

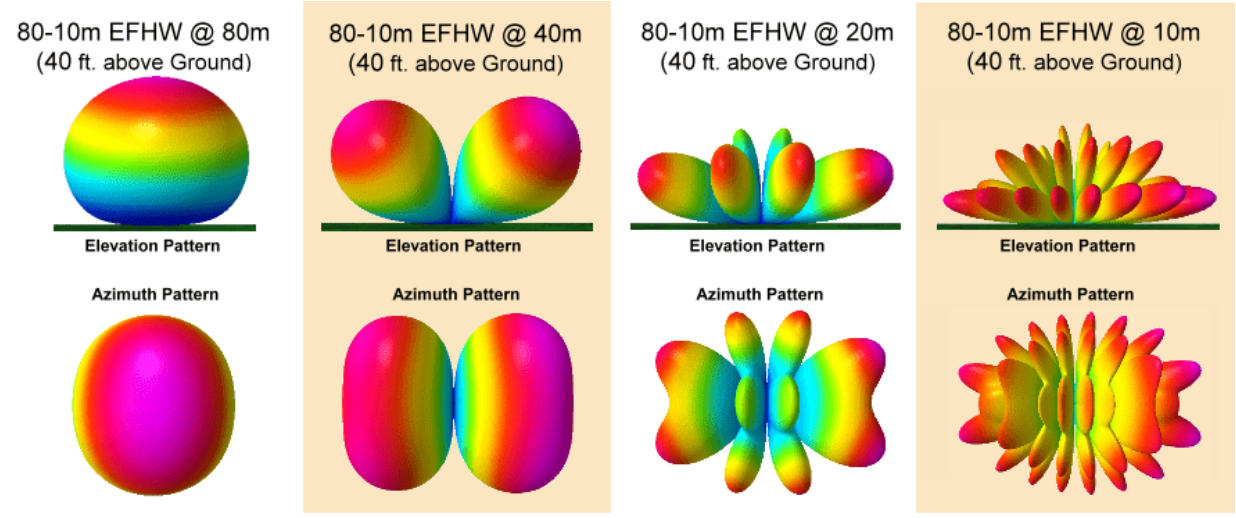
Hot Tips

Good info for the new ham, and old stuff to refresh your memory

Antenna pattern importance

One very important antenna property that's easily overlooked because it's invisible is its strongest and weakest transmitting directions relative to its stationary mounted location. Many hams have purchased otherwise good antennas, and ended up leaving bad reviews, because they were unaware of their signal strength directions.

ture of what we call your ***antenna radiation pattern***, or *antenna pattern* for short. This graphic offers a visual insight on how your particular antenna is performing at its particular location, and is something that should be understood by all HF operators about their antennas. By the way, this diagram isn't burdened by concerns of how the pattern ap-



Elevation and Azimuth Radiation patterns of a 80-10m multiband EFHW Antenna is depicted for 80m, 40m, 20m and 10m bands. The height of EFHW (horizontal configuration) is kept at 40 ft. (~12m) AGL. There are deep broadside nulls on 40m and higher. NOTE: 20m and higher bands produce several deep nulls around the azimuth resulting in numerous area coverage gaps.

Computed and Compiled by Basu VU2NSB - https://vu2nsb.com/

Say your antenna is emitting a signal at a particular frequency and power level. On a three-dimensional paper, place a dot to represent your antenna seen from a distance. Now, draw a line from there to any point on your 3-D paper, the length of the line representing the relative field strength of the signal in that chosen direction. Draw another line from the dot anywhere else, using the same method. Then another, and another, and repeat a thousand times. Finally, erase all the line segments except their end points.

The result is a three-dimensional dotted pic-

pears due to one part of the antenna versus another, because the entire antenna is being viewed like a dot from a distance.

We refer to this kind of *don't-care-about-nuances-at-the-antenna* viewpoint as the ***far-field radiation perspective***. This is relevant to you because you typically don't care as much how your signal behaves right near your antenna as you do with how it behaves after reaching much farther away.

Texas vs. Georgia

One reason some amateur operators are puz-



Hot Tips

Continued

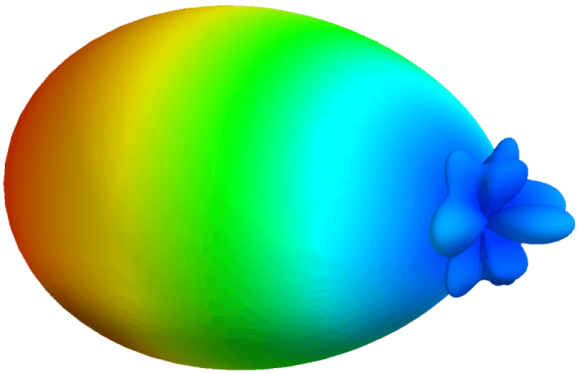
zled by their own poor antenna performance is their misunderstanding, or even complete lack of knowledge, of their antenna patterns. For example, using an end-fed antenna on 20 meters, say an operator in Texas reports your signal as ***5 over 9***, clear as a bell, assuming bells are clear.

You then hear an operator who's booming in from Georgia, but try as you might, the guy in Georgia can't hear you at all. You bring up the **WebSDR**, announce your call sign, and your signal shows up on the online waterfall with a bright 3 kHz line and you can hear yourself really well. Does the Georgia operator have a sub-standard receiver, or is he simply ignoring you?

Assuming the graphic on the previous page was drawn for your particular antenna, if you examine it for 20 meters, you can see a bunch of butterfly "blimps" originating from your QTH (transmitting location). It's very possible that a line drawn from your QTH to the ionosphere, then back down to Texas goes right through one of the blimps (strong signal), while another line drawn between you, the ionosphere, then back down to Georgia goes right between two of the blimps (weak signal), a zone called a ***null***.

But wait, as you recall, if you can hear the operator, he should be able to hear you, right? Not necessarily. The adage is ***If you can't hear 'em, you can't work 'em***. But if you can hear him, there's no guarantee that he'll hear you, so the Georgia ham still needs to hear you, for you to make that contact.

As you can see, the antenna radiation patterns per band are three-dimensional directions of signal strength determined by antenna type, antenna shape, antenna height, antenna mounting style, frequency, terrain, and a few other factors. When displayed graphically, the zones of relatively strong signals appear as blimps, or lobes, as in ***brain lobes***.



A near-perfect directional antenna pattern

The pattern is highly desirable because 1) it exhibits a large front-to-back ratio (meaning not much energy is wasted toward the rear), and 2) it exhibits a large beamwidth (great compromise between high gain and signal coverage), relieving the operator from rotating the antenna with every little frequency change.

So, to solve the problem with the Georgia operator, either raise your antenna a couple of feet, lower your antenna a couple of feet, or if either is not very convenient, forget the Georgia contact and go after the one in Delaware. (Another way to skin this cat, if you really need his contact, look up the Georgia operator on QRZ, email him, and ask him to change bands, since your patten might improve to Georgia on a different band.)

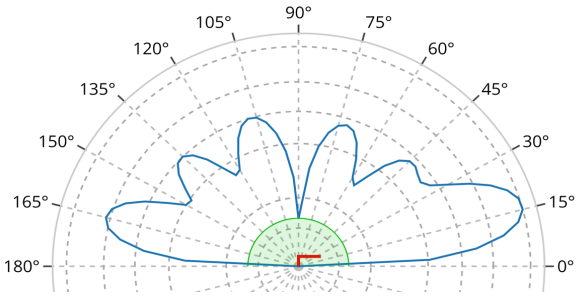
Examining your own antenna pattern also gives you some idea of the direction(s) of your strongest signals. Looking at the above diagram for an end-fed antenna mounted 40 feet up, 40 meters looks pretty ideal for making cross-country contacts, and maybe even DX contacts. On the other hand, at 40 feet up, working 80 meters looks closer to NVIS (near-vertical incidence skywave) propagation, meaning the greater portion of your signal is going straight up, to bounce back to



Hot Tips

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Earth within a couple of hundred miles of your antenna. However, the pattern shows that *some of the signal* reaches out at DX elevations, allowing for limited distant contact.



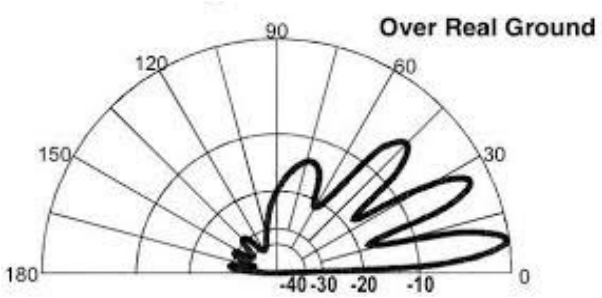
Two-dimensional patterns

All antenna patterns are three-dimensional; that is, they exhibit some amount of signal emission in all directions. However, due to a few assumptions we can often make about symmetry and redundant or repeating polarizations, a two-dimensional view of the same diagram can often prove more useful.

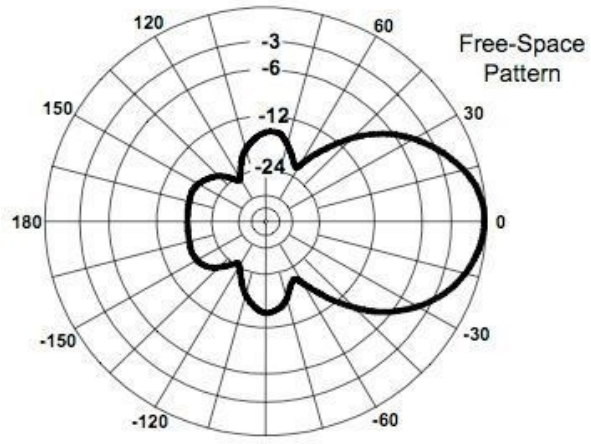
While the 3-D diagram offers ***completeness***, a 2-D picture can offer ***clarity*** by displaying only relevant information. The 2-D diagram above, for example, displays the same pattern for the end-fed antenna on 20 meters, and helps us understand its radiation angles and nulls, but without the full lobe display.

Both 2-D and 3-D displays can present the pattern by looking at its side, known as the ***elevation*** view because it allows you to see its angles of radiation headed skyward. Alternatively, they can present the pattern looking straight down onto it, known as the ***azimuthal*** view, because it allows you to see its radiation directions with respect to its azimuth, or compass directions.

The two antenna patterns to the right were taken from the Amateur Extra exam question pool diagrams and represent those of the same directional antenna. From the elevation view, the "take-off angle" of the highest lobe (called the gain) is between 0 degrees and 15 degrees above level ground. But you can see that the antenna also has signal strength radiating upward at about 25 degrees and 45 degrees in the forward direction, and almost none toward the rear.



Elevation view



Azimuthal view

The azimuthal view for the same antenna displays not only the compass direction of gain, but the beamwidth, which is the angular measurement of signals in the gain direction between the strongest (0 dB) and half-power (–3dB down), which in this case appears to be about (25 degrees up plus 25 degrees down equals) 50 degrees.

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