

# Official Bulletin



## MHz to GHz

The West Australian VHF Group Bulletin

**AUGUST 2008**

THE WEST AUSTRALIAN VHF GROUP (INC)  
PO BOX 189 APPLECROSS

Web site: <http://vhf.worldsbest.com.au>

e-mail committee to: [committee@vhf.wirelessplanet.com.au](mailto:committee@vhf.wirelessplanet.com.au)

President	Wally	VK6KZ			
Secretary	Terry	VK6ZLT	Treasurer	Cec	VK6AO
Activities			Materials		
Publicity					
Museum Rep	Tom	VK6ZAF			
Trustee	Wally	VK6KZ	Trustee	Don	VK6HK
Councillor	Steve	VK6SQ	Councillor	Fritz	VK6UZ

AUG	10	COMMITTEE MEETING	NOV	9	COMMITTEE MEETING
	24	GENERAL MEETING		23	GENERAL MEETING
SEPT	14	COMMITTEE MEETING	JAN	11	COMMITTEE MEETING
	28	GENERAL MEETING		25	GENERAL MEETING
OCT	12	COMMITTEE MEETING	FEB	8	COMMITTEE MEETING
	26	GENERAL MEETING		22	GENERAL MEETING

General Meeting Place: Wireless Hill Museum Lecture Room. Entry via corner of Almondbury and McCallum Crescent Ardross.

Meeting Time: 8pm.

## Editors Note:

Welcome to the 2008 issue of the VHF Group bulletin.

Since our last bulletin the winds of change has been blowing through the group. Before last year's AGM, many members felt the club was starting to lose its way. There was a general consensus the reasons for the clubs existence was declining. Spurred on by Fritz VK6UZ, a rally of ideas was held to find new direction and relevance. The main points borne out of the ensuing discussions were the following.

- 1) Reduce meeting time spent on administrative house keeping.
- 2) Place new focus on building activities.
- 3) Rally members to bring more content to meetings.
- 4) Promote the group better.

As such, the new committee, under the steerage of our new president, Wally (VK6KZ), has commenced implementing many of these recommendations.

Meeting minutes are now e-mailed to members requiring only a call to accept the minutes as read at meetings. General business is raised and handled quickly and efficiently to minimize distraction to areas of non-relevance.

As mentioned in the bulletin last year, the beacon development group has been working towards a new series of beacons. New emphasis has been attached to this activity. More on this later in the bulletin.

A new surge of suggestions has contributed to the meeting forums. It must be noted that this is a continuing requirement and new suggestions are always welcome. These can be in the form of a technical presentation, a discussion forum or any other item one may feel is relevant to the group.

One item that has come to the fore over the last couple of years is Software Defined Radio (SDR). In a SDR receiver the minimum amount of external circuitry is used before the signal is digitized. After that point, software takes over to demodulate the signal. The demodulated signal can be converted back to an analogue form, or, maintain it's digital form for further processing. Phil Harman's (VK6APH) excellent presentation in July of this year provided further insight into the requirements of performing the digitizing process. Of course, the reverse is also possible where software encodes the signal into an I and Q stream for downstream modulation. Of course, new technology can and should be embraced when one feels there are genuine advantages to be obtained. I recall the introduction of Compact Disk (CD) players in the 1980's receiving a drubbing from many audiophiles for one reason or another. In hindsight, one could see many of the objections were due to ignorance of the new technology. CD's are now well imbedded in the mainstream of digital recordings. Further evolution with MP3 compression and portable non-volatile memory has led to an explosion of convenient devices for playing our favorite recordings.

SDR receivers in the form of Digital Audio Broadcast (DAB) radios have been around for some time now. Whilst these provide other services along with normal station listening, some have complained that the equivalent DAB receiver draws up to four times the power consumption of a normal superhetrodyne receiver. Apart from raising the hackles of some green groups, this can have real implications in low power use such as field operations. Phil's talk also highlighted the cost of the analogue to digital converter verses bandwidth and resolution. The analogue to digital converter (A/D) alone can have a cost ranging from one hundred dollars to thousands of dollars, depending on how close to the antenna one wishes to place the A/D. Fortunately excellent dynamic range can be accomplished from even the cheaper units. One point of note though is that the higher the operating frequency the more hardware is required in front of the A/D. Most amateur SDR's currently consist of a transverter which convert the RF signal down to frequencies which are suitable for a PC sound card. Field operations require the addition of a laptop computer and the additional power to run it. This can be weighed against features such as the simultaneous monitoring of multiple channels in different modes and possibly lower noise floor. Undoubtedly, as time progresses, new and more efficient technologies will be found which can reduce the power consumption of these devices.

In the editors view, perhaps the largest impact of SDR in the amateur community will be the widening gulf of technical requirements between the scratch builder and the black box assembler. The black box assembler can chose from a variety of hardware projects such as the Softrock receivers or the products produced by the TAPR group. There are also many SDR receiver software packages

developed by amateurs which are widely available on the web. These items can be assembled to produce an operating transceiver in a short time. This is an excellent path for the time challenged, or, those wishing to compare the new digital techniques with existing analogue technology. Kits and such like have always been useful in introducing the beginner to design concepts, if supported by a clear description of the circuits operation. However, the story is very different for the scratch builder. Not only is the knowledge of wireless design techniques required, but, the addition of SDR's also requires the ability to program microcontrollers and/or Digital Signal Processors (DSP's), along with the understanding of sampling theory and the implementation of efficient mathematical algorithms in software. A very time consuming course to be sure and maybe not a good way to introduce a novice to amateur radio.

The groups AGM will be held on the 22<sup>nd</sup> of September. Nomination forms for the committee are presented later in this bulletin. Please take some time to see if you can help by being on the committee.

This time of the year also means subscriptions are up for renewal. Subscriptions are still \$20.00. While your at it, why not try and see if some of your fellow amateurs would be interested in becoming members. Send them the form attached to the last page.

This bulletins technical articles include, methods of building SMD prototypes and designing a high side current measurement circuit. Finally the editor wishes to thank all those who contributed to the bulletin.

## Club Activities:

### Beacon Refurbishment

Whilst the new generations of beacons are under development, refurbishment of the existing beacons continues. Mt Barker has been somewhat problematic and has required remote monitoring and control. To that end Don (VK6HK) has been working with a remote control utilizing SMS messaging. This has proven quite successful and minimised the number of trips to the site. Support has also come from Terry (VK6TRG ) who was instrumental at refurbishing the 10GHz beacon for use at Busselton. Rob (VK6PO) has been working to refurbish the 1296MHz beacon antenna for Busselton.

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### Committee Nomination Form

West Australian VHF Group Inc. Annual General Meeting 22th September 2007			
Nominations for Group Representatives			
Position nominated: _____			
Proposer: _____			
Name	Signature	Date	
Seconder: : _____			
Name	Signature	Date	
Nominee: : _____			
Name	Signature	Date	

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### Beacon Update Project

The beacon update project is moving slowly forward. Thanks to all who have made contributions to it to date. Don't forget all members are welcome to join in. Just ask any of the committee members.

Steve (VK6SQ) has been working on the modulator components for the first beacon set to operate at 1.2GHz. He has been experimenting with various local oscillator configurations the RF modulator section and has conducted experiments with some DDS chips.

Fritz (VK6UZ) has taken over working on the 10MHz frequency reference. He has tried some new GPS receivers to try and develop a method of obtaining a faster lock off the satellite reference.

On other fronts, the editor has completed a board to allow remote monitoring of voltage and current for use by the beacon controller. The hardware appears to be working whilst the controlling software is still under development. A schematic diagram has been made of the modulator card, the backplane and the supervisory processor. The modulator card is being layout for PCB production whilst the other two boards are awaiting finalisation of other beacon components before committing to a circuit board.

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### **Remote Beacon Project**

This has been merged with the current beacon project. Considerations for power consumption are being taken into account with the current development exercise.

## **Technical Articles:**

### **A Simple Way of Building Prototype Circuits with Surface Mount Devices.**

**By Fritz Berrer VK6YEH.**

The following article describes the procedure for building prototype circuits using surface mount devices.

First, a note of caution!

Some components are sensitive to static electricity, so it is imperative to have a suitable working surface. Antistatic matting and wrist-straps are the standard, but they cost money. A cheap and quick solution is a metal surface, preferably a clean, shiny Aluminium plate, approximately 500x300x2mm in size and earthed via a 1 MOhm 1W resistor.

Whilst working on the board try to keep both wrists on the metal plate, as this ensures a static discharge path to Earth, and equally important, helps steady your hand movements during soldering.

ALWAYS double-check what you are about to do!

Working with SMDs not necessarily requires special or expensive tools.....

A minimum tool kit would be:

Fine tipped tweezers, antimagnetic, straight or bent tips

Soldering iron with fine tip, either round or spade type,

Soldering iron tip cleaner – moist sponge

60/40 alloy rosin-cored solder, 0.3 to 0.71mm diameter

some very fine solderwick, Type: 3SWW or 3SWY

some circuit board cleaner – spray or fluid

a pair of fine, miniature sidecutters, Type: TR-25-P !!

An illuminated magnification lens (x3) makes work a bit easier.

Some of the items described here I buy from:

World Wide Electronics

PO Box 631

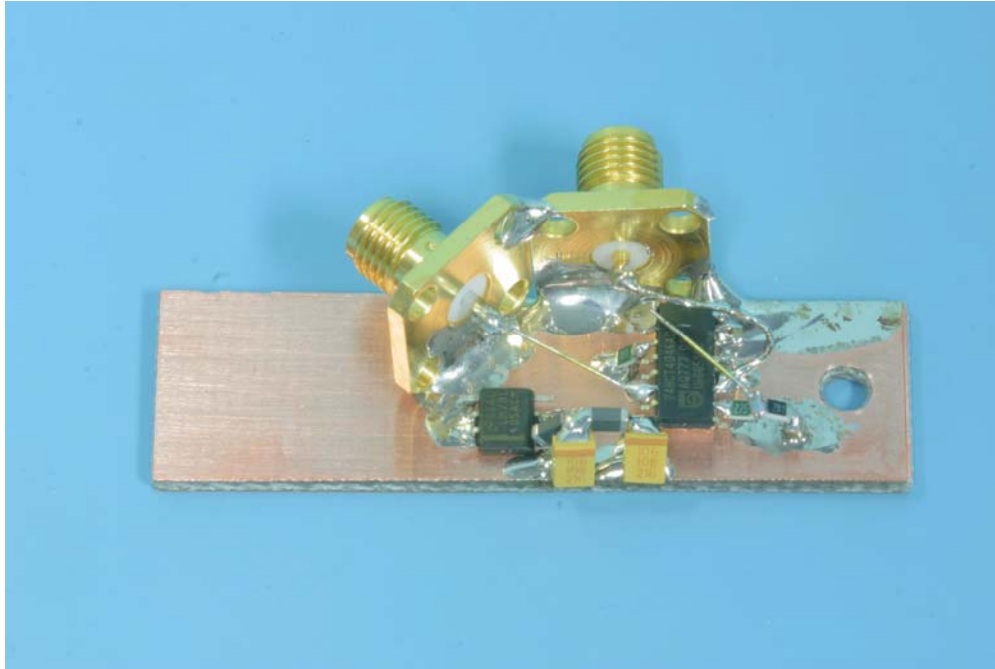
Hillarys WA 6923

Phone (08)9307 7305

Fax (08)9307 7309

<http://members.iinet.net.au/~worcom/>

EMAIL - [worcom@iinet.net.au](mailto:worcom@iinet.net.au)



**Figure 1 - The Completed SMD Assembly**

I suggest downloading Mike’s catalogue, he has a great range of products and good prices. Other local and interstate suppliers also carry a range of suitable tools.

Before beginning construction it is advisable to plan the construction layout, based on information collated from relevant data sheets and other sources. All that’s needed is a single-sided circuit board of suitable size, cleaned with some abrasive kitchen detergent and a coarse sponge. Drill a 3 to 3.5mm diameter hole somewhere near an edge, so the board can be attached to other circuitry, or screwed into a box, if needed. Now, let’s start.....

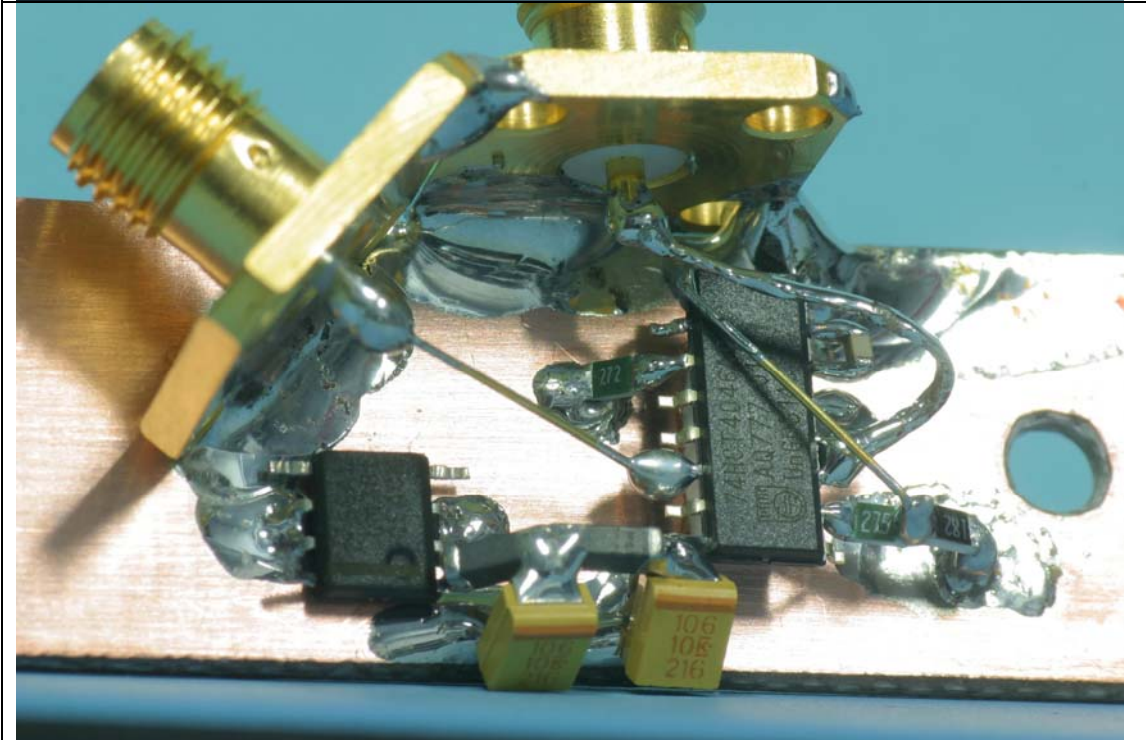
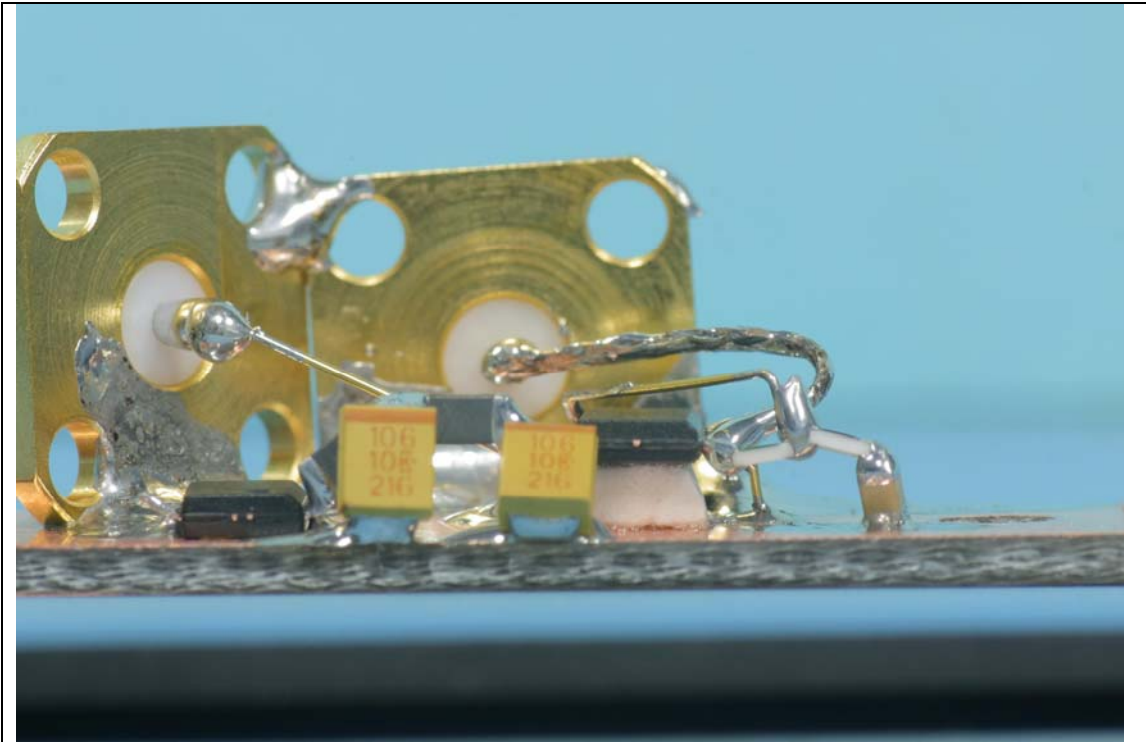
	<p>Affix the SMD, in this case an Integrated circuit, onto the circuit board by means of a short strip of double sided sticky tape. It is important that the position of this slightly elevated fixation has been chosen carefully to allow space for all other components, as well as for “work and tool access” during the assembly.</p>
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**Figure 2 – Preparing an IC for Soldering**

Solder the Input-Output terminals to the board first, as they may be the largest parts, thus requiring a large soldering iron tip. For high heat applications I use a Weller WTCPT iron and a PTDD8 tip. Any other similar iron-tip combination is useable, provided you can apply enough heat quickly to establish a good solder joint. It is important that these solder joints are strong enough to take the physical forces exerted during connecting or disconnecting the circuit board to other circuitry.

Soldering very small SMD components requires a bit of care. Here are some hints.....

- 1) Holding and soldering components can be made a lot easier by resting both wrists and-or both little fingers on the metal plate. This reduces shaking and soldering time to a minimum.



ICs legs may have their GND (grounded) legs directly soldered to the circuit board, as long as the remaining legs are carefully bent up to enable soldering of other connections. Generally, solder connections to ICs or other parts must not exert force, as SMD components are somewhat fragile.

**Figure 3 – Close-ups of the Assemble Circuit**

- 2) It is imperative that the soldering iron tip is kept clean. Rotate the soldering iron whilst pulling it over the moist sponge, this tends to give the tip a glossy surface which will quickly take up

the applied solder. As solder sponges absorb contaminants they need to be washed occasionally. They must only be kept moist, not wet.

- 3) Pre-tinning terminals on components allows for a quick solder joint. The longer heat is applied, the quicker the solder-flux is consumed, the harder it is to create a good joint. Worse still, excessive heat and touch-time may even desolder already completed joints, heat conduction through small parts happens quickly
- 4) Intermittantly sticky-taping the board to the metal plate may aid in soldering the components into their positions.
- 5) Clamping the board in a small bench-mounted swivel vice makes the assembly very easy.
- 6) Good lighting and perhaps a magnification lens (preferably illuminated) aid in the component identification.
- 7) Make sure the component-value-polarity-orientation, etc is correct. It is only too easy to pick the wrong value component.

If and when the circuitry does not behave as per design, troubleshooting reveals the error. Depending on size and complexity of the project, corrective action can take considerable time and may even present other unexpected problems.

Cleaning of completed assemblies, although not necessary, is a personal decision. There are a variety of cleaning agents in spray or liquid form. Some are flammable, some are bio-degradable, some are not. Always read product descriptions and safety instructions carefully, especially when working with chemicals and electrical gear. Your safety is of the utmost importance. Ultrasonic cleaners make cleaning very easy. It is important to handle the board with great care, as SMD components can easily be damaged or broken.

This short article may be of help to quickly get simple projects going. The described methods are ideal for a quick prototype or also a "one-off" circuit. I have built quite a few like that, it sure beats spending a lot of time designing and manufacturing printed circuit boards just for one unit, not to forget the cost of one. The biggest drawback with this construction technique may be some difficulty in replacing components, should the need arise. There is a finite amount of smoke in most components, and all one has to do, is, liberate it, hi, hi. Careful planning of the board layout does some-what ease the difficulties of correcting mistakes.

The photographs are intentionally over-exposed to give a better black&white printout, should that be required. As shown, this rather simple form of assembly is not pretty, but it is quick. As time goes on, more learned, hopefully not too much smoke liberated, some will go on to more SMD construction.

Building with SMDs is very easy once a proper printed circuit board is on hand. A large range of components are available from several Australian suppliers and usually a lot cheaper than through-hole types.

For those wanting to start experimenting with SMDs, let nothing stop you. I am working with SMDs since 13 years and have not looked back. Recently I had to populate a board with through-hole components.....grrrrrr, did not like it one minute. The more people work with SMDs, the more help and experience can also be accessed.

Finally, have fun with SMDs  
and 73s

Fritz, VK6UZ  
tmi@iinet.net.au

## **High Side Current Measurement.**

**By Luigi Iemi VK6YEH.**

Every once in a while one comes across a requirement to automatically measure the current of a device to ensure all is operating properly. This is one of the requirements in the current beacon project. In this case, power amplifiers of up to 50W may be in use resulting in operating currents up to 20A. This

article will attempt to describe the issues in measuring the current and how a high side current measurement may be implemented.

Before proceeding with the main part of the article a review is in order about low side current measurements.

### Low Side Measurement.

The following discussion refers to Figure 4. In this configuration the current measurement device is a 1 ohm resistor placed in the negative line of the load. The measurement circuit and the control circuit derives its power from the same power supply as the load.

Let us assume for a moment that the load is drawing 1A. The voltage across  $R_{meas}$  is 1V above the negative terminal of the power supply and the current measurement circuit is happy to operate there.

Let us now assume the load is a radio with a single ended PTT input. The control circuit is supposed to turn on the PTT by shorting the input to 0V. However, the 0V rail as seen by the load is 1V higher than that seen by the control circuit. Connection of these circuits can result in a myriad of potential problems, such as large ground currents or some of the return current passing through the control circuit bypassing  $R_{meas}$  giving an erroneous reading. Further, the amount of difference in circulating currents is proportional to the current flowing through  $R_{meas}$ . A potential for oscillations exists here which also tend to modulate the voltage across the load.

One can reduce the voltage difference between the load and the controller by reducing the value of  $R_{meas}$ , but this does not remove the underlying problem.

In such situations, connections between the control circuit and the load may need to be galvanically isolated via a transformer or opto-coupler.

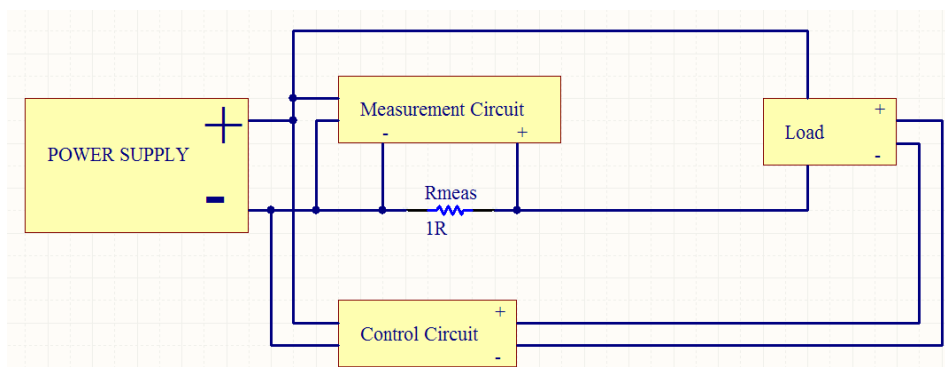


Figure 4 – Low Side Current Measurement

### High Side Measurement:

Referring to Figure 5, it can be seen that if the current sense resistor is placed in the positive line all the components of the system can retain a common 0V connection. The only concern is the drop in voltage to the load caused by  $R_{meas}$ .

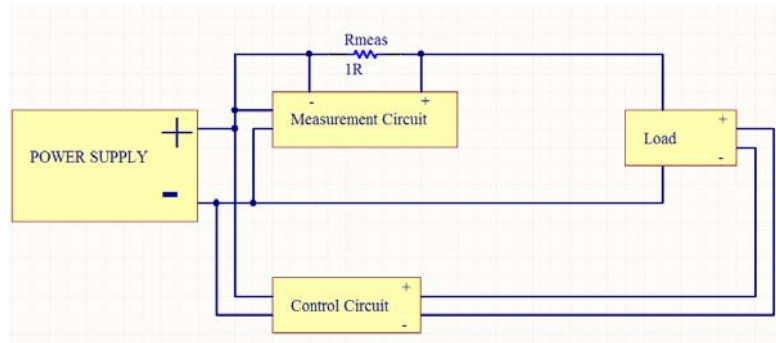
Let us assume the load is drawing 5A and the power supply is 13.8V. The voltage drop across  $R_{meas}$  is 5V and the load only sees 8.8V. Hardly optimal. What's worse is that the power dissipation of  $R_{meas}$  is 25W. Barbecue anyone?

The solution is simple. Let us reduce the value of  $R_{meas}$  to 1milliohm. For the same current, the voltage drop is 5mV. We now have to look for a voltage of 5mV in a 13.8V system. This is a ratio of 2760:1. One requires good common mode rejection to measure such a voltage. Where accuracy is desired, this was possible in the past with resistive divider circuits and instrumentation amplifiers, though it was somewhat expensive.



Today life is made easier with a range of high side current measurement devices. Whilst there are several around, this article will discuss the Maxim MAX4080 range. The devices come in three variants, F, T and S. These provide an output gain factor of 5V/V, 20V/V and 60V/V.

To calculate the desired component values one needs to work backwards. Assume the A/D in the measurement circuit has 8 bit resolution and a full scale voltage of 2.5V, the current to be measured is 5A and we can only tolerate a 0.2V drop on the positive power supply rail.

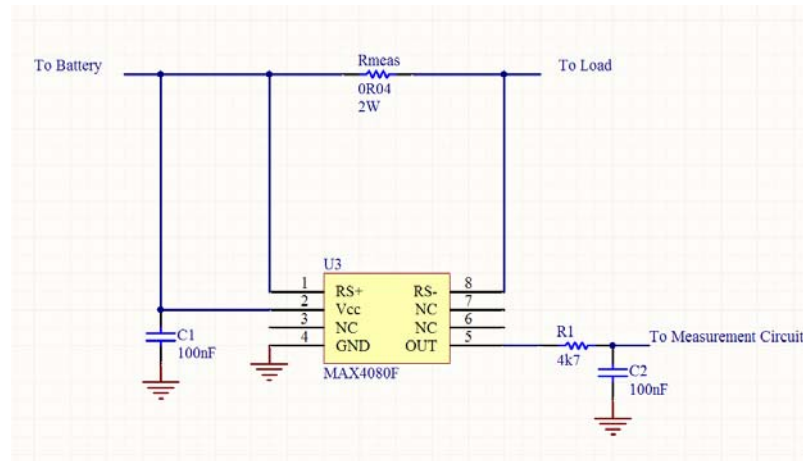


**Figure 5 – High Side Current Measurement**

The current measurement resistor is  $0.2/5 = 40$  milliohms. The power dissipation if the resistor is  $I^2R = 25 \times 0.04 = 1W$ . Therefore use a 2W resistor

The voltage gain required for full scale deflection on the A/D converter is  $2.5/0.2 = 12.5$ . The closest gain below this is 5V/V. Using the MAX 4080F version of the group, the expected voltage into the A/D  $0.2 \times 5 = 1V$ . The number of bits used is  $(1/ 2.5) \times 256 = 102$ bits. Current resolution is  $5/102 = 49$ mA/bit. This should be fine for our requirements.

R1 and C2 is added for noise filtering into the A/D converter.



**Figure 6 – High side Current Measurement Circuit Diagram**

One final reason for choosing the MAX4080. Many of the other high side current measurement devices operate up to 20VDC. This is fine if you are only measuring 13.8V supplies. On occasion, as so happens with our beacon, you may be required to measure the current in a 24V supply. The MAX4080 is capable of measuring currents in voltages from 4.5V to 76VDC.



## WEST AUSTRALIA V.H.F. GROUP (INC.)

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<http://vhf.wirelessplanet.com.au>

### MEMBERSHIP INFORMATION AND APPLICATION FORM

The VHF Group is an association of persons interested in the encourage and scientific development if V.H.F. Radio communications in all its branches, including satellites, Earth-Moon-Earth, long distance (DX), microwaves etc etc etc.

**MEETING PLACE** Wireless Hill Museum lecture room. (Entry via corner of Almondbury and McCallum Crescent Ardross).

**MEETING TIMES** General meeting on fourth Monday of each month except December, 8.00 pm at Wireless Hill. Council meeting on third Monday at 8.00 pm at nominated venues.

**ACTIVITIES** Monthly meeting.  
Swap-meets, junk sales, components sales,  
Regular technical lectures at the meetings.  
Club station at Wireless Hill Museum with HF and VHF antenna systems.

**SUBSCRIPTIONS** Metropolitan \$20.00 per year payable before the end of June for the next financial year. Country \$18.00 per year for those residing more than 60km from the Perth GPO.

### APPLICATION FOR MEMBERSHIP

**SURNAME.....OTHER NAMES.....**

**ADDRESS.....**

**..... POST CODE .....**

**CALLSIGN.....PHONE(H).....**

**(W).....**

**NOMINATOR.....**

**SECONDER.....**

**SIGNATURE.....**

**DATE.....**

**Monthly meeting.**

**APPROVED FOR MEMBERSHIP..... (PRESIDENT)**