A New Meteor Shower, p. 7

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COMMUNICATIONS & TECHNOLOGY
NOVEMBER 2021

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On the Cover: One of the 10-15-20-meter stacks at Central Siberia DX Club station RWØA in Krasnoyarsk, Russia. Inset: Alexey Belov, RUØA, operating the 2021 WPX CW Contest from inside as part of the UCØB Multi-Distributed team. See story, page 8.

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FOCUS ON: Record participation in CQ contests that began in 2020 continues well into 2021 with the running of the CQWW WPX CW contest last March. It was also one of the first contests to feature the Multi-Distributed category, which produced the highest score in 2021. You can read all about it on pages 8 & 15 and view the complete scores beginning on page 97. Also read our review of a new Hex Beam from VHQ on page 24, as well as news of a brand-new meteor shower-the Arids-on page 7.

FEATURES

COLUMNS

DEPARTMENTS

Antennas are a leading interest of many hams. This includes almost anything to do with antennas from theory and design to over-the-air performance. Hams seem to be always searching for improvement and, ultimately, the holy grail. The hex beam (Photo A) is a true example of this interest. Here, K1GUY and K5PA examine the latest innovation in a long line of hexagonal beams.

CQ Reviews:

The VHQ HEX Beam – A New England Survivor

BY KEN STEINER, * K1GUY, AND GENE HINKLE, # K5PA

Amateurs have a long history of antenna experimentation, design, and development. Today, we stand on the shoulders of many giants in the field of antenna development. Many decades ago, Les Moxon, G6XN (SK), started bending antenna elements and developed what we now know as the Moxon Antenna.[1] *Figure 1(a)* shows how a 2-element beam consisting of a driven element and reflector has the end bent at right angles, enabling a smaller antenna size and turning radius. The resulting gain and front-to-back ratio for the radiated signal do not significantly change.

The quest was to find an antenna that had a smaller footprint without sacrificing gain. For amateurs, this would mean a lighter, smaller design, and hopefully less costly, with gain nearly equivalent to a full-size, 2-element Yagi for the given band(s).

In the early 1990s, while dreaming of a snowflake, Mike Traffie, N1HXA, took the idea of creating a new antenna to the next level when he designed the multiband hex beam antenna for 10-20 meters and began to market his HEX-BEAM®.[2] *Figure 1(b)* shows the Traffie wire configuration where the driven element and reflector are bent into the shape of an M and W, what we call an M over W (M/W) configuration. Many were skeptical of the notion that you could nest multiple band elements over each other without severely affecting the overall performance. One such skeptic included a great mentor of the author, the renowned L.B. Cebik, W4RNL (SK), who made this remark during a telephone conversation.[3]

Photo A. VHQ HEX Beam at co-author K1GUY's QTH. (Photos by K1GUY)

Cebik left us a treasure trove of antenna articles and pushed the early development of antenna modeling and innovations. However, Mike Traffie proved all the skeptics wrong with the successful development and commercialization of his multiband HEX-BEAM®.[4] In fact, more recent EZNEC antenna modeling proved that Traffie was right. While Cebik stated the interaction of the multibands would not let a multiband hex beam work well, Traffie found a way! Additionally, Traffie was able to nest his bent elements in such a way as to avoid significant interactions.

As time passed, more and more amateurs came on the air with the Traffie HEX-BEAM® and the hobby noticed. Traffie sold his HEX-BEAM® for over a decade and then decided to retire. Others were encouraged to try and improve on the initial design. Steve Hunt, G3TXQ (SK), published an article on the Broadband Hexbeam, and a new iteration, shown in *Figure 1(c)*, was born that gave a similar gain as the original HEX-BEAM® but with greater bandwidth. This Broadband Hexbeam configuration has the driven element and reflector bent into the shape of an M and U, respectively, what we call an M over U (M/U) configuration. It became the gold standard for a new generation of hex beams that were available commercially at far less cost than the original due to less expensive support arms

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and hardware. For over a decade, many amateurs have been building and buying commercially available broadband hex beams. They were relatively inexpensive and arguably performed as well as or better than an equivalent 2-element Yagi. But refinement has not stopped with the Broadband Hexbeam.

For simplicity, each of the antennas shown in *Figure 1* is for a single band. When multiple bands are needed, each of the individual antennas are "nested" together, as shown in *Figure 2* (the M/U configuration). These views of the six antennas show the concentric antennas from the side and top views that are separated in the vertical plane to reduce interaction. Also, all antennas are connected to the same coaxial feedline shown at the center (tiny dot with circle) of the configuration. This figure is from the EZNEC model of the antenna. The large arrow shows the direction of maximum radiation.

The early Broadband Hexbeam was a great design. However, these antennas were prone to mechanical failure in regions that have severe weather. Direct observation by the authors and others revealed that the hex beams failed due to a weak center post and its base support. As the weather buffs the beam, the base starts to bend due to the weakness of the center post, typically made of 1-1/2-inch square cross-section, 1/16-inch thickness, aluminum stock connected to a piece of hollow schedule 40 PVC pipe or similar material. This causes the hex beam to go out of balance, and places undue stress on the fiberglass support arms. As the center post continues to bend, the arms become over-stressed and snap. The hex beam then collapses on itself, as shown in *Photo B*, resulting in a useless antenna and a mess as well. This is a well-discussed topic in the hex beam forum.[5]

A Better Approach, the VHQ HEX Beam

Snow, wind, and storms have destroyed two of the author's previous hex beams, and, like many other amateurs, the search was on for something that would avoid costly replacement, as well as the repetitive cost of a tower climber. The

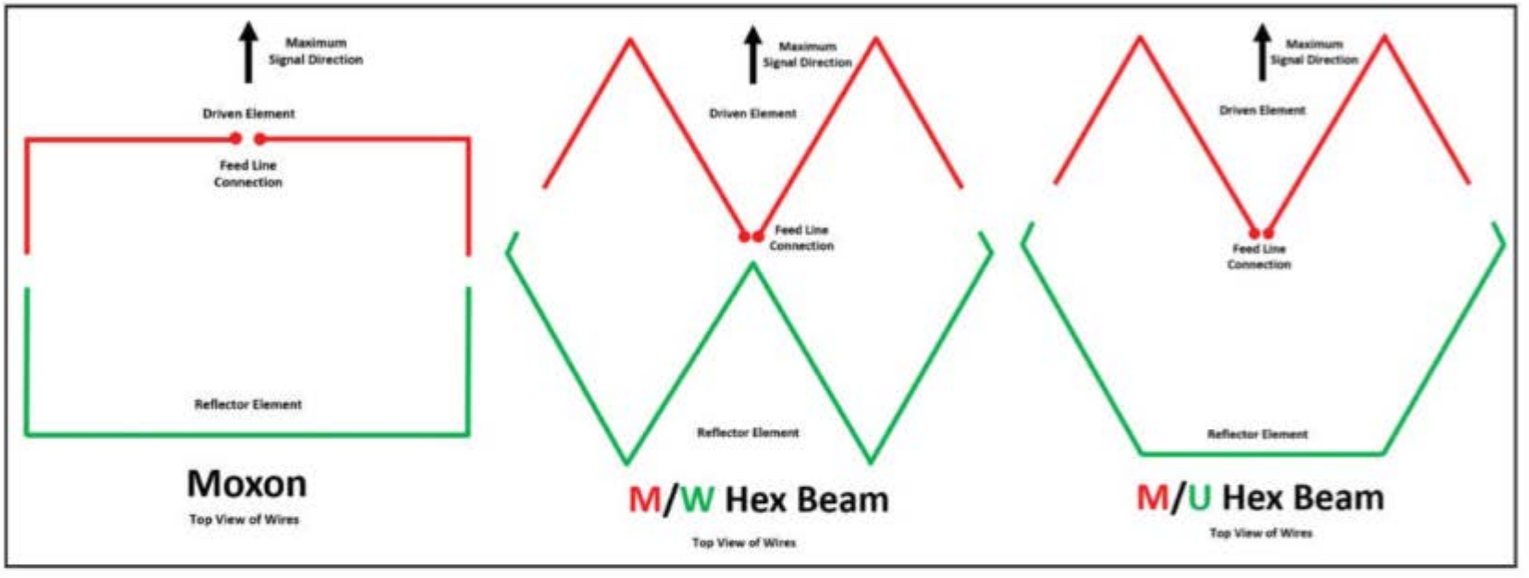

Figure 1. Moxon and hex beam wire configurations. (Illustrations by K5PA, except as noted)

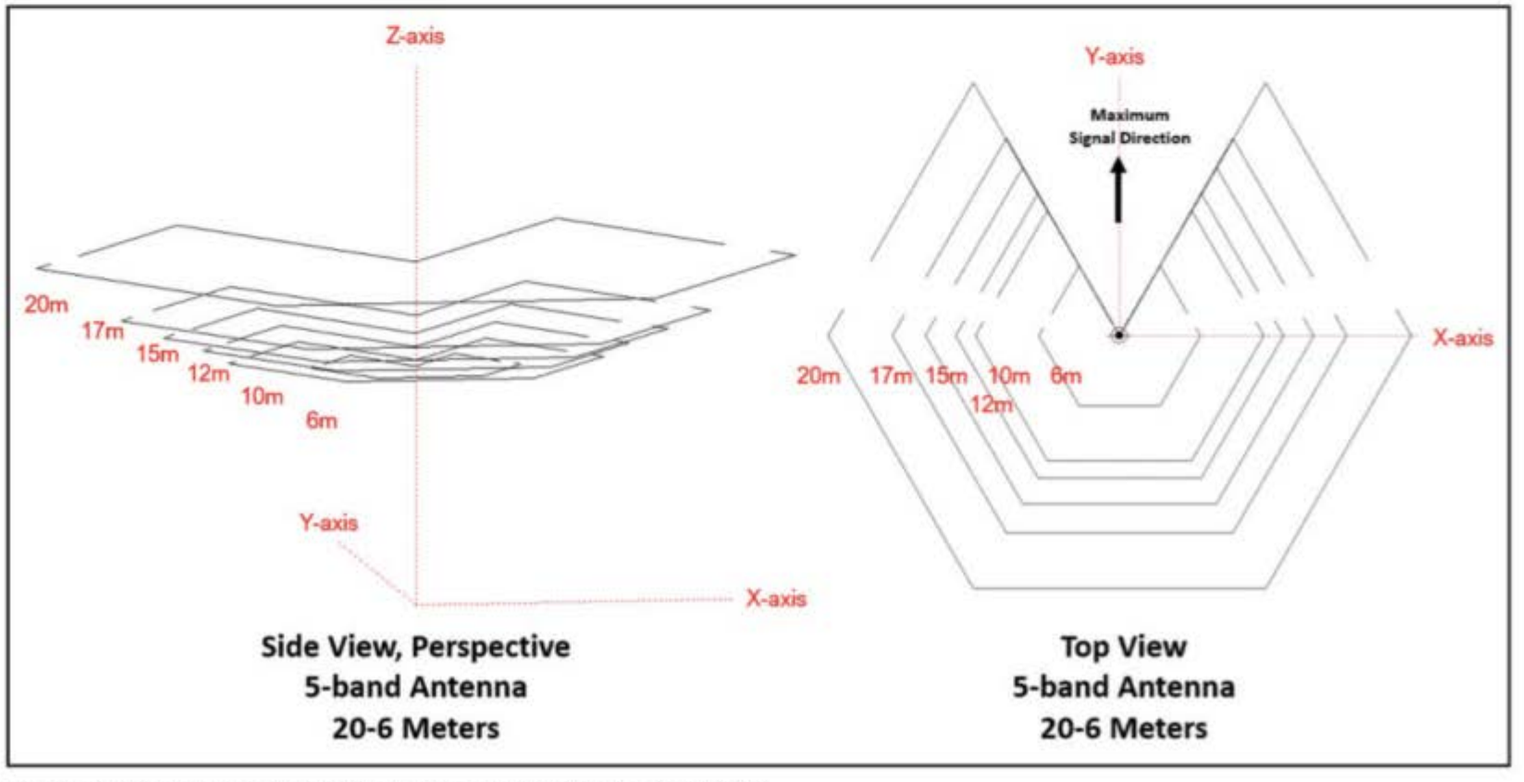

Figure 2. Six-band hex beam showing nested wires (top view).

VHQ HEX beam was found while listening to a local VHF net one evening.[6] Indeed, this beam was developed by a local amateur and machinist, David Lavoie, K1NH (formerly K1VHQ — thus the antenna's name <www.vhqhex.com>), as he, too, had lost his hexagonal beam to a storm. A visit to his machine shop showed firsthand how his new VHQ HEX beam was being manufactured and how it was possible for him to offer a lifetime guarantee, something unheard of until now.

The VHQ HEX beam center post is made of *2-inch square cross section, 1/4-inch thickness* aircraft grade aluminum stock. Compare this to other manufacturers' 1-1/2-inch square, 1/16-inch thickness material. To reinforce the strength of the lower portion of the post, it is mated to the base assembly via a *solid* 1-1/2-inch piece of insulating fiberglass as a dowel. The dowel sits inside the base assembly made from *solid billet* aluminum that was milled by a CNC machine. These parts are then mated to the fiberglass arms.

Photo B. K1GUY's prior hex beam after ice storm.

Photo C. K1GUY's VHQ HEX beam surviving an ice storm.

An engineering model for the center post was created to study the failure modes of previous designs and to determine how well the new design performed. *Figure 3* shows a detailed drawing for the model of the center post. Shown is the VHQ HEX beam center post model, but a competitor's center post was also modeled to measure how much force could be exerted prior to breakage. The bottom of the center post was mounted to a solid base for support. Then a force was applied to the tie ring at the top of the competitor's center post, and the force was increased until breakage occurred at 180 pounds of force. The bottom of the center post flared out and broke. The amount of deflection at the top of the center post was measured as 3.25 inches when it failed. Next, the VHQ HEX beam center post had a force applied to create the identical deflection of 3.25 inches, and no destruction occurred. Furthermore, the force required to create the same deflection was 1,000 pounds owing to the robustness of the design.

The results clearly show the increase in cross-section and thickness of the newly designed center post, and the solid fiberglass dowel provides more than six times the strength compared with earlier designs.

The VHQ HEX beam wire elements consist of heavy-duty 12-gauge Flex-Weave™ clear-coated wire, P/N FW12CR, with a breaking strength of 170 pounds. Compare this to the 16-gauge wire that has been the common practice. Addi-

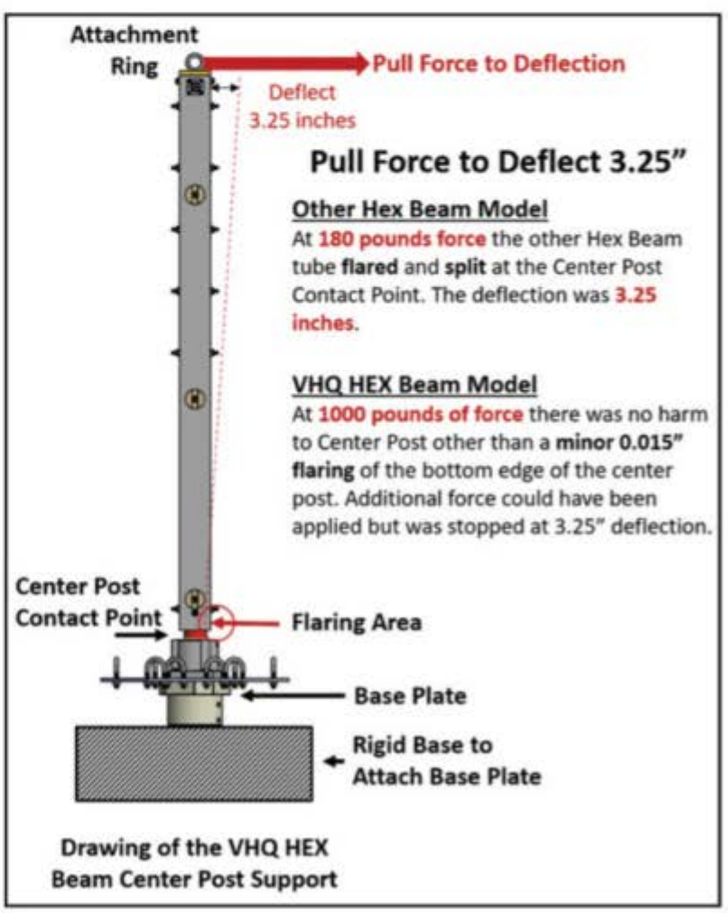

Figure 3. Center post modeling to test robustness. (Illustration by K5PA, adapted from original drawing by K1GHC)

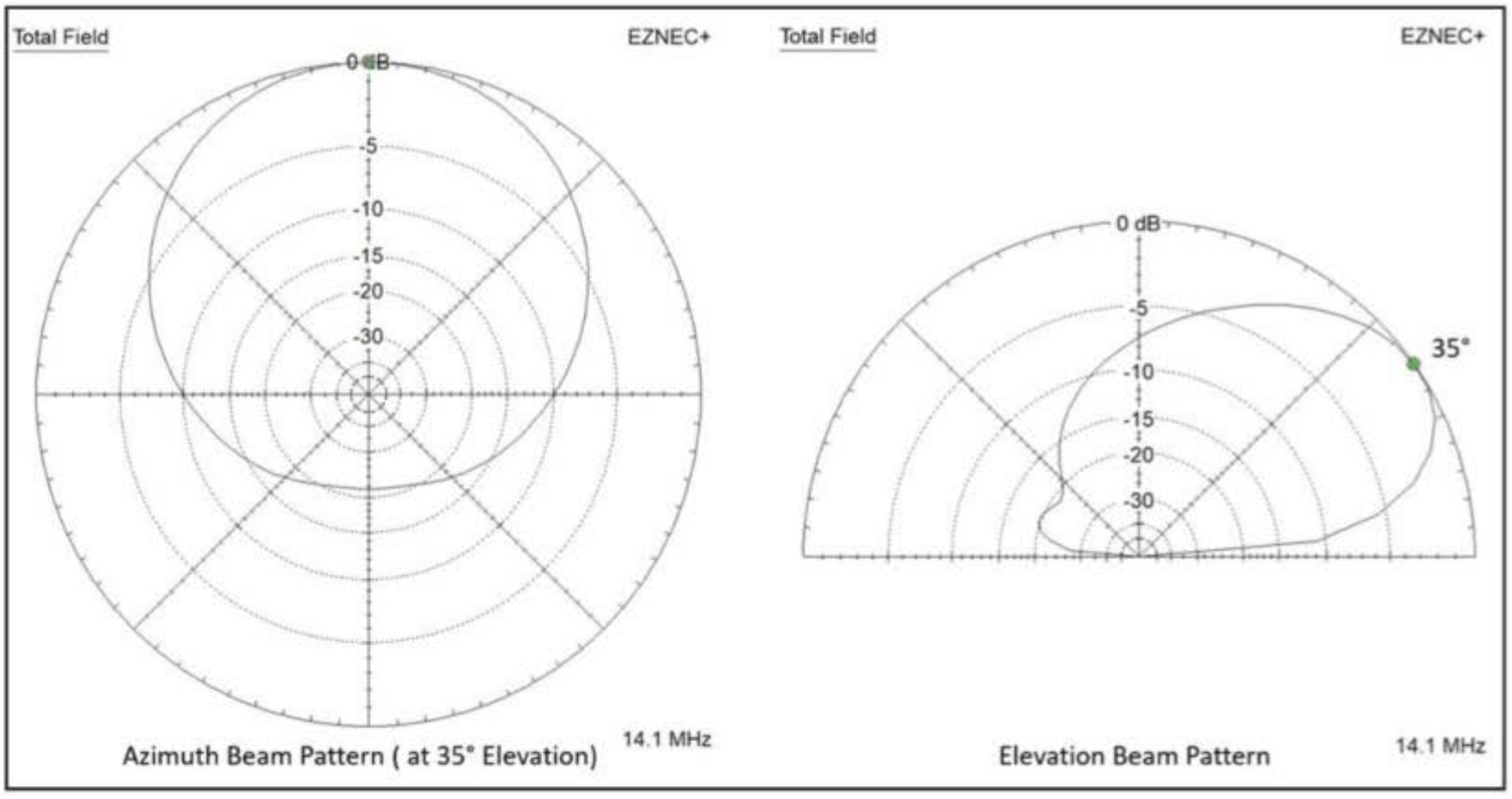

Figure 4. EZNEC antenna model showing typical beam pattern (30-foot height).

tionally, the center post has standoffs mounted to support the coax cable away from the center post. Multiple ferrite cores surround the coax to provide an effective common-mode balun. These practices help maintain a symmetrical beam pattern.[7]

All hardware is marine grade quality, yielding lasting performance even under poor weather conditions. The spreader arms also have aluminum insert supports to provide added strength and durability. All these improvements have resulted in a proven, rugged antenna design, yielding much better performance over prior designs.

Photo C shows the author's VHQ HEX beam surviving a late winter ice storm this year. All the elements are wrapped in snow and ice, yet the full assembly maintains its shape. It came back to life once the storm passed, which is a true testimony to the design's robustness.

Modeling and Measurements

EZNEC+ v6.0.33 with AutoEZ v.2.0.25 modeling software was used to characterize the beam patterns and impedance matching for the hex beam.[8,9] The nested elements of the G3TXQ Broadband Hexbeam antenna, whose wire model was shown previously in *Figure 2*, was adapted to the VHQ HEX beam configuration by adding the 6-meter element and running beam patterns and VSWR curves across all bands (including 2-meters). This EZNEC / AutoEZ antenna model is available at the co-author's amateur radio website for those wishing to change parameters to investigate various configurations.[10]

As expected, the beam pattern is like a 2-element beam centered in each band. For example, *Figure 4* shows the 20-meter band azimuth and elevation beam patterns. There will be slight variations across each band as the frequency is changed. A summary table for the gain, front-to-back ratio, and elevation angle is shown in *Table 1*. Note, the last line is the height of the antenna (30 feet for this model) in terms of wavelength. The maximum gain occurs at lower elevation angles at higher frequencies, resulting in better DX performance. This is because the height, in terms of wavelengths, is increasing at the same time. So, the conclusion is that to achieve a lower elevation angle; the antenna height should be increased. This is something you probably already

	Ham Bands (Meter)						
Parameters	**20**	**17**	**21**	**12**	**10**	**6**	**2**
Gain (dBi)	7.2	7.2	7.2	4.3	7.9	8.4	4.2
Front/Back (dB)	18.6	15.7	12.3	9.56	11.5	13.3	1.6
Max. Gain Angle (°)	35	30	25	25	20	10	5
Antenna Height (λ)	0.43	0.55	0.65	0.75	0.87	1.58	4.33

Table 1. EZNEC model for gain, front / back ratio, and maximum gain by band.

Why All These Different Names for the Hex Beam?

Here is a quick glossary to provide some perspective.

Hex beam – As used in this article, the hex beam is a generic term for a nested set of wire elements held in place by insulated spreader arms to provide single or multiband performance like a 2-element beam.

HEX-BEAM® – This is a registered trademark of Mike Traffie, N1HXA, for the hex beam he manufactured and sold.

Broadband Hexbeam – This refers to the name given by Steve Hunt (SK), G3TXQ, for his wideband hex beam design.

VHQ HEX – This is the design by David Lavoie, K1NH (formerly K1VHQ), for his rugged, wide band hex beam. VHQ HEX beam is an abbreviation for the Very High Quality HEX beam. <www.vhqhex.com>

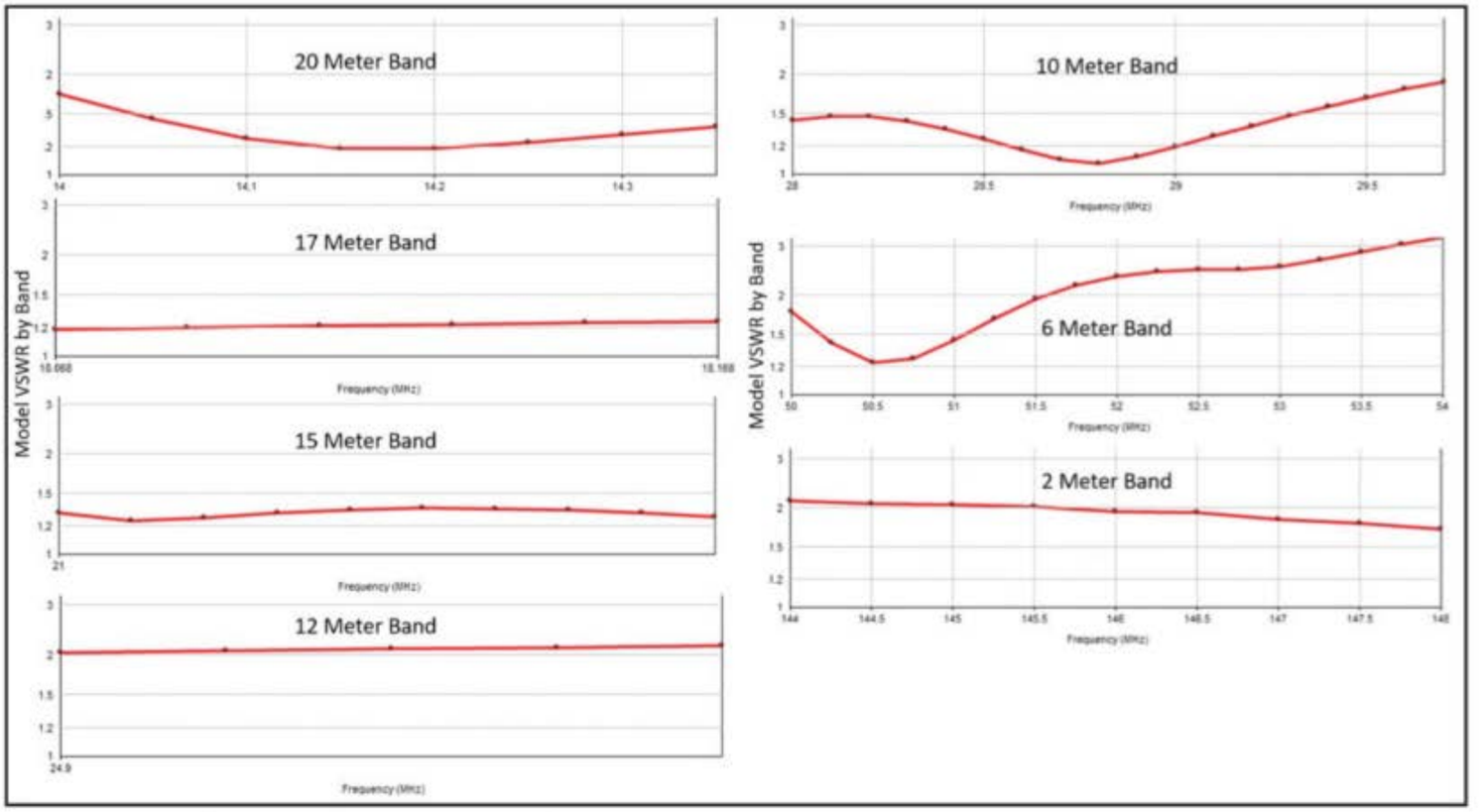

Figure 5. EZNEC antenna model showing VSWR, all bands (20-6 meters) and 2 meters.

realized but is demonstrated by this model. The author's hex beam is located at a height of 95 feet, where there are dual peaks that include a low angle and higher angle, providing excellent DX and local coverage. The adage, "the higher the better," is certainly true whereby the elevation pattern will give increased gain at lower angles.

Figure 5 shows the VSWR curves across each band in the EZNEC model. The model shows a good match, less than 2.0:1 VSWR, across each band. The 6-meter band is slightly higher due to the broader range of frequencies covered.

The beam pattern and VSWR are frequency-dependent, so some adjustments are necessary to optimize the desired performance. Fortunately, for a production antenna like the VHQ HEX beam, all dimensions have been optimized and elements pre-cut to the optimal length at the manufacturing facility, eliminating assembly errors.

Performance

The VHQ HEX beam has performance specifications like a 2-element, horizontally polarized beam antenna. This holds true across the six ham bands from 20-6 meters. On 2-meters, the 6-meter element reacts as a horizontally polarized dipole but has the advantage of being at the elevation of the hex beam. The full specifications for the antenna can be found on the manufacturer's website (refer to Ref. 6).

VSWR measurements were made for the VHQ HEX beam on the author's 95-foot tower using a RigExpert® Zoom AA-230. The measurements were like those shown on the VHQ HEX beam website. Simply put, the VHQ HEX beam displayed improved SWR across all bands, as shown in *Figure 6*.

Experiences with the VHQ HEX Beam

The new VHQ HEX beam sets a new level of ruggedized construction and refinement to the hex beam. Its design with heavy-duty craftmanship has let it withstand the winter here in New Hampshire and would do the same in other similar environments. Many New England hams have lost their lighter-duty hex beams to the severe weather.

For example, George Carmichael, K1GHC, lost his lighter-duty hex beam in a storm and decided to install the VHQ HEX beam after listening to his local net. He finds the VHQ HEX beam is "built like a tank," with a robust center post, 12-gauge elements, and marine grade fittings. The lifetime guarantee on the assembly was a huge selling point after his prior experiences. George found it easily survived one of the worst winter storms. He also found significant improvement in gain and lower VSWR across the bands compared with his prior hex beam. Even under poor propagation conditions, he finds he can work more DX than before.

Over-the-air performance and long-haul DX are testimony as to why the hex beams are still a favorite. The comparison of a resonant dipole at 80 feet compared with the VHQ HEX beam clearly shows the performance you can easily hear and see on the S-meter. Comments are routinely heard on how strong the author's signal is, even under poorer band conditions.

A unique feature of the VHQ HEX beam is its ability to work both 6 and 2 meters as well as the HF bands. Even with the "dipole-like" performance on 2-meters, amateurs such as Ken Burstall, WB8PKK, have been able to work repeaters a hundred miles away with just an Anytone model 878 radio that's running 6 watts!

With a lifetime guarantee, the VHQ HEX beam is destined to provide years of service without worrying about repeat tower climbs and replacements. This antenna is here to stay on the K1GUY antenna farm.

Summary

The authors would like to thank Ken, WB8PKK, and George, K1GHC, for sharing their experiences with their VHQ HEX beam. They all wanted to share their excitement with such a high-quality product. Neither the authors nor our contributors

have any pecuniary interest in the VHQ HEX beam manufacturer. We would also like to thank Jim Millner, WB2REM, for his text edits and advice.

Our interest lies in providing background information on the hex beam, explaining the modeling, construction, and performance. To that end, we have provided a series of web links that will provide more in-depth information. We hope this article further piques your interest in this class of antenna and, particularly, in the robust construction of the VHQ HEX beam that is built to withstand a New England winter. The VHQ HEX beam retails for $1,550 and is available at <www.vhqhex.com>.

Notes:

1. <https://tinyurl.com/5pccdetx>
2. <www.hex-beam.com/description>
3. Personal communications between Cebik and the author
4. <http://karinya.net/g3txq/hexbeam>
5. <https://groups.io/g/hexbeam/topics>
6. <www.vhqhex.com>
7. <http://karinya.net/g3txq/hexbeam/eznec2>
8. <https://eznec.com>
9. <https://ac6la.com/autoez.html>
10. <www.k5pa.com>

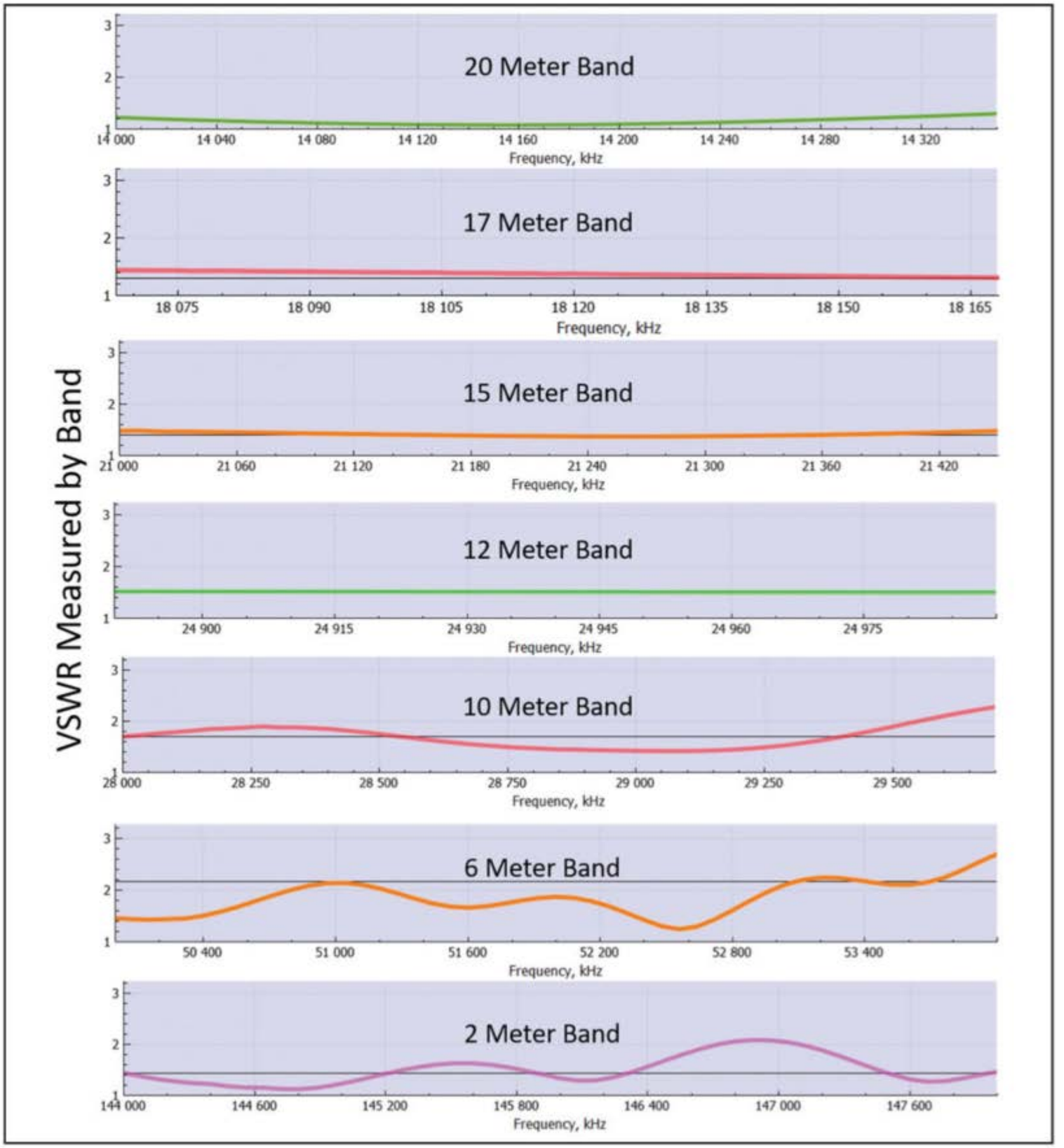

Figure 6. Measured VSWR of VHQ HEX Beam mounted on 95-foot tower.