



REPEATERS VK3RGV 2m
& VK3RGV 70cm
CALL SIGN VK3SOL

Volume 6, Issue 4
August 2008

SADARC

SHEPPARTON & DISTRICT AMATEUR RADIO CLUB

Repeaters: VK3RGV 2m - 70cm - Packet
Freq: 146.650 - 439.775 - Packet 147.575

Founded 1979

Incorporation No. A6677
P.O Box 692 Shepparton 3632

SHOWING OUR APPRECIATION



Terry Fahey from Radio Australia is presented with a certificate of appreciation from President Roger VK2RO in recognition of the tours of Radio Australia Terry conducted for S.A.D.A.R.C. club members in June 2008.

PLEASE NOTE:

The Geelong 2m repeater, VK3RGL on Mt Anakie (147.000MHz, negative offset) now requires a 91.5Hz "sub-audible" tone to open the recently installed CTCSS feature. Users are advised to avoid overdeviating their transmissions as that is likely to interfere with the reliable opening of the repeater.

OFFICE BEARERS

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Roger Conway VK2RO

VICE PRESIDENT:

Kane Hinchcliffe VK3HKH

SECRETARY:

Duncan Cameron VK3DCX

TREASURER:

Daryl Hitchcock VK3KL

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A WORD FROM THE PRESIDENT

AUGUST 2008

this is the only opportunity we have to make an impact on our Financial Bottom Line, tables are still available.

To date, we have not had a very good response on the membership renewals, please, if you have not renewed your annual membership, please do so ASAP, the \$20 fee does not cover very much of our running costs, we do rely heavily on your membership fee to subsidise some of our fixed costs, such as Rent (we have just received notification of \$5p/m increase), Insurance, Repeater up keep, Postage and PO Box rental, Station License Fee, Equipment Purchases, Newsletter costs, Name Badges (for new members), Barbeque subsidies, Xmas Party, and gifts for Guest Speakers, just to mention a few., please, we need your support.

Neil VK3KAL, mentioned at the last meeting, that the 6mtr Repeater should be up and running in the test mode, at Neil's QTH later this month, tune into the Club broadcast on Wednesday

evenings for further information. Get your vertical antennas in readiness for its final home and installation at Mt Wombat later in the year.

Just received a phone call from Danny, the IRLP 70cm Node has been relocated, please note, nothing has changed with its relocation, you can still access the IRLP Node via our 70cm repeater at Mt Wombat as normal.

October meeting, this is our Annual AGM/Club Meeting, please make a note of the date 4th October 2008 usual place and time, please make your self available to attend, this is always the most important meeting of the year, some positions are available to be filled, let our club secretary Duncan VK3DCX know. If you are interested in taking part in the running of your club, all positions are vacant.

The 80m Wednesday Night club net on 3.620mhz at 6.30pm start local time, is going gangbusters, thank you to everyone that has checked in to date and if you

have not had a chance to check in before we look forward to you checking in and supporting our 80m Club weekly net.

Monday nights Newslines on the 2mt repeater at 7.30pm is a real disaster, I feel very embarrassed at the lack of support that Neil VK3KAL receives for the time and effort he puts into running Newslines, my recommendation is to scrap Newslines on the 4th of August. Neil had one check in only, now, lets get fair dinkum about what support you are prepared to give to your club's activities. I am sure Neil would be pleased to hear from you on Monday nights, use it or lose it.

73s For Now Roger VK2RO

MEMBERSHIP FEES ARE NOW DUE \$20

Hi To Everyone,

It was very pleasing to see such a great turn up of members at the last club meeting, thank you to everyone that took the time to avail themselves to make the meeting a great success, also a special thanks to Daryl for a great Barbeque, we all had a great feed prior to the meeting.

For the next meeting in September we will present a video on Dayton 2008, now, if you want to see a real Ham fest, don't miss the next meeting, this is a real eye opener.

High on the agenda for the next meeting will be tying up the loose ends for our Ham Fest, to be held at the usual place in September. We will be looking for volunteers so please make your self available, for any further information about our Ham Fest, please contact Daryl VK3KL. Please support your Club's Annual Ham Fest,



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**PROUDLY SUPPORTING
Shepparton And District Amateur Radio Club**



Gippsland club member of SADARC George Francis VK3HV from Morwell, was one of a few to win the 'lucky door prize' at the recent Gippsland Gate Radio and Electronics Club Hamfest held at Cranbourne recently.

George won an LED Automobile Trouble Lamp

MINUTES OF AUGUST MEETING

Shepparton and District Amateur Radio Club Inc. A6677S. Minutes of monthly meeting held on Saturday 2 August 2008 at the Mooroopna Community Hall, Echuca Road Mooroopna.

Prior to the meeting, members enjoyed a BBQ at the clubrooms. The president Roger VK2RO opened the meeting at 1315 hours and welcomed all present. Roger also extended a special welcome to Terry Fahey from Radio Australia.

Present: Roger VK2RO, Daryl VK3KL, Duncan VK3DCX, Kane VK3HKH, Alan VK3AJD, Max VK3DSF, Alan VK3FALN, Brian VK3HBW, Geoff VK3AHT, Toby VK3PNF, Ron VK3COP, Rob VK3ECH, Les VK3VLG, Terry Fahey Radio Australia Tx site VLA – VLF, Rodney VK3UG, Wayne VK3XQA, Terry VK3MAR, Peter VK3FBEN, Ed VK3BG, Les VK3TEX, John VK3FJHM, Neil VK3XNW, Allan VK3AYD, Pat VK3OV, Steven VK3FSTE, Wes VK3FDDT, Manuel Pace – visitor, Neil VK3KAL, Max VK3MJB, Tibor VK3FTIB, Barrie VK3KBY, Jac VK3TJS, Danny VK3FDTH.

Apologies: John VK3PXJ,

Jan VK3ALF, Clint VK3CAF, Geoff VK3PLW, Angela VK3FELT, Moved Geoff VK3AHT, seconded Peter VK3FBEN and carried.

Inward Correspondence: BARG Newsletter, Membership subscriptions.

Outgoing Correspondence: Letter of thanks to Terry Fahey.

Minutes of the last meeting: The secretary Duncan VK3DCX read the minutes of the last meeting and moved that they be accepted. Seconded by Ron VK3COP and carried.

Business arising from the minutes of the last meeting: Relocation of the IRLP has not yet been carried out. Kane VK3HKH will follow this up with Danny VK3FDTH.

Treasurers Report: The treasurer Daryl VK3KL presented the report on the club finances and also tabled the annual report for 2007/2008.

General Business:

Insurance: Ed VK3BG raised the matter of insurance for the club's radio equipment. Ed has prepared a list of the equipment and he will forward this to the secretary and Kane VK3HKH is to find out whether this equipment

is covered under the hall insurance.

QSL Bureau: Les VK3TEX indicated that members wishing to use the Victorian QSL Bureau must be members of the WIA and also need to register their details with the bureau. If any members would like to utilise the bureau, they should contact Les VK3TEX.

6M Repeater: Neil VK3KAL informed the meeting that the 6M repeater will be on test in about two weeks and will operate on a frequency of 53.725 Mhz.

Comms Day: Daryl VK3KL indicated that 18 tables have been booked so far and that he was still waiting for some replies to his emails.

A discussion then took place on entry tickets and it was decided to use raffle tickets for entry and for the door prize.

Roger VK2RO then tabled a list of jobs required for Comms Day and the following jobs were allocated:

Pat VK3OV will obtain cheques for the hall hire and bond from the treasurer.

Toby VK3PNF will pick up additional trestle tables from the fire brigade if required.

Pat VK3OV will pick up the

hall keys on the Friday.

Max VK3DSF will man the 2M radio to give directions to the hall.

The provision of a door prize is still to be resolved.

Swan Hill Trip: Toby VK3PNF and Duncan VK3DCX gave a summary of activities during the Swan Hill trip.

VK3SOL Log Sheets: Max VK3DSF asked if net controllers for the 80M net could please forward the log sheets to him.

Presentation to Terry Fahey: The president Roger VK2RO thanked Terry Fahey from Radio Australia for conducting tours of the facility for the club members in June, and presented Terry with a certificate of appreciation and two bottles of wine.

Roger VK2RO and Rodney VK3UG gave an interesting talk on portable and mobile radio operation. Roger displayed some of the equipment he uses for portable operation and then both Roger and Rodney showed the members the finer points of mobile installation in their vehicles.

The president closed the meeting at 1510 hours.



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Mobile and Portable Amateur Radio

*Mobile and Portable Amateur Radio
(Revised 6/8/2008)*

(A earlier version of this article has previously appeared in the newsletter, however, because we have so many new amateurs it was decided that it should be presented again – updated)

A bit of history

The history of “mobile” radio communications in Australia dates back to the early 1920s when the likes of the mobile squads of the police forces in Melbourne and Sydney installed two way radio. The transmitters were about 2 Kw in the MF band at around 1600 to 1655 kHz. The ‘mobiles’ could only make contact with the base when stationary. It is not 100% clear but it would appear the base was able to transmit with voice as well as morse code, whilst I believe the mobiles only communicated by morse code. We’ve come a long way since then.

Mobile amateur radio communications would have commenced in the 1930s, but portable operation was more the go, as it was so much more likely to be successful. In the late 1940s ex-service radio equipment was available and a few amateurs were experimenting with mobile operation, but portable operation was still more common. In the 1950s mobile HF communications was starting to take off with many amateurs slinging their HF transceivers under the dashboard of the FE Holden or similar vehicle. 12-volt electrical systems made it much easier to do when compared to the 6-volt electrical systems on earlier vehicles. The antennas were usually 12’ centre loaded whips and the output power of the sets was in the region of 10 watts AM, sometimes-even CW was used. The performance of these installations using the crude – by today’s standard – equipment and the sparse antenna tuning gear was remarkably good.

The equipment was large and often took nearly all the passengers leg room under the dash board, the power supply may have been in the engine compartment as short leads were needed to alleviate voltage drop on the battery to power supply leads. It was often single band or at the most around three bands, and often crystal controlled. The antenna was a centre loaded whip usually mounted on the back of the vehicle but sometimes on the front bumper. The antenna was tuned by using a grid dip oscillator at the base of the antenna. A dip oscillator is still a useful tool for this work. The coaxial cable was disconnected and a small loop of wire wired between the base of the antenna and the earth/frame at the antenna base. The GDO was coupled to the loop and the resonant frequency found. The antenna length was then adjusted until the dip occurred on the designed frequency. In some other instances a field strength meter (a glorified crystal set with a short antenna and a meter in the output)

was used to tune for best performance. In this case the transmitter was used and the field strength meter was set up 10 metres away (approximately and the TX tuned. The antenna then adjusted for a better reading on the field strength meter. This was repeated quite a few times until satisfied that the tuning was right. These methods are still applicable, although we do have more sophisticated methods available to us today which take into consideration not only the tuning but the matching of the antenna to the 50 ohm cable and hence the transceiver. Vehicle ignition noise was a very real problem, which we amateurs hadn’t fully got a handle on. We put a resistor in the coil to distributor lead and a bypass capacitor across the DC feed to the coil. These items helped, but noise limiters in the mobile receivers were often necessary as well.

Today

Things have changed for amateurs in the area of mobile communications. Today’s talk is mostly about HF radio communication, as it is a bit harder to get right than VHF and UHF installations.

Selecting a Band(s) for Operation

The decision must be made as to which band or bands are going to be operated on and that will dictate to some extent the physical layout of the station. The Q of an efficient antenna is quite high, as much as 300, which means that the 3dB effectiveness points of an antenna may be as little as 6 kHz on some lower frequency bands. So the antennas will need to be tuned to the section of the band to be used, or the antenna will need loading coil tappings for various sections of a band to be worked.

The communications range desired is also related to 1. Above, but also relates to how much trouble you are prepared to go to, to make the station effective on the bands of interest. Examples: - a low power transceiver on a small antenna in a compromise position on the vehicle will achieve mediocre results whereas, a high power transceiver on the largest legal

antenna located at the most efficient location on the vehicle will achieve good results most of the time. The best location is in the centre of the roof and using the roof as the ground plane. However, this is rarely practical for HF use.

Modes of Operation

SSB is used by around 95% of amateurs for best efficiency of communications. FM is sometimes used on the 10 metres band. Morse and other digital modes are now rarely used mobile.

Safety and Convenience of Operation

The installation must be placed in the vehicle where the operator, usually the driver, can access it easily. Installing sets these days is difficult as there is rarely space to fit a normal sized set although they are much smaller than the sets of the 1950s and 60s. The most appropriate method is to use a remote control head on the transceiver. The remote head is located in the operating position and the main body of the transceiver is located remotely under a seat, at the rear of the vehicle or some other convenient spot. A multi conductor cable then connects the two units. DO NOT install any radio equipment over the location of the airbag; as in an accident instead of being protected by the airbag you will wear your radio gear in your face!!!

For safety reasons, the head location/set location must be placed so that in an accident the occupants of the vehicle will be unlikely to strike the set, and the set is unlikely to be dislodged and hit an occupant. There must be no sharp edges pointing into the vehicle. A secure mounting with cables dressed out of the way is a necessity. You don’t want to be strangled by the cables – you don’t want them around your feet as in an emergency you may not be able to use a control which could spell curtains for you.

The road rules frown on the operation of mobile phones, etc whilst on the move by the driver when using hand held microphones etc. A headset with boom microphone may be

NEWS FLASH!!!

Richard VK3JFK will be attending our HAM FEST in September 2008, he will be giving a demonstration and talk on D-Star radio, he will also be bringing along a portable D-Star repeater which will be available for use on the day, so if you have a D-Star radio come along a give the portable repeater a go.

Mobile and Portable Amateur Radio Cont...

a much more suitable alternative with a TX on/off switch incorporated in the connecting cable. (See Roger Conway's installation). This has the additional advantage of clearest audio in a noisy environment. If a headset is not used a remote loudspeaker can be mounted near the rear vision mirror that provides good quality audio to the operator. Having a loudspeaker down around your feet is the worst possible installation for audio clarity.

Overall don't rush it. Look at it and think about it before drilling holes etc. Also check what is behind the panel you want to drill a hole through. Drilling through a wiring loom or similar is an expensive mistake.

Installation

A HF mobile may draw 20 amps or more, so a heavy 12-volt+ lead is needed from the battery. Tapping off other places (such as the cigarette lighter socket) is not recommended, as the gauge of wire used in vehicles is often too small, resulting in excessive voltage drop. Use cable of about the diameter of a pencil, with not too much insulation. You want a voltage drop of no more than around 0.5 volts over its length at 20 amps. Some of the cable used by the vehicle audio (boom-boom) types is certainly ideal. A 1Farad capacitor mounted near the set will smooth out any momentary dips in voltage due to the syllabic nature of SSB transmissions. They are expensive. I believe heavy cable is a better solution in 90% of cases. The longer the cable, the heavier it needs to be. It is unnecessary to use a negative cable back to the battery. NOTE: - Most transceivers have their cabinet/case attached to the 12-volt negative line; therefore a separate negative lead to the battery is superfluous. Also the coax cable braid also acts as part of the negative return. Many sets have a dedicated earthing terminal and this should be earthed with a short reasonably heavy cable to the vehicle frame. The metal frame of the vehicle is a very LARGE conductor with little voltage drop. A circuit breaker, a heavy-duty fuse or a thermal link is needed in the line near the battery. Check the voltage drop across these at 20 amps. It should be almost zero but if a fault develops this may not be so. The cable should be run along with other low-tension cables and come through one of the rubber grommets in the firewall. Keep it away from ignition cables. If the cable is going to the rear of the vehicle run it under the doorsills to make sure it isn't damaged. A tidy installation is always to be aimed for. If you have one available, an 18-volt varistor is not a bad idea to incorporate across the 12-volt line to suppress any spikes on the line. I use the heavy duty 2 pin polarised plugs and sockets for supplying power to the transceiver(s) (available from electrical wholesalers). Check with others the conventional wiring of these plugs and sockets as a set may be damaged due to reversed polarity.

Mounting the Antenna

The location of the antenna is regrettably a compromise on HF. Common locations are at

the rear of the vehicle, on the front (remember driver vision ** see 10.), on a gutter, mudguard or in the centre of the roof near the dome light. The coaxial cable to the front of the vehicle must be kept away from the ignition leads to minimise any pick through the coaxial cable braid. The most common braids do let some signal in and out. Don't have the cable running across the vehicle floor as it gets trodden on which doesn't do it much good. Tidiness is most desirable, for looks and safety. A tidy professional installation is more likely to impress people favourably, particularly if you wish to encourage them to become an amateur. ** The motoring authorities regulate obstructions to driver vision. I think the maximum diameter allowed is around a maximum of 90mm, but check to be sure. This is a reason why I use a thin antenna in the field of vision. I mount the antenna so that it is not directly in front of my vision, in fact I mount it slightly to the left of centre and no impairment of vision occurs.

The antenna base must be firmly attached to strong metalwork on the vehicle. Don't pick a location where the vehicle strength is low (i.e. thin metal panels) when aiming to use a big HF antenna. Make sure the location of the antenna does not obstruct lights, doors or any function of the vehicle. The base should not protrude beyond the profile of the vehicle – front, rear or sides. I have had mounts made up to go onto the tow bar at the rear and onto metal brackets around the front of the vehicle. Make them so that they can be easily removed if needed. It is very important to make sure that all connections onto the frame of the vehicle make good contact, and not just at one point. For example if the antenna is mounted on the tow bar, make sure that both ends of a tow bar are effectively earthed to the body of the vehicle. Bad connections mean poor mobile performance. It is desirable to bond the chassis of the vehicle to the body of the vehicle in many places where separate chassis and body construction is used (e.g. most FWDs). Monocoque construction, like most vehicles are these days, is easier to bond to for an effective earth. You may end up with a number of short bonding straps.

Mount the antenna as clear of the vehicle structure as possible. The rear bumper of a sedan is better than the rear bumper of a station wagon for antenna efficiency. The highest field strength is achieved across the vehicle away from the antenna. A rear mount will have best performance ahead of the vehicle. I fitted a mount on the tow bar of the vehicle. The performance of the antenna was poor as it was shielded by the rear of the vehicle and the front of the caravan.

Antenna Tuning and Faults

The antenna can be home made or commercial. Shiny chromed commercial antennas can be quite inefficient. Chrome is not a particularly efficient at RF. All connections on the antenna must be clean and firm. Anti-corrosive paste assists in resisting corrosion and bad

connections, long term. With commercial antennas tune them as required. Home made ones like mine take considerably more mucking about with to get them tuned up and without some test gear you will find this a very difficult task.

Remember that an antenna that is physically short on the wanted frequency may only have a drive impedance of 2 or 3 ohms. If it were to show say 35 ohms on 3.5 MHz this would indicate a problem with the earthing, corroded or bad connections, or too fine a wire on the loading coil. Not good as this load resistance (35 ohms) measured at the base of the antenna may be made up of resistance due to poor connections or too thin a wire used in the antenna-loading coil plus the 2-3 ohms of the radiation resistance – the only effective part of the total “resistance” shown at the antenna base. A dummy load has a 1:1 SWR and it doesn't radiate! 2 to 3 ohms doesn't match to a 50ohm cable and a transceiver at all well. In fact with later transceivers you may get little or no output from them. The matching can take the form of shunt capacity or inductance across the coax at the antenna base. This is in addition to getting the antenna tuned to frequency. Hence you have two interacting adjustments – antenna tune and antenna match. Both need to be as precise as possible for best results. The thing is how to get both of these adjustments right. In times gone by we used a grid dip oscillator to get the antenna tuned to frequency and that can still be used. In conjunction with an SWR bridge the antenna can be tuned. These two instruments have to be used together as just having a good SWR does not mean that the antenna is tuned to the required frequency. However, it is a very laborious task. A much better way to do this is with an antenna analyser such as the MFJ 259B. This and several similar instruments make tuning an antenna much easier. They are expensive, so enlist the aid of an amateur friend who has one so that you antenna can be tuned. They are easily damaged so don't ask for a loan.

If you have one of the automatic antenna tuners mounted near the antenna feed point most of your worries will disappear with regard to tuning the antenna. However, this is an expensive option and the antenna may not be particularly efficient at 3.5 MHz as the antenna is base loaded which is less efficient than centre loading.

Interference

Interference from the automobile ignition system has been the bane of mobile operators ever since mobile operation commenced. Old vehicles have noisy ignition systems; most new cars are remarkably quiet electrically due to the ADRs that they have to meet. Often nothing has to be done or minimal shielding with foil or as I prefer bronze flywire which is bonded to the motor. Diesels have always been quiet as there have been no spark ignition systems on them. However, the latest diesels are not quiet as they use electronic fuel injection, which has

Mobile and Portable Amateur Radio Cont...

a characteristic noise in the receiver similar to spark ignition. Regrettably diesels do not have to comply with spark ignition reduction requirements because it isn't a spark ignition. The layout of the motors (at least mine is) terrible and has so far beaten me in regard to suppressing this noise. I have made some improvements and I haven't given up, just haven't had enough time to experiment further. Ignition noise can be carried along the exhaust pipe and bonding it to the body of the vehicle at the front, middle and rear helps. Bonding from the engine to the firewall or engine bay across the engine mounts with a flexible strap is worth a try. Bonding the bonnet to the engine bay/mudguards is worth a try. Most of the panels are painted then put together with bolts so the bonding can be quite poor. Noise limiters and noise blankers can make the remaining noise more bearably, although these devices can cause cross modulation and distortion of the received signals. Coaxial capacitors can also be used on the supply line to the ignition system and I hope to try that in the Jackaroo. Clip on ferrite rings are also worth a try as is shielding of some critical wires that are carrying interference. Regrettably the layout of some vehicles precludes much success in alleviating interference.

Power line interference is however another story and noise blanker and limiters are the only means of overcoming this problem unless you intend to use FM with hard limiting. BPL is sure to make HF mobile and fixed station operation very difficult too.

Good luck with your installation. The better you install the system, the better the results you will get. Accept that sometimes even though you have your antenna tuned it will not work on one band. Why? A good question. I have posed this at various radio meetings. The antenna can be put on another vehicle and it will work with no retuning, why? This is a rare occurrence for which no one appears to be quite sure of the answer. It may be that the vehicle appears to exhibit a voltage peak (1/2 wave) at the antenna base. Maybe another location on the vehicle will overcome this problem – I don't know. I am quite happy to compare notes with others wanting to work HF mobile. Roger made an interesting and often overlooked point. When stationary the mobile station can be used as a portable station by running out radials from the base of the mobile antenna, and this will achieve better communications.

A SUMMARY

Determine what bands you wish to use mobile. Will it be purely VHF/UHF or do you want to include HF as well.

Work out where you can place your antennas. Keep antennas connected to different pieces of equipment separated as far as practical even though the antennas may be on totally different frequencies. High power radiated from an

antenna in close proximity to another antenna may produce a sufficiently high RF voltage in the receiver on the second antenna and damage the set. The best spot for VHF/UHF antennas is with a mount through the top of the roof, although mudguards are popular. HF antennas cannot be mounted very high on a vehicle if any appreciable length antenna is to be used. Note you need to be constantly aware that your antenna can be broken through contacting trees, car park barriers etc. Sedans can have the antenna mounted on the tow bar at the back or at the front. Station wagons and FWDs need to have the antenna mounted on the front for best performance – mounted slightly to the left of the centreline of the vehicle to allow clear driver vision. Safety is a prime importance for you and others. See above.

Determine where the transceiver(s) can be mounted that will be easy to use whilst mobile and that will not cause injury in an accident. It is necessary to use remote control in many instances today as the interior of vehicles don't lend themselves to mounting the whole set in a position to operate it easily. Some installations I've seen are death traps of exposed sharp metal edges that may kill someone in an accident.

Work out where power, antenna, microphone and speaker cables will run that are neat and not subject to damage, and install them.

Bond various parts of the vehicle and suppress the ignition noise if necessary.

Tune the antennas to the portions of the bands you intend to use, unless you use an automatic antenna tuner, which will do this for you.

TUNING YOUR HF MOBILE ANTENNA

The practical side of tuning the antenna is best shown on actual installations. However, a few tips are in order.

Always tune the antenna out in the clear (3 metres or more) not near trees, metal fences or the garage.

Be aware that HF antennas in particular will whip around when mobile and this will cause some detuning.

The tuning of an antenna on one vehicle may not be the same on another vehicle.

With HF tapped commercial helically wound commercial whips the only adjustment readily available is the adjustable tip of the antenna. This is adjusted as per the instructions. Sometimes this will not get the SWR low enough and shunt capacity may need to be put between the antenna and the vehicle (across the base). This may be anywhere between around 800 pF and zero depending on the band. The lower values will be used on higher frequencies. I use 15pF across the base on my 6m x 1/4 wave on the vehicle, and around 800 pF on 1.84 MHz on my 3.5 metre centre loaded HF whip.

Homemade centre loaded whips like mine require values of between 800 pF (1.84 MHz) and 50 pF (18 MHz) of shunt capacity across the antenna base. The loading coil arrangement

consists of several segments, which are switched into circuit or shorted out to suit each individual band or part of a band. All coils are shorted out on 18 MHz, which is adjusted with some helical windings on the top section of the fibre glass whip. Then a coil is wound with 18 gauge enamelled wire to suit 14 MHz. This is done at the top of the coil former and is in series with the top whip section of the antenna. This is then resonated to the band, with allowance to place the turns close together or to spread them to achieve resonance at the desired frequency. Each subsequent coil is wound in series with each other so that more total coil is in use on the coil former as the frequency is lowered.

At 1.84 MHz the bandwidth of the antenna is around 3 kHz so very accurate tuning is required as this is a very high Q antenna.

The tuning above is best done with something like an Antenna Analyst, which looks at both the resonance and the characteristic impedance of the antenna. So the above work is done in conjunction with the Analyst. The resonance will probably be found to be around the correct frequency but the impedance is too low, which will equate to a high SWR even though the antenna is tuned. By placing a variable capacitance of up to 1000 pF across the antenna base, the impedance can be adjusted for optimum drive impedance. Adjustment of both the loading coil and the shunt capacity is needed, as they will inter-react to a certain extent. Once the correct adjustments have been found for a band, measure the capacity of the variable capacitor and whenever that band is used that amount of capacity needs to be put across the base. This is repeated on each band, and a different value will be needed for each band. I use one variable capacitor and mount it at the base and adjust it for each band. I have marked where the capacitor needs to be set for each band. If in doubt about this enlist the assistance of another amateur who has experience and an Analyst to get your antenna tuned for best performance.

If you want to have the very best a fully remotely controlled antenna like Roger's HF antenna is the way to go. It can be tuned right across every HF band. Another version is one of the automatic tuners that will tune a random length of wire and these would be mounted near the antenna or form part of the antenna. The third of these is an antenna called "a screwdriver" which can be continuously tuned across the HF bands. It can also be home made. All of these three antenna systems are usually tuned from the driver's seat. Some shunt capacity across the antenna base may be required with some of these.

The above gives a number of ideas on how an amateur may install and operate an effective and safe mobile station.

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