

Yagi Antenna Workshop

Building a Tape Measure Antenna

Northeastern University Wireless Club - W1KBN

September 9, 2024
Sign in here!



<https://l.w1kbn.org/signin>

Welcome to Our First Workshop!

- ▶ Welcome to the Wireless Club's first workshop of the semester!
- ▶ Who we are:
 - ▶ We are Northeastern University's Wireless Club, a student group passionate about electronics, antennas, and wireless technologies.
 - ▶ Our workshops are designed to be accessible for all skill levels—whether you have experience or not, you're in the right place.
- ▶ Today's Plan:
 - ▶ Introduction to HAM Radio and Antennas
 - ▶ Step-by-step Yagi Antenna build using a tape measure and basic materials
 - ▶ QA and hands-on assembly
- ▶ Visit our website for more: <https://nuwireless.org/>

Welcome!

- ▶ Wireless Club Meetings: 7 PM Thursdays @ 503 Hayden (Free Pizza!)
- ▶ Workshop Meetings: 7 PM Mondays @ East Village, Room 010
- ▶ Join our Slack:
<https://neuwireless.slack.com/join/signup>
- ▶ Join our mailing list: <http://eepurl.com/gduCIr>
- ▶ Scope of today's workshop:
 - ▶ Rapid-Fire Ham Radio Overview
 - ▶ Antennas 101
 - ▶ The Build: <https://www.instructables.com/The-Tape-Measure-Antenna/>
- ▶ Sign-in: <https://1.w1kbn.org/signin>

Common Terms and Abbreviations

- ▶ **HAM Radio** – Amateur Radio, used for personal, non-commercial communication.
- ▶ **VHF** – Very High Frequency (radio waves in the 30 MHz to 300 MHz range).
- ▶ **SWR** – Standing Wave Ratio, a measure of the efficiency of the antenna's power transfer.
- ▶ **RG-58 Cable** – A type of coaxial cable used for radio frequency signals.
- ▶ **BNC Connector** – A common radio-frequency connector used for coaxial cable.
- ▶ **Impedance Matching** – Adjusting the antenna so the electrical load matches the transmission line for better power transfer.

What is HAM Radio?

- ▶ A hobby and service that allows individuals to communicate using designated radio frequencies for personal, non-commercial purposes.
- ▶ HAM radio operators can use equipment like handheld transceivers (walkie-talkies) to communicate.
- ▶ Different modes include voice (talking), Morse code (using beeps), and data (sending text over the airwaves).

Yagi Antenna Overview

- ▶ A **Yagi antenna** is a type of directional antenna, which means it focuses the radio signal in a specific direction.
- ▶ It consists of:
 - ▶ **Driven Element** – The part that connects to the transmitter/receiver (this part sends or receives the signal).
 - ▶ **Reflector** – A passive element that bounces signals back towards the driven element to strengthen them.
 - ▶ **Director(s)** – Elements that help further focus the signal in one direction.
- ▶ Yagi antennas are commonly used in amateur radio, TV reception, and Wi-Fi because they are great for long-distance communication.

Bill of Materials

Materials Needed:

- ▶ **PVC Pipe (3/4" Schedule 40)** – Minimum 25 inches
- ▶ **Hose Clamps** – 6 clamps, large enough to fit around the PVC pipe
- ▶ **PVC Tee** – 1 piece (3/4")
- ▶ **PVC Crosses** – 2 pieces (3/4")
- ▶ **RG-58 Cable** – 8 feet long, with a connector on one end (e.g., female BNC)
- ▶ **Wire** – 5 inches of wire (e.g., 18 gauge solid copper wire or similar)
- ▶ **Rosin Core Solder** – For soldering connections
- ▶ **Tape Measure** – 1 inch wide
- ▶ **PVC Glue** – For securing PVC joints

Tools Needed:

- ▶ **Soldering Iron** – For soldering wire connections
- ▶ **Tape Measure** – For measuring lengths accurately
- ▶ **Pipe Cutters** – To cut the PVC pipe
- ▶ **Wire Stripper** – For stripping insulation off wires
- ▶ **Shears or Scissors** – To cut the tape measure
- ▶ **Sandpaper** – To smooth cut edges of metal parts
- ▶ **SWR Meter** – For testing antenna performance
- ▶ **Screwdriver/Wrench** – To tighten hose clamps

Step 1: Cutting the Elements

- ▶ Cut two PVC pieces (17.5" and 7") for the frame.
- ▶ Disassemble the tape measure and cut three elements:
 - ▶ Director: 35 1/8"
 - ▶ Driven Elements: Two 17 3/4"
 - ▶ Reflector: 41 3/8"
- ▶ Sand the ends of the elements for safety and soldering.

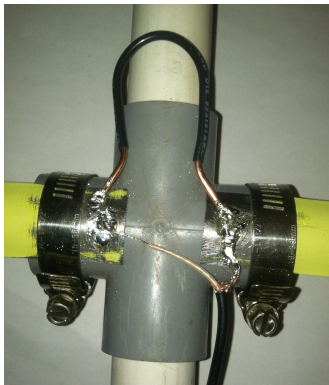


Step 2: Installing the Elements

- ▶ Attach the Director element at the front with hose clamps.
- ▶ Install the driven elements and ensure they are spaced 1" apart.
- ▶ Secure the Reflector element at the rear of the antenna.

Step 3: Soldering the Wires

- ▶ Tin the ends of the driven elements with solder.
- ▶ Solder the RG-58 cable: Inner wire to one driven element, outer to the other.
- ▶ Use a 5" wire to connect the two driven elements.



Antenna Adjustment

- ▶ Use an SWR meter to tune the antenna.
- ▶ Adjust driven elements if SWR reading exceeds 1.2:1.
- ▶ Ensure radio is off when adjusting.

Contact Us

- ▶ If you have any questions or want to learn more, feel free to reach out!
- ▶ Workshop Team Emails:
`{elarbi.m, aviedov.v, heaney.ma}[at]northeastern[d0t]edu`
- ▶ General Workshop Email: [workshops\[at\]nuwireless\[d0t\]org](mailto:workshops@nuwireless.org)
- ▶ Website: <https://nuwireless.org/>
- ▶ Visit us at: Hayden Hall, Room 503

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Design: [Muhammad Elarbi](#), based on LaTeX Beamer

References

- ▶ Original design by Joe Leggio, WB2HOL (http://theleggios.net/wb2hol/projects/rdf/tape_bm.htm)
- ▶ Additional designs: KC0TKS (<http://www.kc0tk.org>) and NT1K (<http://nt1k.com>)
- ▶ This workshop presentation is based on the project tutorial by jcoman (<https://www.instructables.com/The-Tape-Measure-Antenna/>).
- ▶ All images used in this presentation are sourced from jcoman's tutorial on Instructables.