5G Leadership

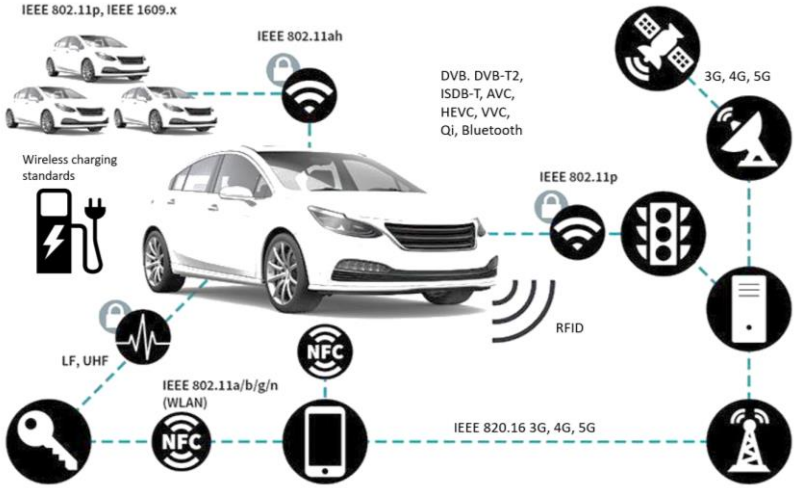
Tim Pohlmann CEO & Founder LexisNexis IPlytics

- **PhD & Post Doc.** TU Berlin, CERNA, MINES ParisTech.
- CEO and **founder of LexisNexis IPlytics**.
- **2023 IAM Strategist 300**. Recognized thought leader.
- **Economic expert** and author of studies for the EU Commission, WIPO and German government.
- Appointed **faculty lecturer** (TU Berlin, EPF Lausanne, CEIPI Strasbourg, Cleveland-Marshall College of Law)
- **Author** of over 50 industry articles published at IAM Magazine, IPWatchdog and Managing IP.

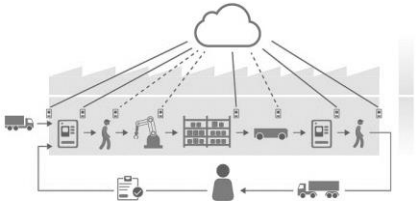
I. Technology Standards and the Future of Connectivity

Standards Connectivity Across Industries

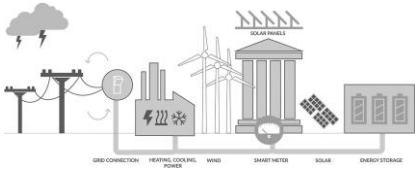
Smart Cars



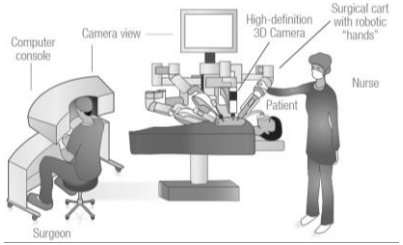
Smart Factory



Smart Energy



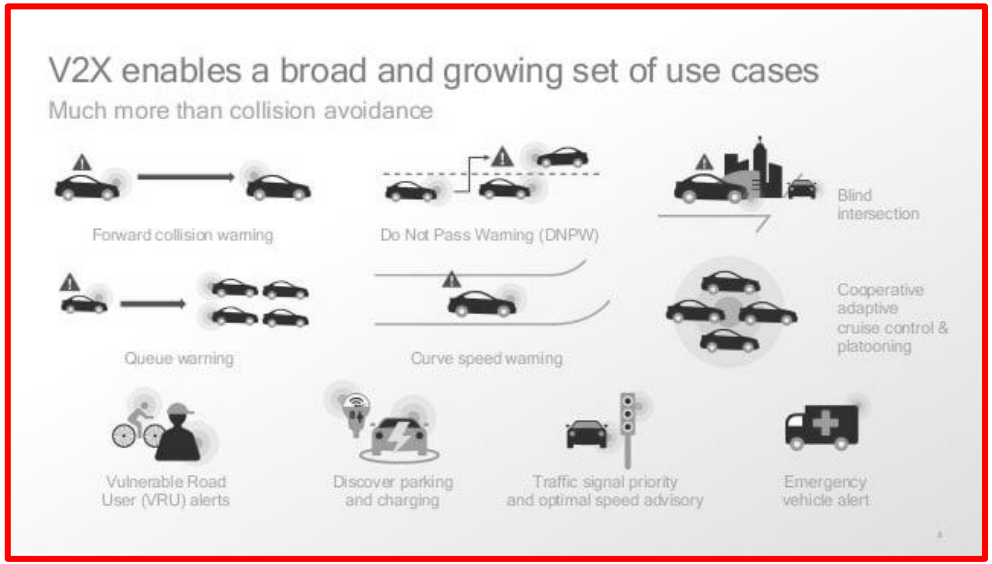
Smart Healthcare



Smart Home

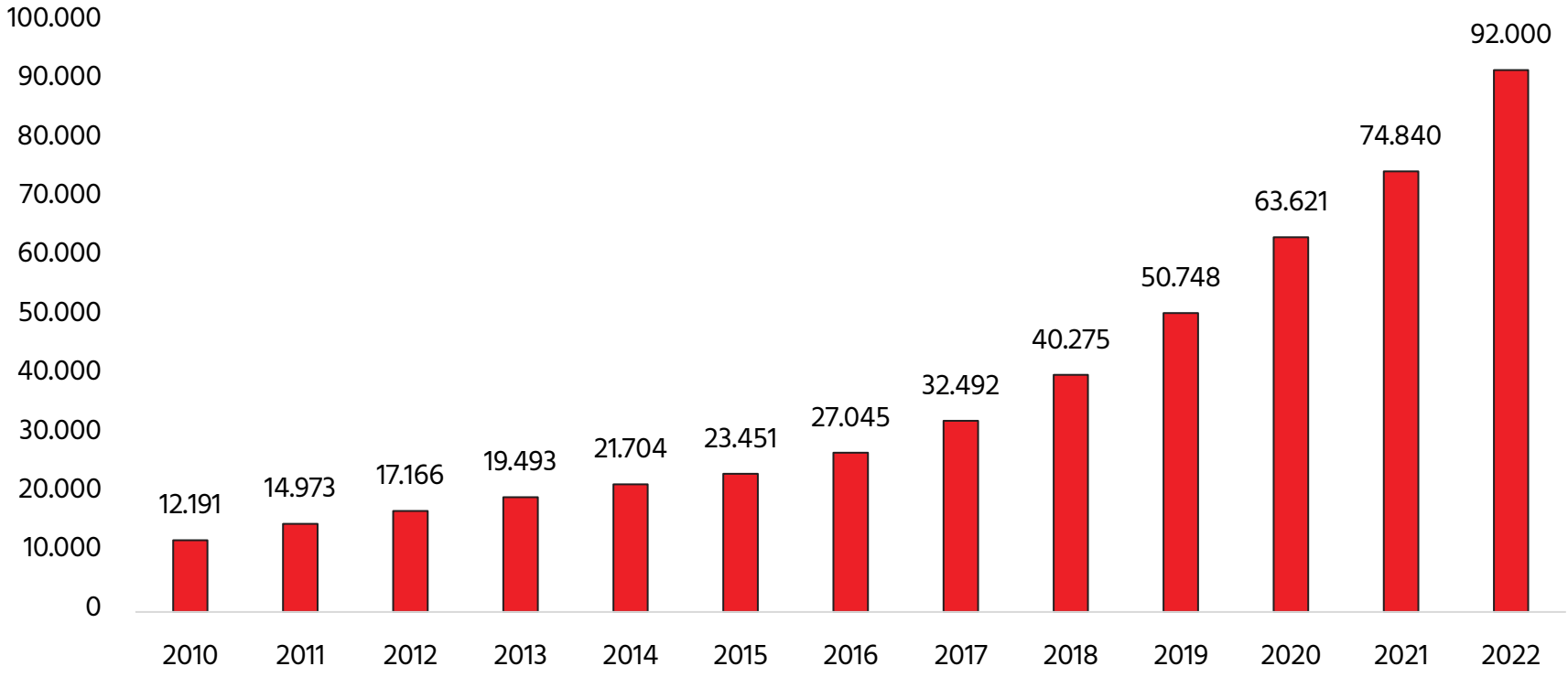
5G and Connectivity – **Smart Cars**

- **5G** enables larger bandwidth to allow cars to exchange real time information with, charging stations, parking lots, roadsides, traffic lights or other cars.
- **5G** will ensure a much more stable network to e.g. enable ADAS driving features to always connect to the Internet.
- **5G** will have a reduced latency to enable high quality streaming for e.g. conference video calls, on demand video streaming or gaming.

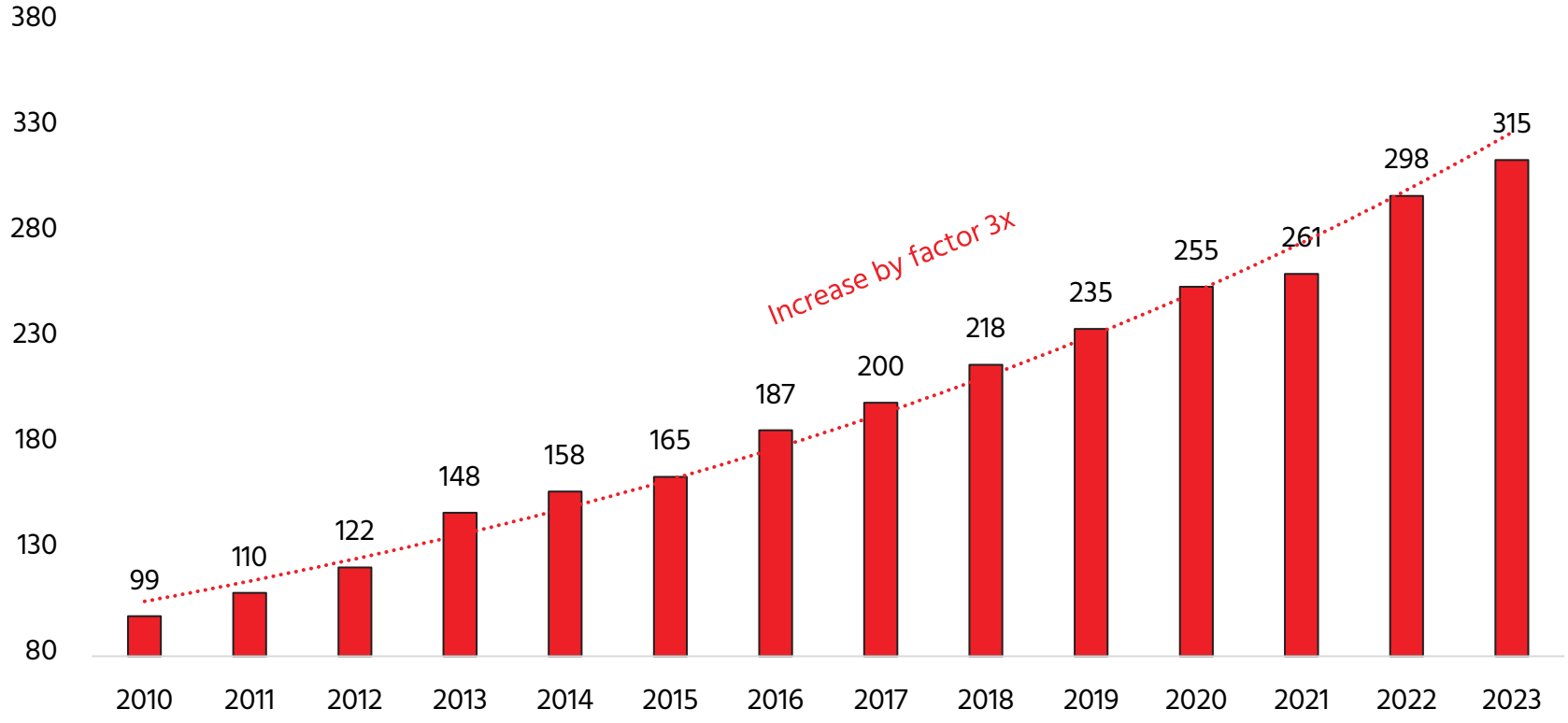


II. SEP Statistics

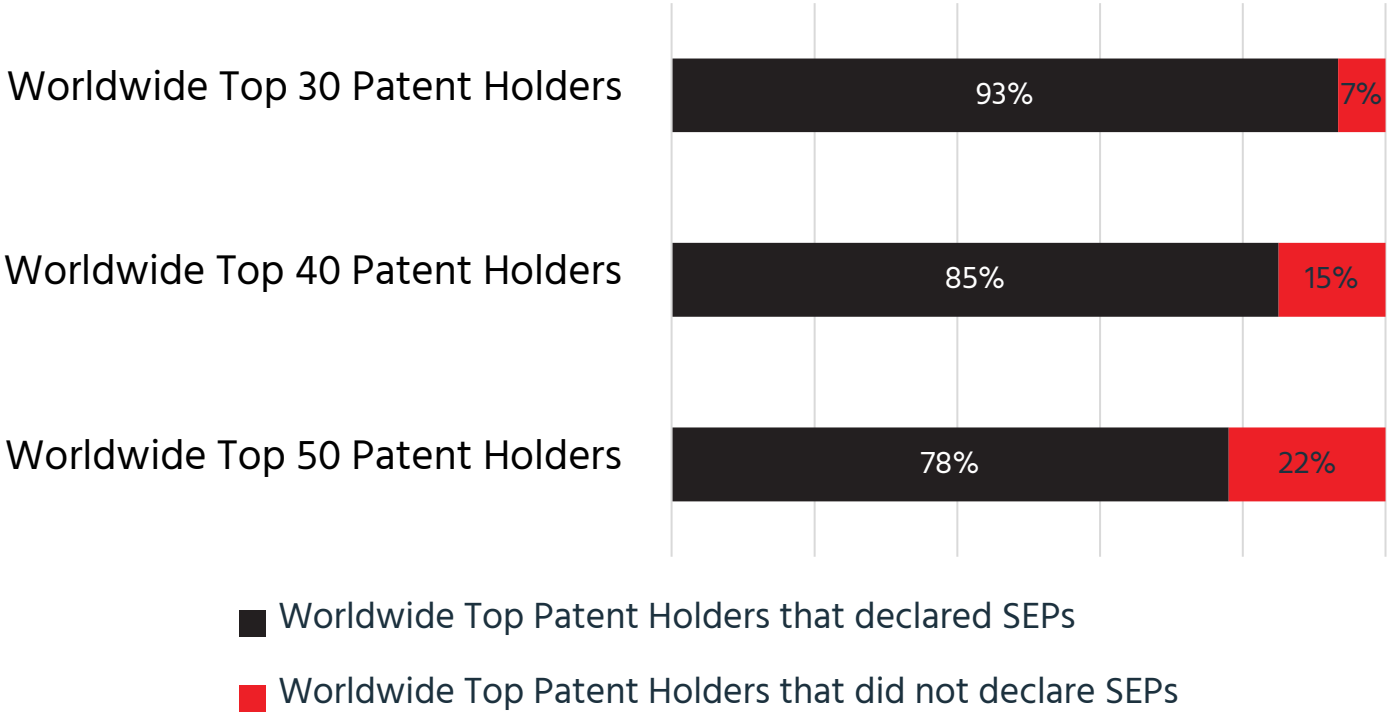
Increasing number of declared patent families across SSO



Fragmentation of declared patent ownership



Share of declared patent holders in top 50



III. 5G Statistics

How to identify 5G leaders?

- The 5G patent declaration data is based on self-declarations. ETSI does not filter or confirm essentiality, nor clean or update patents declared to the database.
- Some level of over-declaration is natural and in good faith, because ETSI requests patent owners to make timely declarations of any potential SEP even if the patent is yet pending and the standard not final.
- While ETSI patent declaration data has limitations, the data is a starting point to identify 5G leaders and is used as a reference point among others in 5G licensing negotiations.
- However, ETSI raw data is grossly inflated and requires accurate patent number normalization, rigorous cleaning and deduplication, family expansion, precise 5G classification and matching to correct patent ownership data and legal status data.

5G Data Cleaning

Match

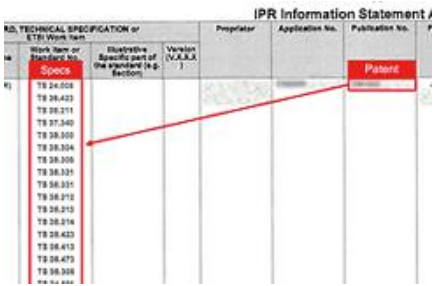
Declared number	Matched application number
WO2006KR03250	WO2006KR3250A
KR20020063942	KR200263942A
HK20010104144	HK2001104144A
KR19980053228	KR199853228A
KR19990054258	KR199954258A
US20060420323	US2006420323A

Declared patent numbers are messy. >40% of the declared **numbers** must be **normalized** to match patent office data.

Clean

Almost 20% of declared patent numbers are ambiguous, requiring checking and cleaning **out false positive**.

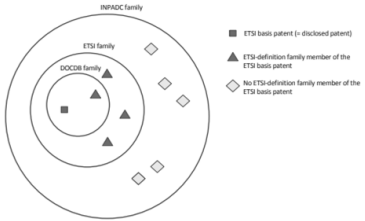
Deduplicate



Patents of the same family are declared multiple times which makes it required to **dedupliucate** and count by family.

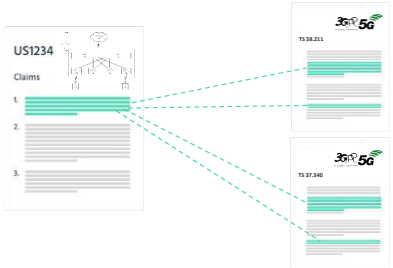
5G Data Processing

Expand



ETSI requires to declare one basis patent only which makes it required to **add family counterparts** from all jurisdictions.

Classify



Patents are declared to ambigous standard projects, which makes it required to classify patents to distinct **standards generations using TS**.

Enhance

IPlytics connects declared patents with accurate **ultimate patent owner** data, **legal status** and **patent family** information.

Data Sources

120 M
Patent Documents

Worldwide Patents (USA, Europe, Korea, Japan, China, etc.)
- Extended patent families
- Legal status (pending/granted, lapsed/revoked/active/expired)
- Worldwide reassignment information
- Worldwide litigation information

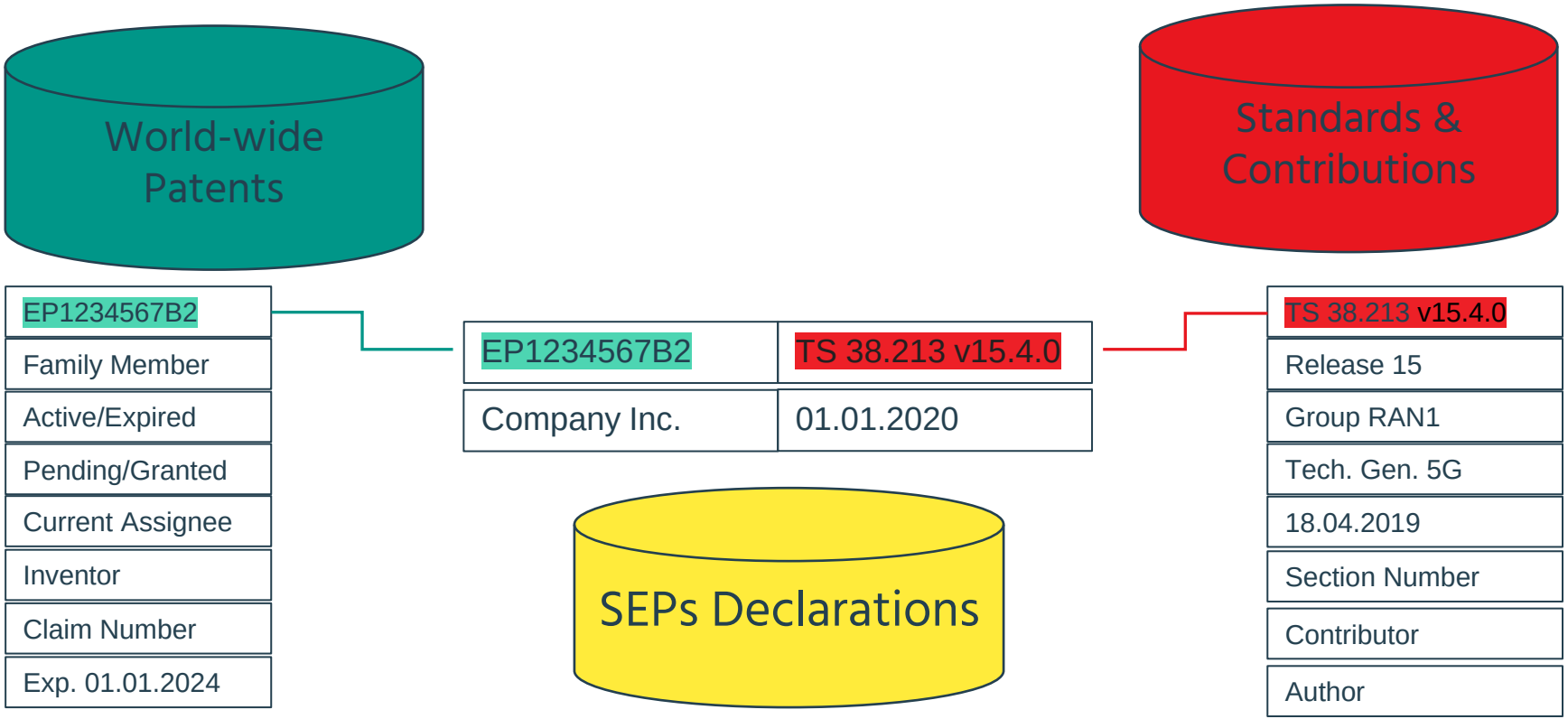
580.000
SEP declarations

Declared Patents
- Patent declaration lists from over 25 standards organizations
- Pooled patent lists form multiple licensing programs
- Patent and standards document ID
- Licensing commitments (e. g. FRAND, reciprocity)

4 M
Standards / Contributions

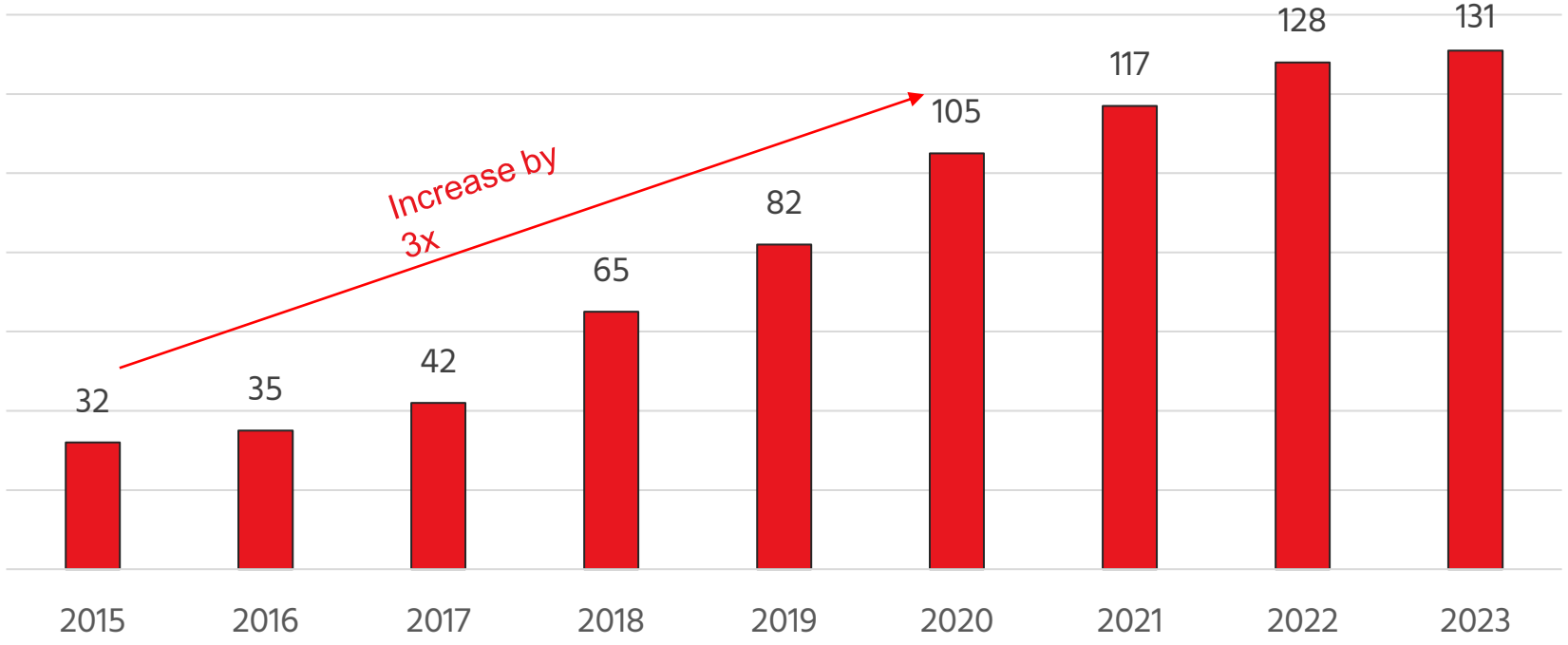
Standards Documents
- 2,5 M standards documents (Full text, author, supporting company)
- 1,5 M standards contributions (Full text, author, contributing company)
- Type (TS, TR, CR, WI), Status (revised, agreed, approved, noted)

Connecting The Dots



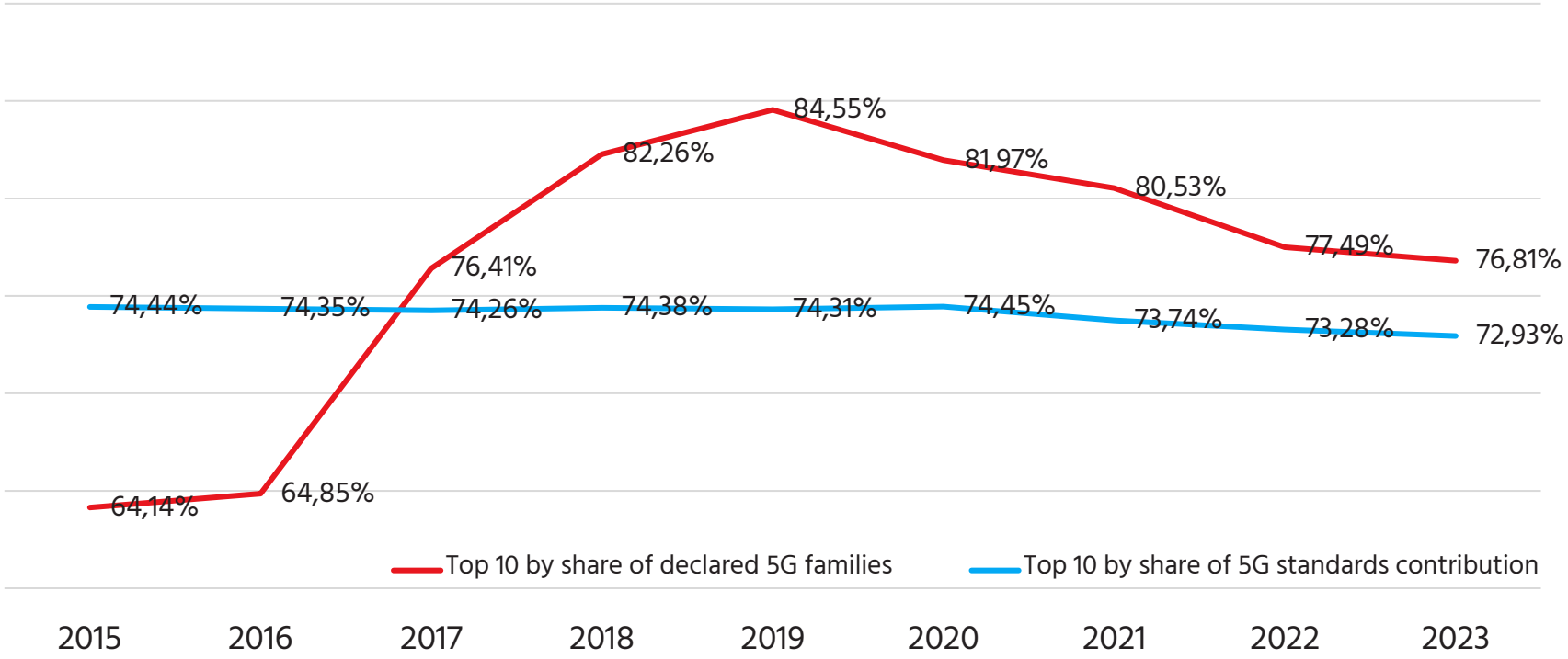
5G patent family-owning companies

Number of 5G patent family-owning companies with at least 2 granted and active EP or US declared patent families by year of declaration and year of patent family grant



Patent family share of the top 10 SEP-owning companies

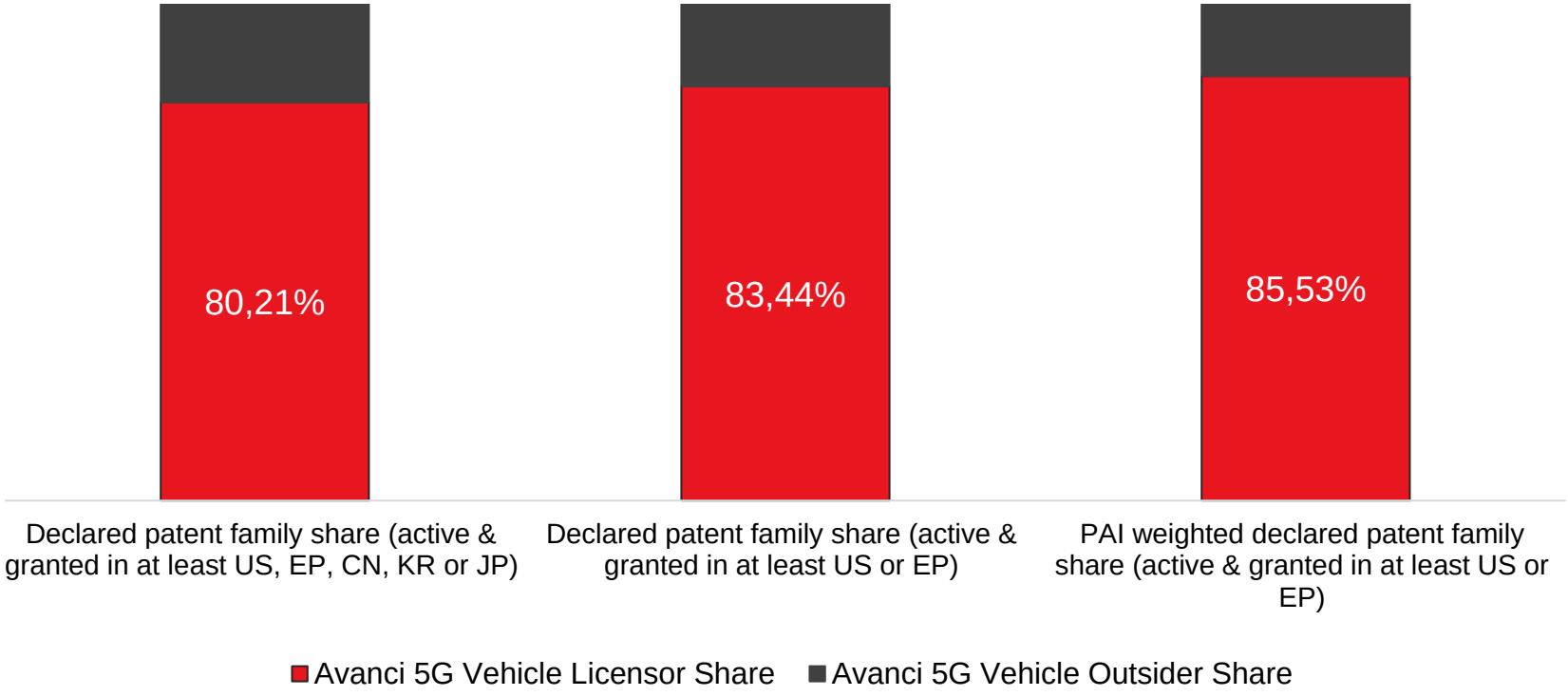
Patent family share of the top 10 SEP-owning companies by year of declaration and year of patent family grant (EP or US), by share of declared 5G families, by share of 5G standards contribution



Ranking of the top 10 5G patent family owners

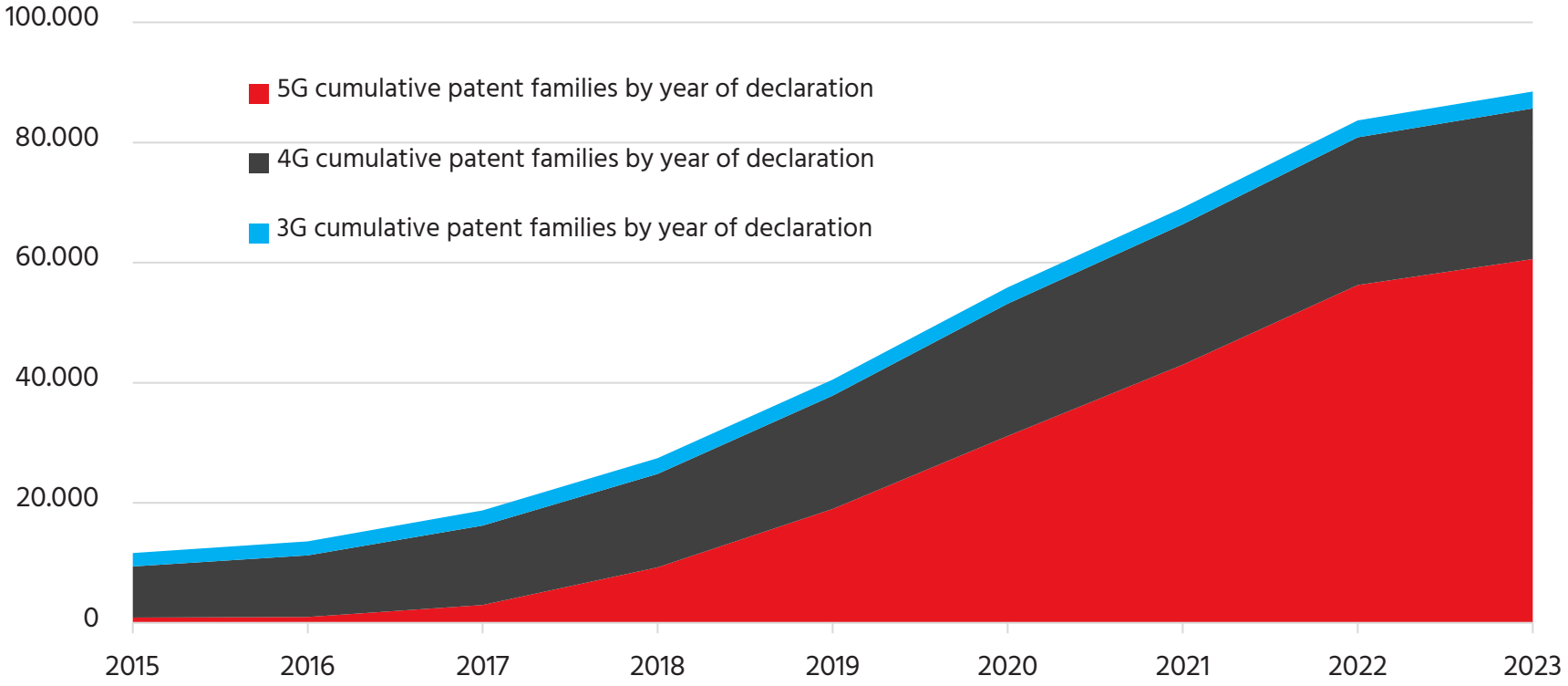
Rank	Ultimate Owner	Rank of 5G families (active, granted in at least EP or US)	Rank of Patent Asset Index Weighted 5G families (active, granted in at least EP or US)	Rank of 5G relevant 3GPP contributions
1	Huawei (CN)	1	3	1
2	Qualcomm (US)	2	1	4
3	Samsung (KR)	3	2	5
4	Ericsson (SE)	6	6	2
5	Nokia (FI)	5	7	3
6	LG Electronics (KR)	4	4	8
7	ZTE (CN)	7	8	6
8	Oppo (CN)	7	12	12
9	NTT (JP)	10	13	9
10	InterDigital (US)	14	5	15

Avanci Vehicle 5G Patent Family Share

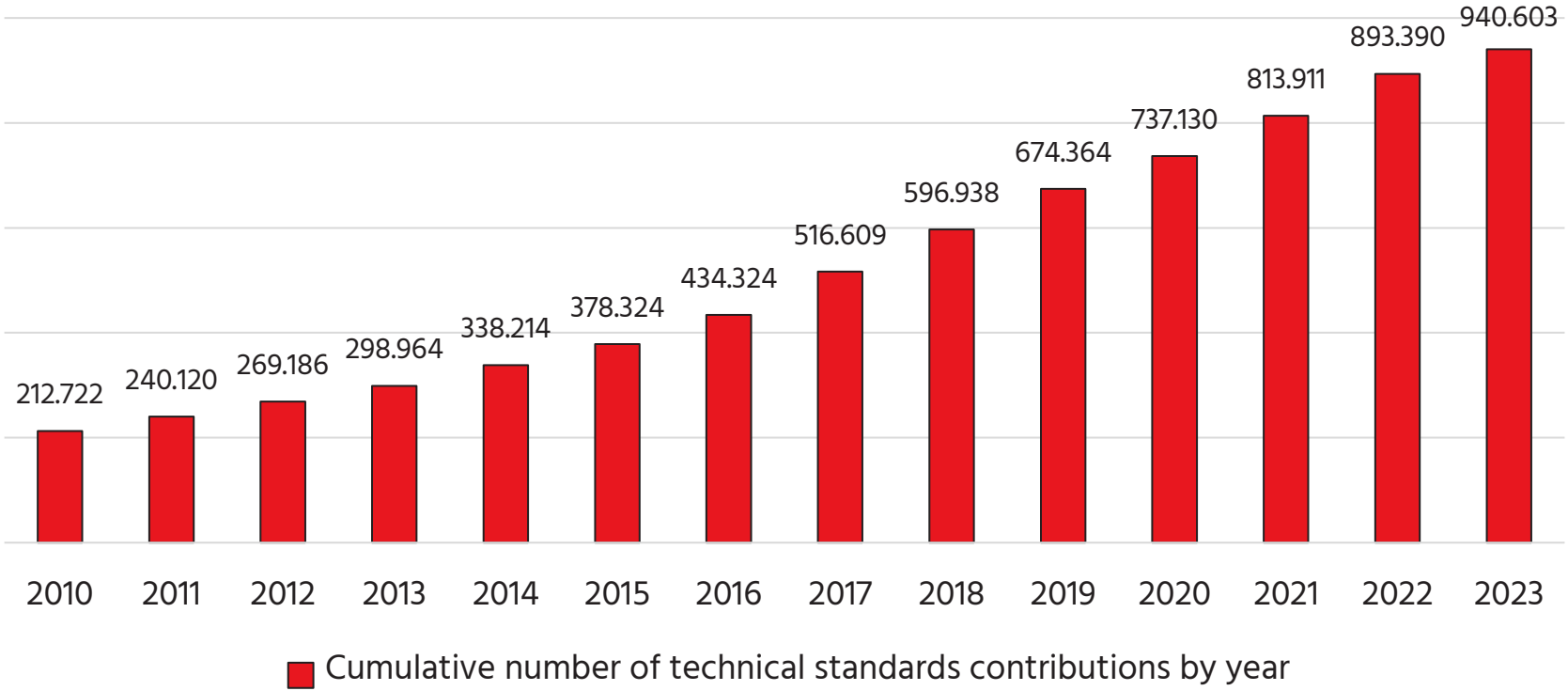


Cumulative number of active 3G, 4G, and 5G declared patent families

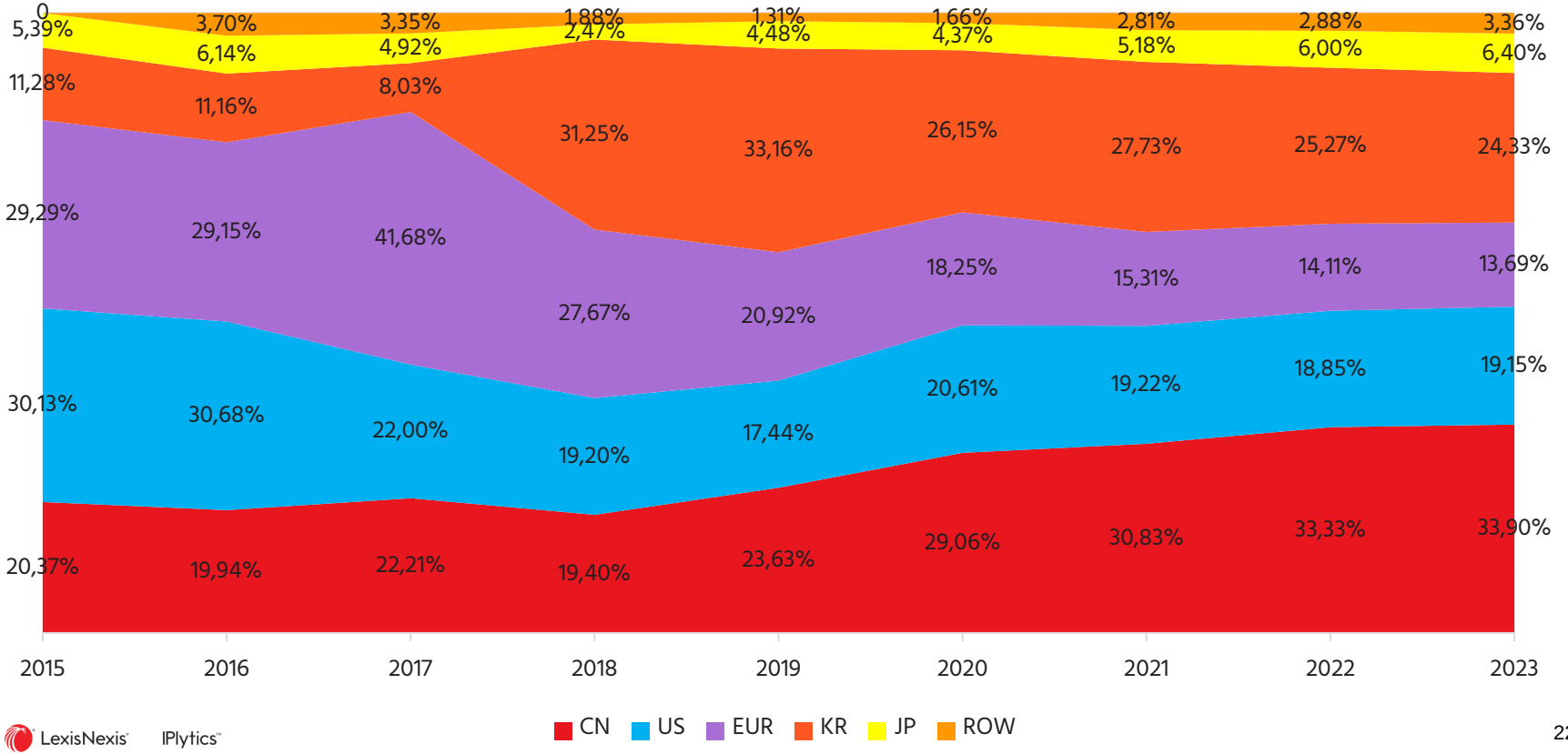
by year of declaration; pending and granted; not lapsed nor expired



Cumulative number of 5G related technical standards contributions over time

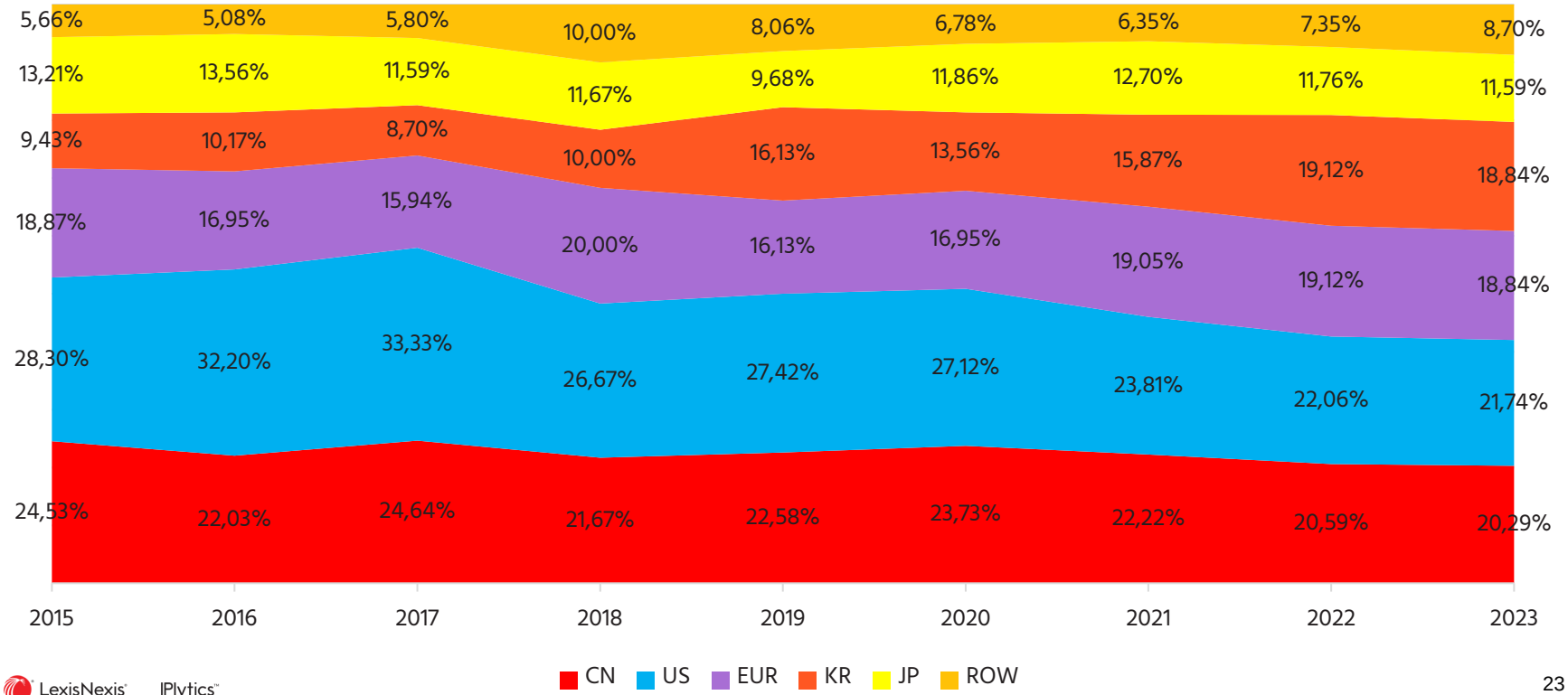


5G patent family (EP or US granted) share by the region of headquarter of 5G-owning companies



Share of the number of 5G-owning companies by the region of headquarter

Owning at least 10 EP or US-granted patent families



IV. SEP Licensing and Litigation

The future of 5G – Challenges for SEP licensing

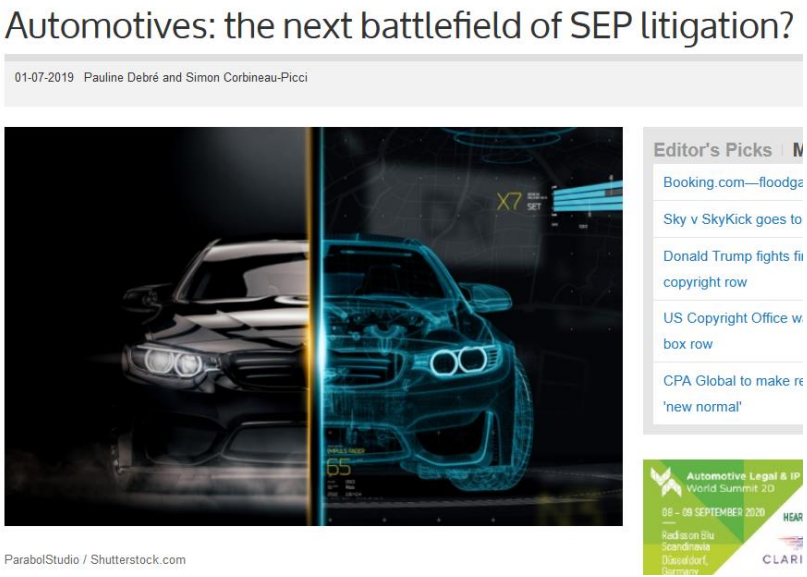
As to a Deloitte study published 2021:

- "The majority of **SEP holders** will actively monetize and **enforce their SEP portfolios** covering 5G standards in this fast-moving, high-investment environment."
- "SEP owners as well as standard implementers are faced with the challenge to **manage operational and financial risks** and cost exposures while striving to maximize value."

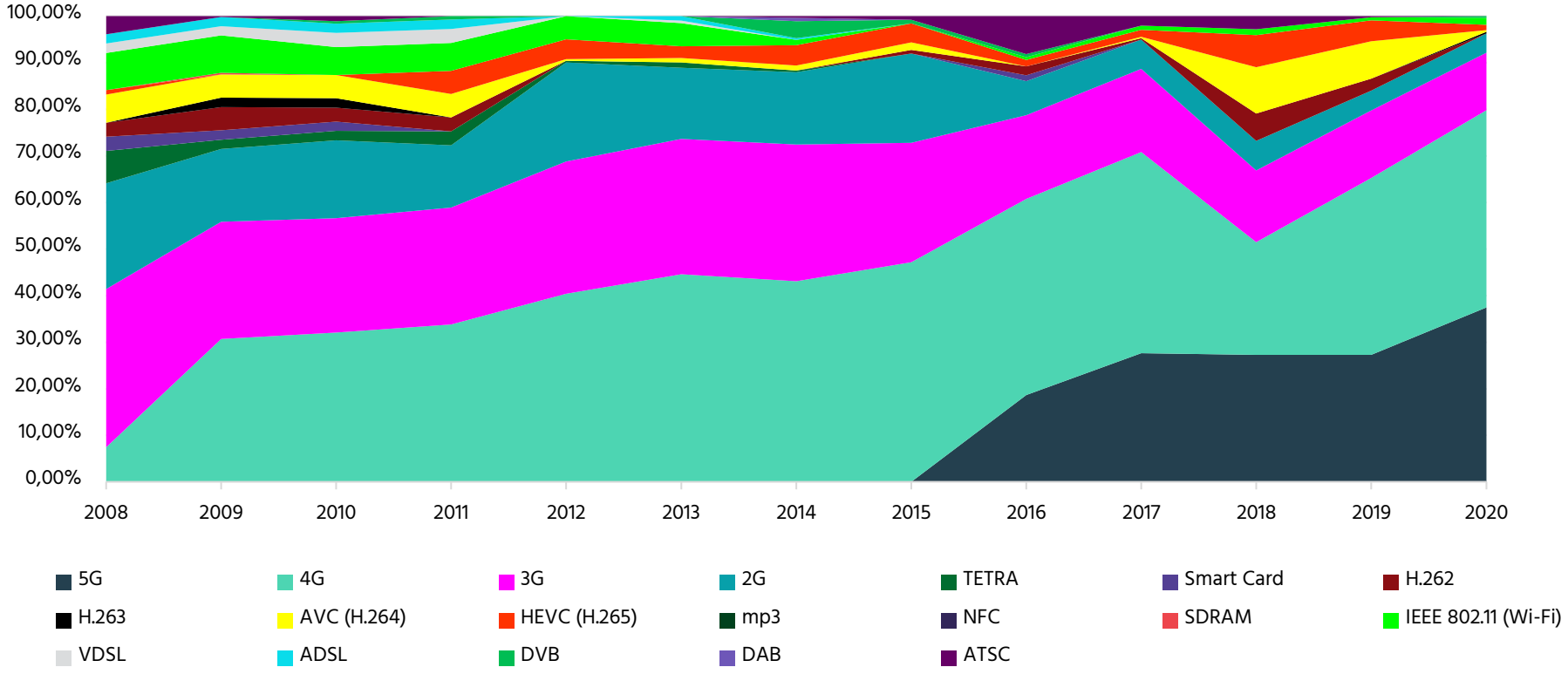
SEP litigation cases

Recent SEP auto industry litigation :

- Nokia vs. Daimler (Germany, 2019)
- Sharp vs. Daimler (Germany, 2020)
- Conversant vs. Tesla (Germany, 2020)
- Sharp vs. Tesla (Japan, 2020)
- Sisvel vs. Tesla (USA, 2021)
- L2 Mobile vs. Ford Motors (USA, 2021)
- IV vs. GM, Toyota, Honda (USA, 2021)
- Sharp vs. Volkswagen (Germany, 2022)
- Optis/Unwired vs. Ford Motors (USA, 2022)



Standards subject to SEP litigation 2001-2021



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SEP litigation statistics

Are declared SEPs more likely to be litigated? (number of US families)

- Yes, data shows that declared SEPs are more than **3x more likely** to be litigated!
- A declared SEP had a chance of **2.27% to be litigated** (US)

Are cases more likely to feature declared SEPs than other cases? (number of US cases)

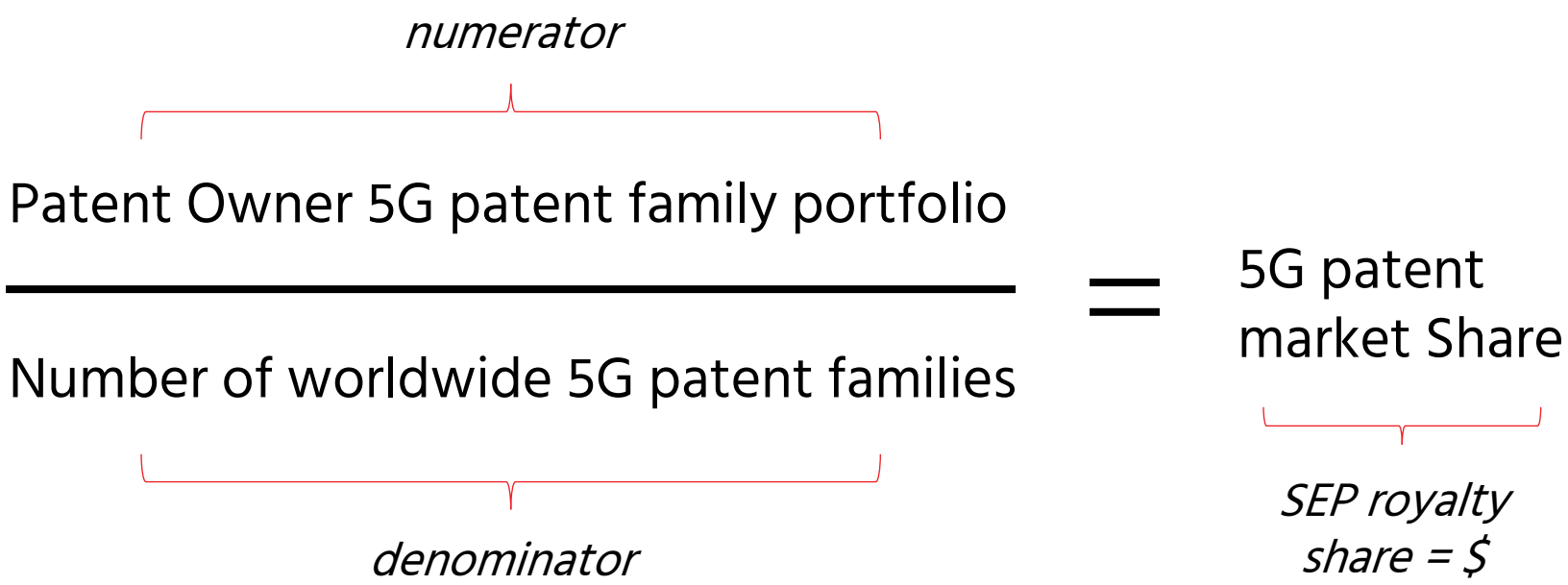
- Yes, over **4x more likely** a US case would feature a declared SEP
- Of all **US litigation cases, 2.06%** featured at least one declared SEP

SEP challenge across industries

- **The Internet of Things (IoT)** heavily relies on connectivity standards such as 4G/5G, Wi-Fi 5/6, HEVC/VVC or many other standards that are subject to thousands of SEPs.
- **SEP litigation sharply increases** across industries and around the world
- It is challenging to **keep up with technology trends**, new standards technologies as well as SEPs or new SEP pool license programs.

V. SEP Data Access Challenges

Determine the Royalty Share



There are always two moving targets when identifying SEP portfolios and standards

Challenges for top-down approaches

SEP portfolios are dynamic in size, value and market share

- - Patents may expire, laps, revoked or invalidated
- + More patents are filed, pending patents are granted
- The change of patent **ownership** (SEPs 2x more often than other patents) may decrease or increase SEP portfolios significantly
- **New versions of standards** are published where newly integrated **sections** are eventually fully **mappable to claims** of patents that were not essential before
- **The overall number of SEPs** for a standard changes (denominator) which changes the **SEP owner's SEP portfolio** (numerator) **share**

➢ **The size, value and share of SEP portfolios may significantly change over time!**

Standard Essential Patent Data (1978-2023)

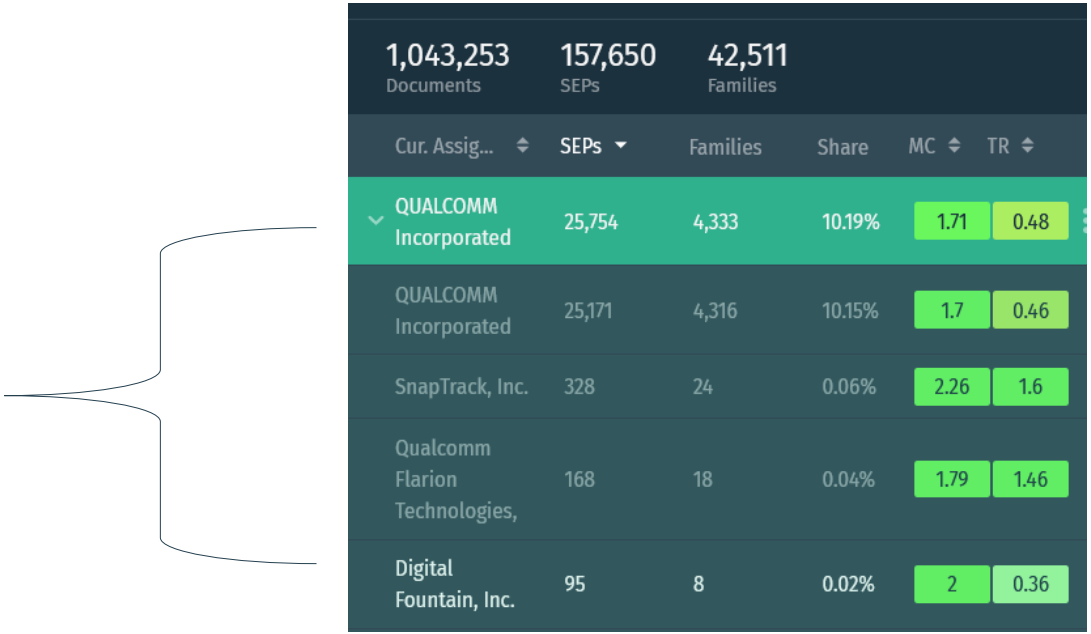
SSO	Example Standards	Declared SEPs
ETSI	2G, 3G, 4G, 5G, NB IoT, LTE-E, ITS, C-V2X, DVB, DMR, DECT, TERA	466,862
ITUT	AVC H.264, HEVC H.265, VVC H.266	37,928
ATSC	ATSC -1.0- 3.0, Over the Air Internet TV Broadcasting	32,162
ISO	RFID, MPEG 1-4, mp3	12,507
ATIS	2G, 3G, 4G, 5G	14,070
IETF	Internet Protocol Standards	8,600
IEEE	Wi-Fi 1-7, DSRC, WAVE, LAN/MAN, Bluetooth, ZigBee, FireWire, WiMAX, Ethernet	7,848
ARIB	2G, 3G, 4G, 5G	2,500
IEC	Electric vehicle conductive charging, Industrial Networks, CQN series RF, RFID	2,200
Wireless Power Con.	Wireless Charging Qi Standard	2,400
OMA	GSM, UMTS or CDMA2000	5,400
ISO/IEC	MPEG Visual	1,770
SMPTE	Motion Picture and Television	2,250

Standard Essential Patent Data (1978-2023)

SSO	Example Standards	Declared SEPs
ANSI	Wi-Fi 1-7, LAN/MAN, Bluetooth, ZigBee, FireWire, WiMAX, Ethernet	1,044
IEEE / IEC	Wi-Fi 1-7, DSRC, WAVE, LAN/MAN, Bluetooth, ZigBee, FireWire, WiMAX, Ethernet	260
ITUR	Radio Transmission	1,690
CCSA	2G, 3G, 4G, 5G	332
VESA	DisplayPort	196
OASIS	XrML WSRP UOML | UOML UDDI	279
Broadband Forum	Ethernet, ADSL, DSL, Optical Fiber	83
TIA	TDMA, CDMA, WCDMA	96
CEN	IST, Electronic Identification, Authentication and Trusted Services	55
SAE	Broadband PLC Communication for Plug-in Electric Vehicles, Mobile Fueling Station	20
ECMA	NFC	3

Corporate Tree Data

- The company portfolio analysis aggregates patents as to the **ultimate parent company**

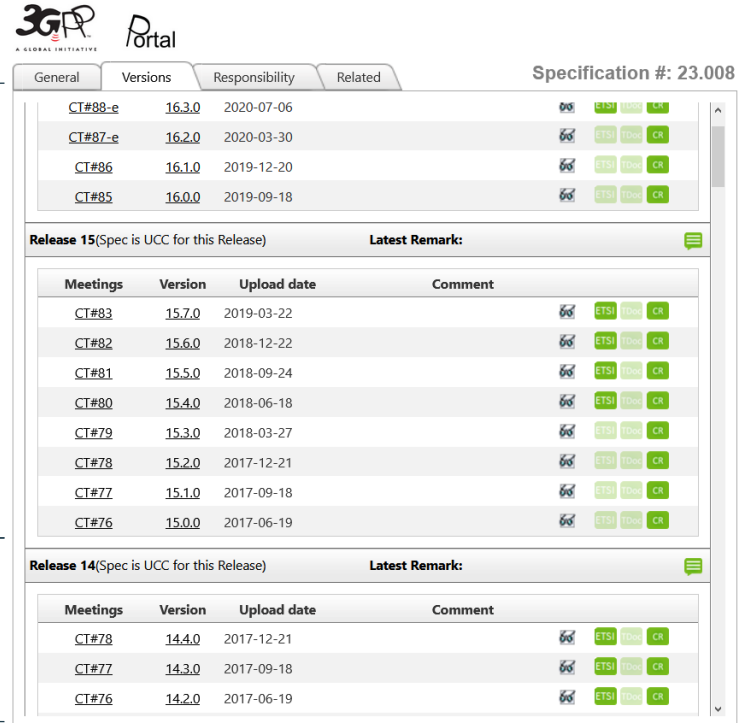


5G Standard specifications defined by 3GPP

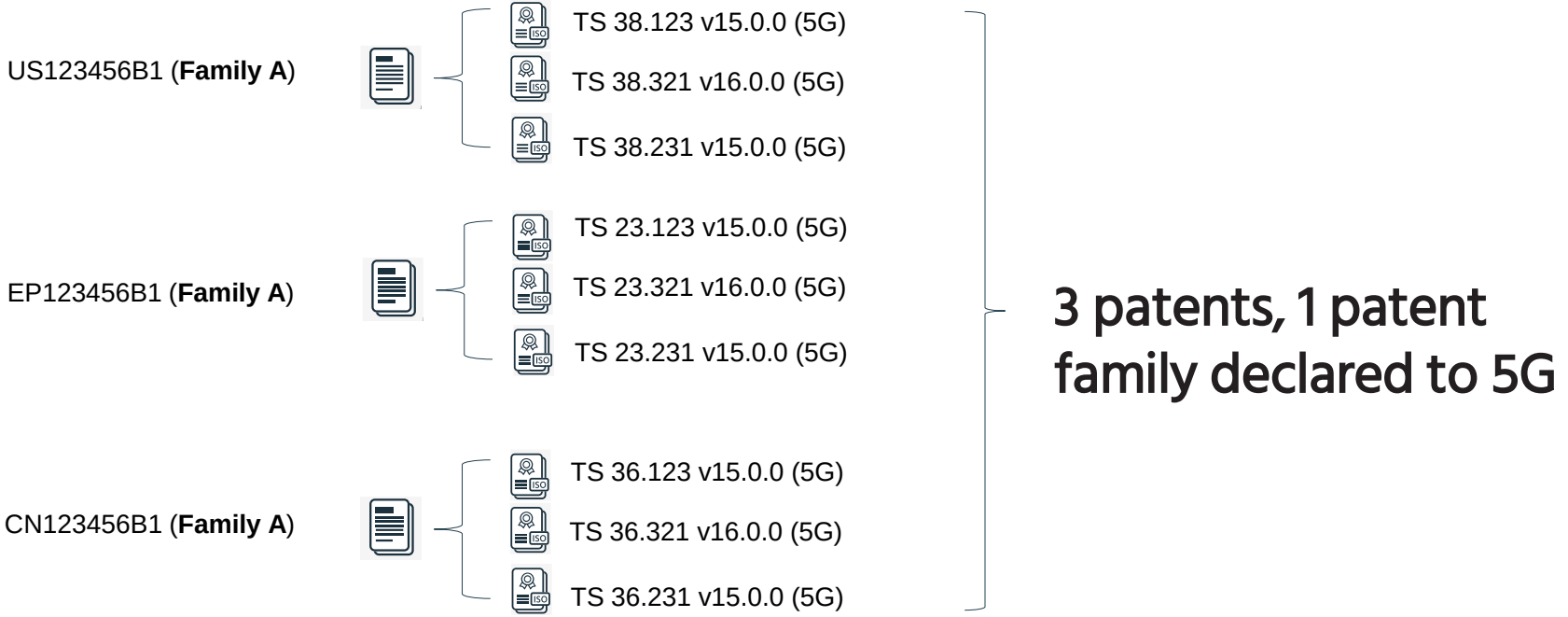
- Different **TS versions** are subject to different releases and to different generations.

5G
(Release 15 & 16)

4G
(Release 13 & 14)



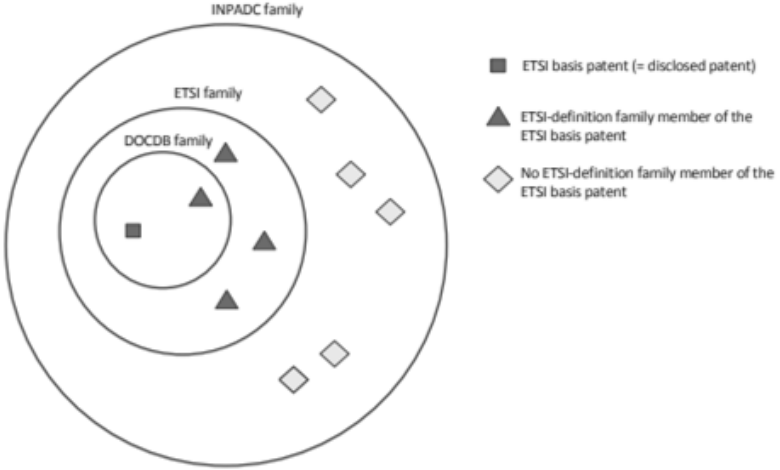
Distinct family counting



Data enhancement – **missing family counterparts**

ETSI Patent Family – basis patent

- The FRAND obligation covers all **ETSI family** (simple family DOCDB) members of initially declared so called **"basis patents".** In other words, the ETSI FRAND obligation only requests the **declaring company to declare at least one patent family member** (ETSI family definition) assuming all other family members are covered by the FRAND commitment.
- As of January 2023, IPlytics added **56,882 US, EP, CN, KR and JP patent counterparts** where at least one family member (ETSI family definition) was declared.



VI. IoT Protocols

Patent Declaration Practices

- **Specific declarations with all details**

Publication Number	Declaring Company	Standard Document	Section Number	Declaration Date
US8837381B2	Ericsson	TS 38.213 v17.1.0	10.2A	19.05.2017
EP2208384B1	Panoptis	TS 38.213 v17.1.0	19.2	07.05.2020
EP1952549B2	Huawei Technologies	TS 38.212 v17.1.0	5.5	23.10.2018
EP2234452B2	ZTE	TS 23.292 v17.0.0	7.4.2.1.2	24.10.2019
EP3496334B1	InterDigital	TS 23.502 v17.4.0	4.15.2	30.09.2021
EP2124499B1	Innovative Sonic	TS 38.331 v17.0.0	8	09.07.2020
US8228827B2	Samsung Electronics	TS 38.321 v15.6.0	5.1.5	23.08.2019
EP3557938B1	Guangdong Oppo	TS 38.331 v17.0.0	5.7.10.5	25.05.2021
EP1705828B2	Nokia Technologies	TS 33.220 v15.3.0	3.2	29.10.2018
EP2289268B8	Xiaomi	TS 24.008 v17.6.0	4.4.4.5	05.06.2020
US8000717B2	QUALCOMM	TS 38.473 v17.0.0	9.3.1.271	16.03.2018
US7643456B2	Conversant Wireless	TS 24.008 v11.8.0	9.5.15a	21.08.2018
US9426697B2	BlackBerry UK Limited	TS 24.301 v17.6.0	5.5.1.2.5C	06.11.2014
US7782818B2	Core Wireless	TS 24.301 v8.8.0	5.3.2	09.06.2017

Patent Declaration Practices

- **Specific declarations with no details**

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EP2208384B1	Panoptis	TS 38.213		07.05.2020
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EP2234452B2	ZTE	TS 23.292		24.10.2019
EP3496334B1	InterDigital	TS 23.502		30.09.2021
EP2124499B1	Innovative Sonic	TS 38.331		09.07.2020
US8228827B2	Samsung Electronics	TS 38.321		23.08.2019
EP3557938B1	Guangdong Oppo	TS 38.331		25.05.2021
EP1705828B2	Nokia Technologies	TS 33.220		29.10.2018
EP2289268B8	Xiaomi	TS 24.008		05.06.2020
US8000717B2	QUALCOMM	TS 38.473		16.03.2018
US7643456B2	Conversant Wireless	TS 24.008		21.08.2018
US9426697B2	BlackBerry UK Limited	TS 24.301		06.11.2014
US7782818B2	Core Wireless	TS 24.301		09.06.2017

Patent Declaration Practices

- **Blanket declarations with no details**

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	Ericsson	TS 38.213		19.05.2017
	Panoptis	TS 38.213		07.05.2020
	Huawei Technologies	TS 38.212		23.10.2018
	ZTE	TS 23.292		24.10.2019
	InterDigital	TS 23.502		30.09.2021
	Innovative Sonic	TS 38.331		09.07.2020
	Samsung Electronics	TS 38.321		23.08.2019
	Guangdong Oppo	TS 38.331		25.05.2021
	Nokia Technologies	TS 33.220		29.10.2018
	Xiaomi	TS 24.008		05.06.2020
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	Core Wireless	TS 24.301		09.06.2017

Patent Declaration Practices

- **Specific declarations with all details**

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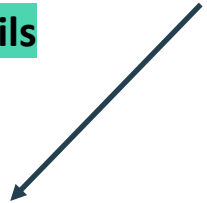

Publication Number	First Applicant/Assignee	Assignee Highest Parent	Inventor(s)	Publication Date	Application Date	Expiration Date	CPC/IPC	Active (not lapsed or expired)	Granted	Litigation Case Name	Litigation Filed Date
US8837381B2	Ericsson	Ericsson	ENGLUND EVA	16.09.2014	27.09.2007	14.10.2030	H04W72/14	true	true	Ericsson Inc., LM Ericsson Telefonaktiebolaget (publ) v. Apple Inc.	2015-02-26

Patent Declaration Practices

- **Specific declarations with all details**

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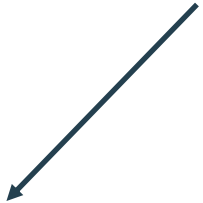
US8837381B2	Ericsson	TS 38.213 v17.1.0	10.2A	19.05.2017



Standard Document ID	Standard Project	Technology Generation	Releases	Committee Groups	ISLD	Pooled?	FRAND	Reciprocity
TS 38.213 v17.1.0	3GPP NR Rel 17	5G	Release 17	RAN1	ISLD-201704-009	not true	true	true

Patent Declaration Practices

- **Specific declarations with all details**

Publication Number	Declaring Company	Standard Document	Section Number	Declaration Date
US8837381B2	Ericsson	TS 38.213 v17.1.0	10.2A	19.05.2017

Publication Number	US8837381B2

CLAIM 13

13. A user equipment (UE) for providing channel state feedback from the UE to a base station, the UE comprising: a determining unit configured to determine whether the UE has received an uplink grant from the base station; and a transmitting unit configured to transmit a first type of channel state feedback information to the base station on the granted resource when the UE has received an uplink grant, wherein the first type of channel state feedback information is a high-resolution type, and a second type of channel state feedback information on a dedicated resource when the UE has not received an uplink grant, wherein said second type of channel state feedback information is a low-resolution type, using a smaller number of bits than the first, high-resolution type.

Standard Document Id	TS 38.213 v17.1.0

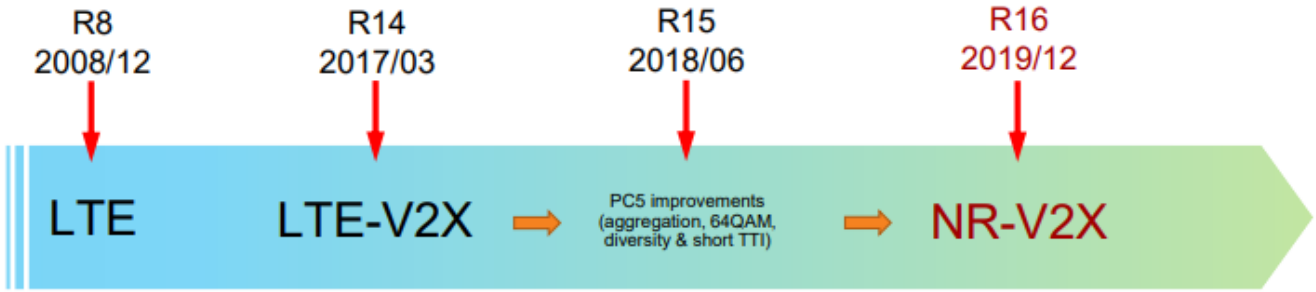
SECTION 10.2A

A UE validates, for scheduling activation or scheduling release, a SL configured grant Type 2 PDCCH if - the CRC of a corresponding DCI format 3_0 is scrambled with a SL-CS-RNTI provided by sl-CS-RNTI, and - the new data indicator field in the DCI format 3_0 for the enabled transport block is set to '0' Validation of the DCI format 3_0 is achieved if all fields for the DCI format 3_0 are set according to Table 10.2A-1 or Table 10.2A-2. If validation is achieved, the UE considers the information in the DCI format 3_0 as a valid activation or valid release of SL configured grant Type 2. If validation is not achieved, the UE discards all the information in the DCI format 3_0. ETSI ETSI TS 138 213 V17.1.0 (2022-05)1603GPP TS 38.213 version 17.1.0 Release 17 Table 10.2A-1: Special fields for SL configured grant Type 2 scheduling activation PDCCH validation DCI format 3_0 HARQ process number set to all '0's Table 10.2A-2: Special fields for SL configured grant Type 2 scheduling release PDCCH validation DCI format 3_0 HARQ process number set to all '1's Frequency resource assignment (if present) set to all '1's

5GAA Automotive Association

- Current version of C-V2X is called LTE-V2X as part of 3GPP Rel-14 & 15
- NR-V2X as part of Rel-16 comes as an improvement to support autonomous driving
- NR-V2X will complement and co-exist with LTE-V2X i.e. operation of NR-V2X alone is not considered.

3GPP A GLOBAL INITIATIVE

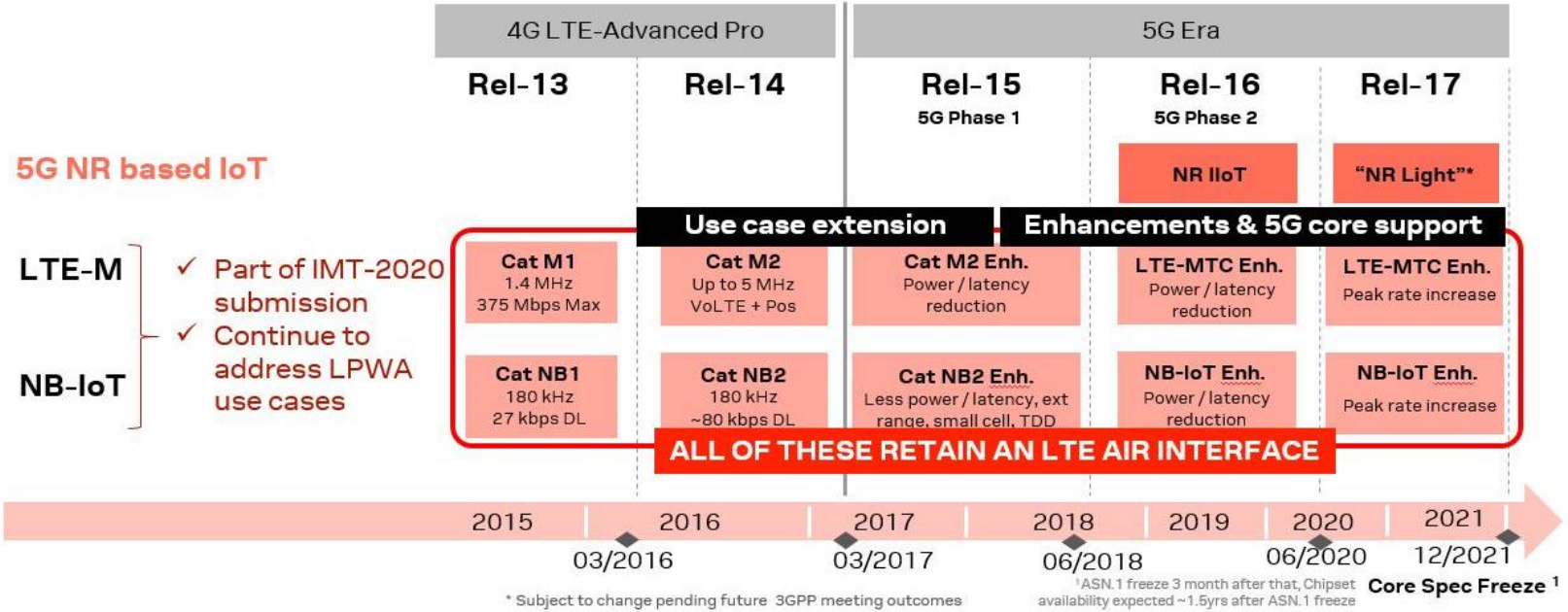


- NR-V2X study item started in June 2018.
- Subsequent NR-V2X work item by December 2019.

V2X Technical Specification (TS) and V2X Technical Reports (TR)

V2X Technical Specification	V2X Technical Reports
TS 22.185	TR 22.885
TS 23.285	TR 36.785
TS 23.286	TR 22.886
TS 24.385	TR 37.985
TS 24.386	TR 23.786
TS 29.388	TR 38.885
TS 29.389	TR 38.886
TS 24.486	TR 23.776
TS 33.185	
TS 33.536	
TS 22.186	
TS 23.287	
TS 24.587	
TS 24.588	
TS 29.486	
TS 36.300	
TS 38.300	
TS 38.101	
TS 38.331	

LPWA Evolution – NB-IoT and LTE-M

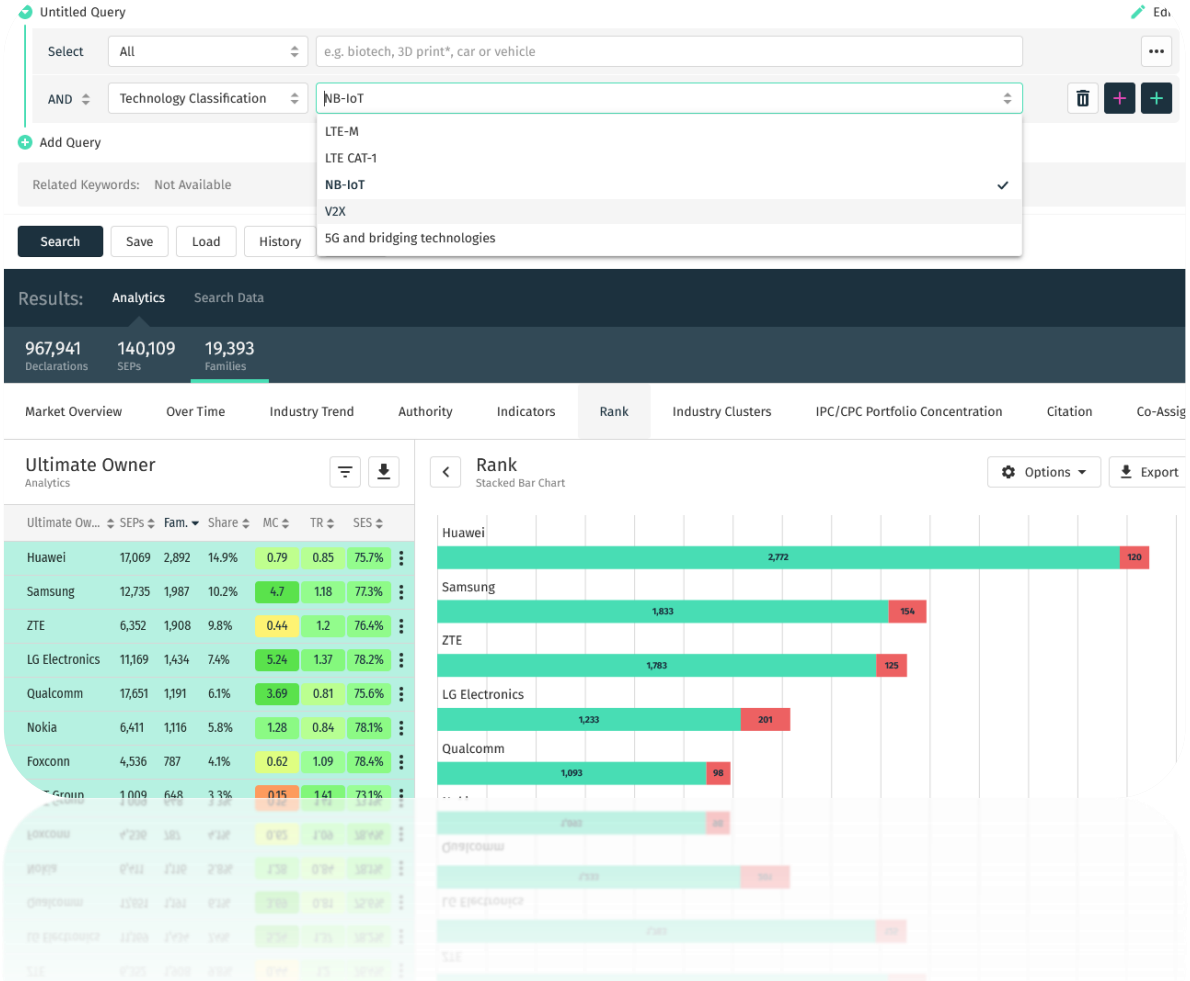


Source: https://www.embedded.com/5g-roll-out-a-marathon-not-a-sprint/

- **NB-IoT,**
- **LTE-M,**
- **LET Cat 1,** Technical Specification (TS)

S.No	Technology	3GPP Standard	4G/5G
1	NarrowBand-Internet of Things (NB-IoT)	TS 36.300	4G
2		TS 36.304	4G
3		TS 36.331	4G
4		TS 36.306	4G
5		TS 23.501	5G
6		TS 37.104	4G/5G
7		TS 36.104	4G
8		TS 36.141	4G
9		TS 37.141	4G/5G
10		TS 36.101	4G
11		TS 36.213	4G
12		TS 36.413	4G
13	LTE-Machine Type Communication (MTC) (LTE-M)	TS 22.368	4G
14		TS 29.368	4G
15		TS 33.187	4G
16		TS 29.274	4G/5G
17		TS 36.413	4G
18		TS 38.413	5G
19		TS 23.501	5G
20		TS 23.401	4G
21	Long Term Evolution Category 1 (LTE CAT 1)	TS 36.306	4G
22		TS 37.104	4G/5G
23		TS 37.141	4G/5G

- Searching by IoT protocols allows refining patent declaration data filtering out non-relevant patents



Takeaways

Why information is key!

Growing challenges:

- The **volume and complexity** of worldwide patents, standards and SEPs is growing daily, making it difficult to manually **identify, analyze and understand** relevant information on connected technologies.
- As a result, there is a growing demand for **IP analytics** in many departments like patent portfolio management, patent licensing, standards development, M&A and legal divisions.

SEP licensors (patent owners)

SEP licensors use of IPlytics Platform:

- Align R&D investments, standards development, patent prosecution, patent portfolio management and licensing/monetarization strategy to **file valid and essential patents** and to **commercialize SEPs** in world-wide licensing campaigns.
- Compare SEP portfolios for **cross-license** negotiations and **monitor competition** making sure to sustain revenues both on the downstream product market as well as upstream licensing market.
- Monitor **competitors' standards development** investments (contribution count) and identify new standards groups to maintain leading positions in standards development.

SEP licensees (standards implementers)

SEP licensees use of IPlytics Platform:

- Value and determine SEP portfolios offered for license. Prepare for **FRAND negotiation**. Identify the numerator and denominator to measure the patent holder's market share.
- **Identify standards subject to SEPs** in the complex value chain of suppliers as SEP holder approach OEMs or at least module supplier
- Monitor SEP filing, SEP change of ownership and litigation to **quantify risks and plan royalty payments**.
- **Identify** industry related (e.g. M2M, IoT, IIoT) **standards development initiatives** to have a seat at the table when future connectivity technology is developed.

IPlytics in a Nutchell

Coverage of worldwide SEP and contribution **data**

- Access to SEP declarations from over 25 standards organizations (over **580k declared patents**),
- Access patent pool listed SEPs from over 10 patent pools (over **60k pooled patents**),
- Access to standards contributions for cellular, wireless and video codecs (over **2M standards contributions**)

Refinement features for SEPs and standards data

- SEPs/contributions can be refined by technology generations (3G/4G/5G, AVC/HEVC/VVC, Wi-fi 4/5/6/7), standards groups and releases (RAN 1, JVET, TGbe, Release 11-18) and protocols (NB-IoT, V2X)

Value standard essentiality (IPlytics **Semantic Essentiality Score**)

- Estimate declared patents' claims likelihood of being essential to declared standards document sections

Identify undeclared patents (IPlytics **Undeclared Patents**)

- Identify patents hidden under blanket declarations for technologies such as video codec (AVC/HEVC/VVC) and Wi-Fi (Wi-Fi 4,5,6).

IPlytics Data - Reference Point

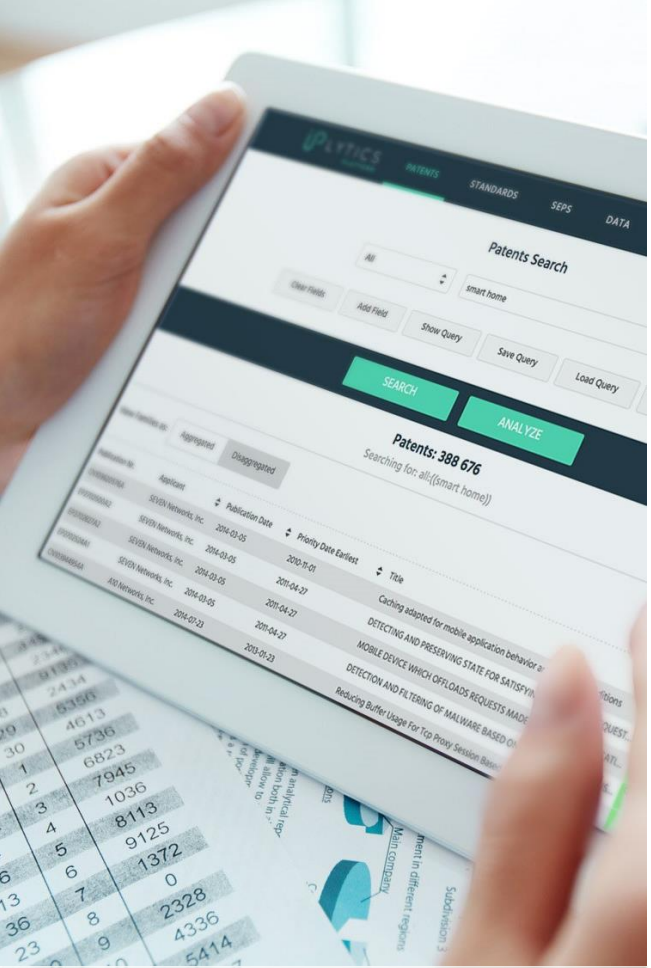
IPlytics data is a worldwide accepted reference point

IPlytics is the most trusted SEP solution in the world - there is nothing that compares with the IPlytics data quality, data coverage and SEP-specific features (SES and undeclared patents):

- 97% of the top 30 SEP holders are IPlytics customers
- Courts reference IPlytics in FRAND determination cases
- IPlytics is used by both implementers and SEP licensors in licensing negotiations as a reference point

Patent Data Can Be One Reference Point – Among Others:

- SEP licensing involves complex negotiations.
- Cleaned and curated patent declaration data can serve as one reference point among others, including details on past contracts, comparable license agreements, claim charts, subject matter expert testimony and more.



Questions?

For more information on LexisNexis® IPlytics please visit: www.lexisnexisip.com/iplytics/

Or request a demo at: www.lexisnexisip.com/iplytics/demo

The 5G patent report 2023 will be published in October 2023.

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Thank You

Tim Pohlmann
Founder and CEO LexisNexis IPlytics

Pohlmann@iplytics.com
[T] +49 (0) 030 5557 4282

LexisNexisIP.com