



**Spectrum sharing, Overview and new approaches**

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**Subject: Spectrum sharing, Overview and new approaches**

Dear Sir/Madam,

Huawei welcomes the opportunity to make this submission to the Australian Communications and Media Authority (ACMA) in response to its "Spectrum sharing, Overview and new approaches", consultation paper.

Huawei appreciated the ACMA holding a spectrum tune-up event on 28<sup>th</sup> August to discuss new and emerging approaches to sharing spectrum and their suitability for Australia. Huawei also thanks and commends the ACMA for continually striving to be effective in planning and managing our national spectrums.

A new approach to spectrum sharing could become a cornerstone at our national spectrum policy to facilitate future sharing solutions in achieving further efficient use of spectrum, and a way of meeting the needs of all spectrum users. Huawei is eager to contribute in future collaborations with the ACMA in the development of spectrum sharing policies and regulatory work programs.

Please do not hesitate to contact us if you have any queries regarding our points in this submission.

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## Spectrum sharing, Overview and new approaches

### EXECUTIVE SUMMARY

The continued rise in mobile data traffic and demand for 5G like carrier grade of services require mobile network operators to hold significant amounts of spectrum.

We believe that the innovation in technologies such as next generations' mobile connections, robotics and automation, artificial intelligence and machine learning, space launch, long-lasting batteries, etc., will cumulatively stimulate many new and diverse applications. There will be a constant increase in demand for radio spectrums from a wide range of commercial and governmental services. With limited radio spectrums, we admit that there is a need for an updated spectrum strategy on how the radio spectrum will be used and managed for the next decades.

Huawei agrees with the ACMA that spectrum sharing is a fundamental component of effective spectrum management and is a key tool in maximising the overall public benefit.

We also emphasise that the need for an exclusive licence for mobile broadband service cannot be supplanted by non-traditional spectrum sharing methods if the adopted sharing frameworks are not reliable and serviceable. Without clear interference protection rules and incentives, both mobile carriers and Tier 1 users will resist to sharing.

Huawei also noted the ACMA's objectives for this paper as summarised below:

- To explore how these shared access models might potentially improve the utility of spectrum in Australia.
- To discuss how the ACMA might balance regulatory, licensing structures and type of technology.
- To provide examples of sharing arrangement (Licensed Shared Access<sup>1</sup> LSA and Citizens Broadband Radio Service<sup>2</sup> CBRS), developed in Europe and in the United States, but does not explicitly endorse any sharing arrangement.

Huawei appreciates the ACMA for being cautious and being open to other means by stating "The non-traditional sharing approaches stated at its paper, may not be always the most appropriate spectrum management to any given set of circumstances."

We thank the ACMA for its efforts and in-depth study done on this subject, in making a diligent consideration as well as beginning to collect views from industry stakeholders about new emerging spectrum sharing approaches.

### OUR PRELIMINARY VIEWS AND RECOMMENDATIONS

- Spectrum sharing framework is to be technically and commercially feasible for both incumbents and potential new users, ensuring reliable, guaranteed access and sufficient quantity to spectrum users. It is also to allow long-term investment and to enable technology evolution.
- Spectrum sharing plan for mobile broadband service is to be done carefully where it is in-demand by the carriers and where it is under used by the incumbent users.

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<sup>1</sup> LSA repository is a knowledge base of incumbent users' technical and operational parameters and required protection requirements, including registered future use of incumbent requirements. The repository is dynamically updated to reflect the continuously changing environment. A LSA controller can connect many LSA repositories from multiple LSA licensee networks. New users seeking access would require a licence before shared access to the band is permitted. (See more details at references given in the ACMA's paper, "Spectrum sharing, Overview and new approaches", August 2019.)

<sup>2</sup> Citizens Broadband Radio Service (CBRS) sharing framework consists of three (3) tiers; 1. Incumbent Access (IA), 2. Priority Access (PA), 3. General Authorised Access (GAA) for sharing spectrum.



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- Spectrum sharing arrangement should not be considered at overly fragmented bands which require complex rearrangement and can undermine international spectrum harmonisation.
- Spectrum sharing is to be a complementary approach to an exclusive licensing system. Sharing should not, however, replace the need to clearing the band in allocating to mobile broadband service.
- Complex sharing framework may make a band unsuitable for 5G and less desirable to mobile carriers.
- Spectrum sharing is to be 'bidirectional', with federal entities granted access to non-federal and other users on a shared basis as well as the other way around.
- Spectrum sharing requires a regulatory framework that encourages sharing and provides incentives to incumbents to release or share their spectrums.
- A network slicing is to be considered as one of the tools to help deliver the spectrum sharing objectives.
- Funded trials and proof of concepts are to be conducted with participation from all stakeholders (incumbent users, regulator, new potential users, network carriers, equipment vendors, device vendors, spectrum brokers) with clearly defined share of responsibilities and collaborations.

### Dynamic Spectrum Access (DSA) and Dynamic Spectrum Sharing (DSS)

The Citizen Broadband Radio Service (CBRS) developed in the United States (US), and the Licensed Sharing Access (LSA) developed in Europe, are new approaches to spectrum sharing (also a focus of this paper) and are often collectively referred to as Dynamic Spectrum Access (DSA).

It is important to note and to clarify, however, to avoid misunderstanding the differences between Dynamic Spectrum Access (DSA) with Dynamic Spectrum Sharing (DSS).

Dynamic Spectrum Sharing (DSS) is a Radio Access Network (RAN) feature for sharing spectrum among cellular technologies such as 3G, 4G and 5G. This intelligent algorithm has been developed by radio base station equipment vendors including Huawei and Ericsson. This key product feature is used to allow an existing mobile network carrier to operate 5G New Radio (NR) and 4G LTE simultaneously.



## **CONSULTATION QUESTIONS AND OUR RESPONSES**

- 1. Given current momentum in international markets and opportunities for other sharing models offered by 5G technologies, is it timely to develop a more detailed consideration of spectrum sharing opportunities in Australia?**

### Huawei's response:

We appreciate the ACMA for providing spectrum sharing initiatives and references that are being tested and considered internationally.

It is essential that the ACMA carefully considers which band(s) and which framework should be suitable for sharing if a non-traditional spectrum sharing model is going to be adopted in Australia in order to ensure it is innovative, feasible and attractive for incumbent users and new seekers.

The Global System for Mobile Communications (GSMA) 5G Spectrum Public Policy Positions paper<sup>3</sup> was released in July 2019 and has commented its position as "Setting spectrum aside for verticals in priority 5G bands (that is, 3.5/26/28 GHz) could jeopardise the success of public 5G services and may waste spectrums. Sharing approaches like leasing are better options where verticals require access to spectrum".

Where an exclusive spectrum licence with traditional spectrum sharing approach is unfeasible and there are no other reasonable alternatives, this non-traditional approach for sharing spectrum could then be considered as last resort.

Thus, in our opinion, the ACMA should first identify the potential sharing band(s) before developing a more detailed consideration of spectrum sharing in Australia. This proposed sharing band must be globally harmonised for ecosystem availability, and must also be useable in sufficient quantities and qualities at areas and times needed by new users.

The ACMA could observe the first preparation meeting for WRC-23, following immediately after the conclusion of WRC-19 on 22 November 2019. This meeting will identify the next 5G key candidate bands, satellite bands and other bands for new areas. This will be important input for the ACMA and concerned industries to examine details of issues, challenges and opportunities in each of the low, mid and high frequency bands.

As we move into the era of 5G and the future connected society, we anticipate the shape of spectrum landscapes will change, and we thank the ACMA for liaising with industry stakeholders in timely for what needs to be done in relation to spectrum sharing to ensure the required spectrum will be made available for both incumbents and new users in each of these International Mobile Telecommunications (IMT) frequency ranges.

- 2. Are there recent developments in sharing techniques that industry and the ACMA should be aware of?**

### Huawei's response:

We noticed that further development for spectrum sharing is now strongly emphasised and included as a key agenda under the mainstream work items for European spectrum regulations.

Radio Spectrum Policy Group<sup>4</sup> (RSPG) established a European Spectrum Strategy working group at the beginning of 2018 with an objective to develop discussions on long-term strategies and issues

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<sup>3</sup> <https://www.gsma.com/spectrum/wp-content/uploads/2019/09/5G-Spectrum-Positions.pdf>

<sup>4</sup> High-level advisory group that assists the European Commission in the development of radio spectrum policy

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for Europe. The RSPG members recently drafted a report on European Spectrum Strategy<sup>5</sup> (Document RSPG19-031) in September 2019. They have identified six (6) themes, namely:

- Meeting the needs of all spectrum users;
- Harmonisations- equipment, standard, spectrum;
- Receivers and standards;
- Innovations;
- Sharing; and
- Role of market.

Interestingly, this draft has a vision of a new mind-set toward spectrum sharing at updated LSA approaches. It's vision include- a) Changing the mind-set of all stakeholders for an exclusive use; b) Changing the assumptions of clearing a band for awarding national licences; c) Promoting studies that focus on sharing and co-existence as long-term solutions; d) Promoting the benefits of developing new sharing mechanisms, Industry to come up with innovative solutions and to work with the spectrum managers; and e) Increasing robustness and sensitivity of transmitter and receiver to facilitate a better sharing and more supplicated co-existence.

The RSPM also released the “Work Programme for 2020 and beyond” (Document RSPG19-029) and that outlined the following work items to discuss with its members at next month in October at Brussels.

- Spectrum Sharing – pioneer initiatives and bands (Draft opinion completion: January 2021)
- Additional spectrum needs and guidance on the fast rollout of future wireless broadband networks
- Role of Radio Spectrum Policy to help combat *Climate Change*
- “Good offices” to assist in bilateral negotiations between member states
- Peer review and member states cooperation on authorisations and awards
- World Radio Congress (WRC) - RSPG's opinion report on the outcome of WRC-19 and preparation for WRC-23 agenda items.

Other recent and interesting developments in spectrum sharing allocation:

- United States (US):

There is a Federal Communications Commission (FCC) requirement to make spectrum available for 5G at mid-band frequencies. Three (3) of America's national carriers have no mid-band. There is no available unused mid-band spectrum for the FCC to allocate either.

The FCC proposed<sup>6</sup> the 3700-4200 MHz frequency block, with a total of 500 MHz bandwidth to be allocated to 5G services in July 2018. (Note: This proposal is different to the other FCC's adoption of a three-tiered spectrum sharing plan with CBRS arrangement at the adjacent 3550-3700 MHz frequency block, a total of 150 MHz bandwidth in April 2015.)

In February 2019, the C-Band Alliance<sup>7</sup> (CBA) then offered a voluntary, market-based plan to clear 200 MHz (out of their 500 MHz block holding) for 5G wireless while fully protecting the television and other current C-band customers. The 20 MHz would also be utilised as a guard band between mobile services and satellite services.

The plan is driven by the economic incentive provided by the market opportunity for the satellite operators to receive proceeds for clearing the spectrum. The proceeds include:

<sup>5</sup> <https://rspg-spectrum.eu/rspg-opinions-main-deliverables/>

<sup>6</sup> <https://www.fcc.gov/document/fcc-proposes-expand-flexible-use-mnd-spectrum>

<sup>7</sup> C-band Alliance is the group of satellite operators including Intelsat, Telesat, SES, and Eutelsat. <https://c-bandalliance.com/>

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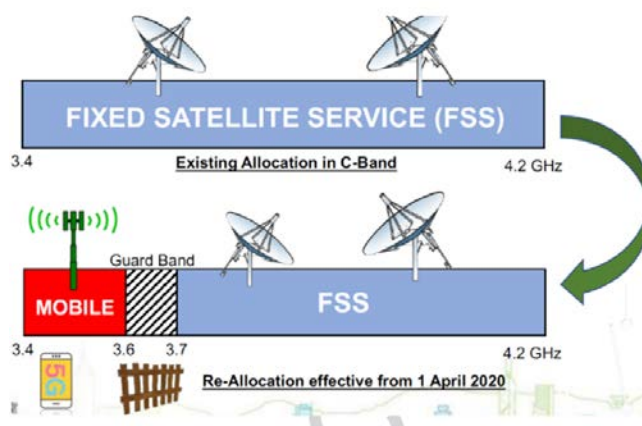
- Incentives for the satellite operators to order new satellites for serving customers in the remaining 300 MHz frequency block;
- Incentives to purchase and install filters; and
- Satellite operators will cover transition costs for their customers.

The FCC is yet to approve this plan proposed by CBA at the time of this report.

- Hong Kong (HK):

Office of Communication Authority (OFCA), the Hong Kong's spectrum regulatory administration announced a provision on changing the allocation of radio spectrum in the 3400-3700 MHz band from fixed satellite service (space to earth) to mobile service in March 2018, to be effective from April 2020.

The guard band 100 MHz is used to protect satellite service in 3700-4200 MHz band. In addition to the guard band, the satellite systems operating in 3700-4200 MHz are required to upgrade to conform a set of baseline parameters. This includes installing band-pass filters to suppress the out-of-band emissions to not interfere mobile services operating in 3400-3600 MHz range.



The above examples in the US and HK, as well as one of the examples given by the ACMA in a paper for the United Kingdom (UK), use a traditional spectrum sharing approach which specifies required frame structure (if no guard band) and, out-of-block emissions for Active and Non-Active Antenna System base stations in managing interference and protecting incumbent users.

### 3. What are the (potentially new) use cases that might benefit from secondary or tertiary access to spectrum and who benefits?

#### Huawei's response:

We will not comment on this question. Please see our response to Question 7.

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### 4. What are the potential challenges/impediments to the introduction of DSA in Australia—technical, industry capability, licensing and regulatory frameworks?

#### Huawei's response:

As already analysed by the ACMA, the sharing development CBRS in the US will allow new entrants (unlicensed 4G LTE mobile services) to access the spectrum whilst incumbents remain 1st tier and are protected. In this CBRS arrangement, we could achieve an increase in spectrum utilisation efficiency, however, we would also need to rely heavily on the actual incumbent system's operational and technical parameters. We note that the current CBRS sharing arrangement has challenges and risks to network and service providers in delivering IMT-2020 use cases' requirement and is, in other words, not practical for 5G mobile broadband services.

With a range of tight regulatory frameworks, the Licensed Shared Access (LSA) may be considered for implementation depending on our nation's circumstances. It is important to acknowledge the difficulties that arise at regulatory framework in even two (2) tiered sharing in the spectrum before considering three (3) or more tiered sharing.

A conference paper<sup>8</sup> published in November 2018 by Seppo Yrijola has summarised (shown below) how spectrum authorisation concepts and their key attributes would look like from the business modelling perspective.

Scenarios/ Attributes	Individual authorization (Licensed)	Shared	General authorization (unlicensed)
Success factors	Spectral efficiency	Spectrum management	Interference management
Customer experience	Guaranteed	Predictable	Unpredictable
Control points	Mobile operators	Spectrum brokers	Device manufacturers
Business models	Traditional access; Connectivity as a Service	Micro-operator; Hosting	Innovative OTT

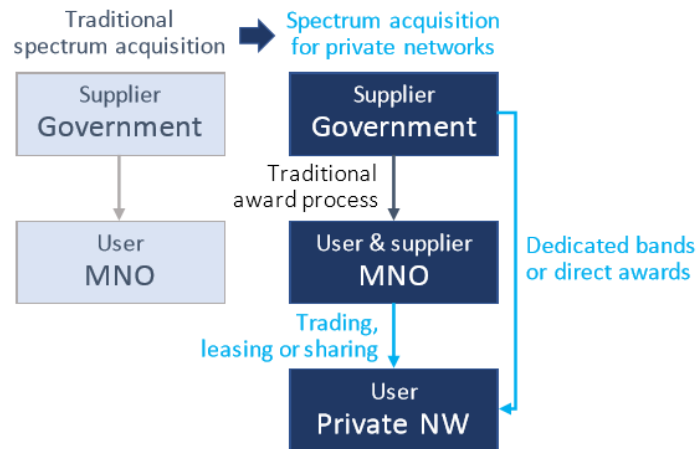
(Source: From Research Gate's paper, "Assessing the feasibility of the US CBRS concept based business models and implications for access and value of spectrum". It can be accessed at link below.)

The same paper also went on to say that 5G local high-quality wireless networks could be deployed on the bands either traded or leased from mobile network carriers when a dedicated award is not possible.

<sup>8</sup> <https://www.researchgate.net/publication/328982107>



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Huawei does not have a complete answer in this submission paper for overcoming the challenges in terms of technical area, industry capability, licensing and regulatory framework, for the introduction of DSA in Australia. We refer our industry colleagues to some documents<sup>9 10 11 12 13 14 15 16 17</sup> relating to understanding the implications of spectrum sharing.

5. **Facilitating spectrum access (e.g. monitoring, control, reporting and assignment) logically necessitates involvement from both government and industry. Are there any early thoughts on what an appropriate industry/government balance might look like? How might the ACMA facilitate shared spectrum access? How might the ACMA address this?**

### Huawei's response:

We will not comment on this question.

<sup>9</sup> D. Guiducci et al., "Regulatory Pilot on Licensed Shared Access in a Live LTE-TDD Network in IMT Band 40," *The IEEE Transactions on Cognitive Communications and Networking (TCCN)*, vol. 3, no. 3, Sept 2017.

<sup>10</sup> 3GPP TR 38.889 V0.0.1: "Study on NR-based Access to Unlicensed Spectrum", 2018.

<sup>11</sup> M. Matinmikko, S. Yrjölä, and M. Latva-aho, "Micro operators for ultra-dense network deployment with network slicing and local spectrum micro licensing," *IEEE VTC Spring 2018. The 2018 IEEE 87th Vehicular Technology Conference, Porto*, 3-6 June 2018.

<sup>12</sup> F. Beltran, "Accelerating the introduction of spectrum sharing using market-based mechanisms," *IEEE Communications Standards Magazine*, vol. 1, no. 3, pp. 66-72, 2017.

<sup>13</sup> ETSI, "Feasibility study on temporary spectrum access for local high-quality wireless networks," *ETSI TR 103 588*, 30 p, Feb. 2018.

<sup>14</sup> FCC, "The Second Report and Order and Order on Reconsideration finalizes rules for innovative Citizens Broadband Radio Service in the 3.5 GHz Band," *FCC 16-55*, 2016.

<sup>15</sup> M. Matinmikko, M. Latva-aho, P. Ahokangas, and V. Seppänen, "On regulations for 5G: Micro licensing for locally operated networks", *Telecommunications Policy*, in press.

<sup>16</sup> T. Kokkinen, H. Kokkinen, and S. Yrjölä, "Spectrum broker service for micro-operator and CBRS Priority Access Licenses," In: *proceedings of 11th International Conference Cognitive Radio Oriented Wireless Networks and Communications (CROWNCOM)*, P. Marques et al. (Eds.): CROWNCOM 2017, LNICST 228, pp. 1–10, 2018.

<sup>17</sup> G. Petersen, "Licensed Shared Access pilot in the Netherlands. CEPT Frequency Management Working Group Meeting Document. Prague." [Online]. Available: [https://cept.org/Documents/wg-fm/33535/5-3\\_pmse-lsa-in-the-band-2300-2400-mhz-nl](https://cept.org/Documents/wg-fm/33535/5-3_pmse-lsa-in-the-band-2300-2400-mhz-nl), 2016.





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- 6. What is the relevance of DSA examples such as the US Citizens Broadband Radio Service (CBRS) arrangements to the Australian spectrum environment? Are there other or lower cost alternatives to help inform access control and assignment systems of incumbent usage in a timely manner?**

Huawei's response:

We will not comment on this question.

- 7. Under a multi-tier DSA approach:**

**Tier 1 (highest priority or incumbent) users would be expected to share spectrum with lower tier users when not being utilised. Are there any specific licensing and/or regulatory arrangements that might incentivise the tier 1 users to release unutilised spectrum for lower-tier access?**

**Tier 2 and 3 users need to vacate spectrum (regardless of their service type or communication urgency) for tier 1 users to operate seamlessly. Do we see potential services/service types in Australia who would fit the criteria of second or third tier users? What are the incentives to adopt a conditional (lower priority) spectrum than an unconditional (full access) spectrum?**

Huawei's response:

The ACMA may consider giving the right to incumbent Tier 1 users for sharing their spectrum voluntarily through a commercial agreement with a new user (Tier 2) to use the spectrum where and when the incumbent is not using it. The Tier 2 usage right should also be specified in the Tier 1 spectrum licensing conditions. This way, Tier 1 licence holders are aware that spectrum sharing is possible to them under conditions and factoring this into their business plans. This will also assist Tier 1 licence holders with a remuneration for sharing their spectrum, especially if they have paid to access that spectrum.

As we understand the DSA framework, Tier 2 and 3 users would need to vacate the spectrum, regardless of their types of service, for the entry of Tier 1 users and to allow them to operate seamlessly.

There is no doubt that there will be some types of services which could compromise the quality of service to their end users to use the spectrum as Tier 2 and 3 user. It is difficult to predict exactly at this point in time as to what types of services can potentially benefit in Australia.

Huawei, however, believes that the innovation in technologies such as next generations' mobile network connectivity, robotics, artificial intelligence, space launch, long-lasting batteries, etc., could stimulate many new and diverse applications where business models and industry's investment are attractive.

The benefits of this, as we progress to the development of the spectrum sharing framework, as compared to using an existing licensing regime such as class licence, are not clear to us at this point. We encourage the ACMA to provide as much clarity as possible during the planning work associated with this.

We are also unsure as to whether national mobile carriers will be interested to hold licensed spectrum rights as a Tier 2 user with the above DSA principles. We ask if we could afford to take a risk in mission critical services. As submitted in our response to the ACMA for "Planning of the 3700-4200 MHz band, Discussion paper", the majority of 5G use cases require very low latency response time, 99.9999% connection availability, high user's throughput and speed.

If we look from another angle, the mobile network carriers are in a unique position as Tier 1 users to leverage additional benefits to all industries from a multi-tier spectrum sharing concept. It is now



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possible to have dedicated virtual sub-networks (the network slices) which will be modelled as Network as Service<sup>18</sup> (NaaS) to different verticals and industries with their diverse use cases. For example, the use of mobile robots in manufacturing has very different requirements to utility meter reading. Mobile network carriers' business models and opportunities are powered by their premium network connectivity and performance. It can also be very attractive to many verticals as they do not require to heavily invest on infrastructure as well as a faster roll out for their services.

As we further examine and develop the approach for spectrum sharing in Australia, we encourage the ACMA to continue following the principles used in current spectrum management programs. They are also consistent with the spectrum management functions set out in the ACMA Act, and have been proven in many effective decisions and outcomes. We refer to the below principles:

- Allocate spectrum to the highest value use (HVV);
- Enable and encourage spectrum to move to its HVV;
- Use the least costly and less restrictive approach to achieving policy objectives;
- To the extent possible, promote both certainty and flexibility; and
- Balance the cost of interference and the benefits of greater spectrum utilisation.

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<sup>18</sup> In the NaaS concept, all network elements from radio access, core network and operation support system including security management and analytics functions can be virtualized and sliced through Network Function Virtualisation (NFV). With the power of programmable function in the Software Defined Networking (SDN), it further customizes for anything as a service (XaaS) solutions for different industries – logistic, automotive, health care, utilities, retail, and etc.



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### **About Huawei**

Huawei is a leading global provider of information and communications technology (ICT) infrastructure and smart devices. With integrated solutions across four key domains – telecom networks, IT, smart devices, and cloud services – we are committed to bringing digital to every person, home and organisation for a fully connected, intelligent world.

Huawei's end-to-end portfolio of products, solutions and services are both competitive and secure. Through open collaboration with ecosystem partners, we create lasting value for our customers, working to empower people, enrich home life, and inspire innovation in organisations of all shapes and sizes.

At Huawei, innovation focuses on customer needs. We invest heavily in basic research, concentrating on technological breakthroughs that drive the world forward. We have more than 188,000 employees, and we operate in more than 170 countries and regions. Founded in 1987, Huawei is a private company fully owned by its employees.

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