

28th Feb 2022

MFJ – 911
4:1 current balun
200ohm dipole
antenna's



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The use of the MFJ-911 balun, can be used to create a 200 ohm dipole, connecting as a balanced antenna load.



Each dipole element would have essentially a 400ohm inductive reactance, details of which are illustrated below.

400 ohm inductor for 20m band
Freq = 14 MHz
ind XL = 391.4 ohms
standard dipole = 782 ohms
ind = 4.45 uH
swr = 1.14:1

air wound coil inductor
for inductance of = 4.45uH
Coil diameter = 1 inches or 25.4mm
Coil length = 1 inches or 25.4mm
by diameter = 16.065491 turns
calculation check by radius = 16.065491 turns

Using the radio propagation model, an ideal of how the antenna may perhaps function.

Radio Range Propagation Model - advanced :- By Alastair GW0AJU (date:- 11th Feb 2022)

example :- Yaesu FT450d : R.F. Sen = 0.25uV @ 10dB s/n , I.F. Bw = 2.7KHz, NF = 4.6dB

Bench Sig Gen input references

I.F. Bw KHz R.F. MHz
 RF sens uV Audio dB s/n

Bench Equated RF results

Sens. dBW NF dB
 'S' points

Source Radio 'Tx' Antenna results

antenna dB eff
 Radio Tx dBW
 dBW ' ERP '
 Watts ' ERP '
 Volts ' ERP '
 'S' points ' ERP '

' Info examples '
 Full wave = 471 Ω, 1/2 wave = 236 Ω, 1/4 wave = 118 Ω
 40m wire on 20m band = (40m wire / 20m band) * 471 = 942 Ω
 dipole = 200 Ω, 50 Ω stub = 50 Ω

enter calculate
"Radio Com's"

On Air RF input Variables

RF "Bw" MHz AF dB s/n

On Air Equated RF results

Sens. dBW Sens. uV
 'S' points

' Com's link input variables '

Radio 'Tx' Power Watts Additional Path Loss dB
 'Tx' ant XL ohms 'Rx' ant XL ohms

Com's Signal Link Distance results

Km
 miles
 +/- ' time zone of arc '

min link distance = 1mm
 min Tx power = 1nW @ 50ohm stub antenna
 Try using individual Tx and Rx antenna's.

Destination Radio 'Rx' Antenna results

antenna dB eff
 dBW
 uV
 'S' points

' Info examples '
 Beam antenna = 10*5dBd ' over dipole ' (voltage gain)
 yagi ohms = 10*5dBd - 7*5dB (dipole loss) = 3dB
 yagi ohms = 10*(3 / 20) = 1*41 * 471 = 665 Ω

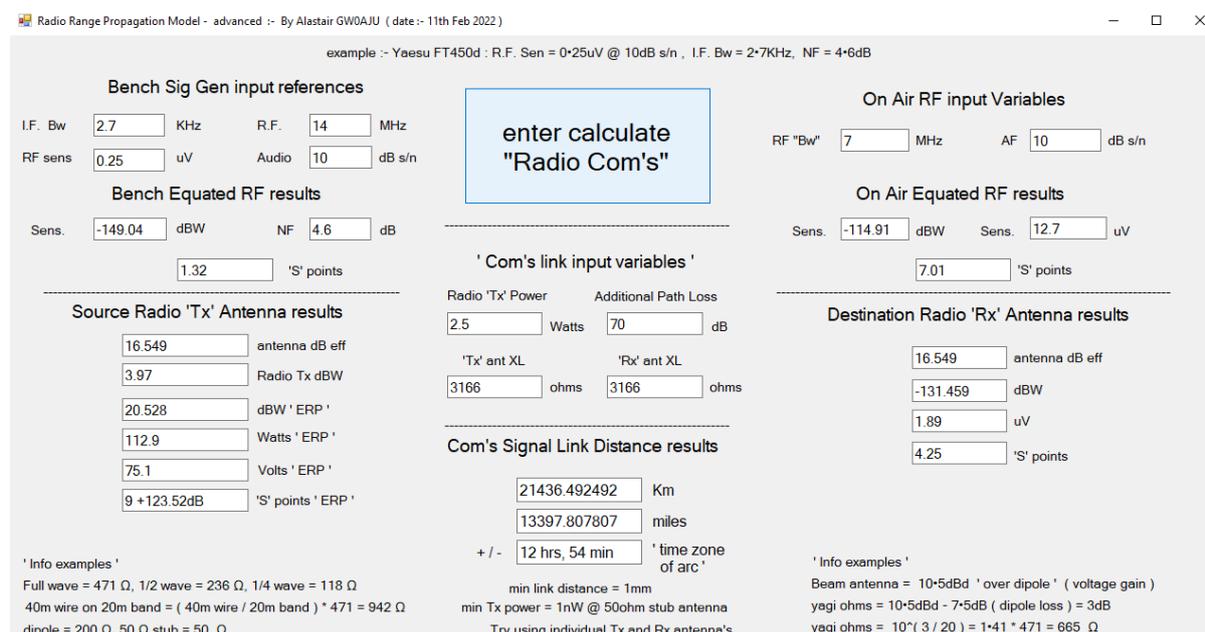
For a cross dipole design, each terminal connector would be connected to two coils, positioned into a “V” shape projecting out from left and right of the MFJ – 911 4:1 current 200ohm balun. Details below illustrate each element with an inductive reactance of essentially 800 ohms.

 air wound coil inductor

for inductance of = 9uH
 Coil diameter = 2 inches or 50.8mm
 Coil length = 1 inches or 25.4mm
 by diameter = 13.0766968 turns
 calculation check by radius = 13.0766968 turns

 400 ohm inductor for 20m band

freq = 14 MHz
 ind XL = 791.6 ohms
 cross dipole = 3166 ohms
 ind = 9 uH
 swr = 1.01:1



Radio Range Propagation Model - advanced :- By Alastair GW0AJU (date :- 11th Feb 2022)

example :- Yaesu FT450d : R.F. Sen = 0*25uV @ 10dB s/n , I.F. Bw = 2*7KHz, NF = 4*6dB

Bench Sig Gen input references

I.F. Bw: 2.7 KHz, R.F.: 14 MHz
 RF sens: 0.25 uV, Audio: 10 dB s/n

Bench Equated RF results

Sens.: -149.04 dBW, NF: 4.6 dB
 1.32 'S' points

Source Radio 'Tx' Antenna results

16.549 antenna dB eff
 3.97 Radio Tx dBW
 20.528 dBW ' ERP '
 112.9 Watts ' ERP '
 75.1 Volts ' ERP '
 9 +123.52dB 'S' points ' ERP '

Com's link input variables '

Radio 'Tx' Power: 2.5 Watts, Additional Path Loss: 70 dB
 'Tx' ant XL: 3166 ohms, 'Rx' ant XL: 3166 ohms

Com's Signal Link Distance results

21436.492492 Km
 13397.807807 miles
 +/- 12 hrs, 54 min ' time zone of arc '
 min link distance = 1mm
 min Tx power = 1nW @ 50ohm stub antenna
 Try using individual Tx and Rx antenna's.

On Air RF input Variables

RF "Bw": 7 MHz, AF: 10 dB s/n

On Air Equated RF results

Sens.: -114.91 dBW, Sens.: 12.7 uV
 7.01 'S' points

Destination Radio 'Rx' Antenna results

16.549 antenna dB eff
 -131.459 dBW
 1.89 uV
 4.25 'S' points

' Info examples '

Full wave = 471 Ω, 1/2 wave = 236 Ω, 1/4 wave = 118 Ω
 40m wire on 20m band = (40m wire / 20m band) * 471 = 942 Ω
 dipole = 200 Ω, 50 Ω stub = 50 Ω

Beam antenna = 10*5dBd ' over dipole ' (voltage gain)
 yagi ohms = 10*5dBd - 7*5dB (dipole loss) = 3dB
 yagi ohms = 10*(3 / 20) = 1*41 * 471 = 665 Ω

It maybe worth noting the transmitter power output, expressed as an average wattage. With my Yaesu FT450d, I added an external mic gain control circuit, running off from the radio's mic socket 5Volt supply. The idea was to vary the radio transmitter power output without digging back into the radio settings.

I found while using an analogue power meter, setting the radio to 100Watts, the analogue power meter registered the radio at an average 50Watts, where from the transmitter output when voice is added to the carrier, the analogue power meter reads up from 50Watts to a peek of 100Watts.

This is interesting, as any propagation models would need to include the transmitter power as an average value. The 50Watts average to a 100Watts peek, is thus the voice signal of the transmission.

The standard dipole, propagation model, averages a radio transmitter of 100Watts, which would be a peek of a 200Watt radio transmitter.

The cross dipole, propagation model, has an average of 2.5Watts, which would be a 5Watt peek transmitter output, or a QRP radio.

Each propagation model result is based upon both radio hams at each end using the MFJ – 911 200ohm dipole, be a standard or cross dipole design.