

O PAPEL COMBINADO DE HSPA, LTE E LTE-ADVANCED NO BRASIL



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- ❑ A non-profit trade association representing suppliers - established October 2, 1998
 - ❑ Promote technologies: 3GPP family - GSM/EDGE, WCDMA-HSPA/HSPA+, LTE/LTE-A

- ❑ Trusted, authoritative source of facts, statistics and objective analysis for the industry globally
 - ❑ Produce regular reports on status of mobile broadband network deployments and development of the devices ecosystems

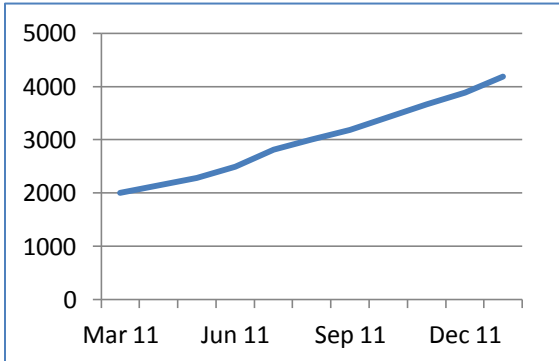
- ❑ Show thought-leadership, educate and influence using information papers and white papers

- ❑ Assist operators e.g. seminars, showcase success stories and viewpoints, case studies, joint papers, campaigns included HSPA/HSPA+, UMTS900, HD Voice (W-AMR), LTE, LTE1800.....

- ❑ GSA website www.gsacom.com has true global reach
 - ❑ 46,200+ registered site users; growing by ~ 1,000 every 35 days

 - ❑ Social Networks presence: LinkedIn, Twitter, Facebook

Global mobile Suppliers Association (GSA)
LinkedIn group www.linkedin.com/groups?gid=2313721



HSPA laid the foundation of Mobile Broadband success

- ❑ Mobile broadband began with WCDMA and its first evolution - HSPA
- ❑ 100% of WCDMA operators have deployed HSPA
 - ❑ 451 commercial HSPA networks in 174 countries
 - ❑ achieved in just over 6 years
- ❑ 876 million mobile broadband subs (WCDMA including HSPA) – end 2011
- ❑ At least 3,362 HSPA user devices launched by 271 suppliers
 - ❑ 440 devices added to GSA's database in the past year
- ❑ Mobile broadband is driving traffic, revenue and profit growth in all markets
 - ❑ Most operators include mobile broadband in their service portfolio



Evolution to HSPA+ is the main trend globally



HSPA+ delivers higher capacity and performance and an improved user experience of mobile broadband

> 41% of HSPA operators have launched HSPA+

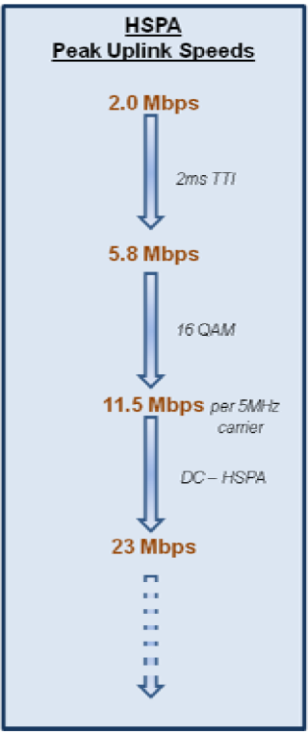
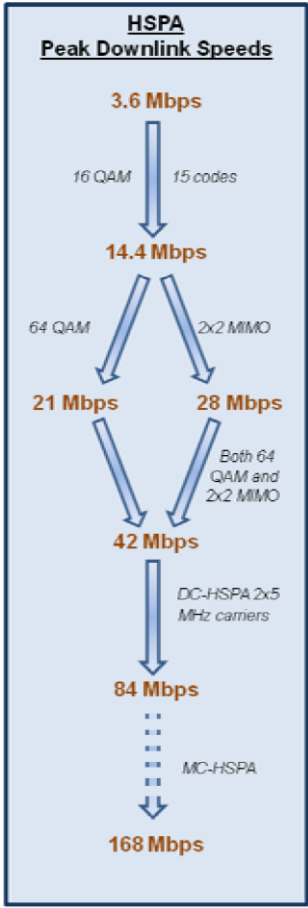
241 operators in 106 countries committed to HSPA+ deployments

187 HSPA+ systems commercially launched in 96 countries

62 operators have commercially launched 42 Mbps DC-HSPA+

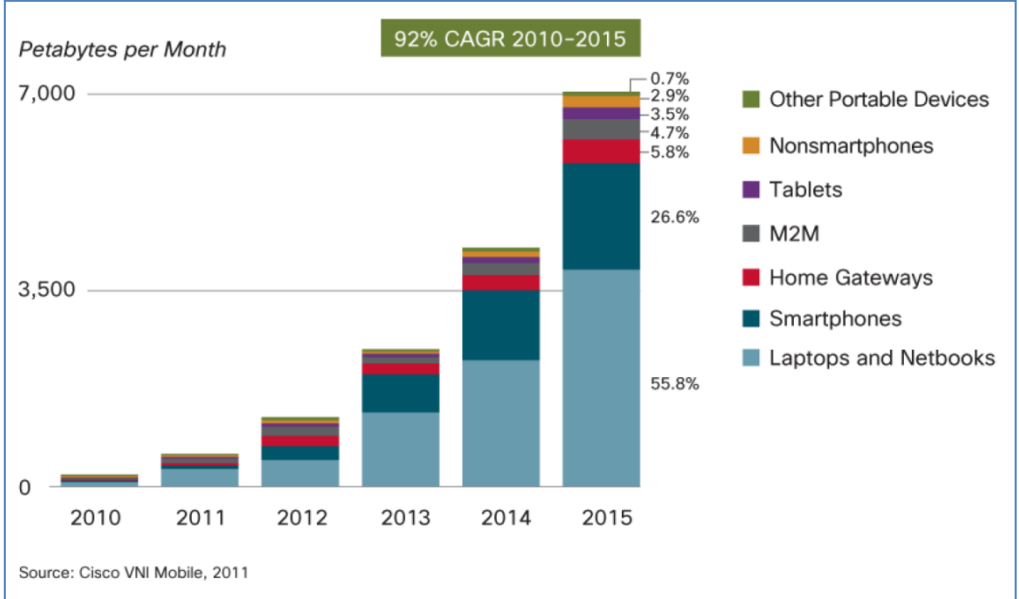
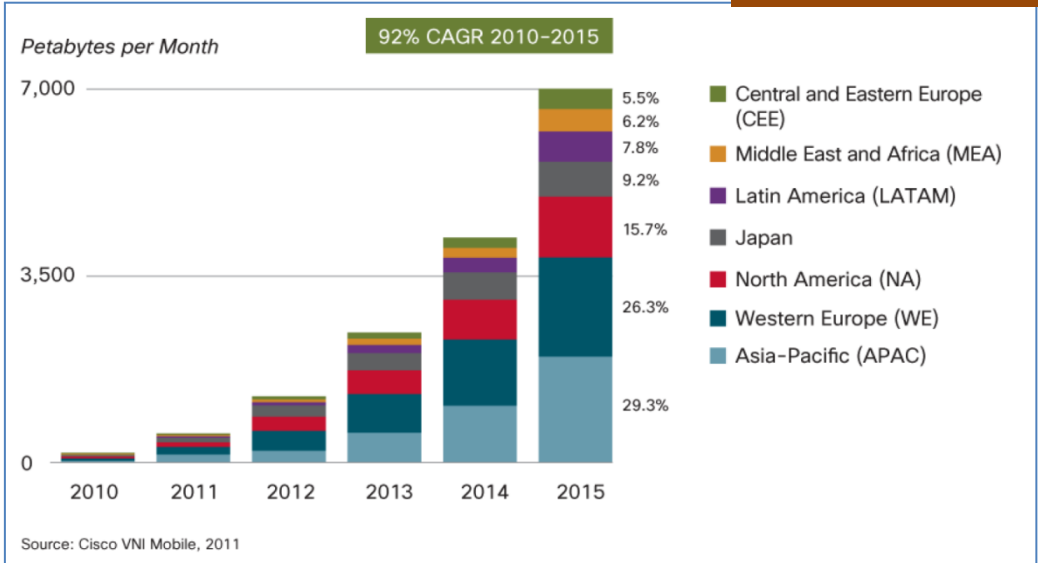
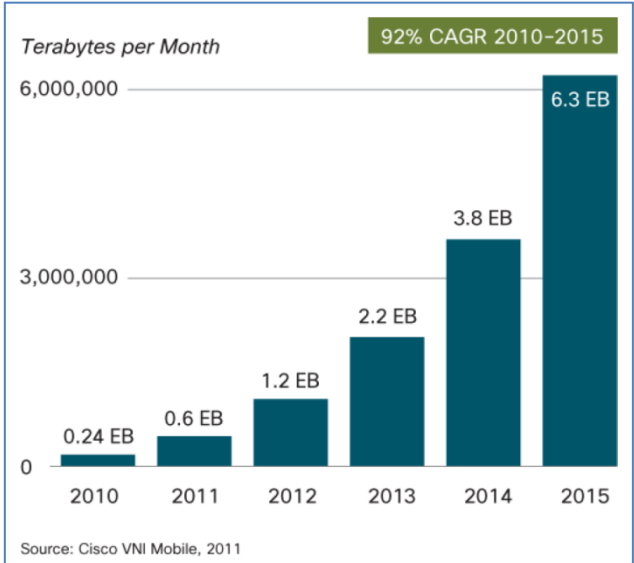
- ❑ 245 HSPA+ devices announced (compared to 92 a year ago)
 - ❑ 137 devices support 21 Mbps peak downlink speed
 - ❑ 14 devices support 28.8 Mbps
 - ❑ 93 devices support 42 Mbps DC-HSPA+ (22 a year ago)
 - ❑ 1 device supports 84 Mbps

- ❑ 27 HSPA+ smartphones (including carrier and frequency variants) are confirmed



HSPA+ is mainstream

Global mobile data traffic



- In 2011 global mobile data traffic grew 133%. Cisco says mobile data will grow another 110% in 2012
- Global mobile data traffic to grow 18 x 2011 - 2016
- By 2016 video is expected to make up 71% percent of all mobile data traffic (2011 = 52%)
- By 2016 there will be more than 10 billion mobile Internet connections

Laptops and smartphones lead traffic growth
 Cisco said in 2011 average traffic per smartphone = 150 Mbytes/ month (55 Mbytes/month in 2010)
 Smartphones represent 12% of total global handsets in use today, but are responsible for > 82% of total global handset traffic

- The primary drive towards LTE comes from the need for network capacity, performance management and efficiency
- Opportunities for new products/services
- Opportunities for revenue growth
 - LTE could be a tool to charge more for mobile data
 - much faster uplink
 - lower latency
 - some new video-based services might only be possible using LTE



The Video tsunami



- 86,000 hours of footage uploaded every day
- An hour's footage is uploaded to the site every second
- More than 4 billion video views per day

Mobile taking a growing share of access

**GSA – Evolution to LTE report
January 5, 2012**

285 operators in 93 countries are investing in LTE

- ❑ 226 network commitments
- ❑ 59 pre-commitment trials and studies
- “LTE is the fastest developing mobile system technology ever” - GSA
- ❑ 49 commercial network launches in 29 countries
- ❑ Number of commercial networks almost tripled in 2011
- ❑ GSA forecast: 119 commercial LTE networks by end 2012
- ❑ 7.6 million LTE subscriptions (end 2011)

- ❑ Initial launches mainly LTE-FDD mode
- ❑ Main frequencies used: 700, 800, 1800, 2600 MHz
- ❑ 4 commercial LTE TDD networks launched

Country	Operator	Launch
Norway	TeliaSonera	14.12.09
Sweden	TeliaSonera	14.12.09
Uzbekistan	MTS	28.07.10
Uzbekistan	UCell	09.08.10
Poland	Aero2/Mobyland/CenterNet (LTE TDD from 10.05.11)	07.09.10
USA	MetroPCS	21.09.10
Austria	A1 Telekom	05.11.10
Sweden	TeleNor Sweden	15.11.10
Sweden	Tele2 Sweden	15.11.10
Hong Kong	CSL Limited	25.11.10
Finland	TeliaSonera	30.11.10
Germany	Vodafone	01.12.10
USA	Verizon Wireless	05.12.10
Finland	Elisa	08.12.10
Denmark	TeliaSonera	09.12.10
Estonia	EMT	17.12.10
Japan	NTT DoCoMo	24.12.10
Germany	Deutsche Telekom	05.04.11
Philippines	Smart Communications	16.04.11
Lithuania	Omnitel	28.04.11
Latvia	LMT	31.05.11
Singapore	M1	21.06.11
South Korea	SK Telecom	01.07.11
South Korea	LG U+	01.07.11
Germany	O2	01.07.11
Canada	Rogers Wireless	07.07.11
Austria	T-Mobile	28.07.11
Canada	Bell Mobility	14.09.11
Saudi Arabia	Mobily (LTE TDD)	14.09.11
Saudi Arabia	STC (LTE TDD)	14.09.11
Saudi Arabia	Zain	14.09.11
USA	AT&T Mobility	18.09.11
UAE	Etisalat	25.09.11
Australia	Telstra	27.09.11
Denmark	TDC	10.10.11
Austria	3	18.11.11
Puerto Rico	AT&T Mobility	20.11.11
Puerto Rico	Claro	24.11.11
Belarus	Yota Bel	01.12.11
Brazil	Sky Brazil (LTE TDD)	13.12.11
Finland	DNA	13.12.11
Uruguay	Antel	13.12.11
USA	Cricket	21.12.11
Singapore	SingTel	22.12.11
Kuwait	Viva	27.12.11
Armenia	Vivacell-MTS	28.12.11
Bahrain	Viva Bahrain	01.01.12
Hungary	T Mobile	01.01.12
South Korea	KT	03.01.12



49 commercial LTE network launches
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LTE TDD – significant activities extend beyond China

LTE TDD: summary of network plans, commitments, trials, deployments

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www.linkedin.com/groups?gid=3978061

Global TD-LTE Initiative launched at MWC 2011

The Global TD-LTE Initiative (GTI) was launched at MWC 2011 aiming to bring together leading industry partners to steer the TD-LTE ecosystem as a major standard in mobile broadband technology & drive the development of next generation mobile broadband networks.

Australia	WiMAX™ operator Vivid Wireless trialled LTE TDD in Sydney for 2 months from December 2010 in high demand, high density, inner city conditions. Commercial launch is expected by 2012. NBN Co is deploying a 2.3 GHz fixed-wireless LTE TDD network to serve rural areas
Brazil	Sky Brazil launched a commercial LTE TDD network in December 2011
Canada	WiMAX™ operator Xplornet has successfully trialled LTE TDD in 2.5 GHz and 3.5 GHz spectrum over existing WiMax infrastructure.
China	China Mobile has launched large-scale LTE TDD trials consisting of more than 1,000 base stations in Beijing, Shanghai, Hangzhou, Nanjing, Guangzhou, Shenzhen, and Xiamen. Commercial services are expected in 2012
Denmark	3 acquired 2.6 GHz TDD spectrum and is deploying a combined LTE FDD/TDD network
France	Orange has deployed a trial LTE network in Paris supporting FDD and TDD modes. FDD-TDD co-existence tests are on-going
Germany	E-Plus, a member of the Global TD-LTE Initiative, is trialling LTE TDD in 2.6 GHz
India	<ul style="list-style-type: none"> RIL has committed to deploy LTE TDD Bharti Airtel, a member of the Global TD-LTE Initiative, is committed to deploy LTE TDD Qualcomm India LTE Venture is committed to LTE TDD deployment. Tikona Digital will deploy LTE TDD Augere is deploying LTE TDD BSNL may introduce LTE TDD MTNL may introduce LTE TDD
Ireland	LTE TDD testing was completed June 2010
Japan	Softbank Mobile is deploying LTE TDD in 2.6 GHz spectrum and has joined the Global TD-LTE Initiative

Malaysia	<ul style="list-style-type: none"> WiMAX™ operator Packet Networks (P1) is planning to deploy LTE TDD on existing sites as an overlay network. WiMAX™ operator Asiaspace is planning to deploy 2.3 GHz LTE TDD
Oman	Omantel showcased LTE TDD during the Salalah Tourism Festival in July 2010 and at Comex 2011, and had become the first Arab network to join the Global TD-LTE Initiative
Poland	Aero2 launched LTE TDD in Band 38 (2.6 GHz), part of Aero2's dual LTE network (LTE TDD and LTE1800 FDD). Aero2 is a member of the Global TD-LTE Initiative
Russia	<ul style="list-style-type: none"> Rostelecom is reported to have approval to deploy LTE TDD network in 2.3 GHz spectrum OAo Voentelecom is trialling LTE TDD
Saudi Arabia	<ul style="list-style-type: none"> Etisalat launched a commercial LTE TDD network in September 2011 STC launched a commercial LTE TDD network in September 2011
Sweden	3 acquired 2.6 GHz TDD spectrum and is deploying a combined LTE FDD/TDD network
Taiwan	<ul style="list-style-type: none"> CHT has completed LTE tests on the high-speed rail system using TDD and FDD modes in 2.6GHz spectrum FarEasTone and China Mobile are co-operating on an LTE TDD trial in Taipei The National Chiao Tung University conducted a trial of LTE TDD in 2010 WiMAX operator Global Mobile Corp will seek approval to allow a switch to LTE TDD once WiMAX coverage hits 70% of the population Fitel (PHS, WiMAX operator) trialling LTE TDD
Thailand	AIS – TOT joint trial in 2.3 GHz band
Uruguay	Dedicado planning deployment in 3.5 GHz
USA	<p>Clearwire requested 3GPP to standardize LTE TDD for operation in the band 2496 – 2690 MHz and in August 2011 announced plans to deploy LTE TDD in this band as an overlay to its existing network.</p> <p>Clearwire is a member of the Global TD-LTE Initiative</p>
Various	US-based VelaTel Global Communications has joined the Global TD-LTE Initiative, and has BWA projects in various markets including in China e.g via its JV with Aerostrong

GSA – Evolution to LTE report
January 5, 2012

Several LTE TDD commercial network launches will take place in 2012

Latest news

SoftBank aims at 97% coverage for LTE TDD network
Soft-launched in Tokyo, Osaka, Fukuoka; commercial launch target by end February

China Mobile Hong Kong wins 2.3 GHz spectrum
February 6, CMHK announced had won 30MHz TDD spectrum (2330 MHz-2360 MHz)

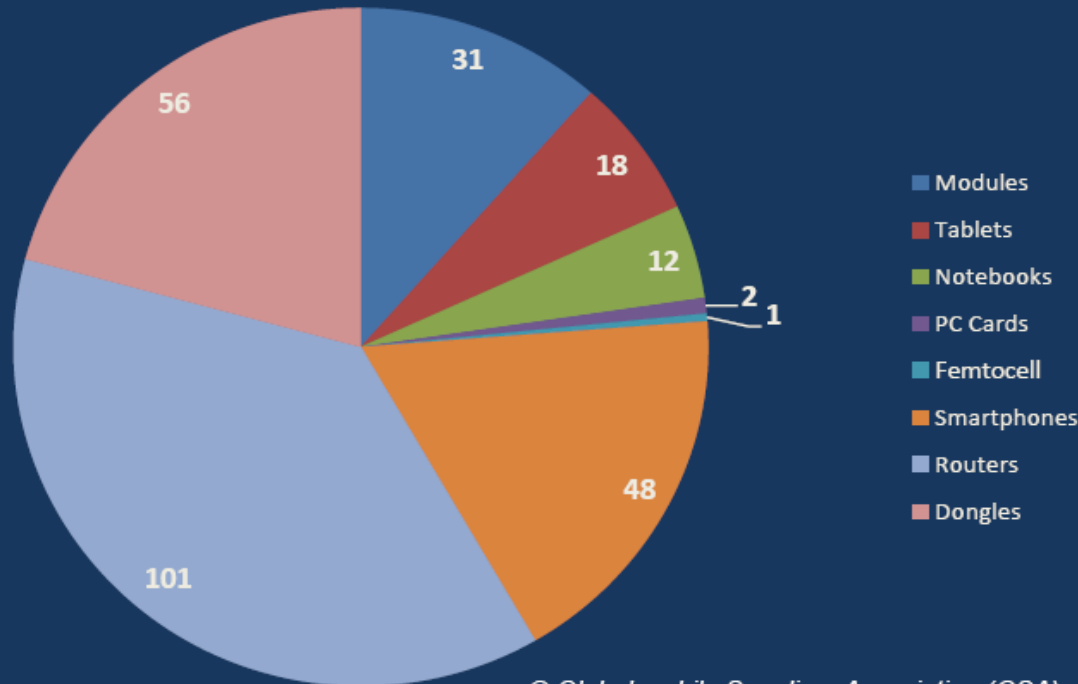
Hutchison Telecom Hong Kong Holdings wins bid for 30MHz block in 2.3GHz band
Additional spectrum will be used for TDD LTE

LTE Devices: 269 products launched



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57 manufacturers



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36% increase in LTE devices announced in 3 months

Over 200 LTE user devices launched in past year

LTE smartphone devices increased 6-fold in 6 months

LTE-enabled tablets more than doubled in 6 months

LTE FDD	
700 MHz	142 devices
800 MHz	52 devices
1800 MHz	50 devices
2600 MHz	65 devices
800/1800/2600 MHz	43 devices
AWS	51 devices

LTE TDD	
2300 MHz Band 40	36 devices
2600 MHz Band 38	36 devices
2600 MHz Band 41	5 devices

Source of data: Status of the LTE Ecosystem report – GSA
January 20, 2012





3GPP defined 30+ potential bands for LTE deployments

Several bands have been used in initial deployments according to availability and national/regional needs

In Europe, APAC and beyond, 2.6 GHz is new spectrum and is the main LTE capacity band

2.6 GHz auctions are completed in several markets including Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Hong Kong, Italy, Netherlands, Norway, Portugal, Singapore, Spain, Sweden

Digital Dividend is also new spectrum for mobile communications

E-UTRA Operating Band	Band name	Uplink (UL) operating band BS receive UE transmit		Downlink (DL) operating band BS transmit UE receive		Duplex Mode
		F _{UL_low}	F _{UL_high}	F _{DL_low}	F _{DL_high}	
1	2.1 GHz	1920 MHz	1980 MHz	2110 MHz	2170 MHz	FDD
2	PCS 1900	1850 MHz	1910 MHz	1930 MHz	1990 MHz	FDD
3	1800 MHz	1710 MHz	1785 MHz	1805 MHz	1880 MHz	FDD
4	AWS	1710 MHz	1755 MHz	2110 MHz	2155 MHz	FDD
5	850 MHz	824 MHz	849 MHz	869 MHz	894 MHz	FDD
6 ¹	850 MHz (Japan #1)	830 MHz	840 MHz	875 MHz	885 MHz	FDD
7	2.6 GHz (IMT Ext)	2500 MHz	2570 MHz	2620 MHz	2690 MHz	FDD
8	900 MHz	880 MHz	915 MHz	925 MHz	960 MHz	FDD
9	1700 MHz (Japan #2)	1749.9 MHz	1784.9 MHz	1844.9 MHz	1879.9 MHz	FDD
10	Ext 1.7/2.1 GHz	1710 MHz	1770 MHz	2110 MHz	2170 MHz	FDD
11	1500 MHz lower (Japan #3)	1427.9 MHz	1447.9 MHz	1475.9 MHz	1495.9 MHz	FDD
12	Lower 700 MHz	699 MHz	716 MHz	729 MHz	746 MHz	FDD
13	Upper C 700 MHz	777 MHz	787 MHz	746 MHz	756 MHz	FDD
14	Upper D 700 MHz public safety/private	788 MHz	798 MHz	758 MHz	768 MHz	FDD
15		Reserved		Reserved		FDD
16		Reserved		Reserved		FDD
17	Lower B, C 700 MHz AT&T blocks	704 MHz	716 MHz	734 MHz	746 MHz	FDD
18	850 MHz (Japan #4)	815 MHz	830 MHz	860 MHz	875 MHz	FDD
19	850 MHz (Japan #5)	830 MHz	845 MHz	875 MHz	890 MHz	FDD
20	CEPT800	832 MHz	862 MHz	791 MHz	821 MHz	FDD
21	1500 MHz (Japan #6)	1447.9 MHz	1462.9 MHz	1495.9 MHz	1510.9 MHz	FDD
24	US L-Band	1626.5 MHz	1660.5 MHz	1525 MHz	1559 MHz	FDD
...						
33	TDD 2000 Lower	1900 MHz	1920 MHz	1900 MHz	1920 MHz	TDD
34	TDD 2000 Upper	2010 MHz	2025 MHz	2010 MHz	2025 MHz	TDD
35	TDD 1900 Lower	1850 MHz	1910 MHz	1850 MHz	1910 MHz	TDD
36	TDD 1900 Upper	1930 MHz	1990 MHz	1930 MHz	1990 MHz	TDD
37	PCS Center Gap	1910 MHz	1930 MHz	1910 MHz	1930 MHz	TDD
38	IMT Extension Gap	2570 MHz	2620 MHz	2570 MHz	2620 MHz	TDD
39	China TDD	1880 MHz	1920 MHz	1880 MHz	1920 MHz	TDD
40	2300 MHz	2300 MHz	2400 MHz	2300 MHz	2400 MHz	TDD
41	US 2600	2496 MHz	2690 MHz	2496 MHz	2690 MHz	TDD
42	3500 MHz	3400 MHz	3600 MHz	3400 MHz	3600 MHz	TDD
43	3700 MHz	3600 MHz	3800 MHz	3600 MHz	3800 MHz	TDD

Note 1: Band 6 is not applicable
Source: 3GPP TS 36.104 V10.2.0 (2011-04)

- ❑ USA leads the way – widespread LTE deployments in 700 MHz* spectrum arising from early switchover from analog to digital TV
 - ❑ Verizon Wireless, AT&T Mobility, others.....
- ❑ In APAC the favoured digital dividend band (APAC700) is 698 – 806 MHz
 - ❑ several allocations made in this band
- ❑ In Europe digital switchover (analog to digital TV) will be completed by 2012 in most countries
 - ❑ Progress is being made to allocate digital dividend spectrum in 790-862 MHz (800 MHz)
 - ❑ DD spectrum has so far been auctioned in Germany, Italy, Portugal, Spain and Sweden
 - ❑ Several more auctions are scheduled for completion in the coming months
 - ❑ 800 MHz is often packaged with 2.6 GHz (prime LTE band for capacity/ urban coverage)
 - ❑ LTE800 networks are commercially launched, initially targeting rural areas
 - ❑ LTE800 is a prime band for LTE and supported by many device vendors
- ❑ Africa and Middle East countries are pressing at WRC '12 for a “second digital dividend” in Europe and Africa, in the 700 MHz band, which offers the prospect of alignment with other world regions using 700 MHz DD spectrum

* The term 700 MHz embraces some or all of the following:

Band 12: (Lower 700 MHz) 699 MHz - 716 MHz / 729 MHz - 746 MHz

Band 13: (Upper C 700 MHz) 777 MHz - 787 MHz / 746 MHz - 756 MHz

Band 14: (Upper D 700 MHz) 788 MHz - 798 MHz / 758 MHz - 768 MHz

Band 17: (Lower B, C 700 MHz) 704 MHz - 716 MHz / 734 MHz - 746 MHz

APAC Digital Dividend (APAC700): 698 - 806 MHz

- ❑ More than 350 operators are estimated to have been allocated 1800 MHz spectrum
- ❑ Today 1800 MHz is mainly used for voice (GSM) service
- ❑ GSM traffic is peaking/reducing; momentum has swung to mobile broadband access
- ❑ Data traffic is growing significantly (for some, exponentially); operators need more capacity and to be able to deliver a better user experience of mobile broadband
- ❑ In many markets 1800 MHz represents the largest spectrum allocation
 - ❑ *60% of 1800 MHz spectrum in the top 7* EU markets is available in 10 MHz or wider assignments*
- ❑ 1800 MHz band is harmonized, non-fragmented, and often only partially-utilized
- ❑ Potential to deploy HSPA or LTE in 1800 MHz
 - ❑ *FT/Orange confirmed throughput advantage of HSPA at 1800 MHz over 2.1GHz*
 - ❑ *Several LTE operators confirmed 2 x coverage advantage compared to 2.6 GHz*
- ❑ 1800 MHz RF components now available in volume production from multiple vendors
- ❑ 14 commercial LTE1800 networks launched

* France, Germany, Italy, Norway, Spain, Sweden, UK (source: Qualcomm)

LTE1800 market status – strong momentum

Band 3	
Total spectrum:	2 x 75 MHz
Uplink:	1710-1785 MHz
Downlink:	1805-1880 MHz

14 commercial LTE1800 systems

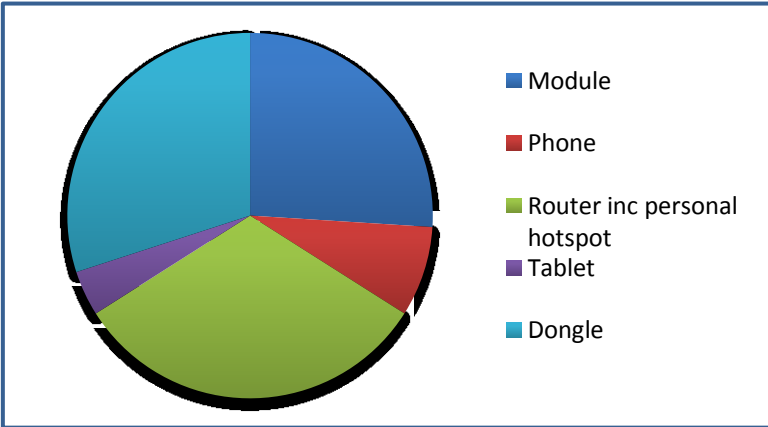
LTE1800 Global Status		
Poland	Mobyland/CenterNet	Commercially launched
Lithuania	Omnitel	Commercially launched
Singapore	M1	LTE1800/2600 commercial service launched
Germany	DT	Commercially launched
Latvia	LMT	Commercially launched
Finland	TeliaSonera	Commercially launched
Saudi Arabia	Zain	Commercially launched
Australia	Telstra	Commercially launched
Denmark	Telia	Commercially launched
Finland	Elisa	LTE2600/LTE1800 – DC-HSPA+ commercial service launched for consumers on November 17, 2011
Hong Kong	CSL Limited	Combined LTE2600/1800 and DC-HSPA+ network. LTE1800 commercially launched November 2011

Singapore	SingTel	LTE1800/2600 commercial service launched
Hungary	T Mobile	Commercially launched
South Korea	KT	Commercially launched
Australia	Optus	LTE1800 in deployment for April 2012 service launch
Australia	VHA	LTE1800 in deployment
Belgium	Mobistar	LTE1800 in deployment
Belgium	Proximus	LTE1800 in deployment
Bulgaria	M-TEL	Trials
Brazil	Oi	Trials
Croatia	VIPnet	800/1800MHz consumer trial launched September 2011
Estonia	Elisa	Interested
Estonia	EMT	In deployment
France	Bouygues T	Trials
France	Orange	Trials
Georgia	Magticom	1800 MHz is an option
Germany	E Plus	Trials
Greece	Cosmote	Trialed. All incumbents acquired more 1800 MHz
Hong Kong	Smartone-Vodafone	LTE1800 in deployment
Indonesia	Indosat	LTE1800 trial ended October 2011. Plans commercial LTE1800 in deployment
Malaysia	Celcom	Trials – 1800 and 2600 MHz
Namibia		Consultation
Philippines	Bayan Tel	Plans to deploy LTE1800
Russia	Tele2	Asked permission to deploy
Singapore	StarHub	Targeting 2012 launch
Slovenia	Mobitel	LTE to be deployed in 800, 1800,2600 MHz. LTE1800 launch target of 2012
South Africa	MTN	LTE1800 in deployment
South Korea	SK Telecom	LTE1800 in deployment
Spain	Yoigo	LTE1800 in deployment
Sri Lanka	Dialog Axiata	Seeking additional 1800MHz spectrum for commercial LTE1800 deployment
Sweden	Tele2	LTE1800 in deployment via Net4Mobility joint venture
Sweden	TeleNor	LTE1800 in deployment via Net4Mobility joint venture
Sweden	Teliasonera	LTE1800 in deployment
Thailand	DPC-CAT	Trials
Thailand	True Move	Trials
Turkey	Avea	Trials
UAE	Du	LTE1800 in deployment, launch anticipated in 2012
UK		Consultation

Excellent choice of LTE1800 devices

50 LTE1800 devices are announced

The number of LTE1800 devices has tripled over the past 6 months



50 LTE use devices announced (GSA)

Embracing the 1800MHz opportunity: Driving mobile forward with LTE in the 1800MHz band



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Prepared for the GSA by:



Free download for registered site users
www.gsacom.com

Registration page:
www.gsacom.com/php/register_form.php4

GSA LTE1800 report

Embracing the 1800 MHz opportunity: driving mobile forward with LTE in the 1800 MHz band

Published November 16, 2011

Co-sponsored by CSL Limited, DT, Elisa, Qualcomm, StarHub, and Telstra

Additional insights: Ericsson, NSN, and TeliaSonera

The report makes a strong case for the re-use of frequencies in the 1800 MHz band to enable improved provision of LTE services, and enable delivery of LTE services even earlier

LTE1800 zone

LTE in 1800 MHz spectrum

White Papers, seminar presentations, plus links to other key resources

LTE1800 resources: white papers, info papers, presentations, etc on LTE1800
www.gsacom.com

- ❑ Providing initial widespread coverage with LTE in the 1800 MHz band can be as much as 60% cheaper than covering the same area with LTE using higher frequency bands
- ❑ Operators will typically deploy LTE across a range of spectrum bands in order to maximise coverage and capacity, and to optimise their cost structures
- ❑ Deployment of LTE 1800 MHz can mean a faster time to market
- ❑ Where LTE has been deployed in another band, deploying additionally in 1800 MHz spectrum can mean improved geographic or indoor coverage at lower cost
- ❑ 1800 MHz is a prime band for LTE deployment in virtually all regions of the world, and is likely to be an important enabler for international roaming
- ❑ Vendors need to develop multi-mode, multi-band handsets, with capability to operate in 1800 MHz as well as other LTE bands and on other networks; specific requirements are likely to vary by region
- ❑ In order to realise the benefits of LTE 1800MHz, regulators need to accelerate efforts to enable refarming of spectrum in the 1800 MHz band. This is underway, but regulators should redouble their efforts to remove barriers as swiftly as possible

- ❑ Prime bands for LTE FDD deployments are emerging, currently:
 - ❑ 700 MHz*
 - ❑ 800 MHz: Europe (digital dividend band)
 - ❑ 2.6 GHz: Europe, APAC, MEA and some Latin American markets committed
 - ❑ 1800 MHz for mobile broadband services – typically re-farmed, some new allocations (e.g. South Korea, Japan)

In European markets, LTE FDD user devices need to support as a minimum:

LTE 800/1800/2600 plus (for US roaming) 700 MHz*

+

3G/WCDMA-HSPA+ in 850/900/1900/2100 MHz

+

GSM/EDGE/GPRS in 850/900/1800/1900 MHz

More LTE (and HSPA) bands will be added in the future !

* The term 700 MHz embraces some or all of the following:

Band 12: (Lower 700 MHz) 699 MHz - 716 MHz / 729 MHz - 746 MHz

Band 13: (Upper C 700 MHz) 777 MHz - 787 MHz / 746 MHz - 756 MHz

Band 14: (Upper D 700 MHz) 788 MHz - 798 MHz / 758 MHz - 768 MHz

Band 17: (Lower B, C 700 MHz) 704 MHz - 716 MHz / 734 MHz - 746 MHz

APAC Digital Dividend (APAC700): 698 - 806 MHz

LTE-A is the next major step in the evolution of LTE. Standardized by 3GPP and approved by ITU as meeting the requirements of an IMT-Advanced system

Key features include:

Optimizing small cell performance using features such as range expansion

Aggregation of frequency carriers

□ more carriers mean higher peak speed, higher capacity, lower latency, enhanced user experience

Introduces advanced antenna techniques

LTE Advanced expected to offer download peak rate of 1 Gbps in a low mobility scenario and 100 Mbps in a high mobility environment

LTE-Advanced is backwards and forwards-compatible with existing LTE systems

Some LTE-Advanced features are expected to be commercialized beginning in 2012

AT&T Mobility and Sprint have each announced plans to deploy LTE-A in 2013



Evolution to LTE Report

GSM/3G MARKET/TECHNOLOGY UPDATE

lte
The LTE system, which is standardized by 3GPP, delivers capacity and data throughput enhancements and low latency, to support new services and features requiring higher levels of capability and performance.

LTE is the next step in the user experience, enhancing more demanding applications such as interactive TV, mobile video blogging, advanced gaming, and professional services. Data rates are significantly higher. LTE supports a full IP-based network and harmonization with other radio access technologies.

LTE standardization by 3GPP covers FDD and TDD modes. Infrastructure solutions offer an easy upgrade path to LTE.

HSPA/HSPA+ is mainstream. LTE is the natural migration choice for GSM/HSPA network operators, and CDMA or WiMAX operators.

The uptake of LTE is a global phenomenon. The primary drive towards LTE from operators comes from the need for more network capacity, performance management and improved efficiencies to drive the unit cost of delivering traffic.

All 3G technologies can harmonize to LTE as a single unifying global standard, for even higher scale economies and simplifying roaming.

GSA has confirmed LTE as the fastest developing mobile system technology ever.

Country	Operator	Launch
Norway	TeliaSonera	14.12.09
Sweden	TeliaSonera	14.12.09
Uzbekistan	MITS	26.07.10
Poland	Aero2/Mobilyand/CenterNet	06.08.10
USA	MetropCS	21.09.10
Austria	A1 Telekom	06.11.10
Sweden	Telefor Sweden	15.11.10
Sweden	Tele2 Sweden	15.11.10
Hong Kong	CSL Limited	25.11.10
Finland	TeliaSonera	30.11.10
Germany	Vodafone	01.12.10
USA	Verizon Wireless	05.12.10
Finland	Elsa	06.12.10
Denmark	TeliaSonera	06.12.10
Estonia	EMT	17.12.10
Japan	NTT DoCoMo	24.12.10
Germany	Deutsche Telekom	05.04.11
Philippines	Smart Communications	16.04.11
Lithuania	Omnitel	26.04.11
Latvia	LMT	31.05.11
Singapore	M1	21.05.11
South Korea	SK Telecom	01.07.11
South Korea	LG U+	01.07.11
Germany	OC	01.07.11
Canada	Rogers Wireless	07.07.11
Austria	T-Mobile	28.07.11
Canada	Bell Mobility	14.08.11
Saudi Arabia	Mobily (LTE TDD)	14.08.11
Saudi Arabia	STC (LTE TDD)	14.08.11
Saudi Arabia	Zain	14.08.11
USA	AT&T Mobility	19.08.11
UAE	Etisalat	25.08.11
Australia	Telstra	27.08.11
Denmark	TDC	10.10.11
Austria	3	18.11.11
Puerto Rico	AT&T Mobility	20.11.11
Puerto Rico	Claro	24.11.11
Belarus	Yota Bel	01.12.11
Brazil	Vivo Brazil (LTE TDD)	13.12.11

285 operators are investing in LTE in 93 countries

229 operator commitments in 76 countries
59 pre-commitment trials in 17 more countries

49 commercial networks in 29 countries

GSA forecasts 119 commercial networks in 53 countries by end of 2012

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REPORT: Status of the LTE Ecosystem

January 20, 2012

This updated report, which was researched and published by GSA (Global mobile Suppliers Association), lists 289 LTE devices launched in the market by 57 suppliers, and confirms how a robust user device ecosystem has been established in support of LTE as the fastest developing mobile communications system technology ever.

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483 HSPA Operator Commitments in 181 countries/territories

451 commercial operators launched 174 countries/territories including 187 commercial HSPA+ networks in 96 countries

The path to mobile broadband began with WCDMA, a 3GPP global standard. Its first evolution - High Speed Packet Access (HSPA), reduces latency, boosts capacity and user data speeds. HSPA is the leading mobile broadband technology globally with 451 networks commercially launched. All WCDMA operators have launched HSPA.

339 HSPA networks support a peak download data speed of 7.2 Mbps or more. User download data speeds typically approach or may exceed 5.0 Mbps, subject to network and user device capabilities, and in some cases user data speeds are much higher. Capacity and performance improve with HSPA Evolution (HSPA+). 241 operators have committed to HSPA+ deployments in 108 countries, including 187 HSPA+ networks in commercial service in 96 countries. Over 41% of HSPA operators have launched HSPA+. Many operators successfully position HSPA+ as an alternative to fixed broadband, with the added value of mobility, reporting strong traffic and revenue growth for mobile broadband services. 196 operators (over 43%) have launched HSPA+ in 93 countries, including 129 networks (65%) supporting 5.0 Mbps peak uplink data speed, of which 12 networks extend to 11.5 Mbps peak.

117 HSPA+ commercial networks use 64QAM for delivering 21 Mbps peak on the downlink, 8 networks support 28 Mbps (16 QAM with MIMO) and 62 networks support 42 Mbps (64QAM and 2 x 5 MHz carriers). This capability was enabled in 3GPP Release 8, which also allows 42 Mbps to be achieved by combining 2 x 2 MHz MIMO and 64QAM in a single 5 MHz carrier. Using 16QAM instead of QPSK on the uplink doubles the peak rate to 11.5 Mbps.

HSPA+ has a strong evolution path. Release 9 combines multicarrier and MIMO technologies in 10 MHz bandwidth to reach 84 Mbps peak downlink. Using multicarrier on the uplink doubles the peak rate to 23 Mbps. Standardization beyond Release 9 leads to the realization of download data speeds exceeding well over 100 Mbps.

- Related resources for GSA registered site users to download from www.gsacom.com include:
- For the global status of HSPA+ see report "Global HSPA+ Network Commitments and Deployments"
 - For UMTS3500 (HSPA) network deployments, launches, developments - see "UMTS3500 Global Status"
 - GSA's on-researched database of 3,362 launched HSPA devices includes 245 HSPA+ products (compared to 92 a year ago) - 93 devices support 42 Mbps DC-HSPA+, and 102 HSPA+ HSPA+ products support LTE. See "HSPA Device Survey - Key Findings"

483 HSPA network commitments in 181 countries/territories

Americas: 115 networks	APAC: 92 networks	Europe: 178 networks	Middle East/Africa: 98 networks
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451 commercial HSPA operators in 174 countries/territories

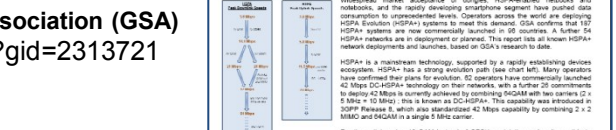
- Americas:** Argentina, Arabia Bahiana, Barbados, Bermuda, Bolivia, Botswana, Brazil, Canada, Cayman Islands, Chile, Colombia, Costa Rica, Curaçao, Dominican Republic, Ecuador, El Salvador, FI, Guinea, Guatemala, Guatemala, Guyana, Honduras, Jamaica, Martinique, Mexico, Nicaragua, Paraguay, Peru, Puerto Rico, Qatar, St. Kitts and Nevis, St. Vincent and the Grenadines, USA, Venezuela
- APAC:** Australia, Brunei, Cambodia, China, East Timor, FI, French Polynesia, Guam, Hong Kong SAR, India, Indonesia, Japan, Laos, Macao SAR, Malaysia, Maldives, Mongolia, Nepal, New Zealand, N. Korea, Philippines, Singapore, Solomon Islands, S. Korea, Sri Lanka, Taiwan, Thailand, Vanuatu, Vietnam
- Europe:** Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Benin, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Gibraltar, Greece, Greenland, Guernsey, Hungary, Iceland, Ireland, Israel, Italy, Jersey, Kazakhstan, Kyrgyzstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Maldives, Malta, Mauritius, Monaco, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovak Rep., Slovenia, Spain, Sweden, Switzerland, Tajikistan, Turkmenistan, UK, Ukraine, Uzbekistan, Venezuela
- MEA:** Angola, Bahrain, Bangladesh, Cape Verde, Congo Rep., Djibouti, Egypt, Ethiopia, Ghana, Iraq, Israel, Jordan, Kuwait, Kyrgyzstan, Lebanon, Lesotho, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Somalia, South Africa, Sudan

- Multi-band networks
- 339 commercial HSPA in
- 241 HSPA+ network commitments
- 205 operators have committed
- Over 43% of
- 40 commercial UMTS3500 network

Global HSPA+ Network Commitments and Deployments

January 29, 2012

GSA confirms 241 operators in 106 countries have committed to HSPA+ network deployments. 174 commercial operators have launched 174 countries/territories including 187 commercial HSPA+ networks in 96 countries. 196 operators (over 43%) have launched HSPA+ in 93 countries, including 129 networks (65%) supporting 5.0 Mbps peak uplink data speed, of which 12 networks extend to 11.5 Mbps peak.



HSPA+ is a mainstream technology, supported by a rapidly evolving device ecosystem. HSPA+ has a strong evolution path (see chart left). Many operators have confirmed their plans for evolution. 32 operators have commercially launched 42 Mbps DC-HSPA+ technology on their networks, with a further 20 commitments to deploy 42 Mbps in 2012. 10 operators have committed to 42 Mbps with two carriers (2 x 5 MHz + 10 MHz) - this is known as DC-HSPA+. This capability was introduced in 3GPP Release 8, which also standardized 42 Mbps capacity by combining 2 x 2 MHz and 64QAM in a single 5 MHz carrier.

For the uplink, using 16 QAM instead of QPSK modulation makes it possible to double the peak rate to 11.5 Mbps. Dual carrier extends the uplink performance up to 23 Mbps peak. 3GPP Release 9 combines multicarrier and MIMO technologies and MIMO enable download data speeds exceeding 100 Mbps to be reached. 3GPP has standardized beyond Release 9 84 Mbps peak downlink, and combinations of multicarrier and MIMO enable download data speeds exceeding 100 Mbps to be reached. 3GPP has standardized beyond Release 9 84 Mbps peak downlink, and combinations of multicarrier and MIMO enable download data speeds exceeding 100 Mbps to be reached. 3GPP has standardized beyond Release 9 84 Mbps peak downlink, and combinations of multicarrier and MIMO enable download data speeds exceeding 100 Mbps to be reached.

The world's first HSPA+ system was launched by Telstra in Australia on February 23, 2009. Using 64 QAM modulation, the system supported a peak download data speed of 7.2 Mbps and a peak uplink data speed of 5.0 Mbps. Telstra subsequently launched an upgrade to 42 Mbps DC-HSPA+ peak downlink data speed in July 2010. At that time, the system supported a peak download data speed of 11.5 Mbps and a peak uplink data speed of 11.5 Mbps. The system was subsequently upgraded to 42 Mbps DC-HSPA+ in Singapore in 2010. The world's first HSPA+ system on March 27th, 2009.

Over 41% of HSPA operators have launched 42 Mbps DC-HSPA+ (high speed uplink) including 129 networks supporting 5.0 Mbps peak uplink data speed including 12 networks supporting 11.5 Mbps peak.

187 HSPA+ systems are in commercial service in 96 countries, as detailed in the following pages:

- 17 commercial networks support 42 Mbps DC-HSPA+ plus another 28 HSPA+ networks in 2012
- 8 commercial networks support 28 Mbps peak downlink data speed. TM have launched the world's first 28 Mbps peak downlink HSPA+ network in 2011
- 62 commercial networks support 42 Mbps DC-HSPA+ plus another 28 HSPA+ networks in 2012

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