SUBELEMENT T9

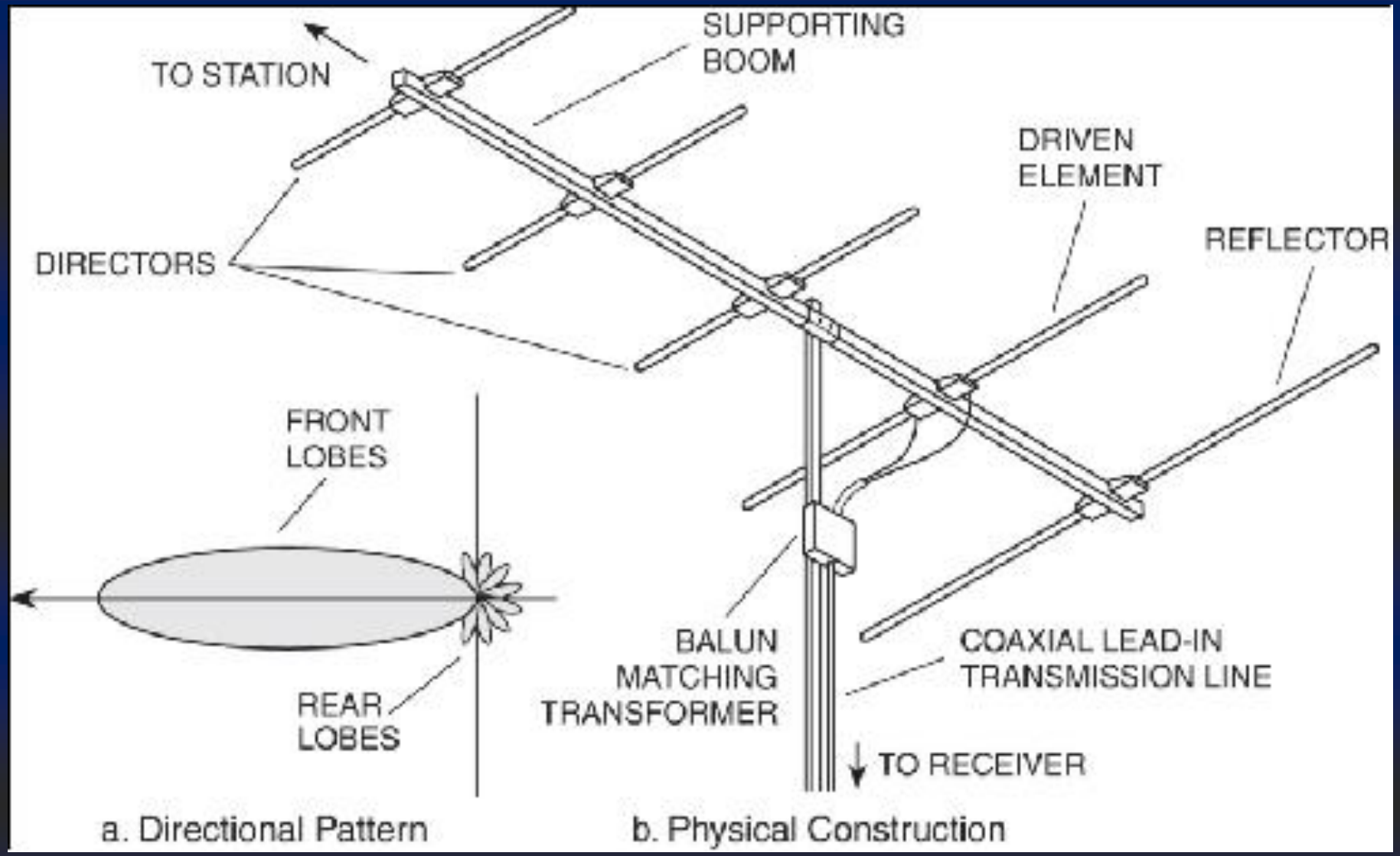
Antennas and feed lines
2 Exam Questions - 2 Groups

T9A – Antennas: vertical and horizontal polarization; concept of gain; common portable and mobile antennas; relationships between antenna length and frequency

A beam antenna concentrates signals in one direction.

A beam antenna is an antenna
An that concentrates signals in one direction.

Pictured is a five element beam, or directional antenna. One element is the reflector and one element is the driven element, which is the one that the feedline would be connected to. The last three elements of the beam are the directors.


TO STATION
SUPPORTING BOOM
DRIVEN ELEMENT
REFLECTOR
DIRECTORS
FRONT LOBES
REAR LOBES
BALUN MATCHING TRANSFORMER
COAXIAL LEAD-IN TRANSMISSION LINE
TO RECEIVER
a. Directional Pattern
b. Physical Construction

The three types of directional antenna that you need to know for the exam are the quad, Yagi, and dish. The one pictured above is a yagi.

The main reason to use a directional antenna is that the gain of the directional antenna increases signal strength in a specified direction when compared to a reference antenna.

T9A01

What is a beam antenna?

A. An antenna built from aluminum I-beams

B. An omnidirectional antenna invented by Clarence Beam

C. An antenna that concentrates signals in one direction

D. An antenna that reverses the phase of received signals

T9A01

What is a beam antenna?

C. An antenna that concentrates signals in one direction

T9A06

What type of antennas are the quad, Yagi, and dish?

A. Non-resonant antennas

B. Loop antennas

C. Directional antennas

D. Isotropic antennas

T9A06

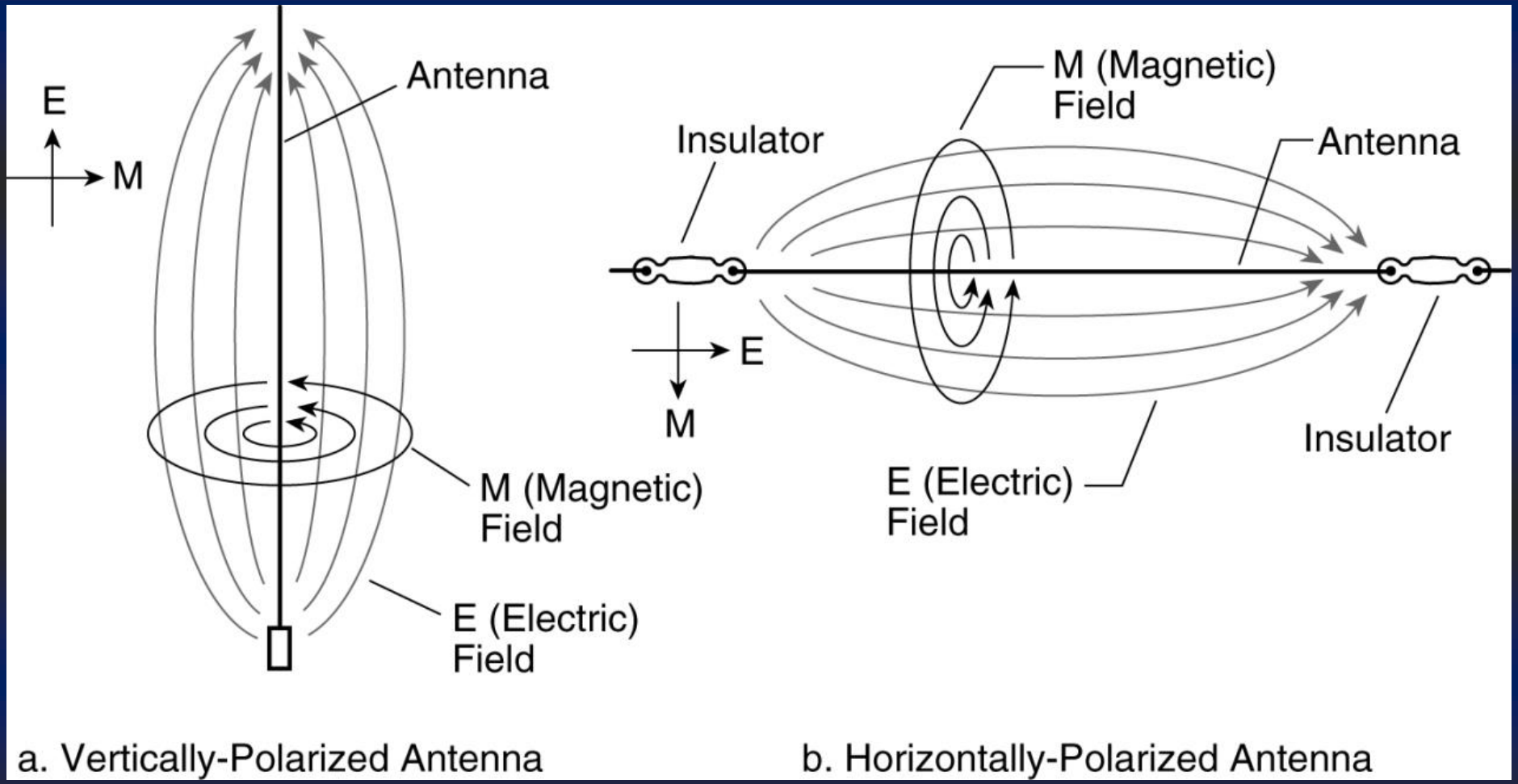
What type of antennas are the quad, Yagi, and dish?

C. Directional antennas

The electric field of vertical antennas is perpendicular to the Earth.

Remember the Horizontal vs. Vertical that was discussed earlier? Verticals physically are perpendicular to the earth and the signals they radiate are also perpendicular to the earth.

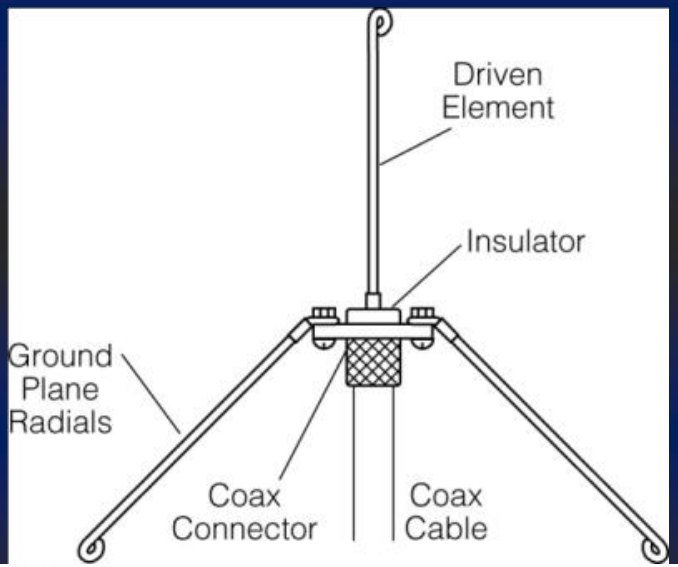
A vertical is simply a radiating element that is ¼ wavelength long.


E
M
Antenna
M (Magnetic)
Field
E (Electric)
Field
a. Vertically-Polarized Antenna
Insulator
M (Magnetic)
Field
Antenna
E
M
Insulator
E (Electric)
Field
b. Horizontally-Polarized Antenna

The formula for building your own vertical antenna is 234 / F = L, where F is the frequency in megahertz and L is the length in feet.

For example, a vertical antenna for 146 MHz. would be 234 / 146 = 1.6 feet. Convert that to inches: 1.6 x 12 = 19.2 inches.

The approximate length of a quarter-wavelength vertical for 146 MHz is 19 inches.



All Views are End Views

Elevation Plane
Radiation Pattern

$\frac{\lambda}{4}$

a. Quarter Wavelength

Elevation Plane
Radiation Pattern

$\frac{\lambda}{2}$

b. Half Wavelength

Elevation Plane
Radiation Pattern

λ

c. Full Wavelength

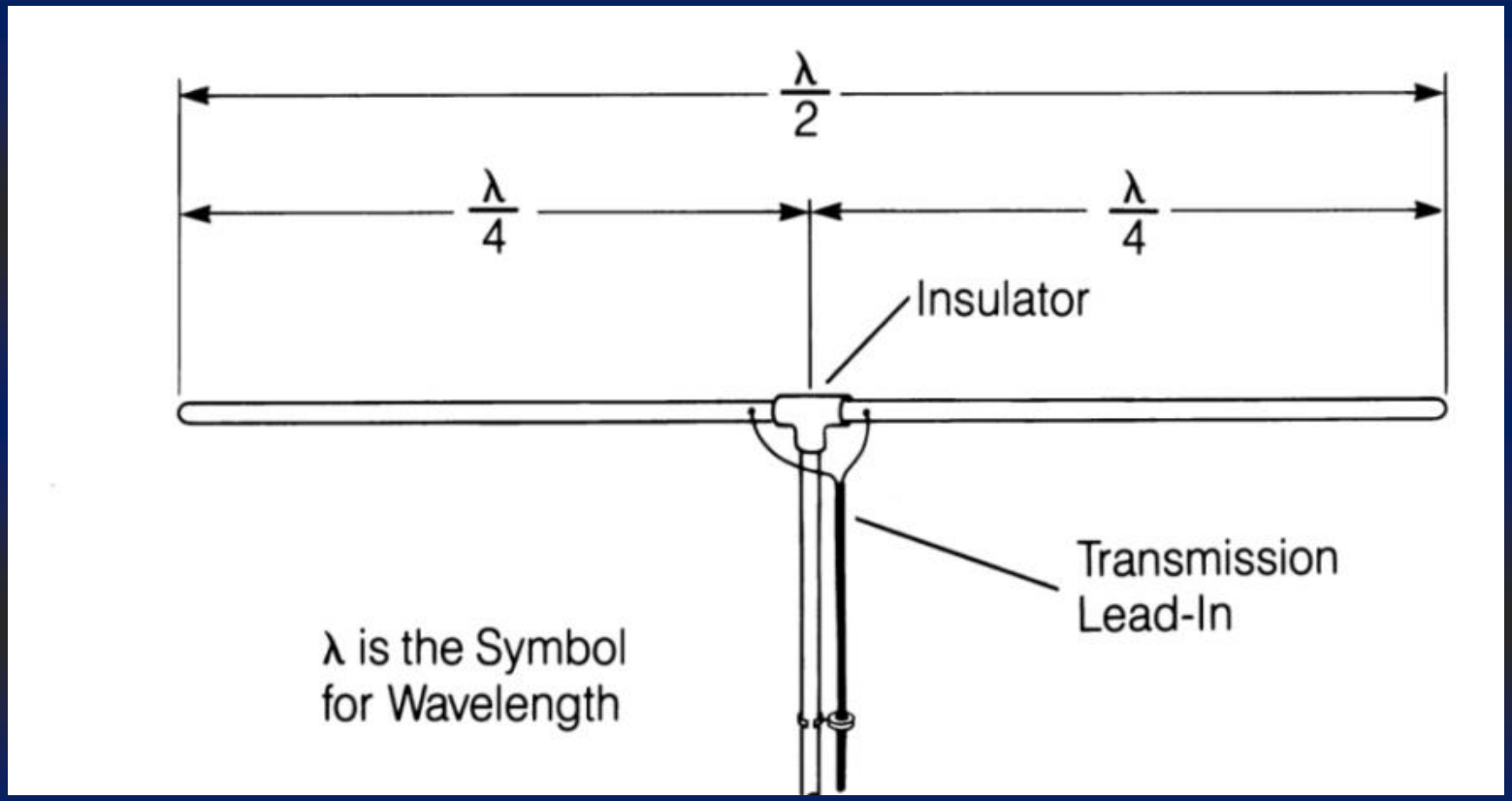
A simple dipole mounted so the conductor is parallel to the Earth's surface is a horizontally polarized antenna.

A dipole is a poplar ham antenna that is ½ wavelength long and feed with coaxial cable in the center. They are very easy to make at home.

The formula for a dipole is 468 / F ≡ L, where F is frequency in megahertz and L is the length in feet.

So, if one would want to make a 6 meter dipole for 50 MHz.: 468 / 50 = 9.36 feet. Convert this to inches: 9.36 X 12 = 112.3 inches.

The approximate length of a 6 meter 1/2-wavelength wire dipole antenna is 112 inches


λ/2
λ/4
λ/4
Insulator
Transmission
Lead-In
λ is the Symbol
for Wavelength

You would change a dipole antenna to make it resonant on a higher frequency by making it shorter.

The strongest radiation from a half-wave dipole antenna in free space is broadside to the antenna.

T9A02

Which of the following is true regarding vertical antennas?

A. The magnetic field is perpendicular to the Earth

B. The electric field is perpendicular to the Earth

C. The phase is inverted

D. The phase is reversed

T9A02

Which of the following is true regarding vertical antennas?

B. The electric field is perpendicular to the Earth

T9A03

Which of the following describes a simple dipole mounted so the conductor is parallel to the Earth's surface?

A. A ground wave antenna
B. A horizontally polarized antenna
C. A rhombic antenna
D. A vertically polarized antenna

T9A03

Which of the following describes a simple dipole mounted so the conductor is parallel to the Earth's surface?

B. A horizontally polarized antenna

T9A05

How would you change a dipole antenna to make it resonant on a higher frequency?

A. Lengthen it

B. Insert coils in series with radiating wires

C. Shorten it

D. Add capacity hats to the ends of the radiating wires

T9A05

How would you change a dipole antenna to make it resonant on a higher frequency?

C. Shorten it

T9A08

What is the approximate length, in inches, of a quarter-wavelength vertical antenna for 146 MHz?

A. 112

B. 50

C. 19

D. 12

T9A08

What is the approximate length, in inches, of a quarter-wavelength vertical antenna for 146 MHz?

C. 19

T9A09

What is the approximate length, in inches, of a 6 meter 1/2-wavelength wire dipole antenna?

A. 6

B. 50

C. 112

D. 236

T9A09

What is the approximate length, in inches, of a 6 meter 1/2-wavelength wire dipole antenna?

C. 112

T9A10

In which direction is the radiation strongest from a half-wave dipole antenna in free space?

A. Equally in all directions

B. Off the ends of the antenna

C. Broadside to the antenna

D. In the direction of the feedline

T9A10

In which direction is the radiation strongest from a half-wave dipole antenna in free space?

C. Broadside to the antenna

A disadvantage of the "rubber duck" antenna supplied with most handheld radio transceivers is that it does not transmit or receive as effectively as a full-sized antenna.

This is obvious when comparing a rubber duck antenna to a 19 inch whip antenna. Generally, a rubber duck antenna is 3 to 8 inches long.

A 19 inch whip would certainly receive and transmit better than a rubber duck antenna.

If repeaters are close, the rubber duck antenna has the advantage of not getting in the way when the hand held is attached to your waist.

The gain of a full sized antenna is greater than that of a rubber duck antenna.

The gain of a directional antenna is greater than that of an Omni directional antenna.

The gain of an antenna is the increase in signal strength in a specified direction when compared to a reference antenna.

A good reason not to use a "rubber duck" antenna inside your car is that signals can be significantly weaker than when it is outside of the vehicle.

T9A04

What is a disadvantage of the "rubber duck" antenna supplied with most handheld radio transceivers?

A. It does not transmit or receive as effectively as a full-sized antenna
B. It transmits a circularly polarized signal
C. If the rubber end cap is lost it will unravel very quickly
D. All of these choices are correct

T9A04

What is a disadvantage of the "rubber duck" antenna supplied with most handheld radio transceivers?

A. It does not transmit or receive as effectively as a full-sized antenna

T9A07

What is a good reason not to use a "rubber duck" antenna inside your car?

A. Signals can be significantly weaker than when it is outside of the vehicle

B. It might cause your radio to overheat

C. The SWR might decrease, decreasing the signal strength

D. All of these choices are correct

T9A07

What is a good reason not to use a "rubber duck" antenna inside your car?

A. Signals can be significantly weaker than when it is outside of the vehicle

T9A11

What is meant by the gain of an antenna?

A. The additional power that is added to the transmitter power

B. The additional power that is lost in the antenna when transmitting on a higher frequency

C. The increase in signal strength in a specified direction when compared to a reference antenna

D. The increase in impedance on receive or transmit compared to a reference antenna

T9A11

What is meant by the gain of an antenna?

C. The increase in signal strength in a specified direction when compared to a reference antenna

While a ¼ wave antenna can be effect, many hams use a 5/8 wavelength antenna for VHF or UHF mobile.

A properly mounted 5/8 wavelength antenna offers a lower angle of radiation and more gain than a 1/4 wavelength antenna and usually provides improved coverage.

When possible, VHF or UHF mobile antennas are often mounted in the center of the vehicle roof because a roof mounted antenna normally provides the most uniform radiation pattern.

Using an antenna on some frequencies, especially on the HF bands can be challenging.

For example, if one wanted to operate 10 meter SSB, the length of the antenna would be a little bit over 8 feet.

If operating 20 meters, the antenna would need to be about 16 feet tall. Not good for going under bridges, stoplights, and trees!

Inserting an inductor in the radiating portion of the antenna to make it electrically longer is a good way to solve this problem.

T9A12

What is a reason to use a properly mounted 5/8 wavelength antenna for VHF or UHF mobile service?

A. It offers a lower angle of radiation and more gain than a 1/4 wavelength antenna and usually provides improved coverage

B. It features a very high angle of radiation and is better for communicating via a repeater

C. The 5/8 wavelength antenna completely eliminates distortion caused by reflected signals

D. The 5/8 wavelength antenna offers a 10-times power gain over a 1/4 wavelength design

T9A12

What is a reason to use a properly mounted 5/8 wavelength antenna for VHF or UHF mobile service?

A. It offers a lower angle of radiation and more gain than a 1/4 wavelength antenna and usually provides improved coverage

T9A13

Why are VHF or UHF mobile antennas often mounted in the center of the vehicle roof?

A. Roof mounts have the lowest possible SWR of any mounting configuration

B. Only roof mounting can guarantee a vertically polarized signal

C. A roof mounted antenna normally provides the most uniform radiation pattern

D. Roof mounted antennas are always the easiest to install

T9A13

Why are VHF or UHF mobile antennas often mounted in the center of the vehicle roof?

C. A roof mounted antenna normally provides the most uniform radiation pattern

T9A14

Which of the following terms describes a type of loading when referring to an antenna?

A. Inserting an inductor in the radiating portion of the antenna to make it electrically longer

B. Inserting a resistor in the radiating portion of the antenna to make it resonant

C. Installing a spring at the base of the antenna to absorb the effects of collisions with other objects

D. Making the antenna heavier so it will resist wind effects when in motion

T9A14

Which of the following terms describes a type of loading when referring to an antenna?

A. Inserting an inductor in the radiating portion of the antenna to make it electrically longer

T9B –

Feed lines: types of feed lines; attenuation vs. frequency; SWR concepts; matching; weather protection; choosing RF connectors and feed lines

Coaxial cable is used more often than any other feedline for amateur radio antenna systems because it is easy to use and requires few special installation considerations.

50 ohms is the impedance of the most commonly used coaxial cable in typical amateur radio installations.

This is because the transceiver is designed to be used with an antenna whose impedance is 50 ohms.

If the antenna impedance is 50 ohms and the transceiver is designed for 50 ohms, then using 50 ohm coaxial cable will provide a perfect 1 to 1 SWR match.

It is important to have a low SWR in an antenna system that uses coaxial cable feedline to allow the efficient transfer of power and reduce losses.

There is greater signal loss at a high SWR than there is at a low SWR. The length of coaxial cable has an effect too.

The longer the run from the antenna, the greater the signal loss. Another thing that contributes to signal loss is frequency.

As the frequency of a signal passing through coaxial cable is increased the loss increases.

If an antenna system has a slightly higher SWR than 1 to 1, an antenna tuner may be used.

An antenna tuner matches the antenna system impedance to the transceiver's output impedance.

In other words, the antenna tuner tricks the transciever into thinking that the SWR is 1 to 1.

Using antenna systems with an SWR of up to 3 to 1 with an antenna tuner will show little signal loss at the antenna.

T9B01

Why is it important to have a low SWR in an antenna system that uses coaxial cable feedline?

A. To reduce television interference
B. To allow the efficient transfer of power and reduce losses
C. To prolong antenna life
D. All of these choices are correct

T9B01

Why is it important to have a low SWR in an antenna system that uses coaxial cable feedline?

B. To allow the efficient transfer of power and reduce losses

T9B02

What is the impedance of the most commonly used coaxial cable in typical amateur radio installations?

A. 8 ohms

B. 50 ohms

C. 600 ohms

D. 12 ohms

T9B02

What is the impedance of the most commonly used coaxial cable in typical amateur radio installations?

B. 50 ohms

T9B03

Why is coaxial cable used more often than any other feedline for amateur radio antenna systems?

A. It is easy to use and requires few special installation considerations

B. It has less loss than any other type of feedline

C. It can handle more power than any other type of feedline

D. It is less expensive than any other types of feedline

T9B03

Why is coaxial cable used more often than any other feedline for amateur radio antenna systems?

A. It is easy to use and requires few special installation considerations

T9B04

What does an antenna tuner do?

A. It matches the antenna system impedance to the transceiver's output impedance

B. It helps a receiver automatically tune in weak stations

C. It allows an antenna to be used on both transmit and receive

D. It automatically selects the proper antenna for the frequency band being used

T9B04

What does an antenna tuner do?

A. It matches the antenna system impedance to the transceiver's output impedance

T9B05

What generally happens as the frequency of a signal passing through coaxial cable is increased?

A. The apparent SWR increases

B. The reflected power increases

C. The characteristic impedance increases

D. The loss increases

T9B05

What generally happens as the frequency of a signal passing through coaxial cable is increased?

D. The loss increases

PL-259 type coax connectors are commonly used at HF frequencies. At HF frequencies, PL-259 fittings have very little loss.

A Type N connector is most suitable for frequencies above 400 Mhz. These are low loss and weather proof. They are also more expensive.

Coax connectors exposed to the weather should be sealed against water intrusion to prevent an increase in feed line loss.

Electrical differences exists between the smaller RG-58 and larger RG-8 coaxial cable in that **RG-8 cable has less loss at a given frequency.**

The lowest loss feed line at VHF and UHF is an Air-insulated hard line.

Lastly, a loose connection in an antenna or a feed line might cause erratic changes in SWR readings.

T9B06

Which of the following connectors is most suitable for frequencies above 400 MHz?

A. A UHF (PL-259/SO-239) connector

B. A Type N connector

C. An RS-213 connector

D. A DB-25 connector

T9B06

Which of the following connectors is most suitable for frequencies above 400 MHz?

B. A Type N connector

T9B07

Which of the following is true of PL-259 type coax connectors?

A. They are preferred for microwave operation

B. They are water tight

C. They are commonly used at HF frequencies

D. They are a bayonet type connector

T9B07

Which of the following is true of PL-259 type coax connectors?

C. They are commonly used at HF frequencies

T9B08

Why should coax connectors exposed to the weather be sealed against water intrusion?

A. To prevent an increase in feed line loss

B. To prevent interference to telephones

C. To keep the jacket from becoming loose

D. All of these choices are correct

T9B08

Why should coax connectors exposed to the weather be sealed against water intrusion?

A. To prevent an increase in feed line loss

T9B09

What might cause erratic changes in SWR readings?

A. The transmitter is being modulated

B. A loose connection in an antenna or a feed line

C. The transmitter is being over-modulated

D. Interference from other stations is distorting your signal

T9B09

What might cause erratic changes in SWR readings?

B. A loose connection in an antenna or a feed line

T9B10

What electrical difference exists between the smaller RG-58 and larger RG-8 coaxial cables?

A. There is no significant difference between the two types

B. RG-58 cable has less loss at a given frequency

C. RG-8 cable has less loss at a given frequency

D. RG-58 cable can handle higher power levels

T9B10

What electrical difference exists between the smaller RG-58 and larger RG-8 coaxial cables?

C. RG-8 cable has less loss at a given frequency

T9B11

Which of the following types of feed line has the lowest loss at VHF and UHF?

A. 50-ohm flexible coax

B. Multi-conductor unbalanced cable

C. Air-insulated hard line

D. 75-ohm flexible coax

T9B11

Which of the following types of feed line has the lowest loss at VHF and UHF?

C. Air-insulated hard line