

# MICROLED DISPLAYS - INTELLECTUAL PROPERTY LANDSCAPE AND ANALYSIS 2021

Market & Technology Report - April 2021

*Joining Apple, Samsung, LG, XDisplay, PlayNitride, Facebook and others, newcomers are accelerating microLED patenting activity.*

## WHAT'S NEW

- Fully updated intellectual property landscape with over 1640 new patent families
- Identify new players, spikes in activity, changes in hot areas
- Identify new technology trends for each segment including transfer and assembly, pixel and display architecture, driving, monolithic microdisplays, color generation and conversion, light shaping and extraction, tiling, in-display sensors etc
- Key technologies and maturity levels

## KEY FEATURES

- Extensive Excel database with 4100 patent families with hyperlinks to original documents, abstracts, assignees and applications in each family
- IP leadership, newcomers and major trends
- Key patents and emerging trends
- IP collaboration networks between players
- Portfolio strength ranking for each technology node
- Time evolution of filings by company, country, technology node and company type
- Geographic trends by country of filing and company headquarters
- Overview of China's IP trends

## AFTER A LATE START, DISPLAY MAKERS NOW STRONGLY DOMINATE IP ACTIVITY

Our micro-Light Emitting Diode (microLED) display report now features close to 9,000 patents from 480 organizations. Most existing display makers were late to the microLED game. Many were initially either dismissive of the technology, or unprepared to tackle its many challenges. Key MicroLED enabling technologies such as mass transfer and LED chips are far from display makers' traditional core expertise. But in 2014, Apple's acquisition of Luxvue put microLEDs on the map. Panel makers realized that it could someday become a credible display technology, disrupt the supply chain and challenge their position.

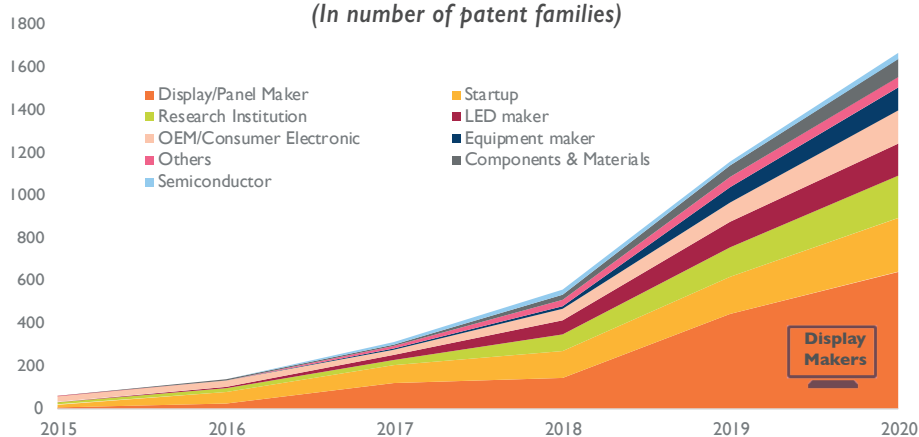
As a result, intellectual property (IP) activity and microLED investment have been increasing exponentially since 2015. All leading consumer electronic companies, panel and LED makers accelerated their microLED development efforts. By 2018, they were joined by equipment makers, material suppliers, and others who, as microLED edges closer to volume

manufacturing, are seeing opportunities to serve the industry with dedicated tools and materials.

More recently, microLEDs' position in leading panel makers' R&D portfolio and technology roadmaps has started to move from defensive to strategic. Companies that have missed the Organic LED (OLED) opportunity, sometimes limited in their ambitions by the massive capital expenditure requirement or a weak intellectual property position, see in microLED a leveled playing field with a lower entry price.

MicroLEDs could rapidly become the dominant display technology in Augmented Reality (AR) glasses. In most high-volume consumer applications however, the risk that microLEDs will ever fully displace Liquid Crystal Displays (LCD) or even OLED remains low. Nevertheless, microLEDs' unique features could guarantee a comfortable share in many high-end segments with attractive profitability and become a key income generator.

**Time evolution of microLED patent publication by company type**  
(In number of patent families)



(Yole Développement, April 2021)

## PANEL MAKER HEAVYWEIGHTS TAKE THE LEAD, BUT STARTUPS AND NEWCOMERS ARE READY TO CHALLENGE

Activity is strongly dominated by Chinese companies, followed by Korea. LG and Samsung made strong showings in 2019 and kept up the pace in 2020 in terms of new applications. Samsung made a remarkable push with more than 130 new patent families, revolving for the

most around its Display division's self-assembled nanorod LED technology, often referred to as Quantum Nanorod Emitting Devices (QNED). The patents show the technology maturing, and a commitment to tackle the challenges associated with moving QNED from the lab to the fab.

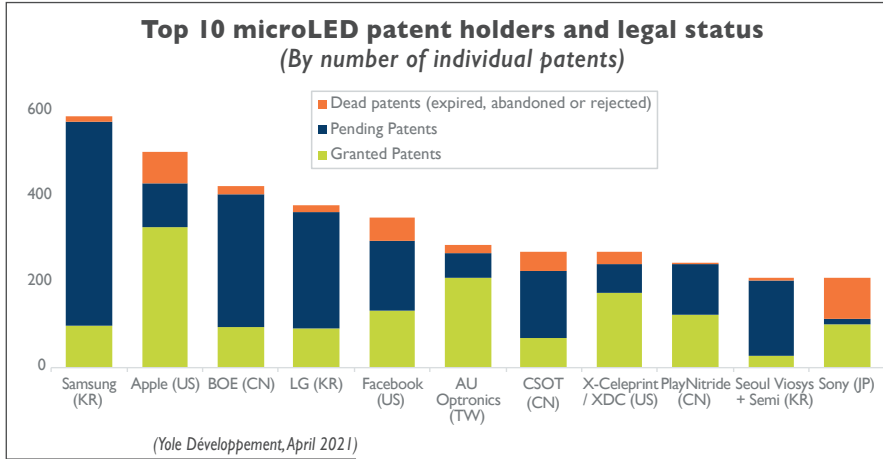
This report has been performed in collaboration with KnowMade and includes in-depth analyses of 5448 patents and patent applications grouped in 2453 patent families.

CSOT and BOE led patenting activity in 2019 and remained close to the top in 2020. With similar levels, startup PlayNitride, which raised another \$50M in 2020 to expand capacity, plays in the same league as leading panel makers and OEMs. Aledia, which moved into a new R&D facility in 2019 and raised close to US\$95M in 2020 to build a fab, is also accelerating its IP effort, inching closer to

historical leaders such as XDisplay. Panel makers that were missing have now entered our patent corpus including Japan Display, CEC Panda, HKC and Sakai Display.

The field is getting crowded but there is still time for ambitious newcomers to build credible portfolios. In late 2019 and early 2020, Konka and Visionox announced plans to invest \$365M and \$175M respectively in mini and microLED development and production ramp ups. Konka only filed its first microLED patent in 2019 and Visionox in 2017, but both already have sizable portfolios of pending applications, some showing a surprising level of maturity.

Activity at Apple peaked in 2017. However, the quality and details of new applications shows how far the company's technology has advanced. The acquisition of Tesoro indicates a focus that is shift or expansion toward enabling volume production rather than fundamental technology development. TSMC, which is expected to be one of Apple's key partners, appears for the first time in our corpus.



### INCREASING TECHNOLOGY MATURITY AND EVOLUTION TOWARD SOLVING MANUFACTURING CHALLENGES

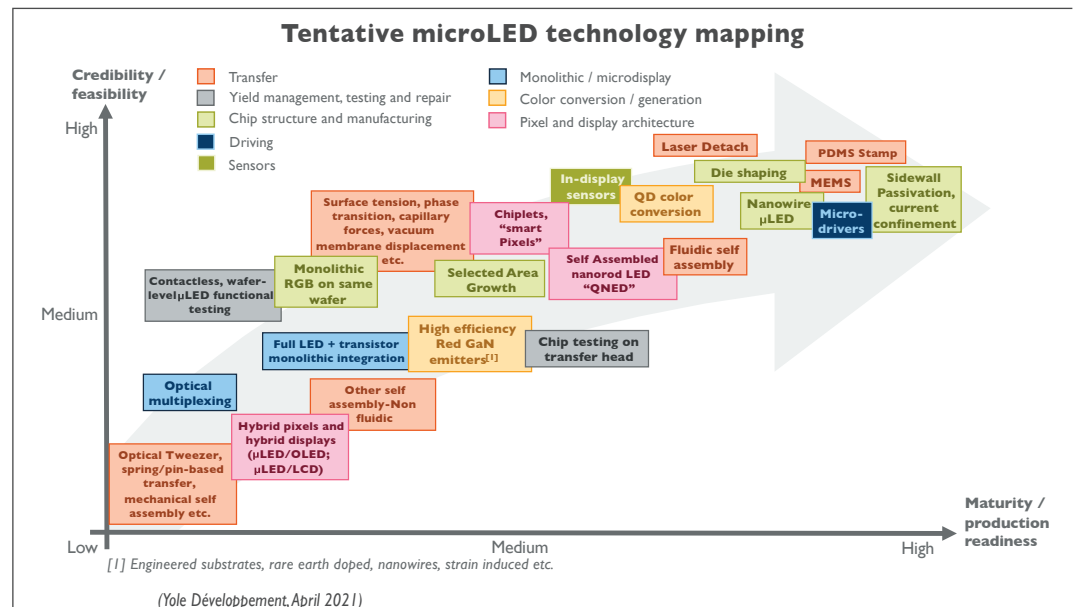
Many recent patents feel “closer to reality”, going deep into details of pixel bank structures and backplanes, or aiming at improving manufacturing efficiency. Detailed analysis shows that most of the IP leaders are moving beyond concepts and lab prototypes and tackling the challenges of bringing microLEDs to mass production. Inventors never seem to run short of new ideas to improve capabilities, cost of ownership, and enable freedom of operation in an increasingly crowded IP landscape.

Growing numbers of applications describe backplanes with testing functionalities, redundancies, and repair management. Efforts to improve small chip efficiency are accelerating on all fronts, including passivation, current confinement, tunnel junctions and plasmon resonance.

New transfer processes keep emerging, exploiting materials' contraction, expansion, phase changes or

surface tension. Polymer stamps still lead, but laser-based transfer dominated activity over the last two to three years. The 2019 comeback of self-assembly was sustained in 2020. Notably, many of LG's recent applications revolve around a technology ecosystem to enable its fluidic self-assembly process. Transfer is only the first step. With bonding pad sizes and gaps shrinking below 5 μm, die interconnects are challenging at microLED scale. Effort on this issue is therefore accelerating.

Growing the three emitter colors on the same wafer is also a hot area. Pixel chiplets that integrate emitters and driving circuits into a microsystem with redistribution layers are on the rise. For AR or light field, optical multiplexing is an intriguing option worth monitoring.



**COMPANIES CITED IN THE REPORT (non exhaustive list)**

Acer, AGC, Aledia, ANK, Aoshi, Apple/Luxvue, Applied Materials, Appotronics, APT, ASTI, AU Optronics, BOE, CEA, CEC Panda, Century Display, Changelight, HKC, Comptek, Cooledge, Corning, Cree, Dai Nippon Printing, Elux, EPilight, EPistar, Erised, Facebook/Oculus, Foxconn, , General Interface Solution, GLO, Globalfoundries, Goertek, Google/X Development, HC Semitek, HCP Technology, Himax, HiSense, HKC, HP, Huawei, IBM, IMEC, Innolux, Intel, ITRI, Jade Bird Display, Japan Display, Konka, , Kyocera, LG, Lightizer, Longli Tech., Lumens, Lumileds, Luxnour Technology, Mikro Mesa, MTC, Nationstar, Nichia, Nitto Denko, Nthdegree, Optovate, Osram, Ostendo, PlayNitride, Plessey, Point Engineering, Prilit Optronics, PSI Corp, Qisda, QMC, Rohinni, Raxium, Sakai Display, Samsung, Sanan, Seoul Semiconductor, Seoul Viosys, Sharp, Shineon, Siphoton, Sitan Technology, Sony, SUSTECH, Syndiant, TCL, TCL-CSOT, Terecircuits, Tianma, Toray Engineering, , Ultra Display Technology, Unimicron, V Technology, Visionox, Vitrolight, Vuereal, X-Celeprint/X-Display, and more.

**TABLE OF CONTENTS (complete content on i-Micronews.com)**

<b>Methodology and terminology</b>	<b>13</b>	> For all upcoming sections: Timeline, portfolio size versus strength index, IP leadership and blocking potential, analysis of recent technology trends, multiple examples of recent patents for each
<b>Executive summary</b>	<b>26</b>	
<b>Introduction to microLED displays</b>	<b>59</b>	
<b>Intellectual property in China</b>	<b>74</b>	
> Geographic trends in patent applications		
> Quality and strength of Chinese IP		
<b>MicroLED IP landscape overview</b>	<b>84</b>	
> Time evolution of patent applications and publications by: country of filing, company HQ, filing country, company type		
> Time evolution of patent applications and publications by: country of filing, company HQ, company type		
> Patent applicant ranking, leading players by region, company type		
> Analysis by company type (display makers, startup, OEM etc.)		
<b>Company analysis</b>	<b>113</b>	
> Application ranking evolution since 2017		
> Companies' portfolios - Technology segmentation		
> Main applicant ranking and legal status		
> Other metrics: Patent portfolio strength index, IP leadership, blocking potential etc.		
> IP transfers, main co-owned IP, collaborations and partnerships		
<b>Leading Company Overview</b>	<b>137</b>	
> BOE		
> Samsung: microLED vs. nanorod LEDs ("QNED")		
> LG		
> Foxconn Ecosystem (Innolux, Sharp etc)		
> TCL-CSOT		
> Playnitride		
> Visionox		
> Facebook		
> AU Optronics		
> Apple		
> Tianma		
> X-Celeprint / XDisplay		
> Sony		
> Konka		
> Lumens		
> Intel		
> Mikro-Mesa		
> Vuereal		
> Aledia		
> eLux		
> Top 40 summary: granted, pending and dead patents in each region		
<b>Technology segmentation and detailed analysis</b>	<b>168</b>	
> Overview of patent families by technology node		
<b>Transfer and interconnect</b>	<b>172</b>	
> Classifications of transfer processes		
> Analyses and IP trends per type of process : Elastomer stamps, MEMS, laser, SLM, self-assembly, phase change, films etc.		
> Transfer equipment		
> Die attach and interconnect		
> Die, backplane and pixel architectures to improve transfer and interconnect		
> New, unusual techniques		
<b>Pixel and display architecture, manufacturing</b>	<b>209</b>	
> Hybrids displays		
> Chiplets and microsystems		
> Thermal management		
> Optical multiplexing		
> Others: carbon nanotube RDL, multiplexed pixels		
<b>Monolithic microdisplays</b>	<b>228</b>	
> MicroLED microdisplay manufacturing		
> High density interconnect		
> Monolithic RGB		
> Color in monolithic microdisplays		
> Key players, new entrants		
<b>Chip design and manufacturing</b>	<b>244</b>	
> Improving IQE and light extraction		
> Anchor and tethers		
> RGB monolithic chips		
> Other notable chip structure innovations		
> Light extraction, beam shaping, cross talk		
<b>Light extraction and beam Shaping</b>	<b>269</b>	
> Emerging trends		
> Cross talk, external beam shaping		
<b>Backplane and display driving</b>	<b>279</b>	
> TFT vs. microdriver ICs		
> Chiplets and microdrivers, "Smart Pixels"		
> PWM and hybrid driving		
<b>Defect and yield management, repair, testing and inspection</b>	<b>292</b>	
<b>Color generation : native and converted</b>	<b>306</b>	
<b>Tiling and narrow bezels</b>	<b>314</b>	
<b>Sensors, others</b>	<b>323</b>	
> Trends: Touch and pressure, eye tracking, non-specific, others		
<b>Annex: older patents, selection of seminal patents</b>	<b>331</b>	
<b>Yole Group of Companies' presentation</b>	<b>350</b>	

**REPORT OBJECTIVES**

- Industry and intellectual property trends: including timeline, geographic trends, shift in leadership, emerging players, and organization types
- Identify leaders and emerging players
- Show leadership per region and company type
- IP leadership and portfolio strength of leading companies, and their technology/application focus
- Deep insights into the status of microLED display technologies, identifying emerging technologies and trends for each technology node
- Show which organizations are developing similar concepts
- Identify IP collaborations between various organizations



**AUTHORS**

**Eric Virey, PhD.** serves as a Principal Display Market and Technologies Analyst within the Photonics, Sensing & Display division at Yole Développement (Yole). Eric has spoken in more than 50 industry conferences over the last 10 years and has been interviewed or quoted in multiple media including: The Wall Street Journal, CNN, Fox News, CNBC, Bloomberg, Financial Review, Forbes, Technology Review, etc. Prior to joining Yole, Eric held R&D, engineering, manufacturing and marketing positions with Fortune 500 Company Saint-Gobain in France and the United States. Eric received a PhD in Optoelectronics from the National Polytechnic Institute of Grenoble. He is based in Portland, OR.



**Nicolas Baron, PhD.** is CEO and co-Founder of Knowmade. He manages the company's development and strategic direction, and personally leads the Electronics & Telecom department. He holds a PhD in Physics from the University of Nice Sophia-Antipolis and a master's degree in Intellectual Property Strategies and Innovation from the European Institute for Enterprise and Intellectual Property (IEEP Strasbourg), France.

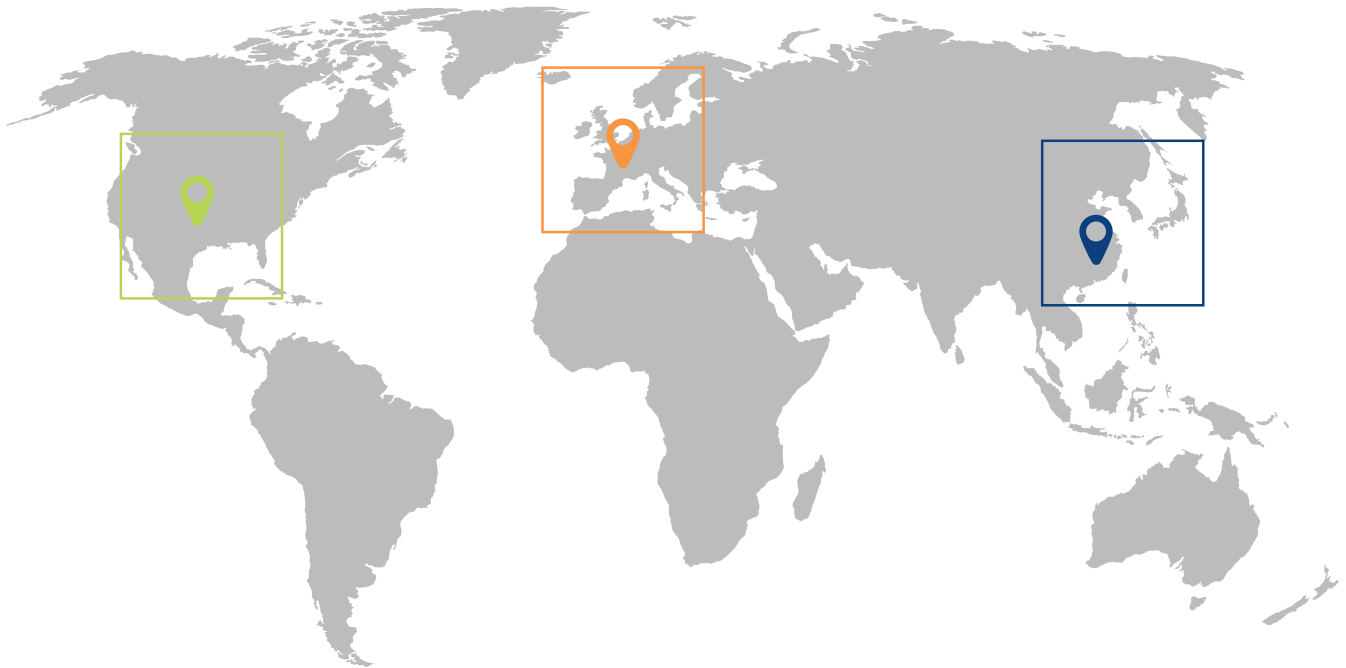
**RELATED REPORTS, MONITORS & TRACKS**



- MicroLED Displays – Market, Industry and Technology Trends 2020
- Displays and Optics for AR & VR 2020
- Microdisplays – Market, Industry and Technology Trends 2020
- Next Generation TV Panel Technology and Market Trends 2020

More information and details about our offers and bundles opportunities on [www.i-micronews.com](http://www.i-micronews.com)

## CONTACT



### Western US & Canada

Steve Laferriere - [steve.laferriere@yole.fr](mailto:steve.laferriere@yole.fr)  
+1 310 600-8267

### Eastern US & Canada

Chris Youman – [chris.youman@yole.fr](mailto:chris.youman@yole.fr)  
+1 919 607 9839

### Europe and RoW

Lizzie Levenez – [lizzie.levenez@yole.fr](mailto:lizzie.levenez@yole.fr)  
+49 15 123 544 182

### Benelux, UK & Spain

Marine Wybraniez - [marine.wybraniez@yole.fr](mailto:marine.wybraniez@yole.fr)  
+49 69 96 21 76 78

### India and RoA

Takashi Onozawa – [takashi.onozawa@yole.fr](mailto:takashi.onozawa@yole.fr)  
+81-80-4371-4887

### Korea

Peter Ok - [peter.ok@yole.fr](mailto:peter.ok@yole.fr)  
+82 1040890233

### Japan

Miho Ohtake – [miho.ohtake@yole.fr](mailto:miho.ohtake@yole.fr)  
+81 34405-9204

Toru Hosaka – [toru.hosaka@yole.fr](mailto:toru.hosaka@yole.fr)  
+81 90 1775 3866

### Japan and Singapore

Itsuyo Oshiba – [itsuyo.oshiba@yole.fr](mailto:itsuyo.oshiba@yole.fr)  
+81-80-3577-3042

### Greater China

Mavis Wang – [mavis.wang@yole.fr](mailto:mavis.wang@yole.fr)  
+886 979336809 +86 136 61566824

### Sales Coordination & Customers Service

David Jourdan – [david.jourdan@yole.fr](mailto:david.jourdan@yole.fr)  
+33 472 83 01 90

Fayçal El Khamassi – [faycal.khamassi@yole.fr](mailto:faycal.khamassi@yole.fr)  
+33 472 83 01 95

## ABOUT YOLE DEVELOPPEMENT

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. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 120 collaborators worldwide covering MEMS and Image Sensors, Compound Semiconductors, RF Electronics, Solid-state Lighting, Displays, Software, Optoelectronics, Microfluidics & Medical, Advanced Packaging, Manufacturing, Power Electronics, Batteries & Energy Management and Memory.

The “More than Moore” market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and Blumorpho, supports industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business.

### CONSULTING AND ANALYSIS

- Market data & research, marketing analysis
- Technology analysis
- Strategy consulting
- Reverse engineering & costing
- Design and characterization of innovative optical systems
- Financial services (due diligence, M&A)

More information on [www.yole.fr](http://www.yole.fr)

### MEDIA & EVENTS

- i-Micronews.com website, application & related e-newsletter
- Communication & webcast services
- Events: TechDays, forums...

More information on [www.i-Micronews.com](http://www.i-Micronews.com)

### REPORTS & MONITORS

- Market & technology reports
- Market and reverse technology quarterly monitors
- Structure, process and cost analysis and teardowns
- Cost simulation tool

More information on [www.i-micronews.com/reports](http://www.i-micronews.com/reports)

### CONTACTS

For more information about :

- Consulting & Financial Services: Jean-Christophe Eloy ([eloy@yole.fr](mailto:eloy@yole.fr))
- Reports & Monitors: David Jourdan ([david.jourdan@yole.fr](mailto:david.jourdan@yole.fr)) & Fayçal Khamassi ([faycal.khamassi@yole.fr](mailto:faycal.khamassi@yole.fr))
- Public Relations: Sandrine Leroy ([sandrine.leroy@yole.fr](mailto:sandrine.leroy@yole.fr))
- Marketing & Communication: Jean-Christophe Eloy ([eloy@yole.fr](mailto:eloy@yole.fr))

Definitions: **“Acceptance”**: Action by which the Buyer accepts these General Terms and Conditions of Sale in their entirety. It is done by signing the purchase order which states “I hereby accept Yole Développement’s General Terms and Conditions of Sale”.

**“Buyer”**: Any business user (i.e. any person acting in the course of its business activities for its business needs) placing an order pursuant to these General Terms and Conditions of Sale, with the exclusion of any individual consumer acting for his/her sole personal interest.

**“Seller”**: Headquartered in Villeurbanne (France), Yole Développement provides marketing, technology and strategy consulting, media and corporate finance services, reverse engineering/costing services as well as IP and patent analysis. With dedicated teams of technology & market analysts, Yole Développement operates worldwide with the key industrial companies, R&D institutes and investors to help them understand the market and technology trends.

**“Contracting Parties”** or **“Parties”**: The Seller on the one hand and the Buyer on the other hand.

**“Intellectual Property Rights”** (“IPR”) means any rights held by the Seller in its Products, including any patents, trademarks, registered models, designs, copyrights, inventions, commercial secrets and know-how, technical information, company or trading names and any other intellectual property rights or similar in any part of the world, notwithstanding the fact that they have been registered or not and including any pending registration of one of the above mentioned rights.

#### “Products”

Our products can be bought either on a unit basis or as a bundled offer (i.e. subscription for a period of 12 calendar months).

#### “Report”

Reports are established in PowerPoint and delivered in a PDF format with an additional Excel file. 30 min of Q&A session with an analyst/author can be included for all purchased reports (except the ones bought as a one user license). More time can be allocated on a fee basis.

#### “Monitor”

Monitors are established and delivered in Excel. An additional PDF can also be added. Q&A with an Analyst is possible for each monitor (except where specified otherwise). Frequency of the release vary according to the monitor or service (quarterly and monthly). All monitor products are eligible for a Corporate License.

#### “Tracks”

Yearly subscription to access a web-based interactive portal to view features and specs of a device or component based on a complete turnaround process.

#### “License”

For the reports 3 different licenses are proposed. Buyer has to choose one license type:

- One User License: The report is intended for only one identified user at the Company purchasing the report - Sharing is strictly forbidden
- Multi-User License: The report can be shared by an identified user at the Company purchasing the report with an unlimited number of employees of said Company, working in the country where the identified user is based. No rights are granted to any employees of any Subsidiaries or Joint Ventures of the Company.
- Corporate License: The report or monitor can be shared by an identified user of the Company purchasing the report with an unlimited number of employees of said Company on a global basis. Subsidiaries controlled by the Company are included, however Joint Ventures involving the Company are excluded.

**DISCLAIMER:** Notwithstanding the fact that certain persons within an organisation may be entitled to access a report pursuant to a Multi-User or a Corporate License, Yole Développement shall in no event incur any liability in any form whatsoever, if Yole Développement should sell one or more licenses directly to any such persons.

#### 1. SCOPE

1.1 Both Contracting Parties undertake to comply with these General Terms and Conditions of Sale.

**ANY ADDITIONAL, DIFFERENT, OR CONFLICTING TERMS AND CONDITIONS IN ANY OTHER DOCUMENTS ISSUED BY THE BUYER AT ANY TIME ARE HEREBY OBJECTED TO BY THE SELLER, ARE DEEMED WHOLLY INAPPLICABLE TO ANY SALE MADE HEREUNDER, AND SHALL NOT BE BINDING IN ANY WAY ON THE SELLER.**

1.2 These General Terms and Conditions of Sale shall be deemed valid and enforceable between the Contracting Parties after acceptance of an order from the Buyer by the Seller pursuant to Article 1.3 below. For such purpose, the Buyer, when signing the purchase order which mentions “I hereby accept Yole Développement’s Terms and Conditions of Sale” is deemed to have fully and unequivocally accepted these Terms and Conditions of Sale.

1.3 Orders are deemed to be accepted only upon written acceptance and confirmation by the Seller, within [7 days] from the date of order, to be sent either by email. In the absence of any confirmation in writing, no order shall be deemed to have been accepted.

#### 2. MAILING OF THE PRODUCTS

2.1 Products are sent by email to the Buyer after Seller’s confirmation:

- Within a few days from the Seller’s confirmation of the order for Products already released and paid; 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 The Seller shall by no means be responsible for any delay pursuant to Article 2.1 above, in particular in cases where a new event or access to new contradictory information would require the Seller analyst to dedicate extra time to compute 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 3 above.

2.4. The mailing is operated through electronic means either by email via the sales department or automatically online via an email/password. The Buyer is responsible for ensuring that the Buyers platform has the required capacities and authorisations to receive the Product(s) emailed by the Seller. If the Product’s electronic delivery format is defective, the Seller undertakes to replace it at no charge to the Buyer provided that the Seller 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 with 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.

2.6 No return of Products shall be accepted without prior written notification from the Buyer to the Seller, even in case of delayed delivery. Any Product returned to the Seller without the Buyer providing prior notification to the Seller as required under Article 2.5 above shall remain at the Buyer’s risk. In no event shall the Seller incur any liability for Products erroneously ordered by the Buyer, or for any request from the Buyer to replace a Product previously ordered by a different Product.

#### 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 deemed to be inclusive of all taxes applicable in the country where the Seller is based (except for France where VAT will be added). The prices are re-evaluated from time to time by the Seller. The effective price is deemed to be the one applicable at the time of the order.

3.2 Payments due by the Buyer shall be sent by cheque payable to Yole Développement, or made by credit card or by electronic transfer to the following account:

HSBC, 1 place de la Bourse 69002 Lyon France  
Bank code: 30056  
Branch code: 00170  
Account n°: 0170 200 1565 87  
BIC or SWIFT code: CCFRFRPP  
IBAN: FR76 3005 6001 7001 7020 0156 587

To secure the payments due to the Seller, the Seller reserves the right to request down payments from the Buyer. In such case, the need for a down payment will be mentioned on the corresponding order.

3.3 Payment is due by the Buyer to the Seller within 30 days from invoice date, except as otherwise specifically agreed in writing by the Buyer and the Seller. If the Buyer fails to pay at the due date and fails to request and obtain from the Seller a payment extension, 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.

3.4 The Seller publications (reports, monitors, tracks...) are due for delivery only after receipt by the Seller of any payment due by the Buyer prior to delivery.

3.5 In the event of termination of the contract by the Seller attributable to Buyer misconduct during the contract, the Seller will have the right to invoice all work performed at the time of termination, 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 the choice of the Products purchased as well as for the use and interpretations the Buyer makes of the documents it purchases, of the results the Buyer obtains, and of the advice and acts the Buyer bases thereon .

4.2 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 a Product or the use of or the inability by the Buyer to use the Seller’s website, or any information provided on the website, or contained in a Product;
- b) Any claim attributable to errors, omissions or other inaccuracies in a Product or interpretations thereof.

4.3 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.

4.4 Any Product that the Seller sells may, upon prior notice to the Buyer from time to time be modified by Seller or substituted with a similar Product meeting the needs of the Buyer. Such modification shall not lead to any liability of the Seller, provided that the Seller ensures the substituted Product is similar to the Product initially ordered.

4.5 In the case where, after inspection, it is acknowledged that a Product contain defects, the Seller undertakes to replace the defective product to the extent reasonably feasible and without indemnification or compensation of any kind for labour costs, delays, loss caused or any other reason being due by the Buyer . This undertaking from the Seller shall be effective for a maximum of two months starting from the delivery date but shall not be applicable in the event of force majeure as described in Article 5 below.

4.6 The deadlines that the Seller is asked to provide for the mailing of a Product are given for information purposes only and are not guaranteed. If such deadlines are not met, this shall not, without the agreement of the Seller lead to any claim for damages or right of cancellation of one or more orders by the Buyer, except for non-acceptable delays exceeding [3] months from the stated deadline. In such case only i.e. only in the event of a delay exceeding (3) months from the stated deadline the Buyer shall be entitled to ask for a reimbursement of any down payment previously made to the Seller, to the exclusion of any other damages.

4.7 The Seller does not make any warranties, express or implied, including, without limitation, those of sale ability and fitness for a particular purpose, with respect to any 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 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, labour difficulties, epidemics, major health event (e.g. Corona virus), equipment failure, late deliveries by suppliers or other difficulties which are beyond the control, and not attributable to 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 a Product, or any part of it to any other party other than employees of the Buyer Company (and only in the country of the Primary User for Multi-User Licenses). The Buyer shall have the right to use Products solely for its own internal information purposes. In particular, the Buyer shall therefore not use any 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 a Product or any derivative thereof.

6.3 If the Buyer would like to use data coming from a Product for presentations, press announcements and any other projects, the Buyer needs to contact Yole Développement’s Public Relations Director (info@yole.fr) to get an official authorization and confirm that the data are up to date. In return the Seller will make sure to provide up-to-date data under a suitable public format.

6.4 The Buyer shall be solely responsible towards the Seller for any infringement of the obligation described in Article 6.3 above, whether such infringement originates from the Buyer’s employees or any person to whom the Buyer has sent the Products. Furthermore, the Buyer shall initiate and personally take care of any related proceedings in coordination with the Seller, and the Buyer shall bear the related financial consequences in their entirety.

6.5 The Buyer shall define within its Company an identified user who shall serve as a contact person for the License purchased by the Buyer. This person will be the recipient of each new report. This person shall also be responsible on behalf of the Buyer, for compliance with all copyrights and other obligations relating to the protection of the Seller’s IP rights and general compliance with the terms of the License purchased by the Company. In the context of Bundle and Annual Subscriptions, the contact person shall decide within the Buyer which person(s) shall be entitled to receive the protected link that will allow the Buyer to access the Products.

6.6 It is acknowledged and accepted by the Buyer that whether purchased in the form of Bundles or Annual Subscription, all unselected reports will be deemed cancelled and lost after a period of 12 month following acceptance of the corresponding order by the Seller in accordance with provisions of Article 1.3 above .

6.7 It is further acknowledged and agreed by the Buyer that any investor in the Buyer Company, any external consultant of the Buyer Company or any joint venture done with a third party in which the Buyer Company is involved , is not entitled to use a Product, without paying to the Seller the full price for a license to the required Product..

#### 7. TERMINATION

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 incurred by the Seller, pursuant to such cancellation or postponement.

#### 8. MISCELLANEOUS

8.1 All the provisions of these General Terms and Conditions of Sale are for the benefit of the Seller, but also for that of its licensors, resellers and agents. Each of them is entitled to assert and enforce these provisions against the Buyer.

Any notices under these Terms and Conditions shall be given in writing and shall be effective upon receipt by the other Party.

8.2 The Seller may, from time to time, update these General Terms and Conditions of Sale, and the Buyer, shall be deemed to have accepted the latest version of such General Terms and Conditions of Sale, once they have been duly communicated to the Buyer by the Seller.

#### 9. GOVERNING LAW AND JURISDICTION

9.1 Any dispute arising out or linked to these General Terms and Conditions of Sale or to any Licenses or Products purchased in application thereof shall be submitted to the French Commercial Court of Lyon, which shall have exclusive jurisdiction upon such issues.

9.2 French law (without reference to any applicable conflict of law provisions) shall apply to these General Terms and Conditions of sale and any agreement between the Buyer and the Seller made pursuant thereto.