









### Some Add'l Component Info

- A transistor is made up of three layers of semiconductor material
- A transistor is used to amplify signals
- The three pins on a transistor, whether it is an NPN or a PNP transistor are Emitter, Base, and Collector
- However, the three pins on a Field Effect Transistor are Source, Gate, and Drain
- A <u>Rectifier</u> is used to convert alternating current to direct current. A rectifier is a component of a <u>Power</u> <u>Supply</u>. A <u>Regulator</u> governs the amount voltage from a power supply

## And Even More...

- A <u>dummy load</u> is non-inductive resistor (usually about 50 ohms) and a heat sink to dissipate the heat

- Dummy loads are used to prevent transmission of signals while testing the equipment
  Rosin core solder is used for electronic circuits. A good solder joint will be bright and shiny
  When measuring resistance with a ohmmeter which shows increasing resistance over time, there is a capacitor in the circuit being measured measured



If a battery is rechargeable, it will say so

Most power supplies (as well as the automotive charging system) deliver 13.7 volts which will draw down to 12.5 volts when transmitting

Shorting the terminals of a 12v battery can cause burns, fire, or an explosion

#### How Much Power Does a Transceiver Need?

- Modern transceivers require at least 12 volts of power
  - Most power supplies, as well as the automotive charging system, deliver 13.7 volts which will drop to about 12.5 volts when transmitting
- The amount of current needed is determined by:
  - The efficiency of the transmitter at full power
  - The receiver and control circuit requirements
  - The efficiency (regulation) of the power supply
  - The amount of heat dissipation
- A 100 watt transmitter will required about 20-25 watts on transmit and 1-5 watts on receive



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	dB	Power Change	
	3 dB	2x Power Change	
	6 dB	4x Power Change	
	9 dB	8x Power Change	
	10 dB	10x Power Change	
	20 dB	100x Power Change	
	30 dB	1000x Power Change	
	40 dB	10,000 x Power Change	

Amount of change in dB of a power increase from 20 watts to 200 watts? 10 dB Amount of change in dB of a power increase from 5 watts to 10 watts? 3 dB

Going the c	Stner way
dB	Power Change
-3 dB	1/2 Power Change
-6 dB	1/4 Power Change
-9 dB	1/8 Power Change
-10 dB	1/10 Power Change
-20 dB	1/100 Power Change
-30 dB	1/1000 Power Change
-40 dB	1/10,000 Power Change

Pfx	Symbol	Factor	Pfx	Symbol	Factor
giga	G	1,000,000,000	millí	m	0.00
mega	M	1,000,000	mícro		0.00000
kilo	k	1,000	nano	n	0.00000000
unít		1	píco	P	0.0000000000

Each step either adds or subtracts 3 decimal positions.



### Random Definitions

<u>Relay</u>: an electrically controlled switch, usually using magnetism (inductance) to switch the relay

Integrated Circuit: a device that combines multiple transistors, capacitors, resistors, etc. into one package

LED's: commonly used as indicators (such as on/off)

Solder: comes in many types. Rosin Core solder is used for electrical circuits. A good solder connection will have a bright, silvery surface. A dull and grainy surface indicates a faulty, or "cold" connection

<u>How to damage a meter</u>? Measure voltages or currents beyond the instrument's rated capacity or measure volts in the resistance setting....

<u>Schematic</u>: An electrical circuit diagram showing electrical components as standard symbols & how the various components are connected. It does not show actual placement, sizes, or wire lengths.



One last thought about a circuit that includes a capacitor: when measuring the resistance with an ohmmeter, the circuit will first show little or no resistance after which the resistance will climb sharply as the capacitor charges and reaches capacity



## Ohms Law Defined

- Ohms Law defines the relationship among Electromotive Force (measured in Volts and depicted as 'E'), Resistance (measured in ohms and depicted as 'R') and Current (measured in amperes and depicted as 'I')
- It further defines the relationship among Power (measured in Watts and depicted as 'P'), Resistance (measured in ohms and depicted as 'R') and Current (measured in amperes and depicted as 'I')









1st Example: Volts = Amperes \* Ohms = 0.5 \* 2 = 1 Volt

2nd Example: Resistance = Volts / Amperes = 2/4 = 0.5 ohms





1st Example: Watts = 10 amperes x 13.8 volts = 138 watts 2nd Example: Amperes = 120 watts / 12 volts = 10 amperes

## The Four Equations

Converting between Wavelength in Meters and Frequency in MHz: Wavelength in meters = 300 / frequency MHz Frequency MHz = 300 / Wavelength in meters

Calculating the length of a dipole in feet: Length in Feet = 468 / Frequency in MHz

Ohms Law: E = 1 x R (where E=volts, I=amperes, and R=ohms). Draw the circle

Ohms Power Law: P = I x E (where P=watts, I=amperes, and E=volts). Draw the circle



What happens to current at the junction of two components in series? It is the same in both components (or, in other words, a series loop has only one path, so the same current goes through each component)

In a parallel circuit, the current will divide at the junction point depending on the value of the components in each leg of the circuit





The proper grounding procedure for a tower is an 8 foot ground rod for each leg of the tower, bonded to the tower and to each other.

Local electrical codes establish the grounding requirements for towers.

Avoid sharp bends with the grounding straps for lightning protection.



Connect all grounds to a common point. No "daisy chains"! Will cause ground loops instead of having all equipment at the same ground

Ground bus bars are a good choice. One side is connected to the house ground (where the green wire is attached) and the other side goes to a good earth ground (wire as short as possible)







#### More on Towers

- A "gin pole" is used to lift tower sections or antennas safely
- Use safety wires on turnbuckles to prevent them from loosening from vibration
- Local electrical codes govern tower grounding requirements
  - Generally separate eight-foot long ground rods for each tower leg, bonded to the tower and each other
  - Use copper strap (lowest impedance to RF) for bonding
  - Keep connections short and direct (no sharp corners)





When antennas are where people may accidentally touch them (such as at a shelter or an outdoor activity), they need to be guarded and well marked

RF energy is <u>non-ionizing</u> radiation (as opposed to nuclear radiation). RF energy doesn't have sufficient energy to cause genetic damage.

## Managing RF Exposure

- The "Duty Cycle" of the RF emitter is an important component of RF exposure
  - Duty Cycle is the percentage of the time that the transmitter is transmitting vs the time it is not
- "Power Density" is the average amount of RF power exposure over a period of time
  - Duty Cycle directly affects power density
  - 3 minutes on and 3 minutes off vs 6 minutes on would double the power density allowed over a 6 minute period



# Some Final Things

- VHF Packet Radio: uses FM emissions, even
- the ISS uses FM packet
  Weak signal work on VHF or UHF? You will ned a multi-mode transceiver operating SSB
- Most repeaters use FM emissions and have a bandwidth of 10-15 kHz
- When controlling a radio controlled device, you must affix a label to the transmitter stating the licensee's name, call sign, and address





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<ul> <li>Applicant fills out the top section down to the signature</li> <li>Upon completion of the exam, the exam coordinator will fill out the bottom section</li> <li>If you have ever been convicted of a felony, a written statement as to why you should be granted a license must be submitted</li> </ul>	<section-header></section-header>

If you've been convicted of a felony, see me after the class for explanation of what the statement must include and how to submit the statement.

Note that a felony conviction does not disqualify an applicant. Further, the VE team has no involvement in the statement submission or review process.

# Taking the Exam

- You'll be given an exam booklet with the 35 questions you are to answer along with an answer sheet
- You'll also be given two blank pieces of paper to use as scratch paper. You must turn in the two sheets of paper, even if they weren't used when you turn in the answer sheet
- If you don't have a pen or pencil, one will be provided
- Make no marks on the exam books.
  Three VE's will supervise the
- Mark your answers on the answer sheet. Double / triple check
- There is no time limit. It's easy to misread a question. Take your time!



- Your test will be different than your neighbors
  - test session and each will independently grade your exam



No login is required as call signs are part of the public record

If the federal government is still in shutdown, no applications will be processed until the FCC returns to work. And then there will be a big backlog.

https://hamstudy.org/



#### That's All for Today!

Thank you for participating in the class And for your interest in Amateur Radio!

