Ham 22 – Real Antenna

Dr. Marc & Rosemary © 220629

1. A radio system consists of three major sub-systems: the transceiver, a power supply, an antenna. Obviously without a power supply, nothing can work. With adequate power, the transceiver will send out a signal, but it goes no where without an antenna. Even a hand-held transceiver will greatly benefit with a separate, real antenna.
2. The antenna may add gain in one direction at the expense of another direction. In every case, the antenna system and its feedline (coax) attenuate the signal supplied from the radio. The antenna contributes all the radiated power. Every antenna design is a trade-off between performance, size, and cost. Another common consideration is many neighborhoods prohibit visible antennas. Consequently, stealth antennas are by far the most common approach.

3. In general, the higher the antenna, the better it will perform. However, with height comes exposure to lightning. Another issue with outdoor antennas is wind-loading or how well the antenna and the tower will survive strong winds. Conventional wisdom is to disconnect your radio before a thunderstorm, but that defeats its use as a weather device.
4. Our considerations for antenna will be stealth, installable by a person without high climbing or electrical skills, and mitigate the risk of lightning and wind. All antennas are a compromise.
5. Beam, yagi, vertical, and myriad variations, while they are effective, do not lend themselves to our constraints.
6. By far the most common VHF antenna is the J-Pole. You can build one for a few bucks. The 'KB9VBR' manufactured unit is a highly-regarded, widely-used antenna. The positive is it only costs $70. The negative is that overall length is about 69". Yes, I have one, and it works. Also, their ferrite cores are inexpensive. A dual band VHF/UHF looks different. Order: 2 Meter J-pole, www.jpole-antenna.com.
7. Numerous other manufacturers have their custom, specialized designs. Most work very well. The Diamond X-50A is a colinear design wrapped in fiberglass. The positive is it withstands winds to 135 mph, the negative is length of 66". The cost is about $100. Yes, I have one, and it works like a champ. Order: Diamond X-50A from ham radio stores.
8. One of the first effective modern technology designs is the CompacTenna, by Dr. Jack Nilsson, N8NDL, https://compactenna.com. See photo on next page. This is a non-line-of-sight antenna with magnetic field enhancement, which relies on dispersed paths much like a WiFi system, making it more effective in a cityscape and around hills. The great positive is antenna height of 7.5" tall with a 4 radial, dropped counter-poise mount. Total height is about 20" with a similar width. A 9" version works even better. The negative is the antenna is about $90 with the counterpoise / ground plane base of $100. The SWR on UHF has deep notches near 1:1 with a high near 1.5:1. Yes, I have two! No better for mobile, small spaces, or terrain is an issue. Order: COMPACTenna 2M-440 and CompacCounterpoise NMO mount, www.dxengineering.com

9. Remember ham is experimenting and design is about trade-offs. Location and mounting are extremely important and determine which will work better for your application. To mitigate lightning and wind, the antenna must be mounted under the cone of protection of the structure. In other words, under a roof or lightning protection system.
10. The National Electrical Code (NEC) and NFPA 780 specify zone of protection. NEC 810.15 states:
    Masts and metal structures supporting antennas shall be grounded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 M (150ft) radius rolling sphere.
11. Attics are often the preferred choice. Under a porch or veranda is another choice, which provides less barriers. Keep the antenna far enough from people to mitigate radiation effects, as specified by FCC standards.
12. A typical parts list illustrates the required components.

Antenna	Select one preferred for location	Online ham vendors
Counterpoise / mount	As required for antenna	Online ham vendors
Coax >25'	RG213 w/ PL259 on ends (0.41")	ABR or other name brand, questionable Amazon
Coax <25'	RG8X w/ PL259 on ends (0.24")	ABR or other name brand, questionable Amazon
3 Ferrite beads/chokes	mix 31, snap-on, fit to coax at antenna DXE-CSB31	www.dxengineering.com
SMA to SO-239 cable	only comes male SMA for connection to handheld	Online ham vendors
SMA female to female	Adapter for Baofeng, etc.	www.amazon.com
Floor flange, 1-1/4"	Galvanized, pipe	Lowes
Pipe & elbow	Fittings for your space. Steel or PVC as needed	Lowes
Wall penetrator or	low voltage electric box or SO239 barrel connect	As required
Window feedthrough	Or manufactured MFJ-4602 or simple homemade	https://hamuniverse.com/kb3qlkfeedthru.html

Ham 22B – Real Antenna Installation

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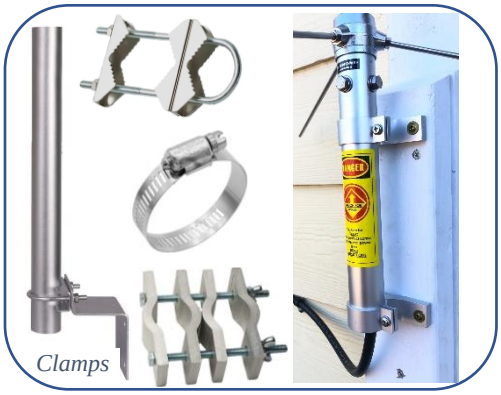
1. Just as no two houses are the same, no two antenna installations can be the same. We can only provide suggestions. Actual installation is a hands-on affair. Virtually all antenna mounts are for a round pipe.

Floor flange

2. A simple, generic mount is a floor flange, which can be installed on the floor or the wall. We suggest 1-1/4" size, since that will support most any size under roof antenna. 1" size is adequate for less than 6'. The flange is galvanized steel, but Schedule-80 PVC works well for the pipe if a metal pole is not needed..
3. If the flange is mounted to a base or floor, a single vertical pipe of desired length is required. If the flange is mounted on a wall, then a nipple is required to extend to an elbow, with another nipple placed vertically to support the antenna.

Compactenna on floor flange



Clamps

4. Attach the antenna base with u-clamps or hose-clamps. Be careful to avoid damage to antenna.
5. These antennas are DC-grounded (look at the photo). Nearby metal objects will couple. Keeping antenna 6-feet away from large metal objects will reduce impact on the SWR and signal.
6. Put silicone grease dielectric on coax threads. Avoid on electrical contact surfaces.
7. Connect coax to antenna base. Hand-tighten only. Wrap with electrical tape to keep moisture out.

J-pole mount with ferrite

8. Snap at least 4 ferrite beads around the coax near the antenna feed. Mix 31 material is preferred. Wrap with Scotch 33 or 88 electrical tape to hold in place. These reduce common mode noise, including lightning, on the shield.
9. Route the coax to enter the building. Near the building entrance, install a PolyPhaser lightning protector on the coax. Ground to the earth and bond to other grounds following NEC Article 810. According to the PolyPhaser engineer, if the coax is more than 30' long use two lightning protectors on either end.
10. If entering from outside, penetration of the wall can be a challenge. A simple window feed-through can be constructed from a metal strip attached to a piece of ¾" wood cut to fit the width of the window opening. Drill the metal strip to mount a SO-239 barrel bulkhead connector. The PolyPhaser can be installed here.

11. Lower the window to seal against the feed-through. Put screws in the window casing so it cannot be opened from outside. Alarm contacts must be moved. The MFJ-4602 is a manufactured version, but is expensive and unnecessarily complex and obtrusive. A feed-through will require two pieces of coax, one outside and one inside. Use silicone grease dielectric on the threads only.

SO-239 Barrel

12. If the PL259 connector is already on the coax, a ¾" hole is required. If the coax does not have an end, drill the size hole required for the coax, then install the coax end. Be sure of where drilling. Do not do like I did through our hardwood floor, but it is close to the wall.
13. If routing from inside a wall, use a low-voltage old-work box, which allows a variety of faceplates. Inside the room, leave enough coax to connect to your radio.
14. For surge suppression, some suggest making a common-mode balun/choke consisting of at least 5-turn-coil. I do not recommend these because of coupling and problems introduced. My preference is to use ferrite beads near the antenna and on any noise source such as switched mode power supplies.

Low-voltage cover

15. Install a common point ground where the coax enters the building. Mount and bond a PolyPhaser. Run #10 AWG wire to a ground rod. Bond the radio and power supply chassis to the common point, if there are connections. Bond all ground rods together.
16. Life is good. Enjoy.