

# A Miniature UHF Fox Transmitter

*Adding a UHF foxhunt to your next ham gathering will enhance your own fun and give the participants some RF moxie!*

Dave Bowker, K1FK



Figure 1—A front and back view of the miniature UHF Fox transmitter.

Since Jamboree On The Air 1997, the Boy Scouts of Maine's Katahdin Council, Troop 189, have actively participated in annual JOTA activities in the north Maine woods, outside of Fort Kent. The Troop 189 JOTA weekend generally involves more than 100 Scouts, leaders and visitors and has become the weekend to introduce Cub Scouts and Webelos to the Boy Scout troop. For JOTA 2001, I added a VHF foxhunt to the traditional HF activities in order to involve more visitors and parents in the Amateur Radio experience. The foxhunters organize into small teams and compete against one another and the clock to locate the fox. While it's lots of fun for all, manipulating a large 3 element, 146 MHz Yagi or a Moxon antenna through the dense forest to locate a 2 meter fox can be quite a challenge.

For JOTA 2003, I designed and built a number of miniature UHF "fox" transmitters (described in this article) and hid them at various locations throughout the woods. Using UHF fox transmitters permits the use of small handheld receivers and antenna-tracking devices. It also makes it easy to place several foxes at different locations to increase the "challenge of the hunt" for the teams.

## Introduction

The UHF fox transmitter shown in Figure 1 can be constructed from readily obtainable components. It requires no special construction techniques or adjustments, and it is programmed by voice using the simple programmer described in

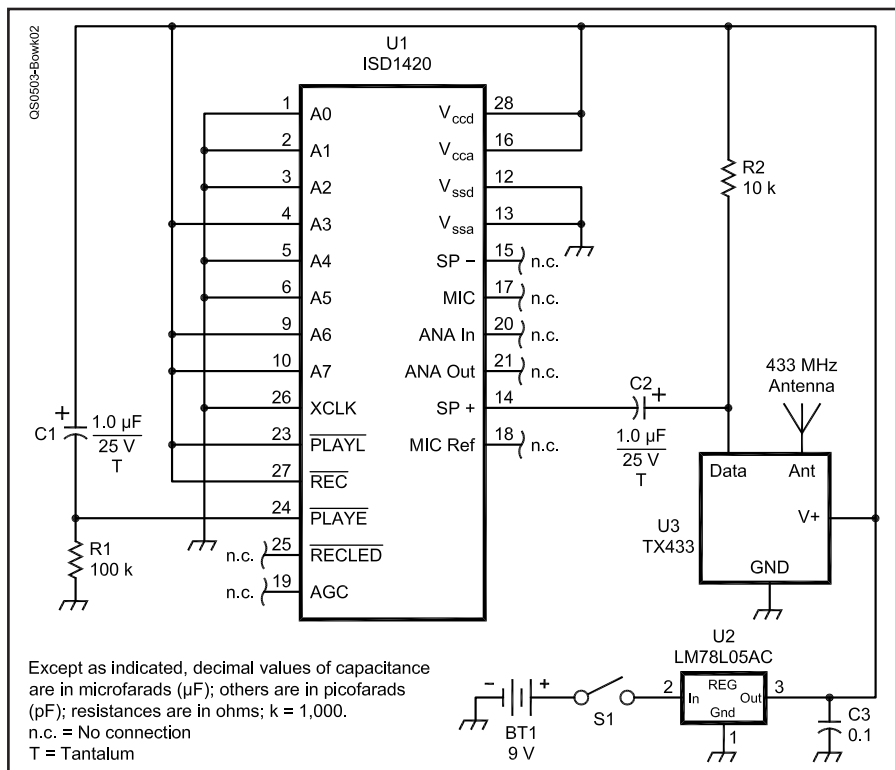


Figure 2—The UHF fox transmitter schematic diagram. JE = Jameco Electronics; [www.jameco.com](http://www.jameco.com). RE = Ramsey Electronics; [www.ramseyelectronics.com](http://www.ramseyelectronics.com). RS = RadioShack; [www.radioshack.com](http://www.radioshack.com).

- BT1—Battery, 9 V alkaline, JE 198731.
- C1, C2—Capacitor, 1.0  $\mu\text{F}$ , 25 V tantalum, JE 154860.
- C3—Capacitor, 0.1  $\mu\text{F}$ , 50 V monolithic ceramic, JE 25523.
- R1—Resistor, carbon film, 100 k $\Omega$ , 1/4 W.
- R2—Resistor, carbon film, 10 k $\Omega$ , 1/4 W.
- S1—Switch, SPST, included with JE 216338 or RS 270-409 battery holder (see Miscellaneous, below).
- U1—Integrated circuit, voice record/playback, ISD1420P, JE 107334.

- U2—Integrated circuit, voltage regulator, 5 V dc, 100 mA, 78L05, JE 51182.
  - U3—Data transmitter module, 433 MHz, RE TX433.
- Miscellaneous**  
 Battery holder, 4 AA type (modified, see text), JE 216338 or RS 270-409.  
 Battery connector, 9 V snap type, JE 11279.  
 IC socket, 28-pin, 0.6" spacing, JE 40328.  
 PC board material, grid-style with solder-ringed holes (from RS 276-158).  
 433 MHz antenna, 7" no. 20 PVC insulated wire.

this article. It has a range of 1/4 to 1/3 mile when used with a 3 element Yagi antenna and an amateur handheld UHF transceiver, depending upon the surrounding terrain. A 9 V alkaline battery provides more than 8 hours of continuous operation.

The heart of this miniature UHF fox is a 433 MHz RF wireless transmitter module marketed by Ramsey Electronics.<sup>1</sup> These miniature (1/2 square inch) modules are intended for intermittent ON/OFF keying (OOK) when used in accordance with FCC Part 15 rules for unlicensed devices. Part 15 devices include such things as remote control door openers, keyless entry systems and data transmitters. The modules are furnished assembled and tested. They operate at a nominal frequency of 433.42 MHz (determined by a surface acoustic wave—SAW—resonator) within the amateur 420-450 MHz band. When they are used in continuous service in Amateur Service applications, FCC Part 97 rules apply, including call letter identification. A single-chip voice record/playback IC provides a prerecorded audio message and call letter ID. Programming modulated CW (MCW) IDs may be accomplished by holding the programmer near the speaker of a code practice oscillator or the side-tone generator of a CW transceiver.

### Transmitter Circuit Operation and Construction

As illustrated in the schematic of Figure 2, the fox is composed of an ISD1420 voice record/playback IC<sup>2</sup> with on-chip nonvolatile memory, a Ramsey Electronics TX-433 RF wireless link module, a 5 V dc regulator and supplementary parts.

Integrated circuit U1 is configured to operate in an automatic power-up looping mode to provide a continuously repeating 20 second voice message programmed into its nonvolatile memory. When power is applied, U1 begins outputting its recorded message. It continues to the end of message and repeats. U3's data input terminal is biased through R2 to enable the TX-433 module, while the applied audio signal of approximately 1 V<sub>P-P</sub> from U1 phase modulates the SAW oscillator.

Construction of the circuit board is straightforward and utilizes a small piece of grid style PC board material cut to 1.1 x 2 inches. A 28 pin IC socket is required for U1 since this device is externally programmed and inserted into the transmitter—all other components and the U3 RF module can be mounted and wired point-

<sup>1</sup>Notes appear on page 30.

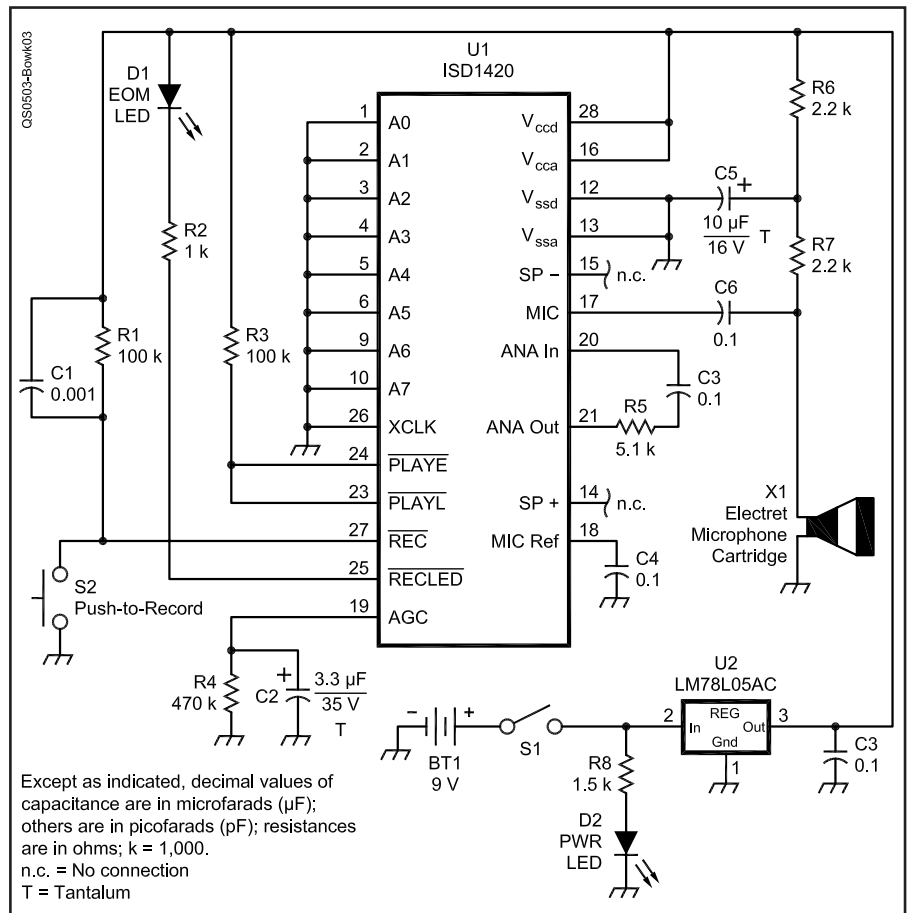


Figure 3—ISD1420 programmer schematic diagram. JE = Jameco Electronics; [www.jameco.com](http://www.jameco.com). RS = RadioShack; [www.radioshack.com](http://www.radioshack.com).

BT1—Battery, 9 V alkaline, JE 198731.

C1—Capacitor, 0.001 μF, 50 V monolithic ceramic, JE 81517.

C2—Capacitor, 3.3 μF, 35 V tantalum, JE 33769.

C3, C4, C6, C7—Capacitor, 0.1 μF, 50 V monolithic ceramic, JE 25523.

C5—Capacitor, 10 μF, 16 V tantalum, JE 94060.

D1, D2—LED, red diffused T1 3/4, LiteON LH3330 or equiv, JE 94511.

R1, R3—Resistor, carbon film, 100 kΩ, 1/4 W.

R2—Resistor, carbon film, 1 kΩ, 1/4 W.

R4—Resistor, carbon film, 470 kΩ, 1/4 W.

R5—Resistor, carbon film, 5.1 kΩ, 1/4 W.

R6, R7—Resistor, carbon film, 2.2 kΩ, 1/4 W.

R8—Resistor, carbon film, 1.5 kΩ, 1/4 W.

S1—Switch, SPST miniature toggle, JE 76523.

S2—Switch, SPST momentary on, JE 164638.

U1—Integrated circuit, ISD1420P (removed from UHF transmitter for programming).

U2—Integrated circuit, voltage regulator, 5 V, 100 mA, 78L05, JE 51182.

X1—Microphone element, electret, JE 137573 or RS 270-090.

#### Miscellaneous

Project box, 4x2x1", RS 270-1802.

Battery connector, 9 V snap type, JE 11279.

IC socket, 28 pin, 0.6" spacing, JE 40328.

LED holder, T1 3/4 (2 required), JE 23077.

PC board (from remaining RS 276-158 material used in transmitter).

to-point, following the general layout shown in Figure 1. The layout is not critical, as all wiring is at low-level dc or audio frequency voltages.

The battery case is modified, using a utility knife and pliers, by removing the three partitions that held the original AA cells and their contact springs and contacts. The cover over the compartment that contains the ON/OFF slide switch is carefully removed by trimming away the three plastic weld points with a utility knife, removing the retaining screw and

cover, and unsoldering and discarding the battery contact from the slide switch center terminal.

The wiring is modified to accommodate the 9 V battery connector/wiring as shown in Figure 2, with the black lead from the battery clip being soldered to the switch center terminal. The compartment cover and retaining screw (previously removed) is replaced and reattached at three points using the tip of a hot soldering iron.

A 1/4 wave antenna is fabricated from a 7 inch length of no. 20 PVC insulated



Figure 4—Two views of the ISD1420 programmer.

hookup wire and routed through the hole in the case from which the original battery leads were routed. The completed component board is mounted to the right side of the case using double-backed foam tape and the power leads and antenna are attached. The entrance hole for the antenna should be sealed with ABS plastic or Duco cement to stabilize the antenna lead.

### Programmer Circuit Operation and Construction

As shown in the schematic diagram of Figure 3, the programmer consists of a 28 pin socket to accept the ISD1420 IC

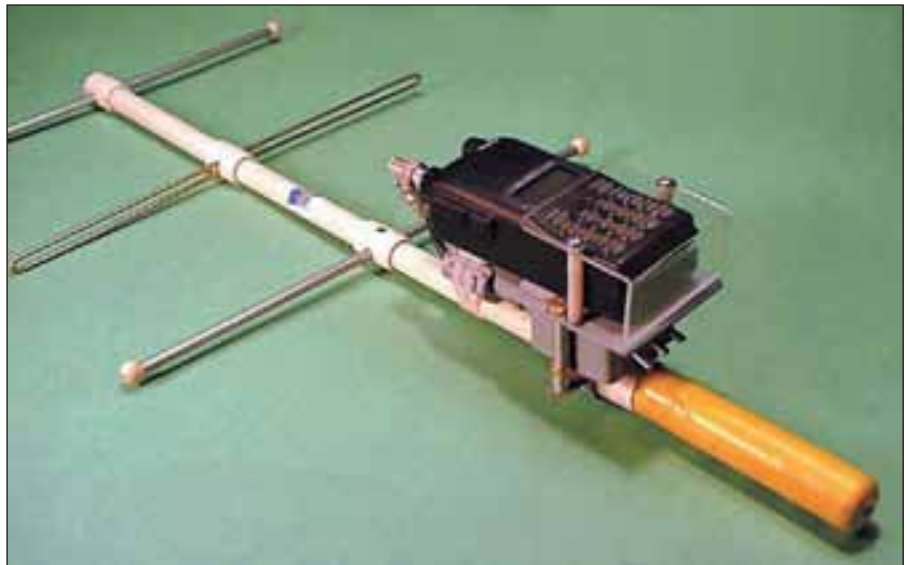


Figure 5—A 433 MHz, 3 element Yagi antenna with an Alinco DJ-596T handheld transceiver and attenuator. The small UHF configuration makes for much easier handling than an equivalent 2 meter version.

to be programmed, the microphone, a power supply consisting of a 9 V battery and 5 V dc regulator, a push-to-record (PTR) momentary pushbutton switch and an end-of-memory (EOM) indicator.

UI is reset to the beginning of memory when power is applied. To record a message, the PTR switch is depressed and held, the EOM indicator illuminates, and the message is spoken into the microphone. The EOM indicator will extinguish after 20 seconds of recording time, after which the PTR switch may be released, power turned off, and the IC removed.

Construction is similar to that used for the fox transmitter and uses point-to-point wiring of the components on a grid-style PC board as shown in Figure 4.

### Tracking Antenna

Shown in Figure 5 is a 3 element Yagi with an Alinco DJ-596 dual-band handheld transceiver and a 120 dB attenuator mounted to the extended boom. The Yagi director and reflector elements are constructed of 1/4 inch diameter aluminum tubing, while the folded dipole driven element is constructed of 1/8 inch diameter brazing rod. The folded dipole element is fed with RG-58C/U coaxial line and a 1/2 wave 4:1 impedance ratio coaxial balun—all contained within the boom—which is constructed of 1/2 inch schedule 20 PVC pipe. The coax cables to/from the attenuator are routed through a Type 43 material ferrite common-mode choke. The mounting for the handheld transceiver includes a plastic shield over the handheld keyboard to prevent accidental activation of the

keypad while tracking the fox.

The design and construction of UHF Yagis, coaxial baluns and attenuators is covered in *The ARRL Antenna Book*.<sup>3</sup> Enjoy this easy-to-build little fox and welcome to the world of transmitter hunting!

### Notes

<sup>1</sup>Ramsey Electronics Inc, 590 Fishers Station Dr, Victor, NY 14564; 585-924-4560; [www.ramseykits.com](http://www.ramseykits.com).

<sup>2</sup>See the Information Storage Devices Web site at [www.isd.com](http://www.isd.com) for data sheets and application notes.

<sup>3</sup>Available from the ARRL Bookstore. Order no. 9043. Telephone toll-free in the US 888-277-5289, or 860-594-0355, fax 860-594-0303; [www.arrl.org/shop/](http://www.arrl.org/shop/); [pubsales@arrl.org](mailto:pubsales@arrl.org).

*Photos by the author.*

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## Strays

I would like to get in touch with...

◇ anyone who's been continuously licensed as a Novice since 1977 or earlier.—*Jodi Morin, KA1JPA; [elo1bev@netzero.net](mailto:elo1bev@netzero.net)*

◇ any amateurs who contacted the hams who were on the 1947 Kon-Tiki Expedition.—*Jerry Uhte, K9UT, 202 Woodlawn Ave, Richmond, IN 47374; [k9ut@aol.com](mailto:k9ut@aol.com)*