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5G：接受还是放弃？[1]

5G正在进入大众市场。这是RF前端领域传统厂商的机会吗？中国企业是否会成为这一变局的一部分？

内容概览：

- 市场预测：
  Yole Développement（Yole）预期RF[2]前端市场将以8.3%的CAGR[3]$_{2021\text{-}2026}$增长，至2026年可达210亿美元以上。
  其中增幅最大的AiP[4]模块CAGR$_{2019\text{-}2026}$为75.5%。
  2026年最具吸引力的细分市场将是PA[5]模块，市场规模近100亿美元。
  与2020年相比，2021年5G手机的数量将增加一倍以上。
- 技术趋势：
  mmWave[6]版的5G技术在2020年进展显著。
  产能紧张使OEM[7]降低了其新机推出的优先级，在某些情况下甚至还会延迟发布日期。
  竞争再次加剧，导致OEM级别的市场份额有所变化。
- 供应链：
  思佳讯、村田制作所、Qorvo、博通和高通是该市场的领导者。
  高通公司利用了5G转型的优势，大大提升了在射频前端市场所占的份额。
  技术独立的强烈意愿正推动着中国OEM、投资者和公共当局对本土企业进行大规模投资。

"移动器件领域正在向5G急剧过渡"，**Yole Développement（Yole）射频器件与技术业务部的技术与市场分析师Cédric Malaquin**称。他补充道：*"与2020年相比，*

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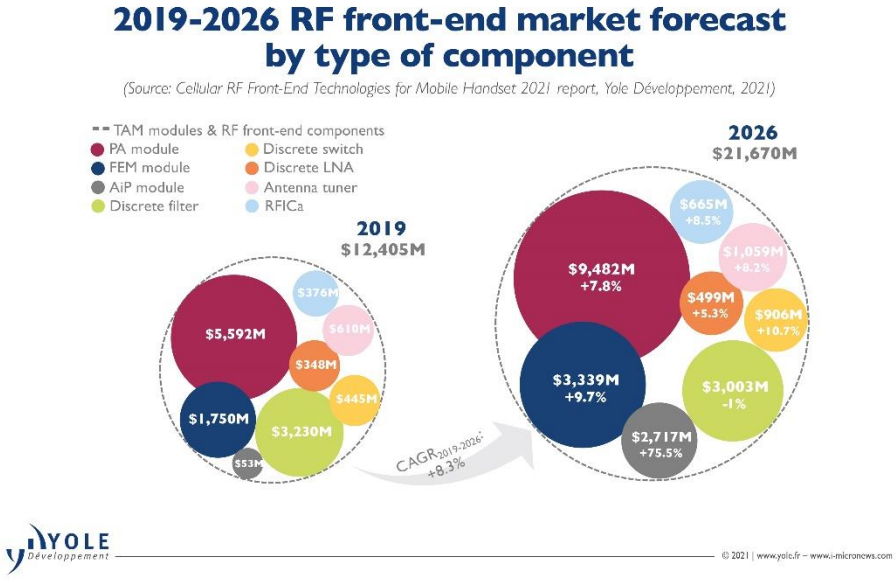
[1]摘自：
《2021年移动手持设备蜂窝射频前端技术报告》，Yole Développement
《2021年RF前端模块比较 - 第2辑——聚焦5G芯片》报告，System Plus Consulting，2021
《智能手机设计赢家季度监测》，System Plus Consulting
[2]RF：射频
[3]CAGR：年均复合增长率
[4]AiP：封装天线
[5]PA：功率放大器
[6]mmWave：毫米波长
[7]OEM：原始设备制造商

2021年5G手机的数量将增加一倍以上。这一渗透率比10年前的LTE[8]标准大大加速。而且5G正在让射频器件的含量前所未有地增加，而以前的无线电标准仍然需要支持。”
因此就必须在手持式设备中装入几百个RF组件。现在受此影响的不仅仅是旗舰机，还有中端和入门级手机。手持设备中实施的5G功能专注于提高下载速度并使上行链路更加稳健。此外它还在毫米波频段创建了一条全新的无线电通路，不过目前只适用于旗舰机型。



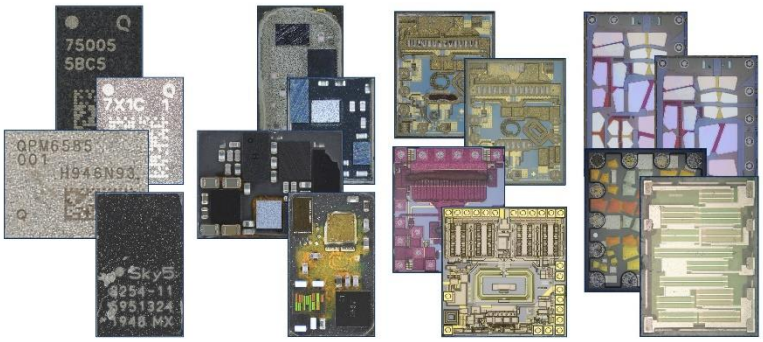
手机行业已经开始向5G过渡。
该技术的首批用例已经成熟，MNO[9]正在向消费者推出新型服务。MNO十分积极地投入更多资源并向消费者展示5G的附加价值，因为5G并不是他们的第一考虑。此外，MNO已经开发出颇具优势的商用5G套餐，尤其是在中国，这让消费者们有了更多的升级动力。
在此背景下，5G在2020年已经强势渗透到智能手机市场，而且随着5G网络在中国、欧洲和美国的扩展，预期还将进一步增长。
在射频前端层面，5G手机比4G手机要复杂。因此有必要分析其技术趋势并预测未来的变化，以更好地了解这个复杂的市场。事实上，正如每一种新的空中标准，5G也是业界竞争企业差异化、创新并最终赢得市场的一个重要机会。今天发布的《2021年移动手持设备蜂窝射频前端技术报告》展示了Yole的分析师们对射频前端市场的发展及其相关生态系统的看法。

[8]LTE：长期演进技术
[9]MNO：移动网络运营商

此外，逆向工程与成本分析公司System Plus Consulting在其发布的 《智能手机设计赢家季度监测》中也带来了对半导体技术的深度分析，包括射频解决方案。您可以在此阅读专题文章。此外，该公司还在《2021年射频前端模块比较 - 第2辑——聚焦5G芯片》报告中从技术与成本方面对2020年在5G毫米波和Sub-6GHz手机中集成的射频前端模块技术发展进行了介绍。

RF front-end modules comparison: B41/n41 PAMiD from Qorvo, Qualcomm and Skyworks

(Source: RF Front-End Module Comparison 2021 – Vol. 2 – Focus on 5G Chipset report, System Plus Consulting)



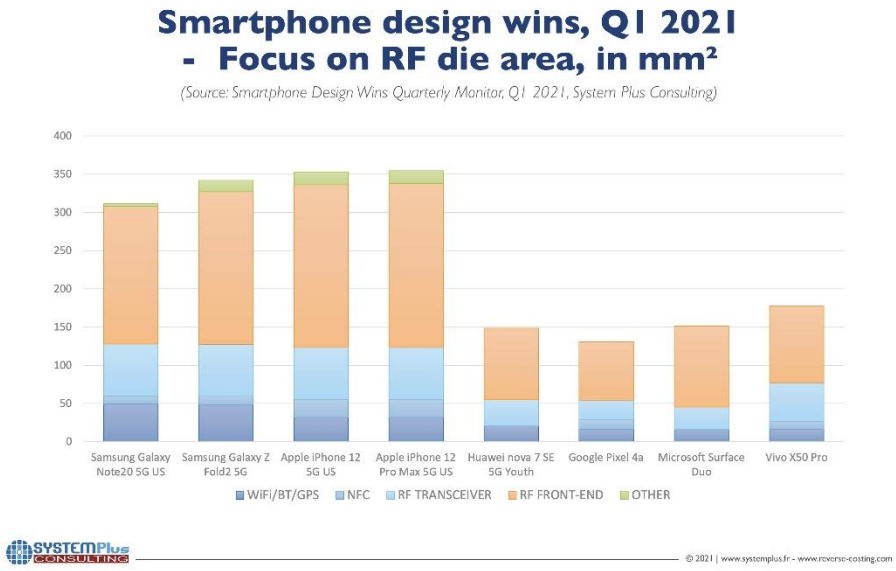
正如在《2021年移动手持设备蜂窝射频前端技术报告》中所述，Yole的射频团队预估，与4G版本相比，每台5G手机中的射频器件含量要高出5-8美元，而mmWave版本还要再增加10美元。

因此，射频前端市场正在蓬勃发展。截至2021年底，它将达到170亿美元，高于2020自然年的140亿美元。此后射频前端市场的增长应该会放缓。当5G成为主流且竞争进一步加剧时，ASP[10]调降力度将会更猛。总体而言，分析师预期从2019年（5G推出的那一年）到2026年之间的CAGR为8.3%，这将带来价值210亿美元的射频前端市场。

5G技术的引入增加了手机的复杂性以及射频器件含量。要采用分立元件构建5G手机，同时又要保持可接受的外形尺寸，这颇具挑战性，将促使更多集成的出现。*“射频前端市场领导者都拥有灵活的模块产品，可适应多种市场需求。此外，有些企业还有专为旗舰机型定制的模块”，***Yole射频业务的技术及相关市场分析师Mohammed Tmimi博士** 称: *“于是，思佳讯、村田制作所、高通、Qorvo和博通共同占据了射频前端市场的85%。市场领导者是思佳讯。”*

[10]ASP：平均售价

而高通的增长最为强劲。在**System Plus Consulting的高级技术与成本分析师Stéphane Elisabeth**看来：*“2019年年末，高通的市场份额低于其他供应商。而三星这样的OEM让这种情况在2020年发生了变化。高通的市场份额在当年年初几乎翻了一倍。然而，随着苹果手机的发布，情况在2019年年末发生了变化。事实上，iPhone系列并没有在其设计中集成的高通组件并不多。苹果的目标是在未来完全避免使用高通的部件。”*



不过市场上已开始涌现出多家来自中国的公司，且在射频前端领域获得两位数的增长。这些新秀大多数从独立式LNA[1]或开关这类分立器件业务起家，这让它们得以积累专门知识并建立起与OEM之间的信任。

这些无晶圆厂中国企业的下一步是将集成模块推向市场。这背后的支持是过去两年它们在中国获得的更多投资。或许并非所有公司都会成功，但在接下去的几年里渴望出现更多的合作与整合。

成功面临的一大困难将是获得晶圆产能。射频元件本身并不短缺，问题更多地在于业内整体的产能紧缺。这一问题正在让业界走向长期供应协议，而这只有大厂商才能负担得起。

包括Yole Développement和System Plus Consulting在内的Yole企业集团全年发布大量报告和产业监测资料。此外，专家们还会进行各种重要讲演并组织关键性会议。

[1] LNA：低噪声放大器

借此机会，请您不要错过为可靠的智能手机供应链做出正确技术选择的绝佳机会——6月29日将由System Plus Consulting首席执行官Romain Fraux和System Plus Consulting部门总监兼消费电子拆解副总裁Jim Mielke通过网络直播进行讲演。敬请在此注册！

此外，Yole射频器件与技术业务部的技术与市场分析师Antoine Bonnabel将参加由EETimes举办的IoT & 5G Wolrd（物联网与5G世界）线上会议，并作题为"5G将私有网络带入生活，但将不得不与边缘计算方法竞争"的演讲。

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About our analysts

As a Technology & Market Analyst, specialized in RF devices & technologies within the Power & Wireless division at Yole Développement (Yole), **Cédric Malaquin** is involved in the development of technology & market reports as well as the production of custom consulting projects.Prior his mission at Yole, Cédric first served Soitec as a process integration engineer during 9 years, then as an electrical characterization engineer during 6 years.He deeply contributed to FDSOI and RFSOI products characterization.He has also authored or co-authored three patents and five international publications in the semiconductor field.Cédric graduated from Polytech Lille in France with an engineering degree in microelectronics and material sciences.

Mohammed Tmimi, PhD., is a Technology and Market Analyst for the RF devices & Technologies Group at Yole Développement (Yole).Prior to Yole, Mohammed was engaged in developing a novel approach for RF/mmW high-speed serial links for high-performance chips at STMicroelectronics' Crolles R&D site in France as part of his Ph.D. During his Ph.D., he also worked on mmW design in advanced FD-SOI nodes and proposed an original interconnect technique for 2.5D/3D packaging.Mohammed now holds a patent on these serial links and has published two scientific papers.Mohammed graduated from INP Grenoble (France) with a master's in microelectronics and an electronics engineering degree from ENSAO (Morocco).He was awarded his Ph.D. in Nano Electronics and Nano Technologies from the University of Grenoble Alpes, France.

Stéphane Elisabeth, PhD is Senior Technology and Cost Analyst at System Plus Consulting, part of Yole Développement (Yole).Stéphane regularly works on numerous reverse engineering and costing reports while also managing custom projects in the RF electronics and advanced packaging fields.His mission at System Plus Consulting is to provide an in-depth understanding of the technologies selected by the leading semiconductor companies as well as the ecosystem around a device.In this context, Stéphane is leading a strategic watch to identify the latest innovative devices and collaborates closely with System Plus Consulting's laboratory to analyze devices or components.His aim is to reveal the link between functionality and the technical choice made by the device maker.Based on the identification of each process step and process flow, our analysts can then provide an accurate evaluation of the manufacturing cost.His significant industrial and technical knowledge allows him also to update internal simulation tools developed by System Plus Consulting's experts.In addition, Stéphane supports the development of RF electronics activities through key customer projects, including presentation of their results.Prior to this collaboration with System Plus Consulting, Stéphane worked on projects in partnership with THALES for the development of innovative hybrid RF circuits.He also regularly publishes articles and interviews within key RF electronics and packaging magazines.Stéphane holds an engineering degree in electronics and numerical technology (Université de Nantes, France) as well as a PhD. in Materials for Microelectronics (Université de Nantes, France).

Romain Fraux is the CEO of System Plus Consulting of Yole Développement.System Plus Consulting focuses on Reverse Costing analysis of electronics, from semiconductor devices to electronic systems.Supporting industrial companies in their development, Romain and his team are offering a complete range of services, costing tools and reports.They deliver in-depth production cost studies and estimate objective selling price of a product, all based on a detailed physical analysis of each component in System Plus Consulting laboratory.Romain has been working for System Plus Consulting for more than 15 years and was previously the company's CTO.He holds a bachelor's degree in Electrical Engineering from Heriot-Watt University of Edinburgh (Scotland), a master's degree in Microelectronics from the University of Nantes (France), and a Master of Business Administration.

Audrey Lahrach serves as a Technology & Cost Analyst, MEMS, Sensors & Display at System Plus Consulting, part of Yole Développement.With significant expertise in the field of MEMS & sensors, including inertial, pressure and gas, as well as in the field of display technologies, Audrey produces reverse engineering & costing analyses while also running custom projects.Her mission is performed in collaboration with the laboratory team, and together they define the objectives of the analyses and determine the methodologies to reveal the structure of the devices and all materials required for their development and production.Audrey's aim is to determine and understand the technology choices made by the leading sensing companies, from the materials to the device

itself.In addition, Audrey runs a technology watch daily to identify innovative MEMS & sensors and related semiconductor manufacturing processes.Her objective is to gain a comprehensive understanding of the evolution of semiconductor technologies and identify the strategy of the leading manufacturers.Thanks to her previous experience with CMOS image sensors and camera manufacturing, Audrey is also involved in the development of System Plus Consulting's imaging activities.Utilizing her knowledge in a combination of MEMS, sensing and imaging, Audrey is overseeing the development of a new System Plus Consulting product, the Smartphone Monitor.Audrey attends international trade shows & conferences to meet the MEMS & sensing companies, from component manufacturers to equipment manufacturers, and to identify the latest innovations.Audrey has taken part in online events to present key results of her teardowns and cost analyses.She has also published some articles in the press.Audrey holds a master's degree in Microelectronics from the University of Nantes (France).

About the reports and monitor

Cellular RF Front-End Technologies for Mobile Handset 2021

5G reaching the mass market is an opportunity and threat for RF front-end legacy players, and is unifying Chinese companies. – Performed by Yole Développement

Companies cited:

Active Semi, AGC, Airoha, Akoustis, Anhui YUNTA Electronic, Apple, ASE, Asus, AT&T, AwinIC,AXT, Broadcom, CanaanTek, Cavendish Kinetics, China Mobile, China Telecom, China Unicom, ChipBetter, CoolPad, Corning, Cypress Semiconductor, DB-HiTek, Dowa, EE, Elisa, Epic MEMS, Ericsson, Etisalat, EtraSemi, Ferfics, Freiberger, GlobalFoundries, Global Wafer, Google, HH Grace, HiSilicon, HMD Global, Honor, HTC, Huawei, Huntersun-MEMS, Infineon, Intel, IQE, Jio, JRC, KDDI, KT, Kyocera, and more…

RF Front-End Module Comparison 2021 – Vol. 2 – Focus on 5G Chipset

Technical and cost overview of the evolution of radio frequency front-end module technologies integrated in 5G mmWave and Sub-6 GHz Phones. – Performed by System Plus Consulting

Smartphone Design Win Quarterly Monitor

The first-ever smartphone technology monitor covering the latest components, packaging, and silicon chip choices of smartphone makers. – Performed by System Plus Consulting

Related reports:

- 5G's Impact on RF Front-End for Telecom Infrastructure 2021
- 5G Packaging Trends for Smartphones 2021
- Apple iPhone 12 series mmWave 5G Chipset and Antenna

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Founded in 1998, Yole Développement (Yole) has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services and well as IP and patent analysis.With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide… More

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