

Antenna Modeling Demo

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Antenna Modeling

- Most modeling software is based on [NEC](#) (Numerical Electromagnetics Code)
 - Developed in Fortran in 1970's
 - Most of today's modeling software is derivative of the original code
 - Developed by Gerald Burke & Andrew Poggio of the Lawrence Livermore National Laboratory.
- NEC software archive: <https://www.pa3kj.com/nec-archives/>

Popular NEC Antenna Modeling Software



- EZNEC (PC, free) – <https://eznec.com/>
 - AutoEZ (\$79) - <http://www.ac6la.com/autoez.html>
- MMANA-GAL (PC) - <http://gal-ana.de/>
- cocoaNEC 2.0 (Mac) - <http://www.w7ay.net/site/Applications/cocoaNEC/>
- YagiCAD - <https://www.yagicad.com/>
- YAGio - <https://wb0dgf.com/Yagio.html>
- NEC2GO - <https://www.nec2go.com/>

EZNEC



- One of the most widely used antenna modeling programs
- Great [documentation](#) – (*you must RTFM*)
- Lots of public (.EZ) files you can download and play with
 - http://www.nic.funet.fi/pub/ham/antenna/NEC/EZNEC_FILES/
 - <http://www.arrl.org/antenna-modeling-files>
- Most important, it's FREE!!
 - Author, Roy Lewallen (W7EL) officially retired January 1, 2022
 - Absolutely no software support moving forward
 - Source code will never be released

Get on with the DEMO already!



EZNEC Pro/2+ v. 7.0

File Edit Options Outputs Setups View Utilities Help

Open Save As Ant Notes

Currents Src Dat Load Dat FF Tab NF Tab SWR View Ant

NEC-2D FF Plot

40-m Inverted V 90 deg incl.

- File: LAST.EZ
- Frequency: 21.2 MHz
- Wavelength: 46.3949 ft
- Wires: 2 Wires, 40 segments
- Sources: 1 Source
- Loads: 0 Loads
- Trans Lines: 0 Transmission Lines
- Transformers: 0 Transformers
- L Networks: 0 L Networks
- Y Param Networks: 0 Y Param Networks
- Ground Type: Real/High Accuracy
- Ground Descrip: 1 Medium (0.0303, 20)
- Wire Loss: Copper
- Units: Feet
- Plot Type: 3D
- Step Size: 5 Deg.
- Ref Level: 0 dBi
- Alt SWR Z0: 75 ohms
- Desc Options
- Gnd Wave Dist: OFF

Average Gain = 0.636 = -1.96 dB *Model contains loss*

3D Plot: 40-m Inverted V 90 deg incl.

File Edit View Options Reset

Highlight

- Off
- Azimuth Slice
- Elev Slice

0 360

0

Slice Azimuth

180

60

0

Cursor Elev

Show 2D Plot

EZNEC Pro/2+

21.2 MHz

2D Plot: 40-m Inverted V 90 deg incl.

File Edit View Options Reset

Highlight

- Off
- Azimuth Slice
- Elev Slice

0 360

0

Slice Azimuth

180

60

0

Cursor Elev

Total Field

EZNEC Pro/2+

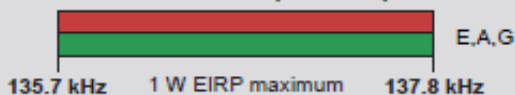
21.2 MHz

Elevation Plot	Cursor Elev	60.0 deg.
Azimuth Angle	Gain	7.02 dBi
Outer Ring		0.0 dBmax
		0.0 dBmax3D

3D Max Gain	7.02 dBi
Slice Max Gain	7.02 dBi @ Elev Angle = 60.0 deg.
Beamwidth	30.9 deg.; -3dB @ 47.6, 78.5 deg.
Sidelobe Gain	7.02 dBi @ Elev Angle = 120.0 deg.
Front/Sidelobe	0.0 dB

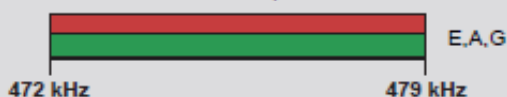
Amateurs wishing to operate on either 2,200 or 630 meters must first register with the Utilities Technology Council online at <https://utc.org/plc-database-amateur-notification-process/>. You need only register once for each band.

2,200 Meters (135 kHz)



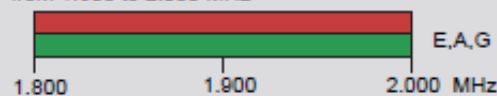
630 Meters (472 kHz)

5 W EIRP maximum, except in Alaska within 496 miles of Russia where the power limit is 1 W EIRP.

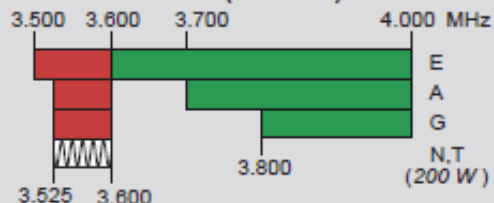


160 Meters (1.8 MHz)

Avoid interference to radiolocation operations from 1.900 to 2.000 MHz



80 Meters (3.5 MHz)

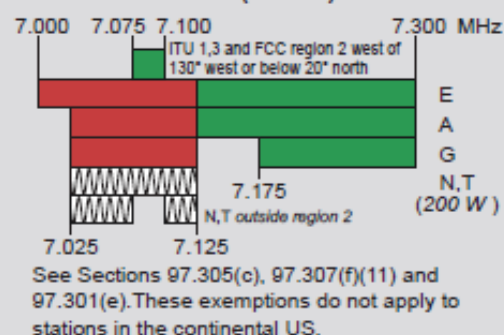


60 Meters (5.3 MHz)

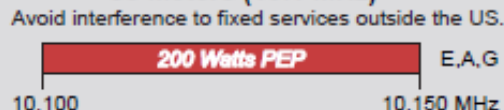


General, Advanced, and Amateur Extra licensees may operate on these five channels on a secondary basis with a maximum effective radiated power (ERP) of 100 W PEP relative to a half-wave dipole. Permitted operating modes include upper sideband voice (USB), CW, RTTY, PSK31 and other digital modes such as PACTOR III. Only one signal at a time is permitted on any channel.

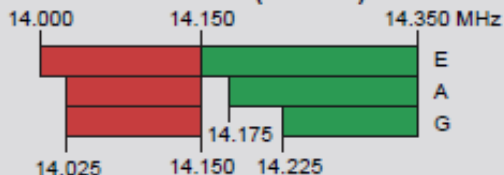
40 Meters (7 MHz)



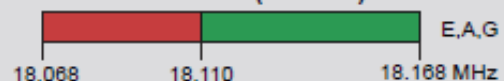
30 Meters (10.1 MHz)



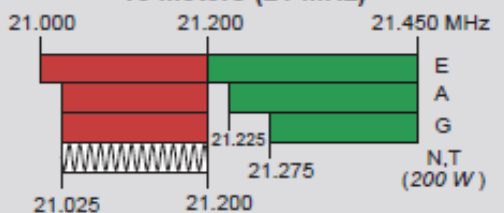
20 Meters (14 MHz)



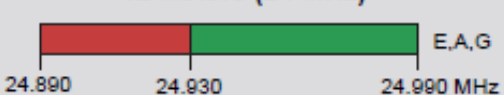
17 Meters (18 MHz)



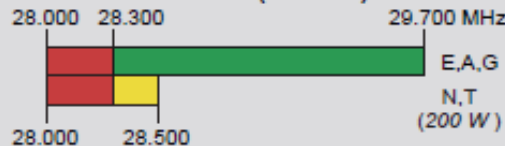
15 Meters (21 MHz)



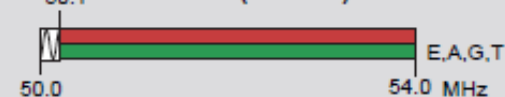
12 Meters (24 MHz)



10 Meters (28 MHz)



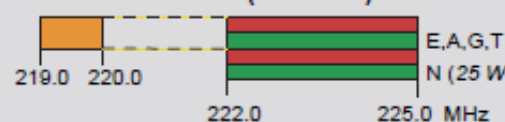
6 Meters (50 MHz)



2 Meters (144 MHz)



1.25 Meters (222 MHz)



*Geographical and power restrictions may apply to all bands above 420 MHz. See *The ARRL Operating Manual* for information about your area.

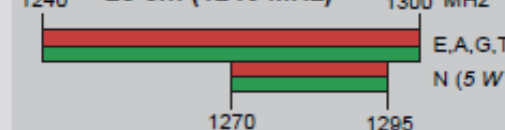
70 cm (420 MHz)*



33 cm (902 MHz)*



23 cm (1240 MHz)*



All licensees except Novices are authorized all modes on the following frequencies:

2300-2310 MHz	10.0-10.5 GHz ‡	122.25-123.0 GHz
2390-2450 MHz	24.0-24.25 GHz	134-141 GHz
3300-3500 MHz	47.0-47.2 GHz	241-250 GHz
5650-5925 MHz	76.0-81.0 GHz	All above 275 GHz

‡ No pulse emissions

KEY

Note:

CW operation is permitted throughout all amateur bands.

MCW is authorized above 50.1 MHz, except for 144.0-144.1 and 219-220 MHz.

Test transmissions are authorized above 51 MHz, except for 219-220 MHz

- = RTTY and data
- = phone and image
- = CW only
- = SSB phone
- = USB phone, CW, RTTY, and data
- = Fixed digital message forwarding systems only

- E = Amateur Extra
- A = Advanced
- G = General
- T = Technician
- N = Novice

See *ARRLWeb* at www.arrl.org for detailed band plans.

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email: newham@arrl.org

Exams: 860-594-0300 email: veo@arrl.org





Delay Line Calculation

Ideal: wavelength * (phase shift in degrees/360)

Proper: wavelength (in cable) * (phase shift in degrees/360)

Final: $((Vf) \times c / \text{freq}) \times (\text{phase shift in degrees} / 360)$

Coax Delay Length (TL/DR):

<https://electronics.stackexchange.com/questions/197900/how-to-determine-length-of-coax-to-get-a-certain-delay>