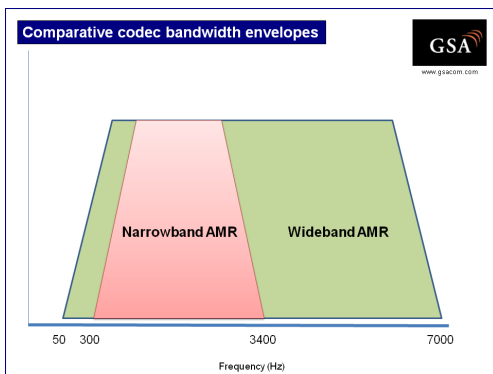


### Mobile HD Voice service using AMR Wideband

Mobile HD Voice based on AMR (Adaptive Multi Rate) Wideband technology (W-AMR) enables high-quality voice calls in mobile networks and an improved user experience. It provides significantly higher voice quality for calls between mobile phones supporting the feature and is implemented and market reality today in GSM, UMTS (WCDMA-HSPA) and LTE networks around the world.

The higher voice quality using HD Voice improves the call experience, allowing people to better share feelings, do business and communicate information. HD Voice transmits a broader spectrum of the human voice; therefore conversation is more natural and is likened to speaking to the other party in the same room. HD Voice also helps people hear better in noisy environments.

HD Voice helps operators to clearly differentiate their offerings and enable high quality services to voice dependent business like call center services, information services, emergency services, etc. HD Voice is also ideal for conference calls and can contribute to a reduction in business travel and raise productivity while reducing the environmental impact. Calls which are easier to hear and understand reduce fatigue typically associated with long conference calls. HD Voice changes that and represents the greatest advance in voice on mobile networks in decades.



W-AMR speech technology is standardized in 3GPP Release 5. The W-AMR speech-compression algorithm doubles voice bandwidth (50–7000 Hz) compared to the current narrowband speech codec (300–

3400 Hz) without extra radio or transmission requirements. According to 3GPP, 12.65 kbit/s or higher coding bit-rates provide high-quality wideband audio (lower bit-rates of 8.85 and 6.6 kbit/s are for temporary use during adverse radio conditions or periods of cell congestion). In subjective tests the HD Voice wideband codec produces better results than the best narrow-band codec.

### Commercial HD Voice services (W-AMR) are launched on 73 mobile networks in 54 countries

From first service launch in 2009, HD Voice using W-AMR is now launched on 73 mobile networks in 54 countries: Armenia, Australia, Austria, Belgium, Bulgaria, Canada, Croatia, Czech Rep., Denmark, Dominican Rep., Egypt, Finland, France, Germany, Hong Kong, India, Indonesia, Ireland, Israel, Italy, Jordan, Kazakhstan, Kenya, Luxembourg, Malawi, Malaysia, Mauritius, Moldova, Netherlands, Nigeria, Norway, Philippines, Poland, Portugal, Qatar, Réunion, Romania, Russia, Rwanda, Saudi Arabia, Serbia, Singapore, Slovakia, Slovenia, South Korea, Spain, Switzerland, Taiwan, Thailand, Turkey, UAE, Uganda, UK, USA.

The maximum benefits from using HD Voice on a compatible mobile network are realized or perceived when both calling and called party use HD Voice-capable phones. Improvements in call quality are also observed even when using an HD voice-enabled phone to call a non-HD Voice phone, due to improvements in the acoustic performance and advanced noise reduction capabilities of most HD Voice phones.

There is a strong business case for Mobile HD Voice.

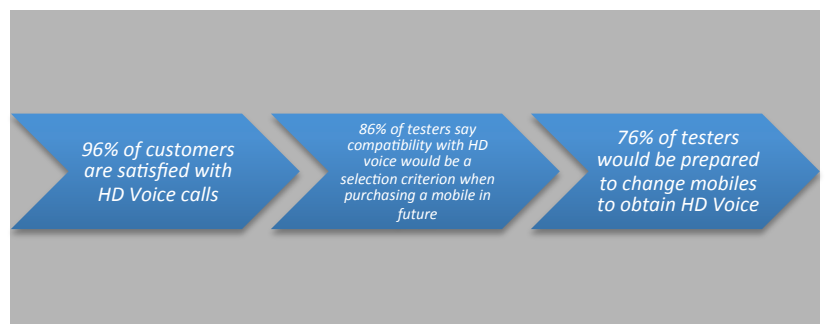
#### Orange

- In October 2012 Orange confirmed almost 4 million subscribers have switched to HD voice on its networks compared to 1 million a year ago

#### Telstra

- Telstra advised GSA (January 2012) that 5% of all calls on its network are HD voice and 10 times YoY growth. Given that users need to be calling another HD device it shows that penetration is building and getting towards a critical mass

Orange Romania reported 10 times the number of HD voice calls initiated in Q3 2012 compared to Q3 2011, and 85% of users observed notable differences between an HD and standard call. Results from an earlier survey by Orange France confirmed:



Network	Country	Launched
Orange Moldova	Moldova	09.09.2009
Orange France	France	19.07.2010
Orange Armenia	Armenia	24.02.2010
Orange UK	UK	01.09.2010
SFR	France	09.2010
Orange Spain	Spain	10.09.2010
Mobistar	Belgium	16.09.2010
VIPNet	Croatia	22.09.2010
Tata DoCoMo	India	03.11.2010
Mobinil	Egypt	09.11.2010
MegaFon GSM from 27.04.11	Russia	10.11.2010
Orange	Luxembourg	08.12.2010
CSL Limited	Hong Kong	12.2010
Turkcell	Turkey	17.01.2011
WIND Mobile	Canada	18.07.2011
TIM	Italy	27.01.2011
Vodafone Turkey	Turkey	01.04.2011
Orange Mauritius	Mauritius	07.04.2011
Orange Réunion	Réunion	2011
Orange Romania	Romania	13.05.2011
3 UK	UK	05.2011
Orange Dominicana	Dominican	06.2011
Du	UAE	06.2011
M-Tel	Bulgaria	14.06.2011
Telstra	Australia	24.06.2011
Orange Uganda	Uganda	07.07.2011
T-Mobile GSM & HSPA	Poland	17.08.2011
Orange Kenya	Kenya	25.08.2011
T-Mobile	Austria	29.08.2011
Mobitel	Slovenia	06.09.2011
VIP GSM & HSPA	Serbia	12.09.2011
Orange	Switzerland	13.09.2011
T-Mobile (planned on GSM)	Croatia	14.09.2011
TDC	Denmark	26.09.2011
A1 Telekom	Austria	10.2011
T-Mobile	Czech Rep	26.10.11
DT	Germany	02.11.2011
Si.mobil	Slovenia	15.12.2011
Bell Mobility	Canada	24.01.2012
Swisscom	Switzerland	01.02.2012
KPN	Netherlands	05.03.2012
Celcom Axiata	Malaysia	07.04.2012
Vodafone Ireland	Ireland	18.04.2012
Kcell	Kazakhstan	2012
Play (P4)	Poland	10.07.2012
T Mobile	UK	08.2012
SK Telecom VoLTE	South Korea	08.08.2012
LG Uplus VoLTE	South Korea	08.08.2012
Orange	Jordan	11.08.12
MTS	Russia	12.09.12
Telus	Canada	21.09.12
TMN	Portugal	28.09.12
Rogers Wireless	Canada	10.12
Smart	Philippines	22.10.12
Bouygues Telecom	France	11.12
DTAC	Thailand	11.12
Q-Tel	Qatar	27.11.12
3	Denmark	20.12.12
Airtel	Nigeria	22.12.12
Orange/Partner	Israel	25.12.12
T-Mobile	USA	08.01.13
Axis	Indonesia	22.01.13
DNA	Finland	28.01.13
CHT	Taiwan	05.02.13
Airtel	Kenya	05.03.13
Airtel	Malawi	05.03.13
Airtel	Rwanda	05.03.13
StarHub	Singapore	07.03.13
Telenor	Norway	19.03.13
Mobily	Saudi Arabia	Mar-13
STC	Saudi Arabia	Mar-13
Netcom	Norway	Apr-13
Orange	Slovakia	16.05.13

Table 1: 73 mobile HD Voice (W-AMR) service launches  
HSPA networks except where stated © GSA – June 4, 2013

### Network aspects

Ordinarily the voice payload for transport in the core network is PCM-coded at 64 kbit/s according to ITU-T Rec. G.711. Narrowband AMR is transcoded to/from PCM which degrades voice quality, adding signal processing complexity. Analog PCM-based transport cannot be used with W-AMR as G.711 only applies to narrowband voice. W-AMR must be based on one of two complementary 3GPP standards: tandem-free operation (TFO) or transcoder-free operation (TrFO). Introduction of W-AMR into GSM systems requires TFO, which is part of 3GPP GERAN, which does not require substantial modification of the core network. W-AMR and TFO can also be introduced into UMTS. A better option however, is to use the recommended TrFO. The combination of TFO and TrFO enables W-AMR calls between all types of 3GPP mobile devices (i.e. GSM/EDGE and UMTS/WCDMA-HSPA).

### Voice for LTE users

LTE systems are all-IP and optimized for data transfer and do not include circuit switched capability as used on previous technologies for voice and SMS services. Since voice and SMS generate the majority of operator revenues globally, voice service is needed for LTE users. With VoLTE (Voice over LTE - defined in GSMA specification VoLTE IR.92, based on 3GPP standards), subscribers can use HD Voice and other new richer communication services using LTE smartphones.

VoLTE aims to provide a voice service at least as reliable as on current cellular systems, but over an all-IP network in a shared resource environment. The operator needs to have an IMS core network. The LTE radio access network and Evolved Packet Core must also support VoLTE, typically enabled by software upgrade. ARCchart forecast that revenue from VoLTE services will reach US\$ 2 billion by 2016. The first wave of commercial VoLTE service launches which include W-AMR HD Voice has begun.

Operator	Country	HD Voice (W-AMR) deployment status
Telenor	Norway	Deploying in HSPA network
Vodafone	Portugal	Deploying in HSPA network
DTAC	Thailand	Deploying in HSPA network
T Mobile	Austria	Trialling VoLTE in LTE network
Sasktel	Canada	Deploying VoLTE in LTE network
China Mobile	China	Trialling/studying VoLTE
E Plus	Germany	VoLTE deployment is planned
Vodafone	Germany	Deploying in HSPA network
CSL	Hong Kong	Trialling VoLTE
NTT DoCoMo	Japan	VoLTE deployment is planned
StarHub	Singapore	VoLTE deployment is planned
Telekom Slovenije	Slovenia	Deploying VoLTE in LTE network
KT	South Korea	Deploying VoLTE in LTE network
Tele2	Sweden	Deploying VoLTE in LTE network
TeliaSonera	Sweden	Deploying VoLTE in LTE network
Etisalat	UAE	Deploying VoLTE in LTE network
AT&T	USA	Deploying VoLTE in LTE network
C-Spire	USA	Deploying VoLTE in LTE network
Clearwire	USA	Deploying VoLTE in LTE network
MetroPCS	USA	Deploying VoLTE in LTE network
Sprint	USA	Deploying VoLTE in LTE network
US Cellular	USA	Trialling VoLTE in LTE network
Verizon	USA	Deploying VoLTE in LTE network

Table 2: W-AMR enabled HD Voice network deployments and trials  
© GSA, June 4, 2013

### HD Voice devices ecosystem

Several HD-Voice phones are available from leading manufacturers, including products for professional broadcasters. Many new models are delivered with HD Voice activated as default. Apple iPhone 5 supports HD Voice. All Xperia™ phones are shipping with HD Voice turned on for use in HSPA networks. Nokia's Symbian Belle release brought HD Voice for GSM operators, enabled by Nokia 600, 700, 701 phones, with HD Voice shipping as the default for WCDMA and GSM modes. Symbian Belle is also available as a software update for current models e.g. Nokia N8, E6, E7, C6-01, C7 and X7, giving owners an upgrade path. Lumia phones have W-AMR support for GSM and WCDMA. Nokia also has more affordable products e.g. X3, C3. Mobile operators often list HD Voice compatible phones. Some are carrier specific and not compatible for other networks or available in all markets. This information is only for interest/guidance:

**3 UK:** HTC Sensation, HTC One S, HTC One X, HTC One V, HTC Sensation XE with Beats Audio, HTC Desire HD, HTC Sensation XL with Beats Audio, HTC Desire S, iPhone 5, LG P920 Optimus 3D, Nokia Asha 300, Nokia Asha 302, Nokia C3-01, Nokia C7, Nokia E7, Nokia N8, Nokia X7, BlackBerry Torch 9810, Samsung GT-S6500, Samsung Omnia Win 7, Samsung Galaxy W i8150, Samsung Galaxy S II i9100, Sony XPERIA Arc, Sony XPERIA Arc S, Sony T19i Live with Walkman, Sony Xperia S, Sony Xperia U, Sony Xperia P  
**KPN NL:** Sony Xperia arc S, Samsung Galaxy S II, Galaxy S Plus, Galaxy Note, Nokia 300, Nokia 700, Nokia Lumia 800

**Play (P4):** Motorola RAZR; LG Prada 3.0, HTC: One X, Rhyme, Sensation XE, Titan, Radar; Samsung: Galaxy S III, Galaxy S II, Galaxy S Plus, Galaxy Note, Wave 3, S5610;

Sony: Xperia PLAY, Xperia ray, Xperia arc, Xperia neo, Xperia X10 mini, Xperia X10 mini pro, Live with Walkman, Xperia S;

Nokia: 500, C6, C7, E6, E7 Communicator, N8, E72, C3-01, Lumia 800, Asha 300, 302, 303, 311

**SK Telecom:** Korean version of Samsung Galaxy SIII LTE is promoted for VoLTE/HD Voice

**LG Uplus:** VoLTE/HD Voice initially on LTE Optimus 2, planned to offer at least 7 VoLTE handsets by end 2012

**Smart Philippines:** Smart Netphone 701, Nokia E7, Sony Xperia Mini, Samsung Galaxy Ace

**TMN:** iPhone 5, Samsung Galaxy S3, S2 LTE, Mini 2, Sony Xperia S/U/Miro/Pro/play/neo/Ray, Arc/Arc S, HTC One X/S, ZTE Tanya, TMN A15 e A8, LG Maximo LG e Prada 3.0, Nokia 300/302/808, Nokia Lumia 710/800/900

**To continue the market development, GSA advocates that all smartphones need to ship with W-AMR activated by default.**

GSA tracks vendor announcements about mobile devices that support HD voice service enabled using W-AMR. GSA's research (07.02.13) identified 160 HD voice phones from 16 manufacturers, including the most popular brands. Check [www.gsacom.com](http://www.gsacom.com) for the latest updates.



The **HD Voice logo** is designed for operators and vendors to market and promote interoperable HD Voice capabilities on their networks and end user products. Details about the logo, how to become a licensee, contacts etc., are available on the GSMA (GSM Association) website [www.gsma.com/technicalprojects/hd-voice/](http://www.gsma.com/technicalprojects/hd-voice/)

### Hear HD Voice!

**Martin Stanford (Sky News presenter)**

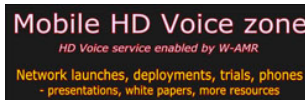
[www.youtube.com/watch?v=bwVPkt6wEw&feature=player\\_embedded](http://www.youtube.com/watch?v=bwVPkt6wEw&feature=player_embedded)

Interoperability between fixed and mobile networks for handling HD voice calls is a priority. A white paper "BT Global IP Exchange" (available in the Mobile HD Voice Zone at [www.gsacom.com](http://www.gsacom.com)) explains how mobile operators can benefit from the opportunity to deliver and charge for cross-network national and international and roaming HD calls. Since October 2012, Orange customers in Romania and Moldova can make HD Voice calls between these countries. Orange supports international HD voice calls between two operators on fixed and/or any mobile network and launched an international HD voice call exchange, which is available to 3<sup>rd</sup> party operators and service providers. Other providers include iBasis, TI Sparkle, and Tata Communications. According to Information Observatory research commissioned by BT, global retail revenue from cross-network HD Voice services could reach GB £1.5 billion by 2015.

**GSA on LinkedIn:** [www.linkedin.com/groups?gid=2313721](http://www.linkedin.com/groups?gid=2313721)

**HD Voice (W-AMR) discussion group:** [www.linkedin.com/groups?=&gid=3032759](http://www.linkedin.com/groups?=&gid=3032759)

HD Voice Zone on the GSA website: [www.gsacom.com/hdvoice](http://www.gsacom.com/hdvoice)



Maps and charts relating to mobile HD Voice are available as PDF files via the links on [www.gsacom.com](http://www.gsacom.com) and also as JPEG files at [www.gsacom.com/news/statistics.php4](http://www.gsacom.com/news/statistics.php4)

**White papers, market updates, graphics** [www.gsacom.com](http://www.gsacom.com)

**White Paper:** *Voice Handover in LTE Networks* - shows that the SRVCC technology performance is now mature for commercial launch. It also means good voice quality in LTE network handover scenarios, non-noticeable interrupt time when doing a handover, as well as seamless HD voice between LTE and WCDMA.

[www.ericsson.com/news/121026-voice-handover-in-lte-networks\\_244159017\\_c](http://www.ericsson.com/news/121026-voice-handover-in-lte-networks_244159017_c)

GSA (the Global mobile Suppliers Association) represents GSM/EDGE, WCDMA-HSPA/HSPA+ and LTE suppliers, providing reports, facts, analysis and information explaining market developments and trends. Information for this report was obtained wholly by GSA (Global mobile Suppliers Association – [www.gsacom.com](http://www.gsacom.com)), referencing information exchanges with key contacts in mobile network operators, in GSA member organizations, with other industry specialists, and public announcements.

Errors and Omissions Excepted.

*Updates are welcome to [info@gsacom.com](mailto:info@gsacom.com)*