



Study Guide For The FCC General Radio Operator License (GROL)

Disclaimer: The purpose of this manual is to assist in studying for the Code 1 Maintenance version of the FCC General Radiotelephone Operator License (GROL) exam. It is not for use with any other programs, schools, or training.

Key Topic 1: Equipment Requirements

1-1A3 Small passenger vessels that sail 20 to 150 nautical miles from the nearest land must have what additional equipment?

- A. Inmarsat-C terminal.
- B. Inmarsat-B terminal.
- C. MF-HF SSB Transceiver.**
- D. Aircraft Transceiver with 121.5 MHz.

1-1A4 What equipment is programmed to initiate transmission of distress alerts and calls to individual stations?

- A. Scanning Watch Receiver.
- B. NAVTEX
- C. GPS.
- D. DSC controller.**

Key Topic 2: License Requirements

1-2A2 When is a Marine Radio Operator Permit or higher license required for aircraft communications?

- A. When operating on frequencies below 30 MHz allocated exclusively to aeronautical mobile services.
- B. When operating on frequencies above 30 MHz allocated exclusively to aeronautical mobile services.
- C. When operating on frequencies above 30 MHz not assigned for international use.
- D. When operating on frequencies below 30 MHz not allocated exclusively to aeronautical mobile services.**

1-2A3 Which of the following persons are ineligible to be issued a commercial radio operator license?

- A. Foreign maritime radio operators unless they are certified by the International Maritime Organization (IMO).
- B. U.S. Military radio operators who are still on active duty.
- C. Individuals who are unable to send and receive correctly by telephone spoken messages in English.**
- D. Handicapped persons with uncorrected disabilities which affect their ability to perform all duties required of commercial radio operators.

Key Topic 3: Watchkeeping

1-3A3 What channel must all compulsory, non-GMDSS vessels monitor at all times in the open sea?

- A. Channel 8.
- B. Channel 70.
- C. Channel 16.**
- D. Channel 6.

1-3A5 Which is true concerning a required watch on VHF Ch-16?

- A. It is compulsory at all times while at sea until further notice, unless the vessel is in a VTS system.
- B. When a vessel is in an A1 sea area and subject to the Bridge-to-Bridge act and in a VTS system, a watch is not required on Ch-16, provided the vessel monitors both Ch-13 and VTS channel.
- C. It is always compulsory in sea areas A2, A3 and A4.
- D. All of the above.**

1-3A6 What are the mandatory DSC watch keeping bands/channels?

- A. VHF Ch-70, 2 MHz MF DSC, 6 MHz DSC and 1 other HF DSC..
- B. 8 MHz HF DSC, 1 other HF DSC, 2 MHz MF DSC and VHF Ch-70.**
- C. 2 MHz MF DSC, 8 MHz DSC, VHF Ch-16 and 1 other HF DSC.
- D. None of the above.

Key Topic 4: Logkeeping

1-4A2 Who is responsible for the proper maintenance of station logs?

- A. The station licensee.
- B. The ship's master and the station licensee.
- C. The commercially-licensed radio operator in charge of the station.
- D. The station licensee and the radio operator in charge of the station.

1-4A4 What is the proper procedure for making a correction in the station log?

- A. The original person making the entry must strike out the error, initial the correction and indicate the date of the correction.
- B. Rewrite the new entry in its entirety directly below the incorrect notation and initial the change.
- C. The ship's master must be notified, approve and initial all changes to the station log.
- D. The mistake may be erased and the correction made and initialized only by the radio operator making the original error.

1-4A5 How long should station logs be retained when there are entries relating to distress or disaster situations?

- A. Indefinitely, or until destruction is specifically authorized by the U.S. Coast Guard.
- B. For a period of three years from the last date of entry, unless notified by the FCC.
- C. Until authorized by the Commission in writing to destroy them.
- D. For a period of one year from the last date of entry.

Key Topic 5: Log Entries

1-5A1 Radiotelephone stations required to keep logs of their transmissions must include:

- A. Station, date and time.
- B. Name of operator on duty.
- C. Station call signs with which communication took place.
- D. All of these.

1-5A3 Where should the GMDSS radio log be kept on board ship?

- A. Sea cabin.
- B. Anywhere on board the vessel.
- C. At the GMDSS operating position.
- D. Captain's office.

1-5A5 Which of the following log keeping statements is true?

- A. Entries relating to pre-voyage, pre-departure and daily tests are required.
- B. Both a) and c)
- C. A summary of all required Distress communications heard and Urgency communications affecting the station's own ship. Also, all Safety communications (other than VHF) affecting the station's own ship must be logged.
- D. Routine daily MF-HF and Inmarsat-C transmissions do not have to be logged.

Key Topic 6: Miscellaneous Rules & Regulations

1-6A1 What regulations govern the use and operation of FCC-licensed ship stations in international waters?

- A. The Maritime Mobile Directives of the International Telecommunication Union.
- B. The regulations of the International Maritime Organization (IMO) and Radio Officers Union.
- C. Those of the FCC's Wireless Telecommunications Bureau, Maritime Mobile Service, Washington, DC 20554.
- D. Part 80 of the FCC Rules plus the international Radio Regulations and agreements to which the United States is a party.

1-6A3 Where do you make an application for inspection of a ship GMDSS radio station?

- A. To the Engineer-in-Charge of the FCC District Office nearest the proposed place of inspection.
- B. To a Commercial Operator Licensing Examination Manager (COLE Manager).
- C. To the Federal Communications Commission. Washington, DC 20554.
- D. To an FCC-licensed technician holding a GMDSS Radio Maintainer's License.

1-6A6 By international agreement, which ships must carry radio equipment for the safety of life at sea?

- A. Cargo ships of more than 300 gross tons and vessels carrying more than 12 passengers.
- B. All cargo ships of more than 100 gross tons.
- C. To the Federal Communications Commission. Washington, DC 20554.
- D. To an FCC-licensed technician holding a GMDSS Radio Maintainer's License.

Key Topic 7: Bridge-to-Bridge Operations

1-7B1 What traffic management service is operated by the U.S. Coast Guard in certain designated water areas to prevent ship collisions, groundings and environmental harm?

- A. Ship Movement and Safety Agency (SMSA).
- B. Water Safety Management Bureau (WSMB)
- C. Vessel Traffic Service (VTS).
- D. Interdepartmental Harbor and Port Patrol (IHPP).

1-7B2 What is a bridge-to-bridge station?

- A. VHF radio station located on a ship's navigational bridge or main control station that is used only for navigational communications."
- B. An internal communications system linking the wheel house with the ship's primary radio operating position and other integral ship control points."
- C. A portable ship station necessary to eliminate frequent application to operate a ship station on board different vessels."
- D. An inland waterways and coastal radio station serving ship stations operating within the United States.

1-7B5 A ship station using VHF bridge-to-bridge Channel 13:

- A. May be identified by the name of the ship in lieu of call sign.
- B. Does not need to identify itself within 100 miles from shore.
- C. May be identified by call sign and country of origin.
- D. Must be identified by call sign and name of vessel.

Key Topic 8: Operating Procedures-1

1-8B1 What is the best way for a radio operator to minimize or prevent interference to other stations?

- A. Determine that a frequency is not in use by monitoring the frequency before transmitting.
- B. Reducing power to a level that will not affect other on-frequency communications.
- C. By changing frequency when notified that a radio communication causes interference.
- D. By using an omni-directional antenna pointed away from other stations.

1-8B2 Under what circumstances may a coast station using telephony transmit a general call to a group of vessels?

- A. When the vessels are located in international waters beyond 12 miles.
- B. When announcing or preceding the transmission of Distress, Urgency, Safety or other important messages.
- C. Under no circumstances.
- D. When identical traffic is destined for multiple mobile stations within range.

1-8B6 What is the priority of communications?

- A. Radio direction-finding, Distress and Safety.
- B. Distress, Safety, radio direction-finding, search and rescue.
- C. Distress, Urgency and Safety.**
- D. Safety, Distress, Urgency and radio direction finding

Key Topic 9: Operating Procedures-2

1-9B2 Ordinarily, how often would a station using a telephony emission identify?

- A. At the beginning and end of each transmission and at 15-minute intervals.**
- B. At least every 10 minutes.
- C. At 15-minute intervals, unless public correspondence is in progress.
- D. At 20-minute intervals.

1-9B4 What should a station operator do before making a transmission?

- A. Transmit a general notification that the operator wishes to utilize the channel.
- B. Ask if the frequency is in use.
- C. Except for the transmission of distress calls, determine that the frequency is not in use by monitoring the frequency before transmitting.**
- D. Check transmitting equipment to be certain it is properly calibrated.

Key Topic 10: Distress Communications

1-10B1 What information must be included in a Distress message?

- A. Name of vessel.
- B. Location.
- C. Type of distress and specifics of help requested.
- D. All of the above.**

1-10B3 What is a Distress communication?

- A. Communications indicating that the calling station has a very urgent message concerning safety.
- B. An official radio communication notification of approaching navigational or meteorological hazards.
- C. An internationally recognized communication indicating that the sender is threatened by grave and imminent danger and requests immediate assistance.**
- D. Radio communications which, if delayed, will adversely affect the safety of life or property.

1-10B4 What is the order of priority of radiotelephone communications in the maritime services?

- A. Government precedence, messages concerning safety of life and protection of property, and traffic concerning grave and imminent danger.
- B. Distress calls and signals, followed by communications preceded by Urgency and Safety signals and all other communications.**
- C. Alarm and health and welfare communications.
- D. Navigation hazards, meteorological warnings, priority traffic.

Key Topic 11: Urgency and Safety Communications

1-11B4 The Urgency signal concerning the safety of a ship, aircraft or person shall be sent only on the authority of:

- A. Person responsible for mobile station.
- B. Either Master of ship or person responsible for mobile station.**
- C. Master of ship.
- D. An FCC-licensed operator.

1-11B5 The Urgency signal has lower priority than:

- A. Ship-to-ship routine calls.
- B. Security.
- C. Safety.
- D. Distress.**

1-11B6 What safety signal call word is spoken three times, followed by the station call letters spoken three times, to announce a storm warning, danger to navigation, or special aid to navigation?

- A. PAN PAN.
- B. SAFETY.
- C. MAYDAY.
- D. SECURITE.

Key Topic 12: GMDSS

1-12B4 GMDSS is primarily a system based on?

- A. Distress. Urgency and Safety communications carried out by the use of narrow-band direct printing telegraphy.
- B. Ship-to-ship Distress communications using MF or HF radio telephony.
- C. VHF digital selective calling from ship to shore.
- D. The linking of search and rescue authorities ashore with shipping in the immediate vicinity of a ship in Distress or in need of assistance.

1-12B5 What is the responsibility of vessels under GMDSS?

- A. Every ship is able to perform those communications functions that are essential for the Safety of the ship itself and of other ships.
- B. Vessels operating under GMDSS, outside of areas effectively serviced by shore side authorities, operating in sea areas A2, and A4 may be required to render assistance in Distress situations, Navigation hazards, meteorological warnings, priority traffic.
- C. Only that vessel, regardless of size, closest to a vessel in Distress, is required to render assistance.
- D. Vessels over 300 gross tons may be required to render assistance if such assistance does not adversely affect their port schedule.

1-12B6 GMDSS is required for which of the following?

- A. Coastal vessels of less than 300 gross tons.
- B. SOLAS Convention ships of 300 gross tonnage or more.
- C. Vessels operating outside of the range of VHF coastal radio stations.
- D. All vessels capable of international voyages.

Key Topic 13: VHF Equipment Controls

1-13C1 What is the purpose of the INT-USA control settings on a VHF?

- A. To change all VHF channels from Duplex to Simplex while in U.S. waters.
- B. To change certain International Duplex channel assignments to simplex in the U.S. for VTS and other purposes.
- C. To change all VTS frequencies to Duplex so all vessels can receive maneuvering orders.
- D. To change to NOAA weather channels and receive weather broadcasts while in the U.S.

1-13C2 VHF ship station transmitters must have the capability of reducing carrier power to:

- A. 50 watts.
- B. 25 watts.
- C. 10 watts.
- D. 1 watt.

1-13C5 GMDSS is required for which of the following?

- A. Sequentially scan all or selected channels.
- B. Monitor Ch-16 continuously and switching to either Ch-70 or Ch-13 every 5 seconds.
- C. Scan Ch-16 for Distress calls.
- D. Scan Ch-70 for Distress alerts.

Key Topic 14: VHF Channel Selection

1-14C2 What is the aircraft frequency and emission used for distress communications?

- A. 156.525 MHz - F1B.
- B. 121.500 MHz - A3E.
- C. 121.500 MHz - F3E.
- D. 243.000 MHz - F3E.

1-14C4 Which channel is utilized for the required bridge-to-bridge watch?

- A. The vessel's VHF working frequency.
- B. VHF-FM on Ch-13 in most areas of the continental United States.
- C. DSC on Ch-70.
- D. VHF-FM on Ch-16

1-14C5 Which channel would most likely be used for routine ship-to-ship voice traffic?

- A. Ch-22A.
- B. Ch-08.
- C. Ch-70.
- D. Ch-16.

Key Topic 15: MF-HF Equipment Controls

1-15C1 Which modes could be selected to receive vessel traffic lists from high seas shore stations?

- A. SSB and FEC.
- B. ARQ and FEC.
- C. AM and VHF-FM.
- D. VHF-FM and SSB

1-15C4 MF/HF transceiver power levels should be set:

- A. Both a) and c) are correct.
- B. To the level necessary to maximize the propagation radius.
- C. To the lowest level necessary for effective communications.
- D. To the highest level possible so as to ensure other stations cannot "break-in" on the channel during use.

1-15C5 To set-up the MF/HF transceiver for a TELEX call to a coast station, the operator must:

- A. Select J3E mode for proper SITOR operations.
- B. Select F1 B mode or J2B mode, depending on the equipment manufacturer.
- C. Select F1 B/J2B mode or J3E mode, depending on whether ARQ or FEC is preferred.
- D. None of the above.

Key Topic 16: MF-HF Frequency & Emission Selection

1-16C2 What is the MF radiotelephony calling and Distress frequency?

- A. Ch-22 VHF.
- B. 2670 kHz.
- C. Ch-06 VHF.
- D. 2182 kHz.

1-16C3 For general communications purposes, paired frequencies are:

- A. Normally used between private coast and ship stations.
- B. Normally used with public coast stations.
- C. Normally used with private coast stations.
- D. Normally used between ship stations.

1-16C6 For general communications purposes, simplex frequencies are:

- A. Normally used between ship stations and private coast stations.
- B. Normally used with public coast stations.
- C. Normally used between ship stations.
- D. Both a) and c) are correct.

Key Topic 17: Equipment Tests

1-17C1 What is the proper procedure for testing a radiotelephone installation?

- A. Transmit the station's call sign, followed by the word "test" on the frequency being used for the test.
- B. A dummy antenna must be used to insure the test will not interfere with ongoing communications.
- C. Short tests must be confined to a single frequency and must never be conducted in port.
- D. Permission for the voice test must be requested and received from the nearest public coast station.

1-17C2 When testing is conducted on 2182 kHz or Ch-16, testing should not continue for more than ____ in any 5-minute period.

- A. 10 seconds.
- B. 1 minute.
- C. 2 minutes.
- D. 30 seconds.

1-17C4 The best way to test the MF-HF NBDP system is?

- A. Make a radiotelephone call to a coast station.
- B. Initiate an ARQ call to demonstrate that the transmitter and antenna are working.
- C. Initiate an ARQ call to a Coast Station and wait for the automatic exchange of answer backs.
- D. Initiate an FEC call to demonstrate that the transmitter and antenna are working.

Key Topic 18: Equipment Faults

1-18C2 Which would be an indication of proper operation of a SSB transmitter rated at 60 watt PEP output?

- A. In SSB (J3E) mode, speaking into the microphone causes power meter to fluctuate slightly around the 60 watt reading.
- B. A steady indication of transmitted energy on an RF Power meter with no fluctuations when speaking into the microphone.
- C. In SITOR communications, the power meter can be seen fluctuating regularly from zero to the 60 watt relative output reading.
- D. In SSB (J3E) voice mode, with the transmitter keyed but without speaking into the microphone, power output is indicated.

1-18C4 What would be an indication of a malfunction on a GMDSS station with a 24 volt battery system?

- A. A constant 30 volt reading on the GMDSS console voltmeter.
- B. After testing the station on battery power, the ammeter reading indicates a high rate of charge that then declines.
- C. After testing the station on battery power, a voltmeter reading of 30 volts for brief period followed by a steady 26 volt reading.
- D. None of the above.

1-18C6 Which of the following conditions would be a symptom of malfunction in a 2182 kHz radiotelephone system that must be reported to the Master, then logged appropriately.

- A. When testing a radiotelephone alarm on 2182 kHz into an artificial antenna, the Distress frequency watch receiver becomes unmuted, an improper testing procedure.
- B. Failure to contact a shore station 600 nautical miles distant during daytime operation.
- C. No indication of power output when speaking into the microphone.
- D. Much higher noise level observed during daytime operation.

Key Topic 19: Antennas

1-19D3 What is the most common type of antenna for GMDSS VHF?

- A. Horizontally polarized circular antenna.
- B. Long wire antenna.
- C. Both of the above.
- D. None of the above.

1-19D6 A vertical whip antenna has a radiation pattern best described by?

- A. A cardioid.
- B. A figure eight.
- C. An ellipse.
- D. A circle.

Key Topic 20: Power Sources

1-20D1 For a small passenger vessel inspection, reserve power batteries must be tested:

- A. Before any new voyage
- B. At intervals not exceeding every 3 months.
- C. At intervals not exceeding every 6 months
- D. At intervals not exceeding 12 months, or during the inspection.

1-20D2 What are the characteristics of the Reserve Source of Energy under GMDSS?

- A. Must be independent of the ship's electrical system when the RSE is needed to supply power to the GMDSS equipment.
- B. Cannot be independent of the propelling power of the ship.
- C. Must be incorporated into the ship's electrical system.
- D. Supplies independent HF and MF installations at the same time.

1-20D5 What is the requirement for emergency and reserve power in GMDSS radio installations?

- A. Only one of the above is required if a vessel is equipped with a second 406 EPIRB as a backup means of sending a distress alert.
- B. All newly constructed ships under GMDSS must have both emergency and reserve power sources for radio communications."
- C. A reserve power source is not required for radio communications.
- D. An emergency power source for radio communications is not required if a vessel has proper reserve power (batteries).

Key Topic 21: EPIRBs

1-21D1 What Is an EPIRB?

- A. An alerting device notifying mariners of imminent danger.
- B. A satellite-based maritime distress and safety alerting system.
- C. A high-efficiency audio amplifier.
- D. A battery-operated emergency position-indicating radio beacon that floats free of a sinking ship.

1-21D2 When are EPIRB batteries changed?

- A. Whenever voltage drops to less than 20% of full charge.
- B. After emergency use or within the month and year replacement date printed on the EPIRB.
- C. After emergency use; after battery life expires.
- D. After emergency use; every 12 months when not used.

1-21D6 What is an advantage of a 406 MHz satellite EPIRB?

- A. It is compatible with the COSPAS-SARSAT Satellites and Global Maritime Distress Safety System (GMDSS) regulations."
- B. Provides a fast, accurate method for the Coast Guard to locating and rescuing persons in distress.
- C. Includes a digitally encoded message containing the ship's identity and nationality.
- D. All of the above.

Key Topic 22: SARTs

1-22D1 In which frequency band does a search and rescue transponder operate?

- A. S-band.
- B. 9 GHz.
- C. 406 MHz.
- D. 3 GHz.

1-22D3 What is the purpose of the SART's audible tone alarm?

- A. It informs survivors that assistance may be nearby.
- B. It informs survivors when the battery's charge condition has weakened.
- C. It informs survivors that a nearby vessel is signaling on DSC.
- D. It informs survivors when the SART switches to the "standby" mode.

1-22D5 At what point does a SART begin transmitting?

- A. A. It immediately begins radiating when placed in the "on" position.
- B. If it has been placed in the "on" position, it will respond when it has been interrogated by a 9-GHz RADAR signal
- C. It must be manually activated.
- D. If it has been placed in the "on" position, it will begin transmitting immediately upon detecting that it is in water.

Key Topic 23: Survival Craft VHF

1-23D2 Which statement is NOT true regarding the requirements of survival craft portable two-way VHF radiotelephone equipment?

- A. Effective radiated power should be a minimum of 0.25 Watts.
- B. Simplex voice communications only.
- C. Operation on Ch-16.
- D. Operation on Ch-13.

1-23D4 Equipment for radio telephony use in survival craft stations under GMDSS must have what capability?

- A. Operation on Ch-16.
- B. Operation on 457.525 MHz.
- C. Operation on 121.5 MHz.
- D. Any one of these.

Key Topic 24: NAVTEX

1-24D2 MSI can be obtained by one (or more) of the following:

- A. NAVTEX.
- B. SafetyNET.
- C. HF NBDP.
- D. All of the above.

1-24D3 Which of the following is the primary frequency that is used exclusively for NAVTEX broadcasts internationally?

A. 518 kHz.

B. VHF channel 16 when the vessel is sailing in Sea Area A1, and 2187.5 kHz when in Sea Area A2.

C. 2187.5 kHz.

D. 4209.5 kHz.

1-24D4 What means are used to prevent the reception of unwanted broadcasts by vessels utilizing the NAVTEX system?

A. Coordinating reception with published broadcast schedules.

B. Programming the receiver to reject unwanted broadcasts.

C. Operating the receiver only during daytime hours.

D. Automatic receiver de-sensitization during night hours.

Key Topic 1 – Marine RADAR Systems

8-1A2 Which of the following has NO effect on the maximum range capability?

A. Carrier frequency.

B. Recovery time.

C. Receiver sensitivity.

D. Pulse repetition frequency.

8-1A5 Which of the following components allows the use of a single antenna for both transmitting and receiving?

A. Modulator.

B. Synchronizer.

C. Mixer.

D. Duplexer.

Key Topic 2 – Distance and Time

8-2A1 A radio wave will travel a distance of three nautical miles in:

A. 6.17 microseconds.

B. 22.76 microseconds.

C. 18.51 microseconds.

D. 37.0 microseconds.

8-2A3 RADAR range is measured by the constant:

A. 150 yards per microsecond.

B. 300 yards per microsecond.

C. 150 meters per microsecond.

D. 18.6 miles per microsecond.

8-2A4 If a target is 5 miles away, how long does it take for the RADAR echo to be received back at the antenna?

A. 123 microseconds.

B. 51.4 microseconds.

C. 30.75 microseconds.

D. 61.7 microseconds.

Key Topic 3 – Frequency and Wavelength

8-3A4 A RADAR operating at a frequency of 3 GHz has a wavelength of approximately:

A. 1 centimeter.

B. 30 centimeters.

C. 3 centimeters.

D. 10 centimeters.

8-3A5 The major advantage of an S-band RADAR over an X-band RADAR is:

- A. It is mechanically less complex.
- B. It has greater bearing resolution.
- C. It has greater power output.
- D. It is less affected by weather conditions.

8-3A6 An X band RADAR operates in which frequency band?

- A. 8 – 12 GHz.
- B. 4 – 8 GHz.
- C. 1 – 2 GHz.
- D. 2 – 4 GHz.

Key Topic 4 – Power, Pulse Width, PRR

8-4A2 A shipboard RADAR transmitter has a pulse repetition frequency (PRF) of 1,000 Hz, a pulse width of 0.5 microseconds, peak power of 150 KW, and a minimum range of 75 meters. Its duty cycle is:

- A. 0.05
- B. 0.5
- C. 0.0005
- D. 0.005

8-4A3 A pulse RADAR transmits a 0.5 microsecond RF pulse with a peak power of 100 kilowatts every 1600 microseconds. This RADAR has:

- A. A duty cycle of 3.125 percent.
- B. A PRF of 3,200.
- C. An average power of 3.25 watts.
- D. A maximum range of 480 kilometers.

Key Topic 5 – Range, Pulse Width, PRF

8-5A1 For a range of 5 nautical miles, the RADAR pulse repetition frequency should be:

- A. 16.2 MHz: or less.
- B. 16.2 Hz or more.
- C. 1.62 kHz or more
- D. 16.2 kHz or less

8-5A3 The minimum range of a RADAR is determined by:

- A. The pulse repetition frequency.
- B. The transmitted pulse width.
- C. The pulse repetition rate.
- D. The frequency of the RADAR transmitter

8-5A6 For a range of 10 nautical miles, the RADAR pulse repetition frequency (PRF) should be:

- A. Approximately 8.1 kHz or less.
- B. 900 Hz.
- C. 18.1 kHz or more.
- D. 120.3 microseconds.

Key Topic 6: Pulse Width - Pulse Repetition Rates

8-6A3 The pulse repetition rate (PRR) refers to:

- A. The pulse rate of the magnetron.
- B. The reciprocal of the duty cycle.
- C. The pulse rate of the klystron.
- D. The pulse rate of the local oscillator tube

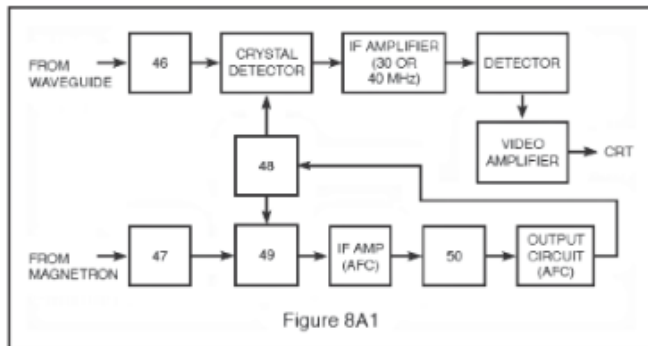
8-6A4 If the RADAR unit has a pulse repetition frequency (PRF) of 2000 Hz and a pulse width of 0.05 microseconds, what is the duty cycle?

- A. 0.05
- B. 0.0005
- C. 0.001
- D. 0.0001

Key Topic 7 – Components-1

8-7A1 What component of a RADAR receiver is represented by block 46 in Fig. 8A1?

- A. The ATR box.
- B. The TR box.
- C. The RF Attenuator.
- D. The Crystal Detector.



8-7A2 A basic sample-and-hold circuit contains:

- A. An analog switch, a capacitor, amplifiers and input and output buffers
- B. An analog switch and an amplifier.
- C. An analog switch, a capacitor, and an amplifier.
- D. An analog multiplexer and a capacitor.

8-7A4 Silicon crystals:

- A. Are very sensitive to static electric charges.
- B. Should be wrapped in lead foil for storage.
- C. Tolerate very low currents.
- D. All of these.

Key Topic 8 – Components-2

8-8A1 The basic frequency determining element in a Gunn oscillator is:

- A. The type of semiconductor used.
- B. The loading of the oscillator by the mixer.
- C. The power supply voltage.
- D. The resonant cavity.

8-8A6 Fine adjustments of a reflex klystron are accomplished by:

- A. Adjusting the flexible wall of the cavity
- B. Varying the repeller voltage.
- C. Adjusting the AFC control system.
- D. Varying the cavity grid potential.

Key Topic 9 – Circuits-1

8-9A1 Blocking oscillators operate on the formula of:

- A. $T = R \times C$.
- B. $I = E/R$
- C. By using the receiver's AGC.
- D. None of the above are correct.

8-9A3 The phantatron circuit is capable of :

- A. Developing a linear ramp voltage when triggered by an external source.
- B. Preventing saturation of the RADAR receiver.
- C. Stabilizing the magnetron.
- D. Being used to control repeller voltage in the AFC system.

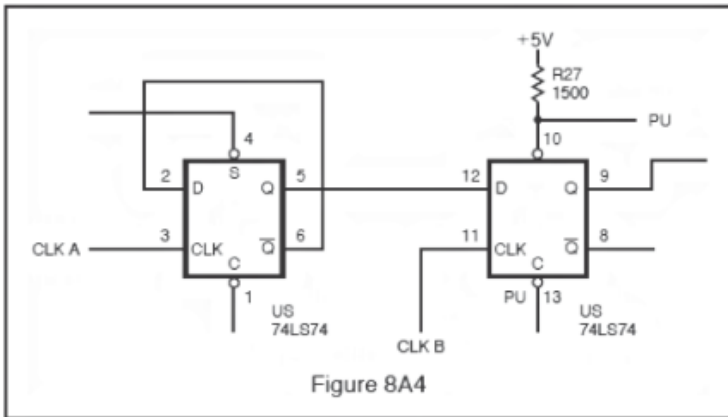
8-9A6 Choose the most correct statement:

- A. The magnetron filament is a low voltage circuit.
- B. The magnetron anode is a low voltage circuit.
- C. The anode of the magnetron carries high voltage.
- D. The filament of the magnetron carries dangerous voltages.

Key Topic 10 – Circuits-2

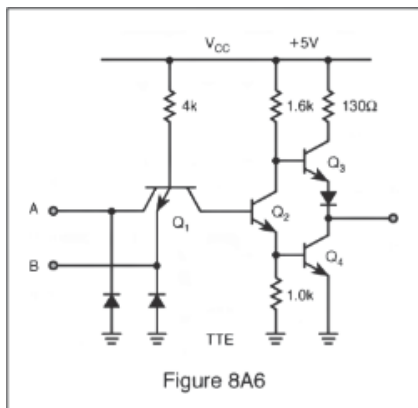
8-10A1 In the circuit shown in Fig. 8A4, us pins 1 and 4 are high and both are in the reset state. Assume one clock cycle occurs of Clk A followed by one cycle of Clk B. What are the output states of the two D-type flip flops?

- A. Pin 5 low, Pin 9 low
- B. Pin 5 high, Pin 9 low.
- C. Pin 5 high, Pin 9 high.
- D. Pin 5 low, Pin 9 high.



8-10A3 In the circuit shown in Fig. 8A6, which of the following is true?

- A. With either A or B low, 01 is off and 02 is on.
- B. With A and B low, 02 is on and 04 is off.
- C. With either A or B low, 01 is saturated and 02 is off.
- D. With A and B high, 01 is saturated and 02 is off.



Key Topic 11 – Transmitting Systems

8-11B1 The magnetron is used to:

- A. Determine the shape and width of the transmitted pulses.
- B. Modulate the pulse signal.
- C. Generate the output signal at the proper operating frequency.
- D. Determine the pulse repetition rate.

8-11B2 The purpose of the modulator is to:

- A. Adjust the pulse repetition rate.
- B. Tune the Magnetron to the proper frequency.
- C. Transmit the high voltage pulses to the antenna.
- D. Provide high voltage pulses of the proper shape and width to the magnetron.

8-11B5 The purpose of the Synchronizer is to:

- A. Ensure that the TR tube conducts at the proper time.
- B. Generate the modulating pulse to the magnetron.
- C. Control the pulse width.
- D. Generate a timing signal that establishes the pulse repetition rate.

Key Topic 12 – Magnetrons

8-12B2 The characteristic of the magnetron output pulse that relates to accurate range measurement is its:

- A. Decay time.
- B. Amplitude.
- C. Duration.
- D. Rise time.

8-12B4 The magnetron is:

- A. A triode that requires an external magnetic field.
- B. A type of diode that requires an external magnetic field.
- C. Used as the local oscillator in the RADAR unit.
- D. A type of diode that requires an internal magnetic field.

Key Topic 13 – Modulation

8-13B2 The modulation frequency of most RADAR systems is between:

- A. 1500 and 7500 Hz.
- B. 3000 and 6000 Hz.
- C. 60 and 500 Hz.
- D. 1000 and 3000 Hz.

8-13B3 A shipboard RADAR uses a PFN driving a magnetron cathode through a step-up transformer. This results in which type of modulation?

- A. Amplitude modulation.
- B. Pulse modulation.
- C. Continuous Wave (CW) modulation.
- D. Frequency modulation.

8-13B6 The purpose of a modulator in the transmitter section of a RADAR is to:

- A. Provide the correct waveform to the transmitter.
- B. Prevent sea return.
- C. Control magnetron power output.
- D. Improve bearing resolution.

Key Topic 14 – Pulse Forming Networks Modulation

8-14B1 The pulse developed by the modulator may have an amplitude greater than the supply voltage. This is possible by:

- A. Employing a resonant charging choke.
- B. Discharging two capacitors in series and combining their charges.
- C. Discharging a capacitor through an inductor.
- D. Using a voltage multiplier circuit.

8-14B4 The shape and duration of the high-voltage pulse delivered to the magnetron is established by:

- A. An artificial delay line.
- B. The time required to saturate the pulse transformer.
- C. The duration of the modulator input trigger.
- D. An RC network in the keyer stage.

Key Topic 15 – TR - ATR - Circulators - Directional Couplers-1

8-15B4 A circulator provides what function in the RF section of a RADAR system?

- A. It permits tests to be made to the thyristors while in use.
- B. It replaces the TR cell and functions as a duplexer.
- C. It transmits antenna position to the indicator during operation.
- D. It cools the magnetron by forcing a flow of circulating air.

8-15B5 A directional coupler has an attenuation of -30 db. A measurement of 100 milliwatts at the coupler indicates the power of the line is:

- A. 1,000 watts.
- B. 100 watts.
- C. 10,000 watts.
- D. 10 watts.

8-15B6 What is the purpose or function of the RADAR duplexer/circulator?

- A. An electronic switch that allows the use of one antenna for both transmission and reception.
- B. A dual section coupling device that allows the use of a magnetron as a transmitter.
- C. A coupling device that is used in the transition from a rectangular waveguide to a circular waveguide.
- D. A modified length of waveguide used to sample a portion of the transmitted energy for testing purposes.

Key Topic 16 – TR - ATR - Circulators - Directional Couplers-2

8-16B4 What device is located between the magnetron and the mixer and prevents received signals from entering the magnetron?

- A. The ATR tube.
- B. The RF Attenuator.
- C. The TR tube.
- D. A resonant cavity

9-16B5 A keep-alive voltage is applied to:

- A. The crystal detector.
- B. The magnetron.
- C. The ATR tube.
- D. The TR tube.

10-16B6 A DC keep-alive potential:

- A. Is applied to a TR tube to make it more sensitive.
- B. Fully ionizes the gas in a TR tube.
- C. Partially ionizes the gas in a TR tube. making it very sensitive to transmitter pulses.
- D. Is applied to a TR tube to make it more sensitive and partially ionizes the gas in a TR tube.

Key Topic 17 – Timer - Trigger - Synchronizer Circuits

8-17B2 The triggering section is also known as the:

- A. Synchronizer.
- B. Blocking oscillator
- C. PFN.
- D. Timer circuit.

8-17B3 Operation of any RADAR system begins in the:

- A. AFC.
- B. Magnetron.
- C. PFN.
- D. Triggering section.

8-17B5 Pulse RADARs require precise timing for their operation. Which type circuit below might best be used to provide these accurate timing pulses?

- A. Single-swing blocking oscillator.
- B. Non-symmetrical astable multivibrator.
- C. AFC controlled sine wave oscillator.
- D. Triggered flip-flop type multivibrator .

Key Topic 18 – Power Supplies

8-18B4 In a fixed-frequency switching power supply, the pulse width of the switching circuit will increase when:

- A. The output voltage increases.
- B. The load current decreases.
- C. The input voltage increases.
- D. The load impedance decreases.

8-18B6 Which of the following characteristics are true of a power MOSFET used in a RADAR switching supply?

- A. High input impedance; failure mode can be thermal runaway.
- B. High input impedance; failure mode can be gate punch-through.
- C. Low input impedance; failure mode can be gate punch-through.
- D. Low input impedance; failure mode can be gate breakdown.

Key Topic 19 – Receiving Systems

8-19C2 Logarithmic receivers:

- A. Can't be damaged.
- B. Have low sensitivity
- C. Can't be saturated.
- D. Should not be used in RADAR systems.

8-19C4 What section of the receiving system sends signals to the display system?

- A. Video amplifier.
- B. I.F. Amplifier
- C. Audio amplifier.
- D. Resolver

8-19C6 In a RADAR receiver, the RF power amplifier:

- A. Requires wide bandwidth.
- B. Does not exist.
- C. Is high gain.
- D. Is low gain.

Key Topic 20 – Mixers

8-20C4 In a RADAR unit, the mixer uses a:

- A. Field-effect transistor
- B. Silicon crystal or PIN diode.
- C. Microwave transistor
- D. Pentagrid converter tube

8-20C6 In a RADAR unit, the mixer uses:

- A. PIN diodes.
- B. Silicon crystals.
- C. PIN diodes and silicon crystals.
- D. Boettcher crystals.

Key Topic 21 – Local Oscillators

8-21C1 The error voltage from the discriminator is applied to the:

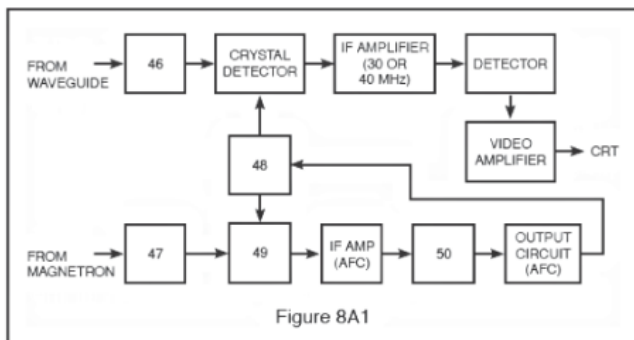
- A. Repeller (reflector) of the klystron.
- B. Grids of the IF amplifier.
- C. Grids of the RF amplifiers.
- D. Magnetron.

8-21C2 In a RADAR unit, the local oscillator is a:

- A. Reactance tube modulator
- B. Hydrogen Thyatron
- C. Pentagrid converter tube.
- D. Klystron

8-21C3 What component of a RADAR receiver is represented by block 48 in Fig. 8A1?

- A. Crystal detector
- B. Discriminator.
- C. IF amplifier.
- D. Klystron (local oscillator).**



Key Topic 22 – Amplifiers

8-22C5 The high-gain IF amplifiers in a RADAR receiver may amplify a 2 microvolt input signal to an output level of 2 volts. This amount of amplification represents a gain of:

- A. 60 db.
- B. 120 db.**
- C. 100 db.
- D. 1,000 db.

8-22C6 In a RADAR receiver AGC and IAGC can vary between:

- A. 10 and 15 db.
- B. 8. 5 and 30 db.
- C. 20 and 40 db.**
- D. 30 and 60 db.

Key Topic 23 – Detectors - Video Amplifiers

8-23C1 Which of the following statements is correct?

- A. The video amplifier is located between the local oscillator and the mixer.
- B. The video amplifier operates between 60 MHz and 120 Mhz.
- C. The video amplifier is located between the 1.F. amplifier and the display system.**
- D. The video amplifier is located between the mixer and the 1.F. amplifier.

8-23C2 Video amplifiers in pulse RADAR receivers must have a broad bandwidth because:

- A. The RADARs operate at PRFs above 100.
- B. The pulses produced are normally too wide for video amplification.
- C. High frequency sine waves must be amplified.**
- D. Weak pulses must be amplified.

8-23C3 In video amplifiers, compensation for the input and output stage capacitances must be accomplished to prevent distorting the video pulses. This compensation is normally accomplished by connecting:

- A. Resistances in parallel with both the input and output capacitances
- B. An inductor in parallel with the input capacitance and an inductor in series with the output capacitance
- C. An inductor in series with the input capacitance and an inductor in parallel with the output capacitance.**
- D. Inductors in parallel with both the input and output capacitances.

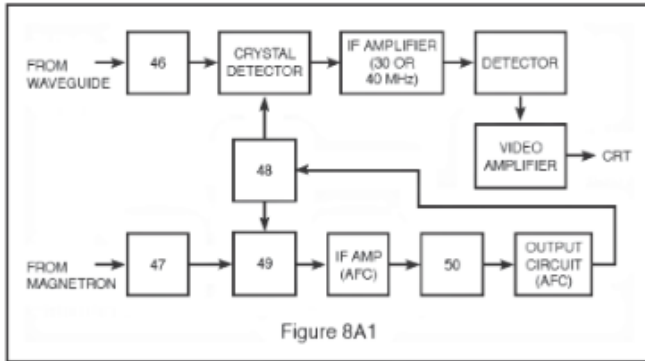
Key Topic 24 – Automatic Frequency Control - AFC

8-24C3 In the AFC system, the discriminator compares the frequencies of the:

- A. PRR generator and magnetron.
- B. Magnetron and video amplifier
- C. Magnetron and klystron
- D. Magnetron and crystal detector.

8-24C6 What component is block 50 in Fig. 8A1?

- A. Crystal detector.
- B. Discriminator.
- C. AFC amplifier.
- D. IF amplifier.



Key Topic 25 – Sea Clutter - STC

8-25C1 The STC circuit is used to:

- A. Decrease sea return on a RADAR receiver.
- B. Increase receiver sensitivity.
- C. Increase receiver selectivity.
- D. Increase receiver stability.

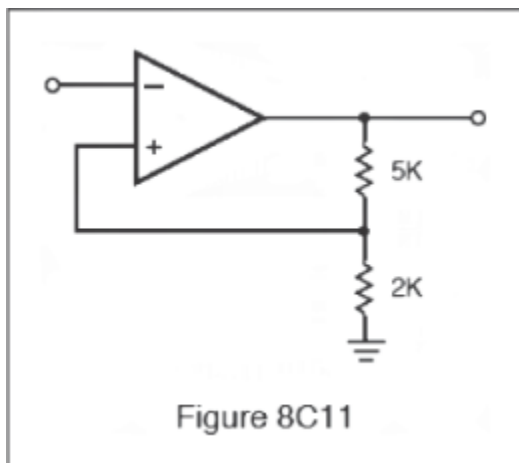
8-25C6 The sensitivity time control (STC) circuit:

- A. Increases the sensitivity of the receiver for close objects.
- B. Increases the sensitivity of the receiver for distant objects.
- C. Decreases the sensitivity of the receiver for close objects
- D. Decreases the sensitivity of the transmitter for close objects.

Key Topic 26 – Power Supplies

8-26C4 With regard to the comparator shown in Fig. 8C11, the input is a sinusoid. Nominal high level output of the comparator is 4.5 volts. Choose the most correct statement regarding the input and output.

- A. The rising edge of the output waveform trails the negative zero crossing of the input waveform by 45 degrees.
- B. The rising edge of the output waveform trails the positive zero crossing of the input waveform by 45 degrees.
- C. The rising edge of the output waveform trails the positive peak of the input waveform by 45 degrees.
- D. The leading edge of the output waveform occurs 180 degrees after positive zero crossing of the input waveform.



8-26C5 When monitoring the gate voltage of a power MOSFET in the switching power supply of a modern RADAR, you would expect to see the gate voltage change from “low” to “high” by how much?

- A. Greater than 2 volts.
- B. 1.0 volt to 20.0 volts.
- C. 300 microvolts to 700 microvolts.
- D. 1 volt to 2 volts.

Key Topic 27 – Interference Issues

8-27C3 Noise can appear on the LCD as:

- A. Erratic video and sharp changes in intensity.
- B. Black spots on the screen.
- C. Changes in bearings.
- D. None of the above.

8-27C6 Noise can:

- A. Increase RADAR transmitter interference.
- B. Change bearings.
- C. Mask small targets.
- D. Mask larger targets.

Key Topic 28 – Miscellaneous

8-28C1 The purpose of the discriminator circuit in a RADAR set is to:

- A. Demodulate or remove the intelligence from the FM signal.
- B. Discriminate against nearby objects
- C. Generate a corrective voltage for controlling the frequency of the klystron local oscillator.
- D. Interference from electrical equipment

8-28C4 The condition known as “glint” refers to a shifting of clutter with each RADAR pulse and can be caused by a:

- A. Low AFC voltage.
- B. Memory failure.
- C. Improperly functioning MTI filter.
- D. Interference from electrical equipment

8-28C6 When the receiver employs an MTI circuit:

- A. Ground clutter will be free of “rabbits.”
- B. The receiver AGC circuits are disabled.
- C. Only moving targets will be displayed.
- D. The receiver gain increases with time.

Key Topic 29 – Displays

8-29D2 Voltages used in CRT anode circuits are in what range of value?

- A. 20-50 mV.
- B. 0.5-10 mV
- C. 10-50 kV
- D. 200-1000 V

8-29D4 LCD patterns are formed when:

- A. When voltage is reduced to the raster scan display.
- B. When the deflection coils are resonant.
- C. When the ship's antenna's bearing is true North.
- D. Current passes through the crystal causing them to align.

8-29D6 Select the statement, which is most correct regarding a raster scan display.

- A. The scan rate for a RADAR system is 30 frames per second.
- B. Raster displays are the same as conventional T.V. receivers
- C. Raster scanning is not used in RADAR systems.
- D. Raster scanning is controlled by clock pulses and requires an address bus.

Key Topic 30 – Video Amplifiers and Sweep Circuits

8-30D2 Which of the following would not normally be an input to the video amplifier?

- A. Resolver signal.
- B. Variable range rings.
- C. Low level video.
- D. Fixed range rings.

8-30D3 The purpose of the sweep amplifier is to:

- A. Increase the power of the video amplifier.
- B. Drive the CRT deflection coils.
- C. Drive the resolver coils.
- D. All of the above.

8-30D6 The main purpose of the video amplifier is to provide:

- A. Antenna X and Y signals.
- B. Resolver signals
- C. Composite video to the cathode of the CRT.
- D. Provide the drive signal to the sweep amplifier.

Key Topic 31 – Timing Circuits

8-31D1 Timing circuits are used to provide what function?

- A. Adjust the sea return.
- B. Develop synchronizing pulses for the transmitter system.
- C. Synchronize the antenna and display system.
- D. Control the North Up presentation.

8-31D2 The circuit that develops timing signals is called the:

- A. Video amplifier
- B. Resolver.
- C. Pulse forming network.
- D. Synchronizer.

8-31D5 The output from the synchronizer usually consists of a:

- A. Sine wave
- B. Pulse or square wave.
- C. Triangle wave.
- D. None of the above.

Key Topic 32 – Fixed Range Markers

8-32D1 Accurate range markers must be developed using very narrow pulses. A circuit that could be used to provide these high-quality pulses for the CRT is a:

- A. Ringing oscillator.
- B. Blocking oscillator.
- C. Triggered bi-stable multivibrator.
- D. Monostable multivibrator.

8-32D2 Range markers are determined by:

- A. The video amplifier.
- B. The CRT.
- C. The magnetron.
- D. The timer

8-32D4 What would be the frequency of a range ring marker oscillator generating range rings at 10 nautical miles intervals?

- A. 8 kHz
- B. 16 kHz
- C. 12 kHz
- D. 24 kHz

Key Topic 33 – Variable Range Markers

8-33D1 The variable range marker signal is normally fed to the input of the:

- A. Sweep amplifier.
- B. Video amplifier.
- C. Range ring oscillator.
- D. Low voltage power supply regulator.

8-33D2 The purpose of the variable range marker is to:

- A. Indicate the distance between two different targets.
- B. Provide an accurate means of determining the range of a moving target.
- C. Provide a means of calibrating the fixed range rings.
- D. Provide a bearing line between your own ship and a moving target.

8-33D5 An important component of the VRM system is the:

- A. STC sensitivity control.
- B. Resolver.
- C. Interference rejection circuit
- D. Shift register.

Key Topic 34 – EBL, Azimuth and True Bearing

8-34D1 The purpose of the Electronic Bearing Line is to:

- A. Measure the bearing of a specific target.
- B. Indicate your own vessel's heading.
- C. Display the range of a specific target.
- D. Indicate True North.

8-34D3 Which of the following inputs is required to indicate azimuth?

- A. Range rings
- B. Resolver.
- C. Synchronizer
- D. Gyro signals.

8-34D6 A true bearing presentation appears as follows:

- A. North is at the top of the display and the ship's heading flasher indicates the vessel's course.
- B. The bow of the vessel always points up
- C. The course of the five closest targets is displayed.
- D. The course and distance of the closest target is displayed.

Key Topic 35 – Memory Systems

8-35D4 How does the dual memory function reduce sea clutter?

- A. It reduces receiver gain for closer signals.
- B. It increases receiver gain for real targets
- C. Successive sweeps are digitized and compared. Only signals appearing in both sweeps are displayed.
- D. The dual memory system makes the desired targets larger.

Key Topic 36 – ARPA - CAS

8-36D1 The ship's speed indication on the ARPA display can be set manually, but does not change with changes in the vessel's speed. What other indication would point to a related equipment failure?

- A. "LOG out" is displayed on the ARPA indicator.
- B. "GYRO OUT" is displayed on the ARPA indicator.
- C. "TARGET LOST" is displayed on the ARPA indicator.
- D. "NORTH UP" is displayed on the ARPA indicator.

8-36D4 Which answer best describes a line on the display which indicates a target's position. The speed is shown by the length of the line and the course by the direction of the line.

- A. Heading Marker.
- B. Range Marker.
- C. Electronic Bearing Line.
- D. Vector.

8-36D5 What is the purpose or function of the "Trial Mode" used in most ARPA equipment?

- A. It selects trial dots for targets' recent past positions.
- B. It is used to display target position and your own ship's data such as TCPA, CPA, etc.
- C. It is used to allow results of proposed maneuvers to be assessed.
- D. None of these.

Key Topic 37 – Display System Power Supplies

8-37D1 The display power supply provides the following:

- A. +18 volts DC for the pulse forming network.
- B. 5 volts DC for logic circuits and +/- 12 volts DC for analog and sweep circuits.
- C. 80 volts AC for the antenna resolver circuits.
- D. All of the above

8-37D6 What display system power supply output would use a tripler circuit?

- A. The logic circuit supply.
- B. The sweep circuit supply.
- C. The HV supply for the CRT anode.
- D. The resolver drive

Key Topic 38 – Miscellaneous

8-38D1 The heading flash is a momentary intensification of the sweep line on the PPI presentation. Its function is to:

- A. Inform the operator of the dead-ahead position on the PPI scope.
- B. Alert the operator when a target is within range.
- C. Alert the operator when shallow water is near.
- D. Inform the operator when the antenna is pointed to the rear of the ship.

8-38D5 The output of an RC integrator, when driven by a square wave with a period of much less than one time constant is a:

- A. Sawtooth wave.
- B. Triangle wave
- C. Sine wave.
- D. Series of narrow spikes.

Key Topic 39 – Antenna Systems

8-39E1 Slotted waveguide arrays, when fed from one end exhibit:

- A. Frequency scan.
- B. Poor performance in rain.
- C. A narrow elevation beam.
- D. High VSWR.

8-39E4 The center of the transmitted lobe from a slotted waveguide array is:

- A. Perpendicular to the antenna.
- B. Maximum at the left hand end.
- C. Several degrees offset from a line perpendicular to the antenna.
- D. Maximum at the right hand end.

Key Topic 40 – Transmission Lines

8-40E3 If long-length transmission lines are not properly shielded and terminated:

- A. Communications receiver interference might result.
- B. The silicon crystals can be damaged.
- C. Overmodulation might result.
- D. Minimal RF loss can result.

8-40E4 A certain length of transmission line has a characteristic impedance of 72 ohms. If the line is cut at its center, each half of the transmission line will have a ZO of:

- A. 36 ohms.
- B. 72 ohms.
- C. 144 ohms.
- D. The exact length must be known to determine Zo.

8-40E6 What precautions should be taken with horizontal waveguide runs?

- A. They should be sloped slightly downwards at the elbow and a small drain hole drilled in the elbow.
- B. They should be absolutely level.
- C. They should not exceed 10 feet in length
- D. None of the above.

Key Topic 41 – Antenna to Display Interface

8-41E3 What is the most common type of antenna position indicating device used in modern RADARs?

- A. Servo systems.
- B. Resolvers.
- C. Synchro transmitters.
- D. Step motors.

8-41E5 An antenna synchro transmitter is composed of the following:

- A. Three rotor and two stator windings.
- B. Two rotor and three stator windings.
- C. Three rotor and three stator windings.
- D. A single rotor and 3 stator windings.

Key Topic 42 – Waveguides-1

8-42E1 Waveguides can be constructed from:

- A. Brass.
- B. Aluminum
- C. Copper.
- D. All of the above.

8-42E2 A microwave transmission line constructed of a center conductor suspended between parallel conductive ground planes is called:

- A. Stripline.
- B. Coax.
- C. Microstrip.
- D. Waveguide.

8-42E6 How is the signal removed from a waveguide or magnetron?

- A. With a thin wire called a J-Hook.
- B. With a waveguide flange joint
- C. With a thin wire called a T-hook.
- D. With a coaxial connector

Key Topic 43 – Waveguides-2

8-43E1 A rotary joint is used to:

- A. Couple two waveguides together at right angles.
- B. Act as a switch between two waveguide runs.
- C. Connect a stationary waveguide to the antenna array.
- D. Maintain pressurization at the end of the waveguide.

8-43E3 A right-angle bend in an X-band waveguide must have a radius greater than:

- A. Two inches.
- B. One inch.
- C. Six inches.
- D. Three inches.

8-43E6 At microwave frequencies, waveguides are used instead of conventional coaxial transmission lines because:

- A. They are smaller and easier to handle.
- B. They are lighter since they have hollow centers
- C. Moisture is never a problem with them.
- D. They have considerably less loss.**

Key Topic 44 – Equipment Faults-1

8-44F1 When you examine the RADAR you notice that there is no target video in the center of the CRT. The blank spot gets smaller in diameter as you increase the range scale. What operator front panel control could be misadjusted?

- A. TUNE.
- B. Sensitivity Time Control (STC).**
- C. Anti-Clutter Rain (ACR).
- D. False Target Elimination (FTE).

8-44F4 While the vessel is docked the presentation of the pier is distorted near the center of the PPI with the pier appearing to bend in a concave fashion. This is a primary indication of what?

- A. The waveguide compensation delay line needs adjusting.**
- B. The CRT filaments are weakening.
- C. The deflection coils need adjusting.
- D. The centering magnets at the CRT neck need adjusting.

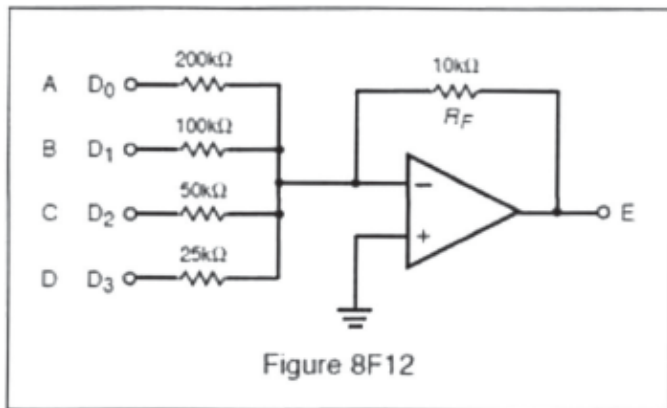
8-44F5 In a RADAR using digital video processing, a bright, wide ring appears at a fixed distance from the center of the display on all digital ranges. The transmitter is operating normally. What receiver circuit would you suspect is causing the problem?

- A. VRM circuit.
- B. Range ring generator.
- C. Video storage RAM or shift register.**
- D. EBL circuit.

Key Topic 45 – Equipment Faults-2

8-45F4 In the circuit contained in Fig. 8F12, there are 5 volts present at points B and C, and there are zero volts present at points A and D. What is the voltage at point E?

- A. 4.5 Volts
- B. -1.5 Volts**
- C. 3.75 Volts.
- D. 23.75 Volts.



8-45F5 If the TR tube malfunctions:

- A. The klystron might be damaged.
- B. The receiver might be damaged.
- C. The transmitter might be damaged.
- D. Magnetron current will increase.

8-45F6 The indicated distance from your own vessel to a lighthouse is found to be in error. What circuit would you suspect?

- A. FTC circuit.
- B. STC circuit
- C. Video amplifier.
- D. Range ring oscillator.

Key Topic 46 – Equipment Faults-3

8-46F1 Silicon crystals are used in RADAR mixer and detector stages. Using an ohmmeter, how might a crystal be checked to determine if it is functional?

- A. It would be more appropriate to use a VTVM and measure the voltage drop across the crystal.
- B. Its resistance should be low in one direction and high in the opposite direction.
- C. Its resistance cannot be checked with a de ohmmeter because the crystal acts as a rectifier
- D. Its resistance should be the same in both directions.

8-46F6 Low or no mixer current could be caused by:

- A. Local oscillator frequency misadjustment.
- B. TR cell failure.
- C. Mixer diode degradation.
- D. All of the above.

Key Topic 47 – Equipment Faults-4

8-47F3 Loss of distant targets during and immediately after wet weather indicates:

- A. High atmospheric absorption.
- B. High humidity in the transmitter causing power supply loading.
- C. Dirt or soot on the rotary joint.
- D. A leak in the waveguide or rotary joint.

8-47F4 In a marine RADAR set, a high VSWR is indicated at the magnetron output. The waveguide and rotary joint appear to be functioning properly. What component may be malfunctioning?

- A. The STC circuit.
- B. The waveform generator.
- C. The waveguide array termination.
- D. The magnetron.

Key Topic 48 – Maintenance

8-48F2 The echo box is used for:

- A. Amplification of the echo signal.
- B. Testing and tuning of the RADAR unit by providing artificial targets
- C. Detection of the echo pulses.
- D. Testing the wavelength of the incoming echo signal.

8-48F3 What should be done to the interior surface of a waveguide in order to minimize signal loss?

- A. Keep it as clean as possible.
- B. Fill it with nitrogen gas.
- C. Fill it with a high-grade electrical oil.
- D. Paint it with non conductive paint to prevent rust.

Key Topic 49 – Installation

8-49F1 Why is coaxial cable often used for S-band installations instead of a waveguide?

- A. S-band waveguide flanges show too much leakage and are unsafe for use near personnel
- B. Losses can be kept reasonable at S-band frequencies and the installation cost is lower.
- C. Dimensions for S-band waveguides do not permit a rugged enough installation for use by ships at sea.
- D. A waveguide will not support the power density required for modern S-band RADAR transmitters.

8-49F2 RADAR interference to a communications receiver is eliminated by:

- A. Using a high pass filter on the power line.
- B. Using a link coupling.
- C. Not operating other devices when RADAR is in use.
- D. Properly grounding, bonding, and shielding all units.

8-49F5 In a RADAR system, waveguides should be installed:

- A. Slightly bent for maximum gain
- B. As long as possible for system flexibility
- C. At 90 degree angles to improve resonance
- D. As straight as possible to reduce distortion.

Key Topic 50 – Safety

8-50F1 Choose the most correct statement with respect to component damage from electrostatic discharge:

- A. ESD damage occurs primarily in passive components which are easily identified and replaced.
- B. ESD damage may cause immediate circuit failures, but may also cause failures much later at times when the RADAR set is critically needed.
- C. ESD damage occurs primarily in active components which are easily identified and replaced.
- D. The technician will feel a small static shock and recognize that ESD damage has occurred to the circuit.

8-50F4 While removing a CRT from its operating casing, it is a good idea to:

- A. Wear gloves and goggles.
- B. Test the second anode with your fingertip
- C. Discharge the first anode
- D. Set it down on a hard surface

8-50F5 If a CRT is dropped:

- A. It might go out of calibration.
- B. Most likely nothing will happen because they are built with durability in mind.
- C. It might implode, causing damage to workers and equipment.
- D. The phosphor might break loose.

Key Topic 1: Electrical Elements

3-1A1 The product of the readings of an AC voltmeter and AC ammeter is called:

- A. Current power.
- B. Power factor.
- C. True power.
- D. Apparent power.

3-1A3 What is the term used to express the amount of electrical energy stored in an electrostatic field?

- A. Volts.
- B. Joules.**
- C. Watts.
- D. Coulombs.

Key Topic 2: Magnetism

3-2A1 What determines the strength of the magnetic field around a conductor?

- A. The resistance divided by the current.
- B. The diameter of the conductor
- C. The amount of current.**
- D. The ratio of the current to the resistance.

3-2A2 What will produce a magnetic field?

- A. A DC source not connected to a circuit
- B. The force that drives current through a resistor.
- C. A current flowing through a conductor.**
- D. The presence of a voltage across a capacitor

3-2A3 When induced currents produce expanding magnetic fields around conductors in a direction that opposes the original magnetic field, this is known as:

- A. Lenz's law**
- B. Gilbert's law
- C. Norton's law
- D. Maxwell's law.

Key Topic 3: Materials

3-3A4 Skin effect is the phenomenon where:

- A. RF current flows in a thin layer of the conductor.closer to the surface, as frequency decreases.
- B. Thermal effects on the surface of the conductor increase the impedance.
- C. RF current flows in a thin layer of the conductor, closer to the surface, as frequency increases.**
- D. Thermal effects on the surface of the conductor decrease the impedance.

3-3A6 Which of these will be most useful for Insulation at UHF frequencies?

- A. Rubber
- B. Wax impregnated paper
- C. Lead.
- D. Mica**

Key Topic 4: Resistance, Capacitance & Inductance

3-4A3 Which of the 4 groups of metals listed below are the best low-resistance conductors?

- A. Stainless steel, bronze, and lead.
- B. Bronze, zinc, and manganese.
- C. Iron, lead, and nickel.
- D. Gold, silver, and copper.**

3-4A4 What is the purpose of a bypass capacitor?

- A. It removes alternating current by providing a low impedance path to ground.**
- B. It removes direct current from the circuit by shunting DC to ground.
- C. It increases the resonant frequency of the circuit.
- D. It forms part of an impedance transforming circuit.

Key Topic 5: Semi-conductors

3-5A1 What are the two most commonly-used specifications for a Junction diode?

- A. Maximum reverse current and capacitance.
- B. Maximum forward current and capacitance.
- C. Maximum forward current and PIV (peak inverse voltage).
- D. Maximum reverse current and PIV (peak inverse voltage).

3-5A4 What are the two basic types of junction field effect transistors?

- A. N-channel and P-channel.
- B. MOSFET and GaAsFET
- C. Silicon FET and germanium FET.
- D. High power and low power.

Key Topic 6: Electrical Measurements

3-6A2 By what factor must the voltage of an AC circuit, as indicated on the scale of an AC voltmeter, be multiplied to obtain the peak voltage value?

- A. 0.707
- B. 0.9
- C. 3.14
- D. 1.414

3-6A4 What is the easiest voltage amplitude to measure by viewing a pure sine wave signal on an oscilloscope?

- A. Average.
- B. DC.
- C. RMS.
- D. Peak-to-peak.

3-6A6 What is the peak voltage at a common household electrical outlet?

- A. 234 volts.
- B. 331 volts.
- C. 165.5 volts.
- D. 117 volts.

Key Topic 7: Waveforms

3-7A1 What is a sine wave?

- A. A wave whose polarity changes in a random manner.
- B. A wave whose amplitude at any given instant can be represented by the projection of a point on a wheel rotating at a uniform speed.
- C. A wave following the laws of the trigonometric tangent function.
- D. A constant-voltage, varying-current wave.

3-7A6 What type of wave is characterized by a rise time significantly faster than the fall time (or vice versa)?

- A. Square wave.
- B. Cosine wave
- C. Sawtooth wave.
- D. Sine wave.

Key Topic 8: Conduction

3-8A1 What is the term used to identify an AC voltage that would cause the same heating in a resistor as a corresponding value of DC voltage?

- A. Cosine voltage.
- B. Power factor.
- C. Root mean square (RMS).
- D. Average voltage.

3-8A2 What happens to reactive power in a circuit that has both inductors and capacitors?

- A. It alternates between magnetic and electric fields and is not dissipated.
- B. It is dissipated as heat in the circuit.
- C. It is dissipated as inductive and capacitive fields.
- D. It is dissipated as kinetic energy within the circuit.

3-8A3 Halving the cross-sectional area of a conductor will:

- A. Double the resistance.
- B. Quarter the resistance.
- C. Halve the resistance.
- D. Not affect the resistance

Key Topic 9: Ohm's Law-1

3-9B2 Which of the following Ohms Law formulas is incorrect?

- A. $I = R / E$
- B. $I = E / R$
- C. $E = I \times R$
- D. $R = E / I$

3-9B3 If a current of 2 amperes flows through a 50-ohm resistor, what is the voltage across the resistor?

- A. 25 volts.
- B. 100 volts
- C. 52 volts.
- D. 200 volts.

3-9B6 A relay coil has 500 ohms resistance, and operates on 125 mA. What value of resistance should be connected in series with it to operate from 110 V DC?

- A. 470 ohms.
- B. 220 ohms.
- C. 150 ohms.
- D. 380 ohms.

Key Topic 10: Ohm's Law-2

3-10B1 What is the peak-to-peak RF voltage on the 50 ohm output of a 100 watt transmitter?

- A. 200 volts.
- B. 70 volts
- C. 100 volts.
- D. 140 volts.

3-10B2 What is the maximum DC or RMS voltage that may be connected across a 20 watt, 2000 ohm resistor?

- A. 100 volts.
- B. 10,000 volts
- C. 10 volts.
- D. 200 volts.

Key Topic 11: Frequency

3-11B1 What is the most the actual transmit frequency could differ from a reading of 462,100,000 Hertz on a frequency counter with a time base accuracy of +/- 0.1 ppm?

- A. 462.1 Hz
- B. 0.2 MHz.
- C. 46.21 Hz.
- D. 0.1 MHz.

3-11B5 What is the most the actual transmitter frequency could differ from a reading of 156,520,000 Hertz on a frequency counter with a time base accuracy of ± 10 ppm?

- A. 146.52 Hz
- B. 156.52 kHz.
- C. 1565.20 Hz.
- D. 10 Hz.

Key Topic 12: Waveforms

3-12B2 At 150 degrees, what is the amplitude of a sine wave having a peak value of 5 volts?

- A. -4.3 volts
- B. +2.5 volts
- C. -2.5 volts.
- D. +4.3 volts.

3-12B4 What is the equivalent to the root-mean-square value of an AC voltage?

- A. AC voltage is the square root of the average AC value.
- B. The DC voltage causing the same heating in a given resistor as the RMS AC voltage of the same value.
- C. The AC voltage found by taking the square of the average value of the peak AC voltage.
- D. The DC voltage causing the same heating in a given resistor at the peak AC voltage.

Key Topic 13: Power Relationships

3-13B1 What does the power factor equal in an R-L circuit having a 60 degree phase angle between the voltage and the current?

- A. 1.73
- B. 0.414
- C. 0.5
- D. 0.866

3-13B2 If a resistance to which a constant voltage is applied is halved, what power dissipation will result?

- A. Double.
- B. Halved.
- C. Remain the same.
- D. Quadruple

3-13B6 What does the power factor equal in an R-L circuit having a 30 degree phase angle between the voltage and the current?

- A. 0.5
- B. 0.866
- C. 1.73
- D. 0.577

Key Topic 14: RC Time Constants-1

3-14B3 What is the term for the time required for the current in an RL circuit to build up to 63.2% of the maximum value?

- A. One exponential rate.
- B. One time constant.
- C. A time factor of one.
- D. An exponential period of one

Key Topic 14: RC Time Constants-1

3-15B1 What is the time constant of a circuit having two 220-microfarad capacitors and two 1-megohm resistors all in parallel?

- A. 22 seconds.
- B. 440 seconds.
- C. 44 seconds.
- D. 220 seconds.

3-15B3 What is the time constant of a circuit having a 100-microfarad capacitor and a 470-kilo ohm resistor in series?

- A. 4700 seconds.
- B. 47 seconds.
- C. 470 seconds.
- D. 0.47 seconds.

3-15B6 What is the time constant of a circuit having two 220-microfarad capacitors and two 1-megohm resistors all in series?

- A. 110 seconds.
- B. 55 seconds.
- C. 220 seconds.
- D. 440 seconds.

Key Topic 16: Impedance Networks-1

3-16B1 What is the impedance of a network composed of a 0.1-microhenry inductor in series with a 20-ohm resistor, at 30 MHz? Specify your answer in rectangular coordinates.

- A. $19 + j20$
- B. $19 - j20$
- C. $20 - j19$
- D. $20 + j19$

3-16B3 In rectangular coordinates, what is the impedance of a network composed of a 10- microhenry inductor in series with a 40-ohm resistor, at 500 MHz?

- A. $40 - j31400$
- B. $31400 - j40$
- C. $31400 + j40$
- D. $40 + j31400$

Key Topic 17: Impedance Networks-2

3-17B3 In polar coordinates, what is the impedance of a network composed of a 400-ohm-reactance capacitor in series with a 300-ohm resistor?

- A. 500 ohms, -53.1 degrees
- B. 240 ohms, $/36.9$ degrees
- C. 240 ohms, -36.9 degrees
- D. 500 ohms, $/53.1$ degrees

3-17B6 Using the polar coordinate system, what visual representation would you get of a voltage in a sine wave circuit?

- A. To graphically represent the AC and DC component
- B. The plot shows the magnitude and phase angle.
- C. To show the reactance which is present.
- D. To display the data on an XY chart.

Key Topic 18: Calculations

3-18B2 A 1-watt, 10-volt Zener diode with the following characteristics: $I_{min.} = 5 \text{ mA}$; $I_{max.} = 95 \text{ mA}$; and $Z = 8 \text{ ohms}$, is to be used as part of a voltage regulator in a 20-V power supply. Approximately what size current-limiting resistor would be used to set its bias to the midpoint of its operating range?

- A. 1 kilohms.
- B. 2 kilohms.
- C. 100 ohms.
- D. 200 ohms

3-18B6 What is the conductance (G) of a circuit if 6 amperes of current flows when 12 volts DC is applied?

- A. 1.25 Siemens (mhos).
- B. 0.50 Siemens (mhos).
- C. 1.00 Siemens (mhos).
- D. 0.25 Siemens (mhos).

Key Topic 19: Photoconductive Devices

3-19C2 What is the photoconductive effect?

- A. The conversion of photon energy to electromotive energy
- B. The increased conductivity of an illuminated semiconductor junction
- C. The conversion of electromotive energy to photon energy.
- D. The decreased conductivity of an illuminated semiconductor junction.

3-19C4 What is the description of an opto isolator?

- A. A P-N junction that develops an excess positive charge when exposed to light.
- B. An LED and a lithium battery cell.
- C. An LED and a photosensitive device.
- D. An LED and a capacitor.

3-19C6 What is the description of an optocoupler?

- A. An amplitude modulated beam encoder.
- B. An LED and a photosensitive device.
- C. A resistor and a capacitor
- D. Two light sources modulated onto a mirrored surface.

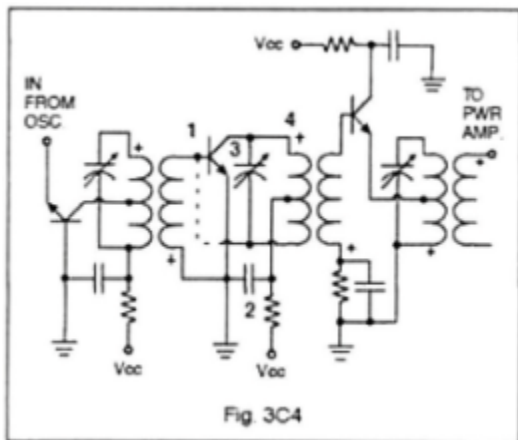
Key Topic 20: Capacitors

3-20C1 What factors determine the capacitance of a capacitor?

- A. Distance between the plates and the dielectric constant of the material between the plates.
- B. Amount of charge on the plates and the dielectric constant of the material between the plates.
- C. Voltage on the plates and distance between the plates.
- D. Voltage on the plates and the dielectric constant of the material between the plates.

3-20C3 In Figure 3C4, which component (labeled 1 through 4) is used to provide a signal ground?

- A. 2
- B. 1
- C. 3
- D. 4



3-20C6 What is the purpose of a coupling capacitor?

- A. It decreases the resonant frequency of the circuit
- B. It blocks direct current and passes alternating current.
- C. It blocks alternating current and passes direct current.
- D. It increases the resonant frequency of the circuit.

Key Topic 21: Transformers

3-21C3 A transformer primary of 2250 turns connected to 120 VAC will develop what voltage across a 500- turn secondary?

- A. 26.7 volts.
- B. 5.9 volts.
- C. 1500 volts.
- D. 2300 volts.

3-21C5 A power transformer has a single primary winding and three secondary windings producing 5.0 volts, 12.6 volts, and 150 volts. Assuming similar wire sizes, which of the three secondary windings will have the highest measured DC resistance?

- A. The 12.6 volt winding.
- B. The 150 volt winding
- C. The 5.0 volt winding
- D. All will have equal resistance values.

Key Topic 22: Voltage Regulators, Zener Diodes

3-22C1 In a linear electronic voltage regulator:

- A. The pass transistor switches from the "off state to the "on" state
- B. The output is a ramp voltage.
- C. The control device is switched on or off, with the duty cycle proportional to the line or load conditions
- D. The conduction of a control element is varied in direct proportion to the line voltage or load current.

3-22C2 A switching electronic voltage regulator:

- A. Provides more than one output voltage.

B. Varies the conduction of a control element in direct proportion to the line voltage or load current

C. Switches the control device on or off, with the duty cycle proportional to the line or load conditions.

D. Gives a ramp voltage at its output.

3-22C5 A three-terminal regulator:

A. Supplies three voltages with variable current

B. Supplies three voltages at a constant current.

C. Contains a voltage reference, error amplifier, sensing resistors and transistors, and a pass element.

D. Contains three error amplifiers and sensing transistors.

Key Topic 23: SCRs, Triacs

3-23C1 How might two similar SCRs be connected to safely distribute the power load of a circuit?

A. In parallel, reverse polarity.

B. In series.

C. In a combination series and parallel configuration

D. In parallel, same polarity

3-23C5 What are the three terminals of a TRIAC?

A. Emitter, base 1, and base 2

B. Gate, source, and sink.

C. Gate, anode 1, and anode 2.

D. Base, emitter, and collector

3-23C6 What circuit might contain a SCR?

A. Shunt across a transformer primary.

B. A light-dimming circuit.

C. Filament circuit of a tube radio receiver.

D. Bypass capacitor circuit to ground.

Key Topic 24: Diodes

3-24C1 What is one common use for PIN diodes?

A. Constant current source.

B. RF switch.

C. Constant voltage source.

D. RF rectifier.

3-24C5 What type of semiconductor diode varies its internal capacitance as the voltage applied to its terminals varies?

A. Silicon-controlled rectifier.

B. Tunnel diode.

C. High forward resistance.

C. Varactor diode.

D. Zener diode.

3-24C6 What is the principal characteristic of a tunnel diode?

A. Negative resistance region.

B. High forward current rating.

C. High forward resistance.

D. Very high PIV(peak inverse voltage).

Key Topic 25: Transistors-1

3-25C2 What are the three terminals of a bipolar transistor?

- A. Input, output and ground.
- B. Cathode, plate and grid.
- C. Base, collector and emitter.
- D. Gate, source and sink.

3-25C3 What is the meaning of the term “beta” with regard to bipolar transistors? The change of:

- A. Base current with respect to emitter current.
- B. Collector current with respect to emitter current
- C. Base current with respect to gate current.
- D. Collector current with respect to base current.

Key Topic 26: Transistors-2

3-26C2 What does it mean for a transistor to be cut off?

- A. The transistor is at its Class A operating point.
- B. There is maximum current between emitter and collector.
- C. There is no base current.
- D. There is no current between emitter and collector.

3-26C3 An emitter-follower amplifier has:

- A. Lowest input impedance of the three amplifier configurations.
- B. More power gain than common emitter or common base
- C. More current gain than common emitter or common base
- D. More voltage gain than common emitter or common base.

3-26C5 What is the meaning of the term “beta” with regard to bipolar transistors? The change of:

- A. Collector current with respect to emitter current.
- B. Base current with respect to gate current
- C. Base current with respect to emitter current
- D. Collector current with respect to base current.

Key Topic 27: Light Emitting Diodes

3-27C1 What type of bias is required for an LED to produce luminescence?

- A. Logic 1 (Hi) bias.
- B. Forward bias.
- C. Logic 0 (Lo) bias.
- D. Reverse bias.

3-27C2 What determines the visible color radiated by an LED Junction?

- A. The amount of voltage across the device.
- B. The amount of current through the device
- C. The color of a lens in an eyepiece.
- D. The materials used to construct the device.

Key Topic 28: Devices

3-28C5 An electrical relay is a:

- A. Remotely controlled switching device.
- B. Current limiting device.
- C. Device used for supplying 3 or more voltages to a circuit
- D. Component used mainly with HF audio amplifiers.

3-28C4 What is the piezoelectric effect?

- A. Reversed conduction states when a P-N junction is exposed to light
- B. Mechanical vibration of a crystal by the application of a voltage.
- C. Mechanical deformation of a crystal by the application of a magnetic field.
- D. The generation of electrical energy by the application of light.

Key Topic 29: R-L-C Circuits

3-29D3 How could voltage be greater across reactances in series than the applied voltage?

- A. Resistance.
- B. Capacitance.
- C. Conductance
- D. Resonance.

3-29D5 What is the characteristic of the current flow within the parallel elements in a parallel R-L-C circuit at resonance?

- A. DC.
- B. Maximum.
- C. Minimum.
- D. Zero.

3-29D6 What is the relationship between current through a resonant circuit and the voltage across the circuit?

- A. The voltage leads the current by 90 degrees.
- B. The current leads the voltage by 90 degrees.
- C. The voltage and current are in phase.
- D. The current and voltage are 180 degrees out of phase.

Key Topic 30: Op Amps

3-30D1 What is the main advantage of using an op-amp audio filter over a passive LC audio filter?

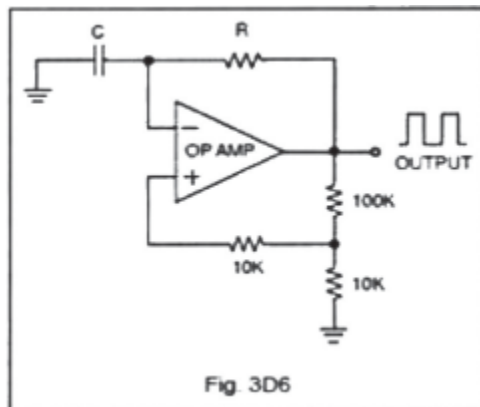
- A. Op-amps are largely immune to vibration and temperature change.
- B. Op-amps exhibit gain rather than insertion loss.
- C. Most LC filter manufacturers have retooled to make op-amp filters.
- D. Op-amps are readily available in a wide variety of operational voltages and frequency ranges.

3-30D5 Which of the following op-amp circuits is operated open-loop?

- A. Non-inverting amp.
- B. Active filter
- C. Inverting amp.
- D. Comparator.

3-30D6 In the op-amp oscillator circuit shown in Figure 3D6, what would be the most noticeable effect if the capacitance of C were suddenly doubled?

- A. Frequency would be lower.
- B. Frequency would be higher.
- C. There would be no change. The inputs are reversed. therefore the circuit cannot function.
- D. None of the above.



Key Topic 31: Phase Locked Loops (PLLs); Voltage Controlled Oscillators (VCOs); Mixers

3-31D1 What frequency synthesizer circuit uses a phase comparator, look-up table, digital-to-analog converter, and a low-pass antialias fi filter?

- A. A diode-switching matrix synthesizer
- B. A direct digital synthesizer.
- C. Phase-locked-loop synthesizer.
- D. A hybrid synthesizer.

3-31D2 A circuit that compares the output of a voltage -controlled oscillator (VCO) to a frequency standard and produces an error voltage that is then used to adjust the capacitance of a varactor diode used to control frequency in that same VCO is called what?

- A. Phase-locked loop.
- B. Doubly balanced mixer.
- C. Variable frequency oscillator.
- D. Differential voltage amplifier.

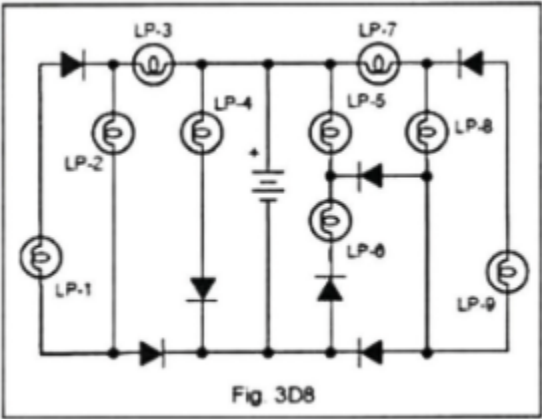
3-31D6 What is the definition of a phase-locked loop {PLL} circuit?

- A. A circuit also known as a monostable multivibrator.
- B. A servo loop consisting of a phase detector, a low pass filter and voltage-controlled oscillator.
- C. A servo loop consisting of a ratio detector, reactance modulator, and voltage-controlled oscillator
- D. A circuit consisting of a precision push-pull amplifier with a differential input.

Key Topic 32: Schematics

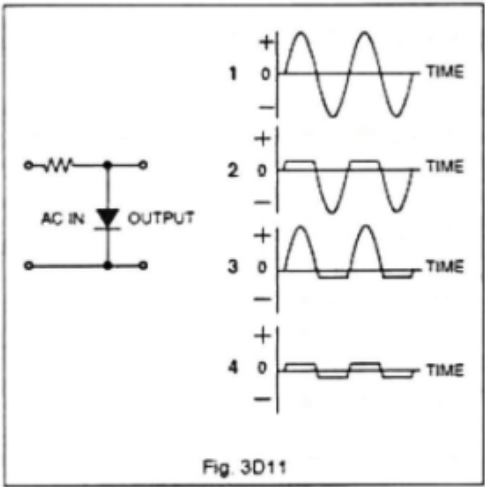
3-32D2 Which lamps would be lit in the circuit shown in Figure 3D8?

- A. 2, 3, 4, 5 and 6.
- B. 2, 3, 4, 7 and 8.
- C. 1, 3, 5, 7 and 8.
- D. 5, 6, 8 and 9.



3-32D6 With a pure AC signal input to the circuit shown in Figure 3D11, what output wave form would you expect to see on an oscilloscope display?

- A. 3
- B. 2
- C. 4
- D. 1



Key Topic 33: Types of Logic

3-33E4 TTL inputs left open develop what logic state?

- A. Random high-and low-logic states.
- B. A low-logic state
- C. Open inputs on a TTL device are ignored
- D. A high-logic state

3-33E6 What do the initials TTL stand for?

- A. Diode-transistor logic.
- B. Transistor-transistor logic.**
- C. Resistor-transistor logic.
- D. Emitter-coupled logic.

Key Topic 34: Logic Gates

3-34E1 What is a characteristic of an AND gate?

- A. Produces a logic "0" at its output only if all inputs are logic "1"**
- B. Produces a logic "1" at its output if all inputs are logic "0".
- C. Produces a logic "1" at its output if only one input is a logic "1".
- D. Produces a logic "1" at its output only if all inputs are logic "1".

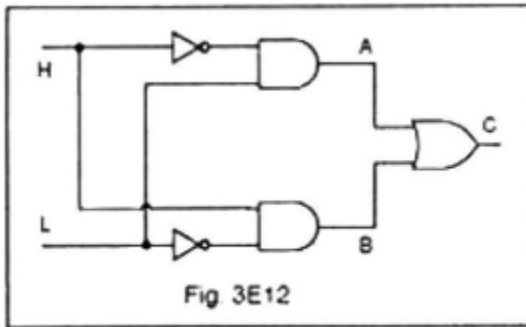
3-34E4 What is a characteristic of a NOR gate?

- A. Produces a logic "0" at its output only if all inputs are logic "0".
- B. Produces a logic "1" at its output if some but not all of its inputs are logic "1".
- C. Produces a logic "1" at its output only if all inputs are logic "1".
- D. Produces a logic "0" at its output if any or all inputs are logic "1".**

Key Topic 35: Logic Levels

3-35E2 For the logic input levels shown in Figure 3E12, what are the logic levels of test points A, B and C in this circuit? (Assume positive logic.)

- A. A is low, B is high and C is high.**
- B. A is low, B is high and C is low
- C. A is high, B is high and C is low.
- D. A is high, B is low and C is low.



3-35E5 Given the input levels shown in Figure 3E14 and assuming positive logic devices, what would the output be?

- A. A is low, B is high and C is high.**
- B. A is high, B is high and C is low
- C. A is low, B is low and C is high.
- D. None of the above are correct

3-35E6 What is a truth table?

- A. A table of logic symbols that indicate the high logic states of an op-amp
- B. A table of logic symbols that indicates the low logic states of an op-amp
- C. A diagram showing logic states when the digital device's output is true.
- D. A list of input combinations and their corresponding outputs that characterizes a digital device's function.**

Key Topic 36: Flip-Flops

3-36E1 A flip-flop circuit is a binary logic element with how many stable states?

- A. 1
- B. 8
- C. 4
- D. 2**

3-36E3 How many flip-flops are required to divide a signal frequency by 4?

- A. 1
- B. 4
- C. 2**
- D. 8

3-36E6 An R-S flip-flop is capable of doing all of the following except:

- A. Refuse to accept synchronous data if asynchronous data is being input at same time.
- B. Accept data input into PRE and CLR inputs without CLK being initiated
- C. Accept data input into R-S inputs with CLK initiated.
- D. Operate in toggle mode with R-S inputs held constant and CLK initiated.**

Key Topic 37: Multivibrators

3-37E2 What is an astable multivibrator?

- A. A circuit that alternates between a stable state and an unstable state
- B. A circuit set to block either a 0 pulse or a 1 pulse and pass the other**
- C. A circuit that alternates between two unstable states.
- D. A circuit that alternates between two stable states.

3-37E4 What is a bistable multivibrator circuit commonly named?

- A. OR gate.
- B. Clock.
- C. Flip-flop.**
- D. AND gate.

3-37E6 What waveform would appear on the voltage outputs at the collectors of an astable, multivibrator, common-emitter stage?

- A. Sawtooth wave
- B. Square wave.**
- C. Sine wave.
- D. Half-wave pulses.

Key Topic 38: Memory

3-38E1 What is the name of the semiconductor memory IC whose digital data can be written or read, and whose memory word address can be accessed randomly?

- A. EPROM - Electrically Programmable Read-Only Memory.
- B. ROM - Read-Only Memory.
- C. RAM - Random-Access Memory**
- D. PROM - Programmable Read-Only Memory

3-38E3 What does the term "IO" mean within a microprocessor system?

- A. Integer operation.
- B. Input-output.**
- C. Internal operation.
- D. Integrated oscillator.

Key Topic 39: Microprocessors

3-39E1 In a microprocessor-controlled two-way radio, a “watchdog” timer:

- A. Verifies that the microprocessor is executing the program.
- B. Connects to the system RADAR presentation.
- C. Assures that the transmission is exactly on frequency.
- D. Prevents the transmitter from exceeding allowed power out.

3-39E6 What circuit interconnects the microprocessor with the memory and input/output system?

- A. PLL line.
- B. Control logic bus.
- C. Data bus line.
- D. Directional coupler.

Key Topic 40: Counters, Dividers, Converters

3-40E4 What integrated circuit device converts an analog signal to a digital signal?

- A. DAC
- B. DCC
- C. CDC
- D. ADC

3-40E5 What Integrated circuit device converts digital signals to analog signals?

- A. ADC
- B. CDC
- C. DCC
- D. DAC

3-40E6 In binary numbers, how would you note the quantity TWO?

- A. 0002
- B. 2000
- C. 0010
- D. 0020

Key Topic 41: Receiver Theory

3-41F1 What is the limiting condition for sensitivity in a communications receiver?

- A. The noise floor of the receiver.
- B. The power supply output ripple.
- C. The two-tone intermodulation distortion.
- D. The input impedance to the detector.

3-41 F3 What is the term used to refer to a reduction in receiver sensitivity caused by unwanted high-level adjacent channel signals?

- A. Overloading.
- B. Intermodulation distortion.
- C. Desensitizing.
- D. Quieting.

Key Topic 42: RF Amplifiers

3-42F3 How much gain should be used in the RF amplifier stage of a receiver?

- A. It depends on the amplification factor of the first IF stage.
- B. As much gain as possible short of self oscillation.
- C. Sufficient gain to allow weak signals to overcome noise generated in the first mixer stage.
- D. Sufficient gain to keep weak signals below the noise of the first mixer stage.

3-42F4 Too much gain in a VHF receiver front end could result in this:

- A. Dramatic increase in receiver current.
- B. Difficult to match receiver impedances.
- C. Susceptibility of intermodulation interference from nearby transmitters.
- D. Local signals become weaker.

3-42F5 What is the advantage of a GaAsFET preamplifier in a modern VHF radio receiver?

- A. Low gain but high selectivity.
- B. Increased selectivity and flat gain.
- C. High gain with high noise floor.
- D. High gain and low noise floor.

Key Topic 43: Oscillators

3-43F2 What is the oscillator stage called in a frequency synthesizer?

- A. Reference standard.
- B. Divider.
- C. Phase detector.
- D. VCO.

3-43F5 What condition must exist for a circuit to oscillate? It must:

- A. Have a gain of less than 1.
- B. Be neutralized.
- C. Have sufficient positive feedback.
- D. Have sufficient negative feedback.

Key Topic 44: Mixers

3-44F2 What is the mixing process in a radio receiver?

- A. The elimination of noise in a wideband receiver by phase comparison.
- B. The combination of two signals to produce sum and difference frequencies.
- C. The elimination of noise in a wideband receiver by phase differentiation.
- D. Distortion caused by auroral propagation.

3-44F4 What are the principal frequencies that appear at the output of a mixer circuit?

- A. The sum, difference and square root of the input frequencies.
- B. The original frequencies and the sum and difference frequencies.
- C. 1.414 and 0.707 times the input frequency.
- D. Two and four times the original frequency.

3-44F5 If a receiver mixes a 13.8 MHz VFO with a 14.255 MHz receive signal to produce a 455 kHz intermediate frequency signal, what type of interference will a 13.345 MHz signal produce in the receiver?

- A. Mixer interference.
- B. An image response.
- C. Local oscillator interference.
- D. Intermediate frequency interference.

Key Topic 45: IF Amplifiers

3-45F1 What degree of selectivity is desirable in the IF circuitry of a wideband FM phone receiver?

- A. 1 kHz.
- B. 15 kHz.
- C. 2.4 kHz.
- D. 4.2 kHz.

3-45F2 Which one of these filters can be used in microminiature electronic circuits?

- A. Floppy disk controller.
- B. Receiver SAW IF filter.
- C. High power transmitter cavity.
- D. Internet DSL to telephone line filter.

3-45F6 How should the filter bandwidth of a receiver IF section compare with the bandwidth of a received signal?

- A. Slightly greater than the received-signal bandwidth.
- B. Approximately four times the received-signal bandwidth.
- C. Approximately half the received-signal bandwidth.
- D. Approximately two times the received-signal bandwidth.

Key Topic 46: Filters and IF Amplifiers

3-46F1 What is the primary purpose of the final IF amplifier stage in a receiver?

- A. Gain.
- B. Bypass undesired signals.
- C. Noise figure performance.
- D. Dynamic response.

3-46F2 What factors should be considered when selecting an intermediate frequency?

- A. Noise figure and distortion.
- B. Interference to other services.
- C. Cross-modulation distortion and interference.
- D. Image rejection and selectivity

Key Topic 47: Filters

3-47F3 What are the three general groupings of filters?

- A. Hartley, Colpitts and Pierce
- B. Inductive, capacitive and resistive.
- C. High-pass, low-pass and band-pass.
- D. Audio, radio and capacitive.

3-47F5 What is an advantage of a constant-k filter?

- A. The ratio of the cutoff frequency to the trap frequency can be varied.
- B. It uses elliptic functions.
- C. It can match impedances over a wide range of frequencies.
- D. It has high attenuation of signals at frequencies far removed from the pass band.

3-47F6 What are the distinguishing features of a Butterworth filter?

- A. It requires only inductors.
- B. A filter whose product of the series- and shunt element impedances is a
- C. It only requires capacitors
- D. It has a maximally flat response over its passband.

Key Topic 48: Detectors

3-48F1 What is a product detector?

- A. It is used to detect cross-modulation products
- B. It amplifies and narrows the band-pass frequencies.
- C. It provides local oscillations for input to the mixer
- D. It uses a mixing process with a locally generated carrier

3-48F2 Which circuit is used to detect FM-phone signals?

- A. Frequency discriminator.
- B. Phase splitter.
- C. Balanced modulator.
- D. Product detector.

Key Topic 49: Audio & Squelch Circuits

3-49F2 What is the purpose of de-emphasis in the receiver audio stage?

- A. When coupled with the transmitter pre-emphasis, fl at audio and noise reduction is received.
- B. No purpose is achieved.
- C. To conserve bandwidth by squelching no-audio periods in the transmission.
- D. When coupled with the transmitter pre-emphasis, fl at audio is achieved.

3-49F4 What causes a squelch circuit to function?

- A. Received tones.
- B. Absence of noise.
- C. Presence of noise
- D. Received digital codes.

3-49F6 What radio circuit samples analog signals, records and processes them as numbers, then converts them back to analog signals?

- A. The pre-emphasis audio stage.
- B. The voltage controlled oscillator circuit.
- C. The squelch gate circuit.
- D. The digital signal processing circuit.

Key Topic 50: Receiver Performance

3-50F2 How can ferrite beads be used to suppress ignition noise? Install them:

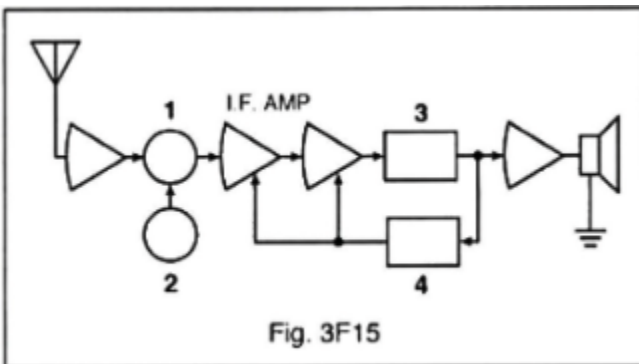
- A. In the resistive high voltage cable every 2 years.
- B. Install them in the primary and secondary ignition leads.
- C. In the antenna lead.
- D. Between the starter solenoid and the starter motor.

3-50F3 What is the term used to refer to the condition where the signals from a very strong station are superimposed on other signals being received?

- A. Intermodulation distortion.
- B. Capture effect.
- C. Cross-modulation interference.
- D. Receiver quieting.

3-50F5 In Figure 3F15 at what point in the circuit (labeled 1 through 4) could a DC voltmeter be used to monitor signal strength?

- A. 4
- B. 2
- C. 1
- D. 3



Key Topic 51: Amplifiers-1

3-51G2 What is the distinguishing feature of a Class A amplifier?

- A. Output for more than 180 degrees and less than 360 degrees of the signal cycle
- B. Output for the entire 360 degrees of the signal cycle.
- C. Output for exactly 180 degrees of the input signal cycle.
- D. Output for less than 180 degrees of the signal cycle.

3-51G3 Which class of amplifier has the highest linearity and least distortion?

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

3-51G4 Which class of amplifier provides the highest efficiency?

- A. Class C.
- B. Class A B.
- C. Class A.
- D. Class B.

Key Topic 52: Amplifiers-2

3-52G2 What input-amplitude parameter is most valuable in evaluating the signal-handling capability of a Class A amplifier?

- A. Resting voltage.
- B. Average voltage
- C. RMS voltage.
- D. Peak voltage.

3-52G3 The class C amplifier output is present for what portion of the input cycle?

- A. Less than 180 degrees.
- B. 360 degrees.
- C. Exactly 180 degrees.
- D. More than 180 but less than 360 degrees

3-52G6 What class of amplifier is characterized by conduction for 180 degrees of the input wave?

- A. Class D.
- B. Class A
- C. Class C.
- D. Class B.

Key Topic 53: Oscillators & Modulators

3-53G4 How does the modulation index of a phase modulated emission vary with RF carrier frequency?

- A. It decreases as the RF carrier frequency increases
- B. Modulation index increases as the RF carrier frequency increases.
- C. It does not depend on the RF carrier frequency.
- D. It varies with the square root of the RF carrier frequency

3-53G6 What is a balanced modulator?

- A. A modulator that produces a double sideband, suppressed carrier signal.
- B. A modulator that produces a single sideband, suppressed carrier signal.
- C. A modulator that produces a full carrier signal.
- D. An FM modulator that produces a balanced deviation.

Key Topic 54: Resonance - Tuning Networks

3-54G5 What is a pi-L network?

- A. A network with only three discrete parts.
- B. A network consisting of two inductors and two capacitors.
- C. A matching network in which all components are isolated from ground.
- D. A Phase Inverter Load network.

3-54G6 Which network provides the greatest harmonic suppression?

- A. Inverse L network.
- B. Pi network.
- C. Pi-L network.
- D. L network.

Key Topic 55: SSB Transmitters

3-55G3 In a single-sideband phone signal, what determines the PEP-to-average power ratio?

- A. The speech characteristics.
- B. The amplifier power.
- C. The degree of carrier suppression
- D. The frequency of the modulating signal.

3-55G4 What is the approximate ratio of peak envelope power to average power during normal voice modulation peak in a single-sideband phone signal?

- A. 2.5 to 1.
- B. 100 to 1.
- C. 1 to 1.
- D. 25 to 1.

Key Topic 56: Technology

3-56G3 What is the name of the condition that occurs when the signals of two transmitters in close proximity mix together in one or both of their final amplifiers, and unwanted signals at the sum and difference frequencies of the original transmissions are generated?

- A. Neutralization.
- B. Intermodulation interference.
- C. Adjacent channel interference.
- D. Amplifier desensitization.

3-56G6 What is the modulation type that can be a frequency hopping of one carrier or multiple simultaneous carriers?

- A. FM.
- B. SSB.
- C. Spread spectrum.
- D. OFSK.

Key Topic 57: Frequency Modulation

3-57H1 The deviation ratio is the:

- A. Carrier center frequency to the audio modulating frequency.
- B. Highest audio modulating frequency to the average audio modulating frequency.
- C. Audio modulating frequency to the center carrier frequency.
- D. Maximum carrier frequency deviation to the highest audio modulating frequency.

3-57H2 What is the deviation ratio for an FM phone signal having a maximum frequency deviation of plus or minus 5 kHz and accepting a maximum modulation rate of 3 kHz?

- A. 1.66
- B. 0.16
- C. 0.6
- D. 60

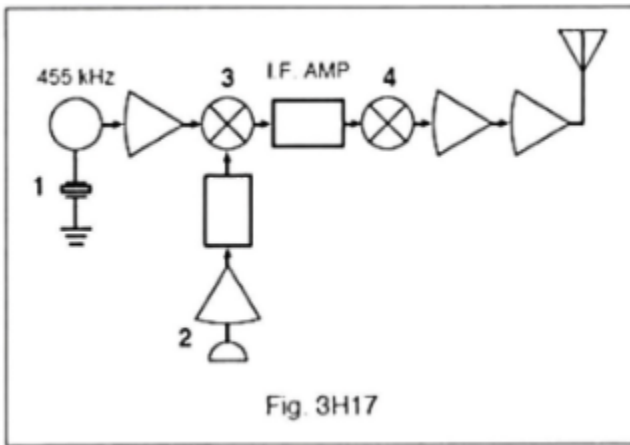
3-57H5 What is meant by the term modulation index?

- A. The ratio between the deviation of a frequency modulated signal and the modulating frequency
- B. The FM signal-to-noise ratio.
- C. The ratio of the maximum carrier frequency deviation to the highest audio modulating frequency
- D. The processor index.

Key Topic 58: SSB Modulation

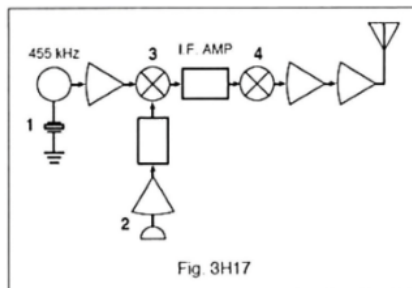
3-58H1 In Figure 3H17, the block labeled 4 would indicate that this schematic is most likely a/an:

- A. Wireless LAN (local area network) computer.
- B. SSB radio transmitter.
- C. Shipboard RADAR.
- D. Audio amplifier.



3-58H2 In Figure 3H17, which block diagram symbol (labeled 1 through 4) represents where audio intelligence is inserted?

- A. 4
- B. 2
- C. 3
- D. 1



3-58H4 What does a two-tone test illustrate on an oscilloscope?

- A. Frequency of the carrier phase shift
- B. Percentage of frequency modulation.
- C. Sideband suppression.
- D. Linearity of a SSB transmitter.

Key Topic 59: Pulse Modulation

3-59H1 What is an important factor in pulse-code modulation using time-division multiplex?

- A. Frequency separation.
- B. Overmodulation and under modulation.
- C. Synchronization of transmit and receive clock pulse rates.
- D. Slight variations in power supply voltage.

3-59H5 In a pulse-position modulation system, what parameter does the modulating signal vary?

- A. The number of pulses per second.
- B. The time at which each pulse occurs.
- C. The duration of the pulses.
- D. Both the frequency and amplitude of the pulses.

Key Topic 60: Batteries-1

3-60I5 The average fully-charged voltage of a lead-acid storage cell is:

- A. 1.56 volts.
- B. 2.06 volts.
- C. 1.2 volts.
- D. 1 volt.

3-60I6 A nickel-cadmium cell has an operating voltage of about:

- A. 1.25 volts.
- B. 1.5 volts.
- C. 1.4 volts.
- D. 2.1 volts.

Key Topic 61: Batteries-2

3-61I1 When an emergency transmitter uses 325 watts and a receiver uses 50 watts, how many hours can a 12.6 volt, 55 ampere-hour battery supply full power to both units?

- A. 6 hours.
- B. 1.8 hours.
- C. 1.2 hours.
- D. 3 hours.

3-61I2 What current will flow in a 6 volt storage battery with an internal resistance of 0.01 ohms, when a 3-watt, 6-volt lamp is connected?

- A. 0.4995 amps.
- B. 0.4885 amps.
- C. 0.5795 amps.
- D. 0.5566 amps.

3-61I3 A ship RADAR unit uses 315 watts and a radio uses 50 watts. If the equipment is connected to a 50 ampere-hour battery rated at 12.6 volts, how long will the battery last?

- A. 28.97 hours.
- B. 1 hour 43 minutes.
- C. 10 hours, 50 minutes.
- D. 29 minutes.

Key Topic 62: Motors & Generators

3-62I2 If a shunt motor running with a load has its shunt field opened, how would this affect the speed of the motor?

- A. It will slow down
- B. It will stop suddenly
- C. It will be unaffected
- D. It will speed up.

3-62I6 The output of a separately-excited AC generator running at a constant speed can be controlled by:

- A. The exciter
- B. The amount of field current.
- C. The brushes.
- D. The armature.

Key Topic 63: Antenna Theory

3-63J1 Which of the following could cause a high standing wave ratio on a transmission line?

- A. Excessive modulation
- B. An increase in output power
- C. Low power from the transmitter.
- D. A detuned antenna coupler.

3-63J6 What is meant by the term antenna bandwidth?

- A. The frequency range over which an antenna can be expected to perform well.
- B. The angle between the half-power radiation points.
- C. The angle formed between two imaginary lines drawn through the ends of the elements.
- D. Antenna length divided by the number of elements.

Key Topic 64: Voltage, Current and Power Relationships

3-64J3 Which of the following represents the best standing wave ratio (SWR)?

- A. 1:1.5.
- B. 1:3.
- C. 1:4.
- D. 1:1.

3-64J5 An antenna radiates a primary signal of 500 watts output. If there is a 2nd harmonic output of 0.5 watt, what attenuation of the 2nd harmonic has occurred?

- A. 10 dB
- B. 50 dB.
- C. 40 dB.
- D. 30 dB.

Key Topic 65: Frequency and Bandwidth

3-65J1 A vertical $1/4$ wave antenna receives signals:

- A. Equally from all horizontal directions.
- B. In one horizontal direction.
- C. In the microwave band.
- D. In one vertical direction.

3-65J2 The resonant frequency of a Hertz antenna can be lowered by:

- A. Placing an inductance in series with the antenna.
- B. Placing a condenser in series with the antenna.
- C. Lowering the frequency of the transmitter.
- D. Placing a resistor in series with the antenna.

3-65J6 To lengthen an antenna electrically, add a:

- A. Resistor
- B. Conduit
- C. Battery
- D. Coil.

Key Topic 66: Transmission Lines

3-66J1 What is the meaning of the term velocity factor of a transmission line?

- A. The velocity of the wave on the transmission line divided by the velocity of light in a vacuum
- B. The velocity of the wave on the transmission line multiplied by the velocity of light in a vacuum.
- C. The ratio of the characteristic impedance of the line to the terminating impedance
- D. The index of shielding for coaxial cable.

3-66J2 What determines the velocity factor in a transmission line?

- A. Dielectrics in the line.
- B. The line length.
- C. The termination impedance.
- D. The center conductor resistivity

3-66J4 A perfect (no loss) coaxial cable has 7 dB of reflected power when the input is 5 watts. What is the output of the transmission line?

- A. 1 watt.
- B. 1.25 watts
- C. 5 watts.
- D. 2.5 watts.

Key Topic 67: Effective Radiated Power

3-67J3 What is the effective radiated power of a repeater with 75 watts transmitter power output, 5 dB feedline loss, 4 dB duplexer and circulator loss, and 6 dB antenna gain?

- A. 150 watts.
- B. 237 watts
- C. 37.6 watts.
- D. 23.7 watts.

3-67J4 What is the effective radiated power of a repeater with 100 watts transmitter power output, 4 dB feedline loss, 3 dB duplexer and circulator loss, and 7 dB antenna gain?

- A. 25 watts.
- B. 400 watts
- C. 100 watts.
- D. 631 watts.

3-67J6 What is the effective radiated power of a repeater with 50 watts transmitter power output, 5 dB feedline loss, 4 dB duplexer and circulator loss, and 7 dB antenna gain?

- A. 31.5 watts.
- B. 69.9 watts.
- C. 300 watts
- D. 315 watts

Key Topic 68: Distance Measuring Equipment

3-68K1 What is the frequency range of the Distance Measuring Equipment (DME) used to indicate an aircraft's slant range distance to a selected ground based navigation station?

- A. 108.10 MHz to 111.95 MHz.
- B. 108.00 MHz to 117.95 MHz.
- C. 329.15 MHz to 335.00 MHz.
- D. 962 MHz to 1213 MHz

3-68K5 What radio navigation aid determines the distance from an aircraft to a selected VORTAC station by measuring the length of time the radio signal takes to travel to and from the station?

- A. RADAR.
- B. Distance Measuring Equipment (DME).
- C. Loran C.
- D. Distance Marking (DM).

3-68K6 The majority of airborne Distance Measuring Equipment systems automatically tune their transmitter and receiver frequencies to the paired ___ / ___ channel.

- A. VOR/marker beacon.
- B. LOC/glideslope
- C. Marker beacon/glideslope.
- D. VOR/LOC.

Key Topic 69: VHF Omnidirectional Range (VOR)

3-69K1 All directions associated with a VOR station are related to:

- A. Magnetic north.
- B. North pole.
- C. North star.
- D. None of these.

3-69K5 The amplitude modulated variable phase signal and the frequency modulated reference phase signal of a Very-high-frequency Omnidirectional Range (VOR) station used for aircraft navigation are synchronized so that both signals are in phase with each other at _____ of the VOR station.

- A. 180 degrees South, magnetic bearing position.
- B. 180 degrees South, true bearing position.
- C. 360 degrees North, magnetic bearing position
- D. 0 degrees North, true bearing position.

Key Topic 70: Instrument Landing System (ILS)

3-70K1 What is the frequency range of the localizer beam system used by aircraft to find the centerline of a runway during an Instrument Landing System (ILS) approach to an airport?

- A. 108.10 kHz to 111.95 kHz,
- B. 329.15 kHz to 335.00 kHz.
- C. 329.15 MHz to 335.00 MHz.
- D. 108.10 MHz to 111.95 MHz.

3-70K3 Which of the following is a required component of an Instrument Landing System (ILS)?

- A. Localizer: shows aircraft deviation horizontally from center of runway.
- B. VHF Communications: provide communications to aircraft.
- C. Altimeter: shows aircraft height above sea-level.
- D. Distance Measuring Equipment: shows aircraft distance to VORTAC station.

3-70K4 What type of antenna is used in an aircraft's Instrument Landing System (ILS)

glideslope installation?

- A. An electronically steerable phased-array antenna that radiates a directional antenna pattern.
- B. A vertically polarized antenna that radiates an omnidirectional antenna pattern.
- C. A folded dipole reception antenna.
- D. A balanced loop reception antenna.

Key Topic 71: Automatic Direction Finding Equipment (ADF) & Transponders

3-71 K1 What is the frequency range of an aircraft's Automatic Direction Finding (ADF) equipment?

- A. 108.10 MHz to 111.95 MHz.
- B. 190 kHz to 1750 kHz.
- C. 190 MHz to 1750 MHz.
- D. 108.00 MHz to 117.95 MHz.

3-71K3 What are the transmit and receive frequencies of an aircraft's mode C transponder operating in the Air Traffic Control RADAR Beacon System (ATCRBS)?

- A. Transmit at 1090 MHz. and receive at 1030 MHz
- B. Transmit at 1030 MHz. and receive at 1090 MHz
- C. Transmit at 1090 kHz, and receive at 1030 kHz
- D. Transmit at 1030 kHz, and receive at 1090 kHz

Key Topic 72: Aircraft Antenna Systems and Frequencies

3-72K4 Aircraft Emergency Locator Transmitters (EL T) operate on what frequencies?

- A. 243 MHz.
- B. 121.5, 243 and 406 MHz.
- C. 121.5 and 243 MHz.
- D. 121.5 MHz.

3-72K5 What is the frequency range of an aircraft's radio altimeter?

- A. 108.00 MHz to 117.95 MHz.
- B. 329.15 MHz to 335.00 MHz.
- C. 4250 MHz to 4350 MHz.
- D. 962 MHz to 1213 MHz.

Key Topic 73: Equipment Functions

3-73K3 Typical airborne HF transmitters usually provide a nominal RF power output to the antenna of __ watts, compared with __ watts RF output from a typical VHF transmitter.

- A. 100, 20
- B. 8, 10, 50
- C. 20, 100
- D. 50, 10

3-73K5 What type of antenna is used in an aircraft's Very High Frequency Omnidirectional Range (VOR) and Localizer (LOC) installations?

- A. Horizontally polarized omnidirection reception antenna.
- B. Balanced loop transmission antenna.
- C. Folded dipole reception antenna.
- D. Vertically polarized antenna that radiates an omnidirectional antenna pattern.

Key Topic 74: Indicating Meters

3-74L2 A 50 microampere meter movement has an internal resistance of 2,000 ohms. What applied voltage is required to indicate half-scale deflection?

- A. 0.05 volts
- B. 0.10 volts
- C. 0.01 volts
- D. 0.005 volts.

3-74L3 What is the purpose of a series multiplier resistor used with a voltmeter?

- A. It is used to increase the voltage-indicating range of the voltmeter.
- B. It is used to decrease the voltage-indicating range of the voltmeter.
- C. A multiplier resistor is not used with a voltmeter.
- D. It is used to increase the current-indicating range of an ammeter, not a voltmeter.

3-74L5 What instrument is used to indicate high and low digital voltage states?

- A. Logic probe.
- B. Ohmmeter.
- C. Signal strength meter.
- D. Megger

Key Topic 75: Test Equipment

3-75L1 How is a frequency counter used?

- A. To heterodyne the frequency being measured with a known variable frequency oscillator until zero beat is achieved, thereby indicating the unknown frequency
- B. To measure the deviation in an FM transmitter in order to determine the percentage of modulation.
- C. To provide reference points on an analog receiver dial thereby aiding in the alignment of the receiver.
- D. To measure the time between events. or the frequency, which is the reciprocal of the time.

3-75L4 On an analog wattmeter, what part of the scale is most accurate and how much does that accuracy extend to the rest of the reading scale?

- A. The accuracy is only there at the upper 5% of the meter, and is not carried through at any other reading.
- B. The accuracy is constant throughout the entire range of the meter
- C. The accuracy cannot be determined at any reading
- D. The accuracy is only at full scale, and that absolute number reading is carried through to the rest of the range. The upper 1 /3 of the meter is the only truly calibrated part.

Key Topic 76: Oscilloscopes

3-76L1 What is used to decrease circuit loading when using an oscilloscope?

- A. Resistive probe.
- B. Inductive probe.
- C. Dual input amplifiers.
- D. 10:1 divider probe.

3-76L2 How does a spectrum analyzer differ from a conventional oscilloscope?

- A. The oscilloscope is used for displaying audio frequencies and the spectrum analyzer is used for displaying radio frequencies.
- B. The oscilloscope is used to display electrical signals while the spectrum analyzer is used to measure ionospheric reflection.
- C. The oscilloscope is used to display electrical signals in the frequency domain while the spectrum analyzer is used to display electrical signals in the time domain.
- D. The oscilloscope is used to display electrical signals in the time domain while the spectrum analyzer is used to display electrical signals in the frequency domain.

3-76L5 An oscilloscope can be used to accomplish all of the following except:

- A. Measure velocity of light with the aid of a light emitting diode.
- B. Measure phase difference between two signals
- C. Measure electron flow with the aid of a resistor.
- D. Measure electrical voltage.

Key Topic 77: Specialized Instruments

3-77L2 What does the horizontal axis of a spectrum analyzer display?

- A. Amplitude.
- B. Frequency.
- C. Resonance.
- D. Voltage

3-77L5 What test Instrument can be used to display spurious signals in the output of a radio transmitter?

- A. A logic analyzer.
- B. A time domain reflectometer.
- C. A spectrum analyzer.
- D. A wattmeter.

Key Topic 78: Measurement Procedures

3-78L3 What is a common method used to program radios without using a “wired” connection?

- A. Using the ultraviolet from a programmed radio to repeal the programming in another.
- B. Banding.
- C. Having the radio maker send down a programming signal via satellite
- D. Infra-red communication.

3-78L4 What is the common method for determining the exact sensitivity specification of a receiver?

- A. Measure the recovered audio for 25 dB of quieting
- B. Measure the recovered audio for 10 dB of StNAD.
- C. Measure the recovered audio for 12 dB of SINAD.
- D. Measure the recovered audio for 10 dB of quieting.

3-78L5 A communications technician would perform a modulation-acceptance bandwidth test in order to:

- A. Determine the effective bandwidth of a communications receiver.
- B. Verify the results from a 12 dB SINAD test.
- C. Determine whether the CTCSS in the receiver is operating correctly
- D. Ascertain the audio frequency response of the receiver.

Key Topic 79: Repair Procedures

3-79L 1 When soldering or working with CMOS electronics products or equipment, a wrist strap:

- A. Must be grounded to a water pipe.
- B. Must have less than 100,000 ohms of resistance to prevent static electricity.
- C. Cannot be used when repairing TTL devices.
- D. Does not work well in conjunction with anti-static floor mats.

3-79L2 Which of the following is the preferred method of cleaning solder from plated-through circuit-board holes?

- A. Use a vacuum device
- B. Use a dental pick.
- C. Use a soldering iron tip that has a temperature above 900 degrees F.
- D. Use an air jet device.

3-79L3 What is the proper way to cut plastic wire ties?

- A. With a knife.
- B. With flush-cut diagonal pliers and cut flush
- C. With scissors.
- D. With semi-flush diagonal pliers.

Key Topic 80: Installation Codes & Procedures

3-80L3 Why should you not use white or translucent plastic tie wraps on a radio tower?

- A. White tie wraps are not FAA approved.
- B. The white color attracts wasps
- C. UV radiation from the Sun deteriorates the plastic very quickly
- D. The black tie wraps may cause electrolysis.

3-80L6 What type of wire would connect an SSB automatic tuner to an insulated backstay?

- A. GTO-15 high-voltage cable.
- B. 16-gauge two-conductor.
- C. RG213.
- D. RGBU.

Key Topic 81: Troubleshooting

3-81L1 On a 150 watt marine SSB HF transceiver, what would be indicated by a steady output of 75 watts when keying the transmitter on?

- A. Both sidebands are being transmitted.
- B. There is probably a defect in the system causing the carrier to be transmitted.
- C. The operation is normal
- D. One of the sidebands is missing.

3-81L2 The tachometer of a building's elevator circuit experiences interference caused by the radio system nearby. What is a common potential "fix" for the problem?

- A. Add an isolating resistor in series with the motor leads.
- B. Replace the tachometer of the elevator.
- C. Add a .01 μF capacitor across the motor/tachometer leads.
- D. Add a 200 μF capacity across the motor/tachometer leads

Key Topic 82: Types of Transmissions

3-82M2 Name two types of spread spectrum systems used in most RF communications applications?

- A. Frequency Hopping and APSK.
- B. Direct Sequence and Frequency Hopping.
- C. AM and FM.
- D. QPSK or QAM.

3-82M4 A TMA radio uses what to carry the multiple conversations sequentially?

- A. Separate time slots.
- B. Separate frequencies.
- C. Separate power levels.
- D. Separate pilot tones.

Key Topic 83: Coding and Multiplexing

3-83M4 The International Organization for Standardization has developed a seven-level reference model for a packet-radio communications structure. What level is responsible for the actual transmission of data and handshaking signals?

- A. The communications layer.
- B. The synchronization layer
- C. The transport layer.
- D. The physical layer.

Key Topic 84: Signal Processing, Software and Codes

3-84M5 Which of the following statements is true?

- A. The Control Signal 1 (0101100) is used to determine the time displacement in SITOR-B.
- B. The Idle Signal (b) (0011001) is used for FEC Phasing Signal 2.
- C. The Idle Signal (a) (0000111) is used for FEC Phasing Signal 1.
- D. The Signal Repetition character (1001100) is used as a control signal in SITOR-ARQ.

Key Topic 85: VHF

3-85N1 What is the channel spacing used for VHF marine radio?

- A. 20 kHz.
- B. 0 kHz
- C. 25 kHz.
- D. 12.5 kHz.

3-85N5 What is the reason for the USA-INT control or function?

- A. It changes channels that are normally simplex channels into duplex channels
- B. It changes some channels that are normally duplex channels into simplex channels
- C. When the control is set to "INT" the range is increased.
- D. None of the above.

3-85N6 How might an installer verify correct GPS sentence to marine DSC VHF radio?

- A. Look for GPS confirmation readout.
- B. Press and hold the red distress button
- C. Look for latitude and longitude, plus speed, on VHF display.
- D. Ask for VHF radio check position report.

Key Topic 86: MF-HF, SSB-SITOR

3-86N1 What is a common occurrence when voice testing an SS8 aboard a boat?

- A. Voltage panel indicator lamps may glow with each syllable.
- B. Ammeter fluctuates down with each spoken word.
- C. Minimal voltage drop seen at power source.
- D. Automatic tuner cycles on each syllable.

3-86N4 Which of the following statements concerning SITOR communications is true?

- A. ARO transmissions are acknowledged by the Information Receiving Station only at the end of the message.
- B. Forward error correction is an interactive mode
- C. ARQ message transmissions are made in data groups consisting of three-character blocks
- D. ARQ communications rely upon error correction by time diversity transmission and reception.

3-86N5 The sequence ARQ, FEC, SFEC best corresponds to which of the following sequences?

- A. Two way communications, one-way communications to all stations. one-way communications to a single station.
- B. Two way communications, one-way communications to a single station. one-way communications to all stations.
- C. One-way communications to a single station, one way communications to all stations, two-way communications.
- D. One-way communications to all stations. two-way communications, one-way communications to a single station.

Key Topic 87: Survival Craft Equipment: VHF, SARTs & EPIRBs

3-87N1 What causes the SART to begin a transmission?

- A. It begins radiating only when keyed by the operator
- B. After being activated the SART responds to RADAR interrogation
- C. When activated manually, it begins radiating immediately
- D. It is either manually or water activated before radiating.

3-87N2 How should the signal from a Search And Rescue RADAR Transponder appear on a RADAR display?

- A. A series of 12 equally spaced dots.
- B. A series of dashes.
- C. A series of twenty dashes.
- D. A series of spirals all originating from the range and bearing of the SART.

3-87N6 What statement is true regarding 406 MHz EPIRB transmissions?

- A. Coding permits the SAR authorities to know if manually or automatically activated.
- B. Allows immediate voice communications with the RCC.
- C. Transmits a unique hexadecimal identification number
- D. Radio Operator programs an I.D. into the SART immediately prior to activation.

Key Topic 88: FAX, NAVTEX

3-88N1 What is facsimile?

- A. The transmission of characters by radioteletype that form a picture when printed
- B. The transmission of video by television.
- C. The transmission of still pictures by slow-scan television
- D. The transmission of printed pictures for permanent display on paper. display on paper.

3-88N2 What is the standard scan rate for high frequency 3 MHz . 23 MHz weather facsimile reception from shore stations?

- A. 150 lines per second
- B. 120 lines per minute
- C. 60 lines per second.
- D. 240 lines per minute.

3-88N3 What would be the bandwidth of a good crystal lattice band-pass filter for weather facsimile HF (high frequency) reception?

- A. 1 kHz at -6 dB.
- B. 15 kHz at -6 dB.
- C. 500 Hz at -6 dB.
- D. 6 kHz at -6 dB.

Key Topic 89: NMEA Data

3-89N2 How should shielding be grounded on an NMEA 0183 data line?

- A. Unterminated at the talker and terminated at the listener
- B. Terminated at both the talker and listener
- C. Unterminated at both ends
- D. Terminated to ground at the talker and unterminated at the listener.

3-89N3 What might occur in NMEA 2000 network topology if one device in line should fail?

- A. The system shuts down until the device is removed.
- B. There will be no interruption to all other devices.
- C. Other electronics after the failed device will be inoperable.
- D. The main fuse on the backbone may open

3-89N6 What voltage drop at the end of the last segment will satisfy NMEA 2000 network

cabling plans?

- A. 2.0 volts
- B. 1.5 volts**
- C. 0.5 volts
- D. 3.0 volts

Key Topic 90: RADAR Theory

3-9003 What is the normal range of pulse widths?

- A. 2.5 ms to 5.0 ms.
- B. 1.0 ms to 3.5 ms.
- C. .05 ms to 0.1 ms.
- D. .05 ms to 1.0 ms.**

3-9004 Shipboard RADAR is most commonly operated in what band?

- A. EHF
- B. SHF**
- C. VHF.
- D. UHF.

Key Topic 91: Components

3-9102 What is the purpose or function of the RADAR duplexer/circulator? It is a/an:

- A. Electronic switch that allows the use of one antenna for both transmission and reception**
- B. Dual section coupling device that allows the use of a magnetron as a transmitter.
- C. Modified length of waveguide that is used to sample a portion of the transmitted energy for testing purposes.
- D. Coupling device that is used in the transition from a rectangular waveguide to a circular waveguide.

3-9103 What device can be used to determine the performance of a RADAR system at sea?

- A. Circulator
- B. Echo box.**
- C. Klystron.
- D. Digital signal processor.

3-9105 Digital signal processing (OSP) of RADAR signals (compared with analog) causes:

- A. Improved display graphics
- B. Improved weak signal or target enhancement.**
- C. Less interference with SONAR systems.
- D. Less interference with other radio communications equipment.

Key Topic 92: Range, Pulse Width & Repetition Rate

3-9203 We are looking at a target 25 miles away. When a RADAR is being operated on the 25 mile range setting what is the most appropriate pulse width and pulse repetition rate?

- A. 0.05 ms PW and 2,000 pps
- B. 1.0 ms PW and 500 pps.**
- C. 0.25 ms PW and 1,000 pps.
- D. 0.01 ms PW and 500 pps.

3-9204 What pulse width and repetition rate should you use at long ranges?

- A. Wide pulse width and slow repetition rate.**
- B. Narrow pulse width and slow repetition rate.
- C. Wide pulse width and fast repetition rate.
- D. Narrow pulse width and fast repetition rate.

3-9205 What pulse width and repetition rate should you use at short ranges?

- A. Narrow pulse width and fast repetition rates
- B. Narrow pulse width and slow repetition rate.
- C. Wide pulse width and slow repetition rates.
- D. Wide pulse width and fast repetition rate.

Key Topic 93: Antennas & Waveguides

3-9303 What happens to the beamwidth of an antenna as the gain is increased? The beamwidth:

- A. Is essentially unaffected by the gain of the antenna
- B. Decreases as the gain is increased.
- C. Increases geometrically as the gain is increased.
- D. Increases arithmetically as the gain is increased .

3-9305 Conductance takes place in a waveguide:

- A. In the same manner as a transmission line.
- B. By interelectron delay
- C. Through electromagnetic and electrostatic fields in the walls of the waveguide.
- D. Through electrostatic field reluctance.

3-9306 To couple energy into and out of a waveguide use:

- A. Capacitive coupling.
- B. Wide copper sheeting.
- C. An LC circuit.
- D. A thin piece of wire as an antenna.

Key Topic 94: RADAR Equipment

3-9402 Prior to testing any RADAR system, the operator should first:

- A. Inform the airport control tower or ship's master
- B. Assure no personnel are in front of the antenna.
- C. Check the system grounds.
- D. Assure the display unit is operating normally.

3-9406 RADAR collision avoidance systems utilize inputs from each of the following except your ship's:

- A. Gyrocompass.
- B. Navigation position receiver
- C. Speed indicator.
- D. Anemometer.

Key Topic 95: Low Earth Orbit Systems

3-95P3 What services are provided by the Iridium system?

- A. Digital voice and Data at 2.4 kbps.
- B. Digital voice and Data at 9.6 kbps.
- C. Analog voice and Data at 4.8 kbps.
- D. Analog voice and Data at 9.6 kbps.

3-95P4 Which of the following statements about the Iridium system is true?

- A. The orbital period is approximately 85 minutes.
- B. There are 48 spot beams per satellite with a footprint of 30 miles in diameter.
- C. There are 48 satellites in orbit in 4 orbital planes.
- D. The inclination of the orbital planes is 55 degrees.

3-95P6 How does the COSPAS-SARSAT satellite system determine the position of a ship

in distress?

- A. By measuring the Doppler shift of the 406 MHz signal taken at several different points in its orbit.
- B. The EPIRB always transmits its position which is relayed by the satellite to the Local User Terminal.
- C. It takes two different satellites to establish an accurate position
- D. None of the above

Key Topic 96: INMARSAT Communications Systems-1

3-96P1 What is the orbital altitude of INMARSAT Satellites?

- A. 22,177 miles.
- B. 26,435 miles.
- C. 16,436 miles
- D. 10,450 miles.

3-96P2 Which of the following describes the INMARSAT Satellite system?

- A. AOR-E at 2s° W, AOR-W at as° W, POR at 175° W and IOR at 56.s° E
- B. AOR at 35° W, POR-E at 165° W, POR-W at 155° E and IOR at 56.5° E.
- C. AOR-E at 15.5° W, AOR-W at 54° W, POR at 178° E and IOR at 64.5° E.
- D. AOR at 40° W, POR at 178° W, IOR-E at 109° E and IOR-W at 46° E.

3-96P6 Which of the following conditions can render INMARSAT -B communications impossible?

- A. An obstruction, such as a mast, causing disruption of the signal between the satellite and the SES antenna when the vessel is steering a certain course
- B. A satellite whose signal is on a low elevation, below the horizon.
- C. Travel beyond the effective radius of the satellite.
- D. All of these.

Key Topic 97: INMARSAT Communications Systems-2

3-97P1 What is the best description for the INMARSAT • C system?

- A. It is a store-and-forward system that provides routine and distress communications
- B. It provides world-wide coverage.
- C. It provides slow speed telex and voice service.
- D. It is a real-time telex system.

3-97P5 When INMARSAT-B and INMARSAT-C terminals are compared:

- A. INMARSAT-C antennas are smaller but omni directional, while INMARSAT-B antennas are parabolic for lower gain
- B. INMARSAT-C antennas are small and omni directional, while INMARSAT-B antennas are larger and directional
- C. INMARSAT-B antennas are bulkier but omni directional, while INMARSAT-C antennas are smaller and parabolic, for aiming at the satellite
- D. INMARSAT-B antennas are parabolic and smaller for higher gain, while INMARSAT-C antennas are larger but omni-directional.

Key Topic 98: GPS

3-98P2 The GPS transmitted frequencies are:

- A. 946.2 MHz and 1226.6 MHz,
- B. 1227.6 MHz and 1575.4 MHz.
- C. 2245.4 and 2635.4 MHz,
- D. 1626.5 MHz and 1644.5 MHz.

3-98P4 What best describes the GPS Satellites orbits?

- A. They are in six orbital planes equally spaced and inclined about 55 degrees to the equator
- B. They are in four orbital planes spaced 90 degrees in a polar orbit.
- C. They are in eight orbital planes at an altitude of approximately 1,000 miles
- D. They are in a geosynchronous orbit equally spaced around the equator.

3-98P6 What is DGPS?

- A. Digital Ground Position System
- B. A system for providing altitude corrections for aircraft.
- C. Correction signals transmitted by satellite
- D. A system to provide additional correction factors to improve position accuracy.

Key Topic 99: Radiation Exposure

3-99Q4 At what aggregate power level is an MPE (Maximum Permissible Exposure) study required?

- A. 1000 Watts ERP.
- B. 100 Watts ERP
- C. 500 Watts ERP
- D. Not required.

3-99Q5 Why must you never look directly into a fiber optic cable?

- A. High power light waves can burn the skin surrounding the eye.
- B. The signal is red and you can see it.
- C. The end is easy to break.
- D. An active fiber signal may burn the retina and infrared light cannot be seen.

3-99Q6 If the MPE (Maximum Permissible Exposure) power is present, how often must the personnel accessing the affected area be trained and certified?

- A. Weekly.
- B. Monthly
- C. Not at all.
- D. Yearly.

Key Topic 100: Safety Steps

3-100Q2 What is the purpose of not putting sharp corners on the ground leads within a building?

- A. It is easier to install.
- B. Lightning will jump off of the ground lead because it is not able to make sharp bends.
- C. No reason.
- D. Ground leads should always be made to look good in an installation, including the use of sharp bends in the corners.

3-100Q5 Do shorted-stub lightning protectors work at all frequencies?

- A. No. the short also kills the radio signals.
- B. No, only at the tuned frequency band.
- C. No. the short enhances the radio signal at the tuned band.
- D. Yes.

3-100Q6 What is a GFI electrical socket used for?

- A. To increase the current capacity of the socket.
- B. As a gold plated socket.
- C. To prevent electrical shock by sensing ground path current and shutting the circuit down.
- D. To prevent children from sticking objects in the socket.