GENERAL Class.
FCC License Preparation
Element 3B

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

G1A01:
General class operators have full privileges over the entire 160 meter band. [97.301]

G1A02:

General class operators have privileges in two areas of this band. In the first area, CW, RTTY, and data privileges exist from 3,525 kHz to 3,750 kHz. In the second area, CW, voice, and image privileges exist between 3,850 kHz and 4,000 kHz. [97.301]

G1A03:

General class operators have privileges in two areas of this band. In the first area, CW, RTTY and data privileges exist from 7,025 kHz to 7,150 kHz. In the second area, CW, voice, and image privileges exist between 7,225 kHz and 7,300 kHz. [97.301]

G1A04:
General class operators have CW, RTTY, and data privileges over the entire 30 meter band. [97.301]

G1A05:

General class operators have privileges in two areas of the 20 meter band. In the first area, CW, RTTY, and data privileges exist from 14.025 MHz to 14.150 MHz. In the second area, CW, voice, and image privileges exist between 14.225 MHz and 14.350 MHz. [97.301]

G1A06:

General class operators have privileges in two areas of the 15 meter band. In the first area, CW, RTTY, and data privileges exist from 21.025 MHz to 21.200 MHz. In the second area, CW, voice, and image privileges exist between 21.300 MHz and 21.450 MHz. [97.301]

G1A07:

General class operators have full privileges on the entire 12 meter band. The CW, RTTY, and data modes may be used from 24.890 MHz to 24.930 MHz. The CW, phone, and image modes may be used from 24.930 MHz to 24.990 MHz. [97.301]

G1A08:

General class operators have privileges over the entire 10 meter band. The CW, RTTY, and data modes may be used from 28.000 MHz to 28.300 MHz. The CW, phone, and image modes may be used from 28.300 MHz to 29.700 MHz. [97.305]

G1A09:

General class operators have privileges over the entire 160 meter band. This band is not divided into sections. The whole band is available for CW, RTTY, data, phone and image transmissions from 1.800 MHz to 2.000 MHz. [97.301]

G1A10:

General class operators have privileges for two areas on the 80 meter band.   The CW and data modes may be used from 3,525 kHz to 3,750 kHz.   The CW, image, and phone modes may be used from 3,850 kHz to 4,000 kHz.   [97.301]

G1A11:

The 7.225 MHz - 7.300 MHz section is the only part of the 40 meter band where General class operators have priviledges for image transmissions.   [97.305]

G1A12:

General class operators have RTTY and data privileges over the entire 30 meter band from 10.100 MHz to 10.150 MHz. [97.305]

G1A13:

General class privileges cover part of the area designated for image transmissions on the 20 meter band. This area is from 14.225 MHz to 14.350 MHz. [97.305]

G1A14:

General class privileges cover part of the area designated for image transmissions on the 15 meter band.   This area is from 21.300 MHz to 21.450 MHz.   [97.305]

G1A15:

General class privileges cover the entire area designated for image and phone transmissions on the 12 meter band. [97.305]

G1A16:

General class privileges cover the entire area designated for image and phone transmissions on the 10 meter band. [97.305]

G1A17:

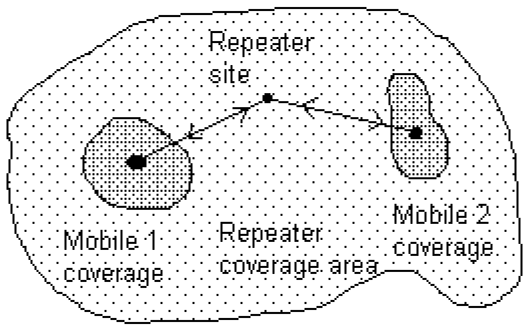
If you are a General class operator and you are operating on a frequency that General class privileges cover.   However, if the station license does not have these privileges, then you must add your call sign to the station call sign.   [97.119]

G1A18:
It is the license held by control operator that determines the privileges held by a repeater station.
[97.205]

G1A19:

Repeaters are usually located on hills or tall buildings. They have efficient antenna(s) for receiving and transmitting. This means that a weak local signal from a handheld transceiver will be re-broadcasted at higher power. The higher power signal from the high antenna location will give 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:



G1A20:

The interference has to be making communications difficult or impossible to be classed as harmful. Harmful interference is not necessarily deliberate. [97.3]

G1A21:

This rule applies to all international amateur communications. Some countries (Great Britain for example) do not permit third party communications by normal amateur radio communications. [97.117]

G1B01:
If you live near an airport, special rules apply. [97.25]

G1B02:
The correct option is a direct quotation from the FCC rules. [97.101]

G1B03:

A beacon station is an automatic station operated by a radio amateur. It is one that transmits an identification signal. Beacon stations are used to determine propagation conditions. If a beacon can be heard from a particular location then there is a chance that you can work amateur radio stations in that location.

G1B04:
The other reasons are all permitted by the FCC rules [97.111] and [97.113].

G1B05:
This is a specific exception to the rule of no music. [97.113]

G1B06:

Certain codes used in data transmission are permitted since their purpose is not to obscure the meaning of the communication. [97.113]

G1B07:

This is a reference to the Amateur Q-codes and the abbreviations used in CW work. They are permitted since their purpose is not to obscure the meaning of the communication. [97.113]

G1B08:

Certain codes used in data transmission are permitted since their purpose is not to obscure the meaning of the communication. [97.113]

G1B09:

Certain codes used in data transmission are permitted since their purpose is not to obscure the meaning of the communication. [97.113]

G1B10:
All the other options are specifically prohibited by the FCC rules.   [97.113]

G1B11:
You need to stop the music from being re-transmitted by your station. [97.113]

G1C01:

There is a blanket power limit of 1,500 watts, but specific power limits apply to certain sub-bands such as the range 3.675 - 3.725 in the 80 meter band. [97.313]

G1C02:

There is a blanket power limit of 1,500 watts. No specific power limit is given in the FCC rules for this frequency. [97.313]

G1C03:

There is a blanket power limit of 1,500 watts, but specific power limits apply to certain sub-bands such as 10.10 - 10.15 MHz. [97.313]

G1C04:

There is a blanket power limit of 1,500 watts, but specific power limits apply to certain sub-bands such as 21.10 - 21.20 MHz. [97.313]

G1C05:

There is a blanket power limit of 1,500 watts; no specific power limit is given in the rules for this frequency. [97.313]

G1C06:

The FCC rules allow power amplifiers to be built to operate below 144 MHz. Under certain conditions, they do not need FCC type acceptance. [97.315]

G1C07:

The FCC rules allow power amplifiers to be built to operate below 144 MHz. Under certain conditions, they do not need FCC type acceptance. This is one of those conditions. [97.315]

G1C08:

High gain high power amplifiers are prone to emission of noise and spurious outputs. The rules are an attempt to limit the gain of high power RF amplifiers. [97.317]

G1C09:
All the other options are specifically mentioned in the rules. [97.317]

G1C10:

Transmission above this data rate is specifically prohibited for each band below 28 MHz. One reason is to restrict bandwidth on amateur radio transmissions on the crowded HF amateur bands. [97.305]

G1C11:

Transmission above this data rate is specifically prohibited for each band below 28 MHz. One reason is to restrict bandwidth on amateur radio transmissions on the crowded HF amateur bands. [97.305]

G1D01:
It makes sense to restrict the tester to preparing tests at a lower level than his/her own. [97.507]

G1D02:
It makes sense to restrict the tester to preparing tests at a lower level than his/her own. [97.507]

G1D03:
It makes sense to restrict the tester to preparing tests at a lower level than his/her own. [97.507]

G1D04:

In other words, this means the 5 WPM code test and the Novice written examination. This is a minimum requirement. You may take the 13 WPM or 20 WPM code tests instead of the 5 WPM test! If you feel you have a chance of passing a code test at higher speed than you need, then take it in addition to the test you feel you are sure of passing. [97.503]

G1D05:

Applicants for the Technician class take the Novice examination plus an extra Technician examination. [97.501]

G1D06:

This is called the Technician Plus class. Applicants for this class must obtain the requirements for the Technician class and pass the 5 WPM code test [97.501].

G1D07:
They must be present and observing the applicants. [97.509]

G1D08:
Each of the VE's must be accredited by the coordinating VEC. [97.509]

G1D09:

When you have a CSCE you may use your new General class privileges with your existing call sign, so long as you add the identifier /AG to the end of it. [97.119]

G1D10:

When you have a CSCE you may use your new General class privileges with your existing call sign, so long as you add the identifier /AG to the end of it. [97.119]

G1D11:

When you have a CSCE you may use your new General class privileges with your existing call sign, so long as you add the identifier /AG to the end of it. [97.119]

G2A01:
We use lower side band on 160, 75 and 40 meters, upper side band on the higher bands.

G2A02:
We use lower side band on 160, 75 and 40 meters, upper side band on the higher bands.

G2A03:
This is a convention; the regulations allow RTTY from 3.500 MHz to 3.750 MHz. [97.305]

G2A04:
This is a convention. In fact, the rules permit RTTY between 14.000 MHz and 14.150 MHz. [97.305]

G2A05:

Baudot code is used by RTTY amateur operators. The term "RTTY" is another name for teleprinters. These are typewriter-like machines used for sending and receiving text by radio.

G2A06:

ASCII stands for "American Standard Code for Information Interchange." This code is used by most computers. There are enough bits to represent each character of the alphabet in upper and lower case, as well as many other symbols. Parity bits are used for error detection.

G2A07:

The frequency shift is the distance between the frequency that represents "space" and the frequency that represents "mark". In an RTTY transmission the carrier frequency rapidly jumps from one to the other giving a characteristic sound.

G2A08:

Mode A (ARQ) stands for Automatic repeat request and mode B (FEC) stands for frame error check. This is all part of the handshaking that goes on when two computers are communicating.

G2A09:

This separation is also called the offset or split.   The output frequency is normally the higher of the two.

G2A10:

VOX is also called Voice Operated Control; your transceiver automatically switches to transmit as you speak.   It is often used by telephony operators on the HF bands.

G2A11:

Full break-in telegraphy puts great technical demands on the receiver that has to achieve full sensitivity from a desensitized state in between each transmitted "dit" and "dah".

G2B01:
This is the polite thing to do.   Late arrivals to your net will easily be able to find you.

G2B02:
Paragraph [97.101] of FCC part 97 regulations is relevant here.

G2B03:
After a contact is made, it is not uncommon to have to QSY to a clear frequency.

G2B04:

The required bandwidth of a CW transmission is typically a few tens of Hz. However, receiver bandwidths are usually set to a few hundred Hz for CW work. So, allow a safety margin.

G2B05:

The bandwidth of a SSB transmission is around 3 kHz. The receiver bandwidth is usually set to this width during SSB contacts.

G2B06:

Although the bandwidth of a RTTY signal is a few hundred Hz it is polite to allow a safety margin. This is because the station receiving the RTTY signal may have its receiver filter set wider than this.

G2B07:

Another name for this sort of map is a "Great Circle" map. This is because the shortest path around the surface of a spherical object such as the Earth is called a Great Circle. Although the country shapes and areas appear distorted, the directions are correct from locations at the center of the map. These maps are great for setting your beam in the correct direction to work a foreign country. Be sure to choose an "azimuthal" map with your location near the center.

G2B08:

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G2B09:

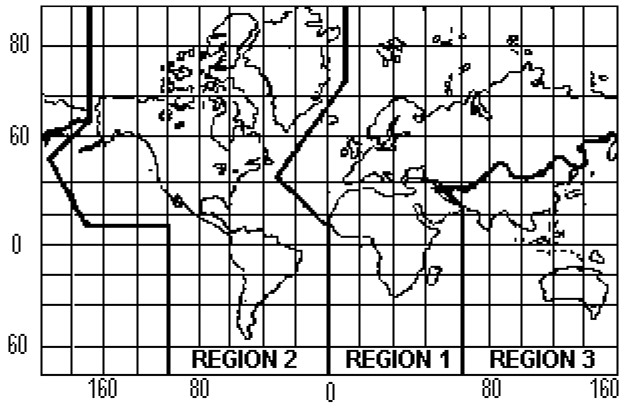
Since we live on the surface of a sphere, there are at least two direct paths to any location. We can either take the short route or we can go in the opposite direction (180 degrees) and get to the location by the long route.

G2B10:

For example, a 20 meter band plan will show where CW, RTTY, and data transmissions exist. It will also show where telephony transmissions are found.

G2B11:

Here is a map of the ITU regions:



G2C01:
In a life threatening emergency, all the rules can be waived.

G2C02:
Radio amateurs have a vital role in disaster situations.

G2C03:

If you were to join the Radio Amateur Civil Emergency Service (RACES) and an emergency occurred, you could find yourself passing traffic to and from Civil Defense organizations.

G2C04:

If you were to join the Radio Amateur Civil Emergency Service (RACES) and an emergency occurred, you could find yourself passing traffic to and from Civil Defense organizations.

G2C05:
In a life threatening emergency, all the rules can be waived.

G2C06:

In a life threatening emergency, all the rules can be waived. This includes the requirement to only use authorized amateur radio frequencies.

G2C07:
Then, you must pass on the information to the appropriate people by the best means that you have.

G2C08:
All classes of licensee are eligible to become RACES members.

G2C09:
The relevant FCC regulation is in [97.117].

G2C10:

Amateur Auxiliaries police the airwaves. They try to sort out problems where amateurs may be violating FCC rules, inadvertently or otherwise.

G2C11:

Amateur Auxiliaries police the airwaves. They try to sort out problems where amateurs may be violating FCC rules, inadvertently or otherwise.

G3A01:

Sometimes, the problem is due to an intensification of the low frequency absorbing D-layer. This atmospheric layer readily absorbs lower frequencies. Moving to a higher band may allow your signals to propagate farther.

G3A02:

Sometimes, the problem is due to an intensification of the low frequency absorbing D-layer. This atmospheric layer readily absorbs lower frequencies. Moving to a higher band may allow your signals to propagate farther.

G3A03:
This radiation travels at the speed of light. Particles from the sun take several days to arrive.

G3A04:

The term "flux" means flow. Solar flux is the rate at which radio energy is flowing out of the sun. The first radio telescope was a VHF antenna pointed at the sun.

G3A05:

The "solar flux index" is a measurement of solar flux at a frequency of 2,800 MHz. This frequency was chosen for the measurement because at this frequency the "radio" sun looks the same size as the "visible" sun. The solar flux measurements are taken at midday at Penticon (in British Columbia). Propagation forecasts are derived from the measurements. These forecasts are broadcast on WWV every hour. The solar flux measurement varies from about 67 units (very low) to around 300 units (very high). The higher the reading, the better the propagation conditions on HF.

G3A06:

Not only do solar storms create disturbances to radio propagation, they also affect the earth's magnetic field.   Sometimes the effect is great enough to temporarily alter magnetic compass readings.

G3A07:

Those parts of the earth at latitudes greater than 45 degrees (nearer the poles) are subject to greater levels of geomagnetic disturbance. This is because the lines of force of the earth's magnetic field are more closely packed and more vertical. This tends to channel ionized particles down to levels that can cause disturbances.

G3A08:

Those parts of the earth at latitudes greater than 45 degrees (nearer the poles) are subject to greater levels of geomagnetic disturbance. This is because the lines of force of the earth's magnetic field are more closely packed and more vertical. This tends to channel ionized particles down to levels that can cause disturbances.

G3A09:

In this question, tropospheric ducting effects are regarded as occurring with ground waves. All other non line-of-sight communications depend on reflected waves from the ionized layers of the atmosphere. These layers are a result of solar activity. OK, so there is moon bounce and repeater operation as well…

G3A10:

Electromagnetic emissions include ultraviolet light as well as X-rays. Particles are also emitted from the sun. They take about two days to arrive.

G3A11:

The critical frequency of the reflecting layers increases with increasing ionization. When sunspot numbers are high, this indicates a period of higher solar flux. This results in greater levels of ionization.

G3B01:

The best chance for a successful contact is on the next band down in frequency from the maximum useable frequency (MUF).   If you go too far down in frequency, your signals may be affected by absorption in the D-layer.

G3B02:

The best chance for a successful contact is on the next band down in frequency from the maximum useable frequency (MUF). If you go too far down in frequency your signals may be affected by absorption in the D-layer.

G3B03:

The sun rotates once every 28 days. The radiation that enhances radio communications is emitted from specific areas that appear on the sun's surface. (These areas will appear and disappear over periods of several months.)

G3B04:
This is the main purpose of amateur beacon stations.

G3B05:

When they reach the earth, they are reflected upwards again.   The bouncing process continues on and on.

G3B06:
There are beacons on all the important amateur bands.

G3B07:
Atmospheric ionization will be low and the MUF will be not much above 20 MHz.

G3B08:

The most reliable long distance band is the 20 meter band. (Therefore, it is also the most crowded band.) Absorption of radio signals in the D-layer is low at this frequency and the MUF is always above 14 MHz

G3B09:
Gray line propagation occurs along the earth's terminator for a short period, twice per day.

G3B10:

The F2-layer is at over 200 miles in altitude and is the highest of the reflecting layers. It has the longest hop distance of all.

G3B11:

The E-layer is the lowest of the reflecting layers at about 70 miles and so the maximum hop distance is less than with F layer propagation.

G3C01:

The E-layer is the lowest of the reflecting layers at about 70 miles and so the maximum hop distance is less than with F layer propagation.

G3C02:

This is the period of maximum solar flux. It is solar radiation that produces the ionized layers in the atmosphere.

G3C03:

The F2-layer is at over 200 miles in altitude. It is the highest of the reflecting layers. The F1-layer and F2-layer merge into one layer at night when it is called the F-layer.

G3C04:

As the angle approaches the vertical, it becomes more likely that the signal will pass straight through the layer. For maximum chance of reflection you want an angle that is as low as possible. Low angle radiation will result in longer hops.

G3C05:

The D-layer is the lowest one. Unlike the other layers it does not enhance radio communication by reflecting signals toward the ground. It absorbs low frequency signals most strongly.

G3C06:

Scatter signals are a result of signals bouncing off transient irregularities in the ionized layers and other brief disturbances in the atmosphere. It is the short lived nature of the irregularities that causes the wavering of the signal. Also there will be several different paths involved. Each of the paths will be rapidly changing. This will cause cancellation and addition effects.

G3C07:

Scatter signals are a result of signals bouncing off transient irregularities in the ionized layers and other brief disturbances in the atmosphere. It is the short lived nature of the irregularities that causes the wavering of the signal. Also there will be several different paths involved. Each of the paths will be rapidly changing. This will cause cancellation and addition effects.

G3C08:

Scatter signals are a result of signals bouncing off transient irregularities in the ionized layers and other brief disturbances in the atmosphere.   These irregularities are small and so the amount of reflected signal is small.   High transmitted powers are used for communication using scatter modes.

G3C09:

Scatter signals are a result of signals bouncing off transient irregularities in the ionized layers and other brief disturbances in the atmosphere. It is the short lived nature of the irregularities that causes the wavering of the signal. Also there will be several different paths involved. Each of the paths will be rapidly changing. This will cause cancellation and addition effects.

G3C10:

Above the MUF, most of the signal passes straight through the ionized layer. A small amount of signal will be scattered in all directions. This can be used for communication by scatter mode. High transmitted power is required for communication using scatter mode.

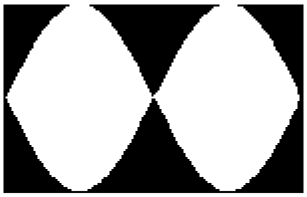
G3C11:

Multi-path fading can often be recognized by its regular nature. The signal level will rise and fall every few seconds.

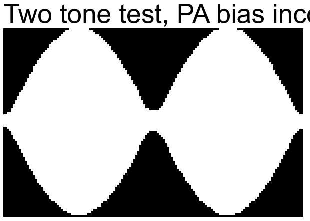
G4A01:

This is often called the two-tone test. It is the simplest and cheapest method of testing a SSB transmitter. Two non-harmonically related audio sine wave signals are used to emulate the speech signal. The resulting detected output is viewed on an oscilloscope. It is important that the two tones are good sine waves. Appreciable non-linearity of the RF amplifier will show up in the oscilloscope pattern. A more sensitive test is to listen for intermodulation products from a two tone test using a receiver.

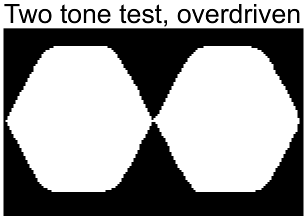
Two tone test, correctly adjusted transmitter:



Two tone test, PA bias incorrect:



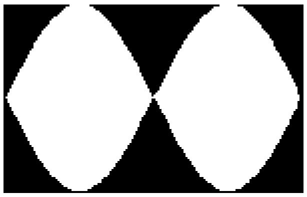
Two tone test, overdriven with flat topping:



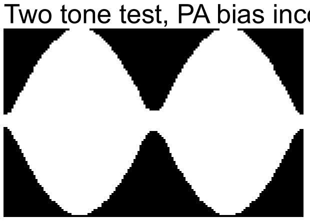
G4A02:

This is often called the two-tone test. It is the simplest and cheapest method of testing a SSB transmitter. Two non-harmonically related audio sine wave signals are used to emulate the speech signal. The resulting detected output is viewed on an oscilloscope. It is important that the two tones are good sine waves. Appreciable non-linearity of the RF amplifier will show up in the oscilloscope pattern. A more sensitive test is to listen for intermodulation products from a two tone test using a receiver.

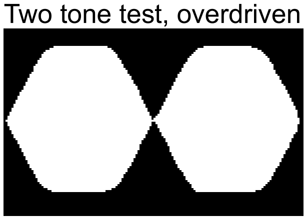
Two tone test, correctly adjusted transmitter:



Two tone test, PA bias incorrect:



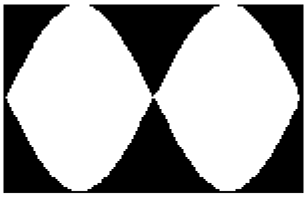
Two tone test, overdriven with flat topping:



G4A03:

This is often called the two-tone test. It is the simplest and cheapest method of testing a SSB transmitter. Two non-harmonically related audio sine wave signals are used to emulate the speech signal. The resulting detected output is viewed on an oscilloscope. It is important that the two tones are good sine waves. Appreciable non-linearity of the RF amplifier will show up in the oscilloscope pattern. A more sensitive test is to listen for intermodulation products from a two tone test using a receiver.

Two tone test, correctly adjusted transmitter:



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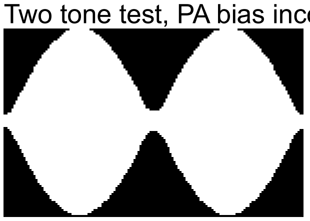

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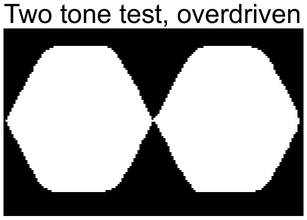
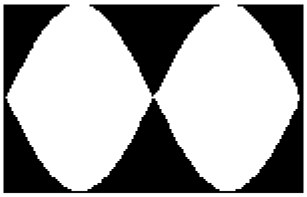


G4A04:

This is often called the two-tone test. It is the simplest and cheapest method of testing a SSB transmitter. Two non-harmonically related audio sine wave signals are used to emulate the speech signal. The resulting detected output is viewed on an oscilloscope. It is important that the two tones are good sine waves. Appreciable non-linearity of the RF amplifier will show up in the oscilloscope pattern. A more sensitive test is to listen for intermodulation products from a two tone test using a receiver.

Two tone test, correctly adjusted transmitter:



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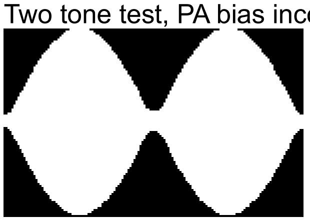

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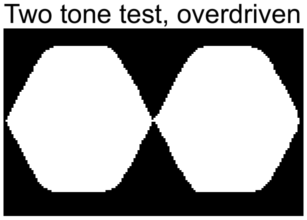


G4A05:

Electronic switches are very fast.   This fast switching could generate spurious signals.   The low pass filter could prevent these signals from being radiated.

G4A06:
They are also more reliable than the older method of using a mechanical relay.

G4A07:

Power amplifier instability can result in spurious emissions or rapid destruction of the tube. For maximum amplifier stability any changes in the output circuitry should not be seen at the input. There should be no feedback.

G4A08:

In vacuum tubes, output signals can leak back to the input by the inter-electrode capacitance. This will cause instability. This instability can result in spurious emissions or rapid destruction of the tube by self oscillation. Neutralization cancels the leaked signals.

G4A09:

The type of feedback that can build up and cause destructive uncontrolled oscillation is positive feedback.   To cancel it out, negative feedback is used.

G4A10:

The type of feedback that can build up and cause destructive uncontrolled oscillation is positive feedback. To cancel it out, negative feedback is used. Neutralization is the process of adding a controlled amount of negative feedback to a RF power amplifier circuit.

G4A11:

In vacuum tubes, output signals can leak back to the input by the inter-electrode capacitance. This will cause instability. This instability can result in spurious emissions or rapid destruction of the tube by self oscillation. Neutralization cancels the leaked signals.

G4B01:

The horizontal channel is often used to sweep the electron beam regularly to allow the vertical channel to display a visual representation of a signal waveform.   An oscilloscope is a versatile piece of test equipment to have in a radio station.

G4B02:

A signal tracer is a signal source that can be injected into a faulty receiver to allow a fault to be isolated to a particular stage. It is commonly used to inject a test signal into the audio circuitry. Then, the technician will listen to the speaker. If the fault is not found in the audio portion of the circuitry, he will then work methodically toward the antenna end until the injected signal is not heard.

G4B03:

This is a way to check out an antenna system without using your transmitter. You need to use your receiver with a noise bridge. In addition to measuring the impedance, a noise bridge can allow you to decide if the antenna needs to be made shorter or longer.

G4B04:

In addition to measuring the impedance, a noise bridge can allow you to decide if the antenna needs to be made shorter or longer.

G4B05:
With a monitoring oscilloscope, you can see what you are radiating.

G4B06:

With a monitoring oscilloscope, you can see what you are radiating. The output of the transmitter is the place to monitor RF. If you monitor at other points you may be introducing distortion or extra signals.

G4B07:

A field strength meter measures RF power. To determine the approximate radiation of an antenna you must first transmit a test signal. Then, you keep the meter fixed (or vice-versa) and rotate your antenna while transmitting.

G4B08:

A field strength meter measures RF power.   To determine the approximate radiation of an antenna you must first transmit a test signal.   Then, you keep the meter fixed (or vice-versa) and rotate your antenna while transmitting.

G4B09:

A field strength meter measures RF power. To determine the approximate radiation of an antenna you must first transmit a test signal. Then, you keep the meter fixed (or vice-versa) and rotate your antenna while transmitting.

G4B10:

An increase of four times corresponds to a change of 6 dB which is one S-unit.   One dB is the minimum detectable audible change.   Press the NuTest "Formula" button for details of the dB system.

G4B11:

An increase of four times corresponds to a change of 6 dB which is one S-unit.   One dB is the minimum detectable audible change.   Press the NuTest "Formula" button for details of the dB system.

G4C01:

Bypass capacitors allow RF energy to leak to ground if they are used correctly. They are often fitted on the output and AC lines of audio equipment.

G4C02:

Modern telephones are prone to picking up RF interference. You may have to install RFI filters on your telephone system.

G4C03:
It will be clearly recognizable as speech, but it will be unintelligible.

G4C04:

The "clicking" will occur when the "dits" and "dahs" are beginning or ending. During a "dit" or "dah" the sound level on the public address system may alter or become distorted.

G4C05:
Grounding is also important for safety reasons.

G4C06:

This ground connection is 10 meters long which is a quarter wave on the 40 meter band, a half wave on the 20 meter band and one wavelength on the 10 meter band.   It will readily pick up RF energy.

G4C07:

Adding a good ground connection will make no difference to the cost.   However, it will have several benefits.

G4C08:

You want to avoid lengths that are resonant at the frequencies your station uses. The ground connection should also have a low impedance. Make sure your ground spike is at least 8 feet long and is placed in soil that is usually damp. Ground connections should be made of thick copper braid. One source of copper braid is coaxial cable. Use the whole cable with the inner and outer conductors connected together.

G4C09:

This is not true. The more station equipment that can be grounded the better. It could also be beneficial to ground your neighbor's audio and TV if they are designed with a suitable ground connection.

G4C10:

For example, a ground connection to a station above ground floor level may be 30 feet long. Thirty feet is 10 meters. This is a quarter wave on the 40 meter band, a half wave on the 20 meter band and one wavelength on the 10 meter band. It will readily pick up RF energy. All equipment connected to it will be "live" with RF energy.

G4C11:
The National Electrical code covers electrical wiring requirements. It does not cover health limits.

G4D01:

A speech processor improves intelligibility by allowing the average power of the transmitted signal to be increased.   An incorrectly used speech processor can cause a broad distorted signal.

G4D02:
A speech processor increases the average power. It does not increase the peak power.

G4D03:

Peak envelope power (PEP) is the maximum power that the transmitter can output. The term "PEV" stands for Peak Envelope Voltage. This is half the peak to peak voltage measured on an oscilloscope.

G4D04:

Using the equation:

Peak envelope power = (PEV x 0.707) x (PEV x 0.707) / Load.

Where PEV stands for Peak Envelope Voltage (half of the peak to peak voltage as measured on an oscilloscope).

We obtain (100 x 0.707) x (100 x 0.707) /50 = 99.7 which is close to 100 watts.

G4D05:

Using the equation:

Peak envelope power = (PEV x 0.707) x (PEV x 0.707) / Load

Where PEV stands for Peak Envelope Voltage (half of the peak to peak voltage as measured on an oscilloscope).

We obtain (500 x 0.707) x (500 x 0.707) /50 = 625 watts (approximately).

G4D06:
With an un-modulated carrier, the average power is the same as the peak power.

G4D07:

If fuses were provided in the ground or return wires and the fuses blew, then the chassis of equipment could become live under certain fault conditions. Note that over 240 volts can be present across the hot conductors of a four wire AC cord.

G4D08:

The lowest AWG numbers are the thickest. When used in household wiring situations, AWG number 14 wire is rated at 17 Amps maximum, continuous duty. This leaves a safety margin.

G4D09:

The lowest AWG numbers are the thickest. When used in household wiring situations, AWG number 12 wire is rated at 23 Amps maximum, continuous duty. This leaves a safety margin.

G4D10:

When used in household wiring situations, AWG number 12 wire is rated at 23 Amps maximum, continuous duty.   This leaves a safety margin if a 20 Amp fuse or circuit-breaker is used.

G4D11:

When used in household wiring situations, AWG number 14 wire is rated at 17 Amps maximum, continuous duty. This leaves a safety margin if a 15 Amp fuse or circuit-breaker is used.

G4E01:

This is how microwave ovens work.   The heating effect will be deep within the tissues and the resulting damage could be painless.

G4E02:

You would not want you or any member of your family to be damaged by the heating effect of RF energy. At VHF and UHF frequencies, it is possible for reflected signals to result in local hot spots of high RF energy.

G4E03:

A dish antenna is designed to focus RF energy. The RF field strength in front of the antenna can be high. Your eyes are especially vulnerable to high RF field strengths.

G4E04:

You would not want you or any member of your family to be damaged by the heating effect of RF energy. At VHF and UHF frequencies, it is possible for reflected signals to result in local hot spots of high RF energy.

G4E05:

A dish antenna is designed to focus RF energy. The RF field strength in front of the antenna can be high. Your eyes are especially vulnerable to high RF field strengths.

G4E06:

Never underestimate the danger of high levels of RF energy.   Apart from the heating effect on tissues, it is also possible to get unpleasant skin burns from antennas, feeders and nearby metalwork.

G4E07:
Put a fence around it and instruct your family to keep away.

G4E08:

Never underestimate the danger of high levels of RF energy. Apart from the heating effect on tissues, it is also possible to get unpleasant skin burns from antennas, feeders and nearby metalwork. Also, NEVER look down a microwave feeder!

G4E09:

A high gain antenna is designed to focus RF energy; the RF field strength can be high even at some distance. Your eyes are especially vulnerable to high RF field strengths.

G4E10:

Never underestimate the danger of high levels of RF energy. Apart from the heating effect on tissues, it is also possible to get unpleasant skin burns from antennas, feeders and nearby metalwork.

G4E11:
The critical angle is related to ionospheric propagation. It has nothing to do with body tissues.

G5A01:

Impedance is the total opposition to AC caused by the combination of resistance in a circuit plus the reactance of the circuit.

G5A02:

Capacitors and inductors are common components in radio circuits. They both pass Alternating Current (AC) but they also oppose it. A voltage drop occurs across them.

G5A03:

Capacitors and inductors have reactance. Reactance is an opposition to the flow of Alternating Current (AC). Reactance is measured in Ohms. It varies with the frequency of the Alternating Current. An inductor has inductive reactance that increases with frequency. Press the NuTest "Formula" button for more details.

G5A04:

Capacitors and inductors have reactance. Reactance is an opposition to the flow of Alternating Current (AC). Reactance is measured in Ohms. It varies with the frequency of the Alternating Current. A capacitor has capacitive reactance that decreases with frequency. Press the NuTest "Formula" button for more details.

G5A05:

Capacitors and inductors have reactance. Reactance is an opposition to the flow of Alternating Current (AC). Reactance is measured in Ohms. It varies with the frequency of the Alternating Current. An inductor has inductive reactance that increases with frequency. Press the NuTest "Formula" button for more details.

G5A06:

Capacitors and inductors have reactance. Reactance is an opposition to the flow of Alternating Current (AC). Reactance is measured in Ohms. It varies with the frequency of the Alternating Current. A capacitor has capacitive reactance that decreases with frequency. Press the NuTest "Formula" button for more details.

G5A07:

Whenever a power source is connected to a load, maximum power transfer occurs when the two impedances are equal. Making sure that the impedance of the source and the load are equal is called "matching". It is important to match your antenna (the load) to your transceiver (the source) to obtain maximum power transfer of RF energy into the antenna.

G5A08:

Whenever a power source is connected to a load, maximum power transfer occurs when the two impedances are equal. Making sure that the impedance of the source and the load are equal is called "matching". It is important to match your antenna (the load) to your transceiver (the source) to obtain maximum power transfer of RF energy into the antenna.

G5A09:

Whenever a power source is connected to a load, maximum power transfer occurs when the two impedances are equal. Making sure that the impedance of the source and the load are equal is called "matching". It is important to match your antenna (the load) to your transceiver (the source) to obtain maximum power transfer of RF energy into the antenna.

G5A10:
The same unit (the Ohm) is used to describe both resistance and impedance.

G5A11:
The same unit (the Ohm) is used to describe both resistance and impedance.

G5B01:
For an explanation of decibels (dB's), press the NuTest "Formula" button.

G5B02:
For an explanation of decibels (dB's), press the NuTest "Formula" button.

G5B03:

6 dB is 3 dB + 3 dB and each 3 dB is a doubling.   Press the NuTest "Formula" button for an explanation of the decibel measuring system.

G5B04:

10 dB is a tenfold increase.   If the signal is ten times stronger than S9 then reducing it by a factor of 1500/150 = 10 will bring it down to S9.

G5B05:

20 dB is a hundredfold increase. If the signal is a hundred times stronger than S9 then reducing it by a factor of 1500/15 = 100 will bring it down to S9.

G5B06:

In parallel connected resistors, the current flow will divide between the resistors. In the case of two equal value resistors half the available current will flow through each resistor.

G5B07:

The total current flowing will always be the sum of the individual currents in each branch.   To visualize this, think of water in a stream splitting up into several streams.

G5B08:
Use the formula: P = (E x E) /R to get (400 X 400)/800 = 200 watts.

G5B09:
Use the formula: P = E x I to get 12 x 0.2 - 2.4 watts.

G5B10:
The question asks for "Watts." This is a unit of power. Use the formula: P = (I x I) x R = 0.061 Watts.
Then, convert: 0.061 Watts = 61 milliwatts.

G5B11:
A transformer can convert voltages. The conversion ratio is directly related to the turns ratio.

Vs/Vp = Ns/Np and so Vs (the secondary voltage) = (Ns/Np) x Vp.
This gives Vs = (500/2250) = 26.7 volts

Press the NuTest "Formula" button for more details.

G5B12:

In this case, we need to know the impedance transformation ratio of a transformer. It is related to the turns ratio by the formula: Np/Ns = square root of (Zp/Zs).

So we have Np/Ns = square root (600/4) = square root of (150) = 12.25

Press the NuTest "Formula" button for more details.

G5B13:

We need to know the impedance transformation ratio of a transformer. It is related to the turns ratio by the formula: (Np/Ns) squared = Zp/Zs.

We have Zp/Zs = (24/1) squared = 576.

So the speaker impedance is 2000/576 = 3.47 which is approximately 3.5 Ohms.

Press the NuTest "Formula" button for more details.

G5B14:

The Root Mean Squared (RMS) value is used in AC calculations to compensate for the fact the average voltage is not at the peak value for all the time.

G5B15:

To convert the Root Mean Squared (RMS) value to peak voltage we multiply it by 1.414 to get 169.7. However, the question asks for peak to peak voltage. Therefore, we need to multiply by 2 to get 169.7 x 2 = 339.4 volts.

G5B16:
To convert from peak voltage to Root Mean Squared (RMS) we divide 17 by 1.414 to get 12 Volts

G6A01:

The temperature coefficient of a resistor may be small if it is designed not to change with temperature. Some resistors are designed to have a large increase or decrease of resistance when the temperature changes. These devices can be used to measure temperature.

G6A02:

Electrolytic capacitors have relatively large values of capacitance for their size. They contain liquids or gels. With time, they can eventually dry out.

G6A03:

Transient voltage spikes are caused by switching of AC power in other parts of your house, in other houses, by local industry or on the power distribution network.   Transient voltage spikes can destroy the rectifiers in a power supply.

G6A04:

In a transformer, the primary winding is connected to the power source (usually your AC supply) and the secondary winding(s) to the load.

G6A05:

The magnetizing current is wasted current that ultimately ends up as heat in the iron core of the transformer.

G6A06:

Rectifiers are used in a power supply to convert the AC from the supply into DC that can be used by electronics equipment. If the peak inverse voltage rating is exceeded (by a transient voltage spike, for example) then the rectifier will fail.

G6A07:

Rectifiers are used in a power supply to convert the AC from the supply into DC that can be used by electronics equipment. If the peak inverse voltage rating is exceeded (by a transient voltage spike, for example) then the rectifier will fail. The rectifier will also heat up and fail if the average forward current rating is exceeded.

G6A08:

The capacitor allows transient voltage spikes to leak harmlessly around the rectifier. The resistance equalizes the reverse voltages across the rectifiers.

G6A09:

In a full wave rectifier, both the negative and positive parts of the AC waveform are switched to positive pulses at twice the supply frequency.   The higher frequency makes it easier to filter the waveform to get pure DC.

G6A10:

In a half wave rectifier, only half of the AC waveform is used. Only the positive part of the AC waveform is used. The negative portion is discarded. The output waveform is more difficult to filter because it consists of a series of pulses at the supply frequency.

G6A11:
Both the positive and negative parts of the AC waveform are used.

G7A01:

A filter capacitor that is in good condition is capable of storing a lethal charge for many hours after the supply is switched off. A power supply bleeder resistor is connected across the capacitor. When the power supply is switched off, it discharges the capacitor in a few seconds.

G7A02:

A filter capacitor that is in good condition is capable of storing a lethal charge for many hours after the supply is switched off. A power supply bleeder resistor is connected across the capacitor. When the power supply is switched off, it discharges the capacitor in a few seconds.

G7A03:
A power supply filter network can be regarded as a low pass filter.

G7A04:

This is because on one side there will be the supply voltage (which could be equal to the peak voltage if not much current is being drawn) and on the other side of the rectifier there will be the peak negative voltage. This will occur once per cycle of the supply waveform.

G7A05:

This is because on one side there will be the supply voltage (which could be equal to the peak voltage if not much current is being drawn) and on the other side of the rectifier there will be the peak negative voltage.   This will occur once per cycle of the supply waveform.

G7A06:

All items in the path between transmitter and antenna should have the same impedance. This satisfies the condition for maximum power transfer.

G7A07:
The filter removes the unwanted side band and further suppresses the carrier.

G7A08:

The balanced modulator mixes the audio signals with an RF carrier to produce a double side band suppressed carrier output.

G7A09:

The mixer, as its name suggests, mixes a local oscillator signal with the incoming amplified signal. This produces a difference frequency called the intermediate frequency (IF). This is then amplified and detected to produce an audio signal.

G7A10:

To detect a single side band signal, a reference signal at the position of the original carrier is required. This is provided by a beat frequency oscillator (BFO).

G7A11:
The IF amplifier gets the weak signals from the IF filter up to a level that the detector can handle.

G8A01:
That is why it is called amplitude modulation!

G8A02:

Phase modulation and frequency modulation are almost indistinguishable in practice.   It is the type of modulation circuit that is different.

G8A03:

Frequency modulation is mainly used on the VHF and UHF bands.   This is due to its inherently greater bandwidth.

G8A04:

Phase modulation and frequency modulation are almost indistinguishable in practice. It is the type of modulation circuit that is different.

G8A05:
Hence it is called Amplitude Modulation!

G8A06:
Part of the suppression occurs in the balanced modulator and the rest (about 20 dB) occurs in the filter.

G8A07:

If only side bands are transmitted, all the available transmitter power is used to convey speech information. Therefore, a single side band transmission can legally be three times as powerful as an equivalent double side band AM signal. All the legal power is focused into the single side band. The other side band and the carrier wave are discarded.

G8A08:

A Frequency Modulated signal can occupy a bandwidth of 10 - 20 kHz.   A phase modulated signal may occupy less space.   A double side band signal will occupy twice the required audio bandwidth giving 6 kHz.   A SSB transmission occupies only the required audio bandwidth of 3 kHz.

G8A09:

The extra emissions from an incorrectly used SSB transmitter are called splatter. If you cause splatter, you are advertising the fact that your transmitter is being used incorrectly or is faulty.

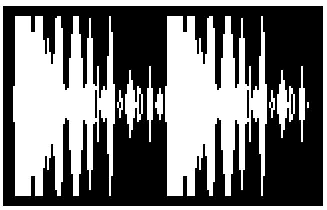
G8A10:

The ALC meter measures the amount by which your audio is automatically being turned down to avoid splatter.

G8A11:
Flat topping refers to the appearance of a badly overdriven SSB transmission on an oscilloscope.

Output of a correctly adjusted SSB transmitter;

Output of an overdriven SSB transmitter showing flat topping:



G8B01:

It is the job of a receiver mixer to convert all the RF frequencies to a standard frequency (the Intermediate Frequency).   The IF can then be filtered, amplified and detected.

G8B02:

When two signals are mixed, one result is a frequency corresponding to the difference between them. In the question, the difference 14.255 - 13.800 gives 0.455 MHz which is 455 kHz, the required intermediate frequency. However a signal on 13.345 MHz will also give a difference of 13.800 - 13.345 = 0.455 MHz which is 455 kHz. So the receiver will also receive this unwanted image signal. The solution is to filter the incoming RF before the mixer stage. The ability of a receiver to reject image frequencies is vital.

G8B03:

SSB transmitters do the signal generation and processing at a fixed frequency before it is mixed to obtain the required variable output frequency.

G8B04:

In FM transmitters it is common to modulate an oscillator at low frequency and then raise the frequency by selecting harmonics in several stages. This also has the effect of increasing the deviation and so the modulator deviation can be kept low to reduce distortion.

G8B05:

FM has a greater bandwidth than AM.   An amateur narrow band FM signal has a bandwidth of about 16 kHz.   This is greater than the permitted bandwidth below 29.5 MHz.

G8B06:
FM has a higher bandwidth than AM.
For a narrow band FM signal we can use:

Bandwidth = 2 (deviation + Maximum modulating frequency)
Giving 2 x (5 + 3) =16 kHz.

So an amateur narrow band FM signal has a bandwidth of about 16 kHz which is greater than the permitted bandwidth below 29.5 MHz

G8B07:

In an FM transmitter the frequency deviation is increased at each stage of frequency multiplication. In this question the frequency increase is 146.52/12.21 = 12 times. So to end up with a 5 kHz deviation we need to start off at the oscillator with a deviation of 5 kHz / 12 = 416.7 Hz.

G8B08:

As we increase the rate of information flow, the minimum bandwidth required increases. This is the case no matter what communication mode is used.

G8B09:
Anything that involves switching between two states is a digital transmission.

G8B10:
The transmitter power is at a maximum and it is the frequency that is being shifted.

G8B11:
This is another one of those amateur radio conventions.

G9A01:

The broadening of bandwidth with increasing element diameter is taken to extremes in the discone antenna. The single cone shaped element can have a frequency range of 10:1.

G9A02:

Beam elements are about half a wavelength long; 33 feet is 10 meters. At 14 MHz one wavelength is 20 meters. You can also use the formula: Driven Element Length = 472/(f in MHz) to get the required length.

G9A03:

Beam elements are about half a wavelength long; 21 feet is 15 meters. At 21.1 MHz one wavelength is 30 meters. You can also use the formula: Driven Element Length = 472/(f in MHz) to get the required length.

G9A04:

This question is tricky since 16.6 feet represents a half wavelength and looks correct. However, we are finding the length of a Yagi reflector. This is always slightly longer than the driven element.

Use the formula: Reflector Element Length = 490/(f in MHz).

Reflector Element Length = 490/28.1 = 17.5 feet (approximately).

G9A05:

In a Yagi the reflector is slightly longer than the driven element. The director(s) are slightly shorter than the driven element. If there are several directors they get progressively shorter with increasing distance from the driven element. Exact dimensions for amateur construction of Yagi antennas can be found in many amateur radio publications.

G9A06:

Generally, the more elements a Yagi antenna contains, the greater its gain will be. However, each added element has less effect. Eventually a law of diminishing returns applies.

G9A07:
Wide spaced Yagi antennas are less practical at HF because they are difficult to construct.

G9A08:
Anything that reduces the effects of overcrowding on this band is a good idea!

G9A09:

Front to back ratios of 15 - 25 dB's are common with Yagi antennas.   A good front to back ratio means that less of your RF power is wasted going in the opposite direction to that intended.

G9A10:
The main lobe is where the action is!   Your transmitted power will be focused there.

G9A11:

Exact dimensions for amateur construction of Yagi antennas can be found in many amateur radio publications. Generally, the more elements a Yagi antenna contains, the greater its gain will be. However, each added element has less effect. Eventually a law of diminishing returns applies. At UHF and VHF it is important that construction is accurate; inaccuracies of 1/8 inches can affect antenna performance at these frequencies.

G9B01:
Use the equation: Total element length (feet) = 1005/(frequency MHz).

This gives 1005/21.4 = 46.9 feet.

So, each side is 46.9/4 = 11.7 feet.

Press the NuTest "Formula" button for more details.

G9B02:
Use the equation: Total element length (feet) = 1005/(frequency MHz).

This gives 1005/14.3 = 70.27 feet.

So, each side is 70.27/4 = 17.6 feet.

Press the NuTest "Formula" button for more details.

G9B03:
The reflector is slightly longer than the driven element.
Use the equation: Total element length (feet) = 1030/(frequency MHz).

This gives 1030/29.6 = 34.8 feet.

So, each side is 34.8/4 = 8.7 feet.

Press the NuTest "Formula" button for more details.

G9B04:
Use the equation: Total element length (feet) = 1005/(frequency MHz).

This gives 1005/28.7 = 35 feet.

So, each side is 35/3 = 11.7 feet.

Press the NuTest "Formula" button for more details.

G9B05:
Use the equation: Total element length (feet) = 1005/(frequency MHz).

This gives 1005/24.9 = 40.36 feet.

So, each side is 40.36/3 = 13.45 feet.

Press the NuTest "Formula" button for more details.

G9B06:
Use the equation: Total element length (feet) = 1030/(frequency MHz).

This gives 1030/14.1 = 73 feet.

So, each side is 73/3 = 24.35 feet.

Press the NuTest "Formula" button for more details.

G9B07:
They are also less affected by being erected at low heights.

G9B08:
The "quad" is a good DX antenna for the HF bands.

G9B09:

Moving the feed point like this is equivalent to rotating the whole antenna around its horizontal axis by 90 degrees.

G9B10:

A good front to back ratio means that less of your RF power is wasted going on the opposite direction to that intended. A delta loop with no reflector or director will have a front to back ratio of 0 dB. In other words, equal power will be radiated in two directions.

G9B11:
The radiation pattern will have two main lobes in opposite directions.

G9C01:
The whole of the length of wire radiates RF energy right from the matching network output.

G9C02:

A random wire element will most likely NOT be resonant at the operating frequency. It will be reactive and the impedance may not be anywhere near 50 ohms. This is fine so long as an antenna matching unit is used.

G9C03:

This is because the antenna will be radiating along its entire length from the output of the antenna matching unit. Some of the antenna radiation will be in the station and could get into the audio circuits of your transceiver where it may be detected.

G9C04:

A ground plane antenna on a flat surface has an impedance of around 35 Ohms. This is not a good match to a 50 ohm feedline. Sloping the radials gives a better match.

G9C05:

A ground plane antenna on a flat surface has an impedance of around 35 Ohms. This is not a good match to a 50 ohm feedline. Sloping the radials gives a better match.

G9C06:

Maximum radiation is at right angles to the direction of the antenna. Little or no RF is radiated in the direction of the antenna.

G9C07:

On HF it is not easy to get an antenna high enough to completely eliminate effects of reflections from the ground. Excellent results can still be obtained at less than optimum height.

G9C08:
This is a sort of Yagi with one director.

G9C09:
This is a sort of Yagi with a reflector.

G9C10:

The wires can be buried just a few inches deep in a lawn. This can be done by cutting slots with a lawn edging tool. The radials should be soldered where they meet. Generally, the shorter the antenna the better the ground plane system should be.

G9C11:
This question has been withdrawn.

G9D01:
Parallel conductor line has very low losses.

G9D02:

A 50 Ohm feed line is preferred because this is closer to the feed impedance of most antennas as well as the output impedance of transceivers.

G9D03:
You will need to use an impedance matching network between your transceiver and this type of feedline.

G9D04:

Some antennas present an impedance of 50 ohms at the feed point. Others do not. Therefore, a matching system has to constructed at the feed point. You will hear terms such as gamma match and T-match. These are devices for matching feed lines to antenna feed points.

G9D05:

Some antennas present an impedance of 50 ohms at the feed point. Others do not. Therefore, a matching system has to constructed at the feed point. You will hear terms such as gamma match and T-match. These are devices for matching feed lines to antenna feed points.

G9D06:

The matching network would also match the 50 ohm output impedance of the transceiver to the 300 ohm feedline impedance.

G9D07:
In feed lines, the losses always increase as the signal frequency increases.

G9D08:

The following are some feedline losses for different types of coaxial cable operating at a frequency of 50 MHz.   All are given as dB of loss per 100 feet of cable.

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

G9D09:
The standing wave ratio is found by taking the ratio: (higher impedance) / (lower impedance).

G9D10:
The standing wave ratio is found by taking the ratio: (higher impedance) / (lower impedance).

G9D11:
The standing wave ratio is found by taking the ratio: (higher impedance) / (lower impedance).