

# General Communication Technician - Level 3 (GCT3) Competency Requirements



The General Communications Technician Level 3 certification is a journeyman level program that goes beyond the U.S. Department of Homeland Security (DHS) guidelines covering all of the disciplines in the COMT program. The GCT-3 program details all areas that a radio communications technician and/or engineer will encounter in the public safety communications or business - commercial radio fields. GCT-3 explores various communications schemes at the system design and engineering levels. GCT-3 examines the most current technology, and promotes good engineering practices; and in concept, takes into consideration all system design parameters at the engineering level. GCT-3 focuses on system design, examining the advantages and pitfalls associated with modern day communications systems, therefore allowing system designers to create the best systems possible for every unique situation. The GCT certification program follows a stackable certification format. GCT-3 can only be obtained after successful attainment of GCT-2 certification. Please re-examine the General Communication Technician Level 1 and Level 2 competencies for prior descriptions of their knowledge benchmarks.

The GCT program certifications are maintainable for all Levels.

## 1.0 Design Considerations

- 1.1. Safety
  - 1.1.1. Discuss Radio Frequency (RF) safety
  - 1.1.2. Identify personal training requirements
  - 1.1.3. Identify signage requirements
  - 1.1.4. Identify detection of RF radiation levels
  - 1.1.5. Describe lightning protection safety measures
  - 1.1.6. Describe ergonomic safety measures
  - 1.1.7. Discuss personal protection equipment (PPE) safety including:
    - 1.1.7.1. vision and eye
    - 1.1.7.2. hearing
  - 1.1.8. Determine how to design tower, elevated surfaces and buildings safety plans
  - 1.1.9. Describe access safety
- 1.2. Coverage requirements
  - 1.2.1. Determine user needs
    - 1.2.1.1. Identify type of business operation
    - 1.2.1.2. Assess user/operator needs
  - 1.2.2. Coverage areas
    - 1.2.2.1. Identify area of operation
    - 1.2.2.2. Explain responsible radiation control and FCC OET65 requirements
    - 1.2.2.3. Determine areas beyond normal operation
  - 1.2.3. In-building coverage:
    - 1.2.3.1. Define normal operation
    - 1.2.3.2. Define "green" buildings
    - 1.2.3.3. Identify use beyond normal coverage area
    - 1.2.3.4. Define "mutual aid"
    - 1.2.3.5. "Illustrate" linking systems
- 1.3. Meeting user expectations
  - 1.3.1. New systems
    - 1.3.1.1. Define requirements
    - 1.3.1.2. Identify new features
    - 1.3.1.3. Explain operation
    - 1.3.1.4. Assure adequate spectrum resources exist prior to procurement
  - 1.3.2. Existing systems
    - 1.3.2.1. Verify current system coverage
    - 1.3.2.2. Identify deficiencies to be addressed
    - 1.3.2.3. Features:
      - 1.3.2.3.1. Determine existing features
      - 1.3.2.3.2. Explain adding new features
    - 1.3.2.4. Channel busy or blocking:

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- 1.3.2.4.1. Identify the need for channel busy or blocking
- 1.3.2.4.2. Develop the implementation of channel busy or blocking
- 1.4. Receiver voting systems
  - 1.4.1. Describe analog signal-to-noise voting
  - 1.4.2. Describe digital summation and error correction
  - 1.4.3. Describe "Receive Signal Strength Indication" (RSSI) voting
- 1.5. Band to Choose
  - 1.5.1. Identify the availability within intended area of operation
    - 1.5.1.1. Describe the characteristics of chosen frequency band
    - 1.5.1.2. Compare paired versus unpaired environments
    - 1.5.1.3. Assess coverage areas
    - 1.5.1.4. Justify subscriber units and costs
    - 1.5.1.5. Evaluate interoperability with neighbors
- 1.6. Simulcast versus Multicast systems
  - 1.6.1. Determine the number of sites needed
  - 1.6.2. Determine the number of channels available
- 1.7. Transmission (Tx) system power levels
  - 1.7.1. Evaluate base station's power levels
  - 1.7.2. Evaluate mobile unit's power levels
  - 1.7.3. Evaluate portable unit's power levels
- 1.8. Locations of infrastructure
  - 1.8.1. Locate new sites
  - 1.8.2. Locate existing sites
  - 1.8.3. Locate new buildings
  - 1.8.4. Locate new towers
  - 1.8.5. Locate water tanks
- 1.9. Other design considerations
  - 1.9.1. Justify the use of lower sites with lower effective radiated power (ERP) and directive patterns with voting and simulcast configurations versus single high site/high effective radiated power (ERP) omnidirectional sites
- 1.10. Site management concerns
  - 1.10.1. Describe intermodulation suppression
  - 1.10.2. Discuss non-linear junctions
  - 1.10.3. Define desensitization
  - 1.10.4. Explain grounding and bonding (NFPA 70 Article 810, Motorola R56 or similar standard)
- 1.11. Site security concerns
  - 1.11.1. Analyze physical plant security
  - 1.11.2. Explain copper theft prevention
  - 1.11.3. Develop infrastructure protection against "bad actors"
- 1.12. Power sources and emergency power
  - 1.12.1. Compare power sources
  - 1.12.2. Explain generator(s)
  - 1.12.3. Explain how to integrate alternative power (renewable energy)
  - 1.12.4. Discuss 100% battery operation
  - 1.12.5. Determine standby power requirements for a site
  - 1.12.6. Determine fuel availability
  - 1.12.7. Explain how to calculate length of time of operation
- 1.13. Interoperability with neighboring systems
  - 1.13.1. Determine RF bands
  - 1.13.2. Investigate system types
- 1.14. Interference considerations
  - 1.14.1. Describe co-channel
  - 1.14.2. Describe adjacent channel
  - 1.14.3. Evaluate blocking / desense
  - 1.14.4. Identify intermodulation
  - 1.14.5. Define "skip"
- 1.15. Permits and zoning requirements
  - 1.15.1. Identify zoning

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- 1.15.2. Describe the obtaining permits process
- 1.15.3. Justify land use
- 1.16. Federal Communications Commission (FCC) licensing {or Canadian-'IC', U. K.-'Ofcom', etc}
  - 1.16.1. Establish system design requirements
  - 1.16.2. Explain how to coordinate/obtain FAA permission (if needed)
  - 1.16.3. Describe the National Environmental Policy Act
    - 1.16.3.1. Identify historic preservation (Section 106 compliance)
    - 1.16.3.2. Identify endangered plants
    - 1.16.3.3. Identify endangered animals
    - 1.16.3.4. Identify historic burial grounds
  - 1.16.4. Determine band(s) of operation
  - 1.16.5. Explain frequency coordination process
    - 1.16.5.1. Compose letters of concurrence
  - 1.16.6. Review construction
  - 1.16.7. Explain the notification of construction completion process (FCC Schedule K)
  - 1.16.8. Explain the license renewal processes
  - 1.16.9. Identify border regions
    - 1.16.9.1. "North of Line A"- Treaty with Canada Harmful Interference Anticipated area
    - 1.16.9.2. "South of Line B"- Treaty with Mexico on the southern US Border
    - 1.16.9.3. "West of Line C"- Treaty with Canada and the region within Alaska
- 1.17. Interference
  - 1.17.1. Discuss anticipating interference
  - 1.17.2. Describe recognizing interference
  - 1.17.3. Discuss eliminating interference

## 2.0 Modulation Schemes

- 2.1. Analog systems
  - 2.1.1. Amplitude Modulation (AM)
    - 2.1.1.1. Explain AM
    - 2.1.1.2. Explain Single Side Band (SSB)
    - 2.1.1.3. Explain Double Side Band (DSB)
    - 2.1.1.4. Explain Amplitude Compandered Single Side Band (ACSSB)
  - 2.1.2. Frequency Modulation (FM)
    - 2.1.2.1. Describe wideband FM
    - 2.1.2.2. Describe mediumband FM
    - 2.1.2.3. Describe narrowband FM
  - 2.1.3. Describe Phase Modulation (PM)
  - 2.1.4. Describe Analog Television
  - 2.1.5. Analog Paging systems
    - 2.1.5.1. Explain Two-tone paging with voice
    - 2.1.5.2. Explain 5/6 tone paging with voice
- 2.2. Digital systems
  - 2.2.1. Project25 (P25) two-way radio systems
    - 2.2.1.1. Describe P25 Phase 1
    - 2.2.1.2. Describe Four level (C4FM)
    - 2.2.1.3. Describe Linear Simulcast Modulation (LSM)
    - 2.2.1.4. Describe Quadrature PSK (QPSK)
    - 2.2.1.5. Describe P25 Phase 2
  - 2.2.2. Digital Mobile Radio (DMR)
    - 2.2.2.1. Explain Tier 1
    - 2.2.2.2. Explain Tier 2
    - 2.2.2.3. Explain Tier 3
    - 2.2.2.4. Explain 2-slot using time division multiple access TDMA (MOTOTRBO)
  - 2.2.3. Next Generation Digital Narrowband (NXDN)
    - 2.2.3.1. Describe 12.5 kHz scheme
    - 2.2.3.2. Describe 6.25 kHz scheme
  - 2.2.4. Discuss OpenSky<sup>®</sup>
  - 2.2.5. Discuss Terrestrial Trunked Radio (TETRA)

- 2.2.6. Discuss TETRAPOL
- 2.2.7. Discuss Time Division Multiple Access (TDMA)
- 2.2.8. Discuss Code Division Multiple Access (CDMA)
- 2.2.9. Digital Paging modulation schemes
  - 2.2.9.1. Describe Two level (C2FM) format
  - 2.2.9.2. Describe Four level (C4FM) format
- 2.2.10. Digital Paging systems formats
  - 2.2.10.1. Explain POCSAG
  - 2.2.10.2. Explain FLEX
  - 2.2.10.3. Explain RE-FLEX
- 2.2.11. Explain Golay error-correcting code

### 3.0 Trunking

- 3.1. Describe trunking in radio communications systems
  - 3.1.1. Explain Single Site
  - 3.1.2. Explain Multi-Site
- 3.2. Define types of radio trunking formats
  - 3.2.1. Describe Logic Trunked Radio (LTR) systems
  - 3.2.2. Describe Smartnet<sup>®</sup> systems
  - 3.2.3. Describe SmartZone<sup>®</sup> systems
  - 3.2.4. Describe enhanced digital access communications system (EDACS<sup>®</sup>) systems
  - 3.2.5. Describe Trident<sup>®</sup> systems
  - 3.2.6. Describe Passport<sup>®</sup> systems
  - 3.2.7. Describe Capacity Plus<sup>®</sup> systems
  - 3.2.8. Describe NEXEDGE<sup>®</sup> systems
  - 3.2.9. Describe IDAS systems
  - 3.2.10. Describe OpenSky<sup>®</sup> systems
  - 3.2.11. Describe P25 Phase 1 systems
  - 3.2.12. Describe P25 Phase 2 systems
  - 3.2.13. Describe MPT1327 systems
  - 3.2.14. Describe TETRA systems
  - 3.2.15. Describe TETRAPOL systems

### 4.0 Combiners, Multicouplers, and Duplexers

- 4.1. Types of combiner systems
  - 4.1.1. Star combiners
    - 4.1.1.1. Describe when to use
    - 4.1.1.2. Explain isolation
    - 4.1.1.3. Discuss insertion loss
    - 4.1.1.4. Define bandwidth
  - 4.1.2. Hybrid combiners
    - 4.1.2.1. Describe when to use
    - 4.1.2.2. Explain isolation
    - 4.1.2.3. Discuss insertion loss
    - 4.1.2.4. Define bandwidth
  - 4.1.3. Diplexers
    - 4.1.3.1. Describe when to use
    - 4.1.3.2. Explain isolation
    - 4.1.3.3. Discuss insertion loss
    - 4.1.3.4. Define bandwidth
- 4.2. Receiver Multicouplers
  - 4.2.1. Define singleband
  - 4.2.2. Define wideband
  - 4.2.3. Define split band
  - 4.2.4. Identify amplification parameters (gain, compression and noise figure)
    - 4.2.4.1. Describe filters
    - 4.2.4.2. Describe when to use tower top amplifiers (TTA)

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- 4.2.4.3. Explain the “caveats” and problems associated with TTA
- 4.3. Duplexers
  - 4.3.1. Describe limitations of certain types of duplexers in an unpaired spectrum environment
  - 4.3.2. Explain specifications
    - 4.3.2.1. Define isolation
    - 4.3.2.2. Define insertion loss
    - 4.3.2.3. Define bandwidth
  - 4.3.3. Identify Band-Pass Only duplexers
    - 4.3.3.1. Describe when to use
    - 4.3.3.2. Explain isolation
    - 4.3.3.3. Discuss insertion loss
    - 4.3.3.4. Define bandwidth
  - 4.3.4. Identify Band Reject Only duplexers
    - 4.3.4.1. Describe when to use
    - 4.3.4.2. Explain isolation
    - 4.3.4.3. Discuss insertion loss
    - 4.3.4.4. Define bandwidth
  - 4.3.5. Identify Band Pass- Band Reject (BpBr) duplexers
    - 4.3.5.1. Describe when to use
    - 4.3.5.2. Explain isolation
    - 4.3.5.3. Discuss insertion loss
    - 4.3.5.4. Define bandwidth
  - 4.3.6. Identify Hybrid duplexers
    - 4.3.6.1. Describe when to use
    - 4.3.6.2. Explain isolation
    - 4.3.6.3. Discuss insertion loss
    - 4.3.6.4. Define bandwidth
- 4.4. Multiband combiners
  - 4.4.1. Describe when to use
  - 4.4.2. Explain isolation
  - 4.4.3. Discuss insertion loss
  - 4.4.4. Define bandwidth

## 5.0 Antenna Systems

- 5.1. Components
  - 5.1.1. Transmission line parameters
    - 5.1.1.1. Explain size
    - 5.1.1.2. Explain material
    - 5.1.1.3. Explain power
    - 5.1.1.4. Explain loss
    - 5.1.1.5. Explain velocity factor
    - 5.1.1.6. Explain impedance
    - 5.1.1.7. Explain flexibility
    - 5.1.1.8. Explain bending radius
    - 5.1.1.9. Explain PIM and the effect of using cables with braid and foil for duplex operations
  - 5.1.2. Connectors
    - 5.1.2.1. Identify types
      - 5.1.2.1.1. Recognize UHF
      - 5.1.2.1.2. Recognize N
      - 5.1.2.1.3. Recognize 7/16 DIN
      - 5.1.2.1.4. Recognize BNC
      - 5.1.2.1.5. Recognize SMA
      - 5.1.2.1.6. Recognize TNC
      - 5.1.2.1.7. Recognize Mini DIN 4.3/10
      - 5.1.2.1.8. Recognize Mini DIN 4.1/9.5
- 5.2. Antenna types
  - 5.2.1. Describe dipole antennas

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- 5.2.2. Describe Yagi antennas
- 5.2.3. Describe collinear antennas
- 5.2.4. Describe corner reflector antennas
- 5.2.5. Describe log periodic antennas
- 5.2.6. Describe cardioid antennas
- 5.2.7. Describe Marconi antennas
- 5.2.8. Describe Stubby<sup>®</sup> antennas
- 5.2.9. Describe multiple in multiple out (MIMO) antennas
- 5.2.10. Discuss custom radiation patterns
- 5.3. Gain
  - 5.3.1. Explain unity gain
  - 5.3.2. Explain dBi (forward gain with hypothetical isotropic antenna)
  - 5.3.3. Explain dBd (forward gain compared with half-wave dipole antenna)
  - 5.3.4. Explain effective radiated power (ERP)
- 5.4. Downtilt
  - 5.4.1. Define downtilt
  - 5.4.2. Describe when downtilt is used
  - 5.4.3. Explain the downtilt formula:  $\text{Angle} = \text{ArcTAN}(\text{Height}/\text{Distance})$
  - 5.4.4. Discuss the “caveats” of using downtilt
- 5.5. Antenna polarization
  - 5.5.1. Identify vertical polarization
  - 5.5.2. Identify horizontal polarization
  - 5.5.3. Identify circular polarization

## 6.0 Consoles

- 6.1. Single Channel consoles
  - 6.1.1. Explain single position
  - 6.1.2. Explain multi-position
  - 6.1.3. Explain multi-position-multi-site
- 6.2. Multiple Channel consoles
  - 6.2.1. Explain single position
  - 6.2.2. Explain multi-position
  - 6.2.3. Explain multi-position-multi-site
- 6.3. Interfaces between consoles and radio base stations
  - 6.3.1. Describe direct connect control
  - 6.3.2. Describe DC remote control
  - 6.3.3. Describe tone remote control
  - 6.3.4. Describe Internet Protocol (IP) remote control

## 7.0 Connectivity

- 7.1. Types of interconnectivity
  - 7.1.1. Cable
    - 7.1.1.1. Define house cable
    - 7.1.1.2. Define telephone company leased lines
  - 7.1.2. Describe local area networks (LAN)
  - 7.1.3. Radio links
    - 7.1.3.1. Describe radio links
    - 7.1.3.2. Describe audio bandwidth limitations
  - 7.1.4. Explain microwave links
  - 7.1.5. Explain fiber optic links
- 7.2. Internet Protocol (IP) Networks
  - 7.2.1. Discuss the OSI model
  - 7.2.2. Describe IP addressing
  - 7.2.3. Describe networks
  - 7.2.4. Describe sub-networks
  - 7.2.5. Describe Voice over IP (VoIP)
  - 7.2.6. Describe Radio over IP (RoIP)
  - 7.2.7. Explain User Datagram Protocol (UDP) streaming on shared IP networks

- 7.3. Simulcast
  - 7.3.1. Explain the use of RF links
  - 7.3.2. Explain the use of microwave radio links
  - 7.3.3. Explain the use of IP links
  - 7.3.4. Explain the use of fiber optic links
  - 7.3.5. Critical Simulcast Parameters
    - 7.3.5.1. Determine frequency
    - 7.3.5.2. Determine modulation level
    - 7.3.5.3. Explain how to calculate time of launch
    - 7.3.5.4. Explain GPS timing

## 8.0 Power Systems

- 8.1. Primary power
  - 8.1.1. Explain how to calculate power requirements
  - 8.1.2. Develop distribution
  - 8.1.3. Design load centers
- 8.2. Backup power
  - 8.2.1. Uninterrupted power supply (UPS) power systems
  - 8.2.2. Explain how to calculate the sizing of the backup system
  - 8.2.3. Determine the length of operation of the backup system
  - 8.2.4. Determine the maximum load on the backup system
  - 8.2.5. Describe the output waveform
- 8.3. Generators
  - 8.3.1. Explain how to calculate the sizing of the generators
  - 8.3.2. Determine the length of operation of a generator system
  - 8.3.3. Determine the maximum load parameters of a generator system
  - 8.3.4. Describe the output waveform
- 8.4. Batteries
  - 8.4.1. Determine the battery voltage requirements
  - 8.4.2. Explain how to calculate the current requirements of a system
  - 8.4.3. Determine how to calculate a plan for the length of operation
  - 8.4.4. Determine what constitutes the maximum load
  - 8.4.5. Explain how to formulate what is needed for proper battery charging
- 8.5. Renewable Energy power systems
  - 8.5.1. Discuss wind generators
  - 8.5.2. Discuss hydro generators
  - 8.5.3. Discuss solar generators
  - 8.5.4. Discuss fuel cells

## 9.0 Interoperability

- 9.1. Determine the role of the Communications Unit Leader (COM-L per D.H.S.)
- 9.2. National Incident Management System (NIMS) / Incident Command System (ICS)
  - 9.2.1. Explain what is in a memorandum of understanding (MOU)
  - 9.2.2. Explain what is the purpose of the NIMS system
- 9.3. Explain how to implement a planned and coordinated communications system deployment
- 9.4. Determine bands used between agencies
- 9.5. Determine modulation schemes used between agencies
- 9.6. Gateways
  - 9.6.1. Define gateways
  - 9.6.2. Classify connections
  - 9.6.3. Determine audio levels
  - 9.6.4. Identify interface leads
  - 9.6.5. Identify interface voltages
- 9.7. Portable or Temporary Repeaters
  - 9.7.1. Identify portable or temporary repeaters
  - 9.7.2. Explain their licensing
  - 9.7.3. Determine secondary status and non-interference to incumbent operations
  - 9.7.4. Explain their operation

## 10.0 RF Propagation and Anomalies

- 10.1. Define ground wave propagation
- 10.2. Define sky wave propagation
- 10.3. Define near vertical incidence skywave (NVIS) propagation
- 10.4. Define line-of-sight (LOS) propagation
- 10.5. Explain propagation prediction programs
- 10.6. Explain skip
- 10.7. Define ducting
- 10.8. Multipath propagation
  - 10.8.1. Describe multipath
  - 10.8.2. Describe reflections
- 10.9. Describe how to calculate Fresnel zones
- 10.10. Describe solar flares
- 10.11. Radio frequency interference (RFI)
  - 10.11.1. Classify fluorescent and CFL (Compact FL) lamps
  - 10.11.2. Classify energy efficient ballasts
  - 10.11.3. Diagnose other transmitters
  - 10.11.4. Explain how to resolve computer processing units (CPU) noise
  - 10.11.5. Identify broadband over power lines
  - 10.11.6. Diagnose cable and master antenna TV leakage
  - 10.11.7. Identify near-field radiation

## 11.0 Simulcast

- 11.1. Design parameters
  - 11.1.1. Describe frequency synchronization
  - 11.1.2. Identify modulation level
  - 11.1.3. Explain how to calculate time of launch
  - 11.1.4. Discuss GPS-disciplined/Rubidium master oscillator
  - 11.1.5. Determine view of sky for GPS antenna
  - 11.1.6. Diagnose interference and spoofing
- 11.2. System optimization
  - 11.2.1. Time-base Requirements
    - 11.2.1.1. Determine reference frequency
    - 11.2.1.2. Determine 1 pulse per second (1PPS) requirements
  - 11.2.2. Modulation Level Identification
    - 11.2.2.1. Confirm that the modulation level is identical at all sites
    - 11.2.2.2. Confirm that the modulation phase angle is identical at all sites
    - 11.2.2.3. Confirm that the audio frequency response is the same at all sites
  - 11.2.3. Time of Launch
    - 11.2.3.1. Determine that the time of launch is identical at all sites

## 12.0 Distributed Antenna Systems

- 12.1. Connectivity to base system
  - 12.1.1. Describe RF connectivity
  - 12.1.2. Describe fiber optic connectivity
  - 12.1.3. Describe Ethernet connectivity
- 12.2. Distribution systems
  - 12.2.1. Describe RF distribution systems
  - 12.2.2. Describe fiber optic distribution systems
  - 12.2.3. Describe Ethernet distribution systems
  - 12.2.4. Describe leaky coax distribution systems
  - 12.2.5. Multiband distribution systems
    - 12.2.5.1. Determine signal levels
    - 12.2.5.2. Explain how to calculate uplink levels
    - 12.2.5.3. Explain how to calculate downlink levels
- 12.3. DAS issues
  - 12.3.1. Discuss noise issues



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- 12.3.2. Discuss intermodulation issues
- 12.3.3. Explain sneak paths
- 12.3.4. Describe isolation requirements and measurements
- 12.4. DAS installation
  - 12.4.1. Manage infrastructure equipment installation
  - 12.4.2. Explain how to inspect cabling
  - 12.4.3. Explain how to calculate power requirements
  - 12.4.4. Describe how to confirm that all antennas are working properly
- 12.5. DAS emergency power
  - 12.5.1. Determine emergency power requirements for DAS
  - 12.5.2. Explain how to perform length of time calculations

### 13.0 Commissioning Systems

- 13.1. Project Management
  - 13.1.1. Create system design
  - 13.1.2. Establish an initial review
  - 13.1.3. Establish a detail design review
  - 13.1.4. Organize factory acceptance tests
  - 13.1.5. Explain how to critique final acceptance tests
  - 13.1.6. Determine pre-installation issues
- 13.2. Installation
  - 13.2.1. Explain how to order all materials for the installation
  - 13.2.2. Describe how to confirm all contractors and vendors are on-time
  - 13.2.3. Explain how to supervise the physical installation
- 13.3. Optimization
  - 13.3.1. Describe how to power on all equipment in systematic manner per factory instructions
  - 13.3.2. Explain how to enter system parameters as required
  - 13.3.3. Test individual components
  - 13.3.4. Test as complete system
- 13.4. Documentation
  - 13.4.1. Describe how to follow-up on all system and detail documentation
  - 13.4.2. System sign off
  - 13.4.3. Confirm all equipment is properly working
  - 13.4.4. Sign off on all details

### 14.0 Emerging Technologies

- 14.1. Long-Term Evolution (LTE) systems
  - 14.1.1. 4G LTE
    - 14.1.1.1. Explore push-to-talk
    - 14.1.1.2. Explain data schemes
  - 14.1.2. 5G
    - 14.1.2.1. Discuss mesh networks
    - 14.1.2.2. Identify bands to choose
  - 14.1.3. LTE-A (advanced = two LTE bands at the same time)
- 14.2. IP radios
  - 14.2.1. Discuss Voice over Internet Protocol (VoIP)
  - 14.2.2. Discuss Radio over Internet Protocol (RoIP)
- 14.3. Discuss First Responder Network Authority (FirstNet = [www.firstnet.gov](http://www.firstnet.gov))

## End of General Communications Technician – Level 3 Competencies

Find an ETA approved test site:

[http://www.eta-i.org/test\\_sites.html](http://www.eta-i.org/test_sites.html)

**GCT - Certification Program Subject Matter Advisory Board:**

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