tance signal propagation. These workers also showed that high-gain beam antennas, a physical improbability on the low frequencies *due to the huge size of* those wavelengths, were now practical.

It was not understood in those days that signals *in the short wave bands* "skipped" off the ionosphere to provide long distance communication with greater reliability and with less need for power than was true for the more noisy longer wave bands. But the signals did just that, and in 1924 the British Empire junked its plans for building a chain of long wave, super power, long range stations in favor of the new short wave, moderate power, longer range system which Marconi and Franklin had developed.[9] From that day to this, the move toward utilization of higher and higher frequencies has never diminished.[10]

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ANTENNA SPECIAL

The search for a better antenna continues...

IDEAS FROM AN ANTENNA EXPERIMENTER

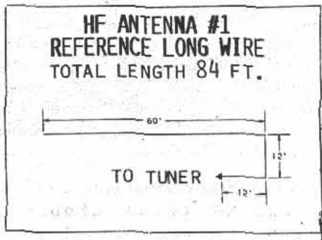
MT reader B.D. Snell is an engineering supervisor for Bendix Corporation and his excellent drafting shows it. Here we take a peek at Mr. Snell's monitoring post layout.

The descriptions of his installation are in his own words.

ANTENNA-AUDIO SYSTEM

HF ANTENNA #1

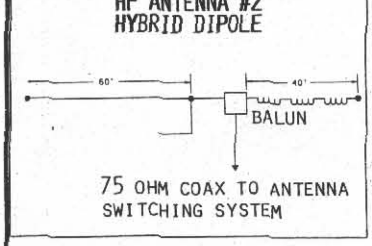
Mounted 15 ft. above ground and orientated North-South; acts as a reference antenna, considered representative of the majority of SWL antennas.



HF ANTENNA #2

Basically a dipole comprised of outdoor Antenna #1 and a 40 ft. trap section mounted indoors along the apex of a roof. The whole antenna forms a shallow "V" with its maximum radiation patter NNE/SSW; it resonates at around 4.7 MHz but has good wide band characteristics.

This was erected to utilize the outdoor section as part of a lower frequency dipole where overall exterior space is restricted and the interior space is insufficient for a full length dipole.



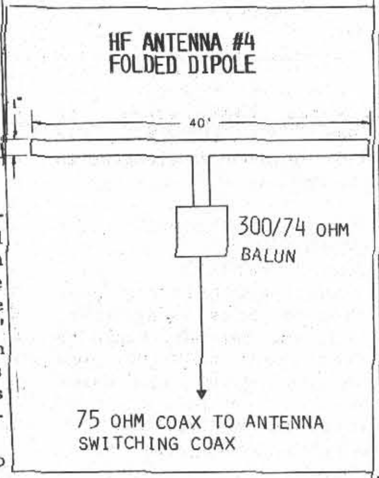
HF ANTENNA #3

A 16-inch shielded loop with a switched matching/loading unit; can be used in the active or passive mode. The active mode uses a Sony active antenna RF amp mounted at the loop and fed via an 0.01 MFd capacitor. The passive mode is via a separate coax to the antenna switching unit.

It is mounted on a rotator 8 ft. above ground. Tests conducted on a military active antenna (*Marconi-H-33-5500-01) indicated* that between 6 and 8 ft. is the optimum height. Effective height can yield gains of up to 30 dB, which is *useful when gain vs frequency* of the active can be -30 dB at 2.0 MHz up to 0dB at 30 MHz. (Regardless of advertising.)

HF ANTENNA #4

Indoor, rafter-mounted folded dipole, utilizing open wire TV feeder (resonant freq. approx. 12 MHz).



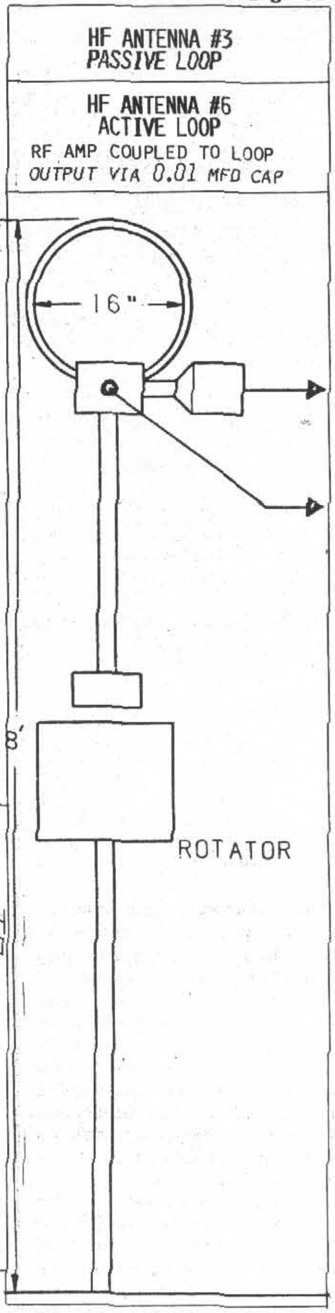
HF ANTENNA #5

A 40 ft. continuous length of aluminum guttering attached to the house 8 ft. above ground and fed at one end by 75 Ohm coax. Included as a "worst case" for a SWL in a zoning restriction area.

HF ANTENNA #6

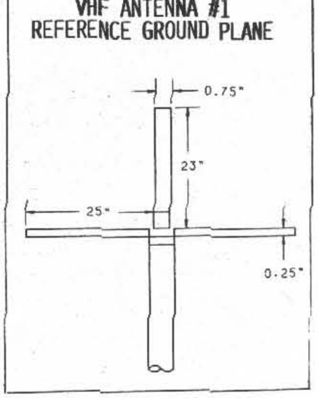
A "Linear inductance *monopole" consisting of a* SLINKY extended to 7 ft. mounted vertically over a radial ground plane 8.6 ft. in diameter and topped by a *2 ft. radial top hat.*

Originally used as a quarter-wave monopole for 33 MHz and located in the attic; later modified by *adding an FET RF amp at the* base and has since been used over the HF bands.



VHF ANTENNA #1

A 121.5 MHz ground plane with a 0.75 inch diameter vertical element; it performs well over the entire high band.

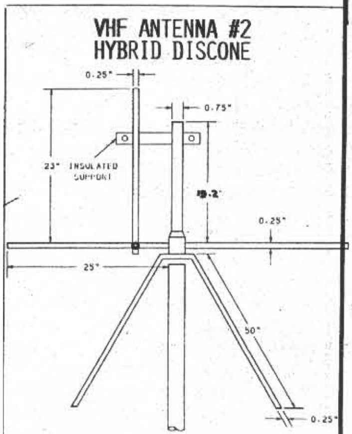


ANTENNA EXPERIMENTER cont'd

VHF ANTENNA #2

This "hybrid discone" antenna was constructed in an effort to utilize the wideband characteristics of the Discone mixed with a couple of discrete frequency vertical elements (145.5 and 121.5 MHz) hopefully possessing a high radiation angle.

Tests against the reference ground plane, in the aircraft band, indicated that it performs extremely well.



(DISC AND VERTICAL ELEMENTS ISOLATED FROM SKIRT)

CONTROL

All antennas feed into an antenna switching unit in the attic, remotely controlled from the operating position: LED's indicate which antenna is selected. The system allows rapid switching between antennas so that comparisons can be made.

An audio switching system is also part of the control unit.

The whole object of this particular exercise is to provide some comparison data for the ordinary SWL utilizing home-built antennas. Future plans call for the provision of an exotic antenna farm.

Have a Lot of Real Estate and a Lot of Wire? Then Build the "SWL LPMA ANTENNA"

By Al Smith, Box 280, Wamsutter, WY 82336

A good directional, wideband, low incidence angle antenna which isn't common in antenna texts is the log-periodic monopole array, or LPMA. The design is similar to the poplar log-periodic dipole array (LPDA), where the performance of the system is a periodic function of the logarithm of the frequency.

In practice it is virtually frequency independent, where subresonant (long) elements act to a degree as reflectors toward the resonant region, and supraresonant (short) elements act to a degree as directors.

By comparison to LPDA antennas, an LPMA can save some real estate and tower footage, and as a low profile wire beam can give high performance.

Its vertical/counterpoise structure optimizes reception from low angles of ionospheric refraction where international broadcast signals concentrate.

The two supporting towers or poles for an LPMA must only be 40 or 60 feet high on the high end for coverage from 9 or 6 MHz upwards, as compared to a much higher tower that is needed to optimize intercontinental reception off an LPDA or other horizontally-polarized beam.

Finally, an LPMA is both wideband and directional so one antenna serves for reception of all short-wave signals from a given direction.

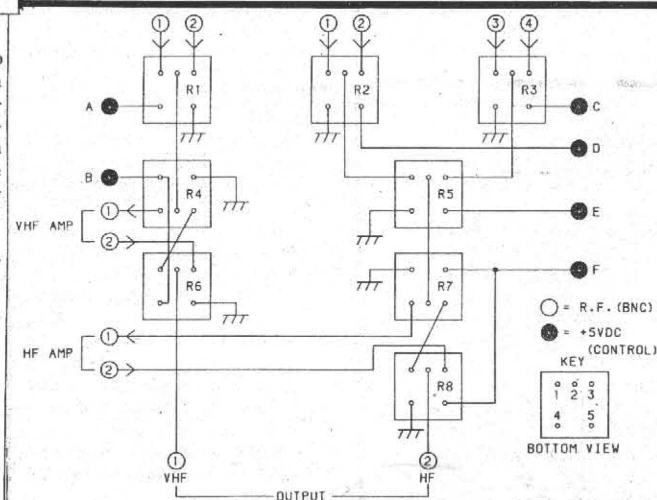
Illustrated here are LPMAs dimensioned for 3 to 10 MHz, 6 to 22 MHz, and 9 to 26 MHz coverage. Or you can develop your own dimensions for other bandpass/gain parameters from LPDA formulae that are available in some antenna texts[1,2] (see bibliography). In practice an LPMA works best with its counterpoise of horizontal elements suspended several feet above ground, perhaps high enough to walk under. Placing the counterpoise only inches off the ground could increase local noise pickup and would decrease input resistance and amplify VSWR.

The LPMA's planar element sets are balanced with respect to each other, and a balun (4:1) must be used in conjunction with a coaxial feedline. If coax was connected without a balun of the correct ratio, LPMA directionality and passband would be ruined.

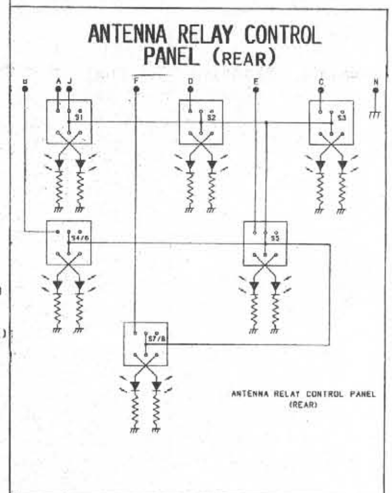
Properly installed, any of the LPMAs in the table should perform near the design specifications, although any antenna's operating characteristics can vary from one site to another.

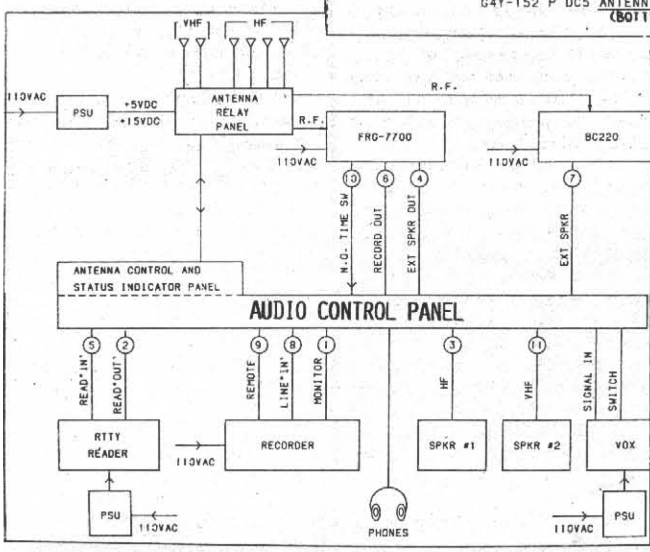
The best SWL antenna installation, regardless of its type, is away from suspended wires, tall buildings, and electrical noise sources.

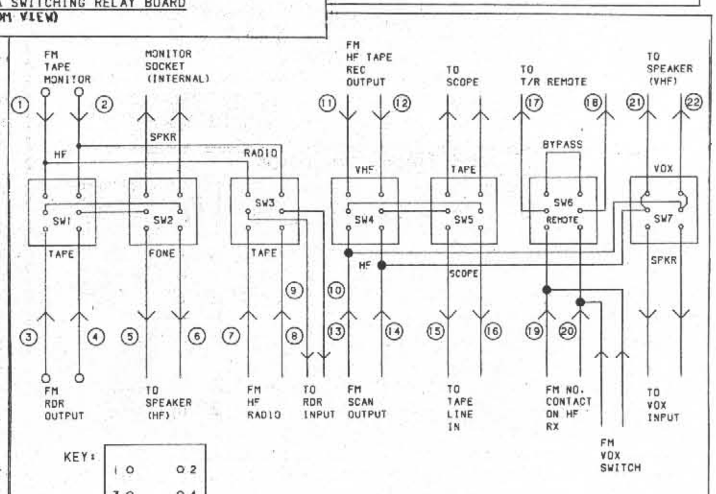
The design for 9 to 26 MHz is very low profile for



G4Y-152 P DC5 ANTENNA SWITCHING RELAY BOARD (BOTTOM VIEW)







AUDIO SWITCHING WIRING DIAGRAM (REAR VIEW) a beam, and wire as thin as AWG#22 is okay; #18 is minimum wire size for the 3-10 MHz LPMA and #20 for 6-22 MHz.

Multistrand wire stretches a lot less than harddrawn copper wire and if the former is used, the wideband nature of log-periodics accept a bit of dimensional distortion without inducing an audible mismatch on the feedline.

One source of inexpensive wideband weatherproof baluns is Microwave Filter Co., 6743 Kinne St., East Syracuse, NY 13057, which sells the W2AU balun.

In building one of these antennas, remember to insulate all element ends and avoid short circuits which occur most easily by twisting its balanced spine.

Keep its wire out of shrubbery, trees and headway, and enjoy a performance edge on international listening with your LPMA! ●

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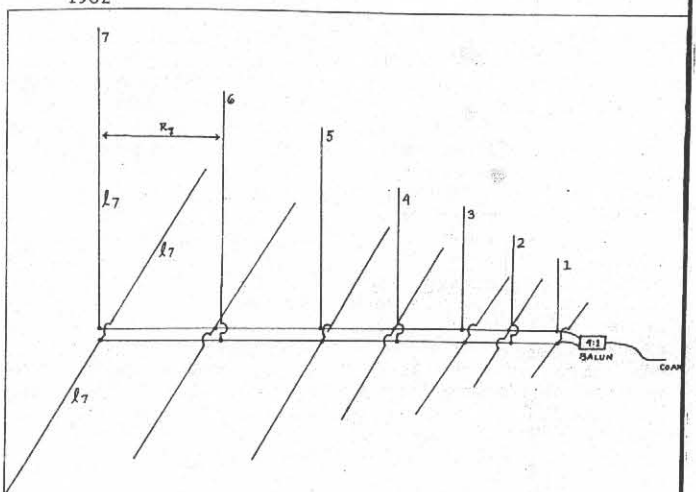
A SIMPLE (BUT SUPER) GROUND

MT reader Ken Hand has come up with an excellent idea for an effective ground for both transmitting and receiving. Ken's idea is to bury a discarded galvanized water tank approximately 9 feet in the ground; a pipe extending from the tank is used for electrical contact.

Ken suggests punching a number of holes in the tank and filling it with water periodically to encourage better electrical contact with the soil. It would also be a good idea to be sure that the pipe threads do not have any residual pipe dope on them or a poor connection is sure to result.

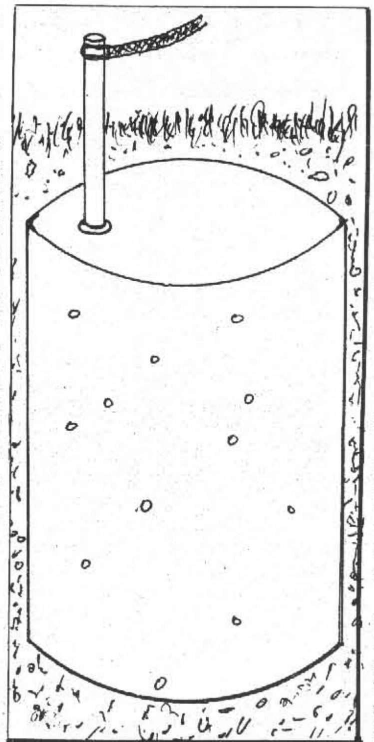
A few additional hints: the larger the tank, the better the ground; add some copper sulfate ("Bluestone") to the tank for even better electrical contact with the soil; use heavy braid from the pipe clamp to your rig (like the shield braid pulled off RG-8/U coax).

Thanks, Ken, for sharing your suggestions with fellow MT readers. ●



LPMA DIMENSIONS TABLE							
Spacing	**R_1**	**R_2**	**R_3**	**R_4**	**R_5**	**R_6**	**Array Length**
3.2-10 MHz	12'2"	15'8"	20'0"	25'8"	33'0"	40'6"	147'
5.9-17.9 MHz	6'7"	8'6"	10'10"	13'11"	18'0"	22'0"	79'10"
9.0-28.0 MHz	4'4"	5'8"	6'9"	9'4"	12'0"	14'8"	52'9"
Elements	**ℓ_1**	**ℓ_2**	**ℓ_3**	**ℓ_4**	**ℓ_5**	**ℓ_6**	**ℓ_7**
3.2-10.0 MHz	24'2"	31'4"	40'0"	51'4"	66'0"	81"	103'10"
5.9-17.9 MHz	13'2"	17'0"	21'8"	27'10"	36'0"	22'0"	56'8"
9.0-28.0 MHz	8'8"	11'4"	13'3"	18'8"	24'0"	29'4"	37'9"

These are developed from a single parameter of [α(apex angle)=22^{o}; σ(relative spacing factor)=0.14; τ(relative scale factor)=0.78]; beamwidth is 80^{o} to 120^{o}; gain is 5 dBd.



UNDERGROUND ANTENNAS

by Bob Grove

A recent editorial in Worldradio (December 1984) brought to mind a concept which seems radical from any practical point of view, but it works.

If you are interested in listening to frequencies at the standard broadcast band and below, and don't want to suspend an outside antenna, you might try burying your antenna wire!

That's right. Radio waves will penetrate soil; the lower the frequency, the greater the depth. This is why the Navy's Project ELF uses such low frequences - to penetrate salt water to a depth of several hundred feet at a frequency of 76 Hz!

But despite soil's notoriously poor conductivity, use insulated wire to prevent coupling to the soil along the length of the wire. Any gauge, stranded or solid, will work.

The 10 dB attenuation points for average 8 millimho soil conductivity are 5" @ 3.5 MHz; 3" @ 10 MHz and 3/4" @ 14 MHz.

Try about 100 feet of any convenient insulated wire buried roughly a few inches deep. There will be some signal attenuation, but hardly noticeable at these frequencies. And best of all, it will be below the sources of most electrical line noise!

Let us know of your successes (or disappointments!). ●

How Long Should That Antenna Be?

When cutting an antenna for a specific frequency, apply two nifty formulas to provide the appropriate length.

If you are planning to erect a dipole for shortwave reception, the proper length in feet may be found by dividing 468 by the center frequency in megahertz. Thus, a 6 MHz antenna is ideally 78 feet long.

Computing quarter-wave ground planes and whips for VHF/UHF applications is just as simple: divide 2808 by the frequency in megahertz to find the length in inches. Thus, the correct length of a 155 MHz antenna element is 18 inches.

And another hint: Dipoles and ground planes without loading coils work well on odd harmonics. Use the 155 MHz antenna at 465 megahertz (3 x 155) and the 6 mehagertz dipole on 18 or 30 megahertz (3 x and 5 x 6) for good performance.

Since receiving antennas are not overly-conscious of standing waves from impedance mismatch, they generally work quite well several percent away from their design frequency. This is the theory behind the design of the Grove Skywire and OMNI, two highly-effective, low-cost antennas for listeners. ●

A COMPACT SHORT-WAVE ANTENNA

MT reader and veteran listener Duncan Cameron recently completed an experiment with his Grove Skywire dipole that he would like to share with fellow SWL's.

Desiring a smaller antenna, Duncan wrapped the two dipole wire elements around a nine-foot length of 1-3/8" wood dowel rod, converting the "flattop" dipole into a helix.

Subsequent monitoring seemed to show no reduction in signal strength; in fact, with only one mast support point the antenna could be rotated to the most favorable direction for best reception and greatest line noise rejection!

And how about fixing the antenna to a TV rotator? Or substituting rigid PVC plastic pipe for the wood dowel?

We would be pleased to hear from MT experimenters regarding their experience and suggestions for compact, directional HF antennas. Now, how about a rooftop RDF for the shortwave spectrum? ●