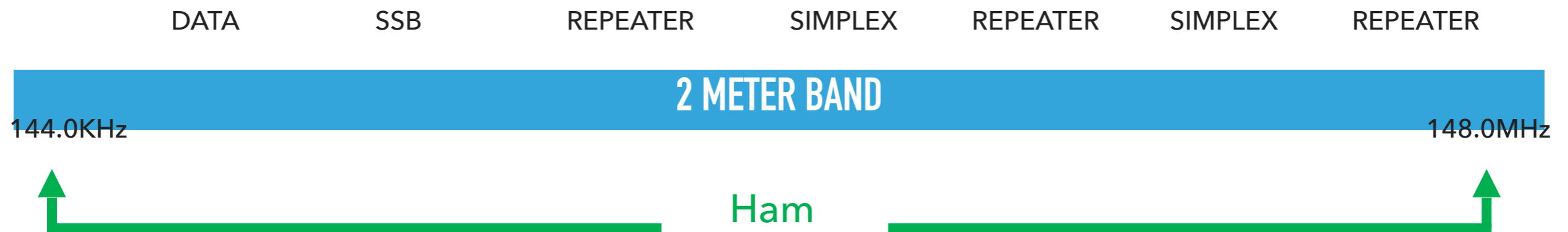


# RADIO 101

**Michael Higgins**  
**KI5ZIQ**

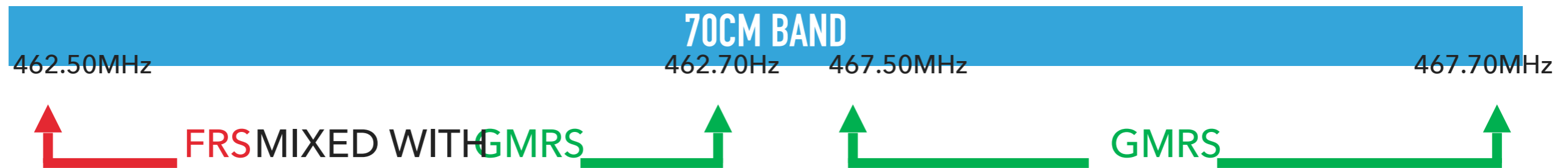


# BAND AND FREQUENCY EXAMPLES



- ▶ **Frequencies are assigned for specific use**
- ▶ **Must have a license to talk**
- ▶ **Power is limited to 1500 Watts**

# BAND AND FREQUENCY EXAMPLES



- ▶ **FRS frequencies are assigned to specific 22 channels**
- ▶ **FRS Power output is limited to .5 Watts to 2 Watts depending on the channel**
- ▶ **You are required to use an FRS designated radio**
- ▶ **FRS does not allow the usage of a repeater**
- ▶ **GMRS frequencies are assigned to specific channels**
- ▶ **Power output is limited to 50 Watts**
- ▶ **You are required to use an GMRS designated radio**
- ▶ **GMRS does have designated repeater channels**
- ▶ **A license is required to use GMRS**

**THAT'S WHY THERE  
ARE SO MANY  
RADIOS TO CHOOSE  
FROM!**

## WHAT RADIO TO BUY?

**First you must ask yourself several questions:**

- What is the main reason for getting a radio?**
- What is my budget? \$25-\$3000**
- Do I just want to listen or use a radio for communicating with others?**
- What will be most useful when things go crazy?**
- What distance do I need to cover when communicating with family/friends?**
- Do I plan on using it for other reasons (storm chasing, hunting) other than listening.**

# RECEIVERS AND TRANSCEIVERS

RECEIVERS ARE DESIGNED TO ONLY RECEIVE CERTAIN FREQUENCIES

TRANSCEIVERS ARE DESIGNED TO TRANSMIT AND RECEIVE FREQUENCIES



AM/FM  
Radio

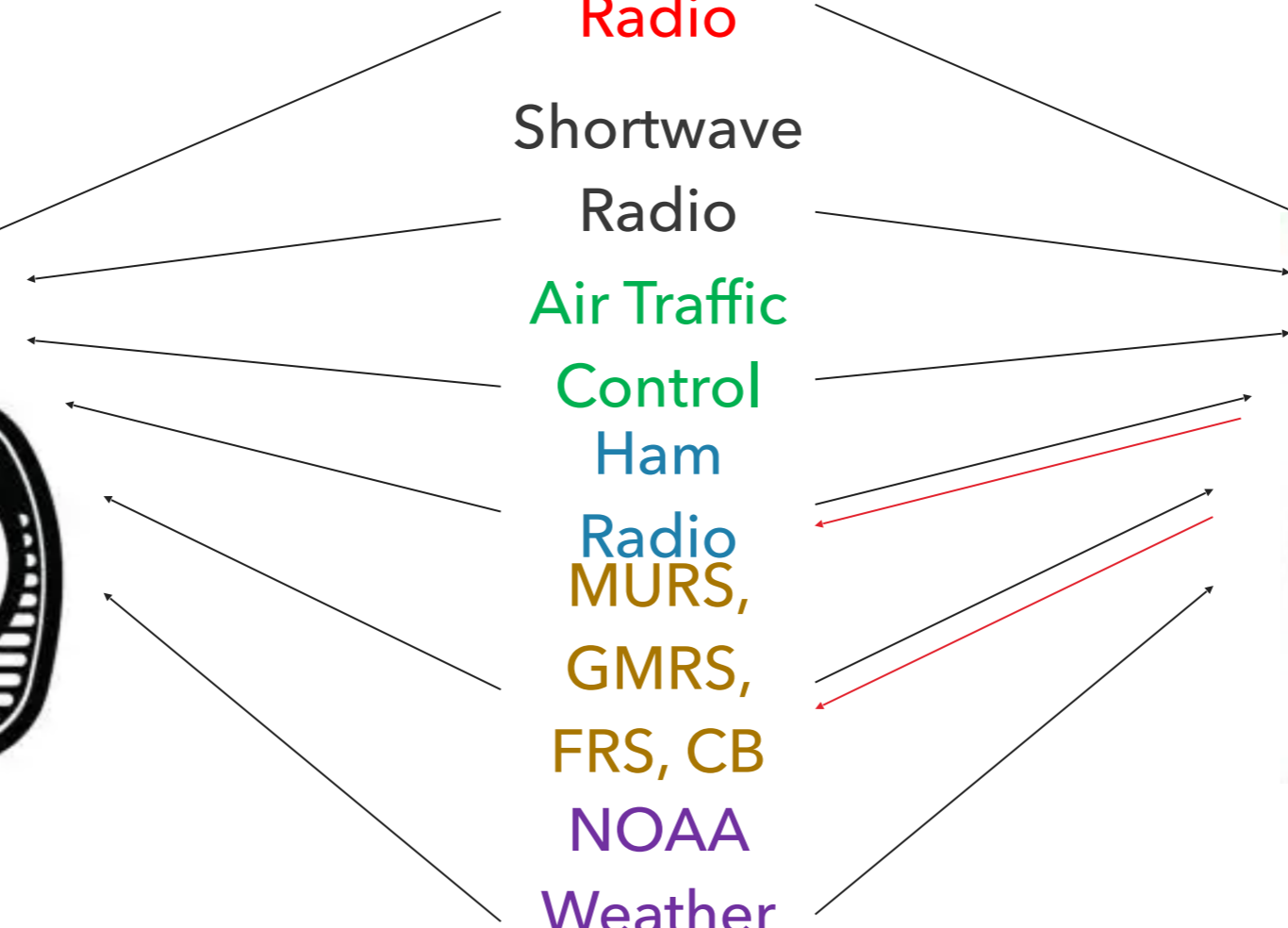
Shortwave  
Radio

Air Traffic  
Control

Ham  
Radio

MURS,  
GMRS,  
FRS, CB

NOAA  
Weather  
Radio



# RECEIVERS

RECEIVERS USUALLY HAVE A BUILT-IN ANTENNA THAT PICK UP BROADCASTS

SOME STATIONS, LIKE THOSE ON SHORTWAVE RADIO ARE ALLOWED TO TRANSMIT ON SEVERAL HF BANDS, BROADCAST AT VERY HIGH POWER AND CAN BE PICKED UP FROM ALL OVER THE WORLD

OTHER RADIO BROADCAST ARE HIGH POWER BUT ARE DESIGNED TO ONLY COVER A REGIONAL AREA LIKE AM/FM RADIO AND NOAA WEATHER RADIO

OTHER BROADCAST ARE LOWER POWER AND ARE DESIGNED TO ONLY COVER A LOCAL AREA LIKE POLICE FIRE DEPARTMENTS

MANY RECEIVERS PICK UP HAM RADIO OPERATORS AS WELL

WHEN CHOOSING A RECEIVER, CHECK THE BANDS THEY RECEIVE

# RECEIVERS

## Recommended Receivers

SHORTWAVE RADIOS ARE DESIGNED TO RECEIVE ALL THE BANDS FOR SHORTWAVE INCLUDING 90, 60, 49, 41, 31, 25, 22, 19, 16, 13, AM/FM, and NOAA Radio.



**Eton Elite**  
AIR/AM/FM/LW/ HF  
Ham/Shortwave/  
NOAA



**Bewinner HRD-737**  
AIR/AM/FM/ HF Ham/  
VHF/Shortwave/CB/  
NOAA  
*USB Charger*



**Weather Radio Raynic**  
AIR/AM/FM/LW/VHF/  
Shortwave/NOAA  
*USB/Crank/Solar  
Charger*



# TRANSCEIVERS

TRANSCEIVERS REQUIRE AN ANTENNA (OR ANTENNAS) DESIGNED TO WORK OFF THE BANDS (FREQUENCIES) THAT IT WAS BUILT FOR

THEY ALSO REQUIRE A MIC TO COMMUNICATE AND A POWER SUPPLY CAPABLE OF POWERING THE RADIO AND SENDING A SIGNAL

MANY TRANSCEIVERS CAN ALSO RECEIVE FROM THE SAME FREQUENCIES THAT RECEIVERS DO. WHILE THESE ARE MORE EXPENSIVE, YOU GET MORE BANG FOR THE BUCK!

# TRANSCEIVERS TYPES

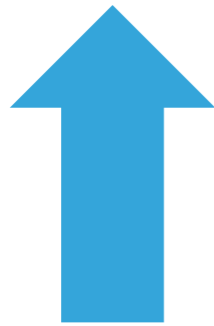
TRANSCEIVERS COME IN THE FORM OF BASE STATIONS, MOBILE, AND HANDY TALKIES (HT). MOST OF THE BANDS THAT ARE OPEN AD DO NOT REQUIRE A LICENSE ARE VHF AND UHF



**KEEP IN MIND: USING AN HT IN A  
CAR DOES NOT WORK WELL**

# HOW A TRANSCEIVER WORKS

TRANSCEIVER RADIOS ARE DESIGNED TO TRANSMIT AND RECEIVE ONLY ON CERTAIN BANDS



POWER INPUT IS MEASURED IN VOLTS AND IS BASED ON THE TYPE OF TRANSCEIVER YOU ARE USING

POWER OUTPUT IS MEASURED IN WATTS AND IS DETERMINED BY FCC LIMITS, FREQUENCIES YOU ARE USING AND YOUR RADIO.

MORE POWER OUTPUT ALLOWS THE SIGNAL TO TRAVEL FURTHER!



ANTENNAS ARE DESIGNED TO ONLY WORK CERTAIN BANDS

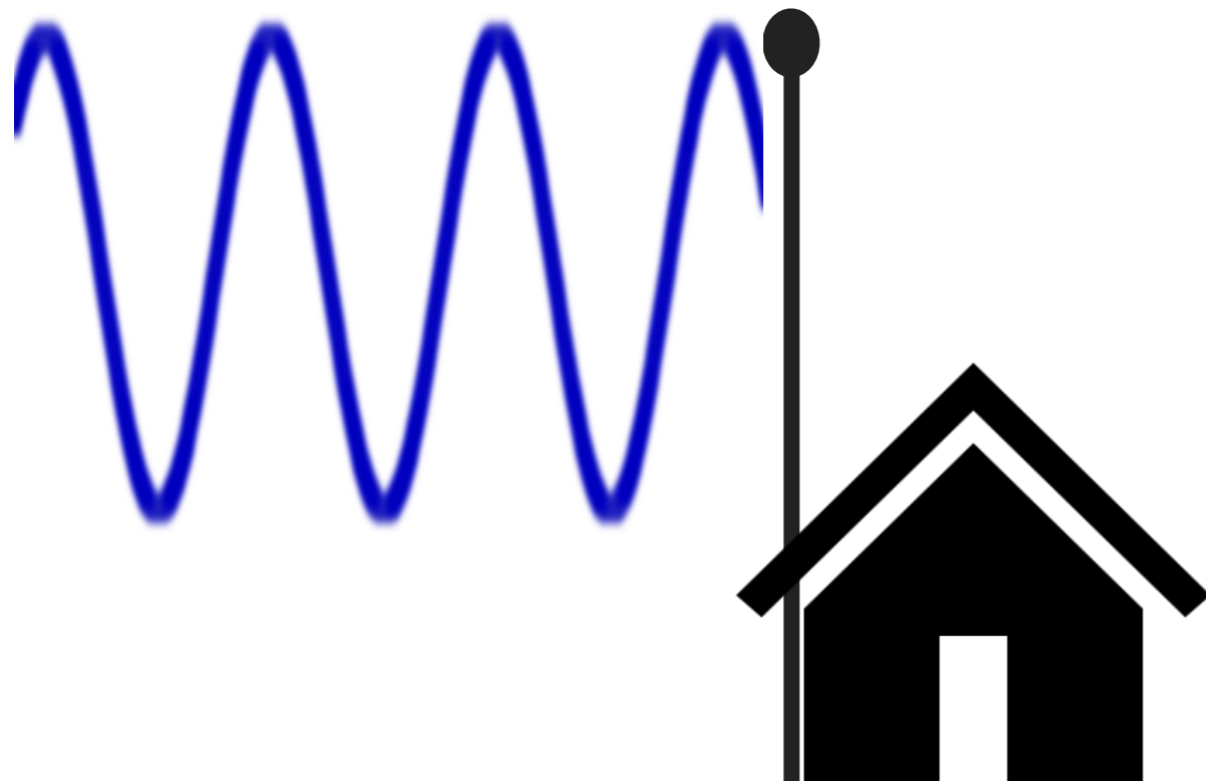
SOME ANTENNAS CAN WORK SEVERAL BANDS

THEY NEED TO BE COMPATIBLE WITH THE TRANSCEIVER

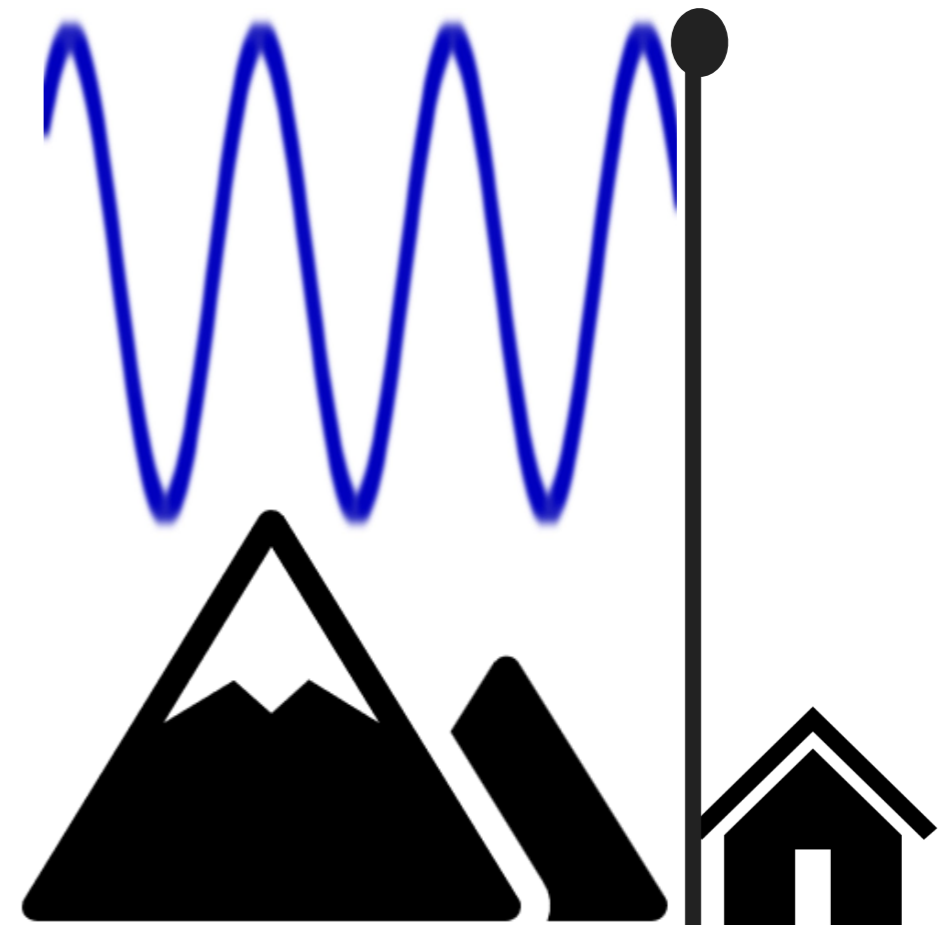
# ANTENNAS

# HOW AN ANTENNA WORKS

**ANTENNAS ARE DESIGNED TO BE THE LENGTH OF THE BAND YOU ARE WORKING**



**THE HIGHER THE ANTENNA, THE BETTER THEY SHOULD PERFORM**



ANTENNAS ALSO WORK IN EQUAL FRACTIONS TO THE BAND YOU ARE WORKING

ALL OF THESE ANTENNA LENGTHS WILL WORK FOR 11 METER CB BAND

11M = 36 Feet



5.5 M = 18 Feet

2.75 M = 9 Feet

**Quarter Length Coiled**

**Quarter Length**

**Half Length**

**Full Length**

# HOW AN ANTENNA WORKS

**COILED ANTENNAS ARE  
PHYSICALLY SHORTER**

**SINCE THEY ARE COILED,  
THE OVERALL LENGTH IS  
EQUAL TO THE BAND YOU  
ARE WORKING**

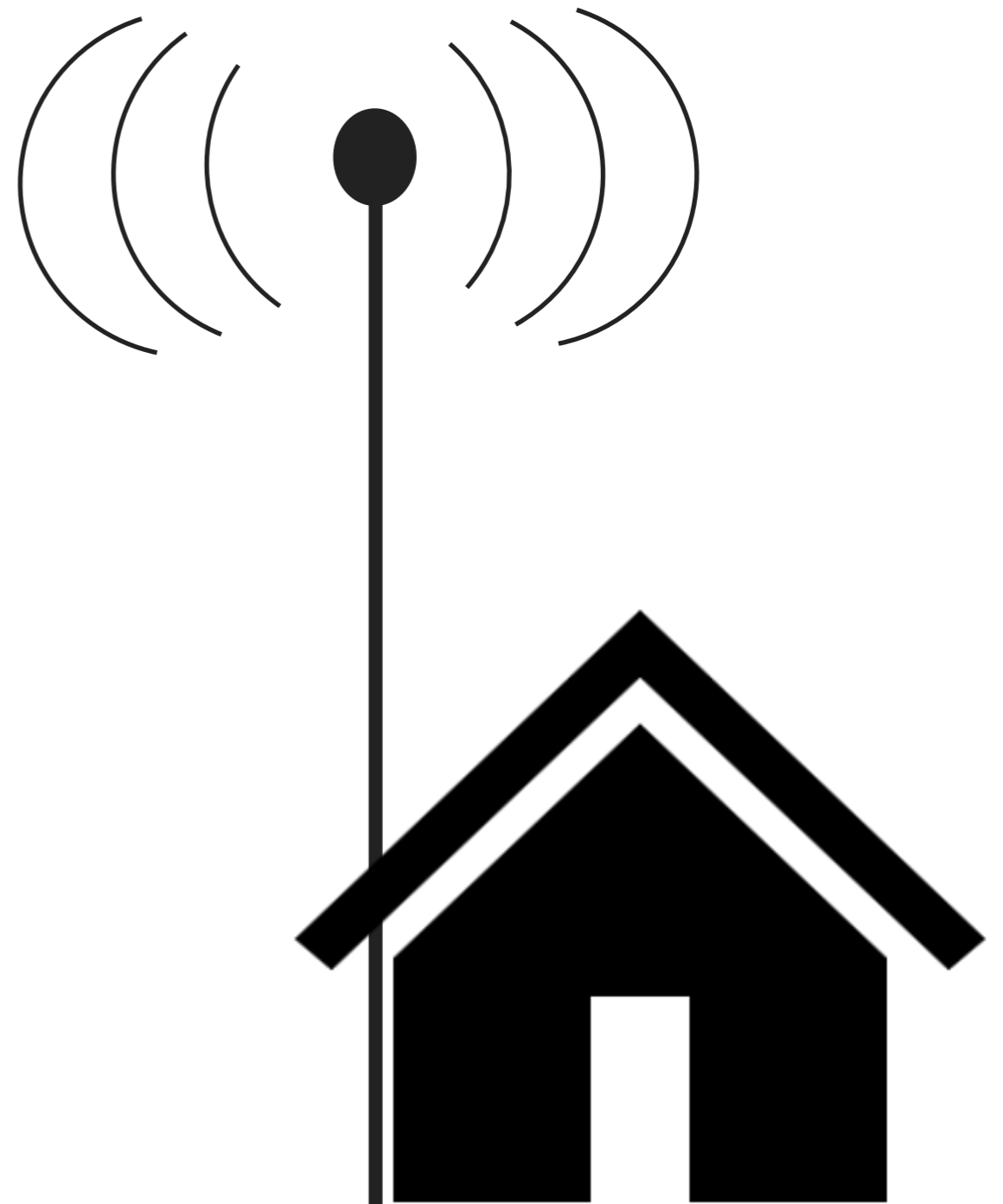


# HOW AN ANTENNA WORKS

**SOME ANTENNAS CAN WORK  
SEVERAL BANDS**

**FOR EXAMPLE:  
AN ANTENNA FOR 2 METER CAN  
ALSO WORK 70 CM BANDS**

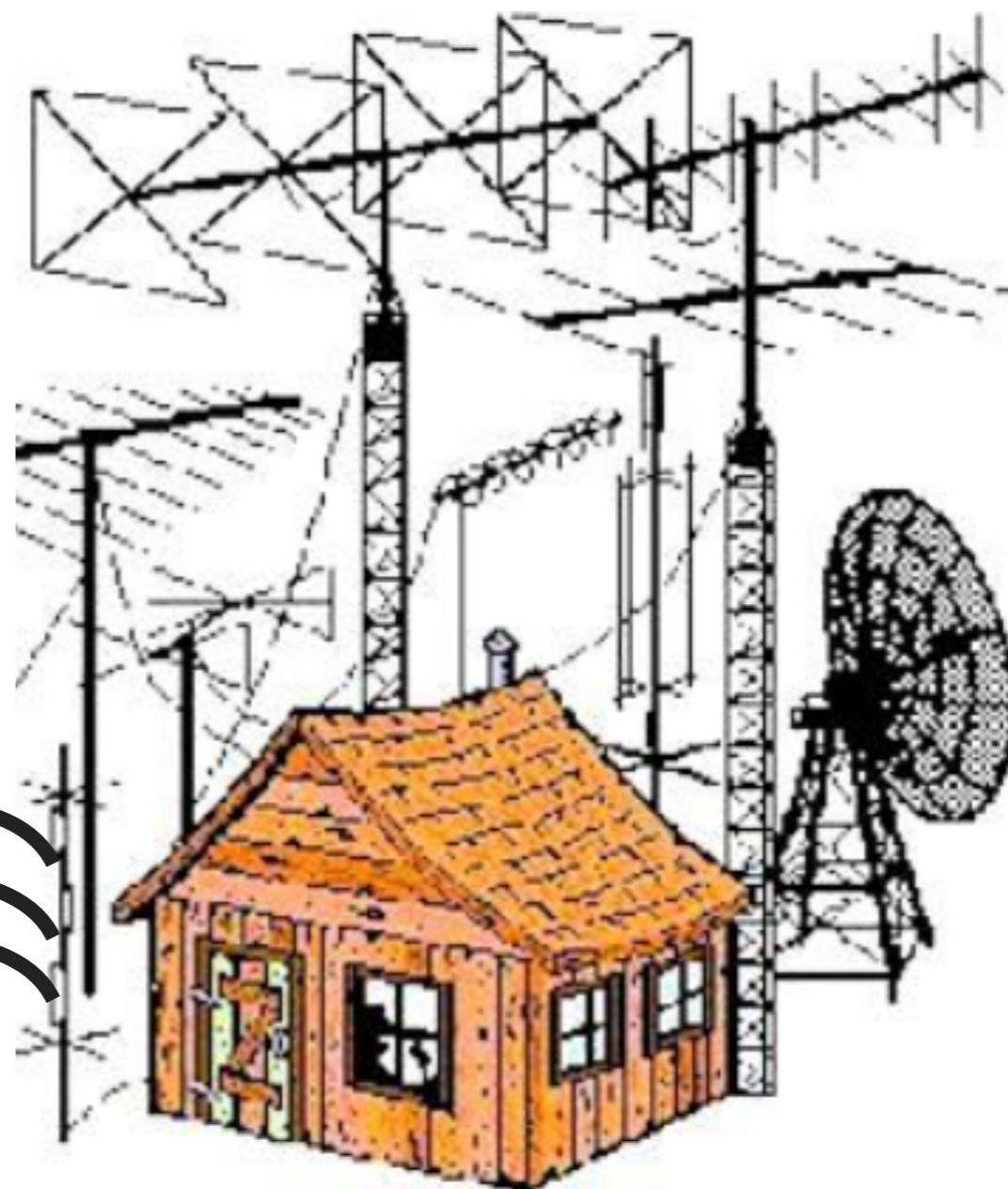
**THERE ARE SEVERAL OTHER  
ANTENNAS FOR HAM BANDS THAT  
WORK MULTIPLE BANDS,  
HOWEVER YOU MUST USE AN  
ANTENNA TUNER IF YOU ARE  
GOING TO TRANSMIT**





# HOW AN ANTENNA WORKS

TRANSCEIVERS DESIGNED TO WORK MULTIPLE BANDS MAY HAVE SEVERAL ANTENNA CONNECTIONS



# **SIMPLEX AND REPEATER COMMUNICATION**

# SIMPLEX COMMUNICATION

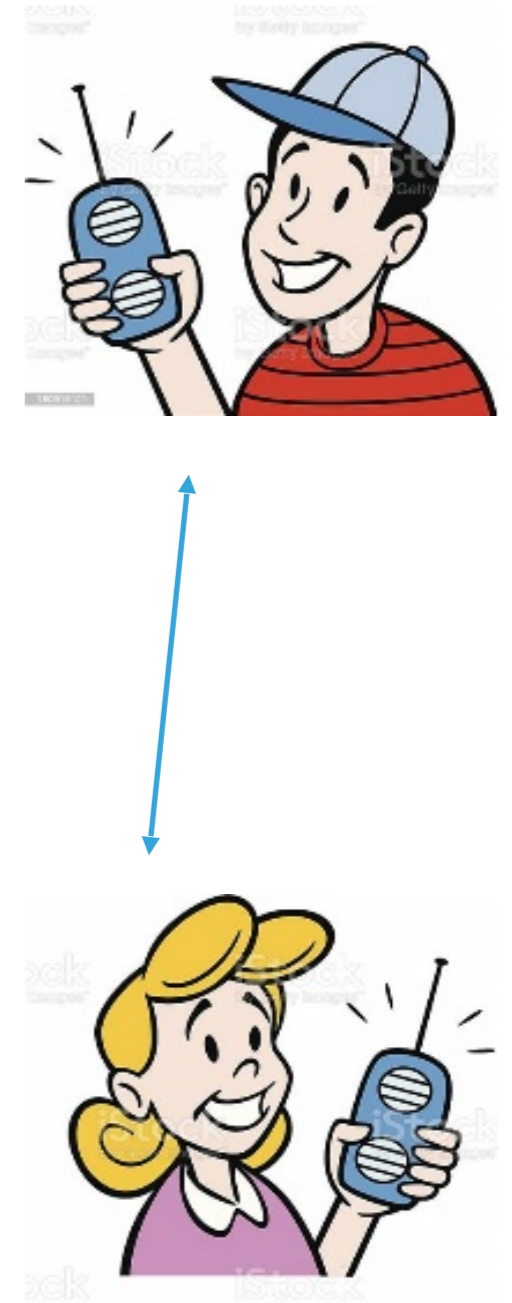
**Simplex is point-to-point communication**

## **CB, MURS, FRS, and GMRS**

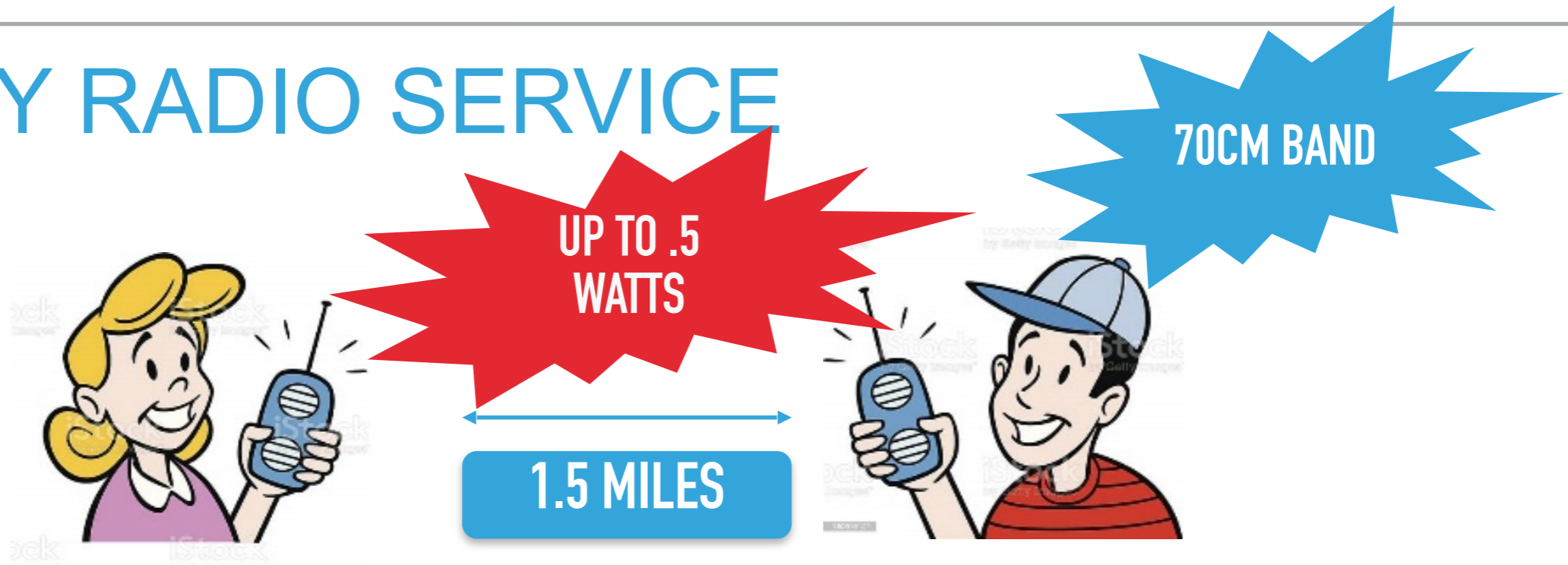
- ▶ The most accessible frequencies to the public, however, they are also the most restricted in power output
- ▶ These limitations greatly impact simplex communication distance and quality

## **Ham radio**

- ▶ Superior to anything when you are trying to get distance because of power output



# FAMILY RADIO SERVICE

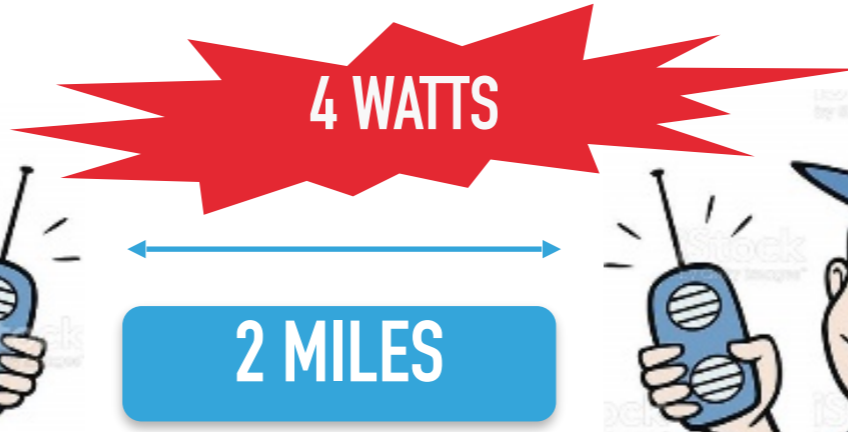


# MULTI USE RADIO SERVICE



# SIMPLEX ON CITIZENS BAND

11M BAND



# SIMPLEX ON GENERAL MOBILE RADIO SERVICE



UP TO 50 WATTS

20 MILES



UP TO 50 WATTS

10 MILES

2M BAND



UP TO 5 WATTS

2 MILES

# SIMPLEX ON HAM (2,200M TO 23CM)



UP TO 1500  
WATTS

AROUND THE WORLD!



UP TO 50  
WATTS

15 MILES

ALL BANDS



UP TO 20  
WATTS

5 MILES

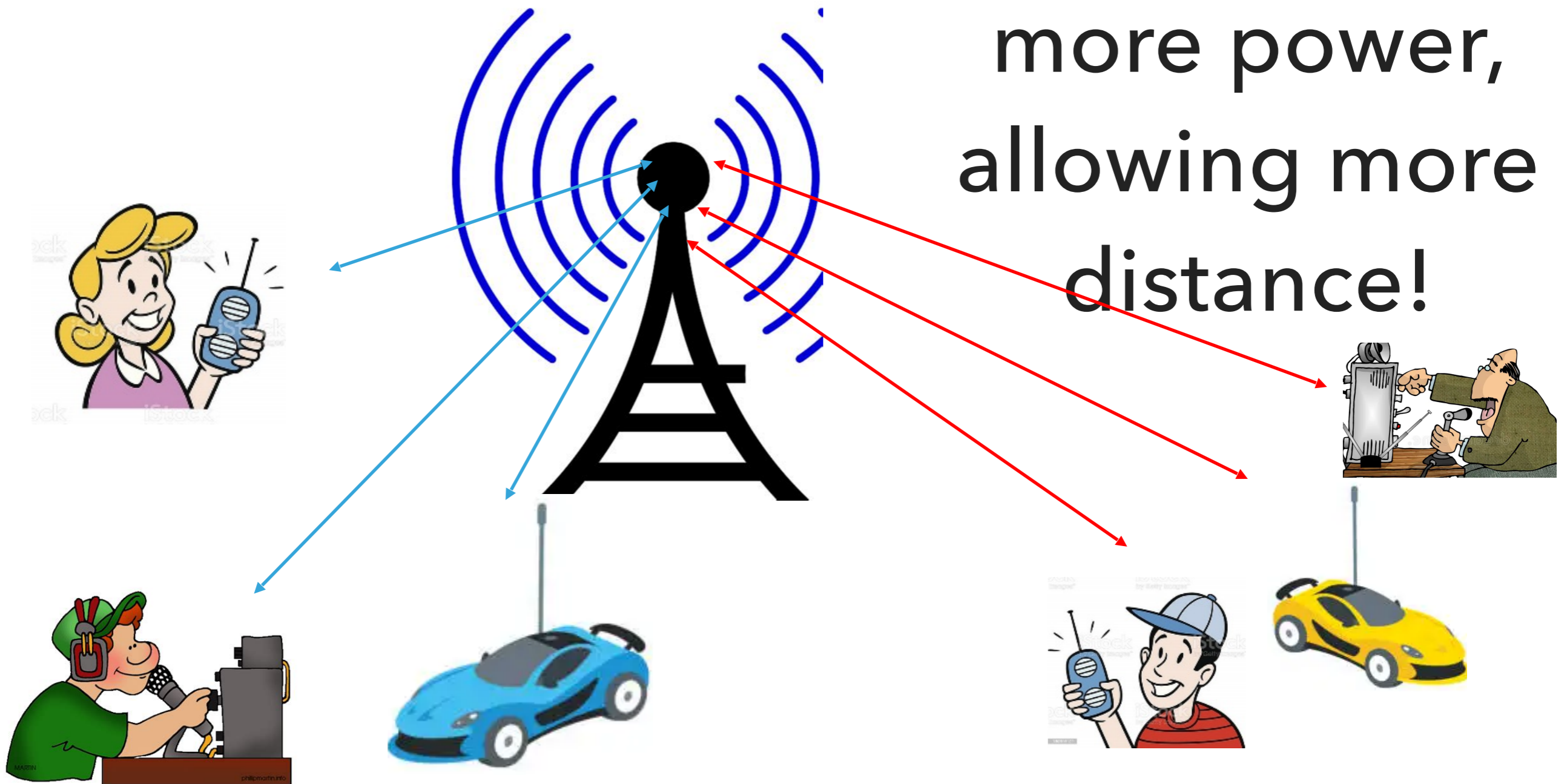
# REPEATERS



# REPEATERS

Take in a signal

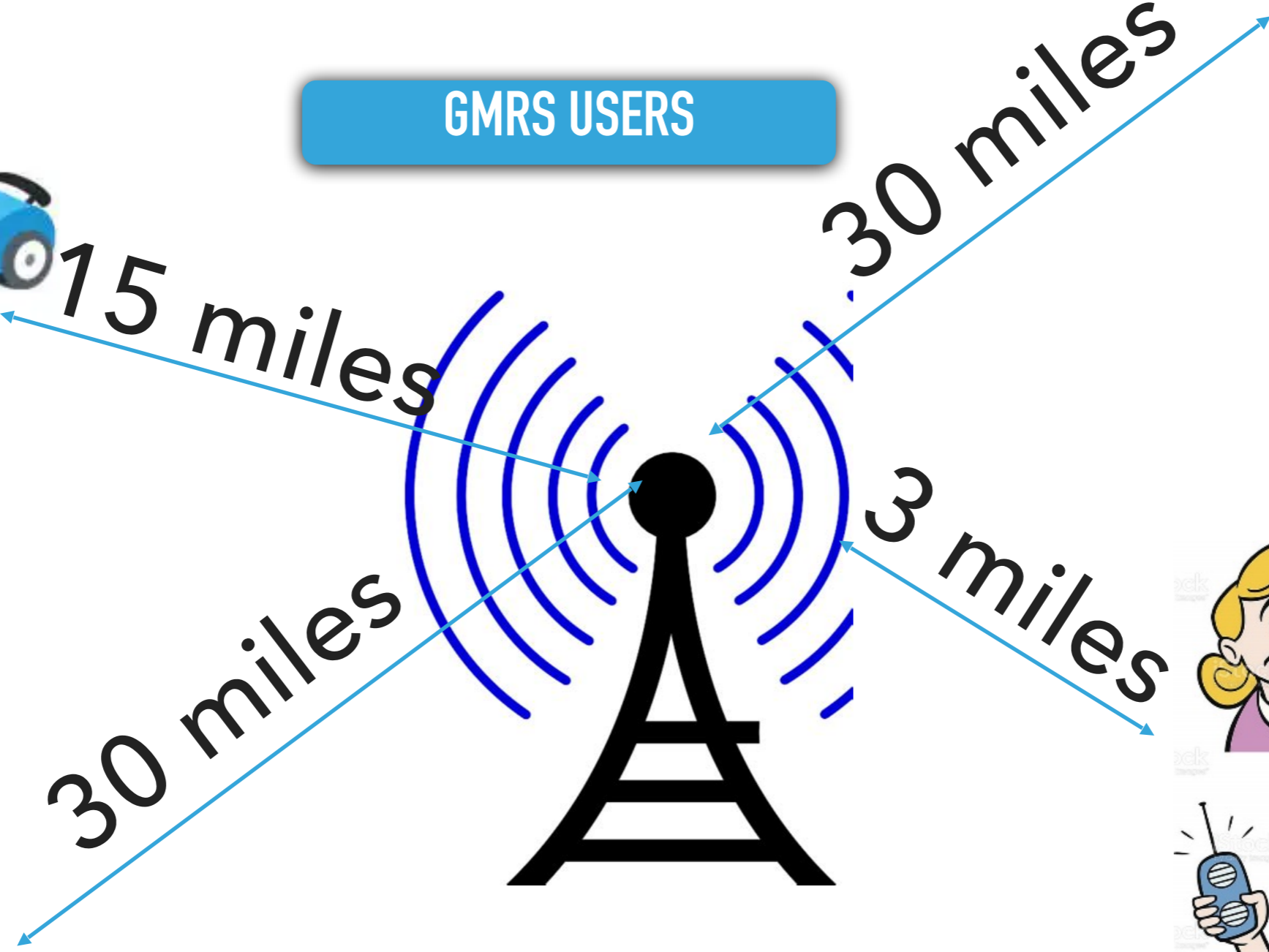
And retransmit  
using much  
more power,  
allowing more  
distance!



# REPEATERS



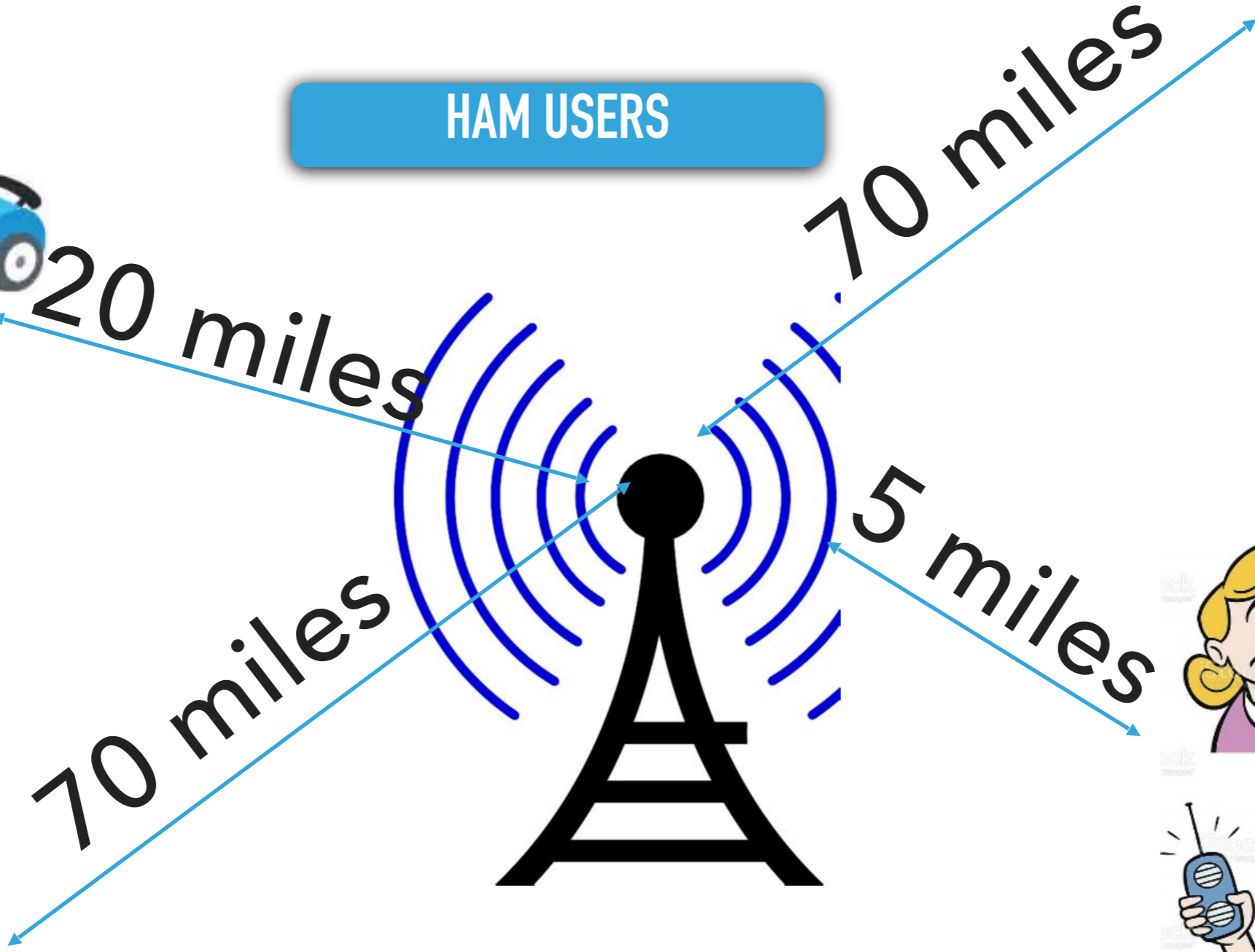
GMRS USERS



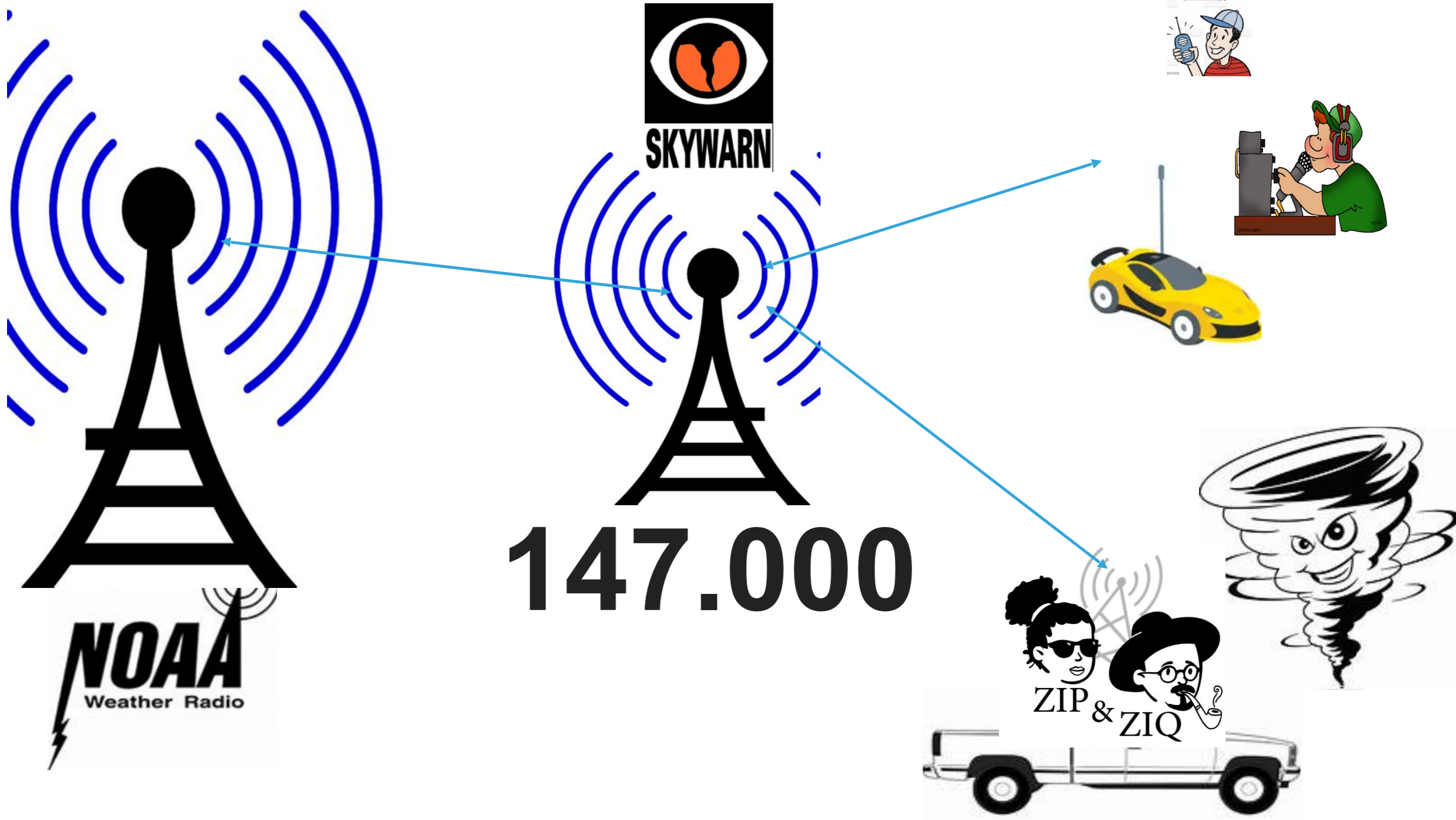
# REPEATERS



HAM USERS



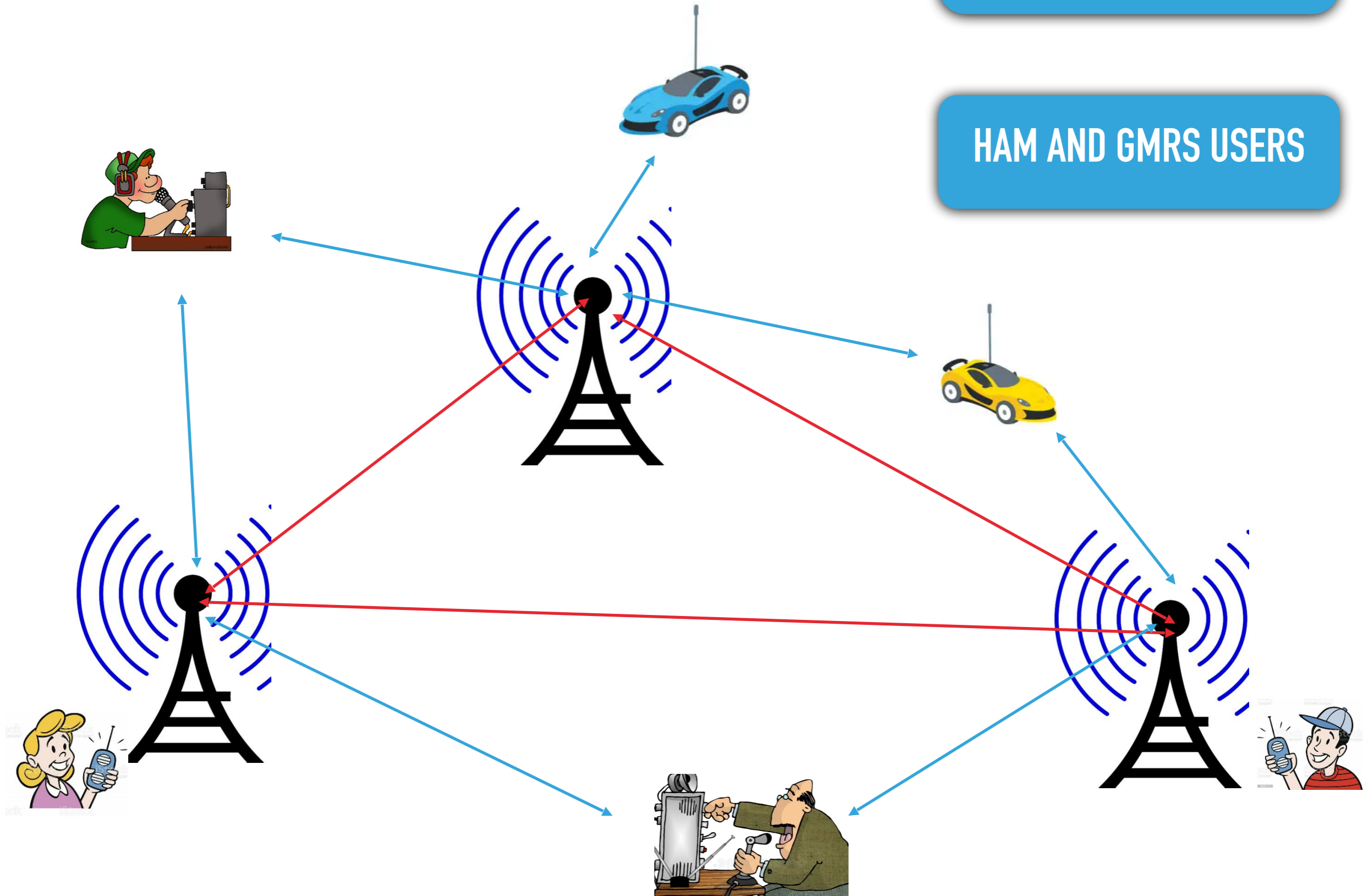
# REPEATERS FOR WEATHER



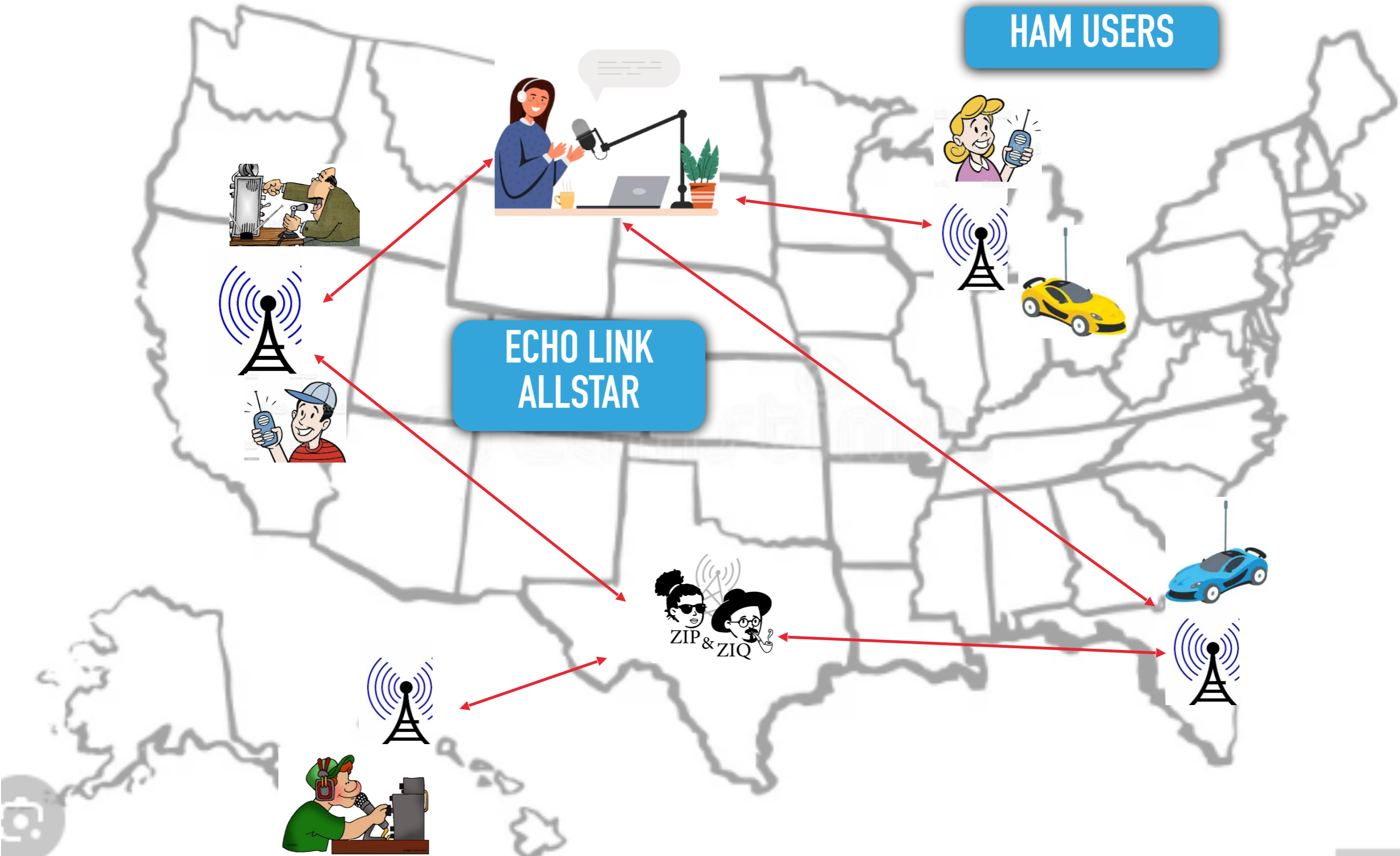
# LINKED REPEATERS

SOME REPEATERS ARE LINKED TO OTHER REPEATERS

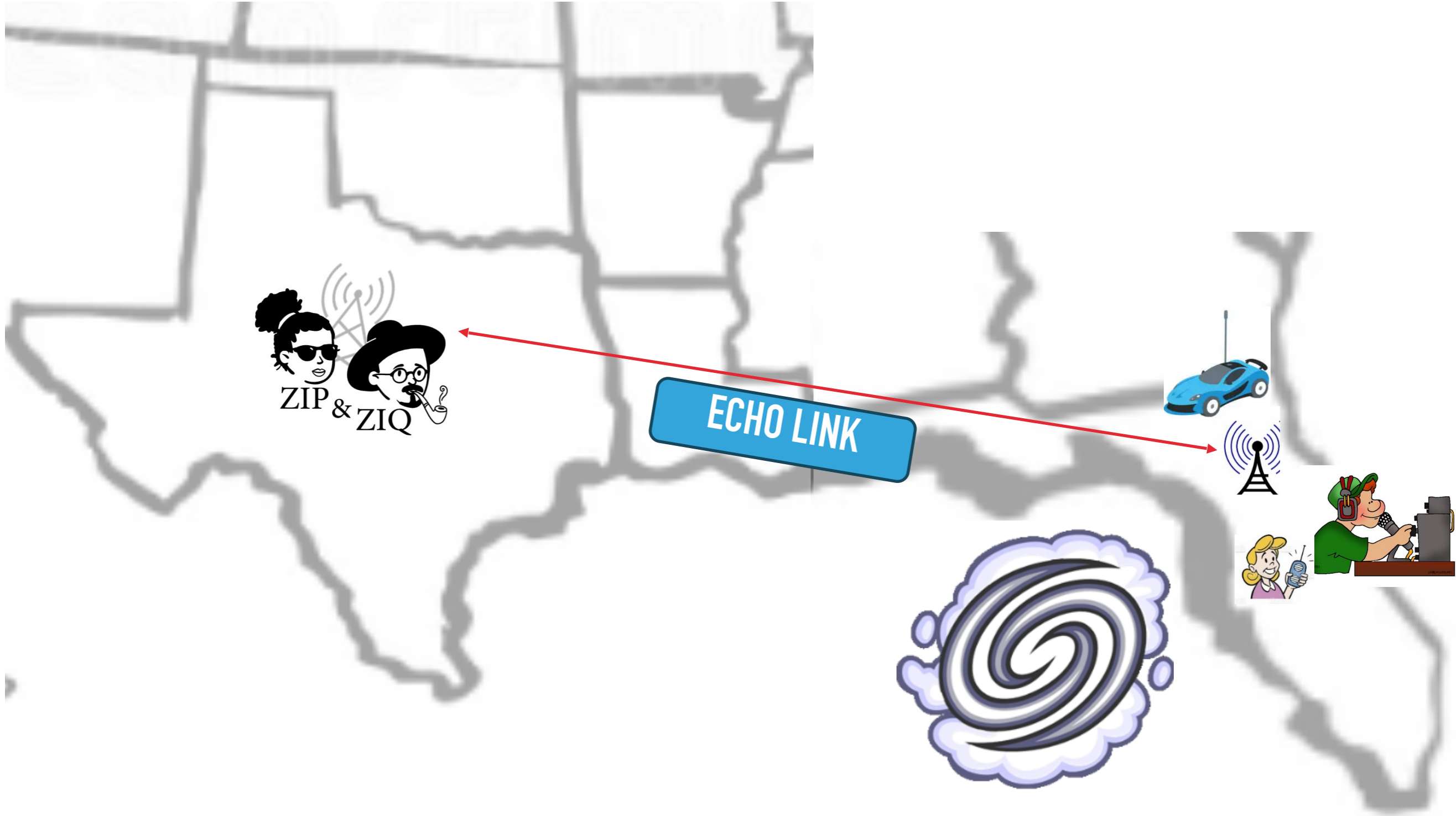
HAM AND GMRS USERS



# INTERNET LINKED REPEATERS



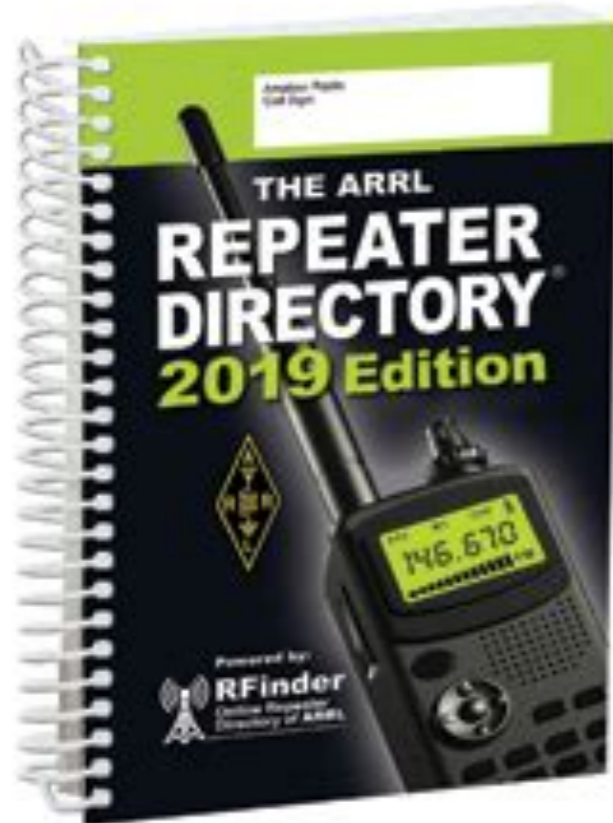
# INTERNET LINKED REPEATERS



# REPEATER REFERENCES



**ARRL**  
The national association for  
**AMATEUR RADIO®**



Home

## Online Lookup

Welcome to Repeaterbook.com

RepeaterBook is Amateur Radio's most comprehensive, worldwide, FREE repeater directory. We are now supporting GMRS!

Amateur Radio and GMRS require an FCC license to legally operate. As such, a valid Amateur Radio or GMRS license is required to register on this site.

RepeaterBook encourages and supports over-the-air repeater use.

Attention: att.net is currently blocking all e-mails sent to that domain.

## Phone App





# LOCAL REPEATERS



GRAYSON COUNTY AMATEUR RADIO CLUB



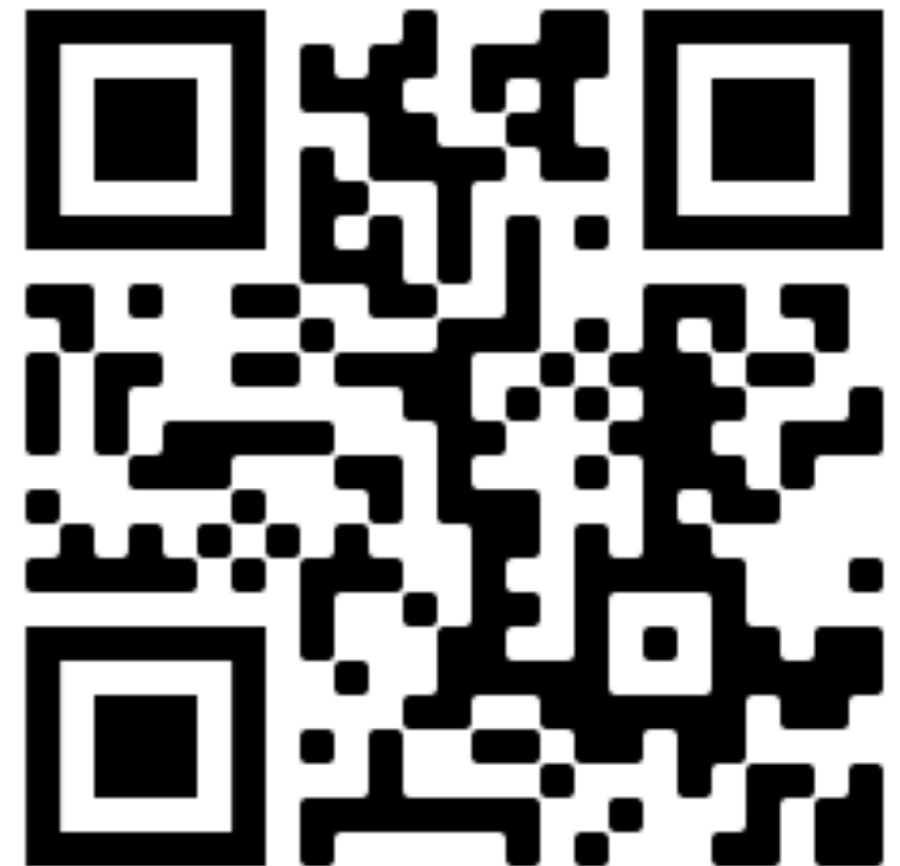
GCARC  
GRAYSON CO. TEXAS USA



# 147.000

Club nets are held at 8:00PM on the 1st and 3rd Sunday of the month.

ARES nets are held at 8:00PM on the 2nd and 4th Sunday of the month.



<https://>

# LOCAL REPEATERS



K5FRC

Fannin  
County  
Amateur  
Radio  
Club

145.470



Tuesday Night Nets at 8:00pm

# LOCAL REPEATERS

## Denton County Amateur Radio Association



**146.920**

### Regularly Scheduled Nets

Each Monday (except 4th of month) at 8:00 P.M. - Information and Training Net

146.920

Thursday immediately prior to club meeting at 7:30 P.M. - ARES Training Net

146.920

Each Sunday at 2:00 P.M. - Digitally Speaking Net 146.920

<https://www.dcara.net/index.php>



**TRANSCIEIVERS  
THAT YOU SHOULD  
CONSIDER!**

# TYPES OF RADIOS

## Using CB, MURS, FRS!

- ▶ **There is NOT a requirement for licensure, anyone may use these frequencies!**
- ▶ **The radio has FCC allocated frequencies preprogrammed with designated channels.**
- ▶ **These radios must be designed for their specific use including power, channel allocation and antenna specifications**
- ▶ **These frequencies are designated for point-to-point (simplex) communication.**
- ▶ **With a few acceptations to MURS, repeaters may NOT be used**



# TYPES OF RADIOS

## Citizen Band (CB) Transceivers



ALLOWS ANYONE TO USE

LIMITS POWER OUTPUT TO 4 WATTS

USED FOR SHORT DISTANCE



26.956 MHz



27.405 MHz

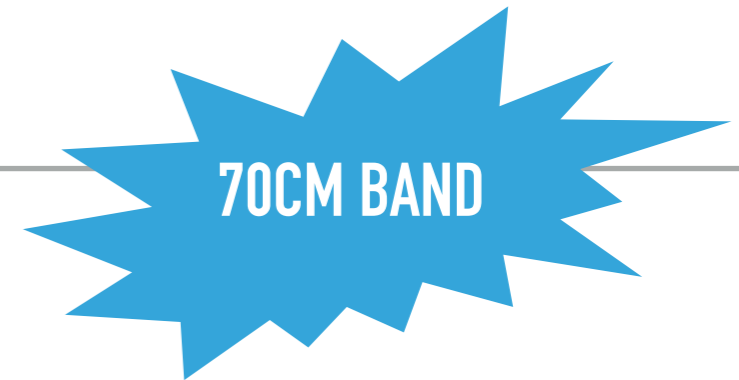


CHANNEL 1



CHANNEL 40





# TYPES OF RADIOS

## Family Radio Service Transceivers



ALLOWS ANYONE  
TO USE

LIMITS POWER  
OUTPUT TO .5  
WATTS

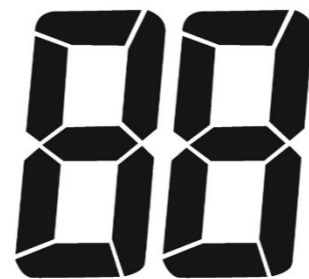
USED FOR SHORT  
DISTANCE



462.5625 MHZ



467.7125 MHZ

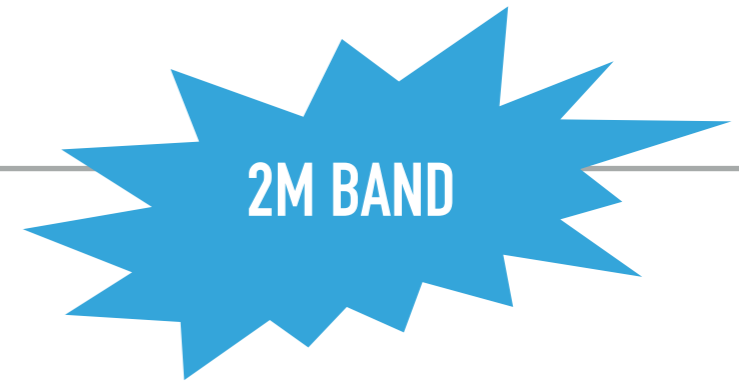


CHANNEL 1



CHANNEL 14





# TYPES OF RADIOS

## Multi-Use Radio Service(MURS)



NO LICENSE  
REQUIRED FOR  
USE

LIMITS POWER  
OUTPUT OF 2  
WATTS

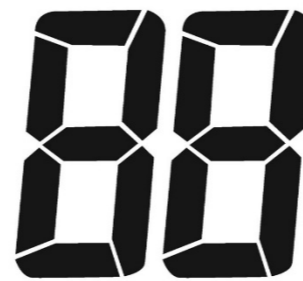
USED FOR SHORT  
DISTANCE NO  
REPEATER



151.82 MHZ



154.60 MHZ



CHANNEL 1



CHANNEL 5





# TYPES OF RADIOS

## Using GMRS!

- ▶ **A license (call sign) is required, but easy to obtain and may be used by immediate family members**
- ▶ **The radio has FCC allocated frequencies preprogrammed with designated channels.**
- ▶ **These radios must be designed for their specific use including power, channel allocation and antenna specifications**
- ▶ **Power output is allowed up to 50 Watts**
- ▶ **In general, these are used for point-to-point (simplex) communication, however, some of the channels may be programmed for GMRS repeaters**



# TYPES OF RADIOS

## General Mobile Radio Service (GMRS)



**MUST HAVE A LICENSE TO USE:  
FEE ONLY**

**LIMITS POWER OUTPUT BETWEEN  
2 AND 5 WATTS**

**USED FOR SHORT DISTANCE AND  
REPEATER**



**462.5625 MHZ**



**467.7250 MHZ**



**CHANNEL 1**



**CHANNEL 30**



## TYPED OF RADIOS

### Using HAM!

- ▶ **A license (call sign) is required to talk and obtained through testing. Anyone may listen on a ham radio.**
- ▶ **These radios can cover a wide spectrum of bands**
- ▶ **Power output is allowed up to 1500 Watts in most cases**
- ▶ **Ham radios may not be used for talking on CB, MURS, FRS, and GMRS frequencies. However, they can tune into most, if not all of them and listen.**

# TYPES OF RADIOS

## Amateur Radio (HAM)



MUST HAVE A LICENSE TO USE:  
FEE AND TEST

WATTAGE OUTPUT  
BASED ON  
LICENSURE

USED FOR SHORT  
AND, LONG  
DISTANCE,  
REPEATER BASED  
ON LICENSE



HUNDREDS OF  
FREQUENCIES ARE  
USABLE BASED ON  
THE LEVEL OF  
LICENSURE

LEVELS OF  
LICENSURE:  
TECHNICIAN  
GENERAL  
EXTRA



CHANNELS ARE  
PROGRAMED BY  
THE USER.

MULTIPLE BANDS  
BASED ON RADIO



# TYPES OF RADIOS

## Recommended Transceivers for Ham



**Yaesu Ft-991a**  
**Most HAM**  
**Bands/NOAA/**  
**FRS/GMRS/**  
**MURS/**  
**Shortwave**



**Baofeng UV-860**  
**Some HAM Bands/**  
**NOAA/FRS/GMRS/**  
**MURS**  
*USB Charger*



**Baofeng F8HP**  
**Some HAM Bands/ NOAA/**  
**FRS/GMRS**

2M AND  
70CM

# THE BEAUTIFUL BAOFENG!

BAOFENG HAS SEVERAL HT RADIOS. THEY CAN BE TUNED AND PROGRAMMED TO COVER SEVERAL BANDS (FREQUENCIES) INCLUDING SOME HAM AND ALL GMRS, NOAA, FM RADIO, AND MURS

KEEP IN MIND, YOU DON'T HAVE TO HAVE A LICENSE TO **LISTEN** TO ANY OF THESE BANDS (FREQUENCIES) INCLUDING HAM AND GMRS



# WHERE TO GO FROM HERE?



## WHERE TO START

**Priority of purchase if it is just for emergency listening purposes:**

- 1. A multi-band receiver(NOAA, Shortwave, AM/FM).**
- 2. A Baofeng 2 meter / 70 centimeter HT transceiver.**
- 3. A mobile CB radio with power supply and external antenna will SSB capabilities. Keep in mind, mobile units can be used as a base station.**





## WHERE TO START

**Priority of purchase if it is for communication purposes:**

- 1. CB mobile radio with SSB capabilities. Keep in mind, mobile units can be used as a base station.**
- 2. GMRS radios and a license**
- 3. Baofeng 2 meter / 70 centimeter HT transceiver and ham license.**



## OTHER CONSIDERATIONS

1. Yeasu FT-991A- It does it all!
2. Portable TV
3. Satellite Phone
4. Back-up Charger (solar power)
5. Solar Powered Generator
6. Faraday Cage



# COMMUNICATION FACTORS

# COMMUNICATION FACTORS

**Your ability to communicate is based on several factors:**

- ▶ **Distance**
- ▶ **Hills and Mountains**
- ▶ **Trees**
- ▶ **Buildings**
- ▶ **Trains and Automobiles**
- ▶ **Antenna Quality, Direction and Height**
- ▶ **Radio Power Output**
- ▶ **Frequency and Band Usage**