were overshadowed in the 1920s by amateurs such as Reinartz who established contacts between the USA and France on 110 metres, and others later to establish world wide communication on the so called useless high frequencies of 20 metres.

Various companies and consortiums rushed in and pushed the frontiers of long distance daylight communications to 10 metres or 30 MHz. Things began to fall apart when above this point they found that the ionosphere was unwilling to co-operate and and refused to continue to reflect the signals, preferring to let them through, so once again the phrase was repeated - VHF is only useful for line-of-sight contacts!

Some added impetus was given to the above statement by the discovery in the early 1920s that bouncing radio signals off ships and aircraft could actually determine their position and that the shorter wavelengths around nine metres led to greater accuracy of their actual location. This was the first use of what later became known as "radar" prior to World War II and with the advent of the war this use of the VHF spectrum was widely used by various military installations.

Despite the "line-of sight" theories, the true VHF amateur pioneers continued their experiments so that by 1927 contacts had been made over 1600 km on 56 MHz, while much work continued on 224 MHz. Marconi bridged 210 km on 500 MHz. Despite these successes, the end result was always unpredictable and the general thinking was that the use of VHF could only be depended

upon for short distance working. This comment is taken up again later under the heading of sporadic E.

Thanks to the work of Major Edwin Armstrong of the US Army Signal Corps during World War I, a major advance in technology was made with his work on the superheterodyne receiver prior to 1920 and the super-regenerative receiver in 1921, all that was needed was for his pioneering work to be recognised and used.

So it was that the amateurs of the early 1930s recognised the worth of the super-regenerative receivers and with the use of modulated oscillators for transmitters, 56 and 112 MHz became the norm for local contacts. By 1935/36 the development of stable transmitters and superheterodyne receivers together with improvements to antennas, was ever increasing the distance of VHF transmissions, especially on 56 MHz. It had already been noted that contacts of more than 1600 km were relatively common during the summer months, but their occurrence were quite unpredictable, although evidence tended to suggest that reflections were occurring from random patches of ionized air in the E layer about 100 km above the earth, hence in time the name for this phenomenom became known as "sporadic E" or Es. Despite much research, to this day no one can reliably predict when or where Es may occur.

Prior to World War II, alert amateurs noted that "auroral propogation" extended their 56 MHz horizons almost as far as the Es signals but this mode of operation will be referred to later in the paper.

With the advent of World War II, there existed a need for improved technology in radio communications. Advancements were made in the production of low loss coaxial cable to feed newly developed high gain antennas, low noise front ends for receivers, especially with the development of cascode circuits using the well known 6AK5 valves, new valves to produce high output power, plus magnetrons and klystrons to produce high power in the microwave regions.

Large sums of money were spent on research into propogation and its relationship to the ionosphere, resulting in extensive information being tabulated in regard to what is called the "maximum usable frequency" or MUF. This is defined as the highest frequency on which a signal when transmitted vertically would return to earth and this information proved invaluable during World War II and to the amateurs as well when they returned to the bands following the war.

After the War, with the advent of television a new problem arose. Long distance VHF signals from the US FM service on 45 MHz were found at times to be interfering with TV signals in the UK. The Federal Communications Commission in the US moved the amateurs down from 56-60 MHz to 50-54 MHz and 112-114 MHz became 144-148 MHz and scrapped the US Channel 1 TV frequency and moved the FM band to 88-108 MHz, which brought some order to what was rapidly becoming a chaotic situation.

Many countries followed the US plan, except Australia which in its wisdom had to go out on a limb and operate a series of TV stations on Channel 0 using 45 to 52 MHz with the result that in the summer much co-channel interference was created and the Australian amateurs eventually lost 50-52 MHz, the low end of which was the international operating segment!

However, the Australian amateurs were able to retain 50-54 MHz until the end of 1963, by which time they had proved that 50 MHz was in many cases superior to 56 MHz, especially when the solar cycle peaked around 1958 to allow contacts with amateurs on other continents. This was because the MUF obviously could rise to 50 MHz but may not always reach 56 MHz. In later years Australian amateurs, with much frustration, were to observe this cut-off phenomenon when the MUF could reach 50 MHz but not 52 MHz!

50-54 MHz or Six Metres As the earlier reading of this paper has indicated, this is a band of truly outstanding interest. After World War II, for about 20 years and before the advent of VHF transceivers, almost without exception, those who ventured to the VHF bands commenced on 50 MHz. At that time it was a band which readily accommodated home constructed gear, mostly of the AM variety, and one could experiment with transmitters, converters, antennas etc., in fact it was a good starting point where for the first time you learned that the length of a piece of wire did, in fact, have some significance!

However, times have changed and so too has the equipment and the operators. The advent of multi-band rigs which include six metres in their band coverage plus the choice from many good quality and readily available used transceivers, ensures that most amateurs with a desire to do so, can operate on six metres.

The six metre operators fall into several fairly well defined categories:-

* one who is quite happy to work across town to his mates, or be part of a crossband contact with an operator on another band, in fact, a contact which is similar to using a telephone. These operators often make good use of the band on a regular basis.

* Then there are those operators who seem to magically appear, out of the woodwork, so to speak, when favourable propogation conditions produce sporadic E or shortened to Es and its associated long distance contacts to stations all over Australia and from time to time to New Zealand and the Pacific Islands.

* the band is also used during contests, field days and portable operations.

* the experienced operator is also aware that six metres is the band used for trans-equatorial (TEP) contacts to countries such as Japan and other Asian areas.

* the truly dedicated DX operator who uses specific out-of-band indicators to warn him of the potential for contacts with stations in other countries embracing all continents, using a mode of propogation known predominantly as F2.

* an increasing number of overseas amateurs are operating via moonbounce (EME) with promising results.

The band commonly known as six metres, was called five metres (56-60 MHz) prior to World War II and for a short period after the war. During the late 1940s the allocation became 50-54 MHz and called six metres.

With the introduction of television channel 0 stations, Australian amateurs lost the 50-52 MHz segment of the band at the end of 1963 and although some limited operation on 50 MHz was permitted during the mid 1980s, it was not until July 1989 that the 50 MHz segment was restored for the use of amateurs, except those within prescribed distances of the remaining Channel 0 transmitters. Thus, most Australian amateurs now have the privilege to use an amateur band which has become available to a majority of the world's amateurs.

Under average conditions, six metres must be considered as a short range band. Except for stations in good locations, such as a mountain top or from level country with no close obstructions, and for those running high power to an elaborate antenna array, distances in excess of 200 km are not likely to provide reliable contacts. The aforementioned larger stations may extend their reliable range by a further 50 to 100 km, especially if similar systems exist at both ends of the contact.

Six metres is supported by a variety of modes of propogation and most of these are referred to in this address. The band is used for local contacts, auroral and meteor reflection contacts, extended range contacts to all parts of Australia, New Zealand and Pacific islands via sporadic E, trans-equatorial contacts to Japan and Asia, world wide contacts via F2, mobile and portable work, moonbounce, repeaters, RTTY etc.

Sporadic E or Es Six metres is not content with being a short range band, so it is capable of providing quite a few surprises. Able to appear at any time of the year but more particularly during November to January inclusive, and for a short period in mid-winter, is the phenomenen known as sporadic E where random patches of ionised air in the E layer reflect the six metre signals, thus increasing the distances over which contacts can be made.

The normal E layer propogation is fairly predictable, but while sporadic E is not predictable, it is so common that it provides one of the greatest sources for extended range contacts on 50 MHz. With the ever changing pattern of ionized air reflecting the signals, wide variations in the locality of stations and their signal strengths can occur.

Whilst Es may be more intense at certain times of the day, during periods of high Es activity the 50 MHz band may be open to some part of Australia all day and well into the night, in fact, there are recorded instances of Es occurring throughout 24 hour periods and yet it can completely disappear within minutes the next day.

It has been said by some propogation experts that there is no direct connection between Es and the sunspot cycle. With this statement I have not been able to completely agree as I feel there is ample evidence to suggest that Es is available on more occasions and for longer periods during the sunspot minima. Therefore, I refer you to the comments on Es under the two metres segment.

It appears that the optimum distance for a single hop transmission is around 1600 km or 1000 miles, roughly the distance between Adelaide and Brisbane and this explains why so many VK4 stations are worked in Adelaide. Whilst 1600 km may be the optimum, generally stations are available several hundred kilometres either side of that distance.

NOMINATION FORM

(Annual election of Office Bearers)

I wish to nominate

_____ _____.

(Member's Name) (Call Sign)

for the position of

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SECRETARY

VICE PRESIDENT

TREASURER

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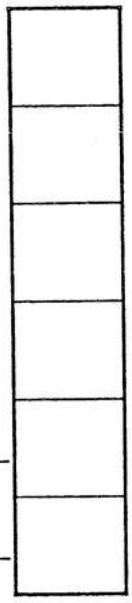

(Place X in Box)

Moved

_____ _____.

(Member's Name) (Call Sign)

Seconded

_____ _____.

(Member's Name) (Call Sign)

I am prepared to stand for the position ,
as nominated above, for the year _____.

_____ _____.

(Member's Name) (Call Sign)

Subscription Renewal Notice

Your membership subscription for the VHF Group was due and payable on or before June 30 1993.

SUBSCRIPTION RATES

COUNTRY MEMBERS	$15.00
METROPOLITAN MEMBERS	$17.00

If you have already paid please ignore this reminder.

If you have any queries please contact Bert on 457 3892.

REMITTANCE ADVICE

To: The West Australian VHF Group (Inc)
P O Box 189
Applecross W A 6153

From: Call Sign:

Address

Post Code:

Telephone Home:

Work:

Date: Amount enclosed:

Note: Unfinancial Members will not receive November or subsequent bulletins.

Because of the vagaries of the band, it is often possible to work, for instance, stations in Rockhampton but not hear the Brisbane stations, or the position of the ionised air may be such that stations are only available from North Queensland.

Double hop Es will provide contacts from VK5 to New Zealand and some Pacific islands, triple hop will extend the distance even further, but the latter is not common.

There are occasions when Es conditions are so wide spread that all States can be worked in a short period of time; at other times perhaps VK2 and 4 are workable at the same time as VK6 or maybe VK8. it is these constantly changing characteristics that makes the band so interesting.

Forward or Tropospheric Scatter Such propogation was first noticed during the 1940s when it was discovered there existed a means of communication over long distances which could not readily be explained by sporadic E, tropospheric bending or other extension modes. Reliable communication could be achieved using high power to a good beam antenna and low noise receiver, and distances of 1000 km or more for commercial users were being covered with a reliability which could not be matched by any other VHF means or HF for that matter. At times the signals would be strong but were subject to considerable variation, however, there was a usable floor level below which they never fell regardless of the weather or any ionospheric conditions. CW is the preferred mode for communication.

Because of their reliability, these scatter circuits have been used for military purposes and over the years many such communication links have been established throughout the world. Local amateurs have also been involved and I recall that some years ago Bob VK5ZDX (now VK5MM) and Wally VK5TCW (now VK4DO) were successfully exploring scatter circuits to stations in other states. Such circuits remain to this day and require only dedicated amateurs at both ends for them to be re-activated. Amateur scatter circuits have used 50 MHz and commercial users only to 100 MHz, beyond which the power requirements are so great as to be uneconomical. Also, increasing the distance beyond about 1200 km requires a similar large and uneconomical increase in transmitted power.

An interesting revelation in regard to scatter circuits is that whilst a very high gain antenna is generally used because it increases the average signal levels, when a deep fade occurs a medium size antenna is equally as successful because it can receive scattered signals from paths other than direct on to the front of the antenna.

To be continued. See next issue for part 2.

I would like to thank Eric Jameison for allowing the VHF Group to print this paper which he presented at the South Australian Technical Symposium presented by the South Coast Amateur Radio Club on 24 July 1993 at the Kingston College of TAFE Adelaide.

I would also like thank Wally Howse for obtaining Eric's paper and Eric's permission to print it in the bulletin.

Wanted

Copy of Kenwood TV 502S 2m Transverter instruction manual and handbook.
I will pay any costs involved or I am prepared to swap the instructions/handbook for a homebrew external VFO to suit a 520S TXCR.
Peter VK6APS 096 521 326 (h) or
096 521 014 (w)

THE WEST AUSTRALIAN V.H.F. GROUP BULLETIN

SEPTEMBER 1993

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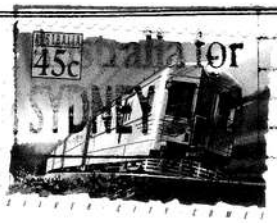

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