Back to the Basics
Setting up a VHF/UHF Station

Back to The Basics
Your First VHF/UHF Station

Topics that will be covered:

- **Radios**
- Base/mobile vs. Hand Held
- Pluses and minuses of each

- **Antennas**
- Vertical
- Beam (Yagi)

- **Coax**
- Size
- Signal loss

- **Additional equipment**
- Power Supply
- SWR meter
- Antenna Switch
- Tuner

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

VHF/UHF Frequencies

VHF 30-300MHz
UHF 301MHz- 3GHz

6 Meters (54.0-54.0 MHz)
2 Meters (144-148 MHz)
1.25 Meters (222-225 MHz)
70 Centimeters (420-450 MHz)
1240–1300 MHz(23 cm band)
2395–2400 MHz (13 cm band,

Radios

What is the first radio many (including me) purchased?

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017


St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Handheld (aka HT, Walkie Talkie, Handy Twinky, etc.

Pluses of HT:

- Price
- Portable
- Small size
- ???

Handheld (aka HT, Walkie Talkie, Handy Twinky, etc.

Minuses of HT:

- Low Power (I can hear everyone but they can't hear me)
- Batteries go dead or wear out
- Antenna (aka rubber duckie)
- ???

HT after market antennas

Types of HT antenna connectors

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Using HT on outside base antenna

SMA toUHF

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017


Questions?
Questions?
Questions?
Questions?
St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Base/Mobile Radio

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Pluses of Base/Mobile

Power

- Usually 5-50 or more watts
- Can be moved from home base to mobile
- ???

Minuses of Base/Mobile

- Cost
- Depends on single or dual band
- $150 ish at the low end for single band
- $400 ish at the high end for dual band
- ???

Single (Mono) Band

2 meters

144-148 MHz TX

136-174 MHz RX

25W Low

65W High

$135.00 ish

Zoom

Dual Band (Cross Band)

2m/70cm

144-146 MHz TX

430-450 MHz TX

118 - 524 MHz RX

800 - 1300 MHz [less cellular]

HIGH VHF/UHF: 50/50W

MID VHF/UHF: 10/10W

LOW VHF/UHF: 5/5W

$350 ish

Dual Band Radio (2m/70cm)

A dual band radio is a communications system that is designed to allow operation on two separate frequency bands.

Cross Band Radio

Crossband (cross-band, cross band) operation is a method of telecommunication in which a radio station receives signals on one frequency and simultaneously transmits on another for the purpose of full duplex communication or signal relay.

What is a Go Box ?


Fan
Light
ON
OFF
MFJ-4125
CLIFF
KCØSDV
Red-Dee-2™
Connect
PAT. 7,275,967
distributed by
www.powerwerx.com
ICOM
St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Can be used as:
Base
Mobile
Portable

- Google “ham radio go box”
- Search You Tube

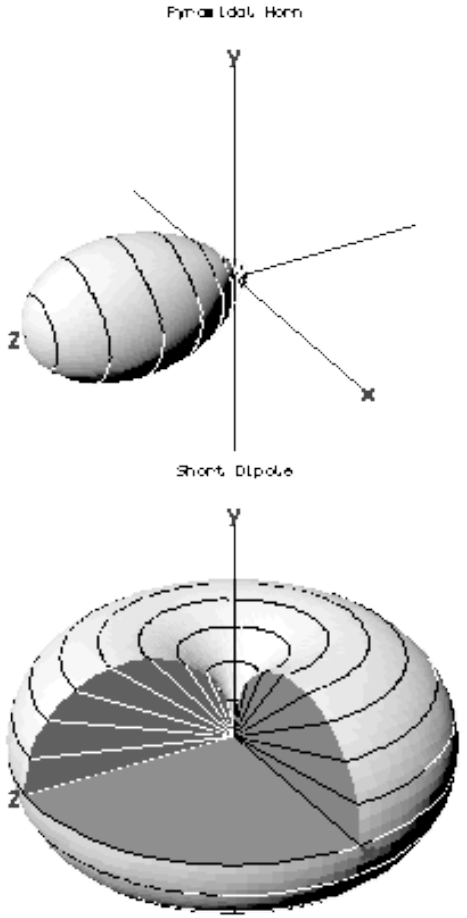
St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Base Antennas

Types

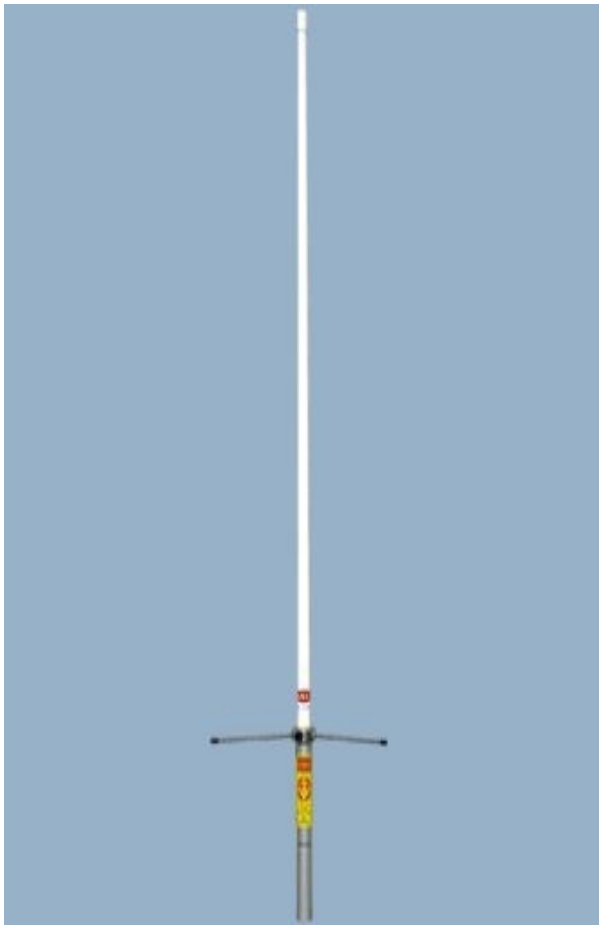
- Vertical (Single or Dual Band)
- Beam (aka Yagi)
  Horizontal or Vertical polarization
- Wire Dipole (not real common in VHF/UHF)
- ???

Vertical antenna radiation pattern



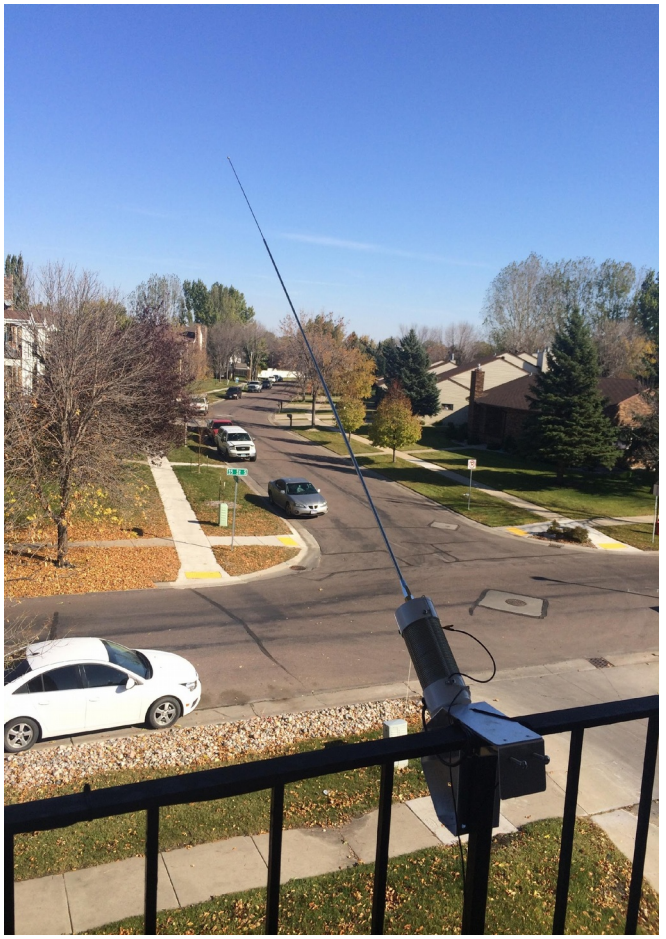
St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Vertical Antennas



St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

More Verticals



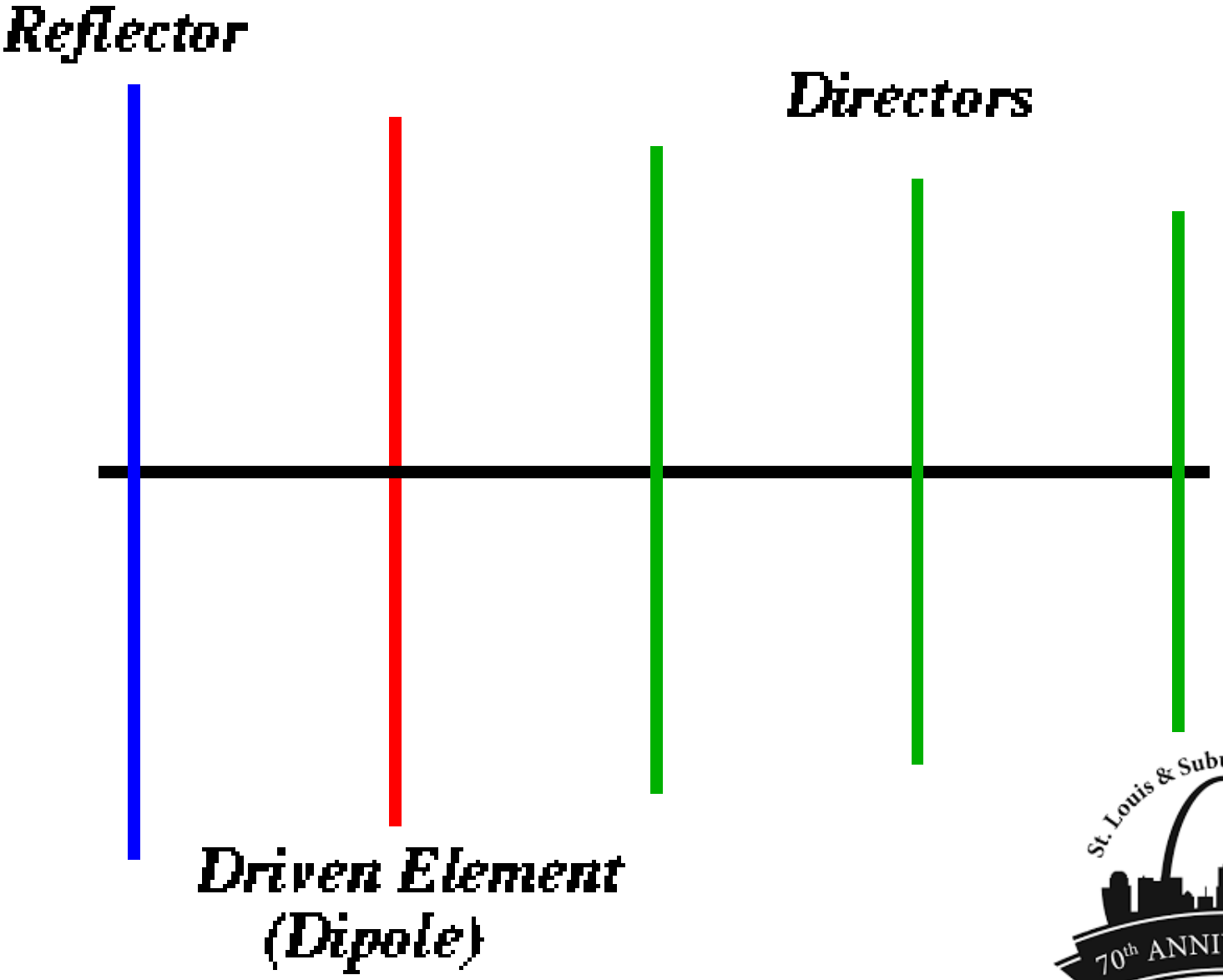
St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Even More Verticals

My favorite Vertical Antenna

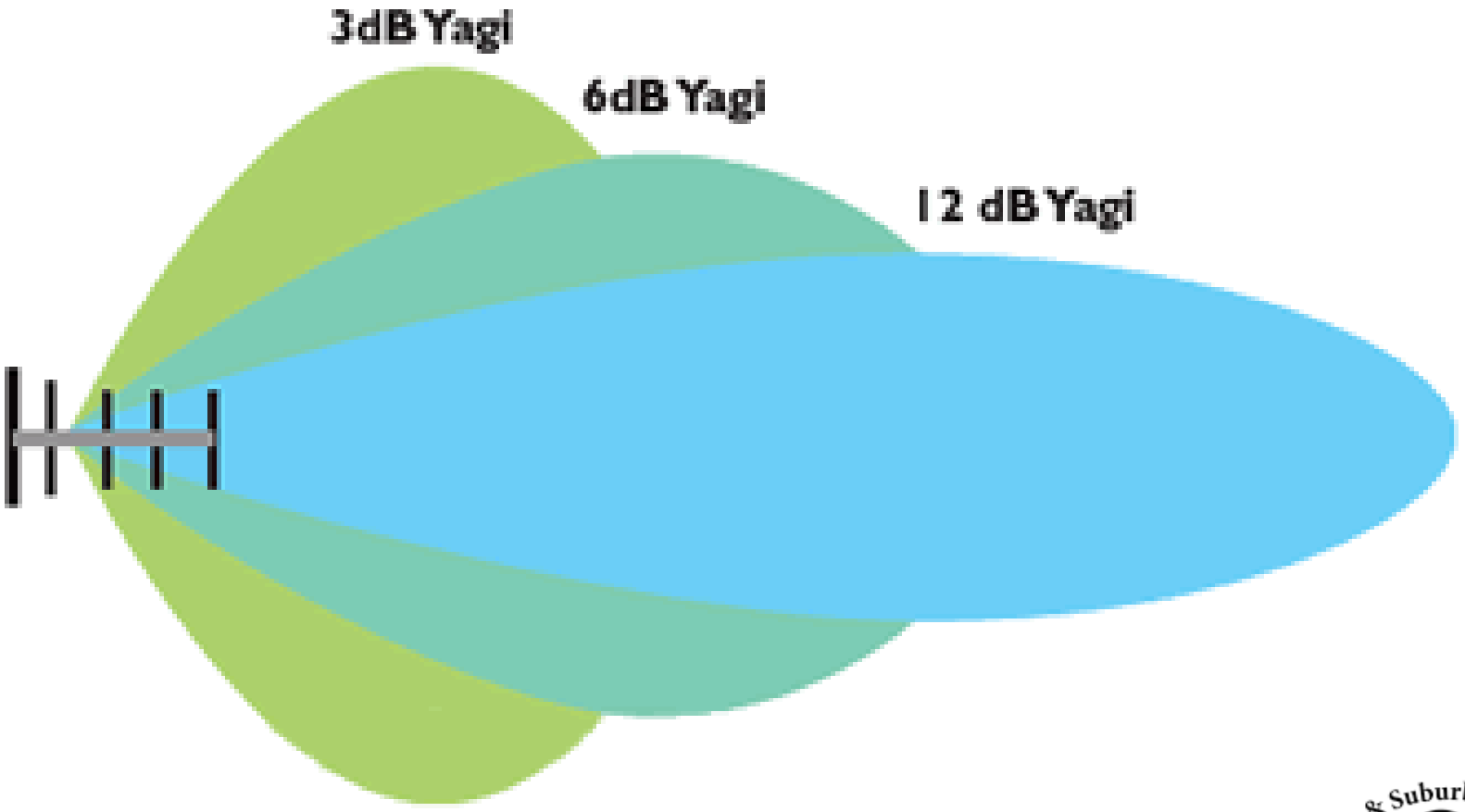
St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

What is a beam antenna?



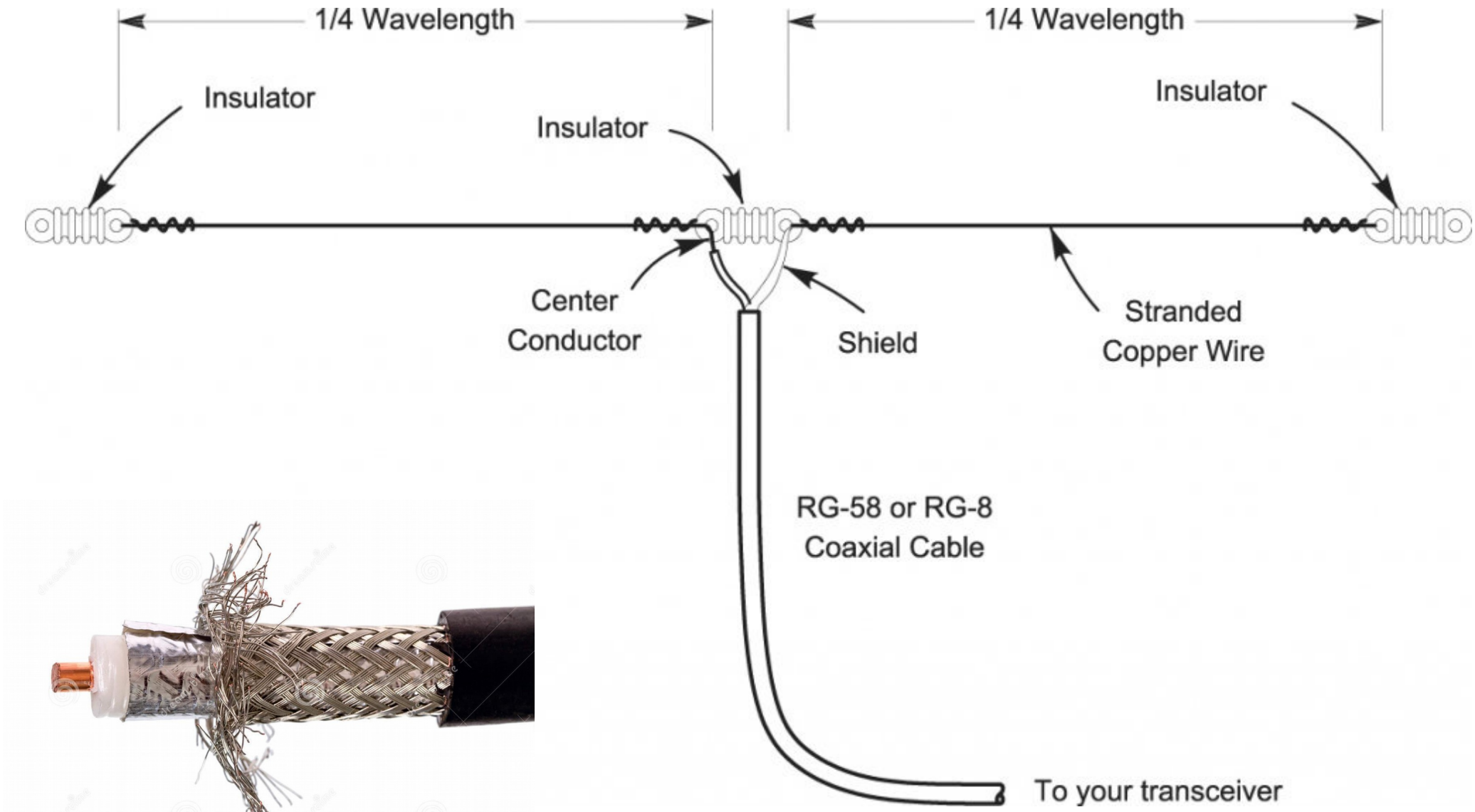
St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Beam (Yagi) radiation pattern

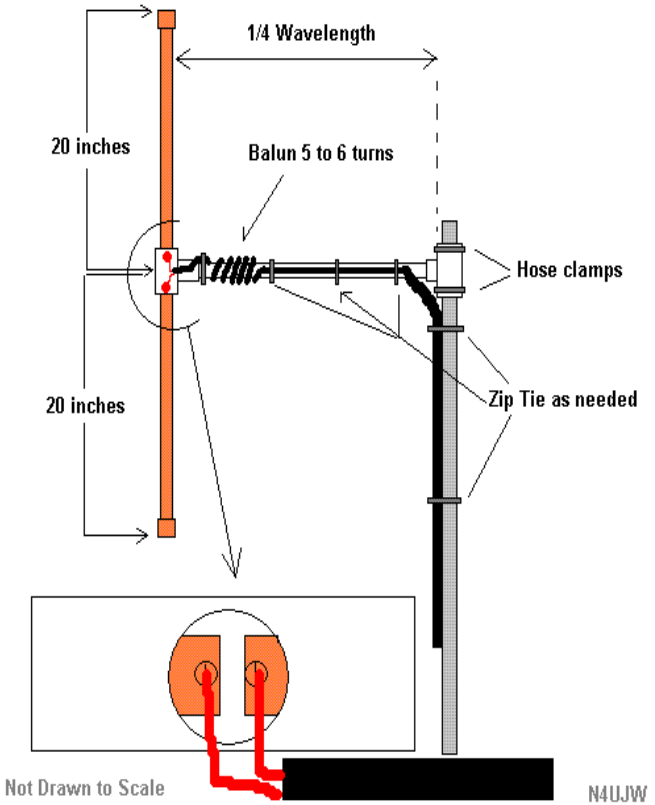


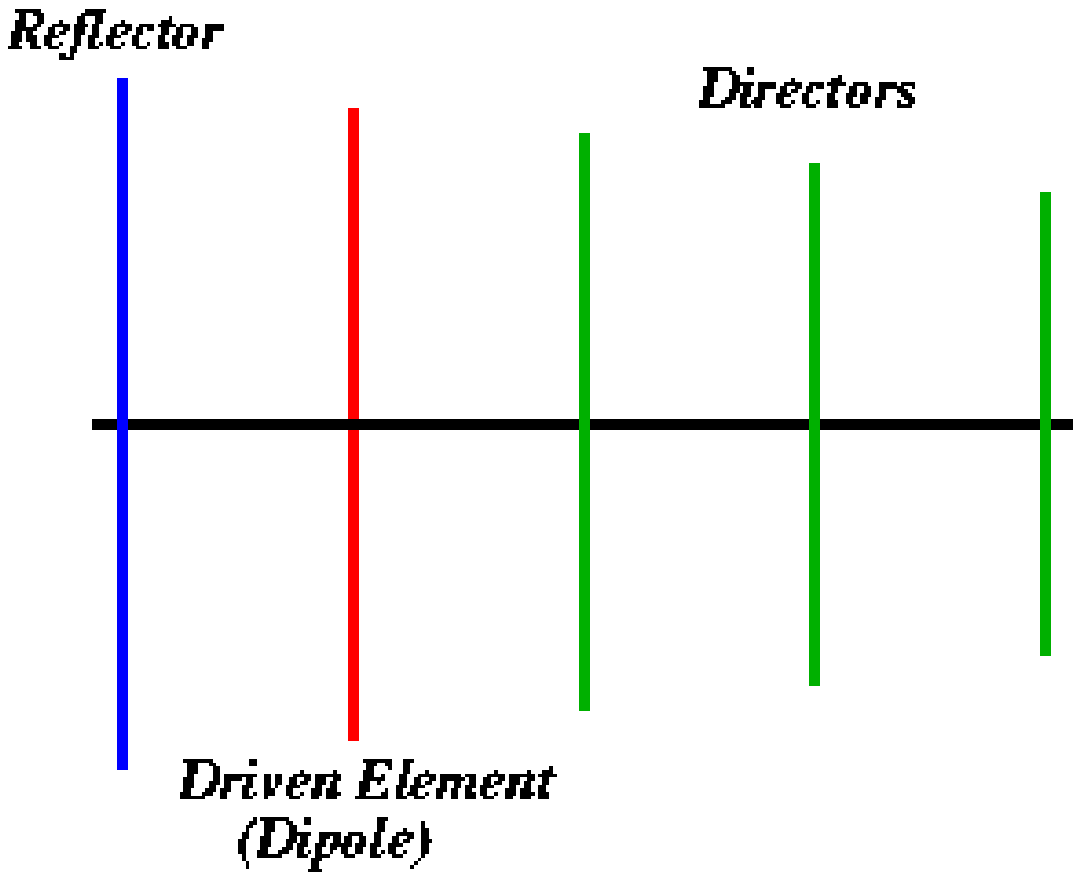
St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Start with this antenna.



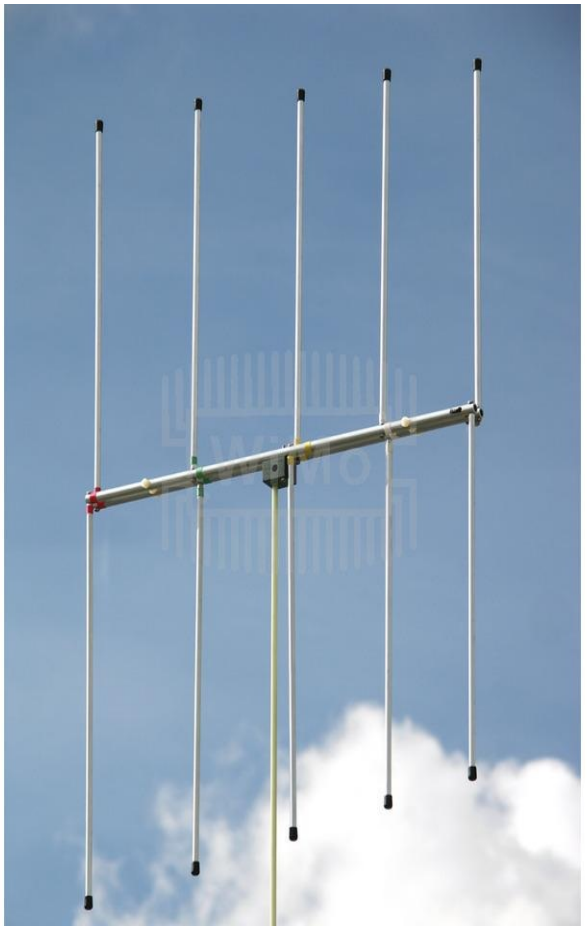
Dipole Antenna

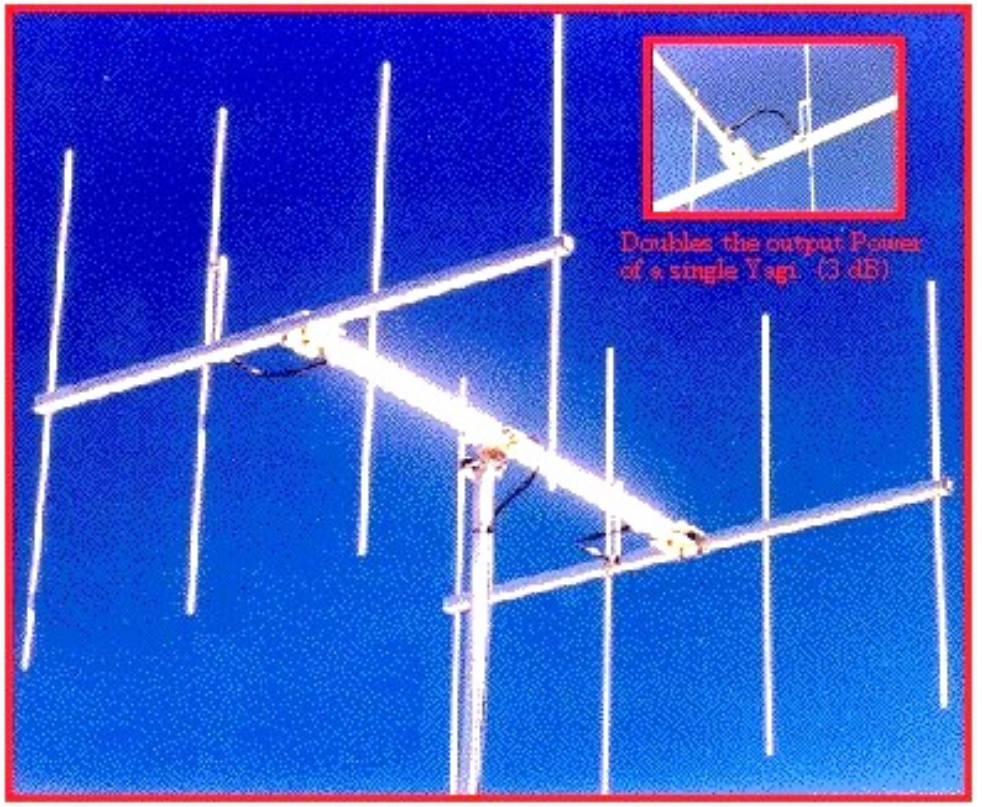




A beam antenna starts with a dipole antenna and a reflector and directors are added. The more directors there are, the more directional the antenna is.

Beam Antennas

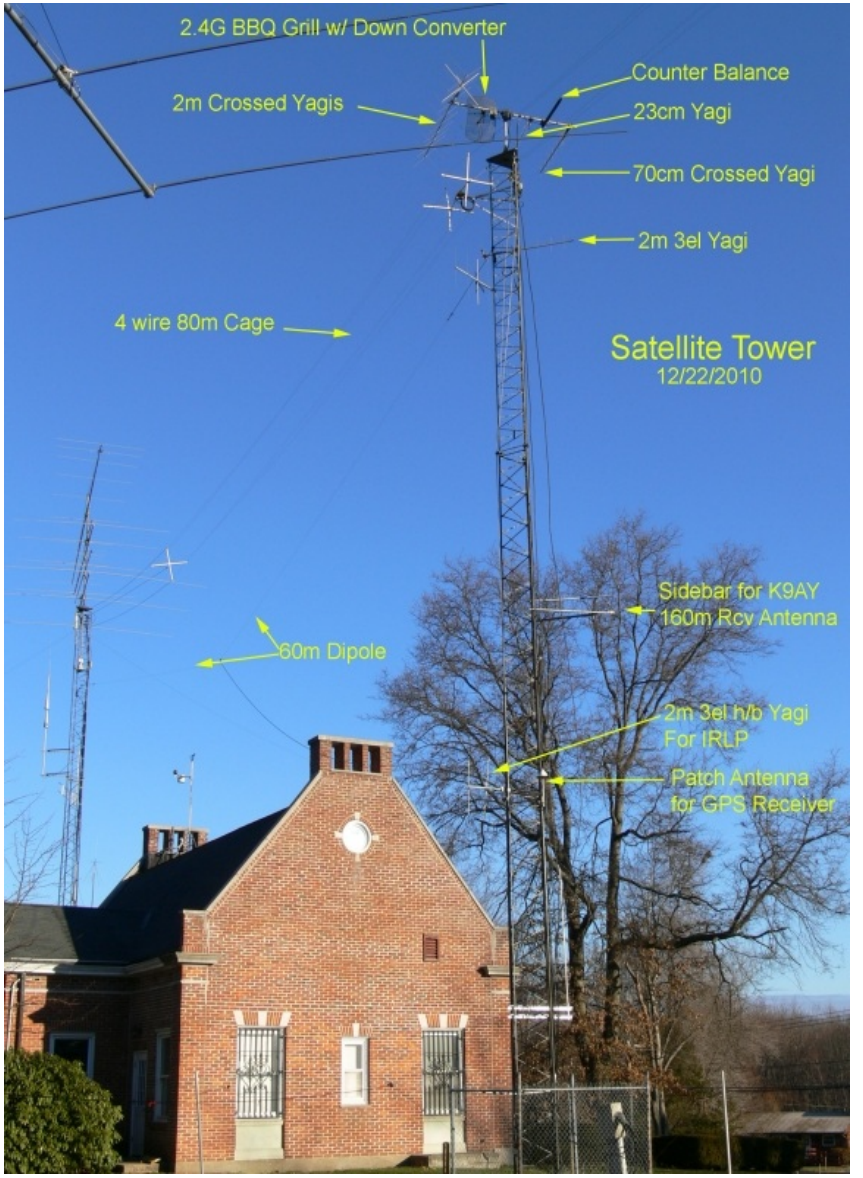




Stack Set includes Two 146-4S Antennas (left & right),
5/8 wavelength (4 ft.) spreader boom with built in Power Divider.
Two 50 ohm coax cables to connect the Power Divider
All Aluminum & Stainless Mounting Hardware.
(Everything you see above except the mast.)

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

More Beam antennas



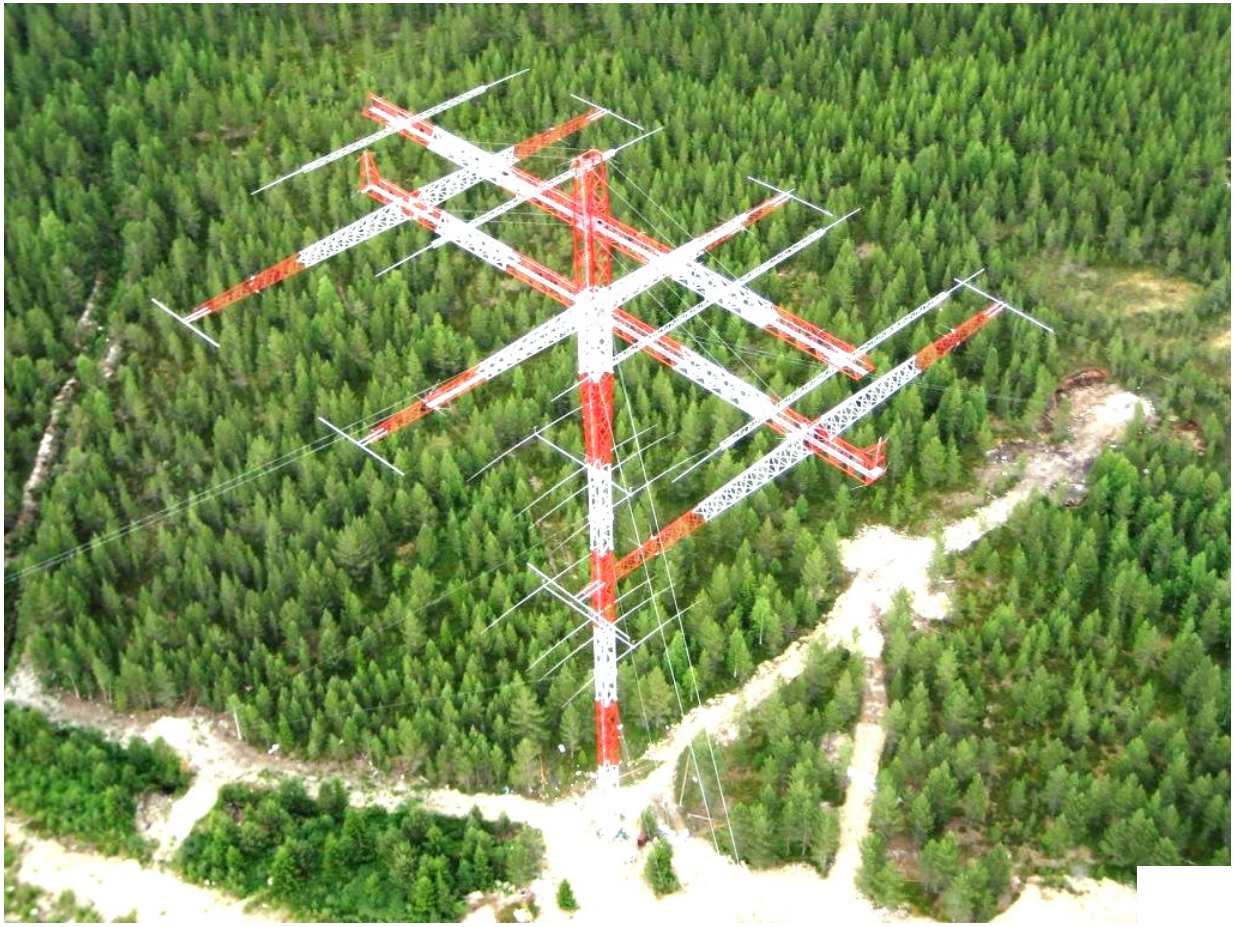
St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017


St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Radio Arcala, located close to Arctic Circle in Finland, is a massive amateur radio contest station.

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

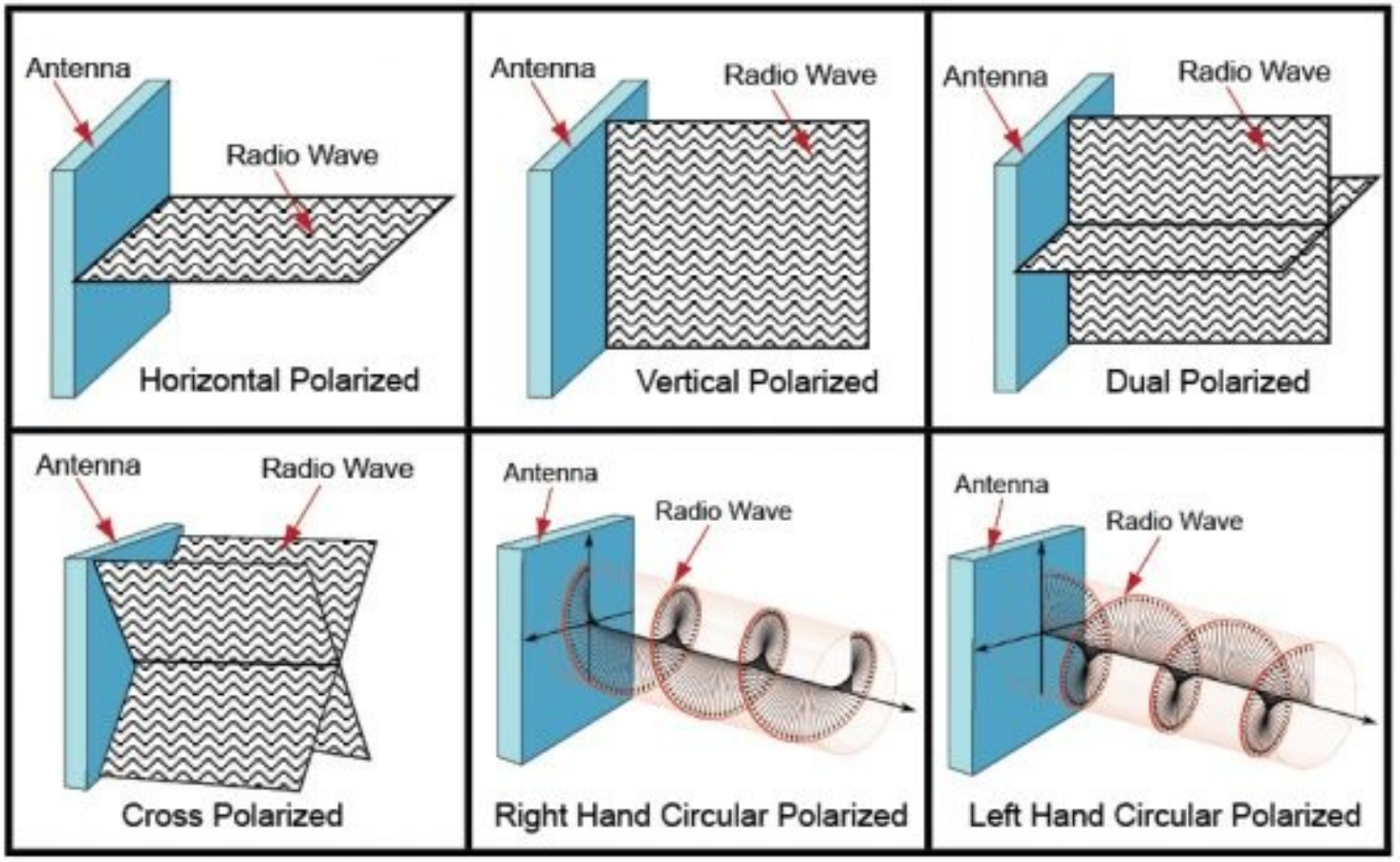
Radio Arcala, located close to Arctic Circle in Finland, is a massive amateur radio contest station.



St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

The OH8X 160m yagi is a 3-element monster with 12.9dBi gain that stands over 100m high and weighs a staggering 40 tons. It occupies a site of around 29,000 square meters and was built from 450 meters of tower sections, which needed 600 litres of paint! The entire tower can be rotated on a 11kW motorized bearing, alone weighing in at 2 tons. Yet, this is an amateur radio antenna.

Antanna Polarization
Vertical
Horizontal



Be sure the antenna is the same polarization as the person who whom you are talking (HT) Different polarization results in signal loss.

Repeaters (next month's topic) are polarized vertical, so have your antenna vertical.

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

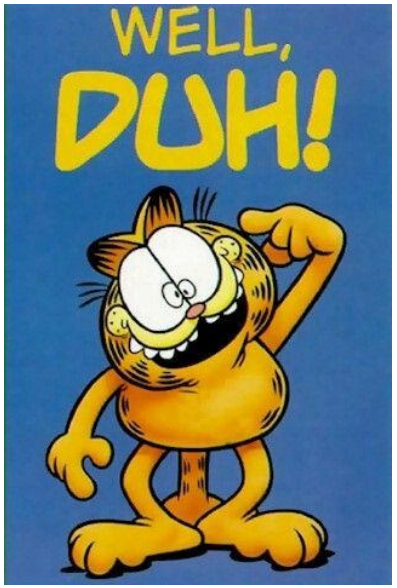
Antenna Gain...What does it mean?

In electromagnetics, an antenna's power gain or simply gain is a *key performance number* which combines the antenna's directivity and electrical efficiency. In a transmitting antenna, the gain describes how well the antenna converts input power into radio waves headed in a specified direction. IT DOES NOT INCREASE THE POWER OF THE RADIO.

Formula to calculate gain looks something like this

$$P(\lambda,\gamma,\psi_0,\rho,\Delta\lambda,I_{\mathrm{B}},\Delta\psi,\Delta\theta) = \int_{-\psi_0+\Delta\psi}^{+\psi_0+\Delta\psi} \frac{2}{3}\frac{e_0\Delta\lambda\Delta\theta\, I_{\mathrm{B}}\,\rho^2}{\varepsilon_0\beta\lambda^4\gamma^4}\left[1+(\gamma\psi)^2\right]^2$$

$$\times\left[K_{2/3}\left[\xi(\lambda,\psi)\right]^2+\frac{(\gamma\psi)^2}{1+(\gamma\psi)^2}K_{1/3}\left[\xi(\lambda,\psi)\right]^2\right] \quad .$$



St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Easier way to calculate gain
Also referred to as ERP (Effective Radiated Power)

GAIN	Power multiplied by +/-
1 dB	times 1,25
2 dB	times 1,59
3 dB	times 2
4 dB	times 2,5
5 dB	times 3,125
6 dB	times 4
7 dB	times 5
8 dB	times 6,25
9 dB	times 8
10 dB	times 10
20 dB	times 100

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Easier way to calculate gain
Also referred to as ERP (Effective Radiated Power)

GAIN	Power multiplied by +/-
1 dB	times 1,25
2 dB	times 1,59
3 dB	times 2
4 dB	times 2,5
5 dB	times 3,125
6 dB	times 4
7 dB	times 5
8 dB	times 6,25
9 dB	times 8
10 dB	times 10
20 dB	times 100

Example of ERP

5 watts output transmitted into an antenna with a 10 dB gain has the ERP of ????

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Easier way to calculate gain
Also referred to as ERP (Effective Radiated Power)

GAIN	Power multiplied by +/-
1 dB	times 1,25
2 dB	times 1,59
3 dB	times 2
4 dB	times 2,5
5 dB	times 3,125
6 dB	times 4
7 dB	times 5
8 dB	times 6,25
9 dB	times 8
10 dB	times 10
20 dB	times 100

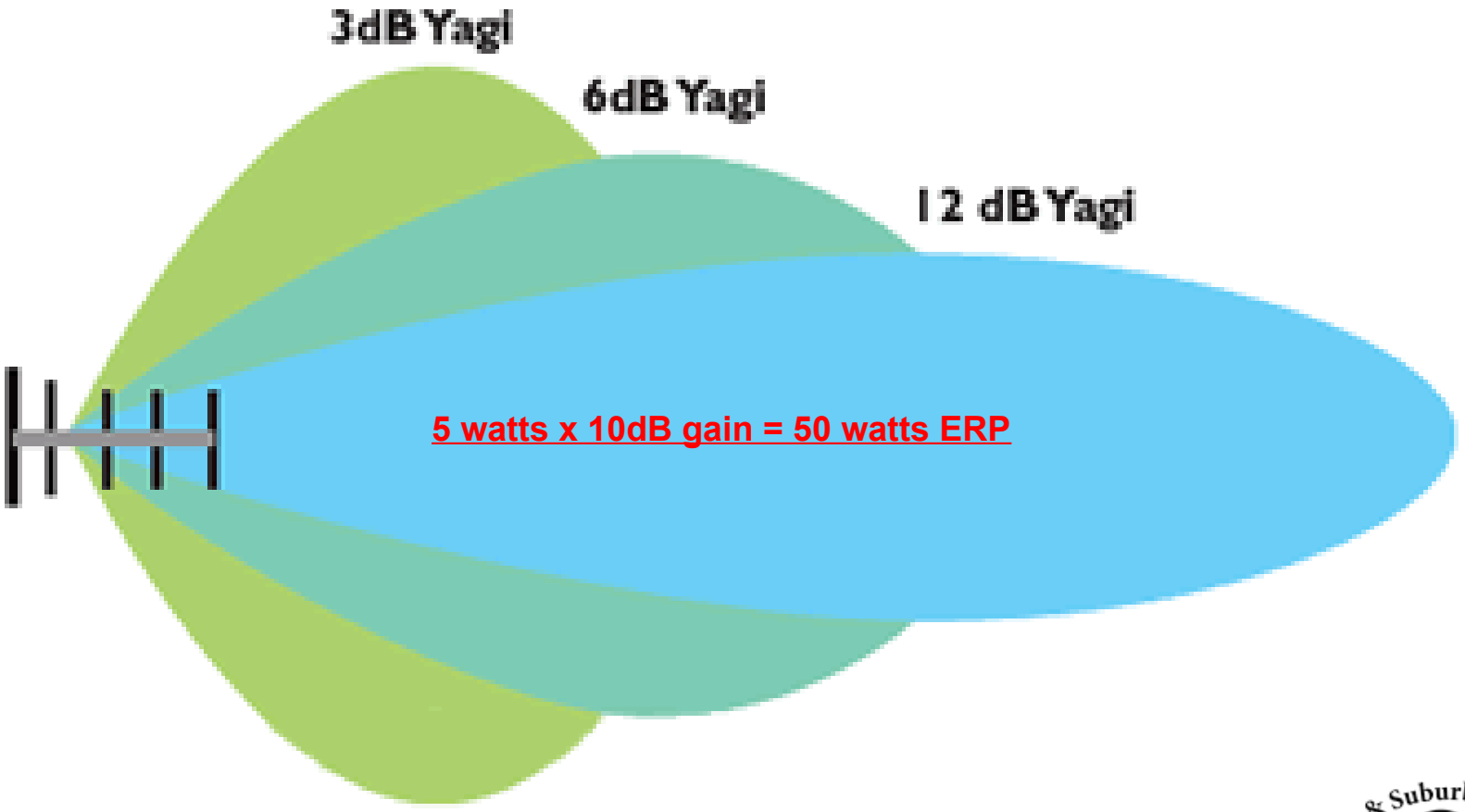
Example of ERP

5 watts output transmitted into an antenna with a 10 dB gain has the ERP of 50 watts.
5 watts x 10=50

Radio is still putting out 5 watts, but all 5 watts are in the same direction.

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Beam (Yagi) radiation pattern



St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

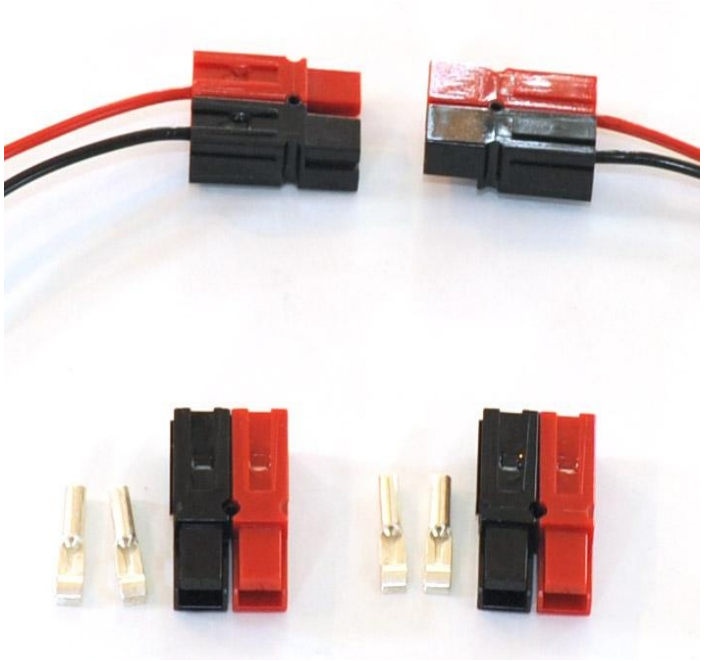
dBi vs dBd

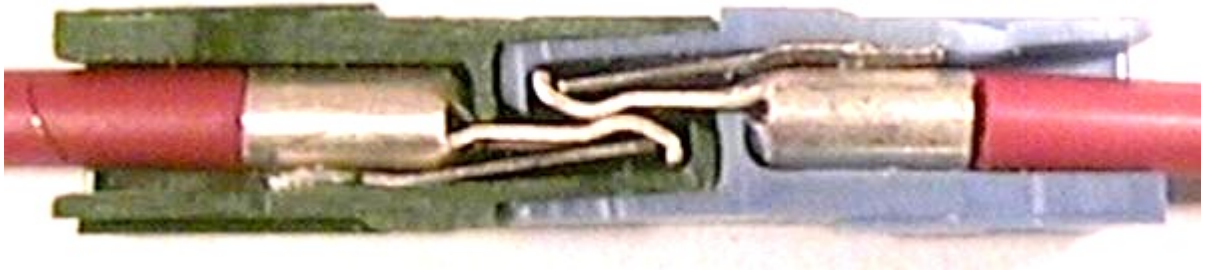
dBi refers to the decibel gain in relation to an "Isotropic Radiator." That is a theoretical antenna which radiates energy equally in all directions (as a perfect sphere.) dBd refers to decibel gain in relation to a dipole antenna. That antenna has a dBi gain of 2.15.

Providing Power to your Station

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Connecting radio to Power Supply

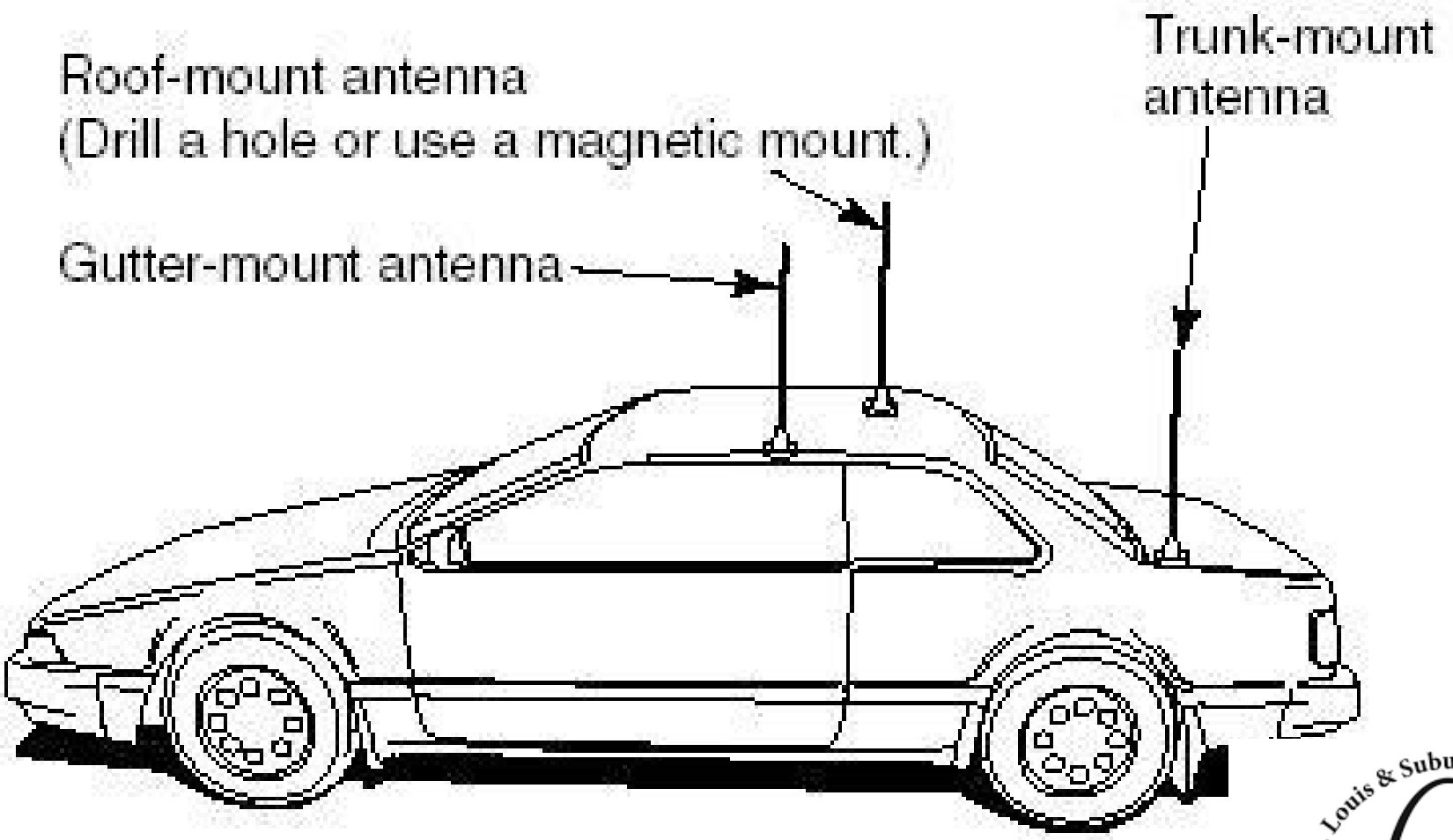




Anderson Power Poles available online or at Gateway Electronics

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Mobile Antennas



St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Mobile Antennas
2 meters

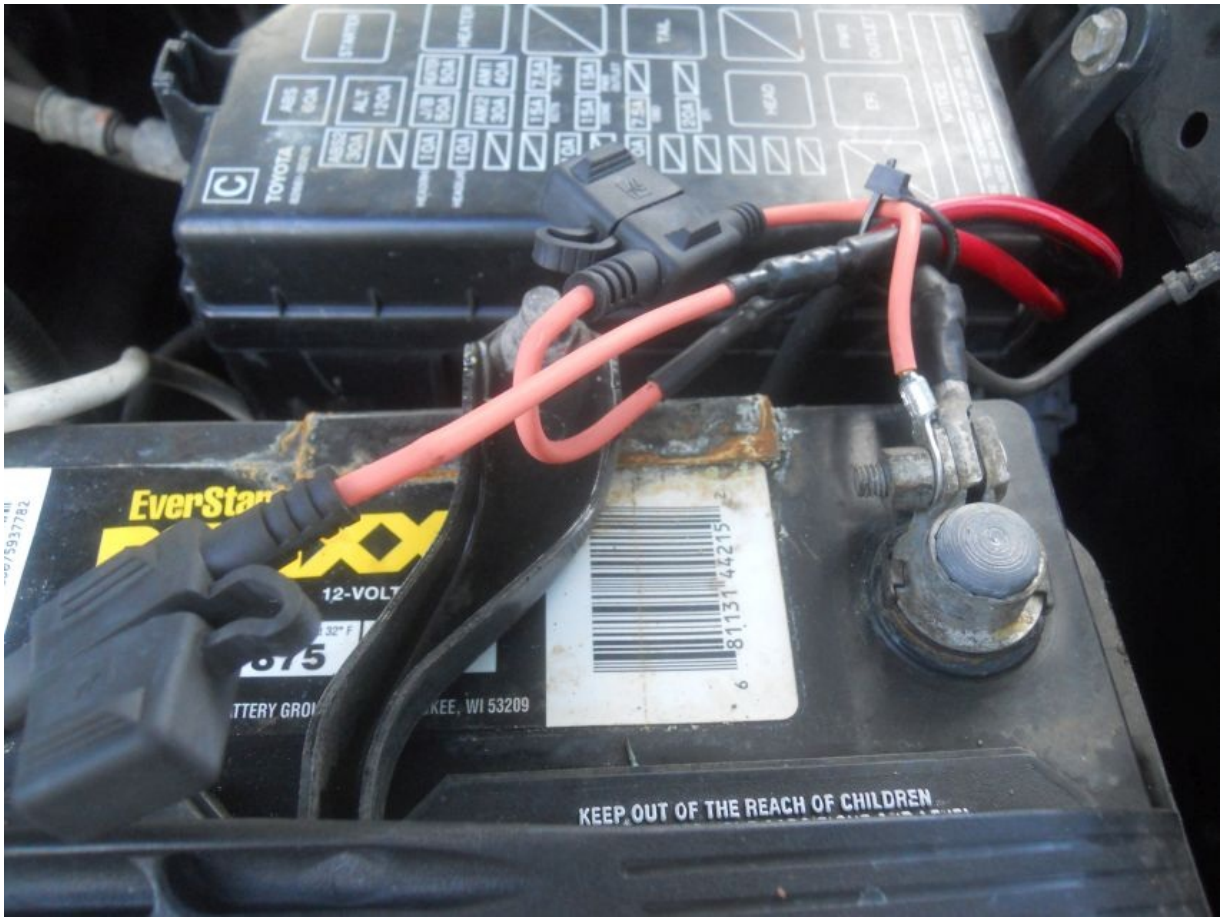
⅝ wave
49 inches long

Quarter ¼ wave
19 inches long

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Dual band mobile antennas.
2m/70cm

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017



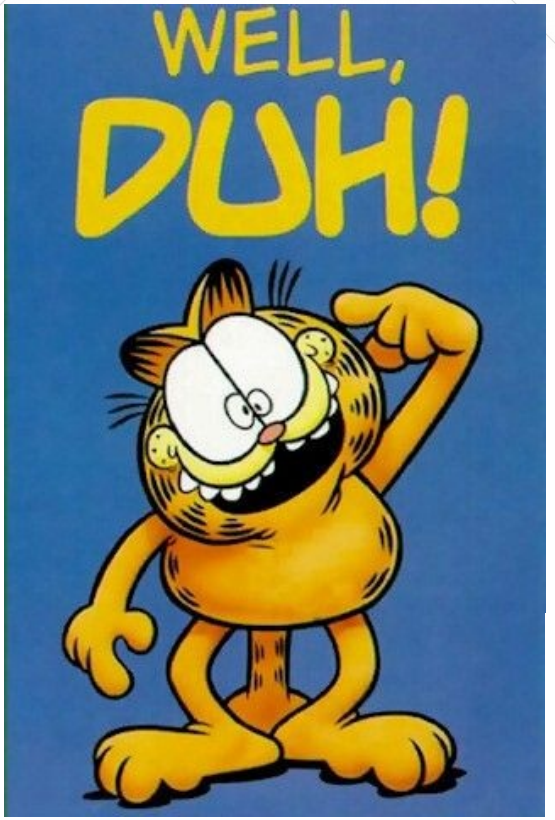
Powering your mobile radio
Connect directly to the battery and fuse as possible to the battery. Ideally, fuse both positive and negative.

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

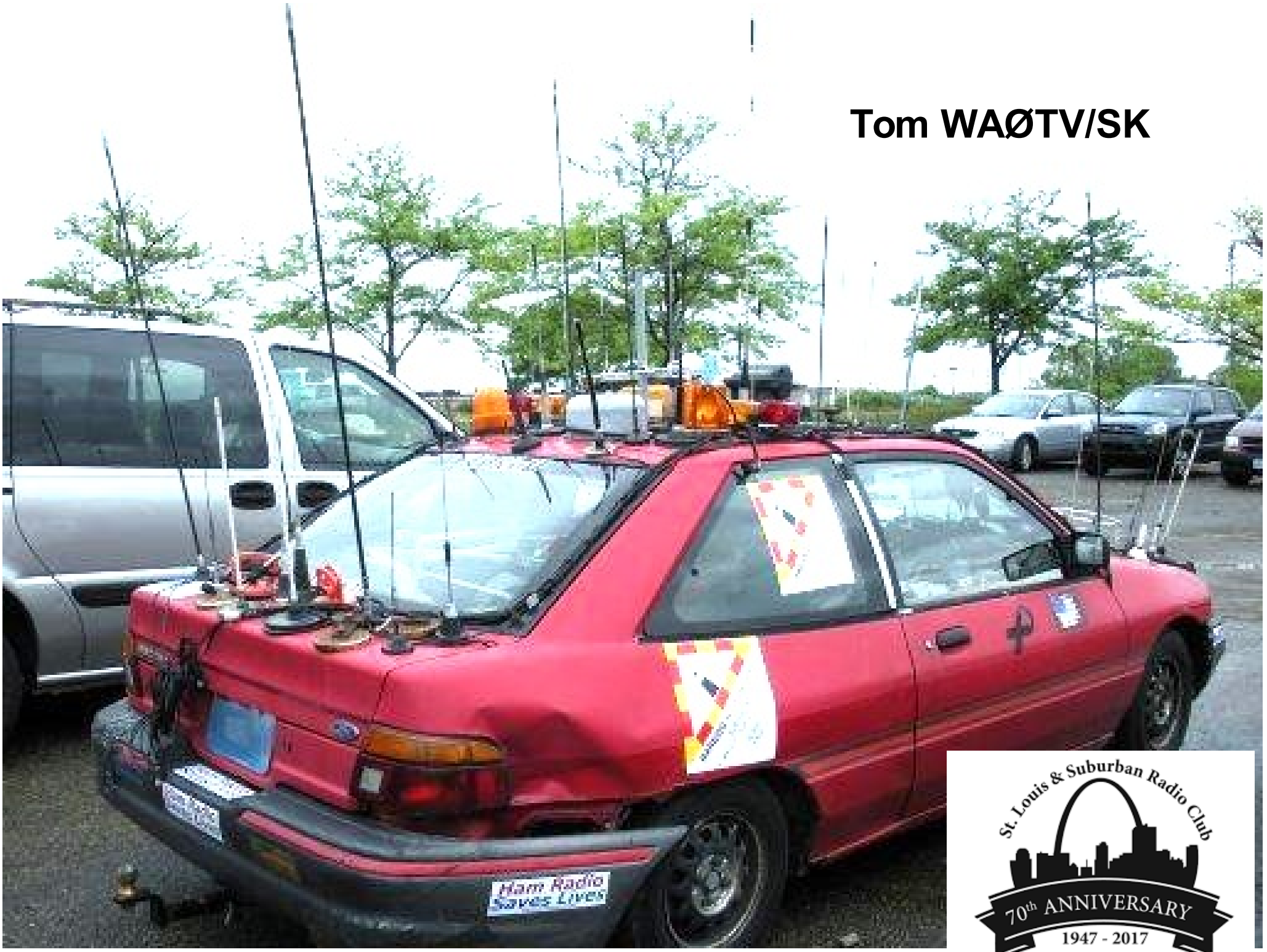
Can you power your radio by using the accessory (aka cigarette lighter) plug?

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Should you power your radio by using the accessory (aka cigarette lighter) plug?



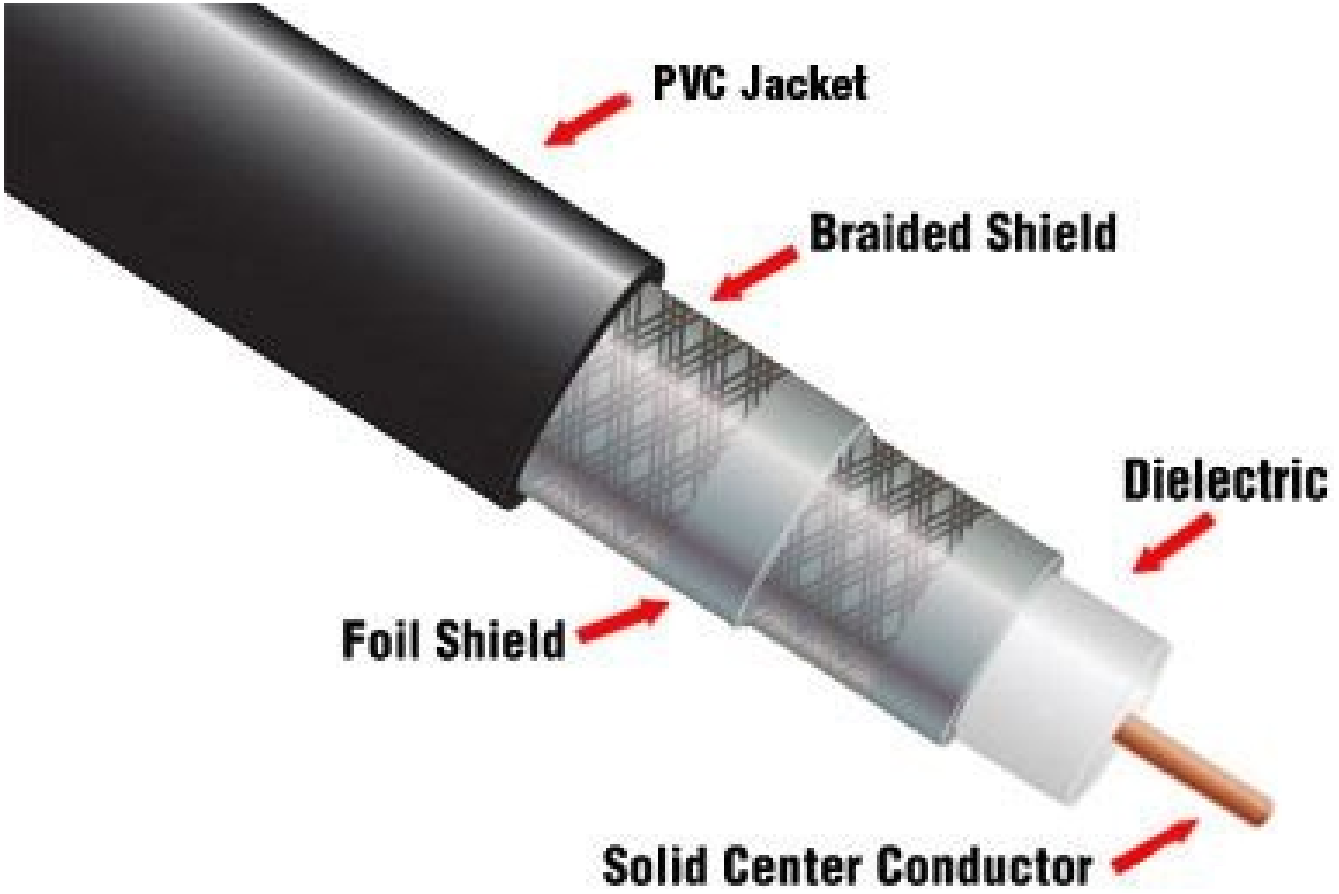
St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017


Tom WAØTV/SK
Ham Radio
Saves Lives
St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Coax

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Coax



St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Common Connectors

PL 259

SO 239
(UHF)

Barrel
Connector

Right Angle
PL 259/SO 239

SMA to SO239

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

What coax should I use?

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Depends !!!!

Coax Cable Signal Loss (Attenuation) in dB per 100ft*								
Loss*	RG-174	RG-58	RG-8X	RG-213	RG-6	RG-11	RF-9914	RF-9913
1MHz	1.9dB	0.4dB	0.5dB	0.2dB	0.2dB	0.2dB	0.3dB	0.2dB
10MHz	3.3dB	1.4dB	1.0dB	0.6dB	0.6dB	0.4dB	0.5dB	0.4dB
50MHz	6.6dB	3.3dB	2.5dB	1.6dB	1.4dB	1.0dB	1.1dB	0.9dB
100MHz	8.9dB	4.9dB	3.6dB	2.2dB	2.0dB	1.6dB	1.5dB	1.4dB
200MHz	11.9dB	7.3dB	5.4dB	3.3dB	2.8dB	2.3dB	2.0dB	1.8dB
400MHz	17.3 B	11.2dB	7.9dB	4.8dB	4.3dB	3.5dB	2.9dB	2.6dB
700MHz	26.0dB	16.9dB	11.0dB	6.6dB	5.6dB	4.7dB	3.8dB	3.6dB
900MHz	27.9 B	20.1dB	12.8dB	7.7dB	6.0dB	5.4dB	4.9dB	4.2dB
1GHz	32.0dB	21.5dB	13.5dB	8.3dB	6.1dB	5.6dB	5.3dB	4.5dB
Imped	50ohm	50ohm	50ohm	50ohm	75ohm	75ohm	50ohm	50ohm

* **Note:** Coax losses shown above are for 100 feet lengths. Loss is a length multiplier, so a 200 ft length would have twice the loss s above and a 50 ft length would have half the loss. This multiplie why you should keep cable installation lengths between radios antennas as short as practical!

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Extra items that are optional but very helpful in setting up and maintaining your station

The SWR meter or VSWR (voltage standing wave ratio) meter measures the standing wave ratio in a transmission line. The meter can be used to indicate the degree of mismatch between a transmission line and its load (usually a radio antenna), or evaluate the effectiveness of impedance matching efforts.

Price range = $50 -150 ish

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

What is SWR?

In radio engineering and telecommunications, standing wave ratio (**SWR**) is a measure of impedance matching of loads to the characteristic impedance of a transmission line or waveguide.

SWR simplified
Get SWR as close to 1.1 as possible.
Use SWR meter to check before transmitting

VSWR Reference Chart		
VSWR : 1	% Forward Power	% Reflected Power
1.5	96	4
2.0	89	11
2.5	82	18
3.0	75	25
3.5	70	30
4.0	64	36
4.5	60	40
5.0	56	44
6.0	50	50
7.0	44	56
8.0	40	60
9.0	36	64
10.0	33	67

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Antenna Switch.

Allows you to operate one radio with two antennas,
OR two radios on the same antenna

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

A dummy load is a device used to simulate an electrical load, usually for testing purposes.
In radio a dummy antenna is connected to the output of a radio transmitter and electrically simulates an antenna, to allow the transmitter to be adjusted and tested without radiating radio waves.

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Websites that are helpful

Www.slsrc.org
Www.eham.net
Www.QRZ.com
YouTube (search for topic)
Vendors:
www.dxengineering.com
Www.hamradio.com
www.mfjenterprises.com/
www.universal-radio.com
And others

St. Louis & Suburban Radio Club
70th ANNIVERSARY
1947 - 2017

Summary

Price for Basic station:

2 meter single band (not HT) - $150 ish

Power Supply- $75 -$100

J-Pole or Vertical antenna $35-75

Coax- depends on how much is needed $30 est

Total = $350 ish

St. Louis & Suburban Radio Club

70th ANNIVERSARY

1947 - 2017

St. Louis & Suburban Radio Club

70th ANNIVERSARY

1947 - 2017