

# Distributed Antenna Systems (DAS) Competency requirements



This competency listing is an identification of individual subject topics in which Distributed Antenna Systems (DAS) technicians and installers are expected to obtain knowledge in order to prepare for the DAS certification examination. This includes basic knowledge concepts of distributed antenna systems and antenna installation. This also includes service and skills applicable to all of the functions required to safely and completely install, maintain, troubleshoot and provide support of in-building distributed antenna systems, communications and electronic equipment.

Distributed Antenna Systems technicians must be knowledgeable in the following technical areas:

## 1.0 Distributed Antenna Systems Fundamentals

- 1.1. Define Distributed Antenna System (DAS)
- 1.2. Describe DAS fundamentals
  - 1.2.1. Define wireless coverage
- 1.3. Define the DAS life cycle
- 1.4. Describe the In-building role of a DAS to include:
  - 1.4.1. Public Safety
    - 1.4.1.1. Public safety versus signal enhancement
  - 1.4.2. Healthcare complex
  - 1.4.3. Large Office
  - 1.4.4. Stadium
  - 1.4.5. Engineering basics
- 1.5. Describe DAS future needs to include:
  - 1.5.1. 4G
  - 1.5.2. Long Term Evolution (LTE)
  - 1.5.3. Small Cells
  - 1.5.4. Campus wide
- 1.6. List Federal Communications Commission (FCC) directives:
  - 1.6.1. Rules and Regulations governing DAS / Signal Booster systems

## 2.0 Safety

- 2.1. Describe the National Fire Protection Association (NFPA) safety guidelines related to DAS
  - 2.1.1. List the National Electrical Codes (NEC<sup>®</sup>) as they apply to In-building DAS
- 2.2. Describe the International Code Council (ICC) guidelines on fire safety
- 2.3. Describe where and how to find local municipality building codes
- 2.4. List Occupational Safety and Health Administration (OSHA) requirements for In-building DAS to include:
  - 2.4.1. Personal Protection Equipment (PPE)
  - 2.4.2. Earthquake remediation
  - 2.4.3. Weather contingencies
- 2.5. List safety requirements of working with Radio Frequency (RF) energy
- 2.6. Explain how to safely handle and dispose of fiber optic cable and optical fiber debris

## 3.0 Signal Requirements

- 3.1. Define DAS coverage needs/Site Survey including:
  - 3.1.1. Quantifying signal loss
  - 3.1.2. Quantifying cable loss
- 3.2. Describe RF and Power requirements including:
  - 3.2.1. Backup
- 3.3. Define attenuation and Free Space Path Loss (FSPL)
- 3.4. Describe different wireless carriers antennas and their frequencies to include:
  - 3.4.1. Multiple In Multiple Out (MIMO)
  - 3.4.2. Single In Single out (SISO)

3.5. List signal requirements in the following DAS:

- 3.5.1. Active
- 3.5.2. Passive
- 3.5.3. Hybrid

**4.0 Equipment**

4.1. Discuss receiving a signal source

4.1.1. Describe Head End, active components including:

- 4.1.1.1. Location paths
- 4.1.1.2. Mounting

4.1.2. Describe how to evaluate schematics, wiring and diagrams including:

- 4.1.2.1. Component access and locating
- 4.1.2.2. Testing wiring and circuits
- 4.1.2.3. Common connection types
- 4.1.2.4. Low current terminations (low voltage)

4.2. Describe the different choices of signal boosting used in a DAS

4.2.1. Repeaters

4.2.2. Amps and bi-directional amplifiers (BDA)

- 4.2.2.1. Channelized BDA's
- 4.2.2.2. Non-channelized BDA's

4.2.3. Base transceiver station (BTS)

4.3. Describe the difference between an interior versus exterior DAS

4.4. Describe Equipment Mounting including:

4.4.1. Grounding and bonding

4.4.2. Access

4.4.3. Installation test equipment

- 4.4.3.1. Digital Multimeter (DMM)
- 4.4.3.2. Polarity Tester

4.4.4. Measurements

4.4.5. Tools

- 4.4.5.1. Common
- 4.4.5.2. Special Purpose

4.5. Explain why labeling is required using TIA 606B standards and labeling per drawings of:

4.5.1. Equipment

4.5.2. Racks

4.5.3. Bays

4.5.4. Mounts

4.5.5. Cables

- 4.5.5.1. Coaxial
- 4.5.5.2. Fiber Optic
- 4.5.5.3. Twisted Pair (Cat 5e, 6, etc.)
- 4.5.5.4. Other copper

4.5.6. Connectors

4.5.7. Splitters

4.5.8. Couplers

4.5.9. Filters and chassis per engineering drawings

4.5.10. Bill of Material (BOM)

4.5.11. Method of Procedure (MOP)

**5.0 Antennas and Transmission Lines**

5.1. Describe the different antennas used in DAS

5.1.1. Donor

5.1.2. Distribution

5.1.3. Indoor

5.1.4. Network components

- 5.2. Describe the function and use of transmission lines
  - 5.2.1. Types
    - 5.2.1.1. Coaxial cables
    - 5.2.1.2. Fiber Optics
    - 5.2.1.3. Twisted Pair (Cat 5e, 6, etc.)
  - 5.2.2. Bend Radius
  - 5.2.3. Data grade testing
  - 5.2.4. Measurements
    - 5.2.4.1. Optical time-domain reflectometer (OTDR)
    - 5.2.4.2. Return Loss
    - 5.2.4.3. Baseline
  - 5.2.5. Conformance testing
- 5.3. Describe the different DAS terminations
- 5.4. Explain how connectivity must be maintained
- 5.5. Explain the use of Splitters and Couplers
  - 5.5.1. Explain insertion loss testing for correct ratios
- 5.6. Describe how harnesses/hangers can and must be used
- 5.7. Define clearances in a DAS

## **6.0 Connectivity**

- 6.1. Describe coaxial connectivity mechanics
- 6.2. Explain how cable preparation, including labeling, for connectors is required
- 6.3. Describe installation procedures, including:
  - 6.3.1. Proofing
    - 6.3.1.1. Tamper resistance
      - 6.3.1.1.1. Mechanical
      - 6.3.1.1.2. Vermin
      - 6.3.1.1.3. Cybersecurity
    - 6.3.1.2. Water
- 6.4. Explain splicing procedures

## **7.0 Testing and Troubleshooting**

- 7.1. Explain Antenna Line Sweep Testing to include:
  - 7.1.1. Return loss
  - 7.1.2. Insertion loss
  - 7.1.3. Distance to Fault
- 7.2. Explain Passive Intermodulation (PIM) testing
- 7.3. Describe the need for coverage surveys to include:
  - 7.3.1. Shadowing
  - 7.3.2. Waveguide effects
- 7.4. Explain post installation quality assessment, including:
  - 7.4.1. Reconnecting power
  - 7.4.2. Resetting devices
- 7.5. Describe how to make received signal strength indicator (RSSI) calculations
  - 7.5.1. Antenna versus actual
  - 7.5.2. Each antenna
    - 7.5.2.1. Spectrum Analyzer (Spec An, Spec A, etc.)
    - 7.5.2.2. Power meter

## **8.0 Documentation**

- 8.1. Define 'As built' documentation
- 8.2. Describe the 'Post install checklist'
- 8.3. Explain Building Codes documentation
- 8.4. Describe permits and why they are required
- 8.5. Proof labeling per drawings

## **End of Distributed Antenna Systems Competencies**

Find An ETA Test Site:

<http://www.eta-i.org/testing.html>

### **Suggested Study Material and Resources:**

Useful DAS courses, white papers, discussion and videos can be found at the following web sites: [www.doverts.com](http://www.doverts.com), [www.birdrf.com](http://www.birdrf.com), [www.hetnetforum.com](http://www.hetnetforum.com) and by contacting ETA<sup>®</sup> International for other DAS resources: [www.eta-i.org](http://www.eta-i.org) and 1-800-288-3824

**DAS training study guide coming soon.**

**Wiring for Wireless Sites;** Ira Wiesenfeld, P.E.; ISBN 978-1401810375; Thompson Delmar Learning; 2002; pp. 260

**Practical Antenna Handbook, 5E;** Joseph Carr & George (Bud) W. Hippisley; ISBN 978-0071639583; McGraw-Hill/Tab Electronics; 2011; pp.784

**Modern Electronic Communication, 9E;** Jeff Beasley & Gary M. Miller; ISBN 978-0132251136; Prentice Hall; 2007; pp.992

**Handbook of Radio & Wireless Technology;** Sam Gibilisco; ISBN 978-0070230248; McGraw-Hill Professional; 1998; pp.640

**Basic Radio, Principles & Technology;** Ian Poole; ISBN 978-0750626323; Newnes; 1994; pp.224

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