Chapter 5: Transmitters

**MULTIPLE CHOICE**

1. The ability to change operating frequency rapidly without a lot of retuning is called:
   a. agility 
   b. expansion 
   c. VFO 
   d. spread-spectrum
   
   ANS: A

2. The difference between the DC power into a transmitter and the RF power coming out:
   a. is a measure of efficiency 
   b. heats the transmitter 
   c. may require water cooling 
   d. all of the above
   
   ANS: D

3. Baseband compression produces:
   a. a smaller range of frequencies from low to high 
   b. a smaller range of amplitude from soft to loud 
   c. a smaller number of signals 
   d. none of the above
   
   ANS: B

4. ALC stands for:
   a. Amplitude Level Control 
   b. Automatic Level Control 
   c. Accurate Level Control 
   d. none of the above
   
   ANS: B

5. In an AM transmitter, ALC is used to:
   a. keep the modulation close to 100% 
   b. keep the modulation below 100% 
   c. maximize transmitted power 
   d. all of the above
   
   ANS: D

6. With high-level AM:
   a. all RF amplifiers can be nonlinear 
   b. minimum modulation power is required 
   c. minimum RF power is required 
   d. all of the above
   
   ANS: A

7. With high-level AM:
   a. the RF amplifiers are typically Class A 
   b. the RF amplifiers are typically Class B 
   c. the RF amplifiers are typically Class C 
   d. the RF amplifiers are typically Class AB
   
   ANS: C

8. With low-level AM:
   a. the RF amplifiers must be Class A 
   b. the RF amplifiers must be Class B 
   c. the RF amplifiers must be linear 
   d. the RF amplifiers must be low-power
   
   ANS: }
9. Power amplifiers must be linear for any signal that:
   a. is complex         c. has variable frequency
   b. has variable amplitude d. all of the above

ANS: C

10. In high-level AM, "high-level" refers to:
    a. the power level of the carrier c. the power level of the final RF amplifier
    b. the power level of the modulation d. none of the above

ANS: D

11. In high-level AM, the power in the sidebands comes from:
    a. the modulating amplifier c. the driver stage
    b. the RF amplifier d. the carrier

ANS: A

12. In an AM transmitter with 100% modulation, the voltage of the final RF stage will be:
    a. approximately half the DC supply voltage
    b. approximately twice the DC supply voltage
    c. approximately four times the DC supply voltage
    d. none of the above

ANS: C

13. Practical transmitters are usually designed to drive a load impedance of:
    a. 50 ohms resistive c. 300 ohms resistive
    b. 75 ohms resistive d. 600 ohms resistive

ANS: A

14. Which of the following can be used for impedance matching?
    a. pi network c. both a and b
    b. T network d. a bridge circuit

ANS: C

15. When a transmitter is connected to a resistor instead of an antenna, the resistor is called:
    a. a heavy load c. a temporary load
    b. a dummy load d. a test load

ANS: B

16. When a transmitter is connected to a resistor instead of an antenna, the resistor must be:
    a. wire-wound c. 1% tolerance or better
    b. noninductive d. all of the above

ANS: B

17. A Class D amplifier is:
    a. very efficient c. essentially pulse-duration modulation


b. essentially pulse-width modulation  
d. all of the above  
ANS: D

18. To generate a SSB signal:  
a. start with full-carrier AM  
c. start with a quadrature signal  
b. start with DSBSC  
d. all of the above  
ANS: B

19. The carrier is suppressed in:  
a. a balanced modulator  
c. a frequency multiplier  
b. a mixer  
d. none of the above  
ANS: A

20. To remove one AM sideband and leave the other you could use:  
a. a mechanical filter  
c. both a and b  
b. a crystal filter  
d. none of the above  
ANS: C

21. A direct FM modulator:  
a. varies the frequency of the carrier oscillator  
b. integrates the modulating signal  
c. both a and b  
d. none of the above  
ANS: A

22. An indirect FM modulator:  
a. requires a varactor in the carrier oscillator  
b. varies the phase of the carrier oscillator  
c. both a and b  
d. none of the above  
ANS: B

23. AFC stands for:  
a. Amplitude to Frequency Conversion  
c. Automatic Frequency Control  
b. Automatic Frequency Centering  
d. Audio Frequency Control  
ANS: C

24. Frequency multipliers are:  
a. essentially balanced modulators  
c. essentially mixers  
b. essentially Class C amplifiers  
d. none of the above  
ANS: B

25. With mixing:  
a. the carrier frequency can be raised  
b. the carrier frequency can be lowered  
c. the carrier frequency can be changed to any required value
COMPLETION

1. The accuracy and stability of a transmitter frequency is fixed by the _________________ oscillator.
   ANS: carrier

2. In the USA, the _________________ sets requirements for accuracy and stability of a transmitter's frequency.
   ANS: FCC

3. In Canada, _________________ sets requirements for accuracy and stability of a transmitter's frequency.
   ANS: Industry Canada

4. Frequency _________________ is the ability of a transmitter to change frequency without a lot of retuning.
   ANS: agility

5. Power output of SSB transmitters is rated by _________________.
   ANS: PEP

6. Reducing the dynamic range of a modulating signal is called _________________.
   ANS: compression

7. The opposite of compression is called _________________.
   ANS: expansion

8. ALC is a form of _________________.
   ANS: compression

9. High-level modulation allows the RF amplifiers to operate more _________________.
   ANS: efficiently

10. Low-level modulation requires the RF amplifiers to be _________________.
    ANS: linear

11. To isolate the oscillator from load changes, a _________________ stage is used.
12. The peak collector voltage in a Class C RF amplifier is ________________ than the DC supply voltage.
   ANS: higher

13. Most practical transmitters are designed to operate into a ________________-ohm load.
   ANS: 50

14. Transmitters built with transistor RF amplifiers often use a ________________ network for impedance matching.
   ANS: T

15. Matching networks also act as filters to help reduce ________________ levels.
   ANS: harmonic

16. Severe impedance ________________ can destroy a transmitter's output stage.
   ANS: mismatch

17. Transceivers combine a transmitter and a ________________ into one "box".
   ANS: receiver

18. To allow a high modulation percentage, it is common to modulate the ________________ as well as the power amplifier in transistor modulators.
   ANS: driver

19. Pulse-width modulation is the same as pulse-______________ modulation.
   ANS: duration

20. Switching amplifiers are sometimes called Class ________________ amplifiers.
   ANS: D

21. Because the sideband filter in a SSB transmitter is fixed, ________________ is used to operate at more than one frequency.
   ANS: mixing

22. To generate a SSB signal, it is common to start with a ________________ signal.
   ANS: DSBSC
23. Indirect FM is derived from ________________ modulation.

   ANS: phase

24. Using a varactor to generate FM is an example of a ________________ modulator.

   ANS: reactance

25. The modern way to make a stable VFO is to make it part of a ________________ loop.

   ANS: phase-locked

SHORT ANSWER

1. If a 50-MHz oscillator is accurate to within 0.001%, what is the range of possible frequencies?

   ANS:
   50 MHz ± 500 hertz

2. What is the efficiency of a 100-watt mobile transmitter if it draws 11 amps from a 12-volt car battery?

   ANS:
   75.8%

3. The power amplifier of an AM transmitter draws 100 watts from the power supply with no modulation. Assuming high-level modulation, how much power does the modulation amplifier deliver for 100% modulation?

   ANS:
   50 watts

4. If the final RF amplifier of an AM transmitter is powered by 100 volts DC, what is the maximum collector voltage at 100% modulation?

   ANS:
   400 volts

5. Suppose the output of a balanced modulator has a center frequency of 10 MHz. The audio modulation frequency range is 1 kHz to 10 kHz. To pass the USB, what should be the center frequency of an ideal crystal filter?

   ANS:
   10.005 MHz

6. Suppose you have generated a USB SSB signal with a nominal carrier frequency of 10 MHz. What is the minimum frequency the SSB signal can be mixed with so that the output signal has a nominal carrier frequency of 50 MHz?

   ANS:
   40 MHz
7. Suppose you have an FM modulator that puts out 1 MHz carrier with a 100-hertz deviation. If frequency multiplication is used to increase the deviation to 400 hertz, what will be the new carrier frequency?

ANS:
4 MHz

8. Suppose you had an FM signal with a carrier of 10 MHz and a deviation of 10 kHz. Explain how you could use it to get an FM signal at 100 MHz with a deviation of 20 kHz.

ANS:
First, put the signal through a frequency doubler to get a 20-MHz carrier with a 20-kHz deviation. Then mix that signal with an 80-MHz carrier to generate a 100-MHz carrier with 20-kHz deviation.