

Enhancing Backcountry Radio Communications

Inexpensive Equipment and
Simple Technique Changes



Introduction

- Paul Robertson
 - 4th Year on Team
 - GCSAR Board of Directors
 - SAR Academy Coordinator
 - Field Director
 - Ham Technician License – KE0ETR



Introduction



Timeliness – Ham Operator Rescue



On Sunday, May 17, 2015 - Grand County Search and Rescue and Alpine Rescue helped 59-year-old Littleton resident, Brad Bylund, off of Mount Flora above Berthoud Pass. – SkyHigh Daily News

Problem

- Growing membership required new radios
 - Can we save money?
 - Is there newer/better equipment
- Difficulty in Backcountry Radio Communication
 - “SAR Repeater doesn’t work here”
 - “Simplex won’t go up the canyon, over the peak”



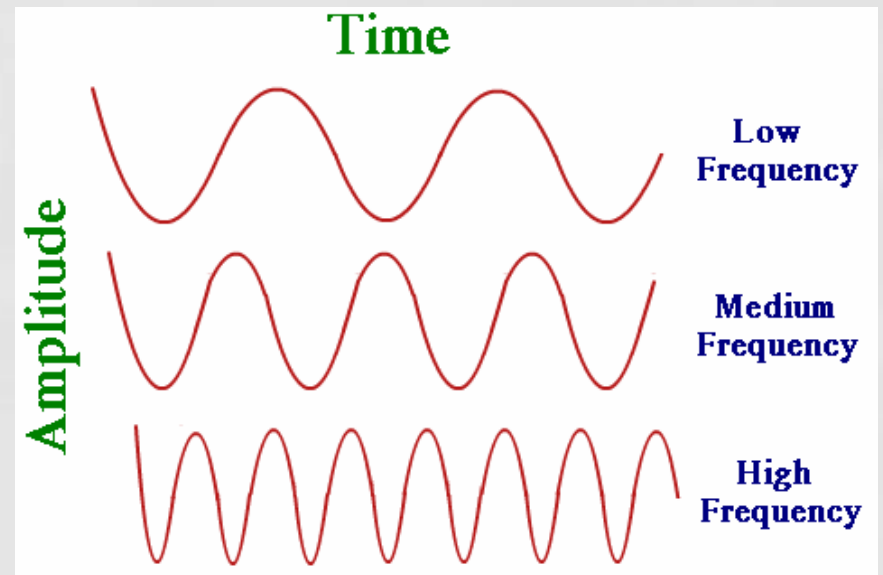
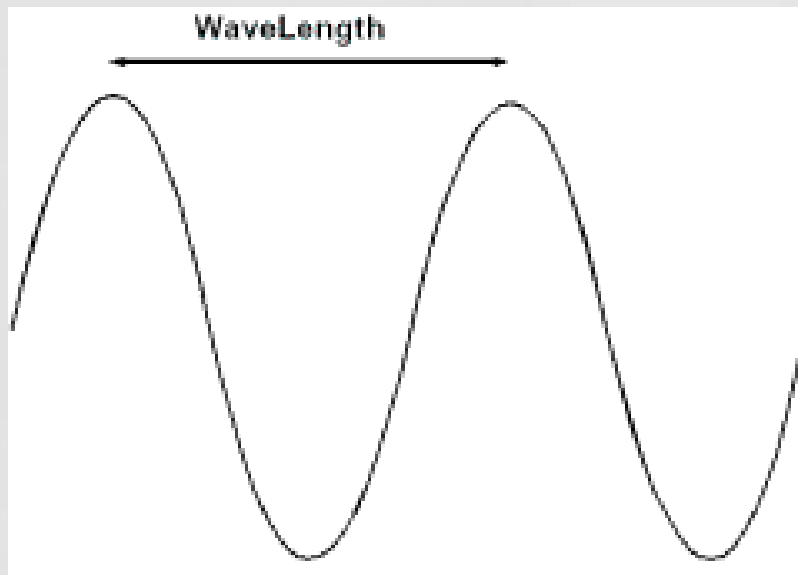
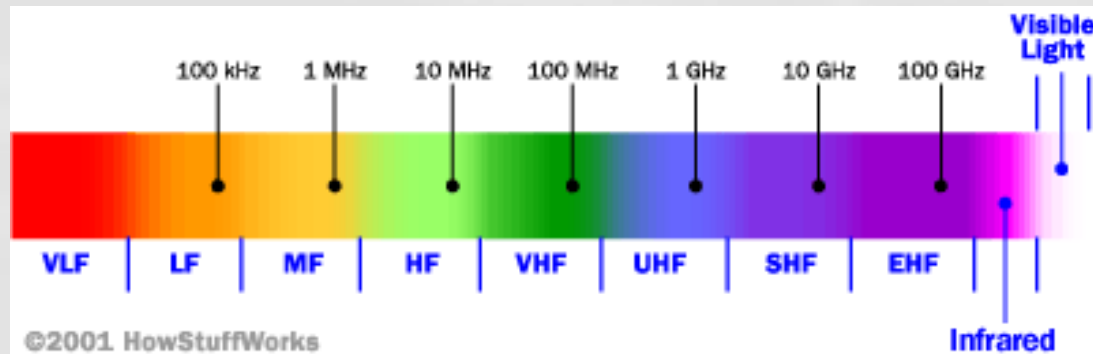
What are the ACTUAL Problems?

- How can we solve them:
 - While purchasing new equipment
 - With modification of equipment, techniques or protocols

How do Radios actually work?

- Radio Waves
 - Frequency
 - Bandwidth
 - Wavelength
- Power
 - Hand held - 5 watts
 - Mobile - 50 Watts
- Antennas

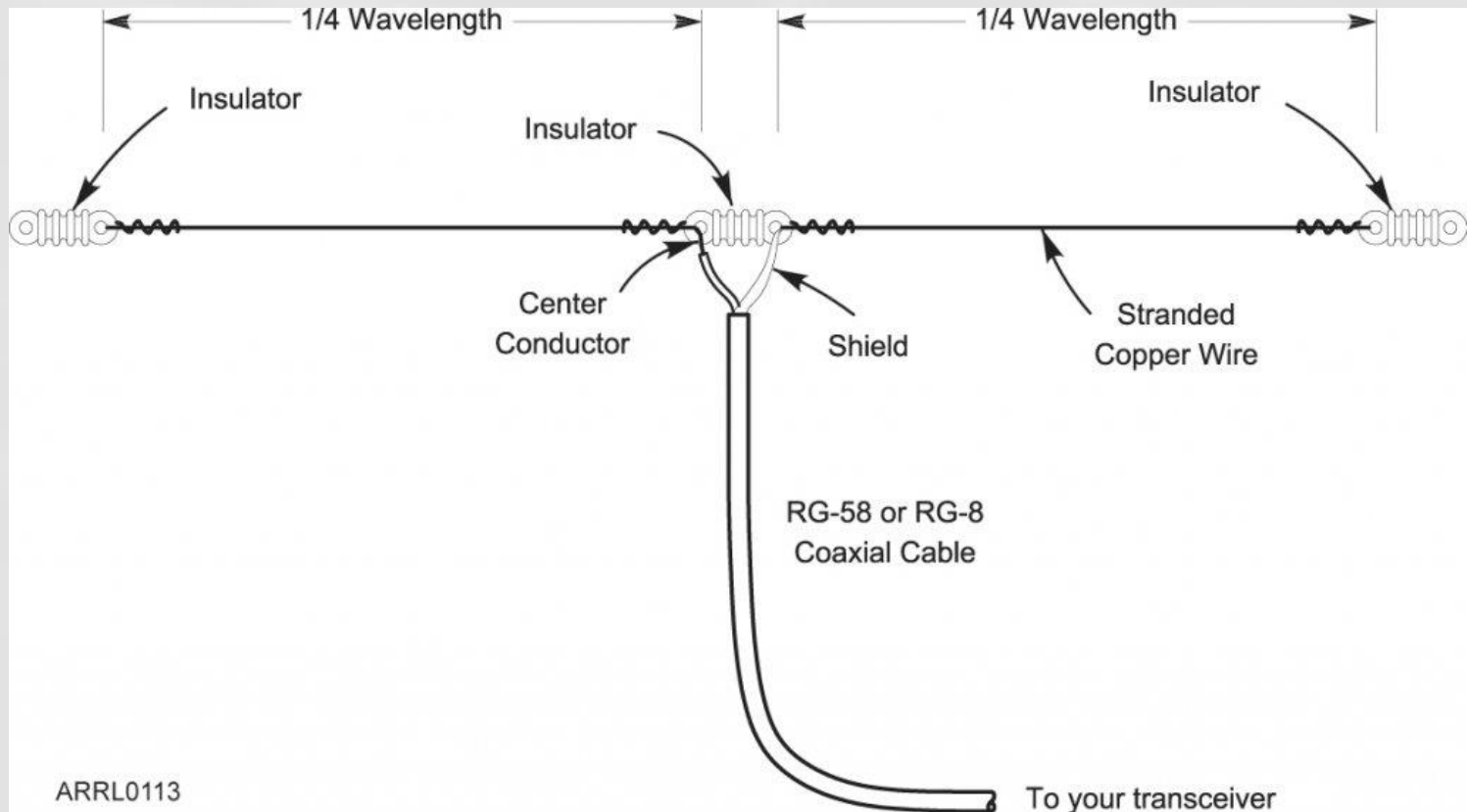
Radio Waves



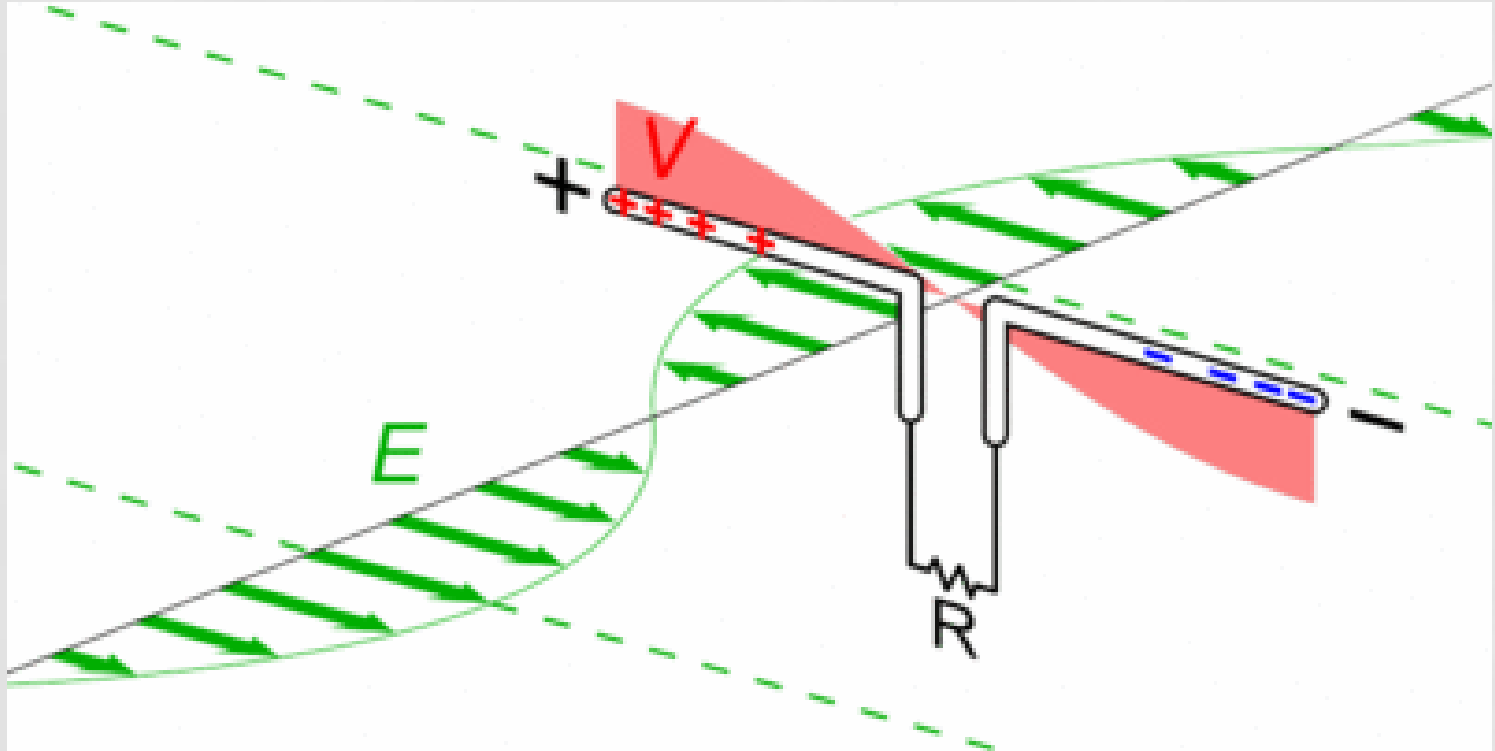
Radio Waves

<u>Frequency</u>	<u>Wavelength</u>	<u>Designation</u>	<u>Abbreviation</u> ^[5]
3–30 Hz	10^5 – 10^4 km	<u>Extremely low frequency</u>	ELF
30–300 Hz	10^4 – 10^3 km	<u>Super low frequency</u>	SLF
300–3000 Hz	10^3 –100 km	<u>Ultra low frequency</u>	ULF
3–30 kHz	100–10 km	<u>Very low frequency</u>	VLF
30–300 kHz	10–1 km	<u>Low frequency</u>	LF
300 kHz – 3 MHz	1 km – 100 m	<u>Medium frequency</u>	MF
3–30 MHz	100–10 m	<u>High frequency</u>	HF
30–300 MHz	10–1 m	<u>Very high frequency</u>	VHF
300 MHz – 3 GHz	1 m – 10 cm	<u>Ultra high frequency</u>	UHF
3–30 GHz	10–1 cm	<u>Super high frequency</u>	SHF
30–300 GHz	1 cm – 1 mm	<u>Extremely high frequency</u>	EHF
300 GHz – 3000 GHz	1 mm – 0.1 mm	<u>Tremendously high frequency</u>	THF

How do Radios actually work?

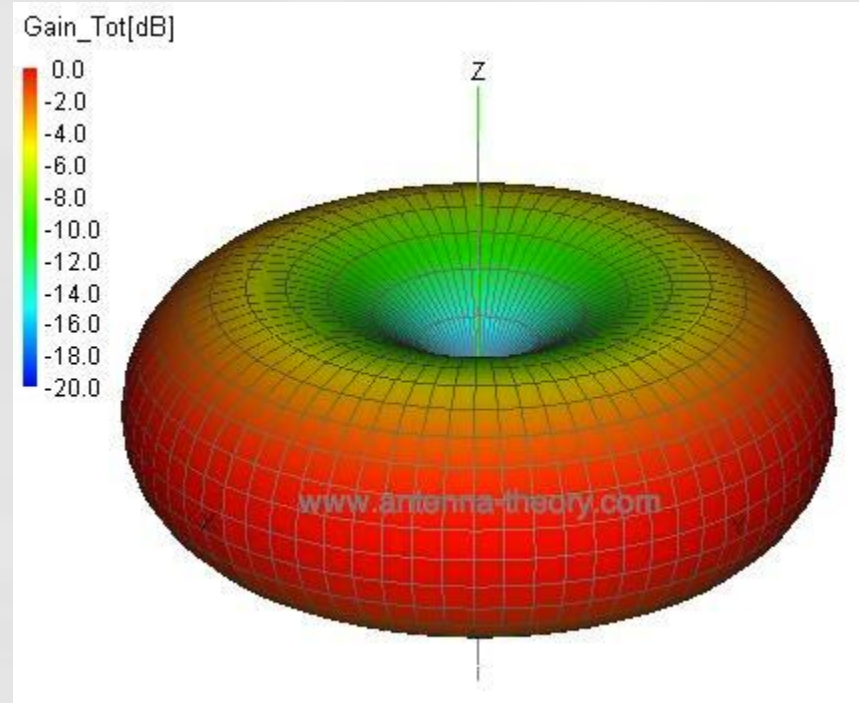
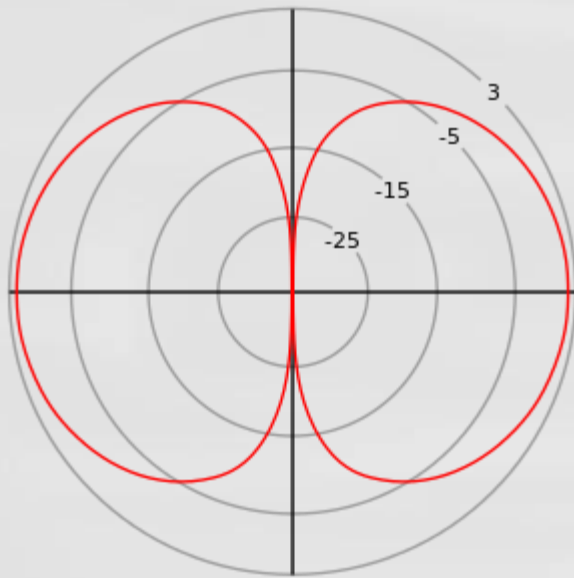


How do Radios actually work?



How do Radios actually work?

- Antennas



How do Radios actually work?

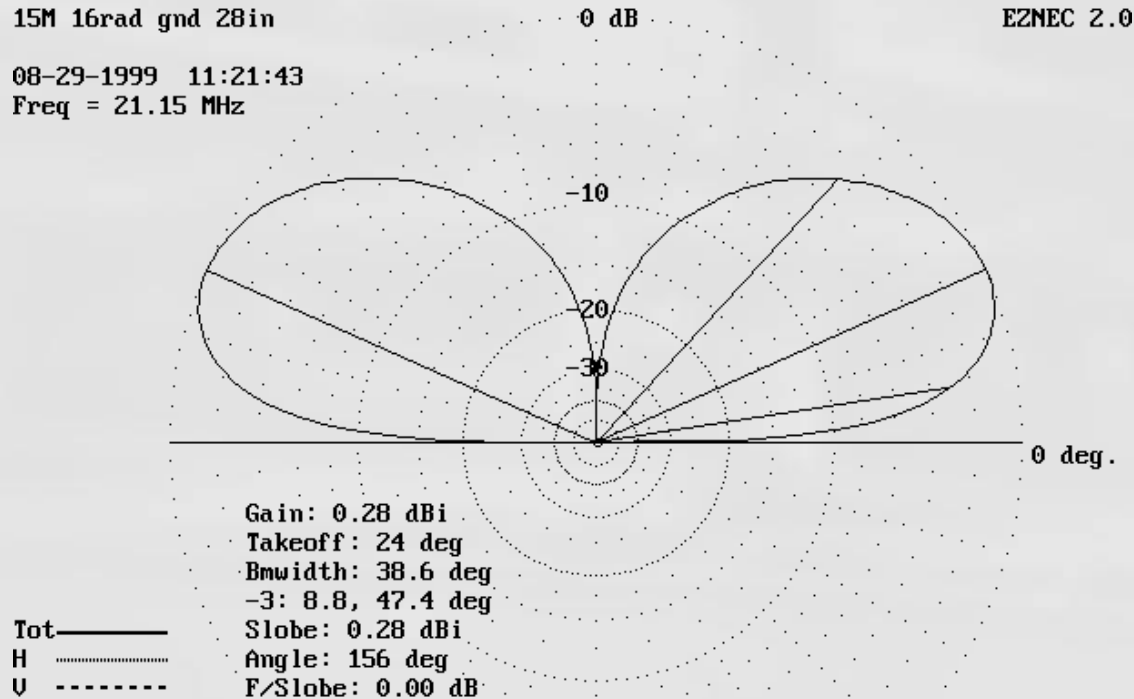
● Antennas

15M 16rad gnd 28in

EZNEC 2.0

08-29-1999 11:21:43

Freq = 21.15 MHz



How do Radios actually work?

- Antennas

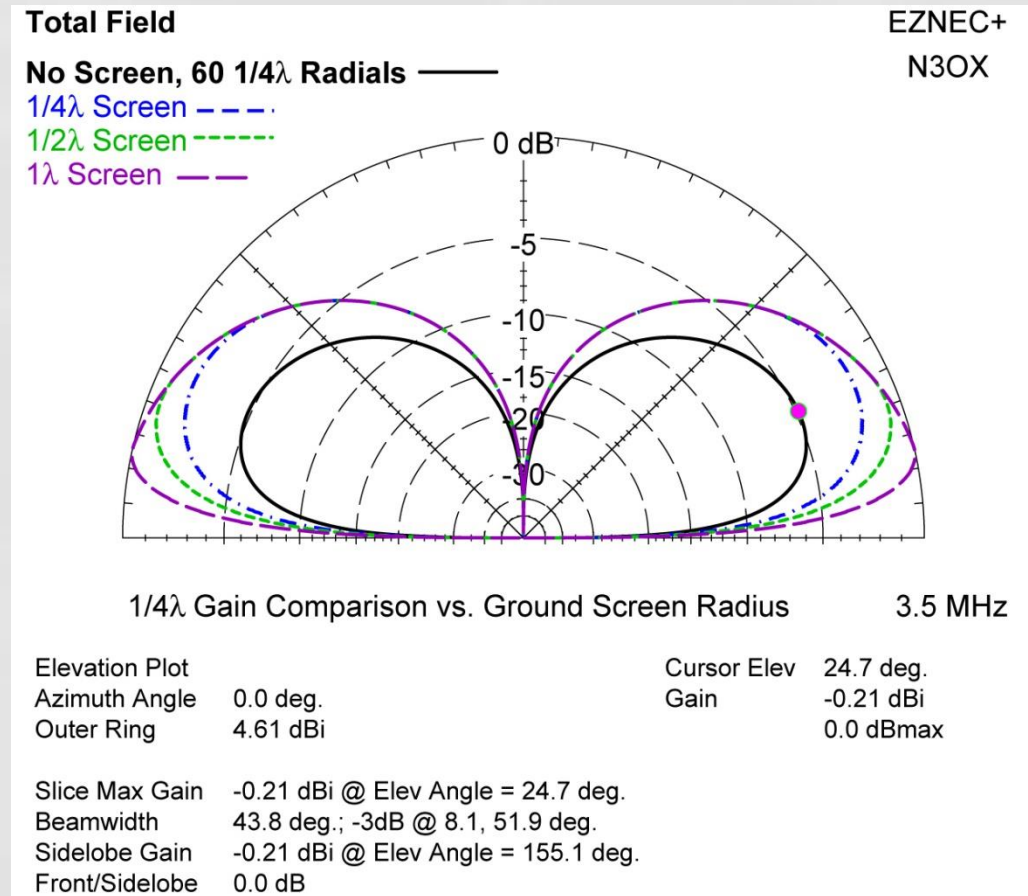


How do Radios actually work?

- Antennas
 - Full Wave
 - 1/2 Wave
 - 1/4Wave
 - 5/8 Wave
 - J-Pole

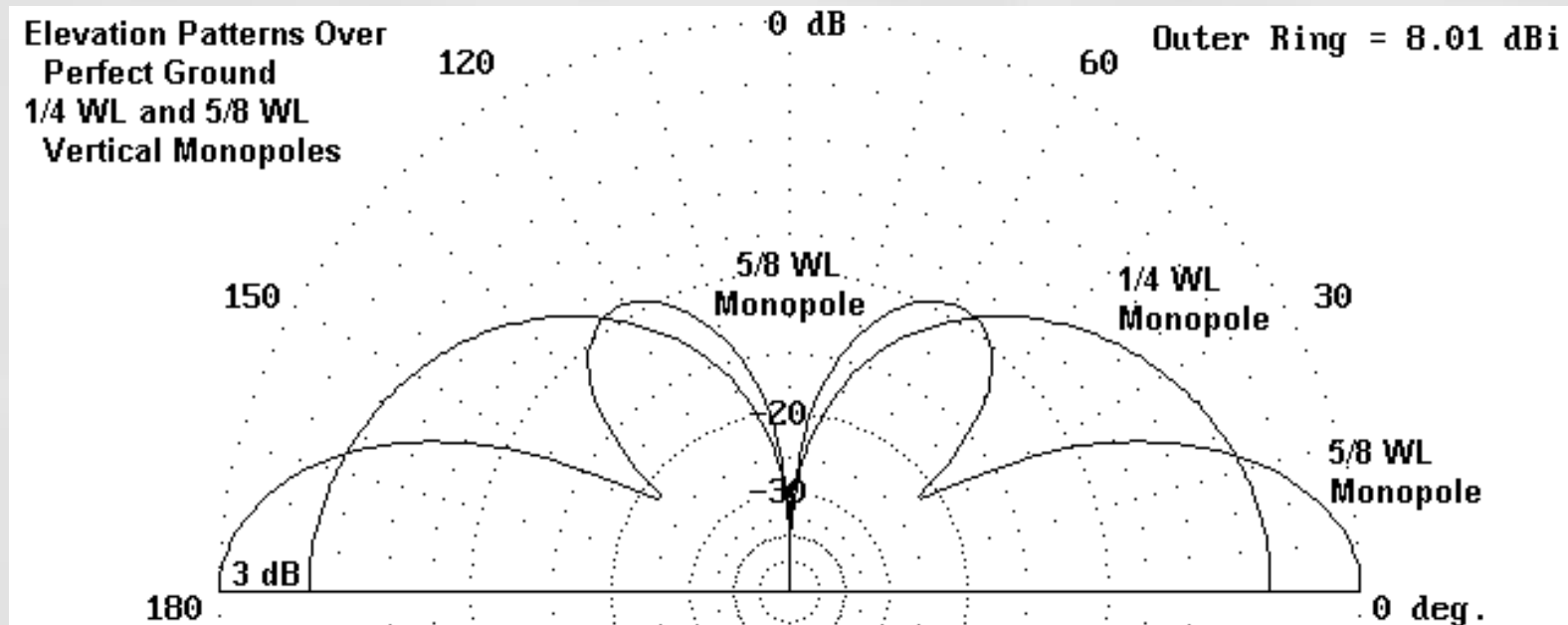
How do Radios actually work?

• Antennas



How do Radios actually work?

- Antennas



How do Radios actually work?

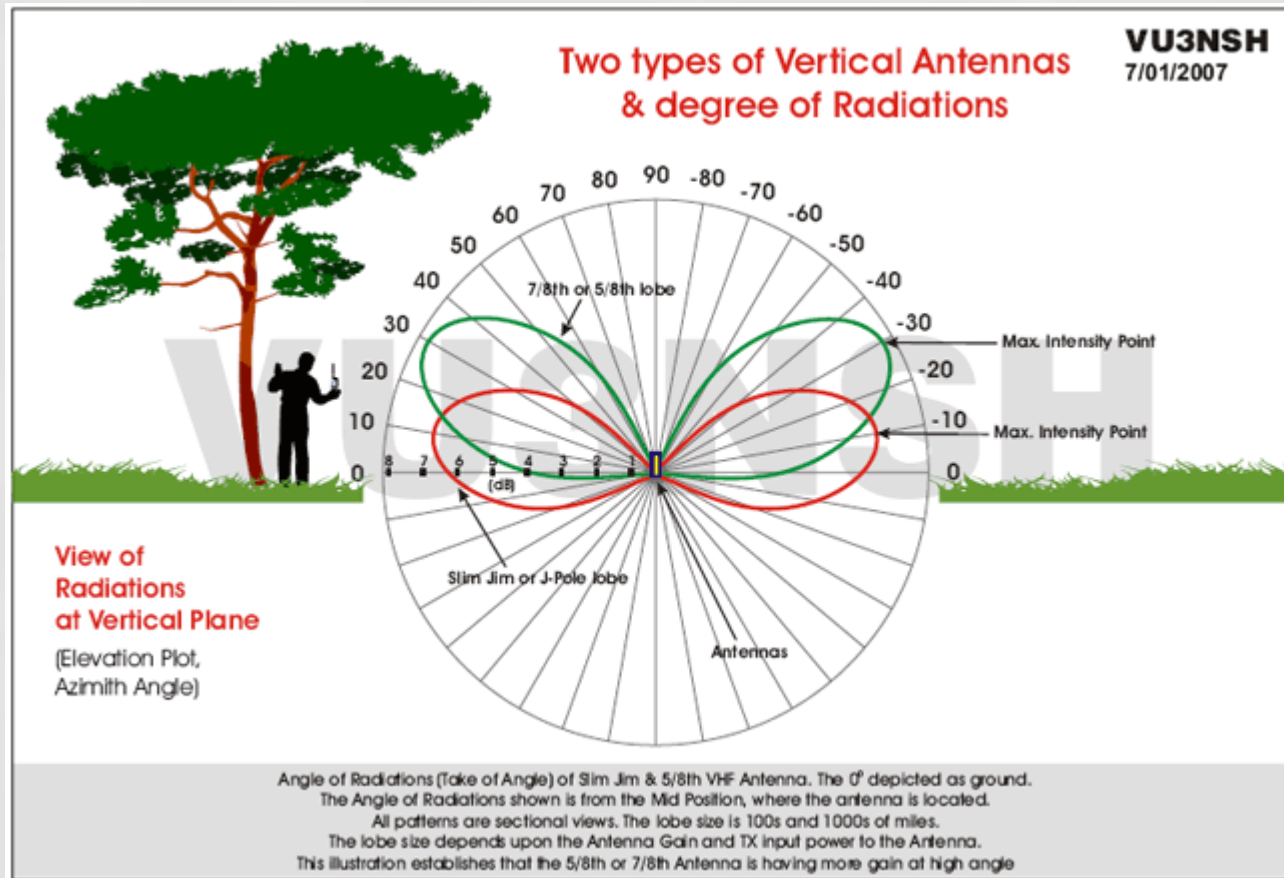
• Antennas

$$\begin{aligned}R_{\frac{\lambda}{2}} &= 60 \operatorname{Cin}(2\pi) = 60 [\ln(2\pi\gamma) - \operatorname{Ci}(2\pi)] = 120 \int_0^{\frac{\pi}{2}} \frac{\cos(\frac{\pi}{2} \cos \theta)^2}{\sin \theta} d\theta, \\&= 15 \left[2\pi^2 - \frac{1}{3}\pi^4 + \frac{4}{135}\pi^6 - \frac{1}{630}\pi^8 + \frac{4}{70875}\pi^{10} \dots - (-1)^n \frac{(2\pi)^{2n}}{n(2n)!} \right], \\&= 73.1296 \dots \Omega;\end{aligned}$$

$$\begin{aligned}G_{\frac{\lambda}{2}} &= \frac{60^2}{30R_{\frac{\lambda}{2}}} = \frac{3600}{30R_{\frac{\lambda}{2}}} = \frac{120}{R_{\frac{\lambda}{2}}} = \frac{1}{\int_0^{\frac{\pi}{2}} \frac{\cos(\frac{\pi}{2} \cos \theta)^2}{\sin \theta} d\theta}, \\&\approx \frac{120}{73.1296} \approx 1.6409224 \approx 2.15088 \text{ dBi};\end{aligned}$$

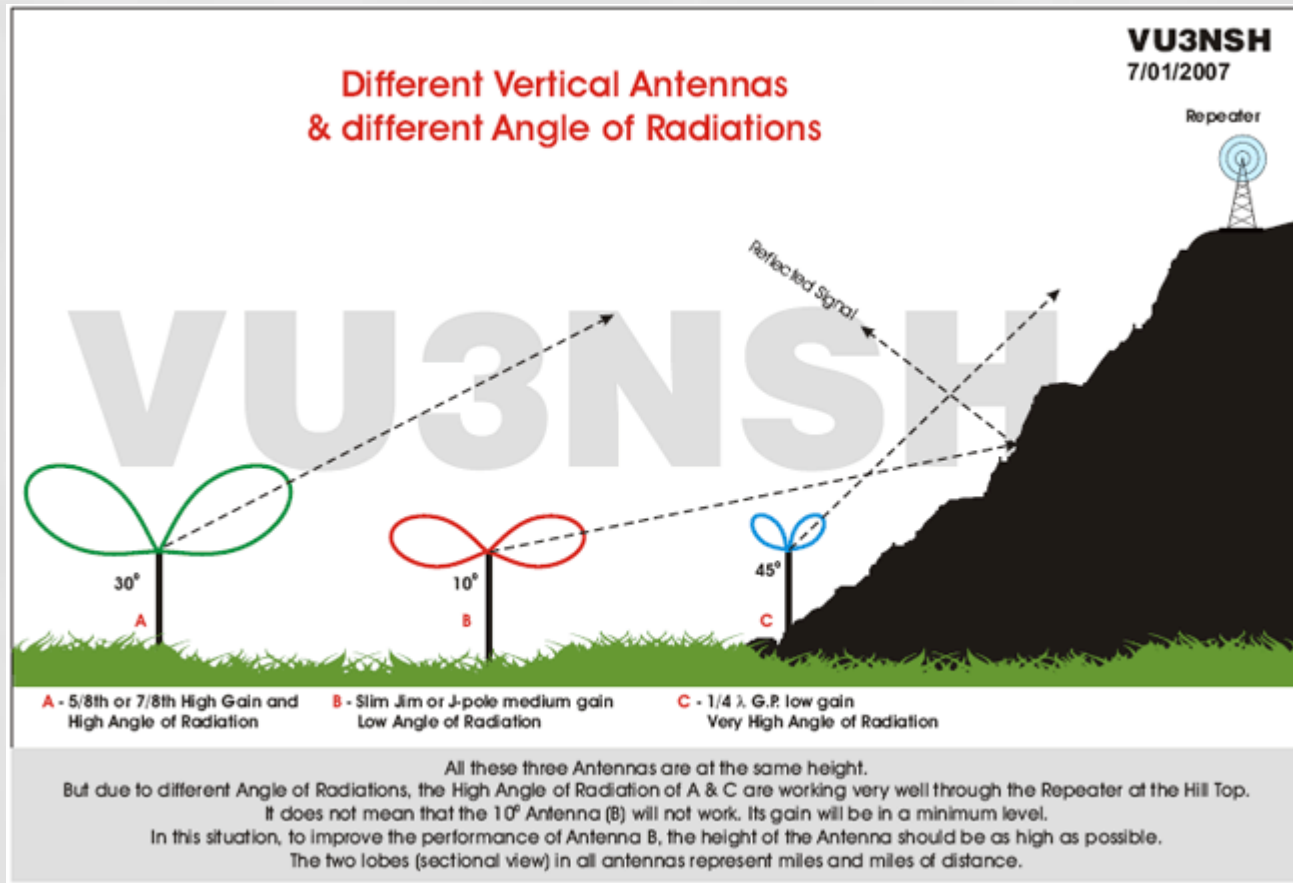
How do Radios actually work?

Antennas



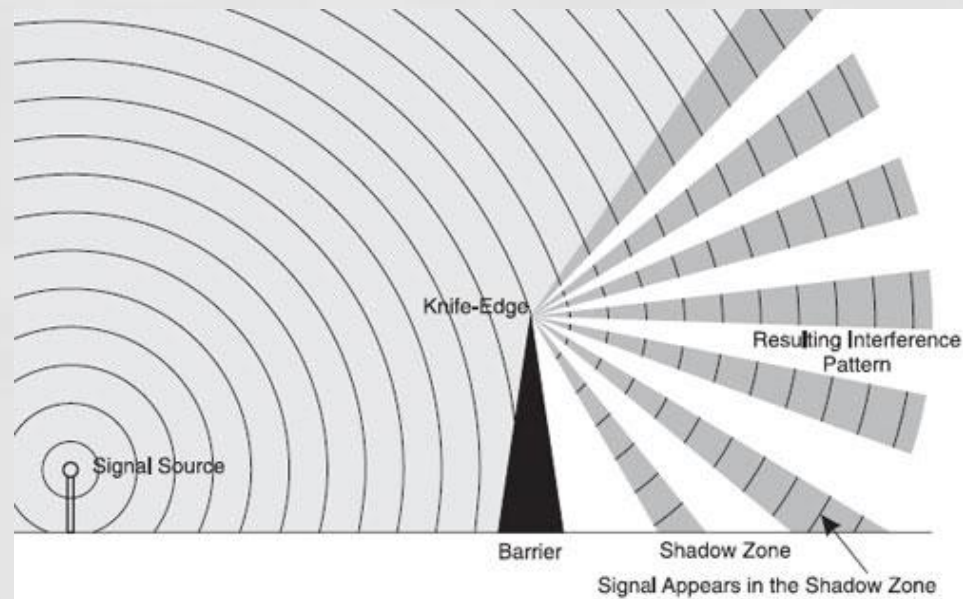
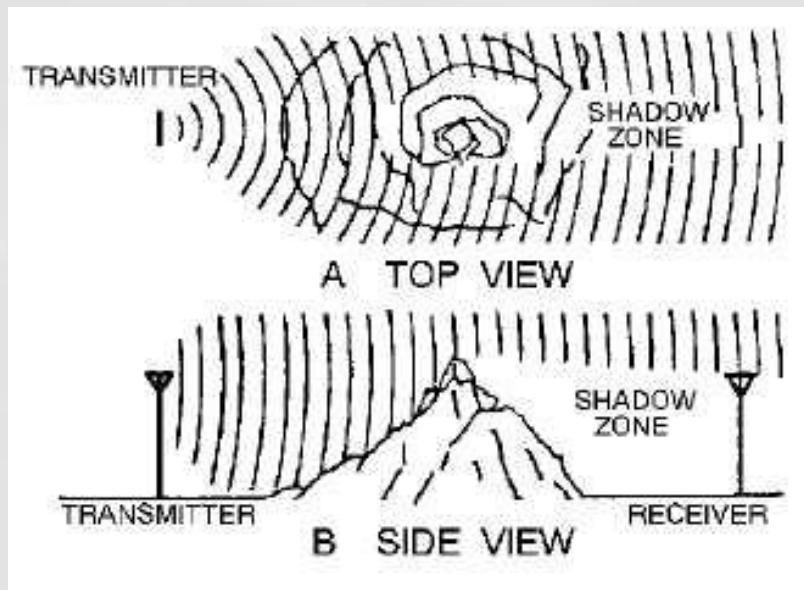
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Antennas



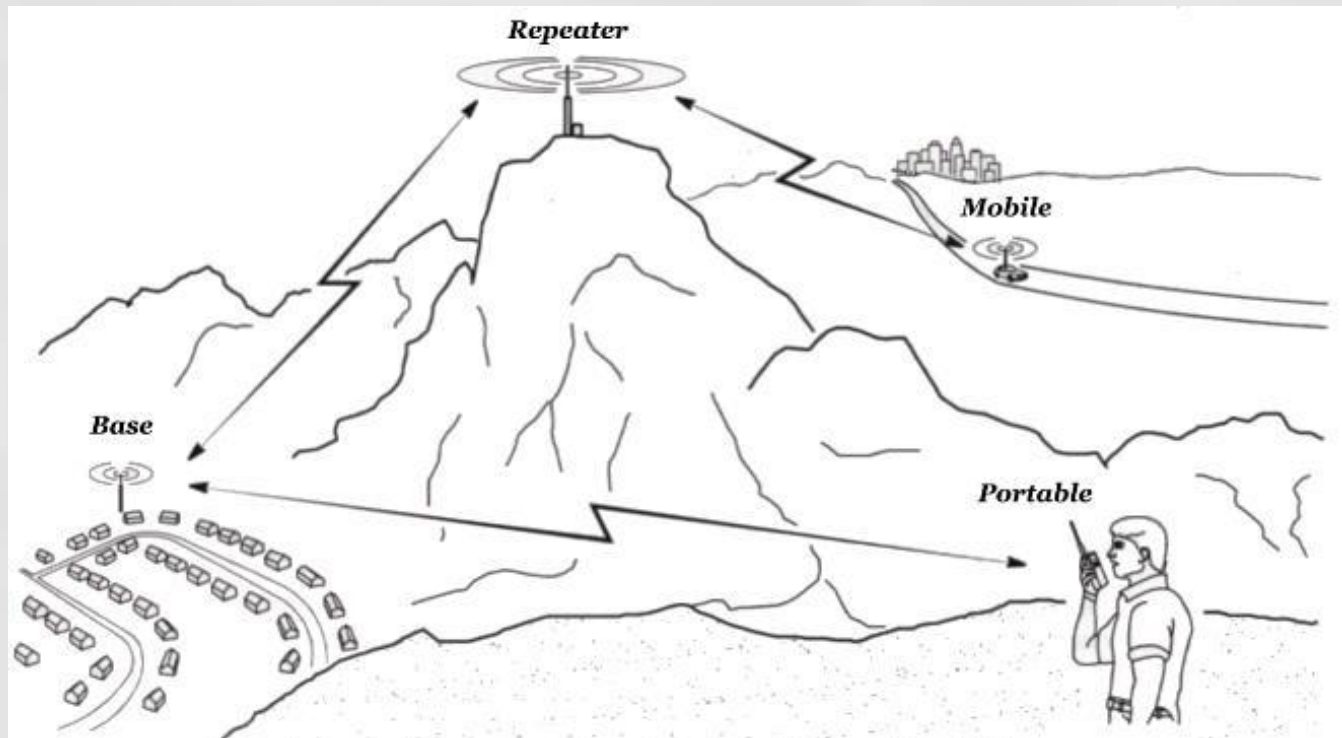
How do Radios actually work?

- Repeaters



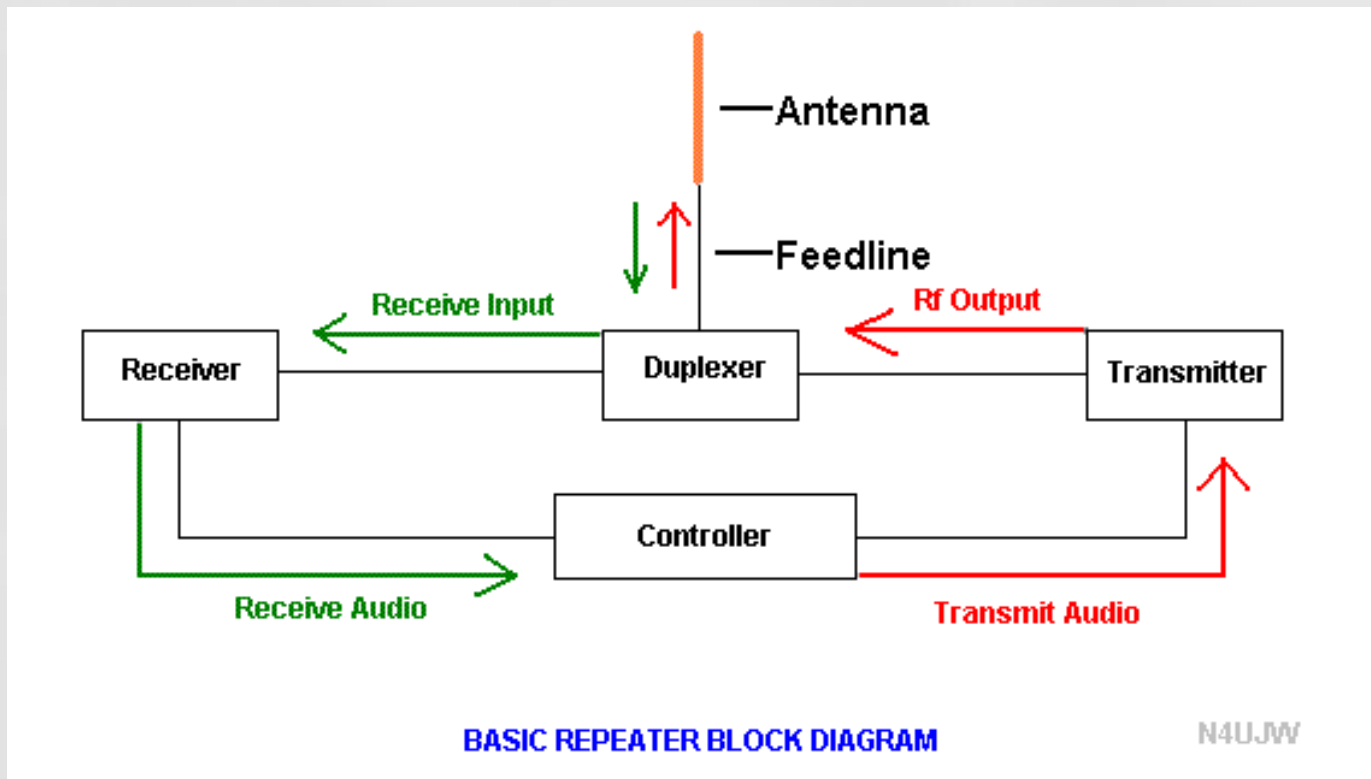
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- Repeaters



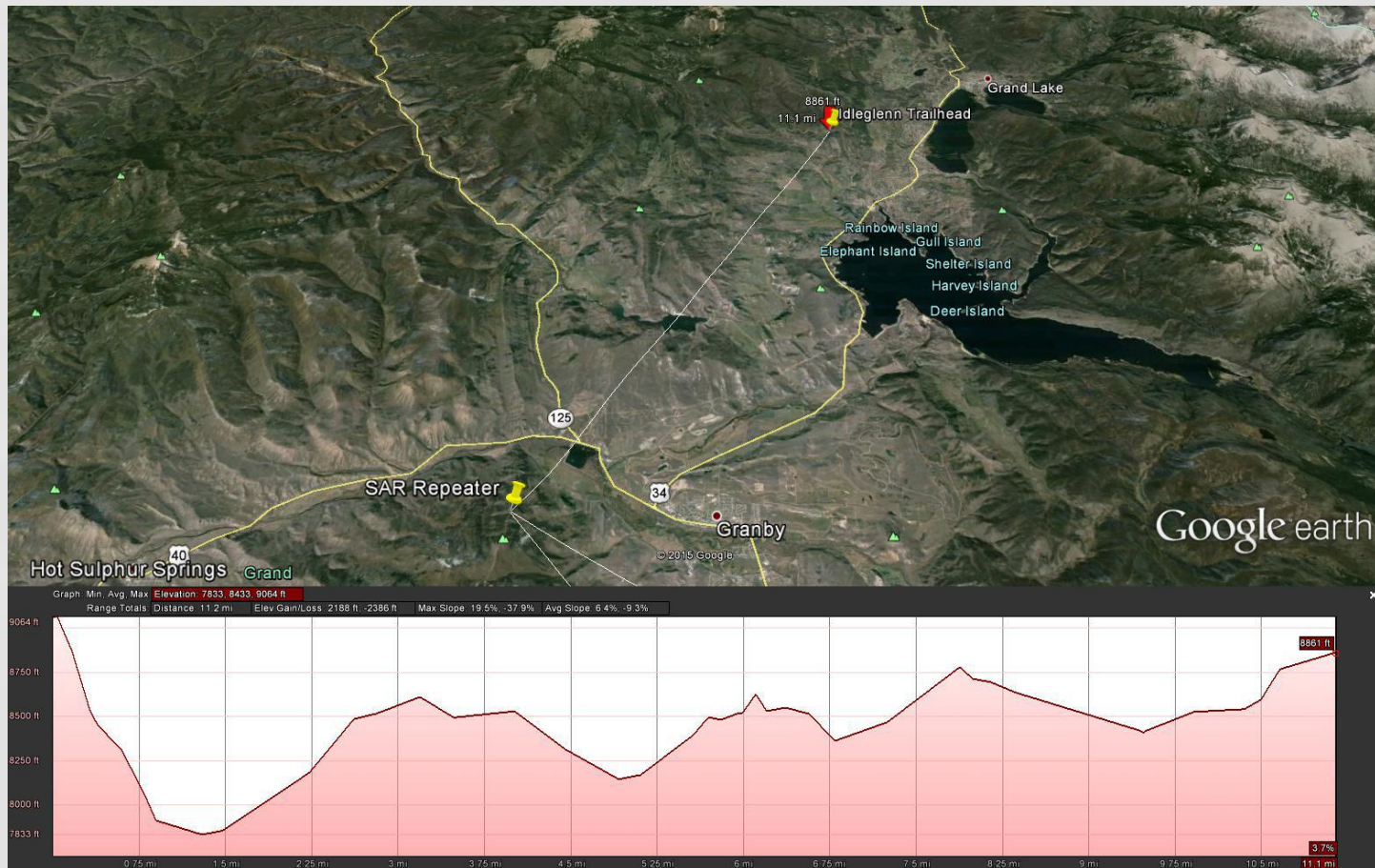
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- Repeaters



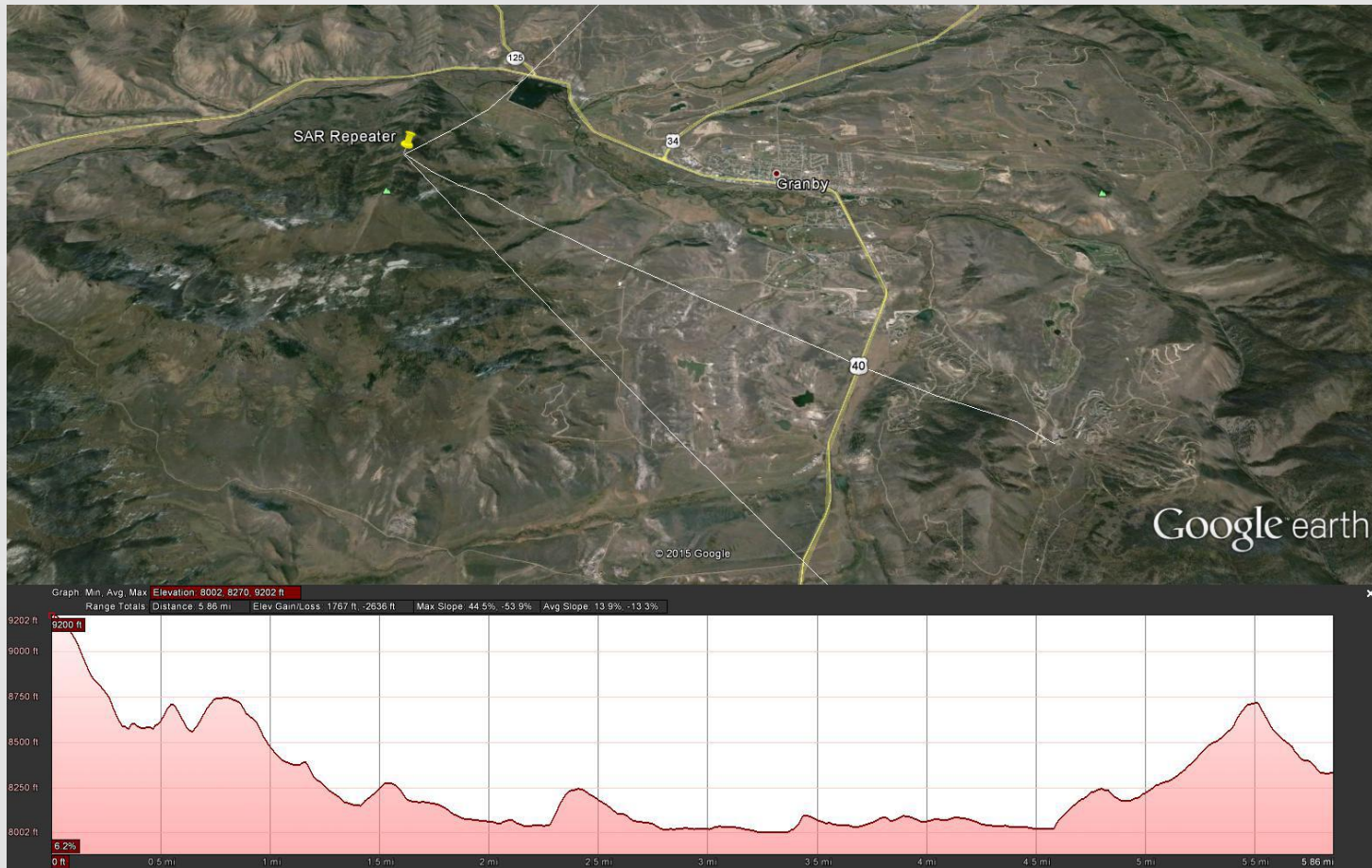
How do Radios actually work?

- Repeaters



How do Radios actually work?

- Repeaters



How do Radios actually work?

- Practical Solutions
 - “Tuned” Frequency Specific Antennas
 - Counterpoise – “Rat Tail”
 - Roll up Dual Band J-Pole Antenna
 - Repeaters

How do Radios actually work?

- Practical Solutions
 - “Tuned” Frequency Specific Antennas



How do Radios actually work?

- Counterpoise – “Rat Tail”



How do Radios actually work?

- Roll up Dual Band J-Pole Antenna



How do Radios actually work?

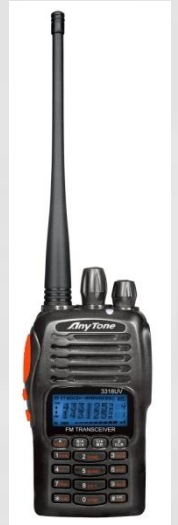
- Repeaters



VHF



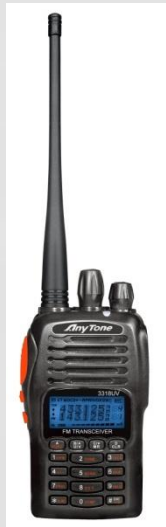
Cross band Repeater
Functionality



UHF

How do Radios actually work?

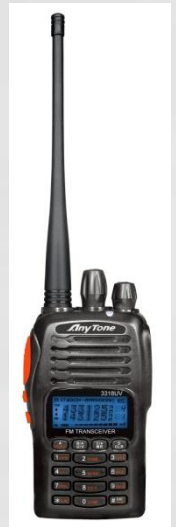
- Repeaters



VHF



Cross band Repeater
Functionality



UHF

How do Radios actually work?

- Repeaters



Cross band Repeater

Enhancing Backcountry Radio Communications

Questions ?

