# Grounding of MiniWhip and other active whip antennas

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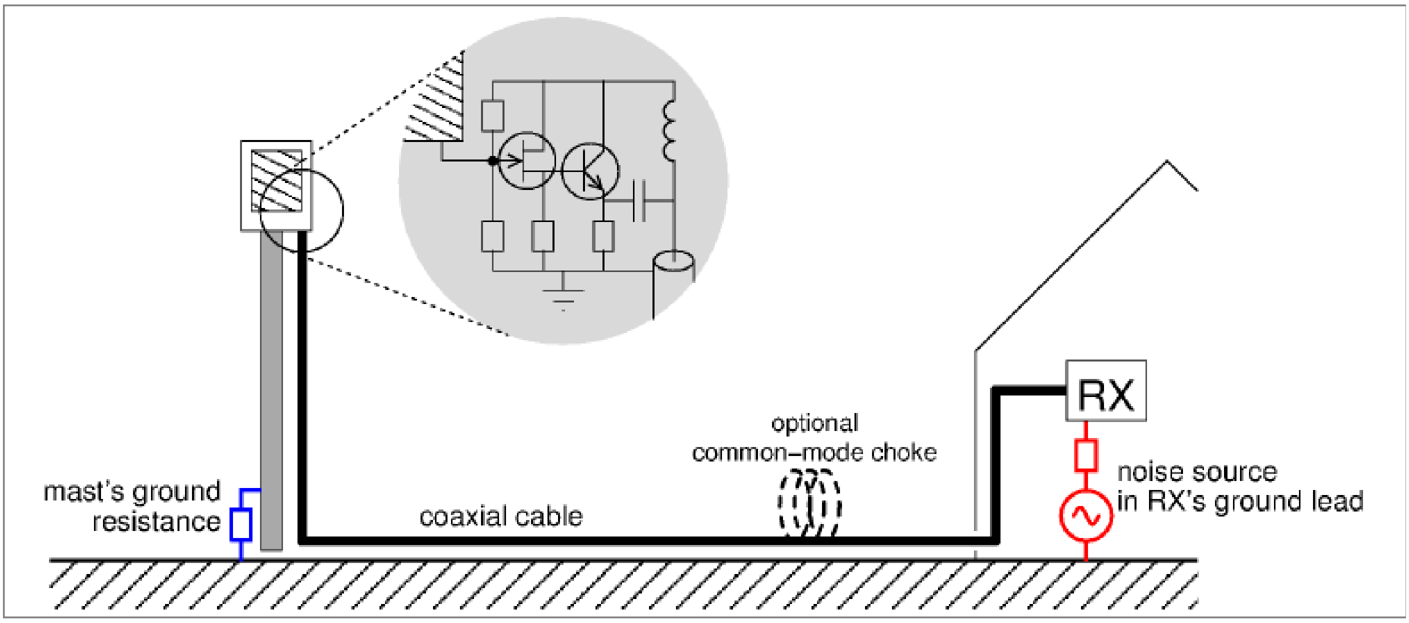
In a previous installment I explained how the MiniWhip antenna works, and why it needs, like other active whip antennas, a good "clean" ground connection. One can also reason about how to achieve that.




The figure shows a typical MiniWhip setup. At the left is a mast carrying the actual MiniWhip, consisting of a metal plate and an amplifier. The mast is grounded, but that grounding is not perfect, as illustrated by the blue resistor. At the right is the indoors receiver. Indoors, there are often noise sources, such as noise on the mains grounding. These are represented here by the red voltage source, which causes the ground connection of the receiver to not be purely at ground potential.

As explained before, the MiniWhip "receives" the potential difference between its metal plate and its ground connection. Therefore, we want its ground connection to be as precisely on ground potential as possible, thus seeing as little as possible of the red noise source. The figure shows that there is a voltage divider, formed by the (red) internal resistance of noise source, and the (blue) ground resistance of the mast. When the former gets larger, and/or the latter gets smaller, less of the noise voltage ends up on the mast, and thus on the MiniWhip's ground connection.

What can be done to improve the situation? Firstly of course, improving the grounding of the mast, or if the mast is non-conductive, making a connection between the cable's shielding braid and a ground electrode. The (red) series resistor of the noise source is the other half of the voltage divider, but is usually harder to change. Another option is to insert a common-mode choke in the cable: its impedance will effectively be in series with the noise source's internal resistance, so the higher, the better. Such common-mode chokes are often used as baluns, and then the criterion is that its impedance should be high compared to the cable's 50 ohm impedance; but in the current application, it's not about the choke's impedance compared to the cable's impedance, but compared to the mast's ground resistance. If the mast is not grounded at all, the common-mode choke will not help.

When installing the MiniWhip for our WebSDR receiver at the University of Twente, we were lucky, in hindsight. Firstly, the building's roof is entirely metal, which gives a good ground plane; our antenna thus does not measure the field's potential w.r.t. the real ground at street level, but w.r.t. the metal roof, which gets us rid of many noise sources in the building. Secondly, we were able to connect the antenna's ground connection to this roof. Thirdly, the situation happened to be such that a long cable to our shack was needed; such a cable has, even without being coiled up, already a substantial inductance, and furthermore it runs immediately near a grounded metal wall, providing a substantial capacitance to ground. That inductance and capacitance form a low-pass filter, again attenuating noise from the shack before it reaches the antenna.

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