



5G Technician: An Introduction to 5G (5GT) Competency Requirements

The 5G for Technicians standalone certification is aimed at cellular technicians and engineers with basic knowledge of the wireless industry. The competency serves as an introduction to 5th Generation (5G) communications technologies and gives cellular technicians the opportunity to earn a certification that has valuable industry application. This knowledge gives a first-hand look at industry standards, real world examples and case studies provided by a committee of subject matter experts with backgrounds in engineering, construction, cell carriers, broadcasting and entertainment.

The following knowledge competency identifies the individual subject topics which **5G Technicians** are expected to learn in preparation for the ETA[®] International **5GT** certification written examination. The examination covers a variety of topics including: 5G industry terminology, uses of 5G (enterprise, consumers and government systems), 5G equipment upgrading specifications, 5G networks, 5G construction best practices, 5G infrastructure design and general design thinking principles and concepts.

1.0 Definition of 5G and Historical Context

- 1.1 The Fourth Industrial Revolution
 - 1.1.1 Comprehend the key historical innovations and time periods leading up to the Fourth Industrial Revolution allowing for 5G capabilities
 - 1.1.2 Recognize the impact of 5G on world communications, as well as the political implications it places on both society and governments
- 1.2 4G Long-Term Evolution (LTE)
 - 1.2.1 Comprehend the communication principles of 4G/LTE
 - 1.2.2 List 4G LTE benchmarks and specifications
 - 1.2.3 Explain how 4G will work alongside 5G
- 1.3 5G by definition
 - 1.3.1 Distinguish the key definitions of 5G as outlined by 3GPP (The 3rd Generation Partnership Project) Release 15
 - 1.3.1.1 Define 5G NR (New Radio) air interface between the mobile device and a base station
 - 1.3.1.1.1 Describe OFDM (orthogonal frequency-division multiplexing) waveforms
 - 1.3.1.2 Describe 5G NR architecture for Radio/Device requirements including
 - 1.3.1.2.1 data rates
 - 1.3.1.2.2 latency
 - 1.3.1.2.3 battery life
 - 1.3.1.3 List 5G rollout dates per release 15
- 1.4 Additional 5G telecommunications standards are defined by
 - 1.4.1 FCC
 - 1.4.2 ANSI
 - 1.4.3 ITU (International Telecommunication Union, IMT-2020)
 - 1.4.4 IEEE

2.0 Safety Review for 5G Technologies

- 2.1 Summarize RF safety best practices using new 5G technologies
- 2.2 Define 5G Public Safety and Security aspects
- 2.3 Describe general communications safety requirements including:
 - 2.3.1 Personal Protective Equipment (PPE)
 - 2.3.2 RF legacy safety procedures
 - 2.3.3 antenna safety best practices
 - 2.3.4 grounding and lightning protection
- 2.4 Explain Safety procedures immersed during updating of older technologies including:
 - 2.4.1 Right-Of-Way (ROW) working safety procedures
 - 2.4.2 Working at heights safety factors
 - 2.4.3 handling fiber optic cabling

3.0 5G Use Cases

- 3.1 5G For Consumers
 - 3.1.1 Describe 'Wireless Broadband' access for enhanced mobile use (eMBB)
 - 3.1.2 Define 'Ultra-Reliable Low Latency' communications (URLLC)
 - 3.1.3 Explain Virtual Reality (VR) concepts
 - 3.1.4 Compare 3D TV and VR for consumers
 - 3.1.5 Identify IoT devices using 5G (mMTC-massive Machine Type Communications)
- 3.2 5G For Enterprise and Construction
 - 3.2.1 Define Artificial Intelligence (AI) affects using 5G
 - 3.2.2 Describe Virtual and Augmented Reality for business use
 - 3.2.3 Explain Autonomous/Self-Driving cars 5G use of 'Ultra-Reliable Low Latency' communications (URLLC)
 - 3.2.4 Explain Autonomous Heavy Machinery
 - 3.2.5 Identify IoT devices as they relate to industrial applications
 - 3.2.6 Explain how Drones (unmanned aerial systems – UAS) can use 5G
 - 3.2.7 Summarize Entertainment Industry Applications of 5G
- 3.3 5G For Healthcare
 - 3.3.1 Describe Robotics 5G use in a healthcare complex
 - 3.3.2 List 5G communications to enable Remote Surgery
 - 3.3.3 Identify IoT Devices applicable to healthcare facilities
 - 3.3.4 Describe interdepartmental communications concerning patient sensor status
- 3.4 5G For Government
 - 3.4.1 Define 5G for Smart Cities
 - 3.4.2 Explain 5G Public Safety and Security attributes
 - 3.4.3 List authority having jurisdiction (AHJ) guidelines and contacts

4.0 5G Technology Enabler and Equipment

- 4.1 Define Heterogeneous Networks (HetNet) using 5G technology to provide access
- 4.2 Describe how Millimeter Waves (extremely high frequencies, mmWaves) are enabling 5G
 - 4.2.1 Explain propagation issues with EHF frequencies
- 4.3 Explain Unlicensed Spectrum sharing opportunities
- 4.4 Define Massive MIMO antenna use
- 4.5 Explain how Beamforming enables 5G communications
 - 4.5.1 Describe how waveguides will be used in 5G
- 4.6 Define D2D (device-to-device) communication
- 4.7 Summarize IoT wireless/wired systems using 5G
- 4.8 Compare Small Cell network capabilities versus DAS, including:
 - 4.8.1 RAN / C-RAN Architecture
- 4.9 Explain network security enhancements required for 5G rollout
- 4.10 Describe 5G modulation schemes requirements

5.0 5G Build Out and Construction Practices

- 5.1 Explain general requirements implementing a 5G build including safety
- 5.2 Fiber Backhaul
 - 5.2.1 Describe Fiber need requirements for 5G
 - 5.2.2 List Best Practice Considerations for fiber installation including:
 - 5.2.2.1 underground boring and working in public Right-of-Way (see 5.4.2.1)
 - 5.2.2.2 fiber and copper antenna links
- 5.3 Upgrading Existing Infrastructure
 - 5.3.1 Define best practices updating older technology
 - 5.3.2 Describe how Network Testing best practices evolve with 5G
 - 5.3.3 Structural Considerations
- 5.4 Ultra-Dense Networks (UDN)
 - 5.4.1 Define UDN and its applications
 - 5.4.2 Define Public Right-of-Way (ROW) including:
 - 5.4.2.1 ROW working considerations and best practices
 - 5.4.2.1.1 Public Safety factors
 - 5.4.2.1.2 Traffic Control Planning
 - 5.4.3 Describe Types of Small Cell applications including:

- 5.4.3.1 Location Scouting Considerations
- 5.4.3.2 Structural Considerations
- 5.4.3.3 Foundation Design Considerations
- 5.4.3.4 Zoning Considerations
- 5.4.3.5 Permitting Considerations
- 5.4.3.6 Describe carrier standard integration with local jurisdiction (AHJ)
- 5.4.4 Explain Small Cell Installation Best Practices including:
 - 5.4.4.1 PIM Testing and safety considerations
 - 5.4.4.2 Fiber Scoping
 - 5.4.4.3 Sweep Testing
 - 5.4.4.4 Ground Testing
 - 5.4.4.5 FCC Required Signage
 - 5.4.4.6 EMF Testing
 - 5.4.4.7 wiring and fiber diagram schematics, electronic and electrical
- 5.4.5 Describe 5G specific equipment components, i.e. radio head connectors and cabling
 - 5.4.5.1 Antennas, Remote Radio Heads, OVP (Overvoltage protection)
- 5.4.6 Describe the ERP (effective radiated power) for 5G millimeter wave devices
- 5.5 Explain how to comply to regulatory bodies considerations
- 5.6 Describe how to commission a new 5G Build

End of 5G Technician: An Introduction to 5G Knowledge Competencies

Find an ETA approved school and approved test site: http://www.eta-i.org/test_sites.html

Additional Study Materials and Resources for ETA 5G Technicians Certification:

5G NR, 1stEd.; Mara Conner Dahlman, E., Parkvall, S. and Sköld, J. (2018).

5G System Design, 1stEd.; Marsch, P., Bulakçi, O., Queseth, O. and Boldi, M. authors(2018); John Wiley & Sons Ltd.

5G Mobile and Wireless Communications Technology, 1stEd.; Osseiran, A., Monserrat, J. and Marsch, P. authors (2016); Cambridge University Press.

Fundamentals of Massive MIMO; Marzetta, T., Larsson, E. and Yang, H. authors (2016); Cambridge: Cambridge University Press.

The 5G Deployment Plan Handbook: Volume 1, 5G technical deployment and history around building 5G and IOT businesses. (5G Deployment Handbook), 1stEd; Sarver, W. (2017); Self-Published.

Also see the 3GPP Website: http://www.eta-i.org/industry_links_and_resources.html

Contact ETA International for additional PDFs, white papers, links, etc. 1-800-288-3824 or eta@eta-i.org

Also see the following websites: www.iccsafe.org, (ICC, IBC, IFC); www.nfpa.org (70- NEC, 70E, 72); www.fcc.gov; https://www.itu-ilibrary.org/science-and-technology/setting-the-scene-for-5g_pub/811d7a5f-00eedfa2-en; <https://www.itu.int/en/ITU-T/jca/imt2020/Pages/default.aspx>;

5G Technician: An Introduction to 5G Advisory Committee:

Patrick McNerney, COO	3D Design & Engineering	pmcnerney@3ddne.com
Nabil Mimouni Ph.D., P.E., President	3D Design & Engineering	
Sam Malone, President	512 New Media	
Jim Parker, Senior Marketing Manager	AT&T	
Bobby McClung, CEO	AWS Communications	bmack@awscom.net
Dale Shumaker, President	Texas State Wireless Association	Dale.shumaker@enertechresources.com
Andrew Kasperek, Real Estate Consultant	JMH, Inc.	andrew@jmhodes.com
Danny Broussard, Director of Operations	VenuBlue	danny@venublue.com
Debra Cruickshank, FOT, FOI	Brandeman Univ. Instructor	
Daniel Jones	3D Design & Engineering	

ETA certification programs are accredited through the ICAC, complying with the ISO/IEC 17024 standard.

