Antenna Airborne Research©

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Spec Review utilizes publicly available manufacturer's specifications ("spec") on the product, usually referred to as the "User Manual" or "User Guide." This can include photos and drawings of the product, a product description of the complete product, its components and connection materials. Many User Manuals also include tuning instructions accompanied with VSWR data, such as charts; however, it is important to know if the VSWR data is from a computer model, or actual testing utilizing reliable measurement devices. Tuning instructions sometimes can indicate if the product is simple or difficult to tune, the sensitivity to tuning settings to nearby objects and height above ground. User Manuals might also include instructions on how to match the particular product (antenna) to a recommended feed line, such as 50-ohm coax, plus placement of the feed line and additional suggestions for entry into a radio room (i.e. house).

A Spec Review includes comments on:

__The materials specified that are used to build the components;

__The ergonomics of the product ("user friendly")

__Installation suggestions for the product(s)

__Assembly/building instructions

__Specifications on efficiency, gain, pattern, power rating, environmental survival

__VSWR charts, tuning directions

__Warranty

Field Review is a hands-on assembly and testing of the physical antenna/product, with measurements using appropriate devices (i.e. VSWR meter, VNA) and power handling

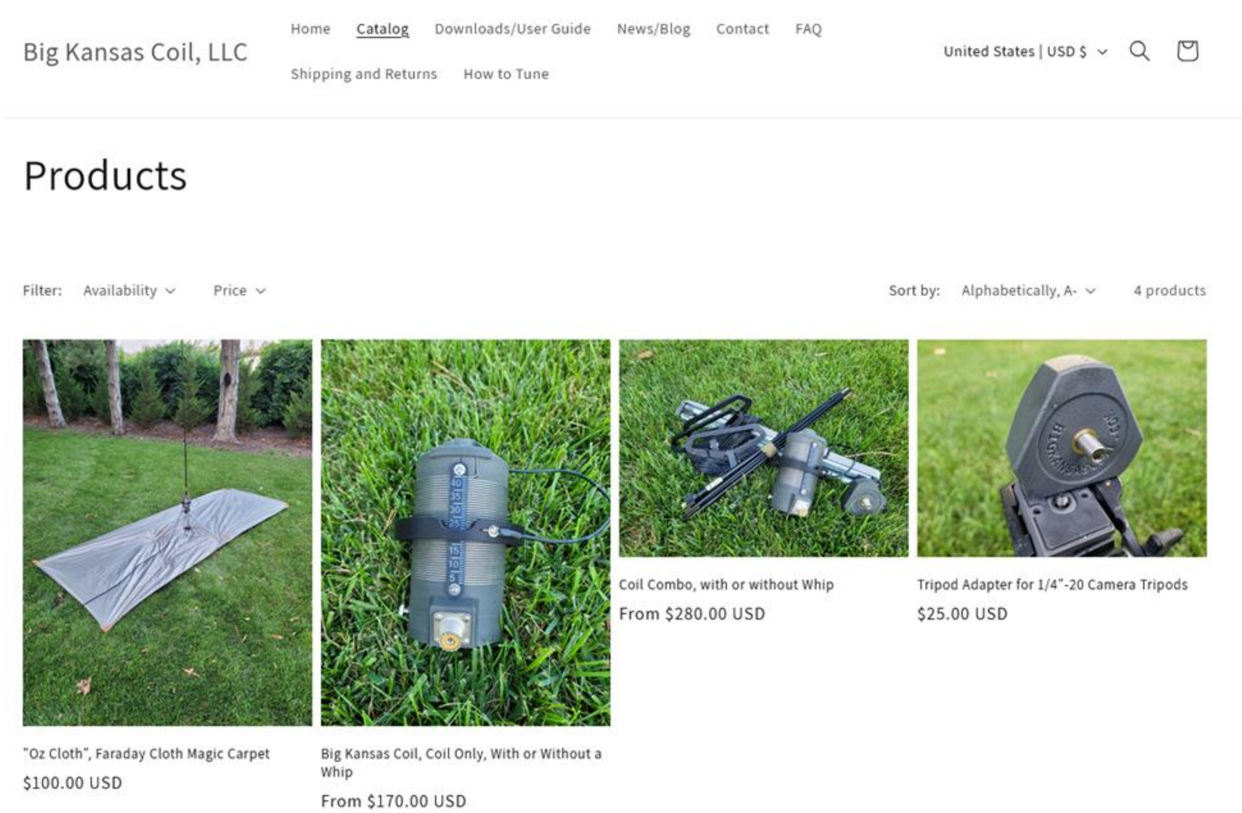
Flight Review includes the above Field Review and adds actual field signal measurements using static signal sources and/or drones through the antenna pattern(s)

AMATEUR RADIO ANTENNA PRODUCT

SPEC REVIEW

using screenshots from the product User Guide

Big Kansas Coil



First Look

__The BKC has a lot of tuning capability with the large coil. The coil is large, which usually means it is low loss ("high Q"). The tuning of the coil also seems to be friendly and simple, with markings for fast resetting.

__VSWR charts are shown for each band, along with length settings for the vertical antenna.

__The components all screw together, making this straight-forward to assemble and use.

__There is a coax connector on the BKC, which makes connection to the rig simple.

__The supplied three (3) 33' ground radials give the impression that the company has thought ahead to provide a radial system for the antenna.

__Optional products continue the impression that the company has designed a complete product.

Looking Deeper

__The VSWR charts show a very flat, wide, low reading for 40 meters and up. The antenna is not tall enough to be this good on the lower bands, which means this is most likely a problem.

__The VSWR charts for 80-75-60 meters look more like practical, except that the vertical antenna is only 97" tall and it is much too short for a reasonable performer on these bands. A full size, ¼ wavelength vertical for 80 is 65-70' tall and this one is only 8'.

__There is no device to adjust the VSWR match and it will be less than 50-ohms on most all of the bands. The only bands it might be close to 50-ohms are 6-10-12 meters, but the tuning instructions have the vertical portion set much shorter than a full-size ¼ wavelength.

__How can the VSWR curves be so flat? Most likely due to lots of loss. There are two clues in the coil description: one is that it is 3-D printed using carbon-infused nylon filament; and second is that the coil is wound using stainless steel wire. Both are sources of loss.

__The above information on VSWR indicates that this product will be a poor performer, especially on the lower bands. The components might be used to make a better antenna.

Detailed Spec Review of the User Guide

Big Kansas Coil, LLC offers several, related products. They are all focused on the core component, their “Big Kansas Coil:

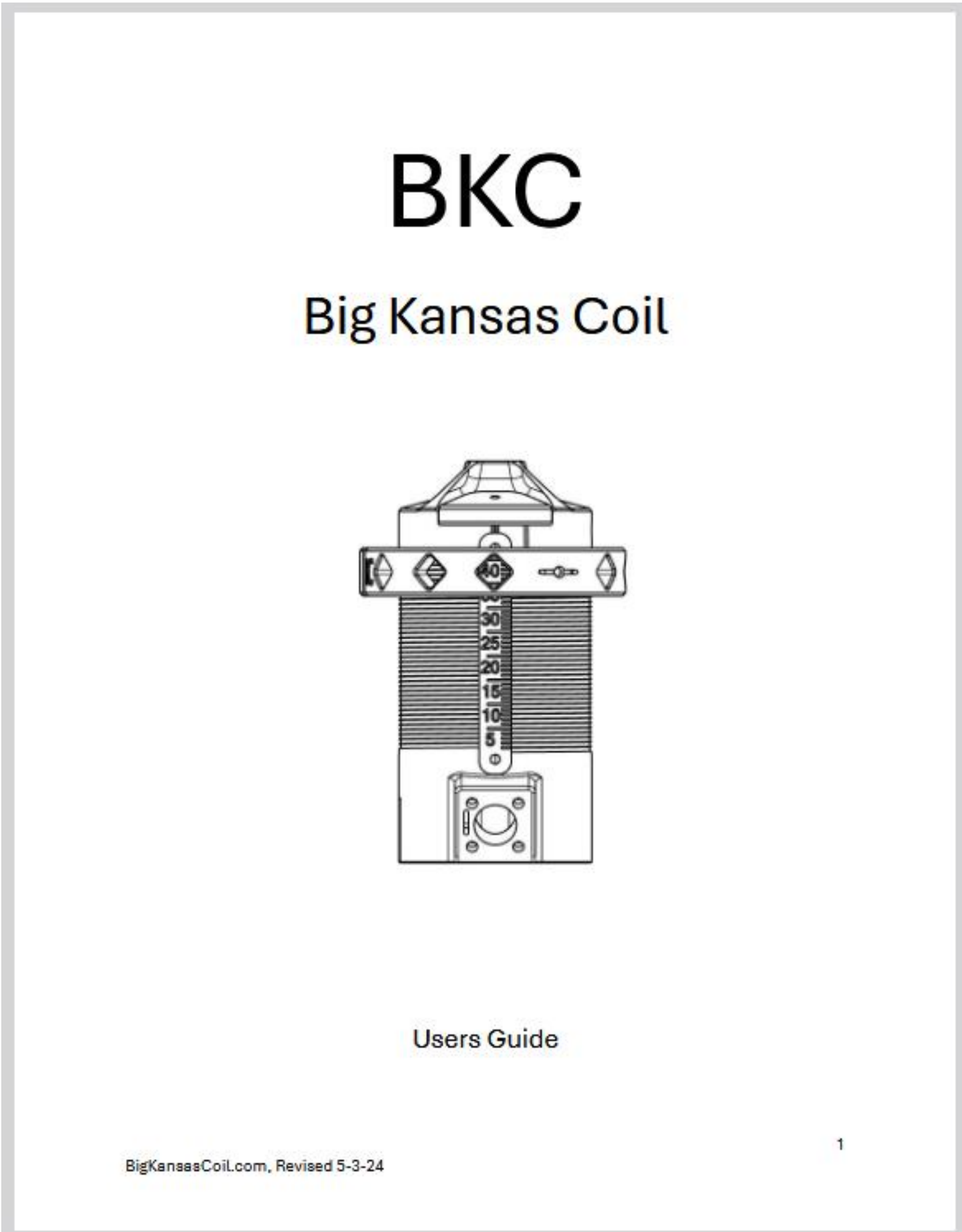
This product is a base-loading device for vertical antennas. Its purpose is to make a vertical of some physical and electrical length look longer/taller electrically by adding inductance at the base of the antenna. It requires the vertical to be attached at the top of the coil. Attachment to the vertical antenna is provided via a female coaxial connector (SO-239) at the base of the coil. This SO-239 connector also connects to a screw terminal on the bottom/side of the coil for attachment to a current return (often called a “ground”, or “radials”) for the vertical.

The coil/vertical antenna combination must be supported above ground and the company has additional products for this purpose. One is a tripod adapter:

The company also has a set of three (3) wires that are each 33’ long that they refer to as “radials” and the User Guide instructs the customer to lay these wires on the ground. The company also offers a metallic, conductive “Faraday” mat for another method of providing a current return. Either of these optional products would be connected to the screw terminal on the bottom/side of the coil to complete their vertical antenna system.

There is a system package available that includes the coil, a multi-section vertical antenna, tripod adapter, short tripod (three short, steel tubing legs) and the three (3) ground wires.

This Spec Review utilizes the information found in the Users Guide and focuses on the core product of the company's antenna system: the coil. Some comments are also offered for additional products.



BKC

Big Kansas Coil

Users Guide

BigKansasCoil.com, Revised 5-3-24

1

Introduction on page 2 of the User Guide (complete Big Kansas Coil User Guide is included at the end of this review):

> ***Important!***
>
> - Do not use near any power lines. If it contacts power lines it can cause an electrical shock and serious injury or death may occur.
> - Keep a clear radius of all vertical antennas and any wires in the air. Improper deployment or windy conditions can cause it to tip over and cause injury and/or property damage
> - Do not exceed any power limits stated, exceeding these limits could cause damage and void your warranty. It is the users responsibility to ensure they are using the antenna properly and take responsibility for any damage to their radio from improper use.
>
> Thank you for purchasing a Big Kansas Coil! This manual is to help you get the most out of your antenna and how to tune and deploy it. Great pride is taken in the quality of product we sell, but if any problems do arise, please email bigkansascoil@gmail.com

These are fairly typical cautions to the customer, along with a "Thank you" to the customer. It also references their warranty, which is found on the last page (page 10) of the User Guide and consists of one (1) line. There is no stated beginning of the warranty period, nor is there a procedure provided, so perhaps the customer would contact the manufacturer via the email link on the last line of the Introduction.

> **Warranty Information**
>
> The Big Kansas Coil is covered by a 1 year limited warranty against manufacturing defects.

The next portion of the User Guide is the set-up section:

> **Setup**
>
> Locate a suitable place for the antenna, staying clear of any potential hazards and metal structures.
>
> Setup a tripod/stake/anchor for the coil to affix to. If using a spike, never drive it in with the coil attached!
>
> Thread the Big Kansas Coil onto the mount
>
> Thread the whip onto the top of the Big Kansas Coil
>
> Deploy radials, stretching them straight out from the base of the antenna in an even pattern.
>
> Attach coax to antenna and radio
>
> Tune coil and enjoy!
>
> Antenna is rated at 100w digital 50% duty cycle.

Referring to “the antenna”, it is presumed that the coil (the “BKC”) is now a component of the antenna system. This would include an appropriate base of some kind, such as the optional tripod. They also mention using a spike in the ground. Whichever attachment is used for the base, it requires a threaded shaft that screws into the base of the BKC. A caution should be noted that if the user is operating in a park, they need to be sure that pounding a spike into the ground is allowed.

> **Tripod**
>
> The tripod utilizes galvanized steel tubing as legs and 8-32 set screws to secure them into the holder.
>
> Start by removing the legs from the holders.
>
> Insert legs into the tripod center section and hand tighten thumb screws.
>
> If necessary secure the tripod down with a tent stake and a rope to the center section, recommended for 17’ whips or high wind days.

> **Radials**
>
> The radials currently sold by Big Kansas Coil are 3 pieces of 33’ 20awg tinned copper wire with a silicone insulation for high flexibility and wrapped on a wire winder. They come with a ring terminal pre attached for fastening to the #8 thumb screw on the side of the coil.
>
> Unroll them from the coil outward in a straight line equally spaced. If they are wrapped with an X pattern you can unfold them just by walking backwards and it will pay off the wire winder.

The supplied radials are tinned copper wire, which is an excellent conductor. The ring terminals on one end makes it simple to attach to the screw terminal on the bottom/side of the BKC. Laying these on the ground is certainly not an optimal current return system; however, these will provide a usable system to operate on the stated bands.

There are several accurate writings concerning the effects of placing radials on the ground. Perhaps the most well-known empirical work is by Rudi Severns, N6LF. His writings are readily available on the Internet, with several on the A.R.R.L. QEX source. Our empirical testing over several years tracks Mr. Severns’ data. Generally, radials that are laid on the ground are 20-30% too long at a specific design frequency. For example, a ¼ λ (¼ wavelength) radial wire cut for the amateur 20-meter band will be 234/14.1MHz = 16.5’ long. If you lay these radials on the ground, attach them to a properly constructed ¼ λ vertical and then run your trusty analyzer on it, it will show the lowest VSWR at around 12MHz, maybe lower. This is because the antenna system (vertical + radials) is electrically lower in frequency than intended. The feed point is not at the center of the antenna system and the highest current point is in the ground. We then want to raise the resonant frequency (the dip) of the antenna, so we shorten the vertical portion. This achieves our goal, but shifts the feed point further off-center, increasing current imbalance and moves the highest current point further down the radials and into the ground. Overall, we now have a vertical antenna system with high loss. This loss can be even higher by not using a current balun between the coax feed line and the antenna feed point. Without the balun, the shield of the coax becomes part of the antenna system, which makes the actual length of the antenna unknown and brings the antenna (energy) into the radio room and house. To minimize the antenna system loss and, therefore, maximize the efficiency, there are several methods. One is to shorten the radials and increase their number (to at least 16), as indicated by N6LF's work. This is relating to a single band antenna, but can be effective to some extent for multiple bands using shorter lengths and higher radial count. Another method is elevating the radials above ground. Two, tuned, elevated radials for a particular band (ref: "Gull Wing radials") is an excellent choice. A third is to have a pair of elevated, short radials that are then tuned to the band in use. These methods refer to the current return for the vertical portion of the system. Measured improvement changing to a single pair of tuned, elevated radials from a minimal ¼ λ ground radial set-up (i.e. 2 or 4 wires) shows a gain of +6-7dB. The key is to not have ground contact with the current return system. The use of the so-called "Magic Carpet" Faraday mat, is not a good solution, as what it does is offer an untuned ground contact, although it is convenient.

Tuning

The BKC is capable of tuning from 6m-80m with a collapsible or telescoping whip and 15-80m with a solid 102" whip.

Tuning is best done with an antenna analyzer for the first time. If not available to you, rough tuning is done by tuning to the loudest noise/signal and then fine tuning with the rig SWR meter.

The lower the scale reads, the less coil is engaged, and the higher frequency it is resonant at.

Higher scale readings engage more coil, and the frequency lowers.

Using the Tuning Ring shorts out the coil and therefore changing how much of the coil is engaged at any time. To change bands you can slide it vertically or move it radially around to fine tune it.

On the top are **A, B, C,** these are there to give fine tuning marks, as you rotate the tuning ring counter clockwise going from A to B to C, you are engaging more coil.

As you rotate the tuning ring and come across the scale on the front, you can just roll right over it carefully.

The diamond cutouts in the tuning ring allow you to read the scale and align it with the desired position. Every 5th coil is denoted by a long has mark and text. Example, the number 5, that is the long has mark above the text "5".

After finding your frequencies for your whip/radial setup, write those numbers down so they are easy to return to for your next use.

This section of the User Guide will be the most used part of the guide, as it instructs the user how to tune the antenna system using the BKC. The first sentence specifies the basic physical form of the antenna:

> **Tuning**
>
> The BKC is capable of tuning from 6m-80m with a collapsible or telescoping whip and 15-80m with a solid 102" whip.

The statement says that a whip length of 102" is required to cover 15-80 meters. The upper bands, 12-10-6 meters implies shorter lengths, as the reference is to a "collapsible or telescoping" whip. This is confirmed by the next section:

> **Tuning Starting Points**
>
> Here are some starting points for frequencies using a collapsible 6 section 97" whip and 3x 33' radials
>
> **4 Sections Folded Down**

Band	Frequency, MHz	Coil Position
6m	50	2

> **2 Sections Folded Down,**

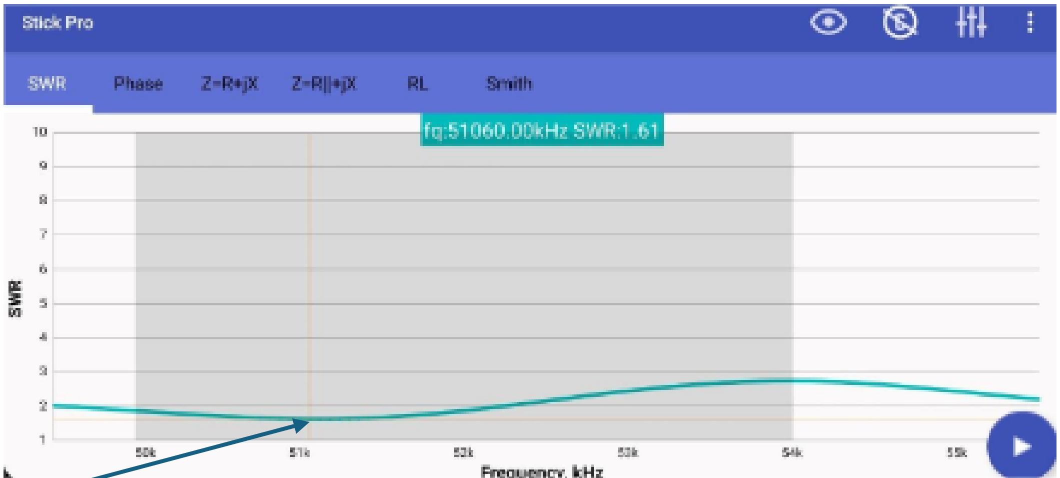
Band	Frequency, MHz	Coil Position
10m	28.3	2-B
15m	21.2	3-B

> **Fully Extended**

Band	Frequency, MHz	Coil Position
17m	18.11	4-C
20m	14.15	6-C
30m	10.1	10-B
40m	7.150	15-C
60m	5.358	22-C
80m	4.0	34
80m	3.5	38

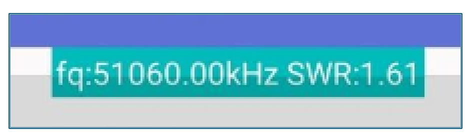
Following the above are several VSWR charts. Each one offers information as to the probable efficiency of the antenna system. The comments are made presuming the three (3) 33' radials are on the ground, or that their optional Faraday mat is being used for the ground system (the current return).

SWR Plots using 97" Whip and 3x 33' Radials

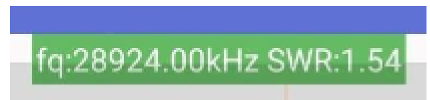


6m SWR, 6 Section Manpack, 4 Sections Folded

10m SWR, 6 Section Manpack, 2 Sections Folded



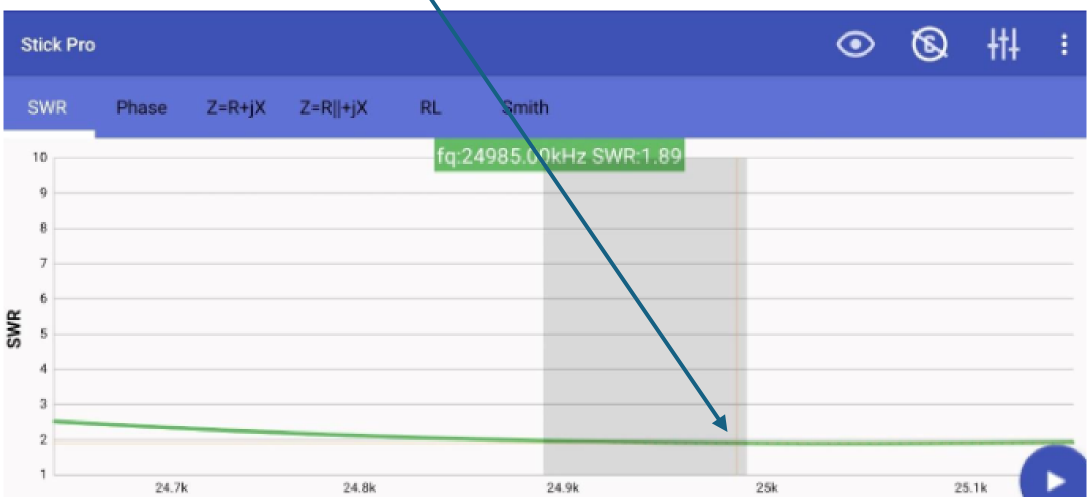
The upper plot is for the 6-meter band. It highlights 51.060 MHz as having the lowest VSWR of 1.6:1, as indicated by the arrow pointing to the vertical line on the display. A ¼ λ vertical for this band would be approximately 56" tall. At the top of the chart, it reads a 97" whip and then at the bottom of the chart indicates 4 sections folded. The 97" whip has 6 sections, so each calculates to a little over 16". If four (4) are folded, that leave two (2) for a height of 2 x 16" = 32", a little under 3'. This is obviously quite short, so the actual height is unknown without physically measuring the whip. Since this is a Spec Review and not a full, physical review, the actual whip length is unknown. It does, however, use a short portion of the BKC for loading at the base, as well as all three (3) of the 33' radials, so we know that this will pull the frequency of the vertical down: the BKC adds inductance and the radials are way too long for this band. It might be that to get any usable VSWR on 6-meters (with the long radials), the whip needs to be this short. With this configuration, a VSWR of 1.6:1 probably means the feed point is above 50-ohms, rather than below, so it would be 50 x 1.6 = 80 ohms. (An 80-ohm feed point with no reactance calculates a VSWR as 80/50 = 1.6 .)



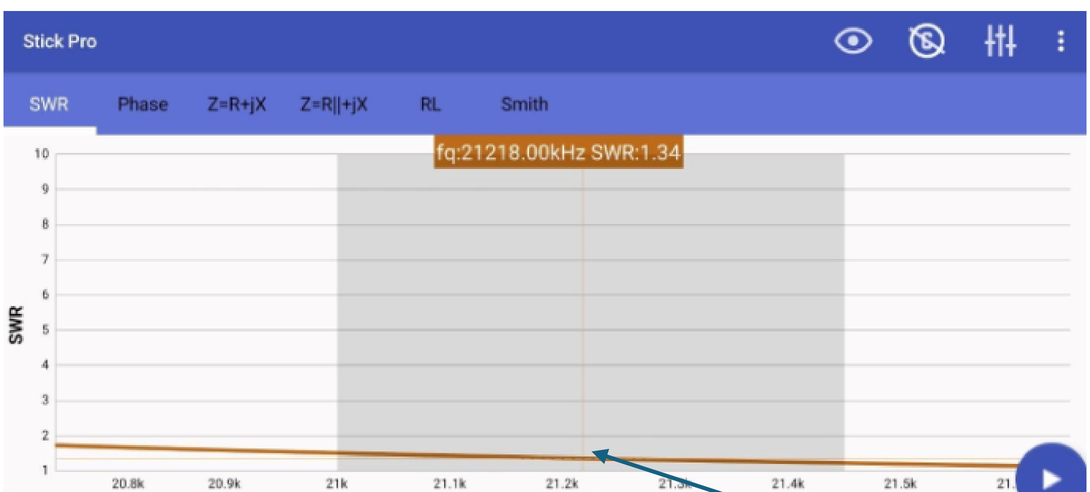
The 10-meter VSWR plot is the lower one on the chart. It highlights 28.924 as the lowest VSWR in the band at 1.54:1, as shown by the added arrow pointing to the vertical line on the display. A ¼ λ vertical for this band would be approximately 98" tall. At the top of the chart, it reads a 97" whip and then at the bottom of the chart indicates 2 sections folded. With two (2) sections folded, this whip length is 4 x 16 = 64". Again, this is quite short, but it is using a small portion of the BKC for loading at the base. The full-length whip (97") would be close to the right length. This set-up is also using the three (3) 33' radials on the ground, so we know they are pulling the frequency low. Like the 6-meter, the 1.54:1 VSWR probably means the feed point is above 50 ohms, close to 80 ohms. If these verticals were intentionally long and either fed off-center, or end-fed, the impedance could well be high, but they are set up as ¼ λ verticals.

Both the 6 and 10-meter installations are likely to have substantial loss. This is due to using the three (3) ground radials that are much too long for the frequency bands in use. This is causing the vertical whip to be shortened and the maximum current is in the ground. A full-size ¼ λ vertical with a proper current return (i.e. 2, tuned and elevated radials) will have a feed point of about 33 ohms. Both the 6 and 10-meter look like they are 80 ohms, so when we start with 33 ohms, we need to find 47 more ohms to arrive at 80. This would be in the form of loss. A simple calculation for efficiency is 33/80 = .41%, which means the antenna is losing about -4dB. Where does this loss come from; or, in better grammar, which components contribute to the loss? The answer is: the whip material, the radials on the ground and the core component in this antenna system, the BKC.

The next two (2) charts are for 12 and 15-meters. Both charts show that two (2) sections of the 97" whip are folded. Remembering that each section is a bit over 16", four (4) sections are now in use for a total of 4 x 16" = 64". The height for a full size ¼ λ vertical on the 12-meter band calculates at approximately 234/24.9MHz = 9.4' = 113". As before, the vertical is physically quite short. Even if we add another 16" to 64", it comes up closer, but still short at 80". There is a small amount of the BKC added at the base and all three (3) of the 33' radials are also deployed. They remain too long, so the frequency of the system is pulled lower. The system on 12-meters is a short, base loaded vertical with three (3) radials that are more than 3X too long, all adding up to a vertical with a high feed point impedance. This is clearly shown on the provided chart for this band, as the best VSWR is 1.89:1, indicating either a feed point at 50/1.89 = 26 ohms, or 50x1.89 = 95 ohms. The latter (95 ohms) is the most likely and, calculating against the 33 ohm ideal vertical feed point, indicates an efficiency of 33/95 = 35%. This equates to a loss of -4.8dB in this configuration.



12m SWR, 6 Section Manpack, 2 Sections Folded



15m SWR, 6 Section Manpack, 2 Sections Folded

The 15-meter chart is similar to 12-meters. The lowest VSWR is in the middle of the band, which would appear to be good; however, like the 12-meter band, it looks like the feed point value is too high. The best VSWR is at 1.34:1 and this most likely means the feed point is above 50 ohms at 67 ohms. The ideal 33 ohm feed point for a full size vertical in relation to this 67 ohms indicates an efficiency of 50%, or a loss of -3dB. This loss is from the short vertical, base loading from the BKC and long radials on the ground.

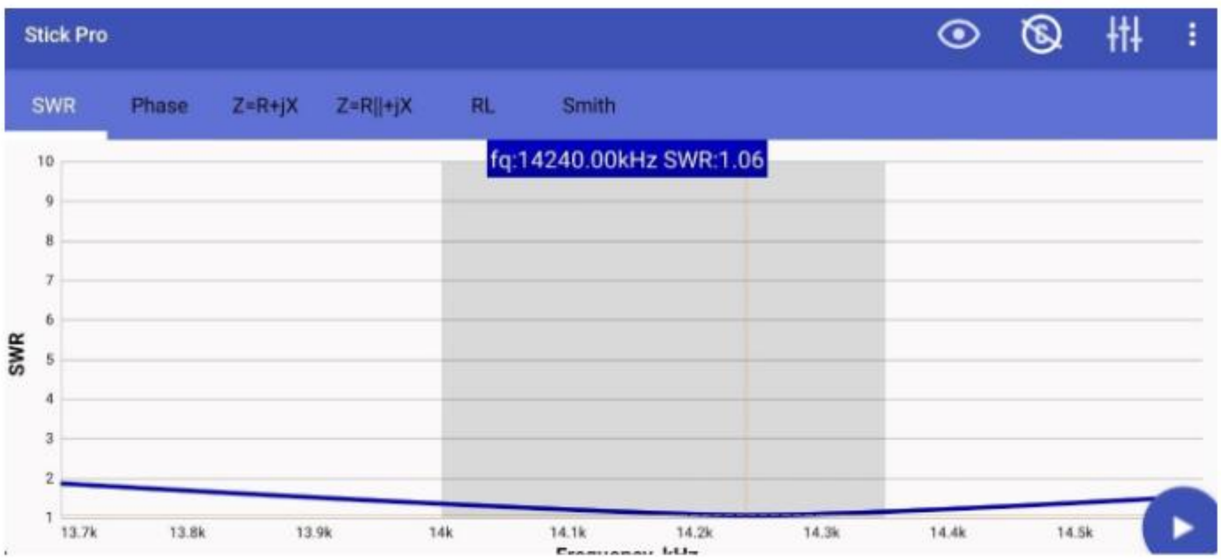
The above VSWR charts indicate that on the top four (4) bands, the VSWR, or resonant point, is not well-defined at all. One normally will notice a significant dip in the readings, but such is not the case. On three (3) bands (10-12-15 meters), the VSWR is a slope. On 6-meters, the VSWR trace is a wavy line, also without a definite dip within the band. Having a sloping reading without a defined, resonant dip indicates the antenna simply is not resonant, but has a VSWR that is usable on each band. The remaining charts for the lower six (2) bands show a defined dip in VSWR on each band. The first two bands, 17 and 20-meters, are very shallow and wide, but there is a dip within each band.

17m SWR, 6 Section Manpack

The vertical is now all six (6) sections, for a height of 97" – no more maybe adding one more section and more turns of the BKC are now included at the base of the whip. The lowest VSWR is right in the middle of the band and noted as 1.07:1. A full size ¼ λ vertical for 17-meters calculates at 234 / 18.1 = 12.9' = 155". The whip is full size at 97", so it is physically and, therefore, electrically, too short. The BKC comes into play here, using more turns on the coil to ass base loading to the whip. The three (3) 33' radial wires are still on the ground and we know that this will pull the frequency down, because they are still too long. A full size vertical with two (2) full length elevated radials at a low height of 15" above the ground (about the height of the BKC package) is on the order of 25 ohms. What is the feed point impedance of an antenna that is 62" of full size with two (2) elevated radials and base loaded according to a computer model? The answer is 13 ohms and the 2:1 VSWR bandwidth is approximately 400 kHz. The chart above for the BKC shows it measures less than 1.4:1 for over a MHz and dips lowest right in the band as a VSWR of 1.07:1.

This means that it is resonant in the band and that the feed point is reading right at 50 ohms. This is the first time on these charts that we have a condition where we should have a feed point substantially less than 50 ohms, yet it is reading 50 ohms. Normally, there would be an impedance step-up device, such as a simple hairpin coil across the feed point, but there is none. This is direct feed from the coax line. Where does the extra 37 ohms (50 - 13 = 37) come from? It comes from loss, a small amount from the whip, some from the radials on the ground (although their affect has been adjusted by resonating the vertical using the BKC) and the major amount from the BKC. A rough estimate of the efficiency is 13 / 50 = 26%, which is a loss of -8.9dB.

The 20-meter chart resembles the 17-meter chart:

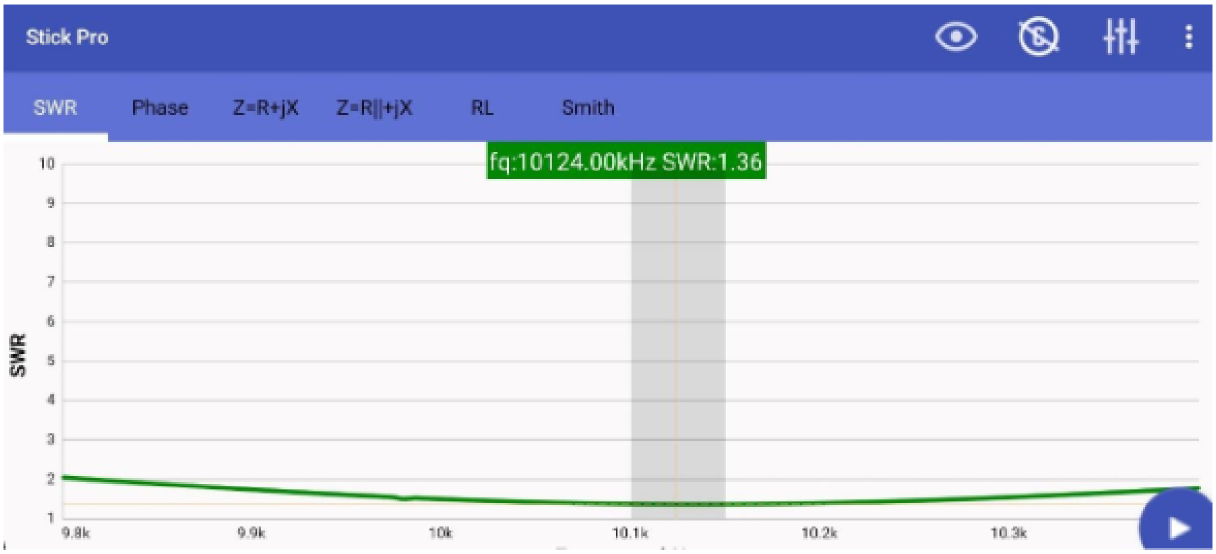


20m SWR, 6 Section Manpack

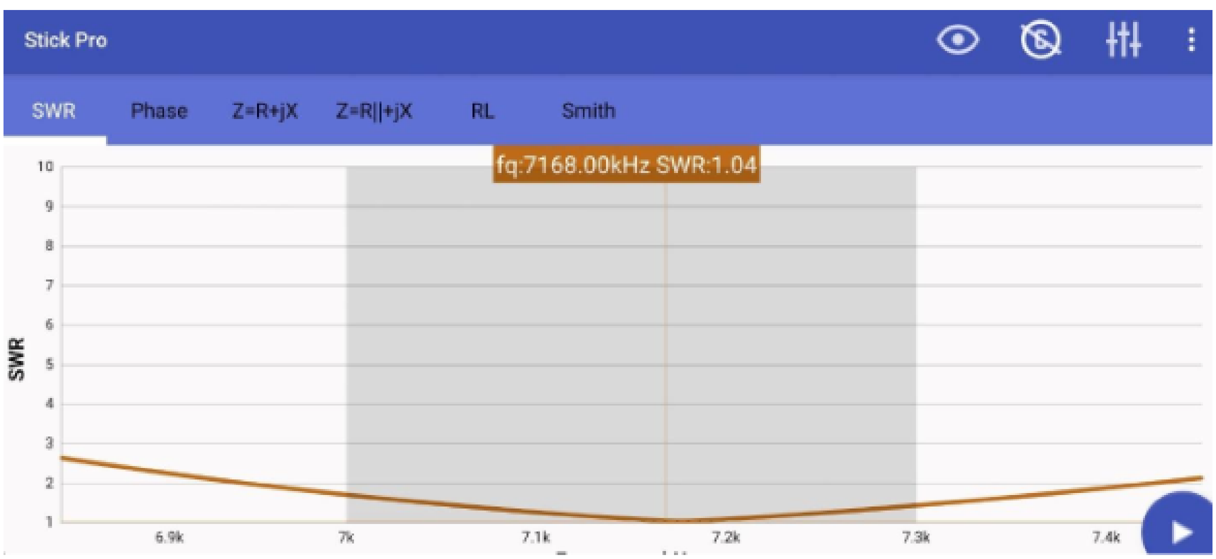
The chart shows a VSWR of less than 2:1 over a MHz again, with a dip and lowest VSWR in the 20-meter band. Using the same procedure as on 17-meters, a 97” vertical on this band, base loaded to resonance, with two (2) full length, elevated radials will have a feed point of about 7 ohms. When this antenna is matched, bring it up to 50-ohms, the 2:1 VSWR bandwidth is about 150 kHz, far less than the above chart showing more than 1 MHz. Once again doing a rough efficiency calculation, it is on the order of 7%, for a loss of -11.5dB.

There are many who will say that losing this much is only two S-units, so it isn’t all that much. This is certainly untrue. Those who actively operate in the HF bands, especially those chasing DX and doing competitions, know that 2dB is significant, much less 6 times this much. While this antenna certainly can make contacts on 20-meters, it is accomplished by the other station making up the difference in the signal path.

The lower frequency bands demonstrate that the BKC can resonate a short antenna (radiator) and have a fairly wide operating bandwidth (i.e. 2:1). The issue is the efficiency of the BKC components. We will look at the 30 and 40-meter bands together:



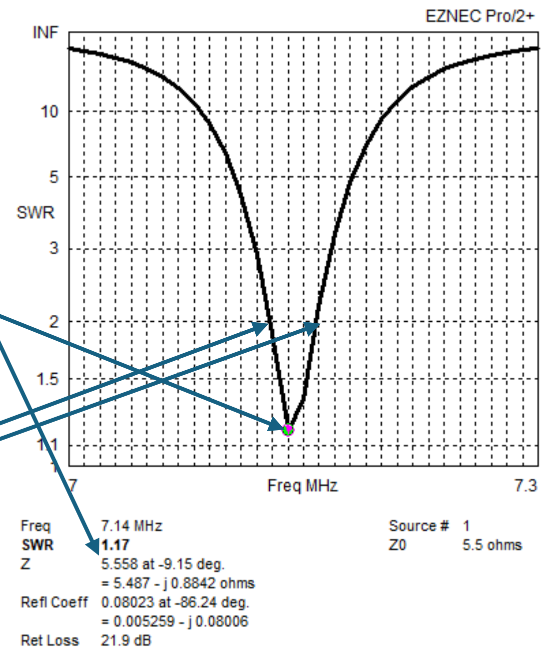
30m SWR, 6 Section Manpack



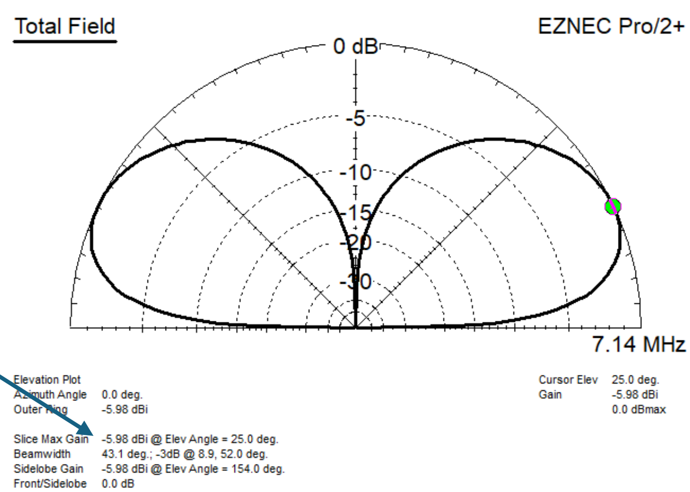
40m SWR, 6 Section Manpack

Both of these bands depend on the BKC to resonate the vertical on each band. The ground radials are still too long, but not as severe as the higher bands. The radiator continues to be extended to the full 97” height as on the 20 and 17 meter bands. To summarize calculated data as above for 20, a full size 30-meter vertical will be approximately 278” and on 40-meters, 395 inches. It is obvious that there needs to be a fair amount of loading to bring a 97" vertical into resonance on 30 and 40. On 30-meters, the vertical will have a feed impedance of about 3 ohms with enough base loading and using two (2) full length, tuned and elevated radials. On 40, the base loaded 97" vertical at resonance will be less than 2 ohms and a 2:1 VSWR bandwidth of less than 50 MHz. Looking at the charts for 30 and 40-meters, it should be apparent that the published VSWR curves are way too optimistic for this very short vertical. They are only this good looking due to substantial loss in the components. On 30, the efficiency calculates to about 3%, with a loss of -15dB and on 40, the efficiency is less than 2 ohms and a loss of -17dB.

An EZNEC simulation representing a best-case short vertical for 40 meters is included here. The vertical is aluminum (not stainless steel), 100" tall, has full length, tuned radials and the entire antenna is elevated 36" above ground. It is resonated with a loss-less coil of 17.3uH. The chart to the right is showing the feed point ("Z") at the bottom of the track is reading 5.5 ohms. This is the actual feed impedance of a short (100") vertical with full-length radials and resonated with the 17.3uH coil. The VSWR graph is set to show the VSWR bandwidth using the 5.5 ohms as the base, not our usual 50 ohms. It shows that 2:1 VSWR bandwidth is approximately 30 kHz.

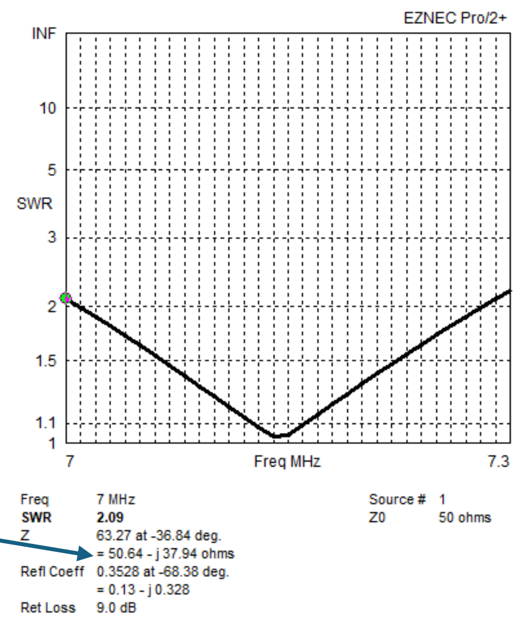


The elevation plot (looking at the antenna from the side) of the antenna over typical ground is shown to the right:



The plot shows a maximum gain (Slice Max Gain) of -5.98dBi. This means the gain is being compared to the theoretical, iso-tropic source, represented by the small letter "i" after "dB". What else might we be able to do here to get a better idea of the BKC performance on 40 meters? One obvious task is to see if we can widen out the VSWR response to look more like that in the User Guide.

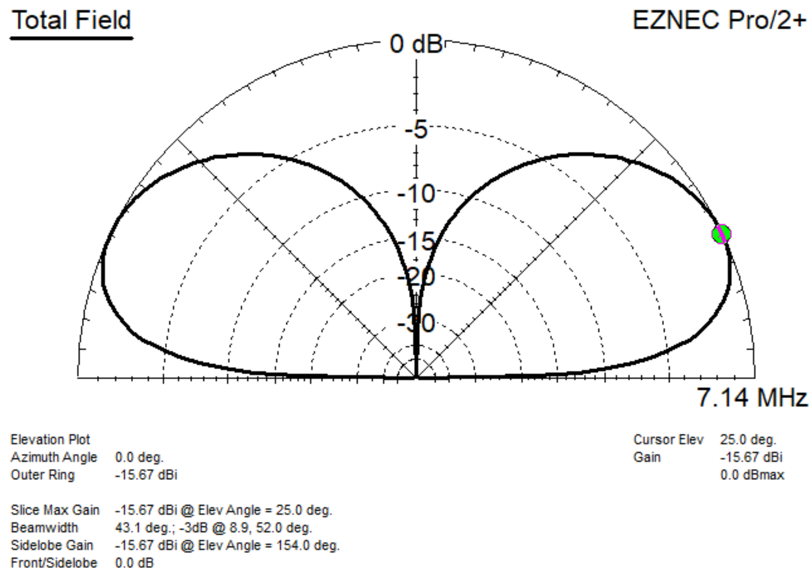
The main method to widen a VSWR bandwidth is to add loss in the antenna system. This can be done in the model by including resistance in the load (the 17.3uH coil). From the above simulation, we know that an antenna without much loss (all aluminum) has a feed point of about 5.5 ohms. This would give us a VSWR of 50/5.5 = about 9:1 if we fed it directly. We could, of course, include an impedance step-up device, such as a hairpin coil across the antenna feed points and increase it to 50 ohms; however, there is no device in the BKC system. We are left with adding resistance to add to the 5.5 ohms and get it to 50 (what our coax feed line wants to see). We now add 45 ohms of resistance to the 17.3uH coil, making the antenna feed point 50 ohms. The result VSWR plot using 50-ohms as the basis is on the right:



This covers the whole 40-meter band, but how does it look compared to the User Guide chart? Trying to properly overlay the two VSWR plots, we can see that adding 45 ohms of resistance broadens out (flattens) the plot, but not even quite as much as the User Guide shows. It can be presumed that there is more loss in the BKC system than in our simulation. How much did we lose in antenna gain by adding the 45 ohms?

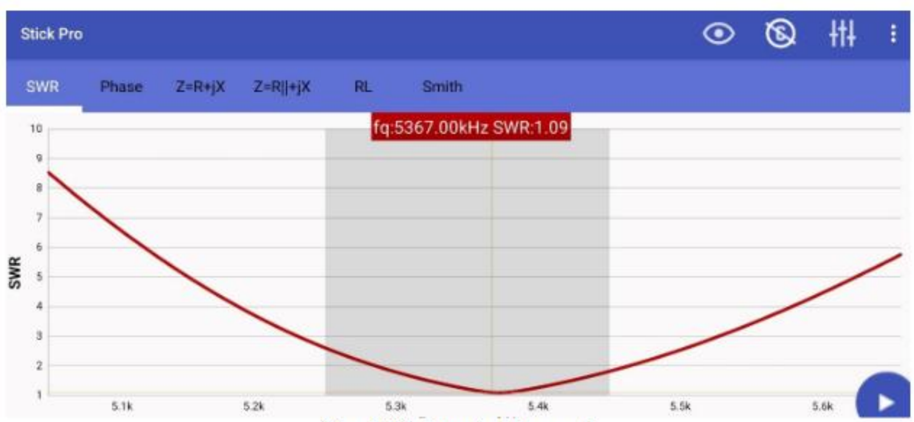
40m SWR, 6 Section Manpack

The plot to the right is the simulation with the added 45 ohms of resistance in the 17.3uH loading coil. It shows that the gain is now -15.67dBi, which is a significant loss of 10dB. Remember that this model includes full-length, tuned radials, etc., so its feed point is higher and loss is less than the BKC system.

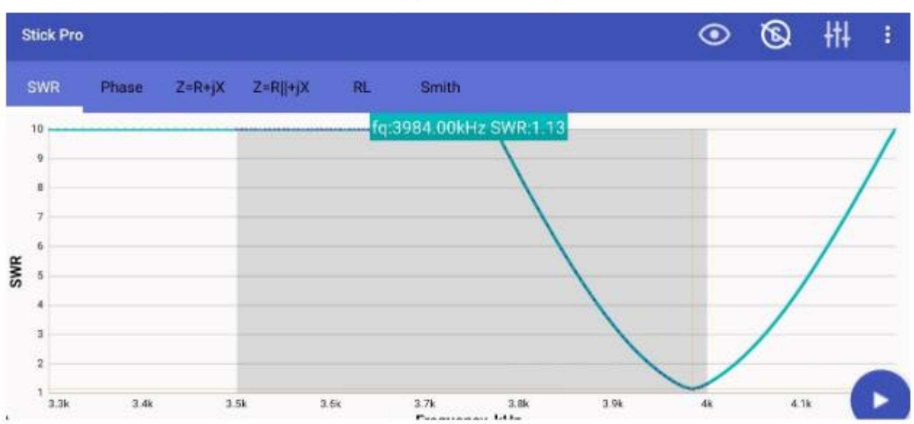


The above simulation is typical of what one will find on all the bands using the BKC system. The VSWR charts are far too good for an efficient antenna system.

The next charts for the lower three (3) bands show much narrower VSWR plots, but have the same issue as the analysis above. The feed point is always around 50-ohms, but it should be much lower. This means, once again, that there is always significant loss in the BKC system.

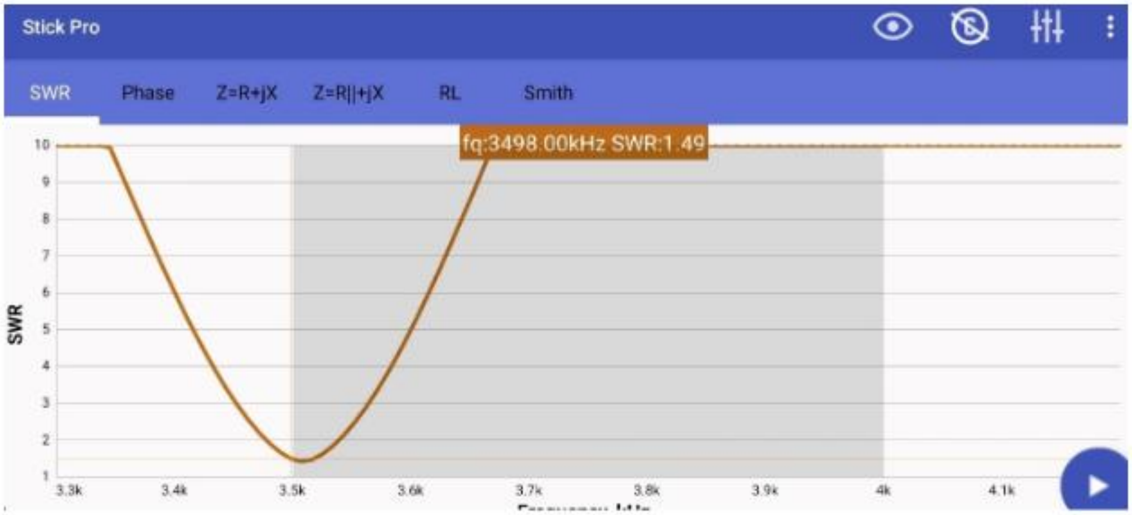


60m SWR, 6 Section Manpack



75m SWR, 6 Section Manpack

Now to the three (3) lowest bands, 60, 75 and 80-meters. All of these require a very substantial amount of loss to achieve resonance in the band and offer any operating bandwidth.



80m SWR, 6 Section Manpack

The antenna feed points on the above 60, 75 and 80-meter bands are all less than 2 ohms, possibly even in the 1-ohm range. The efficiency is less than 2%, with a loss in the antenna system of probably -20dB. This should be expected, as a full size 80 vertical is on the order of 70’ and the whip is only 8’.

Where does all this loss come from? It is mainly in the BKC, the coil. The whip and radials on the ground add to it, but the coil is the main contributor. The web site states the construction of the BKC as shown:

> The Big Kansas Coil is a 3d printed, lightweight, portable base loaded vertical coil. Manufactured out of engineering grade Glass and Carbon Fiber filled Nylon material, it stands up to heat, weather, and rugged portable use without any problems. It is made with 16ga stainless steel wire wrapped around the coil body and allows you to go from 6m all the way to 80m, with a telescoping whip, in a coil less than 6.5” tall and under 14oz!

__A. The coil core contains carbon fiber, which is a poor conductor, but conductive nonetheless

__B. The coil is stainless steel wire, which is a very poor conductor

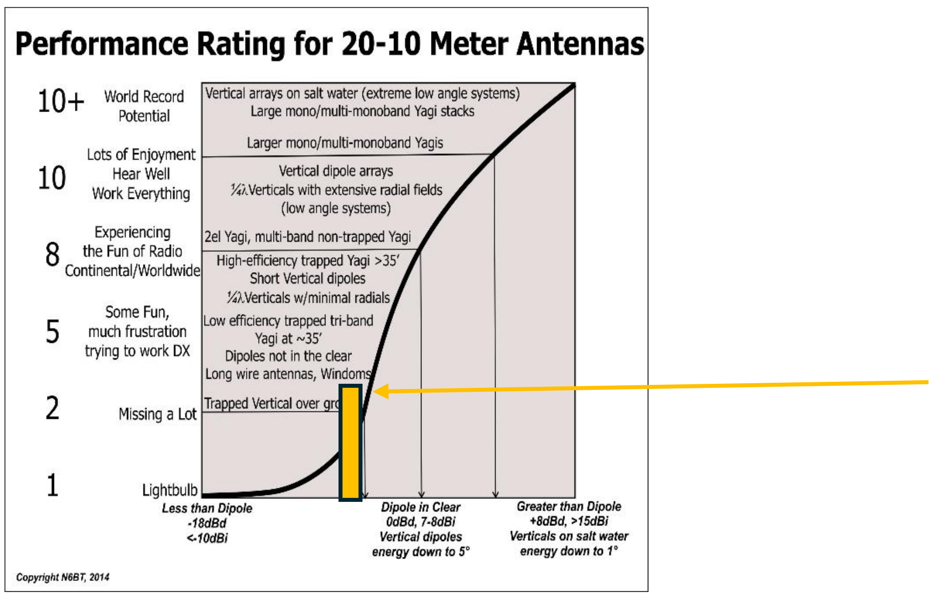
The construction of the whip is not known. Telescoping whip antennas typically have heavy chrome plating (either shiny chrome or black chrome), which is also a poor conductor and contributes to loss.

REVIEW CONCLUSIONS

Marketing focus: low VSWR and ease of tuning

Overall impression: very nice looking, functioning products, user-friendly assembly and adjustments

Probable performance: can make contacts, but with substantial loss. Best opportunities for contacts are on the higher bands, such as 15-12-10 meters. The loss on the lower bands increases substantially. Using the following graph, which relates antenna efficiency to enjoyment of amateur radio, this product would fit as shown on 15-10 meters, providing about a level 2-3 of enjoyment of radio:



On the lower bands, the performance will be substantially lower.

Ways to improve this product:

__rewind the coil using tinned copper wire (replacing the stainless steel). This still leaves the coil core with carbon-infused nylon, but will make a noticeable improvement. The VSWR curves will be much narrower, indicating increased efficiency and less loss.

__raise the radials off of the ground; use two(2) for the band in use and have them elevated (ignore the Faraday mat)

__attach a small copper wire at the base of the telescoping antenna and run it alongside the telescoping antenna (now only a support) to have a good vertical conductor __use a notebook to keep records of the vertical settings with the copper wire and re-wound coil

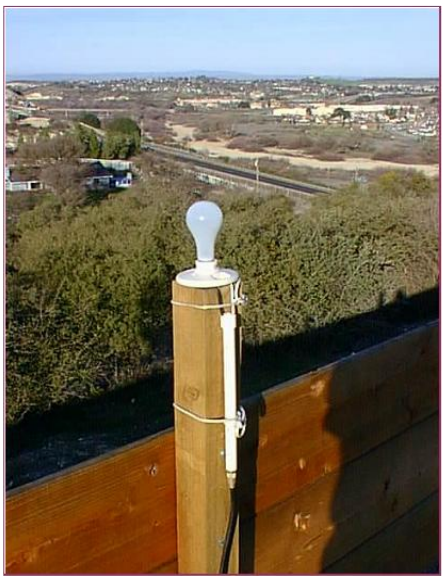
__use a 1:1 current balun or coaxial RF choke close to the feed point

__will likely need a hairpin matching coil across the feed point to bring the feed point up to 50-ohms. If this is needed, the antenna is now much more efficient and the VSWR will make a good dip on an analyzer, plus the 2:1 operating bandwidth will be narrower than the original by a lot.

__when possible, such as on POTA and SOTA, position this vertical adjacent to sloping ground that is sloping downward in the desired direction for contacts.

…end

Remember: Everything Works – the key is, "Compared to what?"



This lightbulb was used in the A.R.R.L. International DX Contest with 120 watts; worked 28 countries and all continents.

The write-up is found back in QST, July, 2000

Everything Works

Your enjoyment of Amateur Radio is directly related to your antenna—although anything will "work."

"N6 Bravo Tango, this is N0 Papa Golf. Tony, Iowa, number 69591." I made it with one call: February 5th, 2000, my first contact with "The Illuminator." KB9TQI, Indiana; N0IJ, Minnesota; K4CIH, Alabama; WA9TPQ, Illinois; N5MT, Texas; KB0MZG, Kansas; and, KX9DX, Illinois were other contacts made in the 10/10 Contest, slipping into the radio room from time to time while working in the yard. The path to Indiana was the farthest on record for me with the 150-W light bulb perched on a fence post. What a pleasant surprise, and there was more to come.

One of the most important aspects of building and evaluating antennas is actually using them in environments where the performance can be measured in a meaningful manner. Claims for how well various antennas "work" are as plentiful as snow flakes in winter and this subject has surfaced in one way or other at every forum or club discussion I have presented since 1978. How many times have we heard someone say, "My antenna really 'works'"?

Performance Envelope

What does the word, "work" mean? The answer is, ***everything does work, to one degree or another***. I hope that everyone will agree that this statement is absolutely true. How well it "works" is the issue and this is the "performance envelope" of the antenna system.

The first time I presented this idea was at the ARRL Pacific Division Convention in the fall of 1998. It was well received and I was encouraged to completely rewrite all of my material. My revised presentation was first viewed at the ARRL Southwestern Division Convention in the fall of 1999. It was further augmented and presented a couple weeks later to a packed double room audience at the ARRL Pacific Division Convention. There were more than a few eyebrows raised when I began with the digital slide, "Everything Works." It seemed to be out of character, because I always focus on efficiency.

I followed with an example of my first antenna, which enabled me to make contacts all over the West Coast on the 40-meter Novice band. I was WV6KUQ and the year was 1959. It was a very simple antenna, since it was the screen on my bedroom window. I made contacts, so I thought it was doing all right. My high school science teacher, the late "Doc" Gmelin, W6ZRJ, tactfully informed me that it probably was not the best antenna and that it could be improved. He was the one who had given me my Novice test, became my Elmer and later was my high school physics teacher. At his suggestion, and with my Dad's assistance (both he and my Mom always encouraged and supported my adventures), we put up a Windom antenna. It was easy and did not require coax. The Windom certainly was not the greatest, but it was a tremendous improvement over the window screen. The performance envelope of the antenna system had been extended.

Witnessing the obvious improvement between the window screen and the Windom sparked my long-term interest in antennas. The performance difference between the two could best be summarized as, "Wow! This is going to be a lot more fun." The Windom antenna enabled me to make my first out-of-state QSO with a fellow Novice back in Delevan, Wisconsin. This was almost 2,000 miles away and we talked for more than 30 minutes. We then put up a vertical antenna for 40 meters made by attaching a large, insulated stranded wire on a wooden 2 × 4 frame. The ground system was a single ground rod (not very efficient, I later learned). This antenna enabled me to make my first DX QSO with JA2CMD. With my Dad's help again, we graduated to a 2-element, trapped tribander, which we managed to raise to 30 feet on a telescoping mast atop the roof. From my experience it was so impressive that I thought it must be the absolute best antenna possible.

This impression, of course, was incorrect. It was only the best one I had used so far. It was my personal, limited perception; certainly not an accurate assessment of the true situation. Strange as it might seem, it has taken years to realize that most everyone goes through this same learning process. Today, even with all the books on various antenna subjects, there remains a similar gap between perception and reality. My reality came into sharp focus in 1983.

Gary Caldwell, VA7RR (WA6VEF at the time), and I went to Saipan for the CQWW CW contest (AH0C). I had operated twice before from the southern end of the island utilizing the existing quad antennas of Byrd Brunemeier and Don Bower who worked for Far East Broadcasting Company (FEBC). After setting up the stations, we were asked if we would rather move to the north end of the island and use the FEBC short-wave broadcast antennas. These were located on Marpi Cliff, about 400 feet above the ocean. That decision took about two seconds.

We had brought along a typical trapped (new) tribander and a 30-foot mast. We also had about 1200 feet of coax. The antennas made available for us at FEBC's site were three TCI-611 curtains, designed for operation between 8-18 MHz (we used them on 40, 20, 15 and 10 meters). Each one cost

A single Illuminator. Notice the balun attached to the side of the post.

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NOTE: All those 28 countries were worked because the other station had a far better antenna system – it made up the difference of the very poor lightbulb "antenna."