A 3-Element Wire Yagi Design for 10.1373 MHz

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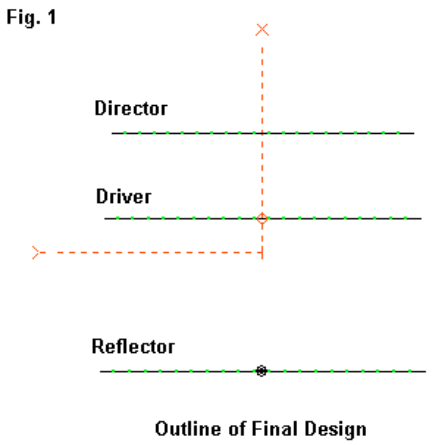
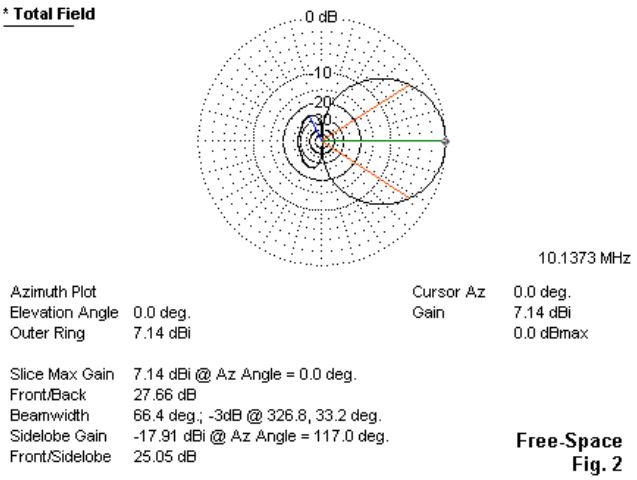
Specifications:
1. Antenna wire: #13 Silky (Wireman): wire diameter: 0.0795", insulation 0.02" polyethylene (dielectric constant 2.25)
2. Operating frequency: 10.1373 MHz
3. Target feedpoint impedance: 50 Ω
4. Target free-space gain: 7 dBi
5. Target front-to-back ratio: 20 dB

Note: the use of insulated wire shortens the dimensions and requires other design adjustments relative to a bare-wire version of the same antenna. The last part of these notes provides information on a bare-wire version of the antenna for comparison.





The outline of the antenna appears in **Fig. 1** above. **Fig. 2** shows the free-space modeled data for the antenna. The wide spacing between the reflector is required to obtain the desired impedance. It can be widened further to raise the impedance closer to 50 Ω, although initial figures are entirely satisfactory. The following table provides the dimensions in feet.

Dimensions	Spacing from Reflector	Total Element Length
Reflector	0	48.20
Driver	22.55	46.84
Director	35.15	44.50

Free-Space Data	Gain	Front-Back	Beamwidth	Impedance	50-Ω SWR
	7.14 dBi	27.66 dB	66.4°	43.3 - j1.9 Ω	1.16:1

Over ground at a height of 48.5' (1/2λ), the array provides the modeled data shown in **Fig. 3** and in the follow data table.

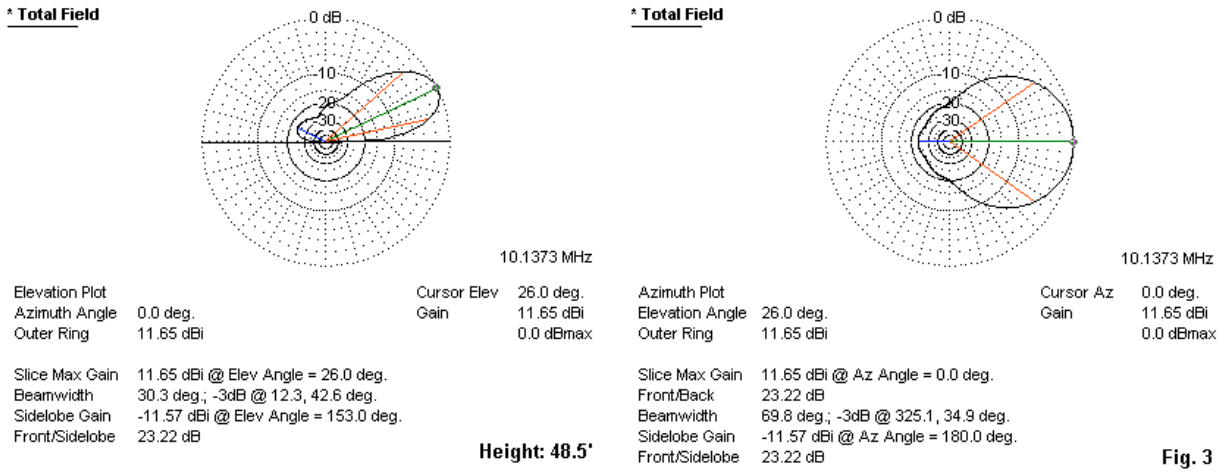


Fig. 3

1/2λ Data	Gain	TO Angle	Front-Back	Beamwidth	Impedance	50-Ω SWR
	11.65 dBi	26°	23.22 dB	69.8°	40.8 - j1.8 Ω	1.23:1

Some adjustment of the antenna dimensions may be inevitable, since wire element construction usually involves a fold-back of the wire at each element tip. The short fold-back length will have a larger effective diameter than the remaining wire and may call for slight wire shortening. As well, terrain features may interact with the array and call for adjustment of element lengths in either direction.

The most useful procedure to follow is to build the beam with some excess wire in the fold-back. Once in place, check the feedpoint impedance. If the SWR is very close to 1:1, the antenna needs no adjustment. If the driver needs adjustment to reduce the SWR (reactance as close to zero as possible), then adjust the reflector and director by corresponding amounts.

The Bare-Wire Version: Insulation has a considerable affect on element length. The following dimensions apply to a bare-wire version of the antenna with equivalent performance. Note not only the longer elements, but also the smaller reflector-to-driver spacing for the same free-space performance.

Dimensions	Spacing from Reflector	Total Element Length
Reflector	0	48.80
Driver	17.55	47.50
Director	30.20	45.00

Free-Space Data	Gain	Front-Back	Beamwidth	Impedance	50-Ω SWR
	7.12 dBi	26.30 dB	65.8°	44.5 - j0.5 Ω	1.12:1

EZNEC model descriptions follow.

3L 30M wire Yagi- insulated wire

--------------- ANTENNA DESCRIPTION ---------------

Frequency = 10.1373 MHz
Wire Loss: Aluminum (6061-T6) -- Resistivity = 4E-08 ohm-m, Rel. Perm. = 1

--------------- WIRES ---------------

No.	End 1 Conn.	Coord. (ft) X	Y	Z	End 2 Conn.	Coord. (ft) X	Y	Z	Dia (in)	Segs	Insulation Diel C	Thk(in)	Loss Tan
1	•	0,	-24.1,	48.5	•	0,	24.1,	48.5	0.0795	21	2.25	0.02	0
2	•	22.55,	-23.42,	48.5	•	22.55,	23.42,	48.5	0.0795	21	2.25	0.02	0
3	•	35.15,	-22.25,	48.5	•	35.15,	22.25,	48.5	0.0795	21	2.25	0.02	0

Total Segments: 63

--------------- SOURCES ---------------

No.	Specified Pos. Wire #	% From E1	Actual Pos. % From E1	Seg	Amplitude (V/A)	Phase (deg.)	Type
1	2	50.00	50.00	11	1	0	V

No loads specified
No transmission lines specified
Ground type is Real, High-Accuracy

--------------- MEDIA ---------------

No.	Cond. (S/m)	Diel. Const.	Height (ft)	R Coord. (ft)
1	0.005	13	0	0

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3L 30M wire Yagi - bare wire

--------------- ANTENNA DESCRIPTION ---------------

Frequency = 10.1373 MHz
Wire Loss: Aluminum (6061-T6) -- Resistivity = 4E-08 ohm-m, Rel. Perm. = 1

--------------- WIRES ---------------

No.	End 1 Conn.	Coord. (ft) X	Y	Z	End 2 Conn.	Coord. (ft) X	Y	Z	Dia (in)	Segs	Insulation Diel C	Thk(in)	Loss Tan
1	•	0,	-24.4,	48.5	•	0,	24.4,	48.5	0.0795	21	1	0	0
2	•	17.55,	-23.75,	48.5	•	17.55,	23.75,	48.5	0.0795	21	1	0	0
3	•	30.2,	-22.5,	48.5	•	30.2,	22.5,	48.5	0.0795	21	1	0	0

Total Segments: 63

--------------- SOURCES ---------------

No.	Specified Pos. Wire #	% From E1	Actual Pos. % From E1	Seg	Amplitude (V/A)	Phase (deg.)	Type
1	2	50.00	50.00	11	1	0	V

No loads specified
No transmission lines specified
Ground type is Real, High-Accuracy

--------------- MEDIA ---------------

No.	Cond. (S/m)	Diel. Const.	Height (ft)	R Coord. (ft)
1	0.005	13	0	0