

# 5G Ecosystem and Opportunities in HK

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**ASTRI** PROPRIETARY

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Hong Kong Applied Science and Technology Research Institute Company Limited

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# Largest Applied Research Institute in Hong Kong

21% PhDs 55% Master's

**500**

Researchers in Hong Kong and  
Mainland

Completed

**600+**

research projects

**Solves industry painpoints**  
with innovations and technologies

**Bridges** the innovation and  
technology **ecosystem**

Transferred almost

**800**

technologies to  
industries

More than

**900**

patents granted

**Drives impact** to make Hong Kong  
and the nation more competitive

Figures as of March 2021





# Integral part of Hong Kong's Innovation & Technology Ecosystem

- <sup>1</sup> Applied R&D centres in Hong Kong include:
- Automotive Platforms and Application Systems R&D Centre (APAS)
  - Hong Kong Applied Science and Technology Research Institute (ASTRI)
  - Hong Kong Research Institute of Textiles and Apparel (HKRITA)
  - Logistics and Supply Chain MultiTech R&D Centre (LSCM)
  - Nano and Advanced Materials Institute (NAMI)

<sup>2</sup> Hong Kong Productivity Council offers integrated advanced technologies and innovative service offerings, including applied technology solutions.

<sup>3</sup> Hong Kong Science Park includes the Science Park, InnoCentre, InnoHK, InnoPark, and the Hong Kong-Shenzhen Innovation and Technology Park at Lok Ma Chau Loop.



# Award-winning Innovations



**2021: 23** awards  
**2019: 21** awards  
**2018: 14** awards



**2021: 7**  
**2019: 11**  
**2018: 11**



**2021: 16**  
**2019: 9**  
**2018: 3**



**2019: 1**



## ICT China Award 2021

**Best Innovative Technology Application Case**



香港工商業獎  
**HONG KONG AWARDS FOR INDUSTRIES**



## Hong Kong Awards for Industries

- Technological Achievement Award (2018)
- Equipment and Machinery Design Award (2019, 2018)
- Equipment and Machinery Design Certificate of Merit (2019)



## HONG KONG ICT AWARDS

- Smart Living (2020, 2019, 2018)
- Smart Mobility (2020)
- Smart Business (2018)

## INNOVATION CHINA

**100 GLOBAL BEST PRACTICES FOR TECHNOLOGY TRANSFER 2021**

**8** technologies awarded  
**Best Cross-border Innovation Technology Transfer Cases**



## ASIA INTERNATIONAL INNOVATIVE INVENTION AWARD

**Gold Award (2019)**



## MEIYA CUP 2019

- 2<sup>nd</sup> Prize: Vocational Group
- 3<sup>rd</sup> Prize: Individual Competition





# Five Core Initiatives

## Smart City

5G Infrastructure



## FinTech

Mission Critical  
Cybersecurity



## Digital Health

5G + AI for Special  
Educational Needs



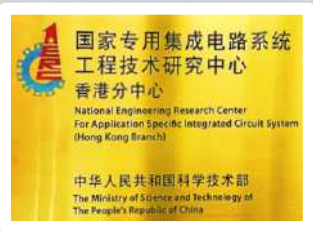
## Intelligent Manufacturing

5G Industrial  
Internet of Things



## Application Specific Integrated Circuits

Power and 5G  
Communications ICs





# 5G = Phone Again?

## Mobile Network Evolution



## 5G Speed in Hong Kong

5G網絡速度測試 (尖沙咀金馬倫道室外環境)

	Speedtest 下載速度	Speedtest 上傳速度
4G	44.6Mbps	27.7Mbps
5G	340.3Mbps	43.7Mbps
5G快過4G	7.6倍	57.80%

	Speedtest 下載速度	Speedtest 上傳速度
4G	109.3Mbps	37.3Mbps
5G	405Mbps	83.3Mbps
5G快過4G	3.7倍	2.2倍

	Speedtest 下載速度	Speedtest 上傳速度	Netflix劇集 下載時間*	FTP測試檔案 下載時間*	FTP測試檔案 上傳時間*
4G	75.4Mbps	18.0Mbps			
5G	391.3Mbps	40.1Mbps	00:08.15	00:27.63	00:54.81
5G快過4G	5.2倍	2.2倍			

\*從Netflix下載《李屍朝鮮》第2季第1集 (檔案大小: 309MB) 的下載速度  
#從本地FTP伺服器下載一個323MB檔案所需時間  
從本地FTP伺服器上傳一個323MB檔案所需時間

unwire.hk



<https://unwire.hk/2020/04/03/5gspeedtest2020/mobile-phone/>

## 5G Foldable Phones



## 5G - 360 Camera Wearables



## 5G Speed in US (Verizon)



<https://sea.pcmag.com/networking/41611/samsung-galaxy-s21-ultra-busts-3gbps-on-verizons-5g-network>

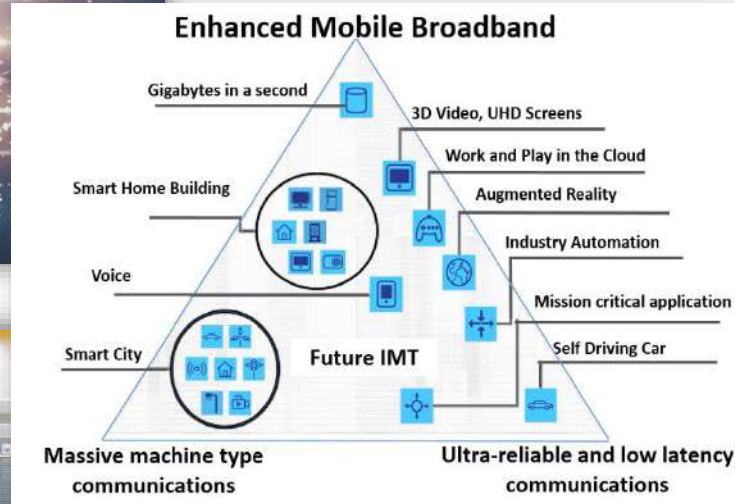


# 5G = New Information Revolution

5G Metaverse



5G Industrial IoT



Source: ITU-R Rec. M.2083



5G Autonomous Driving



- 5G is changing our lives and society and promote a new information revolution.
- 5G正在改變我們的生活和社會，推動一場新的信息革命。



# New 5G Ecosystems

## 5G Smart Airport- Automated Guided Vehicle (Singapore & HK)



## 5G Smart Office



## 5G Smart Factory Realtime Configured Manufacturing



## 5G Metaverse





# New Opportunities - Innovations and Ecosystem



- 5G demands on
  - Innovations** – ASTRI has 5G IPs for industries, enabling HK as an international innovation and technology hub.
  - Ecosystem** – ASTRI as a technology provider to lead, develop and build ecosystem.



## 5G Killer Apps

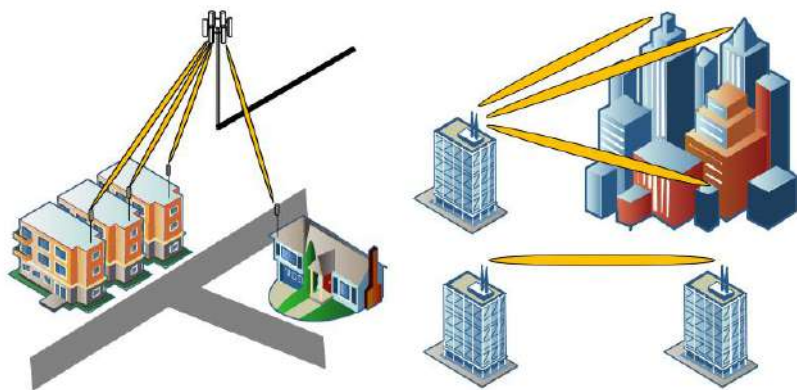
Figure 6: 5G-enabled industry digitalization revenues for ICT players, 2026



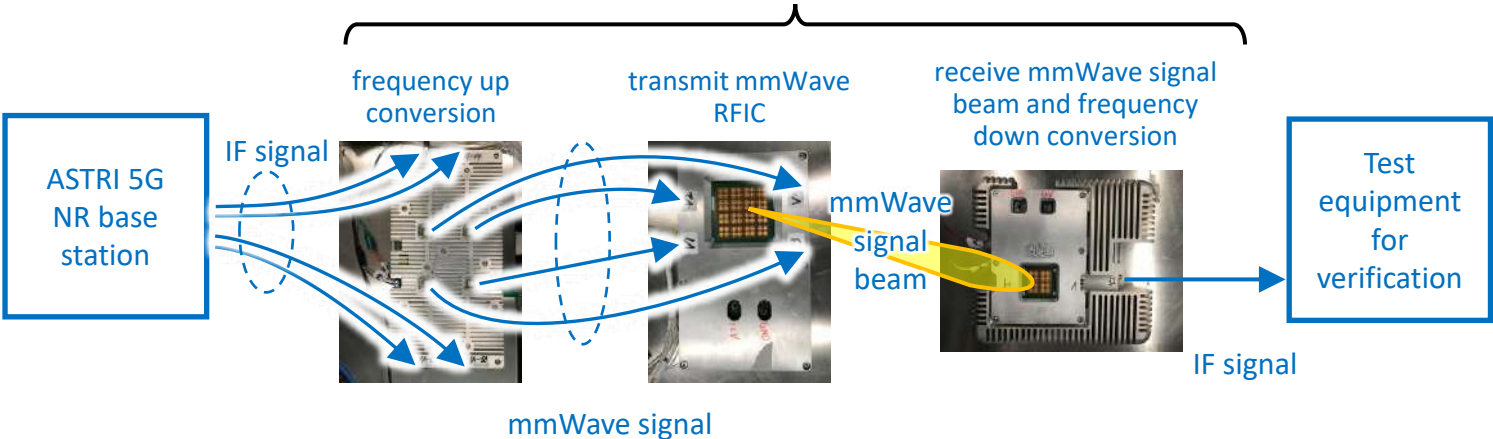
Source: Ericsson and Arthur D. Little, The 5G Business Potential: Second Edition, October 2017

# 5G Spotlights #1: New 5G mmWave Radio Devices

## 5G Beamforming to Enhance Channel Capacity



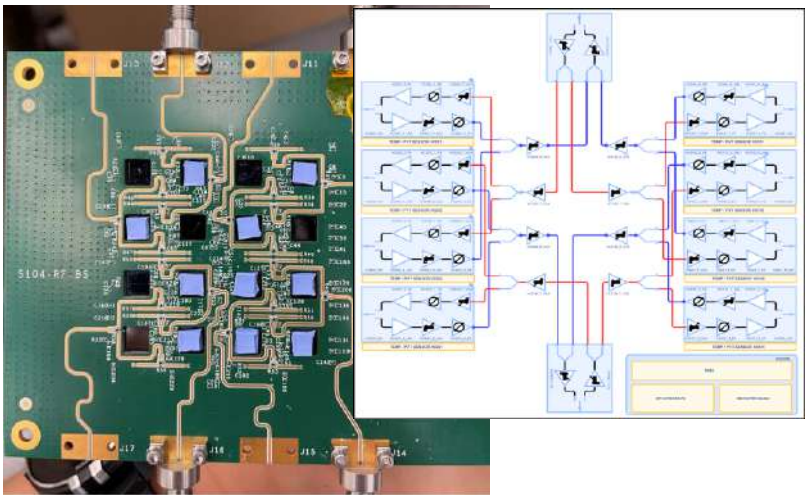
## 5G mmwave RF Front-end



## 5G mmwave Frequency Band

NR operating band	Uplink (UL) and Downlink (DL) operating band F <sub>UL,low</sub> – F <sub>UL,high</sub> F <sub>DL,low</sub> – F <sub>DL,high</sub>	Duplex mode
n257	26500 MHz – 29500 MHz	TDD
n258	24250 MHz – 27500 MHz	TDD
n259	39500 MHz – 43500 MHz	TDD
n260	37000 MHz – 40000 MHz	TDD
n261	27500 MHz – 28350 MHz	TDD

## 5G mmwave Beamforming RFIC

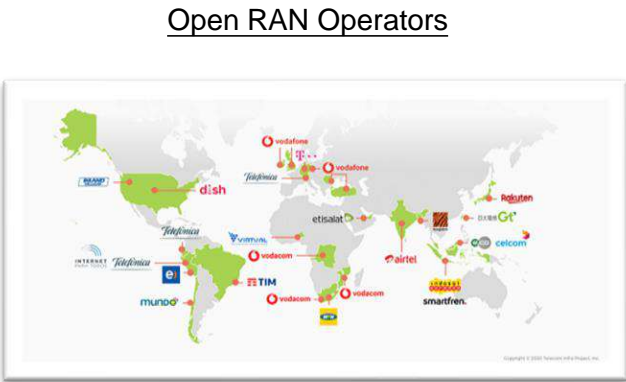
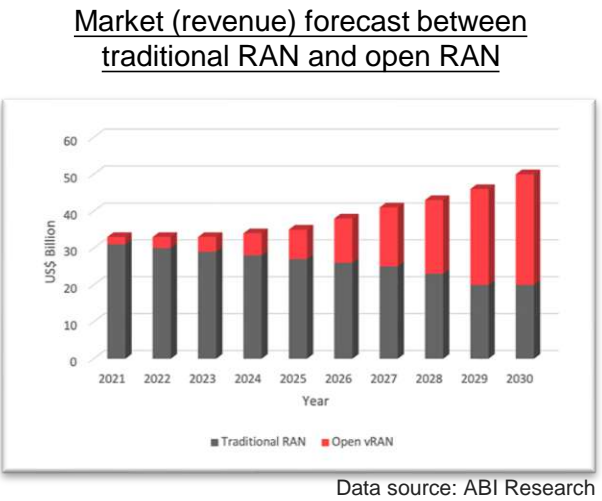
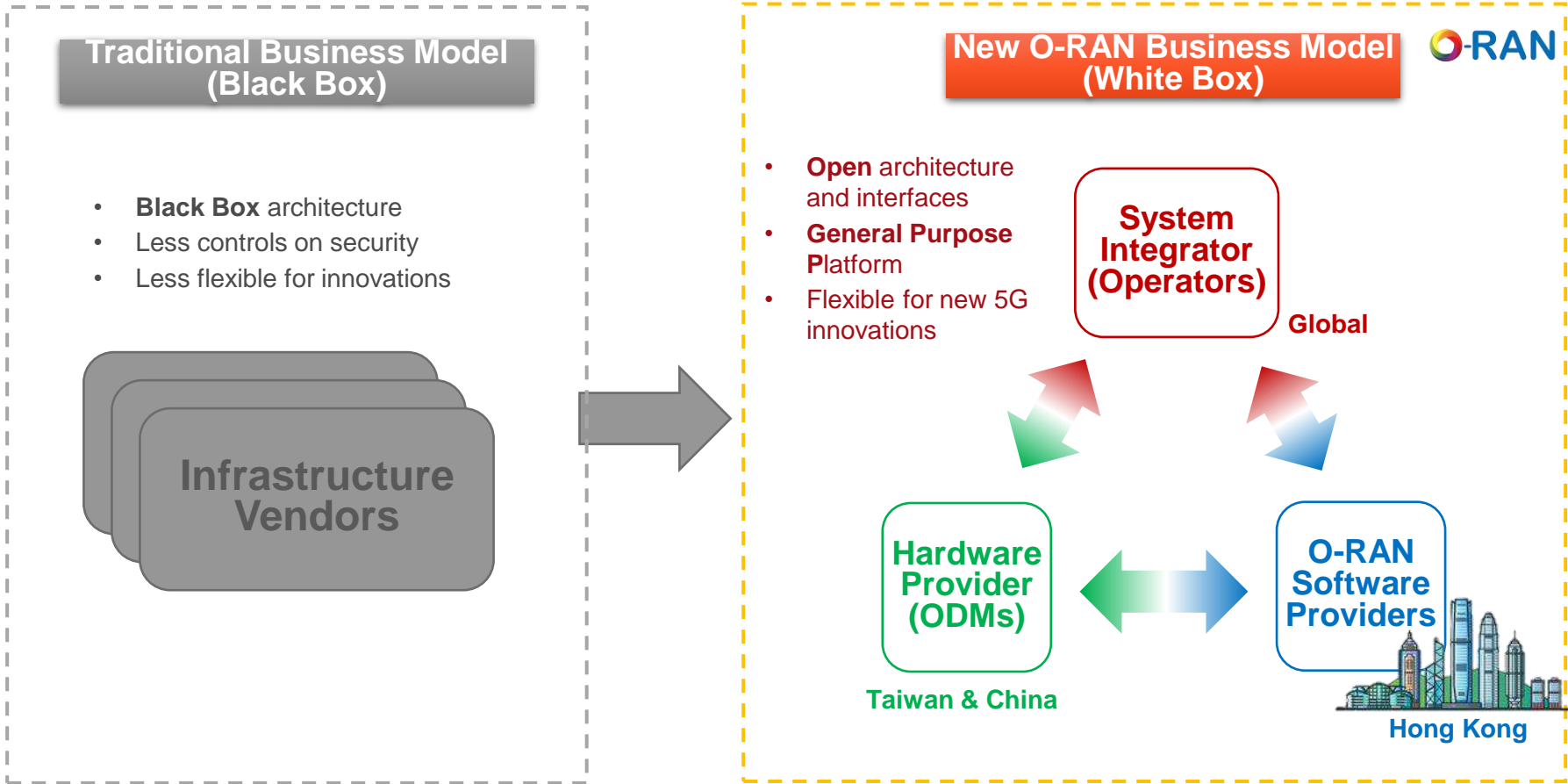


## 5G mmwave RF Front-end Requirements

Multi-beams	Carrier BW 400MHz	Operational BW 1000MHz
EIRP 55dBm/Total RF out 31dBm/Total	Modulation 256QAM (±2.5dB)	512AE M-MIMO
PSD -1dBm/ MHz	DC Power <200W	Beam width 65Deg 7.5Deg



# 5G Spotlights #2: New 5G O-RAN Business Model



# 5G Spotlights #3: New 5G O-RAN Systems

Pioneer development on multiple platforms (x86 & ARM) - cost-efficient

Technology Leadership

Ground-breaking Terabit 5G SA Core Network - collaboration with Intel

ASTRI O-RAN Software support multiple hardware platforms



x86



ARM based SoCs  
(e.g. NXP LX2160A)



LA1200



ASTRI 5G BBU

ASTRI 5G Core

Terabit 5G UPF

Live Throughput  
1,343.08Gbps  
Cloud Native UPF  
Using Xeon 6230N in 4U

- ASTRI's cloud native 5G Core User Plane Function (UPF)
- Supermicro 4U server with Intel® Xeon® 6230N CPUs and Intel® 100G Network Interface Card (NIC)

ASTRI 5G Core Network



Mobile



1U



2U

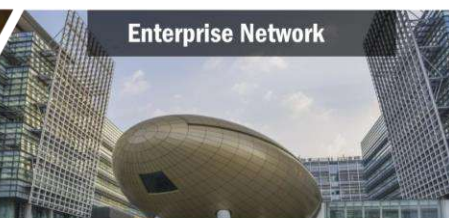


4U

ASTRI  
香港應用科技研究院  
Easy 5G



Cloud Mobile Gaming



Enterprise Network



Connected Vehicle

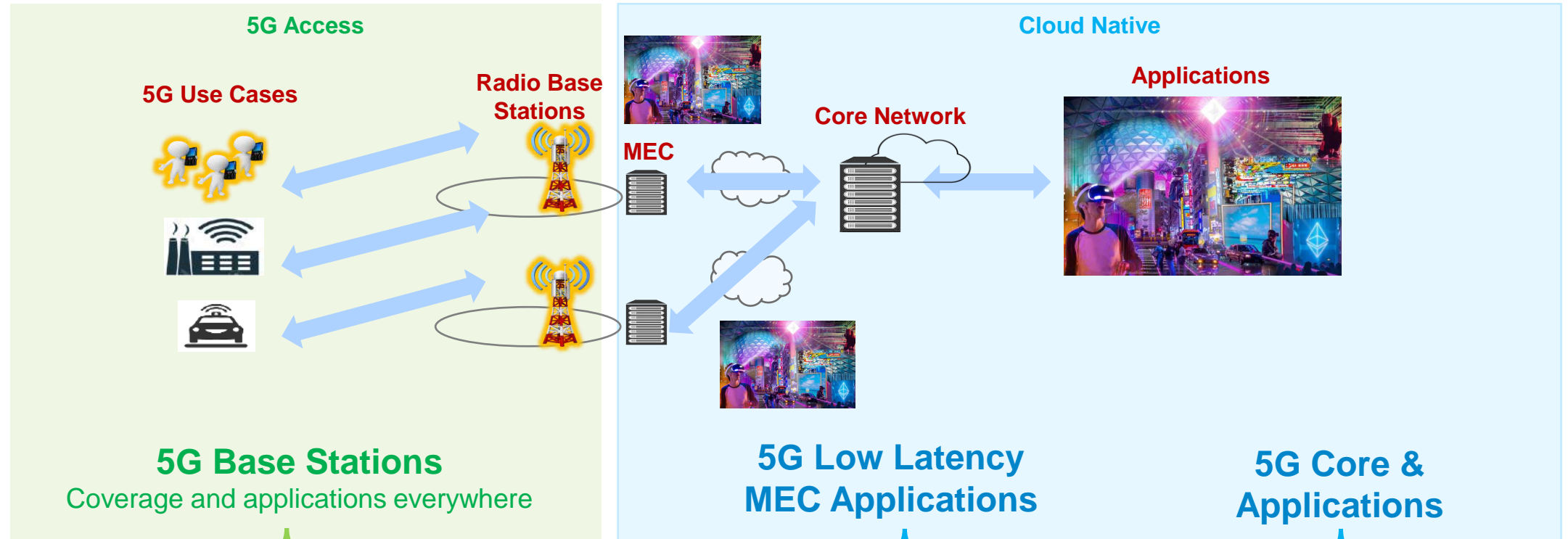


Industrial Mobility

ASTRI



# 5G Spotlights #4: New Cloud Native 5G Networks



O-RAN: Open Radio Access Network    MEC: Mobile Edge Computing

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# 5G Spotlights #5: New Smart Mobility in Hong Kong







Roadside Unit

ASTRI 5G V2X



- 14 km road test route (from Science Park to Shatin Town Center)
- 14xRoad Side Units (RSU)
- 5 C-V2X enabled Traffic Light
- Scalable to different Hong Kong locations





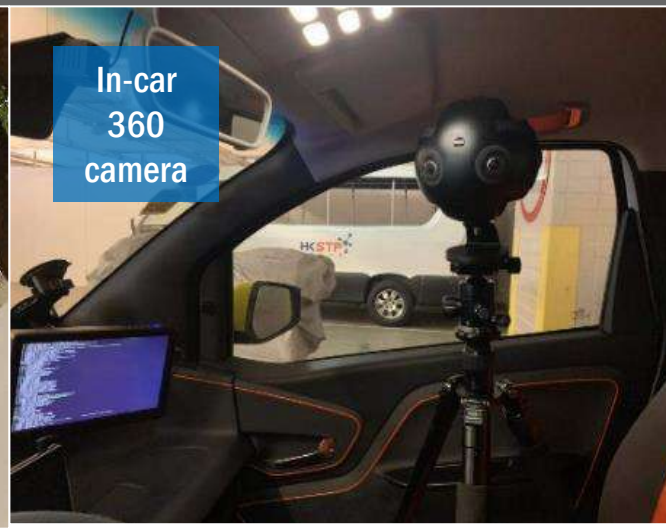
# Smart Mobility: faster, safer, more efficient

- China's first city C-V2X trial - World Internet of Things Expo 2018 (Wuxi)
- Bringing back to Hong Kong, working with Transportation Department

**ASTRI**



China  
Mobile  
28GHz 5G  
BS



In-car  
360  
camera



Autonomous vehicle



# More Footprints in Hong Kong



**OFCA** to lead more 5G network and 5G applications in Hong Kong



**HKT** to work on the 5G O-RAN infrastructure solution



**Hong Kong International Airport** to deploy a commercial Autonomous Vehicles and 5G private network



**Local universities** (e.g., **HKUST, CUHK**) to conduct pre-6G basic research



**Hospital Authority (HA)** on implementing full scale 5G private networks



**Logistics /Factories** deploying the Automated Guided Vehicle (AGV) with 5G connectivity



# 2021 Geneva Awards on Wireless Communications

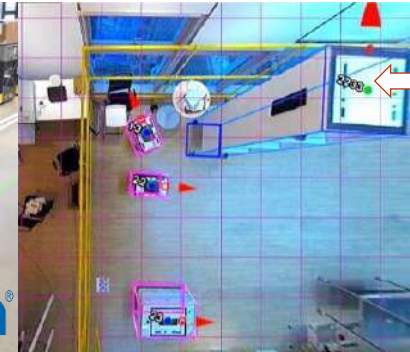
## Awarded Technologies:

1. 5G O-RAN Base Station
2. Mobile Mission-Critical Communications Terminal
3. Improved Multi-Beacon Wireless Indoor Positioning System
4. 5G and Vision-Based AI Improvements for Automated Guided Vehicles (AGV)

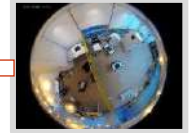


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## 5G + AI AGV Systems



Roof-top camera



In-vehicle camera



## O-RAN Systems

ASTRI 5G BBU



ASTRI 5G Core



## BLE Positioning



## Mission Critical Terminal



# Sample Business Model of ASTRI



## ASTRI IP Technology Transfer

## Product Commercialization

## High-Tech Industry Productizations

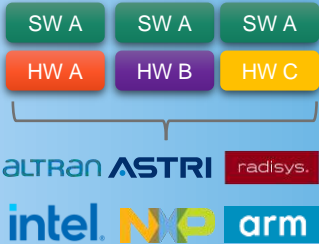
1 Standard Specifications



2 Operators Requirements



3 Platform Integration



4 Conformance & Certifications



5 Field Trials & Deployments





# Invested over HK\$130 Billion in I&T in the Last Four Years

Source: The Chief Executive's 2021 Policy Address

- | **Cyberport** and **Science Park** expansions
- | **Hong Kong-Shenzhen** Innovation and Technology Park
- | HK\$10 billion reserved for **Health@InnoHK** and **AIR@InnoHK**

## 16 **State Key Labs**

In collaboration with  
UGC and other  
Mainland institutions

## 6 **CNERC HK Branches**

1 at ASTRI | 1 at CityU  
2 at HKUST | 2 at PolyU

## 5 **Applied R&D Centres**

APAS | ASTRI  
HKRITA | LSCM | NAMI

## 7 **University Tech Transfer Offices**

## 28 **InnoHK Research Labs**

World renowned universities  
and research institutes

# ASTRI GBA Strategy

ASTRI becomes a part of the ecosystems in GBA to commercialize 5G technologies.

## GBA New Universities



## GBA Enterprises

	Company	Listed	Industry	Revenue (RMB, b)
1	Ping An Insurance (Group)	SH, HK	Financials - Insurance	893
2	Huawei Technologies	N/A	IT - Hardware & Equip	611
3	Foxconn Industrial Internet	SH	IT - Hardware & Equip	280
4	Tencent Holdings	HK	IT - Software & Services	272
5	China Vanke	SZ, HK	Real Estate	224
6	China Merchants Bank	SH, HK	Financials - Banks	208
7	Ping An Bank	SZ	Financials - Banks	103
8	BYD Company	SZ, HK	Autos	94
9	S.F. Holding	SZ	Industrials - Transport	79
10	ZTE Corporation	SZ, HK	IT - Hardware & Equip	64
11	Digital China Group	SZ	IT - Hardware & Equip	63
12	China Int'l Marine Containers	SZ, HK	Industrials - Cap. Goods	62
13	Eternal Asia Supply Chain Mgt	SZ	Industrials - Transport	48
14	AVIC International Holdings	HK	IT - Hardware & Equip	44
15	CGN Power	SZ, HK	Utilities	43
16	Gemdale Corp.	SH	Real Estate	43
17	Konka Group	SZ	Apparel	42
18	Shenzhen Aisidi	SZ	IT - Hardware & Equip	41
19	China National Accord Medicines	SZ	Healthcare - Equip & Serv	39
20	OFILM Group Co.	SZ	IT - Hardware & Equip	38
Total				3,287.84
Average				164.39

Data source: NBS

## ASTRI as one of the Technology Hubs





# Contributing towards the 14<sup>th</sup> Five-Year Plan

## as an innovation and technology hub in the GBA

- Bridges **Dual Circulation** and domestic–international I&T ecosystems
- Supports development of **technology-based industries** in GBA
- Facilitates **R&D investments** from Mainland into Hong Kong
- Develops **global I&T talents**

*“Hong Kong is actively collaborating with other GBA cities to participate in the development of the GBA into an international I&T hub”*

*Mrs Carrie Lam, Chief Executive, Hong Kong SAR*

# Thank You



[www.astri.org](http://www.astri.org) | TECH FOR IMPACT

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