SLVARC
2018 FD
Phone Station
80m/40m Antenna

Design Objectives

Gain and Directionality

Reasonable Electrical Characteristics

Simplicity

Re-use existing materials

Break-down wire spooling

Tree-end pulley for tensioning

Design Features

Two Bands – 80m and 40m

450 ohm feed point

Extended Zepp per Band

Based on last year long-wire
Mid-span capacitive loading
80m tip bent down

Stacked Zepp

Fed with 450 ohm half-twist (phase invert)

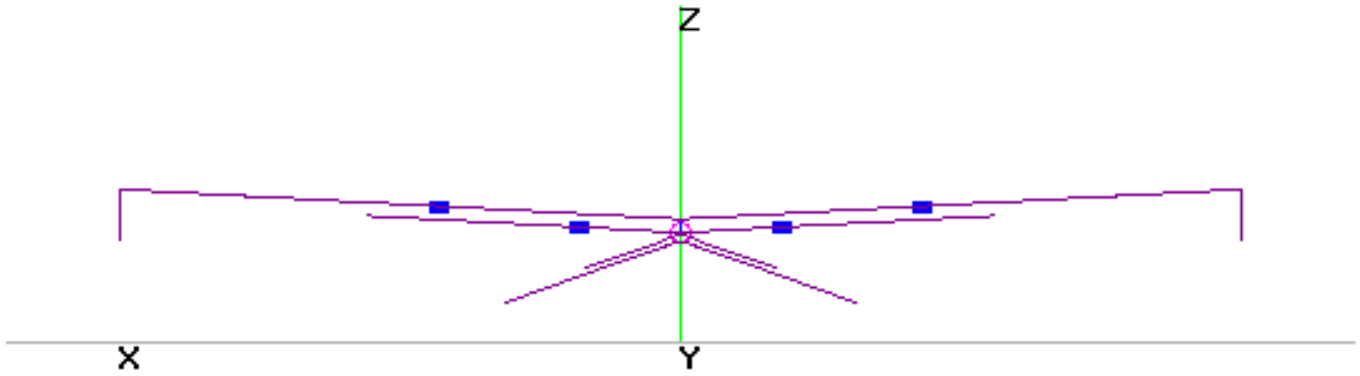
Director elements

Inverted Vee
Lay out on sloping front stay-line

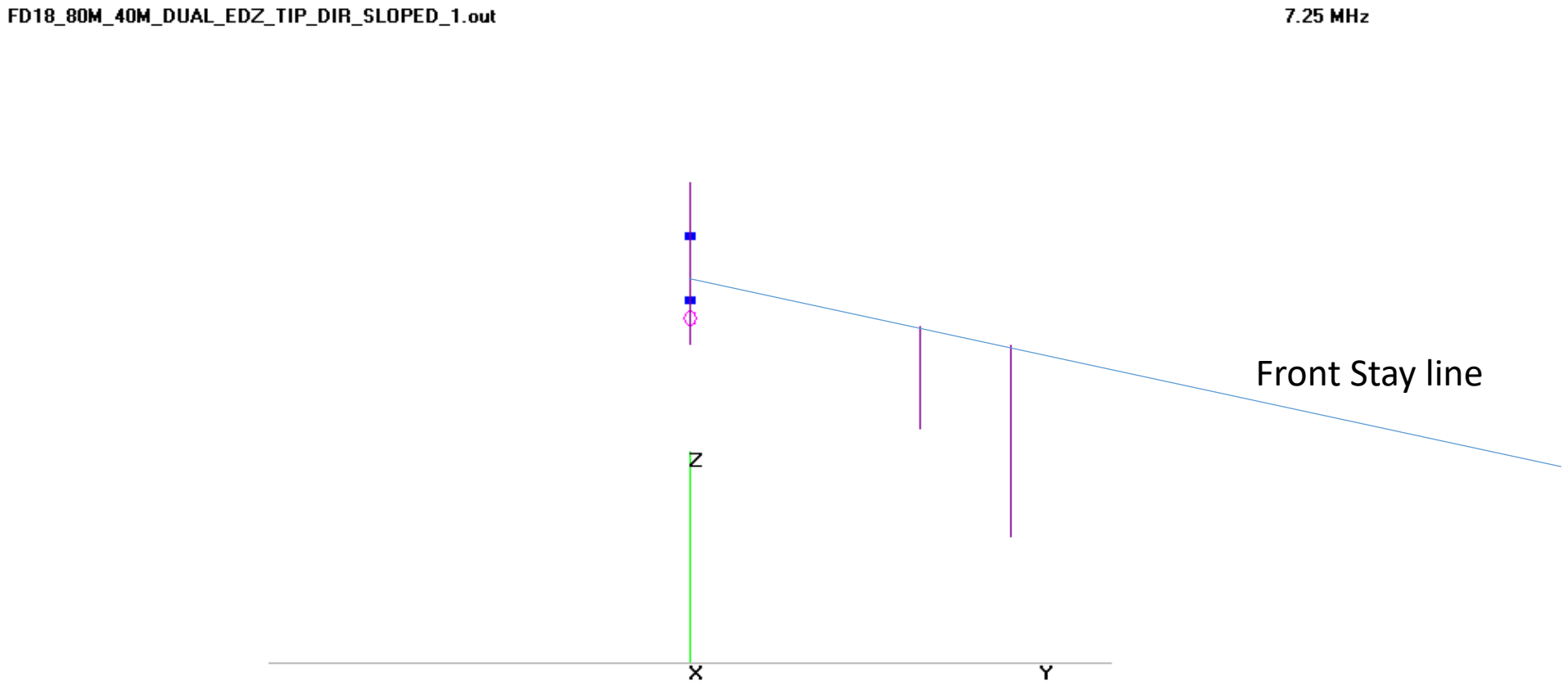
Layout – from East

FD18_80M_40M_DUAL_EDZ_TIP_DIR_SLOPED_1.out

7.25 MHz

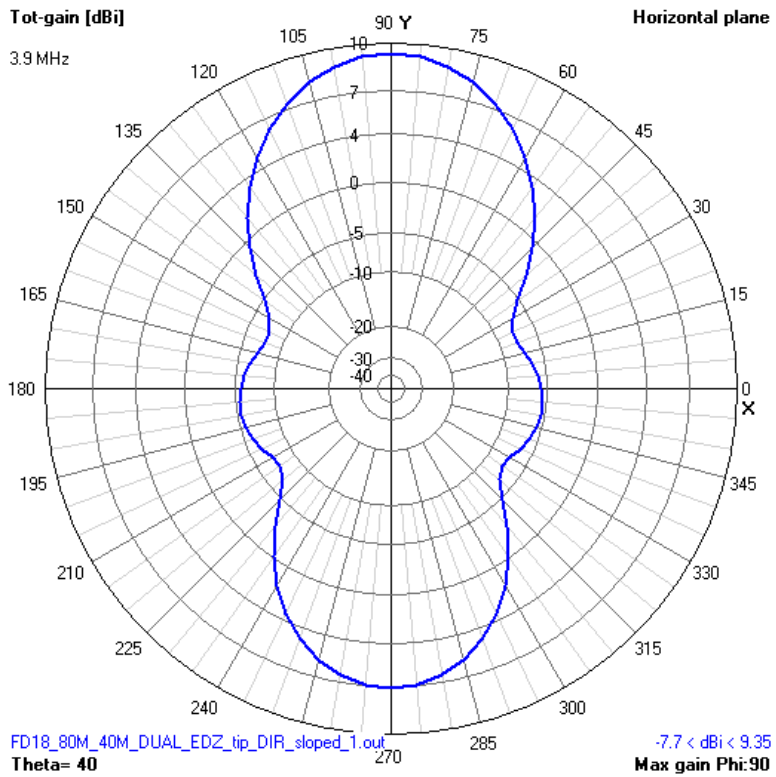


Layout – from South

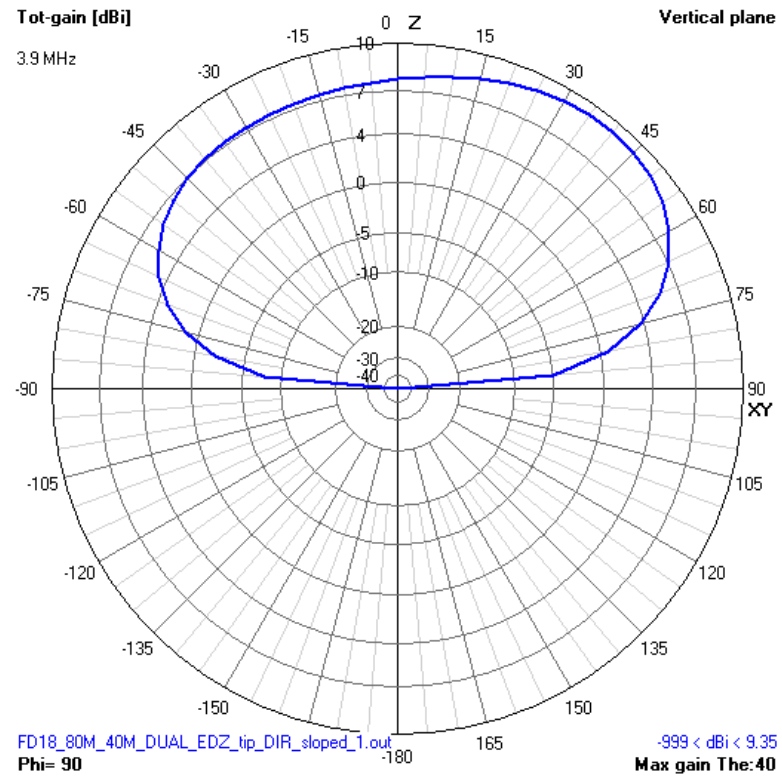


80m patterns

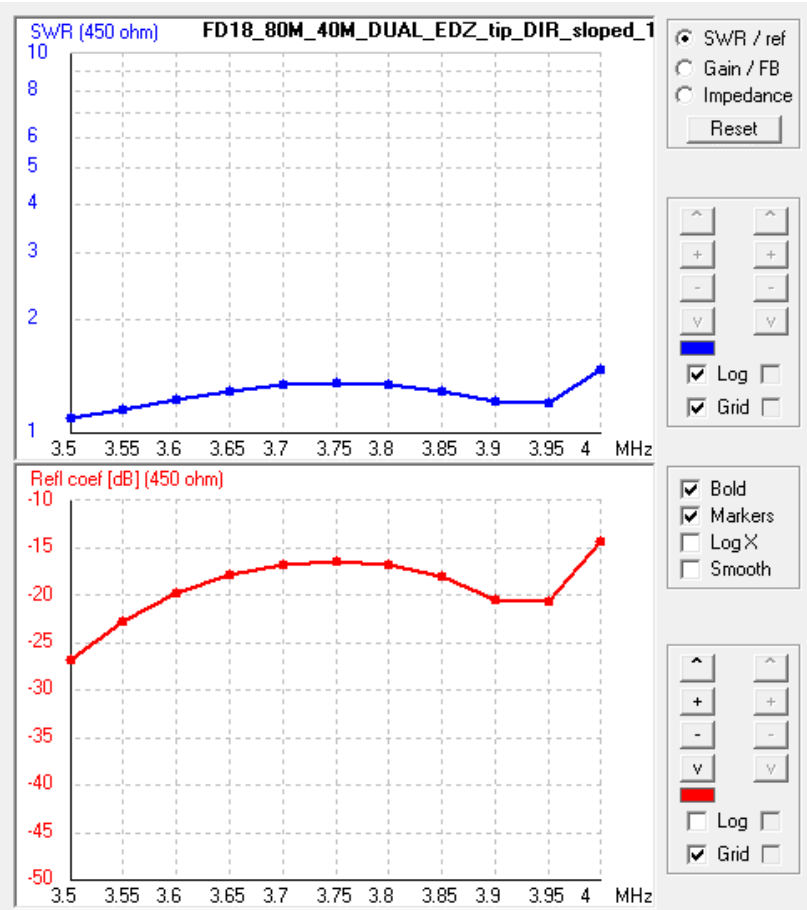
Horizontal

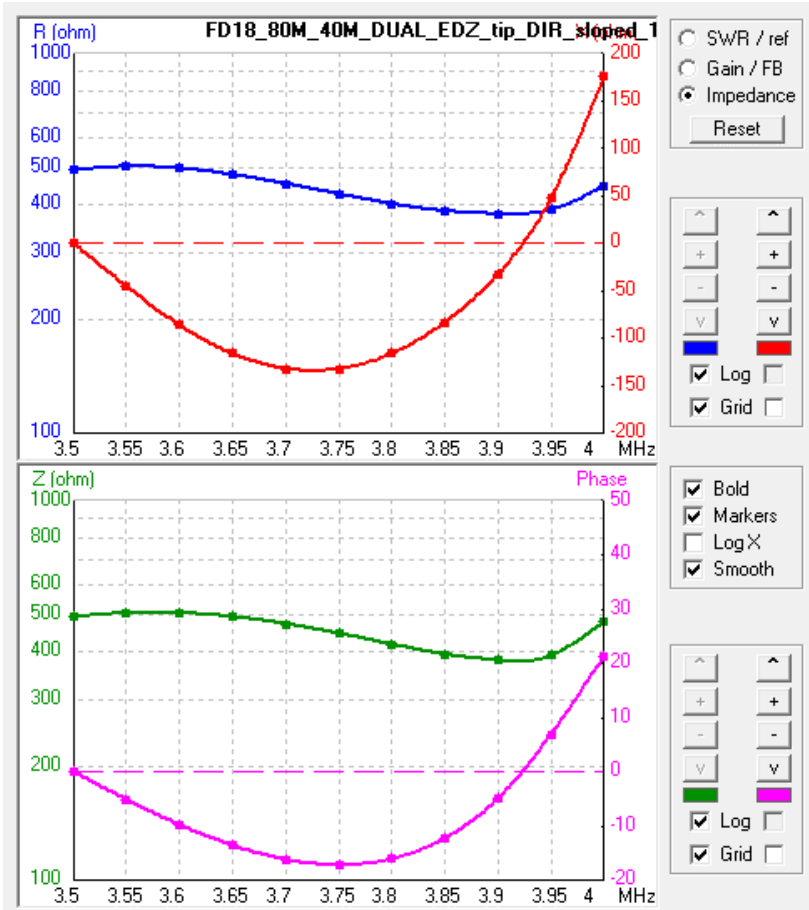


Verical



80m Characteristics

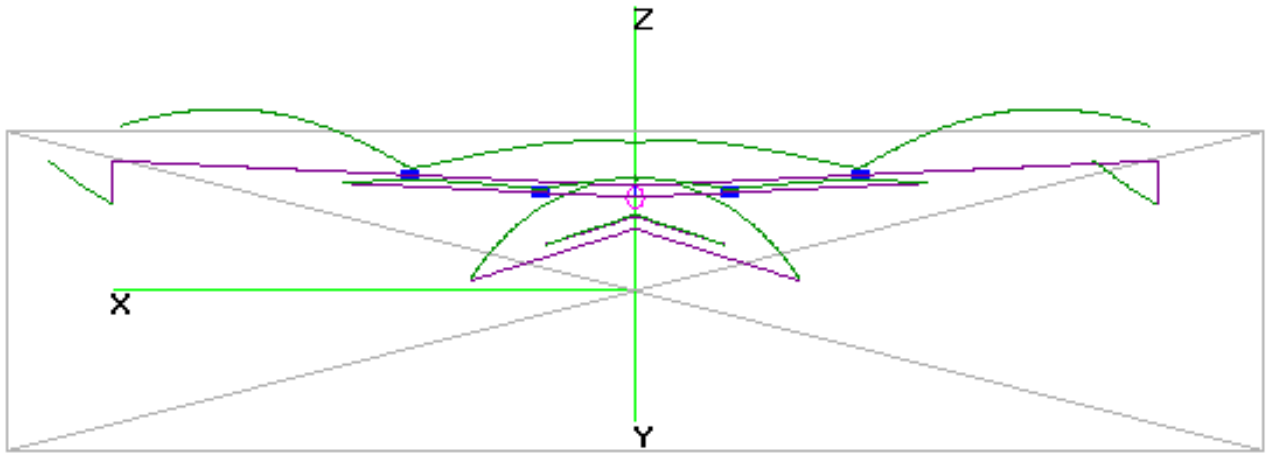




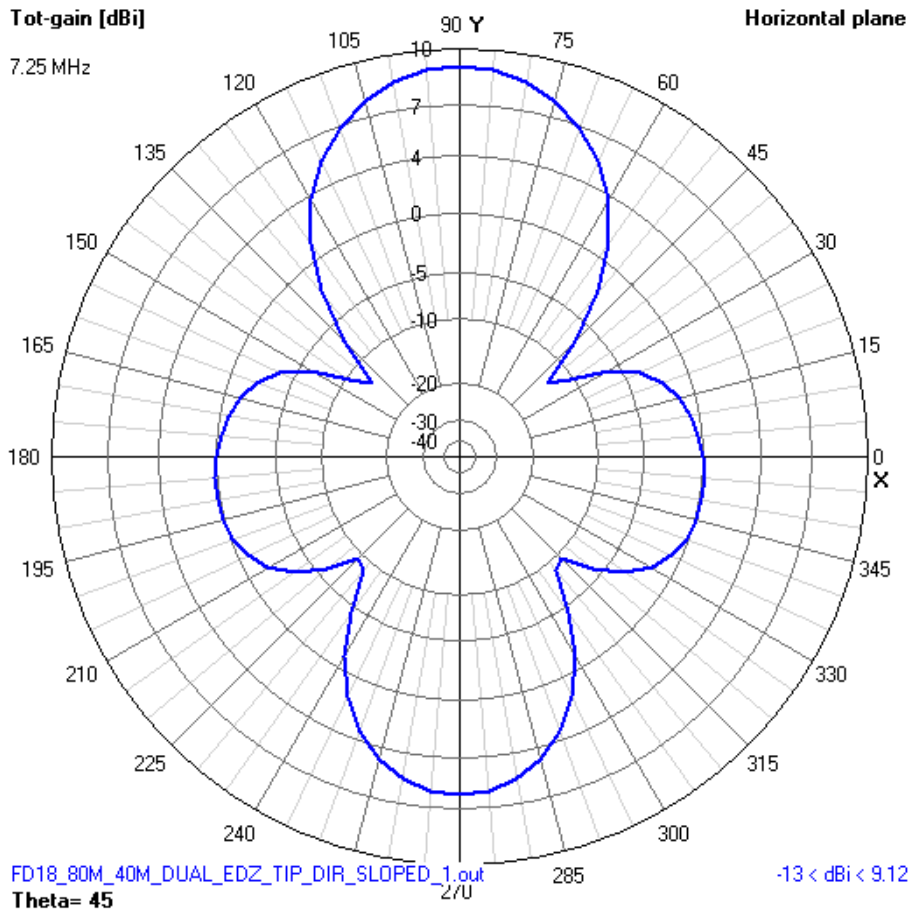
80m currents

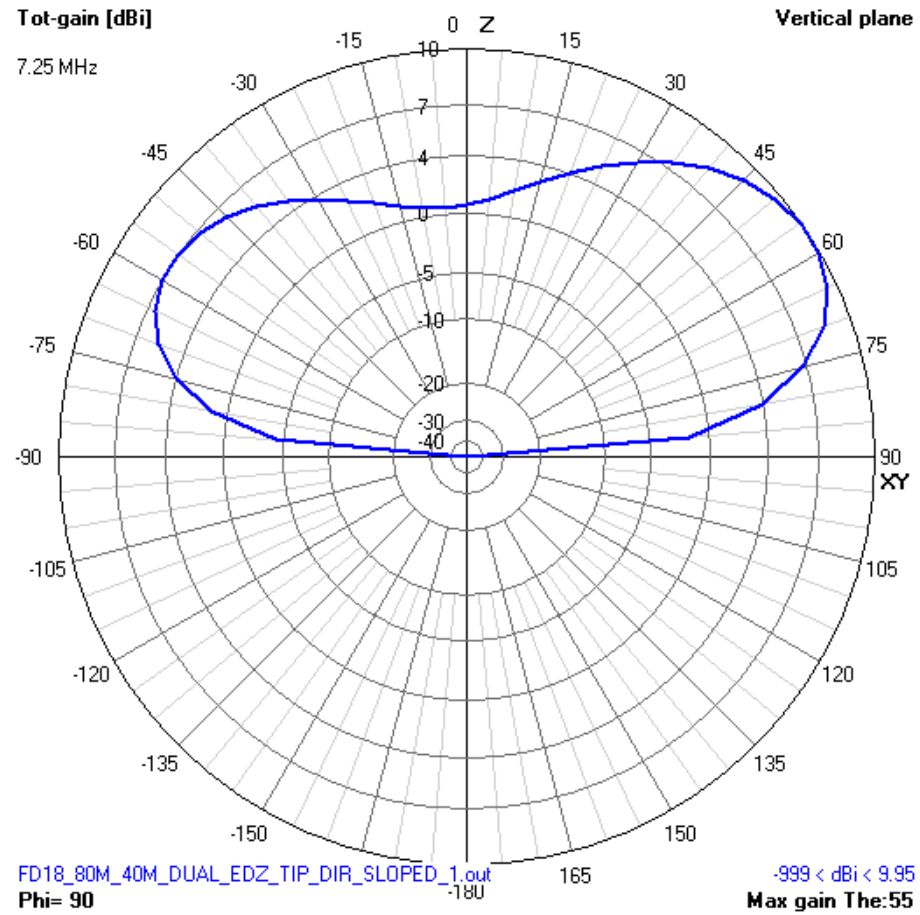
FD18_80M_40M_DUAL_EDZ_tip_DIR_sloped_1.out

3.9 MHz

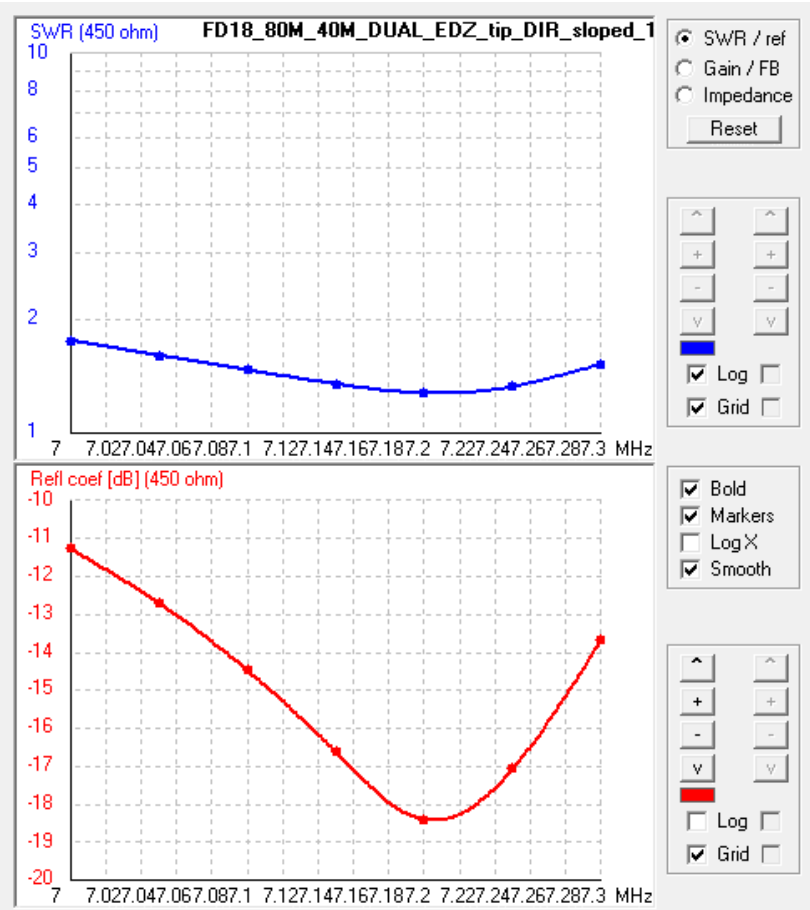


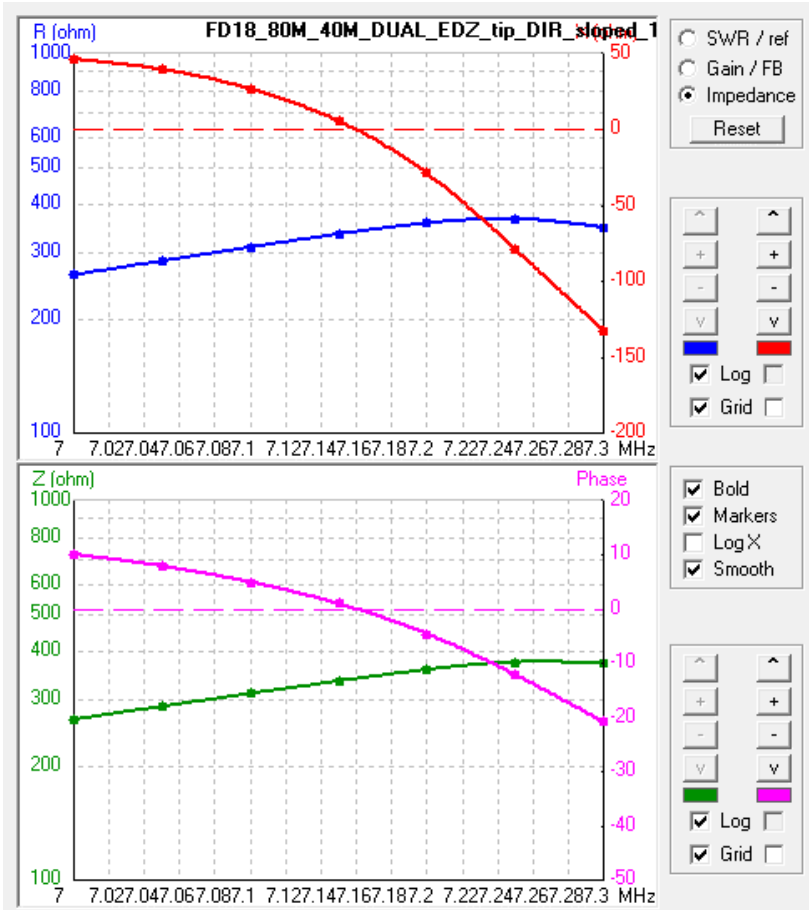
40m patterns





40m characteristics

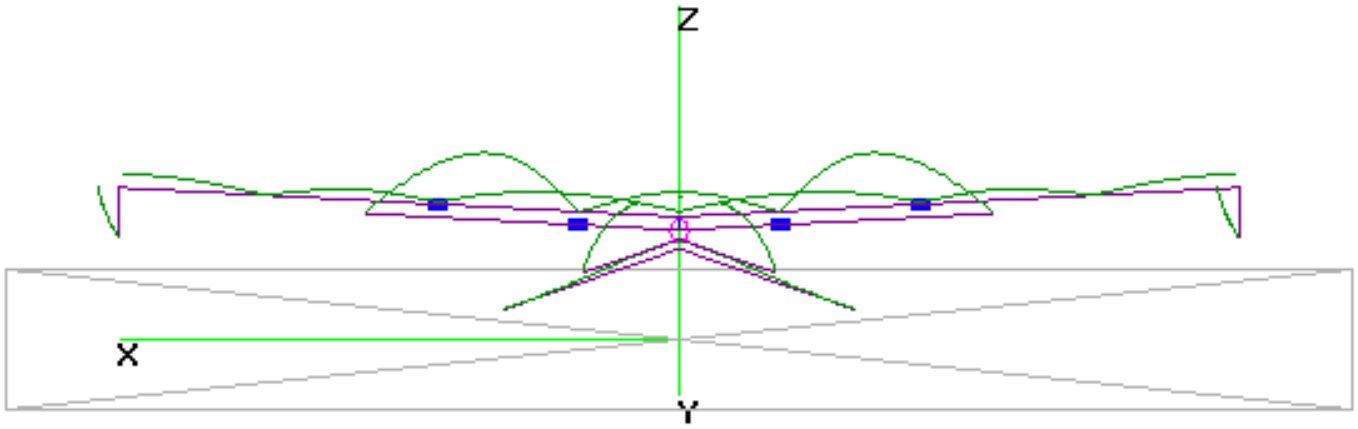




40m currents

FD18_80M_40M_DUAL_EDZ_TIP_DIR_SLOPED_1.out

7.25 MHz



Interesting take-aways

Parasitic relationships broaden and smooth B/W

Height from ground impacts F/B and Z

Relatively stable in face of delta (angles, heights)

Simple construction and set-up

Design – How done

- 4NEC2 tool
- parameterized coding
  - 18 parameters
  - Trig functions
- Extensive use of GENETIC tooling
  - Goal oriented (Z, FB, GAIN)
  - Varying selected parameters
- Step-wise attack
  - 80 zepp, 40 zepp, 80+40 separation, 80 dir, 40 dir
  - Mix different variants to find balance
- Fine-tune using OPT
- Visualizations

Computation

- Asus ROG
  - i7-4700HQ 2.4 GHz
  - 32GB RAM
  - Win10 64bit
- Time
  - 7 days
  - 8 hours/day
- 4NEC2 is single-thread app

4nec2 Source

General Parameters

- CM derived from FD18_80M_40M_DUAL_EDZ_3mrg8_midZ-450ohm_3_1
- CM directors on front-facing (sloping) stay line, each are inverted Vee structure

- SY SEG = 4 ‘4nec2 modeling segments per foot

- SY H=60ft **'height** of ends of 80m wires (trees)
- SY DD=6.5ft '80/40 **vert spacing**

- SY WIRE = #14 ‘antenna wire size
- SY THETA=-5 **'droop** angle of zepp from trees at each end
- SY CD=.5ft ' mid-span connx length

- SY TP=0.42 **'tip** length as **pct of H**

80m Zepp

- CM 80m element
- SY TL = H * TP 'tip is pct of H -- limits excursion so not touch ground
- SY L=70.65407ft ‘inner length
- SY L1=118.9805ft ‘outer length
- SY L1T=L1-TL ‘outer tip drop length
- SY LOAD=9e-12 ‘mid-span load -- capacitance

- CM ---- 80m Zepp calc ---- droops calculated
- SY WDX = L * cos(THETA) 'sub L out from base'
- SY WDZ = H - (L * sin(THETA)) 'sub L down from top'
- SY WDX1T = WDX + (L1T * cos(THETA)) 'outer wire up to tip drop
- SY WDZ1T = WDZ - (L1T * sin(THETA)) 'at tip drop

40m Zepp

- CM 40m element
- SY M=29.55105ft ‘inner
- SY M1=63.18827ft ‘outer
- SY LOADM=7.48e-12 ‘mid-span capacitance

- CM ---- 40m Zepp calc ---- droop calculations
- SY MDX = M * cos(THETA)
- SY MDZ = H - DD - (M * sin(THETA))
- SY MDX1 = MDX + (M1 * cos(THETA))
- SY MDZ1 = MDZ -(M1 * sin(THETA))

Director Elements

- CM Director calculations
- CM elements spaced in front of Zepp (Y-axis)
- CM apex of each director measured down the front-stay slope

- SY GAMMA=-20 'slope angle from apex of Zepp to front anchor
- SY SIGMA=-30 'slope angle of inv-Vee for each director

Note: some flexibility in angles has minimal impact !

80m Director

- SY DB80=30.02147ft 'horz distance to 80m director
- SY DL80=59.56284ft 'length of one side of 80 dir

- SY R80=DB80/cos(GAMMA) 'distance to 80m elt down front-stay
- SY DH80=H+R80*sin(GAMMA) ‘ht along front-stay for 80m apex
- SY DLX80=DL80*cos(SIGMA) 'x offset of 80m Vee end
- SY DLZ80=DL80*sin(SIGMA) 'z offset ...
- SY HD80T=DH80+DLZ80 'ht of Vee apex

40m Director

- SY DB40=21.4708ft 'horiz distance to 40m director
- SY DL40=32.06398ft 'length of one side of 40 dir

- SY R40=DB40/cos(GAMMA) 'distance to 40m elt along front-stay
- SY DH40=H+R40*sin(GAMMA) 'ht along front-stay for 40m apex
- SY DLX40=DL40*cos(SIGMA) 'x offset of 40m Vee end
- SY DLZ40=DL40*sin(SIGMA) 'z offset ...
- SY HD40T=DH40+DLZ40 'height of Vee apex

80m Wires

• cm	tag	seg	x0	y0	z0	x1	y1	z1	size	
• CM	80m element									
• GW	10	L*SEG	CD	0	H	WDX	0	WDZ	WIRE	' inner element
• GW	20	L1*SEG	WDX	0	WDZ	WDX1T	0	WDZ1T	WIRE	'outer element
• GW	25	TL*SEG	WDX1T	0	WDZ1T	WDX1T	0	WDZ1T-TL	WIRE	' tip dropdown
• GM	1	1	0	0	**180**	0	0	0	10	' rot/dup x 2
• cm	80m director									
• GW	26	DL80*SEG	-CD	DB80	DH80	-CD-DLX80	DB80	HD80T	WIRE	' 80m director
• GW	27	DL80*SEG	CD	DB80	DH80	CD+DLX80	DB80	HD80T	WIRE	' 80m director
• GW	160	3	-CD	DB80	DH80	CD	DB80	DH80	WIRE	' center tie

40m Wires

CM	40m element									
CM	tag	seg	x0	y0	z0	x1	y1	z1	size	
GW	30	M*SEG	CD	0	H-DD	MDX	0	MDZ	WIRE	'inner element
GW	40	M1*SEG	MDX	0	MDZ	MDX1	0	MDZ1	WIRE	'outer element
GM	1	1	0	0	180	0	0	0	30	' rot/dup x2

cm	'40m director									
GW	28	DL40*SEG	-CD	DB40	DH40	-CD-DLX40	DB40	HD40T	WIRE	' 40m director
GW	29	DL40*SEG	CD	DB40	DH40	CD+DLX40	DB40	HD40T	WIRE	' 40m director
GW	161	3	-CD	DB40	DH40	CD	DB40	DH40	WIRE	'center tie

Links and Loads

- GW 140 3 -CD 0 H CD 0 H WIRE '80m crosslin
- GW 150 3 -CD 0 H-DD CD 0 H-DD WIRE '40m crosslink
- GE 1

- LD 0 20 1 1 0 0 LOAD '80m
- LD 0 21 1 1 0 0 LOAD '80m

- LD 0 40 1 1 0 0 LOADM '40m
- LD 0 41 1 1 0 0 LOADM '40m

- TL 140 2 150 2 -450 'links both driven centers, twist for 180 degree phase

Excitation

- EX 0 150 2 0 1 ‘lower 40m center
- GN 2 0 0 0 13 0.002 ‘gnd: mountains
- FR 0 5 0 0 3.8 .1 ‘80m default
- 'FR 0 6 0 0 7.2 .05 ‘40m
- EN