A Basic Introduction To Slot Antennas

A Presentation on slot antenna basics by Merton Kenniston, KC1KVA
to the Quabog Valley Amateur Radio Club Nov. 29, 2022

With thanks to:
John Portune, W6NBC and his article
"A Stealth Rooftop Antenna" QST Nov. 2022
and his YouTube presentations

Slot Antennas

- In late 1930's – Early 1940's TV and Radar started to open up significant VHF & UHF experimentation

- Waveguide was starting to be used for these frequencies

- Engineers found that a "SLOT" in a piece of waveguide could act as a UHF antenna

- Slot needed to be approx. ½ λ long

- Needed omnidirectional horizontal polarization - The SLOT antenna met this requirement

Slot Antenna

Slot is approximately ½ λ long
Vertical Size determines bandwidth
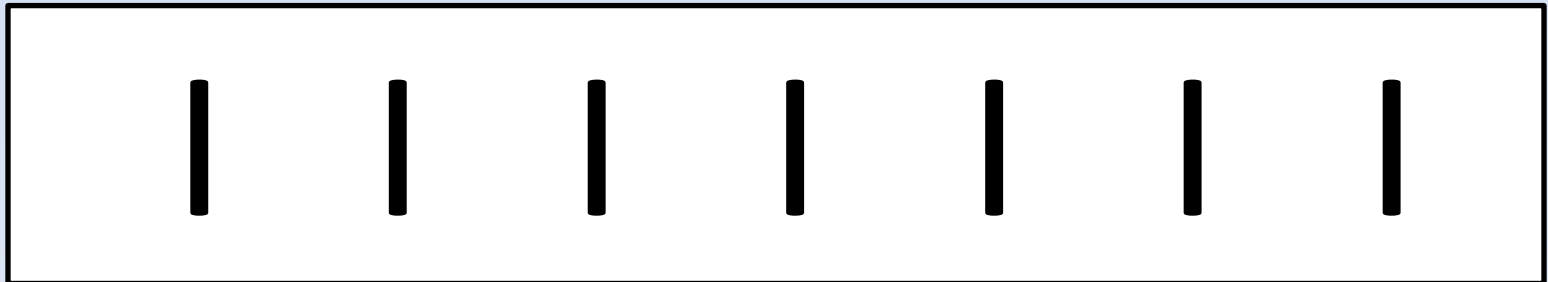
Simple Slot Antennas

Narrow Slot for Narrow Bandwidth

Wide Slot for Wide Bandwidth

The rotating radar antenna on a boat or ship is an example of a specialized use of a slot antenna
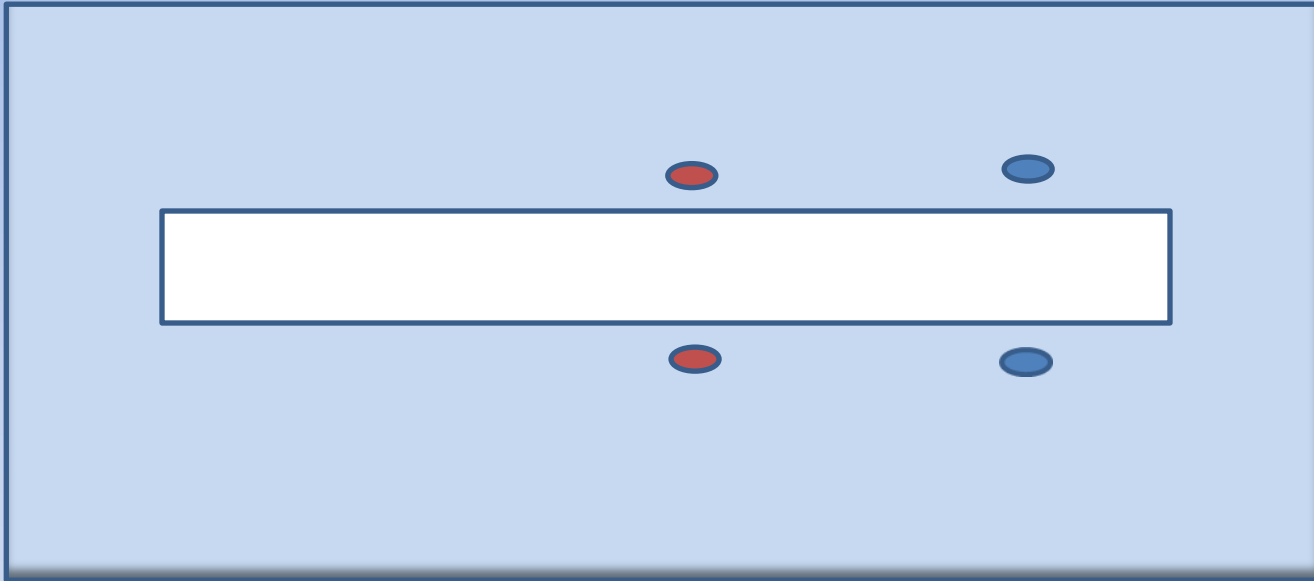
Rotating *Horizontal bar* with parallel *vertical slots* gives *horizontal polarization*

A slot antenna for 40 Meters would be longer than most houses.

Due to the antennas physical size, slot antennas are limited to the higher HF bands, VHF and UHF
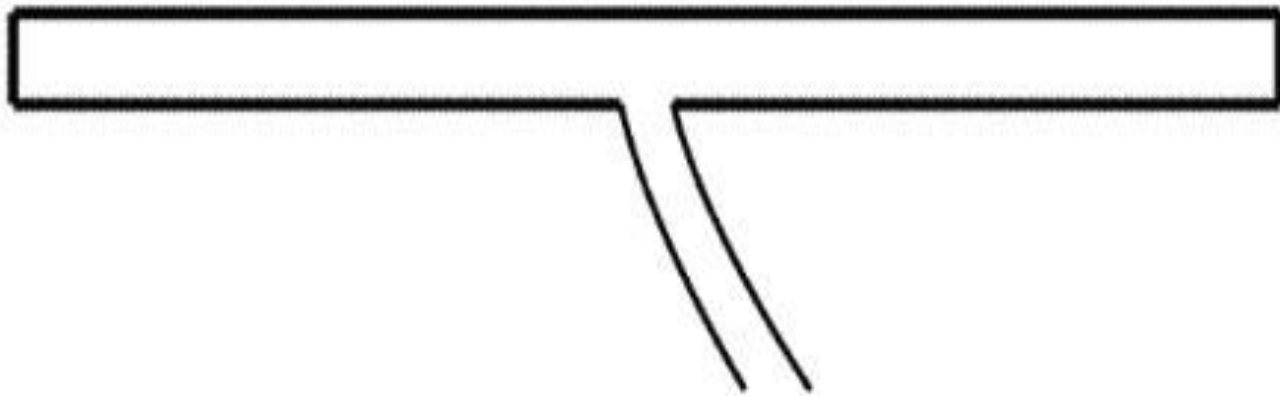
Impedance

Impedance varies by position.
Center (Red) is approx. 300 Ω
50 ohms (Blue) is approx. 1/7 to 1/10λ

Note Similarity to Folded Dipole

Folded Dipole Antenna

What is the approx. conductor length of a folded dipole?

Approximate **conductor length** of a folded dipole is ½ λ x 2 or 1 λ because it wraps around

What was the approx. total **perimeter length** of the slot in a slot antenna?

Perimeter length is slightly over one wavelength

What is the impedance of a folded dipole at resonance?

Impedance of a folded dipole at resonance is about 300Ω

What was the center fed impedance of the slot antenna?

300 Ω

Interesting – Approx. same Impedance and perimeter length.

But what about that sheet of metal the slot was cut into?

The physical size of the material the slot is cut into has little significance.

The current flow in the slot antenna can be compared to AC current skin effect with nearly all of the current flow occurring on the perimeter of the slot

Since skin effect increases with frequency, helping to make the slot antenna uniquely suited to VHF and UHF frequencies and works best on UHF and higher frequencies, causing current flow to occur near the edge of the slot

The Hentenna

- Hentenna – design from 1970's from Japan

- Hen means "strange" in Japanese

- Incorrectly called 1 1/3 λ Loop – actually a "slot"

- 2.5 to 3 dBd gain (equivalent to 2 - 3 element Yagi)

- Frequency and SWR can be adjusted precisely

- **Polarization is perpendicular to mounting orientation**

½ Inch Copper 2 Meter Hentenna

Length: 40.43 Inches, Height: 13.47 Inches, Feedpoint (approx.) 8.08 Inches
½ λ   1/6λ   1/10λ

Variations on Slot Antenna

- Serpentine variations allow slot density at a small cost to polarization

- Antennas can be printed on PC boards

- Several new views on antenna theory lean toward the belief that a few old designs should be considered to be slot antenna variations.

  Folded Dipole
  Loop
  Hentenna

Build Your Own Stealth Slot Antenna

- QST – November 2022 Issue – A Stealth Rooftop Antenna

- Antenna is a Serpentine Rolled Slot Antenna

- Stealth Dimension: 3 Inch tube 12 inches high
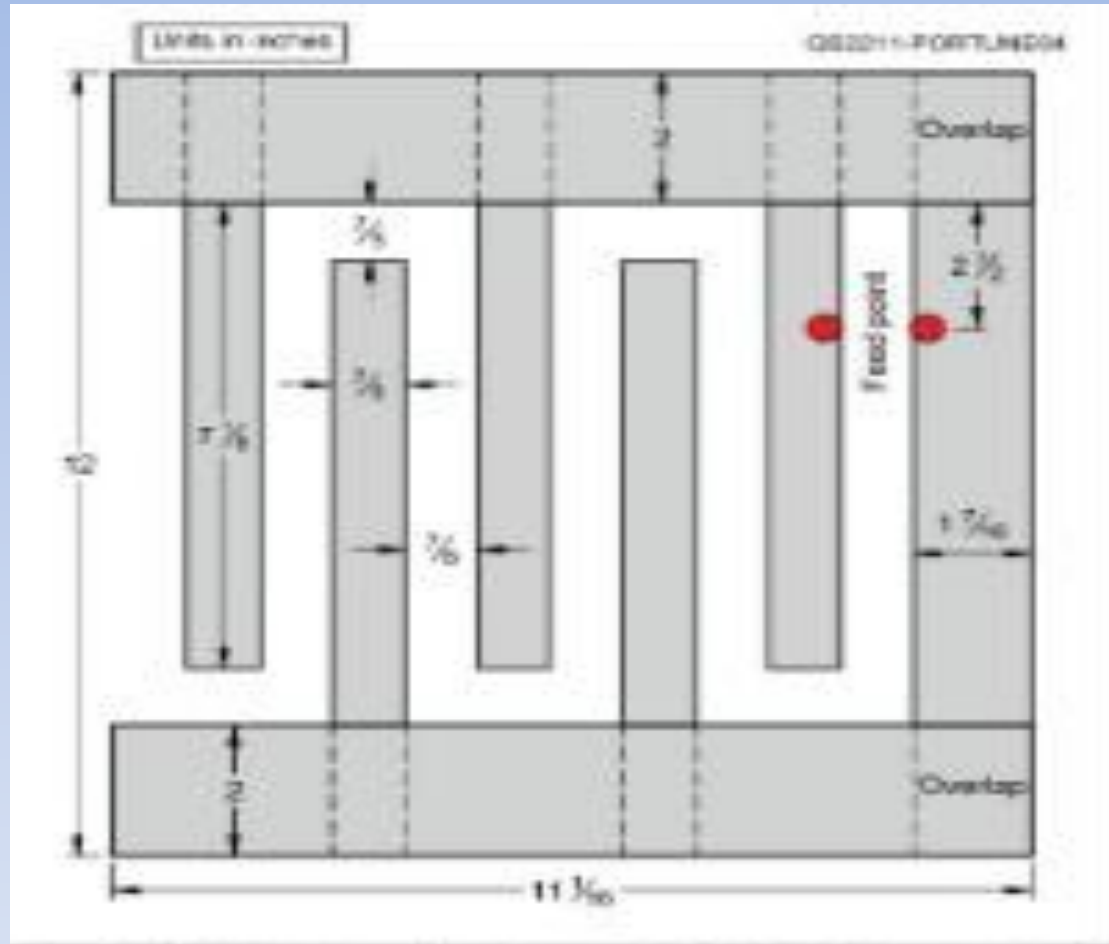
Slot Antenna Layout

Figure 4 — A flat view of the dimensions for a 3-inch version of the stealth rooftop antenna.

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A Stealth Rooftop Antenna – QST Nov 2022

A Completed Stealth Slot Antenna

▲ Figure 1 — My homebrew J pole next to the vent pipe rooftop antenna.

► Figure 2 — This stealth rooftop antenna is made using PVC pipe and heavy-duty 2-inch-wide foil tape, with two, ¼-inch holes drilled near the edge of the staggered slots for attaching a coax pigtail from the inside of the pipe. Note the highlighted shorting tapes.

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On Roof Next to a 2 Meter J-Pole

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My First Prototype Slot Stealth

Imp. 49.995 Ω
BW@ 1.5 SWR ~3mHz

SWR <1.091
Freq. 167.733MHZ