ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

80m
Quick Study

Receiving Antenna Size vs Performance

v01

Jukka OH6LI

Design Target:
to receive better than a full size GP

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

- 80m Full Size GP as reference

- Task:
  Quick study to tell how a simple and affordable receiving antenna gives performance over the Full Size GP

Design Target:
to receive better than a full size GP

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

How to measure the performance

Design Target:
to receive better than a full size GP

- New receiving Antenna Performance Measure: Minimum Discernible Signal

Design Target:
to receive better than a full size GP

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

- New receiving Antenna Performance Measure: Minimum Discernible Signal
  - Excel tool: Dan AC6LA
  - Algorithm: Jukka OH6LI
  - Ideas, clarifications: Markku OH2RA

Design Target:
to receive better than a full size GP

- New receiving Antenna Performance Measure: Minimum Discernible Signal

- Noise Margin as secondary measurable

Design Target:
to receive better than a full size GP

- New receiving Antenna Performance Measure:
  Minimum Discernible Signal

- Calculation based on:
  Antenna peak gain
  Antenna average gain
  QTH noise level - source ITU P.372-13, Figure 10
  Feed system losses
  RX noise figure

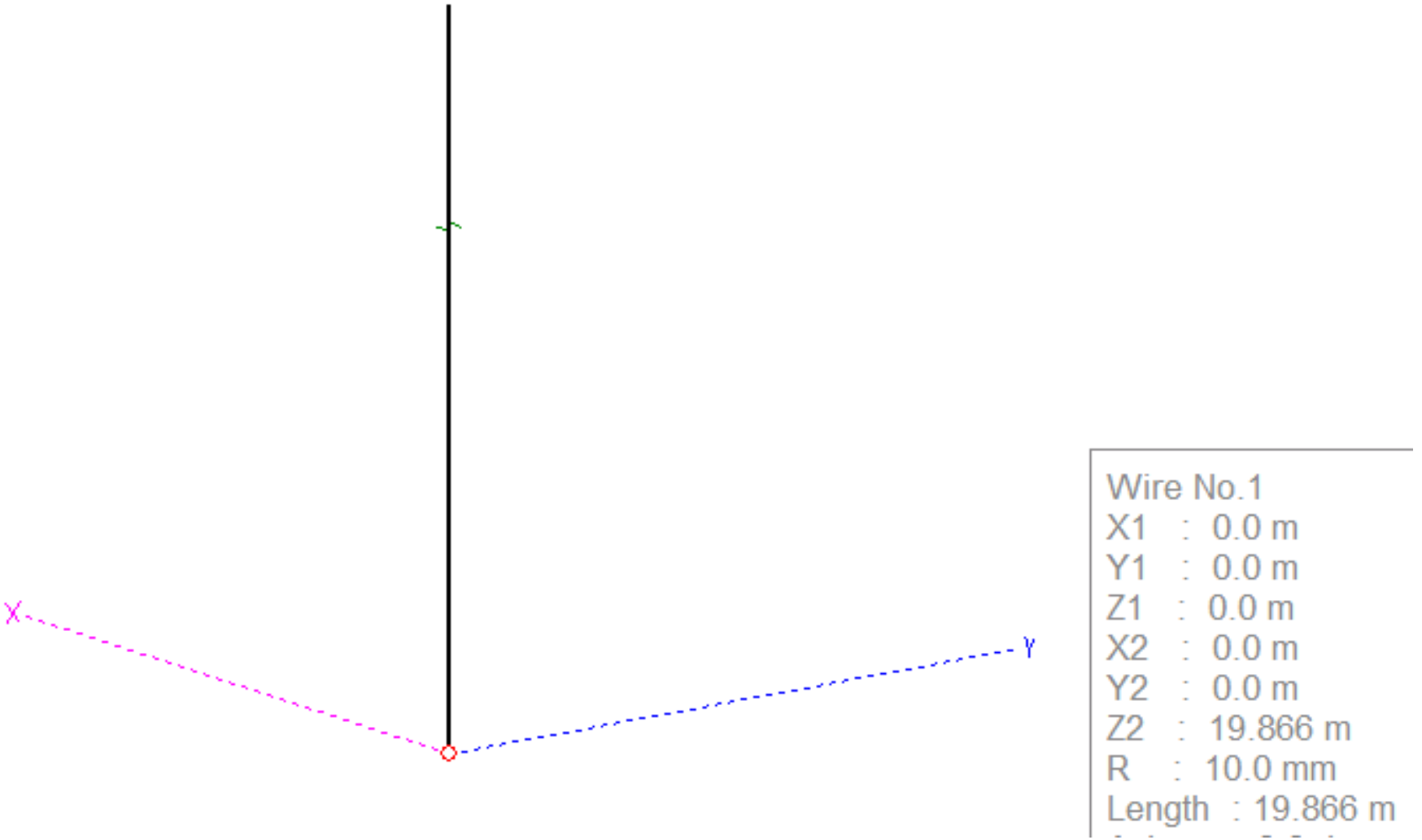
ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Reference: GP on 80m

- Feed at ground level, apex 19.87m
- Wire diameter 20mm copper
- Real ground

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

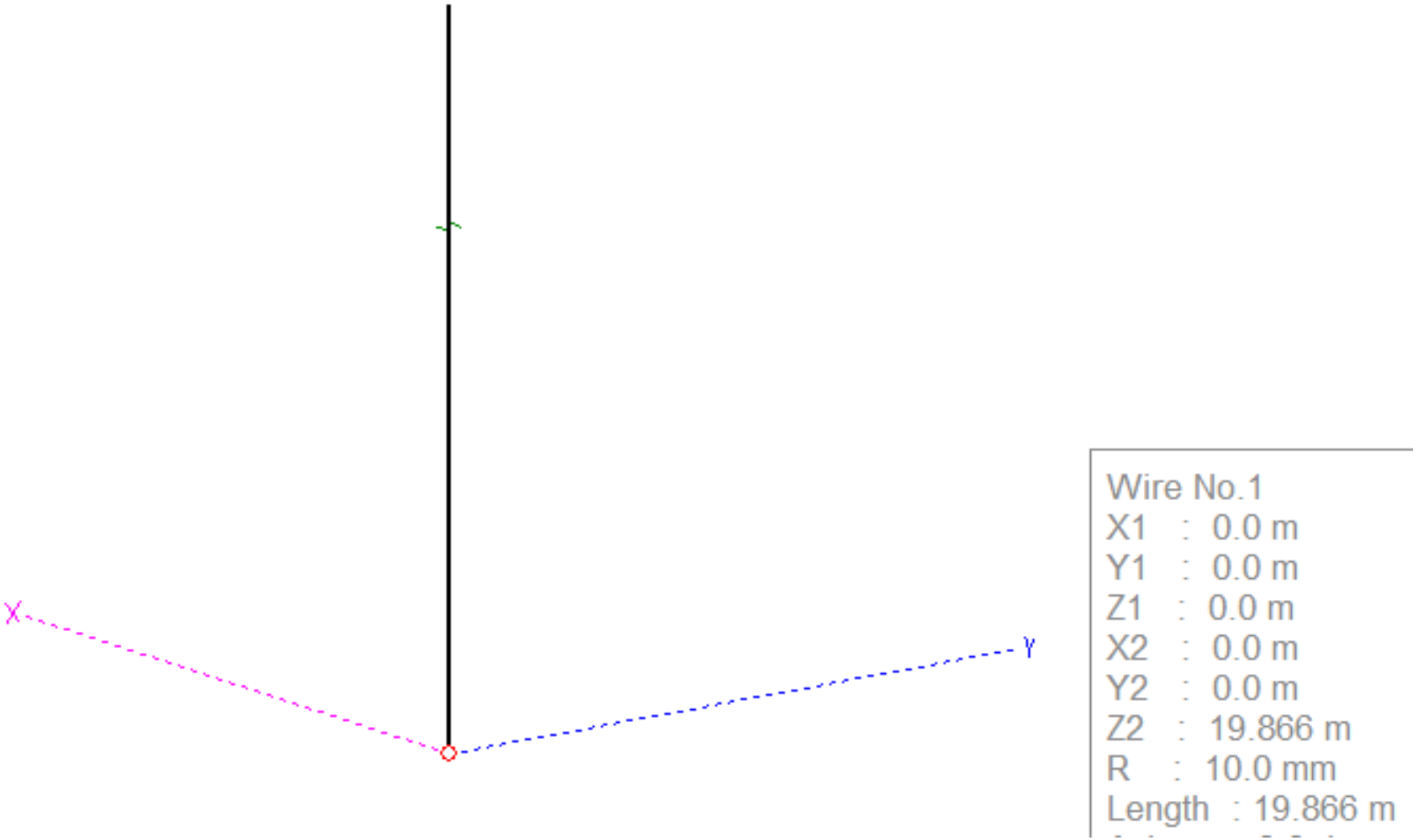
Reference: GP on 80m



ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Reference: GP on 80m

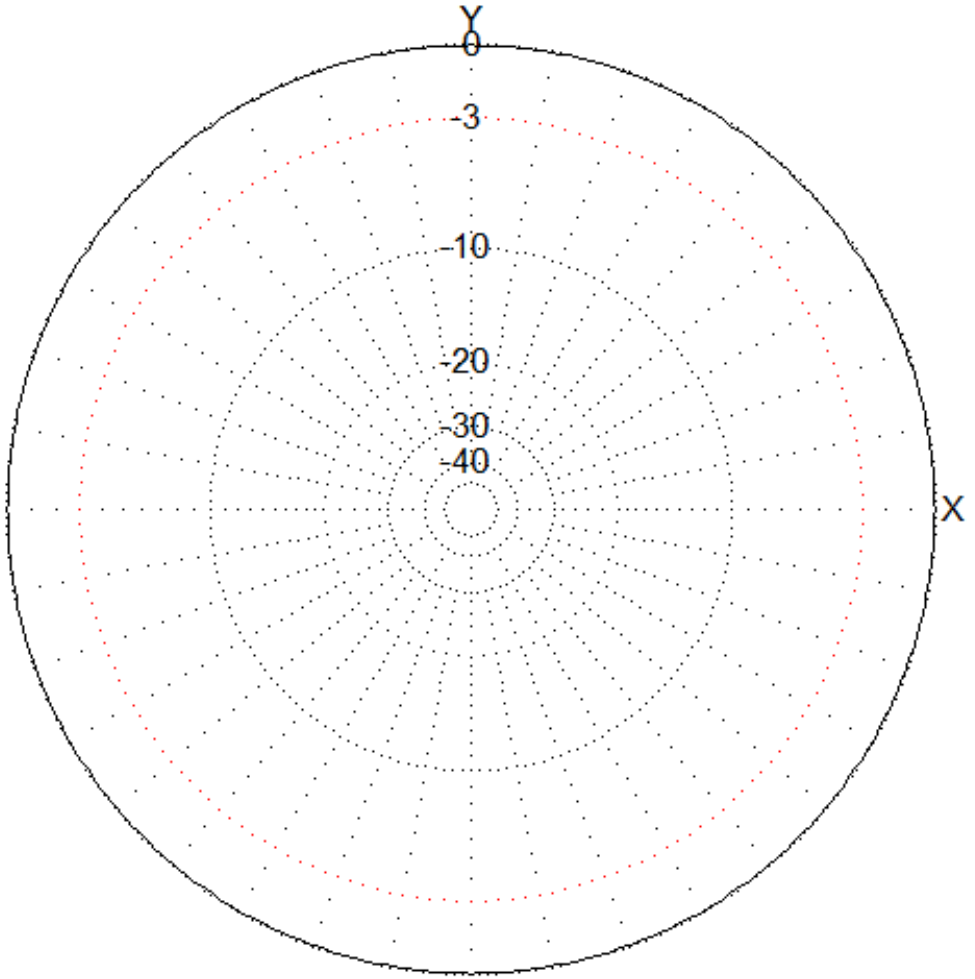
- Feed at ground level, apex 19.87m, W=20Cu

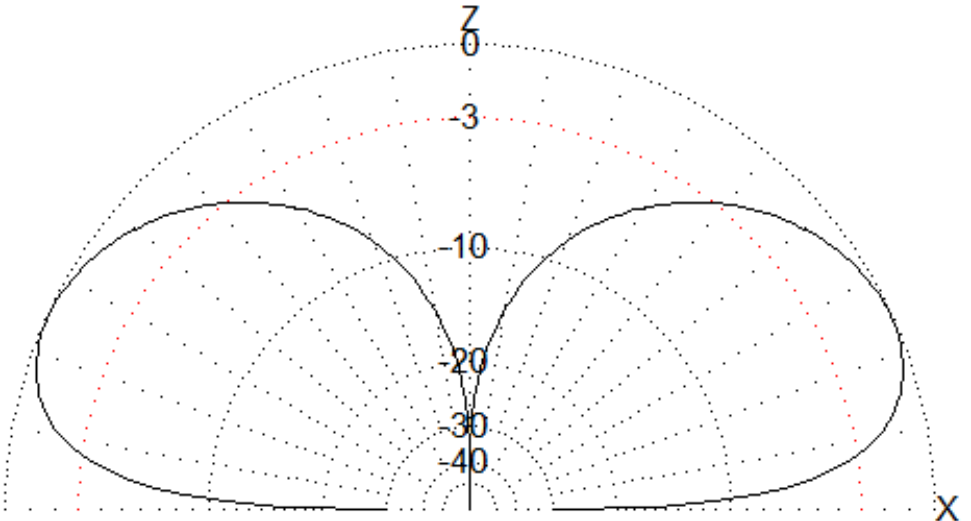


ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Reference: GP on 80m

- Feed at ground level, apex 19.87m, W=20Cu



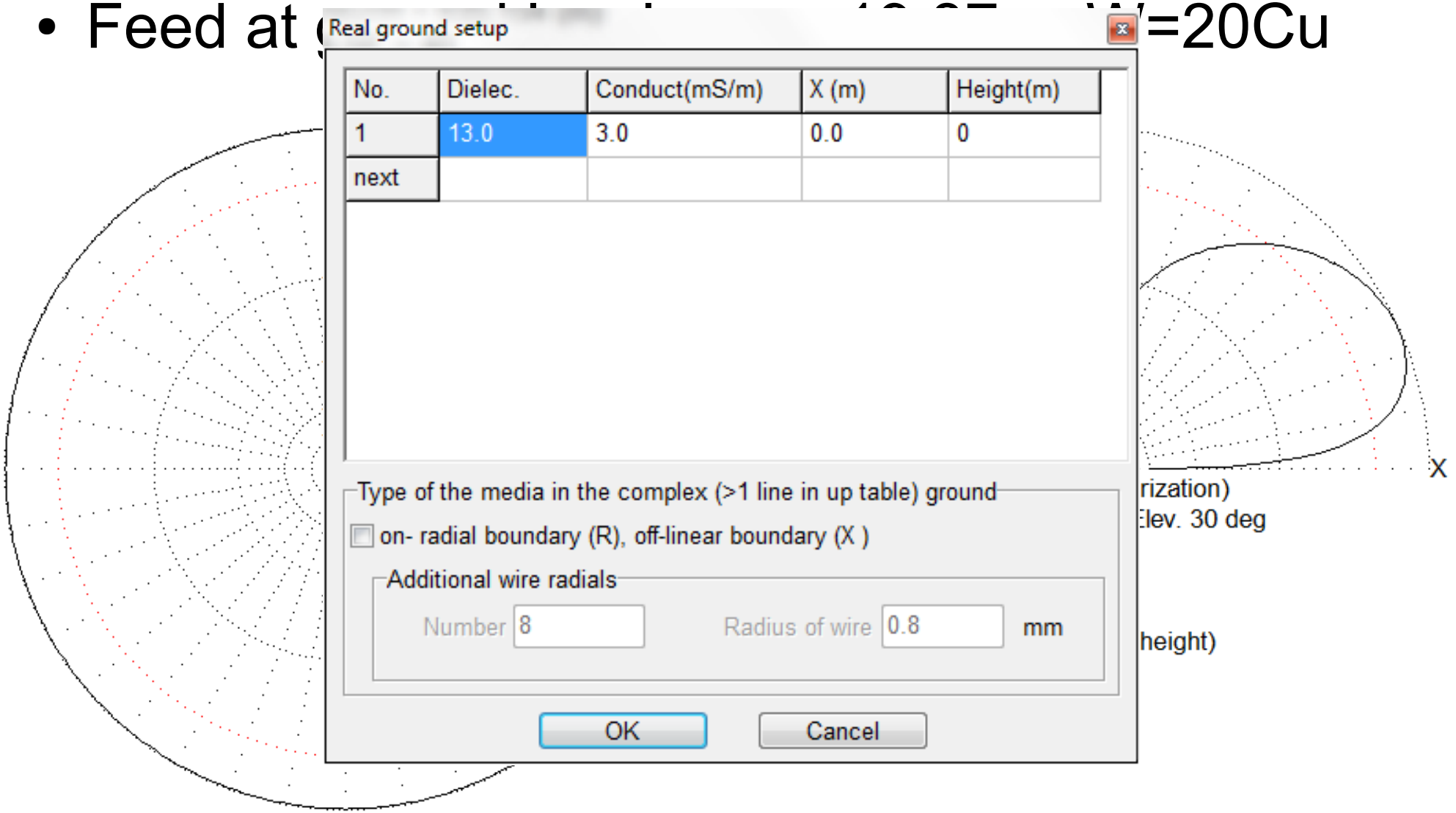


Ga : 0.63 dBi = 0 dB (Vertical polarization)
F/B: 0.00 dB; Rear: Azim. 0 deg, Elev. 30 deg
Freq: 3.650 MHz
Z: 36.143 + j0.007 Ohm
SWR: 1.4 (50.0 Ohm),
Elev: 24.6 deg (Real GND :0.00 m height)

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Reference: GP on 80m

- Feed at [illegible] =20Cu



ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Other Parameters

- First amplifier Noise Figure 4dB
- Matching & Feed Losses 2dB

- QTH Noise specified above -204dBW
  - Fa in ITU P.372 document
  - 56dB for residential QTH on 80m
  - 38dB for rural QTH on 80m

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Other Parameters

- First amplifier Noise Figure 4dB - preamplifier
- Matching & Feed Losses 2dB

- QTH Noise specified above -204dBW
  - Fa in ITU P.372 document
  - 56dB for residential QTH on 80m
  - 38dB for rural QTH on 80m

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Other Parameters

- First amplifier Noise Figure 4dB - preamplifier
- Matching & Feed Losses 2dB

- QTH Noise specified above -204dBW
  - Fa in ITU P.372 document
  - 56dB for residential QTH on 80m
  - 38dB for rural QTH on 80m – 18dB difference

Reference:
GP on 80m

- Feed at ground level, apex 19.87m, W=20Cu

- Residential, QTH Noise 56dB
- MDS -150.1dBW
- Noise Margin 42.6dB

- Rural, QTH Noise 38dB
- MDS -168.1dBW
- Noise Margin 24.6dB

Reference:
GP on 80m

- Feed at ground level, apex 19.87m, W=20Cu

- Residential, QTH Noise 56dB
- MDS -150.1dBW
- Noise Margin 42.6dB

- Rural, QTH Noise 38dB
- MDS -168.1dBW – 18dB better due to QTH Noise
- Noise Margin 24.6dB

Comparison antenna: Modified K6SE / FO0AAA

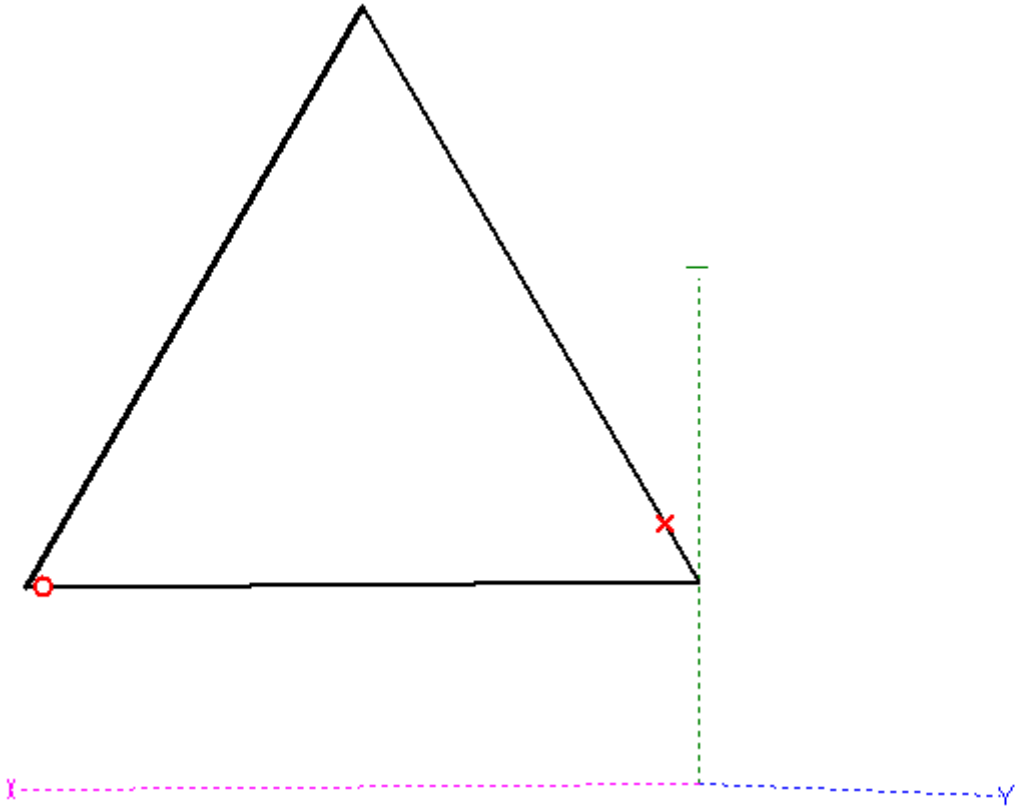
- Triangle shape
- Length 8.0m
- Bottom wire at 2.2m, apex 8.5m
- Wire 4mm diameter copper
- Rear resistor 5% above the rear corner to optimize pattern, value 810-850 ohms

- Lobster antenna

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Basic Lobster

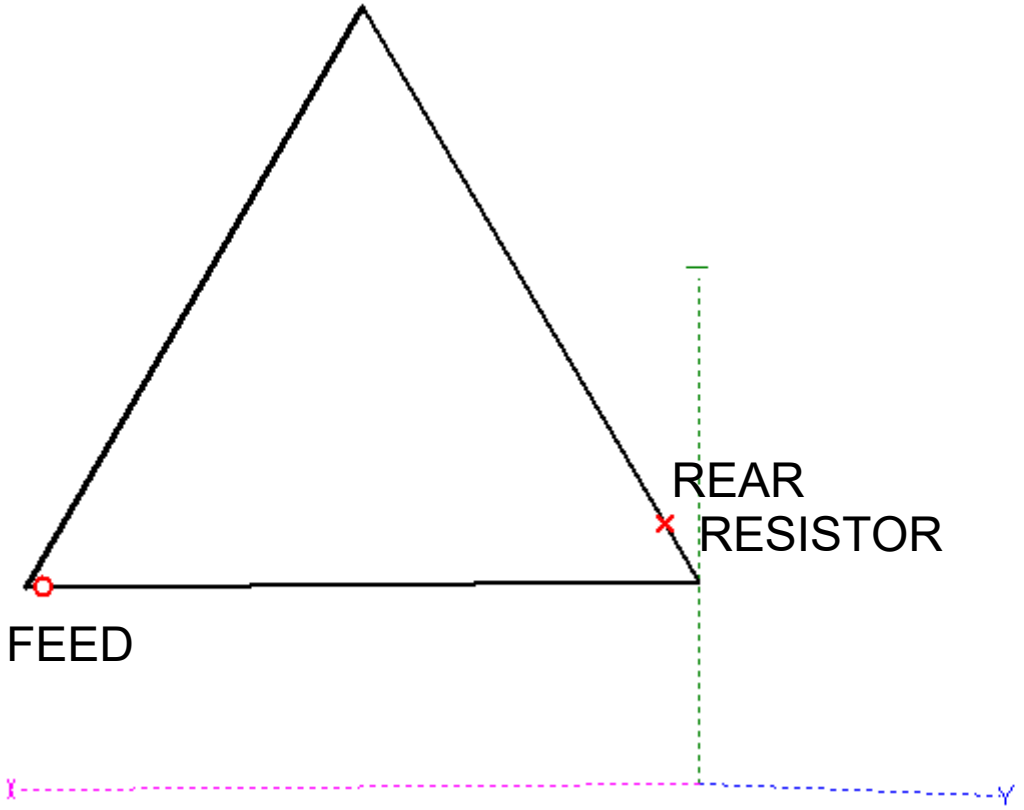
- L=8.0m, bottom wire at 2.2m, apex 8.5m, W=4Cu



ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Basic Lobster

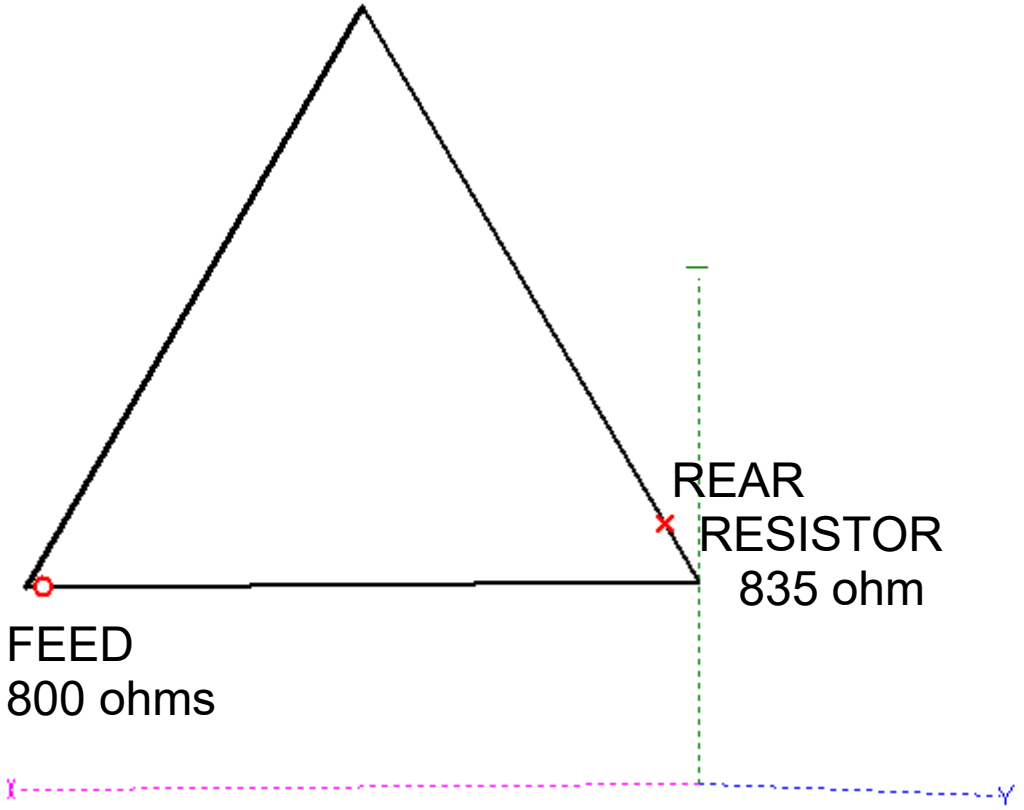
- L=8.0m, bottom wire at 2.2m, apex 8.5m, W=4Cu



ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Basic Lobster

- L=8.0m, bottom wire at 2.2m, apex 8.5m, W=4Cu

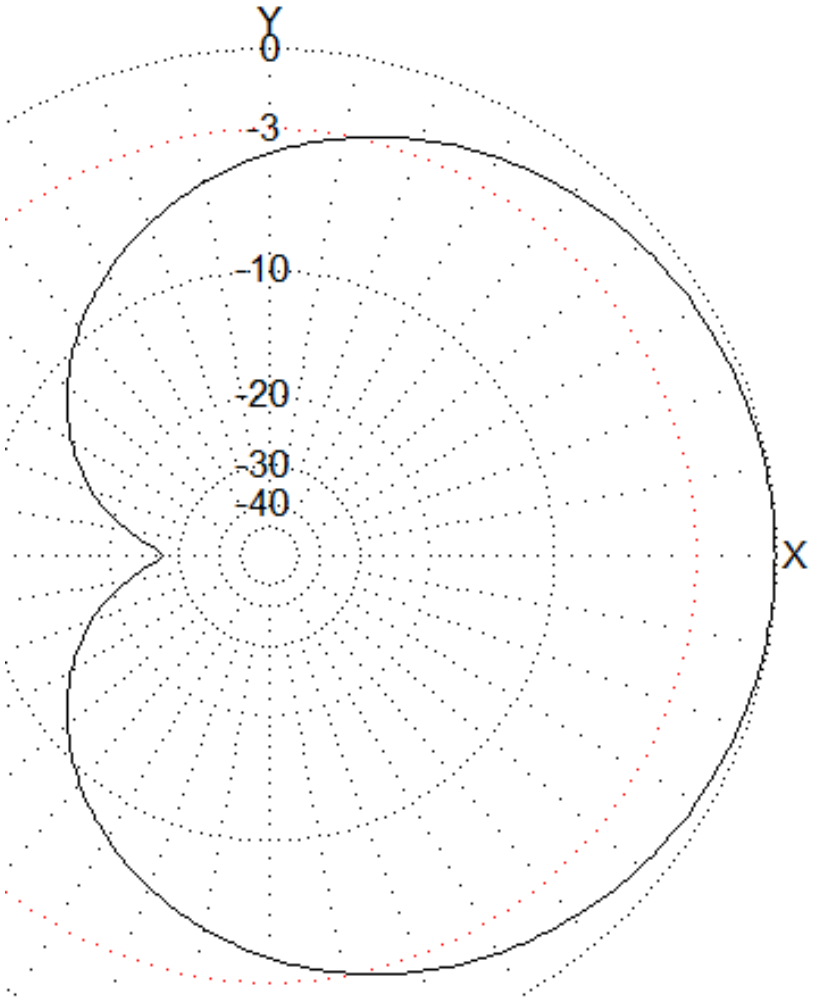


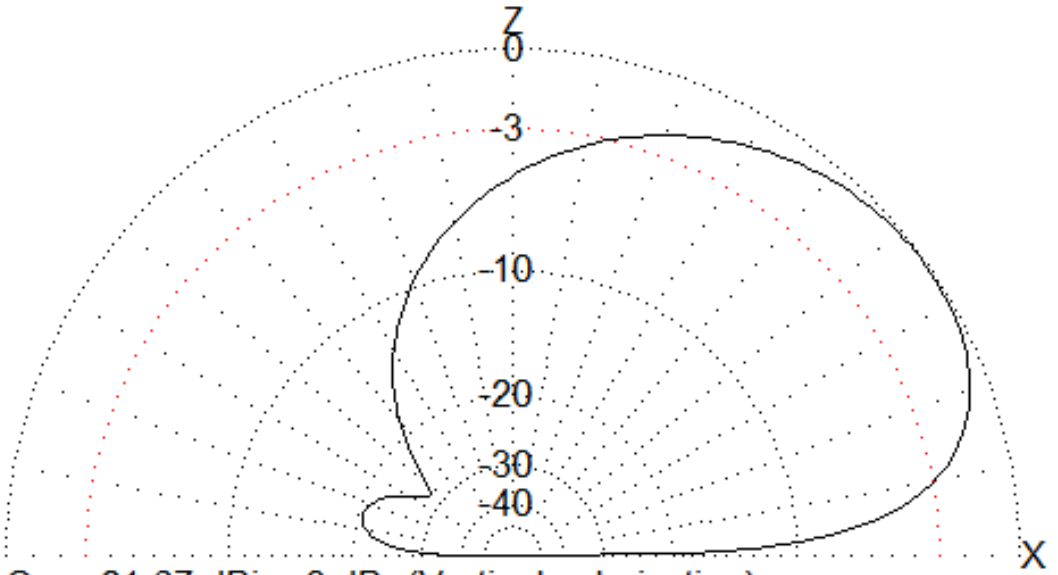
Wire No.3
X1 : 4.0 m
Y1 : 0.0 m
Z1 : 8.5 m
X2 : 8.0 m
Y2 : 0.0 m
Z2 : 2.2 m
R : 2.0 mm
Length : 7.463 m
Azim. : 0.0 deg
Zenith : -57.6 deg

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Basic Lobster on 80m

- L=8.0m, bottom wire at 2.2m, apex 8.5m, W=4Cu





Ga : -21.67 dBi = 0 dB (Vertical polarization)
F/B: 20.42 dB; Rear: Azim. 0 deg, Elev. 40 deg
Freq: 3.650 MHz
Z: 865.896 + j16.197 Ohm
SWR: 1.1 (800.0 Ohm),
Elev: 34.1 deg (Real GND :0.00 m height)

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Basic Lobster on 80m

- L=8.0m, bottom wire at 2.2m, apex 8.5m, W=4Cu

- Residential QTH Noise 56dB
- MDS -152.6dBW
- Noise Margin 17.7dB

- Rural, QTH Noise 38dB
- MDS -168.8dBW
- Noise Margin -0.3dB

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Basic Lobster on 80m

- L=8.0m, bottom wire at 2.2m, apex 8.5m, W=4Cu

- Residential QTH Noise 56dB
- MDS -152.6dBW – Lobster wins GP by 2.5dB
- Noise Margin 17.7dB

- Rural, QTH Noise 38dB
- MDS -168.8dBW
- Noise Margin -0.3dB

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Basic Lobster on 80m

- L=8.0m, bottom wire at 2.2m, apex 8.5m, W=4Cu

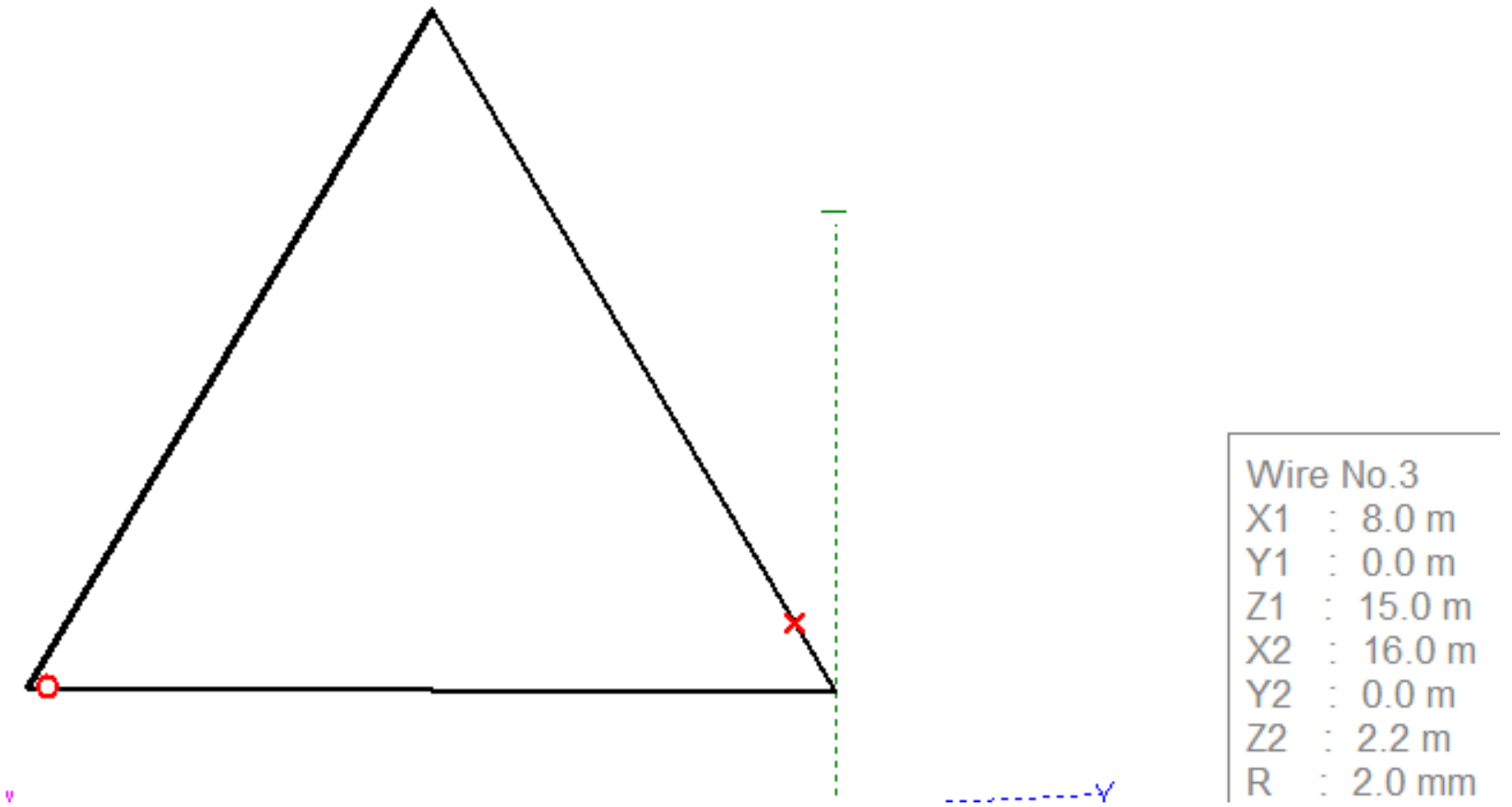
- Residential QTH Noise 56dB
- MDS -152.6dBW – Lobster wins GP by 2.5dB
- Noise Margin 17.7dB

- Rural, QTH Noise 38dB
- MDS -168.8dBW – Lobster wins GP by 0.7dB
- Noise Margin -0.3dB

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Double Size Lobster

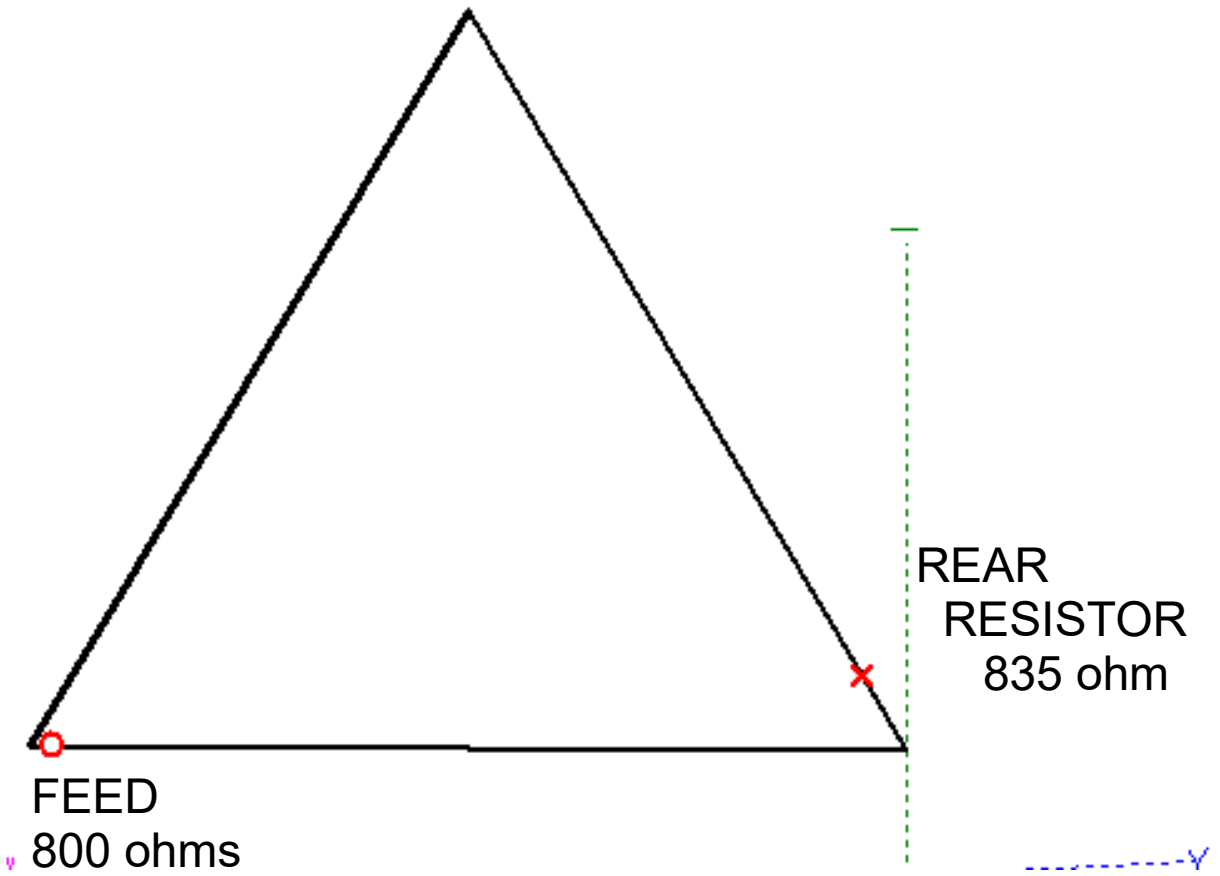
- L=16m, bottom wire at 2.2m, apex 15m, W=4Cu



ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Double Size Lobster

- L=16m, bottom wire at 2.2m, apex 15m, W=4Cu

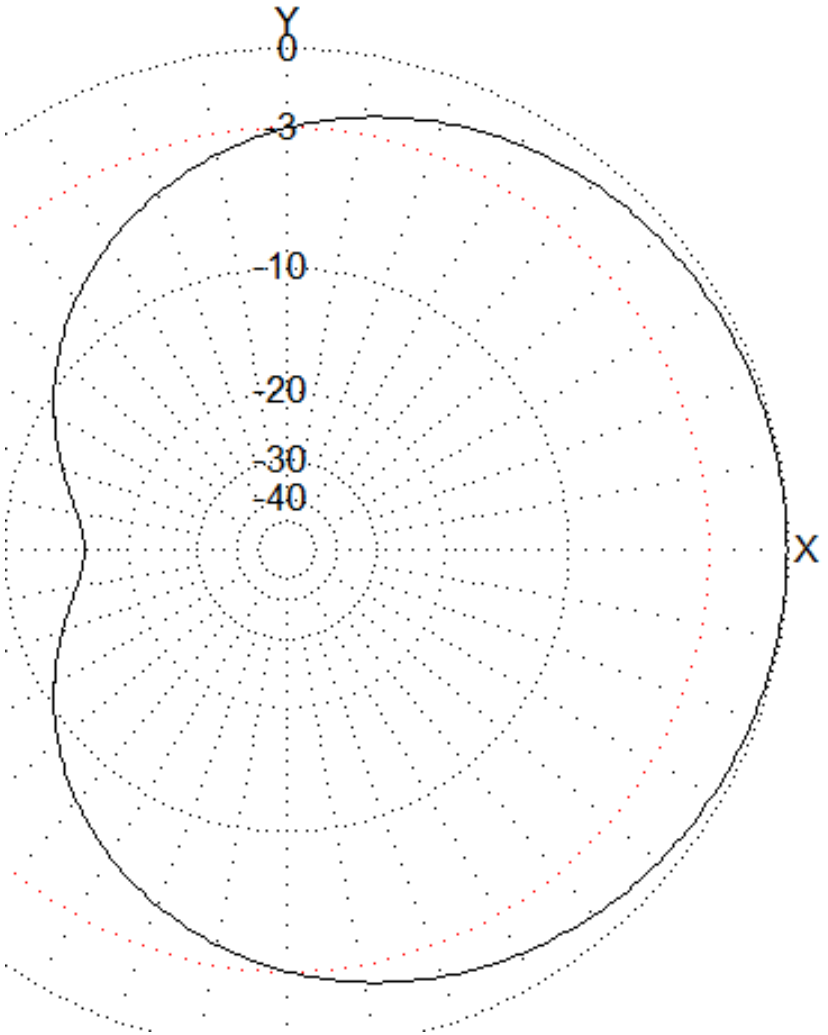


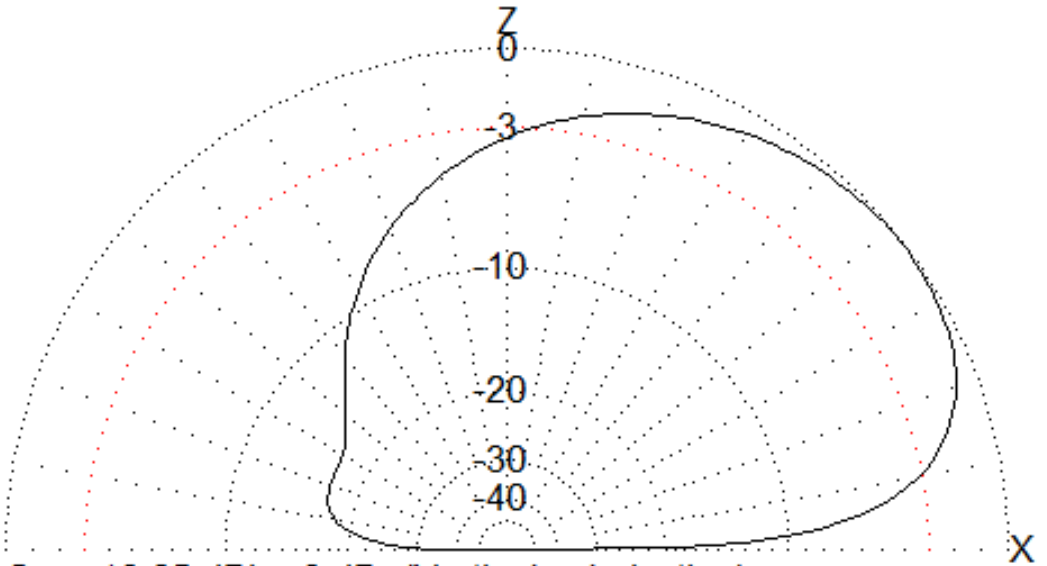
Wire No.3
X1 : 8.0 m
Y1 : 0.0 m
Z1 : 15.0 m
X2 : 16.0 m
Y2 : 0.0 m
Z2 : 2.2 m
R : 2.0 mm

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Double Size Lobster on 80m

- L=16m, bottom wire at 2.2m, apex 15m, W=4Cu





Ga : -10.25 dBi = 0 dB (Vertical polarization)
F/B: 14.93 dB; Rear: Azim. 0 deg, Elev. 40 deg
Freq: 3.650 MHz
Z: 1256.009 - j156.140 Ohm
SWR: 1.6 (800.0 Ohm),
Elev: 37.1 deg (Real GND :0.00 m height)

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Double Size Lobster on 80m

- L=16m, bottom wire at 2.2m, apex 15m, W=4Cu

- Residential, QTH Noise 56dB
- MDS -152.1dBW
- Noise Margin 29.7dB

- Rural, QTH Noise 38dB
- MDS -169.9dBW
- Noise Margin 11.7dB

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Double Size Lobster on 80m

- L=16m, bottom wire at 2.2m, apex 15m, W=4Cu

- Residential, QTH Noise 56dB
- MDS -152.1dBW – Double Size Lobster wins GP
- Noise Margin 29.7dB

- Rural, QTH Noise 38dB
- MDS -169.9dBW – Double Size Lobster wins all
- Noise Margin 11.7dB

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Lobster Size on 80m

- Lobster antenna has a cutoff frequency
  - Lobster functions correctly below the cutoff frequency
- Double Size Lobster pattern starts to get worse on 80m
- Triple Size Lobster is not a viable antenna on 80m

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Results summary

- GP MDS is -150.1 / -168.1 dBW
- Lobster MDS -152.6 / -168.8 dBW

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Results summary

- GP MDS is -150.1 / -168.1 dBW
- Lobster -152.6 / -168.8 dBW
- Double Size Lobster -152.1 / -169.9 dBW

Design target achieved

Basic Size Lobster wins over GP
with a clear margin in rural and residential area

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Findings for 80m

- A receiving antenna length just 8m is enough on 80m band to provide better reception than a Full Size GP – at nearly any QTH, at any time

- Increasing the antenna size will not bring automatical improvement in MDS capability
- Common mode and signal leaking related issues may be improved by increasing the antenna size to Double Size Lobster
- Double Size Lobster provides enough Noise Margin even at the most quiet locations

More Information

- A receiving antenna LIRA with 22m length provides a better MDS than Lobster
  - Beyond the scope of this Quick Study

- Antenna details and simulation models available from Jukka OH6LI
  - Also LIRA design details available

ZERO RADIO CLUB
RADIATORS
AH0K OH0K OH4A OH0V

Excel Workbook

- Excel workbook to analyze MDS and Noise Margin available
- Also Leaking Index for antenna pattern comparisons

Antenna pattern file name	3D Max Gain (dBi)	At Azim	At Elev	Average Gain (dB)	RDF Direc-tivity (dB)	DMF Rear MSL (dB)	Leaking Index (%)	QTH Noise Level (dB)	Noise Margin (dB)	MDS (dBW)	Length (m)	Width (m)	Height (m)
01 GP 80m.csv	0,63	0°	25°	-4,45	5,08	5,08	96,8	56	42,6	-150,1	40	40	20
01 GP 80m.csv	0,63	0°	25°	-4,45	5,08	5,08	96,8	38	24,6	-168,1	40	40	20
02 BasicLobster 80m.csv	-21,67	0°	34°	-29,34	7,67	12,38	78,6	56	17,7	-152,6	8	2	8,5
02 BasicLobster 80m.csv	-21,67	0°	34°	-29,34	7,67	12,38	78,6	38	-0,3	-168,8	8	2	8,5
03 DoubleSizeLobster 80m.csv	-10,25	0°	37°	-17,31	7,06	10,72	86,3	56	29,7	-152,1	16	4	15
03 DoubleSizeLobster 80m.csv	-10,25	0°	37°	-17,31	7,06	10,72	86,3	38	11,7	-169,9	16	4	15
05 LIRA L22 H7.2 80m.csv	-19,29	0°	29°	-28,74	9,45	18,90	46,2	56	18,3	-154,4	22	3	7,3
05 LIRA L22 H7.2 80m.csv	-19,29	0°	29°	-28,74	9,45	18,90	46,2	38	0,3	-170,8	22	3	7,3
06 LIRA L22 H08 80m.csv	-17,59	0°	29°	-27,09	9,50	19,11	46,2	56	19,9	-154,5	22	3	8
06 LIRA L22 H08 80m.csv	-17,59	0°	29°	-27,09	9,50	19,11	46,2	38	1,9	-171,3	22	3	8