W9AY STUDY GUIDE · ELEMENT 8 · FREE SAMPLE

Ship Radar Techniques

Complete question pool, organised by section, with study notes and every answer.

50	280	6	68 min
EXAM QUESTIONS	IN THE POOL	SECTIONS	TO READ ONCE

This is one section, free. 8E, Radar Antennas: all 30 of its pool questions, each with its answer. Read the notes, then cover the answers and work through the questions, and watch how quickly the answers start to stick. The rest of the guide works the same way.

Get the full guide: w9ay.com/study/ship-radar. It adds all 6 sections and every one of the 280 pool questions. Pay through Stripe; your download link appears as soon as you pay and is emailed to you.

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Contents

50 questions on the exam, drawn from 280 in the pool.

SECTION	TOPIC	QUESTIONS	READING
8E	Radar Antennas	30	~7 min

Element 8E — Radar Antennas

Topic 39

Antennas

- The **slotted waveguide array** is the most common RADAR antenna on commercial maritime vessels.
- Slotted waveguide arrays fed from one end exhibit **frequency scan** (beam direction shifts with frequency).
- The center of the transmitted lobe from a slotted waveguide is **several degrees offset** from a line perpendicular to the antenna.
- Good **bearing resolution** depends on a **narrow antenna beam in the horizontal plane**.
- A **longer antenna** produces a **narrower horizontal beamwidth**.

8-39E1 *(modified — acronym expanded)*

Slotted waveguide arrays, when fed from one end exhibit:

- A. Frequency scan.
- *B. High Voltage Standing Wave Ratio (VSWR).*
- C. Poor performance in rain.
- D. A narrow elevation beam.

Answer: A

8-39E2

A typical shipboard RADAR antenna is a:

- A. Rotary parabolic transducer.
- B. Slotted waveguide array.
- C. Phased planar array.
- D. Dipole.

Answer: B

8-39E3

Good bearing resolution largely depends upon:

- A. A high transmitter output reading.
- B. A high duty cycle.
- C. A narrow antenna beam in the vertical plane.
- D. A narrow antenna beam in the horizontal plane.

Answer: D

8-39E4

The center of the transmitted lobe from a slotted waveguide array is:

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

Answer: A

8-39E5

How does antenna length affect the horizontal beamwidth of the transmitted signal?

- A. The longer the antenna the wider the horizontal beamwidth.
- B. The longer the antenna the narrower the horizontal beamwidth.
- C. The horizontal beamwidth is not affected by the antenna length.
- D. None of the above.

Answer: B

8-39E6

What is the most common type of RADAR antenna used aboard commercial maritime vessels?

- A. Parabolic.
- B. Truncated parabolic.
- C. Slotted waveguide array.
- D. Multi-element Yagi array.

Answer: C

Topic 40

Transmission Lines

- **VSWR** of a microwave line can be measured using a **dual directional coupler**, a **power meter**, and a **network analyzer** (all three).
- Characteristic impedance formula: **ZO = √(L/C)**. With 250 µH and 1000 pF, ZO = **500 ohms**.
- Improperly shielded or terminated long transmission lines cause **communications receiver interference**.
- Trap: cutting a transmission line in half does **not** change its **characteristic impedance** — each half retains the same ZO.
- **Standing waves** on a transmission line indicate **some energy is not absorbed** by the load.
- Horizontal waveguide runs must be **sloped slightly downward** at the elbow with a **small drain hole** to prevent moisture buildup.

8-40E1

The VSWR of a microwave transmission line device might be measured using:

- A. A dual directional coupler and a power meter.
- B. A network analyzer.
- C. A spectrum analyzer.
- D. A dual directional coupler, a power meter, and a network analyzer.

Answer: D

8-40E2

The impedance total (ZO) of a transmission line can be calculated by ZO = √L/C when L and C are known. When a section of transmission line contains 250 microhenries of L and 1000 picofarads of C, its impedance total (ZO) will be:

- A. 50 ohms.
- B. 250 ohms.
- C. 500 ohms.
- D. 1,000 ohms.

Answer: C

8-40E3

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

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

Answer: B

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

Answer: C

8-40E5

Standing waves on a transmission line may be an indication that:

- A. All energy is being delivered to the load.
- B. Source and surge impedances are equal to ZO and ZL.
- C. The line is terminated in impedance equal to ZO.
- D. Some of the energy is not absorbed by the load.

Answer: D

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.

Answer: A

Topic 41

Synchros and Resolvers

- The PPI sweep is kept in sync with the antenna using **synchro systems**.
- In a synchro system, angular information is carried on the **stator lines**.
- **Resolvers** are the most common antenna position indicating device in modern RADARs.
- A basic **resolver** contains one **rotor winding** and **two stator windings 90° apart**.
- An antenna **synchro transmitter** has **two rotor** and **three stator** windings.
- Antenna direction can be sent to the display via **3-phase synchros**, **2-phase resolvers**, or **optical encoders** — any of these methods works.

8-41E1

The position of the PPI scope sweep must indicate the position of the antenna. The sweep and antenna positions are frequently kept in synchronization by the use of:

- A. Synchro systems.
- B. Servo systems.
- C. DC positioning motors.
- D. Differential amplifiers.

Answer: A

8-41E2

On a basic synchro system, the angular information is carried on the:

- A. DC feedback signal.
- B. Stator lines.
- C. Deflection coils.
- D. Rotor lines.

Answer: B

8-41E3

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

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

Answer: A

8-41E4

Which of the following statements about antenna resolvers is correct?

- A. Most resolvers contain a rotor winding and a delta stator winding.
- B. Resolvers consist of a two rotor windings and two stator windings that are 90 degrees apart.
- C. The basic resolver contains a rotor winding and two stator windings that are 90 degrees apart.
- D. Resolvers consist of a "Y" connected rotor winding and a delta connected stator winding.

Answer: C

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.

Answer: B

8-41E6

RADAR antenna direction must be sent to the display in all ARPAs or RADAR systems. How is this accomplished?

- A. 3-phase synchros.
- B. 2-phase resolvers.
- C. Optical encoders.
- D. Any of the above.

Answer: D

Topic 42

Waveguide Theory

- Waveguides can be made from **brass**, **aluminum**, or **copper** (all are valid materials).
- A center conductor suspended between parallel conductive ground planes is called a **stripline**.
- Waveguide theory is based on the **movement of an electromagnetic field** (not current flow through wires).
- Waveguides are used at microwave frequencies because they have **lower transmission losses** than other feedline types.
- Waveguide theory also relies on **skin effect** and use of **¼ wave stubs**.
- The signal is removed from a waveguide or magnetron with a thin wire called a **J-Hook**.

8-42E1

Waveguides can be constructed from:

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

Answer: D

8-42E2

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

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

Answer: C

8-42E3

Waveguide theory is based upon:

- A. The movement of an electromagnetic field.
- B. Current flow through conductive wires.
- C. Inductance.
- D. Resonant charging.

Answer: A

8-42E4

A waveguide is used at RADAR microwave frequencies because:

- A. It is easier to install than other feedline types.
- B. It is more rugged than other feedline types.
- C. It is less expensive than other feedline types.
- D. It has lower transmission losses than other feedline types.

Answer: D

8-42E5

Waveguide theory is based on the principals of:

- A. Ohm's Law.
- B. High standing waves.
- C. Skin effect and use of ¼ wave stubs.
- D. None of the above.

Answer: C

8-42E6

How is the signal removed from a waveguide or magnetron?

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

Answer: B

Topic 43

Waveguide Components

- A **rotary joint** connects the stationary waveguide to the rotating **antenna array**.
- Resistive losses in a waveguide are very small because the **inner surface area is large**.
- A right-angle bend in an **X-band waveguide** must have a radius greater than **2 inches**.
- Trap: **coupling capacitance** is NOT used to insert or extract RF energy from a waveguide — use a **current loop**, **aperture window**, or **voltage probe** instead.
- Inside a waveguide the **magnetic field is strongest at the edges**.
- At microwave frequencies waveguides have **considerably less loss** than conventional coaxial transmission lines.

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.

Answer: C

8-43E2

Resistive losses in a waveguide are very small because:

- A. The inner surface of the waveguide is large.
- B. The inner surface of the waveguide is small.
- C. The waveguide does not require a ground connection.
- D. The heat remains in the waveguide and cannot dissipate.

Answer: A

8-43E3

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

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

Answer: D

8-43E4

To insert RF energy into or extract RF energy from a waveguide, which of the following would not be used?

- A. Coupling capacitance.
- B. Current loop.
- C. Aperture window.
- D. Voltage probe.

Answer: A

8-43E5

The following is true concerning waveguides:

- A. Conduction is accomplished by the polarization of electromagnetic and electrostatic fields.
- B. Ancillary deflection is employed.
- C. The magnetic field is strongest at the center of the waveguide.
- D. The magnetic field is strongest at the edges of the waveguide.

Answer: D

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 have considerably less loss.
- C. They are lighter since they have hollow centers.
- D. Moisture is never a problem with them.

Answer: B

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