

How to make a fractal antenna for HDTV / DTV plus more on the cheap

by [williamruckman](#) on January 3, 2009

Table of Contents

- intro: How to make a fractal antenna for HDTV / DTV plus more on the cheap 2
- step 1: Adding the reflector 3
- step 2: Drill holes and add mounting points 3
- step 3: Measure, cut, and strip wire 3
- step 4: Measure and mark wire 4
- step 5: Create fractals 4
- step 6: Create dipoles 4
- step 7: Mount dipoles and mount transformer 5
- step 8: Testing verses store bought antenna 5
- Related Instructables 5
- Advertisements 5
 - Customized Instructable T-shirts 5
- Comments 5

intro: How to make a fractal antenna for HDTV / DTV plus more on the cheap

This instructable is from:

<http://ruckman.net/blog/news.php?item.21.4>

and submitted by William Ruckman of <http://ruckman.net>

The first thing I would like to discuss is a little history, theory, and uses for fractal antennas.

Fractal antennas are a recent discovery. First discovered back in 1988 by Nathan Cohen and later published and patented in 1995. A fractal antenna has a few unique attributes as seen in this definition from Wikipedia:

"A fractal antenna is an antenna that uses a fractal, self-similar design to maximize the length, or increase the perimeter (on inside sections or the outer structure), of material that can receive or transmit electromagnetic signals within a given total surface area or volume."

What exactly does that mean? Well, you need to know what a fractal is. Also from Wikipedia:

"A fractal is generally a rough or fragmented geometric shape that can be split into parts, each of which is (at least approximately) a reduced-size copy of the whole, a property called self-similarity."

So basically, a fractal is a geometric shape that repeats and appears over and over no matter how far out or how far in you zoom magnification.

Source: Wikipedia and <http://patimg2.uspto.gov/piw?PageNum=6&docid=US007088965> Patent number: 7088965]

Fractal antennas have been found to be approximately 20% more efficient than normal antennas. Which could be useful. Especially if you want to make your own TV antenna to pick up over the air digital or high definition video, increase your cellular range, wifi range, FM or AM radio reception, and so on. Most cell phones already have built in fractal antennas. If you noticed in the past few years that cell phones no longer have antennas on the outside. That is because they have a internal fractal antenna etched on a circuit board which allows them to get better reception and pick up more frequencies such as bluetooth, cellular, and WIFI all from one antenna at the same time!

Wikipedia info:

"A fractal antenna's response differs markedly from traditional antenna designs, in that it is capable of operating with good-to-excellent performance at many different frequencies simultaneously. Normally standard antennas have to be "cut" for the frequency for which they are to be used and thus the standard antennas only work well at that frequency. This makes the fractal antenna an excellent design for wideband and multiband applications."

The trick is to design your fractal antenna to resonate at what ever center frequency you wish to receive. Which means it will look different and be sized different depending on what you want to receive. A little math can be used to figure this out. (Or a online calculator)

In my example, I am going to make a simple one but you may want to make a more elaborate one. The more elaborate the better. I will use a spool of 18 Gauge solid core wire to make a antenna as an example but you could go as far as to etch your own circuit boards for aesthetic reasons, to make it smaller, or more elaborate with more resolution and resonance.

I am going to use the example of making a TV antenna for digital or high definition reception for over the air broadcasts. It is easier to work with these frequencies and they fall around half a foot to a few feet in length for half wavelengths of the signal. I am also going to base it off a common dipole antenna for simplicity and cheapness of parts for VHF. For UHF you may want to add a director or reflector which will also make it more direction dependent. VHF is direction dependent as well but instead of pointing directly at the TV station like UHF you want VHF rabbit ears (dipole antenna) to be perpendicular to the TV station. But there is a little more design to that. I want to keep this as simple as possible as it is already a very complex subject.

Basic supplies (cost me about \$15):

Mounting surface such as the plastic project enclosure (8"x6"x3"). <http://www.radioshack.com/product/index.jsp?productId=2062285>

6 screws. I used steel self tapping sheet metal screws.

A impedance matching transformer 300 ohm to 75 ohm. <http://www.radioshack.com/product/index.jsp?productId=2062049>

Some 18 gauge solid hook up wire. <http://www.radioshack.com/product/index.jsp?productId=2036274>

RG-6 coaxial with terminators (and rubber jacket if mounting outside).

Aluminum if using a reflector. The enclosure above came with one.

A sharpie marker or equivalent preferably with a fine tip.

Two pairs of small needle nose pliers.

A ruler of at least 8 inches.

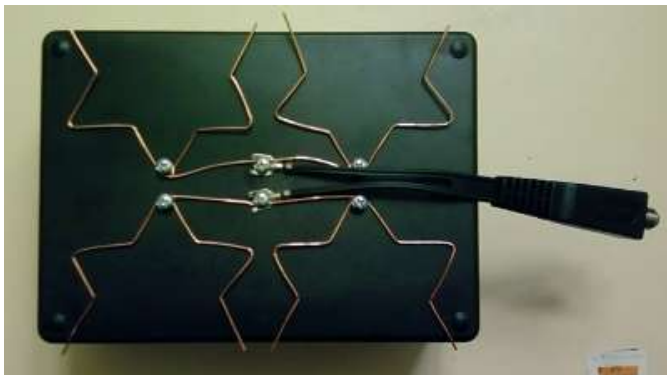
A protractor to measure angle.

A drill and drill bit that is smaller diameter than your screws.

Small wire cutter.

Screw driver or screw gun.

NOTE: The bottom of the antenna is to the right of this picture where the transformer sticks out.



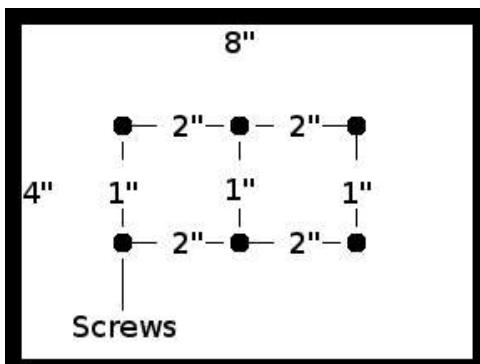
step 1: Adding the reflector

Assemble the enclosure with the reflector under the plastic cover.



step 2: Drill holes and add mounting points

Drill small tap holes on the opposite side from the reflector in the following positions and place a conductive screw.



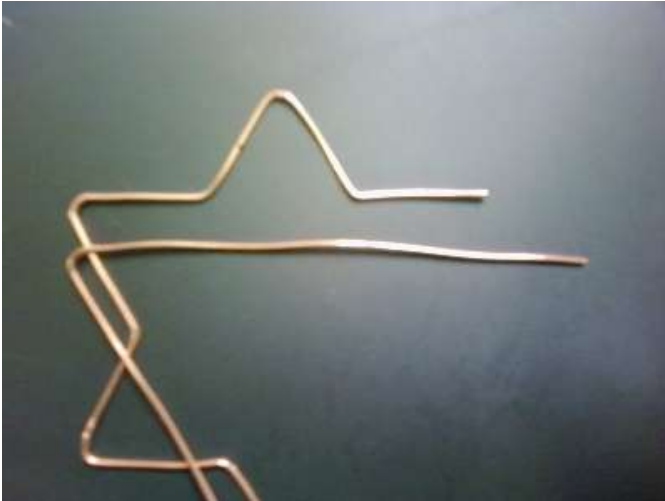
step 3: Measure, cut, and strip wire

Cut four 8" pieces of the solid core wire and strip it bare.



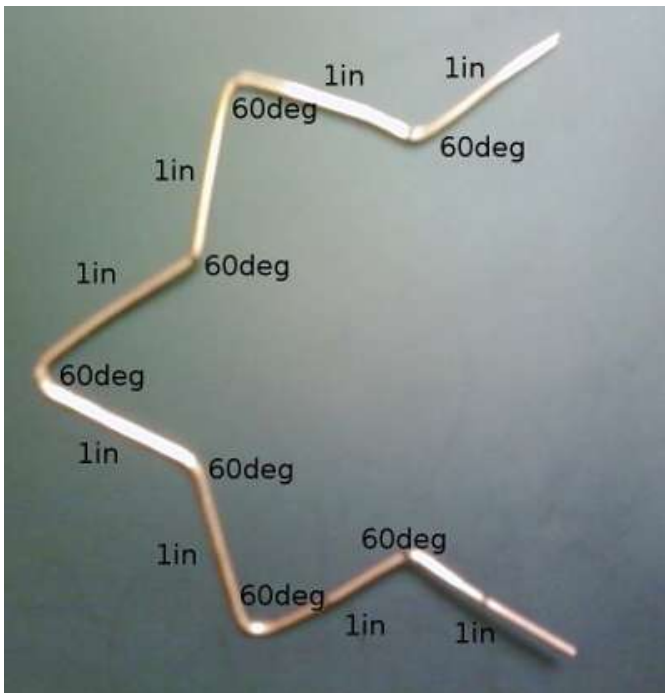
step 4: Measure and mark wire

Use a marker and mark every 1" on the wire. (This is where we are going to make the bends)



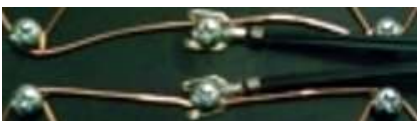
step 5: Create fractals

You will repeat this step for each wire. Each bend on the wire will be 60 degrees exactly as we will be making equilateral triangles with this fractal. I used two pairs of pliers and a protractor. Each bend will be made at the 1 marks. Make sure you visualize the direction of each bend first before making it! Use the diagram below to help.



step 6: Create dipoles

Cut 2 more pieces of wire at least 6 inches long and strip them. Bend these wires around the top and bottom screws going longways and contact the center screws. So all three are contacted. Use the wire cutter and trim unneeded wire.

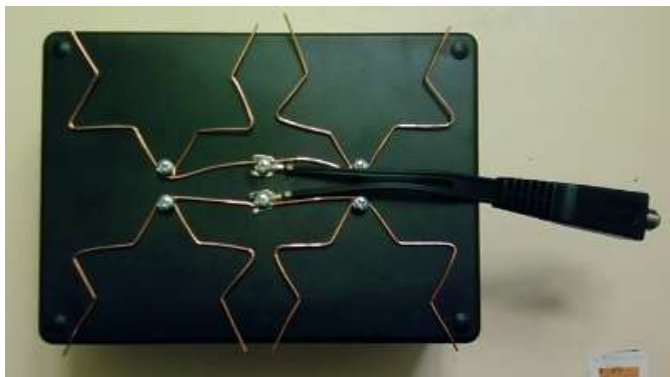


step 7: Mount dipoles and mount transformer

Place and screw down each of your fractals to the corner screws.

Attach the impedance matching transformer across the two center screws and tighten them down.

BUILD COMPLETE! Test and enjoy!

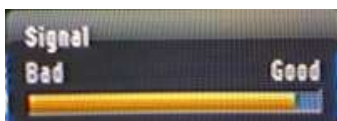


step 8: Testing verses store bought antenna

To see the results of the tests I ran click the link below:

<http://ruckman.net/blog/news.php?item.22.4>

ENJOY!



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jonton says:

Feb 21, 2009. 12:34 AM [REPLY](#)

i just want to say that if you need to, you can use coat hangers and bump it up to 2 inches in between bends. this is amazing how well it works and all from parts in the closet. try it because you are gonna wish you kept the receipt from that \$40 antenna you bought that didnt get you squat for reception



socrateez says:

Feb 19, 2009. 6:17 AM [REPLY](#)

I built this and it works better than my amplified rabbit ears and uhf combo from Phillips. I live in an apartment downstairs surrounded by other taller buildings and large tall trees. I get a reflected signal off a nearby small mountain. My antenna has to point at it and not the transmitter location. I cant even get satellite. My signal fades if a neighbor walks around in their apartment.

This works really well I must say.

In a bedroom I have the same thing only not a fractal, just two bowties. It doesnt work nearly as well and seems narrower in bandwidth over the fractal as ive swapped them. I also tried rabbit ears paired to this with a transformer. In my case, I always get best results with the dipoles directed toward the signal source at a 45 degree angle.

Thanx for this Instructable!

Thanks for all the helpful comments too everyone. :-)



HoldOnTight says:

Feb 16, 2009. 7:49 PM [REPLY](#)

A BIG THANKS!!! to williamruckman for starting this ible thread! I believe this is the defacto DTV antenna ible to date! Good On YOU...williamruckman!



williamruckman says:

Feb 16, 2009. 8:02 PM [REPLY](#)

Thank you all for being so active and adding your own content!



HoldOnTight says:

Jan 11, 2009. 6:01 AM [REPLY](#)

Okay, spent today figuring out the details of the new design. I tested it, but it isn't as good as a DB-8...probably more like a DB4. I'm going to add another iteration to the motif and retest. The current antenna fits in a 49 sq in area, but is about to get bigger, significantly bigger unfortunately. There is no balun...drives 75 Ohm cable directly. I'll take a pic of it before I add another iteration. Lets keep our fingers crossed, for everyone's benefit.



maximzodal says:

Feb 16, 2009. 2:17 PM [REPLY](#)

So, have you had a chance to retest the "another iteration"? Would love to see a photo.

Enjoy your and Williamruckman's repartee. I think I'm learning a lot. Maybe enough to be dangerous.

Max



HoldOnTight says:

Feb 16, 2009. 7:45 PM [REPLY](#)

Maximzodal, I have done another iteration. It improved local UHF low channels significantly (as expected), but I don't think this will be needed after June 08! Also, unexpectedly, the bad side is a reduction of gain at the Higher UHF end of the digital band at a frequency of my interest. Maybe it is just a small bandwidth detuning effect brought about by the added iteration, which is typical of fractals. The pattern has been iterated enough to cover the high UHF channels. So the answer may be to scale the entire fractal slightly to move that dip in gain off of one of my desirable high-uhf channels. Hard to say without antenna analysis model.

I've been looking into different antenna analysis models. It has taken quite a bit of time to research this, pros and cons of each, how to model this antenna... Fractal antennas are a different beast, when it comes to modeling and analysis using the existing software tools. Also, I'm finding that due to the bandwidth, I may have to break down the antenna model into a more simplistic form, then gradually build it up to more of the current version and extrapolate the effects to see if my design is optimal for the Hi VHF and UHF digital band. These antennas can realistically have a size reduction of 10:1 on up to 1000:1 over the old antenna design paradigm. Antenna modeling is needed because the bandwidth range is wide and size reductions may be possible, and then employ multiple patterns to really pull in the signals, like the DB2, DB4 and DB8 versions. Meanwhile, I'm freewheeling and I've got 2 additional patters that I want to try/model. These could be even better! BUT FIRST: Thanks to RVogel for his novel approach of a bunch of nails to make the wire snake exactly to the desired pattern. That is a great prototyping approach. I'm going to build the other 2 types of antennas and test. Trying things, and analyzing the effects helps me understand how to improve further...

VERY IMPORTANT: Also, a **fractal design is very good, but not optimal**...another reason to analyze the antenna via a model.

If you are really itching to try something different, RVogel's approach should be a winner too.



williamruckman says:

Feb 16, 2009. 5:19 PM [REPLY](#)

No, i haven't had time unfortunately. I also want to test it on FM/AM radio reception.



williamruckman says:

Jan 11, 2009. 11:24 AM [REPLY](#)

You should test it with the impedance matching transformer.



HoldOnTight says:

Jan 11, 2009. 1:46 PM [REPLY](#)

The impedance varies with frequency somewhat but it is not too misbehaved for a Fractal antenna.

An approach it to connect to the antenna at a point where the impedance is 75 ohms, but the antenna design would need to be analyzed by computer, which is way beyond the effort I want for one antenna that I will not patent. Secondly, it may be impractical to interconnect the needed connection points, if the distance is extensive > 1/2 in. -- likely the case for my design.

The idea is to make an antenna that is available for the average-joe to assemble from an instructable. Impedance and hence, VSWR are tolerable...

VSWR is reasonable for Fractal elements, typically driven by a 50 ohm load. Fractal elements, according to Cohen have an impedance of about 30 ohms. So, I concede that 75 ohms is a less desirable match, but a balun really wouldn't help since a balun transforms 4:1 and the VSWR would be about the same, with or without a balun. It is possible to build low impedance transformer, with a 2:1 but problematic for HDTV. First, these often are limited in bandwidth and second, building one with the not so common materials is well beyond the capabilities of 99.9% of instructables viewers.

What matters, from my point of view is not reflections, since HDTVs are resistant to some interference with digital processing -- there is no ghosting. I want raw gain to pull in those distant, but desirable signals that originate 50+ miles away.

So, if the wide-band antenna doesn't quite meet my gain goal, which is rather lofty, then an antenna amplifier will help pull in the weaker ones so long as the amplifier is as close as possible to the antenna. The Fractal antennas can be made wideband to cover the desired spectrum, and that is their forte, as are the bowtie designs.

The problem with building a multi-element (Fractal element) antenna is that it becomes physically large to reach the desired gain. But that isn't much good if the antenna is hidden in the attic and then you've got to run 50, 80 or 100 feet to get to the TV.

I want an antenna that doesn't have to be hidden in an attic -- signal losses in coax are terribly high for higher UHF signals. I think it is possible to

build something reasonably small and artistically pleasing or at least easily hidden behind the TV.

That said, have you got your next iteration figured out yet? Time to bend metal!! ;)

Bottom line, No Balun!



bobneumann says:

Jan 29, 2009. 7:25 PM [REPLY](#)

Would a 1:1 balun be appropriate here? I recently found a link to how to make a 1:1 balun from nothing more than 2 differing lengths of RG6 or RG59. I tried it and it seemed to work fine.

I only did it because I'm too cheap to go buy the one from Radio Shack!

But ultimately this antenna is about the right impedance, but unbalanced. Right?



williamruckman says:

Jan 30, 2009. 3:46 PM [REPLY](#)

The length of the coax can attenuate your signal. Shorter and more shielded the better. RG-6 is always best and using higher quality fittings that are tightened down well will help.

A 1:1 balun isn't needed. Typically dipole antennas have an impedance around 300 ohms but fractal antennas tend to be a little more than half of that. usually 150-180 ohms but that also depends on frequency. You would have to do some pretty in-depth mathematics to calculate it. I find it easier to just experiment and find what gives better results through trial and error.

The balun I am using is a 4:1, but maybe you would have better results with a 2:1. But again, it would work best at your dipoles center frequency and since it is a fractal it would also resonate well at some higher frequencies as well.

Which ever way you decide to go, let us all know your results.



HoldOnTight says:

Jan 30, 2009. 2:41 AM [REPLY](#)

A 1:1 coax balun isn't needed and may degrade performance unnecessarily.

I'm a little rusty, but I believe the 1:1 balun, using coax cable, is frequency dependent and works only for a given wavelength. The length of the coax is determined by the frequency, correct?

Insofar as your initial testing, you would need to compare the utility of the balun with the range of frequencies for your channels to the same setup without the balun. Maybe your stronger signals are strong enough to overcome the attenuation brought on by the tuned frequency aspect of the 1:1 balun.

Use of RG-6 would be best for a UHF, to minimize the losses. The next time I buy coax, you can bet it will be RG-6. I'm not a fan of any radio shack stuff...seems to be on the edge of poor quality, btw.



williamruckman says:

Jan 11, 2009. 8:40 PM [REPLY](#)

You could add a variable inductor or capacitor to change the inductance to see if your signal improves at lower or higher impedance values.

Good luck on your endeavor.



HoldOnTight says:

Jan 12, 2009. 3:17 AM [REPLY](#)

Williamruckman: Yes, but as I alluded to, that would be optimal for one frequency and degrade much more with other frequencies in the UHF band.



whytheheckme says:

Feb 14, 2009. 2:25 PM [REPLY](#)

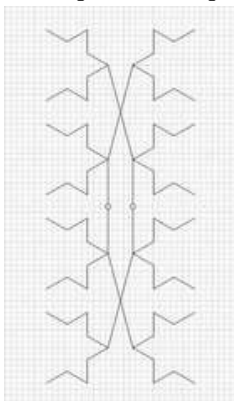
there's only one thing wrong that I see.. its that the measurements of the angles on the antennas are a combination of 120 and 60 degree angles, not all 60 degree angles..





rturpin says:


Feb 12, 2009. 1:11 PM [REPLY](#)

I combined the now famous "coat hanger" DTV antenna (4-phase bow tie) idea with the fractal antenna pattern and am getting very good reception. The resulting antenna is a good bit smaller than the coat hanger model, and reception appears to be as good or better. Have added a diagram.





 **mickydean** says: Feb 11, 2009. 7:41 PM [REPLY](#)
I, too, put this together with coat hangers, piece of wood...however I was not as successful as bytes2go... with an analogue tv I get much better reception with rabbit ears...is this design only suitable for digital broadcast?...also- I just read that a hdtv will not broadcast in hd without the use of a hdmi cable, true? I was thinking a purchasing a new lcd hdtv and would like to rid myself of my cable service and go with an "over the air" antenna such as yours- is there a transformer that accepts hdmi cables? thanks for the help...


 **williamruckman** says: Feb 12, 2009. 7:47 AM [REPLY](#)
This antenna also works on analog. You can get HD on a HDTV without HDMI cables. The digital tuner will be built in. Although, if you want to hook up an external HD device such as a PS3 then you will need an HDMI cable for that. If you want to use an older VCR or something, it will work fine but most people get an upconverter so the signal matches their native resolution. Although, I always go with the theory of crap in, crap out. If you want good quality out you need good quality in.


 **beefaroni** says: Feb 3, 2009. 11:06 AM [REPLY](#)
the biggest plastic project enclosure that they have in stock at my local radio shack was 7x5x3. does it matter it the antenna hangs over or not.
fy: im making your antenna this weekend. i'll tell you how it goes.


 **williamruckman** says: Feb 3, 2009. 7:08 PM [REPLY](#)
If you use a third iteration of the fractal it should fit perfectly.


 **bytes2go** says: Feb 3, 2009. 6:54 PM [REPLY](#)
Threw this together from some coat hangers, wire, screws & a piece of wood, amazing how well it works !!! Can now get stations I could not before... Thanks for the research & simple, but effective and easy to construct design.

 **Vomish** says: Jan 27, 2009. 6:01 AM [REPLY](#)
I was looking at the site you linked from your homepage (Television Frequency Table) and I am wondering why you used the CATV frequencies chart as opposed to the UHF frequencies chart? The CATV chart lists channel 45 at 350 MHz but the UHF chart shows the same channel at about 660 MHz.
BTW, I have built this antenna and am getting excellent results.


 **williamruckman** says: Jan 27, 2009. 10:29 AM [REPLY](#)
Yes that is a CTV chart. Most TV charts don't display the new DTV / HDTV frequencies which is usually UHF. But antennaweb.org does. Try that one.

 **Vomish** says: Jan 27, 2009. 11:13 AM [REPLY](#)
You didn't answer my question which was why use CATV frequencies as opposed to UHF frequencies in your calculations (seeing that most DTV is located in the UHF band with the exception of some areas where the VHF band is used as well)?
BTW, this is an excellent instructable that has got me obsessing over fractal antennas. Thanks!

 **williamruckman** says: Jan 27, 2009. 5:59 PM [REPLY](#)
I just looked at it again. It has both charts in it. UHF and VHF as well as CATV.

 **Vomish** says: Jan 27, 2009. 8:50 PM [REPLY](#)
You are missing my question.
You referenced using 350MHz to calculate the wavelength:
"350Mhz - 8 inch quarter wave - 16 inch half wave - which falls in the Hyper Band - between channel 1 and 90 which is a channel 45 center frequency for best resonance"
In the UHF band, channel 45 is 660MHz not 350MHz (350MHz is in the CATV frequency range).
So, why do you use 350MHz (CATV) instead of 660MHz (UHF) in your wavelength calculation?

 **ste5442** says: Jan 30, 2009. 11:57 PM [REPLY](#)
Doh!
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 **williamruckman** says: Jan 28, 2009. 5:58 PM [REPLY](#)
OK, I have fixed it up. It now reads:
"(350Mhz - 8 inch quarter wave - 16 inch half wave - which falls in the Super Band - between channel 13 and 14 which is a center frequency between the VHF and UHF band for best resonance)"



servant74 says:

Jan 8, 2009. 2:57 PM [REPLY](#)

I know that cell phones often use fractal antenna and I was wondering what the sizes of leads (actually the length between bends) need to be to make one tuned for the digital broadcast TV bands. Would anything be gained by making some additional bends thus making smaller replication in the fractal?

Actually doing this on a printed circuit board, one could get some very fine traces, and it would be 'easily' reproduced.



HoldOnTight says:

Jan 30, 2009. 3:10 AM [REPLY](#)

Yes, but only up to a point. Beyond a 3rd or 4th iteration is impractical to make unless you have really good Printed Circuit Board capabilities.



ste5442 says:

Jan 30, 2009. 11:54 PM [REPLY](#)

It should be easy to replicate a number of times on PCB - its nothing more than copper traces after all. Fractus do not use any special methods for designing their fractal antennas although they do maintain (or license - cant remember!) a patent on the idea of an antenna made from a fractal structure. I guess you could even make the author's antenna out of copper tape on bare FR4 if you had no etching materials.

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mikedoth says:

Jan 3, 2009. 10:19 AM [REPLY](#)

Can someone please explain how the the shape and size affects things? I'm new to EM Waves.



ste5442 says:

Jan 30, 2009. 11:43 PM [REPLY](#)

In reality a dipole or monopole will give the best gain - the only thing a fractal antenna has going for it is size and a possible increase in bandwidth (at the expense of gain).

Fractal antennas have been used for some time and there are patents on the idea (check out a company called Fractus) - the datasheets all show highly negative gain compared to an isotropic antenna ie. -dBi.

That said, its a nice project and nobody likes huge antennas! If we all stuck to monopoles then our mobiles etc would look comical!

Thanks for the instructable - a gain figure would be great though ;-)

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williamruckman says:

Jan 30, 2009. 3:54 PM [REPLY](#)

This Nova video that prompted me to start this design may help answer your question. They start talking about the fractal antennas a little after the halfway point:

<http://www.pbs.org/wgbh/nova/programs/ht/tm/3514.html?site=34&pl=wmp&rate=hi&ch=3>



HoldOnTight says:

Jan 30, 2009. 3:14 AM [REPLY](#)

In laymans' terms, a particular shape optimizes the ability to pull in ALL of the available signal without reflecting part of it (lost signal).



ste5442 says:

Jan 30, 2009. 11:47 PM [REPLY](#)

A particular shape which typically the same as the transmitting antenna....which is not a fractal or folded dipole. Anything less than the 'same' as the

TX antenna will mean less signal at the receiving end :-)

Its a fact determined by the physics unfortunately.

Fractal antennas are smaller and 'can' have an increase in bandwidth - they have less gain compared to their monopole/dipole counterparts though ;-)

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HoldOnTight says:

Jan 31, 2009. 8:34 AM [REPLY](#)

I hear what you are saying, but it is important to compare similar beamwidths, similar bandwidths and antenna gain when comparing antennas in order to arrive at an apples to apples comparison. When you need good performance in all three dimensions, then there isn't much competition. The fractal antennas used in cell phones provide improved performance, and physically small, so that is why they are so widespread today.

If you really don't mind a larger size antenna, then you can go with something like this to really pull in the weak signals:

- Single Bay Gray-Hoverman (SBGH) for nearby to fringe reception range (approx. > 0 to 100 km or > 0 to 60 mi)

- o Two Variants of the SBGH: with 6 Pair Collinear rod reflectors
- o with 30 x 40 Split-Screen Reflector

OR,

- Double Bay Gray-Hoverman (DBGH) for fringe to deepest fringe reception range (approx. 30 to > 160 km or 20 to > 100 mi)

- o Two Variants of the DBGH: with 11 Pair Collinear rod reflectors

- o with 30 x 75 Full-Screen Reflector

Both can be found at: <http://www.digitalhome.ca/ota/superantenna/design.htm>



williamruckman says:

Jan 31, 2009. 11:51 AM [REPLY](#)

I actually looked at these designs, but yes they are big and ugly and directional. Which means this big beast would have to be mounted on a motor to rotate it.



HoldOnTight says:

Feb 1, 2009. 9:47 AM [REPLY](#)

Perhaps you misunderstood me. I believe you are under the assumption that everyone is not too distant from transmitters, but this is not always the case. If someone is distant from the transmitters, they are likely to be desperate and the mini-DB-2 variant in this instructable couldn't cut it. They may be happy to get digital channels even if only from one direction -- the nearest city. It fills a niche for some. People should have access to what they need. So I offered the link to the DIY antenna. No antenna is an end-all be-all solution to everyone's situation.



realistic101 says:

Jan 14, 2009. 6:50 PM [REPLY](#)

Thanks guys, my wife and I were thinking of buying an antenna as we do not watch it too often. Now, the nearest TV stations are about 45 to 70 miles away from our house, will this antenna provide enough strength for good reception. (we live near one of the highest points in Ohio, ie. we are higher than the TV stations around us) Are amplifiers available and usable with this antenna to increase the signal? Sorry but I am a graduate of Mechanical Engineering (6-10 years in fabrication and machine design) and a recent MBA graduate, antennas aren't my forte.



HoldOnTight says:

Jan 30, 2009. 3:01 AM [REPLY](#)

Yes, give it a shot and let us know! :)



williamruckman says:

Jan 14, 2009. 8:07 PM [REPLY](#)

You may be able to get some of the closer stations but maybe not the furthest ones. Only way to know is to try it out. The furthest ones may work with a RF amplifier although I have never tried it.



ste5442 says:

Jan 30, 2009. 11:55 PM [REPLY](#)

Hi,

Will you be designing an antenna amp to complement the antenna?
Nicely documented instructable by the way ;-)

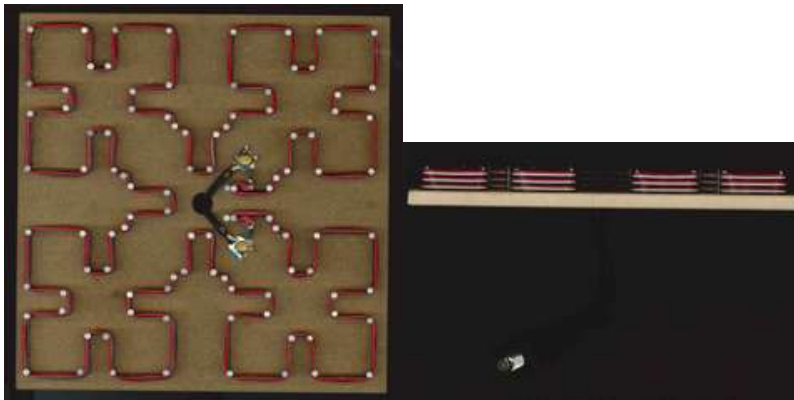
PCB Police Electronics Forum - Try our competition!



RVogel says:

Jan 16, 2009. 12:37 PM [REPLY](#)

Here is a design that I put together. I will try it out tonight to see how it works. It is 6.5"x6.5"x1/4" MDF with a bed of nails (brads) driven into it. I first printed out the paper template on a laser and xerox transferred it with acetone. I pre-drilled all the nail holes on the inside corners of each bend. Hammered nails in, did 3 courses of 3 conductor wire (326-DFV, 6502), soldered terminals, then connected the transformer. I'll use aluminum tape on the back for a reflector. I've included a paper template if anyone is interested in trying it. I have no idea how it will work.



fractal loop antenna.PDF(792x612) 30 KB



HoldOnTight says:

Jan 30, 2009. 2:57 AM [REPLY](#)

You might try adjusting your reflector 1 -2 in from the fractal for best performance. I'm trying to avoid using a reflector to get more coverage from different directions, but this is what I've found works best for max. signal strength.



williamruckman says:

Jan 16, 2009. 3:01 PM [REPLY](#)

Make sure those wires are stripped bare. Hard to tell from the photo.



maximzodal says:

What an exceptionally great project! Can't wait to get my converter box.

However, I guess I don't quite understand how insulation on the wire is going to attenuate the radio signal. Is the insulation partially or completely radio opaque?

Thanks
Max

Feb 16, 2009. 2:11 PM [REPLY](#)



williamruckman says:

The plastic over the wire can reflect and/or absorb some of the signal. It is best to have it bare. I assume it would affect higher frequencies more as they have trouble penetrating objects more than lower frequencies.

Feb 16, 2009. 5:21 PM [REPLY](#)



RVogel says:

No, didn't strip them. Would it make a big difference? Many antennas are enclosed in plastic housings of one form or another, so I figured that the insulation on the wires would be negligible.

Tried it out this weekend. Seemed to work good. Your antenna appears to get a higher signal strength. Both get reception on every single channel. One is I have with my converter box is that the signal strength meter function seems to be a bit random. Sometimes it displays 0%, but all the channels are coming in.

What would be a good way to test signal strength?

Thanks again for the great Instructable! You've put a lot of work into all this and it is inspiring.

Jan 19, 2009. 8:53 AM [REPLY](#)

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