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Chapter 1 : How to Tune an Antenna: 12 Steps (with Pictures) - wikiHow

The horizontal wire, half-wave dipole antenna is one of the simplest HF antennas to set up, it offers very good performance, and that makes it a very popular choice for hams. Let's see how trimming a dipole antenna, and following a few other guidelines, can make it glimmer like an RF gem!

Electronics Mounts Tuning your Antenna - How to set the SWR SWR standing wave ratio , is a measurement of how efficiently your antenna system will radiate the power available from your radio. In simple terms, your radio would like to radiate all of its power, but can only do so if the other components cooperate. Bad coax and mounts, or inefficient antennas and ground plane can cause system bottlenecks. The easiest way to understand the concept is to think of it in terms of water flow. That is, if you put a one inch faucet on a two inch pipe, your potential output will be restricted by the one inch outlet. So goes antenna systems. Setting your antennas SWR will reduce the restriction of radiated power. If all radios only transmitted on one channel, it would be a much easier task to design antennas. As it is, on CB alone, there are 40 channels to contend with. Mobile antennas can only be made to resonate at one specific frequency channel. The goal of the antenna manufacturers is to build the antenna to resonate at a frequency in the middle of the available band channel 19 on CB and make it broad- banded enough to keep the off-frequency related SWR at the two extreme ends of the band below 2. It should be noted that if you communicate on one or two adjacent channels anywhere within the band, you can tune your antenna to achieve optimum performance on those channels. Most people, however, prefer to use the entire bandwidth when tuning. Properly installed antenna system mount, coax and antenna that was made for the type of radio you will be using and has been tested for shorts and opens in continuity. See "Testing Continuity" Functional radio. However, the coax can help or hinder performance. In the end, your SWR should be checked at the radio end because all components will be a part of the final operational system being used. Remember to check for continuity, shorts and opens in your coax and mount installation first. All measurements should be taken with antenna tip on, unless you do not plan to use the tip in normal use. Connect the coax cable that normally connects to the back of the radio to the SWR meter connector marked "Antenna" or "Ant". Now, connect one end of the jumper cable to the back of the radio and the other end to the SWR meter connection marked "Transmitter" or "Xmit". Your SWR meter is now in series in-line with your radio and antenna. Turn your radio on and tune to channel one or the lowest channel on your radio. The following assumes that your SWR meter has a standard set of switches, knobs and meters. There will also be a knob or sliding controller marked "Set" or "Adjust". Most meters come with full instructions. If the common configuration does not match your meter you will need to rely on the meters manual for assistance. While holding the unit in this transmit mode, adjust the meter needle to the set position using the Set or Adjust knob on the meter. As soon as the needle is in alignment with the corresponding mark on the meter face, flip the switch to the Reference REF position. The meter is now showing your SWR on channel one. Note the value and quickly release the microphone switch. Now, switch your radio to the middle channel 19 on CB. Place the meter switch in the Forward FWD position, depress the microphone switch and adjust the meter to place the needle on the Set position of the meter face. Once in the set position, place the meter switch in the Reference REF position and note the reading. Release the microphone switch and write this value down to the nearest tenth of a point. If your antenna system is closely matched to the radio you may get little or no movement from the meter needle on this channel. Finally, place your radio on the highest number channel 40 on CB. With these three readings, you can determine many things about your system. If SWR on all channels is above 2. If SWR is in the "red zone" on all channels, you probably have an electrical short in your coax connectors, or your mounting stud was installed incorrectly and is shorted. If SWR on the lowest channel is higher than it is on the highest channel, your antenna system appears to be electrically short. See the following section title "Adjusting Short Antennas". Depending upon antenna model, this entails screwing down the tunable tip Illustration 1: Firestik II, Firefly , or, removing the tip, making short slits in the plastic covering and unwinding and clipping off wire Illustration 2: Firestik Designer Series antennas require loosening the allen screws and lowering the metal whip Illustration 3. Because we make our antennas extra long, readings which indicate "Short" normally stem from ground plane deficiency lack of vehicle metal surface for the antenna to reflect its signal rom. Ground plane deficiencies can also be compensated for by using dual co-phased antennas or special no-ground-plane antenna kits. Lengthening of the Firestik II and Firefly is accomplished by turning the tuning screw further out Illustration 1. On Firestik and Road Pal models, it requires tip removal, short slits in the plastic covering and, the separation and upward repositioning of three or more wire turns Illustration 4. Firestik Designer Series antennas require loosening the allen screws and raising the metal whip Illustration 3. The shorter the antenna, the more sensitive it is to adjustments. For example, removing two wire turns on a 4 foot antenna might move the SWR by 0. Make smaller adjustments on shorter antennas. However, when tuning co-phased antennas, if you adjust one antenna, it is advisable to adjust the other in equal amounts to keep them in perfect balance.

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Chapter 2 : Tuning your Antenna, How to set the SWR - www.nxgvision.com

A long-wire antenna receives best from the directions perpendicular to its sides. Erect the antenna N-S to receive E-W. It should be at least 30' long and made of multi-strand copper antenna wire supported a minimum of 15 feet off the ground.

They are affected by height above the ground and surrounding objects. In order to get an idea of the right place to start, certain formulas are generally accepted. Various formulas are given for calculating antenna lengths. You will find some variation in the factor required. While is often cited as the formula for a dipole, it assumes some loading effect from the loops at the end where the wire goes through the insulators, and a thin, but finite wire diameter. Use of tubing changes the length needed for resonance. Making bigger end loops starts to turn them into significant "capacity hats" and shortens the resonant length. But most important, environment changes resonance dramatically. High and clear is seldom the case for a real antenna. They are often mounted too low, too close to trees, houses, power lines and other things that will detune them. This will be low in frequency most likely. Measure the resonant frequency. Now calculate your own constant to replace the Using this new "custom created" constant which will probably come out as something like or so, recalculate the length required for the desired resonance. Often this method will zero in on an acceptable tune in just one or two trims. Some of the antenna types listed here will require matching networks or tuners. Other antennas like the dipoles should be a good match for 50 ohm or 75 ohm line depending on how high and clear the mounting is. Low mount dipoles often match 50 ohm line better. A high and clear dipole should have about 72 ohms of input impedance and be a great match for 75 ohm coax. An inverted V has reduced input impedance and is often a good match for 50 ohm cable. The folded dipole needs a 4: Even the quarter wave and three quarter wave verticals can often benefit from some kind of linear transformer matching since they can have feedpoint impedances as low as 35 ohms, or even lower with proximity effects from surrounding objects. Ends of dipoles can be bent if necessary. None of these "fixes" are likely to make an antenna work better, and all will change the resonant length, but they will often make an antenna fit the space available and get you on the air. People have constructed Yagi type antennas entirely of wire, hanging the elements from a rope between two trees. Here are some precalculated figures for the bands from to 6 meters to help you decide what will fit at your QTH and save some brain strain. Just remember that these will need to be cut and adjusted to resonance once installed at your height, in your location. Also there is some argument about the right values, especially for things like full wave loops. There is no substitute for having a few extra inches initially, hanging the antenna where it is going to be installed, measuring the resonance, and then calculating our own custom factor and using this to adjust the antenna again. Expect to hoist and lower the antenna several times before you get it just right with the minimum SWR where you want it in the band. The closer you can get to mounting an antenna high and clear of the ground and other structures, the closer the typical factors will apply and the closer your first calculated length will be to optimal. Use of insulated wire is fine, and there is something in its favor. The insulation somewhat protects the copper inside from corrosion. But the insulation will change slightly the velocity factor of the wire, throwing off the calculated length by a few percent. This is yet another reason to be a few inches generous on your first trial size for an antenna. Cutting is always easier than stretching. There is no substitute for hoisting a first version of an antenna into its working location and doing an SWR plot or similar measurement to find out how critical the tune is and what the current resonant frequency is. Then using that data to custom adjust your length factor and fine tuning.

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Chapter 3 : The WireMan - Antenna Wire

If the antenna reads too long or too short after adjusting the stub, you can try adjusting the length of the long radiating element a little bit. Ring Matched Antennas These antennas use a sliding contact on a ring device.

In tuning a dipole antenna, do you count the wire that is wrapped back around the antenna as length, or just the wire that is between the end insulators? That has nothing to do with "tuning," but I understand the question. Technically, if you make a dipole using insulated wire which I strongly recommend for anything except temporary use , when you "wrap the end" back on itself, the wire that is doubled back is still part of the antenna and contributes to overall length. Normally, folding back just a few inches or several inches and wrapping it around the main element wire is sufficient to hold up an antenna for a lifetime, and if in doubt, you can tie the wire in a knot, solder it or otherwise mechanically secure it so nothing can slip. With a 10 meter dipole, a 1 MHz change in resonance amounts to a dipole length change of seven inches. On 80 meters, a kHz change in resonance as wide as that whole band is! This subject involves "fabricating" the antenna, though, and not "tuning" it. Due to earth proximity and end effects, most dipoles are "too long" if fabricated according to the formula and will have to be adjusted "shorter" to achieve desired resonance. The influence of the earth below and dielectrics close to the tips of an HF dipole influence its length MUCH more than any extra wire wrapped back on itself at each end insulator. I have always measured my dipoles, basically, as the length between the insulators. More specifically, where the wire goes into the insulator hole on one of of the dipole to the insulator hole on the other end of the dipole. You always end up "pruning" the antenna for the lowest swr anyhow, so it is not that critical. An exact measurement is not that critical either for those folks who use antenna tuners. Just the wire between the end insulators. The antenna will be affectd by the local environment. Use a continuous mode such as CW or FM. Keep transmissions very short and use the lowest power possible. Check SWR above the frequency you wish to use and below. Take measurements after trimming just one side, then the other. Sometimes due to local conditions or to get a better match to the coax, the antenna will be slightly longer on one end. Hope this helps, 73,.

Chapter 4 : Basic CB Radio Installation and Troubleshooting | www.nxgvision.com

For a wire antenna, clip off a bit of the end to shorten it (if you have a wire antenna that is already too short, you will need to get a new antenna). 12 Repeat Steps , tweaking your antenna gradually until the SWR readings on the lowest and highest bands, or Channel 1 and Channel 40, are identical.

A second tower, also only about 12m high, is a wind-up tilt-over design, ideal for testing and tweaking antennas. The beams are only about m off the ground, quite low in wavelength terms but it helps enormously to be perched on top of a m hilltop from which the ground slopes steeply away all round. My third tower replaced the first: I was happy to have the base refurbished and rewelded by Red Steel, an excellent local steel firm in Napier. My current antenna line-up The antenna is oriented in a North-South plane and fed in the centre of the bottom horizontally polarized with a quarterwave of 75 ohm coax to match it to the 50 ohm feedline, through a homebrew balun. It is not working well at all on I used to have a square loop suspended between two 25m treetops but that got well and truly knitted into the trees by a passing cyclone a year ago. I need to replace it. It was a much better DX antenna. The antenna will soon be relocated, perhaps replaced with a loop. Works very nicely for such a simple setup. It is just at the right edge of this photo, almost invisible, a stealth antenna! It has an interesting trapless parasitic feed arrangement with interlaced elements. Evidently it still has plenty of DX left in it. It works surprisingly well for such an ugly beast, a temporary antenna that has lasted several years with just one repair so far. Being just over a wavelength above ground, it has some directivity which makes me wonder if my LF loops are far too low! All my antennas use homebrew QRO ferrite baluns. Note the small dummy load on the rightmost antenna port, useful to check from the shack end that the feeder and switch are working properly. The long feeders run partly underground. It was a tedious job hand-digging the trenches but the thought of reducing the local QRM from our computers etc. Constructing simple wire antennas Simple wire antennas like dipoles and verticals are dead easy and very cheap to make: Read up on wire antennas or use my spreadsheet below to figure out how much you will need for, say a halfwave dipole or quarter wave vertical. There are several home-brew options here ranging from suitable pieces of wood, Perspex sheet, plastic or ceramic Tees or open-wire insulators, up to commercial centre pieces with built-in coax connectors. Personally, I like to make up my own IPsealed plastic balun boxes using a toroid plus stainless steel bolts with stainless wing nuts for the antenna wires and either SO connectors or long coax pigtails terminated with in-line SOs again, to avoid unnecessary connectors and save the odd tenth of a dB - they all add up! For wire verticals, it is possible to solder the antenna wire and earth wires directly to the feeder, then wrap the feed point with self-amalgam tape. Coax or open wire feeder, more than enough to reach from the antenna feedpoint once erected to the shack or remote antenna switch. Open wire feeder has negligible losses but the balun and ATU put the losses back in and add complexity, so open wire is only really worthwhile for a multiband doublet antenna, vee-beam or rhombic dream on. Ceramic ones will last approximately forever barring accidentally dropping them on the ground or over-stressing them but are heavier and are quite scarce. Plastic ones will last up to a decade. Electric fence wire insulators are good if you have a farm supplies shop nearby, as they are designed to insulate tens of kilovolts for longterm outdoor use. Bits of Perspex or other strong plastic sheet can be cut to size. At a push, you may be lucky just using the plastic cord see below but it tends to start conducting when wet so the resonant point and match will change in the rain. A wooden winder board on which to wind the antenna. Make these from offcuts of plywood or thin MDF board approximately 30 x 15cm, with U-shaped notches in both short ends to hold the wire in place as you wind. Plastic cord to hoist the antenna. Fairly cheap, thin nylon or polypropylene cord is fine to hold out the ends of a small to medium-sized dipole or vertical, and lasts for ages if not over -stressed. You will need thicker cord or rope up to about mm for large antennas and to hoist the balun and feeder of a dipole. Measure out the exact wire lengths you will need and cut the wire. If you have, say, a convenient fence or wall at least 10m long and some patience, you could measure and mark it permanently with paint or similar markers to use it as a giant ruler. Err on the long side as you will trim the antenna down to resonance later but adding wire would involve soldering bits on, preferably using a decent butane-powered soldering iron yet another worthwhile investment. Make up the feed point. Seal the coax feed point with self-amalgam tape or coax sealant. Take care over this as water in the coax ruins it forever. I sometimes add short lengths of shrink -wrap on the centre ends of the antenna wires in order to label them. Marker pens work for up to a year before fading in the sun. Erect the antenna and test it for resonance. Bring the antenna down, trim a few cm off the ends, put it back up, re-test for resonance and repeat until done. If you get smart, calculating exactly how much you need to trim off, you will inevitably cut off too much at some point. As I said, err on the long side. Work lots of DX. I suspend miscellaneous wire antennas in the trees from time to time. Loops seem to work better than verticals and dipoles, presumably due to their higher radiation resistance - around ohms according to the books - and hence higher efficiency. Whatever, loops work well for me. My first antenna experiment in ZL was simply to add additional wires in parallel to the existing 40m quarter wave vertical, using the same coax feed and ground plane. I added 30m and 80m quarter waves - the 80m one makes an inverted-L. They seemed to work, after a fashion, but were noisy on receive. The design is based on a receiving antenna shown in The Radiotron Designers Handbook of The m vertical will be an inverted L as even our tallest trees are not quite 40m - more like 30m at a guess. The earth mat will be a combination of deer fencing and wire radials. So many antennas in mind, so little time! Using the simplest feed arrangement, the antenna fires across the diagonals giving one of four directions: The pattern is cardioid. The tin roof of my workshop makes an excellent groundplane, roughly 10m square as it happens it was rectangular so I added a tin roof woodshed to make it squarer. The antenna elements are wires, attached to fibreglass roach poles using rings of heatshrink tubing. The poles are a push-fit into surprisingly strong adjustable angled base fittings made to hold Sky satellite dishes, a very convenient arrangement. The purple wire is the earth connection to the coax outer, relying on metal to metal contact of the fitting to the galvanized steel shed to couple it in to the main roof area. The calculated inductance values in the hybrid coupler on 30m require 8 turn coils on T cores, but for some as-yet unknown reason, my shiny new LCR meter from Hong Kong measures them at more than twice the target inductance the calculations and inductance values are correct, but the meter is wrong, although it measures small potted inductors of a similar value correctly. The coupler needs two pF capacitors: I could only find pF HV capacitors in my junk box, so added some coax tail capacitors in parallel in the first version. The toroids are cable-tied to a chunk of PVC pipe to keep them in place.

Chapter 5 : Tuning Your Antenna - Helpful information for tuning Ham Radio Antennas!

For example, removing two wire turns on a 4 foot antenna might move the SWR by ; the same amount removed from a 2 foot antenna may move the SWR by Make smaller adjustments on shorter antennas.

Coil requires removal of 10 turns on one end and 9 turns on the other. I personally do not mind, as it keeps the antenna out of the blazing Arizona sun. I developed some tricks I use for attic installation which you may find helpful if you are also confined to attic antennas. If not, then use whatever installation technique you would like but the tuning instructions will remain basically the same. For the center insulator, I use a spring-loaded clip to first attach the dipole to the center mounting position. You can purchase all the items described in the following sections at your local home store. In the upper right-hand corner of the picture below, you can see the center insulator attached with the spring clip to the eye-hook. Also notice the home-made choke-coil that I made with a section cut from a cardboard concrete form. The antenna on the left is the original meter DX-EE which is using a purchased choke which is made with about 4 feet of coax covered with ferrite beads and then covered with shrink-wrap. The roof is covered with tar-paper and concrete roof tiles. This is all obviously not ideal but you can still make these antennas work quite well. To shorten the antenna, I disconnect from the eye-hook and then make antenna length adjustments as needed. I untie the rope from the Quick-Link, attach the spring then feed the rope through the Quick-Link and make the antenna taught noting the position on the rope where a new knot should be tied. I remove the spring from eye-hook, tie a new knot, and then stretch the spring and reconnect to the eye-hook. This may all be a bit of overkill, but I found it easier than trying to tie a knot while trying to keep the antenna taught, especially if you need to bend yourself back into some tight spot. Once the antenna was installed in its final location, it was time to test the SWR and adjust the antenna. I actually had a 40 meter folded dipole installed exactly where the new WARC-band antenna is installed. That antenna basically was useless compared to the meter DX-EE so I removed it and figured I could use the existing eye-bolts for this antenna. I was a little concerned that removing one antenna and putting up another so close to the existing meter dipole may have affected its tuning so I also checked its SWR. I found that it was slightly de-tuned now on the 10 and 15 meter bands. The center-frequencies had moved slight up which meant those elements were just a bit too short now. I would just need to shorten the amount of wire that was folded back by about an inch to make antenna longer for those elements to get the SWR centered again within the band. This just proves that surrounding antennas and metallic objects can affect attic installations so try to keep the antennas as far apart as possible and away from metallic objects as much as possible. As expected, the resonant frequency for each band had moved slightly lower and would need to be shortened. I started with the 6 meter element first. I ended up cutting off about 3" of wire on each end and still had about 4" wrapped back on itself. I would not suggest cutting wire at all because it is possible to end up being too short. If you feel there is getting to be too much wire wrapped back on the ends and want to cut some off, only cut an inch or so off each end at a time and check the SWR each time to see the affect. I was able to get the lowest SWR on the low-end of 6 meter which is where I wanted to be. I repeated the same steps for the 12 meter element and found that I needed to shorten the elements by about the same 3" as I did for 6 meters. Now for the hard part! Based on my experience tuning the meter dipole, I figured I needed to shorten the element that runs from the center-insulator to the coil by about 12" as a starting point. Now, at this point you might be realizing how much of a pain-in-the-butt this is going to be. Do I really need to remove the coil from the antenna by untwisting all that 9" piece of wire, straighten the wire, cut off 12", and then re-install the coil? What if I am now too short? If I do this instead an inch at a time how many times will I need to do this? I asked myself all these questions and the answer luckily is NO! I learned by my experience with folding the ends of the other elements back that the RF does not seem to care that there is insulation on the wire but only seems to care about the resulting length. What if I was to introduce a bend in the wire in between the center-insulator and the coil? Make sure the zip-ties are tight I actually install 3 once I have finished so the tension on the antenna does not collapse the fold. A normal amount of tension seems to be no problem. I release the tension on the antenna by removing the ends from the eye-hooks now you see how this becomes handy and readjust the "Z"-Fold so its about 1" shorter overall which effectively adds back about 3" of overall length. I needed to repeat these steps one more time to get the center-frequency dialed in. It is also worth noting that I also spot check the 12 and 6 meter SWR to see if changing this wire by so much had any affect. It did slightly on 6 meters, so be sure to check the other bands and tweak as needed. The affect should be minimal. The last task is to tune the 30 meter stubs. Due to the high Q of the coils, the bandwidth on 30 meters is very narrow. You need to tune the antenna for the portion of 40 meters you wish to work. Fortunately, the 30 meter band is only 50 KHz wide so the entire band should be workable. To adjust the length of the stubs, it is just a simple task of unwrapping the wire connected to the end-insulators and adjusting as necessary and loosely wrapping the wire back on itself again. When I first measure the SWR for the 30 meter section, it was resonating at about 8. I started shorting the antenna about 3"-6" at a time until I got close to the 30 meter band. The adjustments become real tricky as you get very close to the band to try and center the lowest SWR right in the middle of the band due to the narrow band and narrow coil bandwidth. I found that this actually has a "very-fine-tuning" affect. I realized that at some point I was "close enough" and considered it done. I cleaned up all my gear and got down out of the attic. Now it was time to check my results! Here are my final readings: Notice the Z varies slightly around 50 Ohms. At this point, I must confess I was more than little concerned that I could get this antenna to work properly since I had to alter the coils. I even noticed that the original coil SWR for 20 meters was not precise for both coils. It is obvious now that this was not an issue. The Z for this band is even more flat at 50 Ohms. Even so, the SWR is not bad across the entire band except for below My tuner will easily handle the higher SWR on the ends. But if you look at the 2: However, the impedance does some strange things in lower portion of the band and becomes a better 50 Ohm match once we get above In fact, you can see that for 17 and 12 meters the lowest SWR occurs a bit higher in frequency. But I am not climbing back into that attic and messing around for an 1. It may appear that for 30 meters we are not covering the entire band. For some reason the software shows the yellow band for 30 meters from For the graph above for 30 meters I manually set the range to proper band edges. I was immediately able to hear the "difference" in the antennas as the WARC bands now come in much stronger on an antenna cut to their size. I think I have also proven it is possible to make these antennas even work in an attic situation. If you attempt to do this on your own, please drop me an email and let me know how it worked. I am good on QRZ. Good luck and 73 de Mike!

Chapter 6 : KING Jackâ„¢ Directional Over-the-Air Antenna with Mount & Built-In Signal Meter (OA)

The Auto-Tuning Antenna system includes the components shown in Figure IV-I. A radio is connected to the SWR Analyzer, which is placed in-line between the radio and antenna.

Why should I do that, you ask? Why tune my antenna? Poorly tuned antennas can lead to increased interference, dropped signals, and lack of ability to make the best quality contacts which is, after all, the purpose of installing this on your rig , and even damage your radio! What is tuning a CB radio? Tuning the radio system is when you adjust an antenna to the correct height so that the radio puts out signals as efficiently as possible. First, you measure how the system is currently performing with an SWR meter, and then you adjust the antenna length or location to improve the signal output. That will give you the best performance and efficiency of transmission. It is worth noting that CB radio tuning is different from tuning a CB antenna. Most often, when you hear or read about "tuning a CB", what they are really talking about is tuning the SWR for the antenna. Tuning a CB radio commonly called a Peak and Tune is something we offer and entails adjusting the actual radio. Tuning the antenna is crucial to the overall perfoamnce of your system. Checking and setting the antenna is critical to overall performance of transceiver radio. During installation of a Business Band, CB, Ham or Marine radio or installing a new antenna, the SWR must checked to ensure the transmit power coming from the radio is traveling through the antenna system correctly. When the signal does not travel through the antenna system correctly, the transmit power is reflected back into the transceiver which causes reduced range and potential damage to the internal parts of your radio. See our explanation of SWR readings below. If you have an SWR ratio reading of 1. A ratio of 3. Instead, the transmit power is reflected back into the radio via the coax cable, causing reduced function. If too much power is reflected back, you risk damaging the internal parts of the radio due increased heat generation. To avoid damage, keep your SWR levels below 2. How can the antenna length be adjusted? That depends on what kind of antenna that you have. Your antenna manufacturer should have instructions explaining how to adjust your antenna. As we said, some CB antennas have a tuning tip, a small screw at the top of the antenna, like the Firestik. To adjust that type of antenna, you turn the screw in or out, easily lengthening or shortening the antenna. The video below shows some of the more common tuning methods. How to tune a CB antenna: Start with selecting an appropriate location to do the tuning open area , then move on to connecting the SWR meter. Tuning the antenna while your vehicle is close to other vehicles, buildings, or even people can give you an incorrect reading. Also, each time you take a reading, make sure your doors, hood and windows are closed. Other SWR meters are available, and some include additional meters. A typical CB radio installation will look similar to the picture above. The picture below shows the same installation with an SWR meter added in line. The instructions further below in this article outline connecting an external SWR meter and tuning a CB antenna. The connector inputs could be on the back and the labels on the front of the meter. Connect the short coax jumper cable coming from the transmitter position on the SWR meter to the back of the CB where you took off the coax cable in step 1. Close the hood and doors on your vehicle, and make sure there are no people or other large vehicles around the vehicle area. Turn on the CB. Set the CB to channel Key the microphone by depressing the talk button and turn knob until the SWR meter indicates the "set" position. Unkey the microphone by letting up on the talk button. Take note of that reading. Repeat steps 6 through 10, this time on channel 1. The lower the reading, the better your CB radio will perform. The goal is to set the antenna to the lowest SWR readings possible, evenly across the 40 channels- for example, the reading on channel 1 and 40 at the same at 1. By having the SWR readings match on channel 1 and 40, your radio will perform well on any of the channels within the 40 channel bandwidth. If they do not match, adjusting the antenna is advised. You could potentially damage your radio. Example of when your antenna system is too short: If the SWR meter reading on channel 1 is 2. You will need to increase the physical length of the antenna system. Possible solutions include adding a spring or quick disconnect, raising the antenna, get longer coax and just make sure to store any excess coax in a figure eight style, about a foot in length, and loosely bound in the center , or re-positioning the antenna. Lengthening of the Firestik II and Firefly is accomplished by turning the tuning screw further out. On the

"Original" Firestik and Road Pal models, it requires tip removal, short slits in the plastic covering and, the separation and upward repositioning of three or more wire turns. Firestik Designer Series antennas require loosening the allen screws and raising the metal whip. Alternatively, if the reading on channel 40 is higher than channel 1, your antenna system is TOO LONG and you need to shorten your antenna system. Example of when your antenna system is too long: If the SWR meter reading on channel 1 is 1. If your SWR is under 1. But the drop from 1. You should try to get it lower, but performance should still be acceptable in this range. To troubleshoot, see this article on problematic CB antenna mounting locations. However, you should definitely try to improve it if you can. Performance in this range will be noticeably decreased, and you might even damage your radio if you transmit frequently and for extended periods. We advise you not to operate your radio in this range.

Chapter 7 : Setting and Adjusting the Antenna - Westwood One

Theoretically, this is an end-fed half-wavelength antenna only on 80m. On 40m, ft. is about one wavelength, so the impedance at the ends should be quite different from the impedance at the end on 80m.

Tune your antenna for better DX by Roy A. But the antenna is another matter. If you are new to the hobby, or if you have been having trouble DXing those really difficult stations, you may find the answer to your reception problems in a properly constructed long-wire antenna - and the "Pi-section Coupler". Normally, the best receiving antenna is considered to be a resonant antenna - one that resonates at a particular frequency. The length of such a BCB antenna would range between and feet - much too long for the space most listeners have available. The solutions is to build the long-wire "Pi-section Coupler" and get the maximum signal transfer out of the antenna you have erected. If you use a "Pi-Section Coupler", your antenna can be as short as 30 feet or as long as feet. The combination can be made to work efficiently at all frequencies between and kHz. The Antenna Construction of a long-wire antenna is simple. If you just remember and adhere to the following rules of safety. Never construct your antenna so that it could fall on power lines or they on it. Always use a lightning arrestor; this not only can save you equipment but may improve the signal, since it drains static electricity from the antenna. A long-wire antenna receives best from the directions perpendicular to its sides. Erect the antenna N-S to receive E-W. A long-wire antenna works best 60 feet above electrical ground 40 to 50 feet above land surface. Egg-type insulators should be used to physically connect the antenna to the supports. To prolong the life of the antenna, coat all solder connections with plastic rubber. Bringing the signal from the antenna to the receiver calls for the use of insulated copper wire of 16 to 18 guage. It should be wrapped to afford mechanical strength and soldered to the end of the antenna at the insulator closest to the receiver. The proper feed line entrance into a house is through a wall using an "All weather wall feed thru bushing" or a similar tubing. Lightning arrestors can be bought for as little as 59 cents. Terminal "G" or "ground" on the receiver should be connected to a good ground. Clean the cold water pipe with emory cloth at the point where you wish to place a "ground clamp" clamps cost approximately 50 cents. Secure the clamp tightly and affix a length of guage insulated wire sufficiently long to go to "ground" on the receiver. Then coat the ground clamp connections with rubber glue. The coupler is particularly useful in matching erratic sometimes high, sometimes low - as you tune various bands impedance of a single wire antenna. RCA phono jack L1: Not only will you greatly increase the incoming signal, but you will also gain experience in apparatus construction. The author assembled his coupler in a clear box. In selecting a box, make sure it is large enough to accept the components. Start making up the coil by drilling two holes in the coil form to pass the coil wire. Insert wire through these holes, leaving 4" extra wire protruding which will be used for hookup later. The holes are intended to hold the wire secure during the winding operation. Wind tightly two turns of coil wire and drill a hole adjacent to the second turn to press-fit a brass nail, used as a lug. Scrape the wire adjacent to the lug hole this is lug 1 , and solder to the coil. Wind four more turns, drill another adjacent lug hole this is lug 2 , and solder. Proceed in this manner, winding the specified number of turns as shown in Figure 1 until the coil is complete. Secure the coil winding through two more holes, leaving 4" extra wire protruding. Solder them to the terminals of SW1, leaving one terminal bare. The bare terminal is 0. The terminal next to 0 is 1, the one next to it is 2, and so on, around the switch. Remember that lug 1 is on the coil end with only 2 turns. Cut he wires soldered to the switch terminals so that they will just reach the corresponding lugs when the switch is one inch from the coil. The outer conductors of J1 and J2 are "ground," as are the terminals associated with the rotor plates in the capacitors. Solder the necessary wires to the proper points to connect the remaining components. Then connect the receiver to J1 and the antenna to J2 using a coax cable. Using the coupler To operate the coupler, set C1 and C2 at the half-open position and rotate S1 until the signal is strongest. Adjust C1 and C2 to peak the signal to maximum while adjusting C1, switch S2 on and off to find its best setting; C2 will have no appreciable effect at some frequencies. The coupler is basically an attempt to effect a more efficient transfer of signal energy from the random length of antenna to the receiver. At some frequencies the coupler will seemingly have no effect, which means the antenna and receiver are matched as closely as possible. At other - or most - frequencies the coupler will have a very decided and noticeable effect. Capacitor C2 whould be switched in and out of the circuit when the coupler seems to have the least effect - especially at lower frequencies. The dial settings should be logged to simplify re-tuning. Editorial notes I have several comments about this excellent article. Also, in the years since this article was published, several things have changed: Unfortunately, the number of coil turns on the original schematic was obscured incompetant Xeroxing. I had enough information to make a pretty good guess in most cases. And note that the prices listed have changed during the years. It will not be very strong, but may suffice. It may be next to impossible to get a pF variable capacitor. Discarded two section tuning capacitors can be used, the larger section is pF. The extra capacitance will make no difference, as you can just use pF of the tuning range. The AM band expansion to kHz should make no difference - as the coupler is usable to frequencies of kHz. A good grounding clamp is a 1" hose clamp from an automotive parts store. A cheap version of this coupler can be constructed using a discarded ferrite bar antenna and two tuning capacitors. The coil is tuned by moving the ferrite bar in and out. The tuning range will not be as great, however. This article originally appeared in Popular Electronics, March, , pp

Chapter 8 : Let's Keep It Simple - Adjusting the Novice Antenna, September QST - RF Cafe

Wire Antenna: This is a piece of wire extending over the PCB in free space with its length matched to Î»/4 over a ground plane. This is generally fed by a Î© 4 transmission line.

This ratio can be calculated by hand as: On a single needle meter the ratio is read directly after calibrating for Forward energy. On dual needle meters the SWR is read from markings at the intersection of the two needles. Of course the goal is always a 1: In most cases SWR under 1. I generally strive for 1. As SWR increases not only do you begin to notice decreases in performance, the levels of standing waves on your coax increase which may contribute to "RF in the shack" problems and interference with other electronics in your immediate area. In severe cases transmitters have actually been damaged by high SWR. Solid state transmitters are far more prone to fail with high levels of returned energy than tube transmitters ever were. While most mid to high end radios do incorporate some kind of built in high SWR protection, most entry level and many older radios do not. This is why most SWR meters have a red marking from about 3: Feedline Issues Coaxial cable, the most common feedline, delivers energy to an antenna in an unequal or "unbalanced" state. RF energy is delivered to the antenna along the center lead. In a perfect system with a 1: All RF power from your transmitter is radiated away by the antenna. However, antennas are seldom perfect and quite often there is current flowing on the shield of the coax. The worst of these conditions occurs when feeding a balanced antenna such as a dipole or loop antenna with coax. This is a natural mismatch in feed methods --balanced antenna: The illustration on the right shows the end of a piece of coax where it connects to a dipole antenna. The arrows represent a moment in time. The blue arrows represent antenna currents. If the antenna cannot get rid of all of the RF energy current will flow on the inside of the coax shield. This is normal and in this condition the currents are fully contained within the coax. However, when a balancing mismatch occurs, it is entirely possible for current to flow on the outside of the coax shield, as shown by the red arrow. This undesirable current is not contained inside the coax and can radiate from the coaxial feedline, getting into nearby electronics in very undesirable ways. This is called "common mode" current since it is actually in phase with the center lead of the coax. This can also happen with unbalanced antennas as well. If you are having common mode current problems you will notice the SWR of your antenna system changing during a rain storm or when the coax is moved or touched. In severe cases, touching your radio equipment can affect the SWR of your antenna. Fortunately there are relatively easy fixes for this problem If you are feeding a balanced antenna such as a dipole or loop you should always use a Balun designed for the range of frequencies in use. A balun is a transformer mechanism that takes the naturally unequal signal from coax and transforms it to a balanced 2 wire signal delivering equal but opposite energies to both sides of the antenna. You are thus feeding a balanced antenna with a balanced signal which should keep both feedline and antenna happy. If you are feeding an unbalanced antenna such as a mobile whip, groundplane or colinear antenna you can add a common mode choke. This can often be as simple as a few coiled up turns of coax positioned near the antenna. The choke forms an inductor with the outside of the coax shield making it an uninviting place for current to flow. The internal signals should not be affected The size of the coil and the number of turns is best determined experimentally; use just enough to eliminate the problem. An excellent article on the construction of common mode chokes, also called Ugly Baluns , can be found on the Ham Universe website. It is a good idea to use common mode chokes or baluns on all your projects. While not absolutely necessary in all cases, this is a simple precaution that harms nothing if not needed. In this way you are taking the structure and other unavoidable local objects into consideration. Because of highly variable conditions, mobile antennas absolutely must be tuned in-place on the vehicle. You should park the vehicle as far from any buildings, light posts or metallic objects as possible. Always take your measurements with all doors or hatches closed. Portable antennas need to be tuned "in the clear", suspended from a non-conductive cord or standing on a non-conductive mount with as much free space around them as you can get. Those with fold-down stands should be tuned on their mounting structure, simulating real-world conditions. Directional antennas should be pointed straight up with their reflectors as far above ground as is convenient. Always keep yourself, your kids, your pets and others well back from antennas while tuning. Beyond the risk of RF burns, there is the matter their body capacity is going to upset your readings. NEVER activate your transmitter while anyone or anything is touching the antenna! Tuning Goals The primary goal in tuning an antenna is to make it usable all across the band s it is designed for. Antennas are resonant devices. That is to say they work best at a single frequency. As you move above or below that frequency their efficiency rolls off, producing standing waves. In order to achieve the goal of usability, you will want to tune the antenna for equal SWR readings at each end of the band. Below is a plot of the SWR for a theoretical well tuned antenna. You want to end up with equal SWR readings at each end of the band you are tuning for. Most antennas behave a little differently below resonance than above and it is rare that you will get the lowest reading exactly in the center of the band. The important goal is equality at the band edges. This ensures the antenna is usable all across the entire band. For this you will need your meter and a short jumper of coax with the correct connectors on it usually PLs. Connect one end of the jumper to the back of your radio. Now connect the other end to the "Transmitter" socket on the SWR meter. Make sure all connectors are well seated and done up snugly. The operation of SWR meters varies a bit from model to model, so be sure to read the instructions for your meter carefully before proceeding. The actual adjustments you will make depend entirely on the type of antenna you are tuning. Those with impedance matching devices are more complex than those with simple top whips. Multi-band antennas introduce a whole new level of complexity. The general measuring procedure is always the same Tune to the low edge of the band you are adjusting for. Tune to the high edge of the band you are adjusting for. If the low edge has the lower SWR the antenna is too long. If the high edge reads lower the antenna is too short. The adjustments you make based on this information will depend on the type of antenna you are adjusting: Whips, Mobiles and Groundplanes These antenna types are adjusted by changing the length of the radiating element s. There is usually a provision to slide the element s in and out for tuning. If the antenna reads too long, adjust the element shorter. If it reads too short, make it longer. Wire Antennas, Dipoles and Loops Wire antennas should always be deliberately cut too long at the start. The only adjustment you have here is to clip a little bit off the end. Be careful to keep the sides of dipoles the same length and make sure the feedpoints of loops stay centered. Cut carefully and in small increments. If you get too short, making them longer is going to be a huge undertaking that might well result in antenna failure once the weather gets at your splices. Once you know the correct direction, adjust the matching device for the lowest SWR. Then, once you find the lowest SWR by this means, try adjusting the length of the driven element to get the SWR equal at the band edges. This might send you back to re-adjusting the matching device. With patience, each cycle will result in smaller movements as you zero in on the perfect settings. J-Pole Style Antennas These are also antennas with matching devices. Fortunately they are a lot easier to adjust than a beam. Here you move the coax up and down on the matching stub to find the lowest SWR. If the antenna reads too long or too short after adjusting the stub, you can try adjusting the length of the long radiating element a little bit. Ring Matched Antennas These antennas use a sliding contact on a ring device. The general procedure is to set the radiating element at the factory recommended length then adjust the sliding contact for the lowest SWR. If the antenna reads too long or too short you can generally adjust the length of the radiating element a little bit to even out the ends of the band. Here you adjust the length of the shortest section for the highest frequency band. Then move to the next section along the antenna for the next lower band and so on, moving to longer sections for lower frequencies, until you have all sections matched. You may need to go back and forth a few times to get everything working right. Also note that multiband antennas use coils and chokes along their length so these adjustments can be quite sensitive. Any place water can get in will cause problems.

Chapter 9 : How to Tune a CB Antenna | CB World

The easiest way to check and adjust the antenna is to use an SWR/antenna analyzer. If you don't have one or can't borrow one, you'll have to use the tried and true method of using an SWR meter and transmitter running at the lowest power setting that will work with your meter.

You have a nice DC power supply ready to provide Now, what do you need to do with that dipole antenna to get on the air? This is a common scenario for many new aspiring HF operators. The horizontal wire, half-wave dipole antenna is one of the simplest HF antennas to set up, it offers very good performance, and that makes it a very popular choice for hams. Try to keep the dipole away from other conductors, especially long, linear ones like household rain gutters, or at least try to avoid aligning the dipole parallel with such conductors. A dipole will provide low take-off angles for good over-the-horizon skip propagation when it is approximately one-half wavelength above the ground. At lower heights the radiation pattern will become more vertically directed and more omnidirectional. Be sure to seal up any connectors that will be exposed to the elements to avoid water penetration into your coaxial feed line. The total length of the dipole should be just under one-half wavelength for the operating band. When the dipole is properly trimmed for an operating frequency the antenna feed point will present an impedance that is closely matched to the feed line impedance. When feed line and antenna feed point impedances match, your antenna system will have effective power transfer and will radiate efficiently. Nearly all antenna systems will have at least a little power reflection due to mild impedance mismatch at the antenna feed point. The standing wave ratio SWR is a comparison of the forward power in your antenna system with the reflected power. A low SWR indicates little power reflection and efficient power transfer to the antenna, while higher SWR values indicate greater reflection and less efficient power transfer. Generally, you should strive for a low SWR in your antenna system. You can judge the proper trim for your dipole by measuring the SWR as you adjust the antenna length. How do you measure SWR in your new dipole? Two very popular instruments for trimming a dipole antenna are the SWR meter and the antenna analyzer. The SWR meter is positioned into the feed line between the transmitter and antenna. Most hams will place the SWR meter into the feed line immediately after the transmitter so the readings are viewable in the shack while transmitting. The SWR meter evaluates feed line voltages in the forward and reflected directions and displays the SWR computation for the operator. So, you have to actually transmit a signal for the SWR meter to take a reading, and you must read the SWR value during the transmission. The antenna analyzer requires the feed line to be connected to it, but no connection to the transmitter is needed. The analyzer generates its own signals for the antenna system, computes SWR, and displays it to the user alongside frequency. It is very common for an antenna analyzer to allow the user to dial through a range of frequencies while observing the SWR readout. This way the user can watch for the SWR value to dip to a minimum value, and thereby see the precise frequency for which the antenna is currently trimmed. Determine the band and frequency range for which you desire the antenna trimmed. For example, you may want to trim a meter band dipole for the General Class phone frequencies of Compute the approximate antenna length for the center frequency of the range for which you are trimming. In our example that would be a trim for about So, perhaps you would cut your meter dipole length to be about 34 feet long, with each of the two segments at about 17 feet. The specific methods used will depend on your dipole configuration flattop, inverted V, or sloper and its height above ground, as well as the type of anchor points being used. If you cannot erect the dipole near its final operating position, approximate it as closely as possible and elevate the antenna above the ground to the extent possible for measurements. Use one of the measurement instruments to determine the frequency at which the lowest SWR is achieved. Given the extra-long length of wire left on the dipole segments, the SWR should bottom out at a frequency below the desired operating frequency. To raise the frequency of minimum SWR, trim the antenna shorter. If the minimum SWR is minimized at a higher frequency than desired, you must lengthen the wire segments. This is usually a very rare circumstance, but to avoid it you should trim carefully and trim often rather than taking only a couple of giant chunks of dipole length at once! Physically trim the wires shorter â€” lower the antenna ends to accomplish this if you erected the dipole near its operating position. You may trim in one of two ways: Either cut the wire or wrap the wire back along itself toward the center feed point. Be sure the wire is routed through the insulating anchor before wrapping, and you may wish to use a combination of cutting and wrapping to carefully trim into just the right frequency without having an excessive wire wrap. Reposition the dipole and make another SWR measurement to see what effect your trim has had. Repeat the trim action in small adjustments until you achieve lowest SWR near the desired frequency. Once you have your antenna trimmed satisfactorily for your desired operations, tie it up permanently and get on the air! Especially if you are using trees as anchor points, be sure to provide some slack and strain relief to avoid snapping a wire when the trees move around with wind. Some operators prefer to hang a weight over a pulley or over a tree limb with the cord attached to the horizontal dipole wire. When the tree moves the cord and weight will keep the wire taught without over-straining it. It is easy to dial across frequencies to find the lowest SWR with an analyzer. You can measure, adjust the trim, and measure again in quick cycles. The SWR will be lowest at just one frequency position, and it will rise gradually for frequencies above and below this center point. A common metric of antenna performance is SWR bandwidth, and this is often defined as the bandwidth for which the SWR is at a value of 2: At SWR values greater than 2: An SWR curve is pretty easy to plot with an antenna analyzer. Simply record the SWR readings every few thousand kilohertz as your dial across the frequencies with the analyzer. Then, plot the SWR values against frequency with graph paper or using a spreadsheet utility on a computer. You must change your transmitter frequency and take multiple SWR readings across the frequency band. Again, tune your transmitter in steps across the band and record the SWR readings with each transmission, and then plot your results as described above. Be sure that you do not transmit in sub-bands for which you do not have privileges! Stay within your license class sub-bands. Your performance with your dipole should be quite satisfactory within the 2: And remember, there are several different varieties of dipole antennas, some of which can help you get onto multiple bands with a single antenna and feed line. The fan dipole, or multi-element dipole, is a good choice for the amateur who wants to have access to three, four, or even more HF bands with a single antenna. The trap dipole offers similar multi-band performance. See our General License Class book for more about these options. I hope this helps you get off to a great start with a dipole antenna on the HF bands. Good luck, and 73!