2020-2024 Extra Class FCC Element 4 Question Pool Effective July 1, 2020

Created April 17, 2024

Which of the following carrier frequencies is illegal for LSB AFSK emissions on the 17 meter band RTTY and data

segment of 18.068 to 18.110 MHz?

A. 18.068 MHz

When using a transceiver that displays the carrier frequency of phone signals, which of the following displayed frequencies represents the lowest frequency at which a properly adjusted LSB emission will be totally within the band?

D. 3 kHz above the lower band edge

What is the maximum legal carrier frequency on the 20 meter band for transmitting USB AFSK digital signals

having a 1 kHz bandwidth?

C. 14.149 MHz

With your transceiver displaying the carrier frequency of phone signals, you hear a DX station calling CQ on 3.601 MHz LSB. Is it legal to return the call using lower sideband on the same frequency?

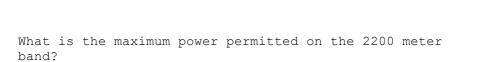
C. No, the sideband will extend beyond the edge of the phone band segment

What is the maximum power output permitted on the 60 meter band?

C. 100 watts PEP effective radiated power relative to the gain of a half-wave dipole

Where must the carrier frequency of a CW signal be set to comply with FCC rules for 60 meter operation?

B. At the center frequency of the channel



C. 1 watt EIRP (Equivalent isotropic radiated power)

If a station in a message forwarding system inadvertently

forwards a message that is in violation of FCC rules, who is primarily accountable for the rules violation?

B. The control operator of the originating station

What action or actions should you take if your digital message forwarding station inadvertently forwards a communication that violates FCC rules?

A. Discontinue forwarding the communication as soon as you become aware of it

If an amateur station is installed aboard a ship or aircraft, what condition must be met before the station is operated?

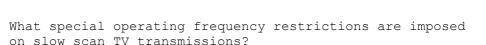
A. Its operation must be approved by the master of the ship or the pilot in command of the aircraft

licensing required when operating an amateur station

aboard a U.S.-registered vessel in international waters?

B. Any FCC-issued amateur license

Which of the following describes authorization or



on sign sound it standards fond.

C. They are restricted to phone band segments

Who must be in physical control of the station apparatus of an amateur station aboard any vessel or craft that is documented or registered in the United States?

B. Any person holding an FCC issued amateur license or

who is authorized for alien reciprocal operation

Except in some parts of Alaska, what is the maximum power permitted on the 630 meter band?

D. 5 watts EIRP

Which of the following constitutes a spurious emission?

D. An emission outside the signal's necessary bandwidth that can be reduced or eliminated without affecting the

information transmitted

Which of the following is an acceptable bandwidth for

Digital Radio Mondiale (DRM) based voice or SSTV digital

transmissions made on the HF amateur bands?

A. 3 kHz

Within what distance must an amateur station protect an FCC monitoring facility from harmful interference?

A. 1 mile

What must be done before placing an amateur station within an officially designated wilderness area or wildlife preserve, or an area listed in the National Register of Historic Places?

C. An Environmental Assessment must be submitted to the FCC

What is the National Radio Quiet Zone?

C. An area surrounding the National Radio Astronomy

Observatory

Which of the following additional rules apply if you are installing an amateur station antenna at a site at or near a public use airport?

A. You may have to notify the Federal Aviation

Administration and register it with the FCC as required
by Part 17 of the FCC rules

To what type	of regulations does PR	B-1 apply?
C. State and	local zoning	

What limitations may the FCC place on an amateur station if its signal causes interference to domestic broadcast reception, assuming that the receivers involved are of good engineering design?

D. The amateur station must avoid transmitting during certain hours on frequencies that cause the interference

Which amateur stations may be operated under RACES rules?

C. Any FCC-licensed amateur station certified by the

responsible civil defense organization for the area served

What	frequ	uencies	are	authorized	to	an	amateur	station	
opera	ating	under	RACES	rules?					

A. All amateur service frequencies authorized to the control operator

What	does	PRB-1	require	of	regulations	affecting	amateur	
radio	7.3							

B. Reasonable accommodations of amateur radio must be made

What must the control operator of a repeater operating in the 70 cm band do if a radiolocation system experiences interference from that repeater?

A. Cease operation or make changes to the repeater to mitigate the interference

What is the maximum bandwidth for a data emission on 60

D. 2.8 kHz

meters?

Which of the following types of communications may be transmitted to amateur stations in foreign countries?

C. Communications incidental to the purpose of the amateur service and remarks of a personal nature

How do the control operator responsibilities of a station under automatic control differ from one under local control?

B. Under automatic control the control operator is not required to be present at the control point

What is meant by IARP?

A. An international amateur radio permit that allows U.S.

amateurs to operate in certain countries of the Americas

When may an automatically controlled station originate third party communications?

A. Never

Which of the following is required in order to operate in

C. You must bring a copy of FCC Public Notice DA 16-1048

permitted?

accordance with CEPT rules in foreign countries where

At what level below a signal's mean power level is its bandwidth determined according to FCC rules?

D. 26 dB

What is the maximum permissible duration of a remotely controlled station's transmissions if its control link

malfunctions?

B. 3 minutes

What is the highest modulation index permitted at the highest modulation frequency for angle modulation below 29.0 MHz?

B. 1.0

What is the permitted mean power of any spurious emission relative to the mean power of the fundamental emission from a station transmitter or external RF amplifier installed after January 1, 2003 and transmitting on a frequency below 30 MHz?

A. At least 43 dB below

Which of the following operating arrangements allows an FCC-licensed U.S. citizen to operate in many European countries, and alien amateurs from many European countries to operate in the U.S.?

A. CEPT agreement

On what portion of the 630 meter band are phone emissions permitted?

D. The entire band

What notifications must be given before transmitting on the 630 meter or 2200 meter bands?

C. Operators must inform the Utilities Technology Council

(UTC) of their call sign and coordinates of the station

How long must an operator wait after filing a notification with the Utilities Technology Council (UTC) before operating on the 2200 meter or 630 meter band?

B. Operators may operate after 30 days, providing they have not been told that their station is within 1 km of PLC systems using those frequencies

What is the definition of telemetry?

A. One-way transmission of measurements at a distance

from the measuring instrument

Which of the following may transmit special codes

intended to obscure the meaning of messages?

A. Telecommand signals from a space telecommand station

What is a space telecommand station?

B. An amateur station that transmits communications to initiate, modify or terminate functions of a space station

Which of the following is required in the identification

transmissions from a balloon-borne telemetry station?

A. Call sign

What must be posted at the station location of a station being operated by telecommand on or within 50 km of the earth's surface?

D. All these choices are correct

What is the maximum permitted transmitter output power when operating a model craft by telecommand?

A. 1 watt

Which HF amateur bands have frequencies authorized for space stations?

A. Only the 40, 20, 17, 15, 12, and 10 meter bands

Which VHF amateur bands have frequencies authorized for space stations?

D. 2 meters

Which UHF amateur bands have frequencies authorized for space stations?

B. 70 cm and 13 cm

Which amateur stations are eligible to be telecommand stations of space stations (subject to the privileges of the class of operator license held by the control operator of the station)?

B. Any amateur station so designated by the space station licensee

Which amateur stations are eligible to operate as Earth

D. Any amatour station, subject to the privileges of the

stations?

D. Any amateur station, subject to the privileges of the class of operator license held by the control operator

Which of the	following	amateur	stations	may	transmit	one-
way communications?						

A. A space station, beacon station, or telecommand

station

For which types of out-of-pocket expenses do the Part 97 rules state that VEs and VECs may be reimbursed?

A. Preparing, processing, administering, and coordinating an examination for an amateur radio operator license

Who does Part 97 task with maintaining the pools of questions for all U.S. amateur license examinations?

C. The VECs

What is a Volunteer Examiner Coordinator?

C. An organization that has entered into an agreement with the FCC to coordinate, prepare, and administer amateur operator license examinations

Which of the following best describes the Volunteer Examiner accreditation process?

D. The procedure by which a VEC confirms that the VE applicant meets FCC requirements to serve as an examiner

What is the minimum passing score on all amateur operator

license examinations?

B. Minimum passing score of 74%

Who is responsible for the proper conduct and necessary supervision during an amateur operator license

C. Each administering VE

examination session?



What should a VE do if a candidate fails to comply with the examiner's instructions during an amateur operator

B. Immediately terminate the candidate's examination

license examination?

To which of the following examinees may a VE not administer an examination?

C. Relatives of the VE as listed in the FCC rules

What may be the penalty for a VE who fraudulently administers or certifies an examination?

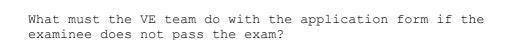
A. Revocation of the VE's amateur station license grant and the suspension of the VE's amateur operator license grant

What must the administering VEs do after the administration of a successful examination for an amateur operator license?

C. They must submit the application document to the coordinating VEC according to the coordinating VEC instructions

What must the VE team do if an examinee scores a passing grade on all examination elements needed for an upgrade or new license?

B. Three VEs must certify that the examinee is qualified for the license grant and that they have complied with the administering VE requirements



A. Return the application document to the examinee

On what frequencies are spread spectrum transmissions permitted?

B. Only on amateur frequencies above 222 MHz

What privileges are authorized in the U.S. to persons holding an amateur service license granted by the government of Canada?

C. The operating terms and conditions of the Canadian amateur service license, not to exceed U.S. Amateur Extra Class license privileges

Under what circumstances may a dealer sell an external RF power amplifier capable of operation below 144 MHz if it has not been granted FCC certification?

A. It was purchased in used condition from an amateur operator and is sold to another amateur operator for use at that operator's station

Which of the following geographic descriptions approximately describes "Line A"?

A. A line roughly parallel to and south of the border between the U.S. and Canada

Amateur stations may not transmit in which of the following frequency segments if they are located in the contiquous 48 states and north of Line A?

D. 420 MHz - 430 MHz

Under what circumstances might the FCC issue a Special Temporary Authority (STA) to an amateur station?

A. To provide for experimental amateur communications

When may an amateur station send a message to a business?

D. When neither the amateur nor his or her employer has a

pecuniary interest in the communications

Which of the following types of amateur station communications are prohibited?

A. Communications transmitted for hire or material compensation, except as otherwise provided in the rules

Which of the following conditions apply when transmitting

spread spectrum emissions?

D. All these choices are correct

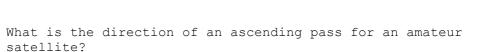
Who may be the control operator of an auxiliary station?

Class operators

B. Only Technician, General, Advanced or Amateur Extra

Which of the following best describes one of the standards that must be met by an external RF power amplifier if it is to qualify for a grant of FCC certification?

D. It must satisfy the FCC's spurious emission standards when operated at the lesser of 1500 watts or its full output power



Saterifie.

C. From south to north

Which of the following occurs when a satellite is using an inverting linear transponder?

D. All these choices are correct

How is the signal inverted by an inverting linear

transponder?

D. The signal is passed through a mixer and the difference rather than the sum is transmitted

What is meant by	the	term	"mode"	as	applied	to	an	amateur	
radio satellite?									

B. The satellite's uplink and downlink frequency bands

What do the letters in a satellite's mode designator specify?
D. The uplink and downlink frequency ranges

What are Kepleri	ian elements?		
A. Parameters th	nat define the	orbit of	<mark>a satellite</mark>

Which of the following types of signals can be relayed through a linear transponder?

D. All these choices are correct

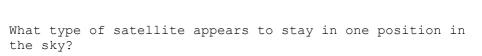
Why should effective radiated power to a satellite that uses a linear transponder be limited?

B. To avoid reducing the downlink power to all other users

What do the terms "L band" and "S band" specify regarding

satellite communications?

A. The 23 centimeter and 13 centimeter bands



B. Geostationary

What type of antenna can be used to minimize the effects of spin modulation and Faraday rotation?

or spin modulation and randady rotation.

B. A circularly polarized antenna

What is the purpose of digital store-and-forward functions on an amateur radio satellite?

C. To store digital messages in the satellite for later download by other stations

Which of the following	techniques	is	normally used by low
Earth orbiting digital	satellites	to	relay messages
around the world?			

B. Store-and-forward

How many times per second is a new frame transmitted in a fast-scan (NTSC) television system?

A. 30

How many horizontal lines make up a fast-scan (NTSC) television frame?

C. 525

How is an interlaced scanning pattern generated in a fast-scan (NTSC) television system?

D. By scanning odd numbered lines in one field and even numbered lines in the next

How	is	color	info	rmatio	on sent	in	analog	SSTV?	
A. (colo	or lin	es ar	<mark>e sent</mark>	seque	entia	ılly		

Nhich	of	the	following	describes	the	use	of	vestigial	

sideband in analog fast-scan TV transmissions?

C. Vestigial sideband reduces bandwidth while allowing

for simple video detector circuitry

What is vestigial sideband modulation?

A. Amplitude modulation in which one complete sideband

and a portion of the other are transmitted

What is the name of the signal component that carries color information in NTSC video?

B. Chroma

What technique allows commercial analog TV receivers to be used for fast-scan TV operations on the 70 cm band?

A. Transmitting on channels shared with cable TV

What hardware, other than a receiver with SSB capability

and a suitable computer, is needed to decode SSTV using Digital Radio Mondiale (DRM)?

D. No other hardware is needed

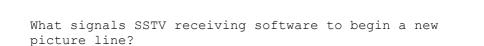
What aspect of an analog slow-scan television signal encodes the brightness of the picture?

A. Tone frequency

What is the function of the Vertical Interval Signaling (VIS) code sent as part of an SSTV transmission?

•

B. To identify the SSTV mode being used



A. Specific tone frequencies

What indicator is required to be used by U.S.-licensed

operators when operating a station via remote control and

the remote transmitter is located in the U.S.?

D. No additional indicator is required

Which of the following best describes the term "self-spotting" in connection with HF contest operating?

A. The often-prohibited practice of posting one's own call sign and frequency on a spotting network

From which of the following bands is amateur radio contesting generally excluded?

A. 30 meters

Which	of	the	following	frequencies	are	sometimes	used	for
amateı	ır ı	radio	mesh net	works?				

B. Frequencies shared with various unlicensed wireless

data services

What is the function of a DX QSL Manager?

B. To handle the receiving and sending of confirmation

cards for a DX station

During a VHF/UHF contest, in which band segment would you expect to find the highest level of SSB or CW activity?

C. In the weak signal segment of the band, with most of the activity near the calling frequency

What is the Cabrillo format? A. A standard for submission of electronic contest logs														
A. A standard for submission of electronic contest logs	Wha	at	is	the	Cabr	ill	o forma [.]	t?						
	Α.	A	sta	andar	d fo	r s	ubmissi	on	of	elect	ronic	contes	st	logs

Which	of	the	following	contacts	may	be	confirmed	through	
the U.	.s.	QSL	bureau sys	stem?					

B. Contacts between a U.S. station and a non-U.S. station



amateur raaro meen neewern.

C. A wireless router running custom firmware

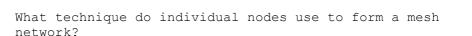
Why might a DX station state that they are listening on another frequency?

D. All these choices are correct

How should you generally identify your station when attempting to contact a DX station during a contest or in

a pileup?

A. Send your full call sign once or twice



C. Discovery and link establishment protocols

Which of the following digital modes is designed for meteor scatter communications?

B. MSK144

Which of the following is a good technique for making meteor scatter contacts?

D. All these choices are correct

Which of the following digital modes is especially useful

for EME communications?

D. JT65

What technology is used to track, in real time, balloons carrying amateur radio transmitters?

C. APRS

B. The ability to decode signals which have a very low

signal-to-noise ratio

What is one advantage of the JT65 mode?

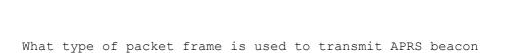
Which	of	the	following	describes	а	method	of	establishing

EME contacts?

A. Time synchronous transmissions alternately from each station

What digital protocol is used by APRS?

C. AX.25



data?

A. Unnumbered Information

What type of modulation is used for JT65 contacts?

A. Multi-tone AFSK

How can an APRS station be used to help support a public service communications activity?

C. An APRS station with a Global Positioning System unit can automatically transmit information to show a mobile

station's position during the event

Which of the following data are used by the APRS network to communicate station location?
D. Latitude and longitude

Which of the following types of modulation is common for data emissions below 30 MHz?

B FSF

What do the letters FEC mean as they relate to digital operation?

-

A. Forward Error Correction

C.	Alternating	transmissions	at	7.5	second	intervals

How is the timing of FT4 contacts organized?

What is indicated when one of the ellipses in an FSK

crossed-ellipse display suddenly disappears?

A. Selective fading has occurred

Which of these digital modes does not support keyboard-to-keyboard operation?

A. PACTOR

What is the most common data rate used for HF packet?

C. 300 baud

Which of the following is a possible reason that attempts to initiate contact with a digital station on a clear

frequency are unsuccessful?

D. All these choices are correct

Which of the following HF digital modes can be used to transfer binary files?

B. PACTOR

Which of the following HF digital modes uses variablelength coding for bandwidth efficiency?

D. PSK31

Which of these digital modes has the narrowest bandwidth?

C. PSK31

What is the difference between direct FSK and audio FSK?

A. Direct FSK applies the data signal to the transmitter

VFO, while AFSK transmits tones via phone

How do ALE stations establish contact?

A. ALE constantly scans a list of frequencies, activating

the radio when the designated call sign is received

Which of these digital modes has the fastest data throughput under clear communication conditions?

D. 300 baud packet

What is the approximate maximum separation measured along the surface of the Earth between two stations communicating by EME?

D. 12,000 miles, if the moon is visible by both stations

В.	A	fluttery	irregular	fading

What characterizes libration fading of an EME signal?

When scheduling EME contacts, which of these conditions will generally result in the least path loss?

will generally locals in one loads pass loca.

A. When the moon is at perigee

What do Hepburn r	maps predict?	
D. Probability of	tropospheric	propagation

Tropospheric propagation of microwave signals often occurs in association with what phenomenon?

C. Warm and cold fronts

What might help to restore contact when DX signals become

too weak to copy across an entire HF band a few hours

B. Switch to a lower frequency HF band

after sunset?

Atmospheric ducts capable of propagating microwave signals often form over what geographic feature?

C. Bodies of water

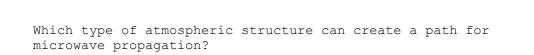
When a meteor strikes the Earth's atmosphere, a cylindrical region of free electrons is formed at what

A. The E layer

layer of the ionosphere?

Which of the following frequency ranges is most suited for meteor scatter communications?

C. 28 MHz - 148 MHz



B. Temperature inversion

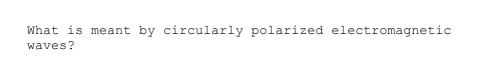
What is a typical range for tropospheric propagation of microwave signals?

B. 100 miles to 300 miles

What is the cause of auroral activity?
C. The interaction in the E layer of charged particles from the Sun with the Earth's magnetic field

Which of these emission modes is best for auroral propagation?

A. CW



B. Waves with a rotating electric field

What is transequatorial propagation?

A. Propagation between two mid-latitude points at approximately the same distance north and south of the

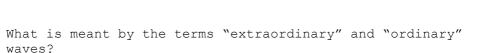
approximately the same distance north and south of the magnetic equator

What is the approximate maximum range for signals using transequatorial propagation?

C. 5000 miles

What is the best time of day for transequatorial propagation?

C. Afternoon or early evening



B. Independent waves created in the ionosphere that are

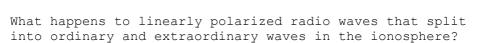
elliptically polarized

Which amateur bands typically support long-path propagation?

C. 160 meters to 10 meters

Which of the following amateur bands most frequently provides long-path propagation?

B. 20 meters



into ordinary and extraordinary waves in the follosphere.

C. They become elliptically polarized

At what time of year is sporadic E propagation most likely to occur?

A. Around the solstices, especially the summer solstice

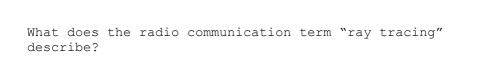
Why is chordal hop propagation desirable?

A. The signal experiences less loss compared to multi-hop using Earth as a reflector

At what	time o	f day car	sporadic E	E propagation	occur?
D. Any	time				

What is the primary characteristic of chordal hop propagation?

B. Successive ionospheric refractions without an intermediate reflection from the ground



B. Modeling a radio wave's path through the ionosphere

What is	s indicated	l by a risi	.ng A or	K index?	
A. Incr	reasing dis	ruption of	the ge	omagnetic	field

Which of the following signal paths is most likely to experience high levels of absorption when the A index or

K index is elevated?

B. Polar

What does	the val	ue of Bz	(B	sub	Z) represent?
C. Direct:	ion and	strength	of	the	interplanetary magnetic
field					

What orientation of Bz (B sub z) increases the likelihood that incoming particles from the sun will cause disturbed conditions?

A. Southward

By how much does the VHF/UHF radio horizon distance exceed the geometric horizon?

A. By approximately 15 percent of the distance

Which of the following descriptors indicates the greatest solar flare intensity?

D. Class X

	What does the space weather term "G5" mean? A. An extreme geomagnetic storm				
A. An extreme geomagnetic storm	A. An extreme geomagnetic storm	What does the	space weather	term "G5"	mean?
		A. An extreme	geomagnetic s	storm	

How does the intensity of an X3 flare compare to that of an X2 flare?

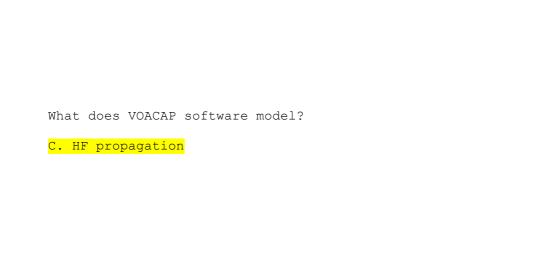
B. 50 percent greater

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flux index

What does the 304A solar parameter measure?

B. UV emissions at 304 angstroms, correlated to the solar



How does the maximum range of ground-wave propagation change when the signal frequency is increased?

C. It decreases

What type of polarization is best for ground-wave propagation?

- - -

A. Vertical



D. Downward bending due to density variations in the atmosphere

What might be indicated by a sudden rise in radio background noise across a large portion of the HF

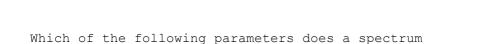
spectrum?

B. A solar flare has occurred

Which of the following limits the highest frequency signal that can be accurately displayed on a digital

oscilloscope?

A. Sampling rate of the analog-to-digital converter



analyzer display on the vertical and horizontal axes?

B. RF amplitude and frequency

display spurious signals and/or intermodulation

distortion products generated by an SSB transmitter?

Which of the following test instruments is used to

B. A spectrum analyzer

How is the compensation of an oscilloscope probe typically adjusted?

A. A square wave is displayed and the probe is adjusted until the horizontal portions of the displayed wave are as nearly flat as possible

What is the purpose of the prescaler function on a frequency counter?

D. It divides a higher frequency signal so a low-frequency counter can display the input frequency

What is the effect of aliasing on a digital oscilloscope caused by setting the time base too slow?

A. A false, jittery low-frequency version of the signal

is displayed

Which of the following is an advantage of using an

antenna analyzer compared to an SWR bridge to measure

antenna SWR?

B. Antenna analyzers do not need an external RF source

Which of the following measures SWR? D. An antenna analyzer
D. An antenna analyzer

Which	of	the	following	is	good	practice	when	using	an	
oscil	loso	cope	probe?							

A. Keep the signal ground connection of the probe as

short as possible

Which	of	the	following	displays	multiple	digital	signal	

states simultaneously?

D. Logic analyzer

How should an antenna analyzer be connected when measuring antenna resonance and feed point impedance?

D. Connect the antenna feed line directly to the

analyzer's connector

Which of the following factors most affects the accuracy of a frequency counter?

B. Time base accuracy

What is the significance of voltmeter sensitivity expressed in ohms per volt?

A. The full scale reading of the voltmeter multiplied by its ohms per volt rating will indicate the input impedance of the voltmeter

Which S parameter is equivalent to forward gain?

C. S21

Which S parameter represents input port return loss or reflection coefficient (equivalent to VSWR)?

A. S11

What three test loads are used to calibrate an RF vector network analyzer?

B. Short circuit, open circuit, and 50 ohms

How much power is being absorbed by the load when a directional power meter connected between a transmitter and a terminating load reads 100 watts forward power and 25 watts reflected power?

D. 75 watts

What do the subscripts of S parameters represent? A. The port or ports at which measurements are made

	ich of ries-t				_	can	be	used	to	measuı	re	the	Q	of	a
C.	The b	andw	idth	of	the	ci	rcu	it's	fred	quency	re	spor	nse	<u> </u>	

What is indicated if the current reading on an RF ammeter placed in series with the antenna feed line of a transmitter increases as the transmitter is tuned to resonance?

D. There is more power going into the antenna

Which of the following methods measures intermodulation distortion in an SSB transmitter?

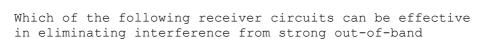
B. Modulate the transmitter using two AF signals having non-harmonically related frequencies and observe the RF output with a spectrum analyzer

Which of the following can be measured with a vector network analyzer?

D. All these choices are correct

What is an effect of excessive phase noise in a receiver's local oscillator?

D. It can combine with strong signals on nearby frequencies to generate interference



signals?

A. A front-end filter or pre-selector

What is the term for the suppression in an FM receiver of one signal by another stronger signal on the same frequency?

C. Capture effect

What is the noise figure of a receiver?
D. The ratio in dB of the noise generated by the received
to the theoretical minimum noise

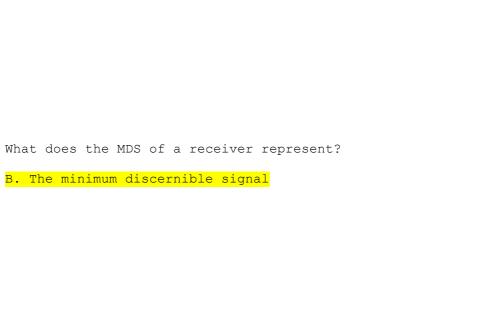
What does a receiver noise floor of -174 dBm represent?

B. The theoretical noise in a 1 Hz bandwidth at the input

of a perfect receiver at room temperature

A CW receiver with the AGC off has an equivalent input noise power density of $-174~\mathrm{dBm/Hz}$. What would be the level of an unmodulated carrier input to this receiver that would yield an audio output SNR of 0 dB in a 400 Hz noise bandwidth?

D. -148 dBm



An SDR receiver is overloaded when input signals exceed what level?

D. The reference voltage of the analog-to-digital converter

Which of the following choices is a good reason for selecting a high frequency for the design of the IF in a superheterodyne HF or VHF communications receiver?

C. Easier for front-end circuitry to eliminate image responses

What is an advantage of having a variety of receiver IF bandwidths from which to select?

C. Receive bandwidth can be set to match the modulation

bandwidth, maximizing signal-to-noise ratio and minimizing interference

Why can an attenuator be used to reduce receiver overload on the lower frequency HF bands with little or no impact on signal-to-noise ratio?

D. Atmospheric noise is generally greater than internally generated noise even after attenuation

Which of the following has the largest effect on an SDR

receiver's dynamic range?

D. Analog-to-digital converter sample width in bits

How does a narrow-band roofing filter affect receiver performance?

C. It improves dynamic range by attenuating strong signals near the receive frequency

What transmit frequency might generate an image response signal in a receiver tuned to 14.300 MHz and that uses a

455 kHz IF frequency?

D. 15.210 MHz

D. Local oscillator phase noise mixing with adjacent strong signals to create interference to desired signals

What is reciprocal mixing?

What is meant by the blocking dynamic range of a receiver?

A. The difference in dB between the noise floor and the level of an incoming signal that will cause 1 dB of gain compression

Which of the following describes problems caused by poor dynamic range in a receiver?

A. Spurious signals caused by cross-modulation and desensitization from strong adjacent signals

How can intermodulation interference between two repeaters occur?

B. When the repeaters are in close proximity and the signals mix in the final amplifier of one or both transmitters

Which of the following may reduce or eliminate intermodulation interference in a repeater caused by another transmitter operating in close proximity?

B. A properly terminated circulator at the output of the repeater's transmitter

146.70 MHz when a nearby station transmits on 146.52 MHz?

What transmitter frequencies would cause an

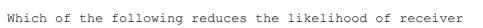
intermodulation-product signal in a receiver tuned to

A. 146.34 MHz and 146.61 MHz

What is the term for spurious signals generated by the combination of two or more signals in a non-linear device

or circuit?

D. Intermodulation



desensitization?

A. Decrease the RF bandwidth of the receiver

What causes intermodulation in an electron:	ic circuit?
C. Nonlinear circuits or devices	

C. To increase rejection of signals outside the desired

What is the purpose of the preselector in a

communications receiver?

band

What does a third-order intercept level of 40 dBm mean with respect to receiver performance?

with respect to receiver performance?

C. A pair of 40 dBm input signals will theoretically generate a third-order intermodulation product that has the same output amplitude as either of the input signals

Why are odd-order intermodulation products, created within a receiver, of particular interest compared to other products?

A. Odd-order products of two signals in the band of interest are also likely to be within the band

What is the term for the reduction in receiver sensitivity caused by a strong signal near the received frequency?

A. Desensitization

What problem can occur when using an automatic notch filter (ANF) to remove interfering carriers while receiving CW signals?

A. Removal of the CW signal as well as the interfering carrier

Which of the following types of noise can often be reduced with a digital signal processing noise filter?

3 3 1

D. All these choices are correct

Which of the following signals might a receiver noise

blanker be able to remove from desired signals?

B. Signals that appear across a wide bandwidth

How can conducted and radiated noise caused by an automobile alternator be suppressed?

D. By connecting the radio's power leads directly to the battery and by installing coaxial capacitors in line with the alternator leads

How can radio frequency interference from an AC motor be suppressed?

B. By installing a brute-force AC-line filter in series with the motor leads the motor

What is one type of electrical interference that might be caused by a nearby personal computer?

C. The appearance of unstable modulated or unmodulated signals at specific frequencies

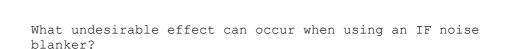
Which of the following can cause shielded cables to

radiate or receive interference?

B. Common-mode currents on the shield and conductors

What current flows equally on all conductors of an unshielded multi-conductor cable?

B. Common-mode current



C. Nearby signals may appear to be excessively wide even

if they meet emission standards

What might be the cause of a loud roaring or buzzing AC line interference that comes and goes at intervals?

Time interference that comes and goes at intervals.

D. All these choices are correct

What could cause local AM broadcast band signals to combine to generate spurious signals in the MF or HF bands?

B. Nearby corroded metal joints are mixing and re-

radiating the broadcast signals

What can cause the voltage across reactances in a series RLC circuit to be higher than the voltage applied to the

entire circuit?

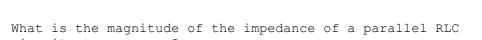
A. Resonance

What is resonance in an LC or RLC circuit?
C. The frequency at which the capacitive reactance equals the inductive reactance

What is the magnitude of the impedance of a series RLC circuit at resonance?

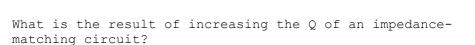
circuit de resonance.

D. Approximately equal to circuit resistance



circuit at resonance?

A. Approximately equal to circuit resistance



matering critate.

A. Matching bandwidth is decreased

What is the magnitude of the circulating current within the components of a parallel LC circuit at resonance?

-

B. It is at a maximum

What is the magnitude of the current at the input of a parallel RLC circuit at resonance?

A. Minimum

What is the phase relationship between the current through and the voltage across a series resonant circuit

at resonance?

C. The voltage and current are in phase

How is the Q of an RLC parallel resonant circuit calculated?

C. Resistance divided by the reactance of either the inductance or capacitance

How is the Q of an RLC series resonant circuit calculated?

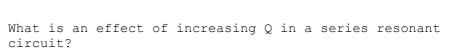
A. Reactance of either the inductance or capacitance divided by the resistance

What is the half-power bandwidth of a resonant circuit that has a resonant frequency of 7.1 MHz and a Q of 150?

C. 47.3 kHz

What is the half-power bandwidth of a resonant circuit that has a resonant frequency of 3.7 MHz and a Q of 118?

C. 31.4 kHz



CIICUIL:

C. Internal voltages increase

What is the resonant frequency of an RLC circuit if R is 22 ohms, L is 50 microhenries and C is 40 picofarads?

C. 3.56 MHz

Which of the following increases ${\tt Q}$ for inductors and capacitors?

A. Lower losses

What is the resonant frequency of an RLC circuit if R is 33 ohms, L is 50 microhenries and C is 10 picofarads?

D. 7.12 MHz

What is the term for the time required for the capacitor in an RC circuit to be charged to 63.2% of the applied

voltage or to discharge to 36.8% of its initial voltage?

B. One time constant

What letter is commonly used to represent susceptance?

D. B

How	is	impedance	in	polar	form	converted	to	an	equivalent	

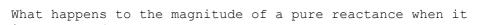
admittance?

B. Take the reciprocal of the magnitude and change the

sign of the angle

What is the time constant of a circuit having two 220-microfarad capacitors and two 1-megohm resistors, all in parallel?

D. 220 seconds



is converted to a susceptance?

D. It becomes the reciprocal

What is susceptance?

C. The imaginary part of admittance

What is the phase angle between the voltage across and the current through a series RLC circuit if XC is 500 ohms, R is 1 kilohm, and XL is 250 ohms?

C. 14.0 degrees with the voltage lagging the current

What is the phase angle between the voltage across and the current through a series RLC circuit if XC is 100 ohms, R is 100 ohms, and XL is 75 ohms?

A. 14 degrees with the voltage lagging the current What is the relationship between the AC current through a capacitor and the voltage across a capacitor?

What is the relationship between the AC current through an inductor and the voltage across an inductor?

A. Voltage leads current by 90 degrees

What is the phase angle between the voltage across and the current through a series RLC circuit if XC is 25 ohms, R is 100 ohms, and XL is 50 ohms?

B. 14 degrees with the voltage leading the current

What is admittance?

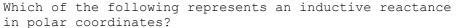
A. The inverse of impedance

Which of the following represents capacitive reactance in

7 _ -; `

rectangular notation?

How are impedances described in polar coordinates? C. By phase angle and magnitude										
C. By phase angle and magnitude	How	are	e impe	edances	s des	scribed	in	polar	coordi	nates?
	C. :	ву р	hase	angle	and	magnitu	<mark>ude</mark>			



In polar coordinates:

C. A positive phase angle

What coordinate system is often used to display the resistive, inductive, and/or capacitive reactance components of impedance?

D. Rectangular coordinates

What is the name of the diagram used to show the phase relationship between impedances at a given frequency?

C. Phasor diagram

What does the impedance 50-j25 represent?

B. 50 ohms resistance in series with 25 ohms capacitive

<u>reactance</u>

Where is the impedance of a pure resistance plotted on rectangular coordinates?

D. On the horizontal axis

What coordinate system is often used to display the phase angle of a circuit containing resistance, inductive and/or capacitive reactance?

D. Polar coordinates

When using rectangular coordinates to graph the impedance of a circuit, what do the axes represent?

A. The X axis represents the resistive component and the Y axis represents the reactive component

Which point on Figure E5-1 best represents the impedance of a series circuit consisting of a 400-ohm resistor and

a 38-picofarad capacitor at 14 MHz?

B. Point 4

Which point in Figure E5-1 best represents the impedance of a series circuit consisting of a 300-ohm resistor and an 18-microhenry inductor at 3.505 MHz?

B. Point 3

Which point on Figure E5-1 best represents the impedance of a series circuit consisting of a 300-ohm resistor and

a 19-picofarad capacitor at 21.200 MHz?

a 19 preciated capacitor at 21.200 miz.

A. Point 1

What is the result of skin effect?

A. As frequency increases, RF current flows in a thinner

layer of the conductor, closer to the surface

Why is it important to keep lead lengths short for

components used in circuits for VHF and above?

B. To avoid unwanted inductive reactance

What is microstrip?

D. Precision printed circuit conductors above a ground plane that provide constant impedance interconnects at microwave frequencies

7	√hy	aı	сe	short	conne	ections	s used	at	microwave	frequencies?
I	3.	То	re	educe	phase	shift	along	the	e connection	<mark>on</mark>

What is the power factor of an RL circuit having a 30-degree phase angle between the voltage and the current?

C. 0.866

In what direction is the magnetic field oriented about a

conductor in relation to the direction of electron flow?

D. In a circle around the conductor

How many watts are consumed in a circuit having a power factor of 0.71 if the apparent power is 500VA?

B. 35<mark>5 W</mark>

How many watts are consumed in a circuit having a power factor of 0.6 if the input is 200VAC at 5 amperes?

D. 600 watts

What happens to reactive power in an AC circuit that has both ideal inductors and ideal capacitors?

B. It is repeatedly exchanged between the associated

magnetic and electric fields, but is not dissipated

How can the true power be determined in an AC circuit where the voltage and current are out of phase?

A. By multiplying the apparent power by the power factor

What is the power factor of an RL circuit having a 60-degree phase angle between the voltage and the current?

C. 0.5

How many watts are consumed in a circuit having a power factor of 0.2 if the input is 100 VAC at 4 amperes?

B. 80 watts

How many watts are consumed in a circuit consisting of a 100-ohm resistor in series with a 100-ohm inductive

reactance drawing 1 ampere?

B. 100 watts

What is reactive power?

A. Wattless, nonproductive power

What is the power factor of an RL circuit having a 45degree phase angle between the voltage and the current?

D. 0.707

In what application is gallium arsenide used as a semiconductor material?

Semiconductor material:

C. In microwave circuits

Which of the following semiconductor materials contains excess free electrons?

A. N-type

Why does a PN-junction diode not conduct current when reverse biased?

C. Holes in P-type material and electrons in the N-type material are separated by the applied voltage, widening

the depletion region

What is the name given to an impurity atom that adds holes to a semiconductor crystal structure?

C. Acceptor impurity

How does DC input impedance at the gate of a field-effect transistor compare with the DC input impedance of a bipolar transistor?

bipolar transistor?

C. An FET has higher input impedance

What	is	the	beta	of	а	bipolar	junction	transistor?

B. The change in collector current with respect to base

<u>current</u>

Which of the following indicates that a silicon NPN

junction transistor is biased on?

D. Base-to-emitter voltage of approximately 0.6 to 0.7 volts

What term indicates the frequency at which the groundedbase current gain of a transistor has decreased to 0.7 of

the gain obtainable at 1 kHz?

D. Alpha cutoff frequency

A. An FET that exhibits a current flow between source and

What is a depletion-mode FET?

drain when no gate voltage is applied

In Figure E6-1, what is the schematic symbol for an N-channel dual-gate MOSFET?

B 4

In Figure E6-1, what is the schematic symbol for a P-channel junction FET?

A 1

Why do many MOSFET devices have internally connected Zener diodes on the gates?

D. To reduce the chance of static damage to the gate

What is the most useful characteristic of a Zener diode?

B. A constant voltage drop under conditions of varying

current

What is an important characteristic of a Schottky diode as compared to an ordinary silicon diode when used as a

power supply rectifier?

D. Less forward voltage drop

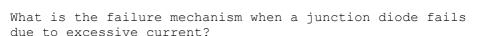
What	type	of	bias	is	required	for	an	LED	to	emit	light?
B. F	orwar	d b:	ias								

What type of semiconductor device is designed for use as a voltage-controlled capacitor?

A. Varactor diode

What characteristic of a PIN diode makes it useful as an RF switch?

D. Low junction capacitance



due to excessive current:

B. Excessive junction temperature

А.	Metal-semiconductor	junction

Which of the following is a Schottky barrier diode?

What is a common use for point-contact diodes?

In Figure E6-2, what is the schematic symbol for a light-emitting diode?

В. :

What is used to control the attenuation of RF signals by a PIN diode?

A. Forward DC bias current

What is the function of hysteresis in a co	omparator?
A. To prevent input noise from causing uns signals	table output

What happens when the level of a comparator's input signal crosses the threshold?

B. The comparator changes its output state

A. Logic devices with 0, 1, and high-impedance output

<mark>states</mark>

Wh	ich	of	the	follo	wing	is	an	advar	ntage	e of	BiCM	OS lo	ogic
C.	Ιt	has	the	high	inpu	t :	impe	edance	e of	CMOS	and	the	low

output impedance of bipolar transistors

What is an advantage of CMOS logic devices over TTL

devices?

D. Lower power consumption

immunity to noise on the input signal or power supply?

C. The input switching threshold is about one-half the

Why do CMOS digital integrated circuits have high

C. The input switching threshold is about one-half the power supply voltage

What best describes a pull-up or pull-down resistor?

B. A resistor connected to the positive or negative supply line used to establish a voltage when an input or output is an open circuit

In Figure E6-3, what is the schematic symbol for a NAND gate?

В. 2

What	is	а	Programmable	Logic	Device	(PLD)?

B. A programmable collection of logic gates and circuits

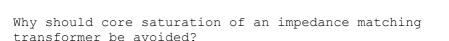
in a single integrated circuit

In Figure E6-3, what is the schematic symbol for a NOR gate?

D . 4

In Figure E6-3, what is the schematic symbol for the NOT operation (inverter)?

C. 5



cramere se average.

A. Harmonics and distortion could result

What is the equivalent circuit of a quartz crystal?

A. Motional capacitance, motional inductance, and loss

resistance in series, all in parallel with a shunt capacitor representing electrode and stray capacitance

Which	of	the	following	is	an	aspect	of	the	piezoelectric
effect?									

A. Mechanical deformation of material by the application

of a voltage

Which materials are commonly used as a core in an inductor?

B. Ferrite and brass

What is one reason for using ferrite cores rather than powdered iron in an inductor?

C. Ferrite toroids generally require fewer turns to produce a given inductance value

What core material property determines the inductance of an inductor?

D. Permeability

What is current in the primary winding of a transformer called if no load is attached to the secondary?

A. Magnetizing current

What is one reason for using powdered-iron cores rather than ferrite cores in an inductor?

B. Powdered-iron cores generally maintain their

characteristics at higher currents

What devices are commonly used as VHF and UHF parasitic suppressors at the input and output terminals of a

transistor HF amplifier?

C. Ferrite beads

What is a primary advantage of using a toroidal core instead of a solenoidal core in an inductor?

A. Toroidal cores confine most of the magnetic field

within the core material

Which type of core material decreases inductance when inserted into a coil?

B. Brass

What is inductor saturation?

C. The ability of the inductor's core to store magnetic energy has been exceeded

				of	inductor	self-resonance?
A. Inter	-tui	en capaci	itance			

Why is gallium arsenide (GaAs) useful for semiconductor devices operating at UHF and higher frequencies?

B. Higher electron mobility

Which of the following device packages is a through-hole type?

_ _ _

Which of the following materials is likely to provide the highest frequency of operation when used in MMICs?

D. Gallium nitride

Which is the most common input and output impedance of circuits that use MMICs?

A. 50 ohms

Which of the following noise figure values is typical of a low-noise UHF preamplifier?

a low horse our preampriller.

A. 2 dB

What characteristics of the MMIC make it a popular choice for VHF through microwave circuits?

D. Controlled gain, low noise figure, and constant input and output impedance over the specified frequency range

What type of transmission line is used for connections to MMICs?

D. Microstrip

How is power supplied to the most common type of MMIC?

A. Through a resistor and/or RF choke connected to the amplifier output lead

Which of the following component package types would be most suitable for use at frequencies above the HF range?

D. Surface mount

What advantage does surface-mount technology offer at RF compared to using through-hole components?

D. All these choices are correct

What is a characteristic of DIP packaging used for integrated circuits?

D. A total of two rows of connecting pins placed on opposite sides of the package (Dual In-line Package)

Why are DIP through-hole package ICs not typically used at UHF and higher frequencies?

C. Excessive lead length

What absorbs the energy from light falling on a photovoltaic cell?

C. Electrons

What happens to the conductivity of a photoconductive material when light shines on it?

A. It increases

What is the most common configuration of an optoisolator or optocoupler?

D. An LED and a phototransistor

What is the photo	voltaic effe	ct?	
B. The conversion	of light to	electrical	energy

A. A device that detects rotation of a control by interrupting a light source with a patterned wheel

Which describes an optical shaft encoder?

mitch describes an optical shart encode.

Which of these materials is most commonly used to create photoconductive devices?

A. A crystalline semiconductor

What is a solid-state relay?

B. A device that uses semiconductors to implement the functions of an electromechanical relay

Why are optoisolators often used in conjunction with solid-state circuits when switching 120 VAC?

C. Optoisolators provide a very high degree of electrical isolation between a control circuit and the circuit being switched

Wha	t is	s the ef	ficiency o	f a	photo	volta:	ic (cell?	
D.	The	relativ	e fraction	of	light	that	is	converted	to
cur	rent								

What is the most common type of photovoltaic cell used for electrical power generation?

B. Silicon

What is the approximate open-circuit voltage produced by a fully illuminated silicon photovoltaic cell?

B. 0.5 V

Which circuit is bistable?

C. A flip-flop

Wh	at	is	the	fur	nctio	on o:	f a	decade	e coi	unter?			
<mark>A.</mark>	Ιt	p P	<mark>rodu</mark>	ces	one	out	put	pulse	for	every	10	input	pulses

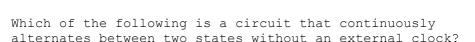
Which of the following can divide the frequency of a

pulse train by 2?

B. A flip-flop

How many flip-flops are required to divide a signal frequency by 4?

 \mathbf{R}



D. Astable multivibrator

What is a characteristic of a monostabl	le multivibrator?
A. It switches momentarily to the oppos	site binary state

and then returns to its original state after a set time

What	logical	operation	does	а	NAND	gate	perform?	

D. It produces logic 0 at its output only when all inputs

are logic 1

What	logical	operation	does	an	OR	gate	perform?	

A. It produces logic 1 at its output if any or all inputs

are logic 1

What logical	operation	is	performed	bу	an	exclusive	NOR
gate?							

C. It produces logic 0 at its output if only one input is logic $\boldsymbol{1}$

What is a truth table?

C. A list of inputs and corresponding outputs for a

digital device

What type of logic defines "1" as a high voltage? D. Positive Logic										
D. Positive Logic	What	type	of	logic	defines	"1"	as	а	high	voltage
	D. Po	ositi	ve I	<mark>Logic</mark>						

For what portion of the signal cycle does each active element in a push-pull Class AB amplifier conduct?

A. More than 180 degrees but less than 360 degrees

What is a Class D amplifier?

A. A type of amplifier that uses switching technology to

achieve high efficiency

Which of the following components form the output of a class D amplifier circuit?

A. A low-pass filter to remove switching signal

components

Where on the load line of a Class A common emitter

A. Approximately halfway between saturation and cutoff

amplifier would bias normally be set?

VVIIc	at Can	рe	aone	LO	brevenc	unwanted	OSCIIIations	T11	dII	
RF	power	amp	plifie	er?						

C. Install parasitic suppressors and/or neutralize the stage

Which of the harmonics?	following	amplifier	types	reduces	even-order	
B. Push-pull						

Which of the following is a likely result when a Class C

amplifier is used to amplify a single-sideband phone signal?

D. Signal distortion and excessive bandwidth

How can an RF power amplifier be neutralized?

C. By feeding a 180-degree out-of-phase portion of the

output back to the input

Which of the following describes how the loading and tuning capacitors are to be adjusted when tuning a vacuum tube RF power amplifier that employs a Pi-network output circuit?

D. The tuning capacitor is adjusted for minimum plate current, and the loading capacitor is adjusted for maximum permissible plate current

In Figure E7-1, what is the purpose of R1 and R2?			
In Figure E7-1, what is the purpose of R1 and R2?			
	In Figure E7-1, wh	nat is the purpose	e of R1 and R2?

In Figure E7-1, what is the purpose of R3?

D. Self bias

What type	of amplifier	circuit is	shown in	n Figure E7-1?
C. Common	emitter			

Which of the following describes an emitter follower (or common collector) amplifier?

common collector) amplifier?

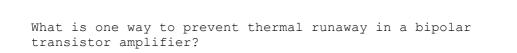
D. An amplifier with a low impedance output that follows

the base input voltage

Why are switching amplifiers more efficient than linear

amplifiers?

B. The power transistor is at saturation or cutoff most of the time



C. Use a resistor in series with the emitter

What is the effect of intermodulation products in a linear power amplifier?

A. Transmission of spurious signals

Why are odd-order rather than even-order intermodulation distortion products of concern in linear power amplifiers?

A. Because they are relatively close in frequency to the desired signal

Wh	at	is	s a	cha	aracte	eristic	of	a	grounded-grid	amplifier
C.	Lo	WC	ing	out	imped	<mark>lance</mark>				

How are the capacitors and inductors of a low-pass filter Pi-network arranged between the network's input and output?

D. A capacitor is connected between the input and ground, another capacitor is connected between the output and ground, and an inductor is connected between input and output

Which of the follo	wing is	a property	$\circ f$ a	T-network	with
WILLOID OF CHE TOTTE	wing is	a property	OI a	I HEEWOIK	W I CII
series capacitors	and a pa	rallel shur	nt ind	ductor?	

C. It is a high-pass filter

What advantage does a series-L Pi-L-network have over a series-L Pi-network for impedance matching between the final amplifier of a vacuum-tube transmitter and an antenna?

A. Greater harmonic suppression

How does an impedance-matching circuit transform a

complex impedance to a resistive impedance?

C. It cancels the reactive part of the impedance and

changes the resistive part to a desired value

Which filter type is described as having ripple in the passband and a sharp cutoff?

D. A Chebyshev filter

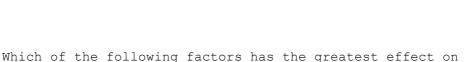
Wha	at are	the	distir	nguishir	ng fea	ature	es c	of an	elliptio	cal	
filter?											
C.	Extre	mely	sharp	cutoff	with	one	or	more	notches	in	the

stop band

Which describes a Pi-L-network used for matching a vacuum tube final amplifier to a 50-ohm unbalanced output?

output

B. A Pi-network with an additional series inductor on the



A. The relative frequencies of the individual crystals

filter?

the bandwidth and response shape of a crystal ladder

D. A filter with narrow bandwidth and steep skirts made

using quartz crystals

Which of the following filters would be the best choice for use in a 2 meter band repeater duplexer?

B. A cavity filter

Which of the following describes a receiving filter's

ability to reject signals occupying an adjacent channel?

C. Shape factor

What is one advantage of a Pi-matching network over an L-matching network consisting of a single inductor and a

single capacitor?

A. The Q of Pi-networks can be controlled

How does a linear electronic voltage regulator work?

maintain a constant output voltage

D. The conduction of a control element is varied to

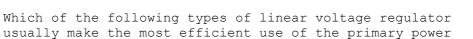
What is a characteristic of a switching electronic voltage regulator?

C. The controlled device's duty cycle is changed to produce a constant average output voltage

What device is typically used as a stable voltage

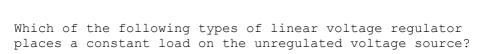
reference in a linear voltage regulator?

A. A Zener diode



source?

B. A series regulator



D. A shunt regulator

What is the purpose of Q1 in the circuit shown in Figure

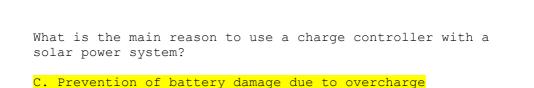
E7-2?

C. It controls the current supplied to the load

What is the purpose of C2 in the circuit shown in Figure E7-2?

A. It bypasses rectifier output ripple around D1

What type of circuit is shown in Figure E7-2?
That time of cinquit is shown in Discuss B7 22
MAL TUDE OF CIRCUIT IS SHOWN IN FIGURE B./-//

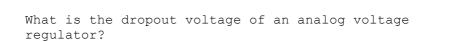


What is the primary reason that a high-frequency switching type high-voltage power supply can be both less expensive and lighter in weight than a conventional power supply?

C. The high frequency inverter design uses much smaller transformers and filter components for an equivalent power output

What is the function of the pass transistor in a linear voltage regulator circuit?

D. Maintains nearly constant output voltage over a wide range of load current



C. Minimum input-to-output voltage required to maintain regulation

What	is	the	equation	for	calculating	power	dissipated	by
2 501	rio	a lir	near wolta	are i	regulator?			

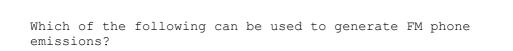
C. Voltage difference from input to output multiplied by

output current

What is the purpose of connecting equal-value resistors across power supply filter capacitors connected in series?

D. All these choices are correct

What is the purpose of a step-start circuit in a high-voltage power supply?	
D. To allow the filter capacitors to charge gradually	



B. A reactance modulator on the oscillator

What is the function of a reactance modulator?

D. To produce PM or FM signals by using an electrically

variable inductance or capacitance

What	is	a f	rec	quer	гсу	disc	rim	nina	ator	stag	ge :	in	a	FM	rece	iver?
D. A	cir	cui	t f	or	det	ecti	ng	FM	sign	nals						

What	is	one	way	а	single-sideband	phone	signal	can	be
gener	rate	5 d S							

A. By using a balanced modulator followed by a filter

What circuit is added to an FM transmitter to boost the higher audio frequencies?

D. A pre-emphasis network

Why is de-emphasis commonly used in FM communications

A. For compatibility with transmitters using phase

receivers?

modulation

B. The frequency range occupied by a message signal prior

What is meant by the term "baseband" in radio

communications?

B. The frequency range occupied by a message signal prior to modulation

What are the principal frequencies that appear at the output of a mixer circuit?

C. The two input frequencies along with their sum and difference frequencies

What occurs when an excessive amount of signal energy

reaches a mixer circuit?

A. Spurious mixer products are generated

Which type of detector circuit is used for demodulating SSB signals?

C. Product detector

What is meant by direct digital conversion as applied to

software defined radios?

C. Incoming RF is digitized by an analog-to-digital converter without being mixed with a local oscillator

signal

What kind of digital signal processing audio filter is used to remove unwanted noise from a received SSB signal?

A. An adaptive filter

What type of digital signal processing filter is used to

generate an SSB signal?

C. A Hilbert-transform filter

D. Signals are combined in quadrature phase relationship

digital signal processing?

What is a common method of generating an SSB signal using

How frequently must an analog signal be sampled by an analog-to-digital converter so that the signal can be accurately reproduced?

B. At least twice the rate of the highest frequency component of the signal

What is the minimum number of bits required for an analog-to-digital converter to sample a signal with a range of 1 volt at a resolution of 1 millivolt?

D. 10 bits

What	function	is	performed	bу	а	Fast	Fourier	Transform?	

C. Converting digital signals from the time domain to the

frequency domain

What is the	function of d	ecimation?		
B. Reducing	the effective	sample rate	by removing	samples



A. It removes high-frequency signal components that would otherwise be reproduced as lower frequency components

Why is an anti-aliasing digital filter required in a

What aspect of receiver analog-to-digital conversion determines the maximum receive bandwidth of a Direct Digital Conversion SDR?

A. Sample rate

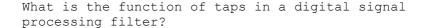
What sets the minimum detectable signal level for a direct-sampling SDR receiver in the absence of

atmospheric or thermal noise?

B. Reference voltage level and sample width in bits

Which of the following is an advantage of a Finite Impulse Response (FIR) filter vs an Infinite Impulse Response (IIR) digital filter?

A. FIR filters can delay all frequency components of the signal by the same amount



D. Provide incremental signal delays for filter

algorithms

Which of the following would allow a digital signal processing filter to create a sharper filter response?

B. More taps

What is the typical output impedance of an op-amp? A. Very low										
A. Very low	Wha	at	is	the	typical	output	impedance	of	an	op-amp?
	Α.	Ve	ery	low						

What is ringing in a filter?	
What is ringing in a filter?	
What is ringing in a filter?	
	?
D. Undesired oscillations ad	dded to the desired signal

What is meant by the term "op-amp input offset voltage"?

C. The differential input voltage needed to bring the

open loop output voltage to zero

How can unwanted ringing and audio instability be

prevented in an op-amp RC audio filter circuit?

A. Restrict both gain and Q

What is the gain-bandwidth of an operational amplifier?

B. The frequency at which the open-loop gain of the amplifier equals one

What magnitude of voltage gain can be expected from the

circuit in Figure E7-3 when R1 is 10 ohms and RF is 470 ohms?

How does the gain of an ideal operational amplifier vary with frequency?

- -

D. It does not vary with frequency

What will be the output voltage of the circuit shown in Figure E7-3 if R1 is 1000 ohms, RF is 10,000 ohms, and 0.23 volts DC is applied to the input?

D. -2.3 volts

What absolute voltage gain can be expected from the circuit in Figure E7-3 when R1 is 1800 ohms and RF is 68

kilohms?

circuit in Figure E7-3 when R1 is 3300 ohms and RF is 47 ± 100 kilohms?

What absolute voltage gain can be expected from the

1 4

What is an operational amplifier?

A. A high-gain, direct-coupled differential amplifier with very high input impedance and very low output

impedance

What are three oscillator circuits used in amateur radio equipment?

equipment.

D. Colpitts, Hartley and Pierce

What is a microphonic?

C. Changes in oscillator frequency due to mechanical

vibration vibrat

How is positive feedback supplied in a Hartley oscillator?

A. Through a tapped coil

How is positive feedback supplied in a Colpitts oscillator?

C. Through a capacitive divider

How	is	pos	itive	feedback	supplied	in a	Pierce	oscillator?
D.	Thr	ough	a qua	artz crys	<mark>tal</mark>			

Which of the following oscillator circuits are commonly used in VFOs?

B. Colpitts and Hartley

How can a	n oscillator's	microphonic	responses	be	reduced?	

D. Mechanically isolate the oscillator circuitry from its

<u>enclosure</u>

Which of the following components can be used to reduce thermal drift in crystal oscillators?

A. NPO capacitors

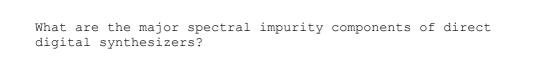
What type of frequency synthesizer circuit uses a phase accumulator, lookup table, digital to analog converter,

and a low-pass anti-alias filter?

A. A direct digital synthesizer

What	information	is	contained	in	the	lookup	table	of	a
direc	ct digital sy	yntl	nesizer (DI	S)	?				

B. Amplitude values that represent the desired waveform



C. Spurious signals at discrete frequencies

Which of the following must be done to ensure that a crystal oscillator provides the frequency specified by the crystal manufacturer?

B. Provide the crystal with a specified parallel capacitance

Which of the following is a technique for providing highly accurate and stable oscillators needed for microwave transmission and reception?

D. All these choices are correct

What is a phase-locked loop circuit?

C. An electronic servo loop consisting of a phase detector, a low-pass filter, a voltage-controlled oscillator, and a stable reference oscillator

Which of these functions can be performed by a phase-

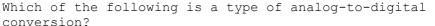
locked loop?

D. Frequency synthesis, FM demodulation

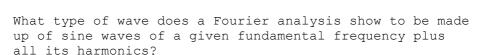
What is the name of the process that shows that a square wave is made up of a sine wave plus all its odd

harmonics?

A. Fourier analysis



A. Successive approximation



all its natmonies.

A. A sawtooth wave

What is "dither" with respect to analog-to-digital converters?

B. A small amount of noise added to the input signal to allow more precise representation of a signal over time

What of the following instruments would be the most accurate for measuring the RMS voltage of a complex waveform?

D. A true-RMS calculating meter

What is the approximate ratio of PEP-to-average power in a typical single-sideband phone signal?

A. 2.5 to 1

What determines the PEP-to-average power ratio of a single-sideband phone signal?

B. Speech characteristics

Why would	a direct	or flash	conversion	analog-to-digital	
converter	be usefu	l for a so	oftware defi	ined radio?	

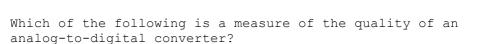
C. Very high speed allows digitizing high frequencies

How many different input levels can be encoded by an analog-to-digital converter with 8-bit resolution?

D. 256

What is the purpose of a low-pass filter used in conjunction with a digital-to-analog converter?

C. Remove harmonics from the output caused by the discrete analog levels generated



A. Total harmonic distortion

What is the modulation index of an FM signal?

A. The ratio of frequency deviation to modulating signal

frequency

How does the modulation index of a phase-modulated emission vary with RF carrier frequency?

D. It does not depend on the RF carrier frequency

What is the modulation index of an FM-phone signal having a maximum frequency deviation of 3000 Hz either side of the carrier frequency when the modulating frequency is $1000~\mathrm{Hz}$?

A. 3

What is the modulation index of an FM-phone signal having a maximum carrier deviation of plus or minus 6 kHz when

modulated with a 2 kHz modulating frequency?

What is the deviation ratio of an FM-phone signal having a maximum frequency swing of plus-or-minus 5 kHz when the

maximum modulation frequency is 3 kHz?

D. 1.67

What is the deviation ratio of an FM-phone signal having a maximum frequency swing of plus or minus 7.5 kHz when

the maximum modulation frequency is 3.5 kHz?

A. 2.14

Orthogonal Frequency Division Multiplexing is a technique

used for which type of amateur communication?

A. High-speed digital modes

What describes Orthogonal Frequency Division

Multiplexing?

D. A digital modulation technique using subcarriers at

frequencies chosen to avoid intersymbol interference

What is deviation ratio?

B. The ratio of the maximum carrier frequency deviation

to the highest audio modulating frequency

What is frequency division multiplexing?

B. Two or more information streams are merged into a

baseband, which then modulates the transmitter

What is digital time division multiplexing?

B. Two or more signals are arranged to share discrete

time slots of a data transmission

How is Forward Error Correction implemented?

C. By transmitting extra data that may be used to detect

and correct transmission errors

What is the definition of symbol rate in a digital transmission?

C. The rate at which the waveform changes to convey

information

Why should phase-shifting of a PSK signal be done at the zero crossing of the RF signal?

Zero Crossing of the Kr Signar:

A. To minimize bandwidth

What technique minimizes the bandwidth of a PSK31 signal?

C. Use of sinusoidal data pulses

What is the approximate bandwidth of a 13-WPM International Morse Code transmission?

C. 52 Hz

What is the bandwidth of a 170-hertz shift, 300-baud ASCII transmission?

C. 0.5 kHz

What is the bandwidth of a 4800-Hz frequency shift, 9600-

baud ASCII FM transmission?

A. 15.36 kHz

Нои	does	ARQ	acco	omplish er	roı	correction?		
D.	If er	rors	are	detected,	a	retransmission	is	requested

Which digital code allows only one bit to change between sequential code values?

D. Gray code

How may data rate be increased without increasing bandwidth?

banawiaen.

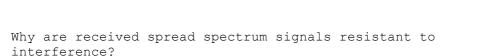
C. Using a more efficient digital code

Wha	at	is	the	rela	ation	ship	between	symbol	rate	and	baud?
A .	Tł	ney	are	the	same						

What factors affect the bandwidth of a transmitted CW

signal?

C. Keying speed and shape factor (rise and fall time)



A. Signals not using the spread spectrum algorithm are suppressed in the receiver

What spread spectrum communications technique uses a high-speed binary bit stream to shift the phase of an RF

carrier?

B. Direct sequence

How does the spread spectrum technique of frequency hopping work?

D. The frequency of the transmitted signal is changed very rapidly according to a pseudorandom sequence also used by the receiving station

What is the primary effect of extremely short rise or

fall time on a CW signal?

C. The generation of key clicks

Wha	at	is	the	most	con	nmon	metl	nod	of	rec	ducing	g key	clicks	?
Α.	Ir	ıcre	ease	keyir	ng v	<mark>rave</mark>	form	ris	se	and	fall	times	<mark>5</mark>	

What	is	the	advantage	of	including	parity	bits	in	ASCII
characters?									

D. Some types of errors can be detected

What is a common cause of overmodulation of AFSK signals?
D. Excessive transmit audio levels

What parameter evaluates distortion of an AFSK signal

caused by excessive input audio levels?

D. Intermodulation Distortion (IMD)

What is considered an acceptable maximum IMD level for an

D. -30 dB

idling PSK signal?

What are some of the differences between the Baudot digital code and ASCII?

B. Baudot uses 5 data bits per character, ASCII uses 7 or 8; Baudot uses 2 characters as letters/figures shift codes, ASCII has no letters/figures shift code

What is one advantage of using ASCII code for data

C. It is possible to transmit both upper and lower case

communications?

text

What is an isotropic antenna?

C. A theoretical, omnidirectional antenna used as a

reference for antenna gain

What is the effective radiated power relative to a dipole of a repeater station with 150 watts transmitter power output, 2 dB feed line loss, 2.2 dB duplexer loss, and 7 dBd antenna gain?

D. 286 watts

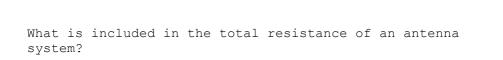
What is the radiation resistance of an antenna?

C. The value of a resistance that would dissipate the same amount of power as that radiated from an antenna

Which of the following factors affect the feed point

impedance of an antenna?

B. Antenna height



D. Radiation resistance plus loss resistance

What is the effective radiated power relative to a dipole of a repeater station with 200 watts transmitter power output, 4 dB feed line loss, 3.2 dB duplexer loss, 0.8 dB circulator loss, and 10 dBd antenna gain?

A. 317 watts

What is the effective isotropic radiated power of a repeater station with 200 watts transmitter power output, 2 dB feed line loss, 2.8 dB duplexer loss, 1.2 dB circulator loss, and 7 dBi antenna gain?

B. 252 watts

What is antenna bandwidth?

B. The frequency range over which an antenna satisfies a

performance requirement

What is antenna efficiency?		
What is antenna efficiency?		
What is antenna efficiency?		
What is antenna efficiency?	 	

Which of the following improves the efficiency of a ground-mounted quarter-wave vertical antenna?

A. Installing a radial system

Which of the following factors determines ground losses

for a ground-mounted vertical antenna operating in the 3 MHz to $30~\mathrm{MHz}$ range?

C. Soil conductivity

How much gain does an antenna have compared to a 1/2-wavelength dipole when it has 6 dB gain over an isotropic

antenna?

A. 3.85 dB

What term describes station output, taking into account all gains and losses?

C. Effective radiated power

In the antenna radiation pattern shown in Figure E9-1, what is the beamwidth?

B. 50 degrees

In the antenna radiation pattern shown in Figure E9-1, what is the front-to-back ratio?

B. 18 dB

In the antenna radiation pattern shown in Figure E9-1, what is the front-to-side ratio?

B. 14 dB

What is the front-to-back ratio of the radiation pattern

shown in Figure E9-2?

B. 28 dB

What	tvpe	e of	antenna	pattern	is	shown	in	Figure	E9-2?
	Elevat			T. O. C. C. C.				9	_, _,

What is the elevation angle of peak response in the antenna radiation pattern shown in Figure E9-2?

C. 7.5 degrees

How does the total amount of radiation emitted by a directional gain antenna compare with the total amount of radiation emitted from a theoretical isotropic antenna, assuming each is driven by the same amount of power?

C. They are the same

What is	the fa	ar fiel	Ld of	an ar	nter	nna?			
				_	of	the	antenna	pattern	is
<mark>indeper</mark>	ndent of	E dista	ance						

What type of computer program technique is commonly used for modeling antennas?

B. Method of Moments

What is the	principle	of a	Method	of Moments	analysis?	

A. A wire is modeled as a series of segments, each having

a uniform value of current

What is a disadvantage of decreasing the number of wire segments in an antenna model below 10 segments per half-wavelength?

C. The computed feed point impedance may be incorrect

What is the radiation pattern of two 1/4-wavelength

vertical antennas spaced 1/2-wavelength apart and fed 180

degrees out of phase?

D. A figure-8 oriented along the axis of the array

What is the radiation pattern of two 1/4-wavelength vertical antennas spaced 1/4-wavelength apart and fed 90

degrees out of phase?

A. Cardioid

What is the radiation pattern of two 1/4-wavelength

vertical antennas spaced 1/2-wavelength apart and fed in

phase?

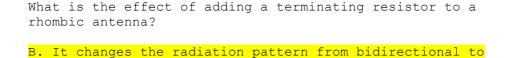
C. A Figure-8 broadside to the axis of the array

What happens to the radiation pattern of an unterminated long wire antenna as the wire length is increased?

B. The lobes align more in the direction of the wire

Which of the following is a type of OCFD antenna?

A. A dipole fed approximately 1/3 the way from one end with a 4:1 balun to provide multiband operation



unidirectional

What is the approximate feed point impedance at the center of a two-wire folded dipole antenna?

A. 300 ohms

C. A half-wave dipole with an additional parallel wire

What is a folded dipole antenna?

connecting its two ends

Which of the following describes a G5RV antenna?

A. A multi-band dipole antenna fed with coax and a balun through a selected length of open wire transmission line

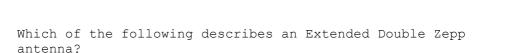
Ţ

polarized antenna affected by being mounted over seawater

How is the far-field elevation pattern of a vertically

D. The low-angle radiation increases

versus soil?



C. A center-fed 1.25-wavelength antenna (two 5/8-wave

elements in phase)

How does the radiation pattern of a horizontally polarized 3-element beam antenna vary with increasing height above ground?

B. The takeoff angle of the lowest elevation lobe decreases

How does the performance of a horizontally polarized antenna mounted on the side of a hill compare with the same antenna mounted on flat ground?

B. The main lobe takeoff angle decreases in the downhill direction

How much does the gain of an ideal parabolic dish antenna change when the operating frequency is doubled?

D. 6 dB

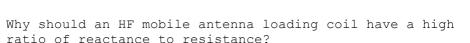
How can linearly polarized Yagi antennas be used to produce circular polarization?

C. Arrange two Yagis perpendicular to each other with the driven elements at the same point on the boom fed 90 degrees out of phase

Where should a high Q loading coil be placed to minimize

losses in a shortened vertical antenna?

A. Near the center of the vertical radiator



Tatlo of Teactance to Tesistance:

C. To minimize losses

What usually occurs if a Yagi antenna is designed solely

for maximum forward gain?

B. The front-to-back ratio decreases

What happens to the SWR bandwidth when one or more	
1 1	
loading coils are used to resonate an electrically short	

antenna?

B. It is decreased

What is an advantage of using top loading in a shortened

HF vertical antenna?

D. Improved radiation efficiency

What	happens	as	the	Q	of	an	antenna	increases?
B. SV	VR bandwi	idth	n ded	cre	ease	es		

What is the function of a loading coil used as part of an HF mobile antenna?

m modific ancoma.

D. To cancel capacitive reactance

What happens to feed-point impedance at the base of a fixed length HF mobile antenna when operated below its resonant frequency?

B. The radiation resistance decreases and the capacitive reactance increases

Which of the following conductors would be best for

minimizing losses in a station's RF ground system?

B. Wide flat copper strap

Which of the following would provide the best RF ground for your station?

C. An electrically short connection to 3 or 4

interconnected ground rods driven into the Earth

What system matches a higher-impedance transmission line to a lower-impedance antenna by connecting the line to the driven element in two places spaced a fraction of a wavelength each side of element center?

B. The delta matching system

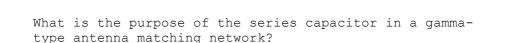
What is the name of an antenna matching system that matches an unbalanced feed line to an antenna by feeding the driven element both at the center of the element and at a fraction of a wavelength to one side of center?

A. The gamma match

What is the name of the matching system that uses a section of transmission line connected in parallel with

the feed line at or near the feed point?

D. The stub match



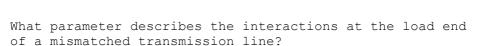
B. To cancel the inductive reactance of the matching network

How must an antenna's driven element be tuned to use a hairpin matching system?

A. The driven element reactance must be capacitive

Which of these feed line impedances would be suitable for constructing a quarter-wave Q-section for matching a 100-ohm loop to 50-ohm feed line?

C. 75 ohms



of a mismatched transmission line.

B. Reflection coefficient

What is a use for a Wilkinson divider?

C. It is used to divide power equally between two 50-ohm

loads while maintaining 50-ohm input impedance

Which of the following is used to shunt-feed a grounded tower at its base?

C. Gamma match

Which of these choices is an effective way to match an antenna with a 100-ohm feed point impedance to a 50-ohm coaxial cable feed line?

C. Insert a 1/4-wavelength piece of 75-ohm coaxial cable transmission line in series between the antenna terminals and the 50-ohm feed cable

What is the primary purpose of phasing lines when used with an antenna having multiple driven elements?

A. It ensures that each driven element operates in concert with the others to create the desired antenna pattern

What is the velocity factor of a transmission line?
D. The velocity of the wave in the transmission line divided by the velocity of light in a vacuum

Which of th	ne following has the biggest effect on the
velocity fa	actor of a transmission line?
C. Dielectr	ric materials used in the line

Why is the phy	sical length of	a coaxial cable	
transmission 1	ine shorter than	its electrical	length?

D. Electrical signals move more slowly in a coaxial cable than in air

What impedance does a 1/2-wavelength transmission line present to a generator when the line is shorted at the

B. Very low impedance

far end?

polyethylene dielectric coaxial transmission line that is electrically 1/4 wavelength long at 14.1 MHz?

What is the approximate physical length of a solid

D. 3.5 meters

What is the approximate physical length of an airinsulated, parallel conductor transmission line that is

electrically 1/2 wavelength long at 14.10 MHz?

C. 10.6 meters

How does ladder line compare to small-diameter coaxial cable such as RG-58 at 50 MHz?

A. Lower loss

Which of the following is a significant difference between foam dielectric coaxial cable and solid dielectric cable, assuming all other parameters are the same?

D. All these choices are correct

What is the approximate physical length of a foam polyethylene dielectric coaxial transmission line that is electrically 1/4 wavelength long at 7.2 MHz?

B. 8.3 meters

What impedance does a 1/8-wavelength transmission line present to a generator when the line is shorted at the

far end?

C. An inductive reactance



What impedance does a 1/8-wavelength transmission line

present to a generator when the line is open at the far

end?

C. A capacitive reactance

What impedance does a 1/4-wavelength transmission line present to a generator when the line is open at the far end?

D. Very low impedance

What impedance does a 1/4-wavelength transmission line present to a generator when the line is shorted at the

far end?

A. Very high impedance

Which	of	the	following	can	be	calculated	using	а	Smith
chart?									

A. Impedance along transmission lines

Wh	at	typ	e of	COO	rdin <i>a</i>	ite s	syste	m is	use	d in	a	Smith	chart?
В.	Re	esis	tance	e ci	rcles	anc	l rea	ctan	<mark>ce a</mark>	rcs			

Which of the	following	is o	ften	${\tt determined}$	using	а	Smith
chart?							

C. Impedance and SWR values in transmission lines

What are the two families of circles and arcs that make up a Smith chart?

C. Resistance and reactance

Which of the following is a common use for a Smith chart?

A. Determine the length and position of an impedance

matching stub

On the Smith chart shown in Figure E9-3, what is the name

terminate?

B. Reactance axis

for the large outer circle on which the reactance arcs

On the Smith chart shown in Figure E9-3, what is the only straight line shown?

D. The resistance axis

	is the pro	ocess of m	normaliza	ation	with r	egaı	rd to	оа
C. Re	eassigning	impedance	e values	with	regard	to	the	prime
cente	<mark>er</mark>							

What third family of circles is often added to a Smith

chart during the process of solving problems?

A. Standing wave ratio circles

What do the arcs on a Smith chart represent? D. Points with constant reactance		
		present?

How are the wavelength scales on a Smith chart calibrated?

B. In fractions of transmission line electrical wavelength

When constructing a Beverage antenna, which of the following factors should be included in the design to achieve good performance at the desired frequency?

D. It should be one or more wavelengths long

Which is generally true for low band (160 meter and 80

meter) receiving antennas?

A. Atmospheric noise is so high that gain over a dipole

is not important

What is Receiving Directivity Factor (RDF)?

D. Forward gain compared to average gain over the entire

hemisphere

What is	s an	adv	antage	of pl	acing	а	grounded	electrostatic	
shield	aroı	ınd	a smal	1 100p	dire	cti	ion-findir	ng antenna?	

shield around a small loop direction-finding antenna?

B. It eliminates unbalanced capacitive coupling to the

surroundings, improving the nulls

What is the main drawback of a small wire-loop antenna

for direction finding?

A. It has a bidirectional pattern

Wha	ıt	is	the	e triangul	Lation	method	of	directi	on	finding?	
C.	An	ter	nna	headings	from	several	dii	fferent	rec	ceiving	

locations are used to locate the signal source

Why	is	RF	attenuation	used	when	direction-finding?	

D. To prevent receiver overload which reduces pattern

nulls

A. It modifies the pattern of a DF antenna array to provide a null in one direction

What is the function of a sense antenna?

What is a Pennant antenna?

B. A small, vertically oriented receiving antenna consisting of a triangular loop terminated in approximately 900 ohms

How can the output voltage of a multiple-turn receiving loop antenna be increased?
D. By increasing the number of turns and/or the area

What feature of a cardioid pattern antenna makes it useful for direction finding?

B. A very sharp single null

What is the primary function of an external earth connection or ground rod?

B. Lightning protection

When	evaluating	RF	exposure	levels	from	your	station	at	а

neighbor's home, what must you do?

B. Ensure signals from your station are less than the uncontrolled Maximum Permitted Exposure (MPE) limits

Over what range of frequencies are the FCC human body RF exposure limits most restrictive?

C. 30 to 300 MHz

When evaluating a site with multiple transmitters operating at the same time, the operators and licensees of which transmitters are responsible for mitigating over-exposure situations?

C. Each transmitter that produces 5 percent or more of its MPE limit in areas where the total MPE limit is exceeded

What	is	one	of	the	potential	hazards	of	operating	in	the	
amate	eur	radi	one of the potential hazards of operating in the radio microwave bands?								

B. The high gain antennas commonly used can result in high exposure levels

Why are there separate electric (E) and magnetic (H) field MPE limits?

D. All these choices are correct

How may dangerous levels of carbon monoxide from an emergency generator be detected?

B. Only with a carbon monoxide detector

				neasur			<u> </u>				
C.	The	rate	at	which	RF	energy	is	absorbed	by	the	body

Which insulating material commonly used as a thermal conductor for some types of electronic devices is extremely toxic if broken or crushed and the particles are accidentally inhaled?

C. Beryllium Oxide

What toxic material may be present in some electronic components such as high voltage capacitors and transformers?

A. Polychlorinated biphenyls

Which of the following injuries can result from using high-power UHF or microwave transmitters?

C. Localized heating of the body from RF exposure in

excess of the MPE limits