MWC
GSMA

5G FUTURES SUMMIT

Welcome

The Mobile Journey: From connecting people to unifying cyber and physical worlds

GSMA Programme

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5G Futures Summit

Moderator

Pablo Iacopino

Head of Research & Commercial Content
GSMA Intelligence

5G Futures Summit: Agenda

SESSION 1:	**5G mmWave: Accelerating the power of 5G**	**09:00**
	Networking & coffee break	**10:30**
SESSION 2:	**Unlocking the value of 5G-Advanced**	**10:45**
	Networking & lunchtime refreshments	**12:20**
SESSION 3:	**5G-Advanced: Intelligent Networking**	**12:50**

MWC GSMA | SHANGHAI 28–30 JUNE 2023

5G Futures Summit

Let’s get started!

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5G Futures Summit

Opening Keynote

5G Futures Global Market Overview

Henry Calvert
Head of Networks
GSMA

5G Futures Summit

Henry Calvert
Head of Networks, GSMA

30th June

GSMA

5G Futures Community

GSMA Open Gateway Community & Cloud Networks Working Groups
(TEC / OPG / OPAG)

GSMA Industry Communities
(Fintech, Identity & Data, Mobility, Digital Industries, Aviation)

5G Futures Community Focus

- 5G mmWave
- 5G Standalone
- 5G Advanced
- 5G New Calling
- AI for Networks

Cloudification of the Network

GSMA Open Infrastructure Activities
(Open RAN, supply chain, T&F, VoIP, 5G-enabled NTN, AI/ML)

Community framework

Community meetings

- Exclusive meetings reserved for global industry experts
- Focused on identifying and addressing industry challenges to 5G adoption
- Findings and insights will inform wider ecosystem and shape community webinar themes and topics of focus

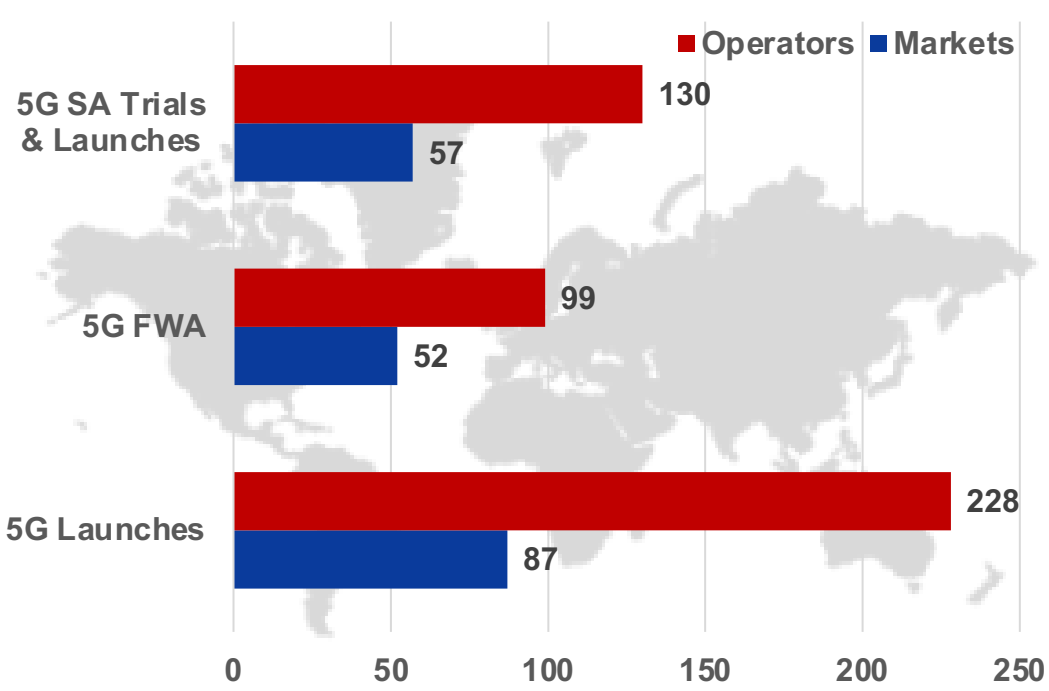
Community webinars

- Open to all community members to attend
- Focused on promoting the key benefits and opportunities of 5G technologies
- Industry experts to present success stories and use cases
- Community experts to present

Communication

- Quarterly update emails on the latest insights and use cases shared with the wider community
- GSMA Networks social channels and website latest news and real-time updates

Fastest Ever Generational Technology Change



	5G adoption, 2030	5G connections, 2030
North America	91%	447m
Europe	87%	634m
Asia Pacific	58%	3.0bn
Latin America	57%	442m
World	54%	5.3bn
MENA	47%	442m
CIS	41%	169m
Sub-Saharan Africa	16%	217m

Source: GSMAi May 2023

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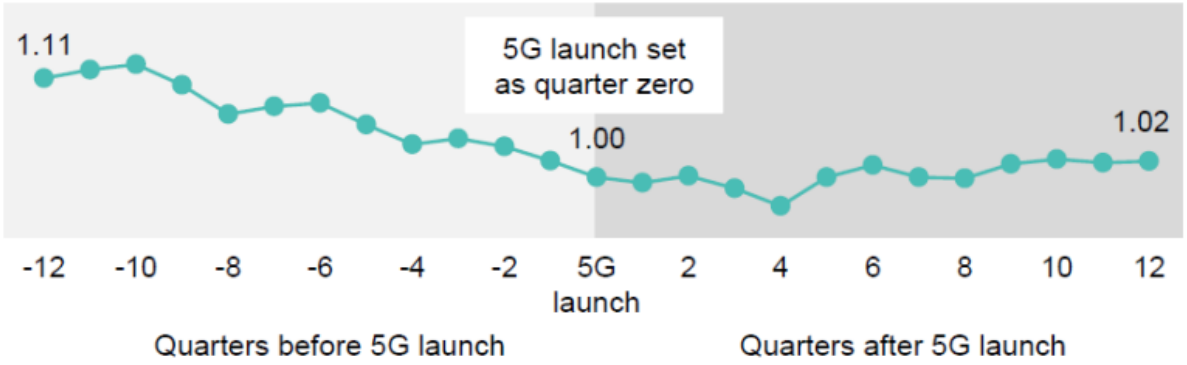
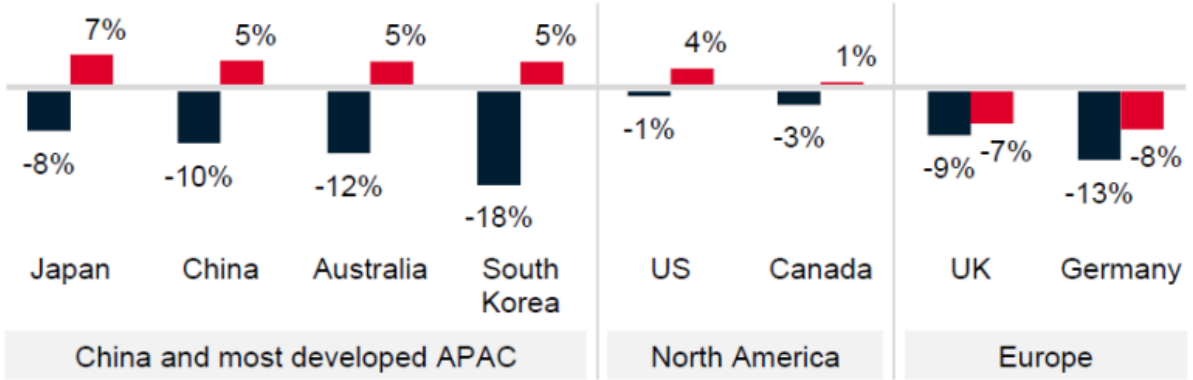
5G Driving ARPU to +ve Connectivity Growth

Mobile ARPU trend before and after the launch of 5G services

Mobile ARPU index (aggregate figures across eight markets analysed)



Mobile ARPU trend by region



ARPU change 12 quarters before 5G launch ARPU change 12 quarters after 5G launch

Source: GSMAi May 2023

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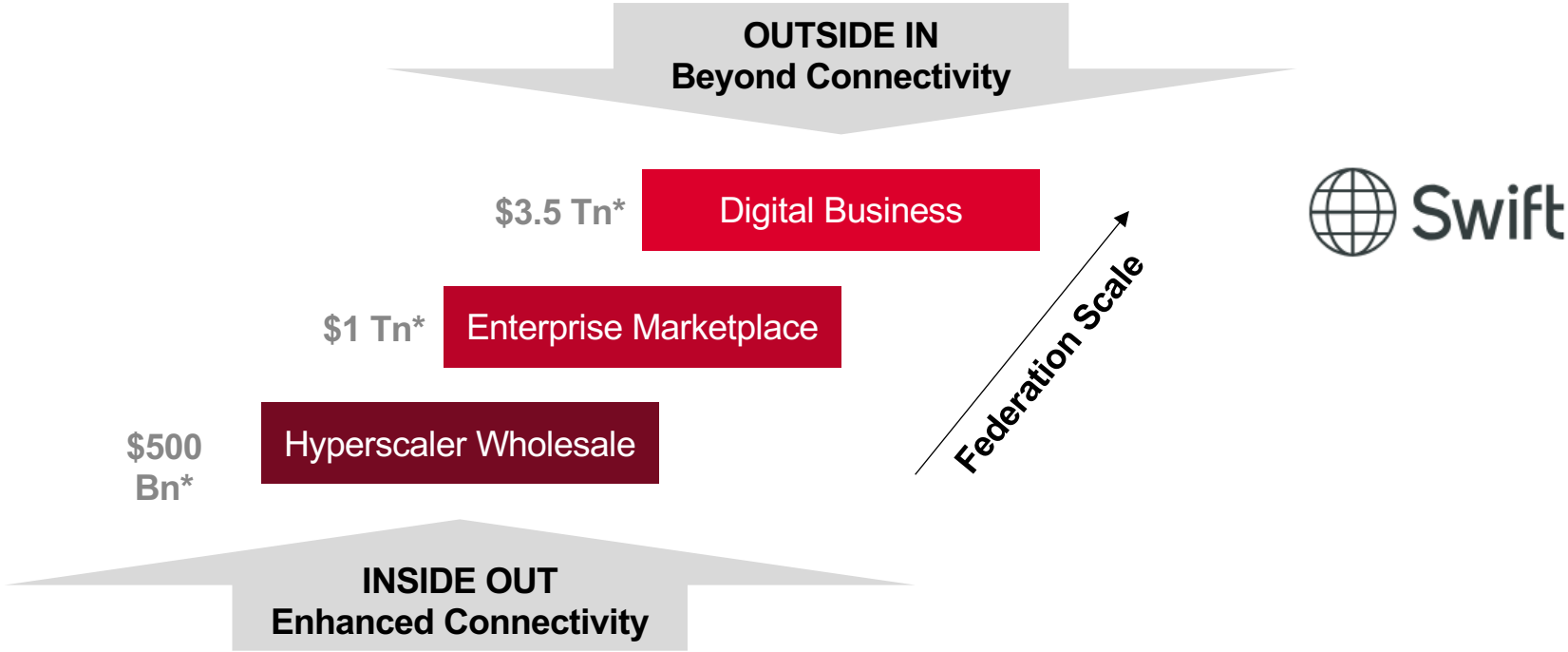
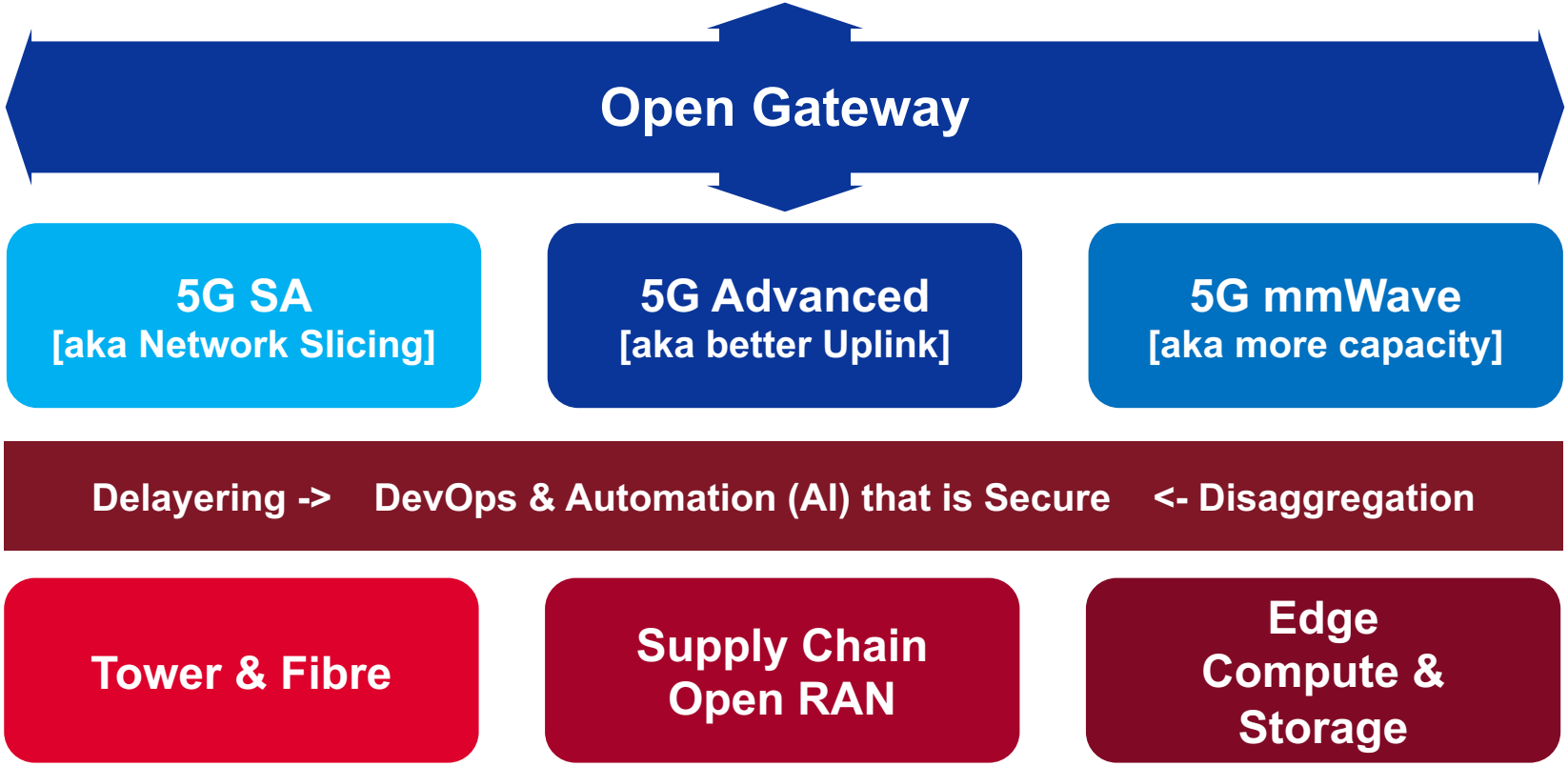
Capitalising on Cloud driven Digital Businesses



* ***2030*** value at stake (McKinsey forecast & GSMA Intelligence)

5G Futures 2023 Focus



Specification by doing code, not documentation

Welcome

Learn more at GSMA Networks

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Session 1

5G mmWave: Accelerating the power of 5G

GSMA Intelligence

Agenda

Keynote speakers

- **Pau Castells,** Head of Economic Analysis, GSMA Intelligence
- **Yan Feng,** VP of 5G&LTE TDD Product Line, Huawei
- **Philippe Poggianti,** VP Business Development, Qualcomm
- **Hu Kaiwei ,** Deputy GM of RAN MKT, ZTE Corporation

Panel discussion

- **Wei Jinwu,** Deputy Dean, China Unicom Research Institute.
- **Wang Qingyang**, Director, Department of Mobile and Terminal, China Telecom Research Institute
- **Dr. Nan Hu,** Vice Director Department of Wireless and Terminal Technology Research, China Mobile Research Institute

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5G Futures Summit

Introduction to 5G mWave

State of the Market & What to Expect Next

Pau Castells
Head of Economic Analysis
GSMA Intelligence

GSMA Intelligence

~~MWC~~ Shanghai 2023. 5G Futures Summit.

Introduction to 5G mmWave

State of the Market and What to Expect Next

Pau Castells
June 2023

Who is GSMA Intelligence?

What do we do and why should you bother listening to me?

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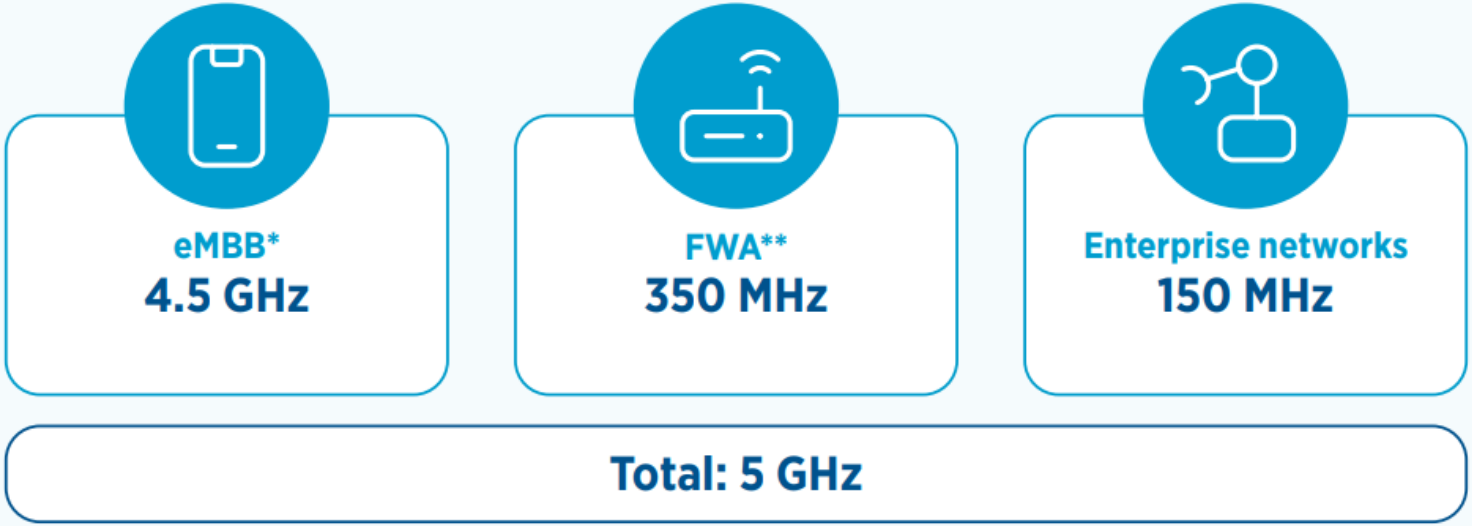
5G mmWave: a reminder

There's a reason we think of it as a "when" not "if" technology.



* In early adopter countries

** In dense urban environments

5G mmWave assignments

The number of markets that have assigned 5G mmWave spectrum continues to grow

Markets with 5G mmWave assignments	Australia, Brazil, Chile, Croatia, Denmark, Finland, Greece, Hong Kong, India, Italy, Japan, Malaysia, Russia, Singapore, Slovenia, Spain, Taiwan, Thailand, Uruguay and the US.

5G mmWave spectrum assignments*

Country	Date	Bands	Bandwidth	Number of winners
Chile	February 2021	26 GHz	1200 MHz	3 – Entel, Claro, WOM
Slovenia	April 2021	26 GHz	1000 MHz	3 – A1, Telekom Slovenije, Telemach Mobil
Denmark	April 2021	26 GHz	2850 MHz	3 – 3, TDC, TT-Netvaerket
Australia	April 2021	26 GHz	Assigned at regional level	5 – Dense Air, Mobile JV, Optus, Pentanet, Telstra
Malaysia	July 2021	26 GHz	1600 MHz	1 – DNB
Croatia	August 2021	26 GHz	1000 MHz	4 – A1, ELO, Hrvatski Telekom, Tele2
Brazil	November 2021	26 GHz	3200 MHz	5 – Algar Telecom, Claro, Neko Services, Tim, Vivo
India	August 2022	26 GHz	Assigned at regional level	4 – Airtel, Reliance Jio, Vodafone Idea, Adani Enterprises
Spain	December 2022	26 GHz	1800 MHz	3 – Movistar, Vodafone, Orange

* Assignments since 2021
** Based on operator frequency data, where available

Market update

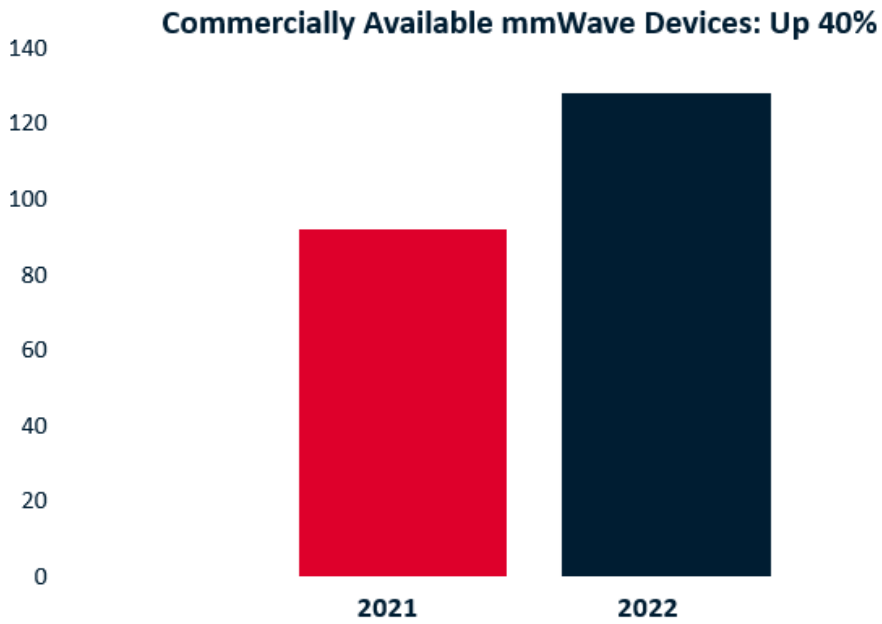
- By the end of Q1 2023, operators had conducted more than 119** 5G trials in the mmWave band.
- Spectrum assignments in the mmWave band for 5G have been slower than expected. There was no new assignment for mmWave in the last quarter.
- Asia Pacific leads (9 mmWave spectrum assignments) followed by Europe (7).
- By the end of Q1 2023, 22 operators** from twelve countries had launched 5G services in the mmWave band.
- In 2023, 15 countries are expected to assign spectrum frequencies in mmWave.

Data correct to 31 March 2023
Source: GSMA Intelligence

5G mmWave devices and equipment

Positive evolution for 5G mmWave device and equipment availability.

Consumer devices



Network equipment

- all major network equipment vendors are now offering 5G mmWave solutions.
- cost gap between sub-6 GHz and 5G mmWave solutions steadily decreasing.

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The Pros and Cons of 5G mmWave

We need to be honest about the value prop…and challenges.

The CONS

- Shorter range
- Indoor penetration
- New deployment strategies required

The PROS

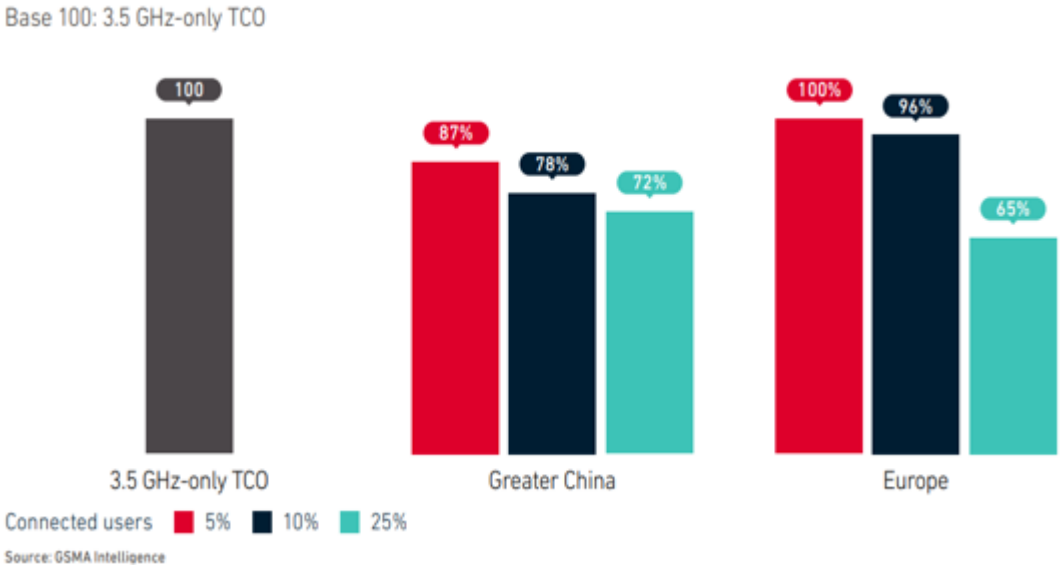
- Mobile data traffic growing rapidly
- High-speeds and low-latency a must for 5G
- More spectral bandwidth and contiguous spectrum than any other band
- **Cost-effective?**
- **Consumer WTP?**

Is 5G mmWave Cost effective?

TCO analysis highlights significant cost efficiencies in dense urban areas

- Two deployment strategies: 3.5 GHz-only vs 3.5 GHz + 5G mmWave
- TCO over a 5-year period
- Scenario constructed using population density and satellite data on major cities in Greater China and Europe

- In **dense urban Greater China,** mmWave cost effective in the densest parts of cities as soon as spectrum is available
- In **dense urban Europe**, 5G mmWave cost effective from 2024 in the densest parts of urban areas if traffic demand is high

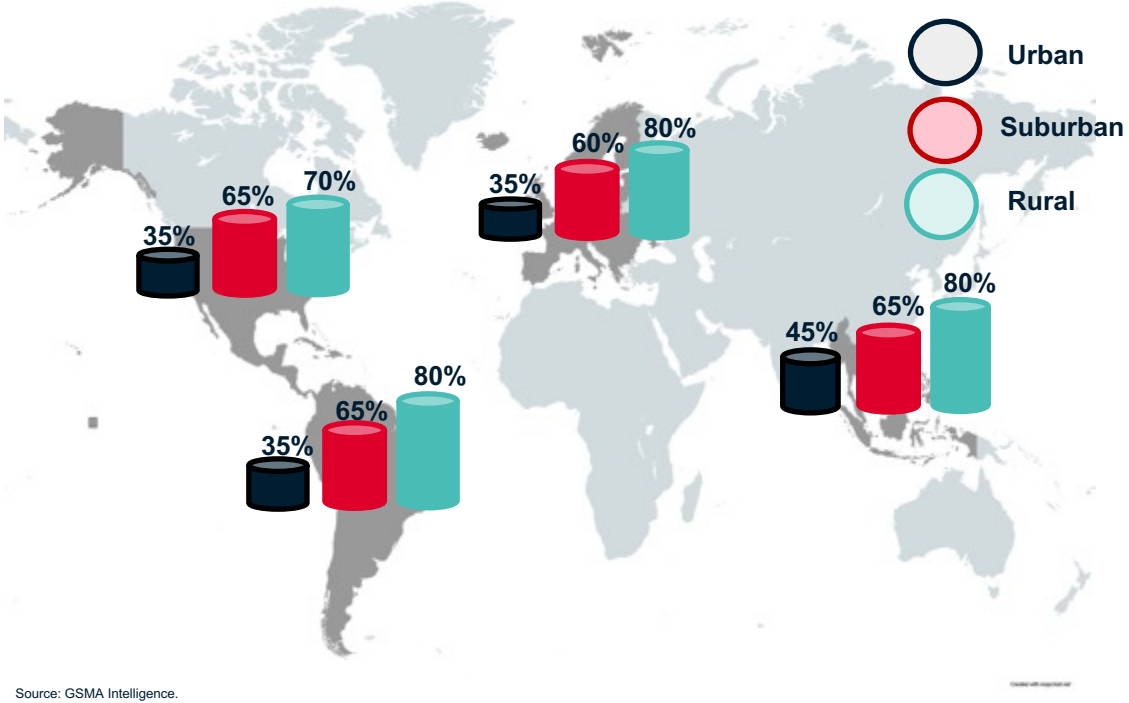


Is 5G mmWave Cost effective?

TCO analysis also highlights cost saving opportunities for 5G FWA vs FTTH

5G mid-band plus mmWave FWA cost-savings vs. FTTH (%)

By region and geo-type, assuming new underground ducts for fibre cables must be built by the MNO



Source: GSMA Intelligence.
Main assumptions: existing 5G network, 400MHz in 26-28 GHz bands, 100 MHz in the 3.5GHz band, 30% market share, 10% busy hour share, 85% DL share of total residential traffic, indoor self-mount CPE, 1:32 fibre cables split ratio.

- Comparing TCOs: 5G mid-band plus mmWave FWA vs. FTTH for an MNO with existing 5G network within 10 years in a typical rural town, suburban and urban area in Europe, the US, Latin America and Southeast Asia.
- Coverage and initial capacity provided by mid-band spectrum. 5G mmWave spectrum used only where and when needed because traffic demand exceeds supply.
- Substantial cost savings when new ducts or poles must be built: up to 80% in rural, 70% in suburban and 45% in urban
- Cost-effective also when ducts/poles can be shared/rented, with up to 30% savings in rural and suburban, 15% in urban

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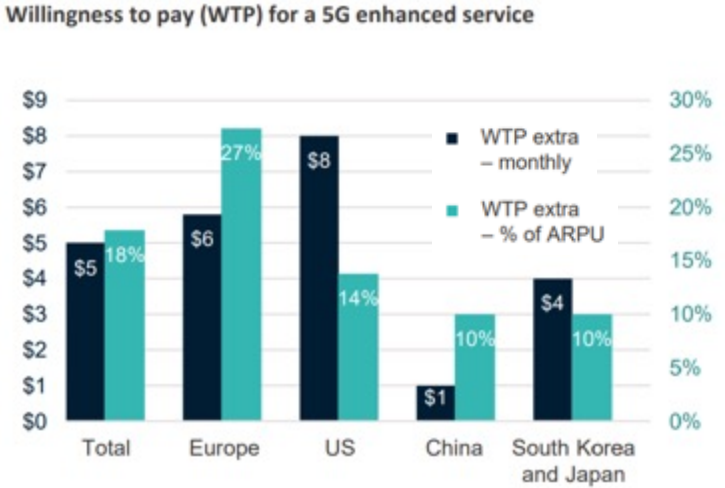
5G mmWave: 2023 and Beyond

5G mmWave fundamentals are solid, but lots of work remains.

The Good News

There's a clear business case: capacity + FWA + new and better services



The Bad News

5G mmWave still remains a minor part of 5G story.

20% share of operators with 5G mmWave spectrum who have launched services.

10% share of commercial 5G devices supporting mmWave bands.

PLUS

- flagship phones w/o mmWave
- South Korean example

The mmWave proposition is clear, and ecosystem progress is commendable. But 5G mmWave 5G has yet to achieve its full potential.

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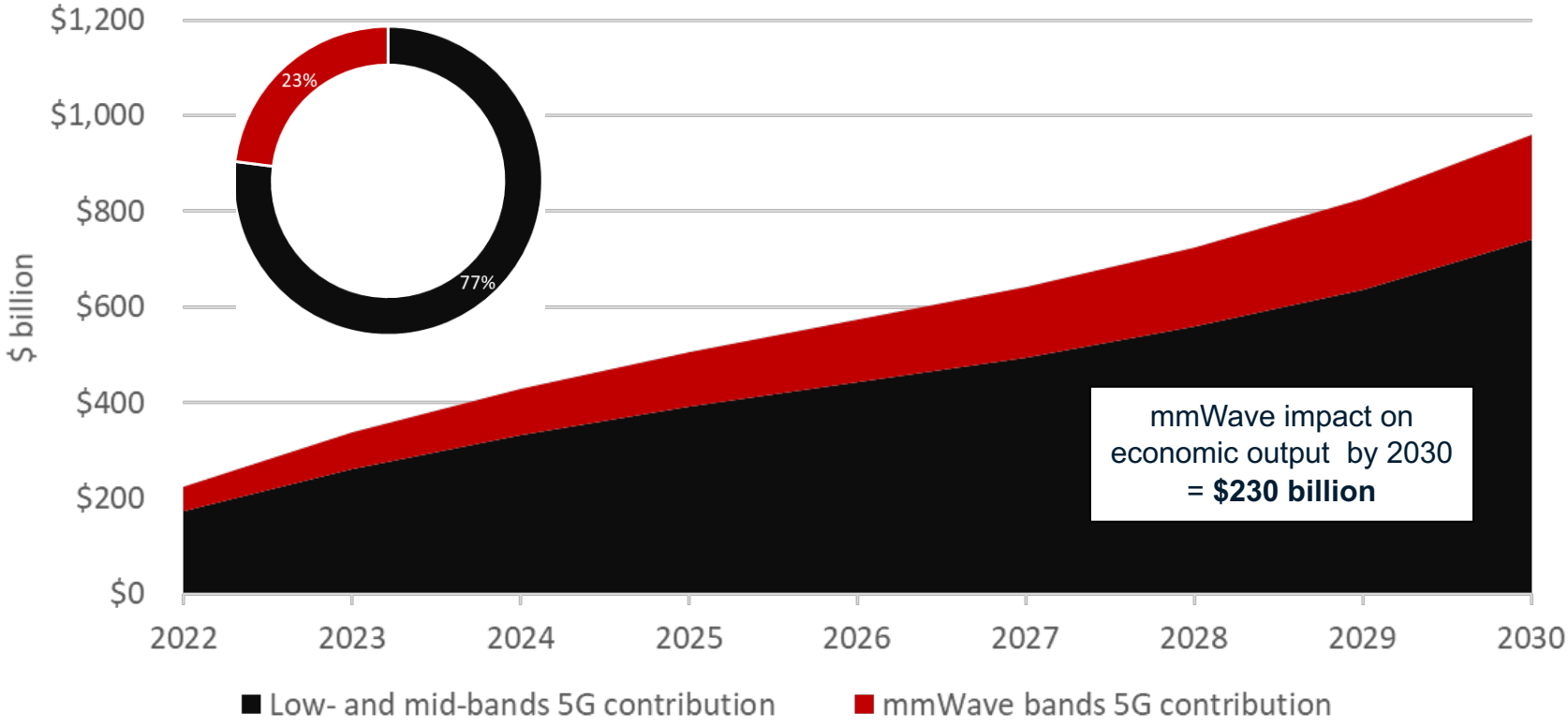
5GmmWave out to 2030

The importance of high-band spectrum will continue to grow.



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Want to Know More?

Check out our 5G mmWave research and quant models.

Thanks

Pau Castells

Head of Economic Analysis

pcastells@gsma.com

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5G Futures Summit

Panel Discussion:
Development, deployment and success factors for 5G mmWave in China

Wei Jinwu
Deputy Dean
China Unicom Research Institute

Wang Qingyang
Director
Department of Mobile and Terminal Technology Research
China Telecom Research Institute

Dr. Hu Nan
Vice Director
Department of Wireless and Terminal Technology Research
China Mobile Research Institute

中国联通
China unicom

5G-A

mmWave: Connecting the Bright Future of 5G-Advanced

Wei Jinwu
China Unicom Research Institute

Profile

Wei Jinwu

Deputy Dean,

China Unicom Research Institute

- Wei Jinwu, Member of the Party Committee and Deputy Dean of China Unicom Research Institute, expert of special allowance of the State Council, professor-level senior engineer. Engaged in the think tank strategy, business development, digitalization and other research and management fields. Specialized in marketing, network, IT and terminals.

China Unicom Contributes to the Rapid Development of 5G

The world's first, largest, and fastest 5G SA network was built through network co-construction and sharing.

1,270,000 gNodeBs

Deeply promoting 5G application "sailing"

- 5,000 5G industry private network customers
- 2,000+ 5G factory projects
- 20,000+ 5G commercial projects
- Covers 60 typical use cases

Offering ultimate 5G network experience

- Continuous 5G coverage in key townships
- 200 million+ subscribers
- 300 MHz bandwidth indoor
- Peak download rate of 4 Gbps+

China Unicom Actively Promotes the Research of mmWave

Led by the IMT-2020 (5G) Promotion Group, China Unicom has been steadily promoting the mmWave closed-loop technology system. The mmWave UE/NW devices are basically ready for commercial use in China.

Technology Innovation

- Proposes and promotes the 26 GHz band, DSUUU, and 200 MHz/CC, which become a mandatory choice for China's industry standards.
- Proposes the flexible frame structure, interference coordination, private network scheme and hybrid networking scheme.

Standards Development

- Promotes the maturity of mmWave in 3GPP/CCSA/IMT2020 standards.

✓ Leads 9 mmWave technology standards in CCSA/IMT2020.

Device Evolution

- Builds a full SA UE/NW device system through IMT2020 and other internal and external field tests.

✓ Promotes the maturity of mmWave UE/NW device form factor and networking architecture.

Ecology Construction

- Builds an innovation platform to propel China's mmWave ecosystem.

✓ Continuously led the organization of the High-Frequency Communication Industry Technology Development Forum, and served as the vice chairman unit of the Millimeter Wave and Terahertz Alliance.

中国联通
China unicom

5G-A

Convergence of mmWave Industry Chain for a Prosperous 5G-Advanced Industry

5G Futures Summit Shanghai

(5G mmWave Session)

China Telecom

2023.6

嘉宾介绍

Wang Qingyang

Director of the Mobile and Terminal Technology Research Department of China Telecom Research Institute

Dr. Wang is currently the director of the Mobile and Terminal Technology Research Department of China Telecom Research Institute, the leader of the Requirement Working Group of China IMT-2030 (6G) Promotion Group, the vice-chairman of China Communications Standards Association (CCSA) TC5. His main research directions include the key technologies, networking solutions and fundamental services of mobile communication systems.

China Telecom Research Institute

Achievements

Top Consultancy

- 17 research departments.
- 2400 employees, over 80% master's degree holders.

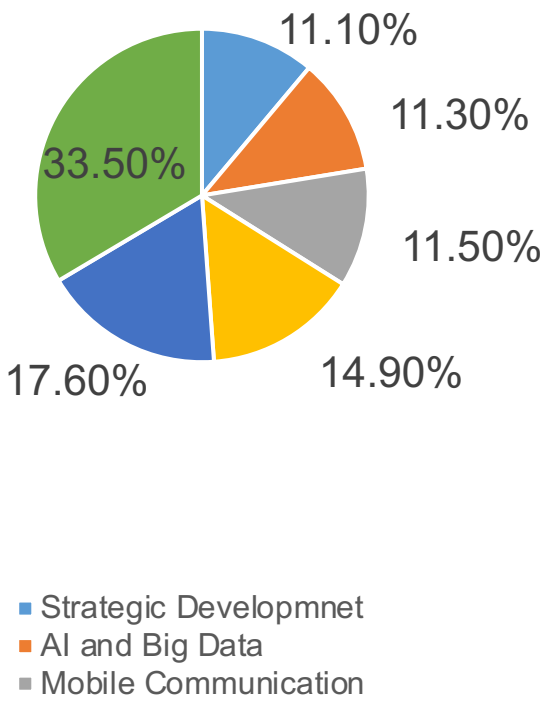
Explorer of Advanced Technology

- Cloud-network Convergence: 5G/6G, optical communication, IP network, cloud computing, AI, future networks, metaverse, quantum information, etc.
- Network and Information Security: data security, cloud-native security, network intrinsic security, etc.
- National Experimental Base: network infrastructure and DevOps R&D cloud platform for end-to-end services and network trial.

Participant of International Cooperation

- A total of 38 chairman/vice chairman in SDOs, including 3GPP, ITU-T, ISO/IEC, ETSI,etc.

Personnel Distribution



Research Achievements in 5G-A and 6G

5G-A

Promotion of 3GPP Wireless Network and Core Network Standardization

- Focus on super uplink evolution, network capacity enhancement, multi-network coordination, and network intelligence, etc.
- Lead more than 30 3GPP projects in Super Uplink Enhancement and Coverage Enhancement, etc.
- Lead 7 3GPP International Standards on Co-construction and Co-sharing, including spectrum bandwidth extension and aggregation.

Reduce costs of 5G network construction

- Over 1 million 5G shared base stations.

6G

6G Network Architecture

- Lead the national key R&D program “6G Network Architecture and Key Technologies” project.
- Propose a new network architecture of Data-driven Distributied Autonomous Architechcture.

6G Wireless Techonologies

- RIS and ISAC, prototype test, self-develop 6G wireless simulation systems.

P-RAN

- Build a theory about proximity radio access network.
- Develop pre-commercial products based on WiFi D2D in the 5G network.

China Mobile has Built the World's Largest 5G SA Network

New infrastructure construction

	No. of gNBs	5G package customers	C-IoT customers
2022Q4	1.25+ million >30%	557 million	890 million

Nan HU

Vice Director
Department of Wireless and Device Technology Research , China Mobile Research Institute

Nan Hu has more than 15 years of experience in wireless communication technology research and standardization in CMCC. He served as the vice chair of 3GPP RAN2 for 4 years.
Currently, he is responsible for CMCC's 5G-A field and serves as the vice chair of 3GPP RAN Plenary.

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Panel Discussion:
Development, deployment and success factors for 5G mmWave in China

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Vice Director
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China Mobile Research Institute

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5G Futures Summit

Keynote: Building Industry Together, Sail 5G mmWave to New Horizons

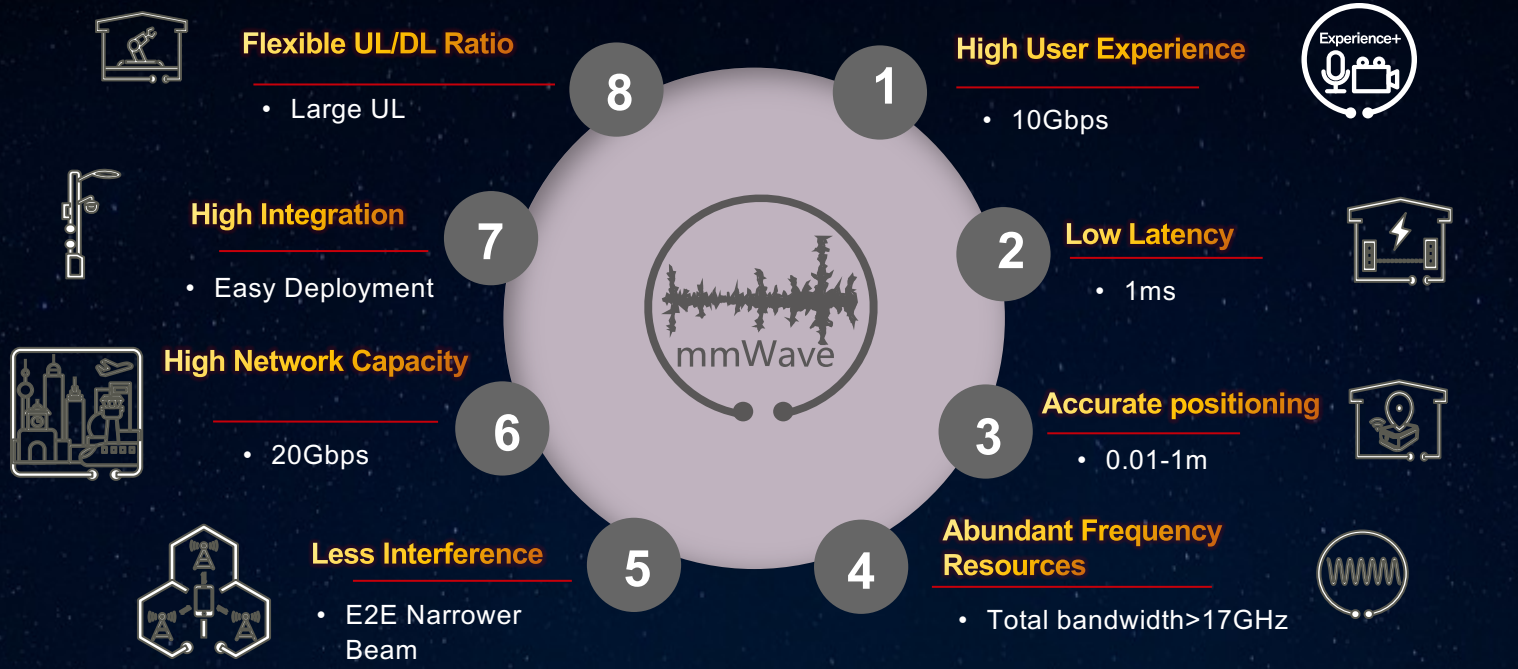
Yan Feng
Vice President of Huawei Wireless Network 5G Product Line
Huawei

Building Industry Together, Sail mmWave to New Horizon

Yan Feng

Vice President of Huawei Wireless Network 5G Product Line

mmWave Key Advantages for New Services



mmWave Networks Deployed and Commercial in Multiple Regions

Large BW mmWave Spectrum is Main Scenario

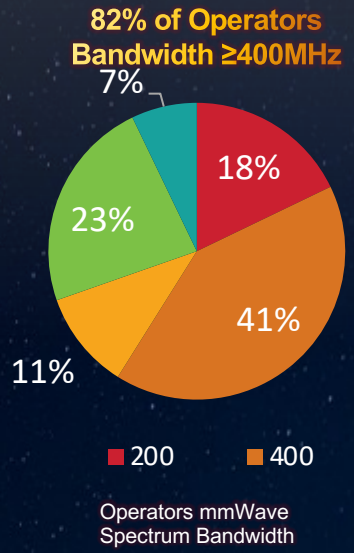
20+ Regions mmWave Spectrum Released

North America: *United States*

Europe: *Italy, Finland, Germany, Croatia, Russia, Denmark, Spain, Greece, Slovenia*

Asia Pacific: *Japan, South Korea, Thailand, Singapore, Hong Kong(China), UAE, Malaysia, India, and Australia*

Latin America: *Guatemala, Argentina, Chile, Brazil, Uruguay*



Operators have Deployed mmWave Networks

mmWave Standard is Ready, Devices have been put into Commercial Practice

Main Features Frozen in 3GPP

2017 — 2023 — 2024

R15~R17

FWA & eMBB Capability Ready

- Beam Management
- Multi-site collaboration
- High and low-band CA
- IAB

R18

Experience Improvement

- Intelligent Beam Management
- Uplink coverage enhancement
- Base station energy saving

mmWave Terminal Develops Rapidly

Main Chip Vendors Provide 5G mmWave Solution

Qualcomm | MediaTek | Samsung

100+ 5G mmWave Devices

Smartphone **50+**

CPE **40+**

Industry Module/Device **10+**

Source from GSA 2020305

mmWave FWA CPL Continuously Decline: Better Coverage & Lower-cost CPE

High EIRP BS + High Gain CPE Reduce 50% Cost

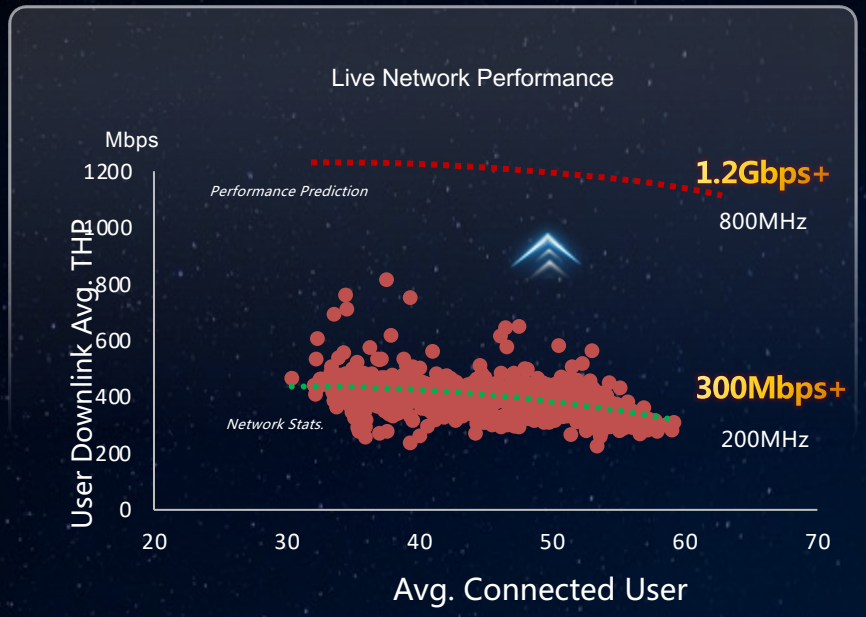
Rich CPE Models and Lower Prices

Chipset	Power class	Price	Performance
X65 + 2 * QTM547	PC1 (VH)		
X62 + 1 * QTM547	PC2 (H)		
X62 + 1 * QTM545	PC3 (L)		
X62, + 1 * QTM547 FR2 only	PC2 (H)		
X62, + 1 * QTM545 FR2 only	PC3 (L)		

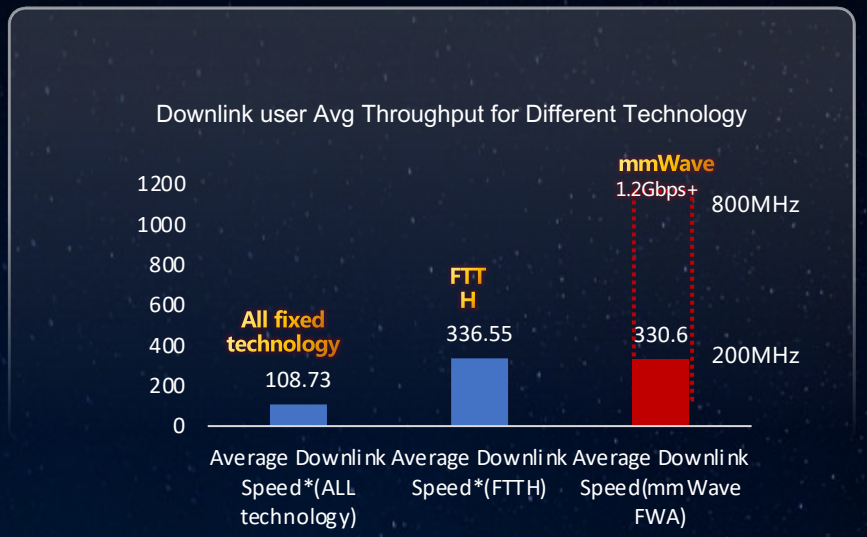
CPL: Cost Per Line

mmWave FWA Ultimate Experience Builds Foundation for Business Success

Ultimate Multi-user Commercial Experience



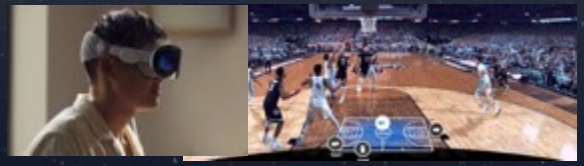
mmWave Provides Fiber-like Experience



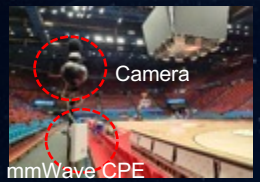
Nation Household Connection Report 2022

mmWave Support Industry to Open New Business Space

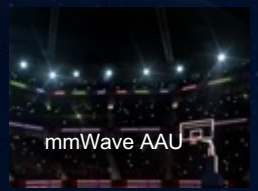
mmWave Realize Panoramic Live-cast of Stadium



One CPE supports Multi-Channel 4K panoramic uplink live-cast

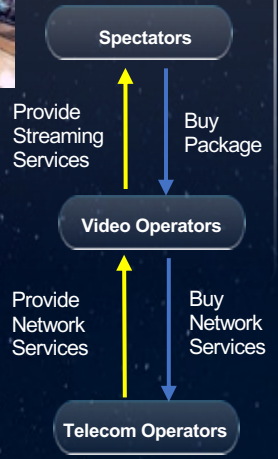


Multi-slot live broadcast



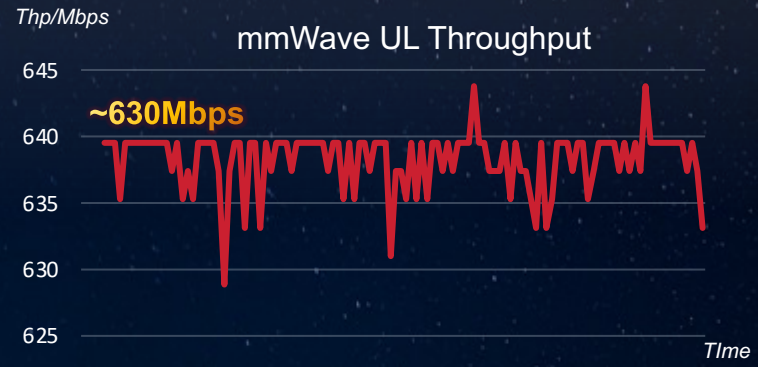
Gymnasium

5G Live Streaming Business Model



mmWave Provides Ultimate UL Experience

Enables Superior UL Experience while Taking into Account DL Experience



Frame Structure: DDDSU, Bandwidth : 400MHz , CPE : 2T2R

ELAA+iBeam Realize mmWave eMBB Commercial Capabilities

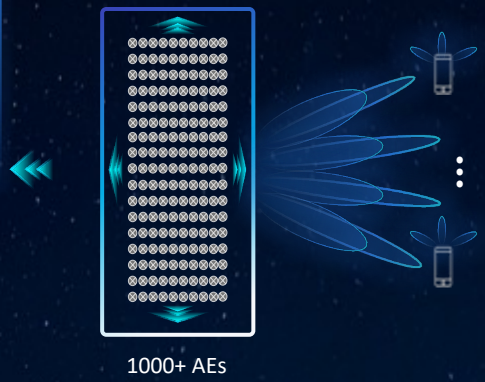
ELAA Improve Antenna Gain, Expands the Coverage

The Larger Antenna Array, the Higher Gain

Antenna Gain= 10×log10(N) dB

N: Number of AE

ELAA: Extremely Large Antenna Array



1000+ AEs

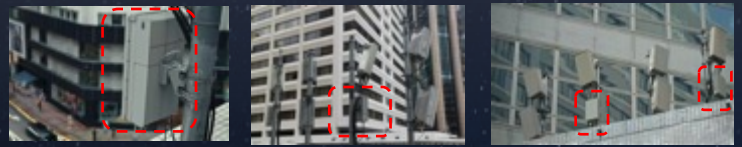
iBeam Ensure mmWave Mobility Performance

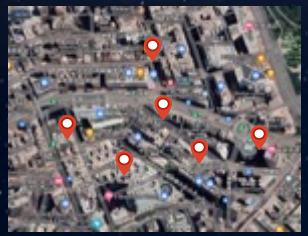
High Density Beam	**Targeted**
Beam Selection	**Precise**
Smooth Beam Handover	**Dynamic**

mmWave eMBB Achieves Ultimate Experience in Dense Urban

mmWave Site 1:1 Deployment in Dense Urban

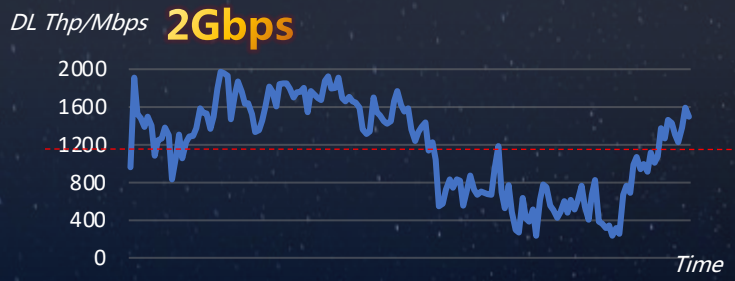
Hong Kong, Causeway Bay (CBD)





Bandwidth	Network :NSA	ISD	Site Hight
400MHz	(Anchor 1.8GHz)	150~200m	~20m

Ultimate Experience in Mobile Scenario



Car Speed: ~30km/h

Avg. DL Thp.:

1.1Gbps

Edge DL Thp :

0.5Gbps

Summary

FWA:

mmWave FWA has realized fiber-like experience. Rich terminal types support differentiated deployment requirements. In future, the Cost Per Line will continue to reduce, accelerating operators business success.

toB：

Cooperate with the industry to explore mmWave application opportunities and play the unique value of mmWave.

eMBB：

eMBB commercial capability of continuous coverage is initially ready. Continuous innovation and cooperation in technologies and industries are ongoing to play the value of eMBB in more countries, regions, and scenarios.

GSMA

5G Futures Summit

Keynote:
Deploying 5G mmWave to unleash the full 5G potential

Philippe Poggianti
VP Business Development
Qualcomm

Qualcomm

Shanghai, China

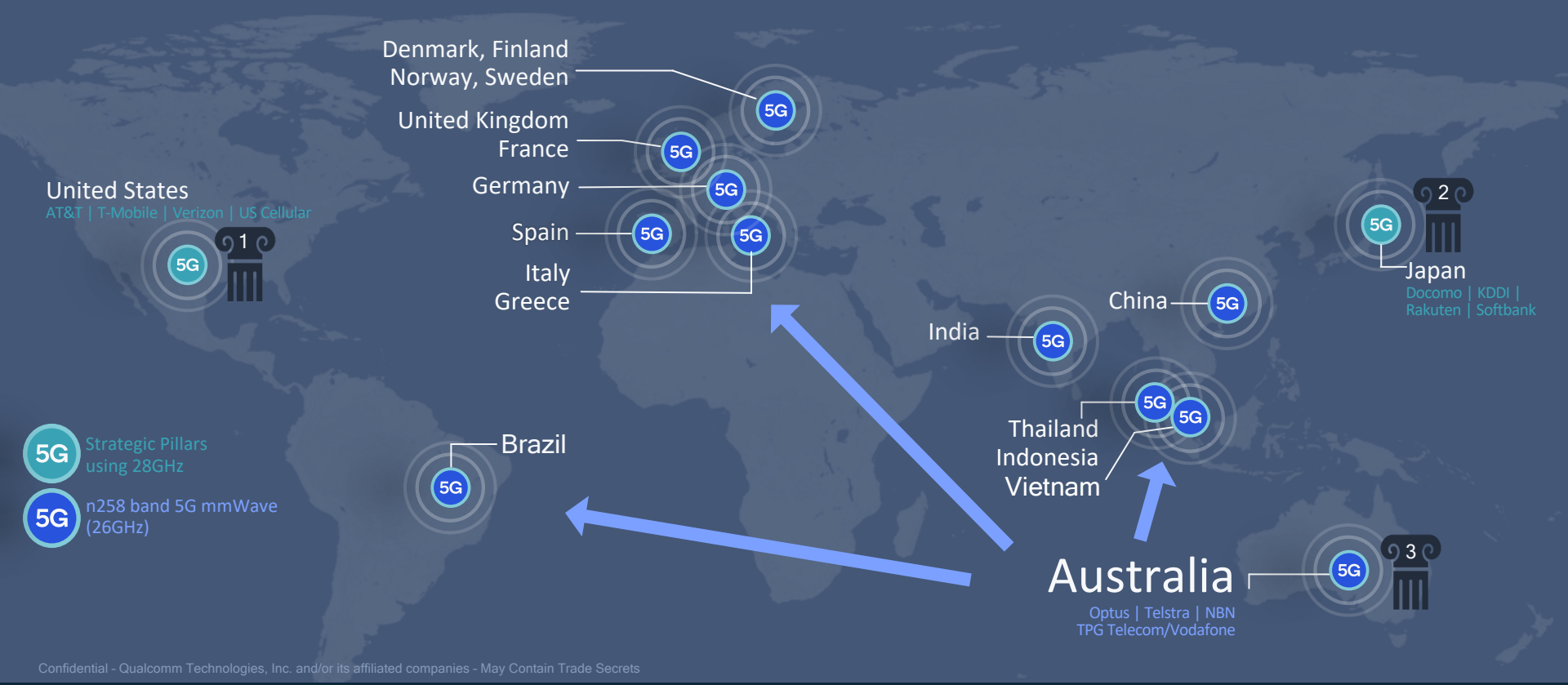
June 2023

Deploying 5G mmWave to unleash the full 5G potential

Philippe Poggianti

Vice President, Business Development

Qualcomm France S.A.R.L



3rd phase of global mmWave commercialization with “26GHz market”

China, India, Europe being part of 26GHz market (3GPP n258 band)

Fixed wireless access

Urban cities, suburban towns, rural villages

Bridge digital divide

Indoor /outdoor venues

Stadiums, Shopping malls, Busy streets, music venues

Transportation hubs

Train terminals, subway stations, airports

Best Quality of Experience in high-density areas

Indoor enterprises

Offices, auditoriums, education campuses

Free up mobility and power hybrid work

Industrial IoT

Factories, warehouses, logistic hubs

Unleash Industry 4.0

5G smartphones

PCs

170+

5G mmWave devices launched or announced by 65+ vendors

Source: GSA, Dec. 2022

Hotspots & IoT

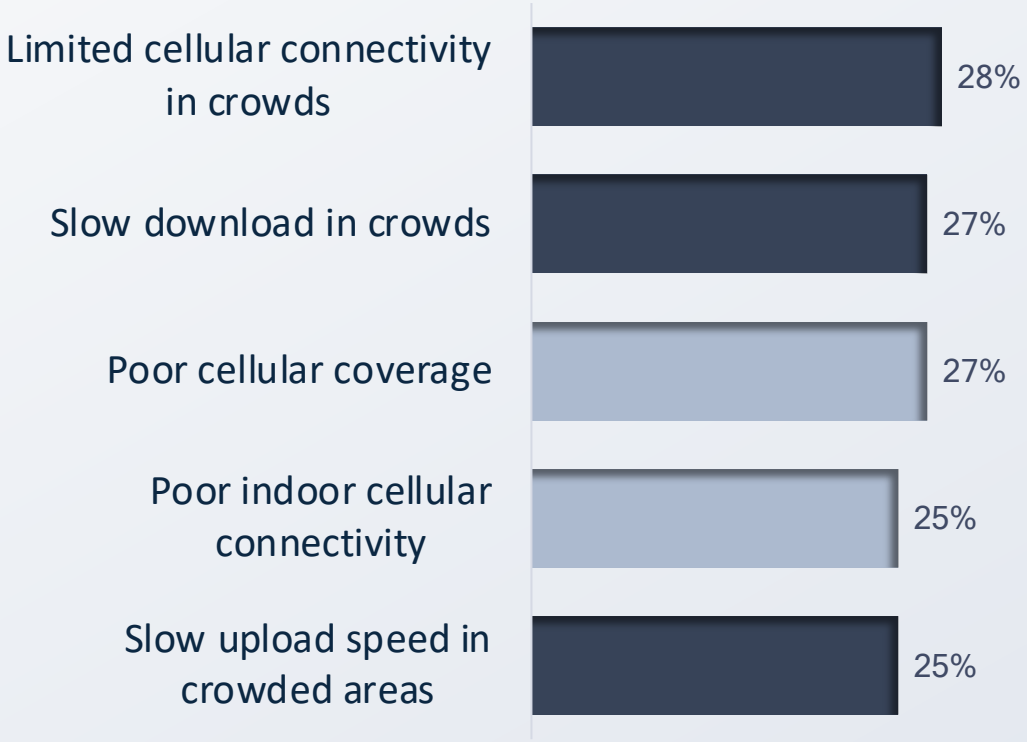
IP camera

CPEs

Modules

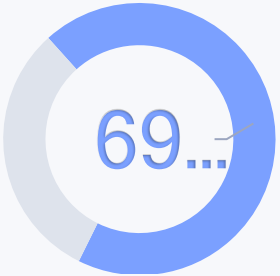
Expanding breadth, availability of 5G mmWave devices

3 out of 5 top connectivity pain points related to crowded areas



Pain points drive interest in 5G mmWave Service

Connectivity Issues
At least weekly in crowded areas



Will pay a premium for 5G Enhanced Service

76%

Screening Requirements:
Min 50% experience cellular issues at least a few times a year

Source: Global consumer survey conducted by Qualcomm Technologies, Inc.

5G mmWave + mid-band = best possible QoE wherever people are

5G mmWave can deliver more uniform user experiences even in congested network

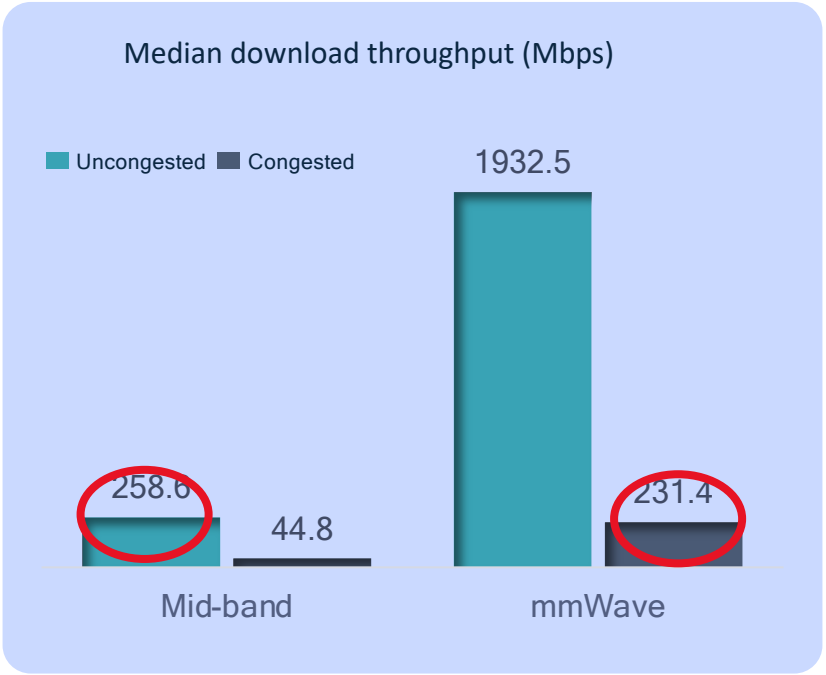
5G mmWave delivers on the promise of extreme capacity and blazing-fast speeds under heavy network loads


Stadiums


Train Stations


Indoor malls


Outdoor hot zones



Source: https://www.rootmetrics.com/en-US/content/mmwave-cutting-through-congestion

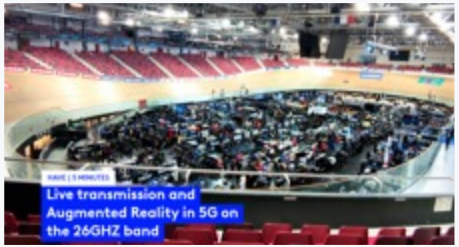
5G mmWave in Europe

TIM
Italy

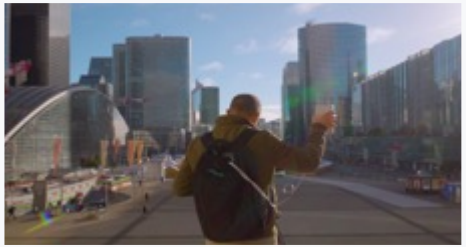
City of Tampere
Finland

SNCF Rennes
France

University of Dresden
Germany



France Television
France



Paris La Defense
France

Dorset Council
UK

Telefonica, Barcelona
Spain

Detailed content available at Financial Times' Waves of Change webpage (except Telefonica example)

A mature ecosystem

1. Commercial in all parts of the world
2. Mature device and infrastructure ecosystem
3. Subscribers want more capacity in crowded locations
4. 5G mmWave is the cheapest solution to cope with it
5. More to come for consumers and businesses

mmWave activation
TIM (Pompeii, Italy)

Thank you

Snapdragon

Follow us on:

For more information, visit us at:

snapdragon.com & snapdragoninsiders.com

GSMA

5G Futures Summit

Keynote:
mmWave Opens New Digital Channel through Second Wave of 5G

Hu Kaiwei
Deputy GM of RAN MKT
ZTE Corporation

mmWave Opens New Digital Channel through Second Wave of 5G

Hu Kaiwei

Deputy GM of RAN MKT, ZTE Corporation

2023.6.30

mmWave to fulfill more 5G commitments in second wave of 5G

2.844 million
5G gNBs in China

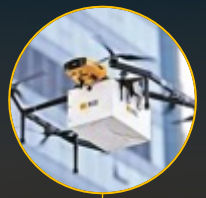
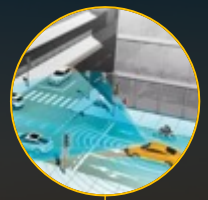
17.26 G
Mobile Internet DOU

740+ Million
5G UE shipments

16,000
5G virtual private networks

—*Source: MIIT, China*

Full spectrum of Sub6G moving towards 5G, rapidly forming large-scale 5G coverage; 100MHz system bandwidth, facing challenges under higher service requirements.

XR/3D Auto Stereoscopy	Machine Vision	Low-altitude economy	V2X
			
Edge rate >100Mbps Latency <20ms	Large UL 100~300Mbps Latency <=1ms	Large UL~50Mbps High-precision positioning	UL rate >60Mbps Accuracy<1m, five “9” reliability

Large bandwidth-> 10G experience | **Low latency-> 1ms** | **Narrow beams-> High-precision positioning** | **High integration-> Light-weight devices**

The mmWave technology improves network capabilities, leading to service upgrade and driving more new services.

Phased approach of mmWave technology to promote 5G innovations

Key technologies of mmWave

Flexible frames	Large-scale antennas	Beam management	Ultra-dense networking
URLLC	High-precision positioning	IAB, FWA	

mmWave1.0

- 100MHz
- 2 channels
- 512 antenna arrays
- EIRP 62dBm

FWA Home Wireless Broadband

mmWave2.0

- 100/**200M**Hz
- **4** channels
- **768** antenna arrays
- EIRP **65dBm**

Enhanced eMBB, 10G experience

mmWave3.0

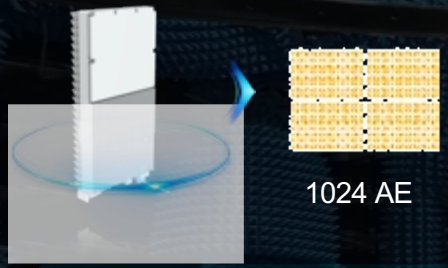
- 100/**200M**Hz
- **8** channels
- **1024** antenna arrays
- EIRP **72dBm**
- **Diversified** equipment types
- **SA networking**

New services like low-altitude perception, V2X

Chip development promotes iterative evolution of equipments.
Domestic mmWave construction can start from high-standard 3.0 SA networking and high-quality commissioning.

ZTE launches indoor and outdoor mmWave equipment to accelerate industrial development

World's first 1.6 GHz mmWave macro station



Ultra-broadband & ultra-large capacity

OBW **1.6GHz** industry's largest bandwidth
25Gbps+ super large cell capacity

Ultra-large antenna scales

Enhanced coverage, up to **10~15**Km
Sensed positioning with accuracy up to sub-meter level

Innovative intermediate frequency (IF) pooled mmWave micro station

Innovative IF pooling
16 radio heads per BBU multi-header management
Flexible deployment to meet high capacity requirements

Enhanced coverage

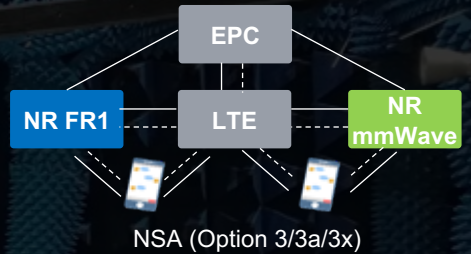
Multiple dAAUs cover the same terminal to improve the stability

Simplest two-layer architecture
2L&2kg lightweight and easy expansion
35W/radio head, low energy consumption

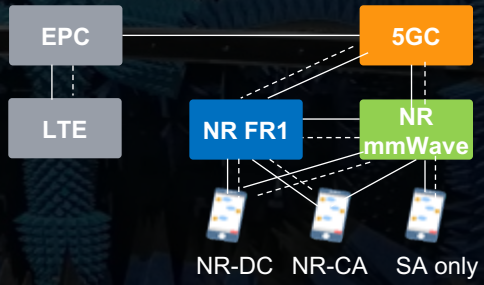
Joint management of beams

Interference reduction, handover delay reduction, and mobility performance improvement

Capable of multiple networking architectures



NSA (Option 3/3a/3x)



Innovative design of new-platform base stations and SA networking architecture for extreme mmWave performance

RIS technology helps extend mmWave coverage

High mmWave bands, weak diffraction, coverage holes for hotspots coverage

Band	Common glass	Concrete	Wood Log	Tree loss	Rain loss	Human body loss
2.6G	2.5	15.4	5.1	6.23	0	2-6
3.5G	2.7	19	5.27	7.67	0	3-7
26G	**7.2**	**109**	**7.97**	**16.46**	**1.57**	**9-13**

Comparison of different material penetration losses (dB) in each frequency band

RIS

Passively adapt to wireless channels → Self-adaptive wireless channel

Outdoor coverage holes

Indoor coverage from outdoors

① Electromagnetic metamaterials
②Phase control components
③Intelligent algorithms

Controllable reflection of wireless signals

Intelligent reconstruction of wireless environment

Static RIS → Collaboration of gNB and RIS, better meeting wireless communication requirements

RIS and mmWave base stations coordinative beamforming to achieve seamless coverage in hotspots

2,058 Mbps

Average rate of network in Shanghai
@400MHz , 2CC
UE: Qualcomm X65
CPE

RIS enhances mmWave coverage and capacity, achieving continuous network coverage.

mmWave’s Large Bandwidth Backhaul Helps Vehicle-Ground System Realize the Ultimate 5G Network for Dual-Use

Full tunnel coverage for Shanghai Metro Line 4

Two sets of mmWave AAUs for tunnel backhaul at each station

mmWave backhaul terminals in carriage + vehicle-mounted indoor distribution system

High-speed large-capacity mmWave backhaul

800MHz bandwidth, achieving **10Gbps+** backhaul capacity

Industry-first vehicle-mounted minisite

Simplified Architecture

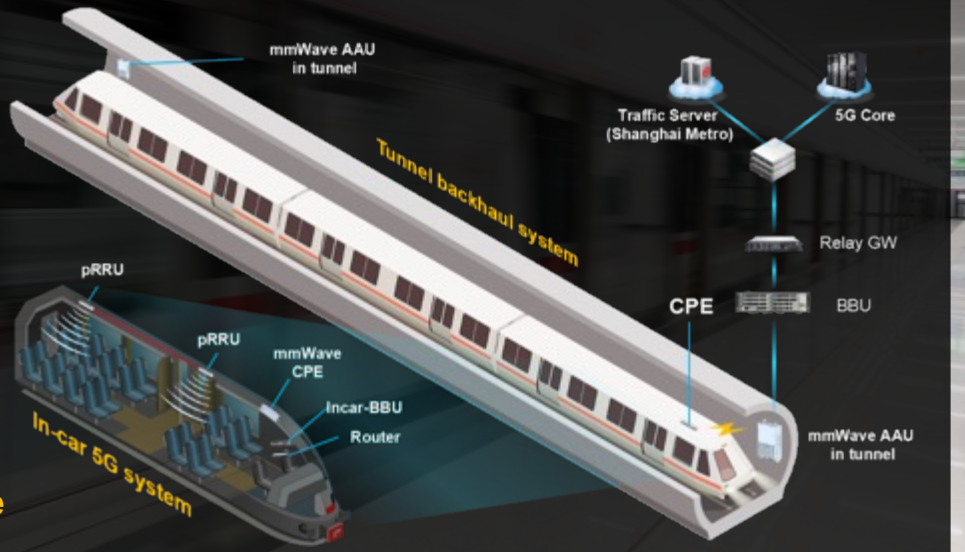
BBU+Qcell **2-layer architecture**

Applicable for **90%+**metro-carriages

Gbps+ User Experience

Avoiding penetration loss, improve **10x** performance.

Stable **over 1Gbps** data rate of users’ experience.



Ultra-large Capacity

Breaking traditional tunnels’ leaky cable mode

One Network Dual-use

Seamless users’ experience for ToC passengers

Intelligent operation and management for ToB Metro

mmWave Integrated Sensing, Communication and Computing, Building Intelligence for Low Altitude Domain

5G Perception

- Sub-meter sensing accuracy
- >1 km sensing distance
- Ubiquitous sensing

5G Communication

- Larger uplink data rate
- Lower transmission delay
- Higher altitude coverage

Low Altitude Sensing

China's low-altitude UAV supervision and regulation market size will exceed RMB 33 billion in the next 3-5 years.

Low altitude sensing

High speed railway boundary

Power grid

Industry-first mmWave based gNB's low altitude sensing was verified in Shanghai in July, 2022.

UAV Logistics

It is estimated that by 2024, the market size of China's UAV logistics will hit about RMB 30 billion.

UAV food delivery

UAV express

ZTE, Guangdong-Hong Kong-Macao Greater Bay Area Digital Economy Research Institute,China Unicom, Skyvtol

Industry-first mmWave's "integrated sensing, computation, control and communication" low altitude UAV test was performed at Shenzhen in May, 2023.

mmWave Integrated Sensing, Communication and Computing: Vehicle-road Collaboration Opens up Digital Intelligent Travel

SHAPING DIGITAL INNOVATION | ZTE

vRSU solution based on gNB with enhanced computing

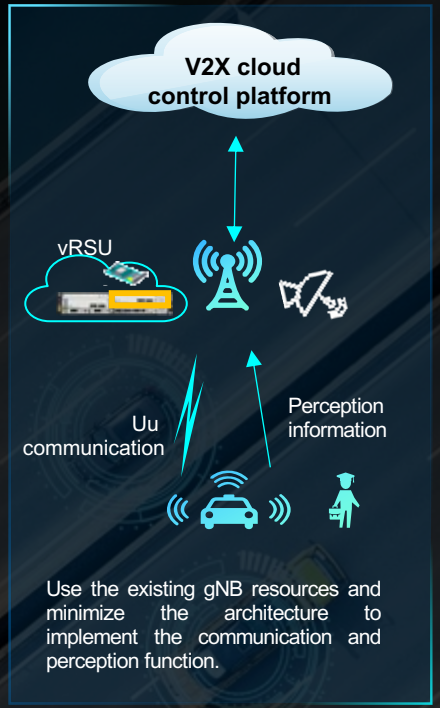
Uu interface added in road-vehicle collaboration

The vRSU computing power gNB and the roadside intelligent gateway work together to analyze roadside sensing information.

Integrated sensing communication & computing based on gNB with enhanced computing

One network for dual-use

And integrated sensing and computation



Use the existing gNB resources and minimize the architecture to implement the communication and perception function.

ZTE mmWave + Vehicle-road collaboration

Enables intelligent vehicle connection

mmWave & RIS

Massive MIMO and RIS **ensure high-precision sensing** for 5G Systems.

Sensing verification based on **mmWave gNB** of vehicles and pedestrians in Shanghai in 2022

NodeEngine Computing power gNB

The industry's only computing gNB provides **powerful real-time computing power** for the perception computing platform.

Decimeter

Distance accuracy

>1km

Sensing distance

0.1km/h

Speed accuracy

Working with Partners to Build mmWave New Digital Channels

@Tokyo

- Real-time transmission of 4K videos
- Verify the **real performance of mmWave networks in dense urban areas**

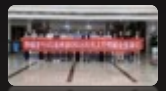
2018

2020

@Zhangjiakou

- The most complete commercial equipment IOT verification
- **Stable DL 1.5Gbps+** @400MHz, with remote 1km+

2021.5



@Shanghai

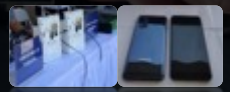
- **World-first** 5G mmWave **1D3U large uplink** lab test
- Single UL user **960Mbps+**

@Shanghai

mmWave **RIS test** completed, mmWave weak coverage enhanced

2021.6

- **The world's first 1D3U** large-uplink multi 8K video
- **The world's first** mobile phone large uplink test



@Huairou

2021.8

@Huairou

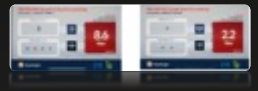
First to complete the NR-DC test, with the single-UE downlink peak rate 2.2Gbps, the highest in the industry

2021.9

2021.11

NR-DC , 256QAM Single UE **8.2Gbps,** the highest in the industry

@Huairou



@Thailand

Together with AIS and Qualcomm, single-UE's downlink peak rate **8.6Gbps,** uplink peak rate **2.2Gbps**

2022.3

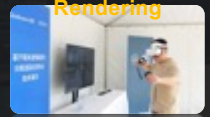
@Huarou

Together with Qualcomm in 5G **mmWave SA networking**: Downlink peak rate of a single UE **7Gbps** and uplink peak rate **2.1Gbps**.

2022.9

- Launched the world's first **1.6GHz** bandwidth mmWave AAU
- Single cell's capacity is **25Gbps**

2023.3



@Huairou

Together with **Qualcomm**, Xiaomi and B&M to demonstrate two major mmWave applications:
8K HD video big uplink real-time transmission
- **Separated XR Rendering**

2023.5

THANK YOU

MWC
GSMA

5G FUTURES SUMMIT

Thank you

GSMA Programme

GSMA

GSMA Intelligence

MWC
GSMA

UP NEXT

5G FUTURES SUMMIT

Session 2: **Unlocking the value of 5G-Advanced**

10:45 – 12:20

GSMA Programme

GSMA