How to build a CB dipole antenna (CB)

The dipole, one of most effective and simple antennas to build.

Learning targets: Acquire basic practical skills on the use of electric material - acquire basic notions on the principles of operation of antennas.

Material

For each antenna:

- 1 connector PL259

- Soldering iron and relative accessories. Solder wire.
- Coaxial cable RG58, at least 5 m long.
- 6 m unipolar wire
- Plastic or wooden plaque.
- Small insulated box for electrical connections.
- 4 wire blockers
- Electrical tape/cable ties
- Nippers/plier
- Multimeter
- Rope
- Meter tape
- CB, with SWR meter/antenna tuner and a RG58 patch cable to connect the two devices.

Time and preferred place: 30 minutes. The building of the antenna can take place in any space, provided that there are electrical connections for the soldering irons. The testing of each antenna requires an outdoor place of about 10 m dimensions, with the possibility to fasten the antenna ends or the antenna center to a high point (trees, buildings, etc.).

Description: First, the PL259 connector must be installed on the end of the coaxial cable that should be connected to the SWR meter/antenna tuner (or directly to the CB). Cut a few centimeters of the plastic jacket surrounding the coaxial cable, the metal braid shield should be visible. Slightly open the braid shield and turn it backwards. Cut part of the inner plastic shield that was covered by the braided shield, to expose the center conductor of the cable (not more than 1 cm). Twist the wires of the center conductor and insert it in the back side of the PL259 connector, so that it enters the center pin of the connector and is visible from its top hole. To do this some strength is needed and the connector should be turned, as if the connector were being screwed on the naked braided shield. To complete the installation of the connector, heat the head of the connector central pin for a few seconds, then put the soldering wire to melt some alloy and block the central wire in the central pin. The mass of melt alloy should not be bigger than the central pin, or the connector...could not be connected! Beware of stray little wires that could connect the metal body of the connector with the central pin. Verify with the multimeter that no short circuit exists between those two components: select the  option and touch the two components with the multimeter tips, the instrument must not beep. A short circuit is as dangerous to the CB as transmitting with no antenna!

Now let's talk about the antenna. Each CB channel corresponds to a frequency of oscillation of electromagnetic waves; these waves travel at light speed, so in the time of a single oscillation the waves cover a distance called wavelength (**λ**). In its simplest form, a dipole antenna consists of two wires connected to the two poles of the coaxial cable; to correctly match the transceiver and the coaxial cable to the antenna, their wires, in total, must be a half wavelength long. The wavelength can be calculated as the ratio between the speed of light and the frequency; in practice, 300/(frequency in MHz) gives the wavelength in meters. In most countries CB channels extend between 26,965 MHz and 27,405 MHz, so a half wavelength is about 5.5 m and the two wires composing the dipole should be 2.75 m long. Always cut the wires a bit longer: it's always easier to shorten the wires than lengthening them.

To assemble the antenna, use the plaque, the wire blockers and the cable ties to fasten one end of each wire close to the coaxial cable end. Similarly to what was done for the PL259 connector, expose the braided shield and the central conductor of the cable, soldering these poles with the two wires ends. Perform these actions so that you can then close the plaque in an insulated box, to protect the electrical connections from the rain. Again, check that no short circuit exists between the two long wires. Finally, just below the connections, wind the coaxial cable in a few turns and block them with a cable tie. This is called an RF choke; it substitutes a more advanced device, a 1:1 BALUN, to improve the matching between the antenna and the coaxial line.

The antenna can be put in horizontal, as high as possible from the ground. The wires should not be directly attached to their support, but to (not metallic) ropes and then these ropes to the supports (trees, buildings, etc.). The wires ends can indeed be electrically dangerous: never touch them when someone is transmitting! Alternatively, the antenna center can be fastened to a high pole and the wires ends are fastened to the ground, forming an angle between 90° and 120°. In this way it's easier to trim the wires and tune the antenna. In this configuration, the antenna is also called an *inverted V*.

Finally, the two wires must be trimmed in length. Connect the antenna to the SWR meter/antenna tuner and this to the CB. Transmit and check the SWR level over the several channels. Shorten the wires, step by step, and test if the SWR gets closer to 1. The orientation of the two wires and their distance from the ground can be used to vary the SWR. The SWR should never ever exceed 2 in any channel.

This type of antenna is useful also during the JOTA-JOTI, to make international contacts. It's length should be calculated according to the ham radio bands. For contacts in the 20 m band (14.00-14.35 MHz), your antenna should be 10 m long. Please refer to the **JOTA-JOTI Ham Radio Handbook** for more details about the ham radio frequencies.

As a final note, remember that the dipole is more able to receive and transmit in perpendicular direction (that is, in and out the paper in the figure below) than in parallel direction.