Antenna Installations: Fact and Fiction

Considering that antennas are daily familiars in the life of the average TV technician, it is quite surprising that they are also among the least understood items with which he deals. Some common misconceptions and half truths concerning them have come to the author's attention in the experience he has had with antenna installations.

These misunderstandings can cause real trouble for the installer faced with decisions a knotty problem involving signal interception. With respect to the common beliefs listed here, concerning how many do you know the full truth?

Note from IG: *I have been working with antennas installation for 20 years and I agreed with the author. I have to add that in the present times there are more myths then truth…*

FICTION: The front to back ratio of an antenna is the ratio between the sensitivity to a signal from a station in front of the antenna and the sensitivity to a signal from a station to the rear of the antenna.

FACT: This half-truth can be a damaging one if it is taken literally. Strictly speaking, the front to back ratio is based upon reception of a single signal originated from one point. The antenna is first oriented so that it is picking up maximum signal from this source while facing it. Then the antenna is rotated through exactly a half turn- 180 degrees- and pickup of the same signal is measured. The front- to- back ratio is the relationship between these two readings.

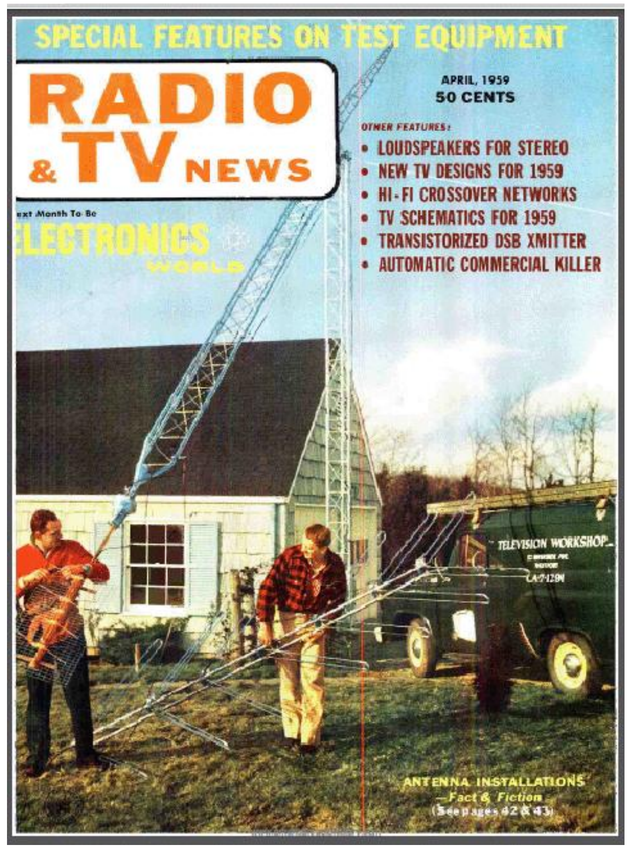
Antenna patterns are such that it is possible for a relatively small shift in orientation-say a shift of 10 degrees- to produce a very great apparent change in this ratio, often by as much as 5 to 20 times. These changes, depending on the particular radiation pattern and the installation, may be more important than an arbitrary ratio.

Another point to remember is that stated front to back ratios must be considered at specific frequencies, since antenna radiation patterns invariably change with frequency.

The technician can be check this ratio himself if the antenna is mounted on a rotator, or can be conveniently rotated on its mast, and a steady signal is available. A word of caution: this method can only be depended on when no significant reflections are present, such as are caused by large metallic structures at some distance or small ones very close.

By Jack Beever, Jerrold Electronics Corp

Credit Line: Radio and TV News, # 4 1959, pp.: 42, 43, 124.



Radio and TV News, # 4 1959
Front Cover

FICTION: A YAGI antenna has many times the gain of a tuned dipole, such as pair of "rabbit – ears."

FACT: If you call three times "many," then it's true. The best YAGI antennas show gains no greater than 12 dB over tuned dipoles, which is four times the voltage. The average cut-to-channel YAGI will have from 8 to 10 dB gain which is from 2.5 to 3.16 times. The big advantages is the often because the YAGI gets put in a better place- up on the mast.

FICTION: Impedance matching between antenna and load is not too important-you can't see the difference.

FACT: if you have more signals than you need, you may not see the effects of mismatch in terms of signal strength, because the set has A.G.C. You may, however, see the secondary effects of mismatch, since a mismatch always causes reflections in the line. These reflections can produce line ghosts- close-in- ghosts that may be so near the primary image as to look smear.

Also, the tuner response will change when it sees a mismatch at the input causing degraded picture resolution on monochrome and kill all kinds of difficulties in color reception.

FICTION: It takes an antenna with a very narrow forward lobe to eliminate a ghost.

FACT: Not so. The ghost elimination depends on the antenna pattern having a sharp null, which may be oriented to ghost source, without moving the pickup lobe too far from the best reception angle. At the high band, for the example, an ordinary broadband conical antenna may do better than a YAGI type, because the conical has three major pickup lobes at the high band. (See radiation patterns, **Figure 1**) Also there are several null points from which to choose. This permits considerable flexibility in orienting the antenna so that it may select the desired signal while rejecting the reflected one.

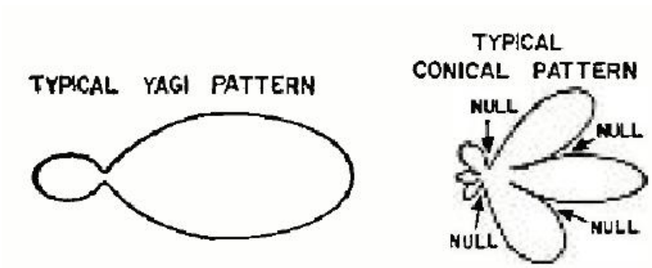


Figure 1 Antenna Pattern for YAGI and Conical TV Antenna

FICTION: An antenna may be shielded from interference with a screen made of metal mesh or sheet metal.

FACT: It won't work. Take the metal mesh- for instance, poultry netting- and place it between a radiation source and an antenna. The incoming radiation impinges on the screen and starts currents circulating in the latter. Since the screen is not loaded- no current is being taken from it- almost all the energy it intercepts is re-radiated – and it re- radiated on both sides of the screen. The idea of the screen is thus defeated.

If a solid sheet of metal is used as the screen, the edges of the sheet radiate, and the pattern of radiation is practically circular, so the same end is practically circular, so the same end result ensues.

If a solid sheet of metal is used as the screen, the edges of the sheet radiate, and the pattern of radiation is practically circular, so the same end is practically circular, so the same end result ensues. This is not mere theory. We have seen it tried more than once.
In one case a screen bigger than a billboard was erected to cut off co-channel interference. It actually seemed to make matters worse.

FICTION: If you stack two antennas you'll get the twice the signal voltage of one.

FACT: If you manage to attain a perfect job of stacking two antennas, you'll gain only a 40 per-cent increase in voltage. What you actually double when you add another antenna is signal power. Double power across a fixed impedance, in this case almost always 300 ohms, results in a voltage increase of 3 dB, which is about 40 per-cent. Since it is almost impossible to get full efficiency, you'll do well to get 30 per-cent in practice.

To get another 30 per- cent on top of this, you'll have to stuck four antennas. Therefore, with one antenna as the reference (0 dB) two will gain 3 dB, four will gain 6 dB, eight will gain 9- dB and so on. Since 6 dB is double voltage, you need four antennas to get twice the voltage of one.

FICTION: As long as they aren't sensitive to the same channel, you can stack antennas close on the same mast within interaction between them.

FACT: It's a myth. Any conductor placed in the field of a transmitting or radiating device will intercept some of the energy of the field. The conductor will re-radiate all of this energy except that part dissipated in "copper losses," that is, due to the resistance of the conductor. The coupling between these metallic elements and the phase shifts caused by re-radiation will have many peculiar effects.

The effects are worse when the conductors are spaced apart less than a half-wavelength at the operation frequency of either antenna. It does no good to argue that one antenna is at right angles to the other since even in this condition, the boom of one antenna is parallel to the other antenna. The boom picks up, too. The same arguments apply to guy wires, which should never run in front of, behind, or through the antennas.

FICTION: Since parallel-wire lead-in, such as 300-ohm ribbon, has only about 2 dB loss per hundred feet at the high channels, the lead loss can be ignored unless the lead is over a hundred feet long.

FACT: The 2 dB /100 feet loss at 200 MHz is accurate figure- but only under free- space, dry-air conditions. Any substance other than dry air that comes in close contact with two lead increased its losses. This includes dust, chemical deposits from smoke, carbon, water, salt, stand-off insulators, feed through tubes in walls, and window sills. Losses are apt to be, in actually, three or four times the nominal cable-loss figure and the more cable involved, the greater the loss.

It's an interesting experiment to connect the down –lead from an antenna to a field –strength meter, and then grasp the wire. A 6- dB drop is not unusual, which is a loss of half the voltage. This loss is caused by absorption of energy contained in the fields between and around the conductors of the twin-lead.

FICTION: Shielded twin-lead should be good for long leads in fringe areas, since noise is so much more of a problem in fridge areas.

FACT: Shielded twin-lead has excellent capabilities for bringing signals through areas of high ambient noise- but not where the signals are very weak.

The presence of the metallic shield makes the loss of this type cable higher than unshielded types. This loss can rarely be tolerant in fringe areas.

FICTION: Coaxial lead should never be used for down-lead because of it has very high losses.

FACT: The nominal losses in twin-lead run between 2 and 2.7 dB/100 feet at channel 13 (the worst VHF case) and are almost invariable higher in actual use. The losses in RG-11/U coaxial cable are 3 dB/100 feet at channel 13, no matter how used. The new foam dielectric cables have less loss the solid-dielectric types and can actually show figures equal to twin lead. These latter cables may be taped to masts, run through conduit, or buried without affecting their loss characteristics adversely. They have been used to cure some knotty problems in color reception caused by direct pickup on twin-lead down-leads. However, one requirement must be met: the antenna must be matched to the cable and the cable to the set by means of matching transformers.

FICTION: You can always get better signals to the set by going higher with the antenna.

FACT: The greatest increase of signal usually occurs in the first 40 feet above the ground or when you clear surrounding obstacles. After this, the increase is slow. On the other hand, as you go up, you increase the length of the down lead. The increase of down-lead losses quite frequently offsets the increase in signal! The net result is that you may get more signal at the antenna, but not at the set. The only way to get around this difficulty is with a mast – mounted preamplifier.

FICTION: When probing for signal in a fringe area, move the antenna up and down until you get the strongest signal, then mount the antenna permanently in the resultant position. This will always be the best place for the antenna.

FACT: This will be the best place for the antenna at this time and for this channel only. The fact is that this point of "best signal" can change with the weather and the season.

The reason for the "hot-spot" is that some refracted radiation is arriving at particular spot in phase with some reflected radiation. The reflected radiation may be from an upper-atmosphere boundary layer, which varies with weather and sunlight, or from a ground reflection, which varies according to the condition of vegetation or precipitation. You cannot depend on these spots.