Ottawa Amateur Radio Club

Groundwave

P.O. Box 8873, Ottawa, Ontario, Canada, K1G 3J2

From the Editor:

February 2012

An old (but still interesting) article on power vs antenna is printed on page 5. The author concludes that you are better off spending your money improving your antenna rather than increasing your power.

Based on this information it would seem to me that a better way of classification for HF contests would be on the basis or effective radiated power (ERP). This would level the playing field by making the outcome more reliant on operator prowess. The categories would be based not just on power output but ERP, a combination of power output and antenna gain. ERP is calculated by adding output power level in dBW to antenna gain dBi to come up with a number ranging from about 0 to 50 dBW. For example, a 5W QRP station with dipole antenna would be rated at about 9 dBW while a kW station with a several yagis would be rated at about 43 dBW.

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Check out our Web Page: ***www.oarc.net***

Next Meeting 7:30 pm, Wednesday, February 8th
in the Colonel By Room at Ottawa City Hall

In This Issue....

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Groundwave

December 2011

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Articles may be submitted for use in this publication provided that they portray events or activities that promote Amateur Radio. Letters and comments are also welcome. Submissions may be made by mail addressed to the Editor care of the OARC, or by e-mail to "ve3igj@rac.ca". Deadline for submissions occurs three days after the regular monthly meeting of the OARC.

Please support your local radio organisations. They support you!

Club Information

The Ottawa Amateur Radio Club Inc. is an association of Radio Amateurs devoted to the promotion of interest in Amateur Radio communications in the National Capital Area and to the advancement and achievement of club members.

Regular Meetings of the OARC Inc. are held on the second Wednesday of each month (except July and August) in the Honeywell Room which is on the second floor of Ottawa City Hall, formerly Regional Municipality of Ottawa Carleton Headquarters, on Lisgar Street. Meetings commence at approximately 19:30 hours. Further details about each meeting is elsewhere in this publication.

Executive Meetings of the OARC Inc. are normally held on the first Wednesday of each month at 19:30 hours. Contact the President to confirm the date, time and place of the next meeting.

The CAPITAL CITY FM Net meets every Monday (except some holidays) at 20:00 hours on the club repeater **VE2CRA 146.940(-)** to pass traffic and to make announcements of interest to Amateurs in the National Capital Region.

The SWAP Net is a service provided and conducted by Ed Seib, VA3ES. This feature appears on the Capital City FM Net. To list items and make inquiries, got to http://www.ncswapnet.ca. You may reach Ed at 613-738 8924 or e-mail him at va3es@rac.ca.

The POT-HOLE Net is a SSB/HF net sponsored by the Ottawa Valley Mobile Radio Club and is conducted every Sunday at 10:00 hours on **3.760 MHz**. All amateurs are welcome to check in.

The POT-LID CW Net is an informal slow-speed **CW** net sponsored and conducted by Ed Morgan, VE3GX, and meets every Sunday, except during July and August, at 11:00 hours on **3.620** MHz, to promote interest in CW and CW procedures.

The QCWA CHAPTER 70 Net meets every Monday evening at 19:30 hours on repeater VE3MPC **147.150(+).** You do not have to be a QCWA member to participate.

The Ottawa Valley VHF/UHF SSB Net is sponsored by the West Carleton ARC. Look for it every Tuesday night (except the first Tuesday of the month) around 21:00 on **144.250,** (roll calls after net on 50.150, 432.150, 222.150, and 1296.100.) Horizontal polarization is preferred.

VE3TEN

Tuning in the beacon so that it makes sense requires you tune to **28.175** on **CW** and read the tone that is there . The spaces between the elements are the higher tone. If that doesn't work, tune to **28.175.28** on **lower sideband** for better results.

Voice (VHF) 146.94/146.34 100Hz CTCSS required
(UHF) 443.300/448.300

VE3TVA Amateur Fast Scan Television Repeater
Currently off the air and looking for a new home.

IRLP Node 2040 146.94/146.34 (VE2CRA/VE3RC)
(Code 411 for info) (Code 204 for activity)
(Code 88 for time)
For further information please contact the Repeater Chair.

Note: The IRLP link is not connected to ECHOLINK. Please do not try to connect using the alpha keys on your keypad. It just confuses the operator.
Note: The IRLP link is disabled during the Capital City Net each Monday. It is disabled from 2000 to 2145 Mondays except for May to August when the link is disabled from 2000 to 2020.

Ottawa Amateur Radio Club
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December 2011

January Minutes

The meeting opened at 19:36 with Greg, VE3YTZ, as chair and 39 people in attendance.

Guests
Peter Carss, VE3XEM, and Amente Bekele, VA3AXB, who came last year and now has passed the test and has his call sign.

Joe Norton
We remembered to bring the plaque today, and so awarded it to Margaret, VE3VXN.

Canadian Ski Marathon
Jjust a reminder that the CSM is Feb 11th and 12th. We've been doing it now for 38-39 years. Regular course this year — Buckingham to Montebello, and then Montebello to La Chute . We're looking for more radio operators. Please contact Harold, VE3UNK at radio1@admin2.ca . We need operators more than we need radios, so don't let a lack of radio hold you back

Club Projects
Mike VE3FFK will take money and sign-ins for the club projects. There is a $35 deposit for each project. Tyler, VA3DGN, and the group are still holding the magloop project. Newcomers welcome ($100 if you have your own capacitor). Dave, VE3KL, is holding his RF components project scheduled to start on Feb. 4 at Algonquin College ($35 cost) . Norm, VE3LC, is holding 2m Big Wheel antenna project ($35).

RAC Winter Contest
We've been doing this for 4 years now at the Diefenbunker. Nine people there and we bought our own transceivers and laptops and hooked up to their 3 antenna systems.
- 1 Phone station, 1 CW station
- 432 QSOs (80m up to 10m)
We were the official Ontario RAC Station. We got VE3VXN on the air during the contest. We produced a QSL card for the event.

Ottawa Antenna Policy
Authority to approve or reject is with Industry Canada.

Dates to Remember

2012

Feb. 11, 12	Canada Ski Marathon
Apr. 11	Homebrew Night
Jun. 13	OARC AGM and Elections
Jun. 23, 24	Field Day
Jul. 1	RAC Canada Day Contest
Sep. 8	Hamfest
Sep. 30	Membership Renewal Deadline
Nov. 1	Joe Norton Award Subm. Due
Dec. ?	RAC Winter Contest

Towers smaller than 15m or modest expansions (< 25%) are exempt. No preferred number of towers.
Set back 1.5m from all lot lines
Prefered max height of 15m from the ground
There is a $300 fee if an application needs to be investigated. This proposal is to be considered at city council on Feb. 28.

RAC 60m
We've been watching the changes to this band in the US. Canada looks like it will copy the regulations from the US. We look forward to a consultation process in near future. It looks very promising that in the first half of the year, we may be on 60m.

Interesting Contacts
VE3DNI: KK4KW first HF contact
VE3DNI: UU2JI Ukraine 15W PSK31

General Meeting
Bert, VE2ZAZ, talked to us about EME. See his web site at http://ve2zaz.net/.

5050 Draw
Winner: VA3AXB -- $17.50
Winner: VE3UNK -- bag of candy left over from Christmas

The meeting closed at 21:33.

Jean, VE3DNI
Secretary

mk's Words

Four months before new rig: HF QSOs in the VE3FFK log: 5 (mostly portable ops on 40-20m). Four months after new rig: HF QSOs in the VE3FFK log: 26 (all at home, mostly CW, mostly 40-10m). That may not be much of a change to those of you who make a half dozen contacts every day, or who spend every spare minute chasing after DXCC country number 98, or 198 or ...
But it is a big change around here. Before, I might spin through a band and hear something interesting, then say "That's interesting" and move on. Now it becomes an attempt at a QSO. More often than not it becomes a successful contact and another memory in the log.

Great, but I'm not sure it's all due to the new rig. With many thanks to the designers of the rig and much respect for the advertisers and reviewers who convinced me that I should part with a stack of twenties to buy it, I think there's something else going on here.

To put the rig into it's new home, I had to take out the old one. At the same time, I had to re-arrange and clean up the little space where it fits. The paddles needed a better place. The built in keyer should be replaced with the outboard one I like better. I had never bothered to wire into the show, since it is so handy for portable work. At the same time the tuner needed a more convenient (reachable) spot.

By the time all this was done, the old rig might well have gone back into the spot with the same result on the QSO total. Maybe not, but I suspect it is so. Make no mistake, I love the new rig, and wouldn't unroll the transaction that brought it here, even if I was paid to, but...

You aren't as likely to go for a Sunday drive in the family clunker with it's fast food wrappers, duct taped visors and dirty windows as you would have when it was shiny and new. I suspect the same phenomenon is happening in my ham shack. Wash the car, vacuum the floor mats and fix the mirror, and see what effect it has on your ham radio enjoyment score. (Then go out and get the new toy anyway, but you'll know why)

73 mk
VE3FFK

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Then, one could establish 4 power categories: <10 dBW, 10 to 20 dBW, 20 to 30 dBW, and >30 dBW.

While power output is easily measured by the transmitter itself or a power meter, antenna gain is a bit more difficult to determine. However, there are formulae for most configurations. Manufacturer's data could also be used. This might also force antenna manufacturers to be a bit more realistic with their antenna gain claims.

This is an interesting idea. I am sure this is not the first time it has been proposed but I have not seen it elsewhere.

Renowned contester Vladimir Sidarau, VE3IAE, will be speaking to us about Logbook of the World. Exchange of electronic QSL cards seems to be the wave of the future, particularly as postage and printing costs continue to escalate. Come to the February meeting and discover the new world of electronic confirmation of your contacts and consider whether this is your medium of tomorrow.

You can also catch us on Mondays at 20:00 local time on the Capital City FM Net using the club repeater VE2CRA (146.940-, 100 Hz CTCSS).

Ian Jeffrey, VE3IGJ, Editor

RAC Treasurer

The Radio Amateurs of Canada (RAC) is looking for a Treasurer who is a Chartered Accountant, Certified General Accountant, or Certified Management Accountant. A certification in amateur radio is optional. As RAC's financial advisor, we need someone to provide direction on the accounts and act as liaison with the external auditors. Experience with QuickBooks would be an asset.

Please speak with your friends, there must be a RAC member who either qualifies or can approach someone for this volunteer position. Interested parties please contact the RAC Corporate Secretary at vo1prb@rac.ca

Paul Burggraaf
RAC Corporate Secretary

Amplifiers vs Antennas

By Kirk A. Kleinschmidt, NT0Z, 16928 Grove St, Little Falls, MN 56345, kirk@cloudnet.com

Think you need a shiny new linear amplifier to chase away your HF radio blues? Think again. What you probably need is a better antenna! Here's why....

Let's start by eliminating any thoughts of fairness and equality regarding this article's handling of the age-old philosophical struggle between amplifiers and antennas. More than a few hams will take exception to my biased statements (common when trampling sacred cows and sneering at tradition), but if you're a typical beginning ham, you're probably wondering whether to buy an amplifier or improve your antenna system—or maybe both. It's a logical question. You want to improve your station's signal quality, make more QSOs, work more DX stations, rack up higher contest scores and chat with others while enjoying armchair copy. You want to know whether amplifiers are a good investment, whether they'll require additional equipment and services, whether they'll provide the boost in readability you've been desiring and so on.

By now you're thinking that I'm an "antenna guy," and that I'm here—through this article—to persuade you to improve your antenna system. You're right! But beyond the many nuts and bolts reasons detailed herein, I'd like you to at least consider a few philosophical reasons to keep your power output at barefoot levels (or less!). Then, if you're not convinced, we'll take a look at the cold, hard facts about amplifiers and antennas.

Amateur Radio's Middle Path

Amateur Radio operation in the US is constituted as a radio service, with rules, regulations and goals that go beyond the interest of mere hobby operation. In becoming licensed hams, we agreed to play by those rules. One of the most important rules compels us to use the minimum transmitter power required to communicate.

That doesn't rule out the use of linear amplifiers, of course, but it does put a damper on their indiscriminate or habitual use. Powering your amplifier through your shack's light switch certainly violates the rule, as does running maximum legal output power when chatting with the gang across town (or when propagation clearly doesn't require it). The minimum necessary power rule is designed to protect us all. It promotes responsible, considerate operation. Try it sometime! Reduce your 100-W signal to 50 or 25 W. Thanks to years of low-power operating, I know that you'll maintain effective communication most of the time. You'll also improve your operating skills, enjoy a greater sense of achievement and gain an intuitive sense of propagation. By the way, the FCC's minimum necessary power rule isn't suspended for contest operation, to work DXpeditions, etc. About the only open-and-shut case for the automatic use of maximum available power is for emergency communications. When someone's life is on the line, the more power the better. That kind of service is what the Amateur Radio Service is all about.

Skill Versus Brute Force

Long before David and Goliath had their epic battle, skill has been tangling with brute force. I'm sure you have your favorite analogy. Basically, it comes down to the fact that any idiot can fire up a water-cooled Voice of America-size transmitter and blurt out a whopping signal. I place hams who take this approach in the same category as the guys who screech the tires on their 1-ton pickups or water their lawns during drought emergencies. Both are equally impressive, I'm sure. On the other hand, if you align yourself with the Davids of the world, substituting skill and persistence for brute force, you'll be in better company—and you'll be upholding the tenets of the Amateur Radio Service.

The Golden Rule

Hams treading the Middle Path are concerned about others—hams, neighbors, family members, etc. They try to fit in, to get along, to accommodate a community of interests in addition to their own. They practice the Golden Rule Do unto others as you would have them do unto you (reasonable variations notwithstanding). As hams who comprise a federally licensed emergency service, we enjoy certain protections from unreasona-

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ble local restriction. These privileges are welcome and necessary as a whole, but they can be easily abused. Just because we can transmit a 1500-W signal doesn't mean we should. Just because we can erect a 200-foot-high antenna tower doesn't mean we should. Hams who follow the Golden Rule integrate their radio pursuits with the pursuits of others—not because they have to, but because they want to! Governments can't legislate common sense. That's up to us.

Okay, that's the end of my emotional pitch for restraint. If you're still tempted to reach for the power switch (the high power switch) or dig into your rainy day fund to purchase an amplifier, let's look at the facts.

The Ham Next Door

To start, let's assume that you have a typical shack. A 100-W transceiver graces your operating desk and "talks" to a coax-fed dipole (or two) through a 300-W antenna tuner. Thanks to the tuner, your rig can happily put out full power regardless of actual antenna/feed line SWRs on the various bands you work. You use the same setup as your "Elmer" and most of the guys in the local radio club. Uncounted thousands of hams have used similar setups over the years, so they must work pretty well, right? Maybe. But maybe not. In fact, you might have noticed that working stations on some bands doesn't seem as easy as it should—especially DX stations. You might even be dreaming of solving your problem by cranking up the power. By adding a gleaming, glowing monster amp to your modest shack, you might think, those stations with once-marginal copy will respond with ease.

It's a comforting image, but it's probably more fantasy than reality. Although you may not yet know it, you'll likely get a lot more signal for a lot less money if you upgrade your antenna system before shelling out the bucks for an amplifier.

The Price of Power

Let's boost our signal a step or two at a time and see how the decibels stack up against the greenbacks. If your amplifier budget is modest, a small solid-state or single-tube amplifier will boost your 100-W barefoot signal to about 500 W. That's enough to be noticed, or so you think—but just how noticeable?

Here's the law every amplifier has to measure up to Every time you double your power output, stations that are receiving your signal hear a 3-dB increase in strength. That's half an S unit! To twitch the needle a full S unit you need to quadruple your power output (a 6-dB increase)! The power output progression looks like this 100 W doubled to 200 W equals a 3-dB increase. Next, 200 W doubled to 400 W equals a 6-dB increase. Then, 400 W doubled to 800 W equals a 9-dB increase (exceeding the output power of our entry-level amplifier). Finally, 100 W times 10 equals 1000 W, a 10-dB increase in power output. Our 500-W output amplifier gives us a smidgen more than a one S-unit boost on the other end. That's not much—especially when you consider the cost.

More Power

So, you want to run even more power? Using our calculations from before, boosting your signal to a kilowatt output provides a 10-dB shot in the arm. That's just under two S units on the other end—S3 to S5, S7 to S9, etc. That's enough of a difference to be noticed, but still not enough to "burn down the barn." And by the way, the most affordable kilowatt amplifiers cost about $1500. If you really go for the gusto and buy a legal-limit amplifier, your 1500-W signal will be about 12 dB stronger than your "barefoot" transceiver. Because of the "price of power," 1500 W is still only two S units stronger! And a legal-limit amplifier is hardly a casual purchase. It'll set your wallet back about $2500.

Hidden Costs

Don't think you can get away with just an amplifier! The power output curve is often deceptive. For example, above 300 W output or so, you'll need a beefier antenna tuner. Expect to spend up to $500 for a good one. And don't forget about the ac mains, either. You can probably get away with running a 500-W output amplifier on 120 V ac, but beyond that, it's 240 V all the way. (Don't believe me? A 500-W output amplifier runs about 1000 W input power. That's 8.5 A at 120 V. With your rig added in, that's more than 10 A. Believe me, the lights in your house will "jump" to the rhythm of your code key or your spoken words!)

Chances are good that you won't know how (or

won't want) install that 240-V line yourself, either. The materials and an electrician to install them likely will total $300 to $500. Many first-time amplifier users don't consider their beast's power supply requirements until they've set up the amp and started "browning out" the rest of their house! If this is you, you'll be lucky if you don't trash your TV set or your home computer in the process of "modulating" your 120-V power feed! If you live in an urban setting, don't neglect the potential "public relations" costs of firing up a killer signal in the midst of all those consumer electronics devices. I know...you can legally stand on the solid rock of FCC-mandated power output limits—but be warned that it can be a lonely vigil.

A Better Way

To save wear and tear on your neighbors, fellow hams, your wallet and even your house wiring, consider improving your antenna system before investing in an amplifier. Here are some ideas to get you started One almost universal way to get out more signal is to get your antenna(s) farther up in the air (your present antenna or a new one). Build a taller mast, find a taller tree or put up a tower. If that dipole just isn't cutting it, put up a contest-winning and DX-catching secret weapon a full-wave horizontal loop for 40 or 80 meters (up as high as possible, of course!). Feed it with coax and use a tuner on bands above the fundamental frequency. That's a "cheap 'n' dirty" way to snag an extra 2 to 10 dB, depending on frequency. Disconnect the feed line from your coax-fed single-band dipole, the one you try to use on several bands, and replace it with 450-O ladder line. With a coax feed, even though your antenna tuner may be presenting a happy impedance to your transmitter, feed line losses due to high SWR may slash your signal by 6, 10 or 25 dB, depending on the band and the size of your dipole! By using 450-O open-wire line you'll likely reclaim most of that lost power. Now that's a 6 to 20-dB shot in the arm that anyone can afford!

For less than the price of an entry-level amplifier you can buy a multiband beam antenna and a decent rotator. This dynamic duo, mounted reasonably high, will offer a 5 to 7-dB steerable improvement to your signal. Remember Amplifiers only boost your transmitted signal and do nothing to improve reception. By rotating a directional antenna you can often achieve a double-whammy—boosting the signal you're trying to receive while attenuating signals that are unwanted. For example, if I'm working a European ham from my Minnesota QTH, a potentially interfering signal from an op in Florida—located in the side null of my directional antenna—may drop 25 dB or more! The difference, more than 30 dB of signal enhancement, could never be achieved by a lone amplifier. On SSB, learn the correct use of your rig's speech processor. There's another 3-dB (or more) improvement, this time in the modulation department! No purchase necessary!

Radio Amateur Hall of Fame

Aftermath

So, after looking at the cold, hard facts, do antennas win out over amplifiers at your shack? Or will your operating table soon be sporting some heavy iron? As always, the choice is yours. Amplifiers do have their uses—especially after you've tweaked your antenna farm. Add a 10-dB amplifier to a 7-dB beam antenna and you've got a whopping 17-dB improvement in signal strength! That will put you on the map—especially when the minimum necessary power required to communicate calls for maximum smoke. And when conditions are poor an amp may make the difference between being heard and being lost in the noise. As long as it's confession time, let me come clean.... Most of my operating over the past 23 years has been at QRP or barefoot power levels, but I've used an amplifier every now and then.

The first was one that I built myself from scavenged parts. I was seduced by the possibility of a glowing 4-400A transmitting tube, and I was trying to work DX on 80 meters with a poor antenna.

The amplifier helped me put a few difficult QSOs in the log, but collateral considerations forced me to abandon my glowing metal and glass monstrosity. The 150-pound amp was collapsing my operating desk, and its draw from the 120-V mains was overwhelming! I could only use it in the wee hours when everyone else was in bed....

After I put up a decent 80-meter antenna, I never looked back. Given the choice, I'll take a "killer"

antenna instead of a "rock crusher" any day! How about you?

S Meters and Radio Lore

Something needs to be said about S meters: With a few exceptions, they're inaccurate, nonlinear and of dubious calibration! Each S unit on a typical S meter is supposed to indicate a 6-dB increase in the strength of a received signal. But it probably doesn't. Or it might—at one frequency on one band (or a few frequencies on a few bands). On other frequencies and modes, however, it might provide readings that are way out in left field. S meters appeal to our senses and to our need to categorize and stratify things in our environment. They can be useful, but we shouldn't rely on them for precise measurements. That's what your brain is for. Use it and forget the bouncing needle!

When Less is More

Now that you've seen that it takes a whopping amount of extra power to make a noticeable difference in received signal strength, you might be wondering whether the cold equations work in the other direction—and they do! If you have an okay signal with 100 W, you'll likely have a workable signal with 25 W, or even 5 W. That's the Holy Grail of QRP (low power) operation. The power output numbers work, just like before, in reverse. Let's say that you have an S9 signal with 100 W output. Cutting your power to 50 W provides a 3-dB decrease in strength. Cutting power to 25 W adds another 3-dB reduction. Therefore, going from 100 W output to 25 W output has reduced your received signal strength by 6 dB—only 1 S unit! By drastically cutting your power output, your signal has dropped from S9 to S8! That's not a big deal! Dropping from 100 W to 10 W is a 10-dB reduction—less than 2 S units. Dropping to 5 W, the commonly accepted threshold for QRP operation, totals 13 dB—just a smidgen more than 2 S units. Your signal will go from S9 to about S7! Again, not a big deal! Add a decent directional gain antenna to the QRP equation and you're back in the old ballpark—while running a lot less power. That's QRP. And it's a lot of fun.

"Real Software" Radio

No extra hardware needed, just your PC, a microphone, speakers and you are ready to call CQ on the virtual Ham Radio bands. Once you have installed this Ham Radio Software you will be able to communicate with thousands of Amateur Radio operators and radio enthusiasts from over 200 countries around the world. You can even use it without a Ham Radio License.

Both Voice (Double Sideband) and CW (Morse code) is supported. The software works in Windows, Linux and Mac or any other Java driven system. HamSphere can be used by licensed Amateur Radio operators and unlicensed radio enthusiasts.

The Ham Radio Software Transmitter virtual output is adjustable between 10 watts and 2.5 kilowatts. HamSphere covers 11 virtual Ham Radio Bands between 160m and 6m. The system does not emit any RF so it is 100% safe to operate in any country. You can also use the built in 48m Broadcast band to create your own shortwave radio station.

- Modes: DSB (Double side band modulation) and CW (built in keyer)
- Filters: 700hz in CW, 2.4kHz and 3.8 kHz in DSB.
- AGC: Fast and slow
- 6, 10, 11, 15, 17, 20, 30, 40, 48, 80, 160m bands.
- Band span: Usable bandwidth for each band is 96 kHz.
- Power: Adjustable between 10 to 2.5 kW.
- Simulation on/off (Turn off shortwave reality mode and use as a 2m like transceiver)

Amateur Radio Simplified

You probably know what the Amateur Radio hobby normally requires such as big aerials, antenna permits, expensive hardware and an abundance of sun spots. Perhaps you live in a block of flats where Amateur Radio is impossible. Well, this Ham Radio software will get you the real Amateur Radio feeling without those things. You will be able to work that DX country on the other side of the world that you always dreamt of working.

Read about Vic VE3JAR, a Ham operator in Canada who has made over 8000 contacts from 224 countries on HamSphere sofar .
From http://www.hamsphere.com

2011-2012 Membership Application/Renewal

Ottawa Amateur Radio Club Inc., Box 8873, Ottawa, Ontario K1G 3J2

☐Single $25 ($20 after Feb 1, 2012)
☐Family $30
☐Junior $15 (under 18 years of age)
☐New Ham - Free (if licensed in current Membership year)
☐Emailed *Groundwave* ☐Mailed *Groundwave* (add $10.00)

Please Note: Membership year is September 1, 2011 to August 31, 2012.

Family Name: _____ First Name/Initials: _____

Address: _____

City: _____ Prov: _____ Post Code: _____

Home Phone: _____ Work Phone: _____

E-mail address: _____ (For *Groundwave* mailing)

Callsign(s): _____
Qualifications: ☐ Basic ☐ Advanced ☐ Morse Code
Year Licensed: _____ RAC Member? Yes ☐

Other Family Members

Name: _____ Callsign(s): _____
Qualifications: ☐ Basic ☐ Advanced ☐ Morse Code
Year Licensed: _____ RAC Member? Yes ☐

Interests: _____

Comments/Suggestions: _____

All members who are in good standing on or before the December General Meeting will be eligible for a free one-time name badge. Members who wish a second or replacement badge may purchase one at the Club Price (approx $7.50 plus tax). Ordered badges will be available in January.

Do you want an **OARC NAME TAG**? Yes ☐ Second or Replacement Yes ☐

ORDER DETAILS - As to appear on badge:

First Name _____ Call Sign _____