AREGNET 5G Workshop

The Bridge Towards 5G

Emmanuel Coelho Alves (Huawei HQ)

Abu Dhabi, 18-09-2017

Agenda

- Road to 5G
- Key Aspects of 5G Spectrum
- 5G National Regulations
- Highlights

Main 5G Services Opportunities

Mobile Video

Mobile Video to Represent
75% of Total Mobile Traffic by 2020

Source: Huawei & Ovum Joint Report "*The Evolution of Big Video – Examining telco transformation video opportunities*" [2016]

BB Access

30M Households Today
200M by 2020 & 680M by 2025*

WTTx: Wireless to the x (4G/4.5G/5G)
*) Huawei estimates, Huawei GAS 2017

5G

Verticals

Industry4.0 $900B by 2025
m-Health $100B by 2022
Connected Car $150B by 2022

Sources: Huawei GAS 2017, Hexa Report 2017

Internet of Things

Cellular IoT Connections Growth from 0.8B by 2020 to 2.5B by 2025

Sources: Huawei mLab 2016, Analysis Mason 04-2016, Strategy Analytics 03-2017

HUAWEI

Current 4.5G Status for Preparing the Evolution to 5G

2. New Services Towards 5G

40+ Projects

NB-IoT

WTTx

Public Safety

8 Projects

152 Projects

3. Shaping Innovations

CloudAIR

LTE-V2V

85 Projects

1. Gigabit LTE

Massive MIMO

8T8R

4T4R

Indoor

11 Projects

1 Trial

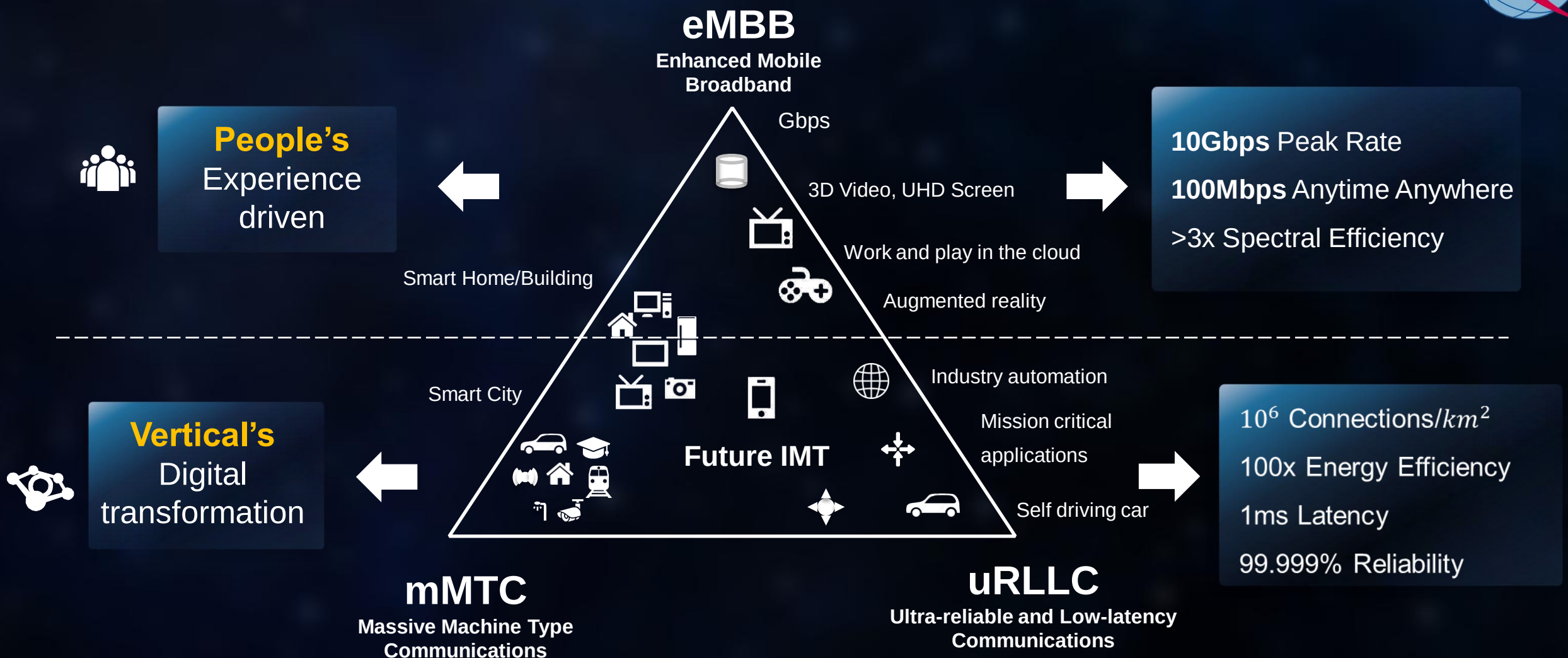
Huawei 4.5G Status @08-2017

Gap Analysis for 3GPP 5G versus 3GPP LTE

Tailored-made network slices essential to meet wireless industry trends

	Latency	Throughput	Connections	Mobility	Network Architecture
5G	**Few** ms E2E Latency	**10** Gbps Per Connection	**1,000K** Connections Per km²	**500** km/h High-speed Railway	**Slicing** Ability Required
GAP	**30~50x**	**100x**	**100x**	**1.5x**	**NFV/SDN**
LTE	30~50ms	100Mbps	10K	350Km/h	Inflexible

Embracing the Super Connected World by 2020 With 5G

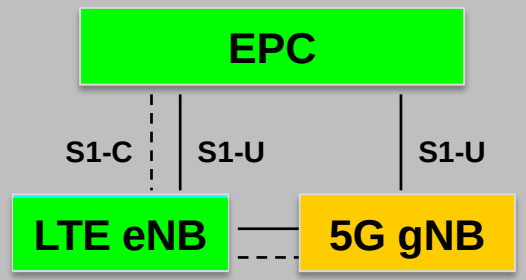


Source: ITU-R WP5D (ITU-R M.2083-2 Recommendation)

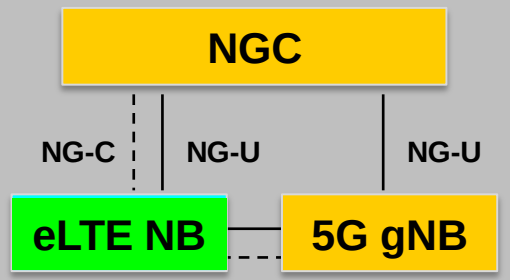
NSA for 5G Rollout and SA for Target Architecture

NSA for Early Deployment

3GPP R15 Option 3x



3GPP R15 Option 7x

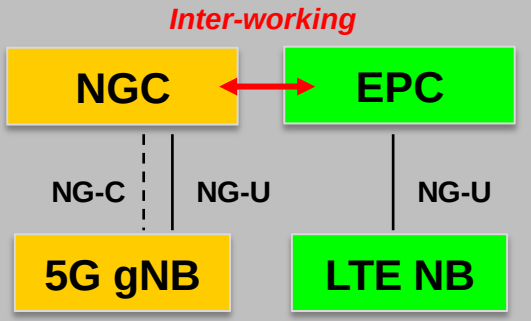


➔ To firstly deploy NSA and later migrate to SA

- LTE or eLTE as anchor
- Re-use of the legacy EPC
- Low requirement for C-band coverage

SA as Target

3GPP R15 Option 2



➔ To directly deploy SA

- 5G NR as anchor
- Rollout of NG Core
- Need for C-band continuous coverage

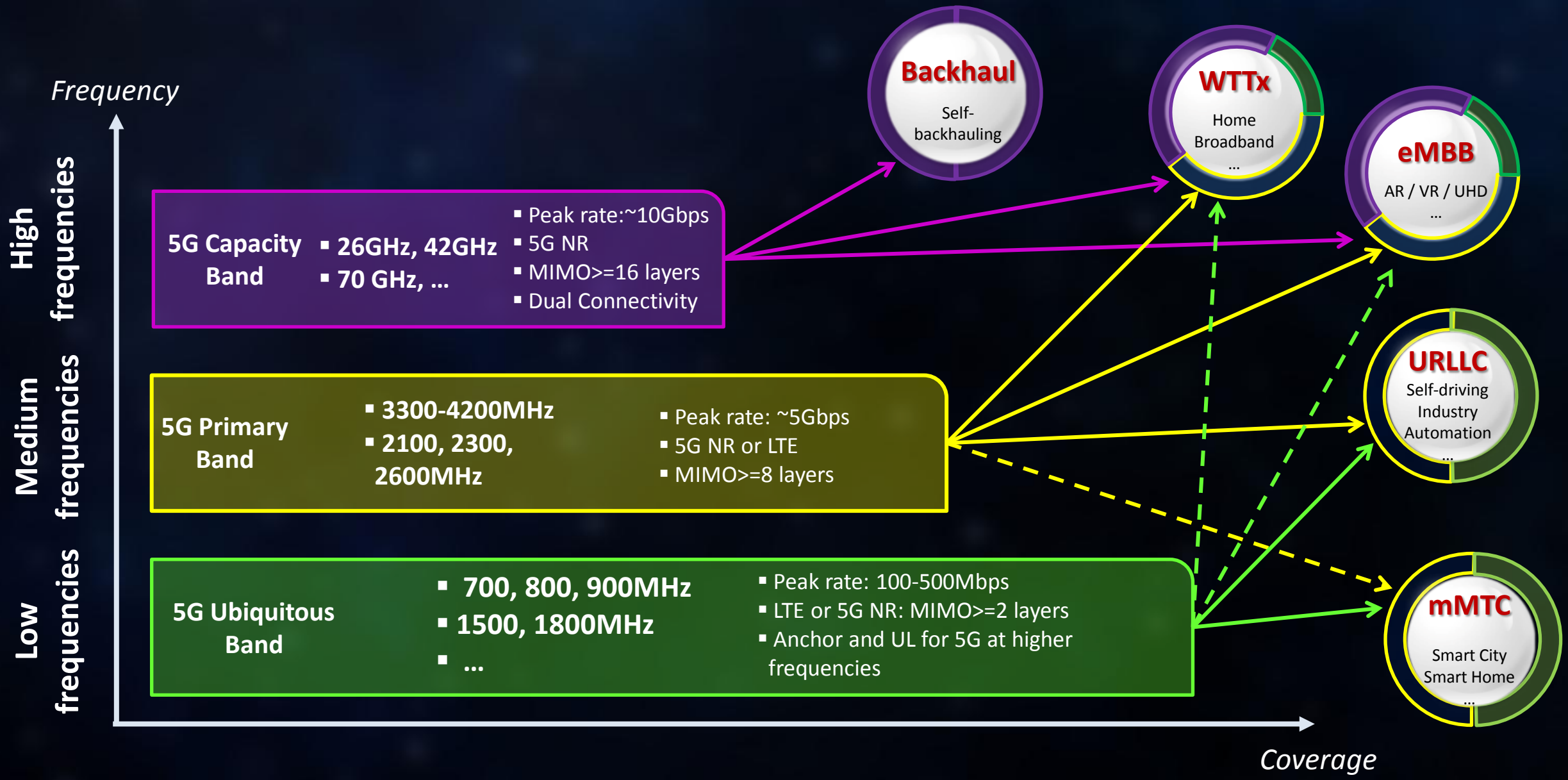
5G Standardization Acceleration to Meet Early Demands

HUAWEI

Agenda

- Road to 5G
- Key Aspects of 5G Spectrum
- 5G National Regulations
- Highlights

Three Layers to Satisfy Demand of Diversified Services



Acceleration of C-band Industry Chain Support (Global Market)

3.3-3.4	(indoor) Available for 5G in 2018~2019
3.4-3.6	Already used for 5G Trial
4.8-5.0	Available for 5G in 2018~2019

3.4-3.6	Issued
3.6-3.8	Issued for 5G in 2017

4.4-4.9	5G spectrum for Tokyo Olympic
3.6-3.8	Will be reallocated for 5G

3.4-3.7	Issued for 5G in 2018

Other Regions	3.4-3.6	Available for IMT use

Unit: GHz

➔ **Need to continue efforts for allocating C-band for 5G NR in MENA Region**

Current World Market View for mmWave Bands in 5G

Confirmed

Likely

Highlights for mmWave Bands in 5G NR Scenarios

- **5G NR Services using mmWave Bands:**
  - On-going standardization (ITU-R WRC-19, 3GPP R15)
  - 3GPP R15 includes 26/28/32/39/42GHz
  - Target for large bandwidth up to 1GHz
  - Possibility to use mmWave for 5G self-backhauling
  - Use cases including WTTx, Smart Home, eMBB, etc.

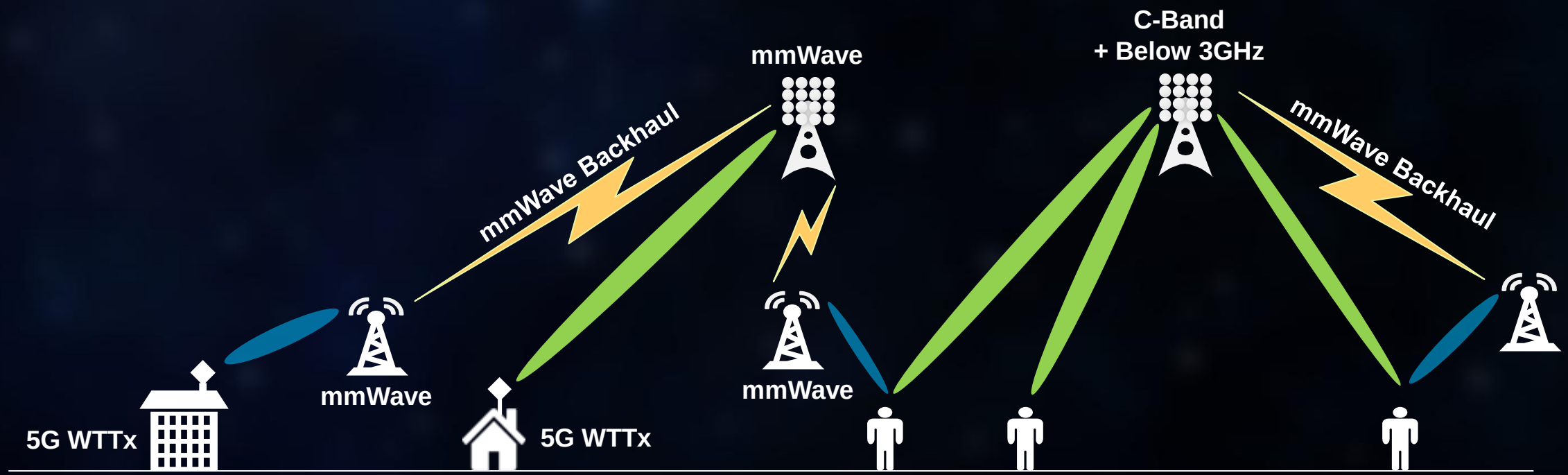
- **5G NR guidance for the best usage of mmWave bands:**
  - 26GHz & 42GHz sharing study by ETSI ISG mWT (Q3-2017)
  - ECC PT1 and ECC WG SE19 works to evaluate a gradual migration of microwave systems on 26/42GHz to other bands (result in 2018)

Summary: Sub6GHz for Coverage, mmWave for Hotspot Capacity

1 C-Band:
- Acquire wide band C-Band, deploy Massive MIMO
- Active DL & UL Decoupling extend coverage

2 Below 3GHz:
- 4T4R as the Basic Configuration in 5G

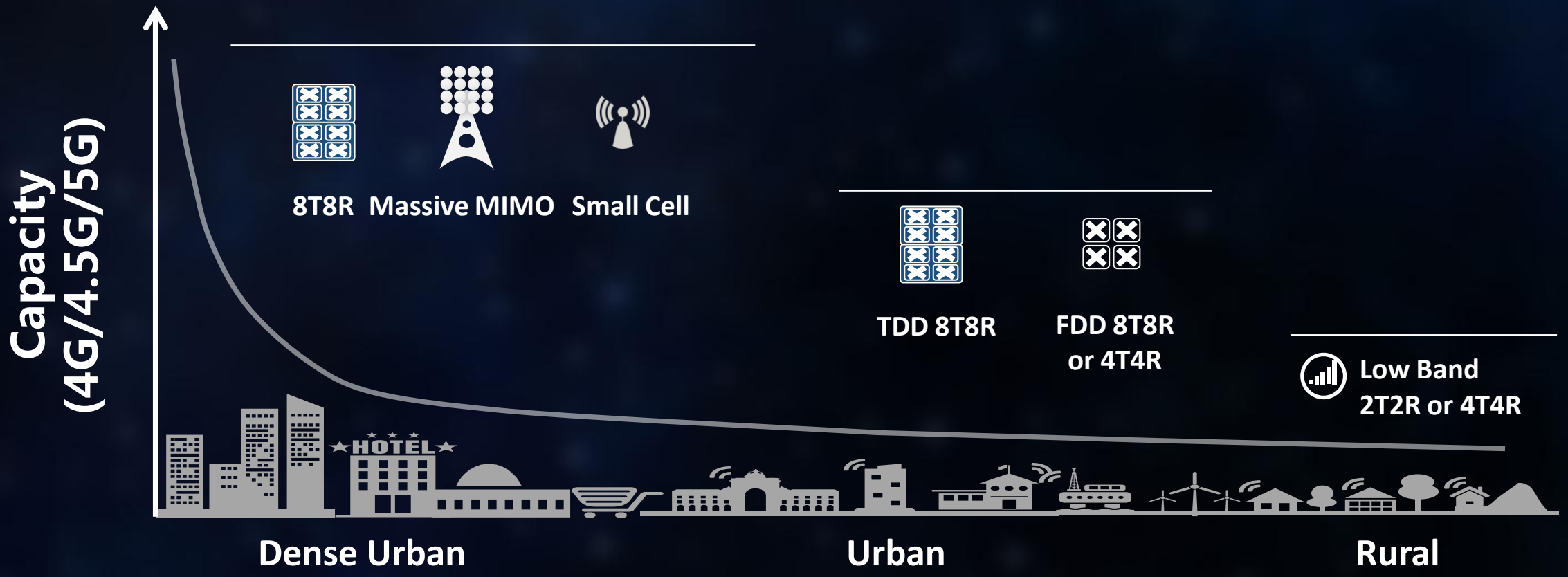
3 mmWave:
- Ultra Capacity boosting in hotspot at rural and indoor
- Home broadband access
- Self-Backhaul for easy site acquisition



Agenda

- Road to 5G
- Key Aspects of 5G Spectrum
- 5G National Regulations
- Highlights

RAN Setup for Multi-RAT Capacity Strategy



- Investments Focusing on Users Experience Gain
- 4T4R, 8T8R and Massive MIMO being key configurations for 5G

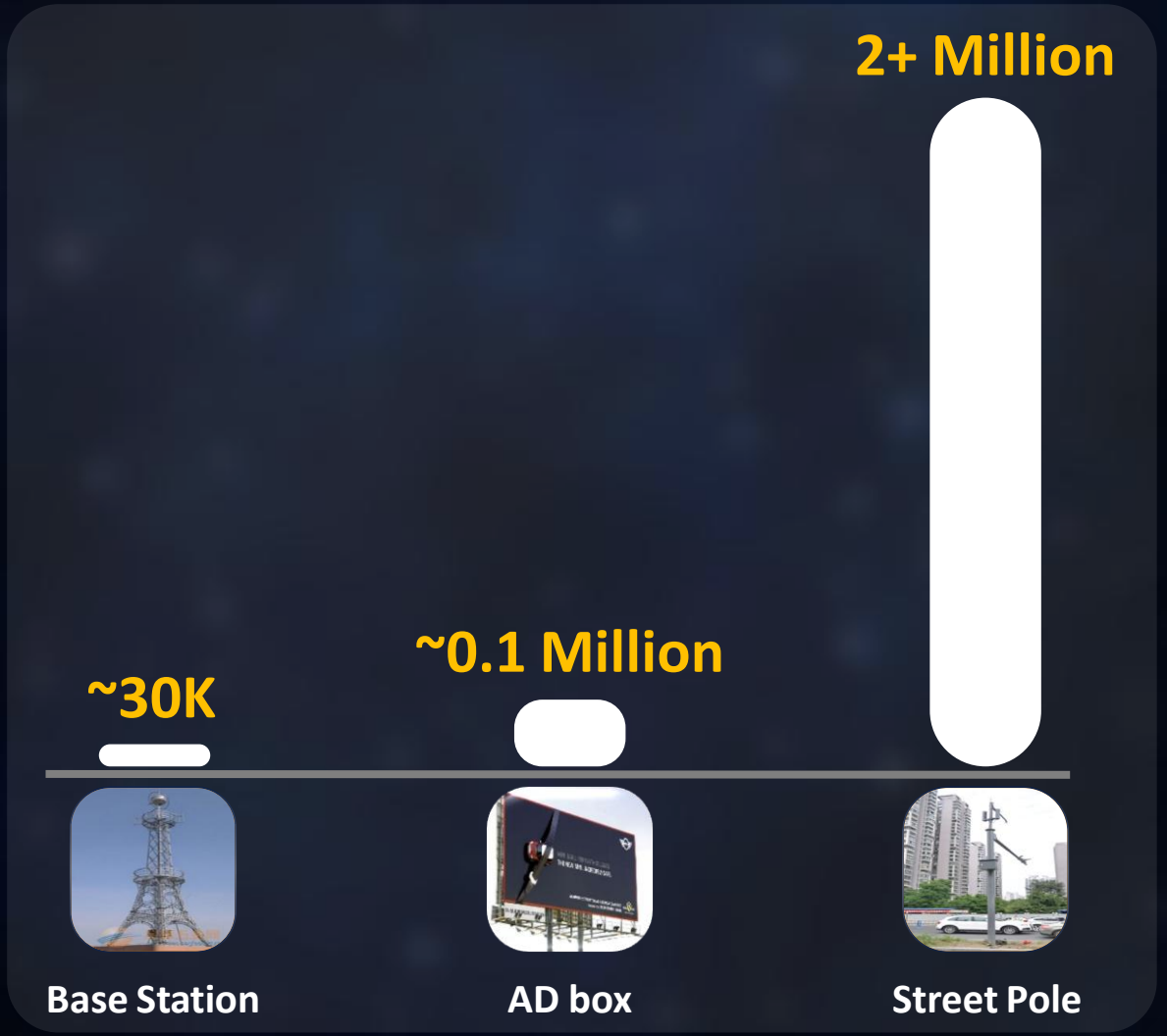
5G Site Densification in DU & Urban Areas

Site Densification: Tower Level to Street Level

- **5G RAN densification to include both macro sites and small cells**
- **In next years ~2.5 Million new sites to be allowed on "street pole site" to lead small cells rollout (around the number of radio sites in China)**
- **Street level rollout lead to new environment adaptation requirements such as easy site installation, NLOS, compactness (invisible)**

Note: On-going Governments activities for small cell rollout policies e.g. Europe (e.g. France, Germany, Italy, UK), Asia (e.g. India, Malaysia), Americas (e.g. Argentina, USA); Small Cell Forum Report [12-2016]

Need for Simplification of Site Acquisition in DU/Urban Areas



- On-going activities in some countries*
- Eco-system ready

Note: Example of a country in Middle East region

*) e.g. Argentina, Australia, Saudi Arabia, USA, etc.

5G Backhaul Strategy Overview

5G Backhaul Requirements	5G Backhaul Solutions	Possible Regulation
RAN Topology Densification, CloudRAN	✓ Fiber to be the first priority	Incentive for fiber rollout expansion
Throughput Avg. 20Gbps / Site	✓ Microwave option if lack of fiber availability	Spectrum Availability, Site
Latency E2E Few Milliseconds	✓ 5G Self-backhauling (on-going 3GPP)	Allocation of sufficient mmWave resources

Agenda

- Road to 5G
- Key Aspects of 5G Spectrum
- 5G National Regulations
- Highlights

Various 5G Services Being Considered and Evaluated

mMTC

Massive Machine Type Communication

Industry 4.0

Smart Farming

Smart Energy

Smart City

Healthcare

uRLLC

ultra Reliable Low Latency Communication

Connected Car

Drone

Industry 4.0

Healthcare

eMBB

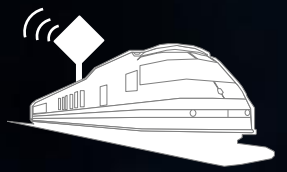
enhanced Mobile Broadband

WTTx3.0 (or FWA)

AR & VR Applications

High-end Smartphone

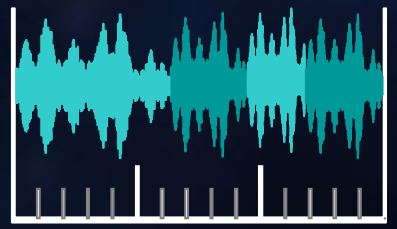
Smart City



Mobile Hotspot

RAN Building Blocks to Support 5G NR Services

1 5G Spectrum Allocation



5G Top Priority for C-band

mmWave Bands for 5G Ultra Large Capacity

2 5G Macro Site Building

Massive MIMO

EMF Regulation

5G Innovative Features (e.g. Uplink Pairing)

3 5G Network Densification

5G Small Cells Rollout

Street Pole for Easy Site Acquisition

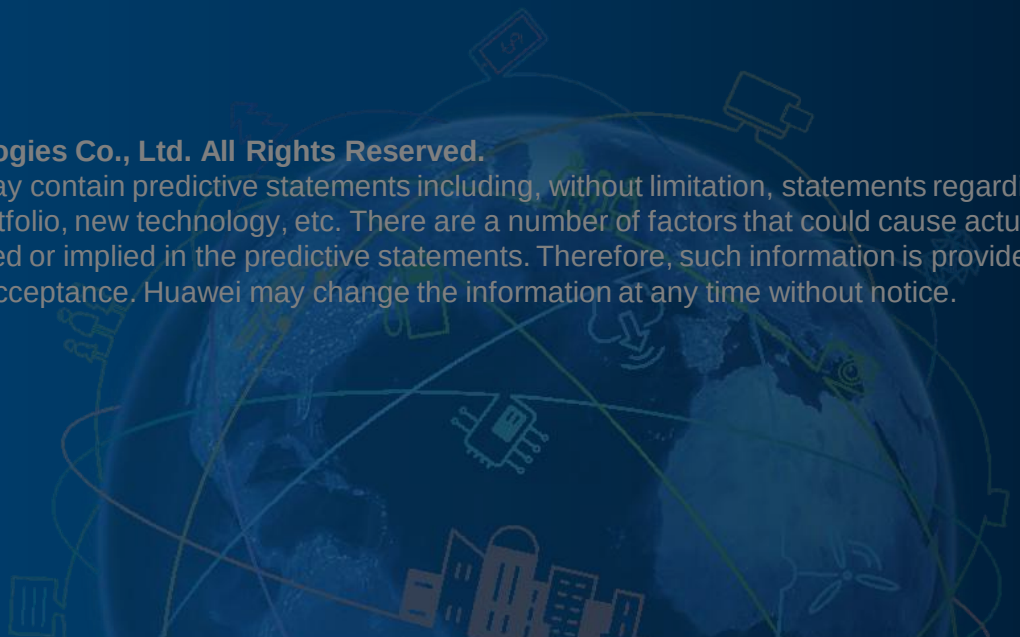
4 5G Backhaul

Fiber to Site

Microwave systems

5G Self-backhauling

THANK YOU



HUAWEI