5G Wireless Training

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5G wireless training (5th generation wireless systems or mobile networks) covers next major phase of wireless and mobile telecommunications standards beyond the current 4G/IMT-Advanced standards. 5G wireless training introduces most dominant technologies and architectures in near future which make 5G technology. 5G networks are expected to roll out broadly after 2020.

Compared with 4G/LTE cellular systems, 5G wireless communication systems (5G) are expected to provide higher spectral and energy efficiency and area throughput growth. Learn the key 5G wireless communication networks cellular architecture and key technologies for 5g communication networks.

5G Wireless Training course covers the fundamental 5G wireless communications including, channels, RF circuits, antennas, propagation, and issues surrounding emerging 5G wireless LAN and cellular/backhaul applications.

Learn how 5G networks could provide more data bandwidth and less latency using built-in computing intelligence to handle more data more efficiently than today's 4G networks. 5G networks will leverage more benefits of Moore's Law due to the convergence of communications and computing technologies and platforms.

5G wireless training covers concepts, services, technologies and network components behind 5G wireless. Find out how 5G wireless networks will be much smarter and faster than 4G. New trends such as M2M, self driving cars, smart cities, connected society , Internet of Things (IoT), broadcast-like services, lifeline communications in times of natural disaster will be part of the new 5G wireless services.

Learning Objectives

Upon completion of this course, the attendees are able to:

- Describe what 5G is
- List the 5G wireless features and their benefits (5G wireless communication networks)
- Describe key 5G technology drivers and enablers of 5G
- List 5G technology candidates in RAN/radio, transport, core networks, interoperability and services
- List 5G Wireless Use Cases
- Describe ITU 5G standards (IMT2020) along with NGMN alliance and 3GPP
- Walk through current and future deployment of 5G scenarios
- Co-Existence of LTE End-to-End Ecosystem with 5G
- List similarities and differences between 5G Radio Access and LTE
- Learn how 5G wireless networks could support up to 1,000-fold gains in capacity
- List requirements to connect 100 billion human and devices with a 10 Gb/s speed with zero-distance connectivity
- Describe new 5G Radio Access Technology Interworking with LTE

- Illustrate 5G wireless communication networks cellular architecture and key technologies
- Illustrate 5G network architecture and components
- List User-Driven 5G Requirements
  Describe the operation scenarios of 5G
- Explain the key RF, PHY, MAC and air interface changes required to support 5G
- Describe features supporting 5G wireless deployments
- Discuss the rationale for 5G wireless and key deployment topologies
- Outline changes required to implement 5G
- Learn about features of Massive MIMO

Course Content

What is 5G Wireless Communication?

- 5th Generation Wireless technology
- 5G as a technology vision
- Why 5G?
- End-to-End 5G Ecosystem
- 5G high level requirements and features
- Basic concepts behind 5G technology of mobile communication
- 5G technologies
- 5G technical objectives

5G Wireless Requirements, Applications, and Services

- 5G promises and challenges
- Disruptive technology directions
- Bandwidth
- Power consumption
- Infrastructure
- Spectral efficiency
- Resilience of the network
- Adapting new topologies
- Radio propagation and channel models
- Pervasive networks
- Internet of things (IoT) and M2M
- Wireless sensor networks and ubiquitous computing
- Wearable devices with AI capabilities

5G Vision

- Key technology drivers and innovations behind 5G wireless
- Next Wave of digital society
- Machine-type Communications
- Smart homes and buildings
- Smart grid
- Smart meters
- Intelligent Transportation Systems (ITS)
- Ultrahigh definition video
- Virtual reality applications
- Fiber-like user experience: 10 Gb/s data rates
- Mobile cloud service
- “Full Immersive” services
- Immersive experience
- Zero latency and response times
- Zero-second switching
- Tactical Radio
- Policy-based DSA systems
- Cognitive radar
- Exa-scale cloud data centers and Edge computing
- Internet of Vehicles
- Ultra-dense networks
- Virtualized and cloud-based radio access infrastructure

5G Wireless Use Cases and Applications

- Description of Use Cases and Scenarios
- Internet of Things (IoT) and Machine to Machine (M2M)
- Smart Grid, SCADA, EMS and Critical Infrastructure Monitoring
- Smart Building and Smart Cities
- m-Health/Telemedicine
- Automotive and Self-Driving Vehicles
- Sports and Fitness Management
- 3D/Virtual Reality (VR)
- Augmented Reality (AR)
- Gaming Applications
- Public Safety and Citizen Analytic
- Location and Context-Aware Services

Overview of Current and Past 5G Wireless Standardizations and Projects

- IEEE
- ITU-T
- 3GPP
- ETSI
- 5G Americas
- WWRF, the METIS Project and the DVB Project
- METIS Project
- Mobile and wireless communications Enablers for the Twenty-twenty Information Society
- European Union Seventh Framework Programme (FP7)
- IEEE 802.xx wireless mobile networks
- Development of World Wide Wireless Web (WWWW)
- 11 Wireless Local Area Networks (WLAN)
- 16 Wireless Metropolitan Area Networks (WMAN)
- Ad-hoc Wireless Personal Area Network (WPAN)
- WiGig or IEEE 802.11ad
- Millimeter Wave Mobile Communications for 5G Cellular
- IEEE 802.22
- DSA modes for WiFi and WiMAX
- Whitespace and WhiteFi
- Emerging field of mmWave communications.
- Ultrawideband WLAN and PAN networks.
- IEEE 802.15.3c 802.11ad/802.11ax/802.11az/802.11ay
- ECMA
- High rate 60 GHz PHY

5G Technology Enablers

- System design concepts
- Dynamic Spectrum Access (DSA)
- Interference Management
- Small Cells
- Coordinated Multipoint
- Mass-scale MIMO, Massive MIMO
- Caching and Delivering Techniques
- Personal Mobile Internet
- Device-to-Device Communication
- Software-Defined Radio (SDR)
- Cognitive Radio

- Smart-radio
- Multi-hop networks
- Direct device-to-device (D2D) communications
- Dynamic Adhoc Wireless Networks (DAWN)
- IPv6 and 6LowPAN
- Centralized RAN vs. Cloud RAN
- NFV, SDN, ICN, semantic and cloud networking
- Direct Device-to-Device Communication (D2D)
- Massive Machine Communication (MMC)
- Massive IoT
- Moving Networks (MN)
- Device-to-Device (D2D)
- Ultra-Dense Networks (UDN)
- Ultra-Reliable Communication (URC)
- Mobile ad hoc network (MANET)
- Wireless mesh network (WMN)
- Vandermonde-subspace frequency division multiplexing (VFDM)
- Millimeter-Wave
- 5G Cloud radio access network (C-RAN)
- Ultra small cells based heterogeneous network (HetNet)
- Heterogeneous cloud radio access network (H-CRAN)
- Disruptive approaches for increasing network capacity
- Programmable optical backbone networks with petabit throughput
- Enhanced Mobile Broadband (eMBB)
- Ultra Reliable and Low Latency Communication (URLLC)
- 5G management and orchestration

5G Challenges and Requirements

- ITU and NMGN use cases for 5G
- New radio access technologies (RAT)
- Spectrum bands availability
- Networks and devices
- Air-interface and RAN systems
- Virtualized architectures
- Service delivery architecture
- Single frequency full duplex radio technologies
- Architecture and key technologies

- Dynamic deployment of network functions
- New wireless backhaul solutions
- Adaptive resource management
- Flexible spectrum usage
- Safety and delay critical network of Cloudlets
- Performance requirements
- Latency
- Always-on users per cell
- Duty cycles
- Signaling loads
- Massive capacity
- Energy consumption
- Spectrum impact
- New architecture for services and service delivery
- Hyper connectivity to trillions of devices
- Massive dense networks
- Massive distributed MIMO
- Advanced interference and mobility management
- Cooperation of different transmission points with overlapped coverage
- Efficient support of machine-type devices
- Latency and enhanced reliability

5G Wireless Air Interface

- New access protocols and procedures for collaborative communications
- Software defined air interface
- Spectral usage techniques
- New multiple accesses (“no cell” concept)
- New radio resource management techniques
- Physical layer procedures, and coding
  New modulations schemes
- Channel models for 2.3 GHz, 2.6 GHz, 5.25 GHz, 26.4 GHz, and 58.68 GHz.
- Advanced MIMO technology with wider bandwidths
- Propagation modeling of densely populated urban areas
- Beamforming, network discovery, and relaying
- Coding and modulation algorithms
- Interference management
- Non-Orthogonal, Asynchronous Waveforms

- Millimeter-Wave Beamforming
- Cooperative diversity and flexible modulation
- C o-existence of macro-cells and cognitive radio small-cells
- Systems for mmWave transceivers

The 5G Operational Scenarios

- Explanation of 5G scenarios
- Examples of 5G technology components
- Cognitive & energy-efficient wireless technologies
- Enhancing LTE radio standards
- Capacity and performance
- System robustness
- 5G wireless implementation roadmaps
- Spectrum metrics
- Interference approaches
- Reconfigurable radio hardware
- 5G evaluation tools and testbeds