Global Mobile Broadband Market Update

Network deployments and device ecosystem developments

- HSPA/HSPA+ and LTE / LTE-Advanced
- Subscriptions growth
- Mobile HD voice and VoLTE
- LTE Broadcast
- 5G

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www.gsacom.com

GSA Secretariat: info@gsacom.com

References GSA's reports and information papers published up the current data

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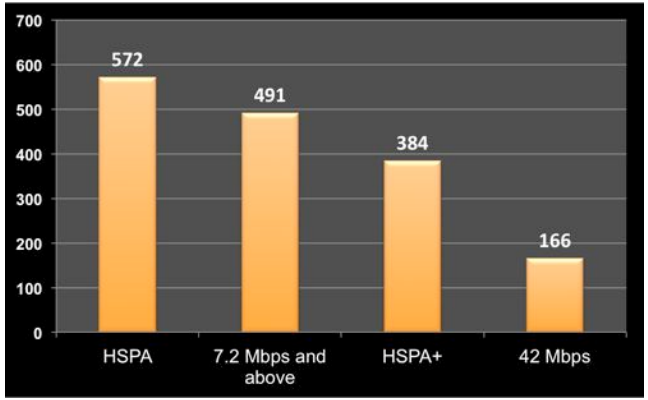
3G/WCDMA systems launched *mobile broadband*

- First commercially launched WCDMA network: 2001
- HSPA upgrade promoted wider acceptance from 2005
- 572 networks are commercially launched in 213 countries
  - *All WCDMA operators have deployed HSPA*
- 1.627 billion WCDMA subscribers including HSPA (Q2 2014)
- 384 HSPA operators i.e. over 67% have deployed HSPA+
- Deployment of 42 Mbps DC-HSPA+ is the major trend in 2014
  - 166 DC-HSPA+ networks (29% of HSPA networks) are commercially launched in 86 countries
- 356 operators i.e. over 62% have commercially launched HSUPA
  - 281 operators support 5.8 Mbps peak data on uplink
  - An additional 20 networks support 11.5 Mbps

- HSPA/HSPA+ is the dominant MBB technology
- Wide coverage footprint + competition in all regions
- Large ecosystem, thousands of user devices
- Benefited from technology neutrality policies
  - *87 UMTS900 systems deployed in 900 MHz*

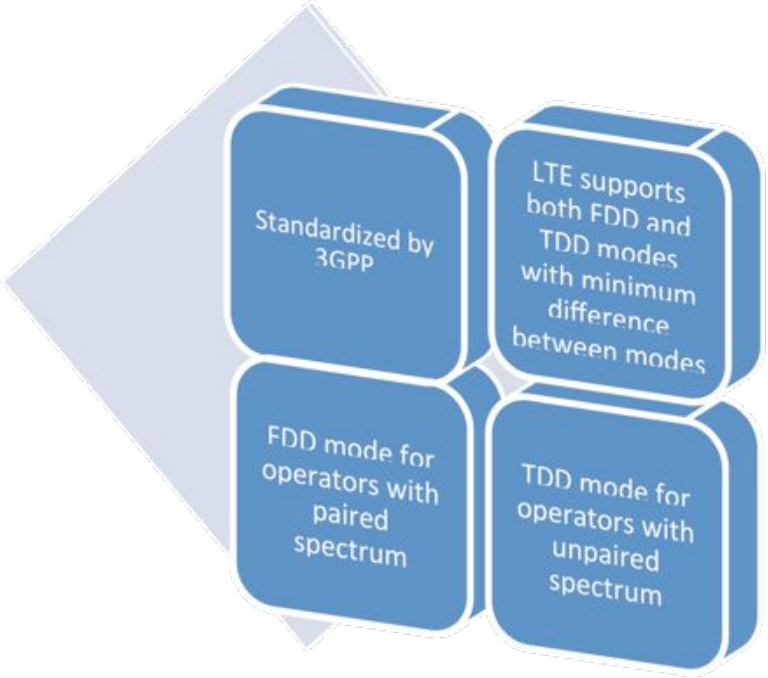


Source: GSA's HSPA Operator Commitments report

Published on October 22, 2014

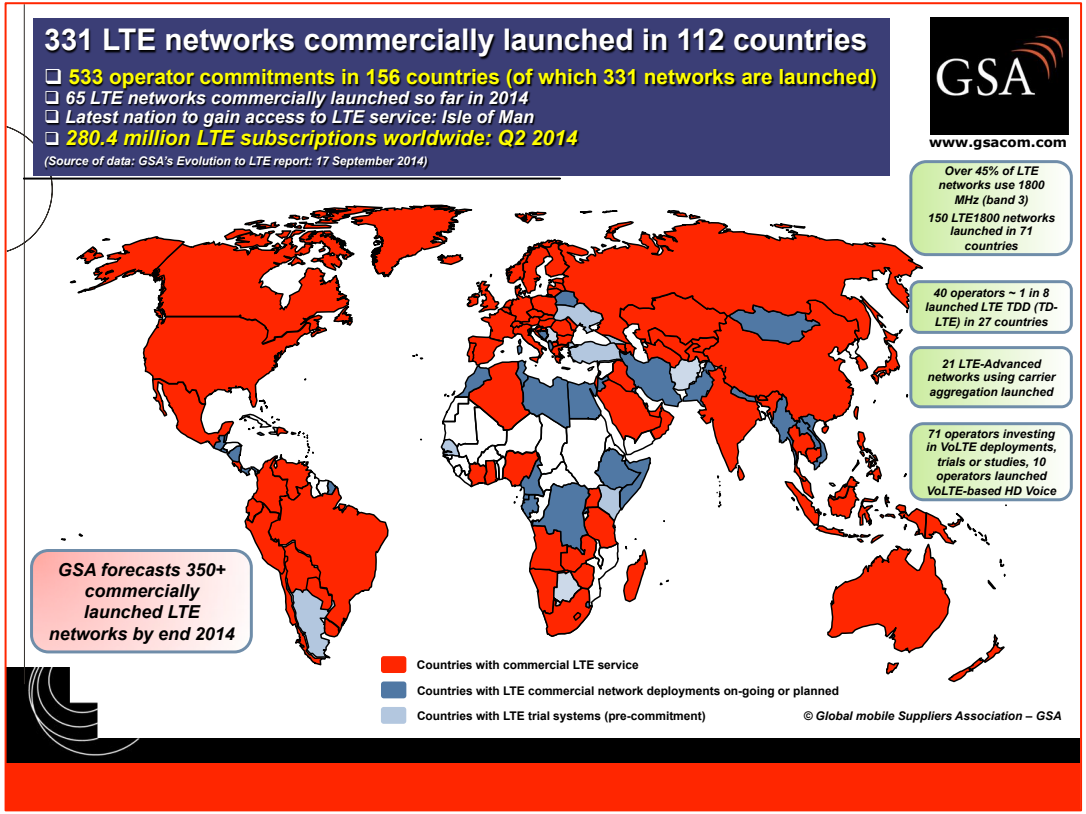
Two Duplex Modes of LTE: 3GPP's LTE standard supports both FDD and TDD modes

LTE technology is mainstream



LTE's global economies of scale can be leveraged in FDD and TDD network deployments and user terminal production

LTE: network deployment commitments in 156 countries



LTE Market Summary

GSA's Evolution to LTE report – September 17, 2014

584 operators investing in LTE in 168 countries

- 533 operator commitments in 156 countries
- 51 pre-commitment trials in 12 more countries

331 commercially launched LTE networks in 112 countries

includes 40 LTE TDD (TD-LTE) networks in 27 countries

GSA forecasts 350+ commercially launched LTE networks by end 2014

291 operators launched using FDD mode only

27 operators launched using TDD mode only

13 operators launched using FDD & TDD modes

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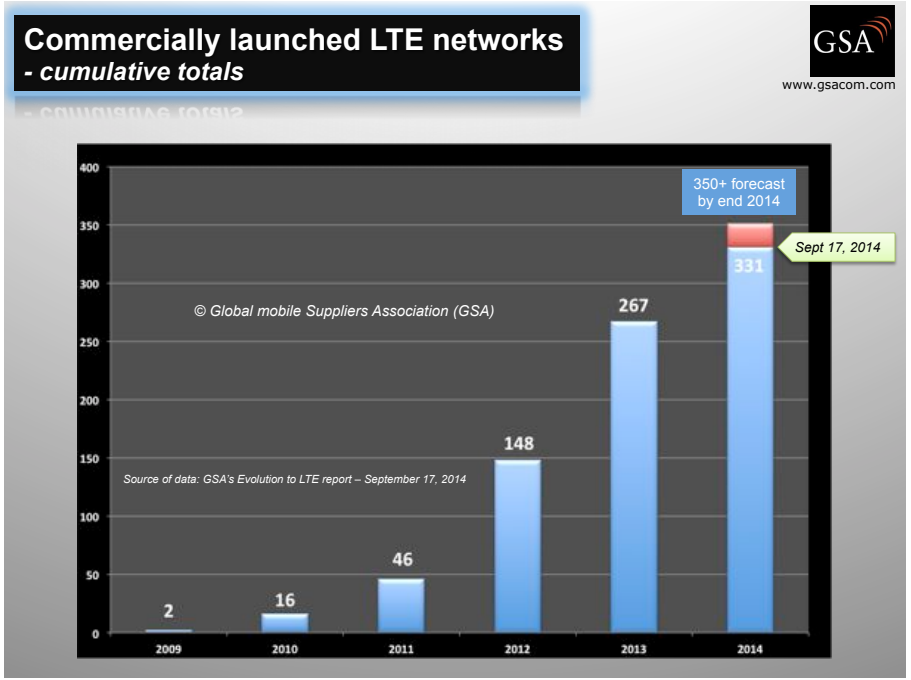
331 total commercially launched networks
In 112 countries

Source: GSA's Evolution to LTE report
Published on September 17, 2014

LTE footprint rapidly expanding worldwide



331 commercially LTE launched networks in 112 countries

GSA forecasts 350+ launched LTE networks by end 2014

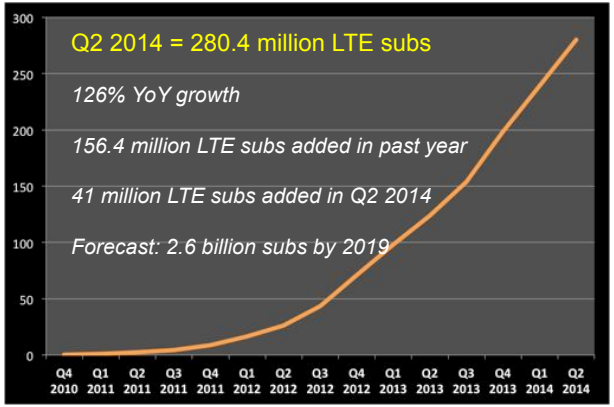
Most networks are deployed in paired spectrum (FDD)

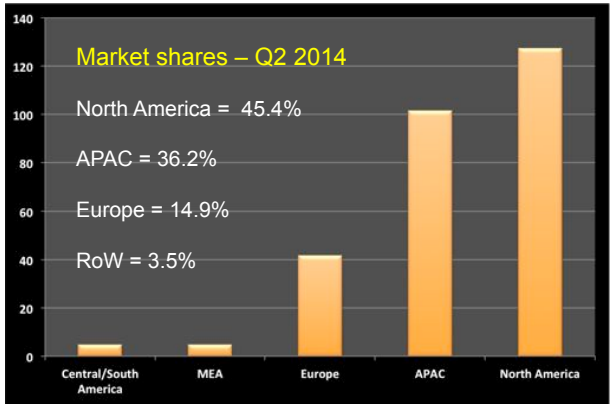
TDD is gaining traction, fast growth particularly in China

1 in 8 LTE networks use TDD mode (TD-LTE)

Data source: GSA's Evolution to LTE report
Published on September 17, 2014

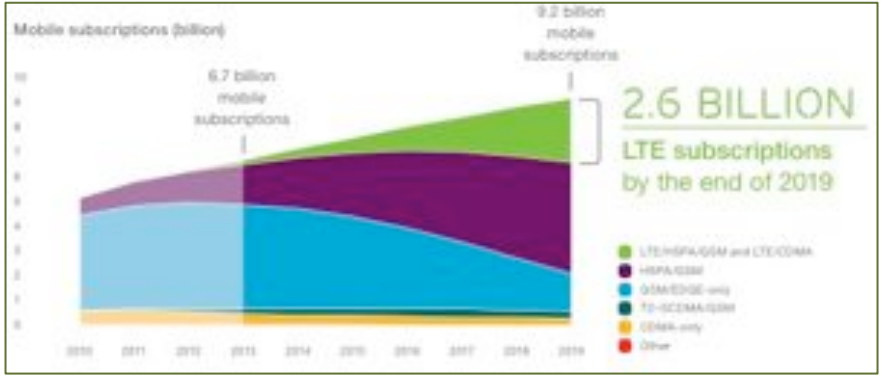
LTE subscriptions worldwide growth





Source: Ovum

LTE subscriptions to reach 2.6 billion by 2019

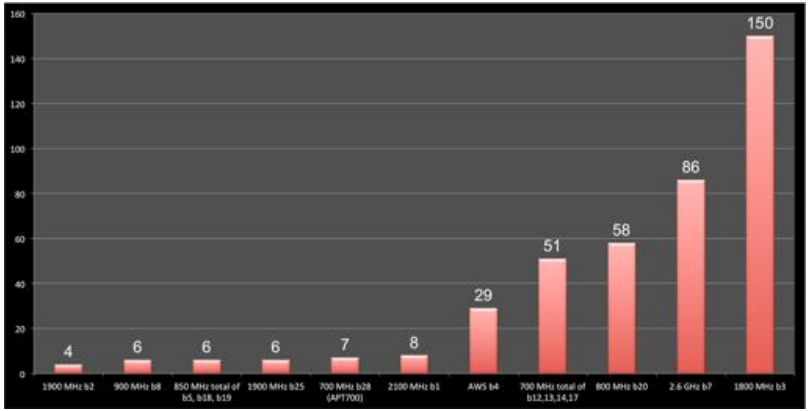


Ericsson Mobility Report

Growth drivers:

- *Smartphones (1.9 billion subscriptions in 2013 rising to 5.6 billion by end 2019)*
- *Data traffic growth, especially video content (60% growth between Q2 2013 and Q2 2014)*
- *Users expect to be able to use their apps (i.e. all apps) anywhere, anytime*

1800 MHz: mainstream / most prominent LTE band globally



LTE is deployed using 1800 MHz (band 3) spectrum in
150 commercially launched systems (LTE1800)
i.e. 43.5% of commercially launched LTE networks in 71 countries

Most used contiguous bands for LTE deployments:

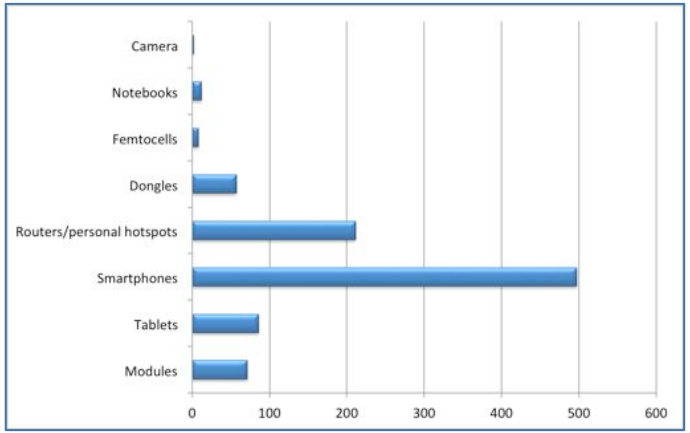
#1 Band 3 (1800 MHz)
#2 Band 7 (2.6 GHz)
#3 Band 20 (800 MHz)

1800 MHz (band 3) has the largest LTE devices ecosystem

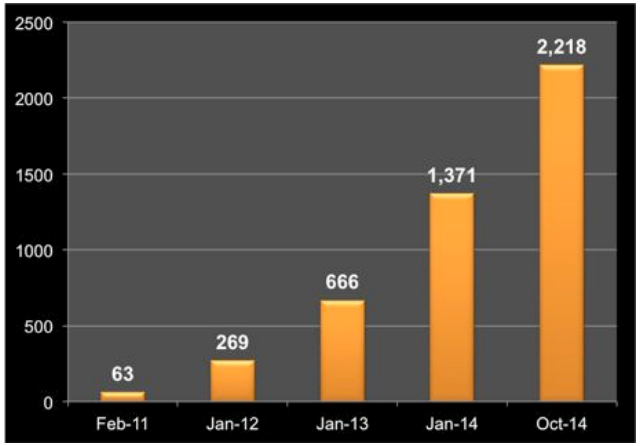
944 LTE1800 (band 3) user devices announced

Smartphones are largest category
(497 devices = > 52% of LTE1800 devices)

Over 42% of LTE devices can operate in 1800 MHz



LTE user devices

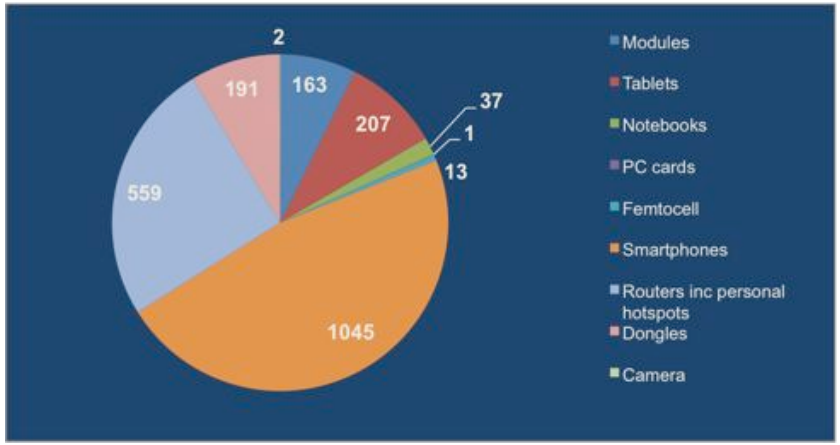


FDD and TDD products

2,216 LTE user devices announced

978new LTE devices announced in past year = 79% YoY growth

183 manufacturers = 52.5% YoY growth



47.1% of LTE devices are smartphones

LTE FDD	
1800 MHz band 3	944 devices
2600 MHz band 7	893 devices
2100 MHz band 1	699 devices
800 MHz band 20	554 devices
AWS band 4	513 devices
800/1800/2600 tri-band	487 devices
700 MHz bands 12 or 17	469 devices
850 MHz band 5	453 devices
900 MHz band 8	425 devices
700 MHz band 13	363 devices
1900 MHz band 2	305 devices
1900 MHz band 25	138 devices
APT700 band 28	55 devices

LTE TDD	
2300 MHz band 40	427 devices
2600 MHz band 38	422 devices
2600 MHz band 41	261 devices
1900 MHz band 39	250 devices
3500 MHz band 42,43	26 devices

LTE / 3G fallback

- ❑ Most LTE operators have existing 2G and 3G network operations
- ❑ These networks generally offer wider & deeper coverage than LTE networks in the initial deployment phase
- ❑ Offering LTE users the opportunity to use i.e. “fallback to” 3G systems is of major strategic importance

- *1,608 LTE devices also operate on either HSPA, HSPA+ or DC-HSPA+ networks*
- *853 LTE devices support DC-HSPA+*
- *478 LTE devices support EV-DO*
- *213LTE devices support TD-SCDMA*

Source: GSA’s Status of the LTE Ecosystem report
Published on October 14, 2014

98% of LTE handsets are 3G/multimode *(41.7% of LTE phones support DC-HSPA+)*
93.7% of LTE tablets are multimode/3G capable *(30.9% of LTE tablets support DC-HSPA+)*

LTE TDD: network deployments and ecosystem

Country	Operator	TDD band
Australia	NBN Co.	Band 40
Australia	Optus FDD & TDD	Band 40
Bahrain	Menatelecom	Band 42
Belgium	b•lite	Band 42
Brazil	On Telecomunicacoes	Band 38
Brazil	Sky Brazil Services	Band 38
Canada	ABC Communications	Band 42
Canada	Sasktel FDD & TDD	Band 41
China	China Mobile	39/40/41
China	China Telecom	Band 40, 41
China	China Unicom	Band 40, 41
Colombia	DirecTV	Band 38
Côte d'Ivoire	YooMee	Band 40
Hong Kong	CMHK FDD & TDD	Band 40
India	Aircel	Band 40
India	Bharti Airtel	Band 40
Indonesia	PT Internux	Band 40
Japan	Softbank FDD & TDD	Band 41
Madagascar	Blueline	Band 41
Nigeria	Spectranet	Band 40
Nigeria	Swift Networks	Band 40
Oman	Omantel FDD & TDD	Band 40
Philippines	PLDT	Band 42
Poland	Aero2 FDD & TDD	Band 38
Russia	Megafon FDD & TDD	Band 38
Russia	MTS FDD & TDD	Band 38
Russia	Vainakh Telecom	Band 40
S. Arabia	Mobily FDD & TDD	Band 38
S. Arabia	STC FDD & TDD	Band 40
S. Africa	Telkom Mobile (8ta)	Band 40
Spain	COTA Murcia4G	Band 38
Spain	Neo-Sky	Band 42
Sri Lanka	Dialog Axiata FDD & TDD	Band 40
Sri Lanka	Lanka Bell	Band 40
Sri Lanka	SLT	Band 38
Sweden	3 Sweden FDD & TDD	Band 38
Uganda	MTN	Band 41
UK	UK Broadband	Band 42, 43
USA	Sprint FDD & TDD	Band 41
Vanuatu	WanTok	Band 40

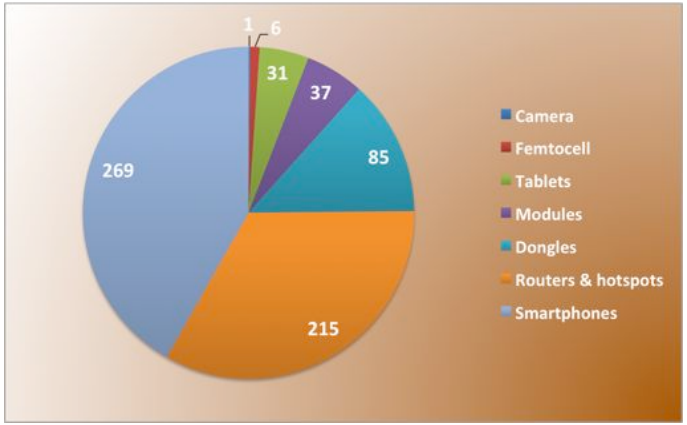
TDD (TD-LTE) mode is the optimal solution for use in unpaired spectrum

40 commercially launched LTE TDD networks in 27 countries

- 13 networks are combined FDD + TDD systems: *dual mode is becoming more common*
- Dozens more LTE TDD networks in deployment or planned
- LTE TDD (TD-LTE) has global traction:
- c. 1 in 8 LTE operators have commercially launched using TDD mode

3GPP band	Frequency	Number of networks
40	2.3 GHz	19
38	2.6 GHz	10
41	2.6 GHz	8
42	3.5 GHz	6
39	1.9 GHz	1

Note: some LTE TDD networks use more than one spectrum band
China Mobile LTE TDD network uses bands 39, 40 and 41



644 devices (370 more than a year ago) operate in LTE TDD mode
Bands 40 and 38 have largest choice of terminals
All form factors supported
174% growth in number of TD-LTE smartphones since March 2014
Growing choice of multiband and dual mode FDD-TDD devices

GAMBoD enables comprehensive analysis of LTE devices ecosystem

www.gsacom.com/gambod

GAMBoD, the **G**SA **A**nalyzer for **M**obile **Bro**adband **D**evices, is a unique search and analysis tool developed by GSA for mobile broadband devices, allowing searches by supplier, form factor, features, peak downlink and uplink speeds, and operating frequency. Results are presented in list form, or as a spreadsheet, or in charts. An RSS feed can be set up to alert as new devices are added to the database. Charts may be inserted into documents or presentations, subject to accreditation of GSA as the source.

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GAMBoD-HSPA

For HSPA, HSPA+ and DC-HSPA+ user devices

Search by manufacturer, product name, form factor, peak downlink and uplink speeds, HSPA operating frequencies, support for EDGE, WLAN, GPS/A-GPS, EV-DO, HD Voice (W-AMR), DTM, and LTE

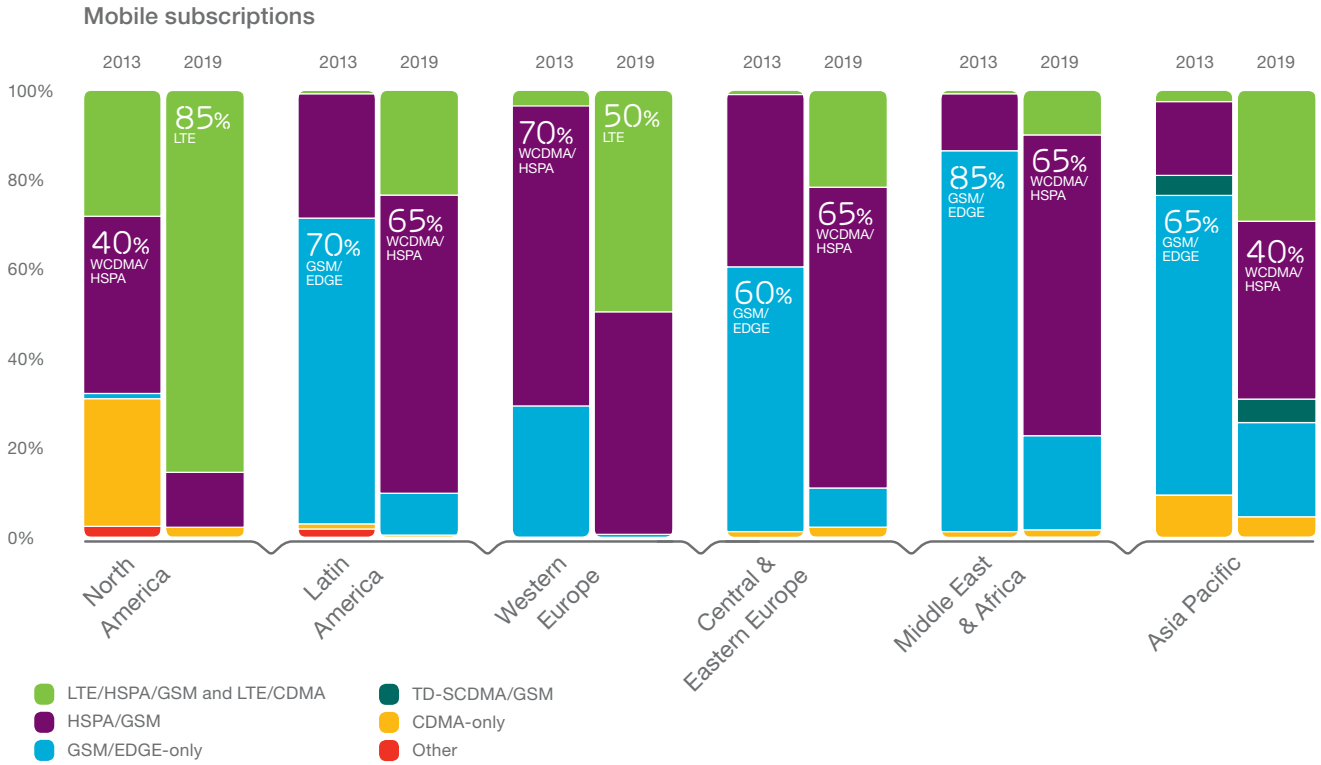
GAMBoD-LTE

For LTE user devices (2,218 devices @ October 14, 2014)

Search by manufacturer, product name, form factor, LTE operating frequencies, Cat 4, Cat 6, VoLTE, and 3G fallback including HSPA, HSPA+, DC-HSPA+, EV-DO, or TD-SCDMA

FDD spectrum selector bands 1, 2, 3, 4, 5, 7, 8, 12, 13, 14, 17, 20, 25, 28, 41
TDD spectrum selector bands 38, 39, 40, 41, 42, 43

Mobile broadband outlook



Ericsson Mobility Report – June 2014

LTE evolution

LTE-Advanced improves spectrum efficiency, delivers increases in capacity & coverage, supports more customers & devices more efficiently, to maintain and improve the user experience of mobile broadband. Key features include:

- ❑ Carrier Aggregation
- ❑ Higher order MIMO
- ❑ SON/Hetnets
- ❑ Interference management
- ❑ Relays

LTE-Advanced is market reality today

21 operators have launched LTE-Advanced carrier aggregation in 14 countries. 79 operators i.e. almost 1 in 4, have launched or are deploying or trialling LTE-Advanced technologies in their networks

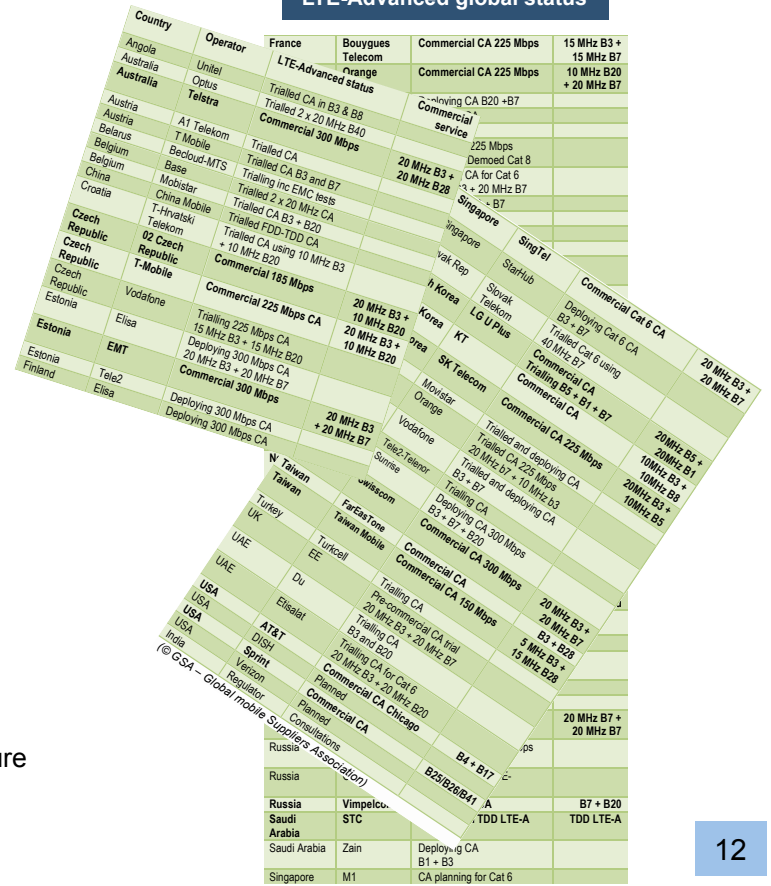
Many operators are deploying two paired 20 MHz carriers (e.g. 20 MHz paired in 1800 MHz combined with 20 MHz paired in 2.6 GHz) to support Category 6 devices (peak 300 Mbps downlink)

- ❑ 300 Mbps LTE-Advanced systems are launched in Russia, Singapore
- ❑ GSA expects that tens of commercial LTE-A Cat 6 300 Mbps networks will be launched by mid-2015
- ❑ 16 Category 6 user terminals are announced

Several operators deploying up to 20 MHz paired spectrum using the carrier aggregation feature "intraband" with contiguous or non-contiguous spectrum to achieve similar performance when used with Category 4 terminals

- ❑ 549 models of Category 4 devices (c. 25% of all LTE devices) are announced

LTE-Advanced global status



Country	Operator	LTE-Advanced status	
Angola	Unitel	Trialled CA in B3 & B8	
Australia	Optus	Trialled 2 x 20 MHz B40	
Australia	**Telstra**	**Commercial 300 Mbps**	**20 MHz B3 + 20 MHz B28**
Austria	A1 Telekom	Trialled CA	
Austria	T Mobile	Trialled CA B3 and B7	
Belarus	Becloud-MTS	Trialling inc EMC tests	
Belgium	Base	Trialled 2 x 20 MHz CA	
Belgium	Mobistar	Trialled CA B3 + B20	
China	China Mobile	Trialled FDD-TDD CA	
Croatia	T-Hrvatski Telekom	Trialled CA using 10 MHz B3 + 10 MHz B20	
Czech Republic	**O2 Czech Republic**	**Commercial 185 Mbps**	
Czech Republic	**T-Mobile**	**Commercial 225 Mbps CA**	**20 MHz B3 + 10 MHz B20**
Czech Republic	Vodafone	Trialling 225 Mbps CA	**20 MHz B3 + 10 MHz B20**
Estonia	Elisa	15 MHz B3 + 15 MHz B20	
Estonia	**EMT**	Deploying 300 Mbps CA	
Finland	Tele2	20 MHz B3 + 20 MHz B7	
	Elisa	**Commercial 300 Mbps**	**20 MHz B3 + 20 MHz B7**
		Deploying 300 Mbps CA	
		Deploying 300 Mbps CA	
N Taiwan	**Taiwan**		
	Wiwacom		
	FarEasTone		
	Taiwan Mobile		
Turkey	Turkcell		
UK	EE		
UAE	Du		
UAE	Etisalat		
USA	**AT&T**		
USA	DISH		
USA	**Sprint**		
USA	Verizon		
India	Reliator		
	Planned		
	Consultations		
	Planned		
Russia			
Russia			
Russia	**Vimpelcom**		
Saudi Arabia	**STC**		
Saudi Arabia	Zain		
Singapore	M1		

Country	Operator	LTE-Advanced status	
France	**Bouygues Telecom**	**Commercial CA 225 Mbps**	**15 MHz B3 + 15 MHz B7**
	Orange	**Commercial CA 225 Mbps**	**10 MHz B20 + 20 MHz B7**
		Deploying CA B20 +B7	
		Commercial service	
		225 Mbps	
		Demoed Cat 8	
		CA for Cat 6	
		+ 20 MHz B7	
		B7	
Singapore			
Singapore	**SingTel**		
Slovak Rep	StarHub		
	Slovak Telekom	**Commercial Cat 6 CA**	
Korea	**LG U Plus**	Deploying Cat 6 CA	
Korea	**KT**	B3 + B7	
		Trialled Cat 6 using 40 MHz B7	
Korea	**SK Telecom**	**Commercial CA**	**20 MHz B3 + 20 MHz B7**
		Trialling B3 + B1 + B7	
		Commercial CA	
Spain	Movistar	**Commercial CA 225 Mbps**	
	Orange		
	Vodafone	Trialled and deploying CA	
	Tele2-Telenor	Trialled CA 225 Mbps	
	Sunrise	20 MHz B7 + 10 MHz B3	
		Trialled and deploying CA	
		B3 + B7	
		Trialling CA	
		Deploying CA 300 Mbps	
		B3 + B7 + B20	
		Commercial CA	**20MHz B5 + 20MHz B1 + 10MHz B3 + 10MHz B8 + 20MHz B3 + 10MHz B5**
		Commercial CA 300 Mbps	
		Commercial CA	
		Commercial CA 150 Mbps	
		Trialling CA	
		Pre-commercial CA trial	
		20 MHz B3 + 20 MHz B7	
		Trialling CA	
		B3 and B20	
		Trialling CA for Cat 6	
		20 MHz B3 + 20 MHz B20	
		Commercial CA Chicago	
		Commercial CA	**20 MHz B3 + 20 MHz B7**
		5 MHz B3 + 15 MHz B28	
		B4 + B17	
		B25/B26/B41	
			20 MHz B7 + 20 MHz B7
			B7 + B20
			TDD LTE-A
		Deploying CA B1 + B3	
		CA planning for Cat 6	

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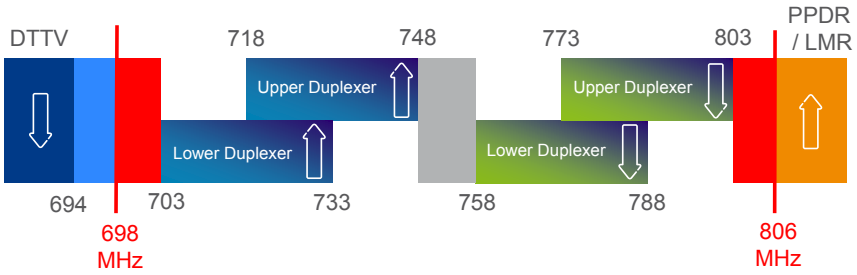
APT700 band plan – *for large-scale growth*



The FDD configuration (band 28) has the most support globally

Widely adopted across the Americas, Asia, Oceania representing around 2.2 billion population

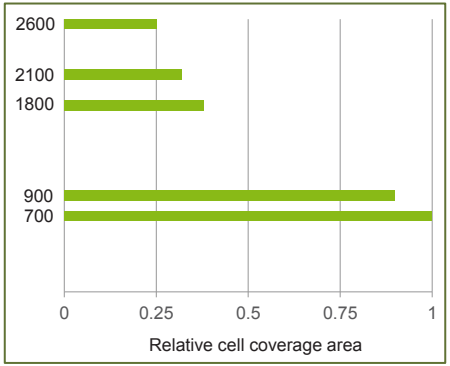
Countries that committed to, or recommend allocating, APT700 FDD spectrum for LTE deployments, include:

Australia, Brunei, Fiji, India, Indonesia, Japan, Malaysia, New Zealand, Papua New Guinea, Singapore, South Korea, Taiwan, Thailand, Tonga, Vanuatu, Vietnam

Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Mexico, Panama, Venezuela

Slow progress in Cambodia, China, Laos, Mongolia, Myanmar, Philippines

ITU Region 1 is planning for compatibility (lower duplexer)



First time that a technology in one band is available almost globally

7 commercially launched APT700 band 28 networks
- many more expected by mid-2015

APT700 Network	Country	Launch date
Digicel	Papua New Guinea	26.03.14
FarEasTone	Taiwan	03.06.14
Taiwan Mobile	Taiwan	04.06.14
Vodafone	New Zealand	18.07.14
Optus	Australia	23.07.14
Telstra	Australia	25.07.14
Spark	New Zealand	28.08.14

Fast building APT700 devices ecosystem

55 devices announced
45 smartphones, 7 tablets, 2 MiFis, 1 CPE

Leading smartphones with APT700 band 28 include Apple iPhone 6 and 6 Plus, and products from Acer, Asus, Foxconn, Fujitsu, HTC, Huawei, LG, Samsung, Sony Mobile, TCL/Alcatel, ZTE

HSPA+ evolution with Carrier Aggregation

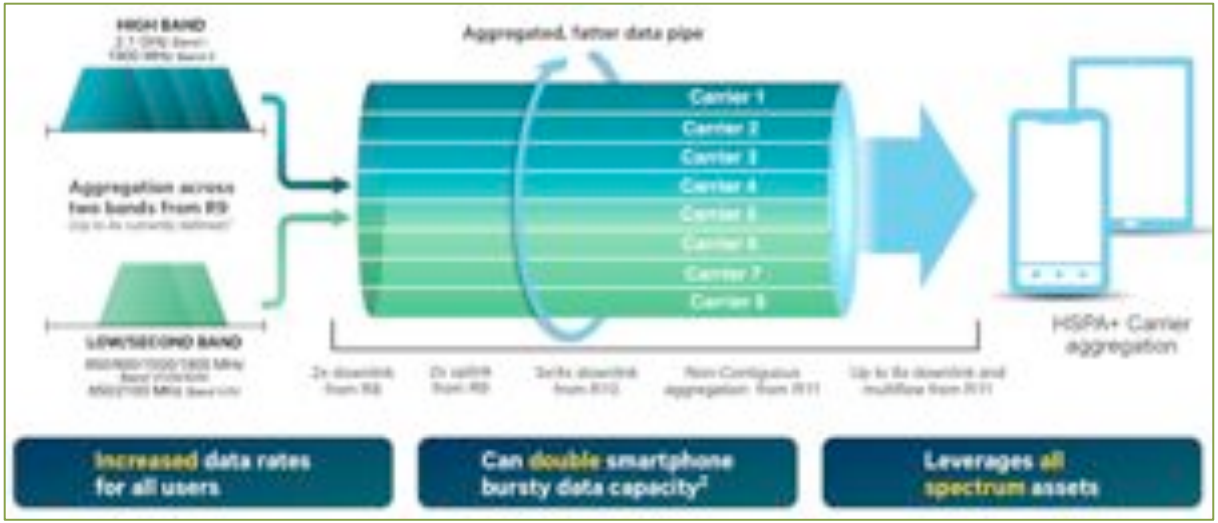
About 75% of LTE operators have also deployed HSPA or HSPA+ systems (source: GSA)

- ❑ HSPA systems are important now, and will be in future, for delivery of mobile broadband together with LTE

HSPA+ carrier aggregation is widely deployed on Release 8 systems

- ❑ 166 commercial 42 Mbps DC-HSPA networks in 86 countries

Release 9 defines aggregation across up to 4 bands



Source of charts: Qualcomm Inc.

Release 10 enables carrier aggregation of up to 4 carriers

Carrier aggregation enhances broadband experience

Download from www.gsacom.com the Qualcomm presentation

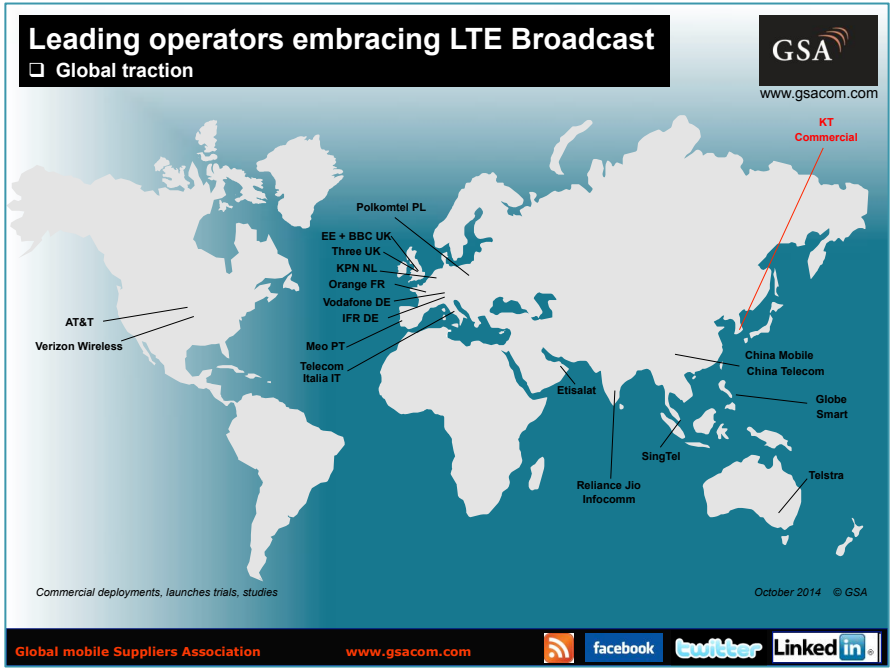
Evolution of HSPA+ Carrier Aggregation

LTE Broadcast

Mobile Broadband users are demanding spontaneous access to video content, a higher-quality experience and more convergent mobile services than ever before. Owing to the popularity and adoption of smartphones and tablets, mobile subscriptions for high data consumption devices are expected to reach 8 billion by 2019. Mobile data traffic is expected to grow 10 fold between 2013 and 2019, driven mainly by video.

LTE Broadcast enables operators to efficiently launch media services over LTE to meet this demand.

LTE Broadcast offers mobile-network operators a profitable business proposition through service differentiation, new revenue opportunities, and more efficient distribution of live and other digital media. LTE Broadcast enables multiple users to receive the same content simultaneously. LTE broadcast can deliver the same content to multiple users with the capability to support a virtually unlimited number of users simultaneously, thereby maintaining efficient use of spectrum and network investments. LTE broadcast is set to open new business models for mobile network operators.



LTE Broadcast zone
eMBMS: papers, presentations, links

http://www.gsacom.com/lte-broadcast/
Information papers, trials results, presentations from network operators and vendors

LTE-Broadcast http://www.linkedin.com/groups?gid=7435919

For LTE Broadcast technology explanation, use cases, ecosystem status, market activities and developments

see GSA's LTE Broadcast (LTE Multicast) market status report

Press release
http://www.gsacom.com/news/gsa_416.php

Public Safety LTE networks

LTE is already widely recognized as the global foundation for cellular communication for commercial users, as well as the dominant public safety technology.

In most parts of the world, public safety organizations use dedicated systems for their mission critical communications. These have primarily been designed and built to provide narrowband services such as dispatching, simple messaging and mission critical voice. But public safety users now have the opportunity to expand this scope thanks to rapid advances in technical development and the implementation of globally standardized solutions – such as LTE – brought to the market by commercial players.

Thanks to its global scale and high volumes, LTE offers both users and service providers the benefits of a single communications network that can provide multiple applications and services at low prices. But for the public safety community in particular, the key advantages of LTE are its ease of interoperability with other networks and its inherently high performance in terms of low latency, data-rates and spectral efficiency.

Using standardized solutions ensures interoperability among vendors. It allows emergency services networks to benefit from developments in the commercial sector as user demands within public safety change rapidly – while at the same time continuing to provide reliable emergency services.

The priority for public safety agencies should be finding the right deployment scenario and operator business model. Taking a broad view, public safety networks should continue to be built on a dedicated emergency services core, with options beyond this – from roaming over commercial networks to a complete dedicated network – depending on local needs and conditions.

Resources on the GSA website

Log in to http://www.gsacom.com

and visit http://www.gsacom.com/lte-public-safety/

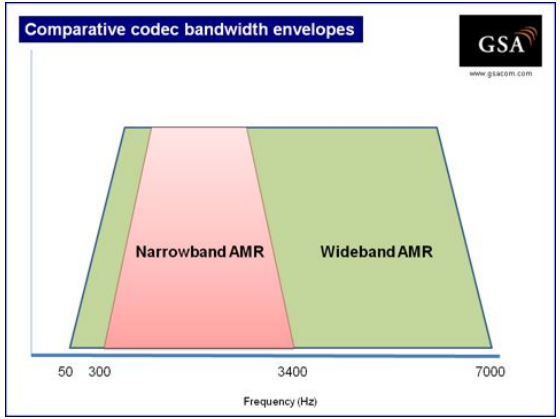
HD voice service on mobile networks

116 mobile operators launched HD voice service
(up to 15.09.14)

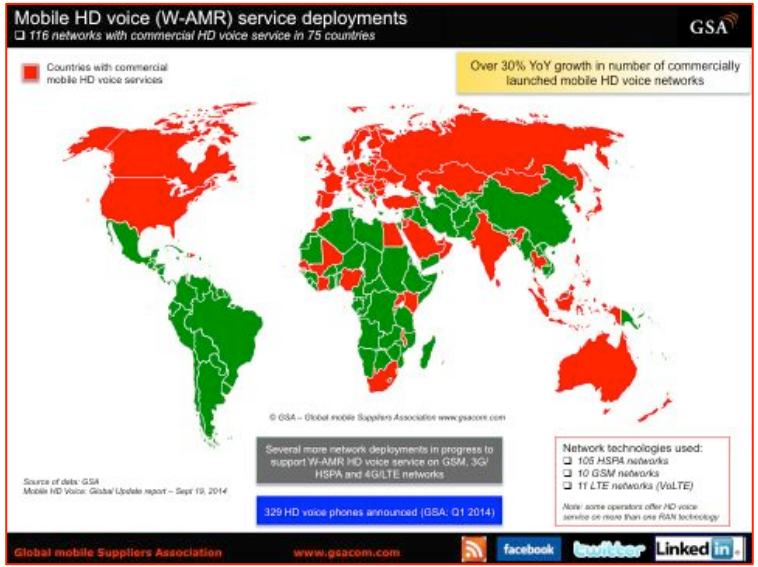
Over 30% annual growth

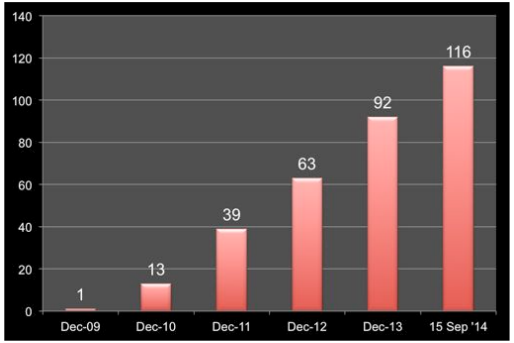
Mobile HD service now launched in 75 countries

329 models of HD voice (W-AMR) enabled mobile phones announced (including VoLTE devices) – Q1 2014



Source:
GSA's Mobile HD voice: Global Update report
GSA's HD voice (W-AMR) mobile phones and suppliers report





Press release
http://www.gsacom.com/news/gsa_415.php

W-AMR enabled HD voice launches
- ❑ 105 HSPA networks
- ❑ 10 GSM networks
- ❑ 11 LTE networks (VoLTE)

Note: some operators offer HD voice service using more than one RAN technology

Almost 1 in 5 HSPA operators have launched HD voice service

71 operators are investing in VoLTE studies, trials or deployments, including 11 operators offering VoLTE-HD voice. The number of launches should reach 19 by end-2014 & double in 2015

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GSA (**G**lobal mobile **S**uppliers **A**ssociation) represents leading GSM, 3G/HSPA and 4G/LTE suppliers worldwide. Our reports and information papers deliver key facts and stats, explain market developments, trends and opportunities, and are the most widely referenced across the industry. GSA shows how international technology standards and alignment of spectrum band choices for mobile network deployments deliver the largest economies of scale and the widest choice of terminals at lowest cost for users. Other activities include holding seminars, briefings, case studies, providing support to campaigns, and speaking at industry events. GSA monitors and regularly provides updates on LTE network deployments and launches worldwide, regulatory developments, and the availability of user devices. These reports in particular are highly anticipated and closely followed by our global website audience that includes over 65,000 registered site users and is referenced by most industry and policy-makers worldwide.

GSA is a ***Market Representation Partner*** in **3GPP** with a seat on its **Project Co-ordination Group (PCG)**

GSA co-operates with other key organizations including COAI, ETSI, GSM Association, ICU, and ITU

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5G
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LTE-Broadcast
LTE Public Safety and Critical Communications
LTE TDD
LTE User Devices
LTE1800
UMTS900

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ZONES
on www.gsacom.com

APT700 zone
White papers, presentations, links

LTE1800 zone
LTE in 1800 MHz spectrum
White Papers, seminar presentations, plus links to other key resources

Mobile HD Voice zone
HD Voice service enabled by W-AMR
Network launches, deployments, trials, phones - presentations, white papers, more resources

LTE Public Safety & Critical Communications systems
papers, presentations, links

LTE Broadcast zone
eMBMS: papers, presentations, links

Resources

- Download via the links on www.gsacom.com
  - *Registration page for new site users http://www.gsacom.com/user/register.php*

RECENTLY ADDED RESOURCES FROM GSA MEMBER COMPANIES

- Measuring and Improving Network Performance (Ericsson)
- 5G: What is it? (Ericsson)
- 5G: What is it for? (Ericsson)
- What is going on in Mobile Broadband Networks? Smartphone traffic analysis and Solutions (Nokia)
- Evolved HD voice for LTE (Ericsson)

Guest contributions

- VoLTE and Next Steps (NTT DoCoMo)
- VoLTE Performance Analysis – independent benchmark study of AT&T's VoLTE network (Signals Research Group)
- The evolution of mobile networks to support the development of smart cities (Telstra)
- Beyond Telecom through world 1st Nationwide LTE (LG U+)
- Role of carrier ethernet in LTE backhaul (Sri Lanka Telecom)
- LTE Broadcast (IDC)