Competency Requirements—2007

RADAR Electronics Technician - RAD

Radar electronics technicians are expected to obtain knowledge of radar basics and concepts which are then applicable to all the various types of avionics, maritime and land Radar systems. Once the CET has acquired these skills, abilities and knowledge, he or she will be able to enter employment in any part of the Radar communications field. With minimal training in areas unique to specific products, the CET should become a profitable and efficient part of the Radar electronics-communications workforce.

RADAR Electronics Technicians must be knowledgeable and have abilities in the following technical and human relations areas:

1.0 Block Diagrams & Schematics

1.1 Draw a block diagram of a basic RADAR transceiver
1.2 Describe the difference between block diagrams and schematics
1.3 List the expected signal levels, voltages or currents expected at various block diagram and schematic points
1.4 Explain the 'divide and conquer' troubleshooting technique
1.5 Explain the use of flow charts
1.6 Discuss the interfacing of major components of the RADAR system

2.0 Components

2.1 Describe the basic components used in a RADAR system
2.2 Identify the common electronics components used in the RADAR system
2.3 List the safety precautions to be used with static sensitive components
2.4 Name the components utilized in RADAR antennas, drives and positioning units
2.5 Describe the usage of ATR and TR tubes
2.6 Compare the different types of RADAR displays
2.7 Explain the uses for various oscillators and timing circuits in a RADAR system

3.0 Cabling and Antennas

3.1 Perform calculations to solve wavelength and frequency problems
3.2 Discuss the differences between coaxial cables RG-6; RG-58 and RG-59
3.3 Discuss the usage of Fiber Optics cabling as well as telephone wiring such as twisted pair and CAT-5
3.4 Show ability to properly prepare cable ends and to crimp fittings onto them
3.5 Show ability to perform splices on coax and twisted pair cables
3.6 Explain reason for using wave guides, rather than cables, for RADAR transmission hardware
3.7 Describe the use of cavity type traps in wave guides
3.8 Demonstrate proper usage of signal level meters and power level equipment
3.9 List possible causes of problems in wave guides
3.10 Demonstrate how to locate shorted or open cables or wave guides
3.11 Explain the mechanical dangers when working around RADAR movable antenna systems
3.12 Explain the radiation dangers when working around RADAR systems

4.0 Hand Tools & Soldering

4.1 Demonstrate proper usage of common electronics technician hand tools, including riveting and drilling equipment
4.2 Explain proper soldering techniques
4.3 Explain precautions required for leaded solder and solder fumes
4.4 Show ability to properly use solder removers such as braid and mechanical solder suckers and vacuum solder suckers
4.5 Explain effects of sloppy soldering such as flicking wet solder or leaving solder bridges or overheating the PC board and ruining the circuit traces
4.6 Discuss the purposes and use of soldering flux

5.0 Mathematics

5.1 Show ability to work algebraic formulas which pertain to electronics work
5.2 Show proficiency with scientific calculators
5.3 Show ability to decipher electronic component and wiring color codes
5.4 Explain the conversion of numbering systems such as decimal, binary, octal and hexidecimal
5.5 Explain the term RADAR MILE and be able to determine distances based on RADAR pulse transmission and reception time periods

6.0 AMPLIFIERS

6.1 List the special purposes of various types of amplifiers used in RADAR transceivers
6.2 Describe some of the differences between audio amplifiers; video amplifiers, RF and IF amplifiers and amplifiers used at RADAR transceiver frequencies
6.3 Explain bandwidth and estimate the minimum bandwidth needed for the amplifiers mentioned in 6.2 above
6.4 Explain safety precautions required when working around high powered amplifiers
6.5 Draw a diagram of an operational amplifier
6.6 Measure the gain of various op-amps
6.7 Compate different types of op-amps, such as high pass, low pass and band pass units
6.8 Describe how to measure the input and output signals to an amplifier and express the gain
6.9 Describe how the gain of an amplifier can be lowered or raised
6.10 Demonstrate proper use of signal generators, oscilloscopes and power meters used with amplifiers

7.0 RADAR Transceivers

7.1 Describe how radio frequency electromagnetic waves are propagated
7.2 Draw a block diagram of a RADAR transceiver
7.3 Indicate the voltage levels at various locations in the transceiver
7.4 List the signals, currents, resistances or voltages expected at various transceiver block diagram and receiver test locations
7.5 Point out the locations in the transmitter section of the receive where high voltage can be a safety problem
7.6 Describe the antenna mobility and positioning circuitry used with RADAR antennas
7.7 Locate and explain each of the components used in the power supply of a transceiver
7.8 List common power requirements for a RADAR transceiver
7.9 Point out the locations in the transmitter section where radiation may be a hazard to flesh or eyes

8.0 Interfacing

8.1 List the expected signal levels which exist at ports or connection plugs between the RADAR and related equipment
8.2 Locating shorts or opens in interconnecting cables, plugs or sockets
8.3 Bundle, dress or secure interface wiring for neatness and safety

9.0 Satellite, Wireless, and Data Communications

9.1 Describe how earth orbit satellite communications system work
9.2 Explain how satellites are maintained at their orbital position
9.3 List several common frequencies or frequency bands used in satellite-earth communications and discuss how RADAR or Satellite or other communications frequencies may interfere with each other
9.4 Discuss power dispersion of uplink and downlink satellite equipment
9.5 Explain GPS, the Global Positioning System and how it is related to RADAR system usage
9.6 List other types of wireless communications currently in use including wireless LANs
9.7 Discuss data communications over WAN, wide area networks, and over LANs, local area networks
9.8 Give an explanation of topography mapping, using transits, aircraft radar, satellite imaging and GPS
9.9 Explain some of the modulation techniques use in transmitting data communications

10.0 Computers and Digital Concepts

10.1 Describe a basic computer
10.2 Explain how computers can be used to record and retain RADAR imagery
10.3 Point out digital gate symbols and construct truth tables for each
10.4 Describe special computer chip types, such as microprocessors, interface chips, modems, special purpose circuit boards, memory devices and control circuits
10.5 Exchange major components of computerized equipment, such as mother boards, memory banks, floppy and hard drives, interface PCIA boards and keyboards and other input devices

11.0 Software—Programming

11.1 Demonstrate ability to use data bases; spread sheets, computer calculators, graphics prorgrams and word processors
11.2 Demonstrate how to install new software in RADAR computer equipment
11.3 Demonstrate how to install new hardware in RADAR computer equipment
11.4 Use a software diagnostic program and explain its use as an aid in troubleshooting
11.5 Demonstrate the use of virus detection programs and utility software

12.0 Troubleshooting

12.1 Demonstrate proper use of common test equipment such as DMM and VOM meters; oscilloscopes, signal generators; frequency meters; dummy loads; digital signal pulsers and probes and high voltage probes.
12.2 Explain non-destructive testing
12.3 Properly tag power sources and transmitting equipment while it is being serviced to protect others who may enter the areas
12.4 Describe troubleshooting procedures for finding RADAR raults, performing visual inspections first after receiving an operator's descriptions of the faults; then verifying the symptoms; then substituting major components, where possible; then using block diagrams and schematics to localize the affected area (s) and finally to find the defective area, component, adjustment, or other factor.
12.5 Determine whether to troubleshoot to the component level or whether it is more practical to replace a major section of the equipment, or whether to recommend replacement of the entire unit
12.6 Describe the record keeping requirements that may be required in some technician positions (health care, avionics, military, etc.)
12.7 List reasons for static buildup on electronic and computer equipment and describe how to reduce harmful effects by utilizing bench and personal grounding practices
12.8 Demonstrate careful measurement techniques when working with transistorized equipment, ICs and so forth
12.9 Explain the use of circuit board bending, application of heat or cold, and any other methods of locating intermittent circuit board conditions
12.10 Explain possible safety problems when several technicians or workers are operating in close proximity
12.11 Describe methods of properly discharging large capacitors and the high voltage used with kinescopes
12.12 Name several reasons for neatness and cleanliness in the technician workshop areas
12.13 Describe how to cross reference parts which may become defective in RADAR electronics equipment and how the technician would go about ordering replacements

13.0 People Relations

13.1 Give a brief description of the CSS, or Customer Service Specialist, program of ETA
13.2 List 10 ways your behavior or that of a fellow employee can be unsafe or likely to reduce the teamwork of the workplace
13.3 State 10 examples of poor personal hygiene and appearance habits which may reflect on your work or your employer
13.4 List 10 examples of telephone practices which may create or tend to cause poor customer relations or people relations within the service company
13.5 Describe the costs your company has which must be included in the service charges which you are responsible for billing and/or collecting

end of RADAR Competencies listing

Suggested Study Materials:

Introduction to RADAR Systems; Merrill Skolnik; ISBN 0-07-057909-1; 580 pp; McGraw-Hill
RADAR Transmitters; George W. Ewell; ISBN 0-07-019843-8; 344 pp;
GROL+; Fred Maia & Gordon West; Master Publishing; 496 pp; ISBN 0-945053-14-2; Available from ETA at 800 288-3824
Modern RADAR System Analysis; David Barton, ISBN 0-89006-170-X; $83; 800 225 9977; 590 pp, 1988
Introduction to Airborne Radar; George W. Stimson, ISBN 1891121014; $129; Hardcover, January 1998; http://www.avionics.com/www/books/airradar.htm

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