

RF Acoustic Wave Filters

Patent Landscape Analysis

October 2019

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ABOUT KNOWMADE

Knowmade is a Technology Intelligence and IP Strategy consulting company specialized in analysis of patents and scientific information. The company helps R&D organizations, investors and innovative companies to understand their competitive landscape, follow technology trends, and find out opportunities and threats in terms of technology and patents.

Knowmade's analysts combine their strong technology expertise and in-depth knowledge of patents with powerful analytics tools and methodologies to turn patents and scientific findings into business intelligence tools. Our 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 watch service.

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Scope of the report

SCOPE OF THE REPORT 2019

- This report provides a detailed picture of the patent landscape for **RF acoustic wave filters**.
- This report covers **patents published worldwide** up to **July 2019**. We have selected and analyzed more than **18,580+** patents and patent applications grouped in more than **7,510+** patent families relevant to the scope of this report.

Example	Selected patents		
	Relevant	Related	Excluded
Patents related to SAW, BAW, FBAR, SMR	X		
Patents related to multiplexers, diplexers, duplexers using acoustic wave filter	X		
Patents related to material growth / deposition for acoustic wave filter applications	X		
Patents related to RF FE module claiming the use of acoustic wave filters		X	
Patents related to acoustic wave filters for non-RF / mobile telecommunication applications			X
Patents related to non acoustic RF filter (LC, microstrip, etc.)			X
Patents related to SAW, BAW, TC SAW etc. for sensor applications			X

Included in the report

- Patents related to acoustic wave filters for mobile applications and devices/modules claiming their use such as duplexers, diplexers and multiplexers

Technologies: SAW, TC-SAW, BAW/FBAR and BAW/SMR

Devices

Not included in the report

- Patents related to acoustic wave sensors
- Patents related to MEMS resonators using mechanical modes
- Patents related to other applications (defense, automotive, medical, etc.) or not compatible with low cost and high-density integration requirements

US5444560 (1991-11-18)
BT
Optical clock recovery

US2017168026 (2016-12-15)
QORVO
Temperature compensation and operational configuration for bulk acoustic wave resonator devices

US2008284544 (2005-07-25)
PANASONIC
Mems filter device having a nanosize coupling element and manufacturing method thereof

A sensing method utilizing a bulk acoustic wave (BAW) resonator, the sensing method comprising: applying an AC signal to the BAW resonator;

Understanding the main trends

Who, When and where?

SAMPLE

IP LANDSCAPE OVERVIEW

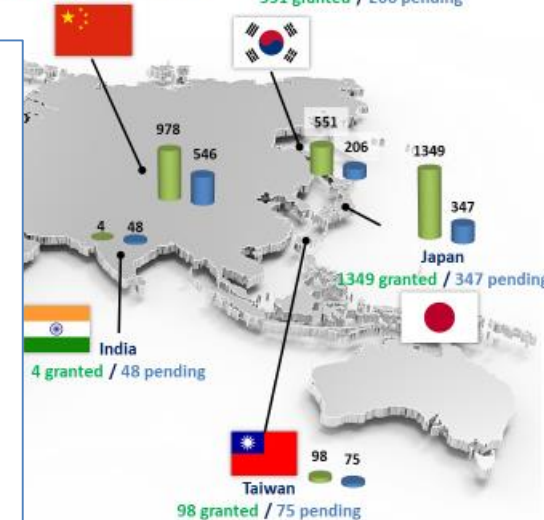
Geographic map of patent applications

USA
2,053 granted / 467 pending

Europe
711 granted / 277 pending

China
978 granted / 546 pending

South Korea
551 granted / 206 pending



IP LANDSCAPE OVERVIEW

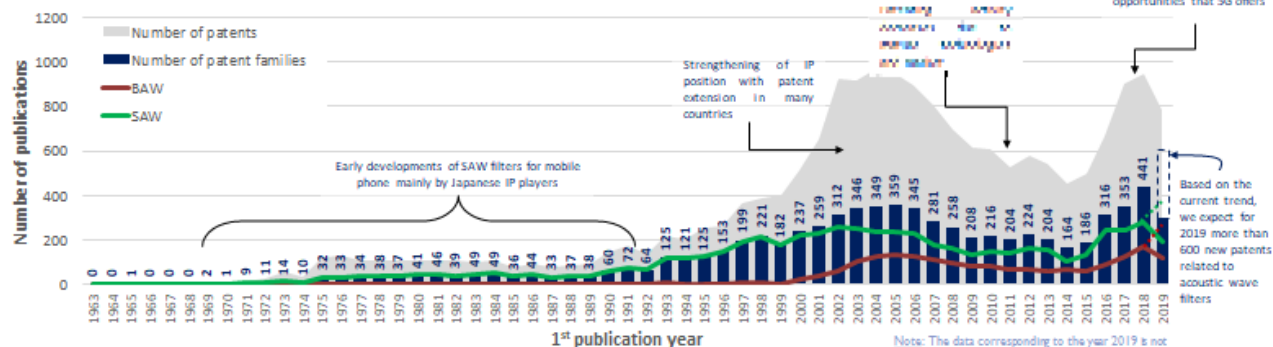
Main patent assignees and their patenting activity

Assignee	Patent families	BAW	SMR	FBAR	SAW	Temperature compensated
	71	1102	95			
	144	414	43			
	74	368	34			
	64	400	31			
	39	374	40			
	101	197	36			
	226	34	41			
	26	257	9			
	56	140	7			
		193	3			
	122	56	6			
	50	102	22			
	17	131	19			
		141				
	35	74	1			
	8	101	2			
	3	96	3			
		79	2			
	4	75	1			
	56	21	4			

IP LANDSCAPE OVERVIEW

Time evolution of patent publications

More than 18,630 patents regrouped in more than 7,510 related to acoustic wave filters have been published worldwide



With more than 960 new patent families publications in less than 2 years, the IP landscape related to acoustic wave filters for handsets has shown a tremendous acceleration. Indeed, after a period of low activity between 2006 and 2015, the rise of 5G related technologies has opened new opportunities that could reshuffle the entire filter landscape.

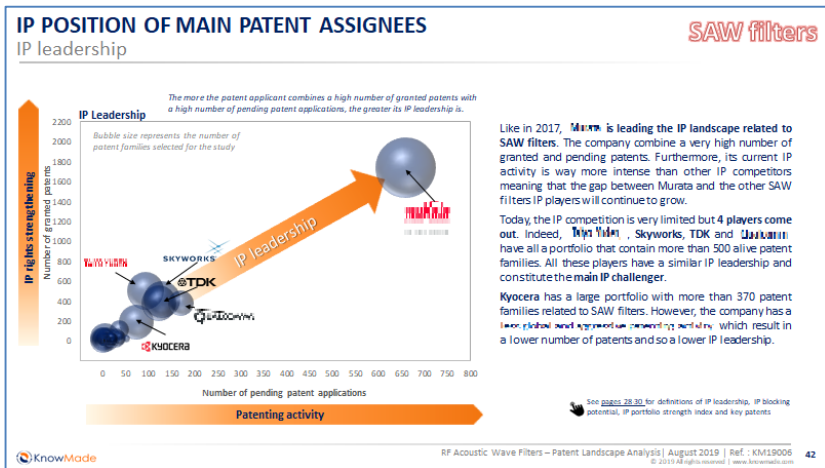
Today, the patenting activity is driven by the main market players that are asserting their development in key regions. In addition to the race between the RF filter giant, the IP landscape analysis also shows an increasing IP activity of IP competitors such as Akoustis, Infineon, and others and attests of the new opportunities that the 5G revolution has opened.

times more inventions than other IP players. Furthermore, main IP players, some of its competitor like Samsung or

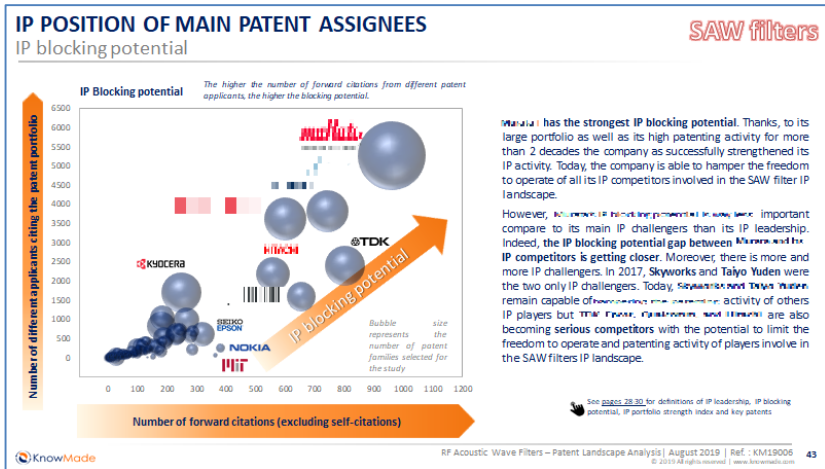
Comparison of IP players

Portfolios analysis and ranking: who has the strongest IP position and why?

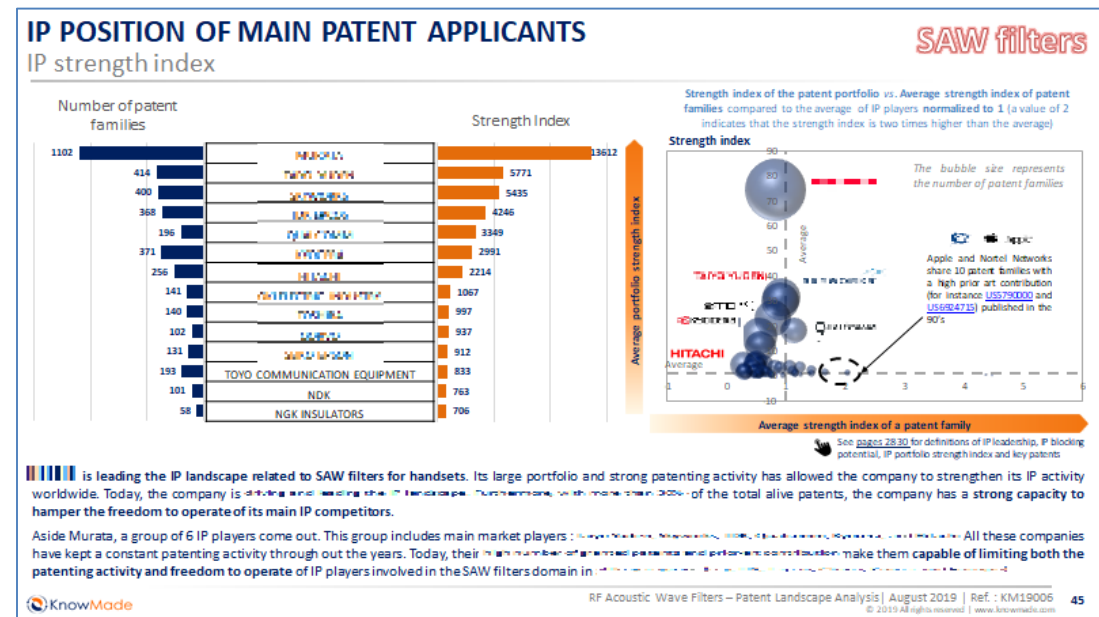
SAMPLE



IP leadership



Blocking potential



Murata is leading the IP landscape related to SAW filters for handsets. Its large portfolio and strong patenting activity has allowed the company to strengthen its IP activity worldwide. Today, the company is **dominating the landscape**. Furthermore, with more than 30% of the total alive patents, the company has a strong capacity to hamper the freedom to operate of its main IP competitors.

Aside Murata, a group of 6 IP players come out. This group includes main market players: **Skyworks**, **TDK**, **Kyocera**, **Hitachi**, **Nokia** and **Intel**. All these companies have kept a constant patenting activity through out the years. Today, their **high number of patents and prior art contributions** make them **capable of limiting both the patenting activity and freedom to operate** of IP players involved in the SAW filters domain in

Understanding recent technological development

Corpus segmentation by recent issues

SAMPLE

PACKAGING FOR ACOUSTIC WAVE FILTERS

Patent landscape overview

Time evolution of patent publications mentioning flip chip or wafer level packaging

Main patent assignees

Assignee	Patent families	Wafer Level			Flip chip		
		Patent families	Granted	Pending	Patent families	Granted	Pending
54	67	101	80	128	284	29	
4	16	28	2	121	239	42	
9	12	17	15	92	125	11	
7	10	14	9	34	38	9	
0	27	41	12	117	104		
6	10	17	22	57	127	20	
2	18	51	10	22	70	6	
2	2		2	20	28	4	
4	1			19	13	1	
3	3	6		19	6		
2	35	13	37	17	3	2	
6	13	12	4	13	25	1	
3	4	9		11	9		

PACKAGING FOR ACOUSTIC WAVE FILTERS

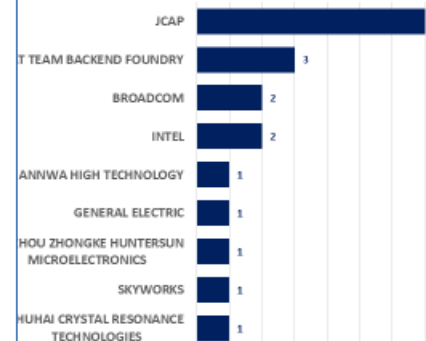
IP Leadership : Flip chip & Die packaging

IP Leadership

The more the patent applicant combines a high number of granted patents with a high number of pending patent applications, the greater its IP leadership is.

Main IP players of the last 2 years

(based on the number patent families claiming the packaging design and manufacturing)



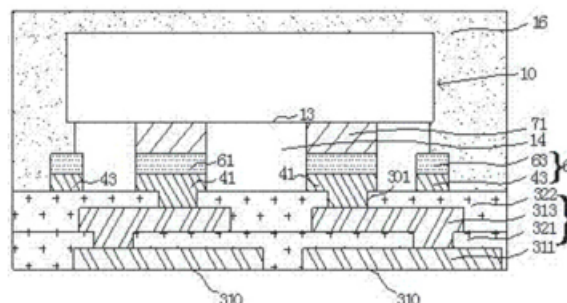
PACKAGING FOR ACOUSTIC WAVE FILTERS

Recent noticeable patents : JCAP approach

JCAP has filed 7 patent families in the last two years related to a surface acoustic wave filter chip package structure based on a wafer level process followed by a flip chip operation. The package comprises a front face of the functional areas of the surface acoustic wave filter chip is provided with a chip comprising a metal connecting block, a redistribution layer, a metal block, and an encapsulation layer for retaining a metal. The metal block is disposed on the chip periphery where the functional areas are connected. The surface acoustic wave filter chip is connected through a multi-point multi-layered metal pieces flip-chip bonding with the rewiring layer.

Overview of the package manufacturing process :

- Step one, providing a carrier wafer, and the adhesive layer is placed over the carrier wafer;
- Step two, the adhesive layer is formed above the multilayer rewiring layer and the opening;
- Step three, the multilayer rewiring layer of the top I is formed in this order through sputtering, photolithography, electroplating metal block II and the block, the surface acoustic wave filter chip metal block I is provided in advance of the functional areas of the chip peripheral region vertically, through a multi-layered redistribution layer and the multilayer rewiring layer with the opening of the metal layer of a re-wiring pattern is fixed, the periphery of the metal block II is disposed on the block I, the block I of the surface acoustic wave filter chip is placed in the inner region is formed a vertical region;
- Step four, and then solder can be electroplated with a metal block I II respectively on the metal block for I layer, a solder layer II, with the tip of the solder layer II metal block to form a metal retaining ring;
- Step six, the surface acoustic wave filter chip flip-chip connected through metal connection block and the second terminals I, was refluxed for another welding solid connection, provided in the surface acoustic wave filter chip metal connection pieces of the functional areas of the chip peripheral region vertically, and the corresponding I and the second terminals;
- Step six, the cleaning filter chip functional area metal surface oxides and contaminants;
- Step seven, encapsulation materials for encapsulating the surface acoustic wave filter chip through a laminated manner, and a multilayer rewiring layer above the exposed portion of metal rings, to form encapsulant layer, while the upper side of the multilayer rewiring layer, the surface acoustic wave filter chip is lower, the metal rings are formed inside the cavity, chip functional area within the cavity;
- Step eight, in the surface acoustic wave filter chip above the encapsulant layers may be thinned by grinding method;
- Step nine, UV light or laser light irradiated through the adhesive layer, with the wafer level package is separate from the carrier;
- Step ten, of the wafer level package using a laser or blade type surface acoustic wave filter are diced into individual packages.



packaging that are compatible with handset cost and size in the handset, IP players have progressively switched to wafer level packaging has

strong acceleration the patenting activity by the main IP players, filed a high number of new patent applications in the field of very integrated devices and modules.

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These companies have already developed and strengthened their IP rights thanks to a high number of patent families.

Other companies have filed more than 8 new patent applications recently, looking for more integrated solutions. Indeed, most recent active players e.g. JCAP, have already achieved a wafer level manufacturing step.

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Patent database

Excel file containing all the patents analyzed in this report with corpus segmentation

SAMPLE



This Excel database allows multi-criteria searches and includes patent publication number, hyperlinks to the original documents, priority date, title, abstract, patent assignees, legal status and technical segment for each patent families.

RF Acoustic Wave Filter - August 2019



Questel unique family ID (FAN) (same number means same family)	Publication numbers	Original document	Title	Abstract	Earliest application date	Earliest publication date	Expected expiry dates	Current assignees	Inventors	Legal status (Pending, Granted, Revoked, Expired, Lapsed)	SEGMENTS								
											BAW	SMR	FBAR	SAW	TCAW	Wafer level Packaging	Flip chip & Die packaging	Duplexers	Multiplexers & Diplexers
85682454	US20190253038	Open	(US20190253038) SG n79 WI-FI ACOUSTIC TRIPLEXER CIRCUIT	An RF triplexer circuit device using modified lattice, lattice, and ladder circuit topologies. The devices can	2019-04-22	2019-08-15	2039-04-22	AKOUSTIS ([US])	HOULDEN Rohan W. ([US])	PENDING									
85390836	WO2019/139076	Open	(WO2019139076) Acoustic wave device	Provided is an acoustic wave device which is capable of more reliably suppressing transverse modes. An acoustic	2019-01-10	2019-07-18	2021-07-11	MURATA MANUFACTURING ([JP])	DAIMON, Katsuya ([JP])	PENDING									
85390596	WO2019/138813	Open	(WO2019138813) Elastic wave device, multiplexer, high-frequency front	This elastic wave device reduces spurious Rayleigh waves generated in frequencies below the passband	2018-12-19	2019-07-18	2021-07-12	MURATA MANUFACTURING ([JP])	Ryo Nakagawa IWAMOTO, Hideki	PENDING									X
85390587	WO2019/138811	Open	(WO2019138811) Elastic wave device, multiplexer, a high-frequency front	In order to reduce stopband ripple in frequencies above an antiresonance frequency, this elastic wave device (1)	2018-12-19	2019-07-18	2021-07-12	MURATA MANUFACTURING ([JP])	Ryo Nakagawa DAIMON, Katsuya	PENDING									X
85390584	WO2019/138812	Open	(WO2019138812) Elastic wave device, multiplexer, a high-frequency front	In order to decrease change due to temperature in higher-order modes occurring above a passband while	2018-12-19	2019-07-18	2021-07-12	MURATA MANUFACTURING ([JP])	Ryo Nakagawa IWAMOTO, Hideki	PENDING									X
85390583	WO2019/138810	Open	(WO2019138810) Elastic wave device, multiplexer, high-frequency front	The purpose of the present invention is to suppress higher-order modes. Defining the elastic wave resonator	2018-12-19	2019-07-18	2021-07-12	MURATA MANUFACTURING ([JP])	Ryo Nakagawa IWAMOTO, Hideki	PENDING	X	X	X	X					X
85390556	WO2019/138786	Open	(WO2019138786) Multiplexer and component device	The present invention is provided with: a first matching circuit (21) having one end connected to a common	2018-12-14	2019-07-18	2021-07-10	MURATA MANUFACTURING ([JP])	Matsubara Yutaka ([JP])	PENDING									X
85384970	US20190222193	Open	(US20190222193) Bulk Acoustic Wave Resonator for having a Lateral Energy	Bulk acoustic wave resonators having a lateral energy barrier are disclosed. In an example aspect, a resonator	2018-01-17	2019-07-18	2038-01-17	QUALCOMM EPCOS ([DE])	BADER BERNHARD ([DE]) TAG ANDREAS ([DE])	PENDING	X	X	X						
85384969	US20190222195	Open	(US20190222195) Acoustic wave resonator, filter, and multiplexer	An acoustic wave resonator includes: a piezoelectric substrate; and an IDT that is located on the piezoelectric	2018-01-12	2019-07-18	2038-10-30	TAIYO YUDEN ([JP])	MATSUDA TAKASHI ([JP])	PENDING									X
85384969	CN110048691	Open	(CN110048691) Acoustic resonators, filters and a multiplexer	An acoustic wave resonator includes: a piezoelectric substrate; and an IDT that is located on the piezoelectric	2018-01-12	2019-07-18	2038-12-07	TAIYO YUDEN ([JP])	MATSUDA TAKASHI IWAKI MASAFUMI	PENDING									X
85384969	JP2019125856	Open	(JP2019125856) Acoustic wave resonator, filter and multiplexer	An acoustic wave resonator includes: a piezoelectric substrate; and an IDT that is located on the piezoelectric	2018-01-12	2019-07-18	2038-01-12	TAIYO YUDEN	IWAKI MASAFUMI	PENDING									X
85384662	US20190221607	Open	(US20190221607) Microfabricated device with piezoelectric substrate and	Systems and methods for forming an electrostatic MEMS plate switch include forming a deformable plate on a	2019-01-13	2019-07-18	2039-01-13	INNOVATIVE MICRO TECHNOLOGY ([US])	GLUEMAN CHRISTOPHER S ([US])	PENDING								X	
85322699	JP2019114964	Open	(JP2019114964) Vibration device, the electronic device and the moving	PROBLEM TO BE SOLVED: The relay board can be detected presence of a crack in the vibrating device, and	2017-12-25	2019-07-11	2037-12-25	SEIKO EPSON	NISHIZAWA RYUTA MURAKAMI SHIRO	PENDING									
85322482	JP2019114732	Open	(JP2019114732) Piezoelectric stack, piezoelectric element and a	PROBLEM TO BE SOLVED: Alkali niobium oxide is formed on the piezoelectric film, a piezoelectric film having a	2017-12-26	2019-07-11	2037-12-26	SCIOCS SUMITOMO CHEMICAL	HORIKIRI FUMIMASA SHIBATA KENJI	PENDING									
85175389	DE102018107496	Open	(DE102018107496) Volume acoustic wave resonator device and method for	A volume acoustic wave resonator device comprises a lower and an upper electrode (120, 360). A piezoelectric	2018-03-28	2019-07-11	2038-03-28	RF360 EUROPE ([DE])	AIGNER WILLI ([DE]) SCHIEK MAXIMILIAN	GRANTED	X				X				
85166529	CN109995342	Open	(CN109995342) Method of preparing air-slotted thin film acoustic	The present invention provides a method for producing air gap type film body acoustic wave resonator,	2019-03-15	2019-07-09	2039-03-15	INSTITUTE OF PHYSICS CHINESE ACADEMY OF	ZHANG ZHONGSHAN LI JUNJIE	PENDING	X				X				
85072639	KR10-1996844	Open	(KR101996844) Filter chip package and wafer level package having	According to an embodiment of the present invention prevents the diffusion bonding layer having a structure	2018-02-14	2019-07-05	2038-02-14	OKINS ELECTRONICS	JUN, JINKOOK PARK, SUNG-KYU	GRANTED								X	
85069619	CN109951172	Open	(CN109951172) Piezoelectric filter device	The present invention relates to a piezoelectric filter device, it is possible to use a single piezoelectric filter	2017-12-20	2019-06-28	2038-10-11	DAISHINKU ([JP])	KOHDA NAOKI	PENDING									

Patent information

Segments

ORDER FORM

RF acoustic wave filters

Patent Landscape Analysis – October 2019

Ref.:KM19006



SHIP TO

Name (Mr/Ms/Dr/Pr):

Job Title:

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Address:

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State:

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Country:

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Date:

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06902 Valbonne Sophia Antipolis
FRANCE

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IBAN: FR76 1460 7003 6360 6214 5695 139
BIC/SWIFT: CCBPFRPPMAR

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- within [1] month from the order for Products already released; or

- within a reasonable time for Products ordered prior to their effective release. In this case, the Seller shall use its best endeavours 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 contradictory information would require for the analyst extra time to compute or compare the data in order to enable the Seller to deliver a high quality Products.

2.3 The mailing of the Product will occur only upon payment by the Buyer, in accordance with the conditions contained in article 3.

2.4 The mailing is operated through electronic means either by email via the sales department. If the Product’s electronic delivery 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.

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IBAN: : FR76 1460 7003 6360 6214 5695 139

To ensure the payments, the Seller reserves the right to request down payments from the Buyer. In this case, the need of down payments will be mentioned on the order.

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 latter shall be entitled to invoice interest in arrears based on the annual rate Refi of the «BCE» + 7 points, in accordance with article L. 441-6 of the French Commercial Code. Our publications (report, database, tool...) are delivered only after reception of the payment.

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

4. LIABILITIES

4.1 The Buyer 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 arising from a material breach of this agreement

4.3 In no event shall the Seller be liable for:

a) damages of any kind, including without limitation, incidental or consequential damages (including, but not limited to, damages for loss of profits, business interruption and loss of programs or information) arising out of the use of or inability to use the Seller’s website or the Products, or any information provided on the website, or in the Products;

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 cannot be guaranteed to be free from errors.

4.5 All the Products that the Seller sells may, upon prior notice to the Buyer from time to time be modified by or substituted with similar Products meeting 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 compensation of any kind for labor costs, delays, loss caused or any other reason. The replacement is guaranteed for a maximum of two months starting from the delivery date. Any replacement is excluded for any event as set out in article 5 below.

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 cancellation of the orders, except for non-acceptable delays exceeding [4] months from the stated deadline, without information from the Seller. In such case only, the Buyer shall be entitled to ask for a reimbursement of its first down payment to the exclusion of any further damages.

4.8 The Seller does not make any warranties, express or implied, including, without limitation, those of

saleability 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 containing contaminating or destructive properties before making the Products available, 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, accident, riot, war, government intervention, embargoes, strikes, labor difficulties, equipment failure, late deliveries by suppliers or other difficulties which are beyond the control, and not the fault of the Seller.

6. PROTECTION OF THE SELLER’S IPR

6.1 All the IPR attached to the Products are and remain 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 Products solely for its own internal information purposes. In particular, the Buyer shall therefore not use the Product for purposes such as:

- Information storage and retrieval systems;

- Recordings and re-transmittals over any network (including any local area network);

- use in any timesharing, service bureau, bulletin board or similar arrangement or public display;

- Posting any Product to any other online service (including bulletin boards or the Internet);

- 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 respect of 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 or postpones the date of mailing, the Buyer shall indemnify the Seller for the entire costs that have been incurred as at the date of notification by the Buyer 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 licensors, employees and agents. Each of them is entitled to assert and enforce those provisions against the Buyer.

Any notices 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.

9. GOVERNING LAW AND JURISDICTION

9.1 Any dispute arising out or linked to these Terms and Conditions or to any contract (orders) entered into in application of these Terms and Conditions shall be settled by the French Commercial Courts of Grasse, which shall have exclusive jurisdiction upon such issues.

9.2 French law shall govern the relation between the Buyer and the Seller, in accordance with these Terms and Conditions.

KNOWMADE

Patent and Technology Intelligence

WHAT WE DO

Knowmade helps customers to understand the **competitive landscape**, follow **technology trends**, and find out **opportunities** and **threats** in terms of **technology** and **patents**.

- Interpreting the **competitive landscape** and **technology developments** throughout **patents** and **scientific information**.
- Turning **patents** and **scientific information** into **business intelligence tools** that give you the capability to
 - Understand your **competitive environment**
 - Be ahead of **technology trends**
 - Identify patent & technology **opportunities**
 - Assess patent & technology **risks**
 - Define your **IP** and **R&D strategy**
 - Monetize your **technologies** and know-how
 - Defend your **business**
- Strong **technology expertise** with an in-depth **knowledge of patents** and **scientific information**.
- Highly **specialized** analysts in the following sectors:

Electronics, Photonics and Wireless communications

Compound semiconductors, Power electronics, Batteries, Memories, RF devices & technologies, Wireless communications, Solid-state lighting & display, Photonics, MEMS, Sensors and Actuators, Semiconductor manufacturing and Advanced packaging.

Life Sciences, Healthcare and Agri-Food

Medical devices, Medical imaging, Microfluidics, Biotechnology, Pharmaceuticals, Food-processing

Patents
Technologies
Prior art
Scientific findings
Opportunities
Partners
Competitors
Newcomers
M&A targets



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



OUR ADDED VALUE

Patent Search

- ✓ **Strong technical expertise of our analysts with PhD degree**
 - Comprehensive search queries and keywords
 - Manual selection of relevant and related patents
 - Manual segmentation by technology & application



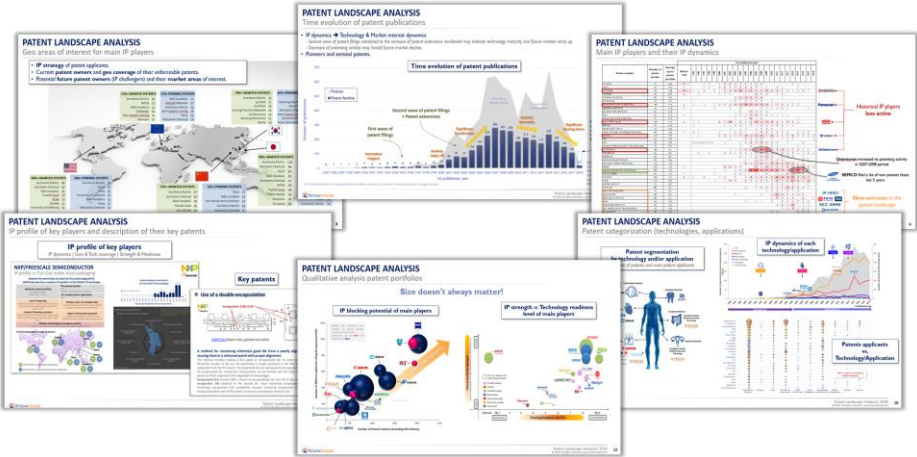
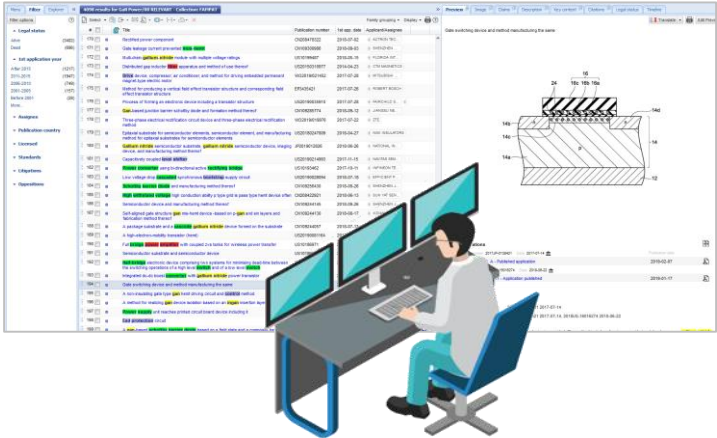
Analytics

- ✓ **State of the art statistical tools**
- ✓ **Innovative methodologies to deliver relevant IP analysis**
- ✓ **Business oriented data representation and graphics**



Results Analysis

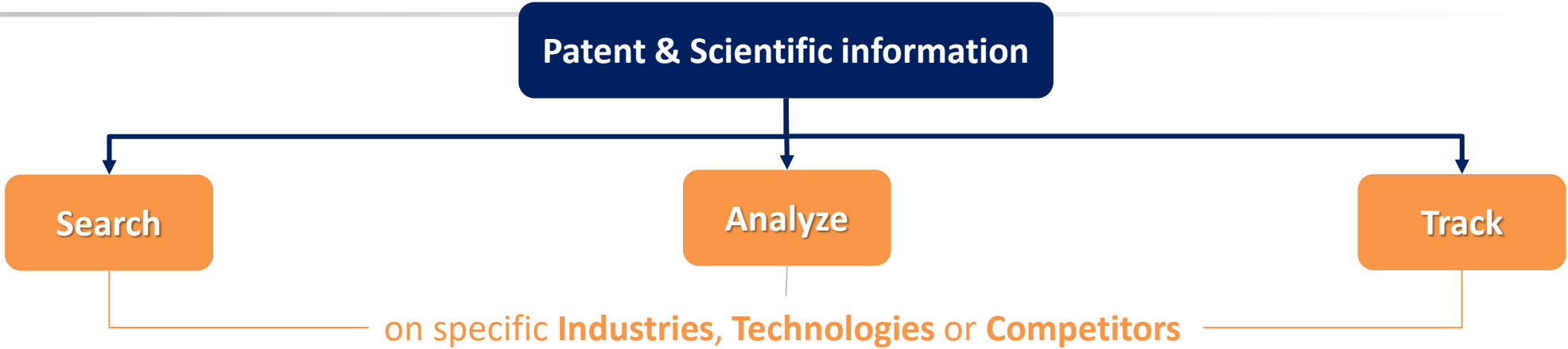
- ✓ **Technical expertise**
 - Highly specialized analysts in your field
 - Benefit from knowledge capitalization
- ✓ **In-depth IP analysis combined with market data and reverse engineering ***
- ✓ **Customer support**



* Our partners



KNOWMADE ACTIVITIES



Prior-art search

Is my invention novel?

Technology scouting

Are there patents or technologies to acquire? ... that could be drawn on to improve R&D?

Patent landscape analysis

*Competitive & technology landscape analysis through patents:
Who? What? Where? Since when? With who?*

Freedom-to-operate

Am I free to sell my product without infringing third-parties IP rights?

Evidence of use (litigation/licensing)

Make the link between patents and product features

Patent valuation

What are the most valuable patents and what is their financial value?

Patent monitoring service

Monitor the IP activity: new applications, new granted patents, patents newly expired

Scientific watch

Monitor the Scientific activity

Competitor watch

Monitor the competitors R&D activities



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