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Heath Model HD-1420 VLF Converter and Model HD-1422 Antenna Noise Bridge

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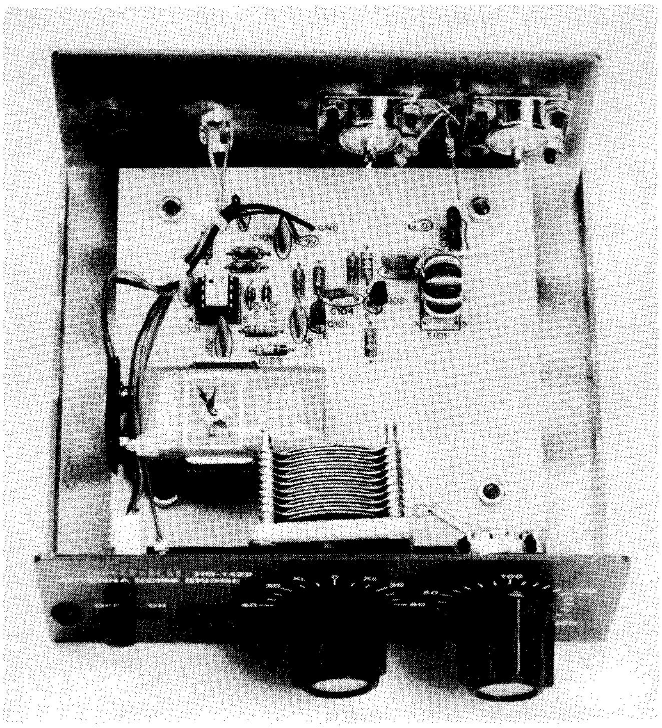

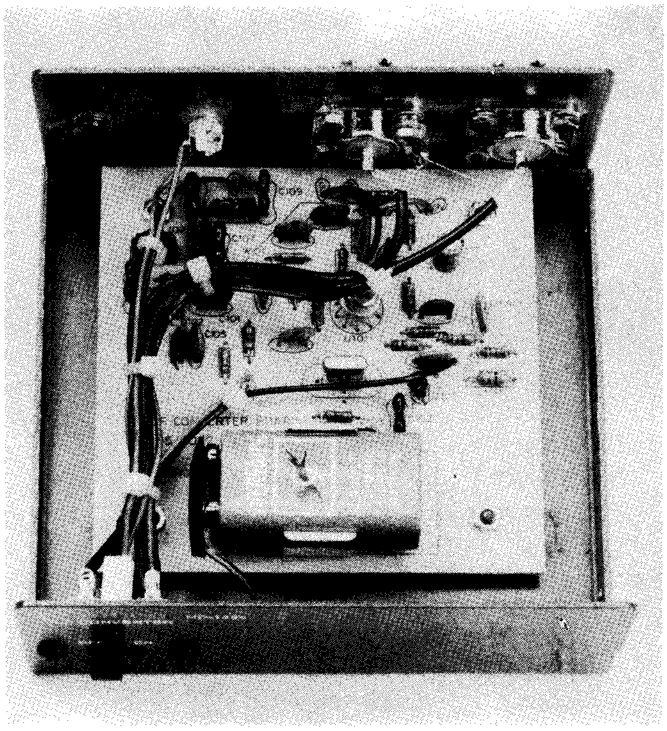

Heath has always been famous for providing reasonably priced accessory and test equipment kits with good performance. This month we look at two new accessory items, the HD-1420 VLF Converter and HD-1422 Antenna Noise Bridge, to see if they are keeping up their fine tradition. These kits were introduced late in 1985 and should be of interest to many amateurs.

VLF Converter Description

The '1420 VLF converter allows you to listen to the frequencies between 10 and 500 kHz, below the standard AM broadcast band. For those of us that own one of the new general-coverage receivers or transceivers that cover part of this band, this unit may be of only academic interest. For those like myself, limited to a ham-band-only transceiver, the possibilities of listening in to the VLF portion of the spectrum are fascinating. I have read several publications that describe the numbers of beacons, broadcast stations and "LOWFERS" operating down there. I really wanted to hear them for myself!

The circuit for the converter is exceptionally simple. A 2N3904 bipolar-transistor RF stage (if you can call 10 kHz "RF"), an MPF105 bipolar-transistor crystal oscillator operating at 3500 kHz and an MC1496G IC mixer comprise the converter (see Fig 1). The converter output is 3510 to 4000 kHz, tunable on an 80-m receiver to cover the 10- to 500-kHz range. There is nothing unconventional in the design—a Colpitts crystal oscillator, an untuned RF stage that is connected directly to the antenna, and a straightforward IC mixer. There is a low-pass filter between the RF amplifier and the IC mixer. In addition to the three active components, there is a small handful of miscellaneous resistors and capacitors. The PC board is silk-screened and solder masked. The general layout is uncrowded and easy to work with. The hardware is of good quality, and all attaching parts are included in the kit.

VLF Converter Construction

As usual, Heath's assembly manual is well written. I had only one problem in assembling the converter. I skipped immediately to the instructions for inserting and soldering the resistors into the PC board. Since there were only 21 resistors, this was a quick task. But when I reached the end of the instructions, I still had one resistor left! I used the schematic and the silk screening on the PC board to identify the resistor I had on hand. I determined that it was R109 (1 kΩ) and installed it.

It was a matter of some time—in fact, not until I built the Antenna Noise Bridge—before I discovered my problem. Heath uses R109 as an example in the preassembly instructions, then just before the detailed piece-by-piece instructions, they say, "Make sure you installed R109 in a earlier step." In building the noise bridge I discovered, after putting in all the resistors I could identify in the instructions, that R101 was left over. That's when the lights came on! I couldn't believe that two kits would have the same problem. After *reading* all the instructions, it soon was apparent that I was the problem with both kits. Moral: Read *and* understand *all* of the instructions before you start soldering! It's very easy, if you have built kits previously, to assume that you know everything. It was a humbling experience (that I shared with absolutely no one, until now).

The balance of the construction was simple. In all, I spent about two hours, total, in building and testing the unit. The kit includes a 9-V battery connector and a battery holder. Unfortunately, when the holder is mounted to the PC board with the two no. 4-40 screws provided, a pair of lumps is created by the screw heads right in the center of the holder. The battery will not then fit cleanly into the holder. I would much prefer to see another type of holder used, in which the battery is mounted on its side and the mounting screws do not interfere with the fit. A 1/8-in, 2-circuit jack is supplied with the kit, and it

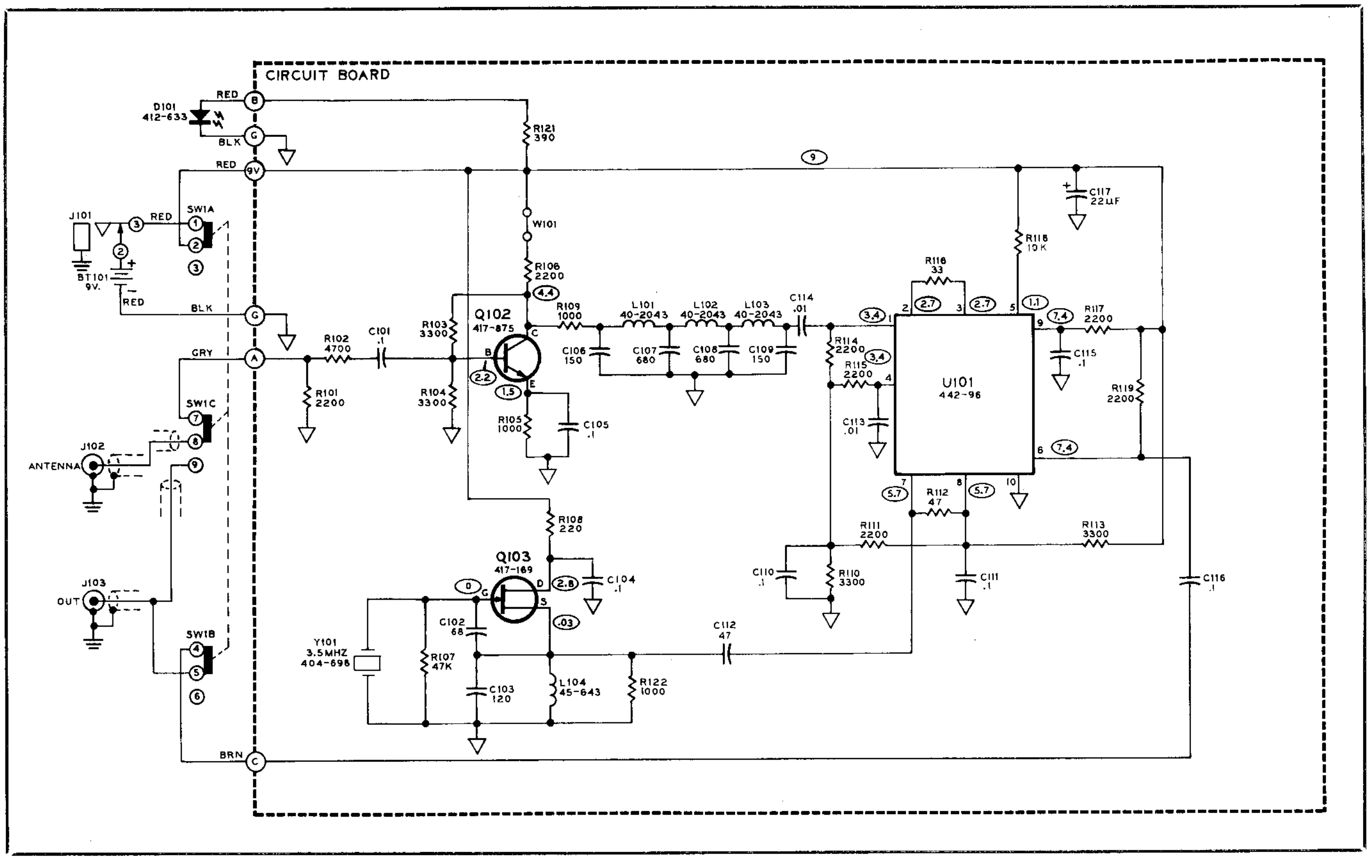

Fig 1—Schematic diagram of the Heath HD-1420 VLF Converter. This drawing is reproduced with permission of Heath Co and does not reflect ARRL style.

is mounted on the rear panel to allow use of an outboard power supply. The 9-V battery will probably not last too long because of the current requirement (20 mA) of the converter.

Performance

I connected the converter to my IC-730 to listen to the VLF band. It was a little disappointing at first—there either were few signals, or the converter was a "leetle mite deef." Since the '730 has no VLF capability, I couldn't compare performance with and without the converter. The manual says to use a long-wire antenna, even a long horizontal wire, or a vertical. I used my 80-m, inverted-V trap dipole. I was able to copy three or four beacon signals, as well as the weather broadcast from station TUK near Boston (about 150 miles away). I then tried a random-wire antenna, but could not copy any additional signals. In several hours of listening, I was unable to copy any "LOWFER" signals. These are stations in the 160-190 kHz band that are permitted license-free operation with transmission power limited at 1 W to an antenna 50 feet long, or less.

In the ARRL Lab, we connected the converter to a Kenwood TS-440S transceiver and used a vertical antenna designed for 30-m operation. We were able to receive the same signals that were copied with the 80-m dipole and the '730. The signals through the converter were about 12 dB (2 S units) below the same signals copied in the TS-440's general-coverage mode on the VLF band. There is either considerable conversion loss in the unit, or the antenna impedance matching is critical. There is no practical way to determine if the converter input mismatch is different than the bare transceiver input mismatch. We did, however, measure the converter MDS (minimum discernible signal, or noise floor). At about 470 kHz, the lowest frequency that our calibrated signal generator can provide, MDS was − 108 dBm. Not too bad for this type of equipment. In subsequent tries to use the converter, I found that the antenna is everything. A vertical is best—then a random wire. The dipole that I used at home came in a poor third.

During another long listening session from my QTH, at about sundown, I was able to copy 33 stations, ranging from the low AM broadcast band (540 to 600 kHz) to some unidentifiable stations at around 25 kHz. It was interesting that I could copy AM broadcast at every 10 kHz from 540 to 600 kHz. Some of the signals came from as far as Boston, and others were in New York. There were several beacons (AM CW) identifiable, as well as two or three additional weather broadcasts in addition to station TUK. Apparently my first attempts were during periods of low activity or poor propagation. I was quite impressed by the converter's performance during this last session.

Antenna Noise Bridge Description

The Antenna Noise Bridge generates a tone-modulated broadband noise signal that is coupled to an impedance bridge. Using the station receiver as an indicator, the impedance bridge measures the resistive and reactive components of the antenna. This allows you to trim the antenna to your favorite operating frequency for the most effective reception and transmission of signals. In addition, the noise bridge can be used to preset an antenna matching network for faster tuning, to tune a quarter-wave transmission line and to measure the values of unknown capacitors and inductors.

The circuit of the noise bridge is simple and effective. The noise generator is a Zener diode, D103 (see Fig 2). The NE555 IC timer, U101, generates an approximate 50-percent duty cycle, square-wave audio signal that is applied to the cathode of D103. The audio modulation thus appears on the noise signal and makes null-detection easier when used with an AM receiver. The broadband noise and audio signal is amplified to a level sufficient to produce a fairly high (about S9) level in the receiver. The impedance bridge portion of the circuit consists of C1, R1, C107 and T101. T101 is a trifilar-wound transformer with one of the windings used to couple noise energy into the bridge circuit. The remaining two windings are arranged so that each one is in an arm of the bridge. In operation, the bridge is adjusted for an audio null in the receiver, using C1 and R1. The dial readings of these components then indicate the resistive and reactive components in the antenna at the frequency to which the receiver is tuned.

Noise Bridge Construction

Construction of the noise bridge is straightforward and requires about two hours. All parts of the kit were provided, and there were good instructions for the assembly

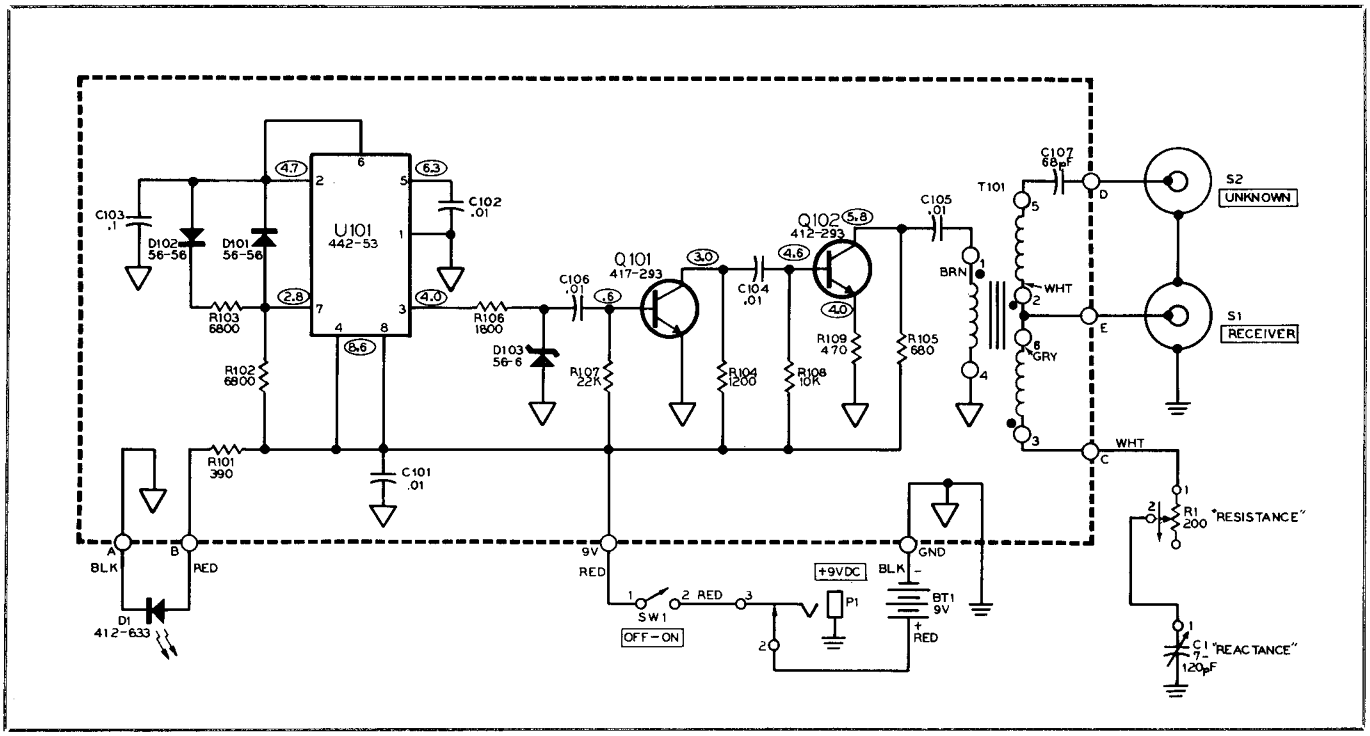

Fig 2—Schematic diagram of the Heath HD-1422 Antenna Noise Bridge. This drawing is reproduced with permission of Heath Co and does not reflect ARRL style.

of the entire bridge. Hardware is of good quality, and there were no shortages.

Performance

The only way I know of to check performance of an Antenna Noise Bridge is to check an antenna with known characteristics to confirm its performance capability. In the ARRL Lab we tested several antennas with the bridge, and invariably it told us exactly what we already knew about the antennas. It is as accurate as any device of its type could be expected to be. I gained confidence in it by also measuring several "unknown" values of inductance and capacitance, and finding that the accuracy was adequate for ham-shack use.

Conclusion

Both kits seem to be reasonable designs at a reasonable price. I was satisfied with the performance of both. The VLF converter seems to operate with a reasonable sensitivity range. It should satisfy the casual VLF listener.

I think that a noise bridge is a must in the shack. With the '1422 you can immediately tell what your antenna is doing. In addition, I see several other ways in which it can help me (in identifying some of those unmarked "goodies" I bring home from time to time).

Manufacturer: Heath Company, Benton Harbor MI 49022. Suggested list prices: Model HD-1420 VLF Converter, $49.95; Model HD-1422 Antenna Noise Bridge, $49.95.

—*Bruce O. Williams, WA6IVC*

Strays

I would like to get in touch with ...

☐ hams interested in starting a 12-m net to exchange QRP construction-project ideas. Bill Copeland, WB6RVE, PO Box 163, Perris, CA 92370.

☐ anyone with information on finding a vintage WW II US Navy TCK transmitter. Jim Berry, K7SLI, 4205 NE 109, Portland, OR 97220.

☐ anyone with a schematic and/or service information for a Xitox Corp Model 100 Leedex video monitor. Mac Campbell, K9ZKX, RR 1, Box 31, Bruceville, IN 47516.

Next Month in *QST*

• ACSSB or FM—which offers communications effectiveness and spectrum conservation? Learn the what, who and how of Amplitude-Compandored Single Sideband in the two-part series beginning in December *QST*.

• Want ac-line spike protection? Plug into Under Construction for details on building a 6-receptacle outlet box with filtering.

• "Three fine mice, see how they run." You'll easily have these MOuSeFET CW transmitters by the tail. Build models for 80, 40 and 30 meters.

• OSCAR celebrates a quarter century of flying high with an anniversary article on the amateur-satellite program—where it's been and where it's headed.

Please note: Although we try our best to include in the next issue all the items we've advertised, from time to time we have to postpone publication for a month or two. If the item you're looking for doesn't appear "next month," it most likely will be in the following month's issue.