

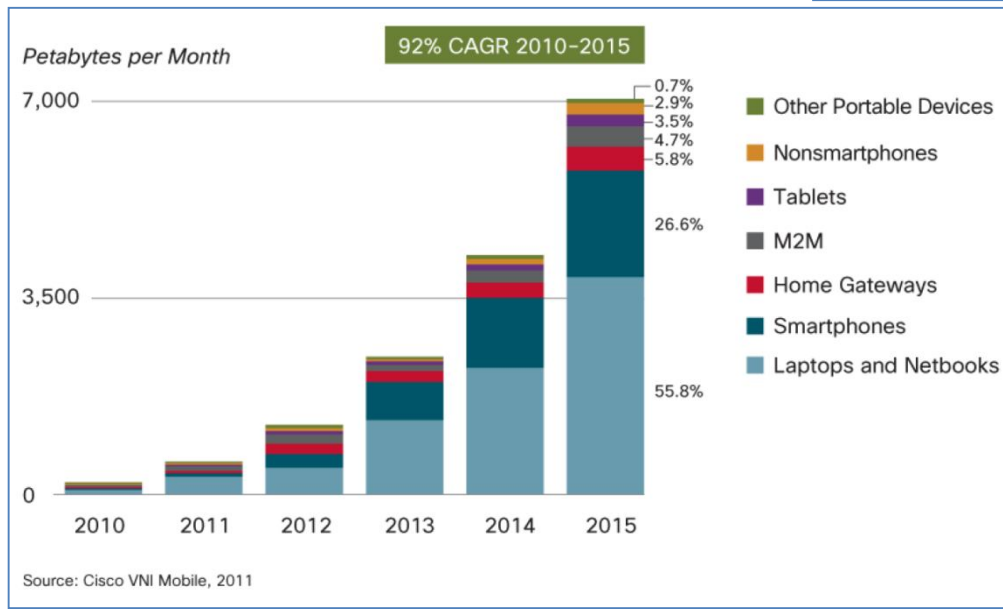
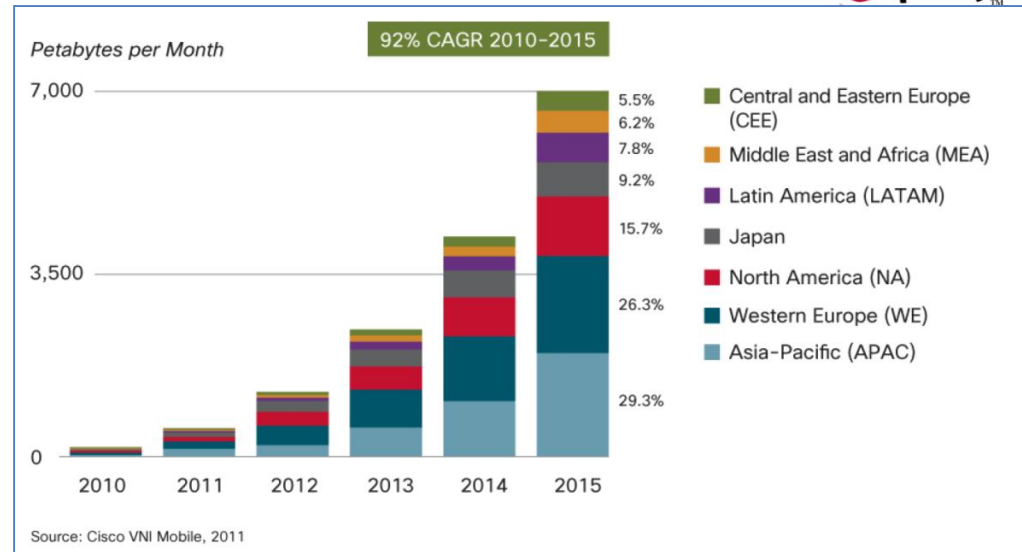
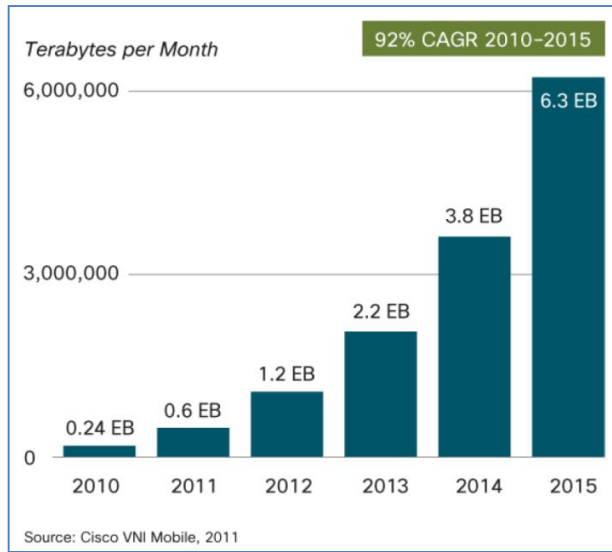


# 3GPP Standards Update Spectrum Usage

Adrian Scrase

Head of 3GPP Mobile Competence Centre

# Mobile Data Demand



- 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

# Drivers for LTE deployment



- 📶 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 .....*



The 3GPP LTE system, which comprises FDD and TDD modes, delivers capacity and data throughput enhancements and low latency to support new services and features requiring higher levels

of capability and performance. The primary drive towards LTE from operators is the need for more capacity, performance management and improved efficiencies to lower the unit cost of delivering traffic. 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. LTE supports a full IP-based network and harmonization with other radio access technologies and is the natural evolution choice for GSM/HSPA, CDMA and WiMAX™ network operators, thereby enabling a single unifying global standard for even higher scale economies and simplifying roaming. LTE is a global phenomenon.

**319 operators are investing in LTE in 97 countries**

258 operator commitments in 84 countries  
61 pre-commitment trials in 13 more countries

**72 commercial networks in 37 countries**

GSA forecasts 134 commercial LTE networks in 57 countries by end 2012

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
USA	Mosaic Telecom	July 2011
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
Kyrgyzstan	Saima Telecom	09.12.11
Brazil	Sky Brazil (LTE TDD)	13.12.11
Finland	DNA	13.12.11
Uruguay	Antel	13.12.11
USA	Cricknet	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
Russia	Yota	15.01.12
Canada	TELUS	10.02.12
USA	Peoples Telephone Co-op	14.02.12
Japan	Softbank Mobile XGP/LTE TDD	24.02.12
Portugal	TMN (Portugal Telecom)	12.03.12
Portugal	Vodafone Portugal	12.03.12
Portugal	Optimus	15.03.12
Japan	eMobile	15.03.12
USA	US Cellular	22.03.12
Croatia	T Mobile/T-Hrvatski Telekom	23.03.12
Croatia	VIPNet	23.03.12
USA	Panhandle (PTCI)	March 2012
Belarus	Yota Bel	01.04.12
India	Bharti Airtel (LTE TDD)	10.04.12
Angola	Movicel	14.04.12
Puerto Rico	Open Mobile	19.04.12
Moldova	iDC	21.04.12
Sweden	3 Sweden	23.04.12
Hong Kong	China Mobile HK	25.04.12
USA	Cellocom	30.04.12
USA	Pioneer Cellular	30.04.12
Netherlands	Ziggo	03.05.12



May 8, 2012: 72 commercial LTE networks are launched - (excluding MVNOs) © GSA

# LTE worldwide

May 8<sup>th</sup>, 2012

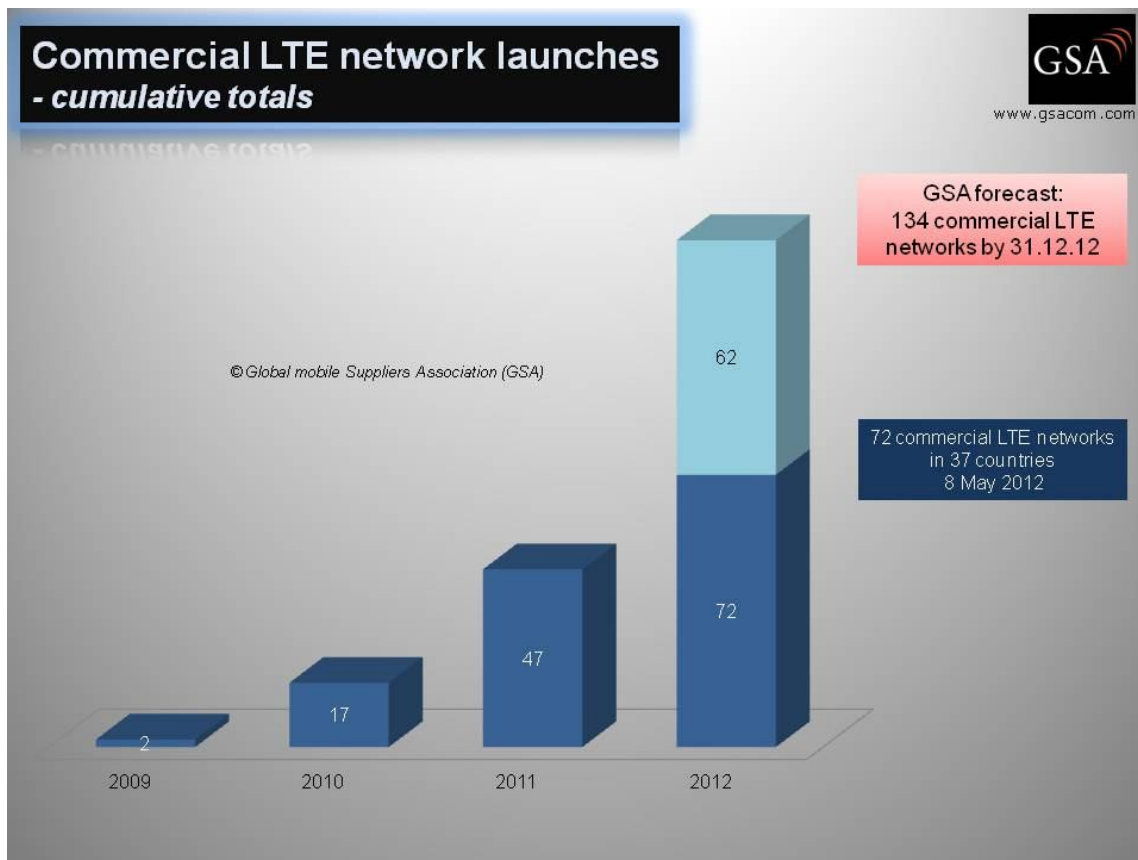
**319 operators are investing in LTE in 97 countries**

258 operator commitments in 84 countries  
61 pre-commitment trials in 13 more countries

**72 commercial networks in 37 countries**

GSA forecasts 134 commercial LTE networks in 57 countries by end 2012

# Deployment Update



plus

Recent news/updates  
Hutchison 3 HK = Launched  
Vodafone NL = Launched  
Tele2 NL = Launched  
T-Mobile NL = Launched  
KPN NL = Launched

c. 17 million LTE subscriptions – Q1 2012

Current total = 77 commercial networks launched



# LTE spectrum bands



- 📶 In Europe, several APAC countries, elsewhere, 2.6 GHz is new spectrum and the main LTE capacity band
- 📶 2.6 GHz auctions are completed in many markets incl. Austria, Belgium, Denmark, Estonia, Finland, France, Germany, HK, Italy, Netherlands, Norway, Portugal, Singapore, Spain, Sweden
- 📶 Digital Dividend is new spectrum for coverage
- 📶 Initial network launches are mainly LTE-FDD
- 📶 The most common frequencies used for LTE are
  - 700 MHz: band 13, band 17
  - 800 MHz: band 20
  - 800 MHz: band 3
  - 2600 MHz: band 7
- 📶 *Deployments made in other bands include 2.1 GHz (band 1), AWS (band 4), South Korea (band 5), 900 MHz (band 8), 850 MHz (Japan - various), 1700 MHz (band 9), etc.....*
- 📶 7 commercial LTE TDD networks are launched

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 <sub>UL_low</sub>	F <sub>UL_high</sub>	F <sub>DL_low</sub>	F <sub>DL_high</sub>	
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 <sup>1</sup>	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)

# LTE TDD



## LTE TDD: Global network commitments, trials, deployments, commercial launches

JOIN GSA's LTE TDD LINKEDIN GROUP:  
1,100+ Members

[www.linkedin.com/groups?gid=3978061](http://www.linkedin.com/groups?gid=3978061)

### Global TD-LTE Initiative

The Global TD-LTE Initiative (GTI) aims 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. Website: [www.lte-tdd.org](http://www.lte-tdd.org)

Australia	WiMAX™ operator Vivid Wireless trialled LTE TDD in Sydney. Commercial launch is expected by 2012.  NBN Co is deploying a 2.3 GHz LTE TDD network to serve rural areas
Brazil	Sky Brazil launched a commercial LTE TDD network in December 2011
Canada	WiMAX™ operator Xplornet trialled LTE TDD in 2.5 GHz and 3.5 GHz spectrum
China	China Mobile launched large-scale LTE TDD trials extended in 2012 to 20,000 base sites. Commercial services expected in 2013
Croatia	Velatel is deploying LTE TDD in 3.5 GHz
Denmark	3 acquired 2.6 GHz TDD spectrum, deploying combined LTE FDD/TDD network
France	Orange has deployed a trial LTE network in Paris supporting FDD and TDD modes. Bollere plans to deploy 3.5 GHz LTE TDD
Germany	E-Plus is trialling LTE TDD in 2.6 GHz
Hong Kong	BWA spectrum won by China Mobile, 21 Vianet Group, and Hutchison 3 HK. China Mobile and Hutchison 3 will each deploy combined LTE FDD/TDD networks
India	<ul style="list-style-type: none"> <li>Bharti Airtel commercially launched LTE TDD service on April 10, 2012</li> <li>RIL is deploying LTE TDD</li> <li>Qualcomm India LTE Venture is committed to LTE TDD deployment.</li> <li>Tikona Digital will deploy LTE TDD</li> <li>Aircel is trialling LTE TDD</li> <li>Augere is deploying LTE TDD</li> <li>BSNL may introduce LTE TDD</li> <li>MTNL may introduce LTE TDD</li> </ul>
Ireland	LTE TDD testing was completed June 2010
Japan	Softbank Mobile commercially launched its XGP/LTE TDD network in February 2012

Malaysia	WiMAX™ operator Packet Networks (P1) plans to deploy LTE TDD overlay network. WiMAX™ operator Asiaspace plans to deploy 2.3 GHz LTE TDD
Montenegro	Velatel is deploying LTE TDD in 3.5 GHz
Nepal	Nepal Tel. is deploying 2.3 GHz LTE TDD
Nigeria	Zoda Fones deploying LTE TDD in 3.5 GHz
Oman	Omantel showcased LTE TDD, plans deployment
Poland	Aero2 launched LTE TDD in Band 38 (2.6 GHz), part of Aero2's dual LTE network (LTE TDD and LTE1800 FDD)
Russia	<ul style="list-style-type: none"> <li>Rostelecom is reported to have approval to deploy LTE TDD network in 2.3 GHz spectrum</li> <li>Voentelcom is trialling LTE TDD</li> <li>MTS is deploying 2.6 GHz LTE TDD</li> <li>Mgeafon is deploying LTE TDD</li> <li>Base Tel. plans LTE TDD network</li> <li>Enforta deploying 3.5 GHz LTE TDD test network</li> </ul>
Saudi Arabia	Etisalat Mobily launched a commercial LTE TDD network in September 2011  STC launched a commercial LTE TDD network in September 2011
Singapore	IDA plans to auction spectrum suitable for LTE TDD
Sweden	3 Sweden is deploying a combined LTE FDD/TDD network (TDD in 2.6 GHz)
Taiwan	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 switch to LTE TDD once WiMAX coverage hits 70% of the population Fitel (PHS, WiMAX™) trialling LTE TDD
Thailand	AIS – TOT joint trial in 2.3 GHz band
UK	UK Broadband deploying 3.5 GHz LTE TDD
Uruguay	Dedicado planning 3.5 GHz LTE TDD deployment
USA	Clearwire announced plans to deploy Band 41 LTE TDD overlay to existing network  WiMAX™ operator Xplornet Communications trialled LTE TDD

## 7 LTE TDD commercial network launches

Aero2, Poland

Etisalat, Saudi Arabia

STC, Saudi Arabia

Sky Brazil

Softbank, Japan

Bharti Airtel, India

3, Sweden

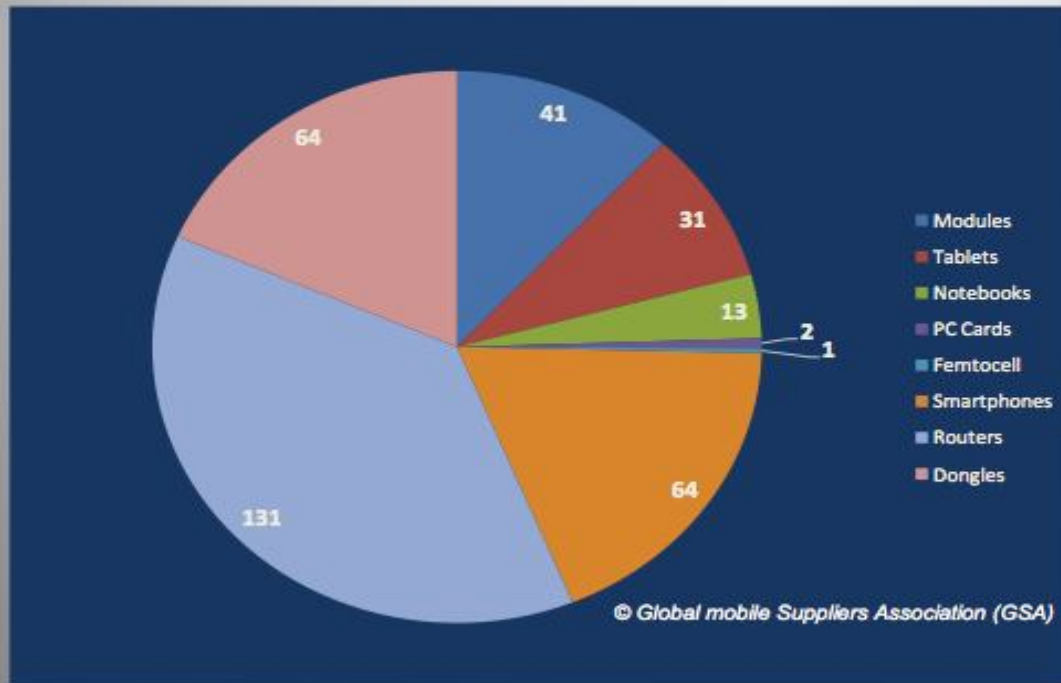
# Device Availability



A GLOBAL INITIATIVE

## LTE Devices: 347 products launched

63 manufacturers



© Global mobile Suppliers Association (GSA)

Source : Status of the LTE Ecosystem report  
© GSA - April 3, 2012  
www.gsacom.com



www.gsacom.com

76% Increase in LTE devices announced since October 2011\*

150 LTE user devices launched since October 2011\*

Number of LTE smartphones grew 33% since January 2012\*\*

LTE-enabled tablets jumped 72% since January 2012\*\*

LTE FDD	
700 MHz	170 devices
800 MHz Band 20	72 devices
1800 MHz Band 3	75 devices
2600 MHz Band 7	94 devices
800/1800/2600 MHz	57 devices
AWS Band 4	72 devices

LTE TDD	
2300 MHz Band 40	43 devices
2600 MHz Band 38	45 devices
2600 MHz Band 41	5 devices

\* As reported in Status of the LTE Ecosystem report - 28.10.11  
\*\* As reported in Status of the LTE Ecosystem report - 20.01.12



# Digital Dividend for Mobile



- 📶 USA leads – widespread LTE deployments in 700 MHz\* spectrum arising from early switchover from analog to digital TV. Examples - 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
  - Digital dividend band is 790-862 MHz (800 MHz)
  - DD spectrum has been auctioned in several countries, more auctions are scheduled
  - 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 is supported by many chipset and device vendors
- 📶 WRC-12 agreed to allocate more UHF spectrum for mobile services in Region 1 (Europe, Russia, Africa, parts of Middle East). This allocation, 694–790 MHz, to come into force in 2015, is next to the existing digital dividend band (790-862 MHz). It will enable countries in Africa and the Middle East to award digital dividend spectrum in the 700 MHz band where parts of the 800 MHz band are used for other systems and services. It also provides additional bandwidth e.g. for mobile broadband in Europe, and raises the prospect of harmonization with other ITU Regions

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

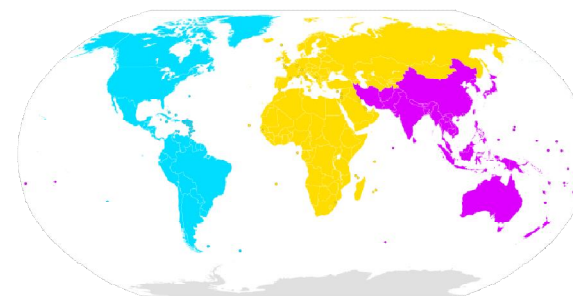
Band 12: (Lower 700 MHz) 699 MHz - 716 MHz / 729 MHz - 746 MHz

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



# Refarming 1800 MHz (Band 3)



- 📶 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
- 📶 18 commercial LTE1800 networks launched

# LTE1800 market status



A GLOBAL INITIATIVE

## 18 commercial LTE1800 systems

### LTE1800 Global Status

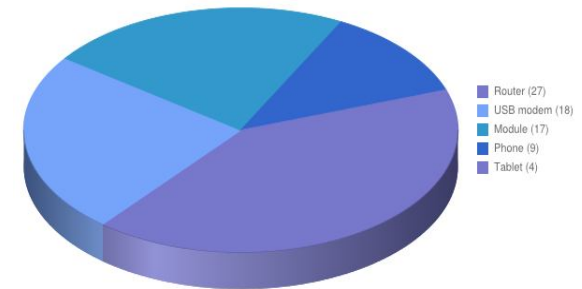
Poland	Mobyland/CenterNet	Commercially launched
Lithuania	Omnitel	Commercially launched
Singapore	M1	LTE1800/2600 commercial service launched
Germany	DT	Commercially launched
Latvia	LMT	Commercially launched
Finland	TeliaSonera	Commercially launched
S. Arabia	Zain	Commercially launched
Australia	Telstra	Commercially launched
Denmark	Telia	Commercially launched
Finland	Elisa	LTE2600/1800 DC-HSPA+ commercial service launched
Hong Kong	CSL Limited	LTE2600/1800 DC-HSPA+ commercial service launched
Singapore	SingTel	LTE1800/2600 commercial service launched
Finland	DNA	LTE1800/2600 commercial service launched
Hungary	T Mobile	Commercially launched
Sth Korea	KT	Commercially launched
Croatia	T-Hrvatski	Commercially launched
Angola	Movicell	Commercially launched
UAE	Etisalat	LTE1800/2600 commercial service launched

LTE1800 trials and deployments across the world

Australia	Optus	LTE1800 in deployment for mid 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	In deployment
Estonia	EMT	In deployment
France	Bouyques	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	LTE1800 in deployment
Indonesia	Indosat	Plans commercial LTE1800 in deployment
Italy	Three	LTE1800 in deployment for use alongside LTE2600
Malaysia	Celcom	Trials – 1800 and 2600 MHz
Namibia		Under discussion
Philippines	Bayan Tel	Plans to deploy LTE1800
Russia	Tele2	Tests completed
Russia	SMARTS	Pilot trial network in Ufa
Singapore	StarHub	Targeting Q4 2012 launch
Slovenia	Mobitel	LTE to be deployed in 800, 1800,2600 MHz. LTE1800 launch target of 2012
Sth Africa	MTN	LTE1800 in deployment
Sth Korea	SK Telecom	LTE1800 in deployment
Spain	Yoigo	LTE1800 in deployment
Sri Lanka	Dialog Axiata	Seeking additional 1800MHz spectrum for LTE1800
Sweden	Tele2	LTE1800 in deployment via Net4Mobility joint venture
Sweden	TeleNor	LTE1800 in deployment via Net4Mobility joint venture
Sweden	TeliaSonera	LTE1800 in deployment
Thailand	AIS/DPC-CAT	Trials
Thailand	True Move	Planning trials
Turkey	Avea	Trials
UAE	Du	LTE1800 in deployment, launch anticipated in 2012
UK	Everything Everywhere	Trialling LTE1800 Provisional approval given to deploy commercial network

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


75 LTE1800 devices announced



© 2012 GSA  
www.gsacom.com/gambod

# 1800MHz opportunities



-  Perceived benefits of re-farming 1800 MHz for LTE use include:
- 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
  - 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



# Thank You !!



## Adrian SCRASE

Head of 3GPP Mobile Competence Centre

More Information about 3GPP:



[www.3gpp.org](http://www.3gpp.org)

[contact@3gpp.org](mailto:contact@3gpp.org)