



5G Alliance for Connected Industries and Automation

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# 5G for the Industrial IoT – An Overview

**Dr. Afif Osseiran**  
8 September 2020

# 5G Alliance for Connected Industries and Automation

## About the Speaker

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**Dr. Afif Osseiran**

General Vice-Chair of 5G-ACIA  
Ericsson

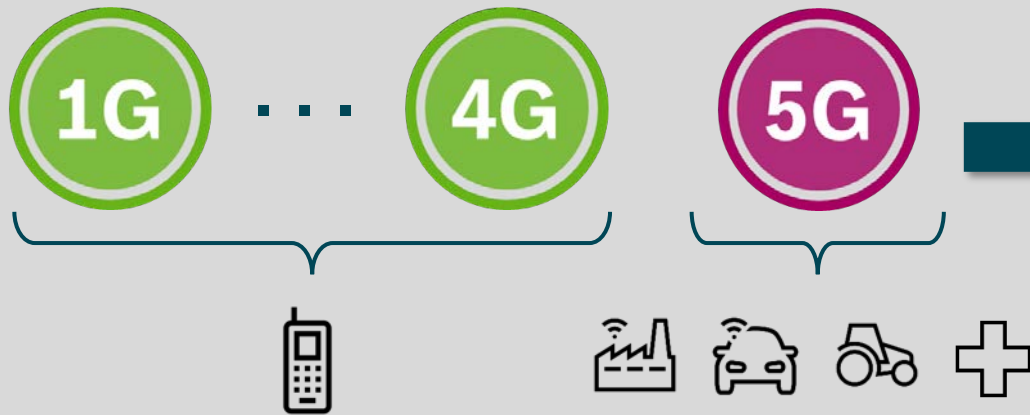
# Introduction



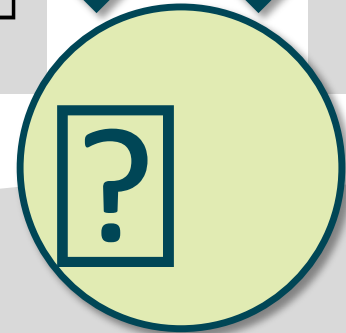
# 5G Alliance for Connected Industries and Automation

## The Role of 5G for Industry 4.0

### The Evolution of Mobile Communications



### The Four Industrial Revolutions



**5G Factory**

**Higher Flexibility**

**Higher Productivity**

**Higher Efficiency**

**Better Usability**

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## The Economic Potential



Source: World Economic Forum, "The Impact of 5G", Jan 2020

Value to unlocked by 5G in manufacturing: > 600 bn USD (KPMG, 2019)

Market for 5G cellular connections in manufacturing to reach 10.8 bn USD by 2030 (ABI Research, 2020)

# 5G Overview



# 5G Alliance for Connected Industries and Automation Use Case Examples

## Automated Guided Vehicles

Image: Bosch



## Augmented & Virtual Reality

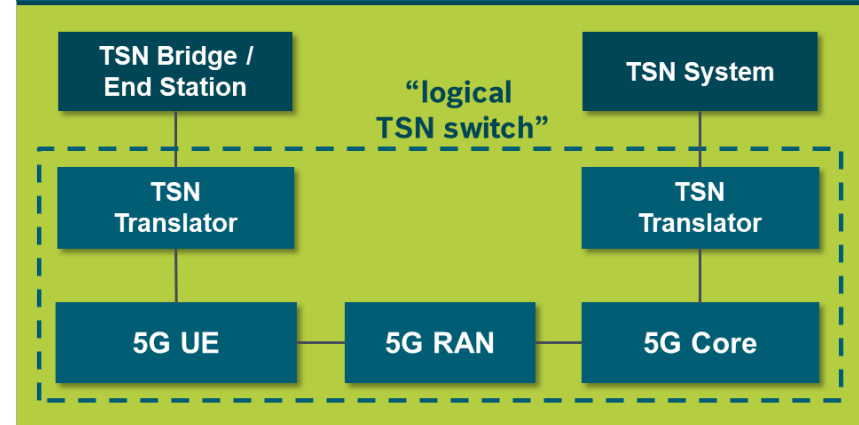
Image: Bosch



## Wireless Sensors & Actuators



## Time-sensitive networking-over-5G



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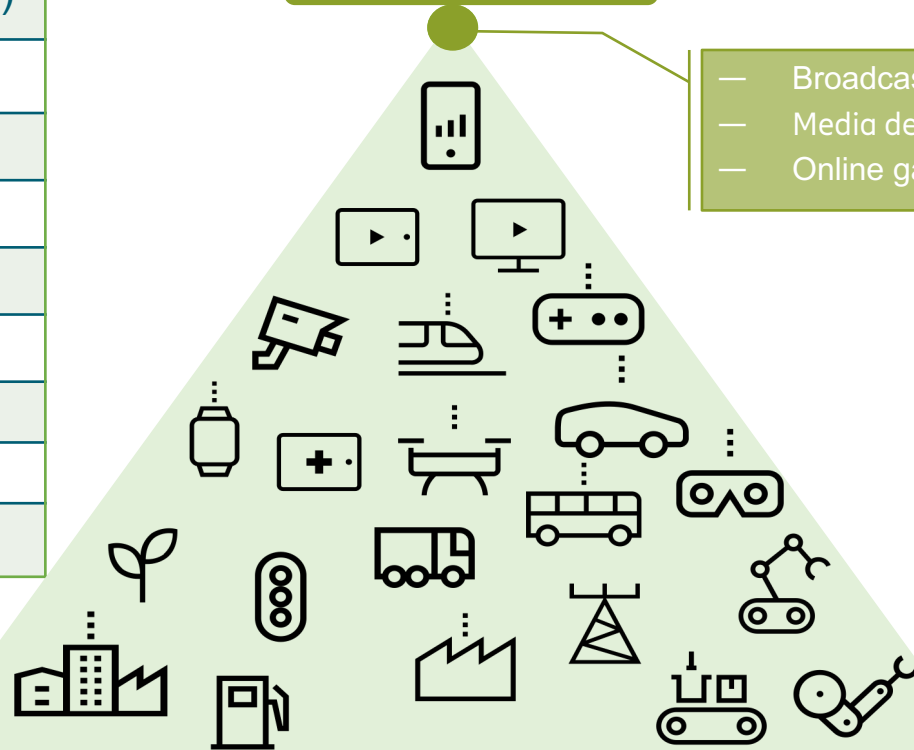
## 5G Applications: Three Categories

Requirement	Value
User plane latency	1 ms, one-way (DL & UL)
Connection density	1,000,000 devices / km <sup>2</sup>
Reliability	99.999% success rate
Data Rate (DL)	20 Gbps
Data Rate (UL)	10 Gbps
Spectral efficiency (DL)	30 bps/Hz
Spectral efficiency (UL)	15 bps/Hz
Mobility interruption time	0 ms
Battery life	10 years

Extreme data rates, Large data volumes, Low latency (best effort)

### Enhanced MBB

- Broadcasting
- Media delivery
- Online gaming



- Augmented reality
- Mobile robots
- Motion control
- Remote control

- Actuators
- Sensors
- Trackers
- Wearables

### Massive MTC

Low cost devices, Extreme coverage, Long device battery life

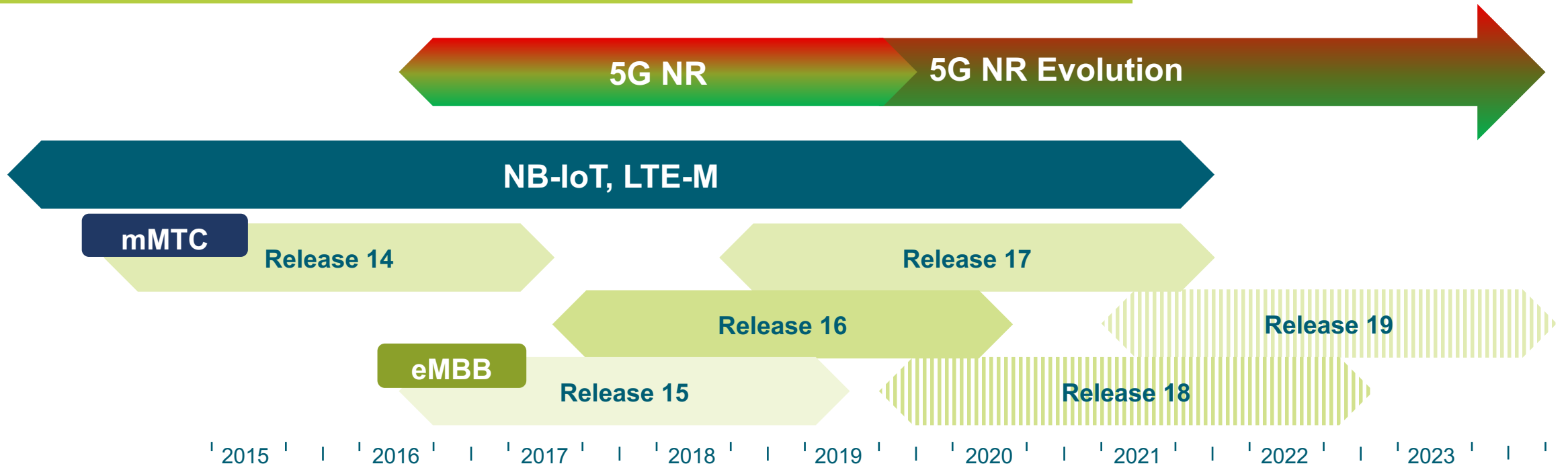
### URLLC (C-MTC)

High reliability, Ultra-low latency, High availability



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## 5G Timeline



- **5G NR** (New Radio) phase 2 to be finalized in June 2020 (shifted by 3 months)
- **5G NR evolution**
  - 3GPP Release 17 officially shifted by 3 months due to COVID-19
  - 3GPP Releases 18 & 19 are too early to predict

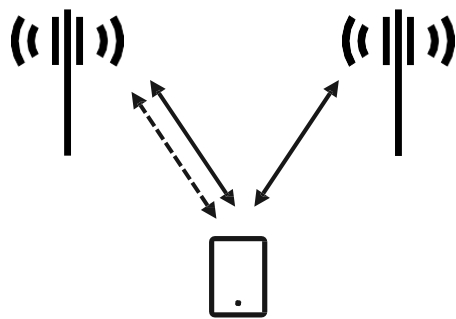
# 5G Alliance for Connected Industries and Automation

## 5G for IIoT in 3GPP: Releases 15 to 17

### cMTC / URLLC

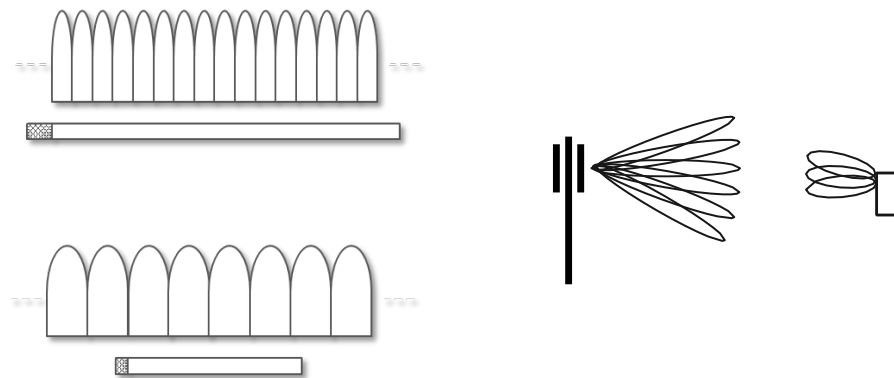
#### Release 15

- Mini-slots, numerologies
- Pre-scheduling, Configured UL grants
- Fast Re-transmission (HARQ)
- Low MCS/CQI
- PDCP duplication, repetitions



#### Releases 16 & 17

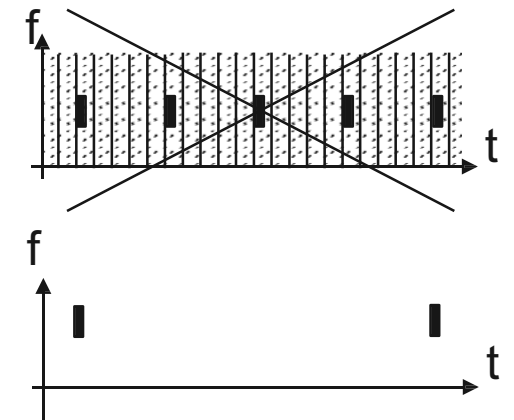
- Access to unlicensed
- Non-Public networks (NR & LTE)
- 2-step RACH
- Mobility enhancements (NR & LTE)
- **XR Evaluations**
- Vehicle-to-everything
- PHY enhancements for URLLC
- RAN Slicing
- Industrial IOT (considering LTE)
- Positioning



### mMTC

#### Releases 15 to 17

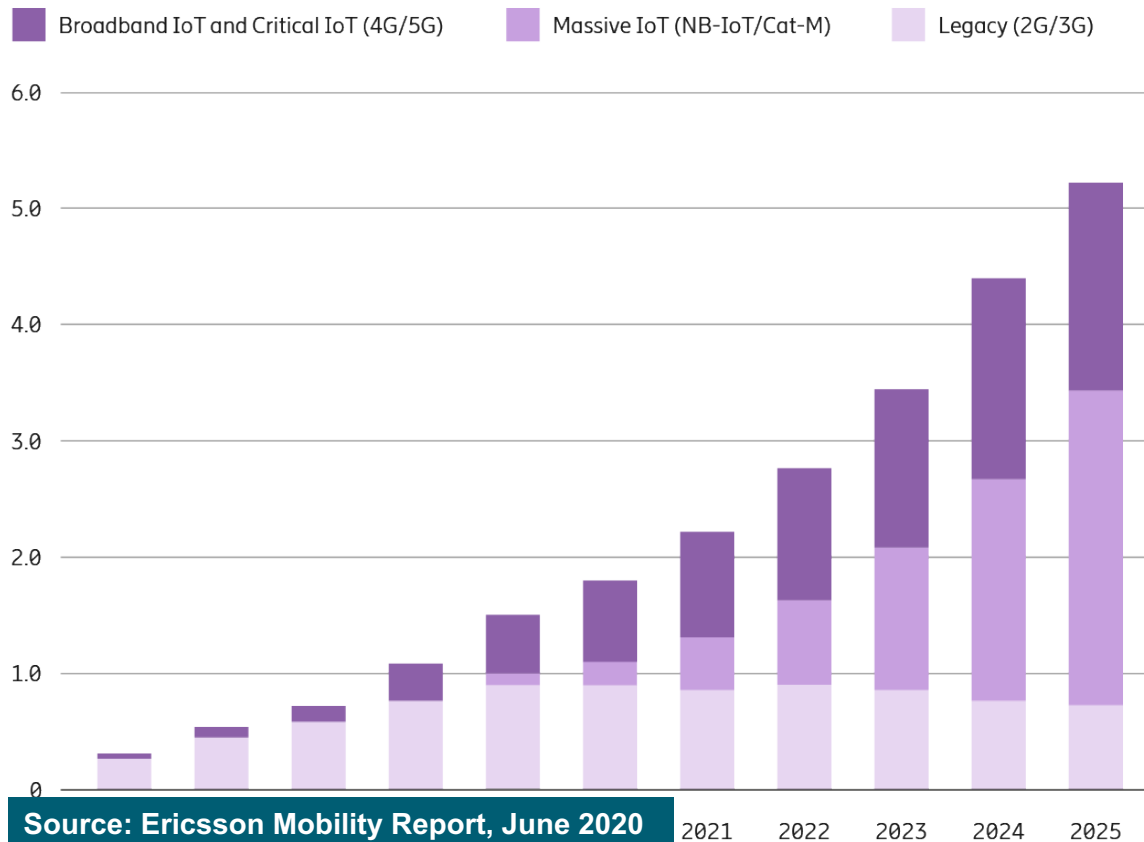
- LTE-M enh.
- NB-IOT enh.
- Small data transmissions in INACTIVE
- **Support of reduced capability NR devices**
- **NB-IOT/eMTC over Non-Terrestrial Networks**



# 5G Alliance for Connected Industries and Automation Cellular IoT Market Development

**Globe:** 190 million 5G subscriptions end of 2020

Cellular IoT connections by segment and technology (billion)



**India:** 230 million 5G subscriptions end of 2025

IoT connections (billion)

IoT	2019	2025	CAGR
Wide-area IoT	1.6	5.5	23%
Cellular IoT*	1.5	5.2	23%
Short-range IoT	9.1	19.1	13%
<b>Total</b>	<b>10.7</b>	<b>24.6</b>	<b>15%</b>

\* These figures are also included in the figures for wide-area IoT

# Deep Dives



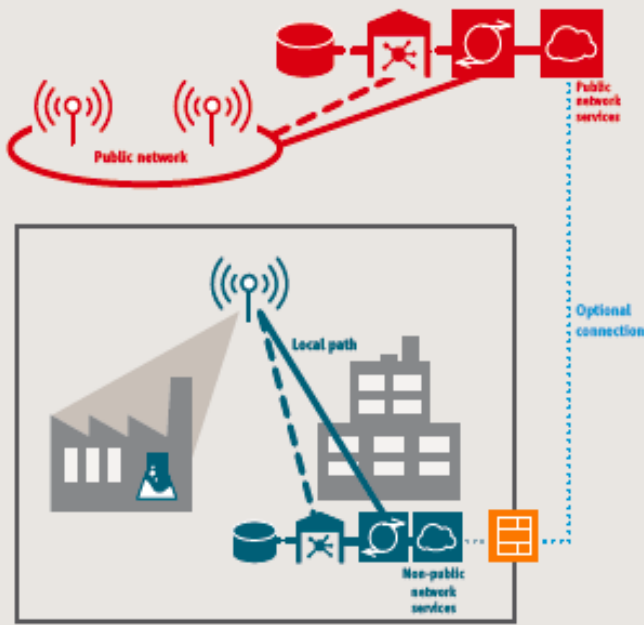
# 5G Alliance for Connected Industries and Automation 5G Non-Public Networks?



# 5G Alliance for Connected Industries and Automation Private Networks / Non-Public Networks

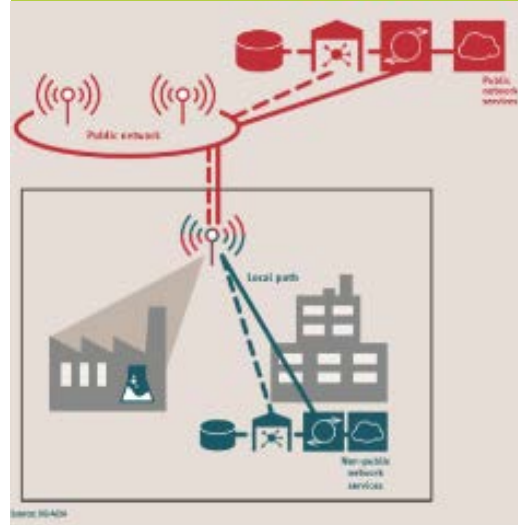
## Deployment scenarios for 3GPP-defined 5G non-public networks

**1** Standalone / isolated deployment

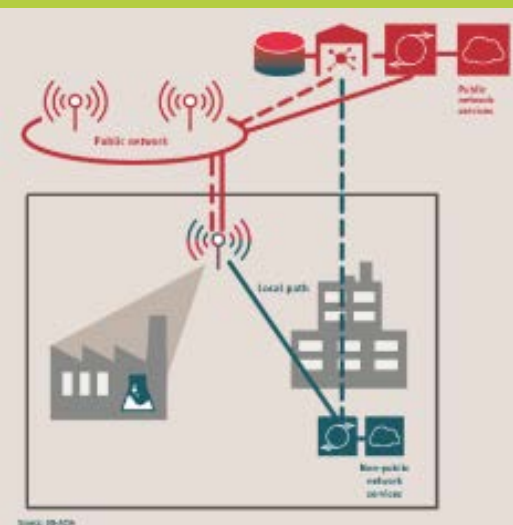


Shared Models

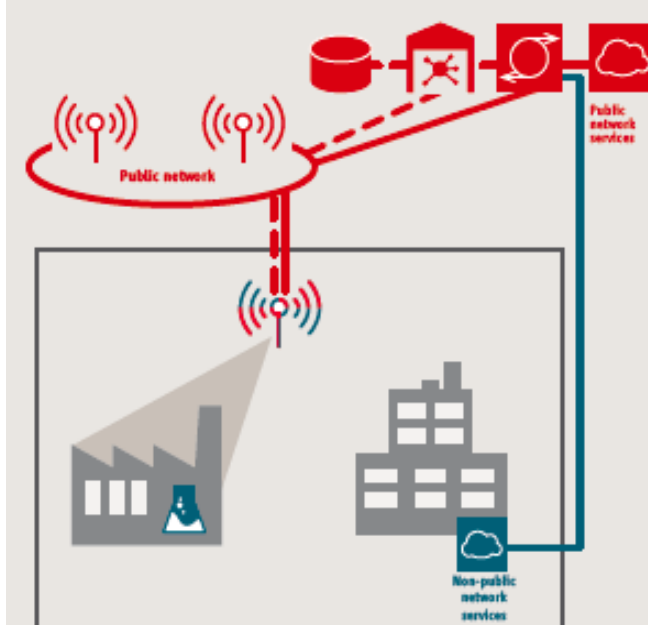
**2** RAN



**3** RAN & Control Plane



**4** Hosted by public Network Operator (e.g. network slicing)



# 5G Alliance for Connected Industries and Automation Potential Spectrum for Industry (Status: Aug. 2020)



- Local licenses  
(France, Germany, Japan, UK)
- Considering local licenses  
(Australia, Chile, China, Finland, Hong Kong,  
Luxembourg, Malaysia, Netherlands, Norway,  
Poland, Slovenia, Sweden)
- CBRS – Citizens Broadband Radio Service  
(US)

## Examples of bands allocated or under evaluation

\* Via MNOs for industrial usage

\*\* Indoor only

	Mid-band (GHz)		Highband (GHz)	
China*	4.80 – 4.90		Australia	24.25 – 27.5
Chile	3.75 – 3.80		Japan	28.20 – 29.10
Germany	3.70 – 3.80		Sweden	24.25 – 25.10
Japan**	4.60 – 4.9		UK	24.25 – 26.50

# 5G-ACIA Overview





# 5G Alliance for Connected Industries and Automation

## Major Objectives of 5G-ACIA

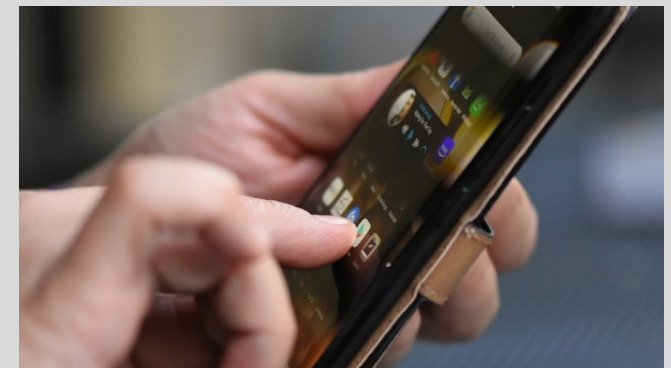
OT Industry



Source: Bosch



ICT Industry



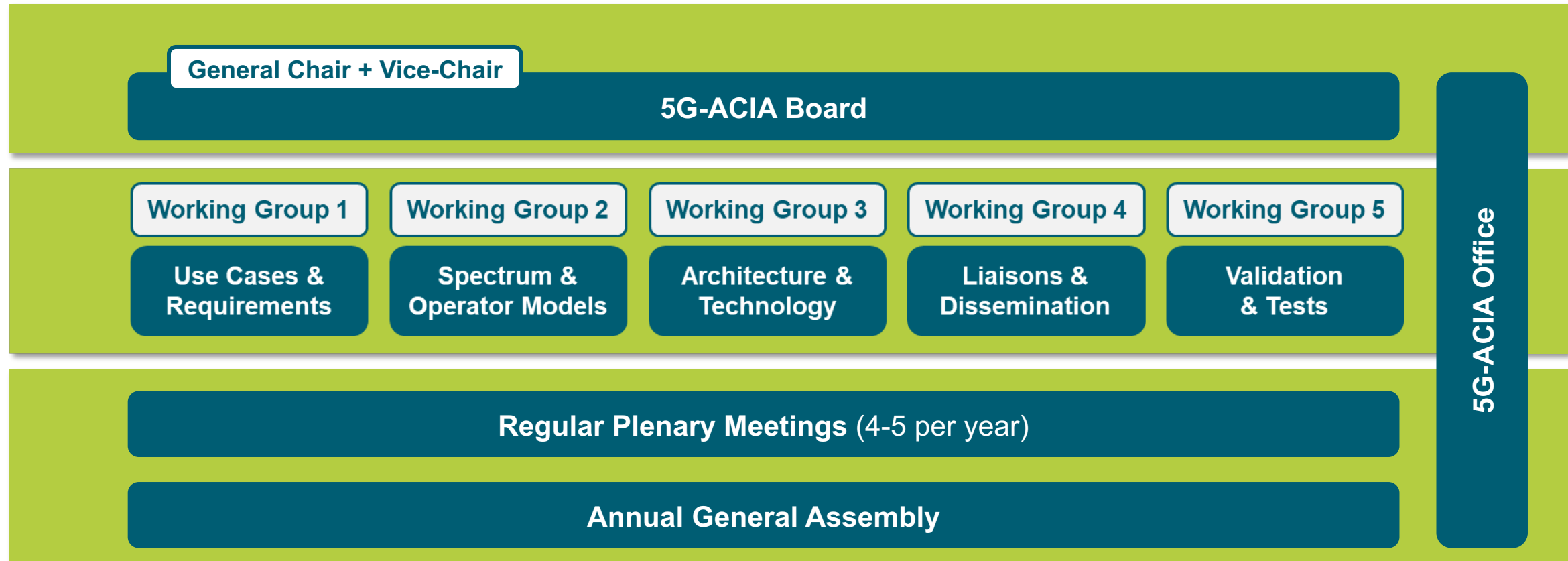
Source: Pixabay

- 1 Establish a common language btw. ICT & OT
- 2 Reflect OT needs in standardization & regulation
- 3 Analyze how 5G may enhance the Industrial IoT
- 4 Identify relevant certification & testing needs
- 5 Develop a sustainable Industrial 5G ecosystem
- 6 Promote Industrial 5G worldwide

# 5G Alliance for Connected Industries and Automation Member Overview (Status: 23 Aug 2020)




# 5G Alliance for Connected Industries and Automation Structure of 5G-ACIA



**Main technical discussions take place in virtual working group meetings. Approvals in plenary meetings.**

# 5G Alliance for Connected Industries and Automation 5G-ACIA Meeting in Sep 2019 in Shanghai



8 September 2020

5G Alliance for Connected Industries and Automation

# 5G Alliance for Connected Industries and Automation

## Major Achievements & Topics

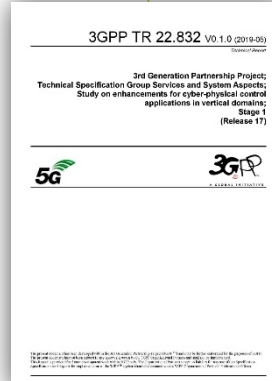
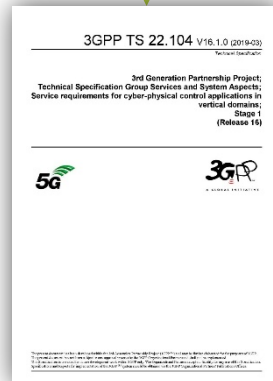
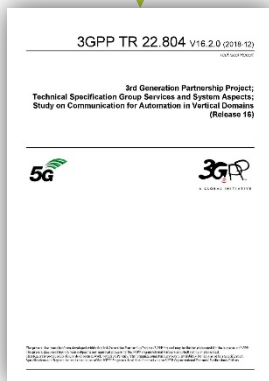
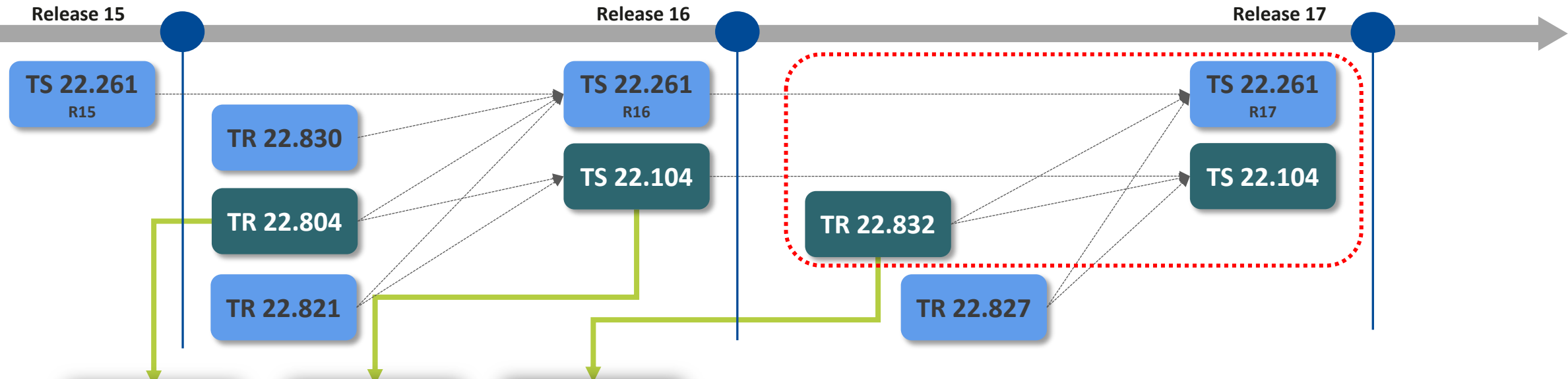
### Achievements (Selected)

- **Ecosystem basis** for industrial 5G
- Recognized by major actors as **the industrial 5G initiative** (China, Germany, India, Japan, Korea, UK)
- Establishment of **common language** and a mutual understanding **between OT and ICT**
- **3GPP** market representation partner (MRP)
- Driver of **IIOT Use cases & requirements** in 3GPP
- Info-sharing for **regulations** related to industries

### Topics (Selected)

- **Deployment options for non-public networks**
- **Gap analysis:** 3GPP requirements vs. capabilities
- **Testbed** framework
- **Integration of 5G** into existing **Industrial Ethernet**
- **Interface** supporting **applications** between 5G NPN and Enterprises
- **Security** aspects
- **Architecture** alignment 3GPP vs. Industry 4.0
- Others: **NW slicing** templates to GSMA, **OPC UA**

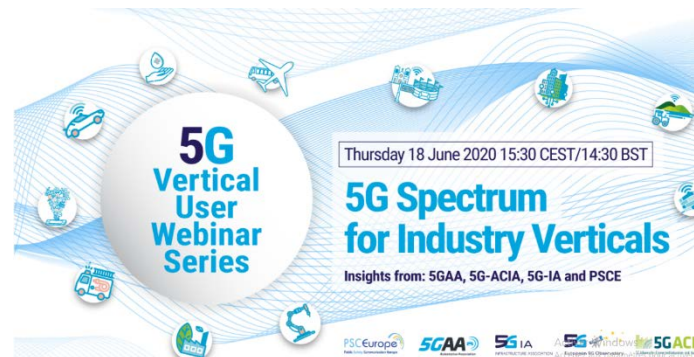
# 5G Alliance for Connected Industries and Automation Major Achievements & Topics



## 3GPP SA1 – collects use cases and requirements for the 5G Net.

- TS 22.261:** Service requirements for the 5G system
- TS 22.104:** Service requirements for cyber-physical control applications in vertical domains
- TR 22.832:** Study on enhancements for cyber-physical control applications in vertical domains
- TR 22.804:** Study on Communication for Automation in Vertical Domains
- TR 22.821:** Feasibility Study on LAN Support in 5G
- TR 22.830:** Feasibility Study on Business Role Models for Network Slicing
- TR 22.827:** Study on Audio-Visual Service Production

# 5G Alliance for Connected Industries and Automation Partner Network



MoU under way

**Wrap-Up**



# 5G Alliance for Connected Industries and Automation Take-Aways



- 1** Industrial 5G may lift Industry 4.0 / the Industrial IoT to the next level.
- 2** There is huge economic potential with manufacturing as one of the most promising areas.
- 3** There are many use cases with very demanding requirements → 5G lead to a convergence.
- 4** URLLC, TSN-over-5G, integrated positioning and dependable QoS as major game changers.
- 5** A close collaboration between the ICT & OT industries is essential for unlocking the full potential.

**Join 5G-ACIA today and learn what Industrial 5G may mean for your business**

# 5G Alliance for Connected Industries and Automation Further Information



[www.5g-acia.org](http://www.5g-acia.org)



White Papers

8 September 2020

5G Alliance for Connected Industries and Automation



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