RADIO AMATEUR EXAMINATION

FRIENDSHIP THRU THE AIRWAVE





Wavelength, Frequency & RF



Frequency Privileges (ITU region 2)

VHF, UHF, Microwave (Tech bands)

6 meters2 meters70 cm

50.0 - 54.0 MHz 144.0 - 148.0 MHz 430.0 - 440.0 MHz

Frequency Privileges (ITU region 2)

HF (Tech band)

- 80 meters
- 40 meters
- 15 meters
- 20 meters
- 10 meters

3.50- 3.9 MHZ 7.0 – 7.1 MHz 21.0 - 21.45 MHz 14.0-14.35 MHz 28.0 – 29.7 MHz

Operating Procedures (cont) Amateur Repeaters





Operating Procedures (cont)

Amateur Repeaters



Electrical Principles

Ohm's Law



E = Electromotive Force measured in VOLTS

/ = Current
measured in AMPERES

R = Resistance measured in OHMS



Hz - kHz
ma - ampere
Ampere
Volt
Conductors & insulators
Open & short circuits

Resistance & Resistors
Inductance & Inductors
Capacitance & Capacitors
Parallel & Series connections

Electrical Principles

Ohm's Law



I = **E** / **R** I is expressed in AMPS

R = E / I R is expressed in OHMS

E = **I x R** E is expressed in VOLTS



Ohm's Law

T5C04 If a current of 2 amperes flows through a 50-ohm resistor, what is the voltage across the resistor?

 $E = I \times R$

$E = 2 \times 50$

A. 25 volts
B. 52 volts
C. 100 volts
D. 200 volts





Ohm's Law

T5C05 If a 100-ohm resistor is connected to 200 volts, what is the current through the resistor?

I = E / R I = 200 / 100

A. 1 ampere **B. 2 amperes**C. 300 amperes
D. 20,000 amperes





Ohm's Law

T5C06 If a current of 3 amperes flows through a resistor connected to 90 volts, what is the resistance?



A. 3 ohms **B. 30 ohms**C. 93 ohms
D. 270 ohms



EXAMPLE QUESTIONS

A 110 volt wall outlet supplies power to a strobe light with a resistance of 2200 ohms. How much current is flowing through the strobe light? Sketch:



Choose your answer below

0.5 amps 2.0 amps 0.05 amps 1.0 amps

3 V is applied across a 6

resistor, what is the current? Values: V = 3 V, I = ?, R = 6

Equation: $I = {}^{\vee}/_{R}$ Numbers: Current, $I = {}^{3}/_{6} = 0.5 \text{ A}$

A lamp connected to a 6 V battery passes a current of 60 mA, what is the lamp's resistance? Values: V = 6 V, I = 60 mA, R = ? Equation: R = $^{V}/_{_{1}}$ Numbers: Resistance, R = $^{6}/_{_{60}}$ = 0.1 k = 100

<u>Resistance</u>

Combined resistance in series: R = R1 + R2This can be extended for more resistors: R = R1 + R2 + R3 + R4 + ...Note that the combined resistance in series will always be greater than any of the individual resistances.





$\frac{R1 \times R2}{R1 + R2}$

Note that the combined resistance in parallel will always be less than any of the individual resistances.





Other concepts

Power
Watt
Wavelength
Frequency
AC
DC



(NOTE: Frequency refers to number of crests of waves of same wavelength that pass by a point in one second.)



Resistors



Variable Resistor





Resistors



Fixed Resistor





More on resistors



Fixed Resistor





More on resistors



Fixed Resistor





Resistor shorthand

Resistor values are often written on circuit diagrams using a code system which avoids using a decimal point because it is easy to miss the small dot. Instead the letters R, K and M are used in place of the decimal point. To read the code: replace the letter with a decimal point, then multiply the value by 1000 if the letter was K, or 1000000 if the letter was M. The letter R means multiply by 1. For example: 560R means 560

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39K means
39 k
2K7 means 2.7
k = 2700
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1M0 means 1.0 M = 1000 k



Transistors



PNP Transistor

"Points in proudly"



NPN Transistor "Not pointing in"





Fixed Capacitor



Variable Capacitor









Fixed Capacitor







Variable Capacitor





Inductors



Fixed Inductor



Variable Inductor



Switches



Double Pole Single Throw DPST



Single Pole Single Throw SPST



Fuses, batteries



Fuse



Single Cell Battery



Block diagrams (super heterodyne)



An FM receiver uses a *limiter* and a *discriminator* to produce an audio signal. These circuits are unique to FM receivers.

Wavelength and antenna length

Half wave dipole antenna length = 468 (in feet) / frequency (MHz) 150 (in mtr) / frequency (Mhz)

Quarter wave vertical antenna

length (feet) = 234 (in feet) / frequency (MHz)
75 (in mtr) / frequency (MHz)

Wavelength and antenna length

Half wave dipole antenna

468 / freq (MHz)	
	feedline

Wavelength and antenna length



Quarter wave vertical antenna

Wavelength and antenna length

How long should you make a 1/4 wave vertical for 440 MHz? length (feet) = 234 / frequency (MHz) length (feet) = 234 / 440 MHz .5318 feet = 234 / 440 MHz (.5318 * 12) inches = 234 / 440 MHz

6 inches

Wavelength and antenna length

How long should you make a 1/4 wave vertical for 28.450 MHz?

length (feet) = 234 / frequency (MHz)

length (feet) = 234 / 28.450 MHz

8.2249 feet = 234 / 28.450 MHz

8 feet

Wavelength and antenna length

How long should you make a 1/4 wave vertical for 146 MHz? length (feet) = 234 / frequency (MHz) length (feet) = 234 / 146 MHz 1.6 feet = 234 / 146 MHz (1.6 * 12) inches = 234 / 440 MHz

19 inches

Wavelength and antenna length

If an antenna is made shorter its resonant frequency.....

INCREASES

If an antenna is made longer its resonant frequency......

DECREASES

Wavelength and antenna length

To decrease the resonant frequency of a dipole antenna...

LENGTHEN the antenna

To increase the resonant frequency of an antenna...

SHORTEN the antenna

Wavelength and antenna length

Multi band antennas

- Allow operation on several bands
- Caveat: may radiate unwanted harmonics

Beam antennas - Yagi

Directional antenna
Yagi construction
Driven element
Parasitic elements

Beam antennas - Yagi



Antennas & feedlines

Beam antennas - Yagi





Beam antennas - Cubical Quad



Two or more parallel four sided loops, each 1 wavelength long.



Antennas

Ground plane
Electrical noise
SWR
Feedlines
Balun







Important

- ADDING TOPIC
- PARALLEL RESISTOR
- SERIAL RESISTOR
- FILTER
- (LOWPASS,HIGHPASS,BANDPASS,BANDSTOP)
- DIFF SIMPLEX AND REPEATER
- POWER SUPLLY
- PROPOGATION(D,E,F1,F2,TROPOSPHERE,IONS PHERE,GROUND WAVE PROPOGATION,SKIP DISTANCE,LINE OF SIGHT)



- Line of sight
- Ionosphere
- Skywave
- Speriodic E(E layer)







Amateur Radio Practices

Grounding and lightning

Electrical ground

SWR Standing Wave Ratio

Good SWR 1.5:1 or less High SWR indicates antenna is wrong length, or there is an open or short in the feed line.

SWR Standing Wave Ratio

Lo Hi 144.1.....148.0 MHz 5:1 <----- 2.5:1 Antenna is too short

SWR meter 1:1 **Test equipment**

Voltmeter Ammeter RF wattmeter Multimeter

Radio Frequency Interference

Receiver overload Harmonic Radiation Low pass filter High pass filter



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 D. 20,000 amperes



Functional Layout

T7A05

In Figure N7-1, if block 1 is a transceiver and block 3 is a dummy antenna, what is block 2?

A. A terminal-node switchB. An antenna switchC. A telegraph key switchD. A high-pass filter



Functional Layout

T7A05

In Figure N7-1, if block 1 is a transceiver and block 3 is a dummy antenna, what is block 2?

A. A terminal-node switch
B. An antenna switch
C. A telegraph key switch
D. A high-pass filter



Functional Layout

T7A06

In Figure N7-1, if block 1 is a transceiver and block 2 is an antenna switch, what is block 3?

- A. A terminal-node switch
- B. An SWR meter
- C. A telegraph key switch
- D. A dummy antenna



Functional Layout

T7A06

In Figure N7-1, if block 1 is a transceiver and block 2 is an antenna switch, what is block 3?

- A. A terminal-node switch
- B. An SWR meter
- C. A telegraph key switch
- D. A dummy antenna



Functional Layout

T7A07

In Figure N7-2, if block 1 is a transceiver and block 3 is an antenna switch, what is block 2?

- A. A terminal-node switch
- B. A dipole antenna
- C. An SWR meter
- D. A high-pass filter



Functional Layout

T7A07

In Figure N7-2, if block 1 is a transceiver and block 3 is an antenna switch, what is block 2?

A. A terminal-node switch
B. A dipole antenna *C. An SWR meter*D. A high-pass filter



Functional Layout

T7A08

In Figure N7-3, if block 1 is a transceiver and block 2 is an SWR meter, what is block 3?

A. An antenna switch **B.** An antenna tuner
C. A key-click filter
D. A terminal-node controller



Electrical Principles

Ohm's Law

T5C06 If a current of 3 amperes flows through a resistor connected to 90 volts, what is the resistance?



A. 3 ohms
B. 30 ohms
C. 93 ohms
D. 270 ohms







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9W2SMF - fadzil