POLITECNICO DI MILANO





Technical defense of IPs in ICT: what to do?

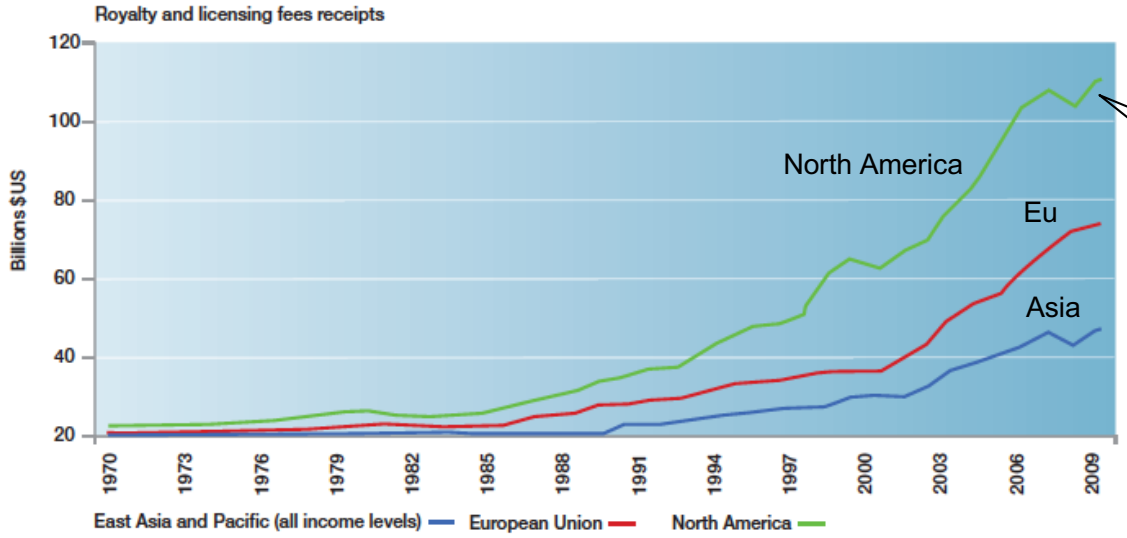
La proprietà intellettuale nell'ICT: come difendersi "tecnicamente"?

U.Spagnolini

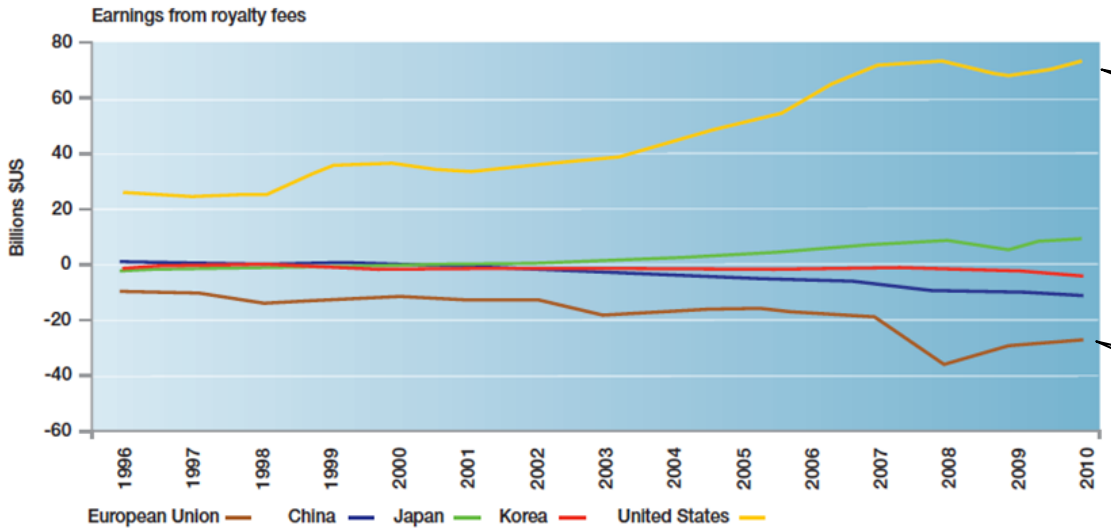
Politecnico di Milano

http://spagnolini.faculty.polimi.it/

Few facts: the in-flow/out-flow of royalties



20 x IMU'12 (IMU'12=4B€) or 1/4 tax income



+15 x IMU'12

-6 x IMU'12

Data source: **IMF**

IMU (Imposta Municipale Unica) is a property tax on the estate in Italy, approx 4BEuro in year 2012

Average monthly tax (Italy, 2016): 451BEuro = 100xIMU

Source http://www.finanze.gov.it

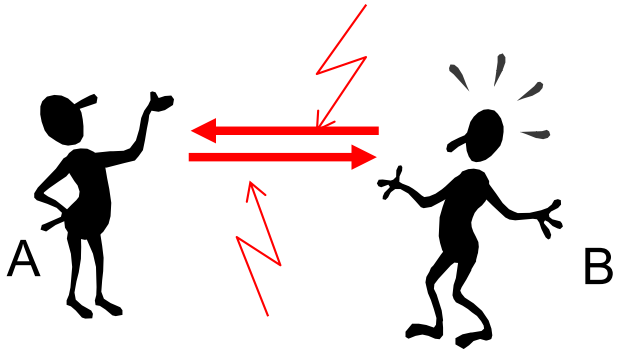
IP as protection of innovations

- Patent **freezes the priority time** of an invention in form of "**technical contract**" where words are used in Claim structure in place of formulas, procedures, schematics, etc… and wordings are used to defend owner's monopolistic rights in front of Court
- **Patent attorney** does not just "translate the innovation descriptions into legal words" but rather forecasts all legal issues that might raise to legally defend the idea in Court in future (Patent Attorney writes the "technical contract" for technical defense)

- Patent aims to defend from others infringing one invention: it does not prevent anyone from doing but rather from making business

Patent attorney vs researcher/innovators

Patent is different from innovation and/or product (and not always coincide)



Example:

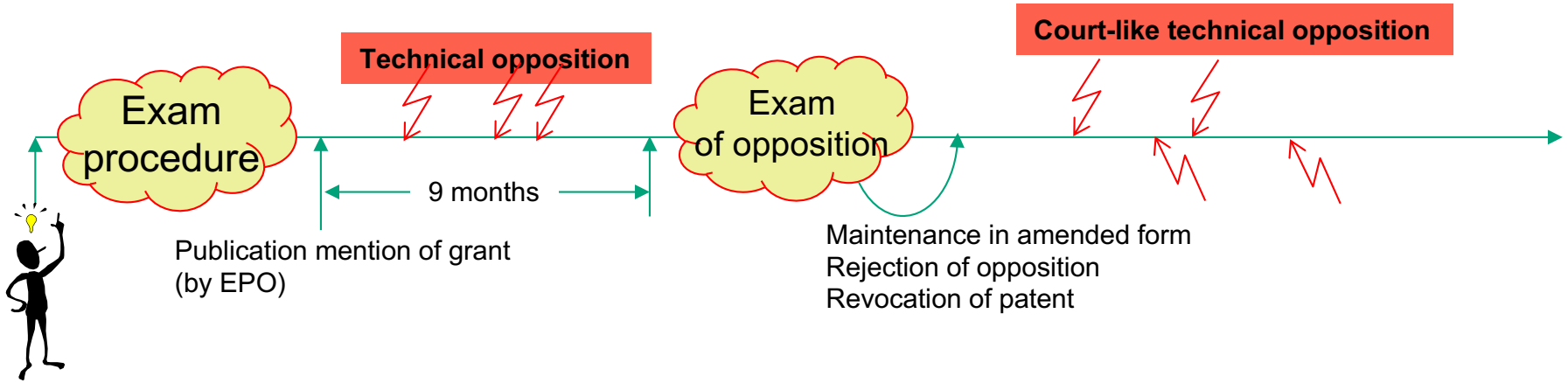
Method to let A and B communicate in noisy environment by a certain algorithm

- **Innovator view**: find the "best algorithm" to let A and B communicate (methods, limits, equations!)
- **Patent Attorney view**: in order to let A and B communicate, they need to agree before. Claim the hand-shake signaling is a stronger patent (=easier to be defended in Court) than the algorithm and equations!

R1: Inventors should design the patent claiming jointly with Patent Attorney by considering the novelty and the detectability of infringements

Patent and invalidity

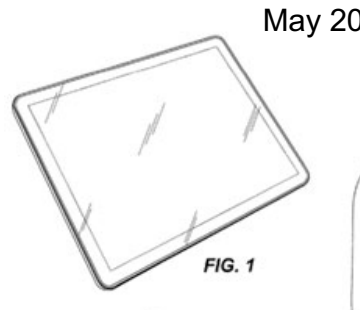
- Patent is a **monopolistic** right granted nationwide after an exam and upon a payment of a fee to legally maintain this right
- Patent are granted after examination with **presumption of validity**

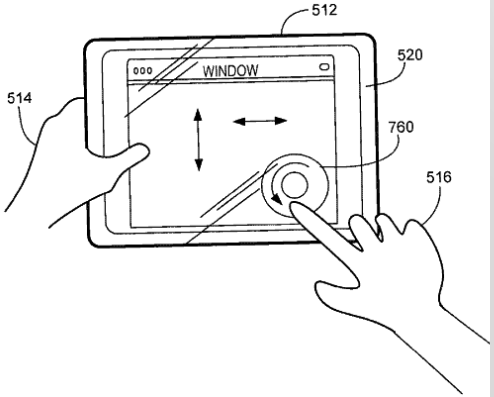


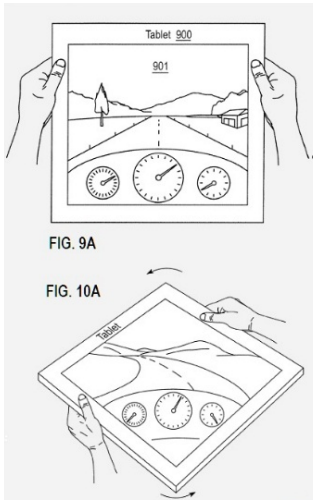
- **After granting**: any patent can be challenged and declared invalid, or partially invalid, or revoked; this is typ. initiated by competitors that have similar product/technology for aggressive/defensive scope

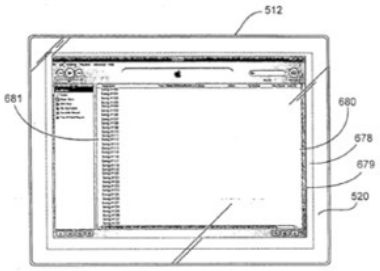
Tablets and IPs

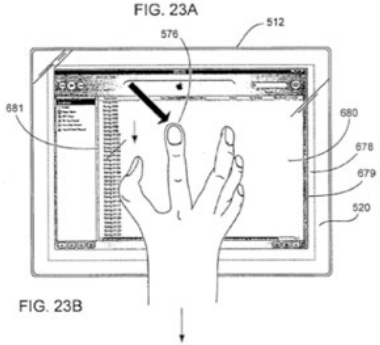
May 2005

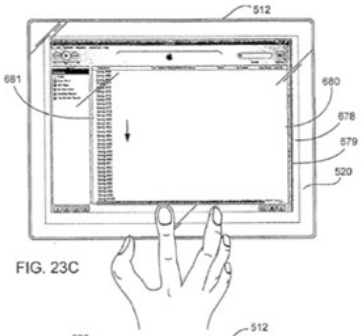


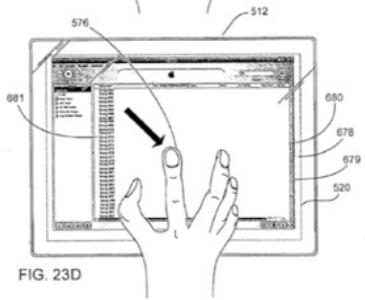












Apple Tablet
The rumor timeline

We've taken every rumor we could scrape up on Apple's mythical device and put them together in one gigantic chart. Can you spot the trends?

	Description	CPU	OS	Size	Launch	Price	Source
NOV 18 2002	Large iPod, no keyboard	Motorola PowerPC	OS X	8" diag.	Early 2004 MacWorld		Matthew Rothenberg eWeek
MAY 23 2005	Whiteish, funky icon menu, touch pen	Intel / PPC Hybrid	OS X "stripped down"		"soon"		Rob Bushway, CutMeLoose
NOV 26 2006	Home automation, Apple Hi-Fi, dockable, HDMI	Intel			Mid-2007		Smarthouse
SEP 26 2007	Modern day Newton, multitouch			1.5x iPhone 720x480	First half of 2008		Apple Insider
APR 27 2009	Media pad, music, HD video, pictures, place calls over WiFi			Smaller than Kindle 9.7"	Summer 2009		BusinessWeek, China Times
JUL 24 2009	Jumbo iPod touch with 3G data	ARM Custom	OS X	10"	Q1 2010	$699 - $799	Apple Insider
SEP 15 2009	Built-in HSDPA	P.A. Semi		9.6"	Feb 2010	$799 - $999	Taiwan Economic News
SEP 29 2009	3G and non-3G, "looks like an iPhone 3G"	P.A. Semi	iPhone OS	10.7" 720p	Announced Jan '10, ships May - Jun		iLounge
OCT 07 2009	Built by Foxconn with e-book functionality			10.6"	Q1 2010		Digitimes
NOV 19 2009	Conde Nast working on version of Wired for Apple Tablet			9.7" LG OLED, 10.6" LCD	Second half of 2010	$2000 OLED, $800 - $1000 for LCD	Digitimes, All Things D
DEC 09 2009	Publishing and e-book focused			10.1" LCD	Mar or Apr 2010	$1,000	Yair Reiner, Oppenheimer
DEC 28 2009				10" glass	Announced Jan, launch Mar or Apr		Digitimes, WSJ China
DEC 30 2009	iPhone-like, video conferencing, 3G, 3D, virtual keyboard			10.1"	Announced in Jan	Less than $1,000	Kai-fu Lee, former Pres. of Google China
JAN 04 2010	Kindle-like wireless		iPhone OS	10 to 11" touchscreen	Announced Jan 27, Mar launch	$1,000	John Paczkowski, All Things D
JAN 07 2010	Big iPhone, but not just a big iPhone, pretty		iPhone OS (modified)		Launched in Mar		Business Insider
JAN 11 2010	Apple pre-orders 10" LCD and OLED			10.1" multitouch LED / OLED			TG Daily
JAN 19 2010				9.7"			China Times
JAN 19 2010				Not 10.1" AMOLED			Ars Technica
JAN 19 2010	Looks like an iPhone			10" glass			Mac Observer
JAN 20 2010	WiFi, not 3G. Hybrid of iPhone, iPod, and Mac	ARM-based	iPhone-esque	10 to 11"	June	$999	Shaw Wu via Apple Insider
JAN 22 2010	Touchscreen MacBook built by Samsung	P.A. Semi	OS X cloud-based	7 to 9"			Richard Doherty, UBS Investment

Apple vs HTC timeline and patent acquisitions

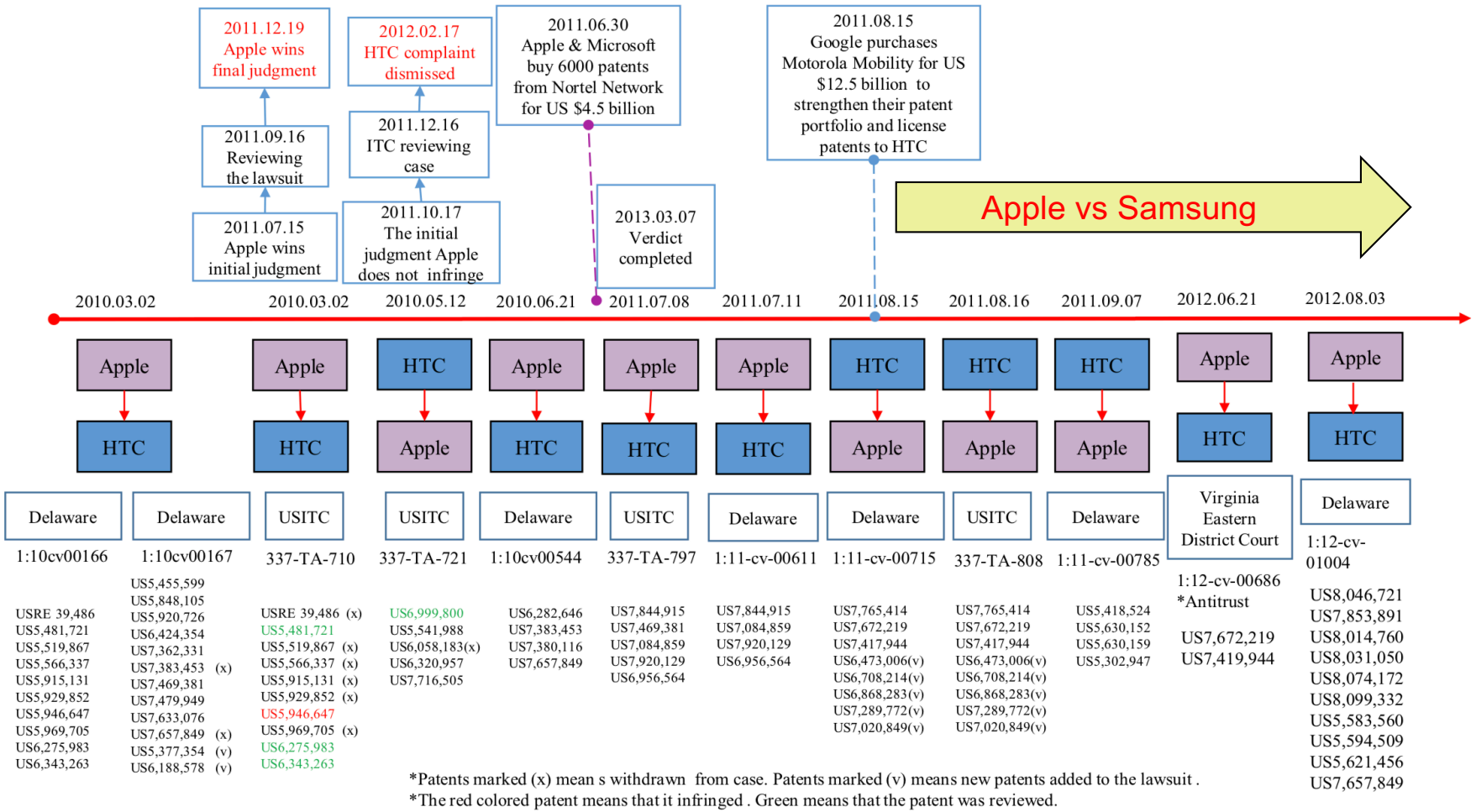
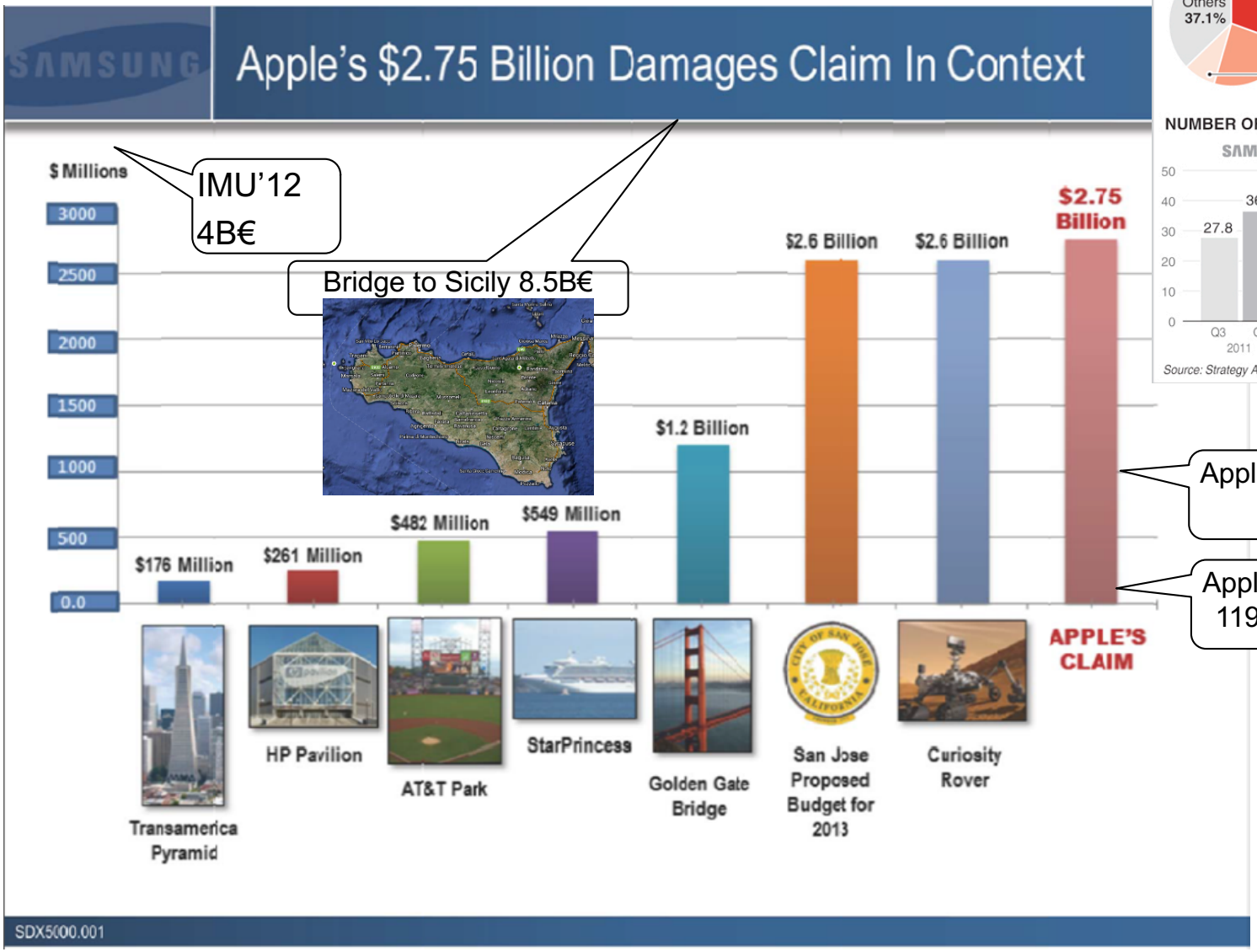
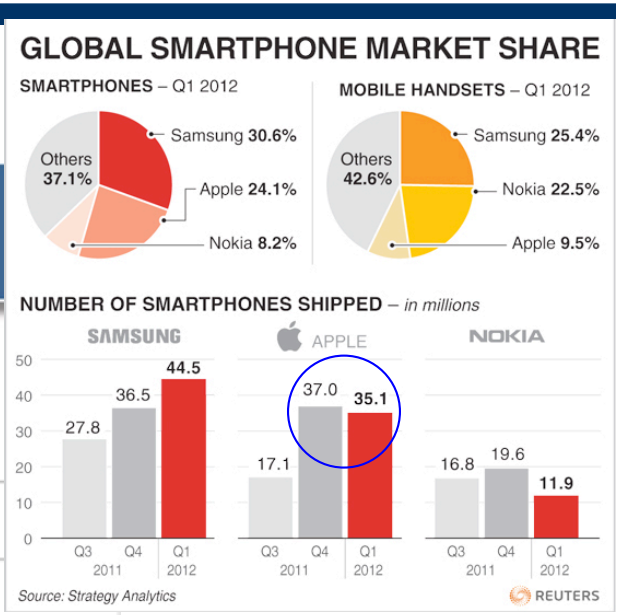


Fig. 1. The litigation timeline of US smartphone cases between Apple and HTC, modified based on [8].

Value of damages and patents (an example)

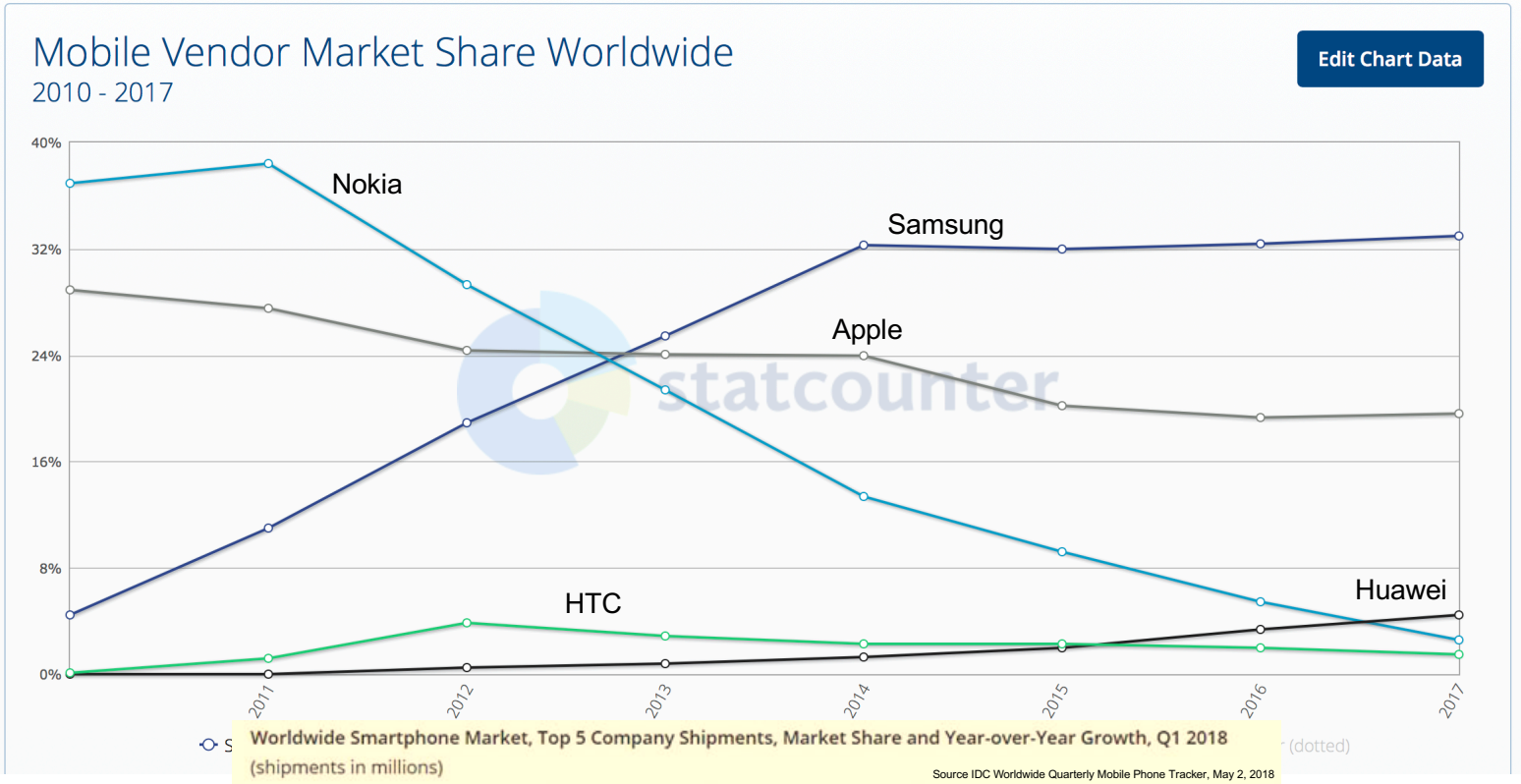




Apple vs Samsung (Aug.'12)

Apple vs Samsung 119M$ (May '14)

Worldwide smartphone market

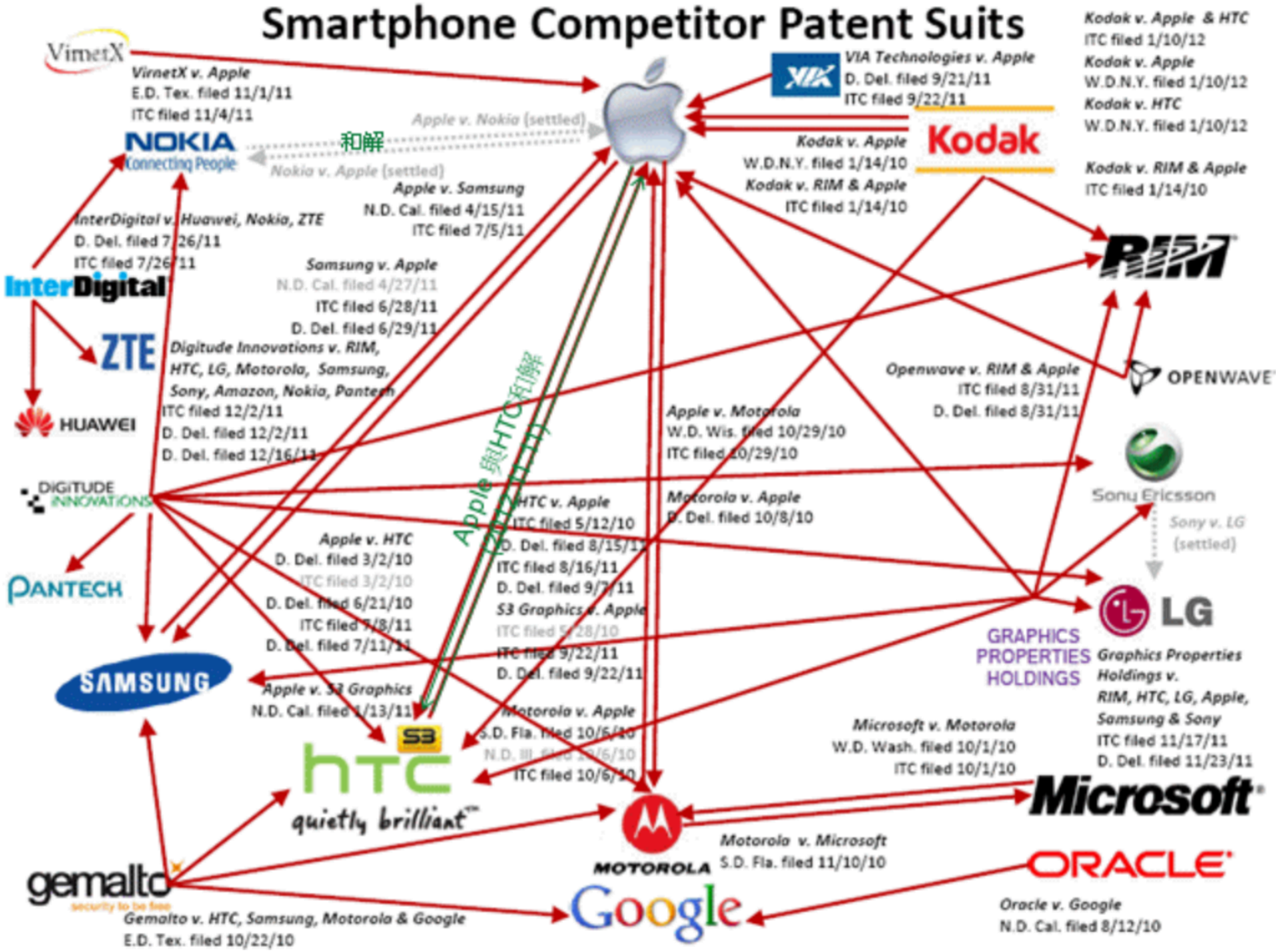


Worldwide Smartphone Market, Top 5 Company Shipments, Market Share and Year-over-Year Growth, Q1 2018
(shipments in millions)

Source IDC Worldwide Quarterly Mobile Phone Tracker, May 2, 2018

Company	1Q18 Shipment Volume	1Q18 Market Share	1Q17 Shipment Volume	1Q17 Market Share	Year-Over-Year Change
Samsung	78.2	23.4%	80.1	23.3%	-2.4%
Apple	52.2	15.6%	50.8	14.7%	2.8%
Huawei	39.3	11.8%	34.5	10.0%	13.8%
Xiaomi	28.0	8.4%	14.8	4.3%	87.8%
OPPO	23.9	7.1%	25.8	7.5%	-7.5%
Others	112.7	33.7%	138.3	40.2%	-18.5%
Total	**334.3**	**100.0%**	**344.4**	**100.0%**	**-2.9%**

(Almost) all-vs-all in smartphones



Source: http://www.netcaucus.org

Standard Essential Patents

- One smartphone stacks multiple patents (up to 250.000!), and Standard compliancy guarantees the interoperability of multivendor devices (scale economies) but there is an apparent contradiction as **any Standard compliant device (=uniformity) stacks multiple patents where each inventor must be guaranteed**

How to rule this complex equilibrium?

- Every industry offers to others its patents to be part of the Standard (e.g., GSM, UMTS, LTE,...) at FRAND (Fair, Reasonable, and Non-Discriminatory) licensing conditions.
- Licensing a patent in FRAND terms is mandatory before the innovation is considered to become part of standard specifications approved by technical Working Groups

- Every patent can be self-declared (to ETSI) as Essential for the Standard and it is in a database of Essential Patents (www.etsi.org/services/ipr-database)
- Any patent **self-declared** as «essential» is not always truly essential.

ICT standard and patents

Standardization (IEEE, 3GPP, ETSI, ITU,…) is crucial to guarantee the interoperability among devices from different vendors (with scale economy)

Standardization: working group (WG) composed of engineers representing companies and institutions.

In IEEE, before every standard-development meeting there is a Call for Patent essential (or deemed to be essential):

> In order for IEEE's patent policy to function efficiently, individuals participating in the standards development process: (a) shall inform the IEEE (or cause the IEEE to be informed) of the holder of any potential Essential Patent Claims of which they are personally aware …
> … (b) should inform the IEEE (or cause the IEEE to be informed) of any other holders of potential Essential Patent Claims …

The participants should be ready to licence at reasonable rates

> a) A general disclaimer to the effect that the Submitter without conditions will not enforce any present or future Essential Patent Claims against any person or entity making…
> b) A statement that the Submitter will make available a license for Essential Patent Claims to an unrestricted number of Applicants on a worldwide basis without compensation or under Reasonable Rates….

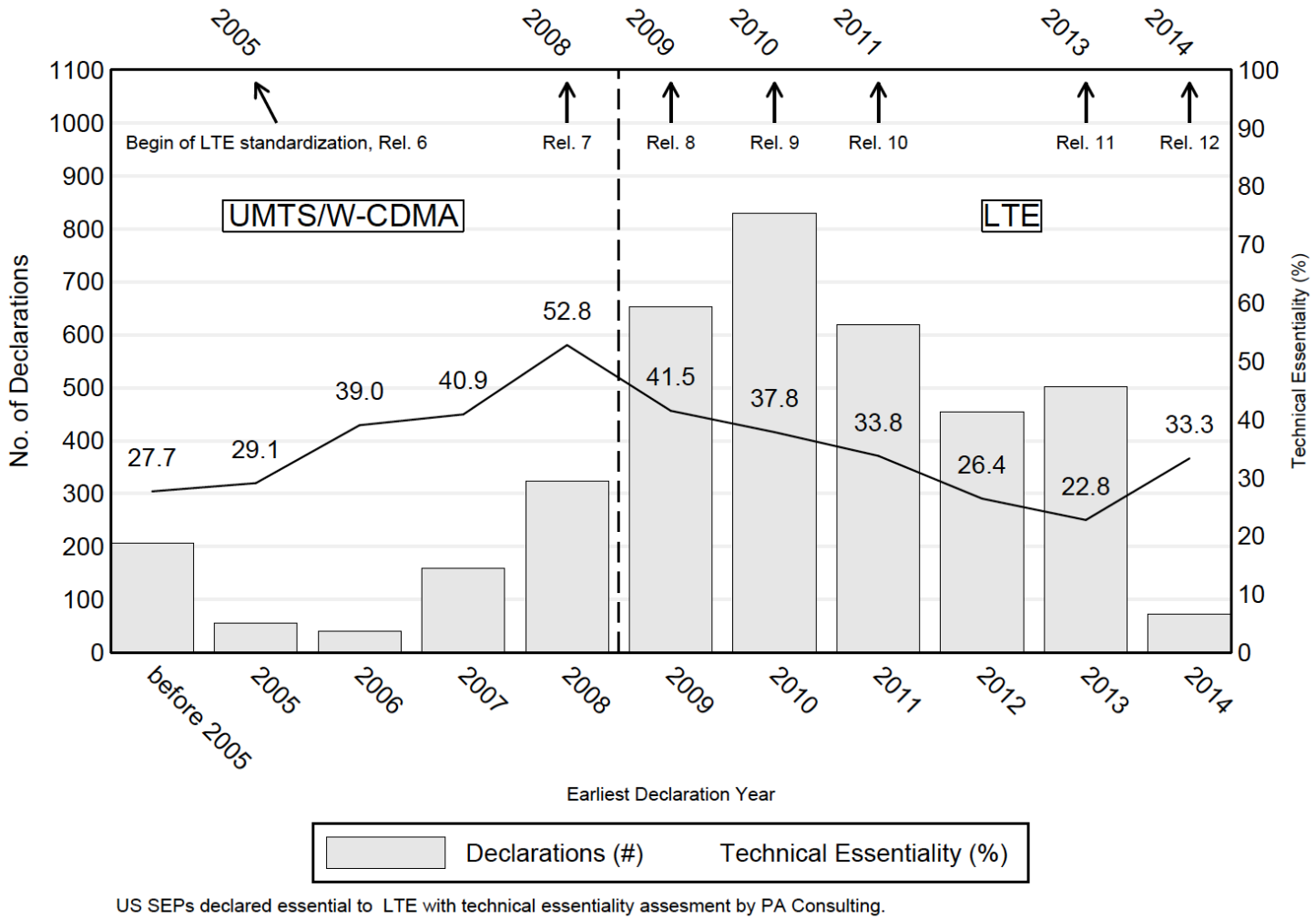
Where reasonable rate is

> Reasonable Rate" shall mean appropriate compensation to the patent holder for the practice of an Essential Patent Claim excluding the value, if any, resulting from the inclusion of that Essential Patent Claim's technology in the IEEE Standard. In addition, determination of such Reasonable Rates should include…

From IEEE-SA Policy 2016

Declaration rates and essentiality at ETSI vs time

During standardizations there are releases of new features, and SEP declarations follow



US SEPs declared essential to LTE with technical essentiality assesment by PA Consulting.

[M.Van Audenrode et al, 2017]

3GPP&3GPP2 essential patents

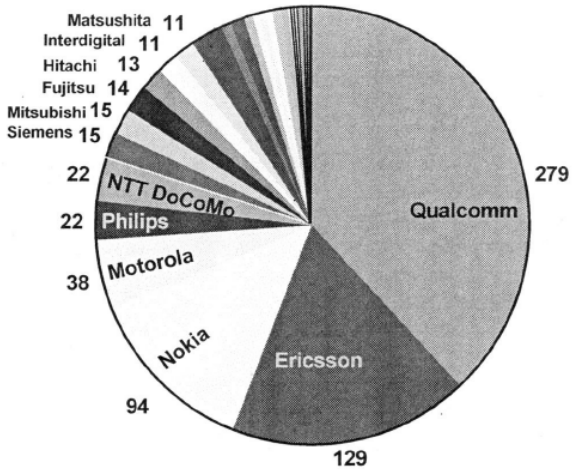


Fig 1: 3GPP Ownership of declared IP

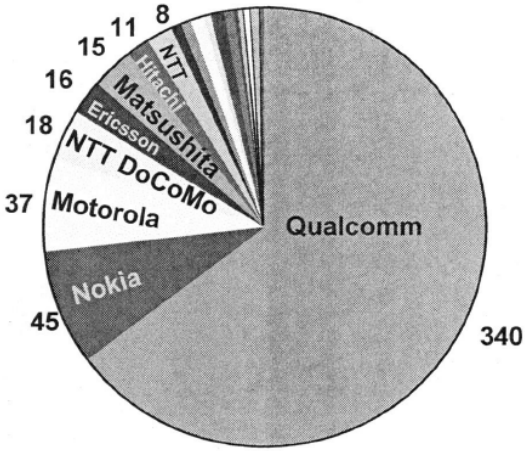


Fig 2: 3GPP2 Ownership of declared IP

Table 3: Technical categories

Technical category	Patents declared Essential to WCDMA		Patents declared Essential to CDMA2000	
	number	percent	number	percent
antenna	20	2.7	17	3.2
call management	24	3.3	14	2.7
cdma	113	15.4	86	16.3
channel coding	50	6.8	30	5.7
circuits	21	2.9	59	11.2
data	13	1.8	12	2.3
fax	3	0.4	3	0.6
handover	80	10.9	49	9.3
layer 2	29	4.0	22	4.2
location	40	5.5	21	4.0
network	59	8.1	32	6.1
radio resources	119	16.3	80	15.2
security	22	3.0	17	3.2
source coding	79	10.8	49	9.3
synchronization	40	5.5	21	4.0
tdma	4	0.5	1	0.2
terminal	7	1.0	6	1.1
not related to 3G	9	1.2	8	1.5
Total	732	100.0	527	100.0

[Goodman & Myers, IEEE 2005]

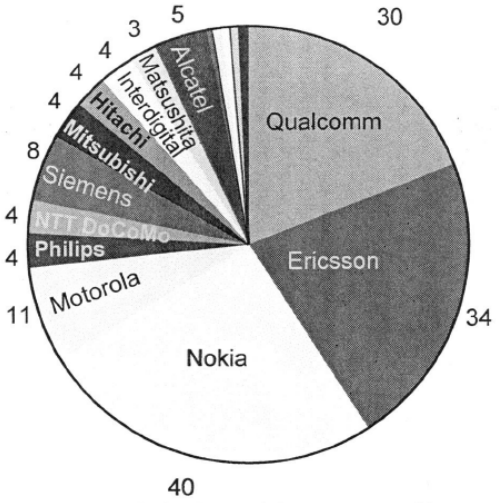


Fig 5: IP judged essential, 3GPP ownership

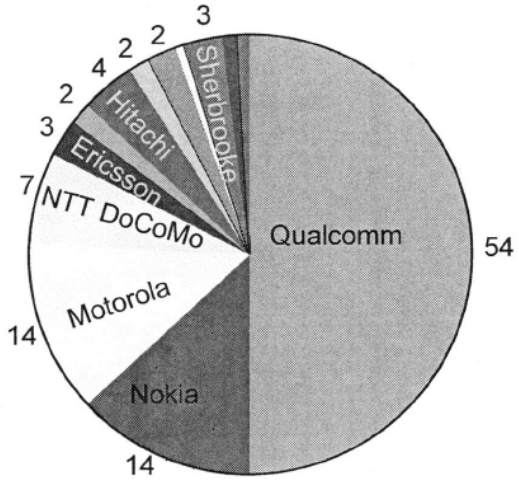


Fig 6: IP judged essential, 3GPP2 ownership

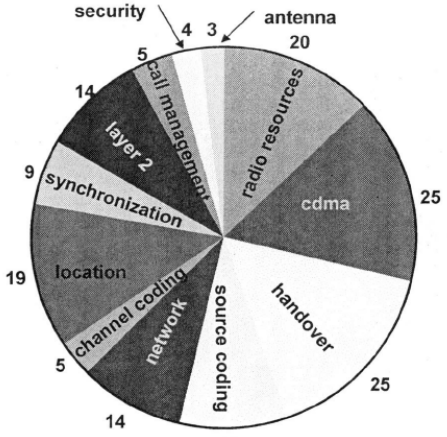


Fig 3: IP judged essential, 3GPP categories

Approx. 21% of declared patents are actually essential

3GPP&3GPP2 essential patents

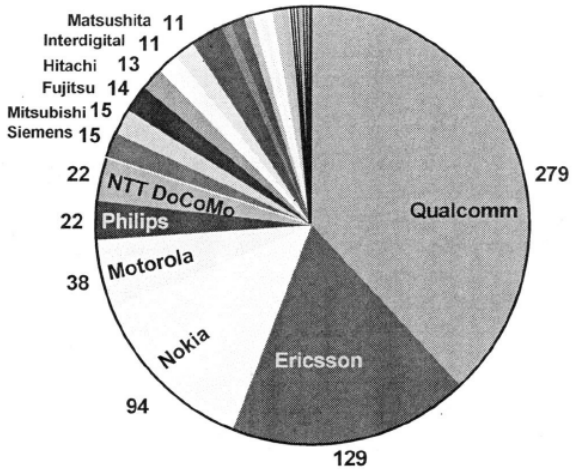


Fig 1: 3GPP Ownership of declared IP

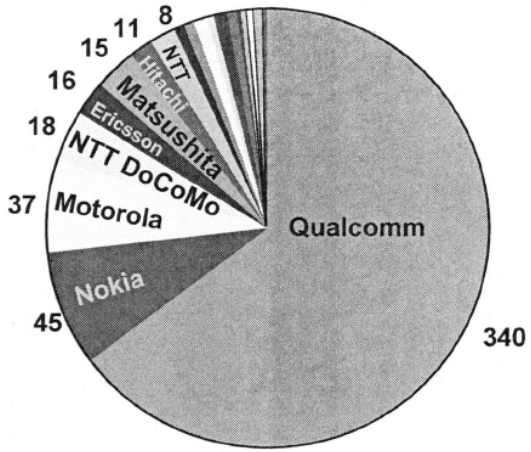


Fig 2: 3GPP2 Ownership of declared IP

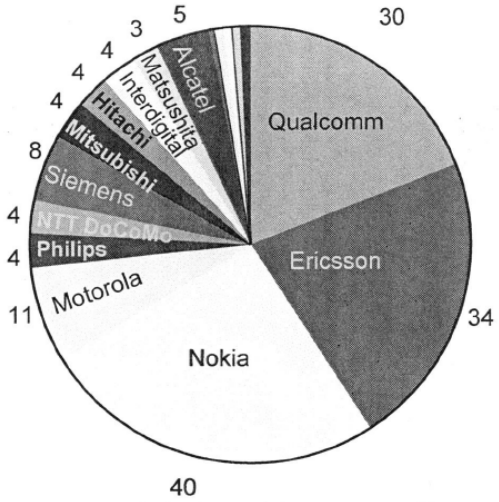


Fig 5: IP judged essential, 3GPP ownership

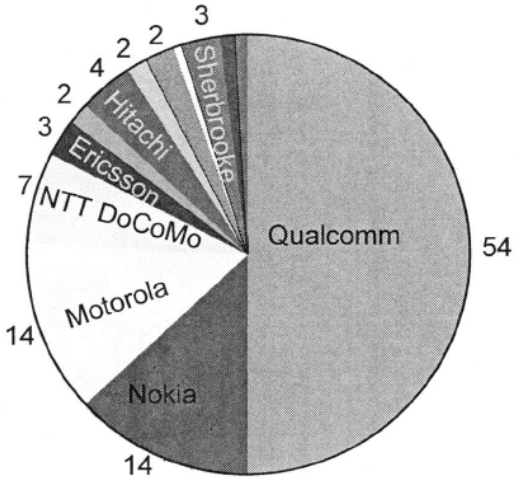
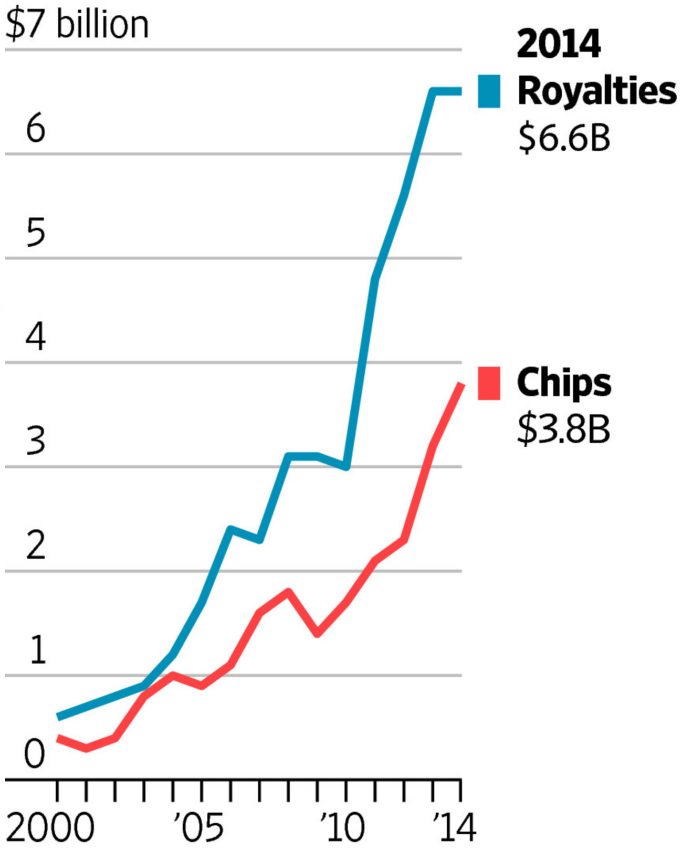


Fig 6: IP judged essential, 3GPP2 ownership

Approx. 21% of declared patents are actually essential

Patent Power

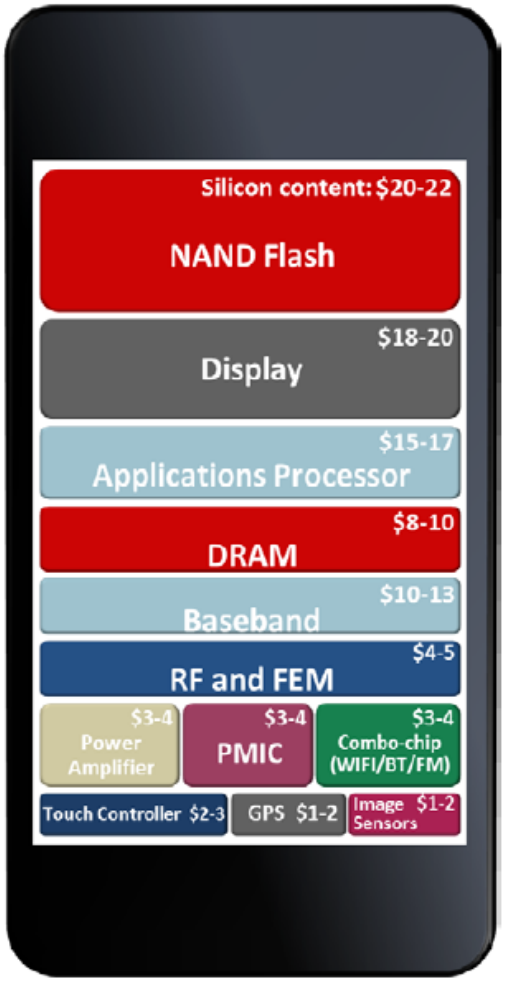
Qualcomm's pretax profit from patent royalties and chip sales

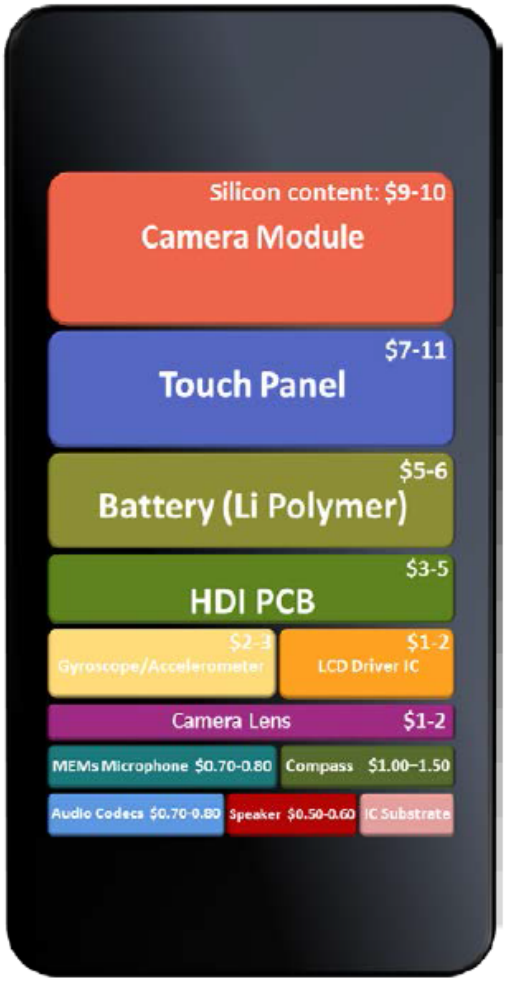


Source: the company

THE WALL STREET JOURNAL.

Royalty vs Hardware in a $400 smarthphone?





Hardware: $120-150

From: The Smartphone Royalty Stack by A.Armstrong, J.J.Mueller, T.D.Syrett (draft paper)

Royalty vs Hardware in a $400 smarthphone?

Company	Royalty ($400 device)	Royalty Rate/Unit
Lucent Technologies	$10,000 + 5% of product[110] (requested)	~$20.00
Agere	5% of product (requested)[111]	$20.00
Motorola	2.25% of product (requested) $0.008 (court awarded)[112] $0.03 (court awarded for Xbox)[113]	$9.00
Innovatio IP Ventures	$3.39 - $36.90[114] (requested) $0.0956 per Wi-Fi chip (court awarded)	$7.20[115]
Sisvel Patent Pool[116]	€0.71 per device (if licensee grants Nokia a license to its 802.11 SEPs) (requested) €0.86 per device (if licensee does not grant Nokia a license to its 802.11 SEPs) (requested)	$1.18
Via Licensing[117]	Per Unit Sliding-Scale Fee Based on Volume, ranging from $0.55 to $0.05 (requested)[118]	$0.55
Ericsson	*$0.50 (requested)* *$0.05 per patent per product (court awarded)*	*$0.50*[119]
Total		**$50.23**

WiFi: $50.23 (12.5%)

From: The Smartphone Royalty Stack by A.Armstrong, J.J.Mueller, T.D.Syrett (draft paper)

Royalty vs Hardware in a $400 smarthphone?

Company	Announced LTE Rate	Royalty ($400 device)
Qualcomm	3.25% of device[31]	$13.00
Motorola	2.25% of device	$9.00
Alcatel-Lucent	Up to 2% of device	$8.00
Huawei	1.5% of device	$6.00
Ericsson	1.5% of device	$6.00
Nokia	1.5% of device	$6.00
Nortel[32]	1% of device	$4.00
ZTE	*1% of device*	*$4.00*[33]
Siemens	0.8% of device	$3.20
Via Licensing	Per Unit Sliding-Scale Fee Based on Volume[34]	$2.10 per unit (sales over 10M units)
Sisvel Patent Pool	0.99 Euros per device[35]	$1.36
Vodafone	Free[36]	$0.00
Total		**$54.30**

LTE: $54.30 (13.5%)

From: The Smartphone Royalty Stack by A.Armstrong, J.J.Mueller, T.D.Syrett (draft paper)

Royalty vs Hardware in a $400 smarthphone?

Technology	Potential Royalty Demands
Cellular Baseband Chip (Standardized)	$54
Wi-Fi/802.11	$50
AAC	$0.20
MP3	$0.95
H.264	$10.60
Operating system software (Microsoft or Android)	$5-8
Total (approx.)	**$121-124**

Royalty: $121-124 (30-31%)

Hardware: $120-150 (30-38%)

From: The Smartphone Royalty Stack by A.Armstrong, J.J.Mueller, T.D.Syrett (draft paper)

Example of patent vs standard (1/3)

(19) Europäisches Patentamt / European Patent Office / Office européen des brevets

(11) EP 1 679 803 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
21.07.2010 Bulletin 2010/29

(51) Int Cl.:
H04B 7/005 *(2006.01)* *H04L 1/00* *(2006.01)*

(21) Application number: **06000204.5**

(22) Date of filing: **05.01.2006**

(54) **Method for configuring gain factors for uplink service in radio telecommunication system**

Verfahren zur Konfiguration von Verstärkungsfaktoren für Dienste in der Aufwärtsrichtung in einem Funkkommunikationssystem

Procédé de configuration de facteurs de gain pour des services de liaison montante dans un système de communication radio

(84) Designated Contracting States:
DE FI FR GB IT SE

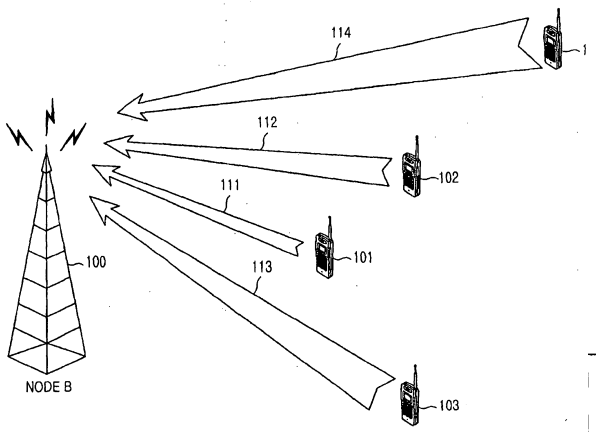
(30) Priority: **06.01.2005 KR 2005001400**
04.02.2005 KR 2005010868

(43) Date of publication of application:
12.07.2006 Bulletin 2006/28

(60) Divisional application:
08019959.9 / 2 077 628

(73) Proprietor: **Samsung Electronics Co.**
Yeongtong-gu
Suwon-si, Gyeonggi-do (KR)

(72) Inventors:
- **Heo, Youn-Hyoung**
  Yeongtong-gu
  Suwon-si
  Gyeonggi-do (KR)
- **Lee, Ju-Ho**
  Yeongtong-gu
  Suwon-si
  Gyeonggi-do (KR)
- **Cho, Joon-Young**
  Yeongtong-gu
  Suwon-si
  Gyeonggi-do (KR)
- **Kim, Young-Bum**
  Yeongtong-gu
  Suwon-si



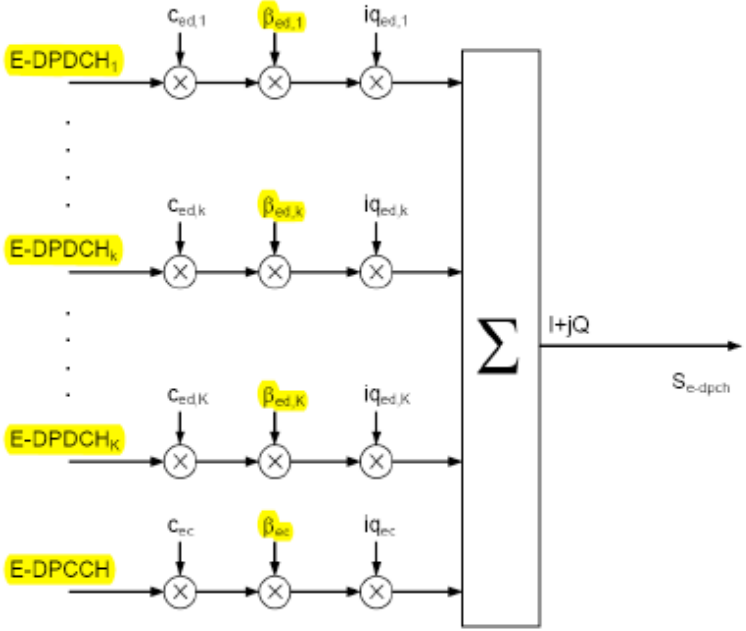


Figure 1C: Spreading for E-DPDCH/E-DPCCH

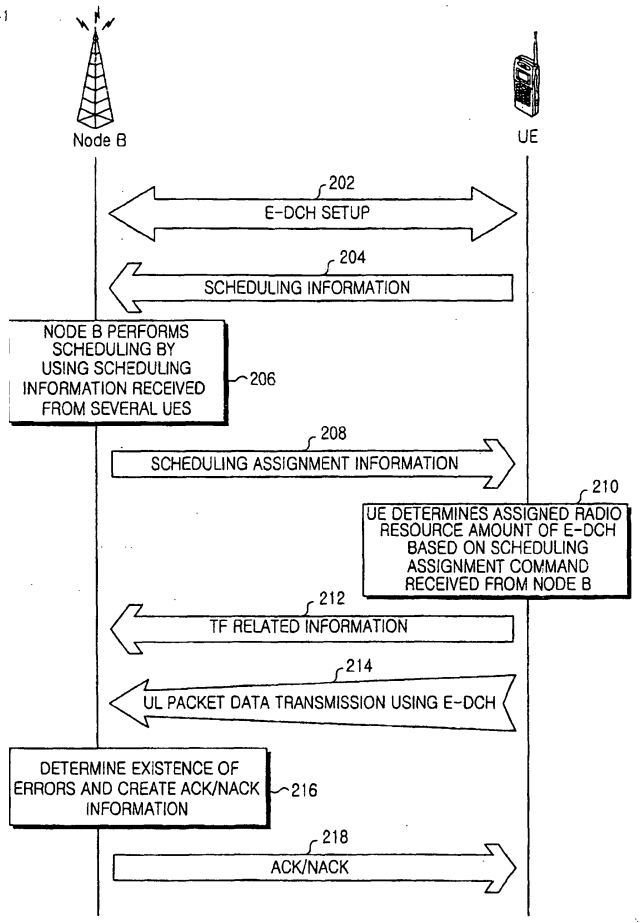
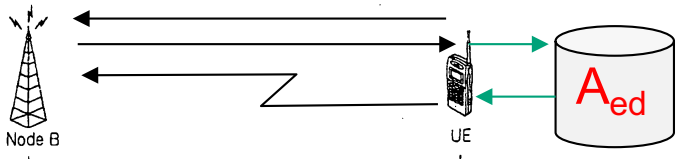


FIG.2

Example of SW patent vs standard (2/3)

Information Element/Group name	Need	Multi	Type and reference	Semantics description
CHOICE *Gain Factors*	MP			
>Signalled Gain Factors				
>>CHOICE *mode*				
>>>FDD				
>>>>Gain Factor β_c	MP		Integer (0.. 15)	For UL DPCCH or control part of PRACH or PCPCH
>>>TDD				(no data)
>>Gain Factor β_d	MP		Integer (0..15)	For UL DPDCH or data part of PRACH or PCPCH in FDD and all uplink channels in TDD
>>Reference TFC ID	OP		Integer (0..3)	If this TFC is a reference TFC, indicates the reference ID.
>Computed Gain Factors				
>>Reference TFC ID	MP		Integer (0.. 3)	Indicates the reference TFC Id of the TFC to be used to calculate the gain factors for this TFC. In case of using computed gain factors, at least one signalled gain factor is necessary for reference.

FIG.4



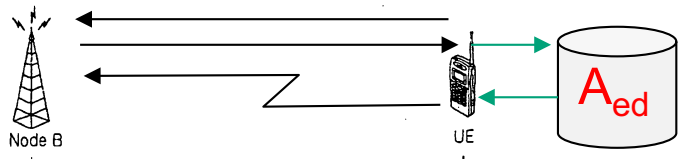
10.3.5.8 Power Offset Information

Information Element/Group name	Need	Multi	Type and reference	Semantics description
CHOICE *Gain Factors*	MP			
>Signalled Gain Factors				
>>CHOICE *mode*				
>>>FDD				
>>>>Gain Factor β_c	MP		Integer (0.. 15)	For UL DPCCH or control part of PRACH or PCPCH
>>>TDD				(no data)
>>Gain Factor β_d	MP		Integer (0..15)	For UL DPDCH or data part of PRACH or PCPCH in FDD and all uplink channels in TDD
>>Reference TFC ID	OP		Integer (0..3)	If this TFC is a reference TFC, indicates the reference ID.
>Computed Gain Factors				
>>Reference TFC ID	MP		Integer (0.. 3)	Indicates the reference TFC Id of the TFC to be used to calculate the gain factors for this TFC. In case of using computed gain factors, at least one signalled gain factor is necessary for reference.
CHOICE *mode*	MP			
>FDD				
>>Power offset P p-m	OP		Integer(-5..10)	In dB. Power offset between the last transmitted preamble and the control part of the message (added to the preamble power to receive the power of the message control part) Needed only for PRACH
>TDD				(no data)

$$\beta_{ed}=A_{ed}\times\beta_c=(\beta_d/\beta_c)\times\beta_c$$

mapping based quantized to 5bits

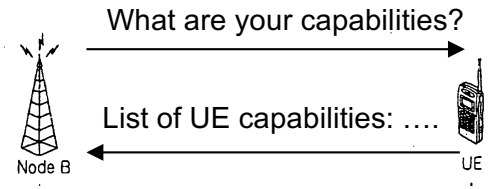
Example of SW patent vs standard (3/3)



$$\beta_{ed}=A_{ed}x\beta_c=(\beta_d/\beta_c)x\beta_c$$

mapping based quantized to 5bits

- Signalling patent can be easier protected than implementation one
- Software signals' manipulations (i.e., scaling) is not unique, not easily accessible for proof of infringement
- Signals' manipulations are IC-based, but assembly company is responsible for infringing



- Proof of infringement by radio-protocol requests

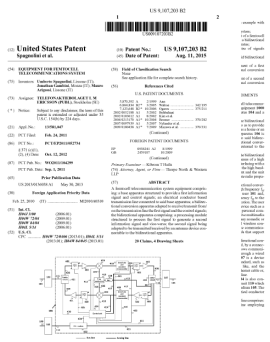
Patent litigations: big vs small company

Lawer(s)
Patent Attorney(s)

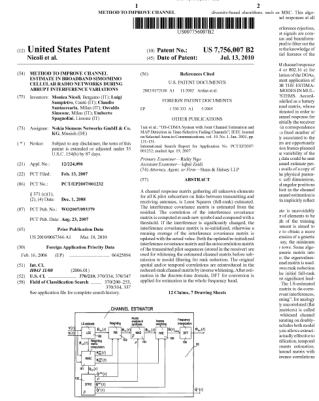
Time-frame is crucial
Trial cost is relevant

Law firm possibly worldwide
Patent Attorneys &Tech. Experts

Time-frame is irrelevant
Trial cost is a small fraction



patent(s) vs patent(s)



Nullity action: prove that patent is obvious and not novel

Null if patent is a simple combination of up to two other priors

Infringement action: pay damages or unpaid royalties or injunction

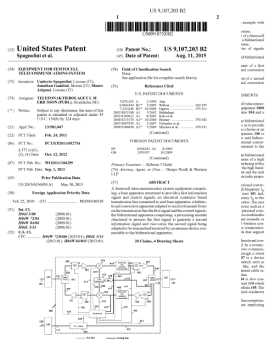
Patent litigations: big vs small company

Lawer(s)
Patent Attorney(s)

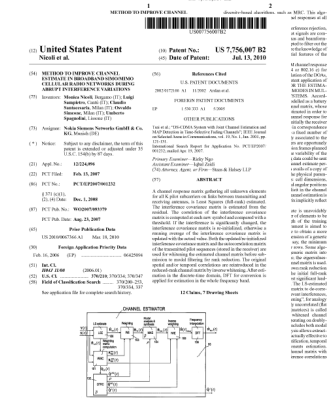
Time-frame is crucial
Trial cost is relevant

Law firm possibly worldwide
Patent Attorneys &Tech. Experts

Time-frame is irrelevant
Trial cost is a small fraction



patent(s) vs patent(s)



A solid patent is necessary to counteract a big-player, but it is not enough ☹

What to do? Well…it depends: i) keep-going if IP is strong without any successful injuction and business is running; ii) come to a deal.

App-developers and patents

- Apps can be patented but must be novel and not obvious (i.e., not trivial)
- Patent claiming should look at future evolutions (not to share publicly beforehand)
- When new app is posted on Google-play or Apple-store it becomes a product subject to the IP and infringement rules

Notice: patents do not increase the business but prevent others to enter into the same business using the same method

To conclude: a personal vision on University vs IP

- Gain more sensitivity to the patenting process in ICT
- Sell research/innovation and take risks/benefits (not just selling patent applications)
- Gain insight in the Intellectual Property scenario