T-Mobile’s LTE & 5G Coverage
T-Mobile’s Coverage Map Portal

https://www.t-mobile.com/coverage/4g-lte-5g-networks
5G will not only be an evolution of mobile broadband networks, it will also enable new unique network and service capabilities:

- Gbps speeds
- Virtual reality and augmented reality
- Industrial automation, eHealth, V2X
- Autonomous vehicles

5G EVOLUTION
5G STRATEGY

INCREASED DATA RATES
INCREASE IN EFFICIENCY:
- ENERGY
- FREQUENCY
- SPECTRUM
- DEVICE

TECHNOLOGIES
- Massive MIMO
- Cloud - RAN
- Network Function Virtualization – NFV
- Mobile Edge Computing - MEC
- Software Defined Networking – SDN
- 5G CORE
- Network Slicing
- Chipset Roadmap
All Spectrum will be needed for 5G over time

- **mmW (DENSE URBAN)**: mmW is best suited to address the eMBB use case. Wide Bandwidth of spectrum provides vast capacity. Best suited for short range in building and urbanized systems.

- **Mid band (METRO)**: 4G LTE evolution for wide area coverage, capacity, voice, and primary mobility layer for 5G.

- **Low band (NATIONWIDE)**: 600MHz NR can address MBB and Massive IoT.

5G Starts with mmW + 600MHz
Eventually all Spectrum is 5G

Coverage
Massive MIMO
Massive MIMO

- Large Scale Antenna Systems
  - Low Cost Power Components
  - Reduced Latency
  - Simplifies Resource Allocation
Centralized - Cloud: Radio Access Network

- **C-RAN Architecture Offers:**
  - Increased Performance
  - Enhanced Flexibility
  - Lower Costs
NETWORK FUNCTION VIRTUALIZATION
NFV – Network Function Virtualization

- **NFV Benefits**
  - Reduce Costs & Consumption
  - Speed to Market
  - Sharing Resources
  - Lower Risks
MOBILE EDGE COMPUTING
Mobile Edge Computing - MEC

- MEC - Highlights
  - Small Cloud Centers at Edge
  - Traffic Monitoring
  - Content Caching
  - Local Data Aggregation
  - Perform Core Network Functions
SOFTWARE DEFINED NETWORKING
Software Defined Networking - SDN

- **SDN Provides:**
  - Separation of Control + Forwarding Plan
  - Control is Programmable
  - Creates Adaptable Network Hierarchy
5G CORE
5G Core

- **5G CORE**
  - HSS  Home Subscriber Server
  - UDM  Unified Data Mgmt
  - PCF  Policy Control Function
  - PCRF  Policy Control Rules
  - SMF  Session Mgmt Function
  - UPF  User Plan Function
  - AMF  Access and Mobility Mgmt
  - NG  Next Generation - RAN
How is traffic handled in architecture 1, 2, 3?

**Option 1**
LTE operation (Today)

**Option 3x**
NSA LTE + NR

**Option 2**
SA NR

- **Control**
- **Data**
- **IMS services**
5G NETWORK SLICING
Network Slicing

- **5G RAN Slicing:**
  - Flexible creation and placement of function instances
  - UE can use multiple network slices at the same time
  - Can treat traffic differently depending on customer requirements
CHIPSET ROADMAP
Chipset Ecosystem in T-Mobile Devices

High
- Qualcomm
  - SDX 55
  - SM 8150
  - MSM 8998
- Intel
  - XMM 8160
  - XMM 7560
- Samsung
  - Exynos
  - Exynos 9810

Mid
- Qualcomm
  - SDM 710*
  - SDM 660
  - SDM 630
  - MSM 8996
- Intel
  - XMM 7260
  - XMM 7360
  - XMM 7480
- Samsung
  - Exynos
  - Exynos 8890
  - Exynos 7885

Low
- Qualcomm
  - MSM 8905
  - MDM 8909
  - MDM 9040
  - MSM 8917
  - MSM 8994
  - MDM 9635
  - MDM 8952
  - MDM 9207
- Intel
  - XMM 7160
  - XMM 7420
- Samsung
  - Exynos
  - Exynos 7872
  - Exynos 9110
- Shimano
  - Shimano 333
- Sequans
  - SQN 3223
- MT
  - MT 6631
  - MT 6290
  - MT 6735
- Sequans
  - SQN 3330
  - SQN 3410
- MT
  - MT 2625

NB-IoT
- Qualcomm
  - MDM 9205
  - MDM 9206
- nRF
  - nRF51
- UBX
  - UBX R5
- RM
  - RM 1000
- ALT
  - ALT 1250
- RDA
  - RDA 8908
- Sequans
  - SQN 5111
- Sequans
  - SQN 3330
  - SQN 3410
- Sequans
  - MT 2621

*SDM 710 – formerly called SDM670
5G
Target 5G device with 600 MHz launch in 1H ‘19

Legend:
NSA: Non-standalone
SA: Standalone

T-Mobile

Release 15
Layer 1, 2 & 3 NR specification
Option 3X specification

SA
Option 2 specification

R.15 NR Chipset

RFFFE for B71 LTE + n71 NR co-existence
mmW RFFE optimization

Device in production form

1st 5G device launch on 1H19

Device Validation

Legend:
NSA: Non-standalone
SA: Standalone

R.15 NR Chipset

RFFFE (EoY ’18)

1st 5G device
Networks to power the future of IoT are here

Built to meet the demands of today and into the future:
- Efficient high and low bands
- Lower costs with more power
- Covers all of North America seamlessly

CAT-1
- Supports VoLTE and Connected Mobility

CAT 1 will allow customers:
- Up to 10 mbps
- Supports VoLTE and Connected Mobility

CAT M
- Late 2018
- Supports Connected Mobility

CAT M will allow customers:
- Up to 1 mbps
- Supports Connected Mobility

NB-IoT
- Narrowband IoT will allow customers:
  - Deliver products fast
  - Provide better coverage
  - Vastly improve battery life
  - Provide cost savings

5G
- A nationwide 5G mobile network will mean:
  - Lower latency
  - Increased battery life
  - More simultaneous connections

2G
- Supported until 2020