Half-Square

The Wire Beam

Edited by Paul Moratto, WPE5AVL/KC5JK

High above the neighborhood, it's wings glistening in the sunlight the Yagi beam floats like a bird of prey. To the radio enthusiast it's an object of veneration and beauty. To everyone else in antenna-hostile neighborhoods, it's an eyesore. Did you know you can get good DX results without a tower and Yagi? Without telling anyone something big happening at your place? How? The most important factor in working DX is low angle radiation. Once you have low angle radiation, gain (achieved by concentrating radiation in the desired direction) can help. The Yagi's gain raises signal strength only about an S-unit in the direction it's pointed. It's the elevation that makes it work DX.

To get DX angle radiation and gain without the tower and Yagi, consider the Half-Square, a simple, light, unobtrusive and inexpensive DX gain antenna that you can hang almost anywhere you can put a dipole.

How is it made? Start with a 1-wavelength wire supported from its ends, and feed it at a point 1/4-wavelength from either end. In this form the antenna is equal to a 3/4-wave long-wire with a 1/4-wave radial. It has a decibel or so of gain off its ends, and its radiation angle is a little lower than a dipole or Yagi of the same height. But it's no killer DX antenna -- yet.

Now move the end support insulators in 1/4-wave, and let the 1/4-wave tails hang down. Bingo! What you have now is a Half-Square -- two 1/4-wave verticals separated by a 1/2-wave horizontal phasing section. By this simple trick you have pushed the takeoff angle down into the serious DX range and you suddenly have nearly an S-unit of broadside gain to boot. As a bonus, the feed-point impedance drops to 50+ ohms.

There is no hocus-pocus or hype here. The design is simple, based on well-known and tested principles. And -- as you yourself will be able to attest -- it delivers the DX. So why is it called a Half-Square? Because when you look at it from the side, if you can see anything at all, you see the upper half of a square floating in the air in front of you.

Someone might ask, if you're talking about low angle radiation from a vertical, wouldn't a base-fed vertical pair be just as good? An upside-down Half-Square would be easier to erect. Far from it. With the vertical you have energy loss at the feed-point and in the traps. Even an elaborate radial system can only partially reduce them. Also, with the vertical, the high current that produces radiation is at ground level rather than up at the top where the Half-Square puts it. So the vertical's takeoff angle is higher than the Half-Square, and obstructions block more of its radiated signal. Result is no gain.

The vertical exceeds the Half-Square only in expense and hassle. If you have the space to hang a dipole, you can hang a Half-Square and be in business with an antenna that quadruples your DX radiation and loses none of its power in ground and trap losses.

Of course, anyone using a base-fed vertical or trap sloper is still 599 in some direction once in a while. But if you want consistent DX performance, the Half-Square will do a lot more for you. You see,

1. Your QRV DX Half-Square is not half of an antenna, it is a whole wavelength of antenna, judiciously folded to direct power where you want it.

2. It's a high efficiency antenna that actually radiates 99% of the power you put into it. That means it radiates from 3 to 6 times as much power as you'll get out of the typical base-fed vertical.

3. On top of that, its twin tails firing in phase concentrate the radiation into a broadside beamwidth more than 4 dB stronger than you'd get with a single vertical radiator of the same efficiency.

4. Because the radiating portion of the Half-Square is at the top, not at the base, your signal clears obstructions and reaches out to its destination.

Half-Square cuts QRN that everyone knows ordinary vertical antennas pick up. The Half-Square, however, is quiet because that kind of noise is cancelled out by the design. When you try

it, you will see for yourself that this is an amazingly quiet antenna.
You'll also see the results of its radiation pattern without even having to transmit. You'll hear the Half-Square rejecting signals arriving at angles higher than 45 degrees (that means signals coming from nearby out to 500 miles). You'll hear it attenuate signals in decreasing but noticeable magnitude out to a distance of about 1200 miles, after which it progressively reinforces them. When the author switched to a Half-Square out in Utah, it sounded as if Japan, Hawaii and the east coast all just moved in next door, Texas and Ohio were still a ways out there, and the California kilowatts were just swallowed up by the ocean.

This is a DX grabbing antenna. Don't expect to have a great field day if you set one of these up in Ohio. From that location you'll work ten times as many stations with a low dipole. But if you want to work the All Asia contest from Georgia without being bothered by kilowatt QRM from New York, Florida and the northwest, a Half-Square will deliver the goods.

Another warning: The Half-Square has two equal broadside lobes, one on each side. That means that if you are sitting in Minnesota and trying to work India over the north pole, you might get some QRM from Brazil, Argentina, and Antarctica coming in from the back side.

Because of the way it is built, it is so easy to install that some users claim to have put it up in as little as 10 minutes. The author tested a Half-Square in all sorts of terrain, under all sorts of conditions -- in a high rise apartment, from the balcony of a second story apartment, from a 3rd story office in a commercial building with acres of fluorescent lights, across a parking lot in the middle of the night. It was hung from rock outcroppings on a treeless desert island, in a northwest rain forest, in a swamp in the Rhine river lowlands, in back yards, and hidden under the eaves in picky neighborhoods and snoopy motels. It proved to be the DX antenna that is easiest to use and delivers the DX.

If you were holding an Antennas West* Half-Square in your hands right now, you could see that it is no ordinary assembly of wire and insulators. It's made of quality, carefully chosen materials that will last. It is precision measured and hand assembled. Each connection is first secured mechanically, then it's bonded electrically, finally it's potted with a special light-weight material that adds more strength and seals out weather permanently. The UV-proof housing at the feed-point includes a drip shield to keep water out of the coax connector. Connections won't work loose or corrode.

Run your fingers along the slippery tough QuietFlex insulation. Acid rain and the invisible pollution that corrodes the surface of ordinary antenna wire cannot penetrate the tough covering that protects the AW* Half-Square. The QRV DX Half-Square is a complete DX antenna that you can install in minutes. It is constructed so that it will be durable, yet it's made in such a way that you can put it into action easily without any help. It satisfies the desire to work DX now rather than next year when you have the budget for a tower and tri-band Yagi.

The author's first test on 15 meters was from a portable location in Germany. He stretched the Half-Square out along the outside wall of an apartment, supported from a fishing rod out the bathroom window on one end and from a bamboo pole tied to the balcony on the other end. It was only 5 feet out from the reinforced concrete wall of the building, and its ends were just high enough that neighbors on the ground floor couldn't grab them. A 15-foot length of coax from the feed-point, brought in through the window, attached it to the rig. The band was so quiet he thought something was wrong. A CQ on 21.025 brought back a JA saying the author was the first European signal he had heard that day. He was 599 barefoot in Tokyo, and the JA's kilowatt and 3 elements were 569 in Frankfurt. When he signed, a string of other JAs began calling, each tail-ending the next. An hour later their KW signals were the same strength as the barefoot DL with the Half-Square. Soon they began working Europeans 600 miles further east and, finally, the DLs with quads and tri-banders. Interestingly, the author could hardly hear any of the Europeans until he switched to a dipole. Why was he the first signal heard when the band opened? Why was his signal so much stronger than theirs? And why could he hardly hear nearby Europeans that were so strong on a dipole? Because the Half-Square concentrates its radiation and listening- power at low DX angles between 10 and 25 degrees, angles so low that for a tri-

bander to give similar performance, it would have to be elevated more than a full wavelength high.

When you think about the engineering, expense, and visual impact of a 20 meter monster array up sixty to ninety feet, you're pleased to compete head-to-head using a Half-Square at roof level. And you know you can beat the tri-banders to the prize by simply raising your Half-Square a little higher. See what it can do for you.

**Editor's note:* The Antennas West product mentioned by the author is now marketed by Radio Paul. It was first reviewed in 73, April 1991, by Jim Gray, W1XU. The article contains enough theory and explanation for any enterprising radio man to build his own. A plan based on that information was published on the KC5JK Packet Radio BBS in LA the same month.

T H E H A L F - S Q U A R E A N T E N N A

Described and Reviewed in 73 Magazine April 1991 by Jim Gray, W1XU

Offered commercially by Antennas West, the subject article contains enough theory and explanation for any enterprising radio man to build his own.

The antenna is similar to the common dipole or doublet in several ways. The most attractive feature is that it requires no more horizontal space than a conventional dipole, yet offers 4dB gain. This is accomplished by feeding two dipoles, end-to-end, in phase, bending the two opposite 1/4-wave ends downward to form a half-square.
See Fig. 1, the following profile or side view.

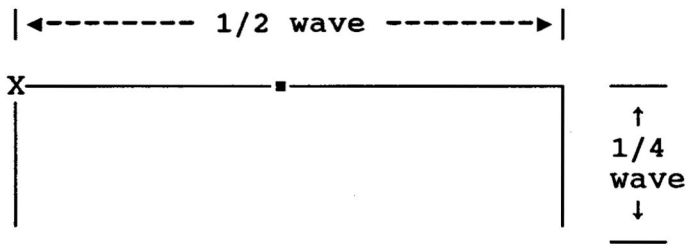

Fig. 1

It may be easier to imagine if you take an existing half-wave dipole, fed at X (above), and bend one leg at 90 degrees downward. Then, connect another half-wave-length to the horizontal end (see dot ▪ in center of diagram above), bending its trailing half downward as well. Of course, this requires that the horizontal portion of the antenna be erected at least one quarter wavelength above ground, but you would do that anyway. Add at least another six percent in height to avoid the trailing ends coupling into ground and causing tuning problems. Like the inverted vee, the trailing ends are in easy reach, making tuning adjustments of the half-square easy.
This antenna presents a very good match to the 50-ohm coax at the feedpoint (X), and has a low angle of radiation.

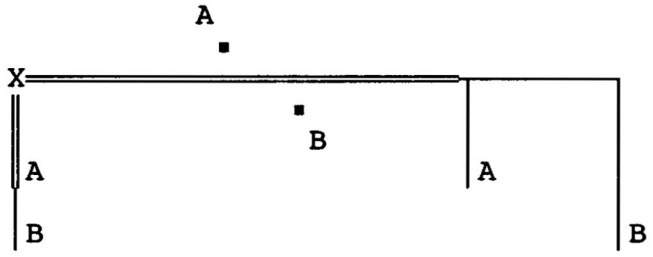

Fig. 2

In Fig. 2 above is shown my own idea for a two band half-square antenna, using common twinlead for the main portion, with single conductor trailing extentions for each band A and B. The two dots ▪ indicate the centers of each, respectively. It works equally as well as the single band design version.

Paul, KC5JK 4/91 (Rev 6/96)