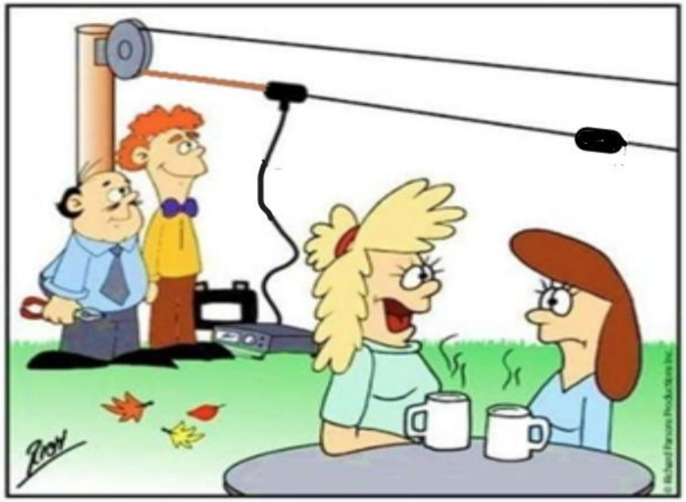
The End-Connected Off Center Fed Dipole Antenna (EC-OCFD)



Stan & Cliff have been working all day on installing my clothesline, Mary.

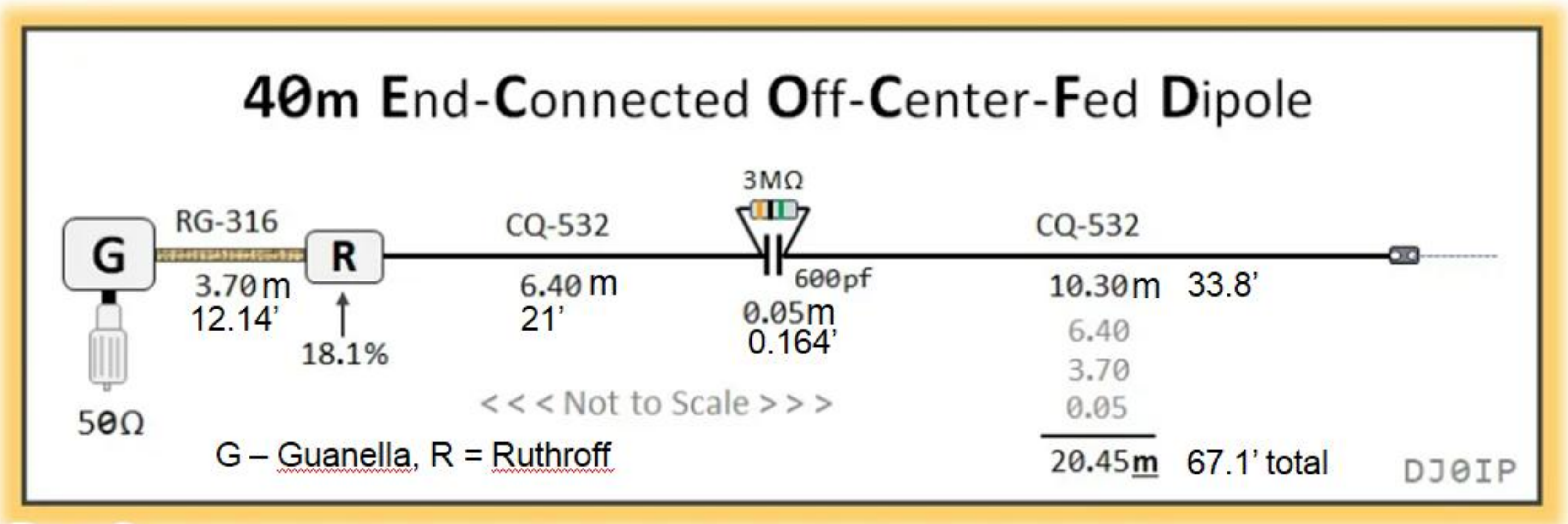
March 11, 2026

Steve Dick, K1RF

In search of the Holy Grail

A simple wire antenna that is low cost, easy to build, and easy to deploy, with great performance, from single band to multiband.

The End-connected Off Center Fed Dipole comes close



Courtesy Rick Westerman DJ0IP

- 40 meter End connected, multiband antenna with low VSWR per band.
- Efficient transmission line-based wideband transformers (>97% efficiency) compared to conventional high turns ratio transformer used in end fed half wave antenna, which is typically <90% efficiency to cover all bands
- Uses lower cost and smaller sized ferrites compared to End Fed Half Wave antenna for a given power level
- Easier to make high power antennas due to their higher efficiency transformers compared to End Fed Half Wave Antenna

End-Connected Off Center Fed Dipole Heritage

- In ~2010 the "City Windom" was introduced by Evgeniy Slodkevich, UA3AHM . The current evolution of the multi-band EC-OCFD design was inspired by Robert Brown, M0RZF for 40 meters and David Cutter, G3UNA for 40/80 meters. Much additional work by Leland M. Farrer (Mel) K6KBE

- It has heritage back to the sleeve dipole commonly used in VHF/UHF antennas. Here is the twist; the antenna is end fed with coax to a 1:1 choke instead of a separate sleeve. This effectively isolates the outer side of the coax braid at ¼ wavelength and makes it the equivalent a radiating sleeve without needing an actual sleeve!

Details of the Evolution of the End Connected Off Center Fed Dipole (EC-OCFD)

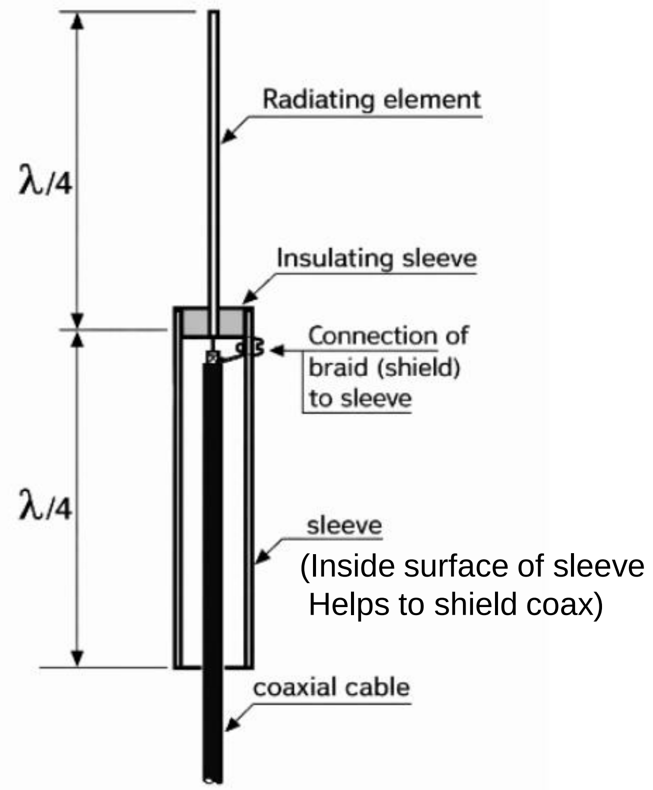
- Sleeve Dipole
  - Fairly common for VHF marine antennas
  - Coax fed with no transformers. Uses a ¼ wave metal sleeve over the coax feedline
- End Fed Monoband Dipole: Replace the sleeve with the outer surface of the coax braid and a high impedance device at the ¼ wavelength point
  - An End Fed Center fed 20 Meter Portable antenna QST Magazine May 2022 pp 30-32" - Phil Salas, AD6X – uses resonant choke for high impedance device
  - The Banana – Callum McCormick, M0MCX - uses standard choke
- The End Connected Off Center Fed Dipole
  - Multiband operation
  - Uses a Ruthroff unun along the ½ wave wire for impedance matching and a Guanella balun at the end of the wire for choking which isolates a section of the coax similar in length to that of a conventional OCFD, and allows it to be used as a radiating element as part of the antenna.

The sleeve dipole

What makes it a sleeve dipole?

- A sleeve dipole differs from a plain dipole because one of the quarter-wave elements is formed by a sleeve conductor around the feedline instead of a separate wire or rod. The sleeve serves two functions:
- **Radiating element:** The sleeve itself acts as the lower quarter-wave radiator.
- **Common-mode choke/balun:** The metal sleeve around the coax prevents currents from flowing back on the outside of the feedline, making the antenna behave more like a balanced dipole.
- This may remove the need for an external choke but they are sometimes added such as a coil of coax in the feedline or ferrite clamp-ons.

Sleeve Dipole Construction

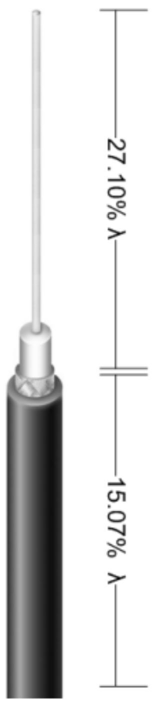


Courtesy DXR Electronics Bits

Banana Antenna – Resonant Half Wave End-Fed Choked Coax Antenna by Callum McCormick, M0MCX

https://www.m0mcx.co.uk/wp-content/uploads/banana-antenna-end-fed-choked-sleeve-resonant-feedline-T2LT-dipole.pdf

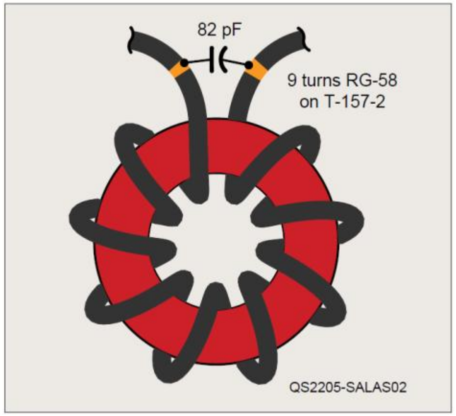
- Initially had poor VSWR results using equal lengths of quarter wave coax and quarter wave center conductor.
- Changed ratio to 15.7% wavelength coax and 27.1% wavelength wire with better VSWR results. Why? Hold that thought…



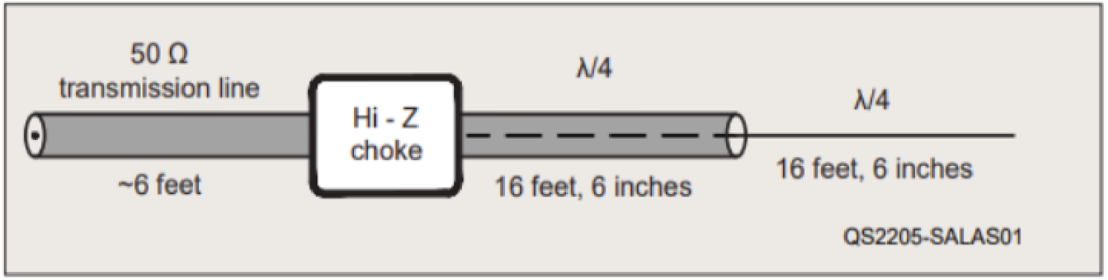
Note: only adds up to 42.3%, not 50% of a wavelength

> 8k choke. 2 x FT240-52 ferrites

An End-Fed Center-Fed 20-Meter Portable Antenna – Phil Salas, QST Magazine May 2022 pp 30-32



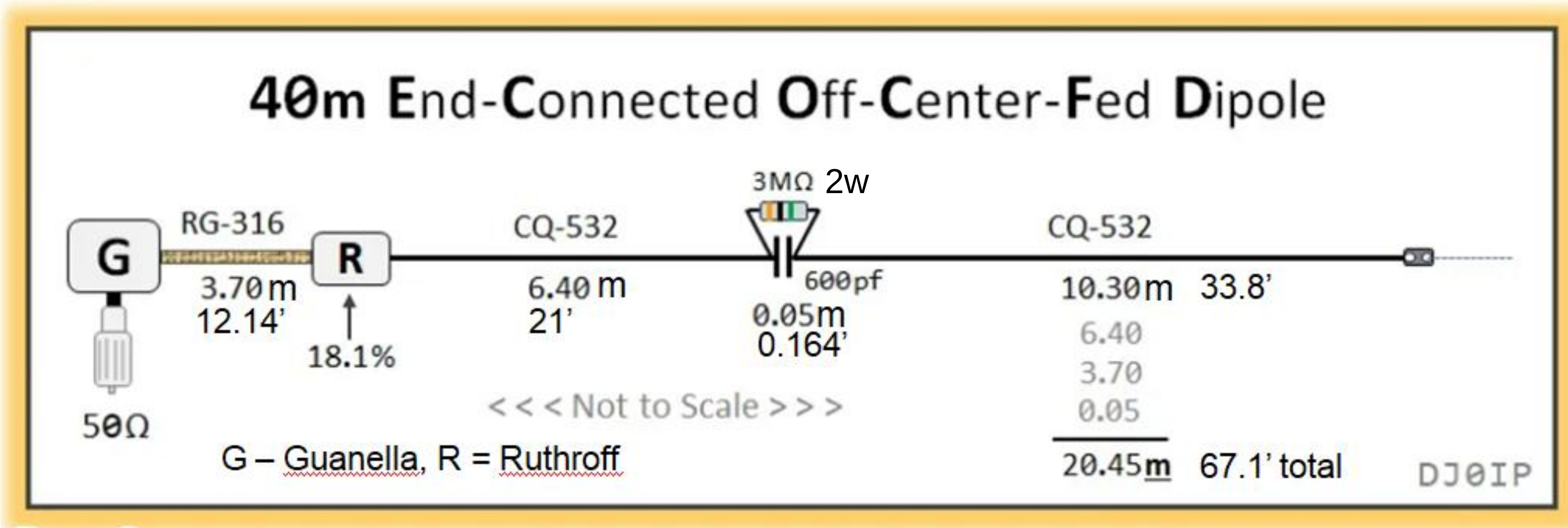
High Z **<u>resonant choke</u>** using T157-2 powdered iron toroid and 9 turns RG-58. Note the 82pF capacitor which converts the standard choke to a resonant circuit on 20 meters



Uses 468/f formula for full wave. Note equal lengths quarter wave coax and center conductor with low VSWR. Why does this work but Callum M0MCX had to change lengths to make his work. Why?

- Monoband antenna only (20 meters).
- Outer coax shield is half the dipole and radiates.
- Inner coax shield is part of the transmission line
- Resonant choke has about 3500 ohms impedance
- Rated 50W 100% duty cycle, 100W CW and SSB

The End Connected Off Center Fed Dipole (EC-OCFD) 40 meter version



Notes:

1. The outside of the coax shield is used as the short-end of the OCFD antenna radiator. It is terminated by a 1:1 Guanella choke-balun. The other leg of the OCFD is normal wire.

2.It is necessary to trim the overall wire length such that minimum SWR on 40m is below the band edge at about 6.808 MHz without the capacitor. This capacitor in the middle raises the resonance of the antenna on 40m, without changing resonance on higher bands. Recommend 3 caps in parallel to distribute current. For CW ops, you don't need cap. Resistor not critical; used to bleed off static electricity

Assembled 40m OCFD

Rated:
-130W digital modes
-300W CW
-650 W SSB

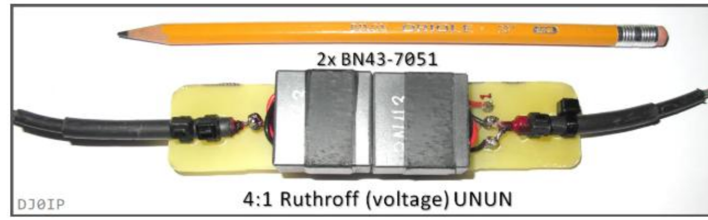
> ~1 dozen built
successfully

See link for more details:
https://www.dj0ip.com/ecocfd-antenna?

Guanella and Ruthroff construction 40m EC-OCFD

The **TX36/23/15/4A11** Toroid is strapped to an FR4 (epoxy board) backplane. The L-Adaptor and the insulator are optional, for use when erected as an Inv.-V antenna. When erected as an Inv.-L they are not required. (Ferrite similar to #43).

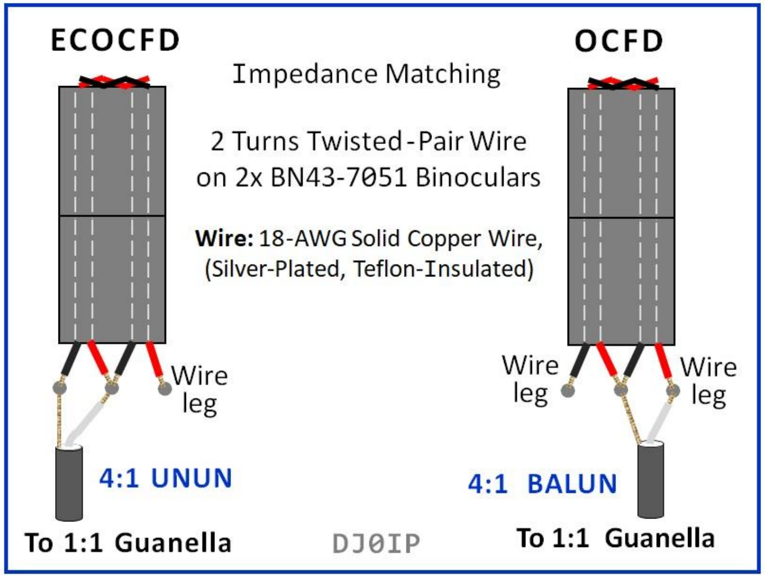
Equivalent to FT140-43. (Fair Rite 5943002701**, $3.77 Digikey** 17 turns of RG-316



The 4:1 Ruthroff (voltage) UNUN has 2 turns of twisted pair transmission line wrapped through a pair of **BN43-7051** Binocular Ferrite cores.
Its efficiency is 99%.

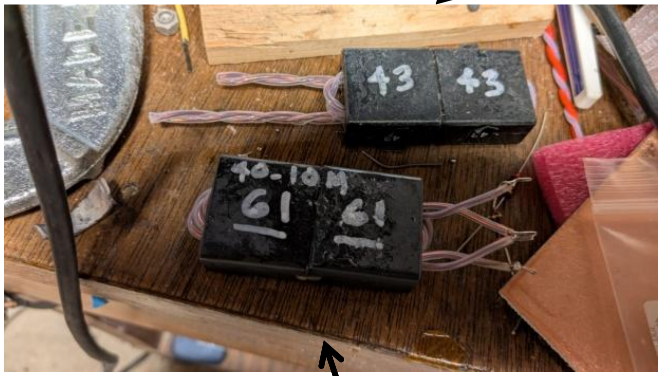
AWG #18 in teflon tubes or insulation
2-Fair Rite 2843009902, $5.04 ea. Digikey

Ruthoff Construction Details



Steve's binocular Ruthroffs

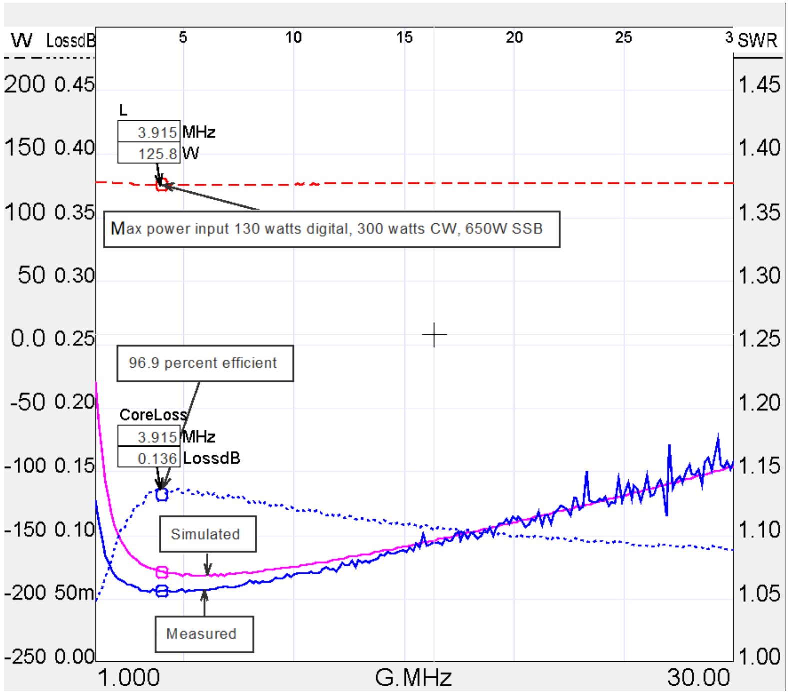
Pair of BN43-7051s
Fair Rite 2843009902, $5.04 Digikey



Fair Rite 2801010002, $5.31 Digikey

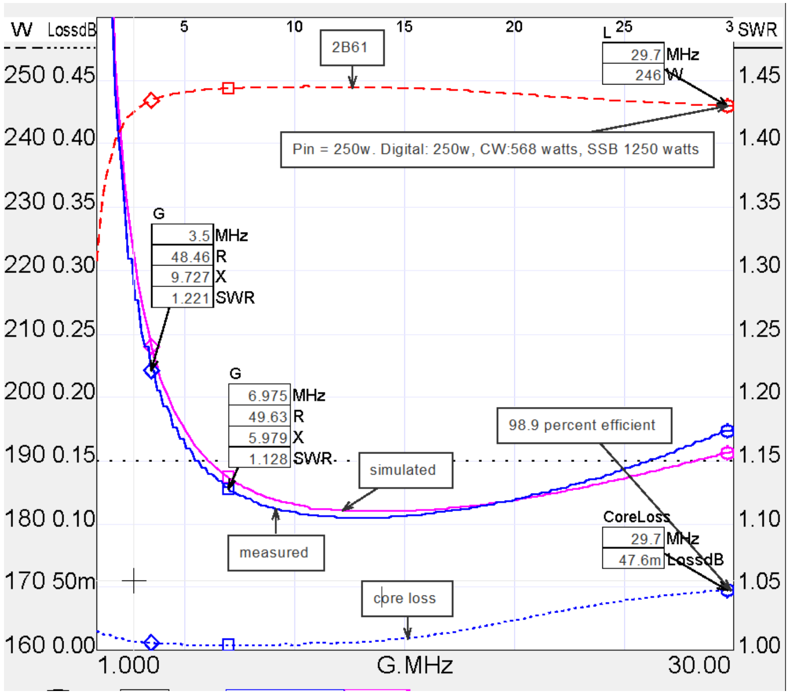
Ruthroff Unun Performance

- 2 BN43-7051: (80-10m):
  - Digital modes:130w
- - CW: 300w
- - SSB: 650w



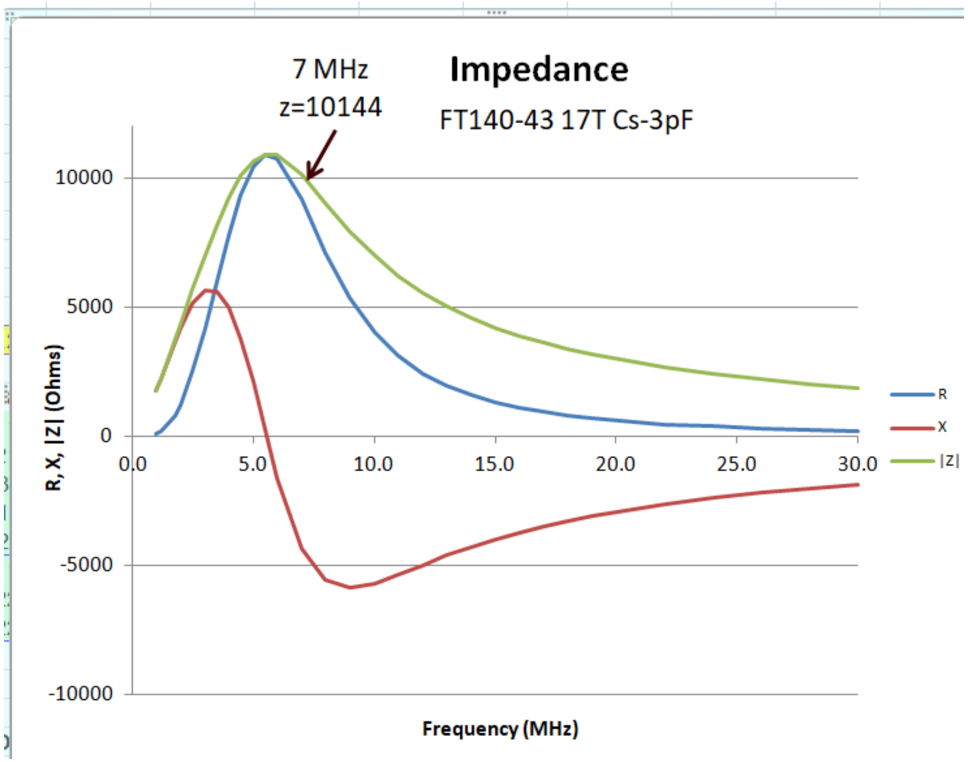
96.9% efficient

- 2 type 61 (40-10m):
- - Digital modes: 250w
- - CW: 658W
- - SSB: 1250W



98.9% efficient
Use with 2 cascaded Guanellas

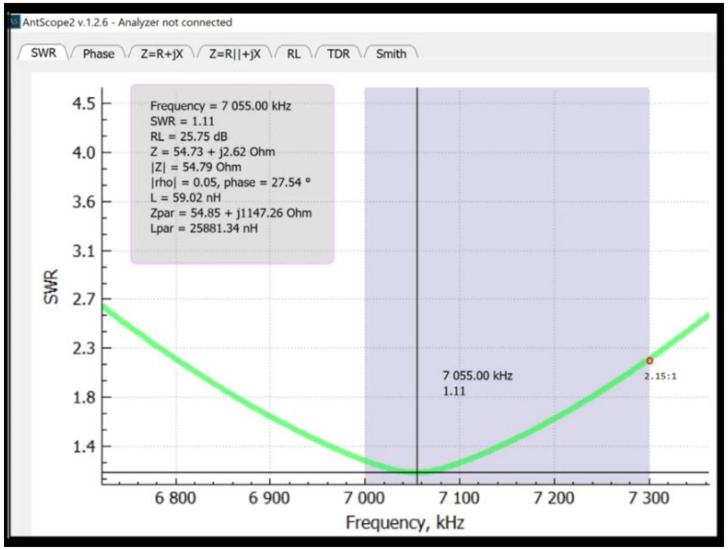
Guanella choke performance
FT140-43 17T common mode impedance plot

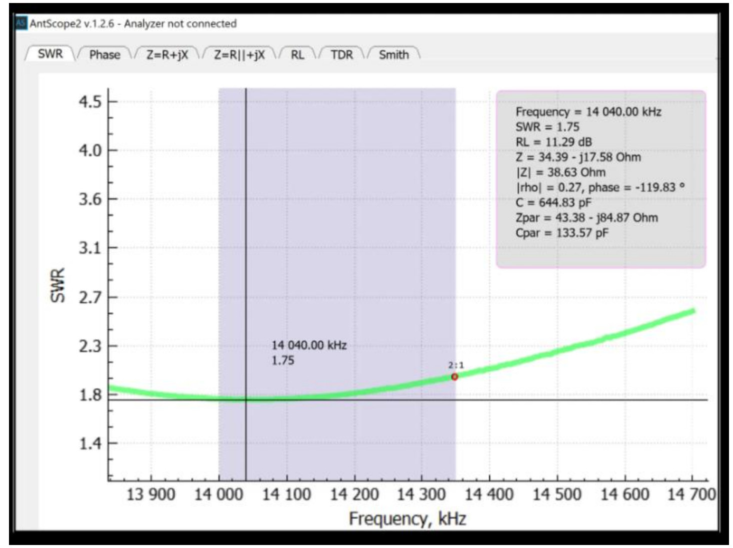


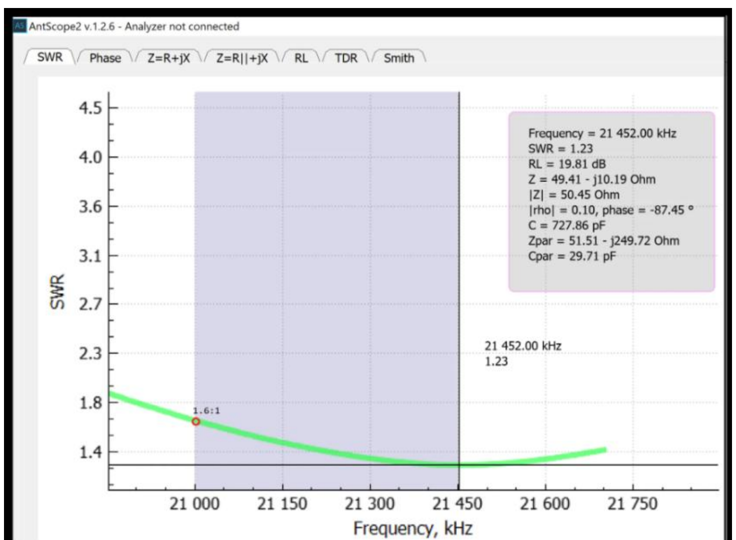
Owen Duffy
Spreadsheet tool
CMC impedance plot

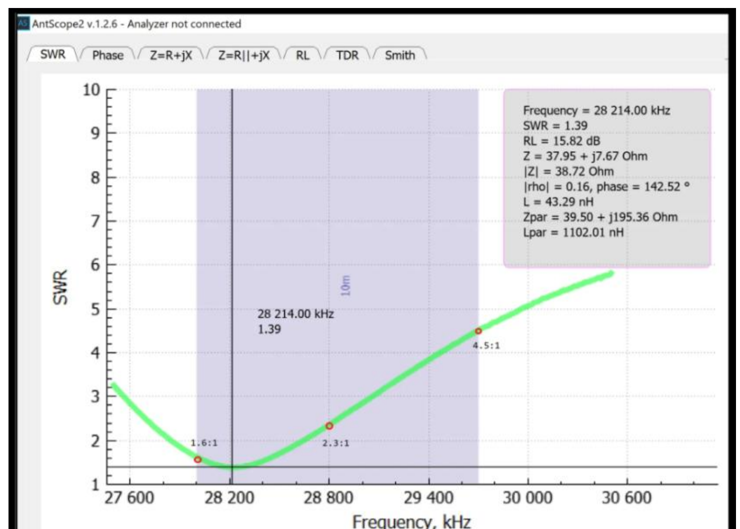
Z = 10,144 ohms
at 7 MHz

VSWR Plots 40M EC-OCFD



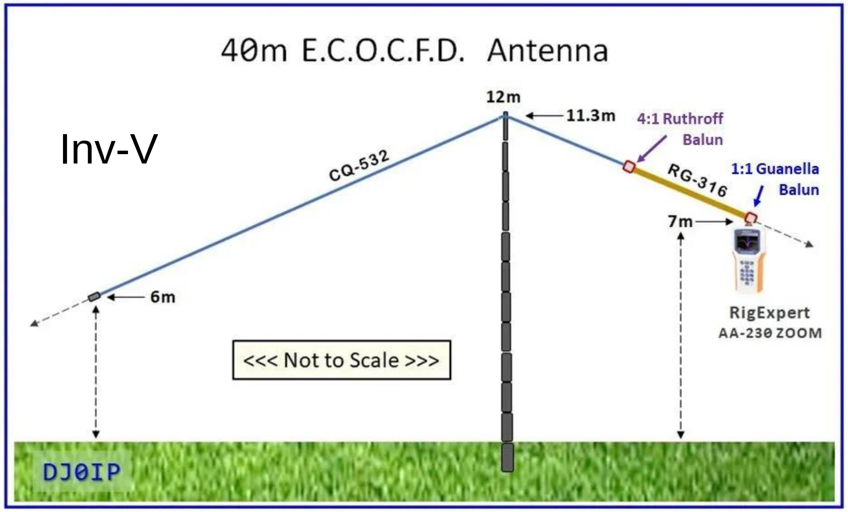


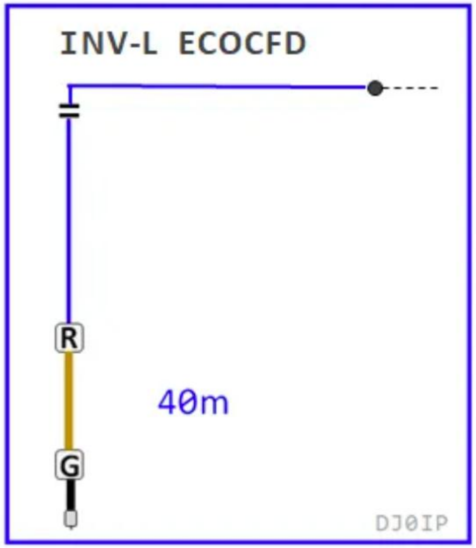


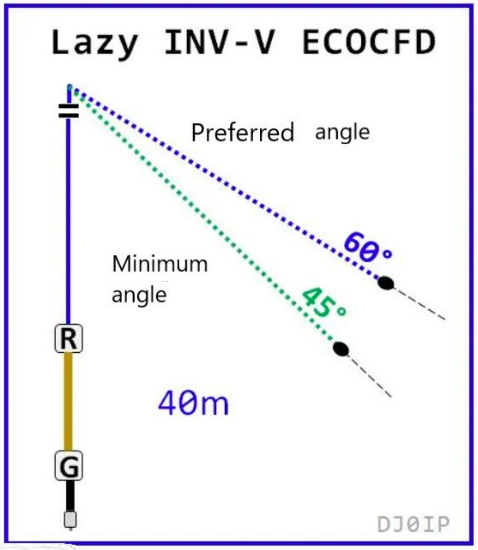


VSWR Plots courtesy DJ0IP

40M EC-OCFD Installation Possibilities





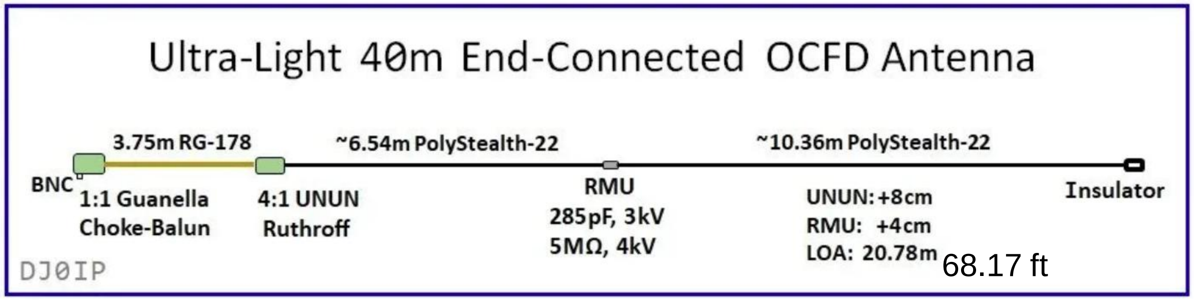


In a nutshell, the two rightmost configurations need only half the space of a horizontal dipole and deliver about the same performance.

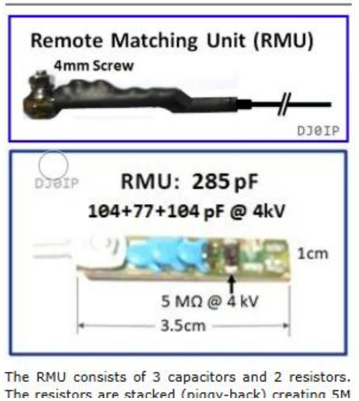
40M EC-OCFD Parts Sources

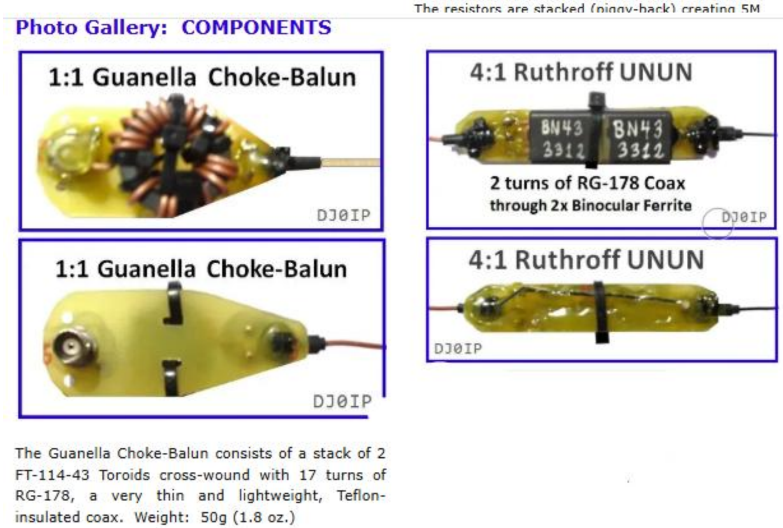
- FT140-43. (Fair Rite 5943002701**,** $3.77 Digikey. Also Mouser, Arrow, Kitsandparts.com
- BN43-7051s (Fair Rite 2843009902,) $5.04 Digikey. Also Mouser, Arrow, kitsandparts.com
- CQ-532 wire: Thewireman.com 50 cents/foot
- Component Sources by Rick Westerman, DJ0IP
- TEFLON-INSULATED WIRE:
  - Here are several sources, no particular order and no personal experience with ordering from any of them:
  - https://bulkwire.com/ptfe-high-temperature-stranded-wire
  - https://www.rfparts.com/tef16.html
  - eBay (search on enamel-insulated wire, look for teflon insulation)
- Enamel-Insulated Wire (Magnet Wire) for Ruthroff
  - Here are several sources, no particular order and no personal experience with ordering from any of them:
  - Remington Industries also available on Amazon
  - eBay (search on Magnet Wire)
- Teflon insulation for magnet wire (for Ruthroff)
  McMaster-Carr - high temperature tube sleeving. Make sure
  ID of tubing >OD of #18 AWG wire (0.047 inches). I used High-Temperature Tube Sleeving, .053" ID (states it is for 16AWG but doesn't fit #16 AWG
- Liquid electrical tape for sealing:
  STAR BRITE Liquid Electrical Tape with Applicator Brush Cap – Amazon

Lightweight EC-OCFD



Courtesy DJ0IP





Choke balun: A stack of 2 FT114-43 (Fair rite 5943001201, **$3.00 Digikey)** with 17 turns RG-178.

It can also be made with a single “double height” FT114-43, Fair Rite P/N 5943001201, **$3.77 Digikey**

Ruthroff:
2 turns of RG-178 through 2X BN43-3312 binocular cores Fair Rite 2843010302 **$1.93 Digikey**

Assembled Lightweight EC-OCFD

Rated:
- 30W digital modes
- 100W CW
- >150 W SSB

This version weighs just 220 grams (7.8 oz.!)

See link for more details:
https://www.dj0ip.com/150w-ecocfd

Components used in a high power EC-OCFD

1kW components used by Mel K6KBE

FT240-31
16T
RG303

8 beads of
Fair-rite
#2631540002
type 31
$1.05 per core

#16 AWG wire

Mounted in
6" mailing tube
Uline
S-12642 tube
S-6225 end caps

Mel ran his version vertical off his 140ft tower

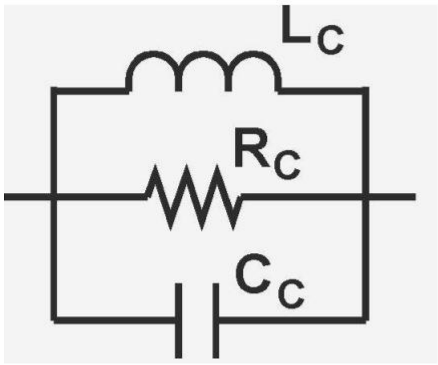
Courtesy Mel Farrer K6KBE and David Cutter G3UNA
https://groups.io/g/ocfd/files/ECOCFD/DIY%20ECOCFDVMARCH23.docx
in https://groups.io/g/ocfd/files Join the OCFD group to read.

The importance of high impedance in the Guanella Choke Balun

- The Guanella choke balun MUST have high impedance in order for the EC-OCFD antenna to work. Use good quality coax with good shield coverage to minimize resistive coax losses.
- See “End Feeding a Center Fed Vertical Dipole”by Jim Brown, K9YC. http://k9yc.com/VerticalDipole.pdf
  and also: k9yc.com/2018Cookbook.pdf Both Contain a wealth of information.
  - Ends of a dipole are high voltage points – High voltage can overheat the choke – Higher choking Z reduces heating – It's the coax shield that gets hot
  - Impedance guidelines from K9YC:
    - For FT240 size toroids at least 15KΩ for 500W – 7.5KΩ for 100W or less, higher Z for long transmit times.
    - Higher choking Z reduces current through the choke, heat is I^2R
    - ● Two chokes divide power between them, and doubles choking Z – Power handling per toroid is reduced to ¼ that of a single toroid!

More on Guanella chokes

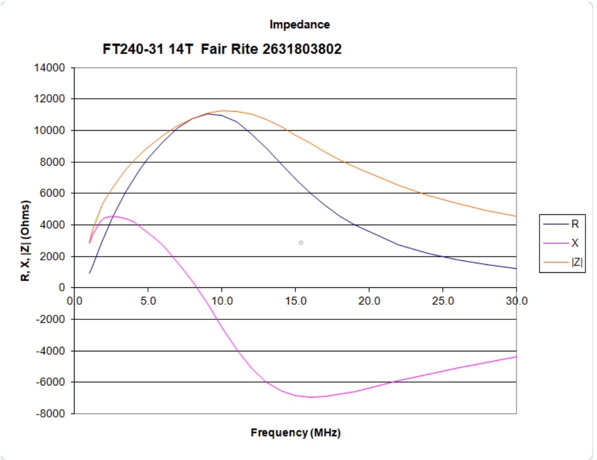
- Simplified electrical model:



All ferrite chokes have a circuit resonance formed by inductance and resistance coupled from the core and parasitic (stray) capacitance between the two ends of the choke. Lc, Rc and Cc describe this circuit resonance. Lc varies with frequency per complex permeability tables.

13-turn (cross-wound) “W1JR”

Represtative Impedance plot single FT240-31 14T

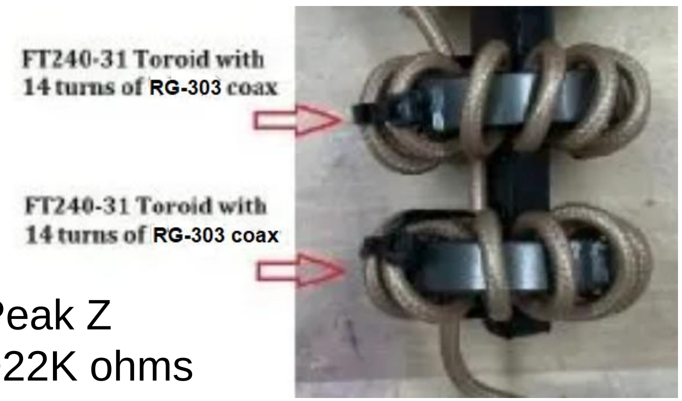


From Owen Duffy Spreadsheet tool

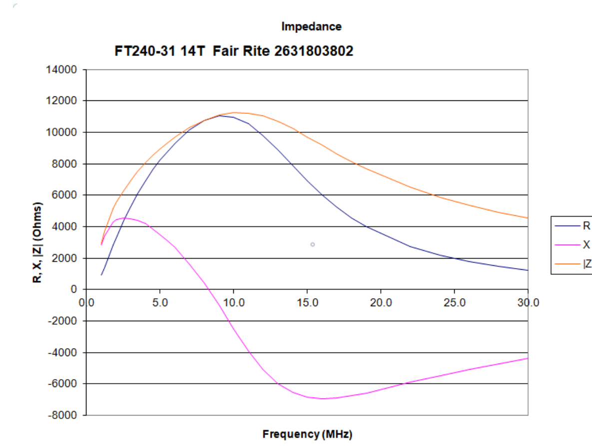
Try to set no. of turns for resonance at the lowest frequency of operation

Common mode chokes used at the K1WAS station- cascaded toroids

- Designed by K1RF, built by David KB1LTW



Peak Z ~22K ohms at ~9MHz



Impedance plot single FT240-31 14T

From Owen Duffy Spreadsheet tool

Excellent performance with triplxer and 3 IC-7300s.

Resonant choke vs. standard choke

- For monoband operation, the resonant choke does not affect theoretical length of halfwave length.
- For a conventional choke, the EC-OCFD will have a shorter length than a conventional OCFD. That's because the initial turns of coax the choke do not have enough impedance to have good choking action and add to the wire length of the EC-OCFD. I found that actual antenna length on 40 meters for an EC-OCFD is about a foot shorter than that used in a conventional 40 meter OCFD. This partially explains Calum's "banana antenna" results. The other part is likely a Guanella choke balun with inadequate choking impedance.

EC-OCFD Vs End Fed Half Wave

Pros EC-OCFD

- Transmission line based transformers are more efficient - >97% compared to EFHW conventional transformer – efficiency ~ 90% at best.
- Lower cost and smaller components for the same power level
- Easier to make higher power antennas
- Fewer issued with common mode - RF in the shack

Cons – EC-OCFD

- Needs expensive and heavy coax compared to wire in the EFHW
- Harder to adjust coax length compared to wire. Can usually adjust the wire by itself.
- Needs a very good high impedance choke balun
- Teflon insulated wire in Ruthroff and lightweight high power coax is expensive

Resource Links

- End Feeding a Center Fed vertical Dipole by Jim Brown K9YC
- The City Windom End Fed Wire Antenna
- The Sleeve Dipole Antenna by FesZ Electronics
- "An end fed center fed 20 meter portable antenna QST Magazine May 2022 pp 30-32" - Phil Salas, AD6X
- "Banana", a Half Wave End-Fed Choked Coax Antenna by Callum McCormick, M0MCX
- 40 meter End Connected Off Center Fed Dipole – Rick Westerman DJ0IP
- Ultra lightweight version -40 meter EC-OCFD - Rick Westerman DJ0IP
- Various antenna presentations on GNARC.org by K1RF
- DIY ECOCFD by Mel Farrer , K6KBE in groups.io/OCFD group. This is a high power low cost EC-OCFD
- Common mode Chokes http://www.karinya.net/g3txq/chokes/
- Component Sources by Rick Westerman, DJ0IP