

Technician Licensing Class

Lesson 3

presented by the Arlington Radio Public Service Club Arlington County, Virginia







Quiz

Sub elements T3, T4, & T5



Good Operating Practices Sub element T6



A <u>Band Plan</u> is a voluntary guideline for using different operating modes within an amateur band.

50.000-50.100: CW - No voice modes allowed per FCC section §97.305 50.060-50.080: CW/Beacon sub-band 50.100-50.300: Phone (SSB), etc. (no FM voice) 54.000 50.100-50.125: DX Window 53.500 50.300-50.600: All modes (simplex) 50.600-50.800: Digital modes (e.g. Packet) 53.000 50.800-51.000: Radio Control (R/C) 51.000-51.100: "Pacific DX window" (SSB/CW) 52.525 51.120-51.480: 6 Meter FM Repeater Inputs (areas w/500 KHz split) 52.000 51.500-51.600: Simplex FM, 6 channels: 51.500, 51.520, 51.540, 51.560, 51.600 51.580, and 51.600 51.500 51.620-51.980: 6 Meter FM Repeater Outputs (areas w/500 KHz split) 51.100 51.000 52.000-52.480: 6 Meter FM Repeater Inputs (for 500 KHz and 1 MHz 50.800 split) 50.600 Note: 52.525, 52.400, 52.040, and 52.020 are widely used for simplex 50.300 operation with 52.525 being the "national simplex" frequency. 50.100 50.000 52.500-52.980: 6 Meter FM Repeater Outputs 53.000-53.480: 6 Meter FM Repeater Inputs and Repeater Outputs

53.500-53.980: 6 Meter FM Repeater Outputs

FM Simplex

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Before you transmit.....

Always <u>LISTEN</u> first!

- If you don't hear anyone give a short call to ask if the frequency is in use (usually only on HF)
- "Is this frequency in use? This is YOURCALL"



Initiating a Contact – HF Bands

- "CQ" means "Calling Any Station"
 - Voice "CQ CQ CQ this is N5NA N5NA N5NA"
 - Morse Code "CQ CQ CQ DE N5NA N5NA N5NA"
 - "DE" means "from" or "this is" in Morse code
 - Send at a speed you can reliably copy
- Answer a CQ
 - Voice Say the other station's call once, followed by "this is", then your call phonetically
 - Morse Code Send the other station's call twice, "DE", then your call twice



Initiating a Contact – VHF/UHF FM

- If you know the other station's call sign...
 - Say the station's call sign, then your call sign
 - "K5RS...N5NA" or "K5RS this is N5NA"
- If you don't know a station to call....
 - Say "This is (pause) 'YOURCALL' monitoring"



ITU Phonetic Alphabet

A Alpha	H Hotel	O Oscar	V Victor
B Bravo	India	P Papa	W Whiskey
C Charlie	J Juliet	Q Quebec	X X-ray
D Delta	K Kilo	R Romeo	Y Yankee
E Echo	L Lima	S Sierra	Z Zulu
F Foxtrot	M Mike	T Tango	
G Golf	November	U Uniform	



ITU Phonetic Alphabet

- Used for accurate copy when band conditions are noisy or crowded.
- Words are internationally recognized substitutes for letters.
- Avoid cute phrases as they are not easily understood by non-English speaking amateurs.
- Generally not needed on repeaters.



Ham "lingo" you may hear.....

- "73" means "Best Regards"
- "DX" means "Distant Station"
- "K" means "Any Station Transmit" used on Morse code
- "QRS?" means "Send More Slowly" used on Morse code
- "Your signal is full quieting..." means your signal is strong enough to overcome all receiver noise used on FM



The RST Reporting System

The RST system is a quick way amateurs use to describe a received signal.

Readability1 = Poor5 = GoodSignal Strength1 = Poor9 = GoodTone (CW only)1 = Poor9 = Good

Note: Do not use the RST system on repeaters.



S - Meter



The S - meter gives a relative "signal" strength reading of a received signal.

A report of "five nine plus 20 db..." means the signal strength reading is 20 decibels greater than strength 9

QSL Cards



A QSL card is a written acknowledgement of communications between two amateurs.

V7/3ZN







Bandwidth



Bandwidth

SSB Signal

RTTY Signal

CW Signal





Harmonic Interference

- Transmitters can generate harmonics that can interfere with other amateurs or other radio services.
- The FCC regulations specify limits for harmonic radiation.
- You are responsible for ensuring your transmitter does not produce harmonic radiation.





Splatter Interference

On SSB, if the microphone gain is set too high it may cause "splatter" interference.



TV Interference

- If you are told your station is causing TV interference, check if it is causing interference to your own TV.
- If harmonic radiation from your transmitter is causing interference to a TV, you are responsible for taking care of the problem.





Low-Pass Filter



A low-pass filter goes between your transmitter and antenna. It helps reduce the strength of harmonic signals that would radiate from your antenna.



Low-Pass Filter





TV Interference

- Receiver overload is caused by nearby strong radio signals.
- If your transmitter is causing frontend overload of a TV, the owner of the TV is responsible of taking care of the problem.
- A break in a cable TV line may allow TV interference when the amateur station is transmitting or may cause interference to the amateur station.





High-Pass Filter



A high-pass filter goes between a TV and antenna.

It is the first step in trying to prevent RF overload from an amateur HF station transmission.



High-Pass Filter







A band-pass filter blocks RF energy above and below certain limits.

A band-pass filter may be used to block interference from a strong transmitter on a frequency near your operating frequency.

Band Pass Filter
Switched In

No Filter

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Other Interference / Signal Problems

- Many telephones are not equipped with interference protection and may receive strong radio signals.
- Spurious radiation from a hand-held transceiver could interfere with other signals on a frequency near yours.
- A bad filter capacitor in a power supply can cause buzzing or hum on a transmitted signal.



Basic Communications Electronics Sub element T7



System of Metric Units

giga	G	10 ⁹	1,000,000,000
mega	Μ	10 ⁶	1,000,000
kilo	K	10 ³	1,000
basic unit		10 ⁰	1
milli	m	10 ⁻³	0.001
micro	u	10 ⁻⁶	0.000001
pico	р	10 ⁻¹²	0.00000000001



Unit Conversion Practice

- 1 kilohertz = 1000 hertz
- 3.525 MHz = 3525 kHz
- 1,000,000 picofarads = 1 microfarad

500 milli-watts = 0.5 watts

3000 milli-amperes = 3 amperes



Voltage & Current

Current is the flow of electrons in an electric circuit.

- Current can be compared to the flow of water in a pipe.
- The basic unit of current is the ampere.
- Electromotive Force or Voltage is the force that pushes the electrons thru the circuit.
 - Voltage can be compared to pressure that pushes water thru a pipe.
 - The basic unit of voltage is the volt.



Conductors

Materials that allow the flow of electrons are called conductors. Some good conductors are:

- Gold
- Silver
- Aluminium
- Copper
- Most metals



Resistance

- Resistance opposes the flow of electrons in a material.
- Resistance limits the current that can flow thru a circuit.
- Resistance can be compared to a restriction in a water pipe.
- The ohm is the basic unit of resistance.







Adding Resistors



The total resistance of two resistors in <u>series</u> is the sum of their individual values.

$$R_t = R1 + R2$$



The total resistance of two resistors in <u>parallel</u> is the product over the sum.

$$R_{t} = \frac{R1 \times R2}{R1 + R2}$$



Voltage and Current?



It is possible to have voltage without current, as in the case of a battery by itself. In order to have current, there must be an electrical path (circuit) from the positive to the negative terminal of the voltage source.



Ohms Law

Ohms Law is a formula that shows the relationship between Voltage (E), Current (I), and Resistance (R).

$E = I \times R$

Ohms Law is applicable to all electrical circuits.



Ohms Law

Electromotive Force, VOLTS



The flow of electrons AMPERES

Resistance to current flow OHMS



Ohms Law Exercise



What is the current through the resistor?



I = E / R = 200 / 100 = 2 amperes



Ohms Law Exercise



What is the voltage across the resistor?



E = I x R = 2 x 50 = 100 volts



Ohms Law Exercise



What is the value of the resistance in the circuit?



R = E / I = 90 / 3 = 30 ohms



Decibel (dB)

The decibel is a comparison of power levels. It is defined as:

10 x log (P2/P1)

For example: P1 = 5 w and P2 = 10 w

P2 / P1 = 10 / 5 = 2 log 2 = 0.3 10 x 0.3 = 3 dB

<u>Just remember – Every 3 dB increase is the same</u> as doubling the power and every 3 dB decrease is the same as halving the power.



Switches



Single Pole Single Throw (SPST)



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www.MiniScience.com
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Double Pole Single Throw (DPST)







SPDT Knife Switch

Single Pole Double Throw (SPDT)





Double Pole Double Throw (DPDT)



Diodes



Adding a diode allows current to flow in only one direction.



The diode changes the alternating current into varying direct current. This circuit is called a rectifier.



Transistors



Transistors amplify signals using low voltages and currents.

This is a PNP transistor.



Integrated Circuits (IC's)



An IC (Integrated Circuit) combines several functions into one package.







Vacuum Tubes



Vacuum tubes can amplify small signals but use high voltages.







- Anytime current flows through a conductor, a magnetic field is created around that conductor.
- If the conductor is formed into a coil shape, the strength of the magnetic field is intensified.
- When the switch is closed, current flows through the inductor, building a magnetic field.
- When the switch is opened, the field collapses, inducing a current in the inductor.
- An inductor stores energy electromagnetically and opposes a change in current.
- The unit of measure is the Henry.



Inductors







Capacitors





A capacitor is made by separating two conductive plates by an insulator or dielectric.

Capacitors store energy electro-statically.

Capacitors tend to block DC and pass AC.



Capacitors

Fixed Value Capacitors

Variable Capacitor

Consists of two sets of rotating conducting plates separated by an insulator, which can be varied in surface area exposed to each other







Adding Capacitors



The total capacitance of capacitors connected in <u>parallel</u> is the sum of the values of the capacitors.

$$C_t = C1 + C2$$

If the capacitor values are equal the total capacitance is twice the value of one capacitor.



Analog Signals

Analog signals have voltage or current values that vary continuously over some range.

Amplitude Modulation (AM) and Frequency Modulation (FM) are examples of Analog modes.



AM





Digital Signals

Digital signals have voltage or current values only in specific steps over a certain range. Typically on or off.

Radio Teletype (RTTY) and Morse Code (CW) are examples of Digital modes.





Schematic Symbols You Need to Know









Fixed-value iron-core inductor

Single-cell battery

NPN transistor

Fixed-value resistor

Variable resistor or potentiometer



Fixed-value capacitor



Antenna



Single-pole, double-throw switch



Double-pole, single-throw switch



Homework

- Study Sub elements T6 & T7 of the question pool.
 - Read the <u>Question</u> and the <u>Answer</u> Three Times.
- Read Chapters 6 & 7 in "Now You're Talking".