

# 5G status in 3GPP & future directions past phase 1 of 5G

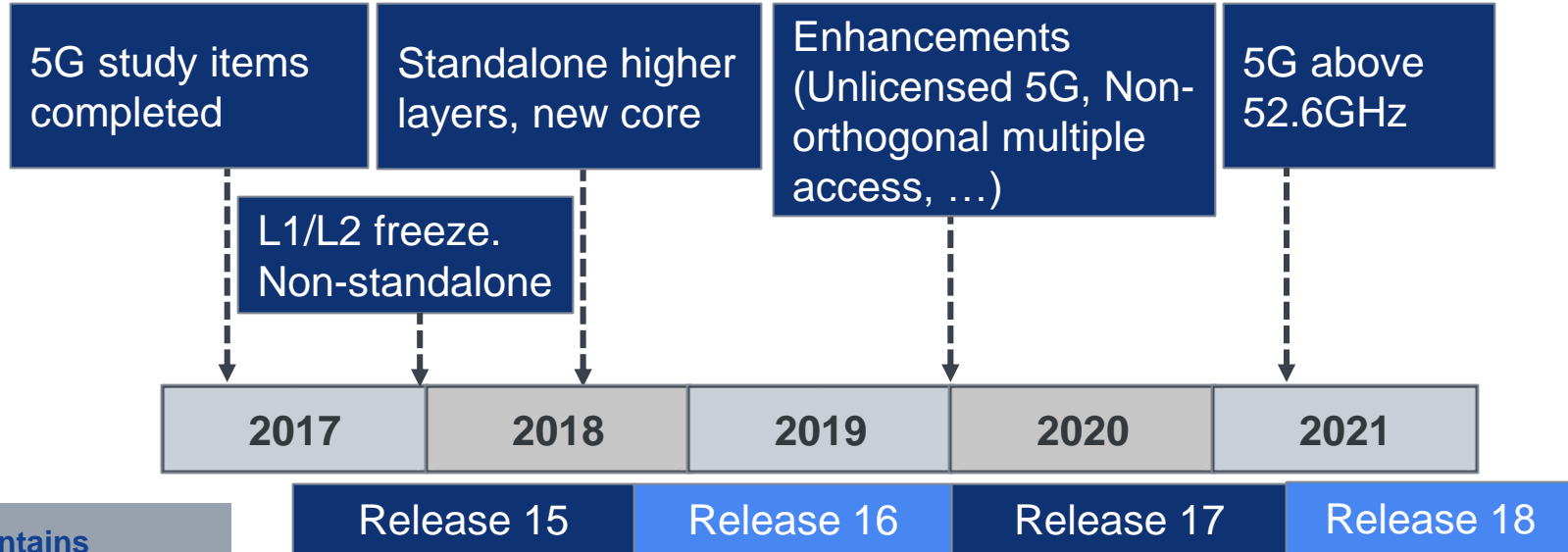
# NOKIA

Antti Toskala, Bell Labs Fellow

Nokia Bell Labs

September 20<sup>th</sup>, 2017

# 5G (New Radio) Schedule in 3GPP



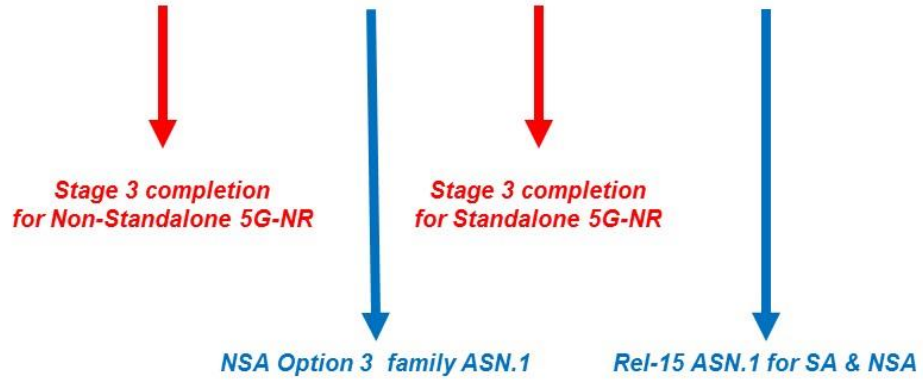
Release 15 contains intermediate ASN.1 freeze for Non-standalone in March 2018

Full ASN.1 freeze September 2018 for full 5G feature set

Note: Release timing beyond Release 15 not confirmed

# 3GPP Release 15 timeline

RAN #74		RAN #75			RAN #78	RAN #80 (Rel-15 completion)			
2016		2017				2018			
Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	



NSA = Non StandAlone = EPC core ("Option 3") & LTE anchor  
 SA = StandAlone

Some non-essential features postponed to 06/18

# 3GPP Release 15 work and study items

## Rel-15 Work item

**New Radio Access  
Technology**

## Studies on-going

Separation of CP and UP for  
split option 2

CU-DU lower layer split for New  
Radio

Test methods for New Radio\*\*

Self-evaluation towards IMT-  
2020 submission

## Studies toward Rel-16 on hold until Dec. 2017

Non-orthogonal multiple access

Non-terrestrial networks\*

EV2V evaluation methodology

Integrated Access Backhaul

Unlicensed spectrum

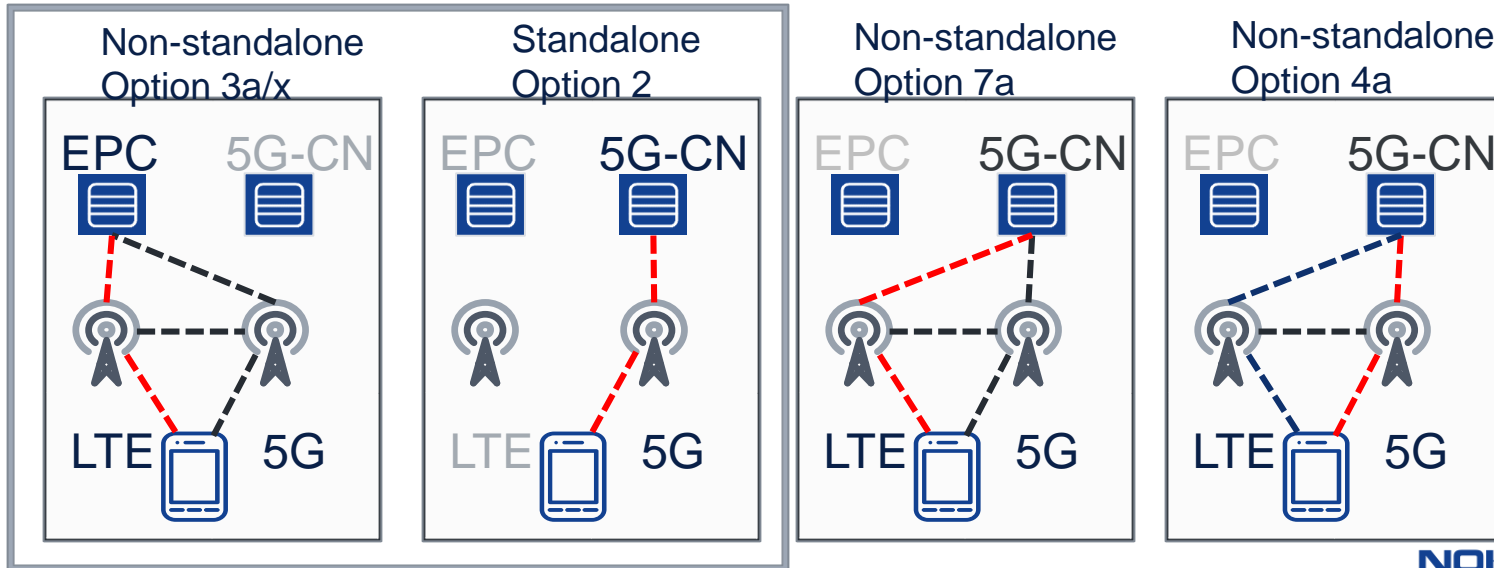
**Additional New Work Items and Studies targeting for Rel-16 are still expected to be approved in December 2017 3GPP RAN plenary**

- RAN level discussion on scenario etc. Ongoing
- \*\* Over the air testing for 5G

# 5G Architecture work in Rel-15

- Option-3 family (non-standalone) is the focus until Dec. 2017 (with LTE as the anchor)
- Option-2 (standalone 5G) has best effort focus until Dec. 2017, and afterwards with priority until June 2018

--- = User + control plane  
--- = User plane only  
5G-CN = 5G core network



# 5G Beyond Release 15 RAN

## Phase 1 WI (Rel-15)

- Main assumption: general support for stand-alone NR below 40GHz (option 2 scenario) including DC with LTE
- 4G-5G interworking
- MIMO/Beamforming (fundamental features)
- Both MBB and URLLC use cases
- Public warning/emergency alert (for regulatory needs)
- RRC inactive data
- E911 support

## Phase 2 WI (Rel-16)

- Potential enhancements for eMBB support below 52.6 GHz
- 4G-5G interworking – remaining options
- 5 GHz for unlicensed spectrum
- Location/positioning enhancements
- MIMO enhancements
- Self Organizing Network Enhancements for 5G
- + Release 15 study outcomes (NOMA, Wireless backhaul etc.)

## Phase 1 SI (Rel-15)

- Non-orthogonal multiple access
- Unlicensed spectrum
- Wireless backhaul
- Satellite 5G
- V2V evaluation methodology
  - Further V2X work (Phase 3) subject the Phase 2 (LTE based) progress
- Additionally: (Subject to Rel. 15 progress & approvals)
- MIMO enhancements
- Location/positioning Enhancements
- High UE Speed 5G support etc....

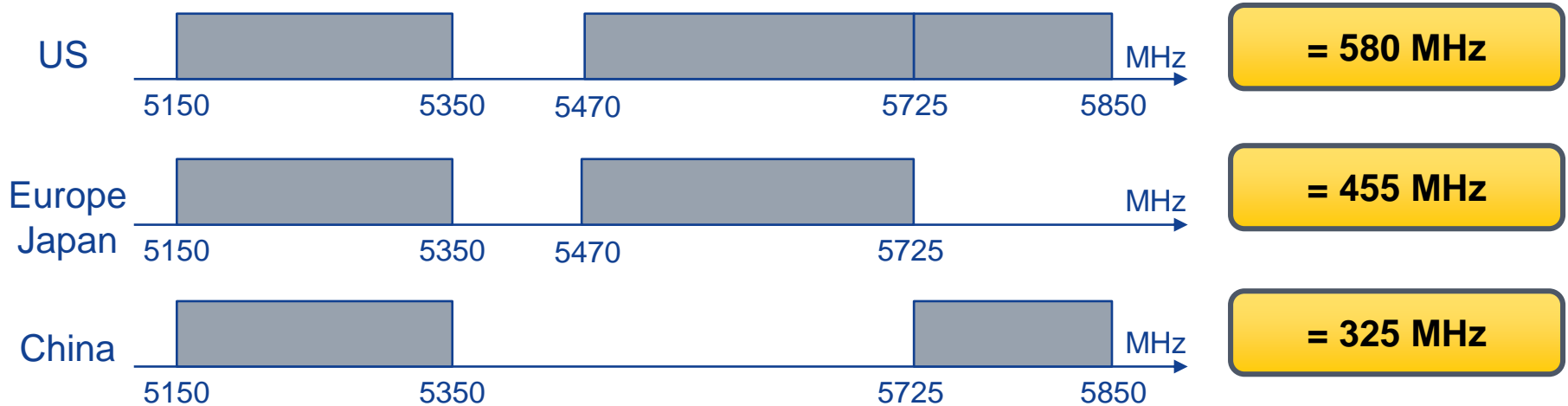
Start 01/18

## Phase 2 SI (Rel-16 studies towards Release 17) tentative list

- Waveforms for > 52.6 GHz
- Multimedia Broadcast/Multicast Service
- Air-to-ground and light air craft communications
- Extreme long distance coverage
- V2V/V2X using 5G
- Wi-Fi /NR interworking
- Further position location
- UE Power Saving and Wakeup Mechanism
- mMTC with 5G
- +++ many others being proposed

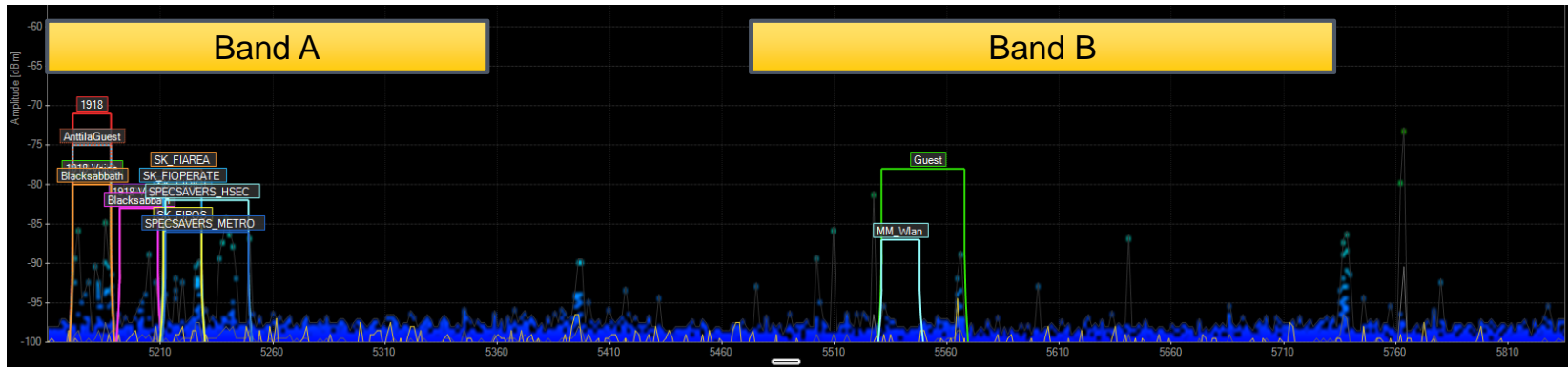
## 5G unlicensed: 5 GHz Band Globally

- All major markets have 300+ MHz spectrum available
- USA has best availability of spectrum at 5 GHz
- China allocated also 5150 – 5350 MHz
- Potentially extending upwards the spectrum until 7 GHz range (USA)



## 5 GHz Scanner in a shopping Mall Open Area: Lot of free spectrum

- Several access points visible. The low part of Band A has many access points. (the activity factor can still be low)
- All signals below -62 dBm
- Several signals above -82 dBm
- Measurements done in 2014





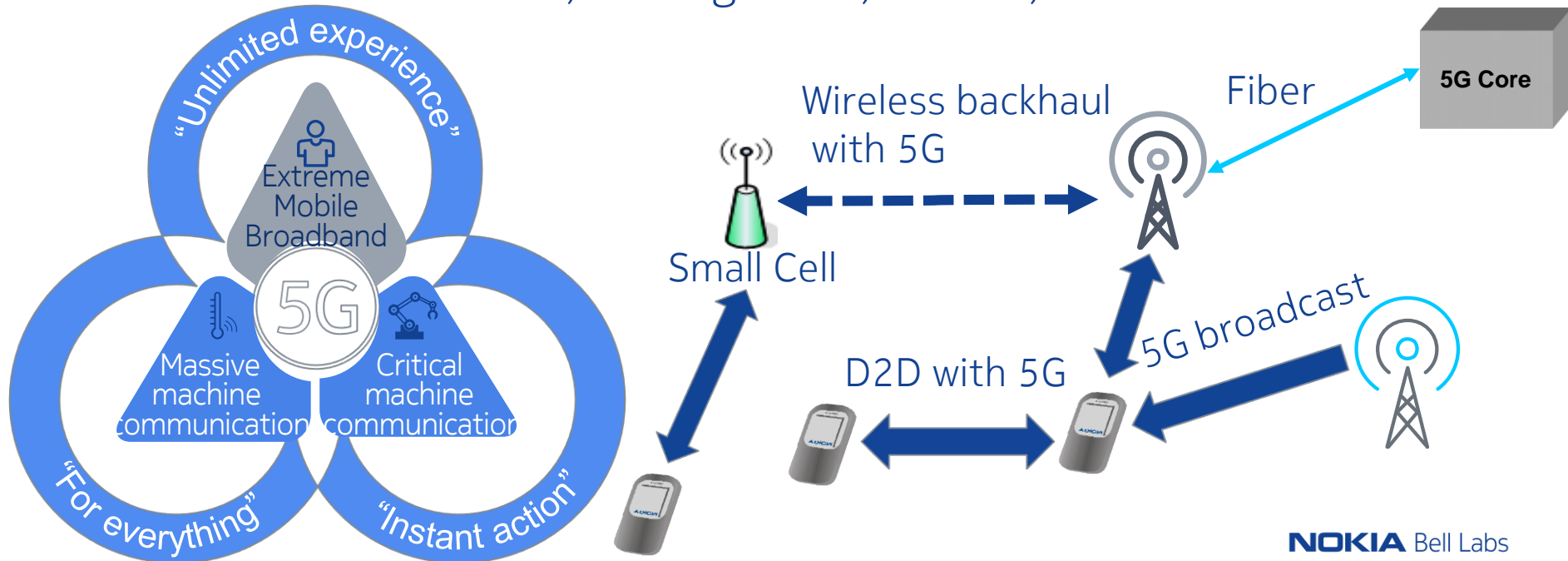
Follow-up measurements in 2017 in the same shopping mall

- More 5 GHz access point added
- But utilization remains low -> in most cases only SSID transmitted
- -> lot of free capacity



## Other directions of 3G Radio Technology beyond Release 15

- Use of 5G radio for:
  - Backhaul, Satellite connections, Device to device, broadcast, Vehicle to Vehicle, air to ground, drones, above 52 GHz ...



# 5G for satellite

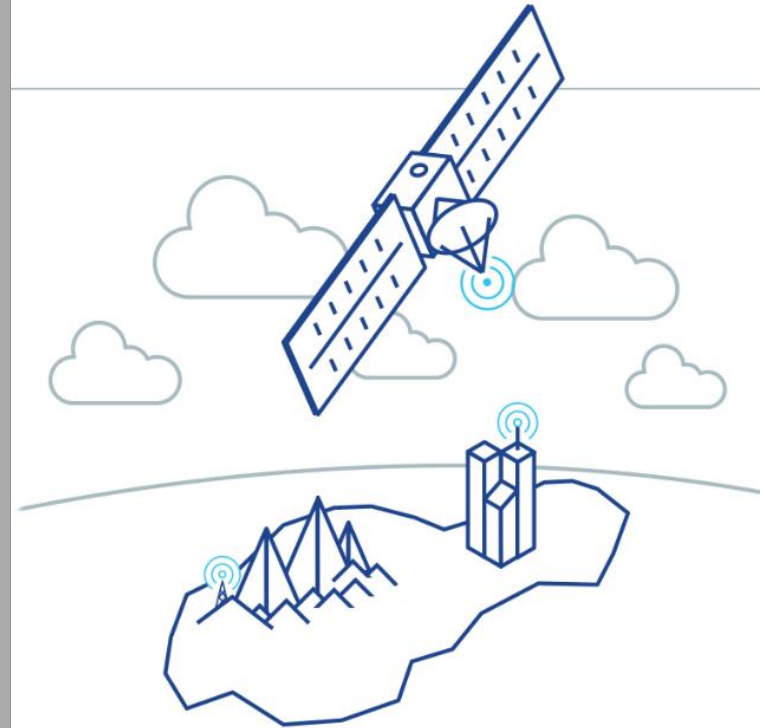
## 3GPP working on satellite aspects

The study item on “Study on non-terrestrial networks” on-going

- **First phase focus on scenarios & assumptions**

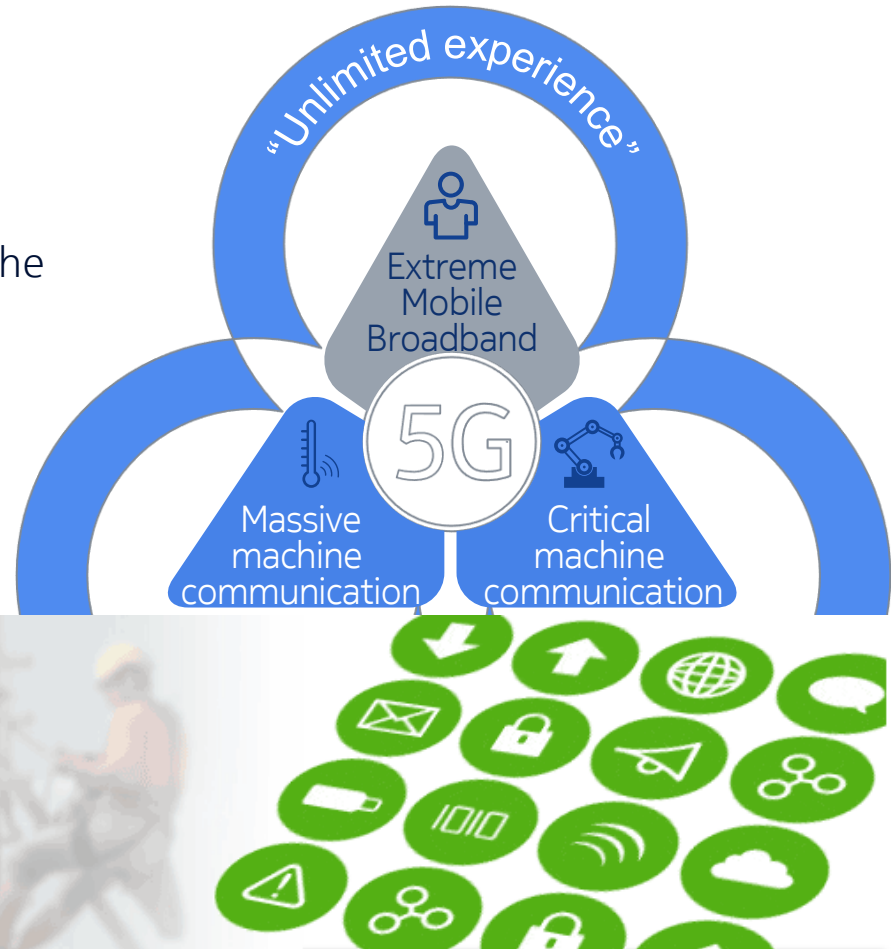
Next step is to investigate the necessary modification for the 5G radio interface (with Phase 1 soon ready) to allow use with satellite

Obviously satellite use with 5G will not allow such high rates, but allows to complement the coverage



# Summary

- First 5G specs are soon here, and then in your pocket...
- This does not mean 3GPP is ready, this is just the first stepping stone to 5G
  - Focus on mobile broadband at first, then time for other use cases
- Stay tuned for the news from 3GPP as the development progresses!



The Mobile  
Broadband Standard  
5G

**NOKIA**

# LTE Small Cell Optimization

3GPP Evolution to Release 13

Edited by  
Harri Holma  
Antti Toskala  
□ Jussi Reunanen



WILEY