GENERAL CLASS

Chapter 5.1~5.5

Radio Signals and Equipment

Chapter 5 Radio Signals and Equipment

5.1 Signal Review
5.2 Radio's Building Blocks
5.3 Transmitter Structure
5.4 Receiver Structure
5.5 HF Station Installation

5.1 Signal Review

page 5-1

Chapter 5.1

Now we are going to start diving deeper into the building blocks inside a radio.

If you want to brush up on schematics and blocks diagrams, see the schematic symbols on Page 4-8 of the General Class Manual.

5.1 Signal Review

page 5-1

Signal Review

Continuous Wave (CW) is a radio signal at one frequency whose amplitude does not change.

Adding information to the signal by changing the frequency, phase angle or amplitude is called **modulation**.

Recovering the information from a modulated signal is called **demodulation**.

5.1 Signal Review

page 5-1

Signal Review

If speech is used to modulate a signal, the result is a **voice mode** or **phone** signal. FM, AM, SSB are examples of voice mode signals.

If data is used to modulate a signal, the result is a **digital mode** signal. RTTY, CW, PSK31, JT65, SSTV and several other digital mode signals are used on the ham bands today.

5.1 Signal Review

page 5-1~2

Amplitude Modulated Modes

Varying the power or amplitude of a signal adds speech or data information is called amplitude modulation or **AM**.

The information is contained in the signal envelope. This is the maximum values of the instantaneous power (peaks) of each cycle.

The AM signal is made up of the **carrier and two sidebands**. The carrier does not have any information, only the sidebands have data.

5.1 Signal Review

page 5-1~2

Amplitude Modulated Modes

AM signal with the carrier and one sideband removed is called a single sideband signal **SSB.**

SSB transmissions have more range than AM because all the signal power is contained in the one side band which carries the information.

AM signals are wider and have a fuller frequency response than SSB so they sound "warmer" but may have more noise.

5.1 Signal Review

page 5-2

Angle Modulated Modes

Modes that vary the frequency of a signal to add speech or data are called frequency modulation **FM**.

The frequency is varied by the instantaneous amplitude of the modulating signal and is called **deviation**.

The same circuit can demodulate FM or PM signals. **FM and PM signals are constant power**.

5.1 Signal Review

page 5-2

Bandwidth Definition

The FCC limits the **signal bandwidth** so that many stations and signal can share the limited amount of spectrum space.

See Table 5.1 for the typical bandwidths of different signal types.

AM – 6 KHz
FM voice – 5 to 16 KHz
CW – up to 300 Hz
SSB – 3 KHz
Digital mode using SSB – 50 to 3000 Hz
Amateur TV – 6 MHz

5.1 Signal Review

page 5-2

G8A02

What is the name of the process that changes the phase angle of an RF wave to convey information?

A. Phase convolution
B. Phase modulation
C. Angle convolution
D. Radian inversion

5.1 Signal Review

page 5-2

G8A03

What is the name of the process that changes the instantaneous frequency of an RF wave to convey information?

A. Frequency convolution
B. Frequency transformation
C. Frequency conversion
D. Frequency modulation

5.1 Signal Review

page 5-2

G8A07

Which of the following phone emissions uses the narrowest bandwidth?

A. Single sideband
B. Double sideband
C. Phase modulation
D. Frequency modulation

5.2 Radio's Building Blocks

page 5-3

Chapter 5.2

Radios are made up from fundamental circuits.

In this section we will cover four types of circuits; **Oscillators**, **Mixers**, **Multipliers** and **Modulators**.

5.2 Radio's Building Blocks

page 5-3

Oscillators

The function of most oscillators is to produce a **pure sine wave** with no noise or distortion.

The **feedback circuit** in the oscillator must include a filter so that feedback is only present at the intended frequency.

LC (Coil+Capacitor) oscillators are more stable than RC oscillators and are used in lots of equipment.

5.2 Radio's Building Blocks

page 5-3

Mixers

A key function in both receivers and transmitters to be able to change frequency of a signal.

Mixer will produce **4 output frequencies**. The output frequencies will be the input frequencies along with the sum and differences of the two input frequencies.

The **local oscillator** is the frequency that you control to be able to receive the desired frequency.

5.2 Radio’s Building Blocks

page 5-4

Multipliers

Instead of the sum and difference of a mixer, a multiplier creates a **harmonic of the input frequency**. Multipliers are often used when a stable VHF or UHF signal is required.

5.2 Radio's Building Blocks

page 5-4

Modulators

Modulators are the circuits which perform the neat trick of adding information to a carrier signal (modulation) using **amplitude**, **frequency** or **phase variations**.

5.2 Radio's Building Blocks

page 5-5~5

Amplitude Modulators

AM was first generated by varying the power supply voltage to the output circuit of a CW transmitter. As the voltage is varied, the **amplitude of the output signal follows** and this is called plate modulation.

Care should be observed when operating close the edge of your licensed band. **USB** signals are modulated **higher** than the frequency on the dial and **LSB** is **lower** by about 3 KHz.

5.2 Radio's Building Blocks

page 5-6

Frequency and Phase Modulators

FM modulation only **changes the frequency**.

PM modulation **changes the frequency and amplitude** of the signal.

To create phase modulation, the reactance modulator is connected to a tuned RF amplifier following the oscillator. The phase is changed but the average frequency will not changed.

5.2 Radio's Building Blocks

page 5-5

G4D08

What frequency range is occupied by a 3 kHz LSB signal when the displayed carrier frequency is set to 7.178 MHz?

A. 7.178 to 7.181 MHz
B. 7.178 to 7.184 MHz
C. 7.175 to 7.178 MHz
D. 7.1765 to 7.1795 MHz

5.2 Radio's Building Blocks

page 5-5

G4D09

What frequency range is occupied by a 3 kHz USB signal with the displayed carrier frequency set to 14.347 MHz?

A. 14.347 to 14.647 MHz
B. 14.347 to 14.350 MHz
C. 14.344 to 14.347 MHz
D. 14.3455 to 14.3485 MHz

5.2 Radio's Building Blocks

page 5-5

G4D10

How close to the lower edge of the 40-meter General Class phone segment should your displayed carrier frequency be when using 3 kHz wide LSB?

A. At least 3 kHz above the edge of the segment
B. At least 3 kHz below the edge of the segment
C. Your displayed carrier frequency may be set at the edge of the segment
D. At least 1 kHz above the edge of the segment

5.2 Radio's Building Blocks

page 5-6

G8A04

What emission is produced by a reactance modulator connected to a transmitter RF amplifier stage?

A. Multiplex modulation
B. Phase modulation
C. Amplitude modulation
D. Pulse modulation

5.2 Radio's Building Blocks

page 5-4

G8B01

What receiver stage combines a 14.250 MHz input signal with a 13.795 MHz oscillator signal to produce a 455 kHz intermediate frequency (IF) signal?

A. Mixer
B. BFO
C. VFO
D. Discriminator

5.2 Radio's Building Blocks

page 5-4

G8B03

What is another term for the mixing of two RF signals?

A. Heterodyning
B. Synthesizing
C. Cancellation
D. Phase inverting

5.3 Transmitter Structure

page 5-7

Chapter 5.3

Transmitters produce **AM**, **CW**, **SSB** and **FM** signals.

The goal for you to transmit a signal you can be proud of every time.

5.3 Transmitter Structure

page 5-7

AM Modes

All amplitude modulated signals (**CW, AM and SSB**) can be generated by the same basic transmitter structure.

Transmitters using DSP (digital signal processor) and SDR (software defined radio) techniques perform the same modulation functions using mathematical operations in a computer chip.

5.3 Transmitter Structure

page 5-7

CW Transmitters

The simplest CW transmitter is a two-stage transmitter consisting of an **oscillator and an amplifier** with the amplifier turned on and off by a key or keyer. See Figure 5.9.

Figure 5.10 allows us to change the output frequency with the VFO (knob on transmitter). This one uses different crystals in the LO circuit.

5.3 Transmitter Structure

page 5-8

SSB Phone Transmitters

Voice signals from a microphone are processed by a speech amplifier and input to the balanced modulator. The output is a **DSB signal**, so a **filter is required to remove the undesired sideband**.

160, 75(80) and 40 meters use **LSB**.
60, 20, 17, 15, 12 and 10 meters use **USB** signals. VHF and UHF use **USB** signals.
See Figure 5.11.

5.3 Transmitter Structure

page 5-8

SSB Phone Transmitters

Split-Frequency operation is a technique of **transmitting** on one frequency and **receiving** on another frequency that is close to the transmitter frequency with **2 VFOs**.

This is used by most DX-expeditions, contesters or some special event stations. This type of operation is similar to handheld 2m and 70cm operation but you are involved in setting the frequency difference.

5.3 Transmitter Structure

page 5-9

FM Transmitters

Practical and inexpensive FM signals can be generated by **modulating at a low frequency and multiply it** to the desired band using a frequency multiplier.

If the modulating frequency is about 12 MHz then 12^{th} harmonic for transmission and the deviation needs to be $1/12^{th}$ of the final deviation of 5 KHz so this would be 416.7 Hz. This is a test question from the pool.

5.3 Transmitter Structure

page 5-9~10

Signal Quality

Operating a transmitter so that the on-the-air signal is **intelligible and does not have excessive bandwidth** is an important part of operating.

Poor signal quality causes excessive bandwidth and can interfere with other operators. Excessive microphone gain or poorly designed linear amplifiers that produce excessive harmonics are common sources of interference. All of these conditions will sound bad and have harmonics outside the intended frequency.

5.3 Transmitter Structure

page 5-10~11

Overmodulation – AM Modes

If the amplitude of an AM or SSB signal is varied excessively then this is called **overmodulation** and can cause flat-topping or clipping. When output signal is clipping then the signal will **generate spurious signals** and have **wider bandwidth** than allowed.

Automatic level control (ALC) circuit should only activate on voice peaks. Two-tone test (700 and 1900 Hz) can be used to adjust gain and level settings for distortion free output. Reducing microphone gain to limit ALC response can help also.

5.3 Transmitter Structure

page 5-11

Speech Processing

Voice signals have a very low average power as compared to CW. Human speech spreads its energy over a wide frequency range with only short periods of high sound levels. When transmitted over HF, an amplitude-modulated signal can be difficult to understand. Speech processing can **increase the average power** without creating distortion and make it easier to understand in difficult conditions. Speech processing requires careful adjustments because too much speech processing can cause distortion. Adding gain to the mid-band audio signals is preferred.

5.3 Transmitter Structure

page 5-12

Overdeviation – FM and PM

FM signals can be overmodulated but instead of distortion the **signal envelope has excessive deviation (frequency changes more than the receiver is expecting)**.

The result of overdeviation is **distortion of the received signal (not transmitted signal)** and might interfere with adjacent channels. Transmitter signal will not be distorted but will contain too wide of a frequency change (deviation) for the receiver to accurate demodulate it back to normal speech.

5.3 Transmitter Structure

page 5-12

Key Clicks

Key clicks are sharp transient clicking sounds heard on adjacent frequencies as the transmitter turns on and off too quickly during CW transmission. If the leading and trailing edges of the **CW key output are too steep (fast)** then key clicks may be generated. Most radios have configuration settings to control this condition. An RC (resistor+capacitor) circuit on the CW key can also help with this condition.

See Figure 5.14 Key closure is very sharp in example.

5.3 Transmitter Structure

page 5-12~13

Amplifiers

Many HF operators use an amplifier (linear) to **increase their radio's output power** when band conditions are poor, propagation conditions difficult or when running nets so that they can be heard easily.

Modes such as SSB require **linear amplifiers** that accurately reproduce the input signal waveform.

Class A is the most linear of all classes but gain is limited. Class C amplifiers (CW) are active for less than one-half of the signal's cycle and would be considered non-linear. Class AB is common for SSB signals.

5.3 Transmitter Structure

page 5-13

Tuning and Driving a Linear Amplifier

Amplifiers have three primary adjustments: **BAND**, **TUNE** and **LOAD**. 'No-tune' or 'auto-tune' amplifiers make adjustments by design or with microcontroller control.

With band switch set properly, use a small amount of power to adjust the TUNE control for minimize plate current and then adjust the LOAD control for maximum plate current. Then increase the drive to the normal value and recheck. Drive power should be checked on grid-driven amplifiers and solid-state amps so that excessive current does not occur.

5.3 Transmitter Structure

page 5-13~4

Neutralization

High power RF amps can become a VHF oscillator.

We want the amplifier to only amplify and not oscillate. If it oscillates on its own, it can overheat and produce excessive harmonics. It can cause amp failure.

So a little bit of **negative feedback** is sent back to the input with a variable cap to keep it from oscillating.

Once the neutralization process is done, it will not need to be done again unless the tubes are changed.

5.3 Transmitter Structure

page 5-8

G4A03

What is normally meant by operating a transceiver in "split" mode?

A. The radio is operating at half power
B. The transceiver is operating from an external power source
C. The transceiver is set to different transmit and receive frequencies
D. The transmitter is emitting an SSB signal, as opposed to DSB operation

5.3 Transmitter Structure

page 5-13

G4A04

What reading on the plate current meter of a vacuum tube RF power amplifier indicates correct adjustment of the plate tuning control?

A. A pronounced peak
B. A pronounced dip
C. No change will be observed
D. A slow, rhythmic oscillation

5.3 Transmitter Structure

page 5-13

G4A05

What is a reason to use Automatic Level Control (ALC) with an RF power amplifier?

A. To balance the transmitter audio frequency response
B. To reduce harmonic radiation
C. To reduce distortion due to excessive drive
D. To increase overall efficiency

5.3 Transmitter Structure

page 5-13

G4A07

What condition can lead to permanent damage to a solid-state RF power amplifier?

A. Insufficient drive power
B. Low input SWR
C. Shorting the input signal to ground
D. Excessive drive power

5.3 Transmitter Structure

page 5-11

G4D01

What is the purpose of a speech processor as used in a modern transceiver?

A. Increase the intelligibility of transmitted phone signals during poor conditions
B. Increase transmitter bass response for more natural sounding SSB signals
C. Prevent distortion of voice signals
D. Decrease high-frequency voice output to prevent out of band operation

5.3 Transmitter Structure

page 5-11

G4D03

Which of the following can be the result of an incorrectly adjusted speech processor?

A. Distorted speech
B. Splatter
C. Excessive background pickup
D. All of these choices are correct

5.3 Transmitter Structure

page 5-13

G7B11

For which of the following modes is a Class C power stage appropriate for amplifying a modulated signal?

A. SSB
B. CW
C. AM
D. All of these choices are correct

5.3 Transmitter Structure

page 5-13

G7B12

Which of these classes of amplifiers has the highest efficiency?

A. Class A
B. Class B
C. Class AB
D. Class C

5.3 Transmitter Structure

page 5-8

G7C02

Which circuit is used to combine signals from the carrier oscillator and speech amplifier then send the result to the filter in some single sideband phone transmitters?

A. Discriminator
B. Detector
C. IF amplifier
D. Balanced modulator

5.3 Transmitter Structure

page 5-9

G8B06

What is the total bandwidth of an FM phone transmission having 5 kHz deviation and 3 kHz modulating frequency?

A. 3 kHz
B. 5 kHz
C. 8 kHz
D. 16 kHz

5.3 Transmitter Structure

page 5-9

G8B07

What is the frequency deviation for a 12.21 MHz reactance modulated oscillator in a 5 kHz deviation, 146.52 MHz FM phone transmitter?

A. 101.75 Hz
B. 416.7 Hz
C. 5 kHz
D. 60 kHz

5.4 Receiver Structure

page 5-14

Chapter 5.4

"You can't work them, if you can't hear them"

That makes the **receiver** just about the most important part of the ham shack. DSP and SDR techniques are quickly replacing analog receivers.

Some of us will add that a decent antenna is also important to be able to communicate effectively.

5.4 Receiver Structure

page 5-14~16

Basic Superheterodyne Receivers

Most analog receivers today use some type of **superheterodyne** designs and is commonly called "superhet".

The simplest combination of stages to make a superhet receiver is an **HF oscillator, mixer and detector**.

SSB and CW signals can be demodulated by a **product detector**. AM signals can use a product detector or envelope detector. FM signals use a **discriminator** or **quadrature detector** to demodulate information.

5.4 Receiver Structure

page 5-14~16

Basic Superheterodyne Receivers

Superhet receivers do have a weakest in that there can be two frequencies that will mix to produce the **IF frequency, typically 455 KHz**.

The mixer uses the sum and difference of the frequencies so filtering is needed to select the correct frequency. The undesired frequency is called an **image frequency**.

5.4 Receiver Structure

page 5-16~17

Digital Signal Processing

DSP technology requires an analog receiver front end to tune in a signal. **DSP technology replaces some of the analog circuitry with software.** Once prepared by the front end, the signal is converted into a digital form by the ADC (analog to digital converter), manipulated by software to decode the data and then converted back into analog by the DAC (digital to analog converter).

Radios with **DSP offer selectable filters to adjust filter bandwidth and shape**. Noise reduction is possible with DSP processing. **Notch filter and Noise Reduction (NB)** can remove noise sources from the desired signal.

5.4 Receiver Structure

page 5-17

Managing Receiver Gain

Receivers need a **lot of gain** to receive the weak signal from the antenna which may be only a few microvolts of RF signal. Good receivers can detect signals with much less than 1 microvolt of amplitude.

Too little gain and we can’t receive the signal but too much gain can cause its own problems, like feedback and/or oscillation.

5.4 Receiver Structure

page 5-17

Managing Receiver Gain – S meter reading

S-reading	HF		Signal Generator emf
	µV (50Ω)	dBm	dB above 1uV
S9+10dB	160.0	-63	44
S9	50.2	-73	34
S8	25.1	-79	28
S7	12.6	-85	22
S6	6.3	-91	16
S5	3.2	-97	10
S4	1.6	-103	4
S3	0.8	-109	-2
S2	0.4	-115	-8
S1	0.2	-121	-14

5.4 Receiver Structure

page 5-17~18

RF Gain and Automatic Gain Control

The amount of **receiver gain** is set by the RF gain control. Once you have tuned in a signal, maximum gain isn't required and may add extra noise to the signal audio. Lower values of gain can reduce the background noise heard in the audio output.

The automatic gain control **AGC** circuit adjusts receiver gain by changing the IF amplifier gain. This voltage is also read by the S meter and each unit is equal to 6 dB. S-9 is the midpoint of the S meter so a signal that is **+20 dB is 100 times** stronger than S-9.

5.4 Receiver Structure

page 5-18

Receiver Linearity

It is **important for the receiver and transmitter to be linear** when processing signals. If the received **signal is distorted in the receiver** then it will appear the same as if the transmitting signal emitted them.

The most common form of receiver nonlinearity is **overload** or **gain compression**. Overload happens when the input simply too strong for the circuitry to handle. The solution to overload is to use the **attenuator** circuit to reduce signal levels overall.

5.4 Receiver Structure

page 5-16

G4A01

What is the purpose of the "notch filter" found on many HF transceivers?

A. To restrict the transmitter voice bandwidth
B. To reduce interference from carriers in the receiver passband
C. To eliminate receiver interference from impulse noise sources
D. To enhance the reception of a specific frequency on a crowded band

5.4 Receiver Structure

page 5-16

G4A11

Which of the following is a use for the IF shift control on a receiver?

A. To avoid interference from stations very close to the receive frequency
B. To change frequency rapidly
C. To permit listening on a different frequency from that on which you are transmitting
D. To tune in stations that are slightly off frequency without changing your transmit frequency

5.4 Receiver Structure

page 5-17

G4C11

Which of the following is a function of a digital signal processor?

A. To provide adequate grounding
B. To remove noise from received signals
C. To increase antenna gain
D. To increase antenna bandwidth

5.4 Receiver Structure

page 5-17

G4C12

Which of the following is an advantage of a receiver DSP IF filter as compared to an analog filter?

A. A wide range of filter bandwidths and shapes can be created
B. Fewer digital components are required
C. Mixing products are greatly reduced
D. The DSP filter is much more effective at VHF frequencies

5.4 Receiver Structure

page 5-11

G4D04

What does an S meter measure?

A. Conductance
B. Impedance
C. Received signal strength
D. Transmitter power output

5.4 Receiver Structure

page 5-18

G4D05

How does a signal that reads 20 dB over S9 compare to one that reads S9 on a receiver, assuming a properly calibrated S-meter?

A. It is 10 times less powerful
B. It is 20 times less powerful
C. It is 20 times more powerful
D. It is 100 times more powerful

5.4 Receiver Structure

page 5-14

G7C03

What circuit is used to process signals from the RF amplifier and local oscillator then send the result to the IF filter in a superheterodyne receiver?

A. Balanced modulator
B. IF amplifier
C. Mixer
D. Detector

5.4 Receiver Structure

page 5-22

G4C04

What is the effect on an audio device or telephone system if there is interference from a nearby CW transmitter?

A. On-and-off humming or clicking
B. A CW signal at a nearly pure audio frequency
C. A chirpy CW signal
D. Severely distorted audio

5.4 Receiver Structure

page 5-14

G7C07

What is the simplest combination of stages that implement a superheterodyne receiver?

A. RF amplifier, detector, audio amplifier
B. RF amplifier, mixer, IF discriminator
C. HF oscillator, mixer, detector
D. HF oscillator, prescaler, audio amplifier

5.4 Receiver Structure

page 5-17

G7C11

What is meant by the term "software defined radio" (SDR)?

A. A radio in which most major signal processing functions are performed by software
B. A radio that provides computer interface for automatic logging of band and frequency
C. A radio that uses crystal filters designed using software
D. A computer model that can simulate performance of a radio to aid in the design process

5.4 Receiver Structure

page 5-16

G8B02

If a receiver mixes a 13.800 MHz VFO with a 14.255 MHz received signal to produce a 455 kHz intermediate frequency (IF) signal, what type of interference will a 13.345 MHz signal produce in the receiver?

A. Quadrature noise
B. Image response
C. Mixer interference
D. Intermediate interference

5.5 HF Station Installation

page 5-19

Chapter 5.5

A working station can be at home or in a vehicle.

HF operating with longer wavelength and maybe higher power can make **RF grounding and interference control more important**.

The General class exam focuses on three related areas: **mobile installations, RF grounding and RF interference**.

5.5 HF Station Installation

page 5-19

Mobile Installations

HF operation is less popular than in the past as hams have turned to VHF and UHF on the road. Compact all-band, all-mode radios have increased HF mobile operations. Icom IC-718, Yaseu FT-857 and Kenwood TS-480 are examples of these mobile radios.

If you have issues getting a mobile system operating, please ask an Elmer or any knowledgeable ham for assistance.

5.5 HF Station Installation

page 5-19

Power Connections

Mobile rigs are capable of putting out 100W and **can need 20 amps or more** so good wiring is needed.

Cigarette lighter ports do not have enough power to run a 100 W radio. That is about 8 amps of power.

All of the **vehicle body panels may not be connected to Chassis Ground** so you should check and add large ground straps if needed. Wide straps provide better RF ground than a single wire.

5.5 HF Station Installation

page 5-19

Antenna Connections

The most significant limitation of mobile operation is that the antenna system must be smaller than a home station. This is particularly true of 75/80 meter band.

When mobile, the **entire vehicle becomes part of the antenna system**. Important points about mobile stations are for example: use the **most efficient antenna** you can get, make sure **RF ground connections** to the vehicle are good and **mount the antenna where it is clear of metal surfaces**.

5.5 HF Station Installation

page 5-19~20

Mobile Interference

HF mobile interference is different from the home station. **Ignition noise** caused by spark plugs can be quite strong. Vehicle accessories and other systems can cause interference.

Other common sources of interfering signals can include: **on-board vehicle computer**, **fuel pumps**, **window controls** and **battery charging systems**.

5.5 HF Station Installation

page 5-20~21

RF Grounding and Ground Loops

Although a **good station ground is important** to prevent electrical shock but at HF and higher frequencies the AC safety ground can act more like an antenna than a ground. See Figure 5.18

Make all ground connections as short as possible to minimize voltage differences between your equipment. If the ground connection approaches an odd number of ¼ wavelengths then it will present a high impedance which will allow voltages to exist on your equipment. **Ground loops** happen when a continuous path exists around a series of equipment enclosures.

5.5 HF Station Installation

page 5-21~22

RF Interference

Radiating a good signal means that you may discover some **unintentional listeners** in nearby receivers and consumer electronics.

Spurious emissions from HF station may be received by radio or TV equipment. Use a low-pass filter to remove the spurious emissions at the station and match the low-pass filter impedance with the impedance of the feed line used. Any spark or sustained arc creates radio noise over a wide range of frequencies. **Remember Spark transmitters???**

5.5 HF Station Installation

page 5-21~22

RF Interference Suppression

The best solution to many types of interference is to **keep the RF signals from entering the equipment**.

Ferrite beads and cores can be placed on cables to prevent RF common-mode current from flowing on the outside of cable braids or shields. Computer and video monitor cables have used them for years.

Interference to audio equipment can sometimes be eliminated by placing a small **bypass cap** (100 pF to 1 nF) across the balanced line or to ground on single ended line.

5.5 HF Station Installation

page 5-20

G4A15

Which of the following can be a symptom of transmitted RF being picked up by an audio cable carrying AFSK data signals between a computer and a transceiver?

A. The VOX circuit does not un-key the transmitter
B. The transmitter signal is distorted
C. Frequent connection timeouts
D. All of these choices are correct

5.5 HF Station Installation

page 5-22

G4C01

Which of the following might be useful in reducing RF interference to audio frequency devices?

A. Bypass inductor
B. Bypass capacitor
C. Forward-biased diode
D. Reverse-biased diode

5.5 HF Station Installation

page 5-22

G4C04

What is the effect on an audio device or telephone system if there is interference from a nearby CW transmitter?

A. On-and-off humming or clicking
B. A CW signal at a nearly pure audio frequency
C. A chirpy CW signal
D. Severely distorted audio

5.5 HF Station Installation

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G4C05

What might be the problem if you receive an RF burn when touching your equipment while transmitting on an HF band, assuming the equipment is connected to a ground rod?

A. Flat braid rather than round wire has been used for the ground wire
B. Insulated wire has been used for the ground wire
C. The ground rod is resonant
D. The ground wire has high impedance on that frequency

5.5 HF Station Installation

page 5-20

G4C07

What is one good way to avoid unwanted effects of stray RF energy in an amateur station?

A. Connect all equipment grounds together
B. Install an RF filter in series with the ground wire
C. Use a ground loop for best conductivity
D. Install a few ferrite beads on the ground wire where it connects to your station

5.5 HF Station Installation

page 5-21

G4C09

How can a ground loop be avoided?

A. Connect all ground conductors in series
B. Connect the AC neutral conductor to the ground wire
C. Avoid using lock washers and star washers when making ground connections
D. Connect all ground conductors to a single point

5.5 HF Station Installation

page 5-21

G4C10

What could be a symptom of a ground loop somewhere in your station?

A. You receive reports of "hum" on your station's transmitted signal
B. The SWR reading for one or more antennas is suddenly very high
C. An item of station equipment starts to draw excessive amounts of current
D. You receive reports of harmonic interference from your station

5.5 HF Station Installation

page 5-19

G4E03

Which of the following direct, fused power connections would be the best for a 100 watt HF mobile installation?

A. To the battery using heavy gauge wire
B. To the alternator or generator using heavy gauge wire
C. To the battery using resistor wire
D. To the alternator or generator using resistor wire

5.5 HF Station Installation

page 5-19

G4E05

Which of the following most limits the effectiveness of an HF mobile transceiver operating in the 75-meter band?

A. "Picket Fencing" signal variation
B. The wire gauge of the DC power line to the transceiver
C. The antenna system
D. FCC rules limiting mobile output power on the 75-meter band

5.5 HF Station Installation

page 5-20

G4E07

Which of the following may cause interference to be heard in the receiver of an HF radio installed in a recent model vehicle?

A. The battery charging system
B. The fuel delivery system
C. The vehicle control computer
D. All of these choices are correct

5.5 HF Station Installation

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G7C06

What should be the impedance of a low-pass filter as compared to the impedance of the transmission line into which it is inserted?

A. Substantially higher
B. About the same
C. Substantially lower
D. Twice the transmission line impedance

Chapter 5 Radio Signal and Equipment

Remember to study ALL questions in your chapters.