

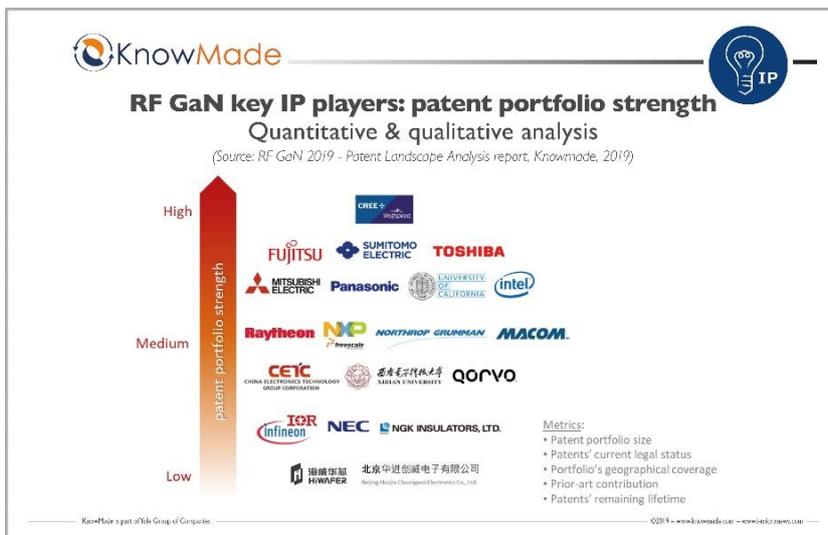


FOR IMMEDIATE RELEASE:

Who is leading the RF GaN IP landscape?

Extracted from: RF GaN 2019 - Patent landscape analysis report, Knowmade - RF GaN market: applications, players, technology, and substrates report, Yole Développement, 2018

LYON, France – February 13, 2019: The RF¹ GaN² industry is showing an impressive growth with a 23% CAGR between 2017 and 2023, driven by telecom and defense applications. By the end of 2017, the total RF GaN market was close to US\$380 million and 2023 should reach more than US\$1.3 billion with an evolving industrial landscape³. Telecom and defense are looking for innovative technologies and RF GaN-based devices are directly answering to the market demand. Defense remains a major RF GaN market segment, as its specialized high-performance requirements and low price sensitivity offer many opportunities for GaN-based products. In 2017-2018, the defense sector accounts for more than 35% of the total GaN RF market, and the global defense market shows no signs of slowing down. “We believe this important GaN market segment will continue growing along with GaN’s overall penetration rate,” asserts **Hong Lin, PhD. Senior Technology & Market Analyst at Yole Développement (Yole)**, part of Yole Group of Companies⁴.



Under this dynamic ecosystem, Yole’s partner, Knowmade, has deeply analyzed the RF GaN IP⁵ landscape and proposes today a dedicated report, [RF GaN 2019 - patent landscape analysis](#). This report reveals the competitive landscape from a patent perspective. Key patent owners, IP & technology strategies, and future intents have been deeply analyzed by Knowmade’s analysts. This

report details competitors’ strengths and weaknesses in terms of

¹ RF : Radio Frequency

² GaN: Gallium Nitride

³ Source : [RF GaN market: applications, players, technology, and substrates 2018-2023 report](#), Yole Développement, 2018

⁴ Source : [RF GaN market: applications, players, technology, and substrates 2018-2023 report](#), Yole Développement, 2018:

⁵ IP : Intellectual Property

Intel, which entered the GaN HEMT patent landscape later, is currently the most active patent applicant and it should strengthen its IP position in coming years, especially for GaN-on-Silicon technology. New entrants in the GaN RF HEMT related patent landscape are mainly Chinese players: HiWafer, Sanan IC and Beijing Huajin Chuangwei Electronics.

Other noticeable new entrants are Taiwan's TSMC and Wavetek Microelectronics, Korea's Wavice and Gigalane, Japan's Advantest, and America's MACOM and ON Semiconductor...

Under this new IP report, the technology intelligence and IP strategy consulting company, Knowmade, has selected and analyzed more than 3,750 patents published worldwide up to October 2018. These patents pertain to RF GaN epiwafers including GaN-on-SiC⁶ and GaN-on-Silicon, RF semiconductor devices, including HEMTs⁷ and HBTs⁸, integrated circuits, including RFICs⁹ and MMICs¹⁰, operating methods and packaging, for all functions, such as RF PAs¹¹, RF switches and RF filters and from radio frequencies <6GHz to microwaves >6GHz and mm-waves >20GHz. A detailed description of this IP report is available on [Knowmade's website](#).

⁶ SiC: Silicon Carbide

⁷ HEMT : High-electron-mobility transistor

⁸ HBT: Heterojunction Bipolar Transistor.

⁹ RFIC: RF Integrated Circuit

¹⁰ MMIC: Monolithic Microwave Integrated Circuit

¹¹ PA : Power Amplifier

ABOUT THE REPORTS:**RF GAN 2019 - PATENT LANDSCAPE ANALYSIS**

The RF GaN market is developing fast, driven by mm-wave, 5G and defense applications. Do current leading market players have the right IP portfolios to face huge opportunities for GaN devices? – Produced by Knowmade

Companies cited in the report:

Cree/Wolfspeed, Sumitomo Electric, Qorvo, Fujitsu, CETC (China Electronics Technology Group Corporation), Toshiba, MACOM, Mitsubishi Electric, Intel, Northrop Grumman, Panasonic, NXP/Freescale, Raytheon, Infineon/International Rectifier, HiWafer, NTT (Nippon Telegraph & Telephone), Beijing Huajin Chuangwei Electronics, Dynax Semiconductor, NGK Insulators, Samsung Electronics, NEC, HRL Laboratories, Japan Radio, TSMC, US Navy, WIN Semiconductors, BAE Systems, Lockheed Martin, Tiger Microwave, Boeing, UMS... [Full list](#)

Author:

- **Dr. Nicolas Baron** is CEO and co-founder of Knowmade. He manages the development and strategic orientation of the company and personally leads the Semiconductor department. He holds a PhD in Physics from the University of Nice SophiaAntipolis, and a Master of Intellectual Property Strategies and Innovation from the European Institute for Enterprise and Intellectual Property (IEEPI) in Strasbourg, France.

**RF GAN MARKET: APPLICATIONS, PLAYERS, TECHNOLOGY, AND SUBSTRATES 2018-2023**

With 5G implementation coming, RF GaN market is developing fast. - Produced by Yole Développement.

Companies cited in the report:

Aethercomm, Alcatel-Lucent, Ampleon, Anadigics, AT&T, Bell Laboratory, Cisco, China Mobile, China Telecom, China Unicom, Cree, Dynax, Dowa, EADS, Epigan, Ericsson, Eudyna, Freiburg/Univ. Ulm/ Fraunhofer IAF, Filtronic, Freescale, Fujitsu, Global Communication Semiconductors, Hittite/Keragis, Huawei, II-VI Inc, IMEC, IMECAS Infineon, Intel, IQE, KDDI, KT, LG Plus, Lockheed Martin, M/A-COM, Microsemi, Mitsubishi Chemical, Mitsubishi Electric, Motorola, NEC, Nitronex, Norstel, Nokia Networks, Northrop Grumman, NTT, NTT DOCOMO, NXP, OMMIC... [Full list](#)

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- **Dr. Hong Lin** has worked at Yole Développement since 2013 as a Technology & Market Analyst. She specializes in compound semiconductors and provides technical and economic analysis. Before joining Yole Développement she worked as an R&D Engineer at Newstep Technologies, heading up development of PECVD cold cathodes for nanotechnology-based visible and UV lamp applications. She holds a Ph.D. in Physics and Chemistry of Materials

ABOUT YOLE GROUP OF COMPANIES

Knowmade is a Technology Intelligence and IP Strategy consulting company specialized in analysis of patents and scientific information. The company supports the business development of R&D organizations, industrial companies, and investors by helping them to understand the competitive landscape, follow the technology trends, and find out opportunities and threats in terms of technology and patents. Knowmade is involved in compound semiconductors, power electronics, batteries, RF electronics & wireless communications, solid-state lighting & display, photonics, MEMS sensors, memories, semiconductor manufacturing & packaging, medical devices, medical imaging, biotech/pharma, and agri-food.

Knowmade's experts provide prior art search, patent landscape analysis, scientific literature analysis, patent valuation, IP due diligence and freedom-to-operate analysis. In parallel the company proposes litigation/licensing support, technology scouting and IP/technology monitoring service. Knowmade's analysts combine their technical and patent expertise with powerful analytics tools and proprietary methodologies, delivering invaluable patent analyses and scientific reviews.

More info on <http://www.knowmade.com> and follow Knowmade on [LinkedIn](#).



Founded in 1998, Yole Développement 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 covering MEMS and image sensors, Compound Semiconductors, RF Electronics, Solid-state lighting, Displays, software, Optoelectronics, Microfluidics & Medical, Advanced Packaging, Manufacturing, Nanomaterials, Power Electronics and Batteries & Energy Management. The "More than Moore" market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and KnowMade, support industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business. . For more information, visit www.yole.fr and follow Yole on [LinkedIn](#) and [Twitter](#).

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