“A novel, low noise, receiving, antenna system that is adaptable to your available space”

The BevFlex-4X System

Presented to The Northern Kentucky Amateur Radio Club

by:

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What are the Low Bands? Why operate there?

- Low bands are 160, 80, 60, & 40 Meters (Some include 30M)
  - Generally the bands that provide long distance propagation at night
- As sunspot cycle continues at the minimum
  - High bands won’t open or will close early
  - Low band propagation improves
Low Band Challenges

- Wavelengths are large, thus antennas are large
  - Can be hard to fit in small city lots
  - Good news: verticals very effective for TX on low bands

- High levels of QRM & QRN
  - Static caused by thunderstorms, often hundreds or thousands of miles away
  - Short skip distances – you can hear every station on the band
  - If you can’t hear DX – you can’t work DX
QRN & QRM characteristics

- Above about 18 MHz receiver internal noise dominates
- Below about 18 MHz atmospheric noise is the main source
  - Great receiver sensitivity not needed
- QRN & QRM often come from a different direction than the desired signal
  - Opportunity to reject other directions, reducing overall noise
Noise vs. Signal Strength

- It's not how loud the signal is, it is how loud it is compared to the noise (S/N)
- Low band signals are often strong, but the noise is stronger
  - Antenna directivity can reduce noise
  - Low band RX antennas often have negative gain, but reduce noise more than the signal = better (S/N)
  - Some might need a pre-amp
Main types of Low Band RX antennas

- Traveling wave wire types – Beverage and BOG
- Loop types – EWE, VE3DO, FLAG
- All of above are uni-directional
- Shielded Magnetic Loop is bi-directional
  (not covered in this talk)
Beverage Antennas

- Developed by Harold Beverage around 1920 at GE
- Long wire towards direction of interest with terminating resistor at far end
- Receives low angle of incidence, DX signals well
- Best if several wavelengths long
- Large if above ground, but smaller close to ground
Beverage antennas are known as traveling wave type antennas.
Basic Beverage Predicted Patterns for 160m and 80m

160M + 500FT

3 dB Beam-width: 86.2°
Front to Back Ratio: 15.0 dB
Elevation Angle 30.0 deg.
Outer Ring -11.3 dB ref.
NEC-4 EZNEC Pro/4

80M – 500FT

3 dB Beam-width: 59.6°
Front to Back Ratio: 20.6 dB
Elevation Angle 29.0 deg.
Outer Ring -4.4 dB ref.
NEC-4 EZNEC Pro/4
Beverage Antenna Characteristics

- Longer is better, but at some point, extra length does not help.
- 500’-1200’ is considered a good length (300’ still works)
- Try to keep it straight and constant height above ground. 7’ is common (above people, deer, etc.)
- Keep away from other metal objects, transmit antennas, etc.
- Provide RX input protection if close to the transmit antenna
- Do what you can for rules above, but don’t let perfection deter you from building one
# Basic Beverage Performance versus Length and Band

<table>
<thead>
<tr>
<th>Antenna Length</th>
<th>Overall Performance Vs. Band</th>
<th>160m</th>
<th>80m</th>
<th>40m</th>
<th>30m</th>
<th>20m</th>
<th>15m</th>
<th>160m</th>
<th>80m</th>
<th>40m</th>
<th>30m</th>
<th>20m</th>
<th>15m</th>
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</thead>
<tbody>
<tr>
<td>100 Ft.</td>
<td></td>
<td>P</td>
<td>F</td>
<td>G</td>
<td>G</td>
<td>E</td>
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<td>P</td>
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<td>150 Ft.</td>
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<td>250 Ft.</td>
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<td>350 Ft.</td>
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<td>450 Ft.</td>
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<td>750 Ft.</td>
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<td>950 Ft.</td>
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</tr>
</tbody>
</table>

E=Excellent, G=Good, F=Fair, P=Poor, NIL=Insignificant
Beverage On Ground (BOG) or Beverage In Sod (BIS)

- Can be Shorter because of lower velocity of propagation on ground
- Velocity factor is 0.5 to 0.6 of Beverage in air
- Electrical length is ~ 2x longer than physical length
- Short BOG can perform very well
- Puts low noise antenna into smaller lot
- 100’- 240’ are popular lengths
- 225’ laid just above surface of the ground is optimal
Beverage On Ground (BOG) or (BIS)

- Does not require supports and not as visible
- Better if it can be a few inches above ground (in sod)
- Mount on low structure to prevent trip hazard
- Signal levels lower than above ground Beverage antenna
- Antenna gain is lower (-25dB vs. -15dB)
- May require a pre-amplifier above 80m frequencies
- Lower impedance than Beverage (~180Ω vs. 470Ω)
175 ft BOG Predicted Pattern 160m

3 dB Beam-width: 98.6°
Front to Back Ratio: 15.1 dB
Elevation Angle 35.0 deg.
Outer Ring -21.6 dB ref.
NEC-4 EZNEC Pro/4
<table>
<thead>
<tr>
<th>Antenna Length</th>
<th>Overall Performance Vs. Band</th>
<th>Relative Directivity</th>
</tr>
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<tr>
<td></td>
<td>160m</td>
<td>80m</td>
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<tr>
<td>100 Ft.</td>
<td>F</td>
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<tr>
<td>150 Ft.</td>
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<tr>
<td>200 Ft.</td>
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<td>250 Ft.</td>
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<td>300 Ft.</td>
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</tbody>
</table>
Low Band, Unshielded, Loop Antennas

- A number of types and configurations
- All are uni-directional (lower noise pickup)
  - EWE
  - VE3DO
  - Flag
  - Pennant
- All of these antennas take up less space than a 40m dipole and can be low to the ground – “backyard friendly”
EWE and VE3DO Antennas

EWE and VE3DO are mounted near the ground.
Predicted EWE Pattern

3 dB Beam-width: 149.2°
Front to Back Ratio: 23.9 dB
Elevation Angle 32.0 deg.
Outer Ring -24.3 dB ref.
NEC-4 EZNEC Pro/4
Flag and Pennant antennas are typically raised 8’ off the ground.
FLAG Antenna Predicted Pattern (160m)

3 dB Beam-width: 150.8°
Front to Back Ratio: 33.2 dB
Elevation Angle 31.0 deg.
Outer Ring -29.7 dB ref.
NEC-4 EZNEC Pro/4

(34 ft x 16 ft @ 10 Ft height)
Introducing the BevFlex-4X System

The most versatile low band / low noise receive antenna system ever!
What is different about this Beverage antenna system?

- All RG-6 coax construction — antenna and feedlines
- All passive — no relays, remote switches or DC on feedline
- Termination resistors located inside the shack
- Feed point can be anywhere along the length of the antenna & the whole length is always used
- Instant switching to reverse directions
The BevFlex System History

Developed by:
Geoff Mendenhall, W8GNM
  • Long career in broadcast industry
  • Several industry awards
  • Nine patents
  • IEEE Life Member
Partner Ned Mountain, WC4X
  • Deeply involved with testing from beginning.

• Original development in 2009
• Released as BevPro-1 in 2013
• BevFlex-4 version released in 2016
• Production/Sales moved to Unified Microsystems May 2019
• Redesigned by W9XT summer 2019
  • Improve ruggedness and weather resistance
  • Improve manufacturability
• BevFlex-4X introduced August 2019
BevFlex-4 Supported Antennas

- Beverage
- BOG / BIS
- EWE
- VE3DO
- Flag

All configurations can instantly be switched between Forward and Reverse directions
Classic Beverage vs. BevFlex-4X
BevFlex-4X has Moveable Feed-point

- The outer surface of the RG-6 coax shield is the antenna wire
- The RG-6 inner surface and the center conductor is a transmission line
- The feed-point unit couples the signals and terminations from both ends to the feedlines back to the shack
- Does not disturb the impedance along the antenna
- Can be placed anywhere along the entire length of the antenna
- The full length of the antenna is always used
- Provides transformer isolation between the antenna and feedlines
- Big advantage for location of feedlines from antenna to shack
BevFlex-4X System Components

- Terminator (two per system)
  - Replaces resistor terminators
  - Enables directional operation
- Feed Box
  - Splits out signals from forward and reverse directions (moveable)
- Switch box
  - Terminates unused direction
  - Selects desired direction
**BevFlex-4X System**

**BevFlex-4X Block Diagram - Beverage Configuration**

- **Terminator Unit**: Terminal 1 to GND
  - RG-6 Coax (REV END)
  - Ground Rod

- **Feed Unit**: Ant Rev, Ant Fwd
  - A OUT, B OUT
  - RG-6 Coax

- **Feed unit may be placed at any point between terminators**

- **Terminator Unit**: Terminal 1 to GND
  - FWD END
  - Ground Rod

- **RG-6 feed lines to shack**
  - Any length, do not need to be the same length

- **Ham Shack**: Forward, Reverse

- **Direction refers to direction of main receive lobe.**

**Typical Beverage length**: 200 ft to 1000 ft, elevated 7-10'

**Control Unit**: Coax

**Receiver**: RX

**Ant Fwd, Ant Rev**

**FWD IN, REV IN, REV END**
THE BEVFLEX - 4X CAN BE USED FOR LOOP TYPE ANTENNAS

EWE * VE3DO * FLAG

- Loop type receive antennas
- Take less space than Beverages – Fits into small lot
- Use the same basic components as Beverages
- Work on different principles
BevFlex-4X System

BevFlex-4X Block Diagram - EWE Configuration

- #12 Antenna Wire, 30 ft to 40 ft typical length
  Top wire elevated at 10'

- Directions indicate direction of main receive lobe.

- RG-6 feed lines to shack
  Any length, do not need to be the same length

Note: Feed line connections are reversed for EWE, Flag, and VE3DO configurations.
BevFlex-4X System

BevFlex-4X Block Diagram - VE3DO Configuration

Horizontal length: 20’-40’
40’ optimized for 160M, 20’ optimized for 80M

#12 Antenna wire

Lower side ground height: 12”-24”
12” optimized for 80M, 18”-24” optimized for 160M

Terminator Unit

Feed Unit

Ant Rev Ant Fwd
A OUT B OUT

FWD END

Terminator Unit

RG-6 feed lines to shack
Any length, do not need to be the same length
Note: Feed line connections are reversed for EWE, Flag and VE3DO configurations.

Ground Rod

Terminals placed near Feed Unit

Ham Shack

Coax

Receiver

Control Unit

Directions
Forward
Reverse
Directions indicate direction of the main receive lobe.

Terminals 1 and 2

Note: Feed line connections are reversed for EWE, Flag and VE3DO configurations.
**BevFlex-4X System**

**BevFlex-4X Block Diagram - Flag Configuration**

- **34’ Typical flag horizontal length**
- **8’ Typical #12 Antenna wire**
- **8’ Typical #12 Antenna wire Lower wire 10’ above ground**

**Directions**
- Forward
- Reverse

**Notes:**
- Feed lines are reversed for Flag, EWE, and VESDO configurations.
- Any length, do not need to be the same length.
- RG-6 feed lines to shack.
BevFlex-4X Antenna Configurations

- Classic elevated Beverage
- Beverage on Ground (BOG) or (BIS)
- EWE
- VE3DO
- Flag

All versions are switchable in forward and reverse directions
Conclusion

- Low band RX antennas really help you hear weak stations
- There are many designs you can chose from
- "If you can’t hear them – you can’t work them"

This and other presentations are available at http://w9xt.com/
BevFlex-4X System Availability

- Unified Microsystems  [www.unifiedmicro.com](http://www.unifiedmicro.com)
- DX Engineering  [https://www.dxengineering.com/](https://www.dxengineering.com/)
- Ham Radio Outlet  [https://www.hamradio.com/](https://www.hamradio.com/)
Questions and Answers

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