MIIT Open Solicitation of Feedback on 5G in the Millimeter-Wave Bands

The Asia-Pacific Satellite Communications Council (APSCC), CASBAA, the Global VSAT Forum (GVF) and the EMEA Satellite Operators' Association (ESOA) (together, the "Satellite Associations") respectfully submit the following comments on the Ministry of Industry and Information Technology's (MIIT) open solicitation of feedback on 5G communications systems in the millimeter-wave (mmWave) bands.[1]

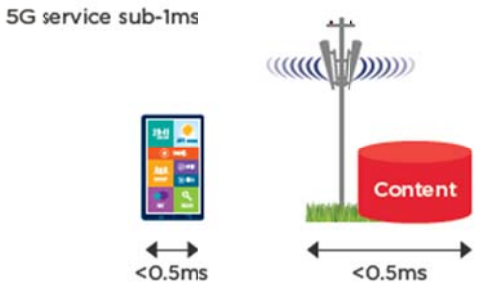
1. The Satellite Associations recommend that MIIT consider the spectrum requirements of all parts of the future 5G ecosystem, and not just the needs of the terrestrial mobile sector.

2. Satellite technologies will play an important role in the future 5G ecosystem, including:

   a. To extend terrestrial 5G networks to places they would not otherwise reach, which is essential for a digitally inclusive society especially in a country as large as China with its significant rural population.

   b. To efficiently support Machine-to-Machine (M2M) / Internet-of-Things (IoT) networks through direct delivery (e.g. connected cars, planes and ships) or backhauling of M2M/IoT data to and from remote locations.

   c. To help terrestrial 5G networks meet the low latency (<1ms) requirements of some of the new 5G applications through efficient multicasting of commonly accessed content to storage caches at multiple 5G base stations.
   While most 5G applications (e.g. Internet of Things) will not have low (<1ms) latency requirements, it is projected that a few, still-emerging applications might (e.g. VR and autonomous driving). According to the GSMA, "any service requiring such a low latency will have to be served using content located very close to the customer, possibly at the base of every cell, including the many small cells that are predicted to be fundamental to meeting densification requirements."[2]



   d. To restore connectivity when existing terrestrial networks have been disabled (e.g. after a natural disaster).

[1] *See* http://zmhd.miit.gov.cn:8080/opinion/noticedetail.do?method=notice_detail_show&noticeid=1781.
[2] *See* GSMA Intelligence, *Analysis: Understanding 5G: Perspectives on future technological advancements in mobile*, at 12-13 (Dec. 2014), https://www.gsmaintelligence.com/research/2014/12/understanding-5g/451/

3. Satellites already play comparable roles in today's 2G, 3G and 4G/LTE networks, and are well placed to continue playing such roles for 5G networks, as more High Throughput Satellites (HTS) in both geostationary (GEO) and non-geostationary (non-GEO) orbits are deployed, and as smaller, more advanced, and lower-cost ground antennas are developed.

4. For satellites to play their role, they will need continued, sustainable access to satellite spectrum. Many HTS satellites have already been deployed in the mmWave spectrum, and many more are planned, and MIIT should try to avoid the spectrum bands that are already in use or that are likely to be used for HTS (and future VHTS) satellite systems.

   a. 26 GHz Band (24.75-27.5 GHz). The 24.65-25.25 GHz band is identified by ITU as the Fixed-Satellite Service (FSS) uplink band intended to feed the 21.4-22 GHz Broadcasting-Satellite Service (BSS) downlink band. The ITU affirmed and expanded this allocation as recently as WRC-12. Without access to this uplink band, the ability to efficiently feed the 21.4-22 GHz band is lost. Satellite operators are just starting to deploy in this band in other parts of the world (e.g. DIRECTV 14 & 15). In the future, it is conceivable that the BSS bands would be used to efficiently multicast content to multiple 5G base stations, as described above. Some HTS systems have also begun to deploy in the 27.0-27.5 GHz band (e.g. Australia's NBN). MIIT should consider either avoiding use of these bands for 5G or ensuring shared use of the band by satellites and 5G mobile services. Sharing is currently being studied by ITU-R TG 5/1 and the results of those studies could require constraints on terrestrial 5G systems.

   b. 28 GHz Band (27.5-29.5 GHz). This band is already extensively used for the latest and next-generation HTS systems around the world, both GEO and non-GEO. Tens of billions of dollars are already invested or planned to be invested in GEO and non-GEO satellite systems at 28 GHz. As a result, all regions at the ITU World Radio Conference 2015 (WRC-15) decided not to study this band for 5G/IMT-2020 at the next World Radio Conference (WRC-19 Agenda Item 1.13). There is no need to examine this band, as there is more than enough other mmWave spectrum under study to meet any realistic 5G spectrum requirements.

   c. 37-42.5 and 42.5-52.6 GHz Bands. Multiple satellite operators have planned next-generation Very High Throughput Satellites (VHTS) using parts of this band, including at least six large constellations of non-GEO satellites, e.g. Boeing, O3b/SES, OneWeb, SpaceX, Telesat, and Theia). The planned VHTS systems will also use parts of the 42.5-52.6 GHz bands for uplinks. MIIT will need to compare the likely spectrum requirements of these future satellite systems and of future 5G mobile systems, and then determine the extent to which each can be accommodated in the available spectrum. At the very least, MIIT should consider limiting its focus to the parts of these bands (37-40.5 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 47-47.2 GHz, 47.2-50.2 GHz, and 50.4-52.6 GHz) that are being studied for 5G/IMT-2020 under WRC-19 Agenda Item 1.13. Sharing studies between future 5G/IMT-2020 and satellite services in the WRC-19 Agenda Item 1.13 bands are underway at the ITU and should be taken into account once concluded. To

the extent that future 5G/IMT-2020 mobile and satellite services are to share the same spectrum, then reasonable sharing conditions based on these studies will need to be developed.

d. Other mmWave Bands. A number of other mmWave in higher frequency bands will be considered for 5G / IMT-2020 mobile services under WRC-19 Agenda Item 1.13, including the 31.8-33.4 GHz (32 GHz), 66-76 GHz (66 GHz) and the 81-86 GHz (81 GHz) bands. The 66 GHz and 81 GHz bands, in particular, are considered very good prospects for international harmonization given their limited existing and planned use by other radio services. The 66 and 81 GHz band in the "high" mmWave bands should yield about 15 GHz of spectrum in contiguous blocks of at least 5 GHz, which could support very wide-band 5G/IMT-2020 carriers. These high mmWave bands should therefore be able to support the development of 5G mobile networks in high-density indoor and outdoor scenarios, such as stadiums, campuses or shopping malls located in urban and suburban areas of China. The use of these bands would also benefit from synergies with WiGig – currently being deployed at 61 GHz – for which chipsets and MIMO antenna systems are already being manufactured.[3]

   The Satellite Associations recommend that MIIT prioritise these lightly encumbered "high mmWave" bands for accommodation of future 5G/IMT-2020. Major Chinese companies such as Huawei have already demonstrated the potential of the high mmWave bands (e.g. at 71 GHz and 81 GHz)[4] to support 5G/IMT-2020 type services. Future 5G user terminals will most likely include multiple radios which support the efficient delivery of various 5G/IMT-2020 services in existing "IMT" frequency bands below 3.6 GHz, high mmWave bands above 66 GHz as well as WIFI (2.4 GHz / 5 GHz) and WiGIG (61 GHz).

Translation Attached

[3] ABI Research, *Mobile and Computing Markets Catapult 60 GHz WiGig into the Mainstream in 2017*, *at* https://www.abiresearch.com/press/mobile-and-computing-markets-catapult-60-ghz-wigig/ (Aug. 2016) (forecasting that 180 million WiGig chipsets will ship to the smartphone market in 2017, with smartphone chipsets accounting for almost half of the 1.5 billion total market shipments by 2021).

[4] *See* Huawei, Press Release, *Telenor and Huawei Jointly Announce First 5G Demo in Norway* (Mar. 30, 2017), *at* http://www.huawei.com/en/news/2017/3/Huawei-Telenor-First-5G-Demo-Norway; *Vodafone, Huawei Reach 20Gb/s speed in 5G Trial* (Jul. 19, 2016), *at* https://www.mobileworldlive.com/featured-content/top-three/vodafone-huawei-reach-20gbps-speed-in-5g-trial/.

Asia-Pacific Satellite Communications Council
Gregg Daffner, President
Daniel Mah, VP Regulatory Affairs
Suite T-1602 Poonglim Iwantplus 255-1
Seohyun-dong, Bundang-gu
Seongnam, Gyeonggi-do
463-862 Republic of Korea
http://www.apscc.or.kr/
gregg@gap-sat.com

CASBAA
Christopher Slaughter, Chief Executive Officer
John Medeiros, Chief Policy Officer
802 Wilson House
19-27 Wyndham Street
Central, Hong Kong SAR
China
http://www.casbaa.com/
john@casbaa.com

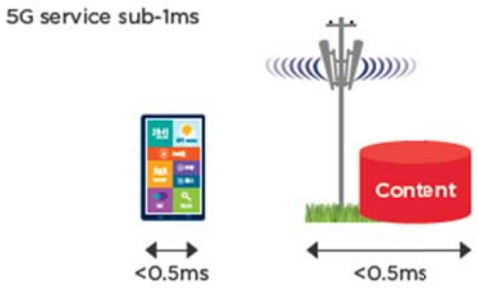
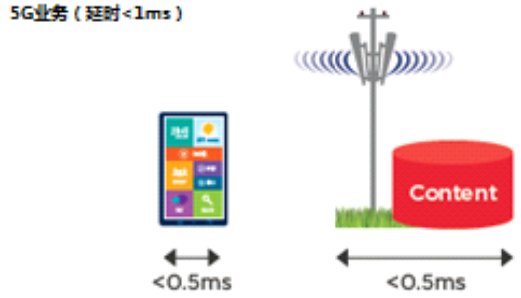
Global VSAT Forum
David Hartshorn, Secretary General
Fountain Court
2 Victoria Sq, Victoria St
St Albans, Hertfordshire
United Kingdom, AL1 3TF
https://gvf.org/
david.hartshorn@gvf.org

EMEA Satellite Operators Association
Aarti Holla-Maini
Secretary General
Bastion Tower, 20th floor
5 Place de Champ de Mars, 1050 Brussels
Belgium
https://www.esoa.net/
sg@esoa.net

Translation

English Text	中文
The Asia-Pacific Satellite Communications Council (APSCC), CASBAA, the Global VSAT Forum (GVF) and the EMEA Satellite Operators' Association (ESOA) (together, the "Satellite Associations") respectfully submit the following comments on the Ministry of Industry and Information Technology's (MIIT) open solicitation of feedback on 5G communications systems in the millimeter-wave (mmWave) bands.[5]	针对贵局发布的《公开征集在毫米波频段规划第五代国际移动通信系统（5G）使用频率的意见》，亚太卫星通信协会（APSCC），亚洲有线与卫星电视广播协会（CASBAA），国际 VSAT 论坛（GVF）和 EMEA 卫星运营商协会（统称"卫星协会"）进行了认真研究和讨论，汇总相关建议如下：
5. The Satellite Associations recommend that MIIT consider the spectrum requirements of all parts of the future 5G ecosystem, and not just the needs of the terrestrial mobile sector.	1. 卫星协会建议工业和信息化部统筹考虑未来 5G 生态系统的整体频谱需求，从而避免仅针对地面移动频谱需求形成单一规划。
6. Satellite technologies will play an important role in the future 5G ecosystem, including:	2. 卫星技术将在未来 5G 生态系统中发挥重大作用，其中包括：
a. To extend terrestrial 5G networks to places they would not otherwise reach, which is essential for a digitally inclusive society especially in a country as large as China with its significant rural population.	a) 作为地面 5G 网络延伸的重要手段，使地面网络覆盖拓展到原本无法达到的区域，这对数字化社会的完整性十分重要，特别是像中国这样幅员辽阔且拥有庞大非城镇人群的国家。
b. To efficiently support Machine-to-Machine (M2M) / Internet-of-Things (IoT) networks through direct delivery (e.g. connected cars, planes and ships) or backhauling of M2M/IoT data to and from remote locations.	b) 有效支持机器到机器（M2M）和物联网（IoT）的数据投递（例如汽车、飞机和轮船的连接），或 M2M 和 IoT 的远端数据回传。
c. To help terrestrial 5G networks meet the low latency	c) 针对部分新的 5G 应用中低时延（<1ms）的需求，通过将经常

[5] *See* http://zmhd.miit.gov.cn:8080/opinion/noticedetail.do?method=notice_detail_show&noticeid=1781.
[5]详见 http://zmhd.miit.gov.cn:8080/opinion/noticedetail.do?method=notice_detail_show&noticeid=1781.

(<1ms) requirements of some of the new 5G applications through efficient multicasting of commonly accessed content to storage caches at multiple 5G base stations. While most 5G applications (e.g. Internet of Things) will not have low (<1ms) latency requirements, it is projected that a few, still-emerging applications might (e.g. VR and autonomous driving). According to the GSMA, "any service requiring such a low latency will have to be served using content located very close to the customer, possibly at the base of every cell, including the many small cells that are predicted to be fundamental to meeting densification requirements."[6]  d. To restore connectivity when existing terrestrial networks have been disabled (e.g. after a natural	访问的内容以多播方式缓存到多个 5G 基站来协助地面 5G 网络满足系统要求。 尽管多数 5G 应用（例如物联网）并没有低时延（<1ms）的需求，但预计此类需求将陆续会在诸如 VR 和自动驾驶等应用中显现。援引 GSMA 的描述，"任何需要低时延的应用，都不可避免地要求其内容存储于用户周边，甚至可能在每一个蜂窝的基站之内，包括旨在满足业务密度要求而建立的关键蜂窝。"[2]  d) 用于地面网络的备份替代方案，应对例如自然灾害等突发情况。

[6] *See* GSMA Intelligence, *Analysis: Understanding 5G: Perspectives on future technological advancements in mobile*, at 12-13 (Dec. 2014), https://www.gsmaintelligence.com/research/2014/12/understanding-5g/451/

[6]详见 GSMA 情报,分析：《理解 5G：未来移动技术的发展前景》第 12 至 13 页（2014 年 12 月）https://www.gsmaintelligence.com/research/2014/12/understanding-5g/451/

disaster).	
7. Satellites already play comparable roles in today's 2G, 3G and 4G/LTE networks, and are well placed to continue playing such roles for 5G networks, as more High Throughput Satellites (HTS) in geostationary (GEO) and non-geostationary (non-GEO) orbits are deployed, and as smaller, more advanced, and lower-cost ground antennas are developed.	3. 卫星在当前 2G，3G 和 4G/LTE 网络中已经发挥了不可或缺的作用，并且随着更多高通量卫星（HTS）在地球同步和非同步轨道上部署以及更加小型化、更先进、更低成本的地面天线的发展，卫星能够在 5G 网络中继续扮演重要角色。
8. For satellites to play their role, they will need continued, sustainable access to satellite spectrum. Many HTS satellites have already been deployed in the mmWave spectrum, and many more are planned, and MIIT should try to avoid the spectrum bands that are already in use or that are likely to be used for HTS (and future VHTS) satellite systems.	4. 为确保卫星继续发挥其作用，卫星频谱的持续可用尤为关键。很多高通量卫星都已经使用了毫米波频谱，并且这一频段也在更多规划中的卫星上进行了配置。因此建议工信部避开在用和规划中的高通量 HTS 卫星（以及未来甚高通量卫星 VHTS）频谱。
a. <u>26 GHz Band (24.75-27.5 GHz)</u>. The 24.65-25.25 GHz band is identified by ITU as the Fixed-Satellite Service (FSS) uplink band intended to feed the 21.4-22 GHz Broadcasting-Satellite Service (BSS) downlink band. The ITU affirmed and expanded this allocation as recently as WRC-12. Without access to this uplink band, the ability to efficiently feed the 21.4-22 GHz band is lost. Satellite operators are just starting to deploy in this band in other parts of the world (e.g. DIRECTV 14 & 15). In the future, it is conceivable that the BSS bands would be used to efficiently multicast content to multiple 5G base stations, as described above. Some HTS systems have also begun to deploy in the 27.0-27.5 GHz band (e.g. Australia's NBN). MIIT should consider either avoiding use of these bands for	a) 26GHz 频段（24.75-27.5GHz） 24.65 至 25.25GHz 频段已经被 ITU 划分为卫星固定业务（FSS）上行频段，用于 21.4 至 22GHz 卫星广播业务（BSS）下行的馈线链路。ITU 于 WRC-12 确定并扩展了这段频率划分，若该上行频段不可用，则 21.4 至 22GHz 频段馈线链路的有效性将会丧失。国际上，卫星运营商正逐渐开始部署这一频段（例如 DIRECTV 14&15）。正如前文所述，可以想象未来很可能使用该 BSS 频段实现向 5G 基站更加有效的内容分发。一些高通量卫星系统已经开始在 27.0 至 27.5GHz 频段进行部署（例如澳大利亚的 NBN），工信部在考虑时应当避免在这些频段使用 5G 通信，亦或确保 5G 移动业务和卫星业务间的兼容性。目前 ITU-R TG 5/1 正在致力于共用研究，研究的结果可能需要针对地面 5G 系统采取一定限制。

5G or ensuring shared use of the band by satellites and 5G mobile services. Sharing is currently being studied by ITU-R TG 5/1 and the results of those studies could require constraints on terrestrial 5G systems.	
b. 28 GHz Band (27.5-29.5 GHz). This band is already extensively used for the latest and next-generation HTS systems around the world, both GEO and non-GEO. Tens of billions of dollars are already invested or planned to be invested in GEO and non-GEO satellite systems at 28 GHz. As a result, all regions at the ITU World Radio Conference 2015 (WRC-15) decided not to study this band for 5G/IMT-2020 at the next World Radio Conference (WRC-19 Agenda Item 1.13). There is no need to examine this band, as there is more than enough other mmWave spectrum under study to meet any realistic 5G spectrum requirements.	b) 28GHz 频段（27.5-29.5GHz）。这一频段已经被全球最新的和下一代的高通量卫星系统广泛应用，包括 GEO 和 non-GEO，涉及的投资总额已经达到数十亿美元。因此 2015 年 ITU 世界无线电大会（WRC-15）的所有区域共同决定不再在下一届世界无线电大会（WRC-19 议程 1.13）中研究 5G/IMT-2020 使用这一频段。鉴于其他在研的毫米波频段已经足以满足任何 5G 频谱现实需求，28GHz 这一段频率可以不用再考虑。
c. 37-42.5 and 42.5-52.6 GHz Bands. Multiple satellite operators have planned next-generation Very High Throughput Satellites (VHTS) using parts of this band, including at least six large constellations of non-GEO satellites, e.g. Boeing, O3b/SES, OneWeb, SpaceX, Telesat, and Theia). The planned VHTS systems will also use parts of the 42.5-52.6 GHz bands for uplinks. MIIT will need to compare the likely spectrum requirements of these future satellite systems and of future 5G mobile systems, and then determine the extent to which each can be accommodated in the available spectrum. At the very least, MIIT should consider limiting its focus to the parts of these bands (37-40.5 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 47-47.2	c) 37-42.5 和 42.5-52.6GHz 频段。很多卫星运营商已经计划将这个频段用于下一代超甚高通量卫星中（VHTS），其中包括至少 6 个 non-GEO 大型星座，例如 Boeing, O3b/SES, OneWeb, SpaceX, Telesat 和 Theia。正在计划的甚高通量卫星系统也将使用 42.5 至 52.6GHz 频段作为上行链路。工信部需要权衡这些未来卫星系统和 5G 移动系统的频谱需求，然后确定各方在可用频谱中用量。至少工信部可将重点放在正在被 WRC-19 议程 1.13 研究的频段上（37-40.5GHz, 42.5-43.5GHz, 45.5-47GHz, 47-47.2 GHz, 47.2-50.2GHz 以及 50.4-52.6GHz）。有关未来 5G/IMT-2020 与卫星业务共用研究正在 ITU 的 WRC-19 议程 1.13 中进行，一旦研究成果输出，应当予以充分考虑。如果未来 5G/IMT-2020 移动业务和卫星业务需要共用某一段频谱，则需要基于这些研究创建合理的共用条件。

GHz, 47.2-50.2 GHz, and 50.4-52.6 GHz) that are being studied for 5G/IMT-2020 under WRC-19 Agenda Item 1.13. Sharing studies between future 5G/IMT-2020 and satellite services in the WRC-19 Agenda Item 1.13 bands are underway at the ITU and should be taken into account once concluded. To the extent that future 5G/IMT-2020 mobile and satellite services are to share the same spectrum, then reasonable sharing conditions based on these studies will need to be developed.	
d. Other mmWave Bands. A number of other mmWave in higher frequency bands will be considered for 5G / IMT-2020 mobile services under WRC-19 Agenda Item 1.13, including the [31.8-33.4 GHz (32 GHz),] 66-76 GHz (66 GHz) and the 81-86 GHz (81 GHz) bands. The 66 GHz and 81 GHz bands, in particular, are considered very good prospects for international harmonization given their limited existing and planned use by other radio services. The 66 and 81 GHz band in the "high" mmWave bands should yield about 15 GHz of spectrum in contiguous blocks of at least 5 GHz, which could support very wide-band 5G/IMT-2020 carriers. These high mmWave bands should therefore be able to support the development of 5G mobile networks in high-density indoor and outdoor scenarios, such as stadiums, campuses or shopping malls located in urban and suburban areas of China. The use of these bands would also benefit from synergies with WiGig – currently being deployed at 61 GHz – for which	d) 其他毫米波段。还有其他一些更高频段的毫米波将在 WRC-19 的 1.13 议程中考虑研究以供 5G/IMT-2020 使用，包括 [31.8-33.4 GHz (32 GHz),] 66-76 GHz (66 GHz) and the 81-86 GHz (81 GHz) 频段。特别是 66GHz 和 81GHz 频段，在当前频谱资源很有限的情况下，考虑到现有或计划使用这两个频段的无线电业务都非常少，因此它们具备非常好的协调前景。"高"毫米波频带中的 66GHz 和 81GHz 频段能够至少提供 5GHz-10GHz 的连续区间，共有 15GHz 频谱，这一特点可以支持非常宽的 5G/IMT-2020 载波。因此这段高毫米波频段可以支持 5G 移动网络在室内外环境中的高密度发展，例如中国城市和郊区的体育场、校园或者商场。这段频率的使用也会受益于 WiGig 目前在 61GHz 发展的协同效应—其芯片组和 MIMO 天线系统已经开始生产。

	chipsets and MIMO antenna systems are already being manufactured.[7] The Satellite Associations recommend that MIIT prioritise these lightly encumbered "high mmWave" bands for accommodation of future 5G/IMT-2020. Major Chinese companies such as Huawei have already demonstrated the potential of the high mmWave bands (e.g. at 71 GHz and 81 GHz)[8] to support 5G/IMT-2020 type services. Future 5G user terminals will most likely include multiple radios which support the efficient delivery of various 5G/IMT-2020 services in existing "IMT" frequency bands below 3.6 GHz, high mmWave bands above 66 GHz as well as WIFI (2.4 GHz / 5 GHz) and WiGIG (61 GHz).	卫星协会建议工信部优先考虑这几个使用率相对较低的高毫米波频段以适应未来 5G/IMT-2020 的发展。中国的一些大型公司，例如华为，已经演示了高毫米波频段服务于 5G/IMT-2020 业务的潜力（例如在 71GHz 和 81GHz）。未来 5G 用户端将很可能搭载多个无线电频段，支持在 3.6GHz 以下现有的 IMT 频段、66GHz 以上的高毫米波频段以及 WIFI（2.4GHz/5GHz）和 WiGIG（61Hz）上支持多种 5G/IMT-2020 业务。

[7] ABI Research, *Mobile and Computing Markets Catapult 60 GHz WiGig into the Mainstream in 2017*, *at* https://www.abiresearch.com/press/mobile-and-computing-markets-catapult-60-ghz-wigig/ (Aug. 2016) (forecasting that 180 million WiGig chipsets will ship to the smartphone market in 2017, with smartphone chipsets accounting for almost half of the 1.5 billion total market shipments by 2021).

[7] ABI 研究,《移动和计算市场让 60 GHz WiGig 在 2017 年成为主流》https://www.abiresearch.com/press/mobile-and-computing-markets-catapult-60-ghz-wigig/ （2016 年 8 月）（预计在 2017 年将有 1.8 亿部芯片组投入智能手机市场，至 2021 年，智能手机芯片组将在 15 亿美元的市场总数中占据近一半的份额）

[8] *See* Huawei, Press Release, *Telenor and Huawei Jointly Announce First 5G Demo in Norway* (Mar. 30, 2017), *at* http://www.huawei.com/en/news/2017/3/Huawei-Telenor-First-5G-Demo-Norway; *Vodafone, Huawei Reach 20Gb/s speed in 5G Trial* (Jul. 19, 2016), *at* https://www.mobileworldlive.com/featured-content/top-three/vodafone-huawei-reach-20gbps-speed-in-5g-trial/.

[8]Telenor 和华为在挪威联合宣布首例 5G 的演示（2017 年 3 月 30 日）http://www.huawei.com/en/news/2017/3/Huawei-Telenor-First-5G-Demo-Norway; Vodafone, 华为在测试中达到 20Gbps 的速率（2016 年 7 月 19 日）https://www.mobileworldlive.com/featured-content/top-three/vodafone-huawei-reach-20gbps-speed-in-5g-trial/