"Sloper Antenna Tests"

Mark Connelly - WA1ION - 16 APR 2001

There has been a lot of anecdotal reportage over the years about the value of "sloper" antennas, particularly with regards to directivity and nulling of "pest" stations from given bearings opposite to the horizontal direction one looks from the high end of the sloper to its low end. This article seeks to look into the performance of these antennas in more detail than afforded by previous accounts in the DX press. A set-up I have used at several locations is illustrated at the end of this article.

In the 1970's I set up a sloper at my parents' house in West Yarmouth, MA with the specific idea of reducing New York City stations. Broadcasters from that area form the biggest obstacle to foreign medium-wave DXing from the southern side of Cape Cod. The antenna worked very well. With WCBS-880 quite strong on a conventional ferrite or air-core loop, Canary Islands and UK stations on 882 kHz were generally just a moderate to strong heterodyne. Sometimes the old R390A could slice out the 882 audio, sometimes it couldn't. When I switched over to the sloper, WCBS dropped markedly in strength relative to the 882 Trans-Atlantics. Around local sunset, clear Canary Islands audio was more often the rule than the exception when using the sloper. Furthermore, right on 880, WCBS had a "hollow" sound because of the groundwave / skywave mix; frequently it was under attack by a co-channel Venezuelan that was barely noticeable on the Space Magnet and Radio West ferrite loops. Other New York stations up and down the dial were similarly reduced, thereby assisting in Trans-Atlantic and Latin American DX catches.

In the '90s, a sloper favoring the southeast was installed at a location in East Harwich, MA. During auroral conditions, Brazilian and deep African stations were often received in its "main beam" while Boston groundwave stations coming from the northwest were noticeably attenuated relative to how they sounded on random wires, ferrite loops, and active whips used at the same location.

For the last 22 years at my home QTH in Billerica, MA I have generally had at least one sloper in use. The one I use for general bandscanning (the "Euro-sloper") slopes downward towards the east-northeast. It puts a definite null towards Worcester, MA; Hartford, CT; New York, NY; and some other major cities on the "I-95 corridor" heading down to DC and VA. For European reception it ALWAYS beats any figure-of-8 pattern loop including the exalted Kiwa. Sometimes I set up a second sloper which gives best reception in the "pest station directions" of west and southwest. Because this second wire slopes downward from east to west, it picks up little in the way of Trans-Atlantics since it's nulling that way. The purpose of the "west-pest" antenna is for phasing against the "Euro-sloper". The level potentiometer on its phasing unit channel is adjusted downwards until a westerly station to be nulled is equal strength with its level on the "Euro-sloper". The phase adjustment for a null can then be enacted with little or no effect on the desired DX signals from the east and northeast.

Several other well-known East Coast DXers - including Bruce Conti, Al Merriman, and Ben Dangerfield - have had similarly good results over the years with the "phased opposing slopers" concept. The bountiful Trans-Atlantic DX logs from all these guys demonstrate that the method works.

Over Easter weekend 2001, it was sunny and mild and the last little patch of snow behind the house had melted away. Over the long winter months, numerous antenna test plans had entered my head and had been scribbled down in my notebook. As soon as weather permitted, I said to myself, I'm going to get some of my higher priority tests off and running. Quantifying the performance of two slopers oriented in opposite directions was a test I'd long wanted to run. How much of these antennas' stated benefits were "for real", how much was just conjecture and "folklore"? It was about time to take some daytime groundwave measurements to find out. Each 30 m sloper ran to one side of the high-impedance winding of a Mini-Circuits T4-6T-X65 (4:1) transformer. The other high-impedance winding was connected to a 10 m wire which ran along the ground to a 1.5 to 2 m long copper pipe earth-ground rod. The low-impedance winding was connected to the center conductor and to the shield of 50-ohm coaxial cable (length less than 30 m) going to the Drake R8A receiver inside the house.

The European (east) sloper showed a definite null on signals in the swath of bearings between 205 and 280 degrees. A sampling of receptions, with dB stated as the strength by which the west sloper signal level exceeded that on the east sloper, follows. Degrees shown are clockwise of true north, e.g. 270 = due west.

650: WJLT-MA: 21.0 dB null: 207.6 deg.
1200: WKOX-MA: 27.0 dB null: 212.7 deg.
1060: WBIX-MA: 30.0 dB null: 212.9 deg.
940: WGFP-MA: 21.0 dB null: 223.9 deg.
600: WICC-CT: 16.8 dB null: 226.0 deg.
660: WFAN-NY: 23.0 dB null: 229.8 deg.
880: WCBS-NY: 22.2 dB null: 229.8 deg.
820: WNYC-NY: 28.8 dB null: 231.5 deg.
710: WOR-NY: 21.0 dB null: 232.0 deg.
1050: WEVD-NY: 19.8 dB null: 232.0 deg.
1010: WINS-NY: 20.4 dB null: 232.3 deg.
770: WABC-NY: 21.0 dB null: 232.5 deg.
1440: WWTM-MA: 20.0 dB null: 234.4 deg.
1310: WORC-MA: 27.8 dB null: 235.3 deg.
1080: WTIC-CT: 19.8 dB null: 237.9 deg.
1120: WBNW-MA: 32.0 dB null: 241.9 deg.
830: WCRN-MA: 27.0 dB null: 241.9 deg.
1470: WSRO-MA: 27.6 dB null: 243.0 deg.
760: WVNE-MA: 23.2 dB null: 246.4 deg.
580: WTAG-MA: 21.0 dB null: 246.7 deg.
640: WNNZ-MA: 18.0 dB null: 253.3 deg.
960: WFGL-MA: 22.0 dB null: 266.4 deg.
1000: WCMX-MA: 21.6 dB null: 269.2 deg.
1280: WEIM-MA: 24.0 dB null: 278.3 deg.
810: WGY-NY: 20.0 dB null: 278.3 deg.

Several weak signal Canadian Maritimes stations were only audible on the east sloper. These included CHTN-720 (PEI), CFDR-780 (NS), and CBA-1070 (NB). Going from one antenna to the other produced different dominants on several channels, for instance WJTO-ME-730 and WGAN-ME-560 on the east sloper, WACE-MA-730 and WHYN-MA-560 on the west sloper.

The western sloper had a somewhat narrower easterly null, most effective between 60 and 120 degrees. The list of stations that it reduced relative to the eastern sloper is fairly short because there aren't many daytime-receivable stations to the east of here.

970: WZAN-ME: 1.2 dB null: 31.1 deg.
730: WJTO-ME: 6.0 dB null: 36.1 deg.
910: WABI-ME: 1.8 dB null: 37.7 deg.
1230: WESX-MA: 8.0 dB null: 92.4 deg.
1360: WLYN-MA: 15.2 dB null: 112.9 deg.
950: WROL-MA: 6.0 dB null: 119.1 deg.
1430: WXKS-MA: 7.0 dB null: 139.8 deg.

Stations "off the side" (e.g. north, south) of each sloper didn't vary much from one antenna to the other. The western sloper had a slight gain advantage a bit more often on these because its grounding was in a somewhat wetter location.

Full bandscan data for these tests may be obtained via the links below: HTML file: "**http://members.aol.com/DXerCapeCod/bscan-billerica.htm**".

Zipped Microsoft Excel file:
"**http://members.aol.com/DXerCapeCod/bscan-billerica.zip**"

I leave it to others such as Neil Kazaross to run EZNEC simulations on these slopers to see how closely the software predictions match the measured results. The foregoing study does show that, for a simple antenna, the sloper has a lot going for it. Two opposing-direction slopers fed to a phasing unit is a time-tested interference-fighting solution endorsed by a number of the hobby's better known practitioners.

ed. note: Mark adds that he believes that "the 10 m wire aids the ground side of things by acting as a short counterpoise or capacitor to ground. Any series inductance and resistance en route to the rods can be considered minimal at medium wave. If I had (a) better quality ground available, I'd go straight to the rods instead."

(The HTML version of this article is available at "**http://members.aol.com/DXerCapeCod/slopers.htm**" . It includes a diagram of the antenna system.)