SUBELEMENT T9

Antennas & Feed Lines

[2 Exam Questions]

PREPPERNET

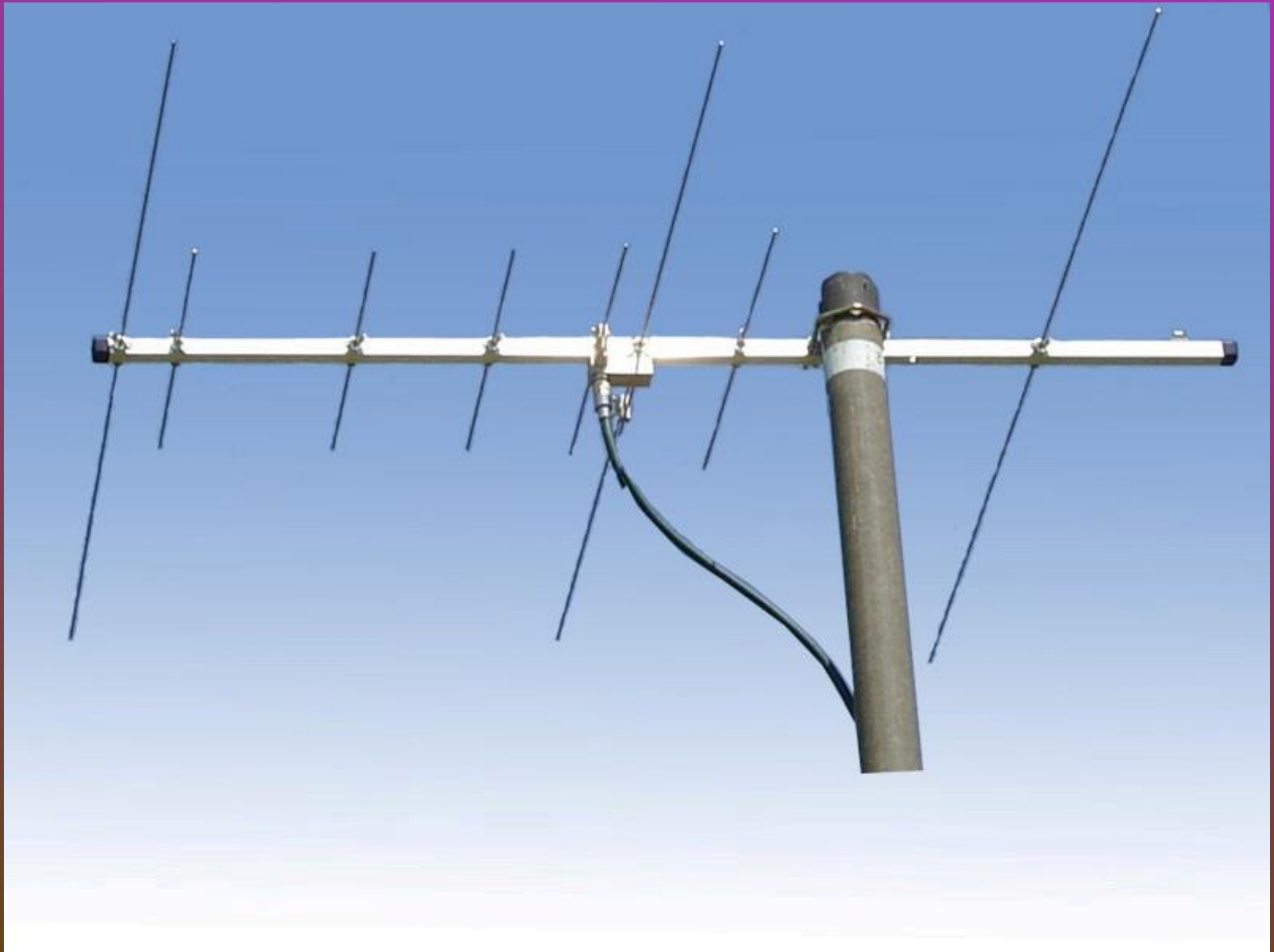
T9A01
WHAT IS A BEAM ANTENNA?

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



The term "beam antenna" is just another name for a directional antenna; it's an antenna that concentrates signals in one direction. You can think of it that it "beams" the signals in a certain direction.

PREPPERNET

T9A02
WHICH OF THE FOLLOWING DESCRIBES A TYPE OF ANTENNA LOADING?

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 in the base of a mobile vertical antenna to make it more flexible

D. Strengthening the radiating elements of a beam antenna to better resist wind damage

PREPPERNET

Inductors in series make an antenna appear electrically longer. So you'd insert an inductor into the radiating portion of the antenna to make it appear electrically longer.

T9A03
WHICH OF THE FOLLOWING DESCRIBES A SIMPLE DIPOLE ORIENTED PARALLEL TO THE EARTH'S SURFACE?

A. A ground-wave antenna

B. A horizontally polarized antenna

C. A rhombic antenna

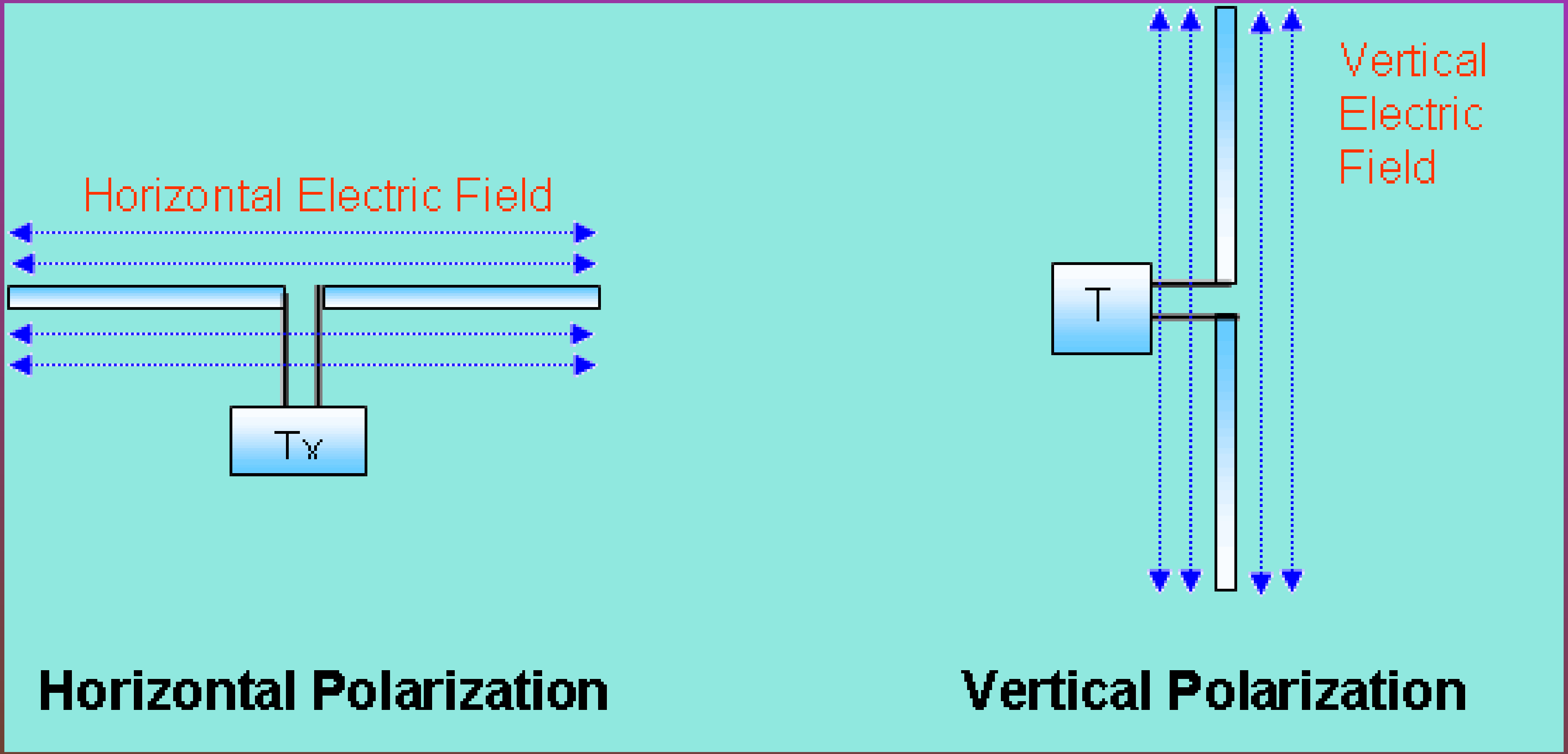
D. A vertically polarized antenna

PREPPERNET

The orientation of the conductor of an antenna relative to the earth's surface determines its "polarization".

- *If the antenna is vertical (perpendicular to the ground) as most antennas are thought to be then it is "vertically polarized"*
- *if it is horizontal (parallel to the ground) then it is "horizontally polarized".*

If the polarization of the sending station's antenna does not match the polarization of the receiving station's antenna signify cant loss in signal can be the result.


Horizontal Electric Field
Tx
Vertical
Electric
Field
T
Horizontal Polarization
Vertical Polarization

T9A04
WHAT IS A DISADVANTAGE OF THE “RUBBER DUCK” ANTENNA SUPPLIED WITH MOST HANDHELD RADIO TRANSCEIVERS WHEN COMPARED TO A FULL-SIZED QUARTER-WAVE ANTENNA?

A. It does not transmit or receive as effectively

B. It transmits only circularly polarized signals

C. If the rubber end cap is lost, it will unravel very easily

D. All of these choices are correct

Smaller antennas use electrical components to maintain resonance on the target frequencies, but having less surface area they don't absorb (or emit) as much power. Therefore they do not transmit or receive as effectively as a regular full-sized antenna.

As a general rule of thumb, the shorter the antenna on a given band the worse the performance will be and the longer the better. Of course, other factors such as the resonance of the antenna on the frequencies used can also affect this!

PREPPERNET

The only reasons to use rubber duck type antennas are that they take up less space and are usually more durable than longer antennas. This makes it easier to keep an HT on your belt compared to a possibly much longer antenna.

These sorts of tradeoffs are more typically worthwhile for commercial users such as security guards who will be near a repeater or other HT users almost all the time, so they aren't nearly as concerned as much about gain as most amateur operators.

PREPPERNET

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 capacitive loading to the ends of the radiating wires

PREPPERNET

Antenna length is inversely related to frequency.

The higher the frequency, the SHORTER the wavelength.

It CANNOT be longer!

T9A06
WHAT TYPE OF ANTENNAS ARE THE QUAD, YAGI, AND DISH?

A. Non-resonant antennas

B. Log periodic antennas

C. Directional antennas

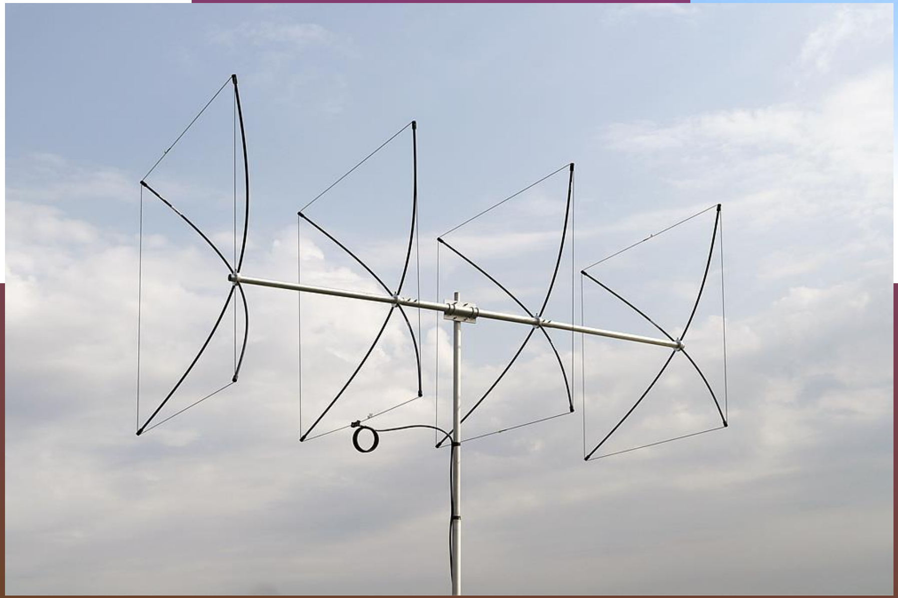
D. Isotropic antennas

PREPPERNET

These are all examples of "beam antennas", also called Directional Antennas.

Yagi are the most common type in ham radio and you've probably seen TV antennas that are Yagi antennas; they have long elements in the back and short ones in the front and make a sort of V shape with their outline. Dish antennas, such as those commonly used by satellite TV systems, are another type are much more obviously directional.

PREPPERNET



PREPPERNET

T9A07
WHAT IS A DISADVANTAGE OF USING A HANDHELD VHF TRANSCEIVER, WITH ITS INTEGRAL ANTENNA, INSIDE A VEHICLE?

A. Signals might not propagate well due to the shielding effect of the vehicle

B. It might cause the transceiver to overheat

C. The SWR might decrease, decreasing the signal strength

D. All of these choices are correct

PREPPERNET

A rubber duck antenna is a sub-performant antenna to start out with, but when you're inside your car you are surrounded by a metal shield that impedes the RF energy to and from your radio, which means that the signal will often be significantly weaker than if you were outside of your vehicle.

In addition some rubber duck antennas are too long to be held vertically which changes the polarization of the signal and causes additional loss.

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

146 MHz is in the 2 meter band.

$$\frac{\mathbf{300}}{\mathbf{146}} = \textit{2.05 (2m)}$$

2 meters is almost 80 inches.

$$\frac{\mathbf{1}}{\mathbf{4}} \times \textit{80 in. = 20 in.}$$

19 inches is the closest answer.

PREPPERNET

T9A09
WHAT IS THE APPROXIMATE LENGTH, IN INCHES, OF A HALF-WAVELENGTH 6 METER DIPOLE ANTENNA?

A. 6

B. 50

C. 112

D. 236

PREPPERNET

To get half-wavelength dipole antenna lengths in feet, divide 468 by the frequency in megahertz:

First convert the wavelength to the frequency in megahertz:

$$\frac{300}{6} = 50\ MHz$$

Then divide 468 by that number:

$$\frac{468}{50} = 9.36\ feet$$

With 12 inches in a foot, you get

$$9.36\ ft \times 12\ in = 112.32\ in$$

PREPPERNET

There are many factors that will affect the amount of length needed for the 1/2 wave dipole antenna, such as the physical characteristics of the wire or nearby conductive sources.

The easiest way to solve this problem is to remember that a meter is a little longer than a yard, or approximately 39 inches. To calculate this, half of the 6 meter wavelength would be 3 meters. To convert that to inches, multiply by 39 inches per meter:

$$3m \times 39in / m = 117in$$

112 inches is the closest to this.

PREPPERNET

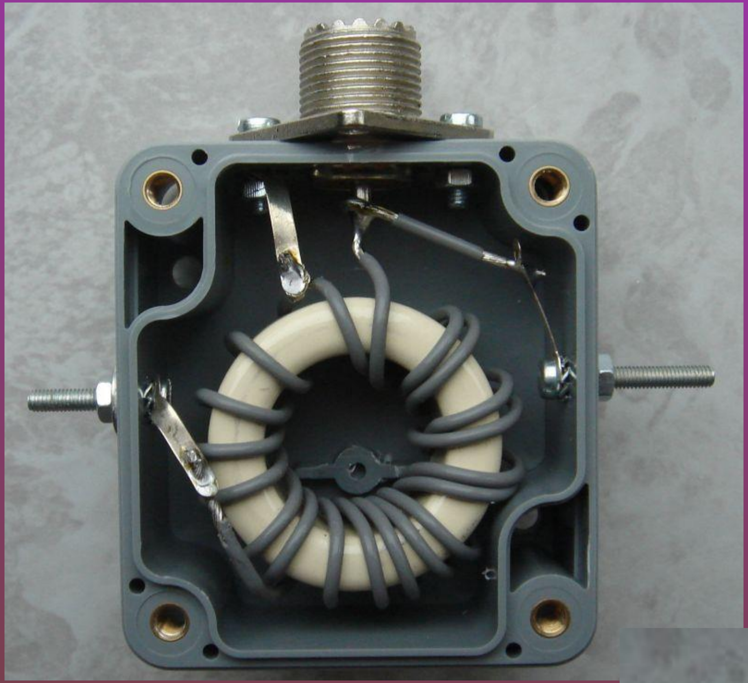
T9A10
IN WHICH DIRECTION DOES A HALF-WAVE DIPOLE ANTENNA RADIATE THE STRONGEST SIGNAL?

A. Equally in all directions

B. Off the ends of the antenna

C. Broadside to the antenna

D. In the direction of the feed line



The radio waves emit out along the length of the dipole outward, and is strongest at the middle. There is little to no RF energy coming out the ends of the antenna.

An isotropic antenna radiates equally in all directions.

The feed line has no effect in the emission of a dipole antenna if properly chocked off by a balun

T9A11
WHAT IS 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 compared to a reference antenna

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

Think of gain as a focusing quality of an antenna, like the reflector on a flash light.

By the geometry of the antenna, we can change how the antenna emits radio waves, or RF energy.

We can focus it like a spot light by using a Yagi antenna, or we can let it flood out more evenly like a room shop light, by using a dipole antenna.

The higher the gain, the more focused the beam of RF energy, which results in an increased signal strength in a particular direction.

PREPPERNET

T9A12
WHAT IS AN ADVANTAGE OF USING A PROPERLY MOUNTED 5/8 WAVELENGTH ANTENNA FOR VHF OR UHF MOBILE SERVICE?

A. It has a lower radiation angle and more gain than a 1/4 wavelength antenna

B. It has very high angle radiation for better communicating through a repeater

C. It eliminates distortion caused by reflected signals

D. It has 10 times the power gain of a 1/4 wavelength design

A 5/8 wave radiates at a lower angle than a 1/4 wave antenna, which is usually a good thing.

Just remember 5/8 is larger than 1/4 so 5/8 is better.

No matter what angle your signal is radiated, you're likely to encounter reflected signals, so a 5/8 wave antenna doesn't eliminate those. In fact, if it sends the signals into nearby mountains, you're more likely to encounter reflected signals with the 5/8 wavelength antenna!

PREPPERNET

T9B01
WHY IS IT IMPORTANT TO HAVE LOW SWR WHEN USING COAXIAL CABLE FEED LINE?

A. To reduce television interference

B. To reduce signal loss

C. To prolong antenna life

D. All of these choices are correct

SWR or Standing Wave Ratio is a measure of how well an antenna system matched to the transmitter and is an indication of efficiency. A low ratio indicates that the transmitted energy is effectively being delivered to the antenna and beyond.

A higher number is an indication that something is not matched and that some of the transmitted energy is returning to the transmitter or reflected back.

You can understand that if we short out the end of the coax that no energy will be put into the air, also if we leave the connector open and not connected to the antenna that energy is not transmitted to the air; instead it goes back into the transmitter and is dissipated as heat.

A very bad SWR can also damage your transmitter.

A very good SWR is 1.1:1, a good SWR is anything less than 1.5:1 and you should be concerned if the value is ever more than 2:1.

PREPPERNET

T9B02
WHAT IS THE IMPEDANCE OF MOST COAXIAL CABLES USED IN AMATEUR RADIO INSTALLATIONS?

A. 8 ohms

B. 50 ohms

C. 600 ohms

D. 12 ohms

PREPPERNET

The most commonly used coaxial cable impedance for amateur radio installations is 50 Ohms.

We have pretty much standardized on this value.

Just memorize this fact.

PREPPERNET

T9B03
WHY IS COAXIAL CABLE THE MOST COMMON FEED LINE SELECTED FOR AMATEUR RADIO ANTENNA SYSTEMS?

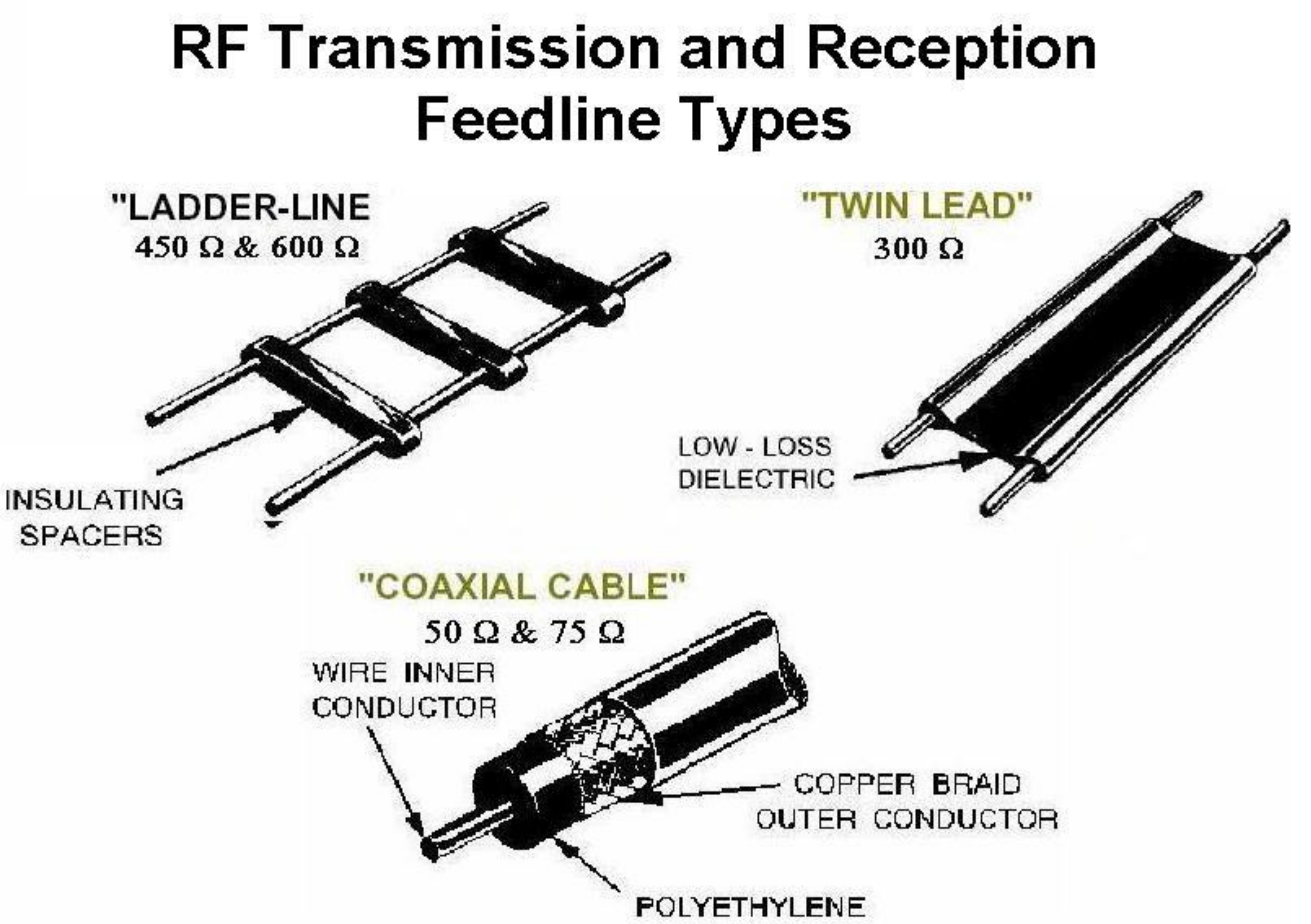
A. It is easy to use and requires few special installation considerations

B. It has less loss than any other type of feed line

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

D. It is less expensive than any other type of feed line

PREPPERNET



When it comes to ham radio there are two types of feed-lines typically used,

balanced feedlines (twin-lead & ladder-line)

or

coax-cable

(RG-58, RG8x & LMR-400)

PREPPERNET

RG-58 Coax

RG-8x Coax

LMR-400 Coax

T9B04
WHAT IS THE MAJOR FUNCTION OF AN ANTENNA TUNER (ANTENNA COUPLER)?

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

PREPPERNET

The best transfer of power occurs when the entire system has the same impedance. Impedance is similar to resistance, except that it varies with the frequency of the signal.

Impedance is created by a combination of capacitance and inductance, and Amateur Radio systems all run at 50 ohms, though some types of feedline may differ, such as twin-lead ladder-line, which is 300 ohms.

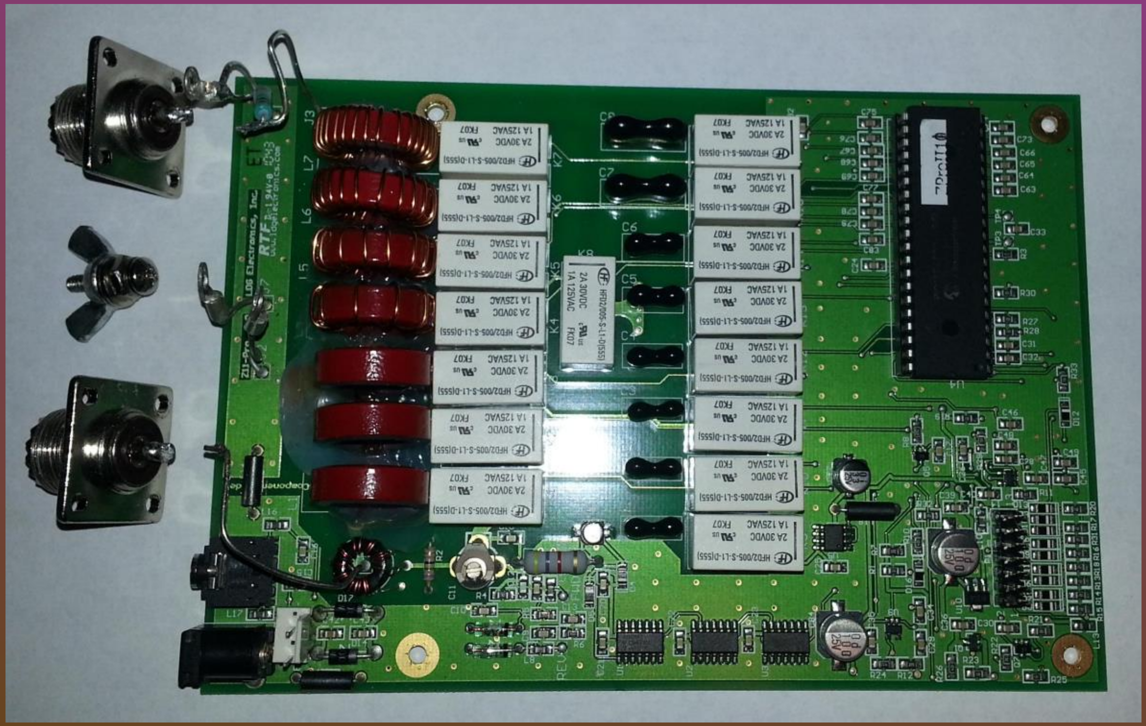
In these cases, something is needed to match the impedance to the rest of the system so that the power can be efficiently converted into a radio frequency (RF) signal.

PREPPERNET

Because impedance is a function of capacitance and inductance, a capacitor and/or inductor can be used to change the impedance.

Antenna tuners contain variable capacitors and/or inductors and can thus be used to adjust the antenna system's impedance to match the transmitter's impedance.

Some operators even use long random lengths of wire as an antenna, using an antenna tuner to match the impedance.



PREPPERNET

T9B05
IN GENERAL, WHAT HAPPENS AS THE FREQUENCY OF A SIGNAL PASSING THROUGH COAXIAL CABLE IS INCREASED?

A. The characteristic impedance decreases

B. The loss decreases

C. The characteristic impedance increases

D. The loss increases

PREPPERNET

There are losses in wires whether it be for electrical power distribution or RF energy, but RF energy has another loss based on frequency.

The coax has inductance in the center wire and in the shield around it. It also has capacitance between the center wire and the shield.

As frequency increases, the reactance of an inductance increased and is in series with the transmitter and the load (antenna) which reduces the current that can flow.

Also as frequency increases the capacitive, the reactance decreases which moves energy from the center conductor to the shield. This working against resistance in the wires and the effect on the inductance makes the cable lose energy as the frequency increases.

That's more than you wanted to know…here is a simple example to help illustrate this.

When you go shopping, the doorway lets people exit the building easily.

If more people are going through and it gets crowded then things can slow down and some of your precious time is lost.

T9B06
WHICH OF THE FOLLOWING CONNECTORS IS MOST SUITABLE FOR FREQUENCIES ABOVE 400 MHZ?

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

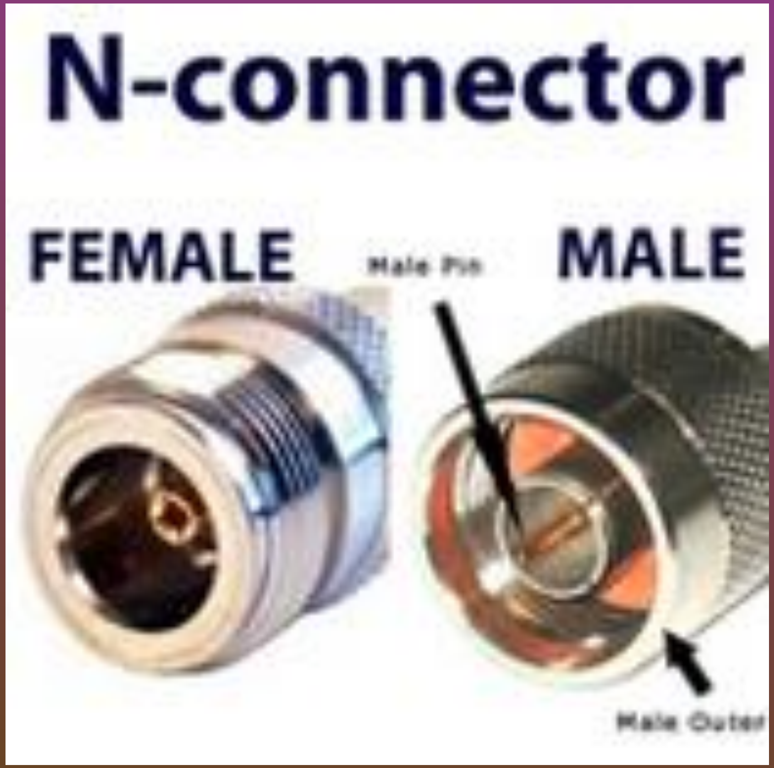
B. A Type N connector

C. An RS-213 connector

D. A DB-25 connector

The Type N connector was designed to handle signals at microwave frequency ranges, and is an excellent choice for RF above 400 MHz.

If you need a last minute aid, it's the only answer without a number.



PREPPERNET

T9B07
WHICH OF THE FOLLOWING IS TRUE OF PL-259 TYPE COAX CONNECTORS?

A. They are preferred for microwave operation

B. They are watertight

C. They are commonly used at HF frequencies

D. They are a bayonet type connector

PREPPERNET

PL-259 (also called SO239) is the most commonly used connector type for mobile and tabletop amateur radio rigs.

They are certainly not water tight and should be protected against water intrusion when installed where they may be exposed to the weather.

They are decent for UHF frequencies, but they are almost universally used at HF frequencies.

PREPPERNET

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

PREPPERNET

If you get water inside your coax connector it can cause a partial or complete short between the center conductor and the shield of the coax connector, which would definitely result in feed line loss.

T9B09
WHAT CAN 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

When you have a loose (or intermittent) connection in your antenna or in a feedline, connector, or adapter, the SWR (standing wave ratio) readings can change every time your cable gets bumped, vibrated, or jiggled.

In this case as in many cases, the simplest answer is often the correct one.

PREPPERNET

T9B10
WHAT IS THE ELECTRICAL DIFFERENCE BETWEEN RG-58 AND RG-8 COAXIAL CABLE?

A. There is no significant difference between the two types

B. RG-58 cable has two shields

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

D. RG-58 cable can handle higher power levels

PREPPERNET

These are probably the two most commonly used 50 ohm coax types; the RG-8 is thicker, less flexible, and as such has lower loss than the RG-58 coax.

Just remember that as a general rule of thumb, a larger cable means less loss.

VS.

PREPPERNET

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

This question is a little bit of a trick question, however, because most beginners who have studied will know the above and will thus assume that the 50-ohm flexible coax is the way to go.

In fact, though 50 ohm flexible coax is probably the most commonly used feedline, an air-insulated hard line has much lower loss.

Air is actually a very good insulator, and the rigidity of the feedline helps keep the loss very low.

The primary disadvantages to an air- insulated hard line are that they are rigid (you can't adjust the installation easily, or move it) and the possibility of getting water inside, which can short out the feed line.

PREPPERNET

END OF SUBELEMENT T9

PREPPERNET