TECHNICIAN Class.
FCC License Preparation
Element 3A

To go to an explanation press the Search button and select the required question designator.

T1A01
Every ham radio station is required to have a control point. This is the place where you have control of the station and can switch it off if required. [97.3]

T1A02
The control point may be physically remote from the station. This is a common situation with unmanned repeaters where the control point may be a transceiver used by the control operator. [97.3]

T1A03
21.1-21.2 MHz are the upper and lower limits to the 15 meter band. [97.301]

T1A04
Novice class licensees do not have privileges on the 6 meters amateur band. [97.301]

T1A05
Novice class licensees do not have privileges on the 2 meters amateur band.[97.301]

T1A06

Novice class licensees are restricted to 25 watts PEP output on the 1.25 meters amateur band. [97.301]

T1A07
Novice class licensees do not have privileges on the 70 centimeters amateur band. [97.301]

T1A08
As a No code Technician operator you do not have a Novice code privileges until you have passed the 5 wpm code test.   (Passing the 13 and 20 wpm tests would also be accepted) When you have passed the Morse code test you become a Technician Plus operator. [97.301]

T1A09
When you pass your Morse code test you become a Technician plus operator. On passing you will be given a CSCE (Certificate of Successful Completion of Examination) Keep this as proof until your new FCC Technician Plus license arrives. [97.9]

T1A10
You can keep your privileges, but not operate, for two years from the expiration date. After this you must start all over again. So, do not forget to renew your license when it is due. [97.25]

T1A11
You can keep your privileges, but not operate, for two years from the expiration date. After this you must start all over again. So, do not forget to renew your license when it is due. [97.21]

T1A12
All changes and renewals must be done on FCC Form 610. Some on-line systems have image files available that allow you to print out your own copies of Form 610. [97.21]

T1A13
For example the maximum power on specified bands could be restricted. [97.27]

T1B01
FM phone emission is generally not used on the HF amateur bands. [97.305]

T1B02
Upgrading to Technician Plus gives a Technician class licensee access to some of the HF long distance bands. [97.301]

T1B03
The bottom 100 kHz is reserved for CW only.   This is a convention on many amateur bands. On this band it is also a FCC rule.   [97.305]

T1B04
The bottom 100 kHz is reserved for CW only.   This is a convention on many amateur bands. On this band it is also a FCC rule.   [97.305]

T1B05
The bottom 100 kHz is reserved for CW only.   This is a convention on many amateur bands. On this band it is also a FCC rule.   [97.303]

T1B06

An example of a band where Amateurs are secondary users is the 70 cm band. It is shared with military radio services who are the primary users. Note that the primary users do not have any obligation to avoid harmful interference to secondary users. [97.303]

T1B07

An example of a band where Amateurs are secondary users is the 70 cm band. It is shared with military radio services who are the primary users. Note that the primary users do not have any obligation to avoid harmful interference to secondary users. [97.303]

T1B08
No Radio Amateur is assigned any particular frequency within the Amateur bands. [97.101]

T1B09
The operator of an amateur repeater that is uncoordinated will be required to sort out any interference problems that occur with repeaters that do conform to the frequency coordination scheme. [97.205]

T1B10
Hopefully, this would be resolved amicably!   Either station would be causing harmful interference if it knowingly affected the other.   [97.205]

T1B11
Either station would be causing harmful interference if it knowingly affected the other. [97.205]

T1B12

The crest of the RF modulation envelope is its peak; it is called peak envelope power. (PEP) [97.36]

T1B13
This is the blanket limit for power output on any band in any mode. [97.313]

T1C01
The maximum separation below 50 MHz is 1,000 hertz. Bandwidth is at a premium on the lower frequency amateur bands and limiting the frequency shift is one factor that reduces bandwidth. [97.307]

T1C02
The mark and space signals are represented by two different frequencies. There are no rules for a maximum frequency separation above 50 MHz. At higher frequencies the amateur bands cover wider frequency ranges and so the limits on frequency shift can be relaxed. [97.307]

T1C03
A data transfer rate of 1200 baud is quite slow compared to telephone based data rates. However, using radio is a lot cheaper than the telephone! [97.307]

T1C04
The faster we send data transmissions the more bandwidth they occupy. The higher frequency bands can accommodate these broader signals. [97.307]

T1C05

The faster we send data transmissions the more bandwidth they occupy. The lower frequency bands tend to be narrower and so the maximum data rate is restricted. [97.307]

T1C06
The faster we send data transmissions the more bandwidth they occupy. The higher frequency bands can accommodate these broader signals. [97.307]

T1C07
The maximum permitted band width for this type of signal is 20 kHz. [97.307]

T1C08
A data rate of 56 kilobauds is faster than the data rate that a normal telephone line will support. [97.307]

T1C09
The maximum permitted band width of this type of signal is 100 kHz. [97.301]

T1C10
The 219-220 MHz section of the 1.25 meter amateur band is reserved for data communications.
[97.313]

T1C11
There are no restrictions on which radio amateurs can use amateur satellites. [97.209]

T1C12
CW is always allowed for station identification purposes. [97.305]

T1C13
Any automatic keyer is subject to this rule. [97.1191]

T1C14
This rule applies to all amateur radio transmissions. [97.119]

T1C15
The extra identifier must be used to indicate that you have operating privileges on this band. [97.119]

T1C16
Your Technician license gives you operating privileges on this band so there is no need to indicate a CSCE for Technician Plus privileges. [97.119]

T1D01
English must be used for station identification and use of the international phonetics alphabet is encouraged. [97.119]

T1D02
English must be used for station identification and use of the international phonetics alphabet is encouraged. [97.119]

T1D03
English must be used for station identification and use of the international phonetics alphabet is encouraged. [97.1192]

T1D04
Radio reception may not always be perfect. If someone uses the letter F in a call sign it may sound like a letter S.' There are several other letter pairs that can be confused under less than perfect reception conditions. The ITU Standard International Phonetics alphabet is designed to solve this problem by providing a standard clearly recognized word for each letter of the alphabet. Here is the alphabet:

A	Alfa	H	Hotel	O	Oscar	V	Victor
B	Bravo	I	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	N	November	U	Uniform		

You do not need to learn these for the examination!

[97.119]

T1D05
The rules state that the source of the transmissions be made clear to those receiving them. [97.119]

T1D06
Radio beacons automatically transmit a call sign on a specific frequency. This allows hams to tune in to determine band conditions. If you can hear a distant beacon you can probably communicate on that band in the direction of that beacon. [97.3]

T1D07
Automatic beacon stations exist on most Amateur bands. They use CW to send their call signs.
[97.203]

T1D08
A holder of a Technician, General, Advanced or Amateur Extra Class operator license may be operate a repeater. [97.205]

T1D09
No station identification is required in the transmitted signal. This is an exception to the rules for identifying amateur radio transmissions. [97.215]

T1D10
No station identification is required in the transmitted signal. This is an exception to the rules for identifying amateur radio transmissions. [97.215]

T1D11
Model craft are normally within sight of the operator.   Therefore, this low power level is quite adequate.
[97.215]

T1E01
Avoid transmitting on a frequency used for emergency transmissions unless specifically requested to do so. [97.401]

T1E02
All restrictions are waived if the emergency is severe enough. [97.401]

T1E03
As an amateur radio licensee you may not broadcast to the public. [97.310]

T1E04
As an amateur radio licensee you may not broadcast to the public. [97.3]

T1E05
There are no satellite uplink frequencies on the 6 meter band. [97.209]

T1E06
NASA often gives blanket permission to retransmit Space Shuttle audio by repeaters. [97.113]

T1E07
You may not receive payment for any third party traffic. [97.11]

T1E08
Third party communications must be of a personal nature. Some countries (such as Great Britain) do not allow their Radio amateurs to send third party communications. [97.115]

T1E09
When someone is using your station, stay with them. You are responsible for making sure that all FCC rules are followed. [97.115]

T1E10
Apart from it being illegal, you would make yourself quite unpopular.   Also, children may be listening.
[97.113]

T1E11
Apart from it being illegal, you would make yourself quite unpopular. Also, children may be listening.
[97.113]

T2A01
A repeater receives on one frequency and transmits on a different frequency. The difference is called the frequency separation or "split". On the 2 meters amateur band a separation on 600KHz is usual.

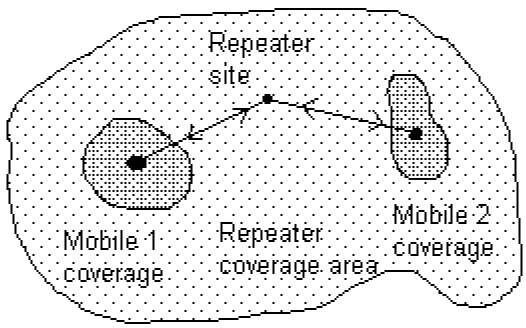
T2A02
A repeater receives on one frequency and transmits on a different frequency. The difference is called the frequency separation or "split". On the 1.22 meters amateur band a separation on 1.6 MHz is usual.

T2A03
A repeater receives on one frequency and transmits on a different frequency. The difference is called the frequency separation or "split". On the 70 centimeter amateur band a separation on 5.0 MHz is usual.

T2A04
When using autopatch to make a telephone call remember that all of the normal FCC Part 97 regulations still apply.

T2A05
Repeaters are usually located on hills or tall buildings. They have efficient antenna for receiving and transmitting. This means that a weak local signal from a handheld transceiver will be rebroadcast at higher power and with a tremendously increased range. On the receiving side, a repeater will pick up the weakest of signals from a wide area. Then, it will retransmit them at higher power to the handheld.

Principle of repeater operation:



T2A06
Many repeaters have a timer to limit transmission times. This is to give everyone a fair chance at using it.

T2A07
During rush hour, repeaters are often used to distribute traffic news amongst radio amateurs.

T2A08
Many repeaters have a beep tone that operates for a short period when the other person has stopped transmitting.

T2A09

Weak signals have a hissing noise superimposed on them. Some of this noise is received and some is generated by the receiver. If a signal is strong enough to completely overcome this noise then it is regarded as a strong signal.

T2A10
Call the other station by its call sign and then give your call sign.   The best way to get the hang of operating procedures is to listen to other hams on the air.

T2A11
Open repeaters are listed in the American Radio Relay League (ARRL) repeater directory.

T2A12

At VHF and UHF frequencies, radio signals are normally limited in range. At lower frequencies, (the HF bands) the range of radio signals is often world-wide. This is due to the ability for HF signals to be reflected from ionized layers in the upper atmosphere. The HF amateur bands are a valuable resource that should be reserved for long-distance use.

T2A13

Closed repeaters are supported by group membership. Often they incorporate features not found in open repeaters. To find out who controls the repeater, listen to the repeater traffic. You may hear announcements giving details of how to join the repeater group.

T2A14

A dummy load is simply a resistance designed to convert RF energy into heat instead of allowing it to be radiated. A dummy load may be as simple as a standard light bulb, or it may be a complex oil cooled device depending on the power levels and frequencies involved. There is often enough leakage from a dummy load to allow local monitoring of the transmitter output using a receiver.

T2A15

It is conventional to use plain language over repeaters. The term "QTH" would be used during a simplex (none repeater) conversation.

T2A16
A repeater is a community resource, leaving a short pause gives others a chance to use it.

T2A17

There may be someone with an urgent message waiting to get onto the repeater. They cannot pass on the message until there is a pause.

T2A18
Repeater users should leave a pause between transmissions. When they do, this is your chance to interject by saying your call sign.

T2A19
It is essential to set up your repeater frequencies with the advice of a repeater coordinator. This is to make sure that your repeater does not cause interference to other repeaters and is not interfered with by other repeaters.

T2A20
It is essential to set up your repeater frequencies with the advice of a repeater coordinator.   This is to make sure that your repeater does not cause interference to other repeaters and is not interfered with by other repeaters.

T2B01

In this context, simplex mode is when you communicate directly with another station communicate without the help of a repeater. Every VHF band has simplex channels. Use them to relieve repeater congestion. The term "simplex" also means that you both share the same frequency and take turns to transmit. This is as opposed to "duplex" where two frequencies are used for simultaneous two way conversation.

T2B02

Modern VHF/UHF FM equipment has a control marked REV. This temporarily switches the receiver frequency to the repeater input frequency. If you can hear the other station on the repeater input frequency then there is no need to use the repeater and you can both change frequency to a simplex channel.

T2B03
If you are operating on the input channel it is likely that you are blocking access to the repeater for everyone else.   Also it is possible that the repeater will be retransmitting your signals and so everyone will know exactly who the culprit is!

T2B04
Every VHF band has simplex channels. Use them to relieve repeater congestion. The term "simplex" also means that you both share the same frequency and take turns to transmit. This is as opposed to "duplex" where two frequencies are used for simultaneous two way conversation.

T2B05
The RST systemuses three digits to represent the Readability, Signal Strength and Tone quality of a received signal.

T2B06
The RST systemuses three digits to represent the Readability, Signal Strength and Tone quality of a received signal.

T2B07
The RST systemuses three digits to represent the Readability, Signal Strength and Tone quality of a received signal. The signal strength scale ends at 9 so to report stronger signals we use the "plus xxx decibels" phrase.

T2B08
It is quite possible that in an emergency the first service to be disrupted will be the AC power to your station and so a hand-held transceiver will give allow continued operation in these circumstances.

T2B09
As a Technician class licensee you do not have privileges on any amateur radio bands below 50 MHz.
[97.301]

T2B10
On many amateur bands specific channels are allocated to digital transmissions.

T2B11
TCP/IP stands for Transmission Control Protocol/Internet Protocol and is the most popular protocol for packet radio working.

T2B12
Any normal TV set can be used to display ATV because amateur TV standards are the same as broadcast TV standards.

T2B13
A multi mode VHF transceiver combined with an efficient high gain antenna would make an effective weak signal Amateur Radio station.

T2C01
Mayday messages are used in cases of dire life-threatening emergency. They must always be taken seriously.

T2C02
A Morse code "SOS indicates a grave emergency involving danger to life.

T2C03
On repeaters, the word "break" is used to indicate an emergency call.

T2C04
In an emergency situation, public service personnel may be communicating with radio amateurs.   They will understand tactical callsigns better than standard amateur radio station callsigns.

T2C05
All transmissions that can affect human health have priority.

T2C06
All transmissions that can affect human health have priority.

T2C07
It is quite possible that in an emergency the first service to be disrupted will be the AC power to your station.

T2C08
If there is no AC power to your station (quite possible in an emergency) you have no means of charging hand-held batteries.

T2C09
A dipole is the simplest antenna to erect. It can be as simple as a piece of wire cut to 468/(operating frequency) feet in length and strung between two objects as high as possible with the ends insulated.

T2C10
RACES stand for "Radio Amateur Civil Emergency Service."   You must be registered to take part in RACES exercises.

T2C11
No more than one hour per week is allowed for RACES drills.

T2C12
If the messages are not clearly understood to be practice messages, considerable worry and wasted effort could result for people who may be listening.

T3A01

VHF signals propagate like light, in straight lines. The normally line-of-sight characteristics of VHF bands can suddenly change during certain weather conditions that favor tropospheric bending. Ranges of several thousands of miles become possible during these periods. They may last for several days.

T3A02
Ducting is due to multiple hops within the lower atmosphere (as low as a few hundred feet). These hops occur due to layers of air that have different levels of temperature and humidity. This effect is more pronounced at higher frequencies, right up to microwaves.

T3A03
To get the waves to bend in the right direction, downwards, the air needs to be in a state of temperature inversion. This means instead of the usual condition where high elevation air is cooler, the air closest to the ground is cooler. VHF enthusiasts soon learn to spot the types of weather conditions that favor widespread temperature inversions.

T3A04
It is widespread temperature inversions that allow ducting of radio signals to take place. Generally, the higher the frequency, the more effective the ducting becomes. Even at a frequency as high as 432 MHz, signals can travel many thousands of miles.

T3A05
VHF, UHF, and microwave signals can all be bent by layers of different density or humidity in the atmosphere. They can be ducted over thousands of miles.

T3A06
Ducting is due to multiple hops within the lower atmosphere (as low as a few hundred feet). These hops occur due to layers of air that have different levels of temperature and humidity. This effect is more pronounced at higher frequencies, right up to microwaves.

T3A07

MF and HF radio waves are prevented from shooting off into space by the ionosphere. Instead, they are bent back toward the surface of the Earth where they may reflect skyward again. This process can be repeated many times and is the basis of world-wide radio communications. At higher frequencies the radio waves pass straight through the ionosphere and are not reflected downwards so sky wave propagation does not occur.

T3A08

To get the waves to bend in the right direction, downwards, the air needs to be in a state of temperature inversion. This means instead of the usual condition where high elevation air is cooler, the air closest to the ground is cooler. VHF enthusiasts soon learn to spot the types of weather conditions that favor widespread temperature inversions. High-pressure weather conditions often give rise to these temperature inversions.

T3A09
The 6 meter band is normally regarded as a short-range VHF band. In summer the E-layer can become sufficiently highly ionized to allow sky wave propagation over long distances, just like the HF bands. Strong long-distance 10-meter band signals are an indication that E-layer propagation conditions are good.

T3A10
The 6 meter band is normally regarded as a short-range VHF band.   In summer the E-layer can become sufficiently highly ionized to allow sky wave propagation over long distances, just like the HF bands.

T3A11
At microwave frequencies the path loss due to water vapor and water droplets becomes high.

T3A12
VHF radio waves travel in straight lines unless reflected off surfaces such as tall buildings or masts.

T3A13
Sporadic E propagation occurs mainly in early summer and can cause the 6 meters band to behave more like a long distance HF band for hours at a time.   Contacts up to 1500 miles are possible.

T3A14
In both of these modulation methods a weak signal can provide useful communications.

T3A15
This is the lowest frequency available to the Technician class amateur and the E-layer often offers good sky-wave propagation in the summer months.

T3B01

The ionized layers can absorb radio waves as well as bending them. On the 80-meter band, daytime signals are rapidly absorbed by the D-layer before they can be reflected back to the surface by any of the other layers. Hence this band is only suitable for short distance communications during daylight. The 1.8 MHz band also suffers from D-layer absorption during daylight hours.

T3B02
The D-layer is closest at around 30 miles height.

T3B03

The ionized layers can absorb radio waves as well as bending them. On the 80-meter band, daytime signals are rapidly absorbed by the D-layer before they can be reflected back to the surface by any of the other layers. Hence this band is only suitable for short distance communications during daylight. The 1.8 MHz band also suffers from D-layer absorption during daylight hours.

T3B04
The D-layer is closest at around 30 miles height.

T3B05

Communicating by scatter mode requires use of higher transmit power due to the small amount of scattered signal that is available for reception. If the signal is close to the maximum useable frequency (MUF) and it is weak and distorted, then it is probably a scatter mode signal. The other options in this question all give strong or undistorted signals.

T3B06

The ionized layers can absorb radio waves as well as bending them. On the 80-meter band, daytime signals are rapidly absorbed by the D-layer before they can be reflected back to the surface by any of the other layers. Hence this band is only suitable for short distance communications during daylight.

T3B07
The D-layer is closest at around 30 miles height and strongly absorbs signals in the 160 and 80 meter amateur bands.

T3B08
Minimum ionization occurs before dawn after the longest period of darkness.

T3B09
In all layers, ionization is at its maximum during midday when solar radiation is at a maximum.

T3B10
Minimum ionization occurs before dawn after the longest period of darkness.

T3B11

In all layers, ionization is at its maximum during midday when solar radiation is at a maximum.

T3B12
The critical frequency is defined as the highest frequency that will be reflected if the signal is transmitted vertically upwards.

T3B13
More solar radiation increases the maximum usable frequency.

T3B14
More solar radiation increases the maximum usable frequency.

T3C01

As the satellite passes overhead it will firstly be moving toward the receiver and then away from it. This relative movement gives rise to a frequency change called the Doppler effect. When a train speeds past blowing its whistle a change in pitch is heard. This is also caused by the Doppler effect.

T3C02
The Doppler effect occurs whenever the source and receiver of a radio (or audio) signal are moving toward or away from each other.   The change in frequency can be used to determine the relative velocity. This effect is put to use in police radar speed checks!

T3C03
If the antennas are not circularly polarized then the signal will fade as the relative orientation of the transmit and receive antennas changes with satellite rotation. Only one of the antennas (transmit or receive) needs to be circularly polarized to reduce the fading effects.

T3C04
This is the same reason that makes VHF and UHF propagation a relatively short range communication mode on the earth's surface.

T3C05
Moonbounce is a marginal communication mode that requires powerful transmitters, large high gain antennas and highly sensitive receivers. Path losses vary between 240 and 300 dB depending on frequency.

T3C06
Doppler shift is present and amounts to a maximum of a few kHz.

T3C07
The highest possible gain is required due to the very large EME path loss.

T3C08
A ground plane antenna does not have a high gain. The highest possible gain is required due to the very large EME path loss.

T3C09

Moonbounce is a marginal communication mode that requires powerful transmitters, large high gain antennas and highly sensitive receivers. Path losses vary between 240 and 300 dB depending on frequency. The moons surface reflects only a small proportion of the incident radio signals; the rest is scattered and absorbed.

T3C10
When the satellite is low on the horizon the path length, and therefore the path loss, is higher. At low angles the signal path will suffer more tropospheric losses especially at higher frequencies such as 10 GHz.

T3C11
The radio signals travel to and from the satellite in straight lines.

T4A01
It is important that the metal exposed parts and chassis of radio equipment are connected to the ground conductor. It is normally green in color. Be aware that foreign radio equipment may use different colors in the AC cord.

T4A02

The fuse should always be on the "live" or "hot" side of the supply. This wire will be red or black. Be aware that foreign radio equipment may use different colors in the AC cord.

T4A03
The white wire is the "return" conductor of the supply.   Be aware that foreign radio equipment may use different colors in the AC cord.

T4A04
The fuse should always be on the "live" or "hot" side of the supply. The white wire is the "return" conductor of the supply. It is important that the metal exposed parts and chassis of radio equipment are connected to the ground conductor.

T4A05
The silver colored screw is always the "neutral" connection.   The brass colored screw is the "live" or "hot" terminal.

T4A06

If you accidentally receive a shock it may be impossible to let go of the live object. This will be due to involuntary muscle contractions that cause you to strengthen your grip on the object. Other people may have to turn off the main power supply to your station so that they can rescue you.

T4A07

If you accidentally receive a shock it may be impossible to let go of the live object. This will be due to involuntary muscle contractions that cause you to strengthen your grip on the object. Other people may have to turn off the main power supply to your station so that they can rescue you.

T4A08
The National Electrical Code specifies electrical safety requirements in the US. Check with this to make sure you comply with safety standards.

T4A09

The National Electrical Code specifies electrical safety requirements in the US. Check with this to make sure you comply with safety standards.

T4A10

Most people assume that secondary cells do not provide harmful voltages. This is not so! Many battery-powered vehicles operate at 48 volts or more.

T4A11
Metal jewelry is highly conductive and is often in good contact with your skin.   It is perfect for giving you a lethal shock.

T4A12
The victim may be paralyzed or tightly gripping the live conductor. This action is caused by the current flow contracting his/her muscles. You must turn off the power before touching the victim. Otherwise you will also be trapped. Alternatively, you may be able to find an insulating object that can be used to drag the victim clear. It is quite possible that the victim's heart will have stopped beating and/or the victim has stopped breathing. In that case, you will need to carry out resuscitation procedures.

T4A13
The fuse on the positive (red) conductor is a safeguard against supply short circuits. The fuse on the negative (black) conductor is a safeguard against excessive ground currents under certain fault conditions.

T4A14

We begin feel pain at 2 milliamperes of current. By the time you feel pain it may be too late to get away. This is because the current causes your muscles to contract. Depending on the orientation of your hands, this might cause you to involuntarily increase your grip on a live conductor. If this amount of current flows across the heart it can be lethal. It is quite easy to disturb the normal pumping of the heart by exposure to external currents.

T4A15

The heart is very sensitive to quite modest amounts of current. If you accidentally touch a live conductor with one hand while resting the other hand on a conductor at earth potential (such as a grounded chassis) then much of the resulting current will flow through your chest. It is quite easy to disturb the normal pumping of the heart by exposure to external currents.

T4A16

We begin feel pain at 2 milliamperes of current. By the time you feel pain it may be too late to get away. This is because the current causes your muscles to contract. Depending on the orientation of your hands, this might cause you to involuntarily increase your grip on a live conductor.

T4B01
We always check for voltage across the conductors of a circuit.

T4B02
An ammeter measures electrical current. The unit used to describe the current level is called "Amperage" or "Amps" for short. To measure current you need to break the circuit (first make sure it is switched off) and insert the meter in series.

T4B03

You want to measure power coming out of the transmitter; so measure at the output. In practice a short length of cable will be required between the transmitter and the meter. At VHF and UHF frequencies, you need to be sure that the loss in this cable is as small as possible.

T4B04

For this technique to work, you need to know certain details about the meter. It is not often necessary with modern equipment. One case where you might need to use this method is if you are extending the range to cover the high voltages associated with tube power amplifiers.

T4B05

A voltmeter is really a current meter that measures current flowing through a fixed resistance.   It uses Ohms law to derive a voltage reading.

T4B06
To make an Ammeter measure more current than it is rated for, we have to allow a known proportion of the current to bypass the meter. This is done by putting a known resistance in parallel with it.

T4B07

A "multimeter" is a multipurpose meter. This means that it can measure multiple things such as voltage, amperage, and resistance. As a Ham radio operator, you will find multiple uses for it. The "multimeter" should be one of your first purchases.

T4B08
The multimeter would pass far too much current which would probably burn out some of the internal components.

T4B09
The multimeter would pass far too much current which would probably burn out some of the internal components.

T4B10
All Amateur radio transmitters are designed to work at an impedance of 50 Ohms. Make sure that the meter and connecting cables are also designed for this impedance.

T4B11

Reflected power is power that was not able to be radiated from the antenna due to an impedance mismatch. It is reflected back down the feed line and ends up as heat. The components that will receive this heat are the antenna feedline itself and the transmitter power amplifier. An excessive amount of heat can damage the output devices in the amplifier. It is a good idea to purchase a watt meter so you can monitor reflected power.

T4B12

You need to know what power is being output from a transmitter as well as the power that is being reflected back due to any impedance mismatch. Most watt meters allow measurements in both directions (forward and reflected). In this case although 90 watts is being sent from the transmitter 10 watts is returning and will be dissipated as heat in the transmitter. The components that will receive this heat are the antenna feedline itself and the transmitter power amplifier. An excessive amount of heat can damage the output devices in the amplifier. It is a good idea to purchase a watt meter so you can monitor reflected power. The total power delivered to the antenna is 90-10 = 80 watts.

T4B13

You need to know what power is being output from a transmitter as well as the power that is being reflected back due to any impedance mismatch. Most watt meters allow measurements in both directions (forward and reflected). In this case although 96 watts is being sent from the transmitter 4 watts is returning and will be dissipated as heat in the transmitter. The components that will receive this heat are the antenna feedline itself and the transmitter power amplifier. An excessive amount of heat can damage the output devices in the amplifier. It is a good idea to purchase a watt meter so you can monitor reflected power. The total power delivered to the antenna is 96-4 = 92 watts.

T4B14
Output power is specified in the FCC regulations as Peak Envelope Power (PEP).

T4B15
Always use replace a blown fuse with one of the correct rating and type.   Note that a blown fuse could indicate a fault, such as a short circuit, in your transceiver.

T4B16
The switch could start to burn or cause a fire in adjacent materials.

T4C01
A marker generator is a highly accurate signal source that gives calibration points at known frequencies on 100 kHz or 1 MHz intervals. It is a useful tool for checking the calibration of your receiver frequency display.

T4C02
A marker generator is a highly accurate signal source that gives calibration points at known frequencies on 100 kHz or 1 MHz intervals.   It is a useful tool for checking the calibration of your receiver frequency display.

T4C03

A "crystal calibrator" is another name for a marker generator. A marker generator is a highly accurate signal source that gives calibration points at known frequencies on 100 kHz or 1 MHz intervals. It is a useful tool for checking the calibration of your receiver frequency display.

T4C04

A signal generator can be used to check receiver calibration and sensitivity. It operates by injecting a low level RF signal of known frequency into the input of a receiver. You can then test the performance and/or calibration of the receiver because you are controlling the input with a calibrated device.

T4C05
Tuned circuits are very common in radio equipment.   They select or reject signals of certain frequencies.

T4C06

Radio antennas and feedlines have a specific impedance which should match the designed impedance of your transmitter. A reflectometer allows you to measure how good a match you have in your antenna system. A bad match results in reflected power. Reflected power is power that was not able to be radiated from the antenna due to an impedance mismatch. It is reflected back down the feed line and ends up as heat. The components that will receive this heat are the antenna feedline itself and the transmitter power amplifier. An excessive amount of heat can damage the output devices in the amplifier.

T4C07

In practice this could be difficult. This is because the feed point should be at the center of a dipole that is strung between two tall objects. As a "second best" option many amateurs make their measurements at the transmitter output. This is not as good because it does not isolate the effects of the feedline itself.

T4C08
You must use a power meter designed for the frequencies you are measuring. VHF and UHF power meters are more expensive because of the delicate components required to build them.

T4C09

You should use a SWR meter designed for the frequencies you are measuring. You may find that some brands of HF SWR meters are useable, though. VHF and UHF SWR meters are more expensive because of the delicate components required to build them.

T4C10

WWV signals are used throughout the US for calibration purposes. Other stations perform this function around the world. The modulation and carrier are locked to highly accurate atomic frequency standards.

T4C11

WWV signals are used throughout the US for calibration purposes. Other stations perform this function around the world. The modulation and carrier are locked to highly accurate atomic frequency standards.

T4D01
A dummy antenna is designed to act like a normal antenna except that it does not radiate a signal. This is because test signals can cause interference to others during transmitter adjustments. However, there is generally enough leakage to allow you to hear the transmitter signal on the nearby receivers in your shack.

T4D02
You could use a standard electric light bulb as a low power dummy antenna. Unlike a special purpose device that is designed as a dummy load, there can be significant radiation of RF energy from an electric light bulb.

T4D03

The resistor should be a 50 Ohm type to simulate a 50 Ohm impedance antenna. The best component to use in a home made dummy antenna is a high power, non-inductive resistor. A set of these resistors connected in parallel makes a good dummy antenna that can be used at high power levels. You might consider putting the resistor in a metal box to reduce the amount of RF leakage. You will need to leave plenty of room for air circulation to allow the heat created by the resistor to dissipate.

T4D04

A dummy antenna is designed to act like a normal antenna except that it does not radiate a signal that could cause interference to others during transmitter adjustments. High power commercial dummy antennas are elaborate affairs with cooling fins or oil cooling. Your dummy antenna can be as simple as an electric light bulb or it could be a large non inductive 50 Ohm resistor.

T4D05
A dummy antenna is designed to act like a normal antenna except that it does not radiate a signal. This is because test signals can cause interference to others during transmitter adjustments. However, there is generally enough leakage to allow you to hear the transmitter signal on the nearby receivers in your shack.

T4D06
You will need a dummy load capable of handling at least 100 watts continuous power. This is because a 100-watt single side band transmitter is capable delivering this much power (even though it is not normally used to output a continuous carrier).

T4D07
Dummy loads function by converting RF energy into heat. Therefore, it is not surprising that they get warm. Be careful not to allow the dummy load to get extremely hot. You can burn it out.

T4D08

The impedance is usually low when the filament is cool and increases with temperature. Although light bulbs make poor dummy loads they are cheap and readily available.

T4D09
All modern Ham receivers have an S-meter.

T4D10
The S-scale used by receiver S meters is a rather informal type of measurement. There are no proper standards.

T4D11
The RST systemuses three digits to represent the Readability, Signal Strength and Tone quality of a received signal. The signal strength is not defined numerically; the exact S level is a subjective estimate.

T5A01
A resistor restricts the flow of current in a circuit. It works by converting some of the electrical power into heat.

T5A02
This is the basis of Ohms Law. Press the NuTest "Formula" button for more information.

T5A03
Press the NuTest "Formula" button for more information.

T5A04

A resistor restricts the flow of current in a circuit. It works by converting some of the electrical power into heat.

T5A05
An inductor often consists of a coil of wire that concentrates the magnetic field, exactly the same way as an electromagnet.

T5A06
The "Henry" unit is too large for use in electronic circuits.   We use millihenrys (thousandths of a Henry) or microhenrys (millionths of a Henry).

T5A07
The "Henry" unit is too large for use in electronic circuits.   We use millihenrys (thousandths of a Henry) or microhenrys (millionths of a Henry).

T5A08
Inductors tend to oppose changes in current. A direct current will not be affected by an inductor but the flow of AC will be reduced.

T5A09

Capacitors store their energy in a static electrical field within the dielectric. The dielectric is an insulating medium (sometimes air) that separates the two electrodes of a capacitor.

T5A10
In electronics, we use microfarads (millionths of a farad) or picofarads (million millionths) of a farad.

T5A11
In electronics, we use microfarads (millionths of a farad) or picofarads (million millionths) of a farad.

T5A12
Since capacitors consist of two electrodes separated by an insulator direct current cannot flow. Alternating current can flow through a capacitor.

T5B01
Press the NuTest "Formula" button for more information.

T5B02
Press the NuTest "Formula" button for more information.

T5B03
Press the NuTest "Formula" button for more information.

T5B04
Press the NuTest "Formula" button for more information.

T5B05
R = V/I = 12/0.15 = 80 Ohms.   (Press the NuTest "Formula" button for more information.)

T5B06

I = E/R = 120/4800 = 0.025 A = 25 mA.   (Press the NuTest "Formula" button for more information.)

T5B07
I = E/R = 120/48000 = 0.0025 A = 2.5 mA.   (Press the NuTest "Formula" button for more information.)

T5B08
I = E/R = 12/4800 = 0.0025 A = 2.5 mA. (Press the NuTest "Formula" button for more information.)

T5B09
I = E/R = 12/48000 = 0.00025 A = 250 uA.   (Press the NuTest "Formula" button for more information.)

T5B10
Press the NuTest "Formula" button for more information.

T5B11
Press the NuTest "Formula" button for more information.

T5B12

You can use the resistor formula for calculating inductance in series and parallel. (Press the NuTest "Formula" button for more information.)

T5B13
You can use the resistor formula for calculating inductance in series and parallel.   (Press the NuTest "Formula" button for more information.)

T5B14
With capacitors you have to be careful to use the opposite of the resistance series and parallel formulae. Remember, they store electrical energy. They do not convert it into heat. (Press the NuTest "Formula" button for more information.)

T5B15
With capacitors you have to be careful to use the opposite of the resistance series and parallel formulae. Remember, they store electrical energy. They do not convert it into heat. (Press the NuTest "Formula" button for more information.)

T6A01

Film resistors consist of a thin film of conductor (often metal) deposited on an insulating core. The film is protected by a coat of enamel or paint that may have bands of color signifying the resistance value. (Press the NuTest "Formula" button for more information on resistor color codes.) A wire wound resistor resembles an inductor (and it will have inductance) except that the wire is a resistive metal alloy rather than copper. Also, the component is often designed to withstand and dissipate heat.

T6A02
This is how volume controls work.

T6A03

Press the NuTest "Formula" button for more information on resistor color codes. Close tolerance resistors are more expensive to manufacture. Therefore, they cost more and are not always required.

T6A04

Press the NuTest "Formula" button for more information on resistor color codes. Close tolerance resistors are more expensive to manufacture. Therefore, they cost more and are not always required.

T6A05

Press the NuTest "Formula" button for more information on resistor color codes. Close tolerance resistors are more expensive to manufacture. Therefore, they cost more and are not always required.

T6A06

This band may not always exist. In the case where it does not, the resistor has a 20% tolerance. In other words the actual resistance value may vary up to 20% of the stated resistance. This allows the manufacturers of resistors to produce them more cheaply. Resistors with a closer tolerance will cost more. Press the NuTest "Formula" button for more information on resistor color codes. You do not need to memorize the resistor color code for the exam.

T6A07

The atoms in a resistor are jiggled around by the current flow as they impede it. This movement results in heat being produced. You need to make sure that the resistor is capable of dissipating this heat. Resistors are manufactured for different power dissipation ratings.

T6A08
A large resistor (with plenty of surface area) can dissipate more power at a given temperature. Another way to increase power dissipation is to make the resistor out of materials that are able to withstand high temperatures. The heat created in the resistor must be transferred to another substance (such as air) to prevent it from burning out. Some high power resistors have cooling fins and others are designed to be fixed to a heat conductive surface such as a chassis.

T6A09

If you calculate 10% of 100 Ohms you will have 10 Ohms. The tolerance is given as 10 percent. So, the resistance can be between (100 - 10) and (100 + 10) Ohms, or 90 to 110 Ohms.

T6A10

High quality, close tolerance resistors are more expensive to manufacture. Therefore, they cost more. They may be marked with the resistance, tolerance and power rating rather than being color coded. They are often are designed to work at lower temperatures.

T6A11

Lower quality resistors with looser tolerances are less expensive to manufacture. Therefore, they cost less and are fine for most purposes. A 20% tolerance resistor will have no tolerance band. Press the NuTest "Formula" button for more information on resistor color codes. You do not need to memorize the resistor color code for the exam.

T6A12
Think of the current having to negotiate those sharp bends and encountering resistance!

T6A13
This is a fixed resistor symbol with the addition of an arrow. The arrow indicates an adjustable component.

T6A14
The resistance value in Ohms is often given next to the symbol. The resistor type and power dissipation rating and other specifications may be given in a parts list printed next to the circuit diagram.

T6B01
The capacitor symbol represents a pair of electrodes separated by an insulating gap.

T6B02

An arrow through a symbol represents the variable version of that component, in this case an ordinary inductor symbol has an arrow through it. Variable inductors usually work in one of two ways. The inductor core material can be moved in and out of the inductor, often this is achieved by forming the material into a screw thread. Inductor cores are often made from compressed iron dust that is held together with glue. Therefore, they are very fragile. Do not use a metal screwdriver to adjust them. You can damage them and end up having to replace the whole inductor. Also, placing a metal screwdriver inside them to turn the screw will temporarily change their inductance rating. When you remove the metal screwdriver, it will return to the original rating. This makes proper adjustment with a metal tool impossible. Special plastic adjustment tools are available. One may have even been provided inside the case of your transceiver. Even when you have the correct adjustment tool, do not attempt to adjust the inductor cores unless you know what you are doing.

Inductance can be altered by varying the number of coil turns as well as the turns spacing. These methods are rarely seen nowadays as they require elaborate and ingenious methods of mechanical construction unsuited to modern production methods.

T6B03

The lines above the coil symbol represent an iron core. High inductance values are achieved by using lots of coil turns and an iron core. Moderate values of inductance use fewer turns and may have ferrite or iron dust cores. The lowest value inductors have no core at all and just a few turns.

T6B04

A schematic diagram represents function rather than physical characteristics. A toriod is functionally identical to a coil with a core, it is the donut shape of the core that gives it its name. The specific toriodal shape of the inductor is not represented in the schematic diagram.

T6B05

A capacitor with a normal dielectric can be connected either way. An electrolytic capacitor must be connected with the correct polarity. The plus sign printed near one of the leads of the capacitor indicates which way round the component must be wired. On a real component the polarity will be marked on the case or terminal. Incorrectly wired electrolytic capacitors may be 'leaky' or have a short lifetime before they become faulty.

T6B06

An arrow through a symbol represents the variable version of that component, in this case an ordinary capacitor symbol has an arrow through it. Variable capacitors usually work in one of two ways. Either the amount of plate area is varied or the distance between the plates is varied. Varying amount of plate area gives a larger range of adjustment. Varying the distance between the plates gives a finer range of adjustment. In either case, this is done by physically moving one set of plates while the other set stays stationary. A third way of varying the capacitance would be by varying the dielectric material. This method is not often used on radio equipment, however. Press the NuTest "Formula" button for more information on how the physical characteristics of a capacitor can affect its capacitance rating.

T6B07

Inductor cores are sometimes made from compressed iron dust that is held together with glue. Therefore, they are very fragile. Do not use a metal screwdriver to adjust them. You can damage them and end up having to replace the whole inductor. Also, placing a metal screwdriver inside them to turn the screw will temporarily change their inductance rating. When you remove the metal screwdriver, it will return to the original rating. This makes proper adjustment with a metal tool impossible. Special plastic adjustment tools are available. One may have even been provided inside the case of your transceiver. Even when you have the correct adjustment tool, do not attempt to adjust the inductor cores unless you know what you are doing. Iron dust cores are being superseded by ferrite cores which are similar but physically more robust because a ceramic material is used instead of glue to hold the iron dust together. Other types of inductor core consist of alloys of iron arranged as thin sheets (laminations) with insulation sandwiched between them.

T6B08
The opposition to the change in current is caused by the magnetic field.

T6B09
Press the NuTest "Formula" button for more information on how the physical characteristics of an inductor can affect its inductance rating.

T6B10
The core concentrates and enhances the magnetic field and this increases the inductance.

T6B11

Placing a metal screwdriver inside an inductor to adjust the core will temporarily change its inductance rating because the screwdriver will act as an addition to the core. When you remove the metal screwdriver, it will return to the original rating. This makes proper adjustment with a metal tool impossible. Special plastic adjustment tools are available. One may have even been provided inside the case of your transceiver. Even when you have the correct adjustment tool, do not attempt to adjust the inductor cores unless you know what you are doing.

T6B12

Capacitors store their energy in a static electric field that builds up in the insulating dielectric material between its plates. (This dielectric can be any good insulator, such as air or a special plastic film.)

T6B13

Capacitors store their energy in a static electric field that builds up in the insulating dielectric material between its electrodes. (This dielectric can be any good insulator, such as air or a special plastic film.) The electrodes of a capacitor should never touch. It is designed to be an insulator to direct current. One test for a capacitor is to attempt to pass a DC current through it by applying a steady voltage (which must be lower than the rated working voltage for the component). If a steady current passes then the component is faulty.

T6B14
Press the NuTest "Formula" button for more information on how the physical characteristics of a capacitor can affect its capacitance rating.

T6B15
Press the NuTest "Formula" button for more information on how the physical characteristics of a capacitor can affect its capacitance rating.

T6B16

Variable capacitors usually work in one of two ways. Either the amount of plate area is varied or the distance between the plates is varied. Varying amount of plate area gives a larger range of adjustment. Varying the distance between the plates gives a finer range of adjustment. In either case, this is done by physically moving one set of plates while the other set stays stationary. A third way of varying the capacitance would be by varying the dielectric material. This method is not often used on radio equipment, however. Press the NuTest "Formula" button for more information on how the physical characteristics of a capacitor can affect its capacitance rating.

T7A01

The letters "VFO" stand for "Variable Frequency Oscillator." A "VFO" can be set to virtually any frequency within its design range. It is much more versatile than a crystal controlled oscillator that can be set to only one frequency. However, it is more likely to drift off frequency than a crystal controlled oscillator.

T7A02

A detector circuit is the part of a radio receiver that extracts the required information from the RF carrier signal. This question tests for knowledge of one particular type of detector circuit called a 'product detector' that is especially good for SSB and CW work.

T7A03
In the case of frequency modulated (FM) transmissions the detector is also called a discriminator.

T7A04

You can see that this is a transmitter because a power amplifier is connected to the antenna. It has a telegraph key so it cannot be a SSB (single side band transmitter) or a packet radio transmitter. Block 1 is a Variable Frequency Oscillator which abbreviates to "VFO" and so the diagram is of a VFO controlled transmitter.

T7A05
Crystal oscillators give an extremely stable output but the frequency cannot be adjusted. Crystal controlled transmitters are designed to work on a number of different fixed channels.

T7A06

The oscillator controls the transmitter frequency. It can be a VFO or a crystal controlled oscillator.

T7A07
A detector circuit is the part of a radio receiver that extracts the required information from the RF carrier signal.

T7A08

A detector circuit is the part of a radio receiver that extracts the required information from the RF carrier signal. A product detector is especially good for decoding SSB and CW signals.

T7A09
A detector circuit is the part of a radio receiver that extracts the required information from the RF carrier signal. A product detector is especially good for decoding SSB and CW signals.

T7A10
A detector circuit is the part of a radio receiver that extracts the required information from the RF carrier signal. In the case of frequency modulated (FM) transmissions, the detector is also called a discriminator and this is the vital clue in this question.

T7A11

A detector circuit is the part of a radio receiver that extracts the required information from the RF carrier signal. In the case of frequency modulated (FM) transmissions, the detector is also called a discriminator and this is the vital clue in this question.

T7A12
A detector circuit is the part of a radio receiver that extracts the required information from the RF carrier signal. If it didn't work then no output would be heard.

T7A13

This is a circuit diagram of a transmitter; it has a power amplifier connected to the antenna. The part of a transmitter that combines audio signals with the RF carrier is called a modulator. There is no such term as a "rectifier modulator", which leaves "reactance modulator" as the correct answer.

T7A14

There are many ways to modulate a radio signal. Basically, they fall into two main areas. We either vary the amplitude of the RF carrier signal as we modulate it or we vary the frequency of the RF carrier signal as we modulate it. These are known as Amplitude Modulation (AM) and Frequency Modulation (FM). Reactance modulation is a common method of producing FM signals so this is an FM transmitter.

T7A15
No modulation would be present so the RF carrier from your transmitter would be unmodulated.

T7A16
All modern HF transmitters have low pass filters built in to the output circuitry.

T7A17
Only signals within a certain band of frequencies will be passed.

T7A18
Only signals within a certain band of frequencies are passed and the rest are blocked.

T7A19
A detector is the part of a radio receiver that extracts the required information from the RF carrier signal.

T7A20
A duplexer can direct signals from (to) a common port to (from) two different ports depending on signal frequency.

T8A01
An unmodulated carrier is conveying no information.   Therefore, it is not being used for communications purposes.

T8A02
Continuous wave (CW) is a term used for Morse code because during the transmission of a "dit" or "dah" the carrier is continuous.

T8A03

There are many ways to modulate a radio signal. Basically, they fall into two main groups. We either vary the amplitude of the RF carrier signal as we modulate it or we vary the frequency of the RF carrier signal as we modulate it. These are known as Amplitude Modulation (AM) and Frequency Modulation (FM).

T8A04
The data rate of packet radio transmissions is much higher than RTTY.

T8A05
This modulation method is not normally used because it is inefficient and wasteful of bandwidth.   Keying of the carrier to produce CW is much better.

T8A06
An amateur FM transmission has better audio quality than an amateur single side band (SSB) transmission, but at the cost of higher bandwidth. This is one reason why FM is not generally used on the crowded HF bands.

T8A07
A single side band signal is fairly economical in bandwidth while allowing reasonable voice quality.

T8A08
By convention, upper side band is used by Hams on the 10 to 20 meter bands. Lower side band is used on the 40 to 160 meter bands.

T8A09
Some VHF transmitters use phase modulation and others use frequency modulation.   Both types of signal are detected in the same way, using a discriminator.

T8A10
Frequency modulation and phase modulation are almost the same thing and are detected in the same way, using a discriminator.

T8A11
MCW stands for modulated CW.   This transmission mode is rarely used.

T8A12
Frequency modulation and phase modulation are almost the same thing and are detected in the same way, using a discriminator.

T8B01
The unmodulated RF carrier contains no information and would normally be transmitted only for test purposes.

T8B02

There are many ways to modulate a radio signal. Basically, they fall into two main areas. We either vary the amplitude of the RF carrier signal as we modulate it or we vary the frequency of the RF carrier signal as we modulate it. These are known as Amplitude Modulation (AM) and Frequency Modulation (FM).

T8B03
The unmodulated RF carrier contains no information and would normally be transmitted only for test purposes.

T8B04
A TNC sits between your terminal (or computer) and your transceiver. It processes data and assembles it into data packets then converts the data to audio signals ready for transmission.

T8B05
We use frequency modulation (FM) on most VHF and UHF bands.

T8B06
FM transmissions take up relatively large bandwidth while SSB transmissions take up less. CW transmissions occupy a very small bandwidth.

T8B07
FM transmissions take up relatively large bandwidth while SSB transmissions take up less. CW transmissions occupy a very small bandwidth.

T8B08

If a smaller bandwidth filter is used then the SSB signal will sound distorted as though the speech is being heard through a pipe. It will not be intelligible. If a wide bandwidth is used adjacent signals and noise will also be heard in addition to the required signal.

T8B09
If a smaller bandwidth filter is used then the FM signal will sound distorted If a wide bandwidth is used adjacent signals and noise will also be heard in addition to the required signal.

T8B10
Because of the large bandwidth dedicated television receivers are used for Amateur TV (ATV) work. Ordinarily domestic receivers can be used to receive ATV signals.

T8B11
The signal bandwidth will be greater than the desired 10-20 kHz.   You will be advertising the fact that your transmitter is faulty or operated incorrectly.

T8B12

Splatter is a characteristic sound. Noise from a badly splattering signal may be heard several kHz from the offending transmission. A transmission that is splattering shows that either the operator is using the transmitter incorrectly or that it is faulty.

T9A01
Yagi antennas are directional.

T9A02
The Yagi antenna should be familiar to everyone since the most basic FM radio antenna is a directional Yagi. It consists of a dipole active element surrounded by a larger reflector behind it and a shorter director in front of it.

T9A03

The most basic FM radio antenna is a directional Yagi. It consists of a dipole active element surrounded by a larger reflector behind it and a shorter director in front of it.

T9A04

In the Yagi, for example, only one element is driven by RF energy. The other elements are passive; they are known as parasitic elements because they obtain their power by induction or radiation from the driven element. Parasitic elements do not have a feedline attached.

T9A05
In the Yagi, for example, only one element is driven by RF energy. The other elements are passive; they are known as parasitic elements because they obtain their power by induction or radiation from the driven element. Parasitic elements do not have a feedline attached.

T9A06

In most beam antenna only one element is driven by RF energy. The other elements are passive; they are known as parasitic elements because they obtain their power by induction or radiation from the driven element. Parasitic elements do not have a feedline attached to them. They operate from energy that is radiated to them by the driven element. That is why they are called "Parasitic." They operate as a parasite, living off the driven element.

T9A07

Cubical quad antennas often have reflectors and directors of similar shape (square) but slightly longer and shorter than the driven element. It is the most directive design because it acts like a Yagi in both the horizontal and vertical planes. It is the equivalent of a RF telescope. The Yagi design allows RF energy to be radiated straight up (where there is no chance for the signal to ever be received). The cubical quad design does not. It focuses the energy into a straight line. However, the cubical quad design is very fragile. It is much more likely to be torn apart during a wind storm than a Yagi.

T9A08
A delta loop antenna is electrically the same as a cubical quad but can be easier to erect. It is also less likely to be torn apart during a wind storm.

T9A09
Collinear arrays have an RF feed to all of the elements and so they are not parasitic.

T9A10
A ground plane antenna consists of one vertical conductor and four or more horizontal ground radial wires.

T9A11

A ground plane antenna consists of one vertical conductor and four or more horizontal ground radial wires. In the case of a car roof mounted whip antenna the roof of the car replaces the radial wires. Ground planes are popular for mobile use due to their non-directional properties. Mounting the ground plane in the middle of a flat metal car roof makes it even more efficient.

T9A12
A roof mounted whip is a none directional antenna. The radiation will be in horizontal directions only if it is mounted on a flat horizontal surface such as the middle of a car roof.

T9B01

It is always the electric field that is used to define polarization of radio waves. Most mobiles on VHF use ground planes that emit vertically polarized waves and so everyone else follows suit.

T9B02
It so happens that a Yagi with vertical elements emits vertically polarized waves. So, this is an easy one to remember.

T9B03
A low angle radiation pattern is most effective for long distance propagation especially at higher frequencies.

T9B04

It so happens that a Yagi with horizontal elements emits horizontally polarized waves. So, this is an easy one to remember.

T9B05
An antenna with vertical elements emits vertically polarized radiation.

T9B06
Antenna polarization is usually chosen based on factors other than the polarization of man-made electrical noise. For example, a mobile ground plane must be erected vertically and so will have vertical polarization.

T9B07

Many users of repeaters will be car based mobiles with whip antennas. These emit vertically polarized waves and so the repeater radio waves must also be vertically polarized.

T9B08

Many factors affect the polarization of satellite transmissions and it can vary minute by minute. For example satellite orientation and Faraday rotation in the radio path are two factors. Circular polarization avoids fading due to polarization mismatch between satellite and earth stations.

T9B09

Stationary areas of minimum and maximum voltage on a feedline are called standing waves. They are a result of the interaction between the forward and reflected power. If the feedline, transmitter, and antenna are perfectly matched then the standing wave ratio (SWR) will be 1:1. In this condition, there would be zero reflected power. All the power going to antenna would be radiated. None would be reflected back down the feedline.

T9B10
A large amount of reflected power is a sure sign that something is wrong with the antenna or the feedline.

T9B11
Forward power is useful power that may be radiated by the antenna if it is an efficient radiator and if the feedline losses are low.

T9B12
A large amount of reflected power is a sure sign that something is wrong with the antenna or the feedline. This reflected power is wasted because it is dissipated as heat in the output circuit of your transmitter.

T9B13
A poor quality coaxial cable will result in less transmitted energy. High losses will also occur on receive and result in loss of weak signals.

T9B14

The conductors of an open-wire feedline have high voltages on them. Strong RF fields exist near the conductors and so it must be installed well away from other objects. A common method is to use plastic rods to hold the feeder away from buildings and towers.

T9B15

Coaxial cable is an unbalanced feedline. Signals from coaxial cable must go through a special transformer called a balun (balance to unbalance converter) to obtain a balanced signal that is suitable to feed a balanced antenna.

T9B16
An open wire feedline is a balanced line. Open wire feedlines have very low loss. (In dry conditions.)

T9B17
A balun converts the unbalanced signal from a coaxial feedline into a balanced signal that is required by most antennas.

T9B18
Tantalum capacitors have high dielectric loss at RF frequencies.

T9C01
Type PL-259 connectors have fairly low loss at VHF frequencies. They are robust and are not very expensive.

T9C02
Good quality BNC connectors are useable up to 5,000 MHz!

T9C03

On frequencies above 300 MHz a PL-259 does not present a constant impedance of 50 Ohms. For this reason it may cause reflected power problems. It also may cause signal loss. The familiar F-connector is a very cheap device that is unsuitable for UHF use. BNC connectors have low loss but the lowest loss of all is obtained with type-N connectors that can be used at up to 10,000 MHz!

T9C04
The main consideration with coaxial feedline is the loss. This is often given in dB per 100 feet at a particular frequency. Here are the losses (at 50 MHz) of the feedlines in the options:

RG-213	1.5 dB
RG-58	3.0 dB
RG-59	2.4 dB
RG-174	5.5 dB

The feedline should also be of the correct impedance. Feedline with an impedance rating of 50 Ohms is most commonly used in Amateur radio. Mechanical stability and weather resistance also need to be considered.

T9C05
Keep your feedline as short as possible.

T9C06
Keep your feedline as short as possible.

T9C07
Keep your feedline as short as possible.

T9C08
If the feedline is experiencing signal loss, it will be absorbing a significant amount of RF energy and converting it to heat. If a high standing wave ratio (SWR) is present, then high voltages and currents will be present in some sections of the feeder that will also cause heating. With a high SWR, it is possible that your transmitter power amplifier is overheating as well.

T9C09
Resistance converts electrical power to heat. You will want all of your RF power to go up to the antenna and be radiated. You will not want it wasted in heating up bad connections in your antenna system. Bad connections are especially likely to occur on your antenna system due to the outdoor exposed location.

T9C10
Resistance converts electrical power to heat. You will want all of your RF power to go up to the antenna and be radiated. You will not want it wasted in heating up poor quality feedline. You will also want all of the signals received by your antenna to end up in your receiver input and not be absorbed by poor quality feedline.

T9C11

Hardly any transmitted radio energy would arrive at the antenna! Most of it would be absorbed in the insulation of the lamp cord which might well heat up enough to melt or burn.

T0A01
A human adult head is resonant at around 400MHz. The hazards of several watts of RF power being dissipated in and around the human brain are not yet clear but it is best to be cautious.

T0A02
Various body parts are resonant between these frequencies and so RF energy absorption is likely to be relatively efficient.

T0A03

Never look down waveguides if there is any chance that RF power could be present. Subsequent damage due to RF heating within eye tissues occurs with little or no pain due to the lack of nerve fibers in this area. Heat damage to the lens of the eye will result in the formation of cataracts.

T0A04
Large antennas have a large near-field. Higher frequency radio emissions have a smaller near-field. Hazardous levels of RF power are most likely to be found within the near field boundary.

T0A05
If you double the distance from the source the power drops by a factor of four. This is an example of the "inverse square law". Increasing the distance between people and an antenna is an effective way to ensure compliance with RF exposure limits. A good way to achieve this is to mount antennas of the top of tall towers which has the added benefit of enhancing the communications efficiency.

T0A06
In the near field of an antenna there can be local "hot spots" where RF energy is concentrated as well as "nulls" where the energy cancels out. The field strength pattern depends on antenna type as well as the presence of nearby objects.

T0A07
The physical constant 377 is for radio waves in air, which is very close to the value for propagation in a vacuum. The Electric and magnetic field strengths given in Figure NT0-1 have this relationship.

T0A08

Never look down waveguides if there is any chance that RF power could be present. Subsequent damage due to RF heating within eye tissues occurs with little or no pain due to the lack of nerve fibers in this area. Heat damage to the lens of the eye will result in the formation of cataracts.

T0A09
A feed horn is an extension of the waveguide it is attached to. Never look into a microwave feed horn if there is any chance that RF power could be present. Subsequent damage due to RF heating within eye tissues occurs with little or no pain due to the lack of nerve fibers in this area. Heat damage to the lens of the eye will result in the formation of cataracts.

T0A10
The FCC RF radiation exposure limits are based upon research and consensus between experts to date. Research is continuing which could cause the limits to be revised in the future.

T0A11
For example between 30 and 300 MHz certain parts of the body may be resonant and absorb energy strongly at specific frequencies. An average human head is resonant at about 400M Hz.

T0B01
The use of an absorption rate is based on an assumption that most RF damage is due to heating effects. The RF exposure limits used in routine evaluation of amateur radio stations is based upon the IEEE C95.1 Standard which, ultimately, is based in an SAR of 4 W/kg. At this level of exposure mammals begin to suffer discomfort and several safety factors are used to arrive at the limits shown in Figure NT0-1.

T0B02

High energy radiation such as x-rays, gamma radiation and ultraviolet radiation can dislodge electrons from atoms. This process is called ionization and is very harmful to living tissues. RF energy cannot do this but, nevertheless, can inflict considerable damage due to heating.

T0B03
The photon energy in an electromagnetic wave is dependent on frequency not power level.

High energy radiation such as x-rays, gamma radiation and ultraviolet radiation have sufficient photon energy to dislodge electrons from atoms. This process is called ionization and is very harmful when it occurs within living tissues. RF energy cannot do this but, nevertheless, can inflict considerable damage due to heating.

T0B04
The use of an absorption rate is based on an assumption that most RF damage is due to heating effects. The RF exposure limits used in routine evaluation of amateur radio stations is based upon the IEEE C95.1 Standard which, ultimately, is based in an SAR (specific absorption rate) of 4 W/kg. At this level of exposure mammals begin to suffer discomfort and several safety factors are added to arrive at the limits shown in Figure NT0-1.

T0B05
For example between 30 and 300 MHz certain parts of the body may be resonant and absorb energy strongly at specific frequencies. An average human head is resonant at about 400 MHz while an entire average human body is resonant at about 35 MHz. Penetration of RF energy into body tissues is also dependent on frequency because lower frequency RF radiation tends to penetrate more deeply.

T0B06
The duty cycle of an FM or PM emission is 100% during transmission periods because the amplitude of the carrier does not vary.

For Morse code emissions the duty cycle is less because, although there is full carrier during "key down" periods, no carrier is being radiated between the code elements under "key up" conditions.

SSB emissions have a lower duty cycle because there is little or no RF signal during speech pauses. Also, during speech the average RF level is much less than the peak level even with considerable speech processing.

T0B07
Time averaging is based on the assumption that damage due to RF exposure is caused by heating of living tissue and this takes a certain time. The FCC exposure limits are based on 6 and 30 minute periods for controlled and uncontrolled environments. Time averaging takes into account the receive periods of two-way transmissions as well as the emission duty cycle.

T0B08
The use of an absorption rate is based on an assumption that most RF damage is due to heating effects. The RF exposure limits used in routine evaluation of amateur radio stations is based upon the IEEE C95.1 Standard which, ultimately, is based in an SAR (specific absorption rate) of 4 W/kg. At this level of exposure mammals begin to suffer discomfort and several safety factors are added to arrive at the limits shown in Figure NT0-1.

T0B09
For example between 30 and 300 MHz certain parts of the body may be resonant and absorb energy strongly at specific frequencies. An average human head is resonant at about 400 MHz while an entire average human body is resonant at about 35 MHz. Also, absorption of RF energy into body tissues is dependent on frequency because lower frequency RF radiation tends to penetrate more deeply.

T0B10
The duty cycle of an FM or PM emission is 100% during transmission periods because the amplitude of the carrier does not vary from the maximum level.

For Morse code emissions the duty cycle is less because, although there is full carrier during "key down" periods, no carrier is being radiated between the code elements under "key up" conditions.

SSB emissions have the lowest duty cycle because there is little or no RF signal during speech pauses. Also, during speech the average RF level is much less than the peak level even with considerable speech processing.

T0B11
Option A is correct because a lower duty cycle gives a lower time averaged exposure level and so the distance can be reduced.
Option B is correct because a higher duty cycle gives a higher time averaged exposure level and so the distance must be increased.
Option C is correct because a lower duty cycle gives a lower time averaged RF level in the surrounding environment.

T0B12
If the "key down" power were 100 watts and the duty cycle were 50% then the time averaged exposure level would be 50 watts and so the compliance distance could be based on this lower power level. A time averaged duty cycle of 50% would be expected for two way radio communications using FM or PM emissions since each station would be expected to be transmitting for about 50% of the total time. For CW and SSB emissions the time averaged duty cycle would be less than 50%.

T0C01
Examine Figure NT0-1, part A) is the table to use for controlled environments. The correct row to use in the case of 222 MHz emissions is 30-300 Mhz which is row 3.
Look at the Power Density column on row 3 and you will see a value of 1.0 which is the required power density. Column 5 shows that this limit is time averaged over 6 minutes. There is no formula on this row.

T0C02

Examine Figure NT0-1, part B) is the table to use for uncontrolled environments. The correct row to use in the case of 222 MHz emissions is 30-300 Mhz which is row 3.

Look at the Power Density column on row 3 and you will see a value of 0.2 which is the required power density. Column 5 shows that this limit is time averaged over 30 minutes. There is no formula on this row.

T0C03
Examine Figure NT0-1, part A) is the table to use for controlled environments. The correct row to use in the case of 440 MHz emissions is 300-1500 Mhz which is row 4.
Look at the Power Density column on row 4 and you will see the formula for the required power density: (f/300) while column 5 shows that this limit is time averaged over 6 minutes.
These results correspond to option C)

T0C04

Examine Figure NT0-1, part B) is the table to use for uncontrolled environments. The correct row to use in the case of 1300 MHz emissions is 300-1500 Mhz which is row 4.

Look at the Power Density column on row 4 and you will see the formula for the required power density: (f/1500) while column 5 shows that this limit is time averaged over 6 minutes.

These results correspond to option D).

T0C05
Examine Figure NT0-1, part A) is the table to use for controlled environments. The correct row to use in the case of 144 MHz emissions is 30-300 Mhz which is row 3.
Look at the electric field strength column on row 3 and you will see a value of 61.4 which corresponds to option A).

T0C06

Examine Figure NT0-1, part B) is the table to use for uncontrolled environments. The correct row to use in the case of 222 MHz emissions is 30-300 Mhz which is row 3.

Look at the electric field strength column on row 3 and you will see a value of 27.5 which corresponds to option B).

T0C07
Examine Figure NT0-1, part A) is the table to use for controlled environments. The power density column has constant values for three frequency ranges:

0.3-3.0 MHz
30-300 MHz
1500-100,00 MHz

Of the four options presented only D (222 to 225 MHz) falls within one of these ranges.

T0C08
Examine Figure NT0-1, part B) is the table to use for uncontrolled environments. The power density column has constant values for three frequency ranges:

0.3-1.34 MHz
30-300 MHz
1500-100,00 MHz

Of the four options presented only D (144-148 MHz) falls within one of these ranges.

T0C09
The FCC document: 'Evaluating Compliance With FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiation' (also known as "OET Bulletin 65.") will have a set of guidelines for calculating field strengths in and around amateur radio stations. Contact the FCC at 1270 Fairfield Rd, Gettysburg, PA 17325; tel. 717-337-1433 for copies or visit their web pages on http:www.fcc.gov.

It is possible to consult various charts and tables to get an idea of field strengths in and around a specific amateur radio station. This is acceptable by the FCC and is expected to be the method used by the majority of radio amateurs.

T0C10
You must add up the RF radiation from each source that is likely to be simultaneously transmitting from your station.

T0C11
A hand held transceiver is portable! In FCC terms portable devices are those that are likely to be used with the antenna within 20 cm of the body.

T0C12
In FCC terms portable devices are those that are likely to be used with the antenna within 20 cm of the body.

T0C13
Section C of Table NT0-1 refers to half-wavelength dipole antenna estimated distances. The first table in this section covers 3.5MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 1.5' will be found.

T0C14
Section B of Table NT0-1 refers to quarter-wavelength vertical antenna estimated distances. The second table in this section covers 7MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 2.7' will be found.

T0C15
Section B of Table NT0-1 refers to quarter-wavelength vertical antenna estimated distances. The fifth table in this section covers 28MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 2 under the heading "Distance to controlled limit" and the required distance of 4.9' will be found.

T0C16
Section C of Table NT0-1 refers to half-wavelength dipole antenna estimated distances. The second table in this section covers 7MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 2 under the heading "Distance to controlled limit" and the required distance of 1.4' will be found.

T0C17
Section C of Table NT0-1 refers to half-wavelength dipole antenna estimated distances. The first table in this section covers 3.5MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 1.5' will be found.

T0C18
Section B of Table NT0-1 refers to quarter-wavelength vertical antenna estimated distances. The fourth table in this section covers 21MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 2 under the heading "Distance to controlled limit" and the required distance of 3.7' will be found.

T0C19
Section B of Table NT0-1 refers to quarter-wavelength vertical antenna estimated distances. The fourth table in this section covers 21MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 8.2' will be found.

T0C20

Section C of Table NT0-1 refers to half-wavelength dipole antenna estimated distances. The fourth table in this section covers 21MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 2 under the heading "Distance to controlled limit" and the required distance of 4.1' will be found.

T0C21
Section C of Table NT0-1 refers to half-wavelength dipole antenna estimated distances. The fourth table in this section covers 21MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 9.2' will be found.

T0C22
Section C of Table NT0-1 refers to half-wavelength dipole antenna estimated distances. The fifth table in this section covers 28MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 12.3' will be found.

T0D01
The FCC regulations do not require field-strength measurements although you can elect to measure the field strength if you have the required expertise and equipment. An alternative is to use computer modeling to evaluate the likely RF exposure levels in and around your station.

The FCC document: 'Evaluating Compliance With FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiation' (also known as "OET Bulletin 65.") will have a set of guidelines for calculating field strengths in and around amateur radio stations. Contact the FCC at 1270 Fairfield Rd, Gettysburg, PA 17325; tel. 717-337-1433 for copies or visit their web pages on http:www.fcc.gov.

It is possible to consult various charts and tables to get an idea of field strengths in and around a specific amateur radio station. This is acceptable by the FCC and is expected to be the method used by the majority of radio amateurs.

Option B is incorrect, the FCC have not undertaken to perform any measurements.
Option C is incorrect, although reducing power will increase the chances of compliance you cannot assume that this alone will suffice.
Option D is incorrect in two ways. FM is a high duty cycle emission. Using a low duty cycle emission will not guarantee compliance with the FCC limits.

T0D02
Reflections from the ground will interact with the fields around your station to produce hot spots of high field strength as well as nulls of low field strength.

T0D03
In the near field the RF field strength will have hot spots of high field strength as well as nulls of low field strength. These variations are due to reflections from any objects in the vicinity including the ground, people and measuring instruments. Considerable skill and experience is needed to obtain accurate measurements.

T0D04
It is possible to consult various charts and tables (such as Table NT0-1 included with NuTest) to get an idea of field strengths in and around a specific amateur radio station. This is acceptable by the FCC and is expected to be the method used by the majority of radio amateurs.

T0D05
Examine Figure NT0-2. The horizontal axis represents distance and this is a logarithmic scale. You need to be especially careful to read values correctly and it is difficult to estimate between the labeled points on a logarithmic scale. Take a straight edge such as a ruler and use it to find which of the labeled points on the diagonal 1000 Watts line is vertically above the 10 meters label on the horizontal axis. Your straight edge should pass over the 10 meters mark on the scale as well as point 1.

T0D06

Examine Figure NT0-2. The horizontal axis represents distance and this is a logarithmic scale. You need to be especially careful to read values correctly and it is difficult to estimate between the labeled points on a logarithmic scale. Take a straight edge such as a ruler and use it to find which of the labeled points on the diagonal 100 watts line is vertically above the 5 meters label on the horizontal axis. Your straight edge should pass over the 5 meters mark on the scale as well as point 2.

T0D07

Examine Figure NT0-2. The horizontal axis represents distance and this is a logarithmic scale. You need to be especially careful to read values correctly and it is difficult to estimate between the labeled points on a logarithmic scale. Take a straight edge such as a ruler and use it to find which of the labeled points on the diagonal 10 watts line is vertically above the 2 meters label on the horizontal axis. Your straight edge should pass over the 2 meters mark on the scale as well as point 3.

T0D08

Examine Figure NT0-2. The horizontal axis represents distance and this is a logarithmic scale. You need to be especially careful to read values correctly and it is difficult to estimate between the labeled points on a logarithmic scale. Take a straight edge such as a ruler and use it to find which of the labeled points on the diagonal 1000 Watts line is vertically above the 3 meters label on the horizontal axis. Your straight edge should pass over the 3 meters mark on the scale as well as point 4.

T0D09
Examine Figure NT0-2. The vertical axis represents power density and this is a logarithmic scale. You need to be especially careful to read values correctly and it is difficult to estimate between the labeled points on a logarithmic scale. Take a straight edge such as a ruler and use it to find which of the labeled points on the diagonal 1000 Watts line is horizontally level with the 0.2 mW/cm^2 label on the vertical axis. Your straight edge should pass through the 0.2 mW/cm^2 mark on the scale as well as point 5.

T0D10
Figure NT0-2 results in worst case exposure values. The actual exposure resulting from power density values derived from Figure NT0-2 could be less due to the time averaged duty cycle of the station emissions.

T0D11
Figure NT0-2 applies to main beam exposure only.

T0D12
Section D of Table NT0-1 refers to VHF quarter wave antenna estimated distances. Row 1 is used for 10 watts transmitter power. Look on row 1 column 2 under the heading "Distance to controlled limit" and the required distance of 1.7' will be found.

T0D13

Section D of Table NT0-1 refers to VHF quarter wave antenna estimated distances. Row 2 is used for 50 watts transmitter power. Look on row 2 column 2 under the heading "Distance to controlled limit" and the required distance of 3.7' will be found.

T0D14

Section D of Table NT0-1 refers to VHF quarter wave antenna estimated distances. Row 3 is used for 150 watts transmitter power. Look on row 3 column 2 under the heading "Distance to controlled limit" and the required distance of 6.4' will be found.

T0D15
Section D of Table NT0-1 refers to VHF quarter wave antenna estimated distances. Row 3 is used for 150 watts transmitter power. Look on row 3 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 14.4' will be found.

T0D16
Section D of Table NT0-1 refers to VHF quarter wave antenna estimated distances. Row 2 is used for 50 watts transmitter power. Look on row 2 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 8.3' will be found.

T0D17

Section D of Table NT0-1 refers to VHF quarter wave antenna estimated distances. Row 1 is used for 10 watts transmitter power. Look on row 1 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 3.7' will be found.

T0D18
Section E of Table NT0-1 refers to UHF 5/8 wave antenna estimated distances. Row 1 is used for 10 watts transmitter power. Look on row 1 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 4.3' will be found.

T0D19
Section E of Table NT0-1 refers to UHF 5/8 wave antenna estimated distances. Row 2 is used for 50 watts transmitter power. Look on row 2 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 9.6' will be found.

T0D20
Section E of Table NT0-1 refers to UHF 5/8 wave antenna estimated distances. Row 3 is used for 150 watts transmitter power. Look on row 3 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 16.7' will be found.

T0D21
Section E of Table NT0-1 refers to UHF 5/8 wave antenna estimated distances. Row 3 is used for 150 watts transmitter power. Look on row 3 column 2 under the heading "Distance to controlled limit" and the required distance of 7.5' will be found.

T0D22
Section E of Table NT0-1 refers to UHF 5/8 wave antenna estimated distances. Row 2 is used for 50 watts transmitter power. Look on row 2 column 2 under the heading "Distance to controlled limit" and the required distance of 4.3' will be found.

T0D23

Section E of Table NT0-1 refers to UHF 5/8 wave antenna estimated distances. Row 1 is used for 10 watts transmitter power. Look on row 1 column 2 under the heading "Distance to controlled limit" and the required distance of 1.9' will be found.

T0E01
The roof of the vehicle acts as an RF shield and reduces the RF field levels in the car.

T0E02
The vicinity of a UHF power amplifier is very much an RF "hot spot" and large field strengths will be present when the amplifier is operating. As well as RF exposure issues there is the danger of electric shock due to the high voltages present around a tube power amplifier.
Finally, the tuned circuits associated with the amplifier could be mistuned by the absence of the shielding and this could result in destruction of the active device whether it is a tube or semiconductor.

T0E03

A hand held will certainly give a higher dose of RF energy to your head due to the proximity of the antenna and lack of shielding despite being of lower level output.

T0E04

The vicinity of a UHF power amplifier is very much an RF "hot spot" and large field strengths will be present when the amplifier is operating. As well as RF exposure issues there is the danger of electric shock due to the high voltages present around a tube power amplifier.

Finally, the tuned circuits associated with the amplifier could be mistuned by the absence of the shielding and this could result in destruction of the active device whether it is a tube or semiconductor.

T0E05
An SWR of 1:1 at your transceiver output indicates that power is being efficiently transferred to your antenna feeder.

High feed line losses can occur in poor quality coaxial feeder. Although undesirable this is not likely to result in feedline radiation since the RF power will be dissipated as heat in the cable dielectric.

Non resonant parasitic elements in a single band antenna indicate a faulty antenna or poor antenna design which will not necessarily result in high RF exposure.

Option C is relevant because RF fields can be high in the vicinity of open wire feedline especially if there is an unbalance or mismatch in the antenna system.

T0E06
Option A is correct. Use coaxial feedline and a good low impedance station RF ground.
Option B is also correct. A vehicle roof acts as an effective RF shield.
Option C is correct. Use coaxial feedline and consider burying sections of it if there are long feedline runs to a remote tower.

T0E07
Option A. Broadband means, by definition, that it covers a wide frequency range.
Options B and C are correct, the instrument does not need to be tuned to specific frequencies and will respond to any frequency within its working range.

T0E08
A narrow bandwidth instrument behaves like a standard radio receiver with a bandwidth of several kilohertz. It may have several bands and must be manually tuned to the frequency of interest.

T0E09
Never look down waveguides if there is any chance that RF power could be present. Due to the transition from feeder to open space there can be RF field nulls and hot spots around the open end of a waveguide. Damage due to RF heating within eye tissues occurs with little or no pain due to the lack of nerve fibers in this area. Heat damage to the lens of the eye will result in the formation of cataracts.

T0E10
For example, mount antennas at the top of towers or relocate antennas away from people.

T0E11
It is important to realize that the limits are exposure limits and not emission limits. These limits are given in Figure NT0-1.

T0E12
Section A of Table NT0-1 refers to "triband" Yagi antenna estimated distances. The second table in this section covers 21MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 16.4' will be found.

T0E13
Section A of Table NT0-1 refers to "triband" Yagi antenna estimated distances. The third table in this section covers 28MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 2 under the heading "Distance to controlled limit" and the required distance of 11' will be found.

T0E14

Section A of Table NT0-1 refers to "triband" Yagi antenna estimated distances. The third table in this section covers 28MHz. Row 1 is used for 100 watts transmitter power. Look on row 1 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 24.5' will be found.

T0E15
Section F of Table NT0-1 refers to 17 element (five wavelength boom) 144 MHz Yagi antenna estimated distances. Row 1 is used for 10 watts transmitter power. Look on row 1 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 22.9' will be found.

T0E16

Section F of Table NT0-1 refers to 17 element (five wavelength boom) 144 MHz Yagi antenna estimated distances. Row 2 is used for 100 watts transmitter power. Look on row 2 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 72.4' will be found.

T0E17
Section F of Table NT0-1 refers to 17 element (five wavelength boom) 144 MHz Yagi antenna estimated distances. Row 3 is used for 100 watts transmitter power. Look on row 3 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 162' will be found.

T0E18
Section F of Table NT0-1 refers to 17 element (five wavelength boom) 144 MHz Yagi antenna estimated distances. Row 4 is used for 1500 watts transmitter power. Look on row 4 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 280.6' will be found.

T0E19

Section F of Table NT0-1 refers to 17 element (five wavelength boom) 144 MHz Yagi antenna estimated distances. Row 4 is used for 1500 watts transmitter power. Look on row 4 column 2 under the heading "Distance to controlled limit" and the required distance of 125.5' will be found.

T0E20
Section F of Table NT0-1 refers to 17 element (five wavelength boom) 144 MHz Yagi antenna estimated distances. Row 3 is used for 500 watts transmitter power. Look on row 3 column 2 under the heading "Distance to controlled limit" and the required distance of 72.4' will be found.

T0E21
Section F of Table NT0-1 refers to 17 element (five wavelength boom) 144 MHz Yagi antenna estimated distances. Row 2 is used for 100 watts transmitter power. Look on row 2 column 2 under the heading "Distance to controlled limit" and the required distance of 32.4' will be found.

T0E22

Section F of Table NT0-1 refers to 17 element (five wavelength boom) 144 MHz Yagi antenna estimated distances. Row 1 is used for 10 watts transmitter power. Look on row 1 column 2 under the heading "Distance to controlled limit" and the required distance of 10.2' will be found.

T0E23
Section G of Table NT0-1 refers to estimated distances to meet RF power guidelines for an array of eight 17 element (five wavelength boom) 144 MHz Yagi antenna. Row 1 is used for 150 watts transmitter power. Look on row 1 column 2 under the heading "Distance to controlled limit" and the required distance of 90.9' will be found.

T0E24
Section G of Table NT0-1 refers to estimated distances to meet RF power guidelines for an array of eight 17 element (five wavelength boom) 144 MHz Yagi antenna. Row 2 is used for 500 watts transmitter power. Look on row 2 column 2 under the heading "Distance to controlled limit" and the required distance of 166' will be found.

T0E25
Section G of Table NT0-1 refers to estimated distances to meet RF power guidelines for an array of eight 17 element (five wavelength boom) 144 MHz Yagi antenna. Row 3 is used for 1500 watts transmitter power. Look on row 3 column 2 under the heading "Distance to controlled limit" and the required distance of 287.4' will be found.

T0E26
Section G of Table NT0-1 refers to estimated distances to meet RF power guidelines for an array of eight 17 element (five wavelength boom) 144 MHz Yagi antenna. Row 3 is used for 1500 watts transmitter power. Look on row 3 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 642.7' will be found.

T0E27
Section G of Table NT0-1 refers to estimated distances to meet RF power guidelines for an array of eight 17 element (five wavelength boom) 144 MHz Yagi antenna. Row 2 is used for 500 watts transmitter power. Look on row 2 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 371.1' will be found.

T0E28

Section G of Table NT0-1 refers to estimated distances to meet RF power guidelines for an array of eight 17 element (five wavelength boom) 144 MHz Yagi antenna. Row 1 is used for 150 watts transmitter power. Look on row 1 column 3 under the heading "Distance to uncontrolled limit" and the required distance of 203' will be found.

The RST system

RST Stands for Readability, Signal strength and Tone. Three digits are used as follows:

Readability:

1 Unreadable.
2 Barely readable.
3 Readable with difficulty.
4 Readable with little difficulty.
5 Perfectly readable.

Signal strength:

1 Very weak signal, hardly detectable.
2 Very weak signal.
3 Weak signal.
4 Fair signal.
5 Fairly good signal.
6 Good signal.
7 Fairly strong signal.
8 Strong signal.
9 Very strong signal.

Tone: (Used with CW only)

1 Carrier is highly modulated, with AC hum. Broad bandwidth.
2 Carrier is highly modulated, with AC hum.
3 Rough tone, some AC hum.
4 Rough tone moderate AC hum.
5 Some AC ripple present on carrier.
6 A little AC modulation present.
7 Traces of modulation can be heard.
8 Slight trace of modulation.
9 Perfect carrier with no modulation.