

5G Patent Landscape Analysis

A Patent Landscape
Analysis



19th Annual LES Silicon Valley Chapter Conference

Wednesday, April 17, 2019

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an eye on invention

Topic – 5G Technology, Standards, Patents

- Technology – massive impact; connecting people and devices.
- Patents/IP – key to the roll-out of this technology revolution.
 - Relationship to standards, technology and product innovation, along with licensing, litigation, and/or patent pools.
 - Network companies, consumer devices, IoT, and industrial IoT
- 5G patent landscape analysis case study to demonstrate:
 - Process to identify key technologies and companies in relation to standards.
 - 5G technology impacting other industries and technologies (automotive).
 - How to generate actionable conclusions that support a business & IP strategy.

Agenda

- What is patent analysis and why is it important?
 - Matt Rappaport
- 5G, the foundations of the technology.
 - Kirk Haselton
- Case Study: The ETSI Standards and 5G Patents.
 - Jesse Hooper, Kirk Haselton, Matt Rappaport
- Where do we go from here?
 - Matthew Rappaport

Presenters

Matthew Rappaport, Co-Founder, President IP Checkups, Inc.



Matthew Rappaport co-founded IP Checkups in 2004 to assist companies in extracting maximum value from patent analytics, to increase organizational knowledge and efficiency, and to help strengthen companies' return on technology investment. Mr. Rappaport specializes in IP strategy, patent landscape analysis, analytics, valuations and market research to help companies align their patent strategy with their business objectives and monetize their intellectual property assets.

Most recently Matthew has led the development and release PatentCAM, a competitive patent and technical information management and monitoring software solution. The platform provides a central, shared repository of institutional knowledge where R&D and IP professionals maintain and manage categorized technical information. It saves technical and legal experts time by reducing administrative tasks, and it cuts down significantly on duplicate research, increasing technology development ROI while reducing risks associated with discovery in litigation.

Mr. Rappaport serves as the industry liaison to the Fung Institute for Engineering Leadership at the University of California, Berkeley. He also sits on the Executive Advisory Council of the Early X Foundation. He has been a member of the IAM Strategy 300 for several years.

Presenters

Jesse Hooper, EE., Senior Patent Analyst, IP Checkups, Inc., & Independent Consultant, Hooper IP.



Jesse Hooper is an electrical engineer and technical research consultant with broad experience in patent data analysis relating to cutting edge communications systems. Mr. Hooper worked at a leading Washington D.C. area patent law firm as a technical analyst, eventually heading their team of electrical engineers on demanding projects frequently related to industry-leading telecommunications infrastructure and hardware systems.

Mr. Hooper joined IP Checkups Inc. in 2012 with dual roles as software consultant for their patent analysis platform PatentCAM™, and curator/analyst of competitive patent landscapes. Mr. Hooper works closely with business, investment, and legal clients at IP Checkups to extract actionable insights from patent-focused industry and competitor trends in support of their unique goals. In addition to a continuing partnership with IP Checkups, Mr. Hooper maintains an independent consulting business, Hooper IP LLC, to serve clients with a broad range of patent needs.

Presenters

Dr. Kirk Haselton, Senior Patent & Business Strategist, IP Checkups, Inc., & Independent Consultant, Haselton IP



Kirk Haselton is a physicist with general technology interests & experience. Since 1996 Kirk has been based in Berlin and is active in European-wide innovation networks and technology development and financing initiatives.

In 2008 Kirk began working exclusively with inventions, technology development and intellectual property as a licensing manager with ipal, a subsidiary of the Investment Bank of Berlin, breaking new ground for universities in Berlin with record income from patent sales and achieving the first project financed by a new IP development fund based in Berlin. In 2013 he started his consultancy, Haselton IP, and assists clients in technology evaluation, patent and portfolio analysis, acquisitions and IP operations, particularly technology scouting, invention analysis, patent prosecution and portfolio management.

Kirk holds a Bachelor of Science with Honors degree in Applied Physics from the California Institute of Technology and M.Sc. & Ph.D. degrees in Applied Physics from Cornell University. Kirk is a Hertz Fellow and the recipient of a NASA Fellowship, both in support of his Ph.D. research, and continues to enjoy participating in and supporting the activities of the Fannie and John Hertz Foundation.

Why is it important?

How is it different from
traditional patent
search?

What is the purpose of
patent analytics?

What is patent landscape analysis?

“Navigating new technologies without a patent landscape is like exploring new terrains without a map.”

- Bruce Resnick, PhD, Patent Agent & Experienced Intellectual Asset Manager

What is Patent Landscape Analysis?

A Process to explore a technical area through searching worldwide patent and technical information to determine:

- who are the key players,
- what technologies and products are they developing,
- where geographically are they filing patents,
- at what rates are patent filing activities happening over time,
- where are there thickets or technical gaps ('white space').

What is the Purpose of a Patent Landscape Analysis?

Reveal limitations (and opportunities) within the technology.

Enables informed decision making:

- Avoid the area.
- Work with others that have a strong market & IP position.
- Design around limitations; stake out and protect new areas.

IP becomes a key driver of organizational decision making

Patent Landscape Analysis Criticism

Many organizations choose to ignore the patent landscape.

- Thickets of overlapping claims.
 - Perceived high costs and legal risks.
 - Short product cycles.
-
- It's difficult to do it correctly.

Wasted time/money on R&D, patent filings, IPR/litigation.

Patent Landscape Analysis Benefits

- Competitive intelligence:
 - Enhance understanding of key players R&D and business activities.
 - Avoid infringing others' patents.
 - Generate additional revenue opportunities.
- Internal intelligence
 - Inform patent filing, R&D, and business development decisions.
 - License or acquire rather than build from scratch.
 - Reduce redundant research, design around.
 - Commercialize faster.

Results in more predictable, valuable & defensible market/IP positioning

How is it different than traditional patent search?

Patent Landscape Analysis	Traditional Patent Search (validity, patentability, FTO, infringement, clearance)
Results viewed through R&D, Business Development, Marketing and Legal Lens	Results viewed through a narrow legal lens
Strategic focus, establish a process that affects organizational structure; supports long-term growth	Event driven, address specific legal oriented questions
Managed by cross functional team (IAM group, R&D, Business Development and legal), mitigate risks while maximizing opportunities	Managed by attorney's and can result in legal opinions that mitigate risks
Drives organizational decision making	Drives legal decision making
Ongoing process that affects organizational growth	Provide a 'snapshot in time' view

What are patent analytics?

Predictable and quantifiable data points derived from patent information that provide insight to make data driven decisions.

- Patent analytics quantify:
 - competitor focus and filing velocity
 - geographic or business unit focus
 - claim drafting techniques
 - prosecution efficiency
 - rejection trends
 - litigation tactics
 - others

Who are the stakeholders and beneficiaries?

- R&D
- Legal
- Corporate development
- Marketing
- Investors/boards

Use patent landscape analysis to support business strategy.

- Paired with market intelligence, it provides a framework for decision making related to:
 - New product development and R&D
 - Mergers, acquisitions, licensing
 - Build vs. buy vs. infringe
 - Competitive intelligence and market entry
- Identifies tangential markets
- Increases revenue opportunities
- Establishes a process for budget evaluation

What is 5G? The Foundations of The Technology

5G - The Foundations of the Technology

- Integrate telecom, computer, and storage resources into **one programmable and unified infrastructure**.
- Enable an optimized usage of all distributed resources.
- System architecture is software based.
- Includes support for:
 - shared infrastructure.
 - multi-tenancy and multi-RAT (with seamless handover).
 - terrestrial and/or satellite communication.
- Massive Machine-Type Communication (M-MTC), and Ultra-reliable Machine-Type communication (U-MTC).

5G - Metrics

Guaranteed user data rate $\geq 50\text{Mb/s}$

Capable of human- oriented terminals ≥ 20 billion

Capable of IoT terminals ≥ 1 trillion

Mobility support at speed $\geq 500\text{km/h}$ for ground transportation

Accuracy of outdoor terminal location ≤ 1 meter

5G - Networks

Radio Network

- Device to Device (D2D)
- Moving Networks (MN)
- Spectrum: low band below 6 GHz with legacy (2-3G) and LTE (4G), high band above 6 GHz (incl. millimeter wave)

Common transport network
unifying front-haul and back-haul

Core network

End Use Applications

Smart Connectivity:

- Automobiles
- Grid
- Factories
- Cities

Digitization of vertical markets

- Automotive
- Banking
- Education
- Energy/Utilities
- Food & Agriculture,
- Government
- Retail
- Healthcare
- Insurance,
- Manufacturing,
- Media
- Real estate
- Transportation

Case Study: 5G Self Declared Standard Essential Patents

A first cut project

DISCLAIMER:

5G technology is a highly complex technology area. The presenters of this case study are not 5G technology *experts*. This is an initial/partial analysis of the 5G patent landscape. The purpose of this analysis is to demonstrate the important steps of a patent landscape study and how to generate actionable business intelligence and conclusions.

Project Background

- Reviewed self-declared standard essential patents (SEPs) related to 5G.
 - Used European Telecommunications Standards Institute (ETSI) database to identify ~4500 patents declared essential to 5G by patent holders.
- Applied unique patent landscape methodology to assess relationship between 5G SEPs, patents and industries/technologies such as automobiles and IOT.

Standard Essential Patents (SEPs)

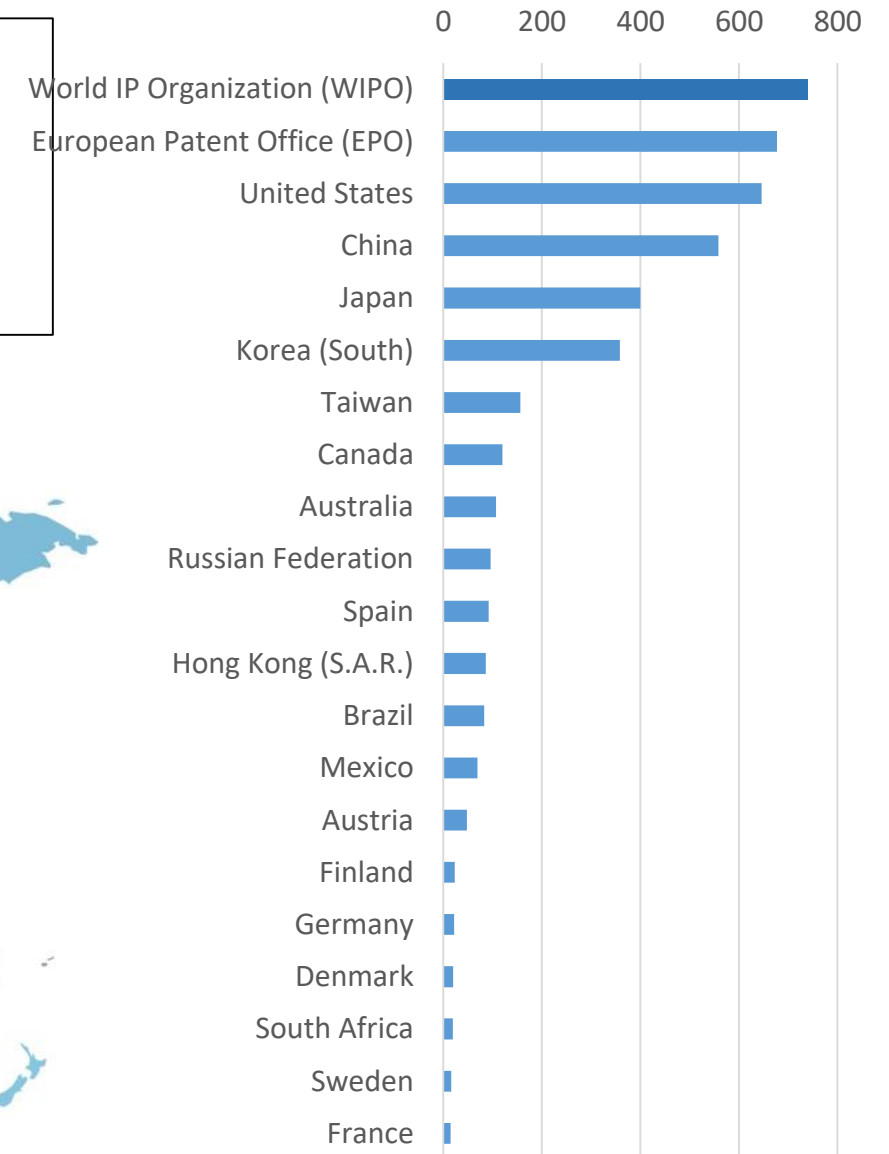
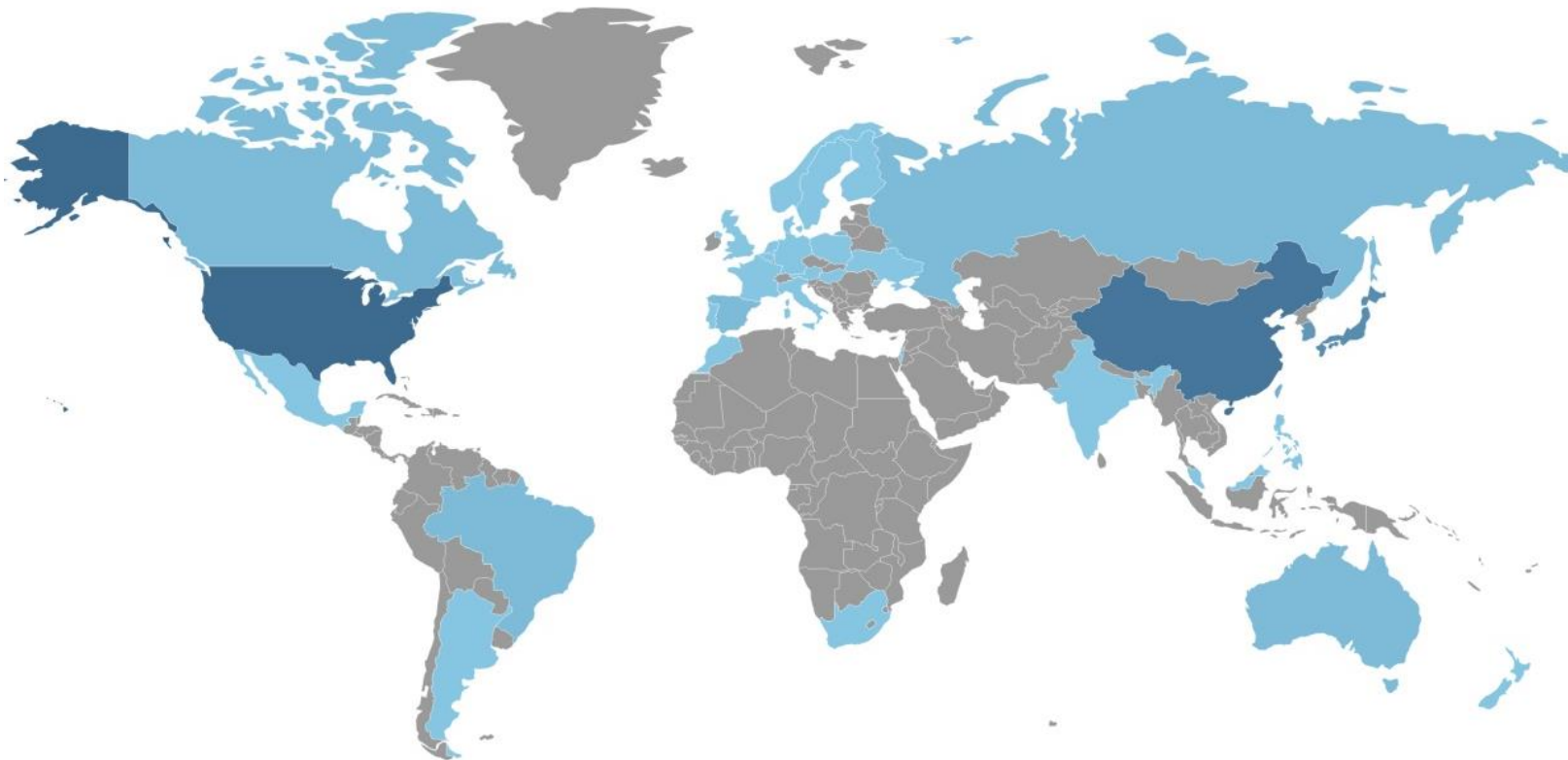
- A standard-essential patent (SEP) is a patent that claims an invention that must be used to comply with a technical standard.
- Standards organizations require members disclose and grant licenses to their patents and pending patent applications that cover a standard that the organization is developing.
 - Licenses must be Fair, Reasonable, and Non-Discriminatory (FRAND).
- Patent holders submit SEP declarations to ETSI which maintains a searchable, publicly available database of SEPs
- These SEPs are self-declared and there is a risk of broad over-declaration.
- Essentiality checks are driven by licensees and pools and remain an important cost factor.
 - European Commission made suggestions for transparency and intermediate steps to checking essentiality in a [2017 publication](#).

ETSI Data Used + Other data

- Data used in our analysis:
 - Technical Specifications (TS) related to 5G, RAN (Radio Access Network), LTE, NR, systems, security, management, provisioning, architecture, service, etc., sourced from ETSI.
- Data not used in our analysis:
 - Group Reports (GR) related to 5G & NGP (Next Generation Protocols).
 - Technical Reports (TR) related to 5G, LTE, & NR (New Radio).
 - Technical specifications (TS) related to
 - Essentiality checks
 - ISO standards
 - IEEE standards
 - ITU standards

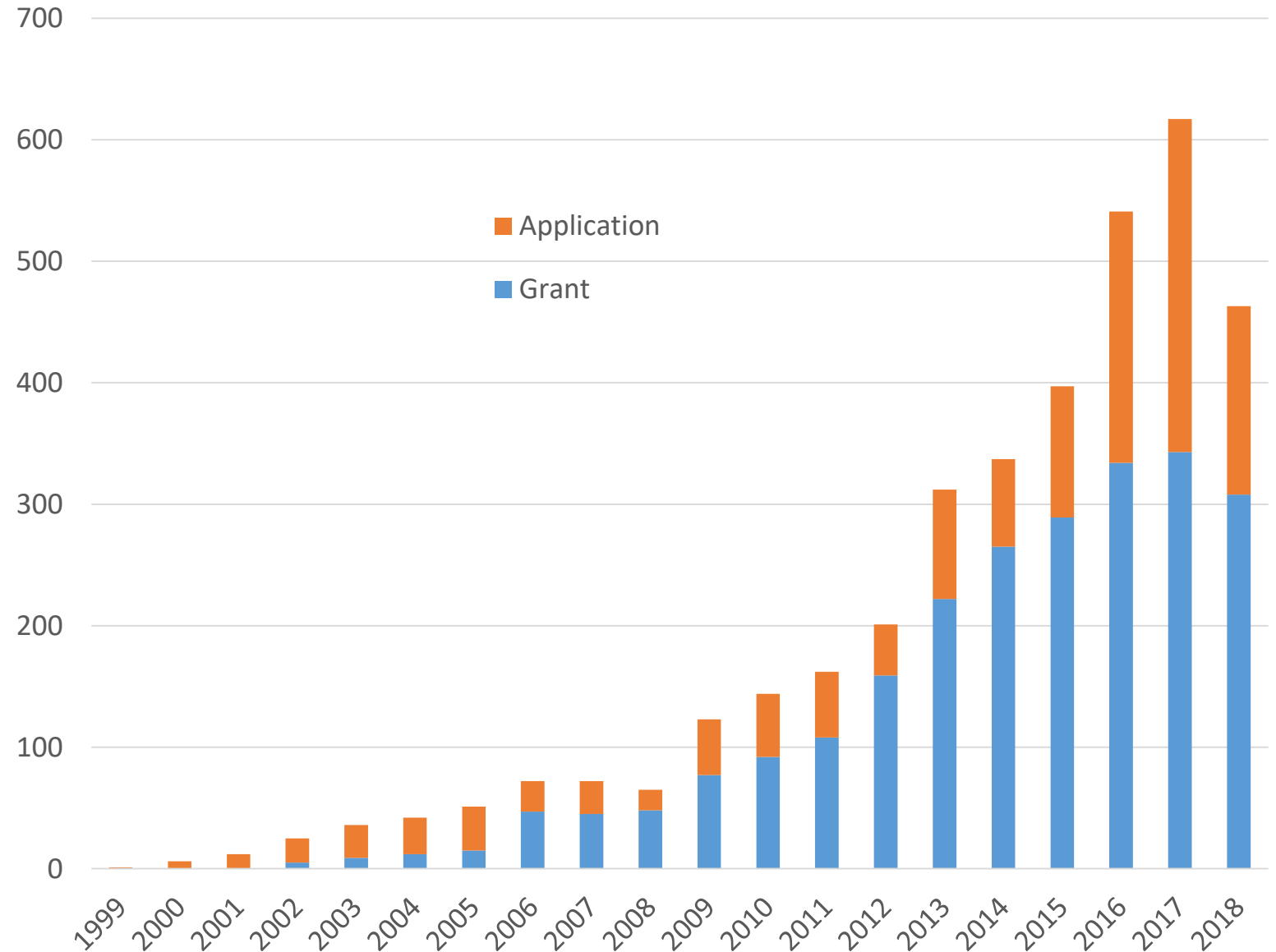
5G SEPs – Global Patent Coverage

- 4,500 ETSI SEPs declared worldwide
- Broad coverage in Europe, Asia, and the Americas
- Large number of recent PCT (WO) applications, still have time to enter national phase.



5G SEPs – Annual Publication Volume

- Filings accelerating in recent years.
- Average of 70% of applications filed and declared SEP are granted each year.
- 2018 shows a decline, but the number of SEP declarations for patents published recently will likely increase.



5G SEPs – Top Global Assignees

Assignee	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
NOKIA		4	16	29	38	46	38	49	39	38	65	74	56	77	92	108	139	137	192	212	1462
INTEL							1						1	4	71	31	110	241	346	234	1060
ALCATEL LUCENT				1	2		1	2	8	2	14	13	17	33	61	75	69	88	60	36	493
QUALCOMM			2		4	5	7	6	7	10	33	29	27	33	46	28	31	22	20	8	321
NTT DOCOMO										1	13	25	33	23	32	36	20	21	15	10	229
ERICSSON		1		7	2	1	4	9	8	4	13	10	10	13	12	9	17	9	19	8	157
BLACKBERRY						4	10	5	7	14	7	10	18	18	5	6	16	15	6	8	152
INTERDIGITAL		2							1	3	4	6	6	8	3	13	16	18	25	10	121
LG ELECTRONICS								2	3			6	8	10	9	17	11	18	17	13	114
HTC													3	6	9	14	9	2	6	8	57
SHARP									2	2	2	3	7	7	6	1	4	5	8	9	57
NEC												2	2		14	5	5	6	11	11	56
KONINKL KPN											2		6	1	9	2	3	5	3	1	32
FUJITSU						1				1		1	2	1	2	2	1	6	3	2	22
NORTEL NETWORKS		1		3	1	1		3	1	4			1	2	1	2	1	1			22
APPLE				1				1					1	1	1	2	2	8	2	2	21
TNO (Netherlands Org. for Appl. Sci. Research)											2		4		5	1	1	1			14
FRAUNHOFER										2		1	1		2	1	3	1	1		12
MITSUBISHI ELECTRIC									3			1	1		1				6		12
INNOVATIVE SONIC SPEED															2	6	2	1	1		12
SIEMENS				2			2	2	3					1							10
INVENTERGY								5				5									10
PANASONIC											3			2		3	1	1			10
CORE WIRELESS LICENSING			1											2	2	1	3				9
CONVERSANT WIRELESS LICENSING									1		1	3			1				1	2	9
SAMSUNG ELECTRONICS							1	1	1	1		1	1	1	1	1					9
HUAWEI								1	1			1	4	1							8

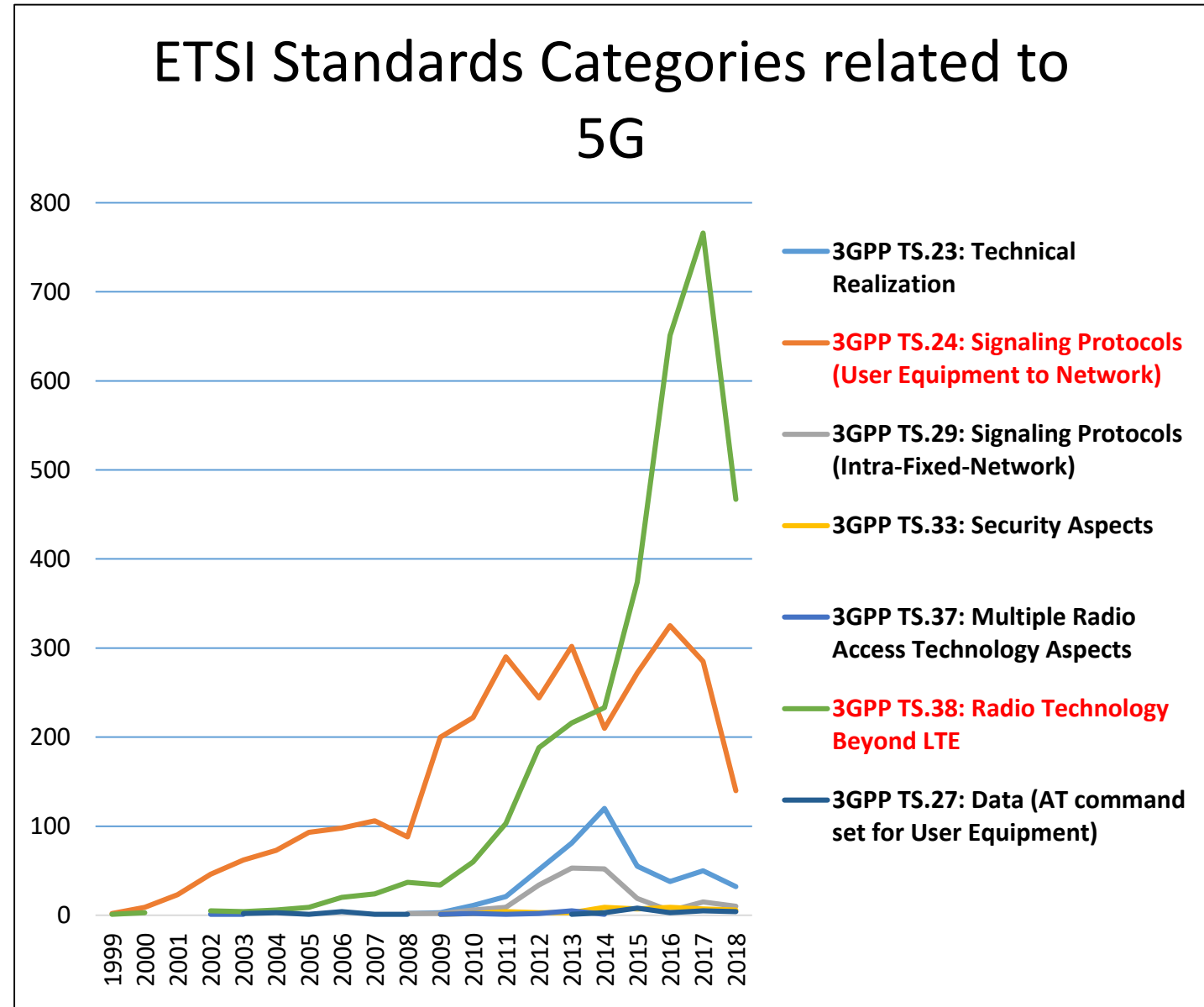
- Nokia, Alcatel, Qualcomm, NTT Docomo, Ericsson, Blackberry.
- Intel has shown the largest acceleration in filing since 2014.
- Notably, automakers are mostly absent from this list.

5G SEPs: Annual publications by Standard Sub-topics

5G SEPs exist in 7 main sub-groupings of standards, defined by:

- Technical realization
- UE<->network signaling protocols
- Intra-network signaling protocols
- Security
- Multiple radio access technology
- Radio technology beyond LTE
- Data

To drill deeper into the technology covered by SEPs, we look to the patent classification system.



Cooperative Patent Classification (CPC) Analytics:

- Patent publications are each assigned at least one classification term indicating the subject to which the invention relates;
- Each publication may also be assigned further classification and indexing terms to give further details of the contents.

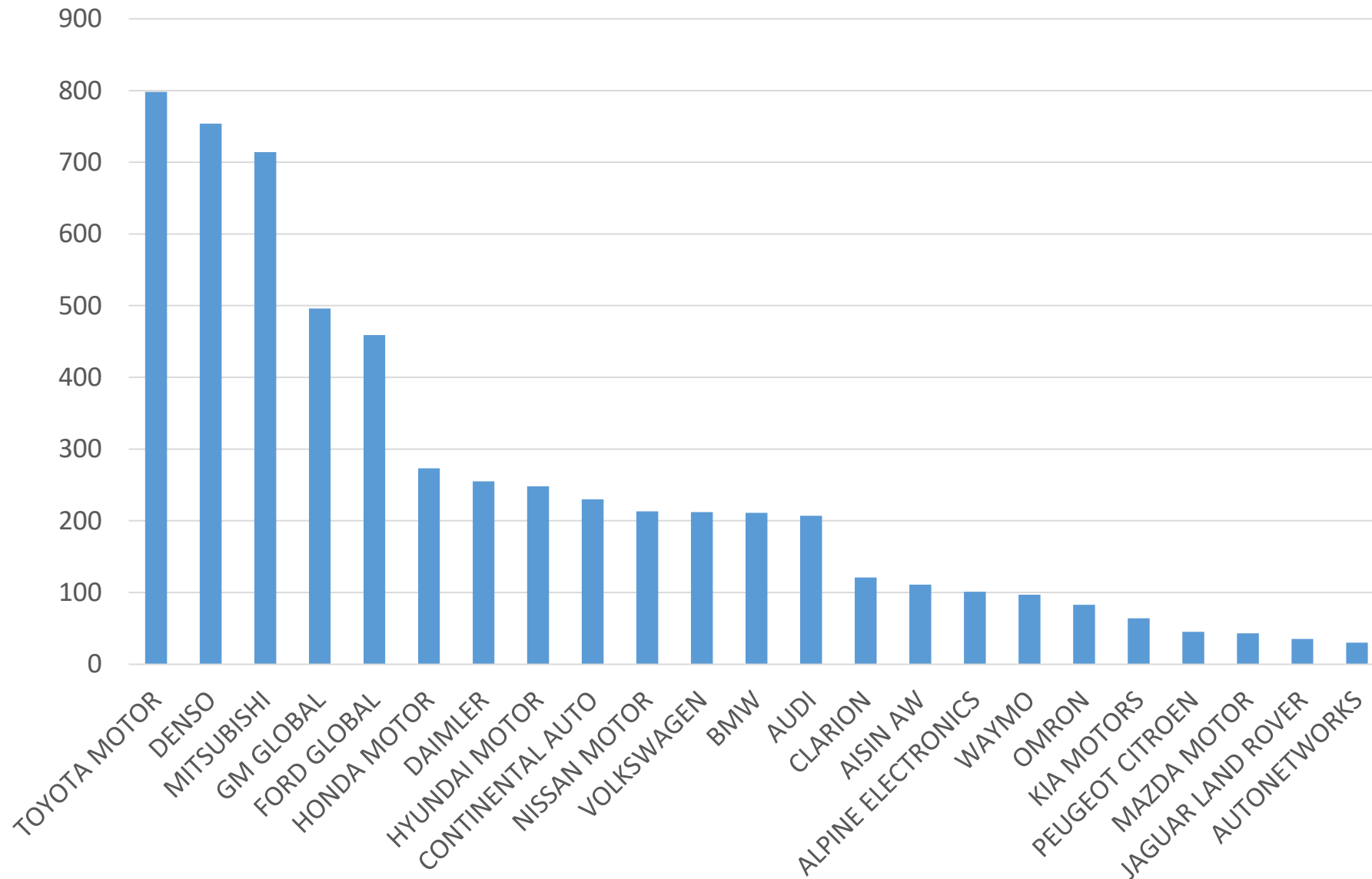
Cooperative Patent Classification (CPC) Analytics: Focus of top SEP Declarations

- The ETSI 5G SEPs are categorized into about **1400 unique CPC designations**.
- Highest numbers for 2014 to 2018 are consistently related to:
 - Energy consumption/power management
 - Channel quality indications
 - Location information
 - Security
 - Multiple use of transmission path.
- Applications involving vehicles, autonomous or otherwise, will involve other location technologies specific to vehicle requirements.

ETSI 5G SEPs – Example CPC Distribution

CPC Symbol	5g SEP Count	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total	CPC Title
H04W4/00	51	22	20	75	11	3	14	3	5	4	2	16	19	32	105	692	435	127	188	55		1828	Services specially adapted for wireless communication networks; Facilities therefor
H04W4/02	419	14	2	24	8			1	1	1		11	9	1	32	306	221	72	92	25		820	•Services making use of location information
H04W4/021	11											1	4		6		1					12	••Services related to particular areas, e.g. point of interest [POI] services, venue services or geofences
H04W4/022	1																1					1	•••with dynamic range variability
H04W4/023	352														9	153	116	11	51	12		352	•••using mutual or relative location information between multiple location based services [LBS] targets or of distance thresholds
H04W4/025	8									1					5		1	9	4			20	•••using location based information parameters
H04W4/027	12														2		1	9				12	•••using movement velocity, acceleration information
H04W4/04	7											1	4		3			5	3	1		17	•••using association of physical positions and logical data; in a dedicated environment, e.g. buildings or vehicles
H04W4/043	5											1	4									5	•••using ambient awareness, e.g. involving buildings using floor or room numbers
H04W4/046	5																	5				5	•••involving vehicles, e.g. floating traffic data [FTD] or vehicle traffic prediction
H04W4/06	288			13		1					2			1	24	203	18	19	18	3		302	•Selective distribution of broadcast services, e.g. multimedia broadcast multicast service [MBMS]; Services to user groups
H04W4/08	14										2					6	2	2	2			14	••User group management
H04W4/12	7						6			1											1	8	•Messaging; Mailboxes; Announcements
H04W4/14	1																				1	1	••Short messaging services, e.g. short message services [SMS] or unstructured supplementary service data [USSD]
H04W4/16	194									1					9	153	2	11	18			194	•Communication-related supplementary services, e.g. call-transfer or call-hold
H04W4/18	41	8	8	12		1											7		5			41	•Information format or content conversion, e.g. adaptation by the network
H04W4/20	1														3				1			4	•Services signaling; Auxiliary data signalling, i.e. transmitting data via a non-traffic channel
H04W4/21	3														3							3	••for social networking applications
H04W4/24	111		10	26	3	1	8	2	4			5	10	17	6	15	4					111	•Accounting or billing
H04W4/30																	2	6				8	•Services specially adapted for particular environments, situations or purposes
H04W4/32	4																					4	•••for collecting sensor information
H04W4/40																		4				4	•••for vehicles, e.g. vehicle-to-pedestrians [V2P]
H04W4/44	2																	2				2	•••for communication between vehicles and infrastructures, e.g. vehicle-to-cloud [V2C] or vehicle-to-home [V2H]
H04W4/46	2																	2				2	•••for vehicle-to-vehicle communication [V2V]
H04W4/50	3															3						3	•Service provisioning or reconfiguring
H04W4/60	133														14	83	2	20	14			133	•Subscription-based services using application servers or record carriers, e.g. SIM application toolkits
H04W4/70	2																	2				2	•Services for machine-to-machine communication [M2M] or machine type communication [MTC]
H04W4/80	148														7	98	5	26	12			148	•Services using short range communication, e.g. NFC/RFID
H04W4/90	3												3									3	•Services for handling of emergency or hazardous situations, e.g. earthquake and tsunami warning systems [ETWS]

Automotive patents classified in same CPCs as the SEPs



- Many automotive company patents were filed in the same CPCs as the SEPs during the same timeframe.
- Many of the automotive company patents **cite the SEP patents as prior art.**
- Considering the automotive companies haven't declared SEPs (at least to ETSI), it is likely they will need to license patents from SEP holder.

Beyond the Patent Landscape

Integrating other information
sources.

Knowledge Integration: Licensing, Pools, Litigation and Market Intelligence

- Automotive company's are barely represented among 5G SEP companies - will need to license 5G technology for their cars:
 - [Audi, BMW and Daimler are working with Ericsson, Huawei, Nokia, Intel and Qualcomm - 5G Automotive Association.](#)
 - [Daimler filed a complaint with the EU commission about Nokia's licensing of SEPs.](#)
- Some automotive companies plan to run their own 5G networks:
 - [BMW, Daimler and Volkswagen are planning their own 5G networks internal to their automobile plants.](#) Also big industry such as [BASF.](#)
 - [Audi is working with Ericsson to implement a 5G test network in production.](#)

Licensing Practices in 5G Industry Segments

- The International Telecommunications Union (ITU), a standardization body AND Next Generation Mobile Networks (NGMN), a company alliance – presented a Joint conference on “[Licensing practices in 5G industry segments](#)”
 - Notable presentation by the JPO regarding essentiality checks and FRAND.
 - Conference concluded with group recommendations for:
 - Improving declarations with more transparency, limit abusive declarations
 - Independent essentiality assessment prior to licensing, share results
 - Explore and establish appropriate 5G patent pool framework

Are pools part of a hybrid solution?

- 5G licensing is still at a very early stage
 - Several patent pools are talking about it, but do not yet appear to be in place.
 - Via Licensing, Avanci, MPEG-LA, SISVEL
 - For connected cars, Audi, Porsche have signed with Avanci – VW possibly next?
- What about OIN or LOT Network?
 - OIN: Linux
 - LOT: Reduce PAE risk.
 - Vehicle members: Mazda, GM, Honda, Ford, Tesla, Kia, Daimler, Waymo, Volkswagen, Nissan
- Hybrid of OIN/LOT?

Establish a
Process:
Decision making,
Conclusions and
Next Steps

Next Steps?

- Address risks & opportunities with other patent owners.
 - Initiate FTO analysis and risk management as well as business, licensing and acquisition contact.
- Dive deep into technology thickets; initiate activity for acquisition/licensing as identified.
- Adjust R&D and product development decisions based on landscape findings.
 - Areas covered as needed given strategic impact of knowing what other approaches are used and what other areas exist.
- Initiate new invention areas to build from scratch.
- For potential litigation begin to compile a “prior art” invalidity list.
- Iterate analysis for narrow themes to update FTO risk and program management.

Executing Decisions

- Integrated process involving:
 - Management team
 - R&D
 - Business development
 - Assessment of current vs. future projects and products.
- Communication: decisions, execution, outcomes, next steps.
 - Get feedback
 - Iterate
 - Follow up with developments, facilitate familiarity with the processes.

Ongoing monitoring – Looking Backward, Going Forward

Valuable inventions are focused on need (not by looking backward).

The backward look helps the forward navigation:

- Initial searches for product clearance, FTO, competitor analysis, etc. are saved.
- Documents are categorized based on tech area, assignee, and other criteria.
- Ongoing monitoring to alert for new publications.
- Primary review for relevance to applications (trigger IDS) and/or products & applications (FTO, trigger review with IP Committee, Product & Project teams, patent counsel).

Conclusions

- 5G Patent landscape:
 - 5G standards declarations have increased dramatically since their inception.
 - The SEPs are distributed among more than 1000 patent classification codes and mostly to telecom, network equipment & chip set manufacturers.
 - Automotive companies are innovating in 5G related CPCs; they are citing SEPs, yet they are not declaring their patents as essential and will arguably need to license from key SEP assignees.
- 5G licensing is still at a very early stage:
 - Similar to 3G and 4G, 5G technology will likely remain fragmented, although pools may form; it is unlikely that they will take off.
 - 5G Licensing revenue will likely be more substantial than 3G/4G due to a much larger pool of licensees.

Conclusions

- Automotive companies could seek to leverage industrial IOT agreements to get access for their vehicles:
 - This will likely benefit network equipment providers.
 - Other conglomerates that need industrial IOT and communications-related end use applications will also likely need to license.
- Patent landscapes offer a powerful platform to understand the players, technology, and timelines to guide your IP, R&D, and business strategy.
 - Identify and evaluate risks/opportunities.
 - Identify players that aren't self declaring.
 - Make informed R&D and business decisions:
 - A pool that is already there,
 - A pool in formation,
 - A direct licensing campaign,
 - Design around,
 - Others...

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