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 | TERRY LEITCH | VK6ZLT H332 7008 | TREASURER | JACK BORTHEN | VK6KDX H 447 5933 |
| COUNCILLOR | BRUCE DOUGLAS | VK6BMD | BULLETIN ED. | VACANT | |
| COUNCILLOR | ROSS TOLCHARD | VK6KAT | MUSEUM REP. | BOB PINE | VK6ZFY |
| COUNCILLOR | CEC ANDREWS | VK6AO | MUSEUM REP. | TOM BERG | VK6ZAF |
| ACTIVITIES | TERRY LEITCH | VK6ZLT | PUBLICITY | VACANT | |
| MATERIALS | JACK BORTHEN | VK6KDX H 447 5933 | LIBRARIAN | ILMAR BELTS | VK6AIB |

## CALENDAR

| | | | | | |
|---|---|---|---|---|---|
| NOV | 15 | COMMITTEE MEETING | DEC | | |
| | 20 | FOXHUNT | | MERRY XMAS | |
| | 22 | GENERAL MEETING | | | |
| JAN | 17 | COMMITTEE MEETING | FEB | 21 | COMMITTEE MEETING |
| | 22 | FOXHUNT | | 26 | FOXHUNT |
| | 24 | GENERAL MEETING | | 28 | GENERAL MEETING |
| MAR | 21 | COMMITTEE MEETING | APR | 18 | COMMITTEE MEETING |
| | 26 | FOXHUNT | | 23 | FOXHUNT |
| | 28 | GENERAL MEETING | | 25 | GENERAL MEETING |
| MAY | 16 | COMMITEE MEETING | JUN | 20 | COMMITTEE MEETING |
| | 21 | FOXHUNT | | 25 | FOXHUNT |
| | 23 | GENERAL MEETING | | 27 | GENERAL MEETING |
| JUL | 18 | COMMITTEE MEETING | AUG | 15 | COMMITTEE MEETING |
| | 23 | FOXHUNT | | 20 | FOXHUNT |
| | 26 | GENERAL MEETING | | 22 | GENERAL MEETING |
| SEP | 19 | COMMITTEE MEETING | OCT | 17 | COMMITTEE MEETING |
| | 24 | FOXHUNT | | 22 | FOXHUNT |
| | 26 | GENERAL MEETING | | 24 | ANNUAL GENERAL MEETING |

West Australian VHF Group Materials List

| PART NUMBER | DESCRIPTION | QTY | PRICE |
|---|---|---|---|
| 1.8-22PF | TRIM CAP(SMALL GRN) | 28 | Ø.45 |
| 1ØØN | DISC CERAMIC | 216 | Ø.1Ø |
| 1ØØN | GREENCAP | 37 | Ø.Ø3 |
| 1ØN | DISC CERAMIC 1ØØV | 393 | Ø.15 |
| 1ØN | MIN. PLATE CERAMIC | 615 | Ø.1Ø |
| 1N5344 | 8V2 5W ZENER | 17 | Ø.2Ø |
| 1N537Ø | 56V 5W ZENER | 24 | Ø.3Ø |
| 1N917B | 27V Ø.4W ZENER | 76 | Ø.Ø5 |
| 2N4Ø91 | NJD FET RF SWITCH | 5 | Ø.1Ø |
| BC548 | NPN GENERAL PURP. | 511 | Ø.Ø4 |
| BFY9Ø | NPN 1GHZ AMP | 7 | 2.ØØ |
| BK 5-65PF | TRIM CAP (LARGE YELL) | 24 | Ø.45 |
| BNC | PLUG | 35 | 3.ØØ |
| F25 | NEOSID SLUG | 396 | Ø.Ø1 |
| FT 2-1ØPF | TRIM CAP (SMALL YELL) | 5 | Ø.45 |
| MFE131 | NMD MOSFET VHF | 16 | 2.2Ø |
| MID 1.4-8.5PF | TRIMCAP (SMALL WHITE) | 85 | Ø.45 |
| MRF9Ø1 | NPN 1GHz 2.5db NOISE | 17 | 3.ØØ |
| MV22Ø9 | 33PF VARICAP DIODE | 3Ø | Ø.45 |
| PCB LAYOUT TAPE | VARIOUS SIZES all for | Ø | 2Ø.ØØ |

These materials are available from the materials officer on meeting nights or drop him a line.

Article by David K Minchin.

An article by David Minchin VK5KK presented to a recent VHF Forum in South Australia (same one as the VK5LP article) and obtained by Wal VK6KZ will be presented in a number of parts over the next few bulletins. Thanks to David for allowing to publish the article and to Wal for gaining permission.

Note that the article is not broken up into logical steps for publication. (If we had a bulletin editor I am sure this could be remedied. Does this inspire any one to volunteer for the position ?) However it will be well worth the wait to get the whole article.

# VK5 MATERIALS

As you will have observed from the front sheet of the bulletin the materials officer is now Jack VK6KDX. He can be contacted at most times on telephone number 447 5933.

If you are interested in the VK5 materials (a summary of some items available below) please have your order in by the monthly meeting and all going well your order will arrive in time for the following meeting.

VK5 Materials.
A full list will be available for perusal at the meeting or your may get one from the materials officer for the cost of the photo copying.

Pre-amps

| | |
|---|---|
| VK5 VHF pre-amp kits for 6M, 2M and 137Mhz WXSAT | $35 or $25 (no relays) |
| VK5 UHF pre-amp kits 70cm and 579Mhz | $40 or $24 (no relays) |
| VK5 UHF pre-amp Kt 1240-1300 | coming soon |

RX convertors

| | |
|---|---|
| YM3UMV 1296Mhz 2.5Db NF | $60.00 |
| DF9DA 1691Mhz short form kit MGF1302 | $40.00 |
| YM3UMV 2304Mhz 3.5Db NF | $65.00 |
| VK5ESC 2400Mhz satellite rx gasfet front end | coming soon |

Transvertors etc

| | |
|---|---|
| VK5 6M Transvertor kit | $170.00 |
| VK5 70CM Transvertor kit | $140.00 |

Linear amps
Short form kits using MITSUBISHI linear modules

| | |
|---|---|
| 6M M57735 10W | $70.00 |
| 2M M57713 10W | temporarily out stock (TOS) |
| 70CM M57716 10W | TOS |
| 23CM M57762 10W | $70.00 |
| 13cm 5W | TOS |

ATV

| | |
|---|---|
| VK5 1250 Mhz ATV RX convertor | $30.00 |
| VK5 2372 Mhz ATV RX convertor | $50.00 |
| VK5 479.25 Mhz FM IF/Demodulator | $80.00 |
| VK5 1250 Mhz FM ATV TX | POA |
| VK5 2300 Mhz FM ATV TX | POA |

There also oscillator kits, xtals, direction finding kits and packet radio kits available .

Components
A wide variety of UHF special semiconductors, MMICS, Mixers and integrated circuits as also available at reasonable prices.

Please note there is handling charge of $2.50 per order to cover post and packing costs. Also prices quoted were as at Dec 1993.

Bulk Purchase of Surplus Radio Equipment

The group has purchased a quantity of radio navigation equipment which was designed to operate in the 420-450 Mhz range. Please note that the TX equipment was designed for pulse service and therefore the transformers in the power supplies may not be suitable for amateur service.

Samples of equipment will be available for inspection at the March general meeting. Equipment may be purchased at the meeting and will be available for pick up at a time to be agreed.

EXCITERS Members $30 Non members $35

Contains 2 x SBL1 mixers numerous SMA and SMC connectors hardline and teflon co-ax patch cords, MHW710-1 10W power amp module, series pair of CM45-12 power transistors, three CM45-12 transistors in parallel. This was a beacon unit is effectively a TX/RX unit.

3.5 kW pulse amplifier Members $75 Non members $85

Contains either an 8126 or 3CX400U7 power tube, a dual TX/RX Dow Key N type relay and a number of SMA and SMC connectors. This is a cavity type amplifier with self contained power supply.

20 kW pulse amplifier Members $40 Non members $45

Contains SMA and SMC connectors. Power tubes appear to be a cascaded pair of 8942s (Max ratings of 2000Mhz and 750 watts) driving a 8938 (Max ratings 500Mhz and 1500 watts). Has separate power supply.

Rotators Members $250 Non members $275

HAM M type rec-conditioned 110V operation.
Expressions of interest sought.

HP scope units as is Members $10 Non members $12

2 port combiners (420-450Mhz) $5

4 port power dividers ( " ) Members $10 Non members $12

430 Mhz pre-amps 16-24Db gain $5

For the first round of purchases each purchaser of excitors and/or rotators will be limited to one rotator and one excitor unit. If demand appears to exceed supply on any of the above items, group members will be given preference. A ballot may be held.

# CONSTRUCTION TECHNIQUES for UHF & ABOVE

by David K Minchin

When you first look at the title of this paper , you must first think " who actually constructs equipment for these frequencies these days anyway!! " . With the proliferation of Commercially available equipment and the minimal availability of parts for higher frequencies the incentives don't seem to be that great. But there has always been an interest for simply nothing more than self advancement of knowledge and doing something that hasn't been done before ... in other words the challenge.

Internationally , this interest has grown steadily in the last 8 to 10 years through the publishing efforts of several groups in Germany , USA and the UK. Proven designs and ideas translate the cold , hard facts of a data sheet to reality for the average enthusiast , albeit like learning from other peoples experiments ( and mistakes ) . The supply lines for some of the harder to get components have become shorter , due to the rise in popularity of these items.

Armed with all this available information and the associated components it should be a lot easier to get to the next stage . Well , not quite , the biggest challenge for the novice is getting it all together and working. But despite this , this is the bit I think most enjoy more than the actual use of the final product. It does not take vast resources of money and test equipment ( but both make it easier! ) , however care and perseverance ... indeed the Construction Techniques required are an acquired art

## Why an Art?

Ok , lets take a quick look at what we are up against. We are working with a RF signal that has a free space wavelength of say among 700 mm at 430 MHz and 30mm at 10,000 MHz. When we collect , amplify , convert or detect this RF signal we must pass it through various mediums. The transmission of this signal , through these mediums must be done with a minimum of loss.

Related to both the size and construction of a Component , the Capacitance and Inductance , becomes more significant as frequency increases. The Reactive component will reach a point where losses increase at an alarming rate , actually giving the component a cutoff frequency. An example of this is the use of SMD type chip capacitors at frequencies above 2 GHz. The multi layer construction of some of these capacitors introduces a fair amount of Inductance when combined with the deterioration of the dielectric and hence the Q factor produces mediocre results.

Rule four. Losses introduced by mismatch become more critical as frequency increases.

Those familiar with lower frequency RF transmission will recognise the term SWR or Standing Wave Ratio. This factor is introduced to measure the matching or energy transfer efficiency of an Antenna at a particular frequency. It follows that the lower the SWR , the higher the efficiency of the Antenna and thus the greater the transfer of energy. Conversely , the higher the SWR , the lower the efficiency and thus the lower the energy transfer. In real life , this matching is applied to more than just Antennae.

Let us translate SWR to a more universal term , Return Loss. Return Loss is read in db and simply the difference between the forward and reflected RF from a circuit. The higher the db factor , the closer the circuit is to its target impedance. Any part of a circuit that is designed to connect to a standard impedance transmission line , whether that be coax or PCB , will present a return loss to the source or load it is connected to. If matching is optimum , it follows that minimal RF will be lost through radiation , heating in components and poor loading in active components.

Active devices also have complicated matching characteristics , with both real and imaginary factors varying with frequency , voltages , etc. Manufacturers summarise these characteristics as S parameters , obtained by analysing the input and output ports of the devices at different frequencies with return loss measuring equipment. It is beyond this paper to discuss the matching calculations , however it is suffice to say that if components are changed in a proven design for those that have different characteristics , matching will change. The result with high gain devices is not only a reduction in gain ( or loss ) but a deterioration in circuit stability. If the

Nothing is perfect. Losses are introduced everytime a component is placed in line or there is a change in the transmission medium or impedance. These losses can be controlled and measured . eg the loss of a piece of coax or the noise figure of a device or be un- controlled . eg the poor matching to a device or filter. Lets firstly look at some of these losses and widen our thinking from traditional low frequency terms. In the following discussion anything through which a transmission line travels . whether it be PCB , Air or Coax is called a " Medium " . Similarly , anything which is connected into that line . whether it be a coax connector . Gasfet or Capacitor , is called a " Component "

Rule one. As we increase frequency , all losses introduced will increase.

The loss of a dielectric medium increases with an increase in frequency. Different dielectrics vary due to molecular structure. The energy lost is directly converted to heat in the dielectric. A graphic demonstration of this is the heating in a 300mm piece of RG58/U at 1300 MHz when passing 150 Watts of RF. The Q factor of a Component is also effected similarly.

Rule two. As we increase frequency , the physical size of a component becomes more critical.

At low frequencies , a component may only be a 1/1000th of a wavelength in physical size. However at Microwave frequencies , this component could be an 1/8 wavelength in size. Suddenly we have a problem in maintaining correct impedances in transmission lines and stopping unwanted radiation problems. And remember that the actual wavelength will always be smaller when travelling through a medium . Eg velocity factor of Coax is 0.66 or for Teflon PCB 0.4 multiplying the problem.

A classic example is thus , how much RF , at 7 MHz , would you expect to see at the end of a 33 foot piece of unshielded wire connecting two coax connectors? Not very much because of the mismatch introduced by an open wire.... <600 ohms impedance . 1/4λ long will present a virtual infinite impedance at the other end. Well , that is exactly the same as a 1/4" long centre conductor of coax in free space at 10,000MHz.

Rule three. As we increase frequency , the Capacitance and Inductance of a Component becomes more critical.

# THE WEST AUSTRALIAN V.H.F. GROUP BULLETIN

## MARCH 1994


The West Australian V.H.F Group (INC)
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