Elecraft AX3 Whip Antenna

Theory of Operation

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Rev. A2 21 March 2025 The AX3 whip offers convenient 30, 20, 17, 15, 12, and 10 meter table-top operation for field and park outings. It has a high level of system integration, incorporating a built-in tripod and other features (see **Construction**). It is intended to be when used with a wide-range internal ATU (automatic antenna tuner). The Elecraft KH1, KX2 and KX3 have compatible ATUs, and an Elecraft T1 ATU can also be used.

Electrical Design and Performance

A unique 4-position, 30 amp jumper block is used to select the AX3's target band. This high current rating ensures the switching mechanism will be low-loss and highly reliable under all SWR and power conditions. Depending on the band, from one to four high-Q inductors are placed in series with the whip. This distributes any heating among the inductors.

In the 10 MHz and 14 MHz contact block settings, the AX3 is resonant very close to the 30 and 20 meter bands, respectively. In the 18 MHz and 21 MHz positions, resonance is midway between two ham bands, allowing an ATU to provide a low-loss (small reactance) match on 17, 15, 12, and 10 meters.

In all cases, specified resonant frequencies are approximate. This reflects variations in inductor tolerance, antenna height, the operator's body capacitance, exact radial length, and the type of terrain.

On all six bands, the antenna's inductor and switching design provide performance similar to monoband whips of the same length. This was verified using far-field tests. This means the AX3 can effectively replace up to six whips, with an ATU providing the means to quickly resonate the system. Elecraft offers wide-range internal ATUs for all of its transceivers to compensate for narrow banded, electrically short antennas, as well as ad-hoc random wires.

Electrically short base-loaded whips of this type are typically 3 to 4 dB below the performance of a full-size vertical mounted at the same operating height. The AX3 is similar. The operator may refer to the AX3 owner's manual for tips on effective use of compromise antennas.

Construction

The AX3 has several mechanical advantages over other compact whips: (1) breaks down into 6" (15 cm) pieces; (2) uses a right-angle BNC connector for convenient coax attachment; (3) has built-in 6" removable tripod legs, as well as a ¼-20 nut in the base for use with camera tripods and hiking poles; (4) includes both a binding post and a mini-banana jack for counterpoise connection.

High-temperature enamel wire is used in the AX3's inductors (as well as those in our other antennas), allowing it to handle up to 30 watts. The design was tested at 50 watts to ensure a conservative rating. By comparison, some competing compact whips begin to fade (become lossier) or become damaged with the application of as little as 8 watts due to the use of small-gauge and/or low-temperature enamel wire.

The AX3 comes with a pre-cut 13' (4 m) counterpoise wire, or *radial*. Its length is a compromise, providing good performance on all six bands when used with an ATU. If desired, additional radials can be added, often improving performance.

NOTE: Without a radial, transmit efficiency suffers; the signal may be as much as 30 dB lower. This is because body capacitance to ground (as a counterpoise) is insufficient for transmit purposes on the HF bands, resulting in much higher ground losses. Adding a radial also reduces RFI effects. The AX3 can be used without a counterpoise during receive-only use. This is convenient for quick checks of band activity.