Advanced Beverage Antenna Designs

Compiled & Annotated
by
Richard C. Jaeger, K4IQJ
July 9, 2013

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. of the General Electric Co. — Assoc. A. I. E. E. of the General Electric Co.

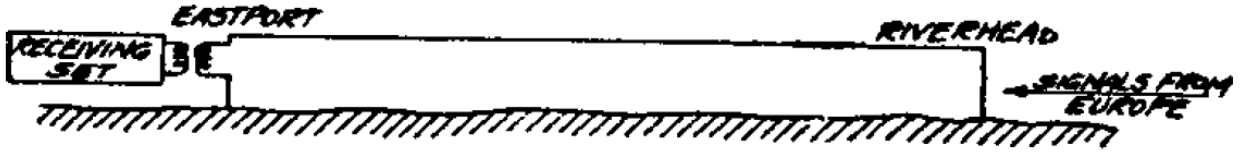
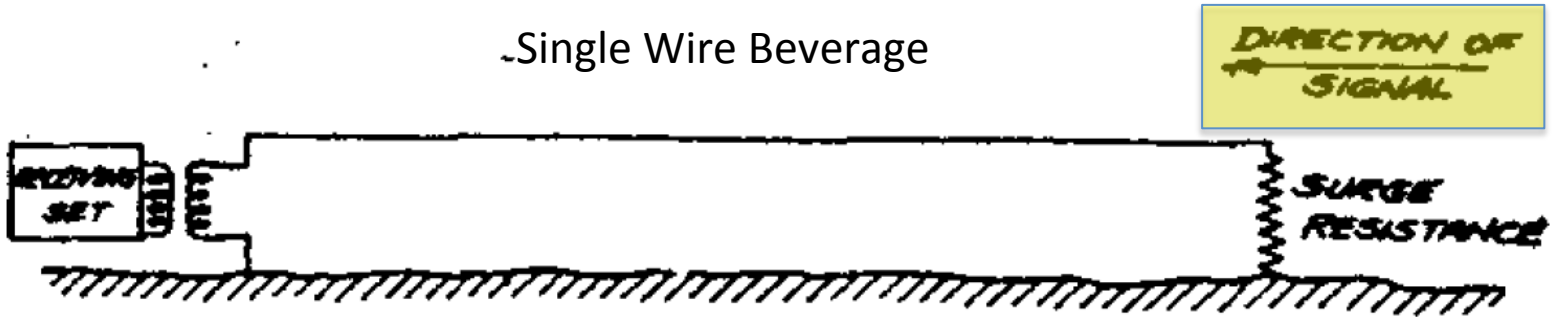


FIG. 1

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 diagramatically in Figure 1.

Actually a BOG!

Single Wire Beverage



Two Wire Beverage

Note!

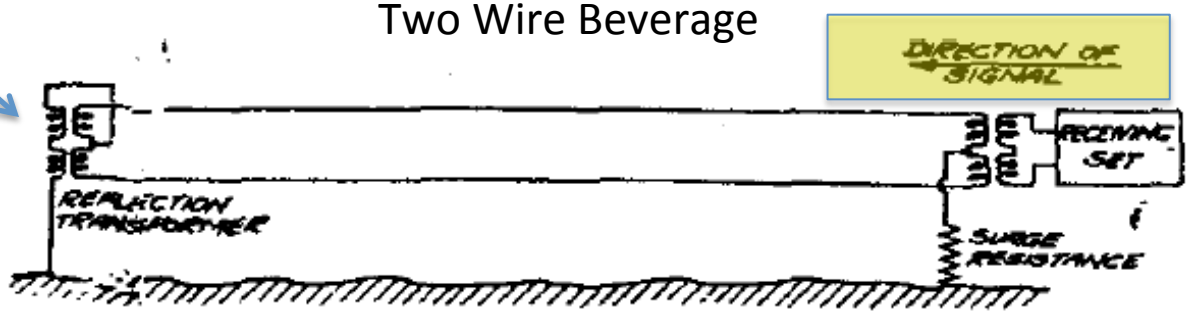


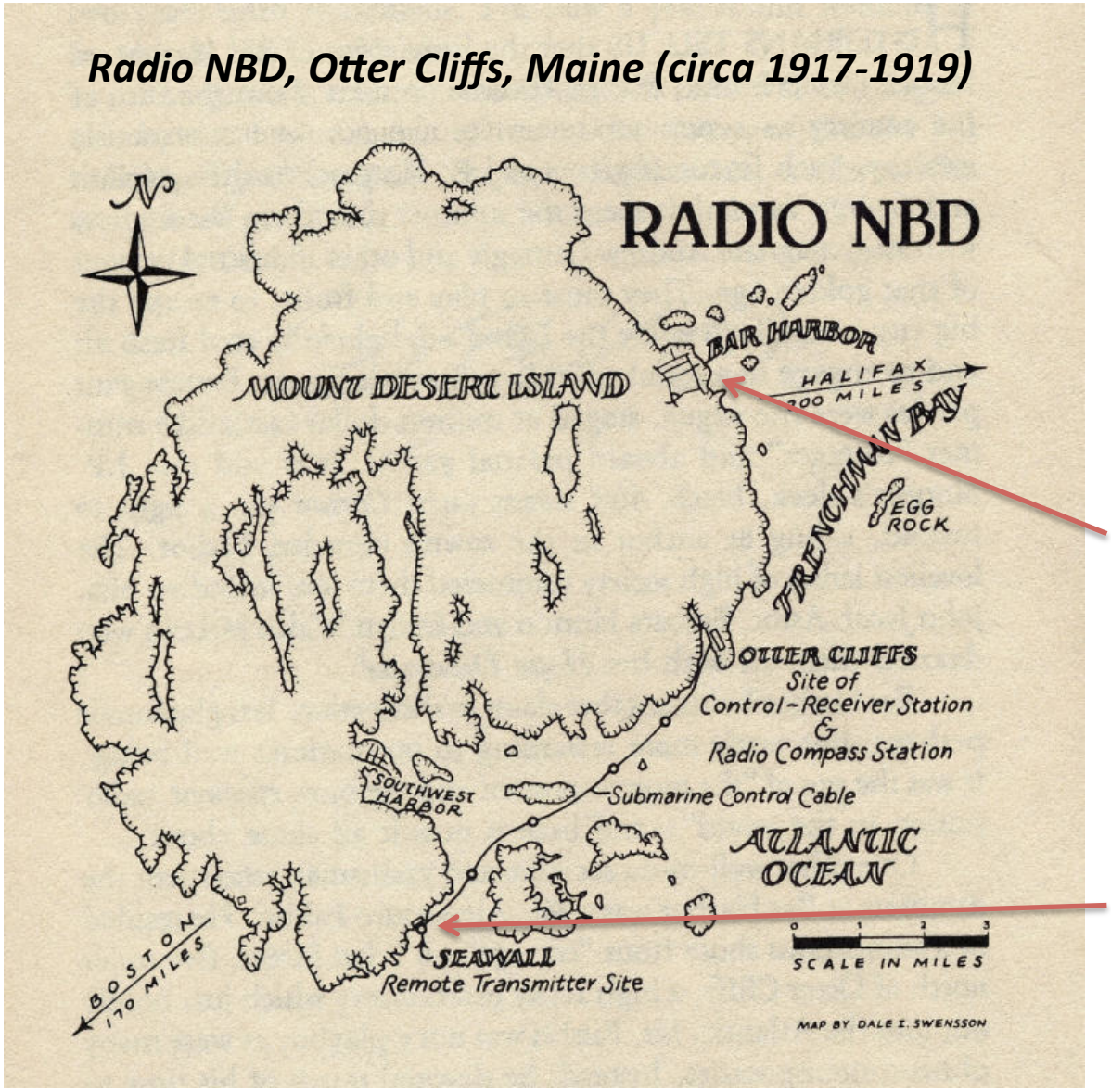
FIG. 18—ARRANGEMENT FOR LOCATING RECEIVING SET AT SAME END AS SURGE RESISTANCE

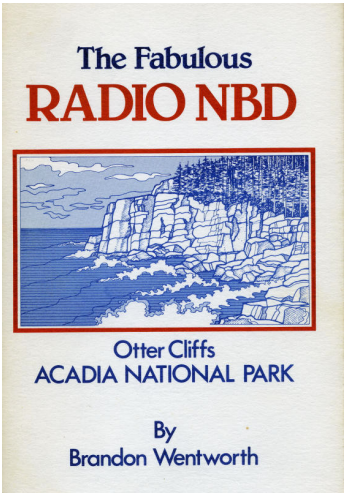
Transactions of the AIEE, pp. 215-265, February 1923.

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.

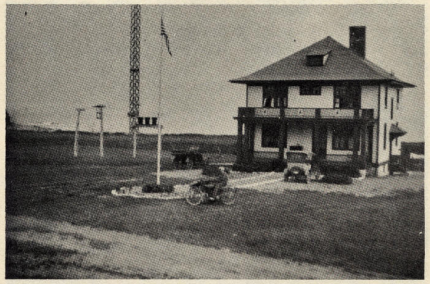
http://www.navycthistory.com/ottercliffs01.html





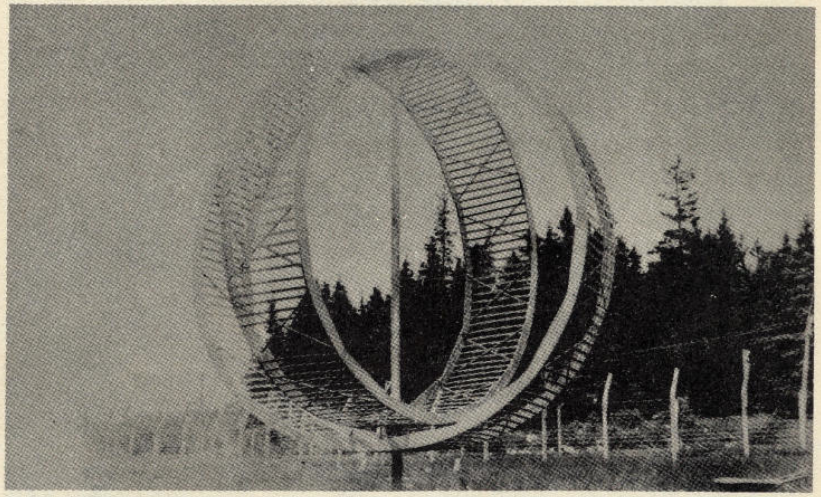
The Bar Harbor Country Club building leased by Mr. Fabbri for use as NBD control and receiver station. *Photo courtesy Carl Herr.*

[7]

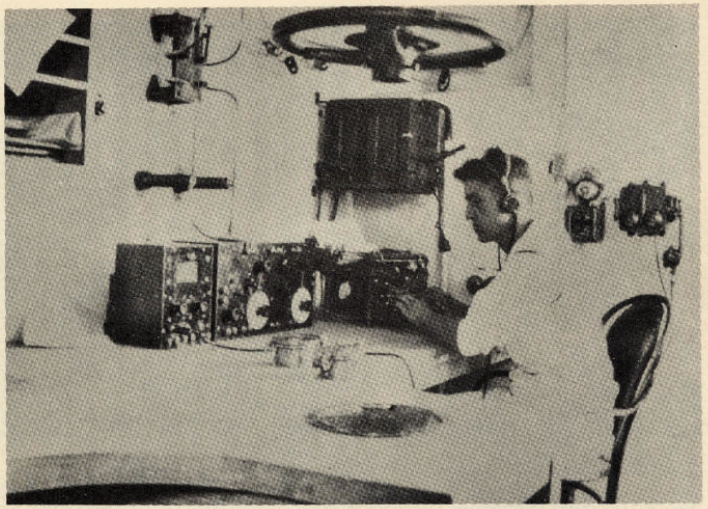


The remote transmitter site at Seawall. According to Fred Grindle, the intrepid motor bike rider is none other than his old friend Carl Herr. *Photo courtesy Mr. Grindle.*

Radio NBD, Otter Cliffs, Maine (circa 1917-1919)



The Pickard directional loop receiving antenna, Otter Cliffs.
Photo courtesy Jesup Memorial Library.



Long wave receiving position, Otter Cliffs. Radioman unidentified. Wheel above his head is for orientation of the Pickard directional loop antenna. *Photo courtesy Carl Herr.*

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

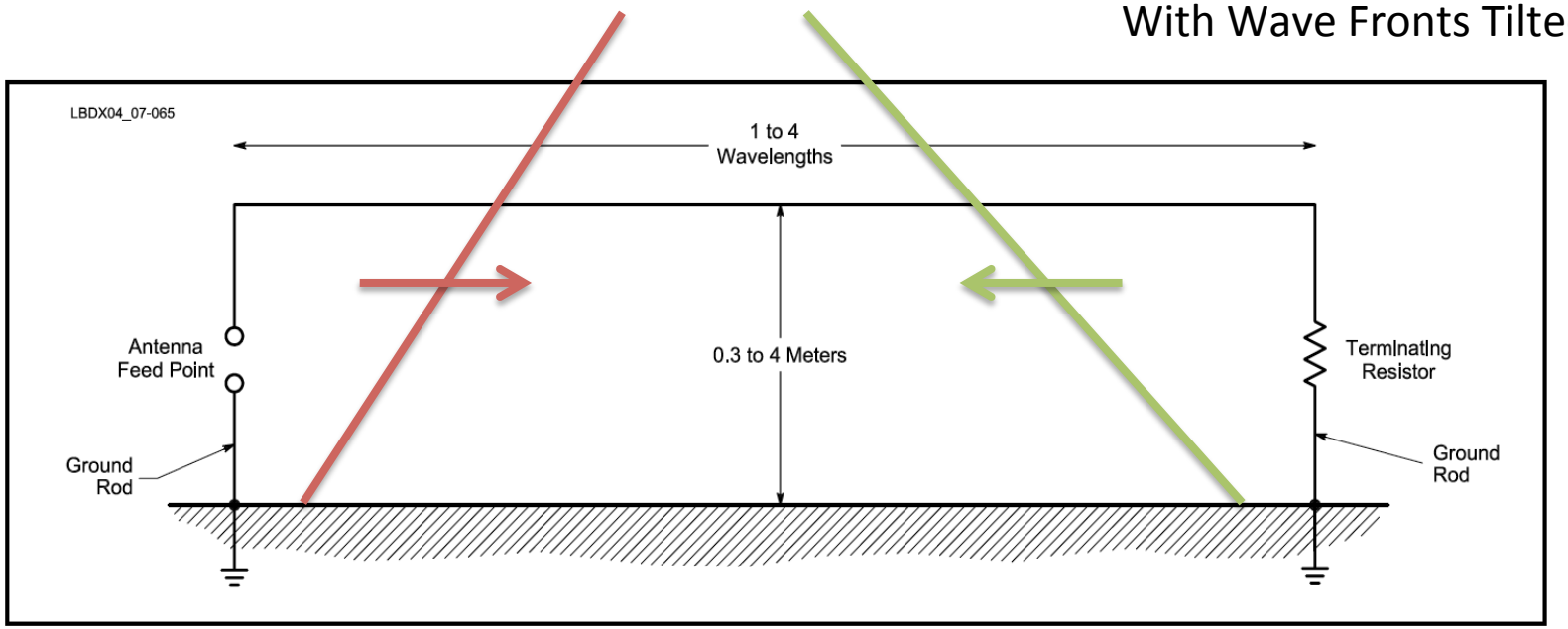
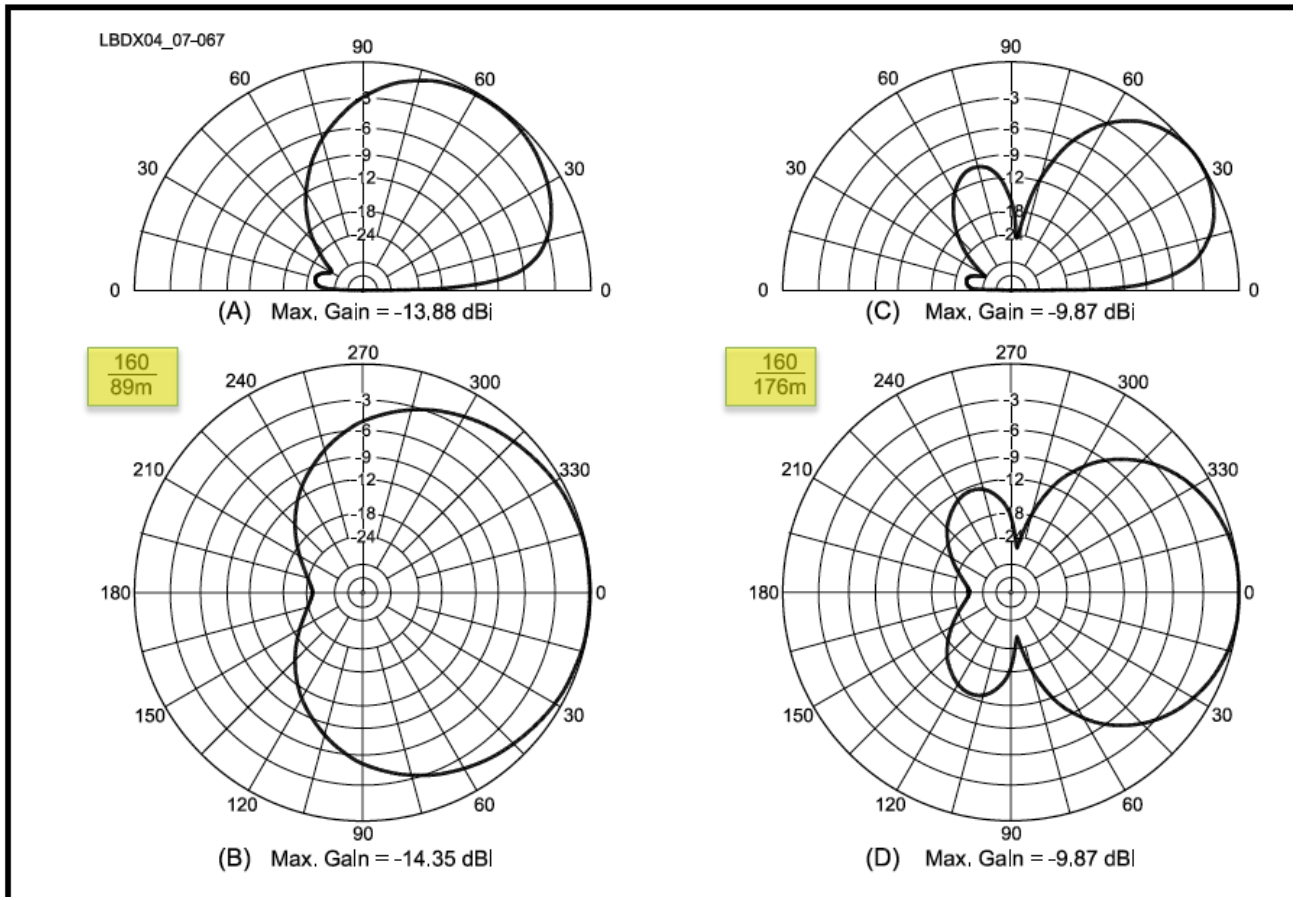


Fig 7-72 — The Beverage antenna is a straight wire, typically 1 to 4 λ long, mounted parallel to the ground at a height of 0.01 to 0.03 λ.

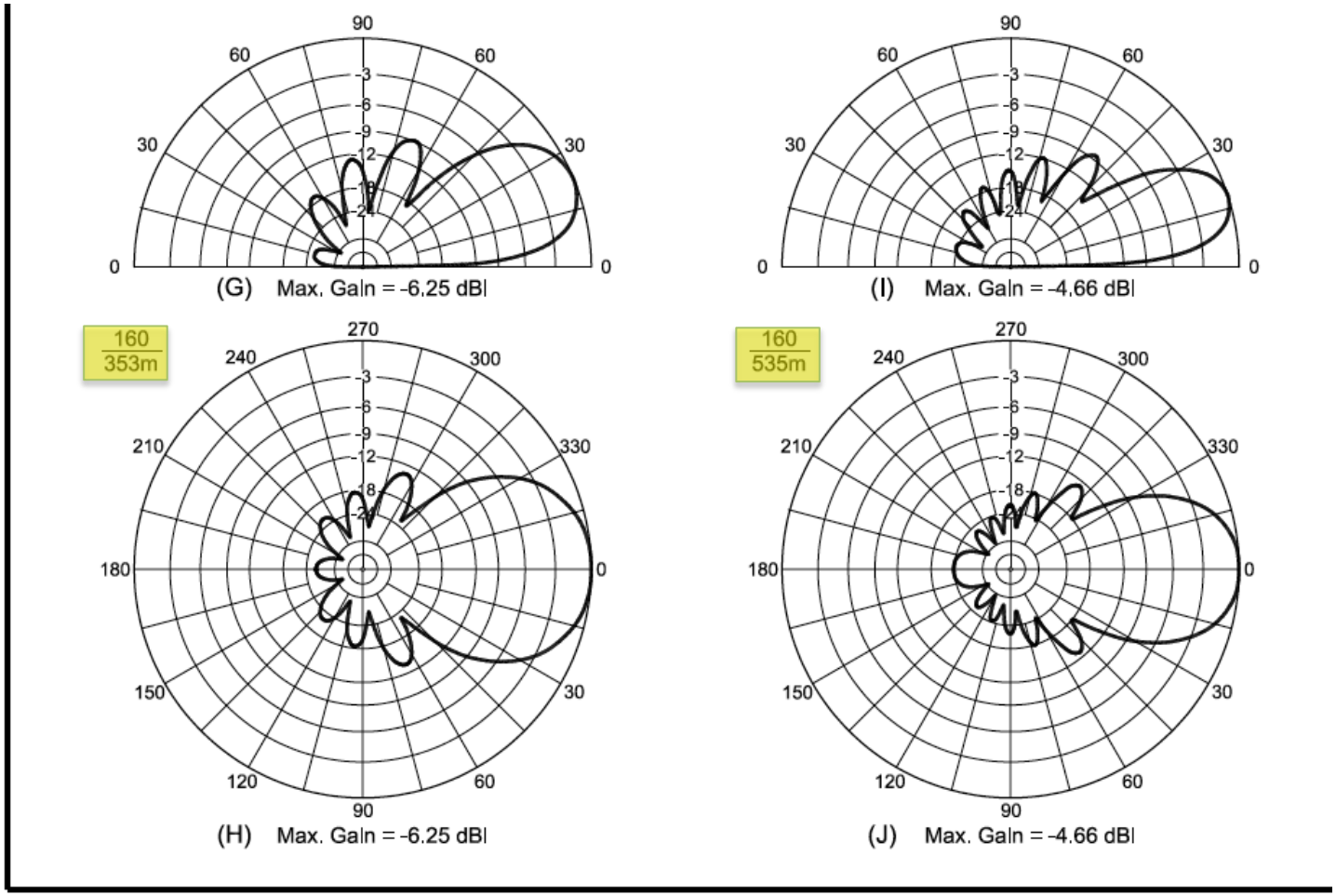
- Lossy Ground → Electric Field Tilts
- No Tilt = No Output (E · dL)
- Doesn't work well over high conductivity ground
  (as discovered by many DXpeditions to remote islands)

Pattern vs Length

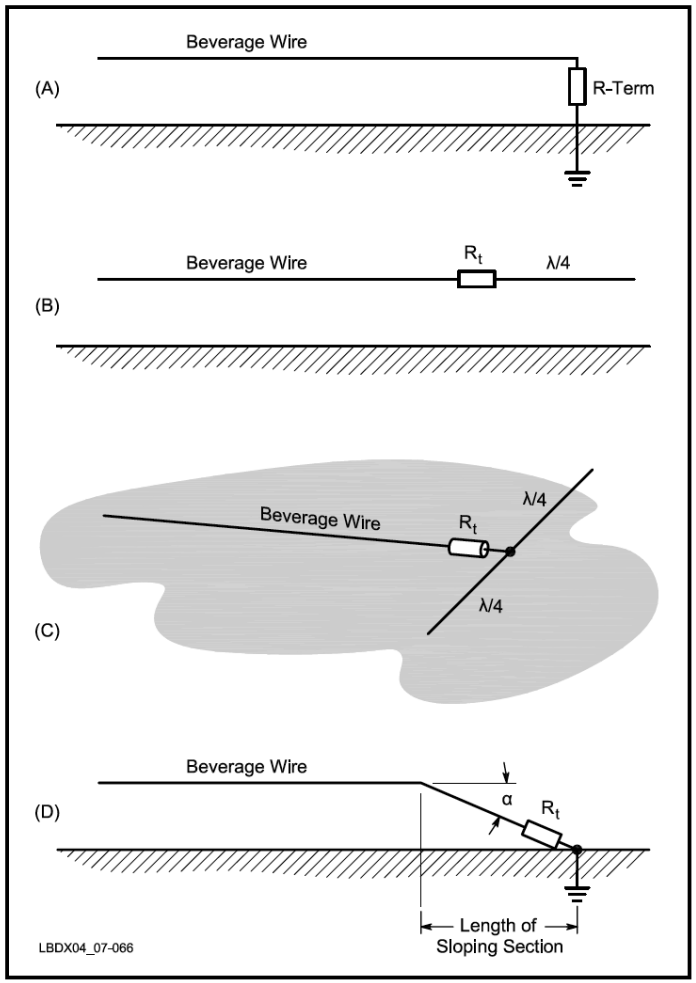


Similar to a single loop

Pattern vs Length (cont.)



Beverage Termination Techniques

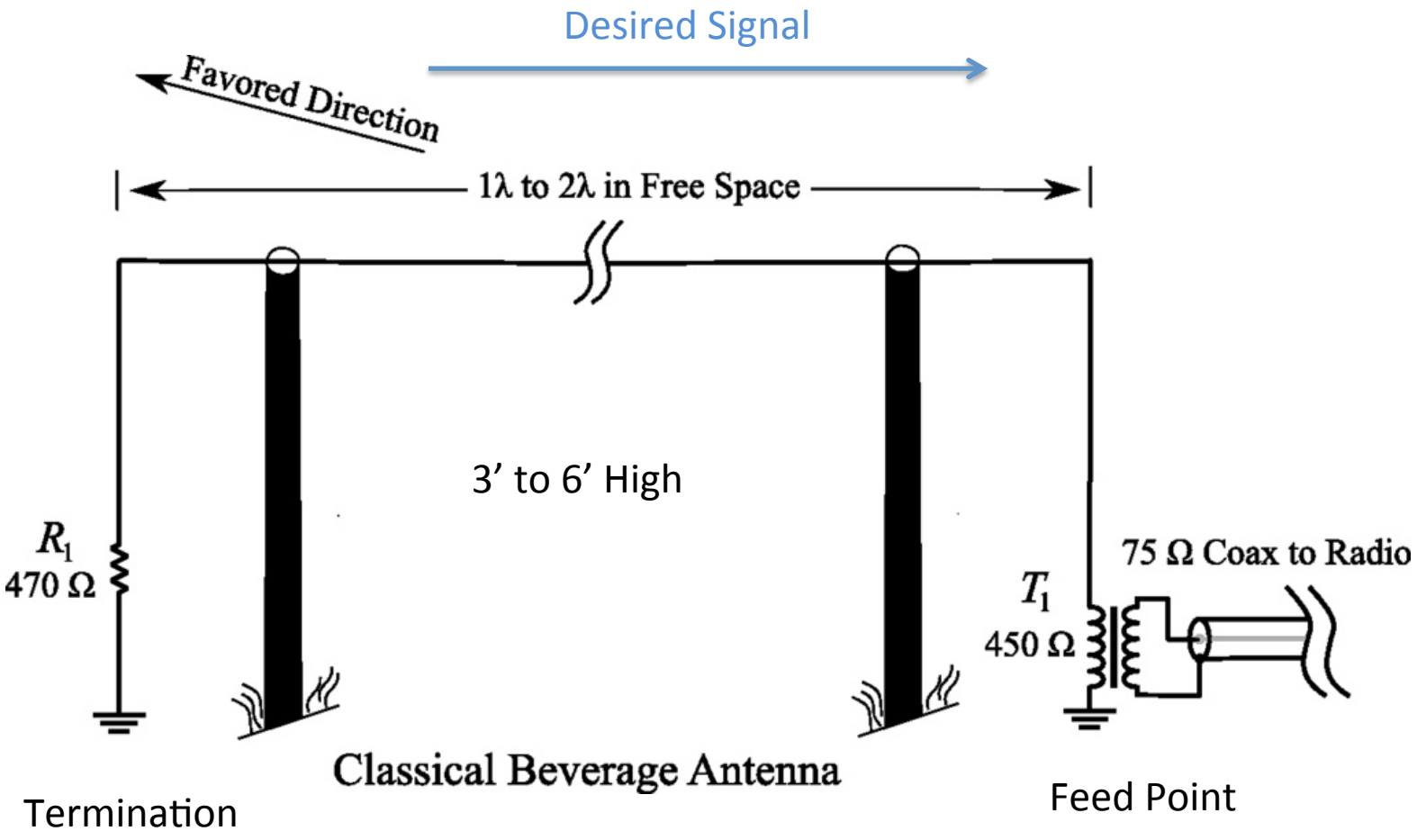


- Basic Termination (≅ 470 Ω)
- (B-C) Good for poor ground and for simulation (EZNEC) – terminated by λ/4 lines
- (D) Preferred to reduce vertical pickup from vertical end

http://kw2p.blogspot.com

Wednesday, August 18, 2010

KW2P Beverage Antenna Designs



Two-Wire Beverage
Using “Reflection Transformer”

Remember Beverage’s Paper!
& Reflection transformer

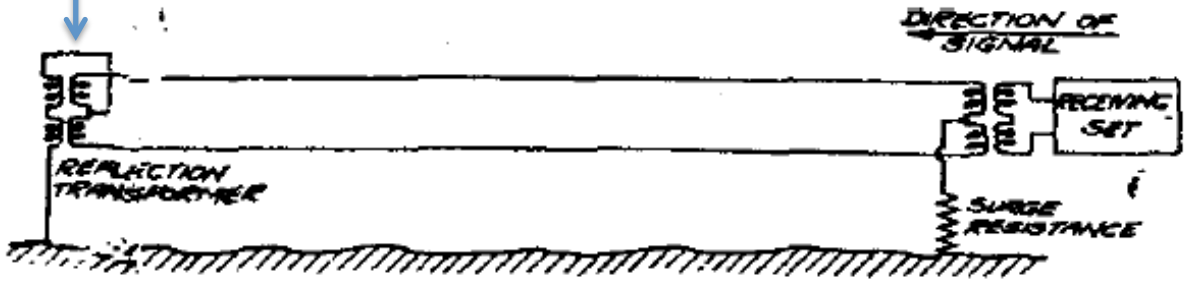
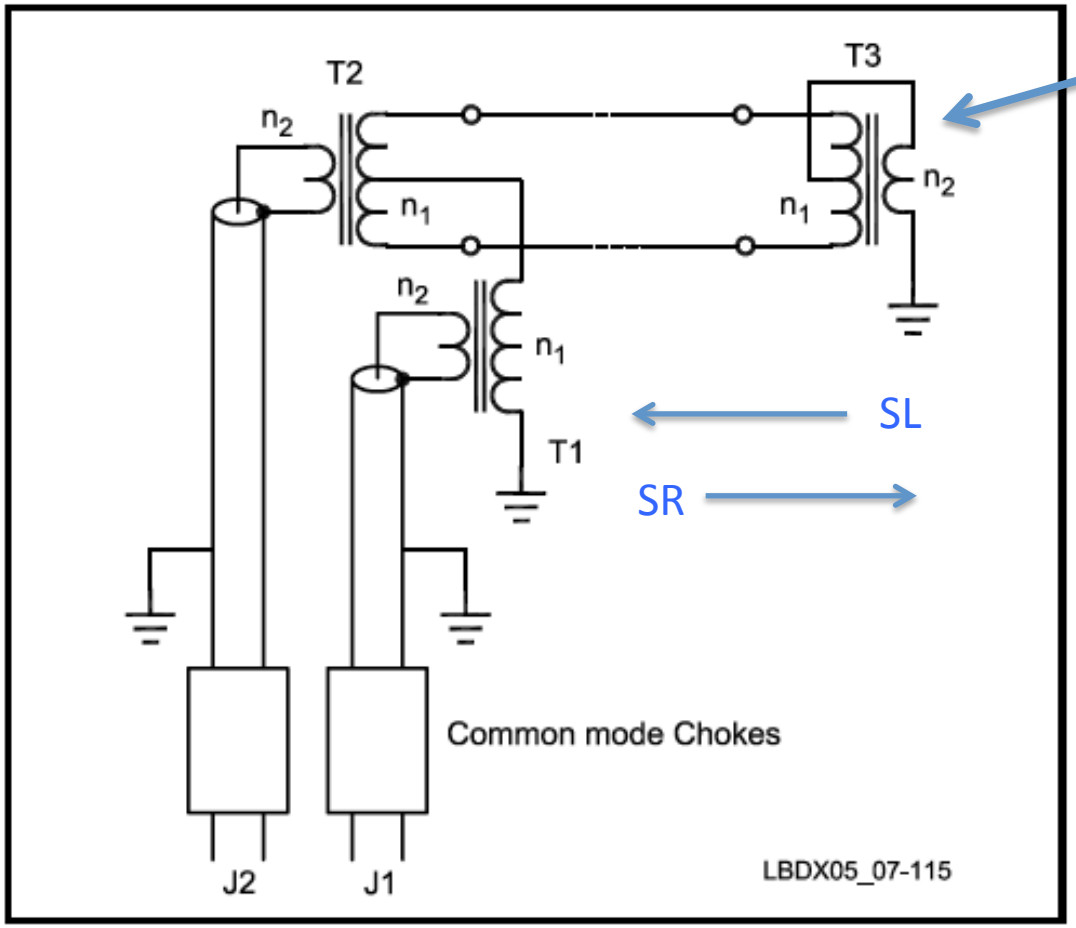


FIG. 18—ARRANGEMENT FOR LOCATING RECEIVING SET AT SAME END AS SURGE RESISTANCE

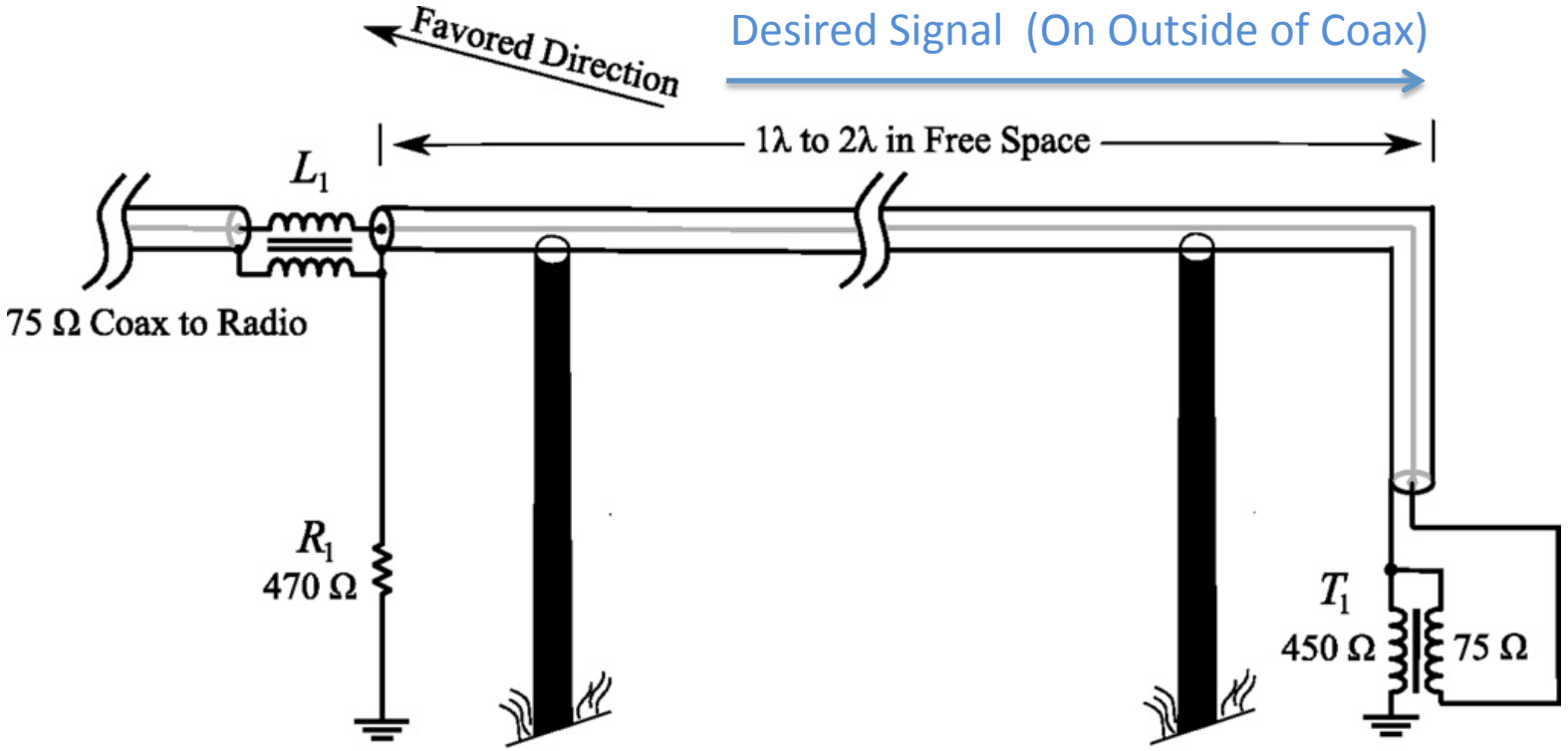
Two-Wire Bi-directional Beverage Clever Use of Transformers!



Reflection Transformer!
(only a 90 year old concept)

- Received signals SR and SL are common to both closely spaced wires (common-mode signals)
- SL is picked off by at center-tap of T2 by transformer T1 and fed to J1
- SR is picked off from center-tap of transformer T3 and sent back down the two-wire transmission line as a differential-mode signal and into coax connected to T2 and J2

End Fed Coax Beverage

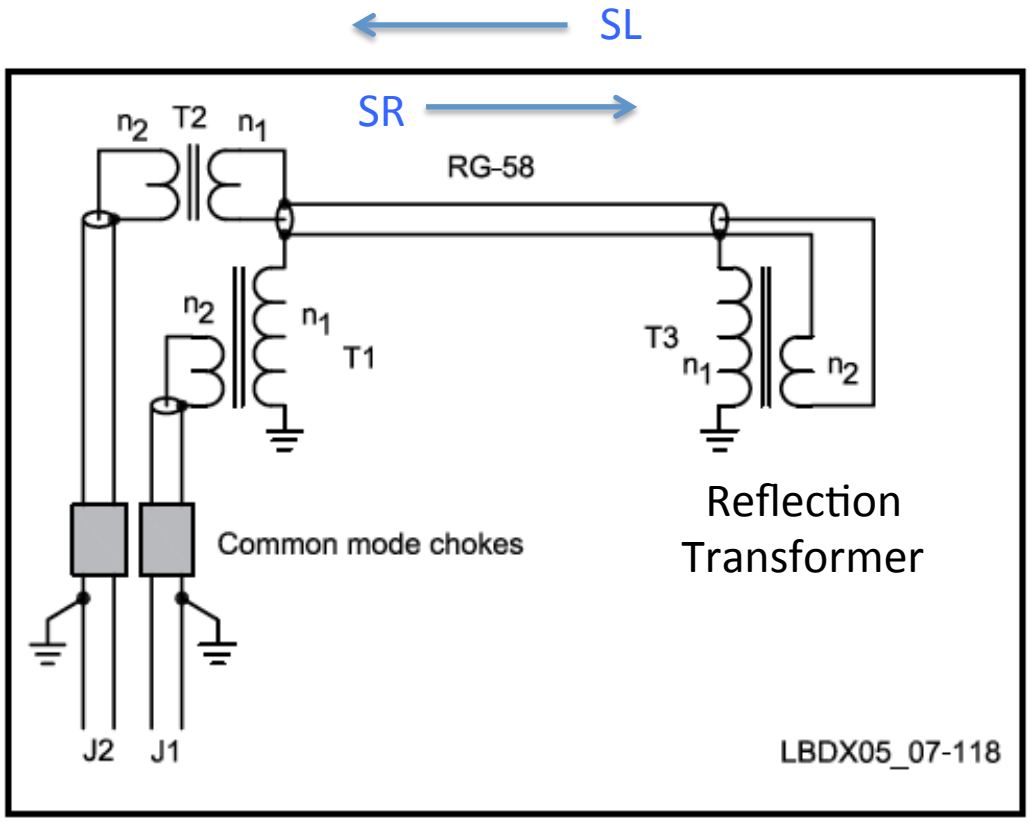


Feed Point & Termination

Reflection transformer

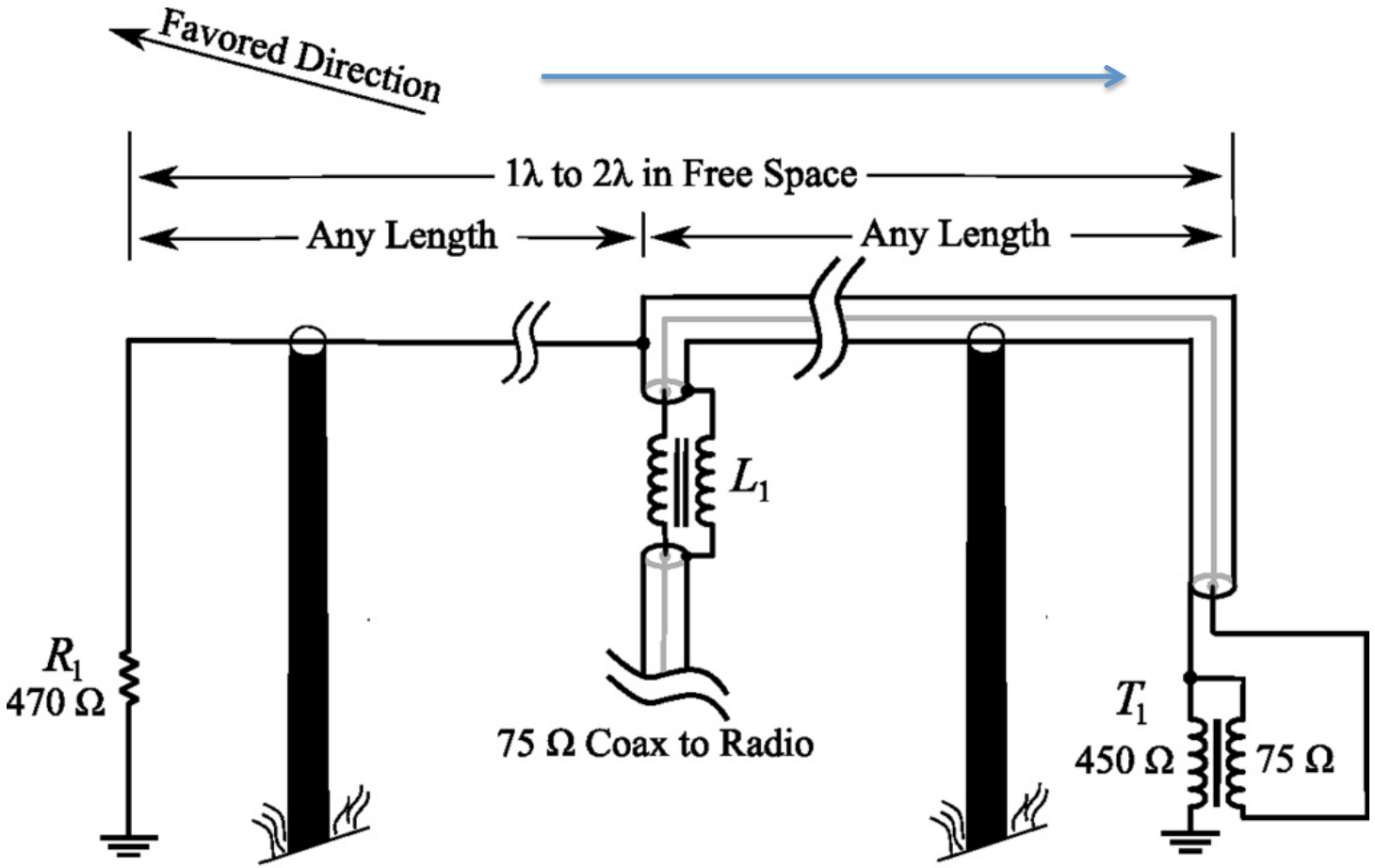
[KW2P Beverage Antenna Designs]

Coaxial Bi-Directional Beverage
More Clever Use of Transformers!



- Received signals SR and SL are both on the outside of the coax
- SL is picked off by transformer T1 and fed to J1
- SR is picked off by transformer T3 and sent back down the inside of the coax transmission line and into the coax connected to T2 and J2

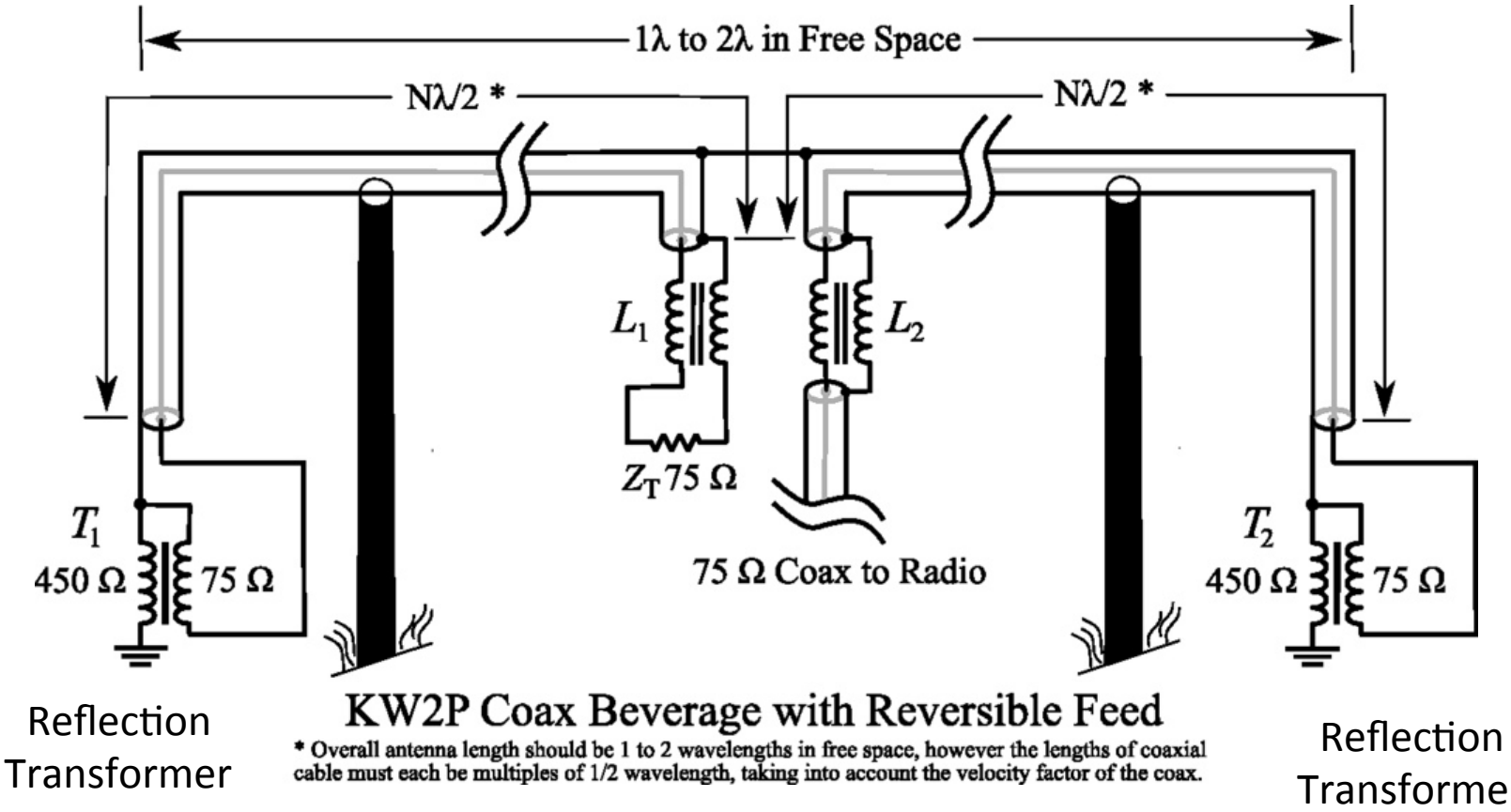
Coax + Wire Beverage – Middle Fed



KW2P Coax Beverage with Middle Feed

Reflection Transformer

Coax Beverage with Reversible Feed



Reflection Transformer

Reflection Transformer

Switch Coax and Termination Z_T to Reverse Directions

Beverage on Ground (BOG or Snake Antenna)

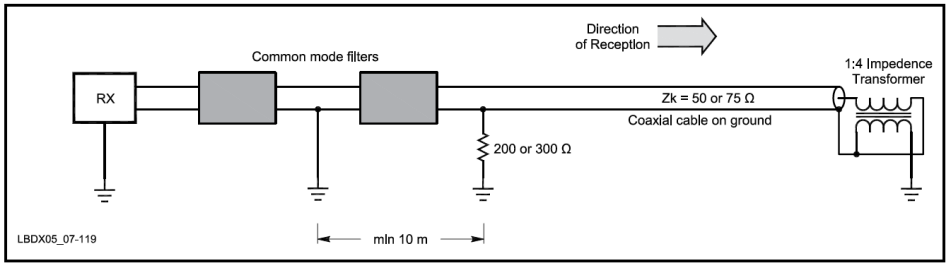
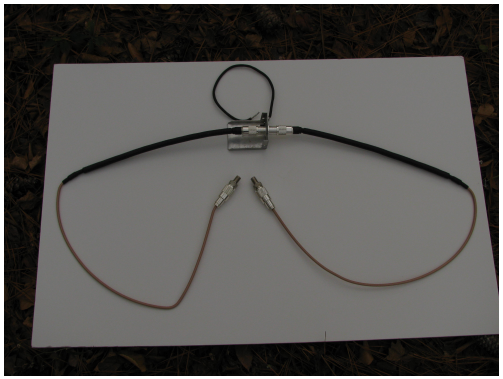


Fig 7-119 — The snake antenna is the back-firing version of the BOG (Beverage On Ground). See text for details.



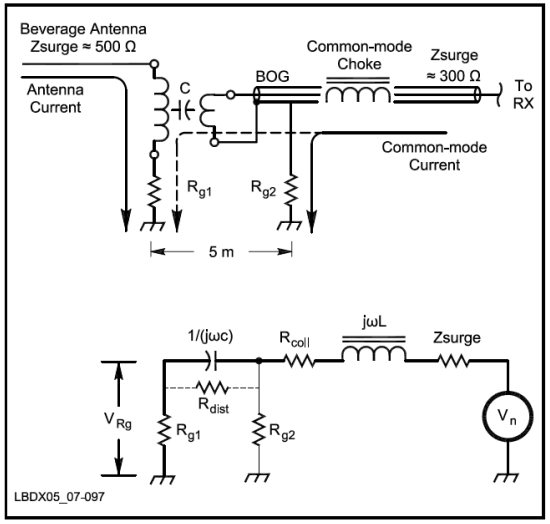


Fig 7-97 — Adding a common-mode choke next to the feed line ground rod is a common way to further improve common-mode signal rejection. See text for details.

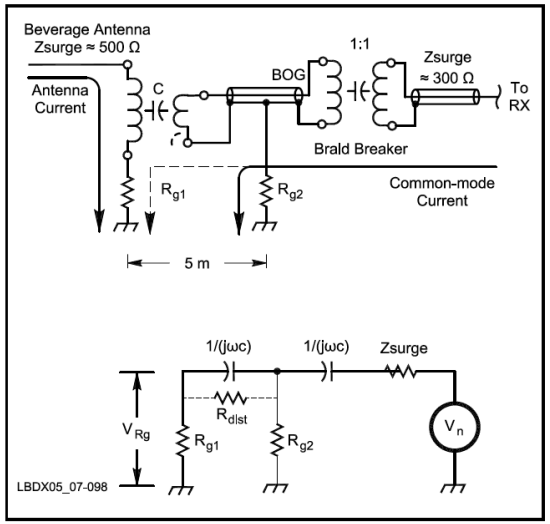


Fig 7-98 — Instead of using a common-mode choke, a braid breaker can be used to insert a high impedance for the common-mode signals. See text for details.

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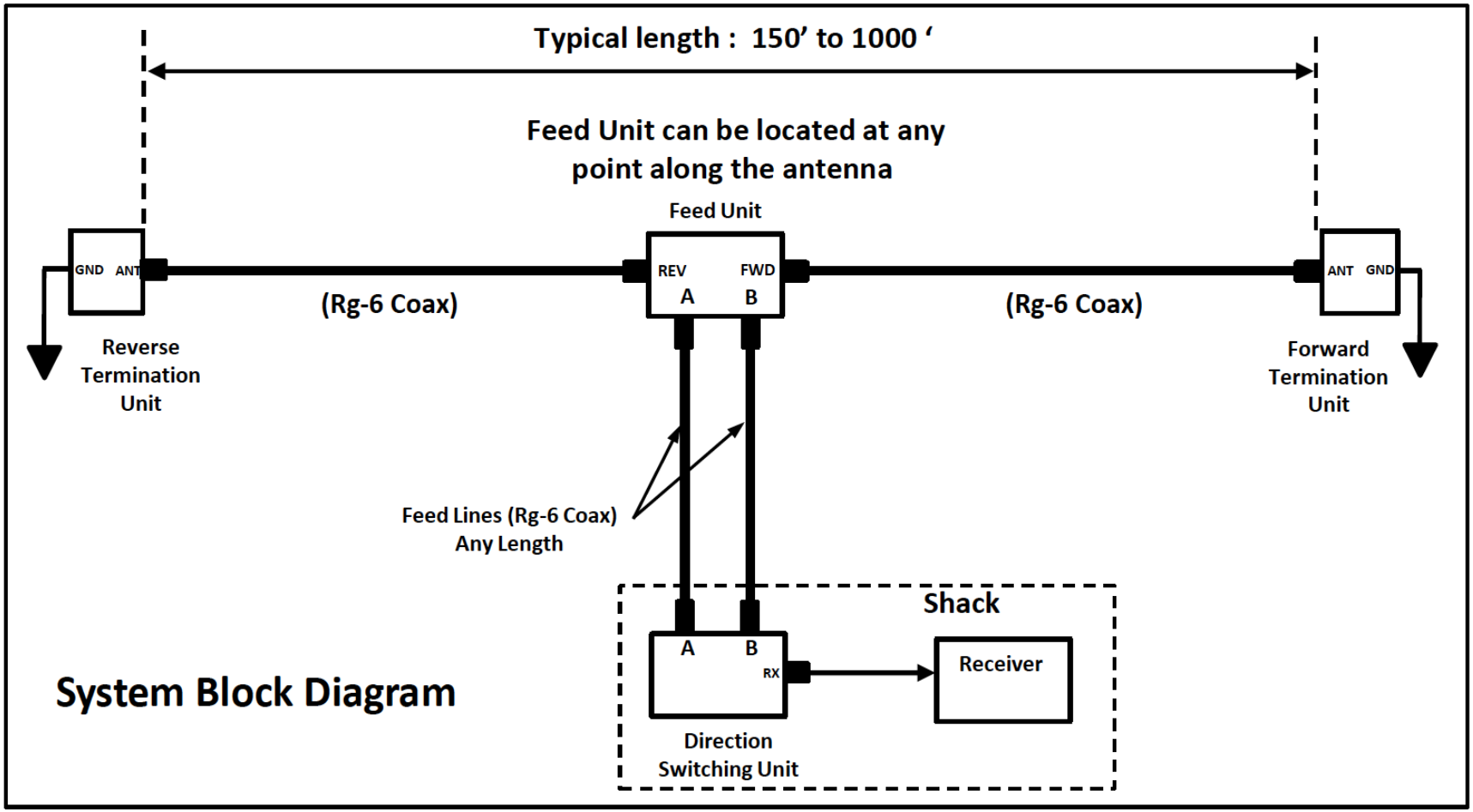
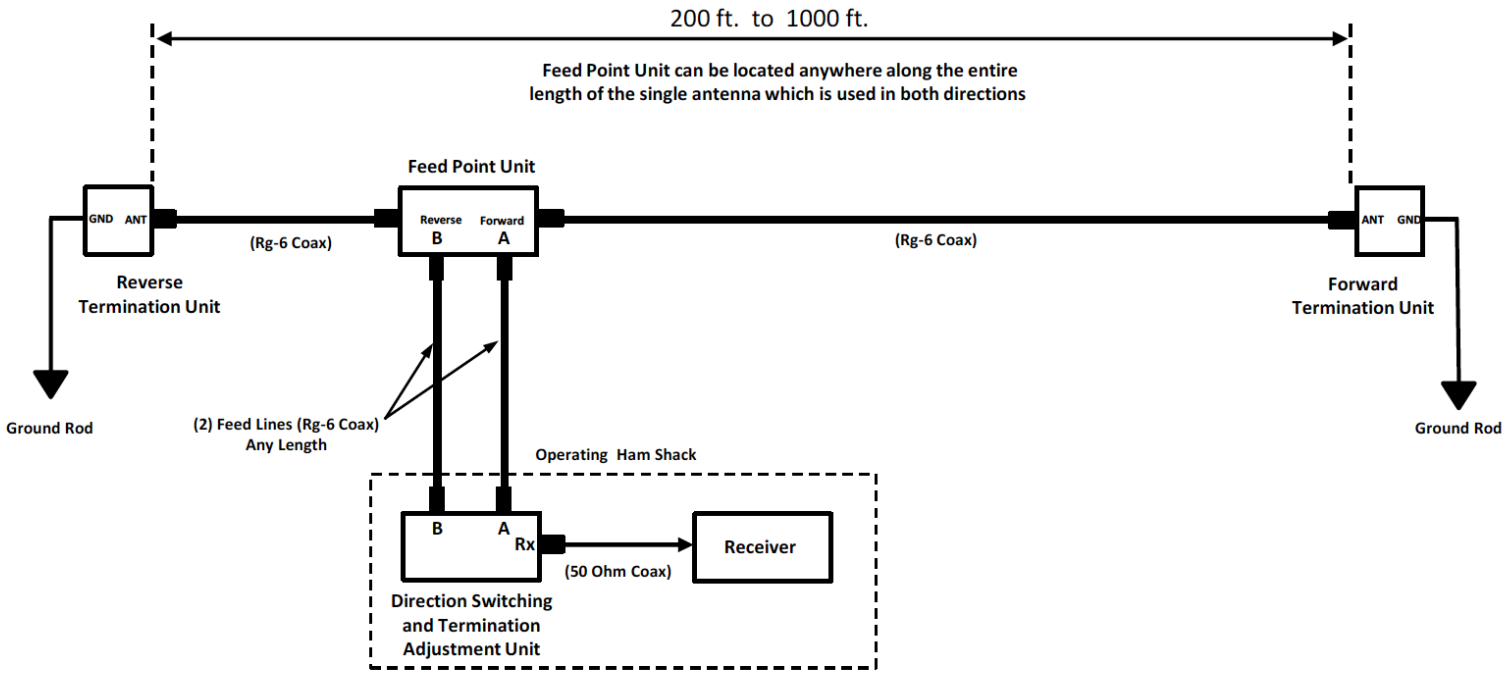
BevPro-1



The following block diagram illustrates the various components of the unique BevPro-1 system



Pixel TECHNOLOGIES

$ 299.95