Wireless Charging
Patent Landscape Analysis
November 2017
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INTRODUCTION TO WIRELESS POWER TRANSFER

Wireless Power Transfer: Current Applications

• Nowadays, wireless power charging is mainly used in consumer applications, i.e. smartphones and tablets. More and more cellphone OEMs integrates a wireless power charging component in their devices.

• Wireless power transfer is expected to extend into numerous application fields, including home appliances, medical devices, military devices and electrical vehicles.

• Despite numerous announcements from car manufacturers, there are still several issues to overcome to see electrical vehicles equipped with wireless power charging: cost, safety, charging station-car positioning, efficiency and worldwide standards compliance.

Source: Yole développement, Power GaN 2016: Epitaxy, devices, applications and technology trends

Source: Toyota

Source: Ikea

Source: BMW
INTRODUCTION TO WIRELESS POWER TRANSFER

Wireless Power Transfer Technologies

• Wireless power techniques mainly fall into two categories: non-radiative and radiative.

• In non-radiative techniques, power is transferred by magnetic fields using inductive coupling or magnetic resonance between coils of wire, or by electric fields using capacitive coupling between metal electrodes. Inductive coupling is the most widely used wireless technology; its applications include charging handheld devices like phones and electric toothbrushes, RFID tags, and chargers for implantable medical devices like artificial cardiac pacemakers, or electric vehicles.

• In radiative techniques, also called power beaming, power is transferred by beams of electromagnetic radiation, like microwaves or laser beams. These techniques can transport energy over longer distances but must be aimed at the receiver. Proposed applications for this type are solar power satellites, and wireless powered drone aircraft.

• The performance and efficiency of wireless power systems strongly depends on power devices. The MHz frequency range need power electronics for a static magnetic field, an electric field and high-frequency wireless communication technology.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Radiative</th>
<th>Distance range</th>
<th>Direction</th>
<th>Power (W)</th>
<th>Frequency</th>
<th>Antenna devices</th>
<th>Commercialized applications</th>
<th>Future applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near-field technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inductive coupling</td>
<td>No</td>
<td>Short (several mm)</td>
<td>Low</td>
<td>10-5K</td>
<td>Hz-MHz</td>
<td>Wire coils</td>
<td>Consumer electronics, smartphones</td>
<td>Computer</td>
</tr>
<tr>
<td>Resonant inductive coupling</td>
<td>No</td>
<td>Medium (several cm)</td>
<td>Low</td>
<td>10-500</td>
<td>kHz-GHz</td>
<td>Tuned wires coils, lumped element resonators</td>
<td>Consumer electronics, smartphones</td>
<td>Biomedical implants, electrical vehicles</td>
</tr>
<tr>
<td>Capacitive coupling</td>
<td>No</td>
<td>Short (several mm)</td>
<td>Low</td>
<td>2.5-2K</td>
<td>kHz-MHz</td>
<td>Metal plate electrodes</td>
<td>Portable devices, smartcards</td>
<td>Routing in large-scale integrating circuits</td>
</tr>
<tr>
<td>Far-field technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microwaves/RF</td>
<td>Yes</td>
<td>Long (several m)</td>
<td>High</td>
<td>1-50m</td>
<td>GHz</td>
<td>Parabolic dishes, phased arrays, rectennas</td>
<td>-</td>
<td>Solar power satellite, drone aircraft, consumer devices</td>
</tr>
<tr>
<td>Laser</td>
<td>Yes</td>
<td>Long (several m)</td>
<td>High</td>
<td>3-1K</td>
<td>≥THz</td>
<td>Lasers, photocells, lenses</td>
<td>-</td>
<td>Drone aircraft, space elevator climbers</td>
</tr>
<tr>
<td>Ultrasounds</td>
<td>No</td>
<td>Long (several m)</td>
<td>High</td>
<td>5µ-50k</td>
<td>&gt;20kHz</td>
<td>Ultrasound transmitter/receiver</td>
<td>-</td>
<td>Consumer devices</td>
</tr>
</tbody>
</table>
INTRODUCTION TO WIRELESS POWER TRANSFER
Standards (1/3)

There are two leading wireless charging standard associations.

• The Wireless Power Consortium was created in 2008 to create and promote wide market adoption of Qi international standard for interoperability across rechargeable electronic devices. It is now the world’s most-used standard.

• It is an open-membership cooperation between Asian, European and American companies (215 companies as of September 2016) working toward the global standardization of wireless charging technology.

• In June 2015, A4WP (Alliance for Wireless Power) and PMA (Power Matters Alliance) merge and rename AirFuel Alliance. This merger could boost the wireless power market.

• Airfuel Resonant (Rezence™) developed by AW4P is a wireless power transfer technology and specification based on the principles of magnetic resonance.
SCOPE AND OBJECTIVES OF THE REPORT

Scope of the report

- This report provides a global picture of the patent landscape for Wireless Power Transfer.
- This report covers patents published worldwide up to July 2017.
- We have selected and analyzed more than 42,800 patents and patent applications (21,900+ patent families) relevant to the scope of this report.

Included in the report

- Patents related to wireless power transfer, including all devices and methods related to wireless power charging (inductive coupling, magnetic resonance, capacitive coupling, RF/microwaves, laser transfer, ultrasounds) and devices charged via wireless power transfer.

Not included in the report

- Patents related to other methods and devices of wireless/contactless energy harvesting from the environment (sun, heat, wind, vibrations, etc.)
SCOPE AND OBJECTIVES OF THE REPORT

Objectives of the report

Understand the competitive landscape
- Identify the major IP players and new comers
- Evaluate the relative strength of their patent portfolio
- Understand their IP strategy (dynamics, countries, technologies...), their strengths and weaknesses
- Identify their IP collaboration network
- Compare their IP and market position

Compare market and IP trends
- Dynamics
- Geographic coverage
- Companies
- Technologies

Understand current and future technological trends and choices
- Identify key and new technologies
- Identify key patents by technologies and assignees
- Identify current legal status of patented technologies

Identify risks and opportunities
- Discover new markets & technology directions.
- Overview of past and current litigations and licensing agreements
- Avoid patent infringement

Understand the competitive environment from technology and patent perspective
MAIN PATENT ASSIGNEES MENTIONED IN THIS REPORT

The data were extracted from the FamPat worldwide database (Questel-ORBIT) which provides 100+ million patent documents from 95 offices.

The search for patents was performed in July 2017 hence patents published after this date will not be available in this report.

The patents were grouped by patent family. A patent family is a set of patents filed in multiple countries to protect a single invention by a common inventor(s). A first application is made in one country – the priority country – and is then extended to other countries.

The selection of the patents has been done both automatically and manually (all details in next slides).

More than 21,900 patent families related to Wireless Power Transfer have been selected for the study.

The statistical analysis was performed with Orbit IP Business Intelligence web based patent analysis software from Questel.

The patents were manually categorized in technical segments using keyword analysis of patent title, abstract and claims, in conjunction with expert review of the subject-matter of inventions (all details in next slides).

For legal status of European (EP) and PCT (WO) patent applications, EPO Register Plus has been used. For legal status of US patents, USPTO PAIR has been used. For legal status of other patents, information has been gotten from their respective national registers.
**METHODOLOGY**

**Patent segmentation**

---

**Technology**

- **Near-field technologies**
  - Inductive coupling
  - Capacitive coupling
  - Magnetic resonance
  - 16,260+

- **Far-field technologies**
  - Ultrasounds
  - RF / microwaves
  - Laser
  - 5,790+

- **Not specified**
  - 3,930+

---

**Applications**

- **Consumer applications**, i.e. phone, computer, cleaner, toy ...
  - 9,400+

- **Healthcare applications**, i.e. pacemaker ...
  - 840+

- **Transport applications**, i.e. electric vehicle, drone...
  - 5,130+

- **Not specified**
  - 10,000+

---

**Standards**

- **QI** Wireless Power Consortium
  - 840+

- **AirFuel Alliance** (A4WP, PMA)
  - 400+

- **QI and AirFuel Alliance**
  - 360+

- **Not specified**
  - 20,250+

---

**Other**

- **Object detection**
  - 490+

- **Position detection**
  - 1,110+

---

The numbers represent the number of patent families* in the corresponding segment. A patent family can belong to several segments.

* A patent family is a set of patents filed in multiple countries to protect a single invention by a common inventor(s). A first application is made in one country – the priority country – and is then extended to other countries.
PATENT LANDSCAPE OVERVIEW

Time Evolution of Patent Publications

Wireless Power Transfer IP Dynamics

22,000+ patent families comprising 42,000+ patents published over the last past 100 years

Chinese universities

Based on the current trend, we expect 6,500+ patent families in 2017.

Note: The data of the year 2017 is not complete since the patent search was done in July 2017.

CAGR (2011-2015) = 43%

Near-field technologies

Far-field technologies

Earliest year of publication

Number of patent families

1917
1918-1940
1941-1960
1961-1970
1971-1975
1976-1990
1991-1995
1996-2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

0
1000
2000
3000
4000
5000
6000
7000
PATENT LANDSCAPE OVERVIEW

Ranking of main Patent Assignees

Ranking of Patent Assignees
(according to the number of their patent families)

5,800+ patent applicants have filed patents related to wireless power charging

Note: All affiliated companies of multinational conglomerates have been merged and they are included under the brand name of the group, i.e. Samsung, LG, Toyota, Sony, Toshiba, Hitachi, NEC, Mitsubishi, Hyundai, Siemens, Philips, Fujitsu, Bombardier...
PowerbyProxi is a spin-out of the University of Auckland. PowerbyProxi has an exclusive license on Auckland Uniservices’ patents related to wireless power transfer.
**PATENT LANDSCAPE OVERVIEW**

Mapping of Global Patenting Activity

For each country or geographical zone:

- Number of **patent families** filed in the country.
- Number of **pending patent applications** in the country (patents in pre-grant stage).
- Number of **granted patents** in the country (patents in force).

* A patent family is a set of patents filed in multiple countries by a common inventor(s) to protect a single invention.

- **USA**: XXX patent families
- **Europe**: XXX patent families
- **India**: XXX patent families
- **Korea**: XXX patent families
- **Japan**: XXX patent families
- **China**: XXX patent families
- **Taiwan**: XXX patent families

**Note:** XXX PCT applications (WO patents) are still in progress.
PATENT LANDSCAPE OVERVIEW
Wireless Power Transfer Technology Breakdown

Near-field technologies
(inductive coupling, capacitive coupling, magnetic resonance)
- patent families

Far-field technologies
(ultrasounds, RF/Microwaves, laser)
- patent families

Main patent applicants

Technology breakdown
- Magnetic resonance (24%)
- Capacitive coupling (2%)
- Inductive coupling (74%)

Technology breakdown
- Laser (6%)
- Ultrasounds (6%)
- RF / Microwaves (88%)
PATENT LANDSCAPE OVERVIEW

Wireless Power Transfer Applications

- WPT components are either directly integrated in the consumer device or in accessories that can be adapted on electronic devices so that they can be wirelessly charged (for instance, cover for smartphone ...).
- A major current trend is to integrate a wireless power charging device for smartphones in vehicles. Some car manufacturers commercialize their own smartphone cover adapted for wireless power transfer.

**Ranking of WPT applications**

(according to the number of related patent families)

**Consumer**

**Transport**

**Healthcare**
# PATENT LANDSCAPE OVERVIEW

Main Patent Assignees by Technologies/Applications

<table>
<thead>
<tr>
<th>All applications</th>
<th>CONSUMER</th>
<th>TRANSPORT</th>
<th>HEALTHCARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>All technologies</td>
<td>XXX</td>
<td>XXX</td>
<td>XXX</td>
</tr>
</tbody>
</table>

## NEAR-FIELD TECHNOLOGY

| XXX patent families | XXX patent families | XXX patent families | XXX patent families |

## FAR-FIELD TECHNOLOGY

| XXX patent families | XXX patent families | XXX patent families | XXX patent families |

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# PATENT LANDSCAPE OVERVIEW

Countries of Granted/Pending Patents for Main R&D Labs, Pure play companies and Component makers

<table>
<thead>
<tr>
<th>Pure play companies</th>
<th>Number of patent families containing granted patents in the corresponding country</th>
<th>Number of patent families containing pending patent applications in the corresponding country</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>13</td>
<td>58</td>
</tr>
<tr>
<td>Europe</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>Japan</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>Korea</td>
<td>24</td>
<td>11</td>
</tr>
<tr>
<td>China</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Taiwan</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>India</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>PCT/WO</td>
<td>22</td>
<td>10</td>
</tr>
</tbody>
</table>

- Most of companies being both an integrator and a component and device maker hold numerous granted patents and pending patent applications worldwide. It suggests a strong interest for this field for many years and a willpower to secure their developments in numerous countries from the perspective to make/commercialize their products worldwide.

- Contrary to other component and device makers who mainly have alive patents in their operating countries, holds the highest number of granted patents and pending patent applications worldwide, suggesting a strong interest and a willpower to globally secure their developments.

- Most of pure play companies owned few granted patents, but they have numerous pending patent applications, reflecting the recent and strong interest for wireless charging technologies.
NEAR-FIELD TECHNOLOGIES

IP portfolio size vs. IP strength index

- Integrators and End-Users (Electronic)
- Integrators and End-Users (Transport)
- Both component makers and integrators
- Pure Play Companies
- Component and device makers
- R&D labs

- LG
- Philips
- Seiko-Epson
- Sony, A
- Toshiba,
- Intel, Samsung,
- Panasonic, Fujitsu, Hitachi, Sumitomo, TDK, and other
- General Electric, Bosch
- Amlogic, Instruments, Yundai, Kia,

- Strength Index of patent portfolio

- Patent portfolio size (number of patent families)

- Design
- Patent position
- License
- Customer
- Market

- Out of the total 50 strongest patents, IP strength strength portfolio contains
- A significant number of 
- Both companies and patents, with
- A variety of geographical locations

- In the most cases, the strong IP strengths among
- Not only the pure near-field technologies but also near-
FAR-FIELD TECHNOLOGIES
IP Blocking Potential

The more the number of forward citations from different patent applicants is high, the more the capacity to limit the patenting activity of other firms is important.

Note: This graph is at patent family level. The identification of a “blocking patent” requires an in-depth specific analysis of each patent documents composing the patent families.

- **has the strongest IP blocking potential.** Its patents related to far-field WPT received a lot of forward citations from numerous different patent applicants. That means the company have the capacity to limit the patenting activity of other firms on far-field WPT technologies. Furthermore, the company owns a lot of enforceable patents in key countries enabling it to hamper the freedom-to-operate of other firms.

- Even if **have the largest patent portfolios, they show a lower IP blocking potential than**

- Despite their weaker patenting activity, **have a relatively high IP blocking potential.**
**NEAR-FIELD TECHNOLOGIES**

Market position vs IP position

<table>
<thead>
<tr>
<th>Market Position</th>
<th>No products with near-field WPT technology</th>
<th>Components for near-field WPT</th>
<th>Accessories for near-field WPT</th>
<th>Products with near-field WPT technology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IP Position</strong></td>
<td>Very Strong</td>
<td>Strong</td>
<td>Medium</td>
<td>Low</td>
</tr>
</tbody>
</table>

* IP position of each companies has been evaluated from the IP leadership, IP Strength Index and IP Blocking Potential of their patent portfolio in each supply chain segments.

- **Witricity** is the first company to have the ability to charge any and all devices without cables and transfer.
- **Auckland** is a global leader in near-field WPT technology, and thus have been able to secure numerous key patents.
- **NASA** is the original pioneer in wireless power transfer, and their technology has been adopted by many companies.
- **AMO** and **IDT** are commercializing near-field WPT technology for consumer devices and are expected to have an early market position.
- **Auto brands** such as **Audi**, **Honda**, **BMW**, and **BYD** are actively focusing on integrating near-field WPT technology into their vehicles, and are likely to start to commercialize in the near future.
### IP AND MARKET POSITION OVERVIEW

**Pure play companies and R&D laboratories**

<table>
<thead>
<tr>
<th>Products on the market</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>The number represents the number of patent families</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Near-field technologies</th>
<th>Far-field technologies</th>
<th>Applications</th>
<th>Products on the market</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No. of patent families</strong></td>
<td><strong>IP leadership</strong></td>
<td><strong>Geographic coverage</strong></td>
<td><strong>Impact Factor</strong></td>
</tr>
<tr>
<td>Low</td>
<td>Small</td>
<td>Very high</td>
<td>High</td>
</tr>
<tr>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Medium</td>
<td>Large</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Low</td>
<td>Very large</td>
<td>Very high</td>
<td>Low</td>
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- Mainly file patents related to their operating field and commercialized products (near-field technologies and consumer applications for wireless power charging). Despite its noticeable IP position, it doesn’t commercialize products related to wireless power charging. Contrary to other car manufacturers, it files numerous patents on far-field technologies. It is worth to highlight that a major current trend is that’s why most of car manufacturers and some electronic integrators file patents on both consumer and transport. They commercialize products specially adapted for this application.

- Mainly file patents and commercialize products related to near-field technologies for consumer applications, except who also file numerous patents on far-field technologies and who file numerous patents on transport applications, are the main who commercialize wireless power charging components for transport applications has a strong IP position.

- Commercialize components for consumer, transport and healthcare applications. have strong patent portfolios.

- Only few companies commercialize and file patents on products for healthcare applications.
INTEL

Patent portfolio summary for Wireless Power Transfer

- **Large Portfolio**
- **Patent families**
- **1994 Oldest priority date**
- **4 Patent family average age**

**Near-field technologies**
- **Patent family impact**
- **Portfolio strength and IP blocking potential**
- **Leadership**

**Far-field technologies**
- **Patent family impact**
- **Portfolio strength and IP blocking potential**
- **Leadership**

**Applications**
- **Consumer**
- **Transport**

*Map showing countries with patent families: USA, Europe, Korea, Japan, India, China, Taiwan.*

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In this study, a “key patent” refers to a “seminal patent”. A seminal patent has a strong technology impact and an important prior art contribution. It has the capability to limit the patenting activity of other firms. Identification of seminal patents is based on the number of citations received by the patents (forward citations). A seminal patent has a high number of forward citations compared to the other patents published the same year, or it has received a high number of citations per year on average since its publication. Note: The patents listed below are the representative members of the key patent families.
Recent patent families related to Wireless Power Transfer

Note: The patents listed below are the representative members of the most recent patent families.
This database allows multi-criteria searches and includes patent publication number, hyperlinks to the original documents, priority date, title, abstract, patent assignees, technological segments and legal status for each member of the patent family.

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  (Yole développement, April 2017)
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**Wireless Charging: Patent Landscape Analysis (November 2017)**

Ref.: KM17010

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**Check**
To pay your invoice using a check, please mail your check to the following address:

KnowMade S.A.R.L.
2405 route des Dolines, BP 65
06902 Valbonne Sophia Antipolis
FRANCE

**Money Transfer**
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Bank: Banque populaire St Laurent du Var CAP 3000 - Quartier du lac- 06700 St Laurent du Var
IBAN: FR76 1560 7000 6360 6214 5695 126
BIC/SWIFT: CCBFRPPNC

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**RETURN ORDER BY**

**E-mail:** contact@knowmade.fr
Mail: KnowMade S.A.R.L. 2405 route des Dolines, 06902 Sophia Antipolis, FRANCE

**PRODUCT ORDER**

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For price in dollars, please use the day’s exchange rate. For French customer, add 20% for VAT.

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Signature:
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   - within a reasonable time for Products ordered prior to their effective release. In this case, the Seller shall use its best efforts to inform the Buyer of an indicative release date and the evolution of the work in progress.

2.2 Some weeks prior to the release date the Seller can propose a pre-release discount to the Buyer.

The Seller shall by no means be responsible for any delay in respect of article 2.2 above, and including in cases where a new event or access to new confidential information would require for the analyst extra time to prepare the report or compare the data in order to enable the Seller to deliver a high quality Product.

2.3 The mailing of the Product will occur only upon payment by the Buyer, in accordance with the conditions contained in article 5.

2.4 The mailing is operated through electronic means either by email via the sales department. If the Product’s electronic format is defective, the Seller undertakes to replace it at no charge to the Buyer provided that it is informed of the defective formatting within 90 days from the date of the original download or receipt of the Product.

2.5 The person receiving the Products on behalf of the Buyer shall immediately verify the quality of the Products and their conformity to the order. Any claim for apparent defects or for non-conformity shall be sent in writing to the Seller within 8 days of receipt of the Products. For this purpose, the Buyer agrees to produce sufficient evidence of such defects.

3. PRICE, INVOICING AND PAYMENT

3.1 Prices are given in the orders corresponding to each Product sold on a unit basis or corresponding to annual subscriptions. They are expressed to be inclusive of all taxes. The prices may be reevaluated from time to time according to the evolution of the market.

3.2 Payments due by the Buyer shall be sent by cheque payable to Knowmade, Paypal or by electronic transfer to the bank account noted on the invoice.

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To ensure the payments, the Seller reserves the right to demand payments from the Buyer. In this case, all the charges (including late fees) are the buyer’s responsibility.

3.3 Payment is due by the Buyer to the Seller within 30 days from invoice date, except in the case of a particular written agreement. If the Buyer fails to pay within this time and fails to contact the Seller, the Seller may cancel the order without any prior notice or any prior notice whatever, in accordance with article L. 441-6 of the French Commercial Code. Our publications (report, database...), which are delivered only electronic, may be reevaluated by the Seller.

3.4 In the event of termination of the contract, or of misconduct, during the contract, the Seller will have the right to invoice the stage in progress, and to take legal action for damages.

4. LIABILITIES

4.1 Compensation or any other individual or legal person acting on its behalf, being a business user buying the Products for its business activities, shall be solely responsible for choosing the Products and for the use and interpretations he makes of the documents it purchases, of the results he obtains, and of the advice and acts it deduces thereof.

4.2 The Seller shall only be liable for (i) direct and (ii) foreseeable pecuniary loss, caused by the Products or any event as a result of their use.

4.3 In no case shall the Seller be liable for a) any direct or indirect lost profits, lost business interruption and loss of programs or information arising out of the use or inability to use the Seller’s website or the Products, or any information provided on the website, or in the event of its inability, b) any claim attributable to errors, omissions or other inaccuracies in the Product or interpretations thereof.

4.4 All the information contained in the Products has been obtained from sources believed to be reliable. The Seller does not warrant the accuracy, completeness adequacy or reliability of such information, which are subject to change without notice.

4.5 All the Products that the Seller sells may, upon prior notice to the Buyer from time to time be modified in accordance with the needs of the Buyer. This modification shall not lead to the liability of the Seller, provided that the Seller ensures the substituted Product is similar to the Product initially ordered.

4.6 In the case where, after inspection, it is acknowledged that the Products contain defects, the Seller undertakes to replace the defective products as far as the supplies allow and without indemnities or reimbursement of any kind for labor costs, delays, loss caused or any other reason. The replacement is guaranteed for a maximum of 7 months starting from the delivery date. Any replacement is excluded for defects or misuse.

4.7 The deadlines that the Seller is asked to state for the mailing of the Products are given for information only and are not guaranteed. If such deadlines are not met, it shall not lead to any damages or compensation of any kind. In the event of force majeure, the Seller reserves the right to modify in good faith the deadlines informed to the Buyer. In such case only, the Buyer shall be entitled to ask for a reimbursement of its first down payment or the exclusion of any further damages.

4.8 The Seller does not make any warranties, express or implied, including, without limitation, those of salability and fitness for a particular purpose, with respect to the Products. Although the Seller shall take reasonable steps to screen Products for infection of viruses, worms, Trojan horses or other codes designed to damage computer systems, the Seller cannot guarantee that any Product will be free from infection.

5. FORCE MAJEURE

The Seller shall not be liable for any delay in performance directly or indirectly caused by or resulting from acts of nature, fire, flood, accidents, riot, war, government intervention, embargoes, epidemics, difficulties, equipment failure, late deliveries by suppliers or other difficulties which are beyond the control of the Seller.

6. PROTECTION OF THE SELLER’s IPR

6.1 All the IPR attached to the Products and are the property of the Seller and are protected under French and international copyright law and conventions.

6.2 The Buyer agreed not to disclose, copy, reproduce, redistribute, resell or publish the Product, or any part of it to any other party other than employees of its company. The Buyer shall have the right to use the Product solely for the purposes described in this agreement. In particular, the Buyer shall therefore not use the Product for purposes such as:

   - Information storage and retrieval systems;
   - Records and databases transmitted over any network (including any local area network);
   - use in any timesharing, service bureau, bulletin board or similar arrangement or public display;
   - are delivered only electronically.

- Licensing, leasing, selling, offering for sale or assigning the Product.

6.3 The Buyer shall be solely responsible towards the Seller of all infringements of this obligation, whether this infringement comes from its employees or any person to whom the Buyer has sent the Products and shall personally take care of any related proceedings, and the Buyer shall bear related financial consequences in their entirety.

6.4 The Buyer shall define within its company point of contact for the needs of the contract. This person will be the recipient of each new report in PDF format. This person shall also be responsible for respecting the copyrights and will guaranty that the Products are not disseminated out of the company.

7. TERMINATION

7.1 If the Buyer cancels the order in whole or in part postpones the date of mailing, the Buyer shall give written notice to the Seller. The Seller reserves the right to cancel the order if the Buyer breaches the terms of such delay or cancellation. This may also apply for any other direct or indirect consequential loss that may be borne by the Seller, following this decision.

7.2 In the event of breach by one Party under these conditions or the order, the non-breaching Party may send a notification to the other by recorded delivery letter upon which, after a period of thirty (30) days without solving the problem, the non-breaching Party shall be entitled to terminate all the pending orders without being liable for any compensation.

8. MISCELLANEOUS

- All the provisions of these Terms and Conditions are for the benefit of the Seller itself, but also for its employees and agents. Each of them is entitled to assert and enforce those provisions against the Buyer.

- The Prices and Texts under these Terms and Conditions shall be given in writing. They shall be effective upon receipt by the other Party.

- The Seller may, from time to time, update these Terms and Conditions and the Buyer, is deemed to have accepted the latest version of these terms and conditions, provided they have been communicated to him in due time.

- GOVERNING LAW AND JURISDICTION

- Any dispute arising out or linked to these Terms and Conditions or to any contract (orders) entered into between the Seller and the Buyer, shall be resolved by the court of Paris, which shall have exclusive jurisdiction upon such issues.

- The Buyer shall not be entitled to any compensation or any claim of any nature, with respect to the Buyer. Although the Seller shall take reasonable steps to screen Products for infection of viruses, worms, Trojan horses or other codes designed to damage computer systems, the Seller cannot guarantee that any Product will be free from infection.
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Microelectronics | Compound Semiconductors | Power Devices & Systems | RF & Microwave Devices | LED/OLED | Imaging & Display | MEMS Sensors & Actuators | Photonics | Battery | Manufacturing & Advanced Packaging | Micro & Nanotechnology | Biotechnology | Cellular & Molecular Biology | Microbiology | Dermatology | Pharmacology | Oncology | Immunology | Medical Devices & Medical Imaging | Agri-Food & Environment

Executive team

Dr. Nicolas Baron
CEO and co-founder of Knowmade.
He leads the Microelectronics and Compound Semiconductors department. He holds a PhD in Physics from the University of Nice Sophia-Antipolis, and a Master degree in Intellectual Property Strategies and Innovation from the European Institute for Enterprise and Intellectual Property (IEEPI Strasbourg), France.

Dr. Brice Sagot
CTO and co-founder of Knowmade.
He leads the Biotechnology and Life Sciences department. He holds a PhD in molecular biology from the University of Nice Sophia-Antipolis, France.

Analyst team

5 full time analysts with PhD degree and in-depth knowledge in Intellectual Property and Scientific Information.

Founded in 2009
Headquartered in Sophia Antipolis FRANCE

JEI since 2013 (Innovative New Company)
CIR accreditation since 2012 (Research Tax Credit)

Partners

+ expert network (Industrial & Academics)
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KNOWMADE OFFERS YOU THE CAPABILITY TO

✓ Understand your competitive environment
✓ Follow technology trends
✓ Indentify patent/technology opportunities
✓ Assess patent/technology risks
✓ Strategize your IP and R&D
✓ Monetize your technologies and know-how
✓ Defend your business

KNOWMADE OPERATES IN THE FOLLOWING SECTORS

❖ Semiconductors
  Compound semiconductors, Power & RF electronics, LED lighting & display, Photonics, Memories, Advanced packaging

❖ MEMS, Sensors & Actuators
  Inertial sensor, Microphone & Microspeaker, RF switch, filter & resonator, Environmental sensor, Optical sensor & actuator, Microfluidics, Microfabrication technologies

❖ Batteries & Energy Management
  Energy storage, Battery cell & pack, Power electronics, Renewable energies

❖ MedTech
  Biotech, Pharma, Medical devices, Medical imaging

Patent landscape analysis
Scientific review
IP portfolio assessment
Patent valuation
Freedom-to-operate analysis
Litigation & licensing support
Patents linked to products
Technology scouting
Technology trends
Competitive IP landscape
Market trends
Reverse engineering

Make strategic decisions
Sustain competitive advantages
Speed R&D and enhance innovation process
Align R&D and IP with key business objectives
Strengthen IP portfolio and acquire technologies
Anticipate risks and defend core businesses
Explore new opportunities and monetize IP
INTELLIGENCE CYCLE

Tracking key technologies and competitors’ R&D activities in order to anticipate changes, early detect business opportunities, mitigate risks, and make strategic decisions

- Real-time alerts
- Periodic newsletters
- Analysis reports
- Web-based collaborative platform

- Data collection
  - Monitor / Identify / Process
  - Patent & Scientifique databases
  - Web and business information
  - Powerful intelligence softwares

- Data analysis
  - Select / Analyze / Assess
  - Analysts combining technical and patent expertise
  - Powerful analytics tools and proprietary methodologies
  - High-added value patent analyses and scientific reviews

- Dissemination
  - Share / Integrate

- Information needs
- Your business strategy

- Technology & patents
  - Competitors
  - Customers & partners
  - Target companies

- Decision making
  - Innovation strategy
  - Business development

Your business strategy

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Each year, Knowmade publishes a comprehensive collection of reports in various technology fields. These fact-based analyses can provide you with the reliable information you need to advance your business and your competitive position.

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- Patent Trolls in the Semiconductor Market – Litigation Risk and Potential Targets 2017
- GaN Technology – Top-100 IP Profiles 2016
- GaN Devices for Power Electronics – Patent Landscape 2015
- GaN-on-Silicon Substrate – Patent Landscape 2014

### POWER ELECTRONICS
- GaN Devices for Power Electronics – Patent Landscape 2015

### RF DEVICES & TECHNOLOGIES
- RF Acoustic Wave Filters (SAW, BAW, FBAR/SMR) – Patent Landscape 2017*

### LED
- Phosphors and QDs for LED Applications – Patent Landscape 2015
- Nanowire LED – Patent Landscape 2014

### IMAGING
- Uncooled Infrared Imaging – Patent Landscape 2017*
- Biomedical Photoacoustic Imaging – Patent Landscape 2015
- Honeywell Microbolometer – Patent Portfolio Analysis 2015
- Capsule Endoscopy – Patent Landscape 2014

### MEMORY
- 3D Monolithic Memory – Patent Landscape 2017*
- Patent Trolls in the Semiconductor Market – Litigation Risk and Potential Targets 2017
- ReRAM and Memristor Technologies – Patent Landscape 2015
- Emerging Non-Volatile Memories (eNVM) – Patent Landscape 2014

### BATTERY AND ENERGY MANAGEMENT
- NMC Li-ion Batteries – Patent Landscape 2017

### MEMS SENSORS & ACTUATORS
- RF Acoustic Wave Filters (SAW, BAW, FBAR/SMR) – Patent Landscape 2017*
- Uncooled Infrared Imaging – Patent Landscape 2017*
- Pumps for Microfluidics – Patent Landscape 2017
- Knowles MEMS Microphones in Apple iPhone 7 Plus – Patent-to-Product Mapping 2017
- Microfluidic Technologies for Diagnostic Applications – Patent Landscape 2017
- MEMS Microphone – Patent Infringement Risk Analysis 2015
- Capacitive Fingerprint Sensors – Patent Landscape 2015
- Honeywell Microbolometer – Patent Portfolio Analysis 2015
- Emerging MEMS – Patent Landscape 2014

### ADVANCED PACKAGING
- Hybrid Bonding for 3D Stack – Patent Landscape 2017*
- 3D Monolithic Memory – Patent Landscape 2017*
- TSV Stacked Memory – Patent Landscape 2016

### MEDTECH
- Pumps for Microfluidics – Patent Landscape 2017
- Microfluidic Technologies for Diagnostic Applications – Patent Landscape 2017
- 3D Cell Culture Technologies – Patent Landscape 2016
- Biomedical Photoacoustic Imaging – Patent Landscape 2015
- Capsule Endoscopy – Patent Landscape 2014

* Coming soon

Complete list of reports on www.knowmade.com
CUSTOM STUDY & CONSULTING
Tailor-made analysis to meet your needs and budgetary constraints

Prior art search
Evaluate the patentability of your invention in the course of a patent filing.
Invalidates competitor’s patents in the course of patent litigation or in anticipation of one.
Make third-party observations concerning the patentability of competitor’s inventions.

Patent landscape analysis
Understand the competitive environment and the technology trends from a patent perspective.
Identify key players, their IP strategy and their key patents.
Know IP collaborations, licensing agreements and litigation history.

Freedom-to-operate analysis
Assess the risks to infringe third-party patents.
Ensure that your products/processes can be safely manufactured, sold and used in specific countries without infringing patents held by others.

Litigation and licensing support
Evidence of infringement/non-infringement for offensive/defensive support.
Defend your position in licensing negotiation or patent litigation.

Patent assessment
Identify most valuable patents prior to patent acquisition/sales, licensing agreement, capital fundraising process, M&A or IP due diligence.
Estimate the financial value of your patent portfolio.

IP due diligence
Assess the patent portfolio of a company and reveal the SWOT matrix prior to patent acquisition/sale, licensing agreement or M&A.

Scientific literature analysis
Pinpoint key research findings and new emerging research fields, key laboratories and scientific experts, industrial/academic research collaborations, and identify prospective R&D partners.

Technology scouting
Identify, qualify and get access to external innovation.

IP & Technology watch service
Follow IP/technology trends, keep a watch on your competitors and identify new entrants, anticipate the changes, early detect business opportunities and mitigate the risks.
## CUSTOM STUDY & CONSULTING
Tailor-made analysis to meet your needs and budgetary constraints

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<td>Understand the competitive landscape</td>
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<td>Know the key players and their key patents</td>
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<td>Follow the technology trends and identify emerging technologies</td>
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<td>Track competitors, their IP activity, strategy and future intents</td>
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<td>Know your competitors’ strengths and weaknesses</td>
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<td>Early detect business opportunities</td>
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<td>Evaluate the patentability of your inventions</td>
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<td>Invalidate competitors’ patents</td>
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<td>Prevent registration of critical patents from competitors</td>
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<td>Identify patents used in products</td>
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<td>Make evidence of patent infringement</td>
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<td>Evaluate the risks to infringe someone else’s patents</td>
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<td>Mitigate the risks of patent litigation</td>
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<td>Defend your position in licensing negotiation or patent litigation</td>
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<td>Reduce the risks in M&amp;A</td>
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<td>Evaluate your real patent protection</td>
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<td>Benchmark patent portfolios</td>
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<td>Identify the most valuable patents and estimate their financial value</td>
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<td>Monetize your patents and identify potential licensees/buyers</td>
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<td>Acquire technologies or identify potential licensors</td>
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<td>Speed your R&amp;D and enhance your innovation process</td>
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<td>Decrease R&amp;D and IP costs</td>
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<td>Identify free technologies which can be used safely</td>
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<td>Identify key research laboratories and potential R&amp;D partners</td>
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TRAINING & WORKSHOP
Benefit from face-to-face meeting with our experts

Training
Knowmade provides guidance to companies and research laboratories seeking to gain an understanding of the issues linked with competitive intelligence, set up an internal intelligence process or improve their existing processes.

- Patent information for R&D, strategy and marketing
- Patent Intelligence: Tapping the economic potential of patent information
- Technology Intelligence and Innovation
- Setting up a strategic intelligence unit
- Intelligence process optimization

Workshop
Objective
One day face-to-face presentation of our data and analysis with Q&A session on specific questions of your choice (direct interaction with our experts at your site)

- Have the ability to ask questions or for specific analysis before the workshop
- Access to Knowmade ongoing analyses
- Direct contact with Knowmade analysts
- Open Q&A session with the key persons of your company

Content
- Presentation of updated Knowmade analyses
- Presentation of the analysis done for your company
- Executive synthesis
- Q&A session and open discussion