

The Windom Handbook

(C) 1959-2013

By G. E. "Buck" Rogers Sr; (69+ years as K4ABT)

Home of the [original WINDOM](#) The favorite Multi-Band Antenna for all HF use. **The number "1" HAM station, field-day, and contesting, wire type antenna in the world today.** The [BUXCOMM model 802134 Windom](#) is an antenna that enables operation, 80 through 6 meters, without an antenna tuner. As a matter of interest, we use the [Windom BUXCOMM model 802134](#) up to 2 meters (146 MHz).

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VHF was fun, but most of our enjoyment was on HF; September 1949, I was exhausted from climbing poles and trees to move, remove, add, or change my single-band HF antenna's.

The secret to it all, was *to remember and change the plug-in "tank-coil" to match the antenna band.* My ole 807 rig was home-brew, that I had built on an old Atwater-Kent radio chassis. I had wound the tank-coils on phenolic, plug-in coil forms (No, it was NOT a pi-section, tank-circuit, it was a real, sure enough, *link coupled output*, no less).

I won't forget the day and all the jumping up and down by some SWLs who were listening on another band. I had my 80 meter (3735 kc, now called kHz) crystal plugged into my homebrew rig, with the antenna connected and away I went to make some serious early morning CW contacts on 80 meters.

CAVEATE: *The night before, I had been operating 40 meters.* This morning, I wanted to make some 80 meter contacts.... BUT, and However, *I forgot to change the "plug-in" tank coil from the 40 meter plug-in, to the 80 meter coil.*

By forgetting to change the 40 meter plug-in coil to the 80 meter coil, I had doubled in the final.... and the 3735 rock, had put my RF signal output on 7470 kHz.

YES! *you bet I got a letter...* matter-of-fact, I received a "Show-Cause" notice from the FCC monitoring station at Powder Springs, Georgia, and furthermore, I received a letter from an OO in Delaware. Never again, did I forget to switch the plug-in tank coil when I changed bands... moreover, I made sure the crystal I was using was for the band I was operating on. To help me remember, I made an entry into my log book of each band change, and a check-mark to indicate that I had indeed changed the tank-coil to correspond with the crystal frequency. Yes Leroy, *there really is more than one reason or purpose for using a log book.*

In later years I made enough money picking cotton to buy a WRL Globe Scout kit. It was band-switching from 160 to 10 meters, in six (6) steps; 160, 80, 40, 20, 15, 10 meters. No more plugging and switching tank coils to change bands.

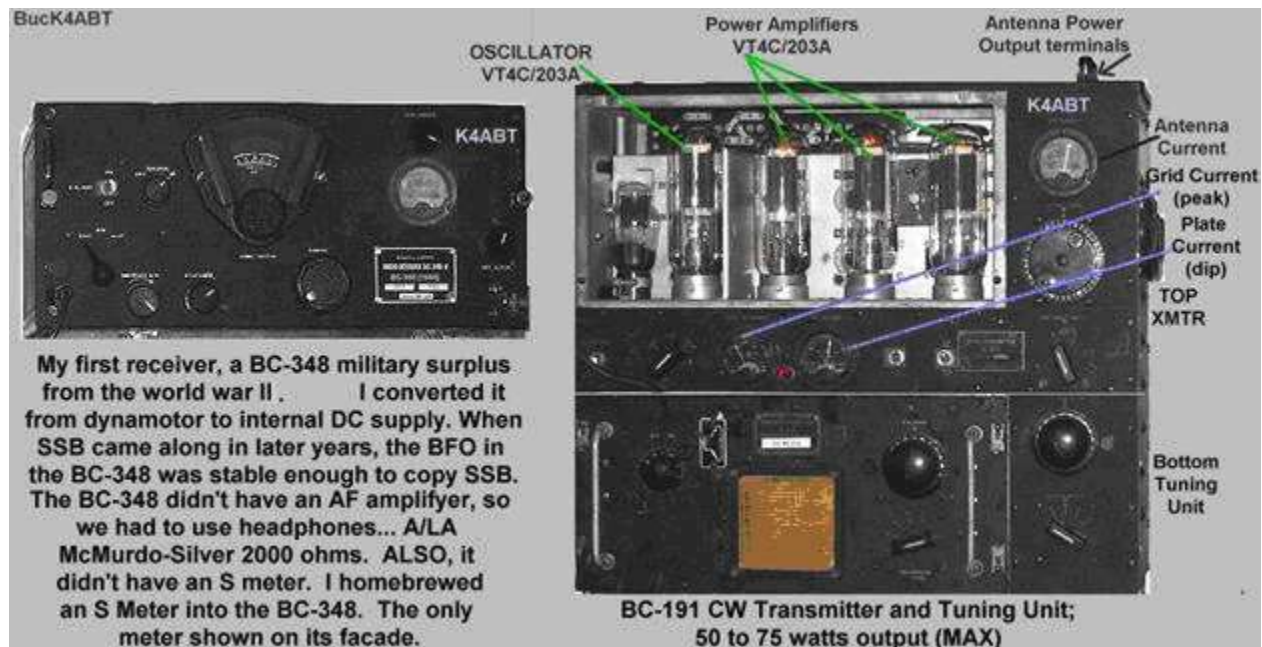


Globe Scout by World Radio Laboratories "WRL" Leo Meyerson, W0FGQ founder, became SK at age 100, 2011

I purchased it in the early 1950's, in kit form. The Globe Scout was 89.95 as a kit, and 100 dollars wire and tested. The kit was equipped with a 6146 final tube. The power input was about 60 to 70 watts, and the output power was between 35 and 45 watts. I made some modifications to it using an 814 final, and add more modulation by changing the modulator section to a more robust "Heising" modulation, modulating both the final plate and screen grid.

Antenna tuners were few and far between. This being the case, it's a good thing the more up-to-date transmitter's used Pi-Section output tuning. Yes, I wrote, "transmitter's;" Transceivers were unheard of in those days..... In those younger years of my HAM radio hobby, I had used single band dipoles and doublets for almost every HF Amateur band. I had tried long-wires, doublets, dipoles, and Zepps, but again, operation was restricted or limited to single band operation, maybe two bands at most; That is, until I got a world war II surplus rig, from Buckners Army Surplus depot in Anniston, Alabama. The BC-348 receiver was great, but it only covered 2 Mc (now called MHz). through 18 Mc (A/LA MHz). About the same coverage with the MOPA BC-191 transmitter, (2 Mc to 18 Mc) (al,et MegaCycle(s)).

In those days, we could buy surplus gear "by the pound" because most of it was dynamotor powered, or operated from 400 cycle (er..uh, Hertz) mains. I removed the dynamotor from the BC-348, and built a 115 V powered supply, and with a mercury vapor, "80 rectifier tube." And the BC-191 transmitter, I built a pole-pig power supply, using a couple of 866 mercury vapor rectifiers. This was my "big-gun" CW transmitter.



When operating CW with this beast (BC-191) the sound on the air was almost like a bell ringing. At 35 to 45 words per minute, it really sounded like an old fashioned telephone bell ringing.

Enter, THE WINDOM: Call it what you like, OCF, OCFD, or the name for which it is named... its namesake is Windom. *If it walks like a duck, quacks like a duck . . . It's a DUCK!* The Windom was, is, and will be the dominant wire antenna in the world for many years to come. The Windom was first designed in 1923. It was fed by a single wire (coaxial cable was not around in those days), The designer William Litell Everitt (his photo is shown elsewhere on this page), brought it to the world in 1923, and later wrote a brief about it in 1926 and again in QST 1929.

The original Windom offset single-wire-fed antenna goes back to the early days of HAM radio. Although it was fed off-set, the early Ham's called it a "T" match.

The problem with the early Windom was the single vertical wire feeder was *first*, not the best feed-point impedance, and *second*, the trick with the 1929 version was harmonic operation and establishing a reasonable impedance at the feedpoint. The vertical wire was in fact a radiator. It radiates, regardless of length, because there's RF flowing on it. Without a shield around the vertical wire, the skin-effect of the open wire feeder was in fact *a radiator*.

In the early days of Ham radio, Hams used open-wire parallel feeders separated by a 2 to 4 inch insulator or cured bamboo spacer between the parallel wires. This type feeder was referred to as "*ladder-line*."

In those days, coaxial cable was used mostly for audio feeds to prevent hum in early AM radio stations, especially where the studios were in the *near-field* of the transmitting apparatus and antenna.

Coaxial cable, or **coax** is a type of cable that has an inner conductor surrounded by a tubular insulating layer, surrounded by a tubular conducting shield. Many coaxial cables also have an insulating outer sheath or jacket. The term coaxial comes from the inner

conductor and the outer shield sharing a geometric axis. Coaxial cable was invented by English engineer Oliver Heaviside, who patented the design in 1880. Coaxial cable differs from other shielded cable used for carrying lower-frequency audio signals. In the mid 1930's, a more robust version of coax was developed that would work all the way into the high-frequencies, as time went on, coax was further improved to the point it could be used into the VHF, and UHF spectrum.

As coaxial cable became available for the High-Frequencies, and *Ham Operator Affordable*, we learned to use coax to replace the vertical open-wire, feed-line (radiator) on the original Windom. **As I mentioned, it's still a Windom.**

Since we had already found the "sweet-spot" an off-set feed point about 14% away from the center of the Windom, the feed-point of the Windom, it was easy enough to break the feed-point and insert an insulator (figure 1). Here we used coax cable to feed the Windom, thereby removing the random length vertical radiating wire. Since the impedance of the coax used was 50 ohms (MOL), a matching device called a BALUN was employed to make the transition from the 50 ohm unbalanced coax to balanced 233 ohm feed-point of the Windom. **Note the junction of L1 and L2 in Figure One (1) below.**

It is still a Windom, with a few improvements that make the Windom antenna more efficient.

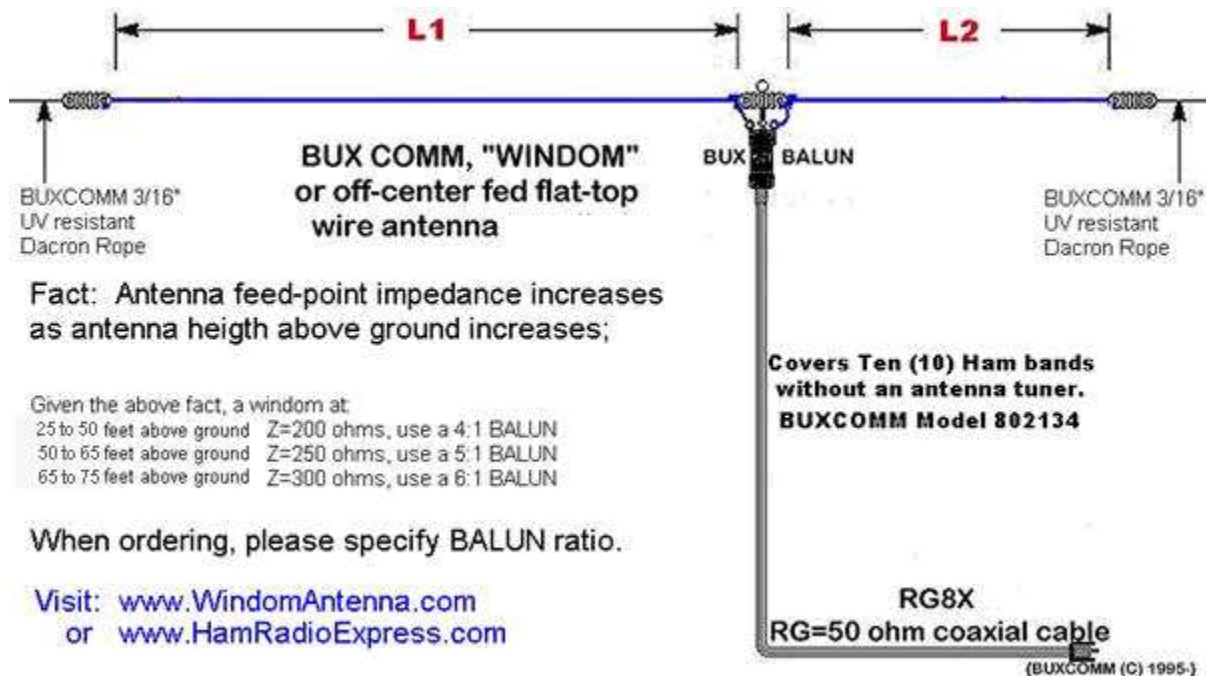


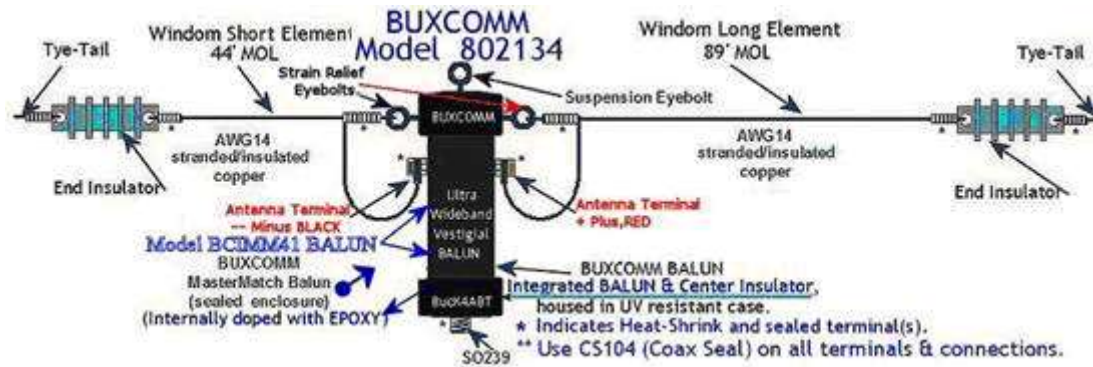
Figure 1

A detailed article by Loren G Windom, W8GZ written in the September, 1929 issue of QST Magazine. The Windom gained its fame then and many times through the following years. I had heard of the "Windom" and read a few articles about the Windom, but most of my thoughts were ... ho-hum.. just another dipole fed a bit off-center.

Then one fall evening in 1949, at a meeting of the GARC in the old "Sea Scouts" club house near the Coosa River in Gadsden, Alabama; I listened as some of my "Elmer's" discussed the Windom all-band HF antenna. It was when Jack Kennamer, (W4YPC) (SK), mentioned

using one ([Windom](#)) antenna on all HF bands.... without an antenna tuner...! my ears went directional !

That last phrase caught my undivided attention. "all HF bands, ..etc" What ! A multi-band HF antenna? Surely I had been blessed.



To think that I could hang a Windom, and no longer have to climb the poles and trees to hang another (single band) HF antenna was great news to me. To be able to use it without an antenna tuner was icing-on-the-cake. For a kid without extra funds, an antenna tuner was a luxury that I could not afford. Even my first transmitter was a single 807 rig I homebrewed on an old Atwater-Kent radio chassis, my grand-father had given me.

In those days (1945-1949), a BALUN was unheard of. My Elmer's described, a means of connecting the coax to the coax fed Windom antenna using a lossy, nine (9) turn coil of the coax feed-line at the feed point. This coil of feedline coax formed a "de-coupling" loop. The de-coupling loop provided a crude BALUN of sorts that would prevent some RF from being re-radiated off the coax shield. In later years I learned about something called a "BALUN."

The transition from single wire to Coaxial Feeding:

The Windom has now become possibly the most popular multi-band HF wire antenna ever. In the early days of the Windom, it was fed with a single wire, connected at a "sweet-spot" approximately 14 % off center.

Several years later and after the advent of the BALUN, the Windom received a slight modification to enable the use of coaxial cable instead of the single wire. By using an antenna analyzer and a Boonton antenna bridge, the "sweet-spot" became the feed point of the Windom. The Boonton antenna bridge and the antenna analyzer resolved a slightly different sweet-spot that displayed an impedance measuring between 200 and 250 ohms(Z). With the introduction of a BALUN at the feed-point, using coaxial cable as RF feedline to the Windom/OCF became simplicity in itself.

My Introduction to BALUNs:

I was first introduced to BALUNs when I read papers written in 1953 by Alan Newman Jr, for his post graduate thesis while he was attending the Naval Academy at Monterey, California. For the moment, my BALUN reference had been by Gaunella and some papers from other sources.

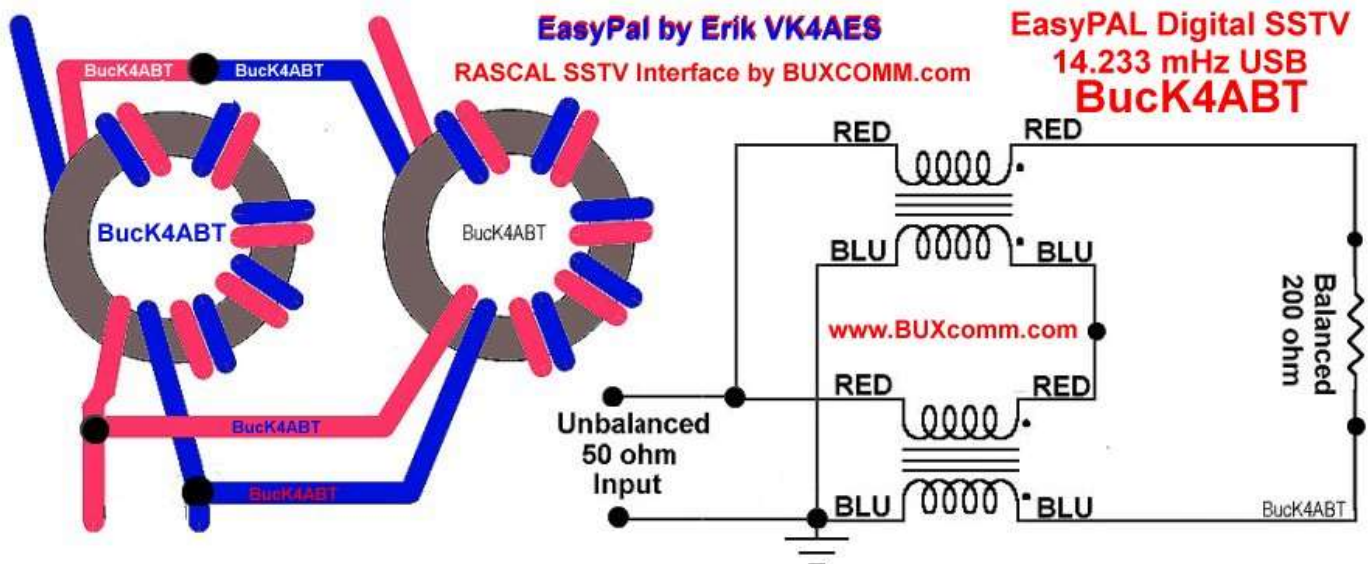
After a stint in the U S Marine Corps, I used my benefits to acquire more knowledge in RF and Electronics design. In in the midst of these learning curves BALUNs really caught my attention. As time went on, BALUN's began to come into use almost everywhere. Some of

my early BALUN learning happened while I was attending Lee **DeForest Institute** (now DeVry University) at 4141 Belmont Avenue in Chicago, Illinois.

In my studies I learned about every facet of Electronic and RF communications that was available. BALUN's had come into their own as they were finding their place in standard broadcast applications.

It was during the period while attending DeForest Institute that I took a part-time employment with a company that manufactured all type of transformers. The company was **Chicago Standard**, now called **Stancor**. At Stancor, we also manufactured a form of BALUN for the standard broadcast industry that later would simplify or reduce the size of the tower-base tuning unit (or dog house). This gave me a better understanding as to the *how, and why*, these devices were necessary to provide maximum transfer of RF energy from the transmitter and tuning unit into the antenna. Thus the term; Transmission Line Transformer (TLT) found its place in our RF applications, both commercial and hobby.

One of our most popular BALUN's employed in Amateur Radio applications is the Guanella 4 to 1 current type BALUN. The 4 to 1 BALUN is the BALUN most used with the *true* Windom Antenna, simply because it more closely matches the 233 (mol) ohm feed point of a Windom antenna, when installed between 25 and 50 feet above ground.



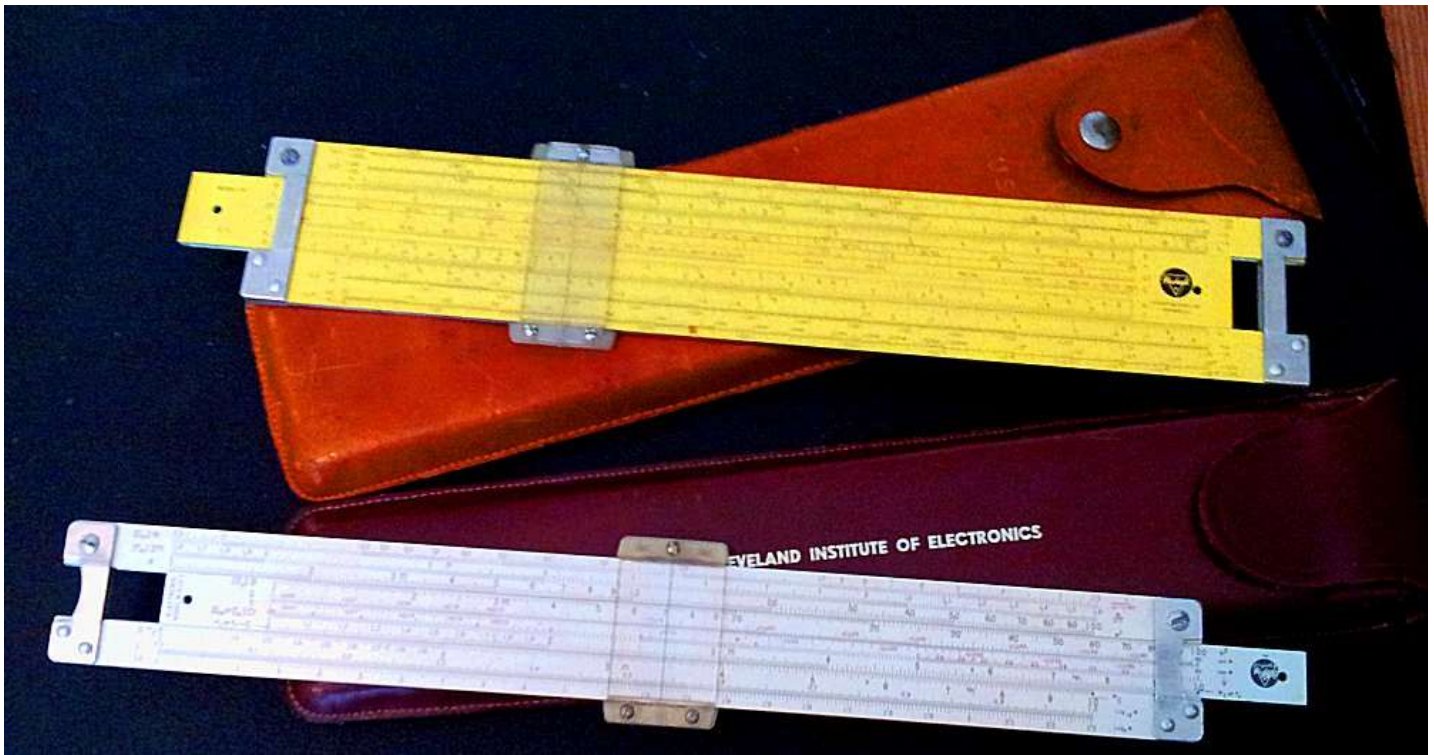
On the left is the pictorial of a Guanella 4 to 1 current BALUN, the drawing on the right is a schematic of the same BALUN.

When we read some of the ARRL handbook and various Antenna books, the ARRL doesn't describe a Guanella BALUN. They actually refer to it as a 4:1 balanced impedance matching transformer. In a manner of speaking, this is a small part of what it does. Some HAMs change it into a BALUN *of sorts* by connecting one side of the balanced output to ground. When it is connected in this manner, it becomes a *voltage* BALUN because it has no way to limit common mode currents. BUXCOMM manufactures only current BALUNs, voltage BALUNs are built by special order only.

Technology Evolution:

Let's stop a moment to interject a bit of history, better yet, some of the evolution in technology from those days to the present. Our calculators in 1953 and 1954 were

somewhat different from the LED and micro-processor devices of today. To give you some idea of the mechanical calculators we used in those days, look over the two items shown here. They were called Slide Rules, or in our slang terms of that day and age... (Slip-Sticks). They may be a bit out of date, but these tools of the Electronic Engineering profession were very accurate.



The SlideRule at top of photo is my U S Marine Corp (U S Navy) issue, the lower "Slip-Stick" is the slide-rule issued to me as one of my Advanced Engineering Tools by Cleveland Institute of Electronics. Note: Both slip-sticks are "Pickett," the US military version is made of hardened, precision laminated bamboo, while the CIE version is made of Hard-Drawn magnesium. Yes, there were some K & E slip-sticks, but I never saw one until I went to Cal Tech.

Many of today's Hams moved away from imparting credit to the original designers of the Windom. They are trying to call it an Off-Center fed dipole, or OCF. In either application, *the Windom is still a Windom, by whatever name or title we assign to it.* As I stated before; Call it what you like, OCF, OCFD, or the name for which it is named... its namesake is Windom. *If it walks like a duck, quacks like a duck . . . It's a DUCK!* Throughout this and many other antenna related documents this is true. To avoid any further confusion, we'll use Windom to reference both titles and labels. (Windom and/or OCF).

Today, many Ham's are using this multi-band, HF Windom/OCF antenna with satisfying results. This is one of the reasons that Windom/OCF antennas are being deployed worldwide!

Not only is this antenna a great HF antenna, it also exhibits gain greater than dipoles that are installed for single band operation. Another feature of the Windom/OCF antenna is the greater bandwidth on each band than that of a single-band wire-type antenna. Of course the best feature of all is that no antenna tuner is necessary.

Because of the harmonic relationships of second, third, fourth, etc, harmonics, the Windom excels. The only reason an antenna tuner might be used is when an unrelated harmonic band or frequency is employed. As built, the Windom can be made to operate 160, 80/75, 40, 20, 10, 6, and even 2 meters. Fifteen (15) meters is missing from the list because it is not a harmonic multiple of any of the aforesaid bands. To remedy this issue with 15 meters or any other non-harmonic related band, the use of an antenna tuner is the solution.

In 1958 I read more papers by Gillette Guanella which referenced a "current" type BALUN. then I came across Thomas O'Meara's papers, "Analysis and Synthesis with the Complete Equivalent Circuit for Wide-Band Transformer." This is when I made some design changes to the original Windom antenna. In 1968, I met Lew McCoy W1ICP (SK). Lew filled in a lot of blanks I needed answers to:

We talked about the Windom antenna and how we were building them. Lew had some ideas that I felt had enough merit to give them a try...

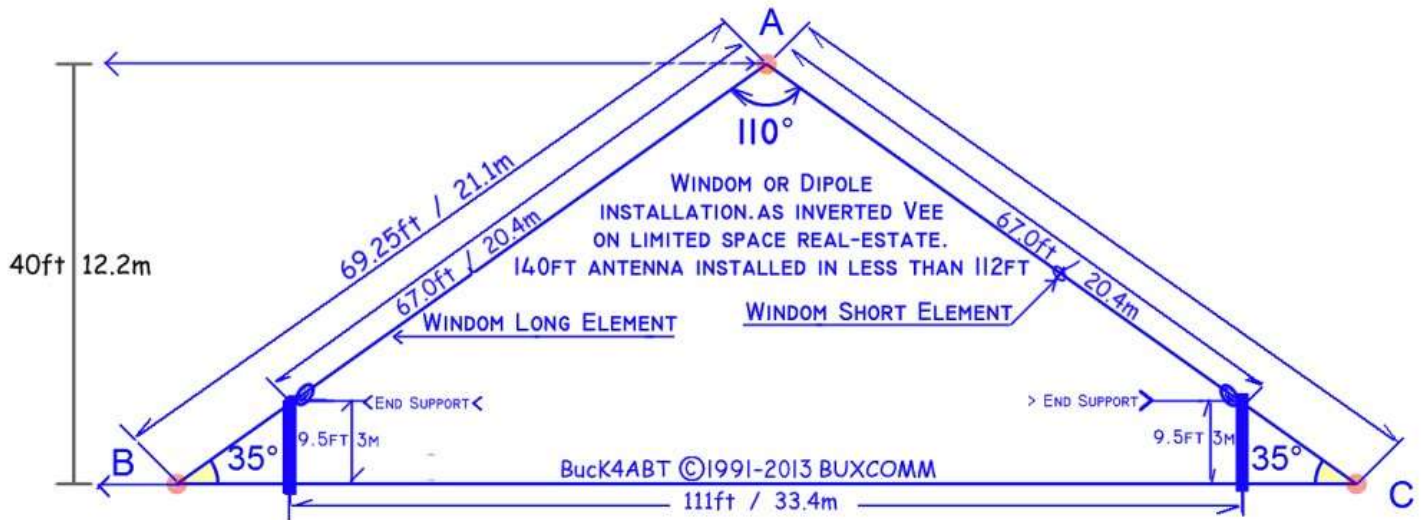
I made the changes and... !! walla, almost like magic, Lew's current type BALUN design gave us the bandwidth that we needed to turn the WINDOM into an eight (8) band, *plus* HF antenna (even adding some VHF bands).

An old theory; A new design: THE WINDOM ANTENNA

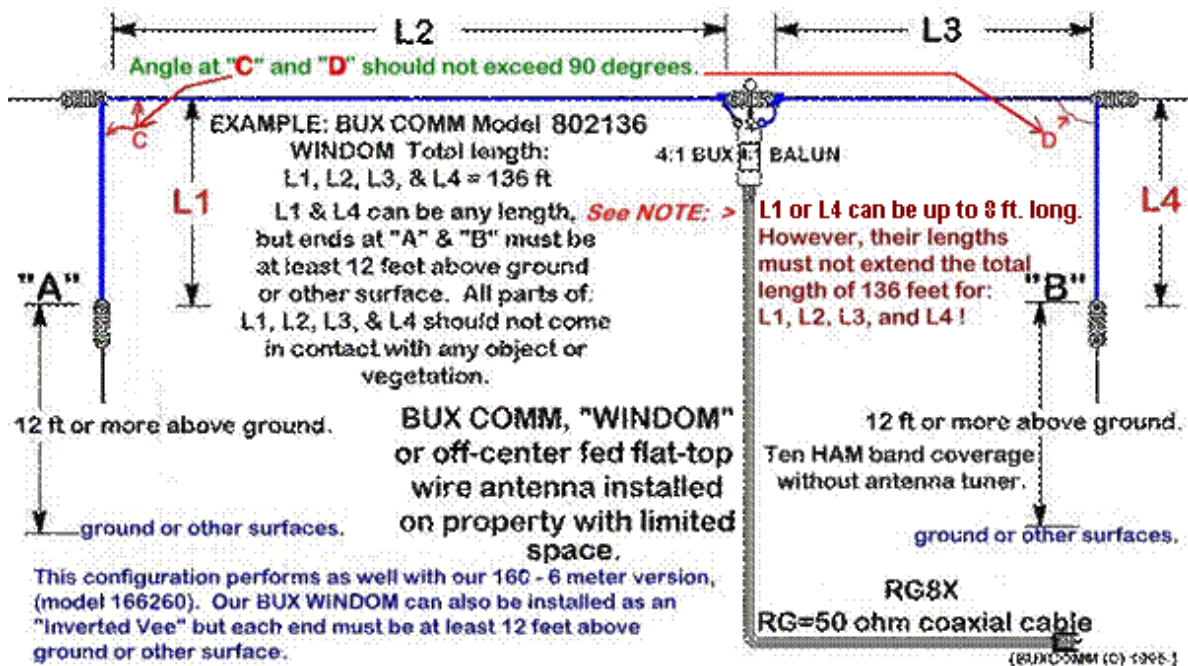
Before we get into the core of our topic, I have to clear some misgivings and challenges to my arithmetic from a few new HAMs who want to add notches to their six-shooters... I first wrote this article in February 1958, and for more than 50 years MOL "more or less", I've presented the reader of this article with the correct formulae to determine the Windom dimensions.

In recent years a few new HAMs who cannot see the forest for the trees; By that, I mean, they look at the formula that I use, but they don't look at the frequency I use to determine the final answer (result). Some of us like to operate in the lower, or CW portions of the HAM bands, and in the case of 20 meters, PSK31 near 14070.15. Others want their antenna(s) to be more resonant in the phone (voice) portion of each band. I'll clarify with some added details.

The BUXCOMM Windom antenna is an Omni-directional, off-center-fed, wire type antenna, that when installed at 35 to 65 feet above ground will exhibit a feed point Impedance just above 200 ohms (MOL, slightly more). For most Windom users, we install our BUXCOMM 802134 Windom in the Horizontal or "flat-top" plane as we would with any other Multi-band antenna. *Where real-estate is limited, the Windom may be installed as an inverted "Vee", or as a sloping antenna (mutt and jeff) style; that is, long (tall) end higher than the (short) end.*



The Windom can be installed as an Inverted Vee, however, do not allow either of the two elements to exceed an angle of 110 degrees, against one another ... in either plane, E or H. There is one exception... and that is; when it becomes necessary to reduce the ends lengths, due to lack of real-estate (property), a 90 degree "drop-end" is allowed, as long as the drop-end length does not exceed 8 feet, or 2.7 meters.



The Windom can be installed as a Droop-End (see above drawing) or as a sloper, but in no case, should the angle be greater than 90 degrees against itself or the other element. **To use an angle that folds against the pattern of the opposite end, or the feed line of the Windom, could change the impedance of the feed-point, change the multi-band features, and most important, destroy the radiation pattern characteristics of the antenna.**

Although the elements might be insulated, the two elements of the Windom elements should never be closer than 4 feet of any limbs, metal or vegetation. PVC insulation does not attenuate the RF signal radiating from the element wire(s). We've found a minuscule

(tiny) amount of change in the radiating characteristic of PVC covered wire is to the wire diameter. We compensate for that change in size when we build the Windom.

For the purists who assert that a Windom or OCF antenna should be fed with a 6 to 1 (300 to 50 ohm) BALUN may learn this is nonsense. The only time we use a 300 to 50 ohm (6 to 1) BALUN is when the feed point of our Windom is 60 (or more) feet above ground. The idea for a 50 to 300 ohm (1:6) BALUN being the BALUN of choice for a Windom came about during a period when the Windom was fed with 300 ohm "ladder-line." In those days 300 ohm "ladder-line" was in short supply. If a Windom builder or user wanted to use this feed method, they had to construct their own 300 ohm ladder-line.

Since the gain/loss difference between ladder-line and coax was minimal, this notion soon gave way to the more popular (available) 52 ohm coaxial cable. We've made several measurements with the 80 through 6 meter Windom using various impedance analyzers and bridges. We found the feed point impedance of a Windom installed at a height of 35 to 55 feet will exhibit a feed point impedance of 233 ohms, +/- 15 ohms (MOL). The slight variance in this measurement depends on the actual height of the wire elements above ground. Our impedance measurements were made while using the 35 to 55 foot height above ground, window.

When using the Windom within this 35 to 55 foot window, we recommend using a 4:1 (200 to 50 ohm) BALUN. The Windom is a half-wavelength antenna, normally cut for the lowest frequency band in which it is to be used. The lead-in is connected about fourteen (14%) percent from the center of the antenna to provide a better impedance match. For 80 through 10 meters, and if you have sufficient space, make the Windom about 133.7 feet, long. This should provide good performance on the band of frequencies where you plan to operate most. For maximum performance, the Windom may be cut to a particular HAM band, using the following formula:

Example: $L = 468 / F$, We will use 3.5 MHz (80 meters) as the lowest frequency (band) of operation, thus: 468 divided by 3.5 MHz (F) = 133.7 feet.

Where L is the required length of the antenna in feet, and F is the known frequency in MHz. As example, divide 468 by 3.5 MHz (a frequency for the 80 meter band). The result is 133.7 feet (MOL), which is the overall horizontal length of the Windom.

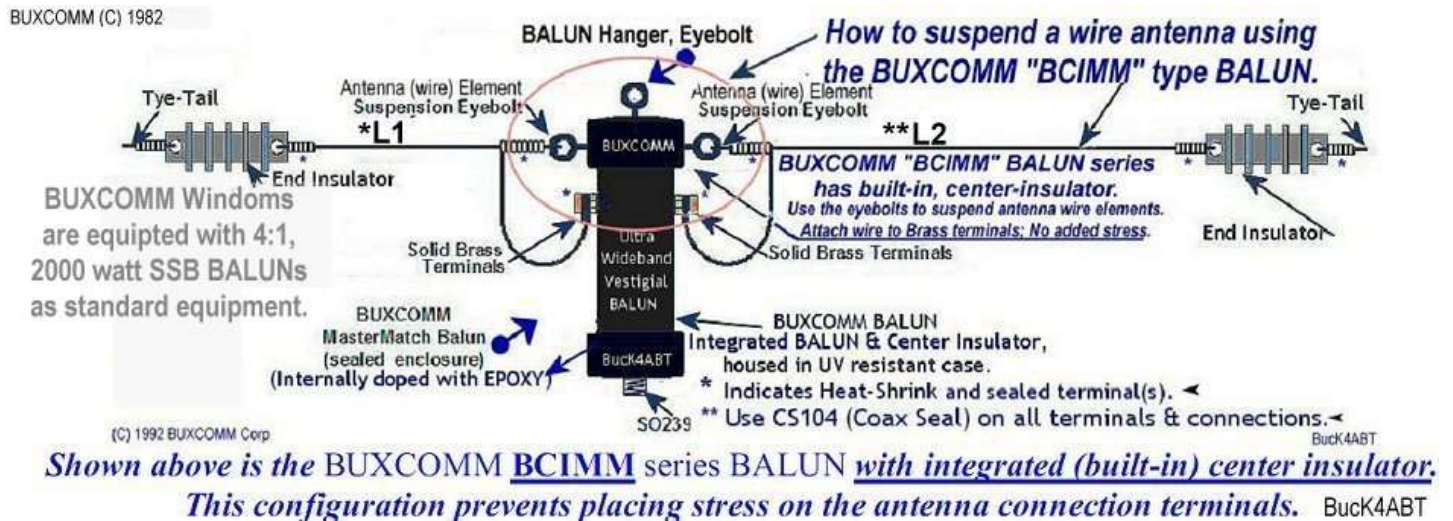
I have found that using .67 and .33, we are able to make the Windom behave with improved bandwidth, or extended band-coverage. We've also found that our Windom will perform well on some of the WARC bands. There is a caveat, if we use a broad-band BALUN with our Windom, we may find that our Windom will also cover six and two meters as well.

Over the years, I've also found that 85% of all BALUNS are not symmetrical; That is, the terminals of a current BALUN do not exhibit the same RF component. For this reason, we designate the hotter post of our BALUNS and identify them by a plus + or, minus - to enable the user to attach the hot (+) post to the longer element of the Windom. This is not a pre-requisite, but it can make a slight difference when operating without an antenna tuner.

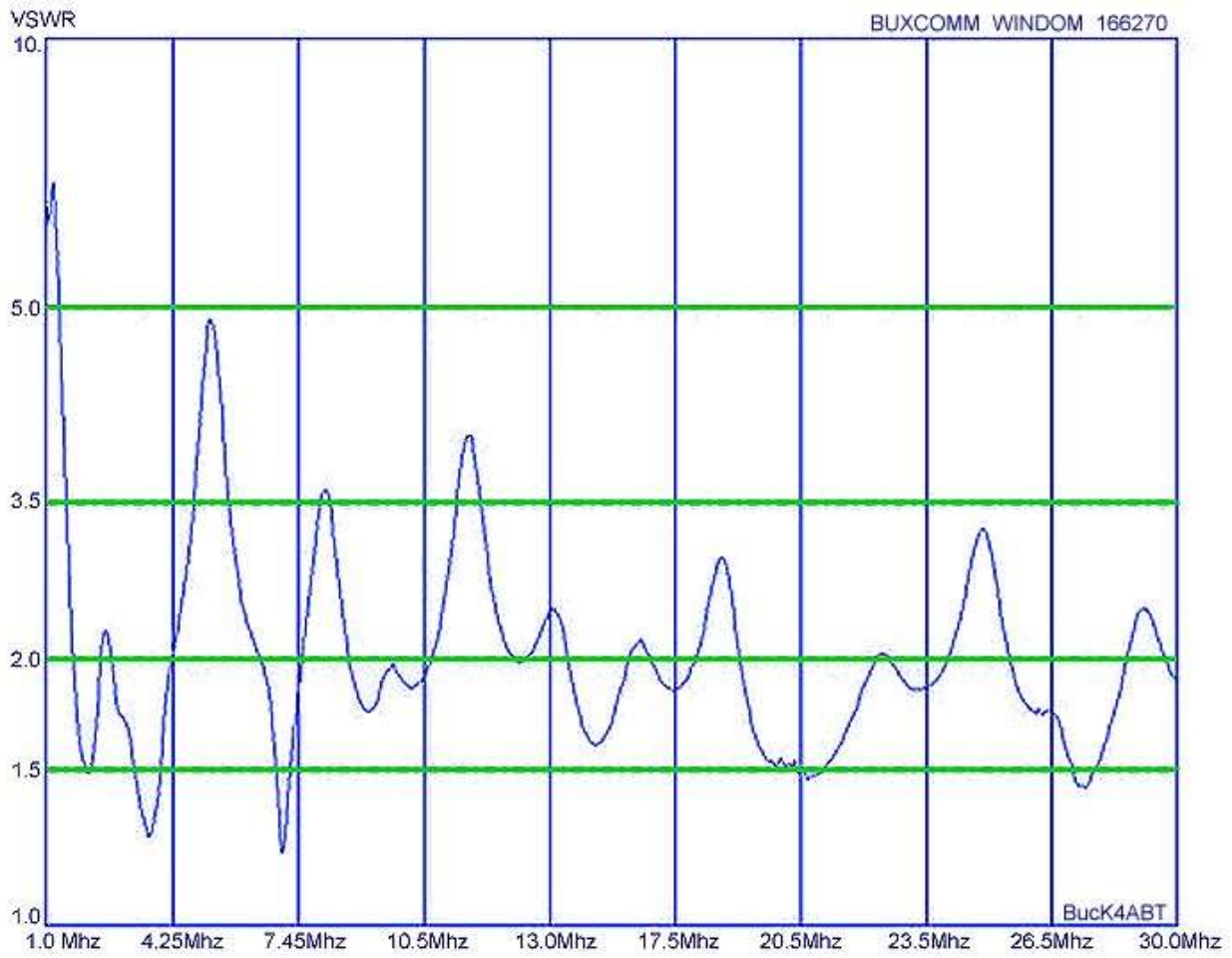
Let's continue with our above calculations; To find the length of the long side (L2) we multiply 133.7 by .67. Our product is: 89.6 feet. Following the same calculations for the short side, (L1), we multiply 133.7 by .33, our product is: 44.2 feet. To check our arithmetic, we add 89.6 feet to 44.2 feet, and we find our length confirms our formulae, 133.8 feet total radiating length of our 80 thru 6 meter Windom. To preserve the "end effect" we round our length off to the nearest foot, or to 134 feet (*this length does not include the end insulator and tye-tails*).

When mounted horizontal to the ground, at an elevation of 40 to 60 feet, the Windom assumes a feed-point impedance near 223 ohms. Since we plan to use a 50 ohm coax cable as our feed-line, then we should use a 1 to 4 (50 ohm to 200 ohm BALUN, (BUXCOMM cat# B2K41 or B2KC41, *the "C" indicates a built-in center insulator*) . The B15K41 or B15KC41 BALUN(s) may also be used.

Our next step is to determine the length(s) of each side (wire element). The *short element* we will refer to as "**L1**," and the *long element* as "**L2**." Refer to "**figure L1L2**" below: The element lengths are simply a percentage of the total length to determine the offset of the feed point. Rather than do the juggling act for the 14% offset of the feed point added to one side or subtracted from the other, we've found that using 0.67 to calculate the long element, and 0.33 to find the length of the short element, puts us near the best feed-point offset.



Figure, L1-L2



BUXCOMM model 166270 Windom Typical VSWR vs Frequency. The above plot displays the frequency curves from 1 to 30 mHz. Having shown this graph of the HF portion covered by the BUXCOMM Windom, the photo below provides evidence of the BUXCOMM Windom's performance at six (6) meters and further into the VHF region.



The Windom in the real world:

In most of my research, the Windom antenna is slightly directional towards the longer element. In my typical, on-air operating, I have not been able to distinguish any directivity in the Windom's we use. In effect the Windom has greater gain over a single band dipole. The most important features are that it is a multi-band antenna which exhibits a marked gain/bandwidth factor across so many HF frequencies.

Depending on where the Windom antenna is erected, its personality can be a tad agile. In short, you can't take an illustration out of an antenna handbook and expect the same results in two different geographic locations. The soil at your QTH may be different to the soil resistance at my QTH. In either location, the feed-point impedance will remain close to the same resistance when the Windom is installed between 30 and 55 feet above ground.

A Windom that is resonant will exhibit a feed-point impedance of between 200 and 250 Ohms. This 200 to 250 ohm feed-point is transformed to 48 to 53 ohms by a 4:1 BALUN. This transformation matches the 50 ohm coaxial cable/feedline from the transmitter.

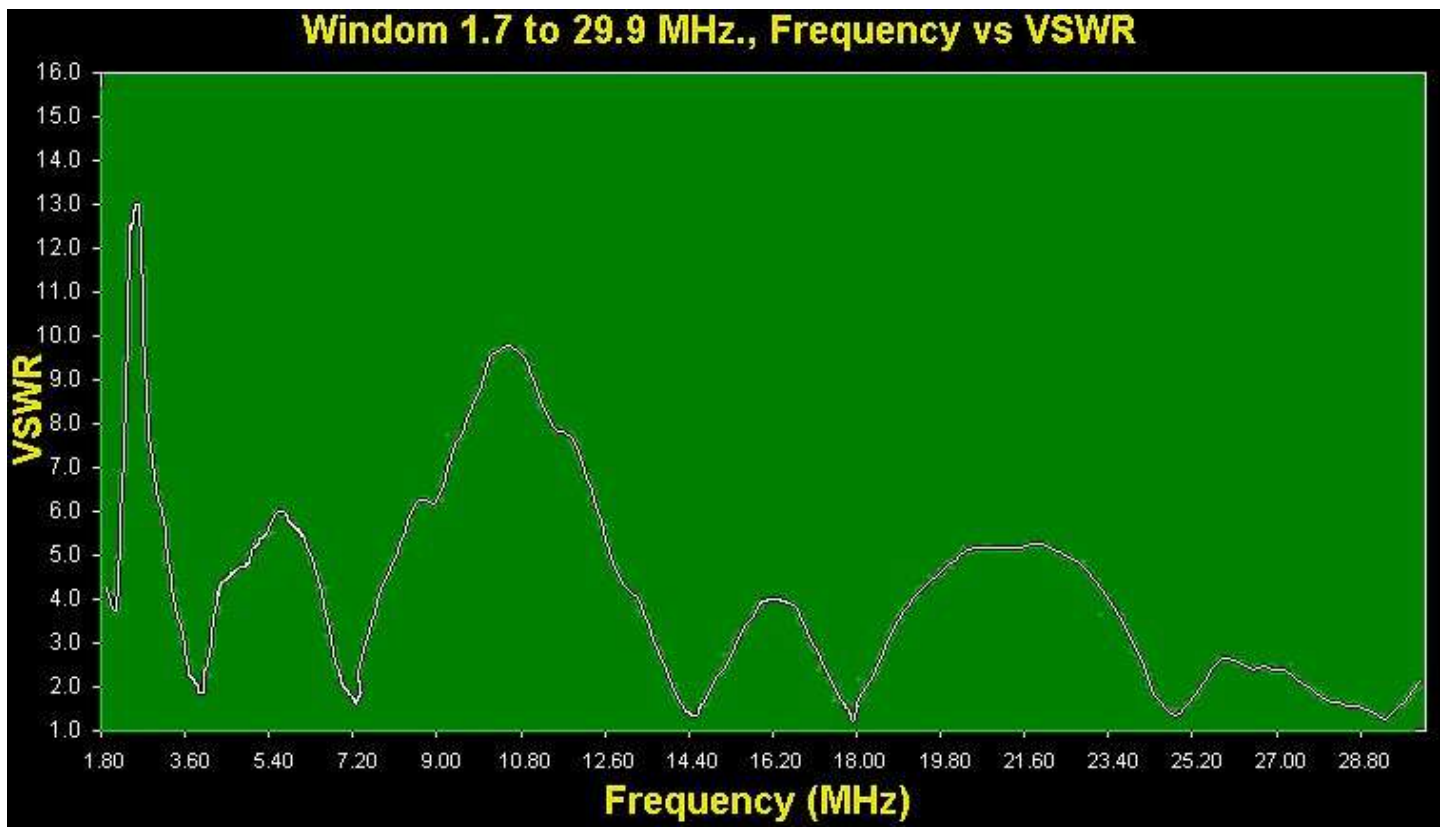
The Windom or off-center fed dipole has roughly the same input impedance across the HF frequencies, and 6 meters. The impedance at 2 meters is less, however, it is not enough to circumvent the Windom performing with pleasing results at 146 mHz. If cut, tuned and correctly installed, you can easily get ten to twelve bands of HF and VHF operation from a BUXCOMM (802134) Windom antenna, *and without an antenna tuner.*

1.8 MHz	3.5 MHz	7.0 MHz	10 MHz	14 MHz	18 MHz	21 MHz	24 MHz	28 MHz	54 MHz
160 Mtrs	80/75 Mtrs	40 Mtrs	30 Mtrs	20 Mtrs	17 Mtrs	15 Mtrs	12 Mtrs	10 Mtrs	6 Mtrs
1.2	1.6	1.1	1.1	1.8	1.3	2.6	1.7	1.2	1.7

BUXCOMM Windom model 166265 Typical VSWR readings made mid-band of the ten bands shown. Windom was erected with BALUN at 40 ft above ground. In the clear, away from metal or vegetation.

The VSWR readings shown above may vary slightly depending on the; soil density, composition, moisture content, and proximity to ground.

The following graph is a plot of an HF Windom, 1.7 to 30 MHz VSWR vs Frequency display. This graph illustrates a more ideal performance curve that enables us to view the "hills and valleys" across the Windom's bandwidth at HF.

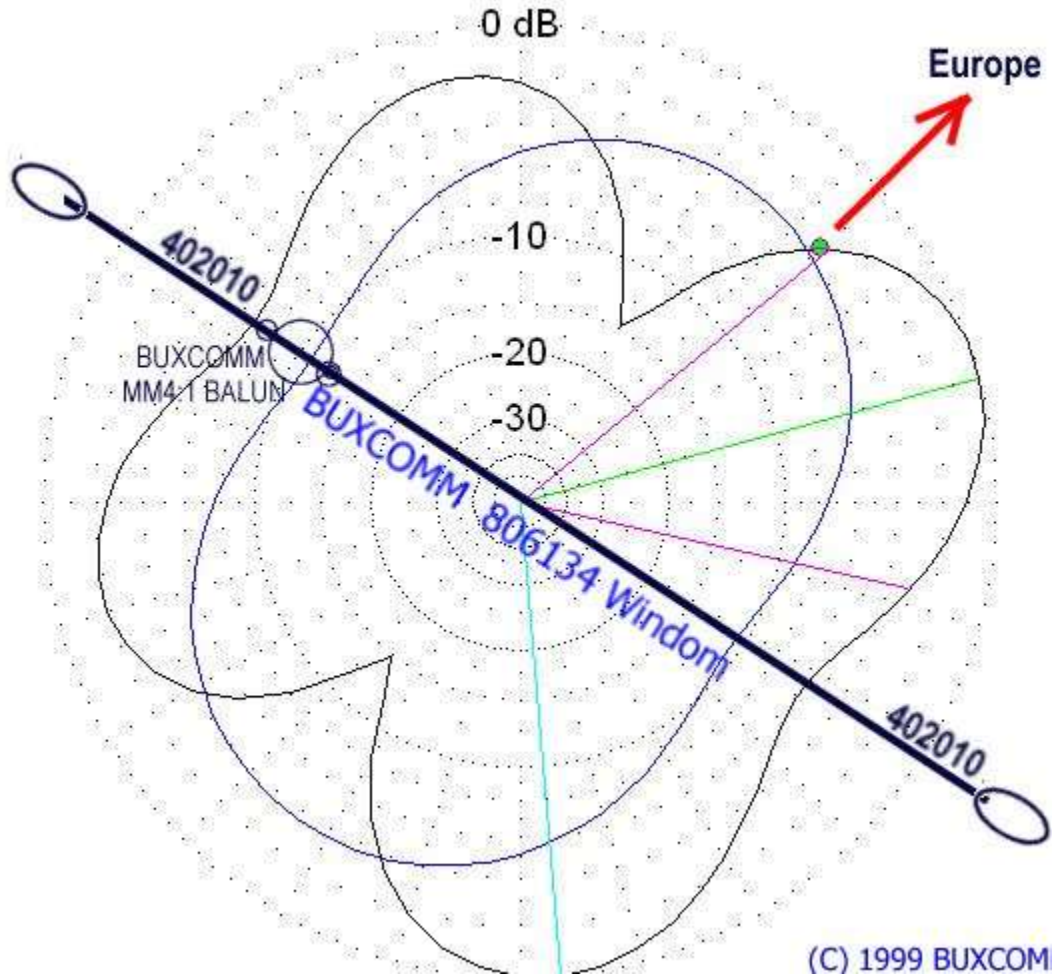


Installation Information:

The ideal height for the Windom is 35 to 45 feet. It affords the Windom a low angle signal take-off, creating a greater coverage area. As an inverted Vee, at 35 to 45 feet elevation, an angle of approximately 110 to 120 degrees at the feed-point, makes the BUXCOMM Windom ideal for use as an "Inverted V."

For use as an inverted V, erect the BUXCOMM Windom antenna at 40 feet above ground, with each leg tapering to approximately 8 to 10 feet above ground. Support the ends out of reach of human or animals.

With the ends having a fall from the apex of 60 degrees from horizontal the distance between ends (or real-estate required), is approximately 115 feet. As a safety precaution, be sure the ends are at least 8 feet or more above ground. I prefer the ends 12 feet or more above ground. By keeping the ends higher, we notice that more of our RF component is presented in the horizontal plane, and increases the low-angle of radiation component.



Shown here is an image to illustrate the orientation I use for my main Windom installation.

The BUXCOMM Windom model 806134 when delivered is approximately 134 feet *MOL*. To raise the resonant frequency into the voice segment of each band, some operator's remove a foot of wire from each end (not recommended). Where possible, route the coax cable to the shack by running it away from the antenna at a 90 degree angle. Length of the coax is not critical, but remember, shorter is always better.

If the question ever prods your brain...; "Which end of the Windom should I elevate highest?"... Here is where common sense comes into play. **ALWAYS**, and in never question the common-sense answer; **ALWAYS whenever possible, the longest end, should be the elevated end.**

Here's why..... In the late forties, I raised my first Windom, and in doing so, I had our old farm-barn on one end at about 15

ft, and on the other, I had to use a 30 ft Martin Gourd (Home for Martin's (birds that chased bigger birds away).. kept the hawks away from our hen-house)), it was the highest point, so I opt'd to use it to attach the short element of my Windom. This allowed the feed-point to be nearest my ham shack. *WRONG, not the best decision.... But we learned another "Windom lesson."*

Having learned a valuable lesson, since then, I have always used the center conductor of the coax or the positive (HOT (+)) post of my 4 to 1 BALUNs to feed the longest element of my Windom(s). Since we began building and selling Windom's in 1959, we've built and sold more than 95,000 Windoms worldwide; With this record, we surely are doing it right. All have been assembled and tested with the long-leg affixed to the "hot" post of the BALUN, and the recommendation "when possible, allow the long-element be at the greater height."

Note: Our tilt-over EZ-UP antenna test-stands are 11 feet above ground. We've worked thousands of DX stations with PSK31 running no more than 50 watts output.

Always trying to make the Best, BETTER:

For the record, my next Windom installation was to use an open-wire, ladder type, feed-line. In those days, open-wire ladder-line was not available, and even if it was, I didn't know where, nor if I could afford it . . . SO, I set about building some "home-brew" open-wire (ladder-line). The reason for this modification to my Windom, was because I had been told the feed point of this antenna was near 250 ohms. I had no means to measure it, so I took the word of my Elmer's (Jack Kennamer W4YPC and Gale Caudle W4CFB).

I went shopping at an all purpose junk-yard under the east-Gadsden side of the Coosa river bridge. In the late forties, this is where Alabama Power Company (APCO) dumped defective power transformers (pole-pigs). The owner of the junk yard would share the copper wire (from within the transformer), with me if I would take them apart and salvage the hypersil cores and copper. Tearing apart those old pole-pigs, to recover some of the varnish (or formvar) covered copper wire was not an easy task, but I prevailed.

The next step was to take a walk down by the creek near our home to gather some small (fishing cane) bamboo. Early on, I learned to let it dry (cure) from the green color to a tan, or yellow color. When it reaches the yellow (cured) state, the insulating properties of the cane was much improved.

Using the copper wire I had salvaged from the defective pole-pigs, I fabricated the 250/300 ohm (MOL) ladder-line. Spacing the

cane spreaders at 8 inch intervals along the ladder, it took awhile . . .

Dump that power sopping Antenna Tuner:

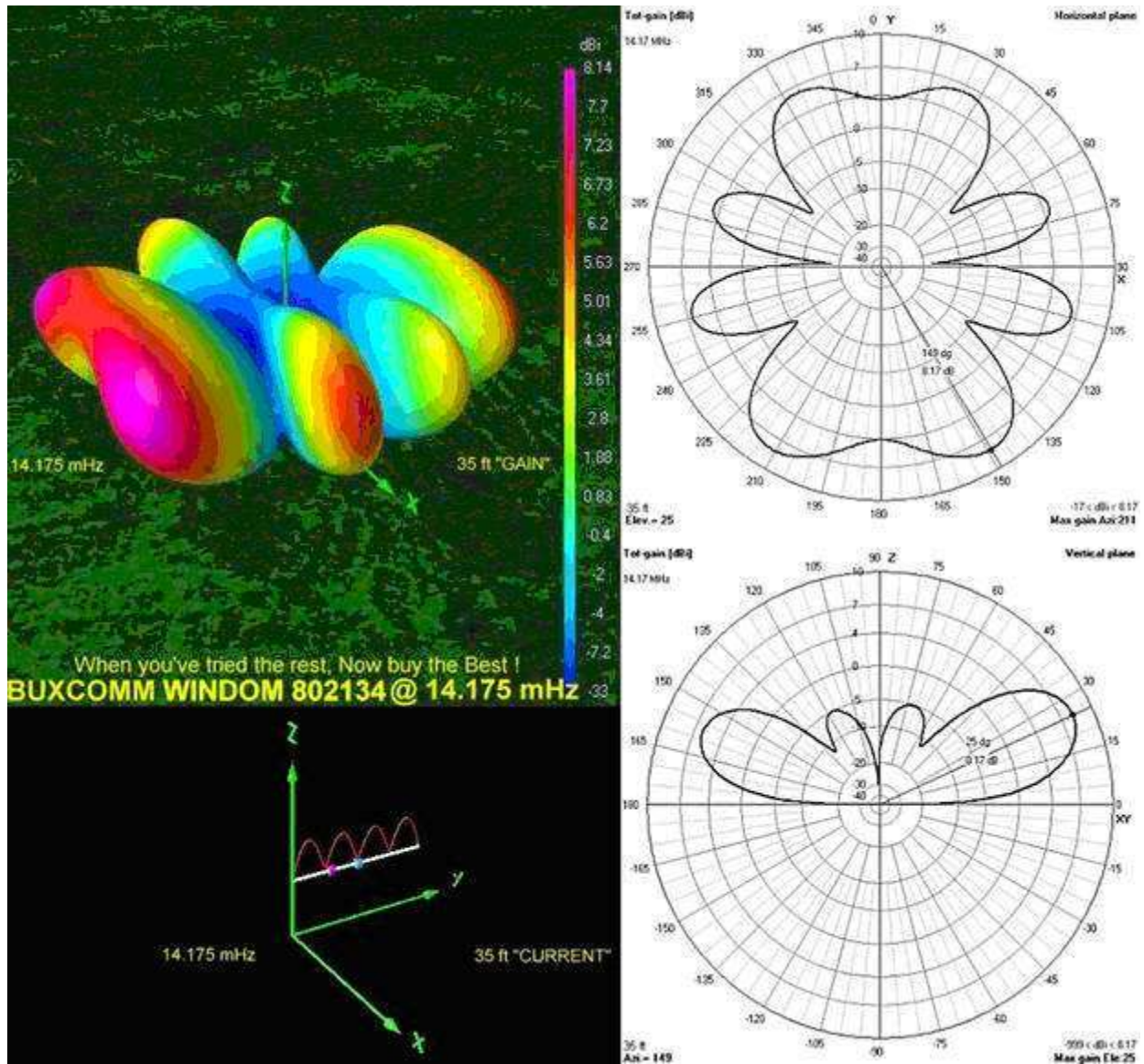
Wow, what a difference it made! Away with the antenna tuner. Never again! I've not used an antenna tuner for more than 60 years. I learned a long time ago, that antenna tuners can consume a lot of my precious power (watts/dB) when it changes the output impedance of my transmitter, to match the impedance of the antenna feed-point.

There are several other reasons for NOT using an antenna tuner... for instance; Using the multi-band Windom, I can change frequencies and/or bands without having to stop and retune (the tuner) every time I change band or frequency. It's also one of the best reasons for using the Windom as the antenna of choice for field-day and contesting. While the other guy is tuning up, I'm making points elsewhere.

Remember, there is no free-lunch, when inductive reactance and capacitive reactance is being set to the same (resonance), it is performing that impedance balancing act at the expense of some power being wasted within that passive device we call an "antenna tuner."

Now-a-days, I use a more efficient method to match my feed-line to the antenna. It's called a BALUN, coupled with a good quality 50 ohm coaxial cable such as: RG8X, RG8, or RG213.

It does not matter whose [BALUN](#) you use; Ours, (BUXCOMM MasterMatch series) or others; PLEASE, Please seal all terminals and appendages in or out of the [BALUN](#) with Coax-Seal CS 104. It does not matter whose [BALUN](#) you use, NO ONE makes a [BALUN](#) that is impervious to driving Rain.... sooner or later, it will fail because of moisture ingress. If you don't wish to seal all the [BALUN](#) terminals, then drill a 1/8 inch "weep" hole in the bottom of the [BALUN](#).



UP CLOSE, dealing with the reality of ground (earth's) influence on an antenna's feed-point:

Pay close attention to what I'm about to say. This is very a very important point that many wire-type antenna vendors don't tell you. * Impedance at the feed point of the Windom (or any wire type antenna) increases at resonance as the height above ground increases !

Having made this statement, I should clarify how we arrived at this axiom: Here in the BUXCOMM lab and our antenna farm, we made many tests with the Windom at various heights above ground. After many, and I mean "many" trials with the Windom at various heights above terra-firma, we found optimum performance at thirty-three (33') feet above ground while using a 4:1 BALUN at the feed point.

When we raised the BUXCOMM Windom above 55 feet we found the feed-point impedance at 75 meters rose to 266 ohms. To make our Windom appear at a more constant feed-point impedance, and at the same

operating frequency, we made a change in the [BALUN ratio from 4:1, to 5:1](#). With our [5:1 BALUN \(model B15K51\)](#), the impedance at resonance remained fairly constant when our Windom was 45+ feet above ground. *To negate the BALUN variables, you might consider using a BUXCOMM [B2LISO, Line Isolator](#) at the input to the coax cable feedline. Install it past the tuner, and/or the RF (linear) amplifier, or the coax input connector.*

As can be clearly seen, the best or ideal height of our Windom is between 30 and 50 feet. In addition to this being a good height to provide a good low angle of radiation, it also enables us to use the most desirable BALUN. A 4 to 1 current BALUN is the easiest wide-band BALUNs to build that allows a wide bandwidth for HF frequency coverage. The BUXCOMM 4 to 1 BALUN uses a special selection of ferrite cores to enable coverage of all the HF frequencies, and well into the VHF region.

As we increased the height above ground to between 55 and 70 feet, we found the impedance at the feed point had risen to almost 300 ohms (actually 284 ohms MOL). To maintain a well-matched BALUN to feed-point equivalent, we changed the 5:1 BALUN to a (BUXCOMM B1C61) 6:1 BALUN.

When in doubt, use the following *rule-of-thumb* to match/balance your Windom and BALUN;

Antenna height above ground:

30 to 65 feet (optimum performance) use Windom with 4:1 BALUN, 50>200
ohm (BUXCOMM model B2KC41)

65 to * 75 feet, use Windom with 6:1 BALUN, 50>300
ohm (BUXCOMM model B15K61)

* No test results available above 75 feet

BucK4ABT

Today we have toroid cores and BALUN devices that provide a more efficient means of coupling RF energy to the antenna (reducing the VSWR, "standing-waves"), while performing better impedance matching. In the drawing shown above, I've drawn the exact dimensions of the Windom I built in 1949. The only differences in my Windom of 1949 and today are:

- 1) the material the insulators are made of, and
- 2) I've substituted a 4 to 1 BALUN for the (lossy) 9 turn, 8 inch diameter, decoupling loop.
- 3) added coaxial cable feed via the 4:1 BALUN.

As I soon learned, this is one of the best and least expensive HF multi-band antennas ever made. It appears as an off-centre-fed (OCF) dipole. This Windom/off-center fed design is actually the way the first Windom antennas were designed. The short side of this story is: the early Windom's were fed with a single wire (non-coaxial) which allowed the RF to radiate freely inside and outside the HAM shack.

Some review; UPDATING THE "ORIGINAL" [WINDOM](#):

Using an open-wire feeder from the transmitter to the antenna was somewhat dangerous when running power levels above 50 watts. This is in difference to today's rules regarding RF radiation exposure, so to prevent this radiation by the feeder wire, we have adopted the use of coaxial cable to feed the Windom antenna. In order to do so, we had to move a bit further away from center than the designer of the Windom had.

Today, our Windom is still a Windom, although some purists wish to open a name for themselves by calling it an OCF. An apple is still an apple, regardless of what name it is called. The only "real" difference is that today, we have refined the Windom design by adding a BALUN, and feeding it with coaxial cable. In the early days, the BALUN and coaxial cable were not an available commodity, thus the designer had to work with whatever was available.

Call it a *Windom*, a *po-dunk holler Windom*, an *OCF*, or simply by its name. As I stated earlier, an "Apple is still an apple, regardless of what name we give it." *If it looks like a duck, quacks like a duck, and walks like a duck, IT'S A DUCK!*

Note: *When attaching the Windom to a BUXCOMM, BALUN (and if the label is not labeled with plus (+) or minus (-) signs), the antenna terminal posts are referenced by viewing the BUXCOMM BALUN label with the antenna terminal posts upright, label in perspective; the top, right post is the plus (+) or HOT side.*

Feeding the Windom:

When the Windom is 25 to 65 feet above ground, the feed point comes closer to being a 223 ohm feed-point, and since we adapted the Windom for coax feed, we now use a 1 to 4 (B15C41) current BALUN. When installed *more than 65 ft above ground*, use a 6 to 1 BALUN. When ordering a BUXCOMM Windom antenna, many customers will order the [6:1 BALUN](#) because a friend told them to do so. These are customers who are sometimes misled by the unknowing. The 6 to 1 BALUN is OK when employed with the Windom feed point above or more than 65 feet above ground.

With the offset near one third (1/3) distance from one end, we find the Windom has a median impedance of approximately 223 ohms. This impedance is more practical for using a 4:1 BALUN at the feed-point. In order to use a 6:1 BALUN and achieve a close impedance match, we must move the feed-point a greater height (60 to 75 feet) above ground.

We have moved to a more desirable feed-point (33 %) offset, and use a [4:1 BALUN](#) (20 to 40 ft above ground) or a [5:1 BALUN](#) when we have the Windom feed-point 40 to 60 feet above ground. When in doubt, use the [4 to 1 BALUN](#) (BUXCOMM model B1C41). In either case, the 4 to 1 and 5 to 1 BALUN's are more efficient in the transfer of RF energy than a 6:1 BALUN.

Using a [4:1BALUN](#) at the feed-point of the Windom antenna, we can operate without the use of an antenna tuner. The Windom is an uncomplicated, easy to use, harmonic related antenna. If we are the owner of an antenna tuner then by all means use it. Since I run 200 watts (or less) I for one don't like the idea of placing too many obstacles (antenna tuner) in line with my antenna, because each transition from one feed-line, tuner, or other transmission line transformer simply adds more losses into the equation and thus reduces this wonderful antenna's high performance.

It could be that many young hams ignore the multi-band Windom antenna because of its sheer simplicity and may think it's too good to be true. Think about it, and while you are doing so, remember, the more trinkets, and unnecessary inserts that are placed into the RF path to the antenna are simply "window-dressing" or gimmicks. These added "gimmicks" become losses to that extra bit of RF signal that could have made that rare and needed contact (difference) in a contest pile-up. The original coax cable fed Windom has proven itself over and over, to be the number one wire type antenna with the most versatile and valued performance record in the HF communications world.

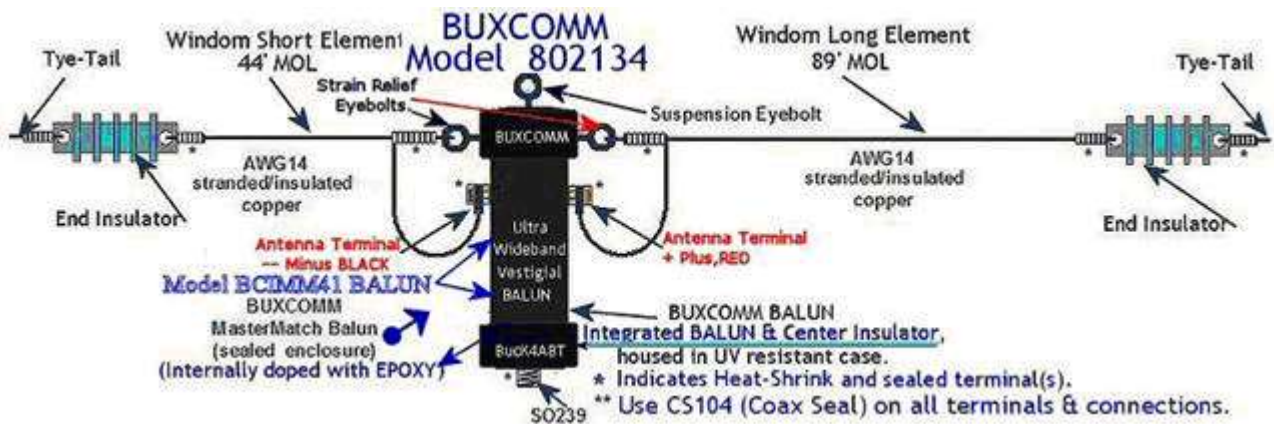
Today, many radio amateurs are using multiband Windom antennas with more than satisfactory results. It would not be without reason that Windom antennas are being employed during IARU HF World Championships, worldwide DXpeditions! and most of all, by "high-stake-contests." The complexity of feeding other dipoles and doublets, the losses in dipoles with traps, and the esoteric marketing of some other antennas seem to appeal to them more. In the long haul, they find the Windom is the best choice for all these applications, uses, and easy band changing.

Remember the axiom: "When you have achieved perfection, anything more becomes a point of diminishing returns." Enough said!

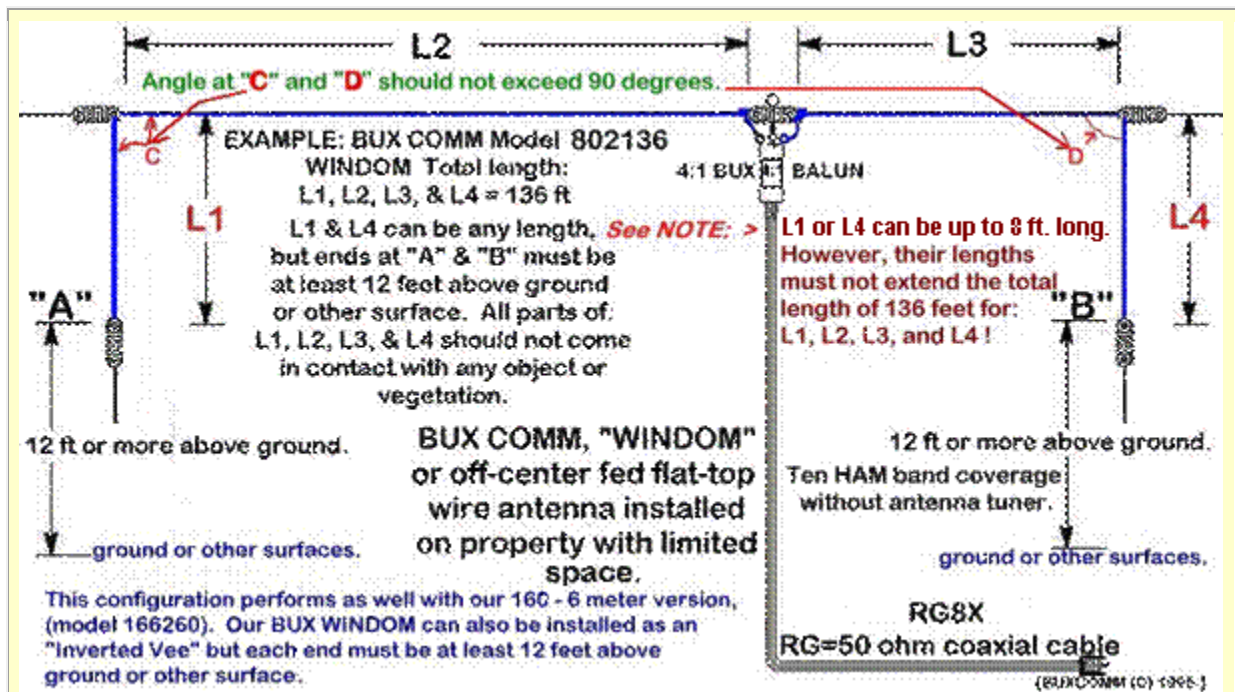
Trust me on the above paragraph, as I have experimented with every antenna concept or design that can be imagined. Having built and sold thousands of Windom and T2FD antennas, I've found that It's difficult to improve on perfection.

BUXCOMM BALUN's are specific to our antennas, plus we build a variety of 1200 watt BALUN's to fit various antenna applications:
Here is our new line of BALUN's that cover the medium & high power applications where a 1200 watt BALUN is needed:

All BUXCOMM 160 through 2 meter WINDOMs are factory assembled and tested.↓



Similar to WINDOMs shown above, The BUXCOMM WINDOM is completely assembled, ready to connect the coax, and erect. BUXCOMM Windom's are power rated at 1200 watts SSB and include all insulators, high-tensile strength, super flexible PVC covering, Power-Flex, tinned, copper wire, connectors, and BALUN. Our High-power versions are rated at 2500 watts and are identified with an "HP" in the model number. See coaxial cable and related items below. You can be on the air in no time, with any of our Windom's. BUXCOMM Windom's are the choice of Hams, World Wide.



The Windom can be installed as a Droop-End (see above drawing) or as a sloper, but in no case, should the angle be greater than 90 degrees against itself or the other element. **To use an angle that folds against the pattern of the opposite end, or the feed line of the Windom, could change the impedance of the feed-point, change the multi-band features, and most important, destroy the radiation pattern characteristics of the antenna.**

- For the best performance and reliability, use high-quality RG-8X, RG8U, or in the case of high power, and VHF, use RG213.
- Antenna cable should run as directly as possible from the antenna *BALUN* to the transceiver or tuner.
- Avoid sharp bends in the cable as they can impair performance by crimping or creating a time domain reflected (TDR) impedance change.

Antenna Feed-line and Cable Tips:

By cutting the coax feed line in multiples of quarter wavelengths, we often see a reduction in some VSWR readings, with HF wire type antennas.

Let's calculate a 1/4 wavelength of a radio wave at 3.8 MHz. Using the formula $234/f$ (where "f" is the frequency in MHz), it will appear as 234 divided by 3.8 equals antenna length in feet. Likewise, to calculate the length of a 1/2 wave feed cable, use 468 instead of 234. When solving for the length in meters, the formula is a bit different ($300/f$, where "f" = Frequency (MHz)).

Hams in the United States are more familiar with the (1/2 wave) $468/f$ and (1/4 wave)

$234/f$, so the lengths are expressed in "feet.". Below, I have shown a method to measure the antenna feed line length when calculating coaxial 1/4 and 1/2 wavelength transmission lines. In order to determine coaxial transmission line lengths or impedance matching feed lines, we *must* include the velocity factor of the coaxial cable for the type coax we plan to use, in our calculations.

See velocity factor (VF) cable table below:

Velocity Factors (VF) for coaxial cables used by Amateur/Ham radio operator's.

Coaxial Cable type	Velocity Factor VF
RG-8 & RG-213	.66
RG8X & RG-58	.66
Ladder/Window Line	.91
Twin-Lead	.82
9913	.78

**234 divided by f (f=3.8 MHz) x VF equals length in coaxial feed line. ie:
234/3.8 MHz, times .66 = 41 feet (approx)**

Most popular coaxial cable velocity factors (VF) are shown in the table above:

If you are using one of the popular coaxial cables like RG-8 or RG-213, these cables have a velocity factor of 66% or .66.

This indicates the electrical length in the real world is 66% of the wavelength in free space. Use the "VF" figure in your calculations.

To determine the length of a 1/4 wavelength feed-line/cable use the formula " $(234/f) \times VF =$ " in the above calculation.

Apply the formula using the lowest band/frequency of the antenna you plan to operate. After solving a quarter wavelength $(234/f) \times (VF=)$ formula, apply its length in exact multiples; 1 times, 2x, 3x, etc.

Outdoor antennas should have lightning protection. Use a gas-stop or gap type BUXCOMM [7516](#) grounding (lightning) block where the antenna cable enters the house or transceiver/tuner. Run a wire from the grounding screw or tap, to your station's ground rod BUXCOMM [model GROUND ROD](#)

- This is not only an important safety consideration but also a National Electrical Code (NEC) requirement
- Outdoor connections should be protected from exposure to the elements by applying silicone grease to prevent oxidation.

There is an exception; When the antenna "elements" are made of twin-lead, and fed with coaxial cable via a [BALUN](#), then we understand how the ladder-line or twin-lead can indeed become the radiating element(s). e.g. "[Folded Dipoles](#)," [JPOLE](#), [T2FD](#), and [Compact Dipole](#), In the case of the [G5RV](#), the thirty-three feet of ladder-line or twin-lead, *transmission line transformer* (TLT) should have a twist of one-half turn per foot.

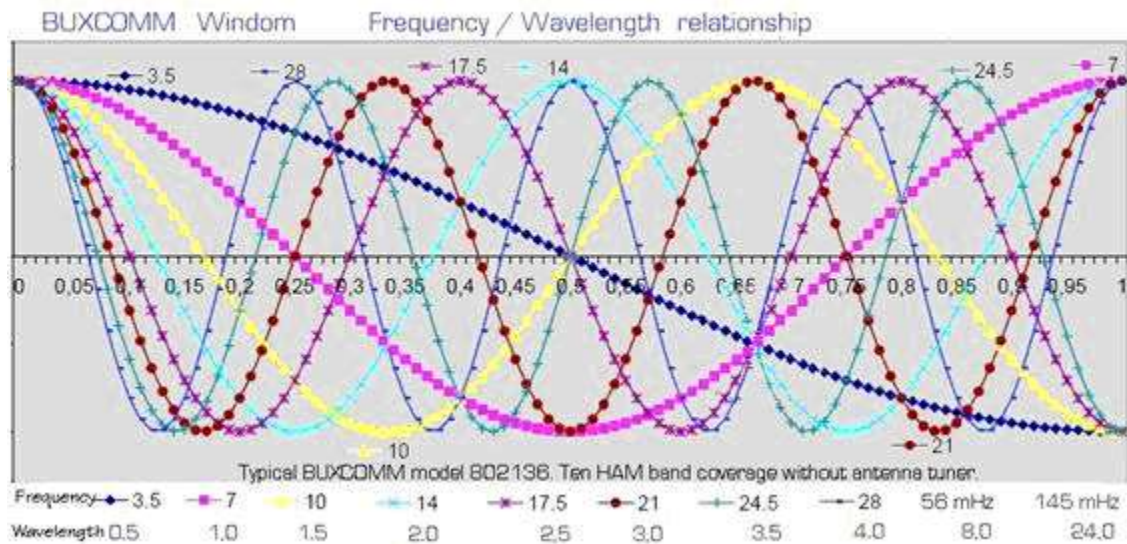
A touch of Class, The [Windom](#) and the J-POLE
By Glynn E. "Buck" Rogers Sr K4ABT

The J-POLE has been around since the early days of HAM Radio, and is a direct descendant of the "[Windom](#)" Like the Windom or ZEPP, the J-POLE is a spin-off, or a modified WINDOM for VHF and UHF. One of the first articles I wrote about the J-Pole was in HRC magazine in 1958. Since 1958, I've written several j-pole articles in CQ Magazine and other HAM Radio publications. Here, my references are to the early, 1923 (version) Windom (Article by Loren G. Windom September 1929, QST magazine) .

If you look at the feed method for the early Windom, it was fed with a single wire. You soon see the similarity between the Windom, ZEPP, and the J-Pole.

Look close at the configuration of the Jpole and the Windom, and you will understand why in many of my articles in CQ Magazine and other publications, that I often refer to the Jpole as a VHF Windom, with the short section folded back on itself to form the parasitic element. It is for this reason that I feel these are two of the best antennas ever designed. Having said this, you will also note that the Windom (and the Jpole) are powerful antennas that provide outstanding performance on all bands above the band for which they are cut or designed for.

The reason these two antennas perform so well (as Multi-Band antennas; Windom for HF & lo VHF, Jpole VHF & UHF), is because they operate at harmonics of the fundamental or lowest frequency for which they are cut/designed. To add additional feeders (ladder-line), other than 50 ohm coax or UNUNs is a waste of RF energy. Only 50 ohm coaxial cable and a BALUN at the feed-point is all that is necessary. Anything more, add losses into the equation that cannot be overcome after-the-fact. See "frequency vs wavelength" and "ham-band, harmonic relationships" in the following color-coded chart.



From: Richard Soikkeli
 Sent: Monday, May 19, 2008 11:35 AM
 To: support@buxcomm.com
 Subject: Thanks for your fantastic Windom antenna!

Dear Buck,

Thank you so much for your patient technical help and the Buxcomm Quality windom antenna. 2 weeks ago down came the 102' G5RV and up went the [802134 BUXCOMM Windom](#).

Now I am filling the log book with countries I rarely could even hear before, much less work, even with 500w CW. I have "busted" some pile ups with a first or second call and got real 599 rpts from DX over 8000 miles away. The low noise factor and gain does the trick. Also, I don't have RF into my son's computer speakers any more and I'm sure the neighbors are happier.

I am advising our Field Day team to ditch the g5rv's as they don't compare at all as you told me would be the case. I only wish I had heard about BUXCOMM Windom's sooner and had more fun working DX over the years. I just installed a 2nd windom for my jr. high ham station. Now its time to break out the QRP rig and see what it will do too. I will be ordering more parts soon.

73 and thanks again, Rick AE6RS

To manage both CW and Phone portions of the HF bands with the Windom, some "pruning" of the elements L1 & L2 can be made. Pruning (reducing) the length of L1 & L2 may cause an increase in VSWR at the lower ends of the band(s). Always remember to make the cuts proportional to each element. If you remove 12 inches (1 ft) from L1, remove only six (6) inches from L2.... If you remove 2 feet from L1, remove one (1) foot from L2. Do not remove more than 3 feet total (L1=2 ft, L2=1 ft)

The Windom above is cut for the CW portions of the HF bands.

For the technical minded Windom builder, we opt for the [4:1 BALUN](#) (B15C41) because it is; more efficient, and weighs less. Another nice feature we found using our Rhode & Swartz Antenna Systems Analyzer, the Windom

exhibits similar feed-point impedance across the bands from 75 through 6 meters.

A word to the wise.... NEVER make any angle of the Windom (or any flat-top antenna) more than 110 degrees. Ends can hang down, from a horizontal plane, but do not allow the angle to be tighter than 90 degrees e.g. 75, 45, degrees etc. A Windom may also be installed as an Inverted Vee, as long as the Apex (Point where BALUN feeds the Windom) is not sharper than 90 degrees. The Windom is suitable for mounting as an inverted V, supported between two masts, tower, or trees. I often have HAMS call or email me (support@buxcomm.com) asking me why... their new antenna has a high VSWR, or is difficult to tune; Well here is my answer, reference any wire type antenna: **Windom's or any type wire antenna (bare or insulated) wire elements must not come in contact with limbs, vegetation or metal objects. In practice, try to keep both ends (wire elements) of the Windom three (3) or more feet away from any limbs, vegetation or metal objects.**

I will elaborate; Although the wire is covered with non-signal degrading PVC insulation, the proximity of the (insulated) wire to limbs, vegetation or metal, will sometimes introduce enough stray capacitance to detune and often change the reactance and surge impedance enough to destroy the pattern, VSWR, and impedance of the antenna. (this same rule applies to all wire type antennas, be they: Dipoles, Zepp, ALE, Long-wire, G5RV, T2FD, etc).

The [BUXCOMM Windom](#) can be purchased in several different band or lengths. The number of bands covered is determined by the length.

The 160 thru 6 meters version is approximately 260 total length. [BUXCOM P/N 166260 With Current BALUN](#) attached The 80/75 thru 2 meters version, [BUXCOM P/N 802134 With Current BALUN](#) attached, is approximately 136 ft total length. The 40 thru 6 meters version is approximately 66 ft total length. [BUXCOMM P/N 40670 With Current BALUN](#) attached, and the 20 thru 6 meters version is approximately 37 feet, total length. [BUXCOM P/N 20634 With Current BALUN](#) attached

AN UPDATE:

Since writing this article several decades ago for a major HAM radio magazine, I've received tons of mail (and eMail) asking for more information, especially with regards to my 160 meter version;

The [BUXCOMM model 166260 Windom antenna is a horizontal wire, multi-band antenna intended for use without an antenna tuner on 160, 80, 40, 30, 24, 20, 17, 15, 10, 6, and 2 meters.](#) The WARC bands of 30, 17, 15, and 12 meters by using an antenna tuner. The antenna wire is made of 61 strands of silver flashed wire and covered with non-metallic, super-flexible PVC insulation. Each end of the BUXCOM Windom's have end insulators made of high tensile strength TyNYTE. The Center insulator is also Tynyte, and is fed by customer's choice of either a [4:1 or 6:1 BUXCOMM MasterMatch BALUN](#) transmission line transformers. The BALUN feed is attached near the one-third offset point according to the feed-point required by the BALUN ratio (200 ohms/4:1, 250

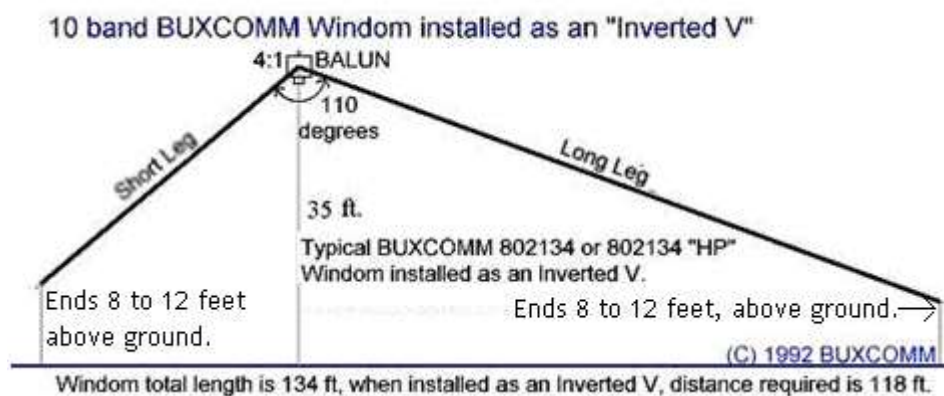
ohms/5:1, or 300 ohms/6:1). By using a different feed-point for 4:1 BALUNS, a slight increase in antenna efficiency is realized when using the B1C51 (243 ohm) feed which results good VSWR on all referenced HAM bands. The antenna is suitable for mounting as a dipole, supported between two masts, tower, or trees.

The Windom wire elements should not come into contact with any limbs or other vegetation. Here's why; Although the wire is covered with non-signal degrading PVC insulation, the proximity of the (insulated) wire to limbs, vegetation or metal, will sometimes introduce enough stray capacitance to detune and often change the reactance and surge impedance enough to destroy the pattern, VSWR, and impedance of the antenna.

The sky-blue insulation on the wire elements of our Windom antennas provide esthetic blending with the environmental surroundings, added tensile strength, and most important, it prevents oxidation of the wire. Oxidation can wreak havoc after a few years exposure to the elements.

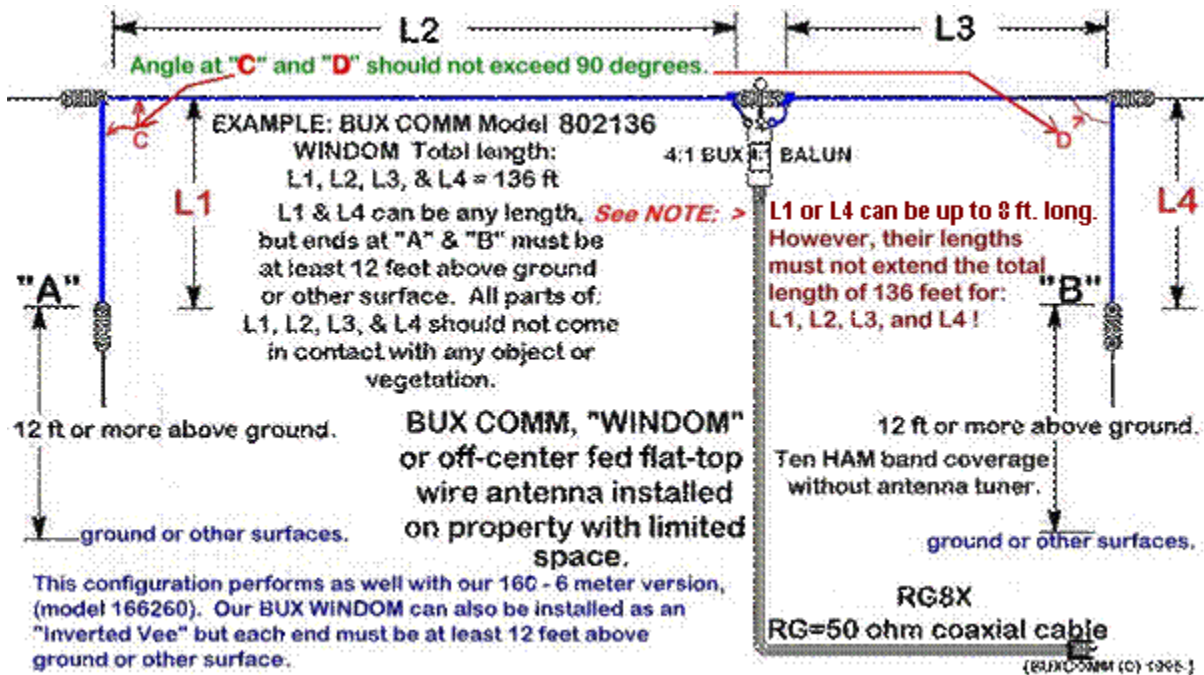
A few new HAMS do not understand why we advise against allowing the wire elements (although insulated) to come in contact with metal objects, tree limbs, and similar vegetation. Here, insulation does not prevent "proximity influence (added capacitance), and RF absorption" by nearby vegetation, be it limbs, or metallic objects. The same thing happens when the "sap" is up in the limbs, as happens when the antenna elements come in contact with, or near metal objects; stray capacitance, both inductive and capacitive will surely detune a well engineered antenna. ***Although the wire is covered with non-signal degrading PVC insulation, the proximity of the (insulated) wire to limbs, vegetation or metal, will sometimes introduce enough stray capacitance to detune and often change the reactance and surge impedance enough to destroy the pattern, VSWR, and impedance of the antenna.***

The [BUXCOMM Windom](#)'s may also be installed as an "inverted Vee".



Do not exceed 90 degrees when erecting the [Windom Antenna](#) as an "inverted Vee". Specifications: Frequency range: 1.8 – 2.0 MHz 3.5– 4.0 MHz 6.8 – 7.4 MHz 13.9 – 14.7 MHz 27.8 – 29.8 MHz 49.5 – 54.0 MHz Feed-point Impedance 50 ohms VSWR <2.0:1 Horizontal Polarization (If suspended as an Inverted Vee, do not exceed 90 degrees) Maximum power 1000 Watts SSB, 600 W AM/CW, Wire Length [model 166260 = 260ft.](#) WARC bands of 30, 17, 15, and 12 meters by

using an antenna tuner. Now-a-days, I see a lot of knock-offs of the windom, they even try to change the name or use acronyms and try and relate it to the dipole. The Windom is still a Windom, regardless of what they call it. As with the "apple." The apple is still an "apple" regardless of what other name they try to give it!



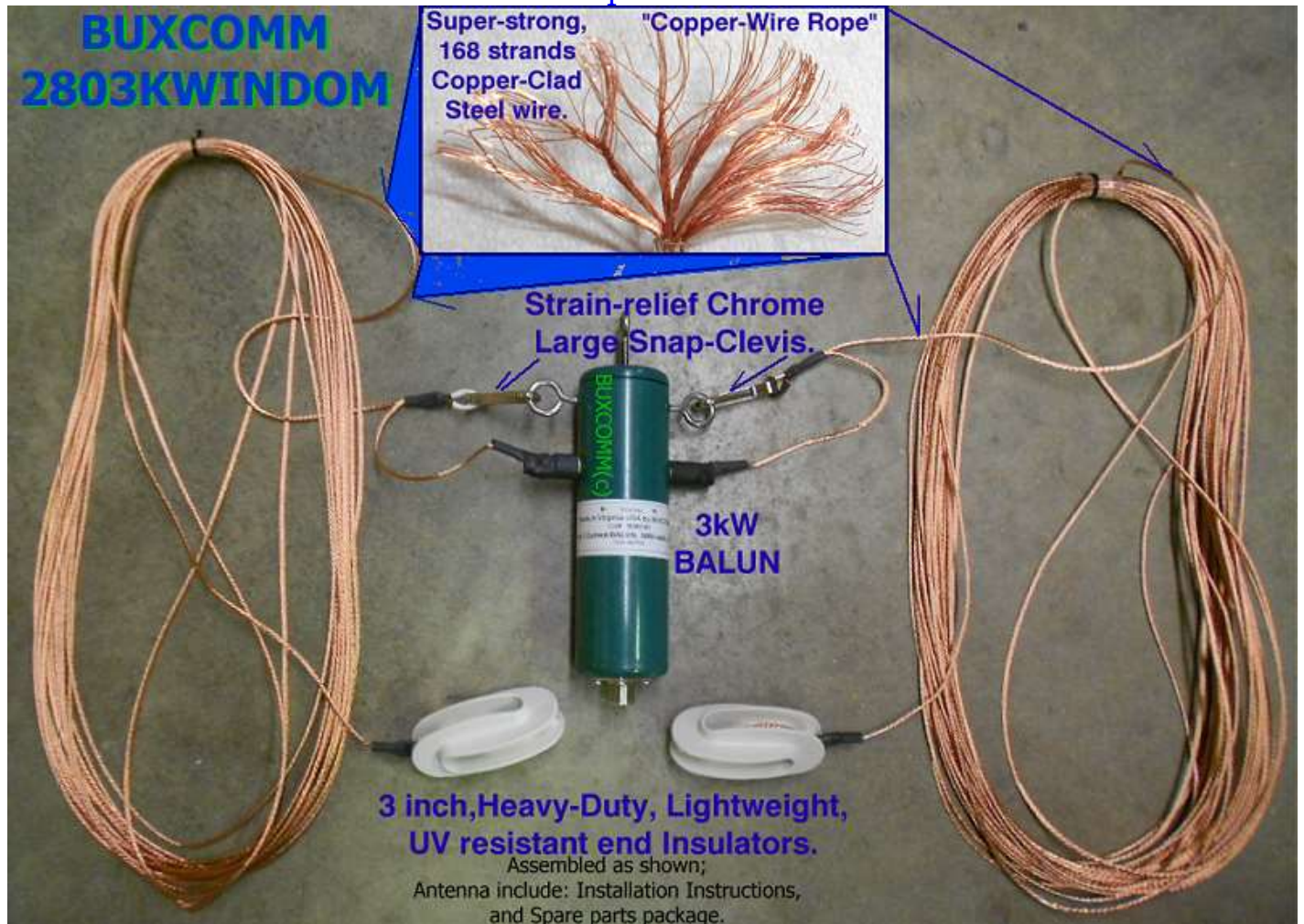
It is important that I repeat the following paragraph:

The Windom can be installed as a Droop-End (see above drawing) or as a sloper, but in no case, should the angle be greater than 90 degrees against itself or the other element. **To use an angle that folds against the pattern of the opposite end, or the feed line of the Windom, could change the impedance of the feed-point, change the multi-band features, and most important, destroy the radiation pattern characteristics of the antenna.**

Note: When attaching the Windom to a BUXCOMM, 4:1, 5:1, or 6:1 BALUN (and if the label is not labeled with plus (+) or minus (--) signs), the antenna terminal posts are referenced by viewing at the BUXCOMM BALUN label with the antenna terminal posts upright, label in perspective; the top, right post is the plus (+) or HOT side.

Having said that: Here then is "the rest of the story." The Quality goes in, before our name goes on.

The BUXCOMM *signature* Windom; Another quality antenna from BUXCOMM Corporation.



The latest addition to the BUXCOMM WINDOM family is the **Cat# 2803KWINDOM**

This Windom is our Commercial and Military grade antenna that is in use by our armed-forces in Qatar and other countries worldwide. The BUXCOMM 2803KW

is manufactured and assembled entirely in Evington, Virginia USA.

Because most wire type antennas are installed at a height between 35 and 55 feet, we elect to use a 4:1 BALUN powerRated @ 3000 watts SSB. The RMS power rating is well above the Amateur Radio Legal Limit.

The feed-point BALUN serves as both a "center insulator" and the device that matches our Windom/OCF to the 50 to 55 ohm coaxial cable. The input to the BALUN is a standard SO239 which accepts a PL250 male coax connector.

The feed-point is fourteen (14%) percent (MOL) from the center of the

antenna. This feed point provides a better impedance match. For 80 through 2 meters.

The BUXCOMM 2803KWindow is approximately 133.7 feet, long. This should provide good performance on the band of (HF & VHF) frequencies without the use of an antenna tuner. Although a slight increase in VSWR may occur at 15 meters, an antenna tuner may be used for maximum performance.

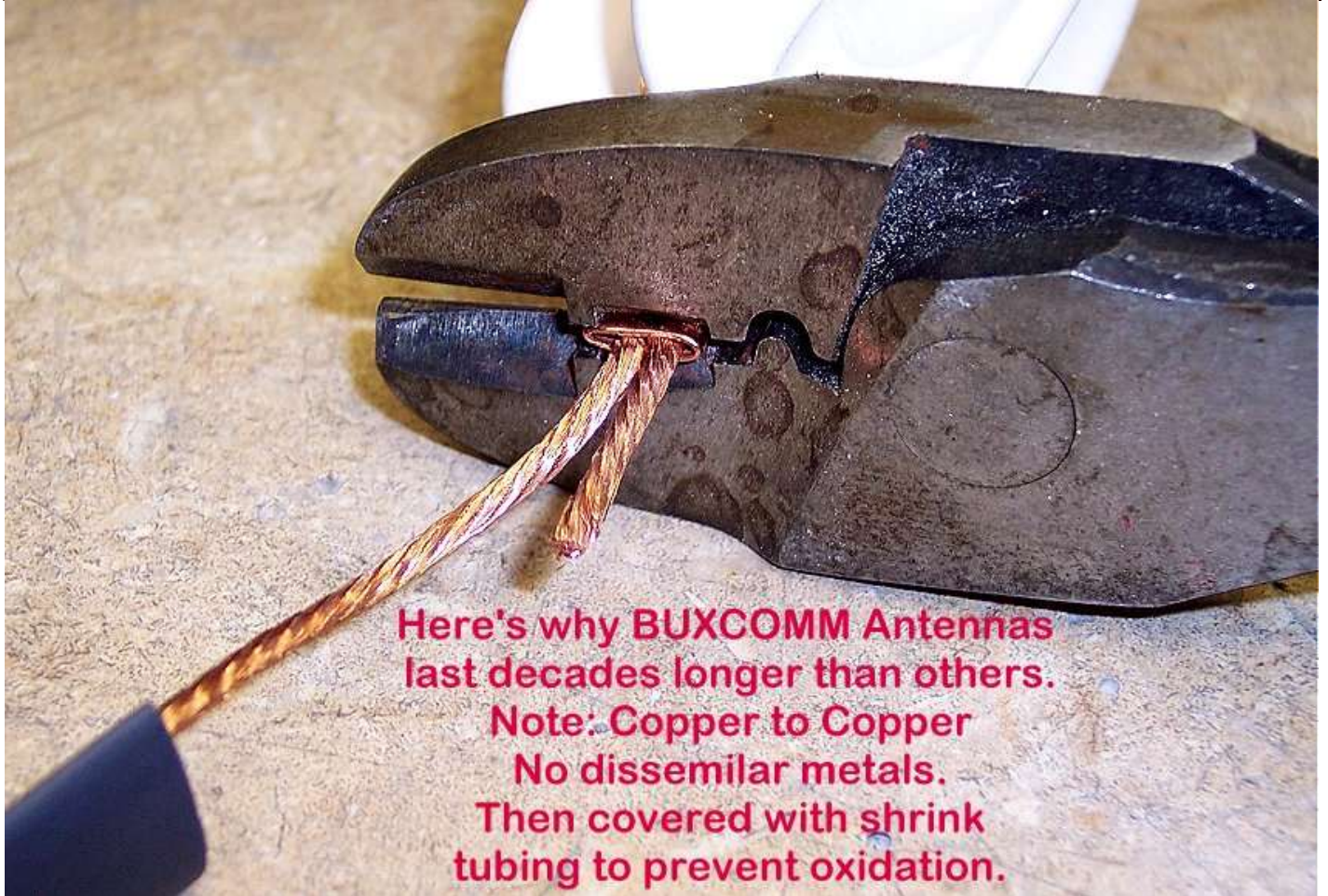
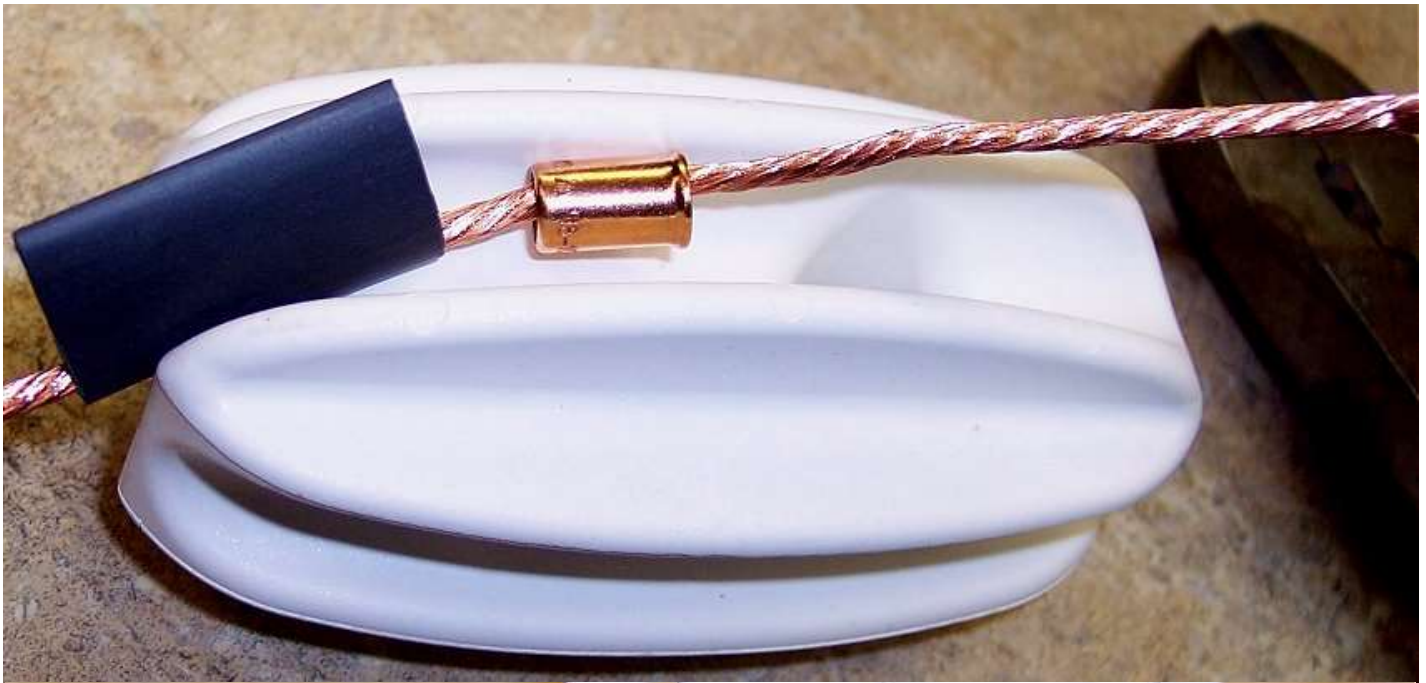
We have found that 85% of complete Window antenna BALUNS are not symmetrical; That is, most manufacturers supply a BALUN with a frequency response that rapidly rolls off somewhere around 26 to 28 MHz.

The method we use to overcome this obstacle was to select a "proprietary" mixture of ferrite, winding ratios, and swept teflon* covered wire that would give our BALUN the bandpass we needed to reach well into the VHF region with our harmonic related Window. In our lab measurements, our "special" BALUN's display a VSWR better than 1.5:1 at 175 MHz. In addition, by using this special built, broad-band BALUN with our Window, we have an HF and VHF Window antenna that now covers eighty (80) through two (2) meters, still without an antenna tuner.

When we first developed our broadband BALUN, we found that it would allow use of our Window antennas well into the VHF region. Later, some of our competitors decided to make the same claim, they, not realizing, that their BALUN must have a band pass that let their OCF's operate into the VHF region. Many operator's who were duped by their hype later found their antennas would NOT perform above 28 to 29 Mhz. As a matter of fact, they soon learned that the antenna they had bought was incapable of operation above 28 MHz due to the rapid roll off of the BALUN band pass.

The wire we use to manufacture the BUXCOMM 2803KWindow consists of 168 strands of copper clad steel wire. Not only does it give added strength to the antenna, it will last much longer than ordinary wire type antennas. The wire is 7 bundles of 24 wires to each bundle. The wire is called Copper Wire Rope, as it is woven, not twisted.

* teflontm is a registered trademark of and by E.I DuPont.



**Here's why BUXCOMM Antennas
last decades longer than others.
Note: Copper to Copper
No dissimilar metals.
Then covered with shrink
tubing to prevent oxidation.**



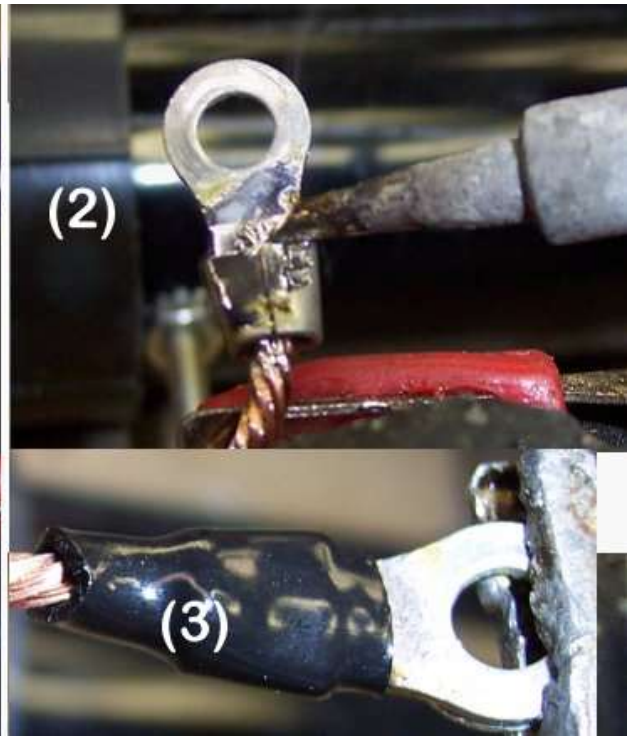
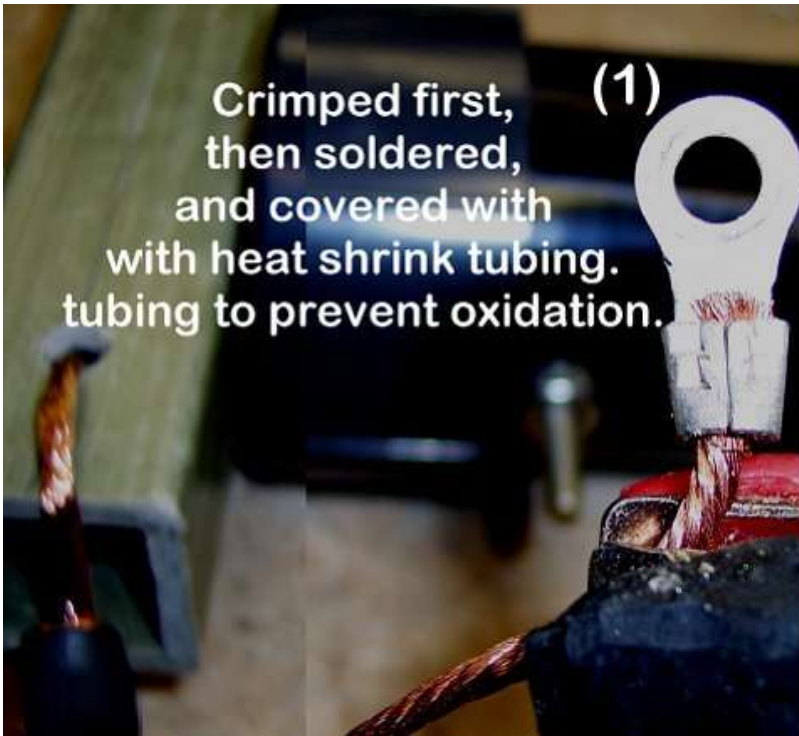
NOTE: The Satin finish of the Light-weight, Heavy Duty end insulator.



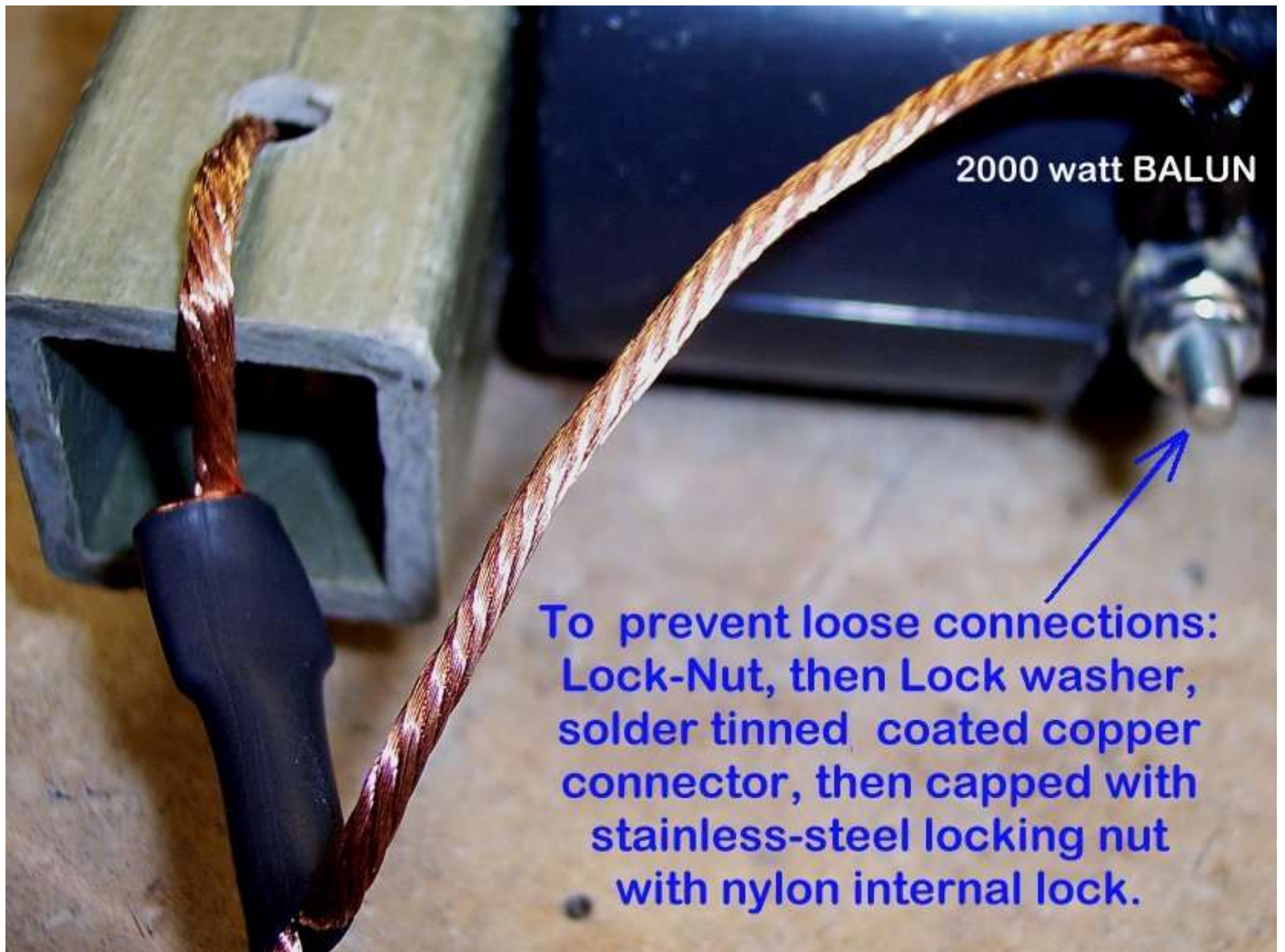
No dissimilar metals to corrode or oxidize, we use copper to copper connections.



Non-abrasive copper crimp is used, then covered with heat-shrink tubing for many years of use.



Crimped, soldered, and covered with weather proofing.



The Quality goes in, before our name goes on.

Large, LightWeight, Heavy-Duty
3 inch Fiber-glass/Delrin insulators

SuperFlex, 168 strands
Copper Clad steel wire.
Strong, Kink, and tangle proof
made for decades of service.



This is where our name goes

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and MORE !



William L. Everitt, as faculty advisor to the students who worked on the antenna, contributed much to its development. Everitt began his amateur career in 1914 as 2ABI; in 1921 he became 8CRI. When he decided to go into communications professionally, he dropped amateur radio because he did not want to have the same vocation and avocation. Everitt was later to become a prominent author and educator. He retired as Dean of Engineering at the University of Illinois and went on to become Dean Emeritus at that university.

The "[Windom Antenna](#)" was described by Loren G. Windom in QST magazine, September 1929. Pages 19 through 22. It is named after its inventor/designer (See Photo below).



Loren "Windy" Windom, W8GZ, for whom the antenna was named, did not, oddly enough, pursue electronics professionally, but became a lawyer in Ohio. Windom then serving 1940-45 commander of the 145th Infantry; he was later appointed by the governor as the 37th Adjutant General of Ohio in 1959, He always remained an active amateur.

BUCKnote: Photo Top Left; The transmitter shown is the Central Electronics model 20A Multi-phase transmitter It was a Phasing type side-band (slicer). It ran a pair of 6AG7 (metal tubes) which were used in the output as a class AB1 linear amplifier. Later, Collins crystal lattice filters were added to suppress one of the sidebands to make the CE 20A into a "single" sideband transmitter. Lower-left; beneath the phasing exciter is a Collins RF power amplifier, Center is the *National HRO-50* with its tuning units (3) sitting atop a Precision Electronics receive Pre-Selector. In the early fifties, the HRO was one of a few receivers that had a BFO stable enough to inject some Beat-Frequency (local carrier) and receive DSB or SSB.

Loren Windom, W8GZ, was first to reveal the antenna to the radio amateur community by describing the antenna in the September 1929 issue of QST. Although it was first built and tested by William Everitt (see photo), it was by Windom's name that the antenna became known.

The Windom antenna is an off-center fed dipole with an unbalanced coax feedline. In 1937, the Windom was first described as a compromise multi-band antenna. The antenna can be employed on most all HAM bands 80, through 10 meters. What became perhaps the most popular multi-band Windom design of all, was the Windom antenna, described by the late first build and tested by William Everitt (see photo), it was by Windom's name that the antenna became known. It had the same dimensions as the multi-band [Windom Antenna](#), but fitted with a 200 Ω to 50 ohm, (4:1) BALUN at its feed-point and fed with coax.



In recent years, some operator's are using 300 to 50 ohm, or 6:1 BALUNS. They base their decision on the simple math that the feed point is three (30) ohms closer to 300, than 200. In reality and measured with highly accurate antenna bridges, we have found the feed point impedance of the Windom to be 233 ohms. The feed-point of the Windom is 223 ohms nominal, this is a measured impedance while the [Windom Antenna](#) is suspended at 40 feed above ground. Has anyone ever heard of "surge-impedance?" In tests, we've found, there's no significant difference in performance either way. Therefore, the trade-off is a matter of personal choice. Mine of course, is the [Windom Antenna](#), with a 4:1 Current BALUN ([B15C41](#)). If you plan to run more than 1000 watts SSB into our Windom, we suggest you request our Windom with the [BD2K41 Current BALUN rated at 2kW SSB](#).

When you go to http://www.buxcomm.com/catalog/index.php?main_page=product_info&cPath=49&products_id=1932

you will see the menu shown below; Here you can enter or select two (2) choices;

- 1) The WINDOM model for the bands and power level you wish to us, and,
- 2) The BALUN type/ratio you wish to have attached to your Windom.

Here are some final notes:

In our [BUXCOMM BALUN's](#), we make it a point to polarize the posts of our MasterMatch series, identified by a RED or BLACK dot, or ring on the brass terminal posts. This provides the user with a benchmark that allows the BLACK post to be used towards the "cold" side of the antenna and the RED post is

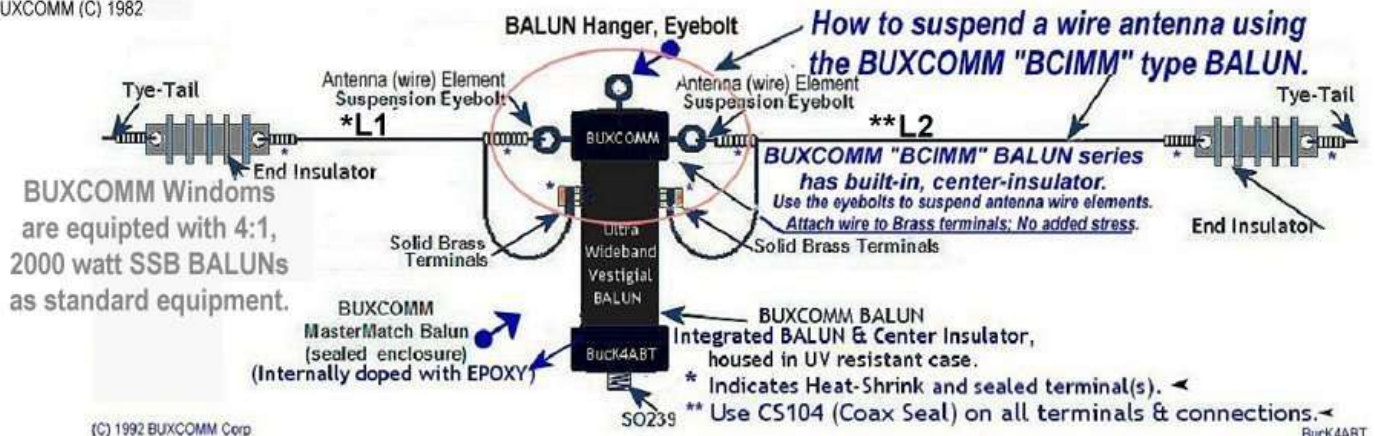
connected to the long, or "hot" side of the antenna. Some old-timers of my vintage, refer to the cold side of the antenna as the "parasitic" element.

Note: When attaching the Windom to a BUXCOMM, 4:1, 5:1, or 6:1 BALUN (and if the label is not marked with plus (+) or minus (-) signs), the antenna terminal posts are referenced by viewing at the BUXCOMM BALUN label with the antenna terminal posts upright, label in perspective; the top, right post is the plus (+) or HOT side.

As a point of interest, in some installations, the coax feed-line may pass through the RF field of the antenna, RF current can be introduced into the feed-line after the balun. In this situation, a 1:1 Current Choke should be inserted into the feedline near the feed-point of the antenna.

HOW TO HANG BUXCOMM BALUNS

BUXCOMM (C) 1982



Shown above is the BUXCOMM BCIMM series BALUN with integrated (built-in) center insulator.
This configuration prevents placing stress on the antenna connection terminals. Buck4ABT

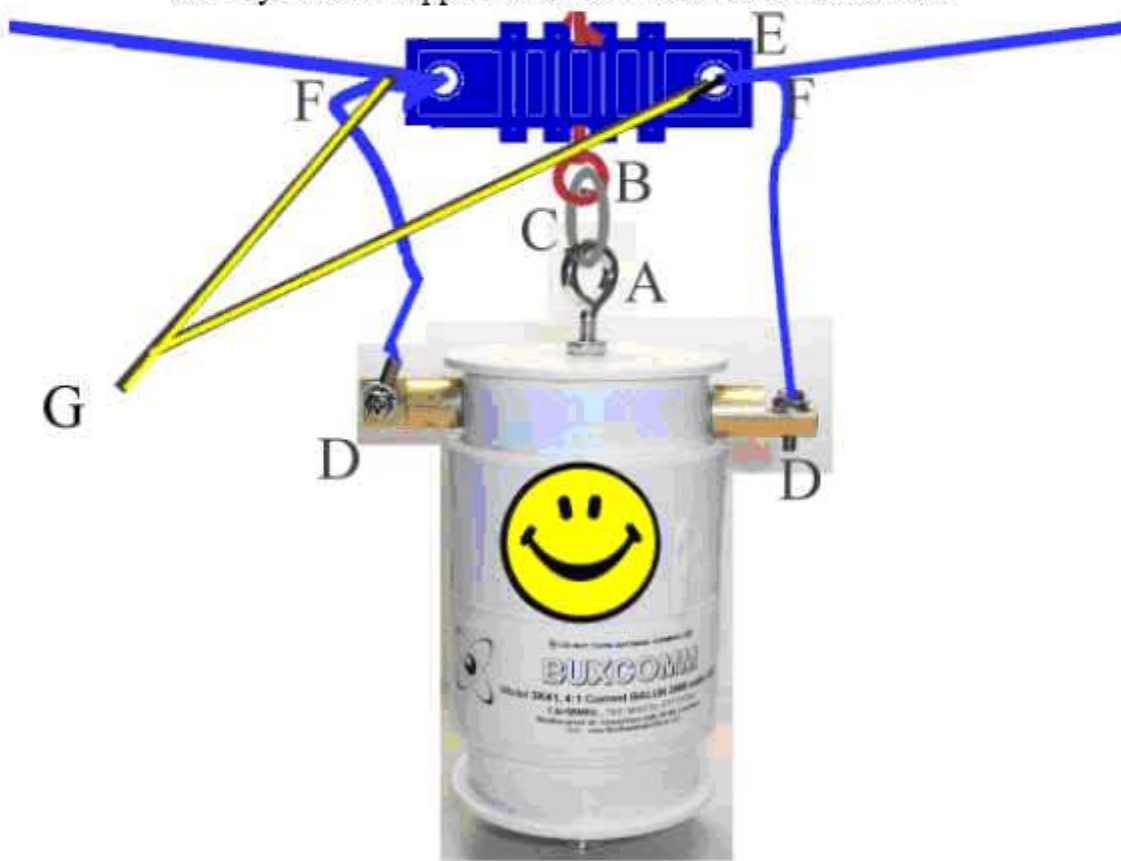
How to hang a BALUN without damaging BALUN Antenna terminals.



“WRONG”

Do not support BALUN by Antenna Wire/Elements,

Use Eyebolt to support BALUN from Center Insulator.



“RIGHT”

A= BALUN Support Eyebolt,

B= Center Insulator Eyebolt Support

C= Support Link between Center Insulator and BALUN Eyebolt

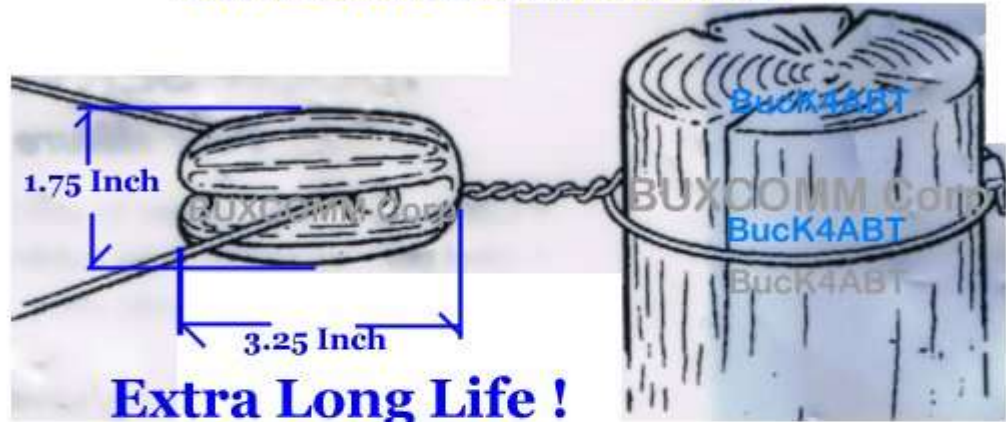
D= Antenna Terminals/BALUN Connectors

E= Center Insulator

F/F=Loop antenna wire element(s) through insulator holes ,

G= Fold back wire element onto itself, secure with Ty-Wrap and cover with tape

Made specifically for BUXCOMM Extra, Heavy-Duty Very Light-weight, Glass Reinforced Polyester Antenna Insulators



OH, BTW, there's a new kid on the block.... an insulator that has the strength of those "strain type" used with tall tower guy wires, but at one fifth the weight. In addition, it can be used in several different configurations as shown in the adjoining photo illustration.

They are packaged 2 per pack, and the BUXCOMM catalog number "[INSUL4WAY](#)."

Light weight and most durable, three and 1/4 inch (3-1/4"), Glass fiber reinforced insulator, the strongest insulator in its size and class.

A great Heavy Duty, end Insulator for heavy copper-clad steel antenna wire. UV resistant, white, and it's the strongest fiber-glass impregnated Polyester available.

Suitable for high tensile strength applications. See the photo for the various uses and configurations. The BUXCOMM [***INSUL4WAY***](#) insulators has a satin-slick finish that enables rope to slide easily thru the suspension hole for up and down loading. Handles our BUX516, 5/16 inch Rope with ease. [In Stock and Ready For Immediate Shipping.](#)

Here's more commendation for our BUXCOMM Windom antennas:

Sent: Monday, October 16, 2006 2:55 PM

To: support@buxcomm.com

Subject: BUXCOMM WINDOM

Hello

I couldn't resist the opportunity to tell you about your Windom antenna I bought a couple weeks ago. I have been off the air for a number of years. Probably close to 15 to be exact. My oldest son got his ham ticket this past summer and started buggin me to get on the air. That's when I decided to bite the bullet and get on.

After working for days trying to make my old "Inverted V" work. I turned to you folks and your off center fed Windom. Since then I hung the antenna at the 70' mark on my tower and the long end to about the 55' mark on a tree in the back yard. My station is simple, I use the Kenwood TS-180s barefoot to the Windom. I love to work rtty and packet. I am using an ancient AEA Pakratt232.

I have heard DX that I never heard in my years of being a licensed Ham. I have worked Italy, England, South Africa and last night I worked a station in Chile. CHILE! Now that is at the other end of the world! This is so neat, I can't tell you how much I am loving your antenna. Remember this is barefoot. I have my dad's SB-230 amp, but it's not hooked up. I don't have the DIN plug for my 180 yet.

If you have customers asking how your BUXCOMM Windom antenna works, give them my call and I will be happy to meet them on the air.

73, and thanks again.

Bob WB8UJB

From: Andy KA3ODJ

Sent: Wednesday, June 07, 2006 6:49 PM To: support@commparts.com Subject: 166261W100 Just wanted to let you know that your 166261W100 antenna here at KA3ODJ is working like Gang Busters. Purchased the antenna primarily as a 160 Meter antenna for the Internet Remote Base. The SWR and performance exceeded what I had expected, I have added it to the selection choices for the other bands. Can not wait to get the ends up higher, they are only 35" or so right

now. Getting good reports from the users of the Internet Remote Base. No RF Problems at the coax end either, I also am using one of your Master Match at the antenna switch. I am running an Icom PW1 and in the past, I've had RFI issues in the shack resetting the computer, but no more, with this new BUXCOMM Windom, it's clean as a whistle. Feel free to give your antenna a try if you like. To operate Remote, You will have to download W4MQs software to get access. <http://wpmq.com>. Thanks for a great product at a fair price. Andy KA3ODJ

Metric Conversion

INCHES	FEET	YARDS
To Millimeters Inches x 25.40 To Centimeters Inches x 2.54 To Meters Inches x 0.0254 From Millimeters M x 0.03937 From Centimeters C x 0.3937 From Meters M x 39.3701	To Millimeters Feet x 304.8 To Centimeters Feet x 30.48 To Meters Feet x 0.3048 From Millimeters M x 0.00328 From Centimeters C x 0.03281 From Meters M x 3.28084 From Centimeters C x 0.01094 From Meters M x 1.0936	To Millimeters Yards x 914.4 To Centimeters Yards x 91.44 To Meters Yards x .9144 From Millimeters M x 1.094 x 10⁻³ From Centimeters C x 0.01094 From Meters M x 1.0936

WINDOM, to ZEPP, to VHF J-POLE.

BUXCOMM BALUNS are more than just antenna matching devices:

- * Help keep RF out of the shack.
- * Provides maximum transfer of RF to the antenna.
- * Elimination of radiation from the feeder cable
- * Makes the antenna radiation pattern predictable.
- * Reduces QRN and TVI to the neighbors.

BUXCOMM BALUNs should be installed at the antenna feed point, or where the coax or feed-line attaches to the above ground antenna. BUX BALUNs are used to connect balanced antennas to unbalanced transmission lines, such as coax cable. Their primary purpose is to prevent antenna (RF) currents from flowing down the outside of the cable. Another function of the BUXCOMM B1C41 is to match the impedance of an unbalanced coax to the balanced feed point of a balanced input antenna(s). BUX Line-Isolator BALUNs may also be installed anywhere along the cable to prevent the destructive influence of induced RF currents (VSWR). The best location for the BUXCOMM (LINE ISOLator) B2LISO is to install it at the output of the transceiver or between the linear and the coax cable feed line to the BALUN at the antenna.

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Reg. tm BUXCOMM Inc.,2004-2012

**Glynn E. "Buck" Rogers Sr., is an RF and Digital Systems Engineer
and pioneer of circular polarized TV transmitting antennas,
digital communications, and digital (HDTV)**

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