

Installation guidelines to comply with FCC Part 15 Rules

The FCC Part 15 regulations governing this device are as follows:

Section 15.219 Operation in the band 510 - 1705 kHz.

(a) The total input power to the final radio frequency stage (exclusive of filament or heater power) shall not exceed 100 milliwatts.

(b) The total length of the transmission line, antenna and ground lead (if used) shall not exceed 3 meters.

(c) All emissions below 510 kHz or above 1705 kHz shall be attenuated at least 20 dB below the level of the unmodulated carrier. Determination of compliance with the 20 dB attenuation specification

may be based on measurements at the intentional radiator's antenna output terminal unless the intentional

radiator uses a permanently attached antenna, in which case compliance shall be demonstrated by measuring the radiated emissions.

With regards to the installation, the main issue for the user is to make sure he/she complies with section (b), which specifies the antenna configuration. The primary point here is to make sure the total length of the antenna wire, the ground wire, and the transmission line from the device to the antenna (if used) does not exceed 3 meters. The intent of the regulation is to limit the physical size of the antenna system such that the radiated field strength does not create interference with licensed AM stations.

This product does not use a transmission line, so we are only concerned about the total length of antenna and ground. The antenna length is obvious and easily measured, but the ground is not as clear cut. Ground generally means the earth, but in RF it's more complex. We will define "ground" as the antenna counterpoise, which is any of the conductors connected to the chassis of the unit. This counterpoise forms a major part of the antenna system, which is why the FCC includes it in the overall length.

If the unit is mounted close to earth, and it is grounded directly to a ground rod, then the antenna can be very close to 3 meters long. Here, there is no counterpoise so it's not a concern. This arrangement is probably the best in terms of performance, as it excites a ground wave field component that most broadcast facilities rely on for propagation. However, impedance matching can be unpredictable and dependent on ground losses so it's best to test this against an elevated installation to decide. It is also not very convenient, and can expose the unit to vandalism and other effects.

The question arises "what if I mount the unit on a pole?". Here, the unit is located up and away from ground, making less likely to be interfered with. Doing this creates a dilemma for the installer, as the ground lead by itself is usually longer than 3 meters. A solution for this is to install a ferrite choke core in the ground wire coming from the unit. This choke has a very high impedance in the AM broadcast band, and essentially reduces the currents on the outer portion of those conductors to zero. They are now not a part of the antenna system.

Choke coil details

The choke coil consists of an Amidon (<http://www.amidoncorp.com/>) FT-193-J ferrite core, wound with at least 17 turns of the ground wire. This configuration in our testing shows a 6000 ohm impedance at 1MHz.

Using less turns will violate the FCC regulations. In field testing we have shown a 3db signal degradation using a 20 foot ground wire with the insertion of such a choke coil. The choke coil should be installed directly at the ground terminal binding post of the transmitter to limit the radiator in the system to the approved length limit.