ACTIVE ANTENNAS
And The Shortwave DXer

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Active receiving antennas have been around, in various forms, for many years. Typically, these antennas use a 1 meter whip and a bipolar device to provide 12-18dB of gain (and a noise figure of 5 to 6dB) from 150KHz to 30MHz. This kind of raw gain and poor noise figure will adversely affect the front end of most receivers. As a matter of fact, using a pre-amplified antenna with the Sony 2010 or Sangean ATS-803 has not been recommended for this very reason.

True active antenna preamplifiers use electronic circuitry to transform the impedance of a short whip (usually about ten kilohms at 2 MHz) to an impedance more suitable for the desired frequency range. They act as current amplifying devices to convert at small input signal voltage at a high impedance input to nearly the same voltage at a low impedance output. Designers of HF active antennas must pay close attention to the amplifier's dynamic range and distortion. A good signal-to-noise ratio is essential to get the rare DX into the log. Signal-to-noise ratio of an active antenna is determined by the active devices within the antenna preamplifier. As long as the proper devices are chosen and operated within the linear portion of their operating ranges, the noises generated by the preamplifier will not affect overall performance.

Since the short 1 meter whip used in most active antenna applications is rather inefficient below 15MHz, some form of preamplification is needed to increase antenna output voltages to a useable level. If the short whip were connected directly to the input terminals of an HF receiver the signals would be greatly attenuated due to the terrific impedance mismatch existing at the antenna terminal.

Extreme care must be taken in the design and selection of the preamplifier network for an active antenna. Unfortunately, semiconductor devices suffer from second/third order intermodulation distortion (intermod) products caused by non-linearities in operating characteristics.

These problems manifest themselves in "ghost signals" being present on the bands (ie. AM broadcast signals in the middle of the 49 meter band). For frequencies between 150KHz and 15MHz, true active antennas DO NOT provide any preamplification.

Active antennas have a definite place in the SW shack. Traditionally, these antennas have been relegated to those poor souls who, for one reason or another, cannot erect an outside antenna. Here, the active antenna really shines. Active antennas can also be used to back up an existing antenna farm. They are ideal for the traveling SWL who wants to spend some time scanning the bands while on the road.

In 1983, R.W. Burhans wrote a five part article on active antennas for Radio Electronics magazine. Part one was in Feb '83 issue. This should be required reading for anyone who wants to find out how active antennas are supposed to work, how to design your own, and proper installation of these devices. The tricks of matching a short whip section over a wide range of frequencies makes for some interesting reading.

There are many so called "active" antennas on the market today. They feature wide-band, high gain amplifiers, lots of knobs and controls, and marginal performance even under ideal conditions. Unfortunately, the majority of these units are not true active antennas. They exhibit extremely high gain and mediocre to poor noise figures and less than spectacular performance. I have used the Datong AD-270, several versions of the MFJ's product, the Sony AN-1 and a Palomar unit. Out of all of these, the Datong AD-270 comes the closest to being called a true active antenna. Any time peaking and variable gain controls are present, it tells me that the unit is a preamplified antenna system as opposed to a true active antenna.

Two examples of a true active antennas are manufactured by Inline Components 4521 Campus Drive, No 113, Irvine, CA 92715. Their AC-1 Indoor Micro-Module Active Antenna is a scant 2 X 2.5 X .75 inches. The one meter flexible wire whip protrudes from one edge of the plastic case while the receiver coax and power connector are on the opposite edge. The AC-1 has a wide dynamic range and a 1.5dB noise factor. It operates from a 5-16 VDC source and comes supplied with a 9 volt adaptor for AC mains use. There are not controls on this active antenna. Just hang it in a window by the whip using a small suction cup (supplied), plug in the AC power supply and connect the 10 foot length of RG-174 coax to the receiver. The entire antenna system can be rolled up to form a compact bundle only a couple of cubic inches in size. When compared to the built-in whip on my Sony 2010, the AC-1 consistently yielded a 2 S-Unit increase in signal strength. Stations barely audible with the Sony whip suddenly became readable when the AC-1 was plugged into the receiver. There was little increase in background noise and no noticeable intermod or adjacent channel interference when switching between the active antenna and the 2010 whip, indicating that the AC-1 does not adversely affect receiver performance.

The AD-2 Portable AC/DC Active Antenna measures 4 X 5.25 X 1.5 inches in size and has a built in 9 volt battery for power. A collapsible 1 meter whip on the top of the box is pulled up for use. An AC adaptor is also supplied. This antenna is connected to the receiver by a 10 foot length of RG-174 coax. Controls are simple; an on/off switch, power connector and RF connector. That's it. Plug it in and go to work.

In a side by side test using the AC-1 Micro-Module and the AD-2 Portable Active Antennas on my Sony 2010 and comparing the results using the 2010's built in whip (on the same signals) the two active antennas consistently outperformed the 2010 whip. A second receiver (Icom R-70) using an external 50 foot sloper antenna was also used to check the active antennas performance against a "real" antenna system. In several instances (on frequencies below 5 MHz) the two Inline Components active antennas actually outperformed the R-70 with an external antenna!! The tests were conducted using African stations between 4 and 5 MHz over a period of several months. Additional testing was done on the major SW bands and amateur bands. I suspected that there would be a definite improvement in signals when using the active antennas on the Sony 2010. I was NOT ready for the surprising results when the active antennas were compared to the R-70's external antenna. African signals heard clearly on the 2010 using the AD-2 and AC-1 active systems were much less readable on the Icom due to the increased noise present on the external antenna system.

To be fair, there tends to be some intermittent noise generated in my neighborhood that adversely affects reception on external antennas. Tests at a later period showed no local interference present and the R-70 with the external antenna performed slightly better than the two active antennas.

Conclusions which can be drawn from these experiments:

1. Active antennas can enhance the performance of most portable SW receivers.
2. Tests show that the Inline Components active antennas will outperform built in whip antennas on SW portables by almost 2 S-Units across the HF spectrum.
3. Under certain conditions, active antennas can outperform external wire antennas.
4. Active antennas can compliment any antenna system, adding versatility and portability.
5. Beware of imitations!! Do your research first and buy intelligently. Not all "active antennas" are created equal.

NOTE: In talking with Wes Olson from Inline Components, I was advised that the late model Sony 2010 receivers had a design change in the RF front end that made them perform less than adequately with their AC-1 and AD-2 antennas. Apparently this has led to the common practice among many retail outlets who offer the Sony AN-1 preamplified antenna as a freebie with the purchase of a new 2010. In any event, the Inline Components active antennas work VERY well with my 2010 which was purchased from Universal SW in Sept '88.

Cost (including shipping) of the AC-1 Micro-Module Active Antenna is $ 33.00. The AC-2 Portable Active Antenna costs $ 61.00 (shipping included).

Both are available from Inline Components, 4521 Campus Drive, No. 113, Irvine, CA 92715.