ANTENNAS for V/UHF SCANNERS

There have been many questions regarding how to select an antenna for scanning. This is a Readers Digest version of antennas, meant to give new users some idea of the different antennas and their good and bad points. At the end, I give some specific recommendations on how to build a general purpose VHF/UHF antenna system. This is not an all inclusive book on antennas, but rather a guide for novices in their quest to learn more about their scanning hobby. What's the best antenna? There would seem to be as many different answers, as there are people asking the question. Everybody has a favorite band that they listen to, and different antennas work better on different frequencies. But the fact is, the general principles remain the same for everybody. The object of an antenna is to deliver as much signal as possible to the antenna jack on the back of the radio at the frequency you're listening to.

GENERAL: Antennas are, invariably a compromise. If you have unlimited room, and very deep pockets, you can put up an antenna farm with a different antenna and radio for each band that you listen to, but if you're like the rest of us, you WILL compromise. If you only listen to one band, then your best bet is an antenna designed specifically for that band. A 1/4 wave ground plane, or a 1/2 wave dipole antenna is a good choice for omni-directional listening at a low cost. It will have the added benefit of being less efficient out of band, which if you live in a dense signal environment, may attenuate those out-of-band intermod producing signals.

1/4 Wave Ground Plane Antenna This is a single band vertically polarized antenna with a relatively narrow frequency range. Its major benefits are its low cost and small size. The ground plane isolates your antenna from having to be coupled to earth ground at a specific multiple of the wavelength, by simulating ground with the radially mounted elements around the bottom. Most RT antennas on vehicles are 1/4wave Verticals, and use the Car body as a counterpoise. There are some versions that have several vertical elements but each vertical element will only be resonant in one band. While it will receive signals in all bands, it will only be efficient in the band that the vertical elements are cut to resonance.

Discone Antenna This is a relative of the 1/4 wave ground plane antenna optimised for wide frequency bandwidth. It offers 0dB of gain, on frequencies from about 120-1300MHz, and with a vertical element on top, it is usable down to about 30MHz. Gain is achieved by compressing the radiation pattern into a donut shape with little of the signal radiating upwards or downwards, concentrating the pattern perpendicular to the vertical axis of the antenna. It is called a discone because it is comprised of two parts, the disc, a group of elements parallel to the ground around the top, and the cone, the diagonal radial elements around the bottom. These could be made from a solid metal disc and a cone shaped sheet metal radial, and perform the same, but the wind loading would be increased. The Diamond D130 is a good discone for general purpose scanning. I believe that the discone is the best all band antenna, it really works. I don't know of ANY other omni-directional antenna usable for TRANSMITTING on ALL VHF and UHF ham bands (50, 144, 220, 432, 900, & 1200 MHz). The broadband characteristics of Discones make them the antenna of choice for Military and commercial applications were coverage of a wide range of frequencies outweighs the need for gain.

1/2 Wave Dipole Antenna This is also a single band antenna that offers gain in a relatively narrow frequency range. The dipole antenna is the standard against which gain is measured on all antennas, and it is twice as long as a 1/4 wave antenna. It has balanced signal and ground sides, which means that the coax feed is in the centre of the antenna. The centre conductor is hooked to the top half and the shield connects to the lower half. It requires a balun to connect it to coax cable, although there are feed techniques that can do the job of matching the antenna to the 50 ohm coax. It is fairly large for the frequency it's tuned to, and like the ground plane antenna, it isolates your antenna from having to be coupled to earth ground at a specific multiple of the wavelength, by simulating ground with the lower half of the antenna. The dipole can be oriented either vertically or horizontally.

Yagi Beam Antenna TheYagi-Uda parasitic array is another single band antenna. It is a group of dipoles of a defined length, connected to a boom, to hold them a specific distance apart. It offers excellent gain, and front-to-back isolation. The gain is determined by how many elements are used as directors, and is achieved by limiting how many directions a signal can be received from. Like a magnifying glass focusing the sun, the smaller the spot the hotter it gets. The most useful feature of a beam antenna, is that the can be rotated to null out a signal you do not want or maximizing the one you do want. You will need a rotor to point it in the right direction; if you want to listen in more than one direction. The down side is, it will only have gain in a narrow frequency range, which again can be beneficial in a dense signal environment to attenuate those intermod producing signals. It is commonly used by commercial and amateur operators, since it is an inexpensive and very efficient type of antenna for single band, point to point, communication in the VHF/UHF range. For use with a scanner, the point to point gain can be a limitation.

Log Periodic Beam Antenna The Logarithmically Periodic Dipole Array is a beam antenna optimised for wide frequency bandwidth. It offers 5-15dB of gain with a moderate 10-15dB of front-to back ratio; the beam width is fairly wide when compared to a Yagi. It is a group of dipoles of decreasing size (with the longest in back and the smallest in front), connected to a boom, to hold them a specific distance apart. The tapering of the elements is what gives it the wide frequency range, by always providing an element that resonates near the operating frequency. It is most commonly used in TV antennas, where operation on many frequencies is required. The down side is that the LPDA can be fairly large for a VHF/UHF antenna. Like the standard Yagi, being directional it requires a rotator if you need to monitor signals from different directions.

Active Antennas. These come in a variety of configurations, with the common denominator being a high Gain Broad-Band pre-Amplifier either at the Mast Head or at the point of connection to the receiver. It is this amplifier that provides the gain for reception of weak signals. These antennas are fine in weak signal areas, particularly rural locations where there is not a high density of RF. In urban locations they have a tendency to overload the already super-sensitive front-ends of modern receivers.
The Diamond D505, with a pre-amplifier that has variable gain is a preferred model.

TV Antennas
A TV antenna is NOT a very good scanner antenna because it is optimized only for the TV bands. If you look closely at a TV antenna you will notice that the taper of the elements is not uniform. There will be several long ones (Chan 2-6 at 54-88MHz) then

several medium long ones, usually interspersed with the long ones (Chan 7-13 at 175-216MHz), and then a bunch of short ones, all the same length (UHF 470-812MHz). If the frequencies that you do listen to are close to the TV bands, then after re-orienting a TV antenna to vertical polarization, it may work, but it remains a poor compromise. Most frequencies of interest to sticky-beakers are well removed in frequency from the allocated TV bands.

FeedLine Cable It doesn't matter how good your antenna is, if you are feeding it with poor quality coax. The loss that a coax has, is determined by many factors, most having to do with the density and effectiveness of the shield and the dielectric (the insulator in the center). If the shield is not very good, the more of the signal will be lost before it gets to your radio. If the dielectric is poor, the impedance of the coax will vary. Cheap coax may have a 98% shield to spec but it won't be consistent across the entire length of the cable. The same applies to the dielectric, if it's uneven, the characteristic impedance of the coax will vary tremendously. The result is poor performance, particularly at the higher frequencies. Frequency is the other MAJOR contributing factor in determining your losses. The higher the frequency, the higher the loss. If you only listen to the lower VHF bands 30 –80MHz band, then a VHF 1/4 wave ground plane antenna and any kind of coax will do, such as RG58, which is easily routed, and not very expensive. But if you listen to the UHF portion of the spectrum you can significantly improve your reception, by just using better quality coax.

The Antenna Installation There is no substitute for altitude, when it comes to monitoring V/UHF signals. However, we can't all live on the top of a hill. With any antenna installation the first consideration is to clear adjacent objects and obstructions. Wavelengths above ground is not an issue at VHF/UHF Frequencies, as it is most certainly likely to exceed a 1/4wave above ground ! After you have cleared any obstructions, more height will give only slightly improved range. Remember line-of-sight won't change much with another 5 or 10 metres of elevation. It takes 10s or 100s Metres of elevation to make a discernible difference. In essence, higher the better, within the bounds of practicality and permanence

CONCLUSIONS and Personal Preferences:

As with any antenna installation it is a case of minimising the compromises. Yes, more gain is available from a single frequency tuned antenna, be it a Vertical or Yagi, but in most cases sticky-beakers require an antenna capable of providing adequate coverage over a very wide range of freqs. This puts the DISCONE ahead as a No1 choice and it is indeed the antenna I use for all local scanning. If I lived in the country and required detection of much weaker signals the Diamond D505 would be a preference, but here in Auckland it is unsuitable. For monitoring more distant repeaters and weak simplex signals I use my LPY, but of course to be effective, that requires the additional cost of a rotator – this array therefore rounds out at something approaching $1K, so you need be serious !