



# FEEDBACK

The Official Newsletter of the  
Georgian Bay Amateur Radio Club

January 2019

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President .....Tom VA3TVA

Vice-President... Frank VA3GUF

Treasurer.....Bobby VE3PAV

Secretary.....Peter VE3BBN

## Message from the President



**Tom VA3TVA**

Happy New Year! I hope that every one had a good Christmas season.

Winter has finally arrived in earnest, even if sporadically. It's been as consistent as HF propagation. Dr. Tamitha Skov, The Space Weather Woman had predicted marginal improvements in propagation into the new year. Talk around the breakfast table on the 12th make the marginal improvements seem very small. Now that the cold weather has arrived, it must be time for me to spend sometime outside to get an HF wire up to check out the propagation myself.

The new club executive has met, and we have a number of irons in the fire. Field day is at the top of our list. Followed up closely by club fundraising. In the past couple of years, the club has spent a fair bit of money on an amplifier and tuner for field days, and general member use. We have also spent money to improve our repeater system. Tom VA3TS has put considerable time and energy in to our repeaters. I for one really appreciate his work and dedication. Thankyou Tom.

Moving ahead into the new year, we will be looking for volunteers to assist with organising field day. There are a number of jobs needing doing. A lot of details to look after. The more people willing to lend a hand, will mean less for each of us to do, and more for all to be enjoyed.

Another item of note is that our meeting location has been changed. We will no longer be at the professional center. This month we will be meeting at the Century 21 office at 927 2nd Ave E. Owen Sound. We are very fortunate that Bernie was able to find a location and set it up for us on such short notice. I look forward to seeing every one there next week. Being as we will be meeting in down town Owen Sound, I recommend the we try to arrive a few minutes early, as parking may not be as handy as it was in the past.

Looking forward to seeing as many as are able to come to our meeting next week.

73 Tom VA3TVA

# Minutes of Meeting

There wasn't a meeting in December other than the Christmas Luncheon, and therefore no minutes.

## Repeater Etiquette

**Starting a QSO via a directed call.** There are two main ways by which a QSO can begin, one is via a directed call and one is via monitoring. A directed call is where one amateur calls another amateur individually, such as "VA3XYZ from VE3ABC". In such a case, VE3ABC is looking for one particular individual, VA3XYZ. It generally is not an invitation for anyone other than VA3XYZ to return the call. If VA3XYZ doesn't answer the call, VE3ABC may just clear off by saying "VE3ABC clear", or may clear and listen for other calls by saying "VE3ABC clear and listening". The "and listening" or "and monitoring" implies they are interested in hanging around to QSO with anyone else who might be listening at that time. "Listening" and "monitoring" don't mean you are listening to somebody else's conversation, they mean you are listening for other people who may want to call you to start a new QSO. Likewise, just saying your call by itself with nothing following it is meaningless. If you were to say "VA3XYZ", people listening wouldn't know if that means you were monitoring for calls, whether you were testing, or whether they missed the callsign of a party you were calling. Be concise, but be complete.

**Starting a QSO via a monitoring call.** If the repeater is not in use, simply stating your callsign followed by "listening" or "monitoring" or "mobile" implies that you are listening to the repeater and are interested in having a QSO with anyone else. Calling CQ on a repeater is generally not common, a simple "VA3XYZ listening" will suffice. There is no need to repeat the "listening" message over and over again as you might do when calling CQ on HF. Once every few minutes should be more than sufficient, and if someone hasn't answered after a few tries, it probably means there is nobody around.



*VE3GBT Repeater*

If someone is listening and wants to QSO, they will answer back. Avoid things like "is anybody out there" or "is there anybody around on frequency"; it sounds like a bad sci-fi movie.

**Joining a QSO in progress.** If there is a conversation taking place which you would like to join, simply state your callsign when one user unkeys. This is the reason for having a courtesy tone: to allow other users to break into the conversation. One of the stations in QSO, usually the station that was about to begin his transmission, will invite you to join, either before making his own transmission. Don't interrupt a QSO unless you have something to add to the topic at hand. Interrupting a conversation is no more polite on a repeater than it is in person.

**Interrupting a QSO to make a call.** If you need to make a call to another amateur but there is already another QSO going on, break into the conversation during the courtesy tone interval by saying your callsign. One of the stations will allow you to make your call. If the station you are calling returns your call, you should quickly pass traffic to them and relinquish the frequency to the stations who were already in QSO; don't get into a full QSO in the middle of someone else's conversation. If you need to speak with the party you call for a significant length of time (say, more than 15 seconds), ask them to either wait until the current QSO has cleared, or ask them to move to another repeater or simplex channel to continue the conversation.

**Roundtables and "Turning it Over".** When more than two amateurs are in a QSO, it is often referred to as a "roundtable" discussion. Such a QSO usually goes in order from amateur A to amateur B to amateur C and eventually back to amateur A again to complete the roundtable. To keep everyone on the same page, when any one amateur is done making a transmission, they "turn it over" to the next station in sequence (or out of sequence, if so desired). Without turning it over to a particular station when there are multiple stations in the QSO, nobody knows who is supposed to go next, and there ends up either being dead silence or several stations talking at once. At the end of a transmission, turn it over to the next station by naming them or giving their callsign, such as "...and that's that. Go ahead Joe." or "...and that's that. Go ahead XYZ." If it's been close to 30 minutes, it's a good time to identify at the same time as well, such as "...and that's that. VA3XYZ, go ahead Joe."

**IDing and Who's Who?** By regulations, **you must always identify at 30 minute intervals** and at the end of a transmission. If you are making a test transmission or calling another party, this is a one-way transmission. Since it has no "length" as there is no QSO taking place, you should identify each time you make a call or a test

transmission. When identifying yourself and another party (or parties), or when making a directed call, your callsign goes LAST. "VA3XYZ, VE3ABC" means that VE3ABC is calling VA3XYZ, not the other way around. There is no need to identify each time you make a transmission, only once every 30 minutes. You do not need to identify the station with whom you are speaking, only your own callsign, but it is generally polite to remember the call of the other station. **Avoid phonetics on FM** unless there is a reason for using them, such as the other station misunderstanding your callsign. When phonetics are needed, stick to the standard phonetic alphabet.

**Cross Band Repeating.** Transceivers capable of cross band repeating are fairly easy to come by, and provide an easy way to utilize your mobile radio and a handheld to keep in touch with the repeater. This is handy if you are on your property away from your base station or perhaps in a basement or a building with poor coverage. The same rules regarding identification apply.

**Repeater Linking.** Another application of cross band capable mobile radios is to actually connect 2 repeaters. So, for example, to use the VHF frequency on VE3GBT and crossband to the UHF frequency on VE3OSR. This would allow users to utilize both repeaters at the same time. While this is possible, those who wish to do this must obtain the permission of the repeater owners and once again the same rules regarding identification apply. Repeater owners will get upset if you use the link frequency for your qso. **The link is there for the repeaters to communicate over, not you.**

**Demonstrations.** From time to time, an amateur may want to demonstrate the capabilities of amateur radio to another non-amateur. The typical way to do this is to ask for a "demo" such as "VA3XYZ for a demonstration." Anyone who is listening to the repeater can answer them back. Usually telling the calling party your name, callsign, and location is what they are looking for, not a lengthy conversation. Someone doing a demo may ask for stations in a particular area to show the range of amateur radio communications, such as if the calling station is in Port Elgin, they may ask for any stations in Woodford or Owen Sound areas, which is more interesting than demonstrating that they can talk to someone in the same town as they are in.

**Signal Reports.** If you are unsure how well you are making it into the repeater, **DO NOT kerchunk the repeater.** Any time you key up the repeater, you should identify, even if you are just testing to see if you are making the machine. "VA3XYZ test" is sufficient. Do not use the repeater as a "target" for tuning or aiming antennas, checking your transmitter power, etc. Use a dummy load where appropriate, or test on a simplex frequency. If you need someone to verify that you are making the repeater OK, ask for

a signal report such as "VA3XYZ, can someone give me a signal report?" "Radio check" is a term most often used on CB, "signal report" is what most amateurs ask for.

**Language.** Aside from some of the techno-syncretisms inherent in amateur vernacular, **use plain conversational English.** The kind of English that would be suitable for prime-time television, not R rated movies. Avoid starting or encouraging conflicts on the air. If a topic of conversation starts to draw strong debate, change the subject. Avoid "radio-ese" lingo whenever possible. CB has its own language style and so does amateur radio, but the two are not the same. Amateurs have "names", not "personals". Although many new hams have graduated from the CB ranks, let's try to keep CB lingo off the amateur bands. When visiting a new repeater, take some time to monitor before jumping in to get a feel for the type of traffic and operating mannerisms of that particular system. Some repeaters are very free-wheeling in that there are people jumping in and out of conversations constantly. Others primarily have directed calls on them and discourage ragchewing. Others are member-exclusive repeaters. Listen before you talk, when in Rome do as the Romans do. In all cases **minimize the use of Q Codes** on FM.

**Emergencies.** If there is a QSO going on, break into a conversation with the word "Break" or "Break for priority traffic." **DO NOT USE THE WORD BREAK TO JOIN IN A QSO UNLESS THERE IS AN EMERGENCY!** All stations should give immediate priority any station with emergency traffic.

**Malicious Interference.** If there is malicious interference, such as kerchunking, touch-tones, rude comments, etc. **DO NOT ACKNOWLEDGE IT!** Continue the QSO in a normal fashion. If the interference gets to the level where it is impossible to carry on the QSO, simply end the QSO as you normally would. If these situations persist then there are actions to take, most notably by informing ISED. (Industry Canada).

**Power.** Use the minimum power necessary to complete a QSO. However, the minimum power necessary doesn't just mean you are barely tickling the repeater receiver squelch. If someone says that you are noisy, increase power or relocate or take whatever measures you can to improve your signal. Continuing to make transmissions after being told your signal is noisy is inconsiderate to those listening. The amateur radio manufacturers continue to come up with newer, smaller handheld radios, many with power levels well under a watt. Many new amateurs start out with a handheld radio as their "first rig". Although convenient, they aren't the most effective radios in terms of performance. Without a good external antenna, operating a handheld radio indoors or inside a car is going to result in a lot of bad signal reports.

# Ham Radio HF/VHF Antenna Lengths Chart

Here is a handy chart for determining 1/4 wave verticals, 1/2 wave dipoles, and full wave loop lengths. All antenna lengths in the information below are in feet and are the results based on the standard formula of  $468 / \text{Mhz} = \text{total length in feet}$ . Loop antenna lengths are based on using  $1005 / \text{Mhz} = \text{total loop length in feet}$ . As with any antenna, lengths should be cut longer than formula results and then trim as needed for best swr. The chart covers all ham bands from 160 meters through 2 meters only.

Ham Radio HF/VHF Antenna Lengths Chart in Feet				
Ham Band (Meters)	Frequency (Mhz)	1/4 wave (Feet)	1/2 wave Dipole (Feet)	1 wave Loop (Feet)
<b>160</b>	1.800	130' 0"	260' 0"	558' 4"
	1.850	126' 6"	253' 0"	543' 3"
	1.900	123' 2"	246' 4"	528' 11"
	2.000	117' 0"	234' 0"	502' 6"
<b>80</b>	3.500	66' 10"	133' 9"	287' 2"
	3.750	62' 5"	124' 10"	268' 0"
	3.900	60' 0"	120' 0"	257' 8"
	4.000	58' 6"	117' 0"	251' 3"
<b>60</b> Under new rules effective March 5, 2012	5.330.5	43' 9"	87' 8"	188' 5"
	5.346.5	43' 7"	87' 5"	188' 0"
	<b>NEW 5.357</b>	---	87' 4"	---
	5.371.5	43' 5"	87' 1"	187' 1"
	5.403.5	43' 3"	86' 6"	186' 0"
<b>40</b>	7.000	33' 5"	66' 10"	143' 7"

	7.150	32' 9"	65' 5"	140' 7"
	7.300	32' 1"	64' 1"	137' 8"

<b>Ham Band (Meters)</b>	<b>Frequency (Mhz)</b>	<b>1/4 wave (Feet)</b>	<b>1/2 wave Dipole (Feet)</b>	<b>1 wave Loop (Feet)</b>
<b>30</b>	10.100	23' 2"	46' 4"	99' 6"
	10.150	23' 1"	46' 1"	99' 0"
<b>20</b>	14.000	16' 9"	33' 5"	71' 9"
	14.150	16' 6"	33' 1"	71' 0"
	14.300	16' 4"	32' 9"	70' 3"
	14.350	16' 4"	32' 7"	70' 0"
<b>17</b>	18.068	12' 11"	25' 11"	55' 7"
	18.168	12' 11"	25' 9"	55' 4"
<b>15</b>	21.000	11' 2"	22' 3"	47' 10"
	21.200	11' 0"	22' 1"	47' 5"
	21.450	10' 11"	21' 10"	46' 10"
<b>12</b>	24.890	9' 5"	18' 10"	40' 5"
	24.990	9' 4"	18' 9"	40' 3"
<b>10</b>	28.000	8' 4"	16' 9"	35' 11"
	28.500	8' 3"	16' 5"	35' 3"
	29.700	7' 11"	15' 9"	33' 10"

**Note: For 28.400Mhz use formulas below**

<b>Ham Band (Meters)</b>	<b>Frequency (Mhz)</b>	<b>1/4 wave (Feet)</b>	<b>1/2 wave Dipole (Feet)</b>	<b>1 wave Loop (Feet)</b>
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6	50.000	4' 8"	9' 4"	21' 1"
	54.000	4' 4"	8' 8"	18' 7"
2	144.000	1' 8"	3' 3"	7' 0"
	148.000	1' 7"	3' 2"	6' 9"
<b>Antenna length is based on the following formulas:</b>				
<b>1/2 wave dipole (feet) = 468 / frequency in Mhz. (1/4 wave, use 234 / frequency in Mhz)</b>				
<b>Full wave loop (feet) = 1005 / frequency in Mhz</b>				
<b>Cut total wire length slightly longer for connecting insulators/pruning as needed for lowest swr.</b>				

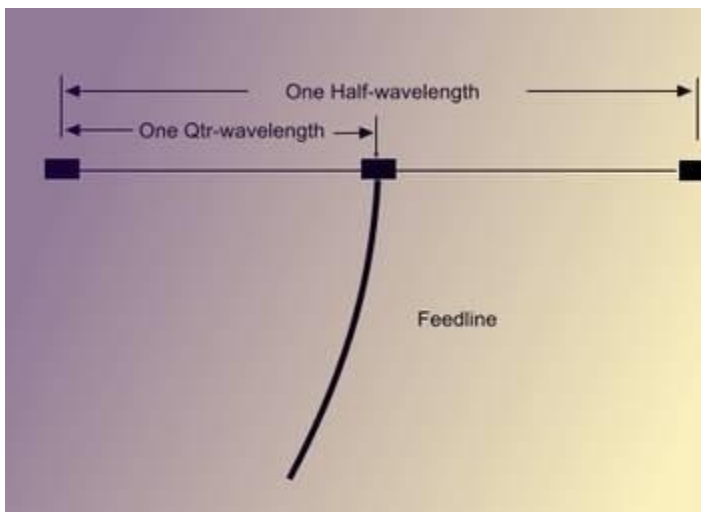
## Dipoles and Inverted Vees

The basic formula for determining the length of a center fed, half-wave wire *Dipole* or *Inverted Vee* antenna is:

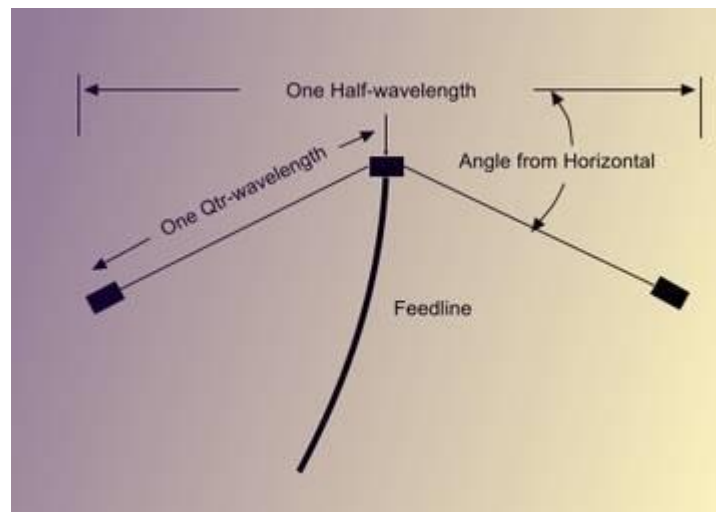
$$468 \div \text{freq (mHz)} = \text{Length (feet)}.$$

This formula takes into consideration the capacitive "end-effect" from insulators which shortens the physical length requirement for the equivalent electrical length. The inverted Vee antenna will be shorter by 2 - 5% depending on the angle from horizontal.

### Half-wave Flat Top Dipole



### Half-wave Inverted Vee Dipole





The feed point impedance of a Dipole in free space is close to  $75\Omega$ . Dipoles can be fed directly with  $50\Omega$  or  $75\Omega$  coax, or with a 1:1 balun at the feed point. The slight mismatch when using  $50\Omega$  coax can be easily matched with an antenna tuner. More importantly, for symmetrical current distribution, reduced feedline radiation, and thus a cleaner pattern, a balun should always be used at the feed point.

Due to the proximity to ground at the end of each leg, the feed point impedance of an Inverted Vee is very close to  $50\Omega$ . Inverted Vees thus can be fed with  $50\Omega$  coaxial cable, with or without a 1:1 balun. (The advice regarding the use a feed point balun pertains to the Inverted Vee as well.)

Both Dipoles and Inverted Vees can be fed with  $300\Omega$  or  $450\Omega$  ladder or open wire feeders into a balanced Antenna Tuner. This configuration, known as a "Doublet", will work well as a multiband antenna.

Flat-Top Dipole or Inverted Vee? As is often the case when given a choice, there are trade-offs involved. The Inverted-Vee requires only one tall support, and less horizontal spread than the Flat-Top Dipole. It is also a very close match to  $50\Omega$  coax. On the other hand there is some loss of gain because the pattern is less directional, and the bandwidth is narrower than the the horizontal dipole.

**CONSTRUCTION NOTES:** Half-wave Dipoles and Inverted Vees are very easy to construct, and are great for homebrew projects. You may purchase commercially made end insulators and center insulators with coax connectors built in, but why not make it truly homebrew and make your own hardware? It is quite easy using schedule 40 PVC pipe. Admittedly, if you are going to use a balun at the feed point, purchasing a center insulator with the balun built in is certainly a lot less work!

If you decide to roll your own, be sure all connections are secure, both mechanically and electrically. Be sure to properly solder all joints and to use weatherproofing. Remember to provide some type of strain relief at the center insulator for your "dangling" feedline. Not only does the feedline represent a strong downward tug, but when the wind blows the mechanical stress on your connections increases dramatically. A good strain relief system is to wrap the feed cable once around the center insulator and secure it with "**UV-Resistant**" (usually black) tie-wraps. You will, of course "invent" something much more sophisticated for your design!

Suitable feedline can be  $50\Omega$  coax, such as RG-58, RG-8X, RG-8, RG-213, or  $75\Omega$  types such as RG-11, RG-59, RG-6, or even  $75\Omega$  twin lead. Believe it or not, even zip cord (lamp cord) will perform quite well. Of course you need to "size" your feedline

according to the power you intend to run. Power in excess of 200 watts can develop very high RF voltages. Be sure your feedlines and antenna hardware can handle the power.

In the real world — where you build your antennas — the actual impedance of your wire antennas will depend on several variables. i.e. height above ground, proximity to large, especially metallic, objects, and proximity to other resonant antennas. **Always cut your antenna lengths a bit long**. This will allow you to "fine tune" the antenna by trimming. You will quickly learn that "trimming" is a LOT easier than "adding to"!

When you decide where to "hang" your antenna, remember that the horizontal radiation pattern of a Dipole in free space is a wide "Figure-8", which radiates perpendicular to the axis of the dipole. The vertical radiation pattern depends on the height above ground. As stated above, to be an effective DX antenna, a low-angle signal take-off is required, and that means your dipole must be at least one-half wavelength above ground.

If you choose to build an Inverted Vee, be sure the angle of the sloping legs is not more than 45 degrees (the inside angle at the feed point is not less than 90 degrees). If you increase the slope more than this, the Inverted Vee will begin to act like a vertical monopole with an omnidirectional radiation pattern.

Finally, don't fret about fractional parts of an inch when using the measurements from the calculator above. At HF frequencies, an inch is such a small part of a wavelength that it is a non issue.

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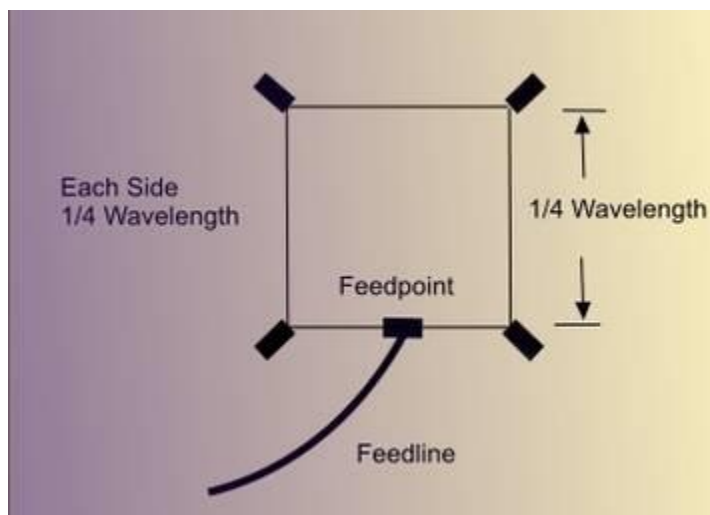
## Full Wave Loops

The basic formula for determining the length of a full-wave wire **Loop** antenna is:

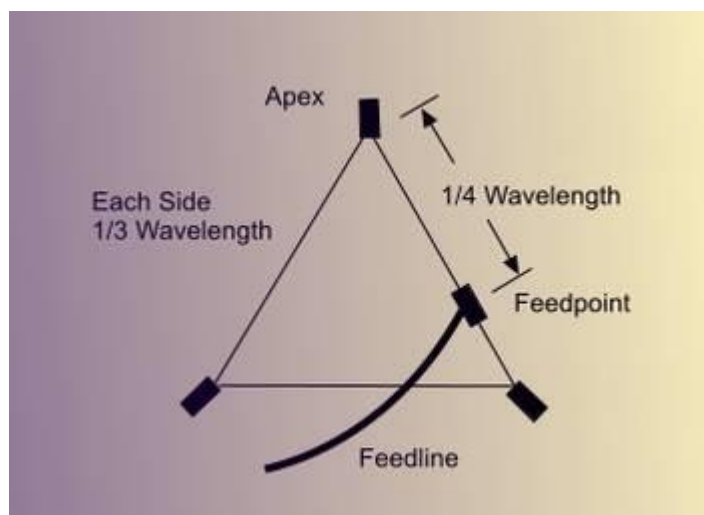
$$1005 \div \text{freq (mHz)} = \text{Length (feet)}.$$

Since closed loops are not subject to "end-effect" the calculated physical lengths with this formula are longer than corresponding dipole dimensions and are close to free space dimensions. Since the loop dimensions are larger than those of a half-wave dipole, the radiation efficiency is also higher.

## Full-wave Quad Loop



## Full-wave Delta Loop



The feed point impedance of a full-wave loop in free space is approximately 100-120  $\Omega$  with a gain over a dipole of 1.35 dB. In the real world, installed at practical amateur heights (physically close to ground), the range of feed point impedance can be from 50-240  $\Omega$  depending on configuration, orientation, and choice of feed point. One of the realities that comes with choosing a full-wave loop is the need for some type of feed point matching system.

If you study the literature you will discover a near endless array of configurations for a full-wave loop. You can choose a square or diamond, equilateral triangle with apex up or down, feed point on the bottom, side, corner... All these "adjustments" affect the feed impedance, gain, polarization, pattern, and of course, the support structure requirements.

For our purposes, we will limit this discussion to two configurations, both optimized for certain HF bands. 1.) the bottom-fed quad loop is a very good choice for the 20-10M bands. It has the highest gain at low take-off angles, and the horizontal polarization is great for these frequencies. 2.) The off-corner fed, equilateral delta is a solid performer on the amateur frequencies below 20M. With its low angle take-off, vertical polarization, and single support requirement, it is a great choice for low band DXers. Study the literature. You may find another configuration more suited to your requirements.

At take-off angles of interest to DXers, the full-wave loop's horizontal radiation pattern in free space is a wide "Figure-8" which radiates perpendicular to the plane of the loop. Interestingly, at very low angles, some radiation from the delta loop is end fire... that is, parallel with the plane of the loop. Of course, to achieve such low angles would require

the entire loop to be mounted at least 1/4 wavelength above ground. That would be quite a challenge at 3.5 and 1.8 MHz!

**CONSTRUCTION NOTES:** Because of their size, full-wave loops present additional challenges to the builder. Basically, all the dipole construction notes above, pertain to loop construction as well. There is no substitute for good engineering practice, and common sense still rules the day. There are however, a few considerations unique to the loop.

Because of the large size of low frequency loops, the length of the feedline represents a significant load on the wire element. This is especially true for high power levels when larger coax is required. You should carefully design the feed point mechanics for strength. One solution which solves two design issues, is to use heavy duty ladder line, and feed the antenna through a balanced antenna tuner. This solves the weight problem as well as the need for a feed point matching system.

If you don't have a sufficiently tall support structure for a full-wave loop, don't despair. There is significant empirical testimony to the efficacy of a low-to-the-ground, sloping delta loop. Modeling will confirm a 1-3 dB gain in directivity in the direction of the slope.

All-in-all, full-wave loops are very good antennas. If you feel like experimenting, or if your low-band antenna farm needs a bit of improvement, by all means try a loop. (I personally know of a real-estate challenged ham that worked 20M DXCC running 100 Watts with a single element quad loop nailed to the side of his house. - ed.) If you always wanted to try 80M, here's your chance. Remember... even a lousy antenna is better than no antenna!

## Snowbird Net

Check out 14.160 USB 8:00 – 9:00 AM daily. From Gene VE3IJD/W4 *There's a few of us here in Florida now and we'd like to hear you on 20, around 8 am if the band opens, see you there, Gene*



## Websites of Interest

Copy/Paste the urls below into your browser

### Ham Radio Tower Grounding with Cadweld

<https://youtu.be/sEDo0qvvi4Q>

### About Duplexers

<http://www.repeater-builder.com/antenna/db/pdfs/db-about-duplexers.pdf>

## Canadian National Parks on the Air

<https://cnpota.ca/>

## Elmira December Newsletter

[http://www.ontars.com/erc\\_news/december\\_2018.pdf](http://www.ontars.com/erc_news/december_2018.pdf)

## dB Calculator

<http://www.sengpielaudio.com/calculator-amplification.htm>

## Inverhuron Ham Radio Club

<https://www.ve3ihr.ca>

## Open Street Map

<https://www.openstreetmap.org/#map=10/44.4233/-80.9849>

# SWAP SHOP

I have too many projects sitting on shelves that I'll never get around to building. Offering these to GBARC members first.

### For Sale:

One BITX40 40m 10W SSB transceiver, semi kit (factory assembled boards, needs mounting in enclosure).

Ashar Farhan VU2ESE design. Bought from HFSIGNALS, read about it at

<http://www.hfsignals.com/index.php/bitx40/>

Still in carton. Original cost \$59 USD. Will sell for \$30 CDN + shipping, or I can deliver to a GBARC meeting

One  $\mu$ BITX 80-10m 10W SSB/CW transceiver, semi kit (factory assembled boards, needs mounting in enclosure).

Ashar Farhan VU2ESE design. Bought from HFSIGNALS, read about it at

<http://www.hfsignals.com/index.php/ubitx/>

Still in carton. Paid \$129 USD.

\*\*\*plus\*\*\*

One custom metal case for  $\mu$ BITX, Siemens gray, unused. Includes small parts e.g. connectors, knobs, speaker, feet, screws etc.

Bought from AmateurRadioKits.in (Sunil Lakhani VU3SUA) See it at

<https://amateurradiokits.in/product/universal-case-siemens-grey-for-ubitx/>

Paid \$43 USD + \$22 USD shipping.

Both for sale as a package only. Total cost was \$194 USD. Will sell for \$100 CDN + shipping, or I can deliver to a GBARC meeting

73 Dave, VE3WI [candu.nuke@gmail.com](mailto:candu.nuke@gmail.com)

# Letters to the Editor



Thought this was an interesting mod to the [QCX cw rig](#) to allow it to do FT8 by changing the firmware in it [https://github.com/olgierd/qcx\\_f](https://github.com/olgierd/qcx_f) some people are very inventive.

Might be a reason to pick up one of the QCX single band cw kits at \$50 US, but then their upcoming QSX SSB single band version at approx \$75 US which is to have a 24 bit usb sound adapter feature which you could use with the FT8 software is looking better, and the QSX gives you 10 watts instead of the 3 to 5 watts people are getting with the QCX build. The age old problem of, do I wait for a unreleased design and the normal delays to release date, compared to something you can get now.

While trying to figure out the QCX or QSX answer, I ordered one of these to play around with

<https://www.tinusaur.com/product/tinusaur-bundle-starter-3-edu>

at \$12 US plus \$2 US shipping I could not pass it up, have a project that the ATtiny85 might be useful in. Time to figure out a new tool chain

<https://tinusaur.org/projects/blocktinu/> or go with an old one, the Arduino IDE.

73 Carl  
VE3APY

## The Last Word

A few words of appreciation to those that contribute to this newsletter by submitting news stories or interesting web links or ideas. If you have something then send it to [contact@gbarc.ca](mailto:contact@gbarc.ca) , any format, any size, anytime, but if you want it to appear in the current months newsletter, then send it by the 3<sup>rd</sup>

Tuesday of the month.



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**Membership** for details regarding membership in the club go to:

<https://www.gbarc.ca/gbarcmembers.php>

*The next newsletter will be in February.*