Resistance vs. Resistivity

Imagine that you have two wires—one copper, the other silver. Which wire has the lower resistance? The tendency is to say "silver" because we know that silver is a better conductor than copper.

In fact, we don't know which wire has the lower resistance. For example, a 2-yard length of No. 18 silver wire would indeed have a lower resistance than a similar length of copper wire. But, that same piece of silver wire would have a higher resistance than a 1-yard length of No. 18 copper wire.

Wire diameter also affects resistance. Even though silver is a better conductor than copper, that same 2-yard length of No. 18 silver wire would have higher resistance than the same length of No. 12 copper wire.

To make a comparison and establish which metal is the better conductor, we need a standard. The standard for establishing the resistance of metals is a cube with 1-centimeter sides. In this case, the resistance of silver is lower than copper. Similarly, by this standard, the resistance of tin, lead, and nickel is higher than the resistance of copper.

The resistance of this standard cube is known as the resistivity of the metal and it enables you to compare how different metals resist current flow.

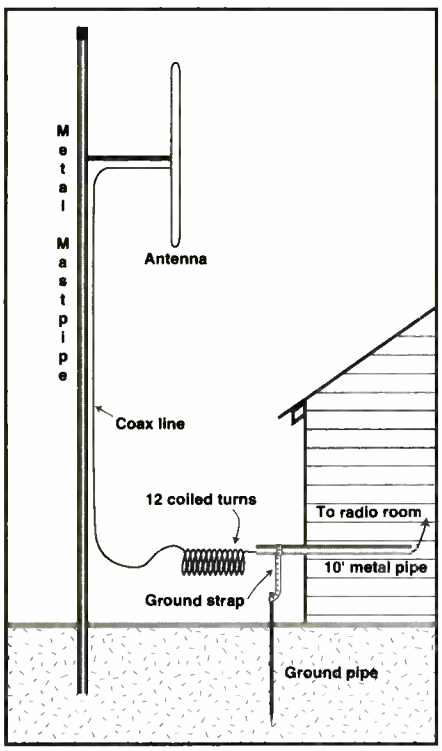
Similarly, when we want to compare the ground conductance in different areas, we need some standard to make sure that we are making a valid comparison. Comparing the conductance of a 2-yard stretch of fair soil is not a fair comparison to the conductance of a 10-yard section of good soil.

The established standard for conductance is known as conductivity. By using standard practices, standard circuits and standard formulas as illustrated in the accompanying article, it is possible to establish the effect the Earth has on radio signals and compare various locations.

Soil Conductivity and Grounding

Adapted from the *Antenna Factbook* by Bob Grove

As the foregoing article indicates, the earth plays an important role in radio signal propagation. However, radio waves only travel through the ground at very close ranges or at low frequencies, so, for signal propagation, the electrical qualities of soil are significant only in reception of low and medium wave stations. At higher frequencies, radio waves are intercepted by the antenna metal, but not by the soil beneath it which absorbs and dissipates the signal as heat.



Still, the same qualities which make the soil a good conductor of low-frequency radio waves also make it a good conductor for grounding your radio equipment. Attaching the chassis of your radio to a buried conductor in moist soil will protect you from electrical shock, drain off static charge buildup, help dissipate nearby lightning-induced spikes, and even reduce electrical noise pickup.

A good electrical ground consists minimally of two eight-food metal rods, at least ten feet apart, connected to the radio equipment by a short length of heavy braid. As indicated in the accompanying article, moist, mineralized soil is best; dry, sandy soil is worst.

■ Lightning Protection

Nothing can withstand a direct lightning hit. The best you can expect from a lightning arrestor or surge protector is to harmlessly short-circuit small voltage spikes resulting from nearby hits.

Old-style, spark-gap, antenna lightning arrestors were satisfactory for high-voltage-tolerant, tube-type equipment, but not for modern, low-voltage, solid-state equipment. Gas-discharge tubes which fire at under 100 volts offer better protection, while allowing full amateur transmitter power to pass unaffected.

During storms or extended periods of non-use, disconnect your antenna line from your radio. You may wish to ground it or, alternatively, hang the connector away from the radio equipment, even hanging it inside a glass tumbler for additional insulation.

Improved lightning protection may be realized by suspending the antenna below the top of a well-grounded metal mast (which then becomes a lightning rod), by coiling the coax for about a dozen turns before it enters the building, and by passing the coax through a ten-foot metal pipe which is well-grounded.

Although electrical power line protection is beyond the scope of this sidebar, highly-effective metal-oxide varistors (MOVs) are available in strip-line extension cords, and even for distribution panels to protect the whole house.