

# Advanced Beverage Antenna Designs

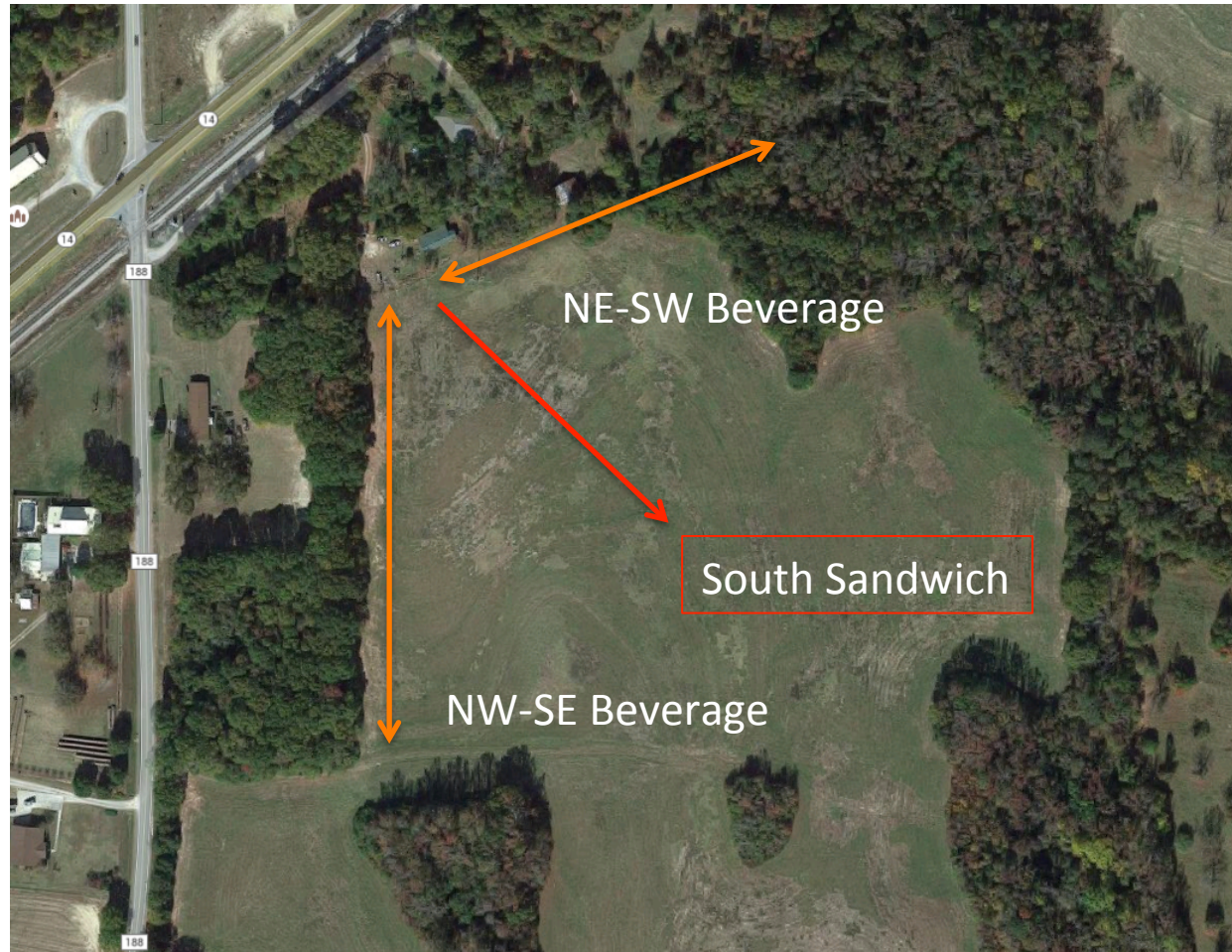
Dick Jaeger, K4IQJ

Bob Schafer, KA4PKB

John Rowell

# W4HOD Beverage Locations

Backup Antenna Desired for VP8STI



Transactions of the AIEE, pp.  
215-265, February 1923.

50 pages!

# The Wave Antenna

## A New Type of Highly Directive Antenna

BY HAROLD H. BEVERAGE, CHESTER W. RICE, and EDWARD W. KELLOGG  
of the Radio Corporation of America      Assoc. A. I. E. E.      Assoc. A. I. E. E.  
of the General Electric Co.      of the General Electric Co.



FIG. 1

The capabilities of the wave antenna were discovered through work done by Beverage in studying the properties of long ground antennas, of the order of a half wave length or more long, in which he discovered that under certain circumstances they showed marked unidirectional properties. One of his antennas consisted of a No. 14 B & S rubber covered wire approximately six miles long laid on the scrub oak and sand of Long Island from Eastport to a point near Riverhead. This northeasterly direction was chosen in order to best receive the European stations. The antenna is pictured diagrammatically in Figure 1.

Actually a BOG!

# Borrowed from Wikipedia

## “Beverage Antenna”

- The **Beverage antenna** is a long wire receiving antenna mainly used in the high frequency (shortwave) and medium frequency radio bands. It is used by amateur radio, shortwave listening, longwave radio DXers and in military applications.
- The antenna was patented in 1921 and named for its inventor Harold H. Beverage.
- Beverage experimented with receiving antennas similar to the Beverage antenna in 1919 at the Otter Cliffs Radio Station.
- By 1921, Beverage long wave receiving antennas up to nine miles (14 km) long had been installed at RCA's Riverhead, New York, Belfast, Maine, Belmar, New Jersey, and Chatham, Massachusetts, receiver stations.
- Perhaps the largest Beverage antenna—an array of four phased Beverages three miles (5 km) long and two miles (3 km) wide—was built by AT&T in Houlton, Maine, for the first transatlantic telephone system opened in 1927.



## Figures borrowed from: ON4UN's Low-Band DXing Book

- Desired Signal Appears at Antenna Feed Point
  - Unwanted Signal Dumped into Terminating Resistor
- Vertically Polarized Signals  
With Wave Fronts Tilted

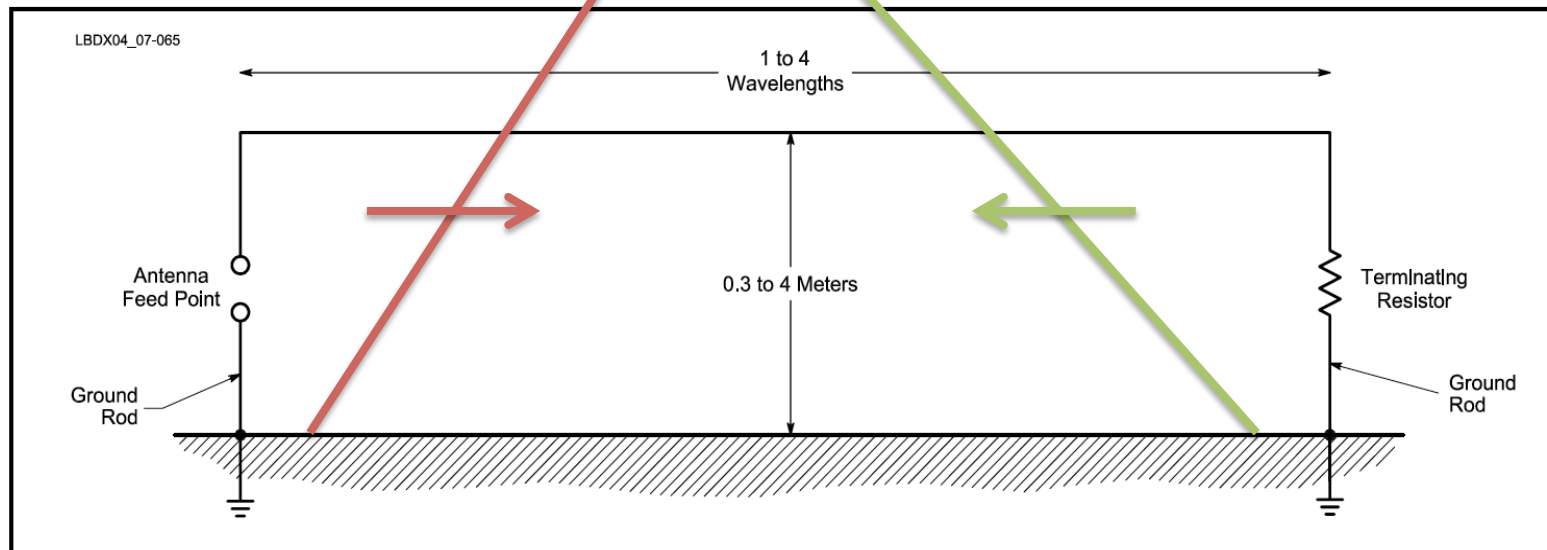
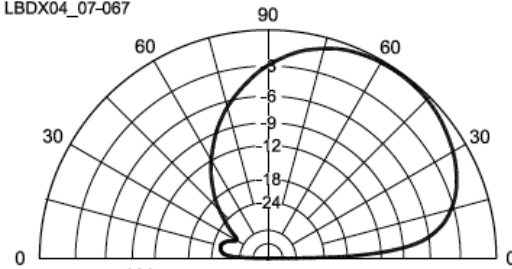


Fig 7-72 — The Beverage antenna is a straight wire, typically 1 to 4  $\lambda$  long, mounted parallel to the ground at a height of 0.01 to 0.03  $\lambda$ .

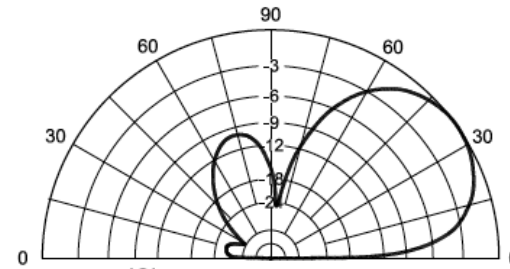
- Lossy Ground  $\rightarrow$  Electric Field Tilts
- No Tilt = No Output ( $E \cdot dL$ )
- Doesn't work well over high conductivity ground  
(as discovered by many DXpeditions to remote islands)

# Pattern vs Length

LBDX04\_07-067

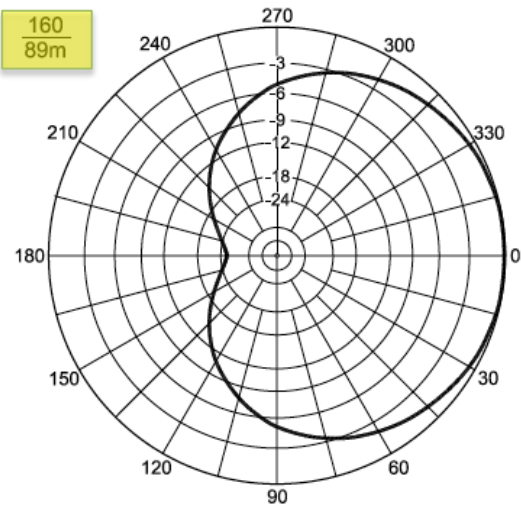


(A) Max. Gain = -13.88 dBi



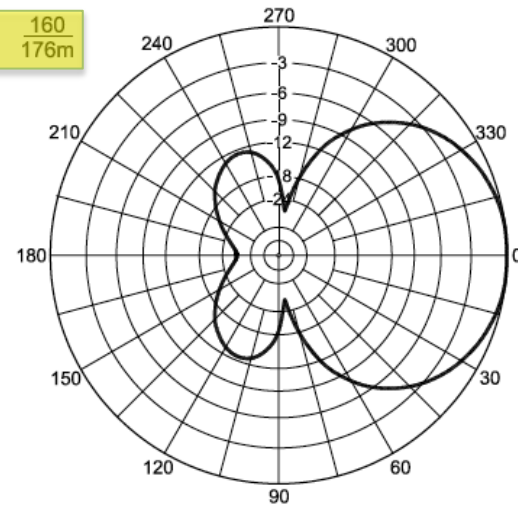
(C) Max. Gain = -9.87 dBi

$\frac{160}{89m}$



(B) Max. Gain = -14.35 dBi

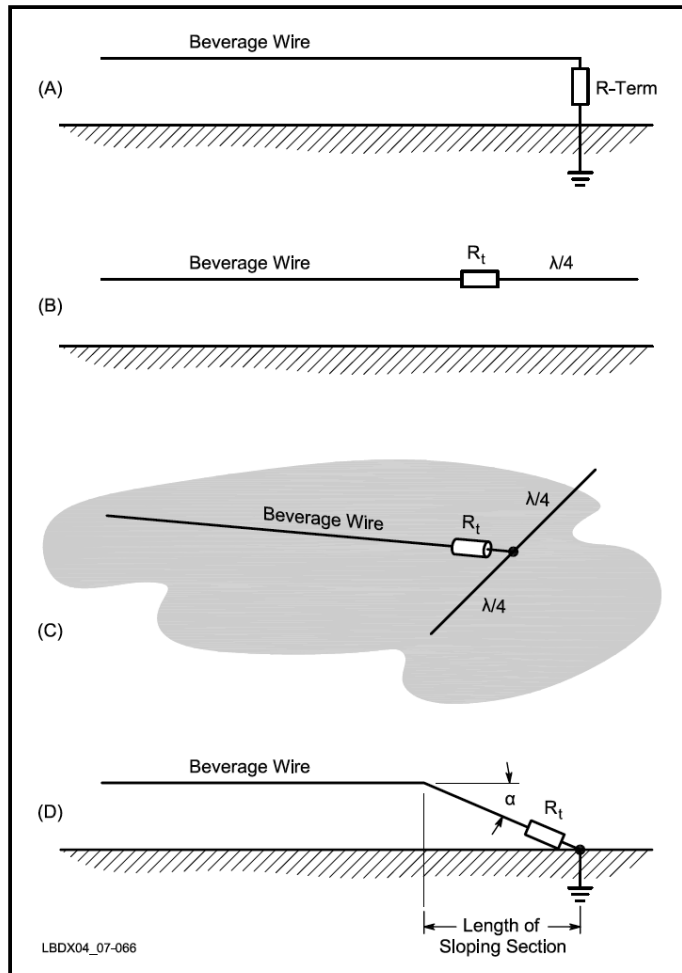
$\frac{160}{176m}$



(D) Max. Gain = -9.87 dBi

Similar to a single loop

# Beverage Termination Techniques



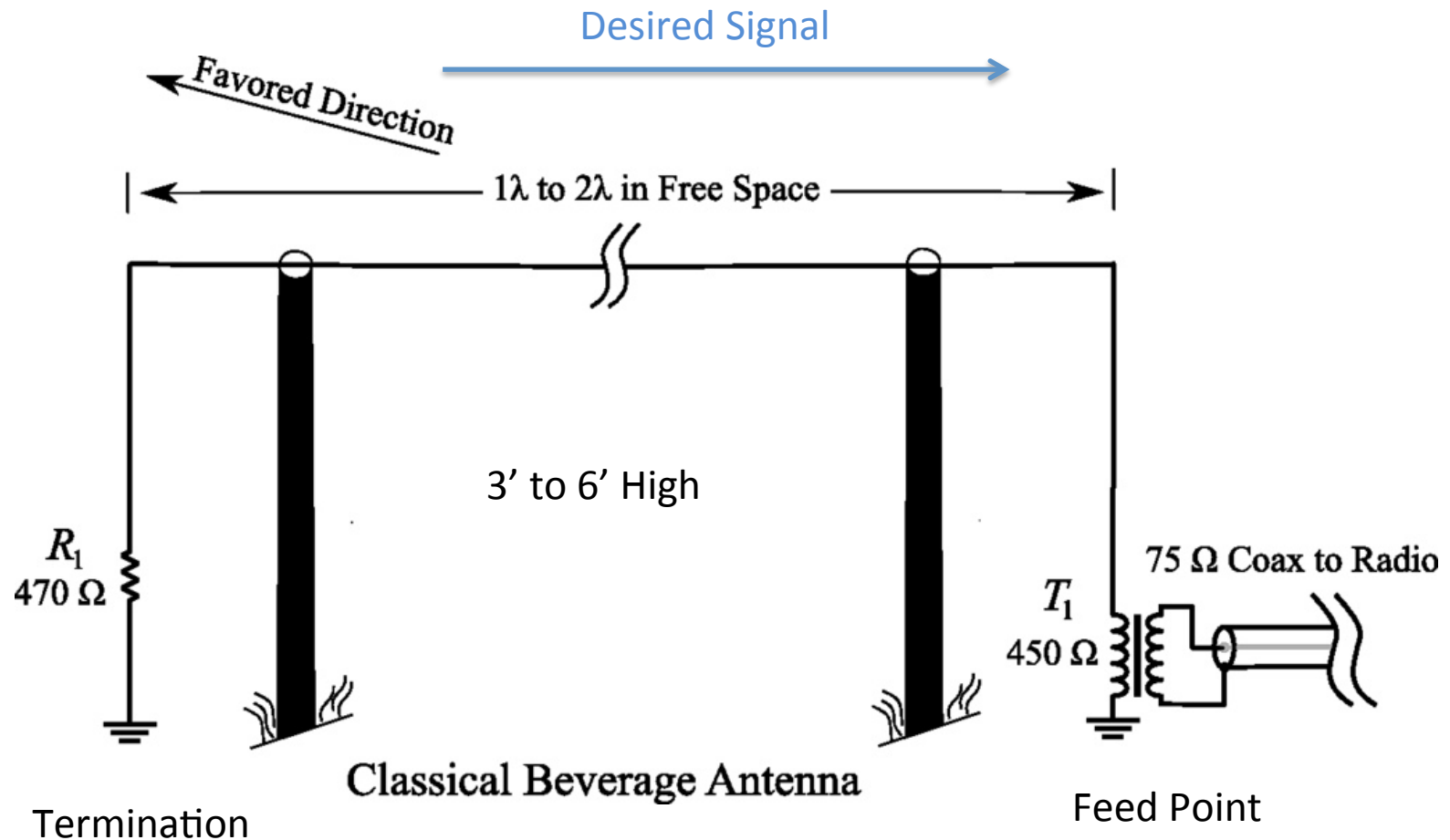
- Basic Termination ( $\approx 470 \Omega$ )
- (B-C) Good for poor ground and for simulation (EZNEC) – terminated by  $\lambda/4$  lines
- (D) Preferred to reduce vertical pickup from vertical end

<http://kw2p.blogspot.com>

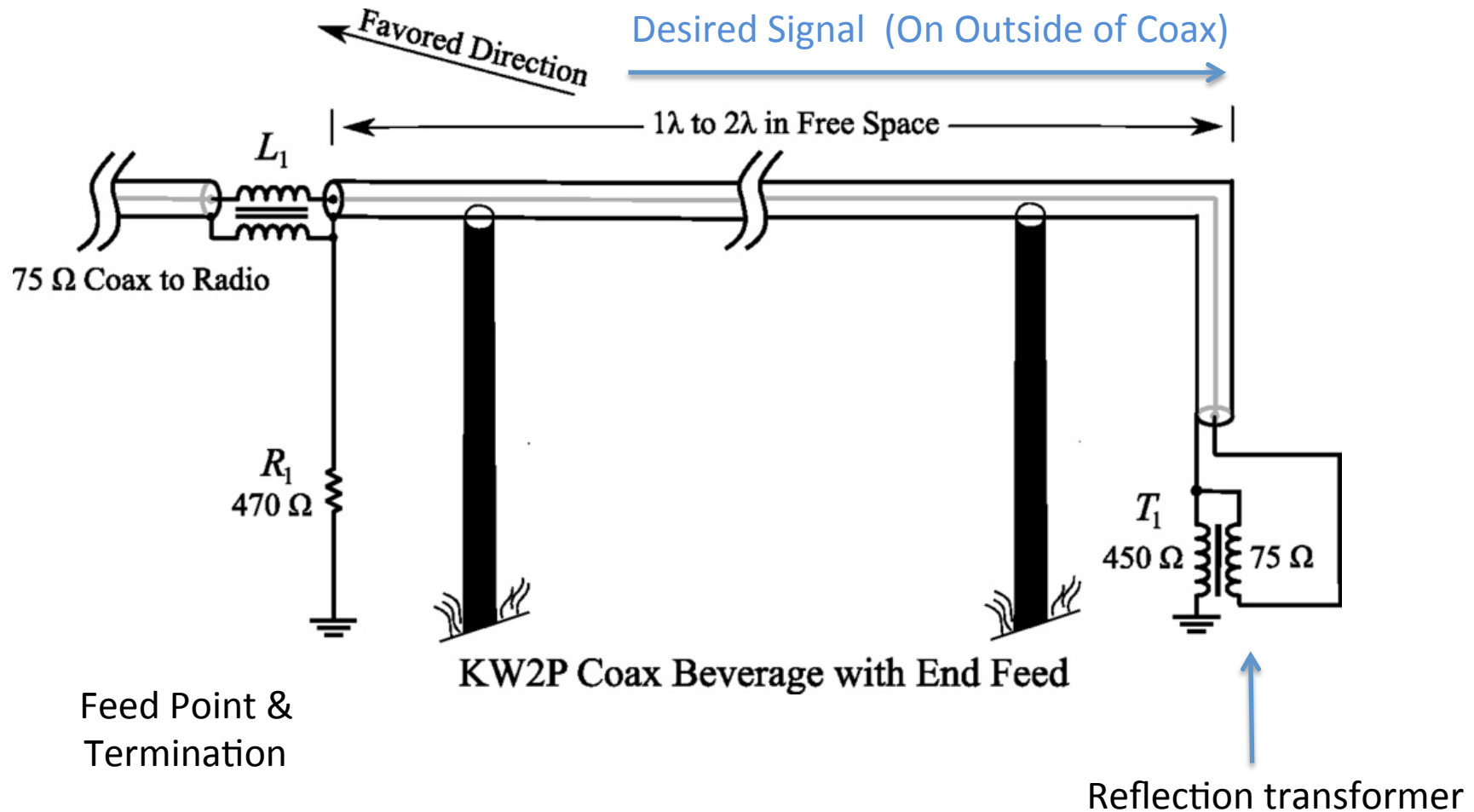
Wednesday, August 18, 2010

**KW2P Beverage Antenna Designs**

Signal Output Increases with Height



# End Fed Coax Beverage



[KW2P Beverage Antenna Designs](#)



# Tests of Dipole on the Ground

- 80M Dipole Cut to 3.525 MHz
- Measured Resonance: 2.1 MHz
- Resonant Frequency 60% of Expected Value
- $1/4 \lambda$  radial for 160M: 77 Ft.
- BOG terminated with Two 77 Foot Radials.

# Luis, IV3PRK (HC1PF)

## Modeling Results



- <http://www.iv3prk.it/p1.htm>  
<http://www.iv3prk.it/new-page.htm>  
<http://www.iv3prk.it/hc1pf-bog-2.htm>  
<http://www.iv3prk.it/bog-modeling.htm>

# IV3PRK Modeling Results

## Quotes from Experienced Users

KD9SV wrote:

..... the three "Beta Testers" for my RBOG all used 180ft of WD-1A and Carl, K9LA will be doing a write-up in NCJ magazine sept/oct timeframe about his results. I'm not sure that anybody knows the correct formula for BOG antennas length and it would be different at every location...

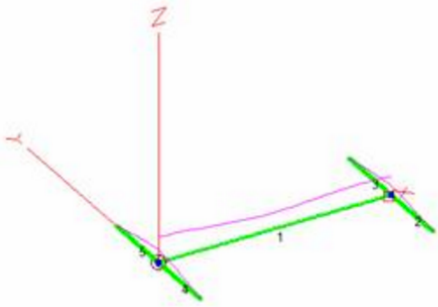
and K1FZ said:

I have sold many BOG antenna transformers and most customers find that 200 feet is best. But on sand, desert and other insulating earth the length can be much longer

**The BOG is a tuned antenna, not like an above ground Beverage.**

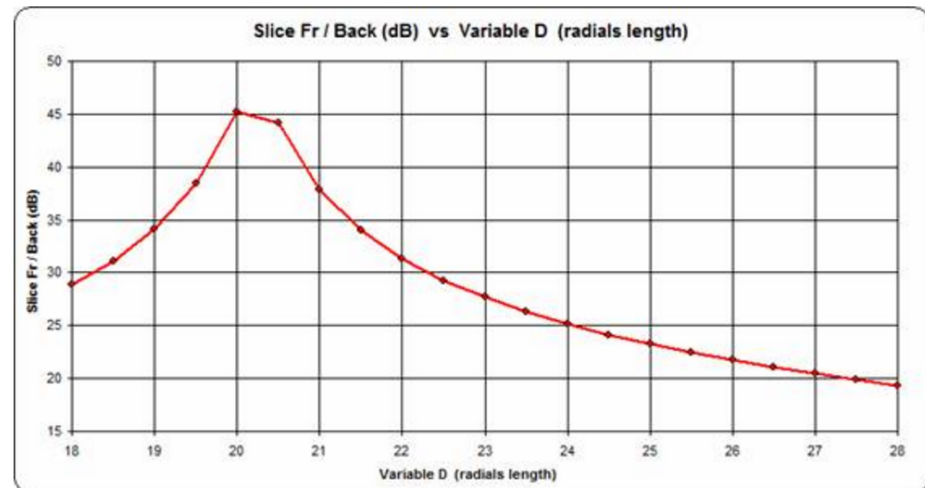
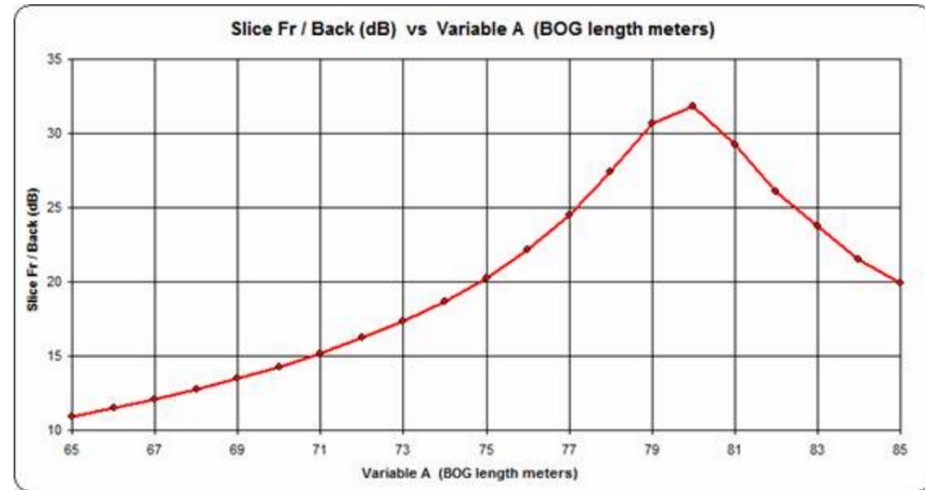
# IV3PRK EZNEC Modeling Results

## F/B vs. Beverage & Radial Lengths



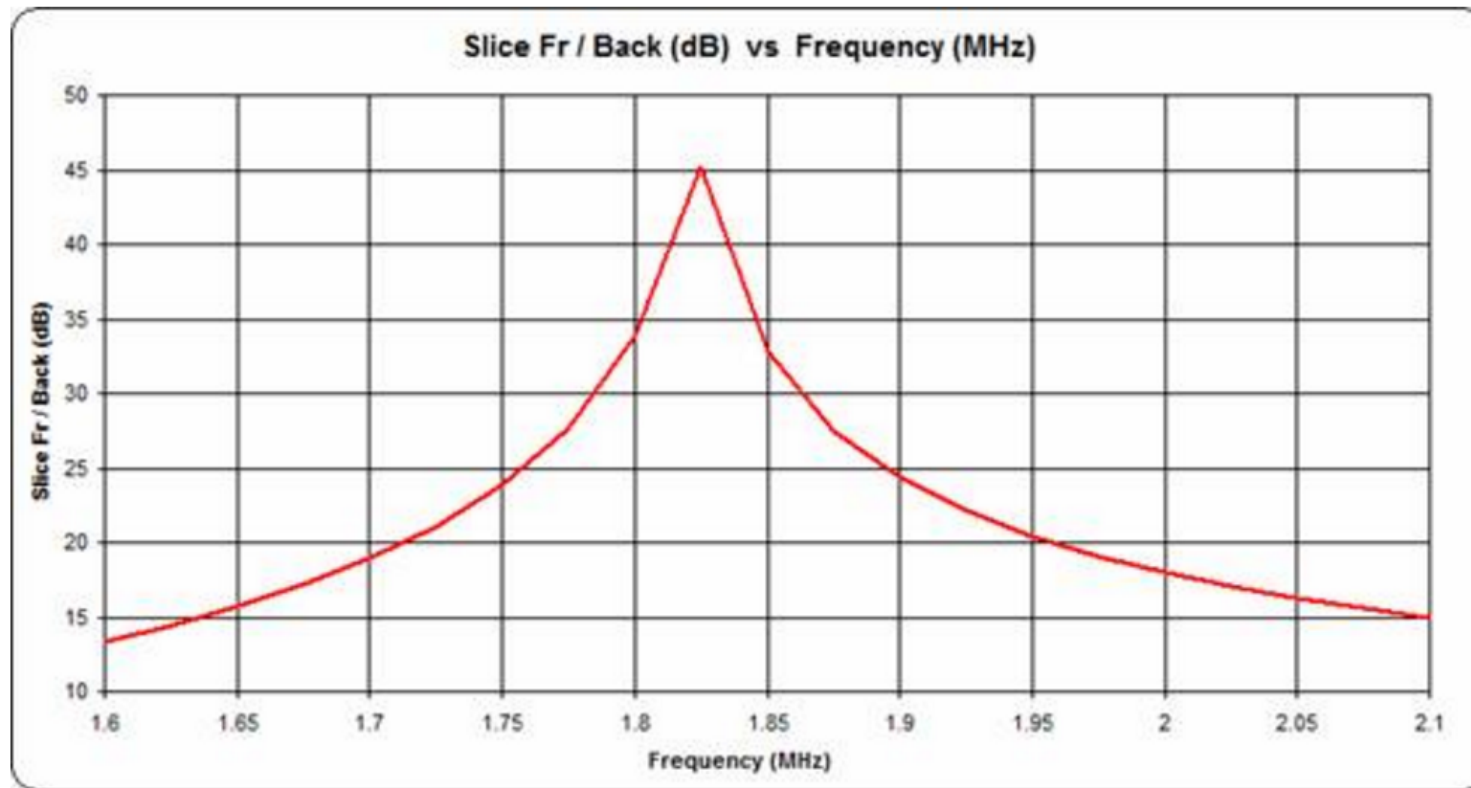
Model for Reversible BOG

Clearly Exhibits Resonant Behavior



# IV3PRK EZNEC Modeling Results

## F/B vs. Frequency

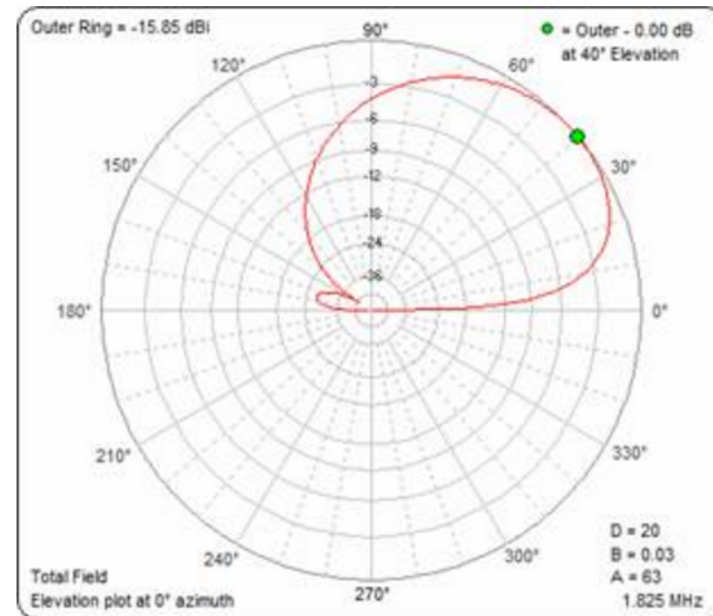
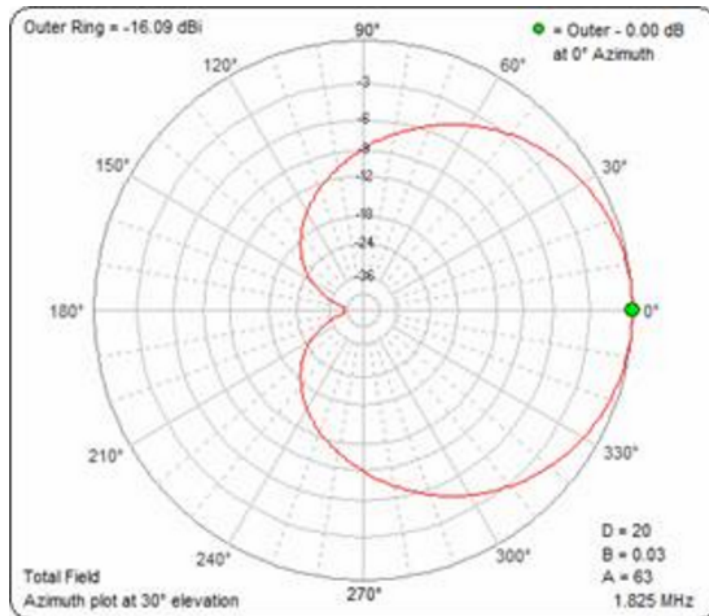


**It confirms that the BOG is a sharp resonating antenna which has nothing to do with the classic Beverage and the other broadband receiving loops**

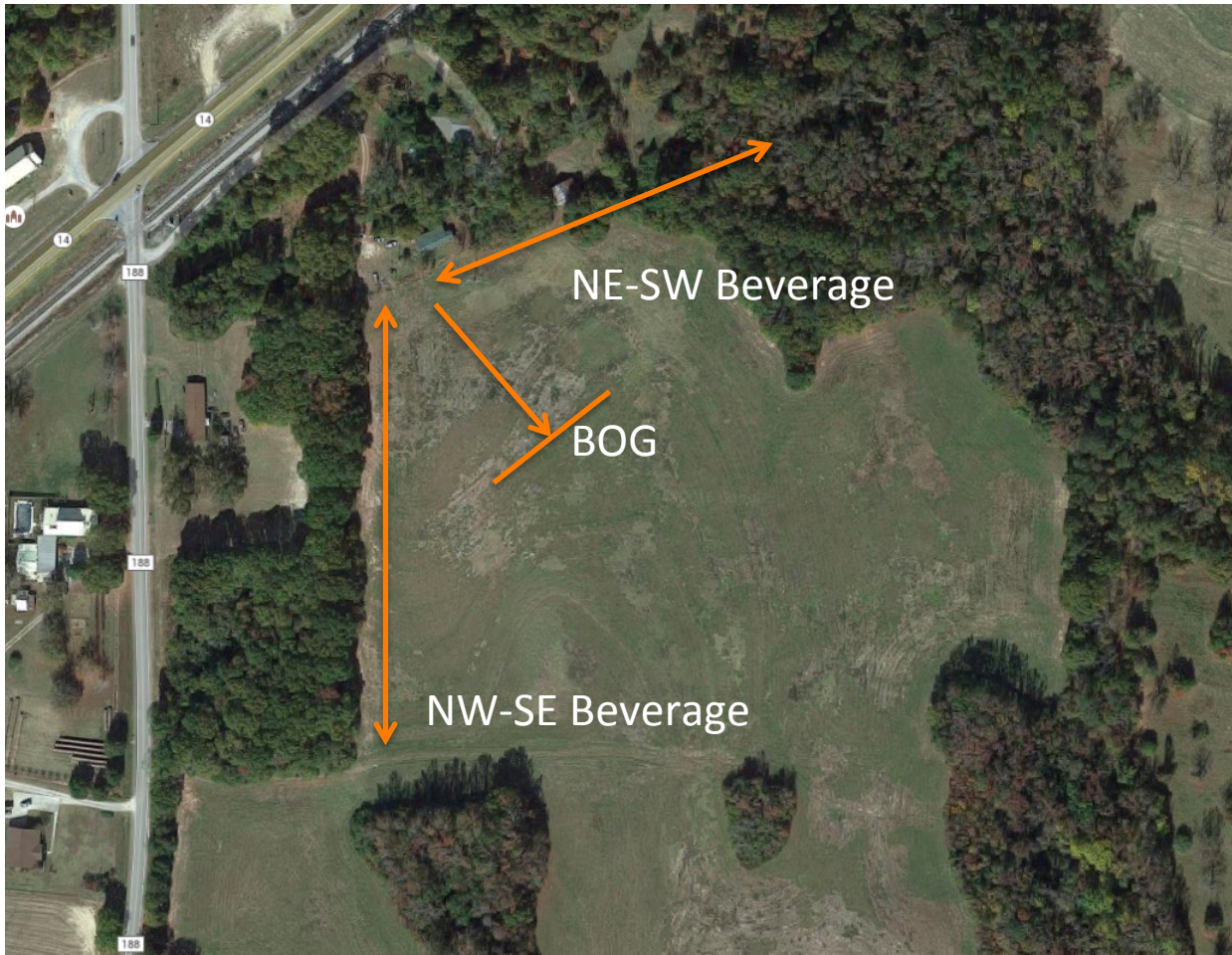


# IV3PRK EZNEC Modeling Results

## Final BOG Pattern



# W4HOD Beverage Locations



## Beverages

NE-SW & NW-SE  
575 Ft. Long  
6 Ft. High  
Reversible

## BOG

SSE  
180-200 Ft. long

# W4HOD Coax BOG

## Design Details

- Approximately 180 Ft. Long
- Terminated in 270 Ohms to Ground Stake +  
Two 70 Ft. Radials
- 9:1 Transformer
  - (Just what I had laying around)
  - 30 Ohms → 1.7:1 SWR
  - Doesn't matter so much on receive
- Pointed at VP8STI



# W4HOD Coax BOG Implementation

Feedpoint  
K9AY Loop Transformer



BOG Termination  
270 Ohms + 2 Radials



# W4HOD Coax BOG

## Results

- Could Not Hear VP8STI on My Inverted-L TX
- Could Not Hear VP8STI on My 3-Element K9AY Loop Arrays
- Could Not Hear VP8STI on the W4HOD NE-SW Beverage
- Could Not Hear VP8STI on the W4HOD NW-SE Beverage
  
- Could Only Hear VP8STI on the W4HOD BOG !!!
  - and reasonably good copy – I couldn't believe it!
  
- VP8STI in the Log for #264 on 160 M and #311 on 80 M !

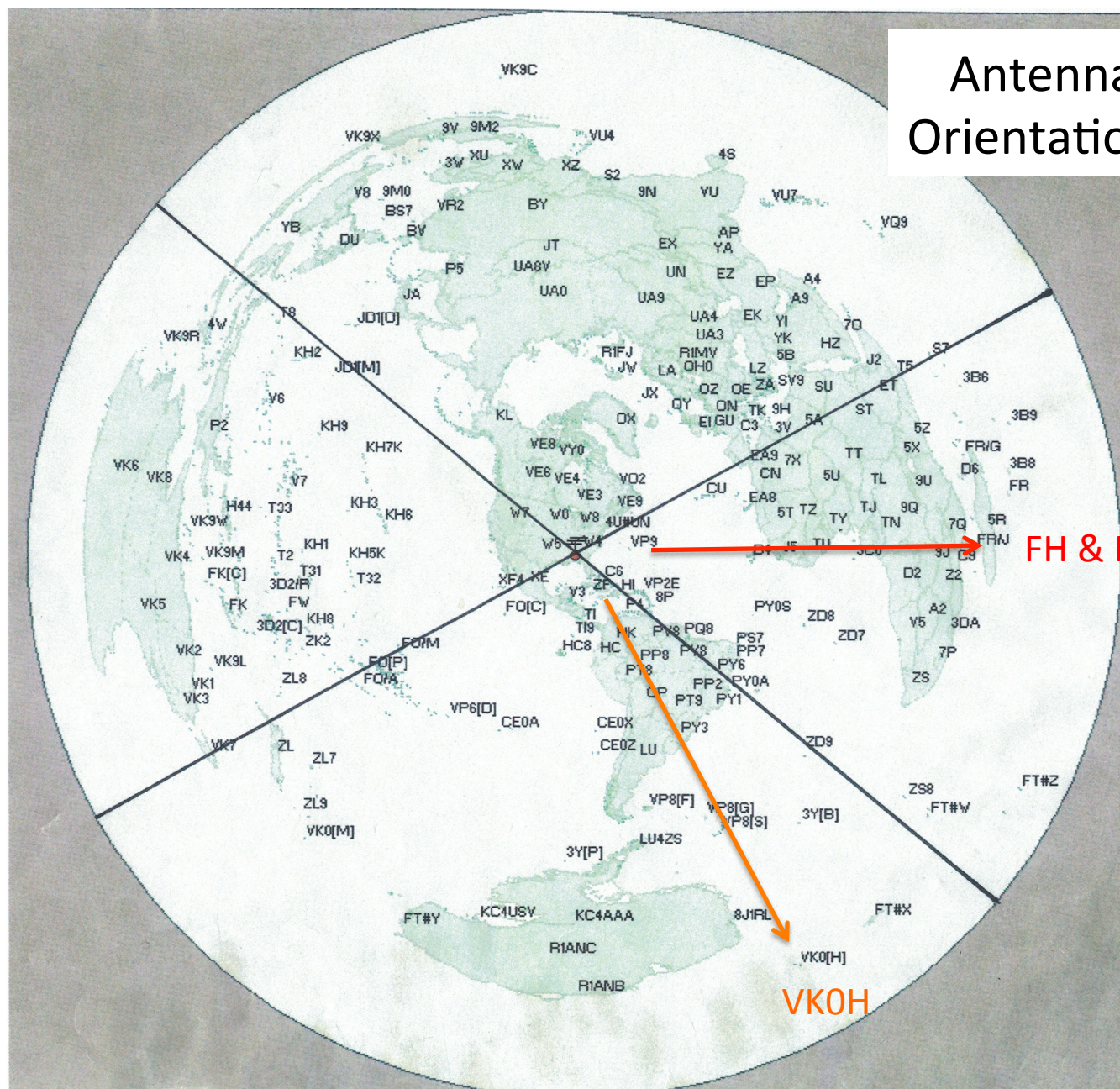


# W4HOD Coax BOG

## Upcoming Dxpeditions – Tough Ones!

- VK0EK - Heard Island – 150°
  - 160/80/15/12/10/RTTY
  - 60 min of Common Darkness Around Our Sunset
- FH – Mayotte – Operators on Way to FR/J – 78°
  - 160
  - 3 hrs 15 min of Common Darkness
- FT4JA – FR/J - Juan de Nova (& Europa) – 85°
  - 160/80/12
  - 3 hrs 20 min Common Darkness

# Antenna Orientations

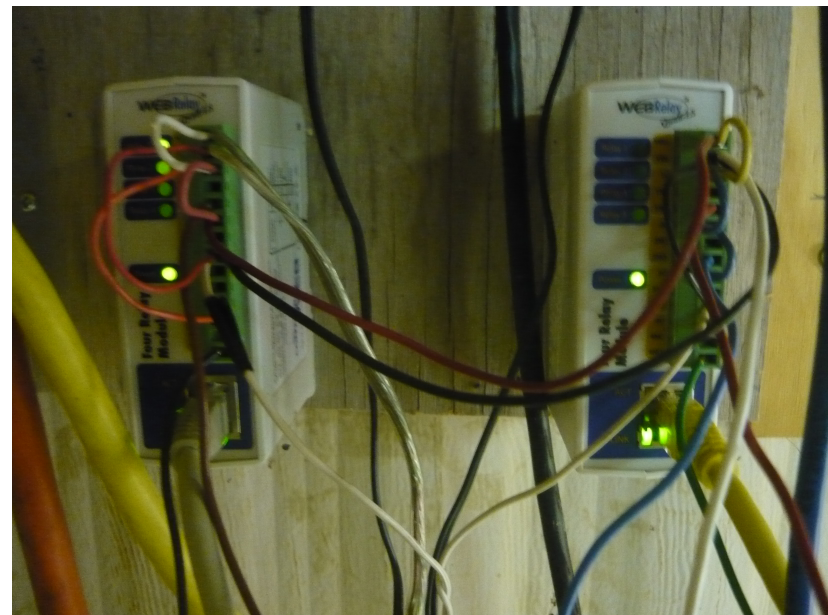




# W4HOD Remote Beverages

## CloudIQ SDR & WebRelay Antenna Control

- Cloud IQ & Power Supply
- <http://www.rfspace.com>
- WebRelays
- <http://www.controlbyweb.com/>
- Direct Internet Control



# W4HOD Remote Beverages

## Let's See if We can Hear Anything

Home band: 160m ...on Network The ON4KST chat Webrelay Quad 1 Webrelay Quad 2 Club Log: Expeditions World Time ...d the World Google Maps  
Webrelay Quad 1 Webrelay Quad 2

Beverages & Shunt Feed		
Power	Ant On	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Not Used	---	<input type="checkbox"/> -- <input type="checkbox"/> --
Not Used	---	<input type="checkbox"/> -- <input type="checkbox"/> --
Shunt Feed 160/80	80	<input type="checkbox"/> 160 <input type="checkbox"/> 80

Home band: 160m ...on Network The ON4KST chat Webrelay Quad 1 Webrelay Quad 2 Club Log: Expeditions World Time ...d the World Google Maps YouTube News  
Webrelay Quad 1 Webrelay Quad 2

Bev. Direction and Preamp		
NE/SW Beverage (01)	1	<input type="checkbox"/> On <input type="checkbox"/> Off
NW/SE Beverage (11)	0	<input type="checkbox"/> On <input type="checkbox"/> Off
Preamp	On	<input type="checkbox"/> On <input type="checkbox"/> Off
NE-NW/SW-SE Control	NE-NW	<input type="checkbox"/> SW-SE <input type="checkbox"/> NE-NW

Remote Antenna Control Software

# W4HOD Remote Beverages

## RFSpace CloudIQ SDR

