The Saxophone Antenna: A True Dual-Band UHF and VHF J-Pole

A unique J-pole that covers the 144 and 440 MHz bands with excellent performance.

Kosta Kropivny, PhD, VA7KL

Building a J-pole antenna that performs well on the VHF and UHF bands can be challenging. The monoband collinear J-pole, or super J-pole, is an improvement of a regular J-pole. It combines two λ/2 radiating sections with a collinear phasing stub between them. However, if tuned on UHF, this antenna won't resonate on VHF unless you make the J element ¾ λ instead of ¼ λ. Also, you can't get a 50 Ω impedance on both bands when feeding the antenna from the bottom end.

Igor Goncharenko, DL2KQ, proposed a wire antenna at **http://dl2kq.de/ant/3-85.htm** (check your browser for Russian translation) that uses a 3⁄2 λ radiating element on UHF and consists of two ⅝ λ elements separated by a λ/4 phasing stub and a ¾ λ J element. DL2KQ proved that an impedance of 50 Ω on both bands can be achieved by bending the J-element wire along its length. On VHF, this antenna works as a slightly shortened J-pole with the inductance of the phasing stub in the middle. On UHF, it works as a super J-pole with a ¾ λ J element. On both bands, this wire antenna radiates at low angles. However, it's narrowbanded, so it must be tuned to the desired UHF and VHF band segments.

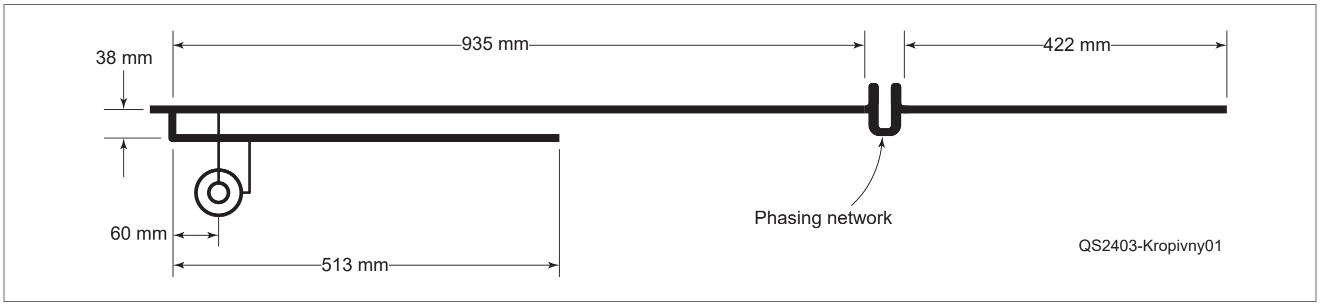

Figure 1 — Dimensions of the saxophone antenna. This drawing is not to scale.

Figure 2 — Phasing stub components.

Figure 3 — The assembled phasing stub.

Parts and Construction

I've further developed this antenna with thick pipes using MMANA-GAL (**http://gal-ana.de/basicmm/en**) and building a dozen prototypes (see the lead photo). The optimal design of the dual-band UHF and VHF **J**-pole is shown in Figure 1. All of the measurements are from pipe center to pipe center.

The elements are made from a type-L copper pipe with an inner diameter of ½ inch and an outer diameter of ⅝ inch. You'll need a hot torch, flux, and solder, and you should solder the junctions outdoors or in a well-ventilated area. The RF N-type connector ground is soldered directly to the **J** element (as shown in the lead photo). Components for the phasing stub are given in Table 1 and are shown in Figure 2. The assembled phasing stub is shown in Figure 3. The dimensions are optimized for 146 and 446 MHz. The exact shape of the phasing stub is not very important, but its overall length must be 320 millimeters. This should work correctly when using the pipe fittings specified. The length of the phasing stub mainly affects the UHF resonant frequency. The VHF resonance is mainly controlled by the positioning of the feed point and minor bending of the **J**-element tip. I call this a saxophone antenna, as I think the phasing stub resembles part of a saxophone.

Table 1 — Copper Water Pipe with an Internal Diameter of ½ Inch and an External Diameter of ⅝ Inch

Quantity	Description	Lowe's Part Number
1	½-inch × 10-foot copper pipe	#LH04010
2	½-inch caps	#W 07007L
1	½-inch tee	#W 04006L
3	½-inch, 90-degree elbows	#W 01622L
6	½-inch, 90-degree female elbows	#W 01652L
2	½-inch, 45-degree elbows	#W 03326L
1	Female N-type connector	

MMANA-GAL simulations show that this antenna has a low angle of radiation on VHF and UHF bands. Figure 4 shows one of these antennas installed on a

Figure 4 — The roof-mounted saxophone antenna. The coiled choke balun shown is a poor choice. A much better solution would be two to three turns of the coax through a mix-31 toroid.

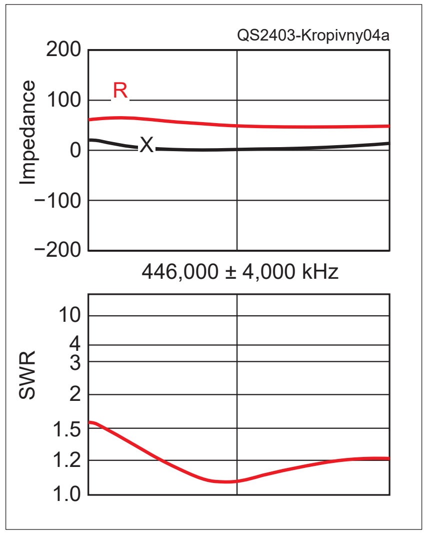

Figure 5 — UHF measurements.

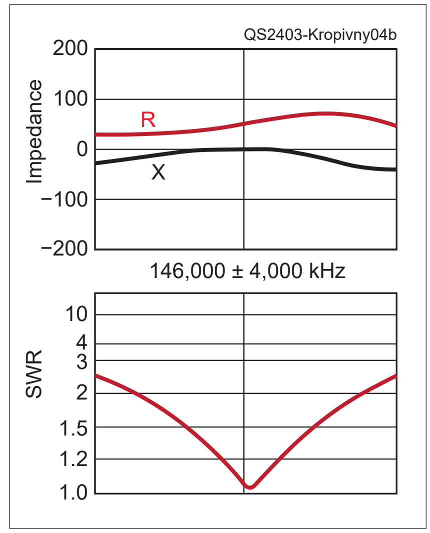

Figure 6 — VHF measurements.

chimney, and Figures 5 and 6 show the UHF and VHF measurements. The measured SWR and impedances correspond well to the MMANA-GAL simulated data. As you can see, the achieved bandwidth covers the full VHF band and the repeater region on the UHF band. I was able to make contacts with all operational repeaters in the area, which was previously unattainable with my 5 W Yaesu FT2DR with its short rubber duck antenna.

Conclusion

As computer simulation and practical experience shows, this thick, dual-band **J**-pole antenna brings together the advantages of a few well-known predecessors. In particular, it incorporates a low angle of radiation and a 1.5:1 SWR bandwidth of 4 MHz on VHF and 12 MHz on UHF, which results in long-term tuning stability. The antenna is less than 1.5 meters in height and is mechanically sturdy and self-supporting. Also, tuning is essentially independent for the two bands. Finally, this antenna is dc-grounded for static electricity and lightning protection.

All photos provided by the author.

Kosta Kropivny, PhD, VA7KL, earned his Advanced license in Canada in 2015. He became interested in radio in secondary school in the Ukraine, when he built a crystal radio with a variometer. Kosta continued his education at the Moscow Institute of Physics and Technology, where he obtained a master's degree in electronics, specifically in underwater antenna arrays. Later, while working for the Russian Space Agency, he obtained his PhD in air dynamics. Since moving to Canada 25 years ago, Kosta has been working as a senior engineer for a major telecom company. His ham radio interests include chasing DX, building antennas, and developing new algorithms for SSB transceivers. Some of his projects can be found on his website at **www.va7kl.com**. Kosta can be reached at **admin@va7kl.com**.

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