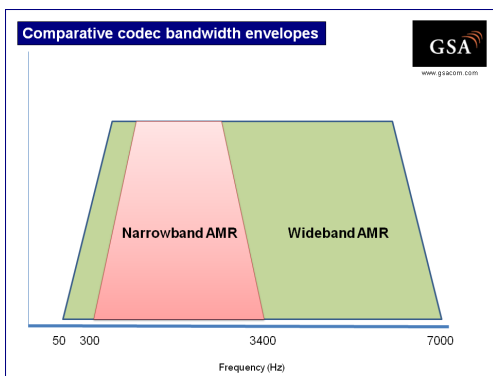


This report by GSA gives a status summary of mobile HD voice operator commitments & service deployments and launches globally on 2G/GSM, 3G/HSPA & 4G/LTE networks (i.e. VoLTE) & the maturing W-AMR enabled mobile HD voice user devices ecosystem

Introduction

Mobile HD voice based on Adaptive Multi Rate Wideband (W-AMR) technology 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 deployed 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 differentiate their offerings and enable high quality services e.g. voice dependent business like call centres, information and emergency services, etc. HD voice is ideal for conference calls and can contribute to a reduction in business travel and raise productivity while reducing environmental impact. Calls that are easier to hear and understand reduce the fatigue often associated with long conference calls. HD voice 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.

145 mobile operators commercially launched HD voice service in 85 countries

- 127 on 3G/HSPA networks
- 15 on 2G/GSM networks
- 30 on LTE networks (VoLTE)

* some operators offer HD voice service on more than one radio system

HD voice service is commercially launched in Albania, Armenia, Australia, Austria, Bahrain, Bangladesh, Belarus, Belgium, Bulgaria, Canada, China, Croatia, Czech Republic, Denmark, Dominican Republic, Egypt, Estonia, Finland, France, Gabon, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Italy, Ivory Coast, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malawi, Malaysia, Mali, Malta, Mauritius, Moldova, Mongolia, Montenegro, Morocco, Myanmar, Netherlands, New Zealand, Nigeria, Norway, Oman, Philippines, Poland, Portugal, Qatar, Réunion, Romania, Russia, Rwanda, Saudi Arabia, Senegal, Serbia, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Tajikistan, Thailand, Turkey, UAE, Uganda, UK, Ukraine, USA, Uzbekistan

Several countries have competing mobile HD voice operators. Interconnection between these networks for end-to-end HD voice calling is a priority and in progress as well as provision for handling international HD voice calls, and for HD voice calling between fixed & mobile networks.

The maximum benefits from using HD voice are realized when both calling and called party use HD voice phones on a compatible mobile network. Improvements in call quality are also observed even when using an HD voice 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:

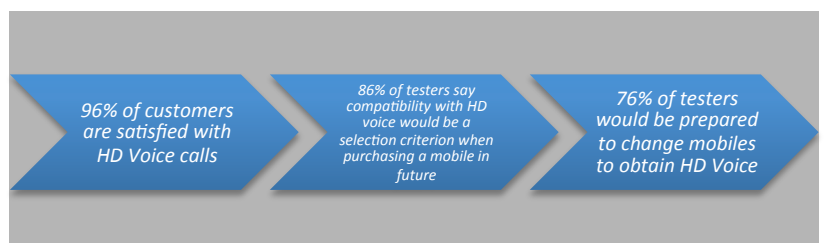
Worldwide

- There are over 300 million HD customers (Q1 2015 est.)

France

- < 50% of installed base has HD voice devices (Q1 2015)

Orange France studies confirmed:



Network aspects

The voice payload for transport in the core network is usually PCM-coded at 64 kbit/s (ITU-T Rec. G.711). Narrowband AMR is transcoded to/from PCM but 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 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).

Most HD voice devices operate on 3G/HSPA networks, with some working on GSM networks. Many new models are delivered with HD Voice activated as default. A number of operators are now deploying HD voice capability on their 2G/GSM networks for which compatible phones are commercially available.

A growing number of LTE user devices incorporate W-AMR technology today and several LTE operators are deploying VoLTE with HD voice as the first service offer.

Note that with HD voice capable terminals some are operator specific and not compatible for use in other networks or available in all markets. This information in this report is for interest/guidance only for readers. Availability of the W-AMR feature in any device for a specific market must always be checked directly with the phone manufacturer concerned.

To continue the market development, GSA advocates that all smartphones should be delivered with W-AMR activated by default.

Many operators provide demonstrations of mobile network HD voice quality on their websites for customers to compare with standard mobile voice quality. The link below references one of the earliest demonstrations and has been listed to by over 89,000 visitors.

Hear HD Voice!

Martin Stanford (Sky News presenter)

www.youtube.com/watch?v=bwVPkt6vwEw&feature=player_embedded

A white paper "BT Global IP Exchange" (available in the Mobile HD voice Zone on www.gsacom.com) explains how 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 for 3rd party operators and service providers. Other IPX providers include Aicent, BICS, iBasis, TI Sparkle, TSIC, and Tata Communications.

According to research by *Innovation Observatory* for BT, global retail revenue from cross-network HD voice services could reach GB £1.5 billion by 2015.



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

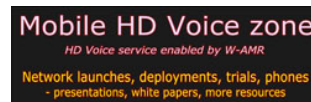
<http://www.gsma.com/network2020/hd-voice/>

Since June 12, 2013 DECT Cat-iq 2.0 certified devices may also use this logo.



HD Voice (W-AMR) discussion group:

www.linkedin.com/groups?=&gid=3032759



On the GSA website www.gsacom.com/hdvoice

Maps and charts relating to mobile HD voice are available as PDF files via the links on www.gsacom.com and also as JPEG files at www.gsacom.com/news/statistics.php4

White papers, market updates, graphics www.gsacom.com

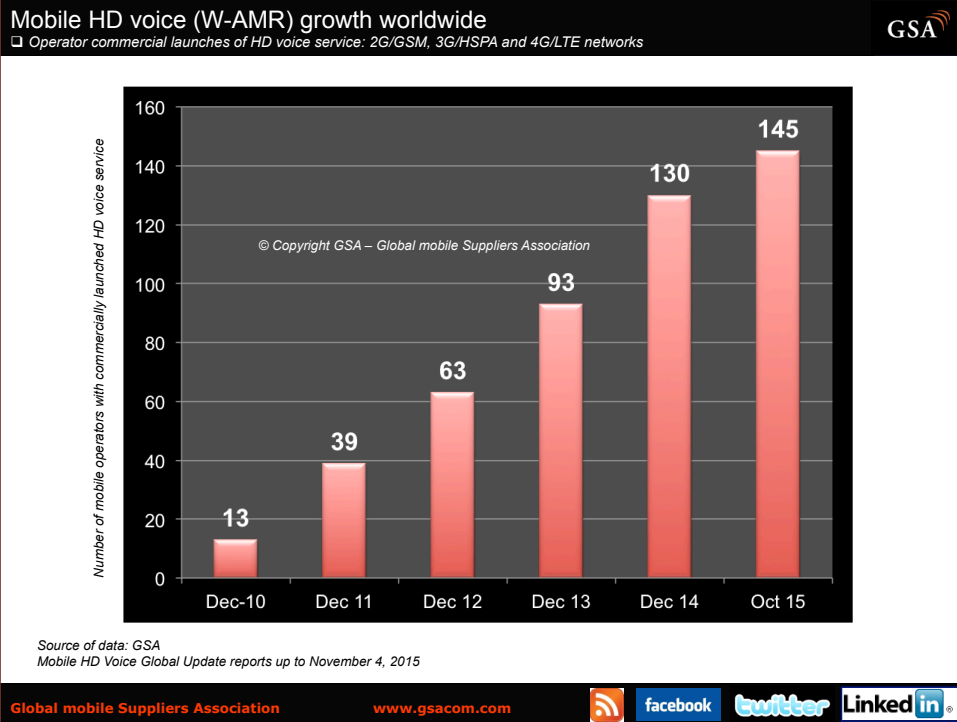
White Paper: Voice Handover in LTE Networks - shows that the SRVCC technology performance is mature for commercial launch. It also means good voice quality in LTE network handover scenarios, non-noticeable interrupt time when doing a handover, as well as seamless HD voice between LTE and WCDMA.

www.ericsson.com/news/121026-voice-handover-in-lte-networks_244159017_c

OPERATOR	HSPA network	GSM network	LTE network	COUNTRY	HD voice service 1 st launch date
Orange Moldova	<input checked="" type="checkbox"/>			Moldova	09.09.2009
Orange France	<input checked="" type="checkbox"/>			France	19.07.2010
Orange Armenia	<input checked="" type="checkbox"/>			Armenia	24.02.2010
Orange UK	<input checked="" type="checkbox"/>			UK	01.09.2010
SFR	<input checked="" type="checkbox"/>			France	09.2010
Orange Spain (Catalonia region)	<input checked="" type="checkbox"/>			Spain	10.09.2010
Mobistar	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Belgium	16.09.2010
Vipnet	<input checked="" type="checkbox"/>			Croatia	22.09.2010
Tata DoCoMo	<input checked="" type="checkbox"/>			India	03.11.2010
Mobinil	<input checked="" type="checkbox"/>			Egypt	09.11.2010
MegaFon (initially HSPA, with GSM from 27.04.2011)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Russia	10.11.2010
Orange Luxembourg	<input checked="" type="checkbox"/>			Luxembourg	08.12.2010
CSL Limited	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	Hong Kong	12.2010
Turkcell	<input checked="" type="checkbox"/>			Turkey	17.01.2011
TIM	<input checked="" type="checkbox"/>			Italy	27.01.2011
WIND Mobile	<input checked="" type="checkbox"/>			Canada	02.2011
Vodafone Turkey	<input checked="" type="checkbox"/>			Turkey	01.04.2011
Orange Mauritius	<input checked="" type="checkbox"/>			Mauritius	07.04.2011
Orange Réunion	<input checked="" type="checkbox"/>			Réunion	2011
Orange Romania	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	Romania	13.05.2011
3 UK (VoLTE later)	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	UK	05.2011
Orange Dominicana	<input checked="" type="checkbox"/>			Dominican Republic	06.2011
Du	<input checked="" type="checkbox"/>			UAE	06.2011
M-TEL	<input checked="" type="checkbox"/>			Bulgaria	14.06.2011
Telstra (VoLTE in 2015)	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	Australia	24.06.11
Orange Uganda	<input checked="" type="checkbox"/>			Uganda	07.07.2011
T-Mobile Poland	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Poland	17.08.2011
Orange Kenya	<input checked="" type="checkbox"/>			Kenya	25.08.2011
T-Mobile Austria	<input checked="" type="checkbox"/>			Austria	29.08.2011
Mobitel	<input checked="" type="checkbox"/>			Slovenia	06.09.2011
VIP Serbia	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Serbia	12.09.2011
Orange Switzerland	<input checked="" type="checkbox"/>			Switzerland	13.09.2011
T-Hrvatski Telekom	<input checked="" type="checkbox"/>	Planned		Croatia	14.09.2011
TDC	<input checked="" type="checkbox"/>			Denmark	26.09.2011
A1 Telekom	<input checked="" type="checkbox"/>			Austria	10.2011
T-Mobile CZ	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	Czech Republic	26.10.2011
DT	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Germany	02.11.2011
3 Austria	<input checked="" type="checkbox"/>			Austria	16.11.2011
Si.mobil	<input checked="" type="checkbox"/>			Slovenia	15.12.2011
Bell Mobility	<input checked="" type="checkbox"/>			Canada	24.01.2012
Swisscom (VoLTE later)	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	Switzerland	01.02.2012
Dialog Axiata	<input checked="" type="checkbox"/>			Sri Lanka	14.02.2012
KPN	<input checked="" type="checkbox"/>			Netherlands	05.03.2012
Celcom Axiata	<input checked="" type="checkbox"/>			Malaysia	07.04.2012
Vodafone Ireland	<input checked="" type="checkbox"/>			Ireland	18.04.2012
Kcell	<input checked="" type="checkbox"/>			Kazakhstan	2012
Play (P4)	<input checked="" type="checkbox"/>			Poland	10.07.2012
T-Mobile UK	<input checked="" type="checkbox"/>			UK	08.2012
SK Telecom			<input checked="" type="checkbox"/>	South Korea	08.08.2012
LG U Plus			<input checked="" type="checkbox"/>	South Korea	08.08.2012
Orange Jordan	<input checked="" type="checkbox"/>			Jordan	11.08.2012
MTS	<input checked="" type="checkbox"/>			Russia	12.09.2012
Telus	<input checked="" type="checkbox"/>			Canada	21.09.2012
Meo	<input checked="" type="checkbox"/>			Portugal	28.09.2012
Rogers Wireless	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	Canada	10.2012

KT			<input checked="" type="checkbox"/>	South Korea	08.10.2012
Smart	<input checked="" type="checkbox"/>			Philippines	22.10.2012
Bouygues Telecom	<input checked="" type="checkbox"/>			France	11.2012
DTAC		<input checked="" type="checkbox"/>		Thailand	11.2012
Ooredoo	<input checked="" type="checkbox"/>			Qatar	27.11.2012
3 Denmark	<input checked="" type="checkbox"/>			Denmark	20.12.2012
Airtel	<input checked="" type="checkbox"/>			Nigeria	22.12.2012
Orange (Partner)	<input checked="" type="checkbox"/>			Israel	25.12.2012
T-Mobile US (HSPA first, VoLTE launched 22.05.14)	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	USA	08.01.2013
Axis - Axiata	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	Indonesia	22.01.2013
DNA	<input checked="" type="checkbox"/>			Finland	28.01.2013
Chunghwa Telecom	<input checked="" type="checkbox"/>			Taiwan	05.02.2013
Orange CI	<input checked="" type="checkbox"/>			Ivory Coast	28.02.2013
Airtel	<input checked="" type="checkbox"/>			Kenya	05.03.2013
Airtel	<input checked="" type="checkbox"/>			Malawi	05.03.2013
Airtel	<input checked="" type="checkbox"/>			Rwanda	05.03.2013
StarHub (HSPA first, VoLTE launched 28.06.14)	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	Singapore	07.03.2013
Telenor	<input checked="" type="checkbox"/>			Norway	19.03.2013
G-Mobile	<input checked="" type="checkbox"/>			Mongolia	20.03.2013
Mobily	<input checked="" type="checkbox"/>			Saudi Arabia	03.2013
STC	<input checked="" type="checkbox"/>			Saudi Arabia	03.2013
Netcom	<input checked="" type="checkbox"/>			Norway	04.2013
Cosmote	<input checked="" type="checkbox"/>			Romania	15.04.2013
AIS	<input checked="" type="checkbox"/>			Thailand	06.05.2013
Orange Slovakia	<input checked="" type="checkbox"/>			Slovakia	16.05.2013
Cosmote	<input checked="" type="checkbox"/>			Greece	11.06.2013
Cmogorski Telekom	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Montenegro	24.06.2013
Vodafone	<input checked="" type="checkbox"/>			Australia	25.06.2013
Magyar Telekom	<input checked="" type="checkbox"/>			Hungary	01.07.2013
Vodafone	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	Germany	26.07.2013
Bite	<input checked="" type="checkbox"/>			Lithuania	31.07.2013
Bite	<input checked="" type="checkbox"/>			Latvia	05.08.2013
Kyivstar		<input checked="" type="checkbox"/>		Ukraine	08.08.2013
Telenor	<input checked="" type="checkbox"/>			Hungary	29.08.2013
Telenor Serbia	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Serbia	16.09.2013
Vodafone	<input checked="" type="checkbox"/>			New Zealand	07.11.2013
MTS	<input checked="" type="checkbox"/>			Belarus	11.12.2013
Viva	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	Kuwait	25.12.2013
Orange	<input checked="" type="checkbox"/>			Mali	01.2014
2 Degrees	<input checked="" type="checkbox"/>			New Zealand	21.01.2014
Orange Sonatel	<input checked="" type="checkbox"/>			Senegal	14.02.2014
TeliaSonera	<input checked="" type="checkbox"/>			Sweden	01.03.2014
Telefonica O2 incorporating E Plus	<input checked="" type="checkbox"/>			Germany	12.03.2014
Nawras	<input checked="" type="checkbox"/>			Oman	22.03.2014
Inwi	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Morocco	24.03.2014
Tele2	<input checked="" type="checkbox"/>			Sweden	25.03.2014
Viva	<input checked="" type="checkbox"/>			Bahrain	29.03.2014
Zain	<input checked="" type="checkbox"/>			Bahrain	31.03.2014
EMT	<input checked="" type="checkbox"/>			Estonia	06.05.2014
3 HK			<input checked="" type="checkbox"/>	Hong Kong	15.05.2014
Altel	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Kazakhstan	15.05.2014
Etisalat	<input checked="" type="checkbox"/>			Sri Lanka	22.05.2014
AT&T Mobility			<input checked="" type="checkbox"/>	USA	23.05.2014
SingTel			<input checked="" type="checkbox"/>	Singapore	31.05.2014
NTT DoCoMo			<input checked="" type="checkbox"/>	Japan	06.2014
Beeline	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		Russia	16.06.2014
Robi Axiata	<input checked="" type="checkbox"/>			Bangladesh	22.06.2014

Global growth of HD voice (W-AMR) services



Download this chart from
<http://www.gsacom.com/news/statistics>

HD voice service launches 2009 - 2015

HD VOICE DEVICES ECOSYSTEM: 2G/GSM, 3G/HSPA and 4G/LTE - VoLTE

HD voice compatible user devices incorporating W-AMR technology are mainstream. Several hundred products have been launched in the market including by all the leading smartphone brands and models and across a wide range of price points, especially for use on 3G/HSPA networks. Support for W-AMR in smartphones is mainstream and as a result GSA no longer maintains a database of devices for use on 3G networks. Some suppliers also support the 2G/GSM HD voice market.

The ecosystem for **HD voice compatible VoLTE terminals** for use on 4G/LTE networks is developing fast. GSA monitors and regularly reports on its progress. Initially operators have deployed VoLTE for delivering HD voice service for LTE users. On November 2, 2015 in its **Status of the LTE Ecosystem report**, GSA confirmed that 246 VoLTE-capable devices (taking into account carrier and frequency variants) including 224 smartphones have been announced by leading vendors including Apple, Asus, Fujitsu, Huawei, LG, Motorola, Pantech, Samsung, Sharp, and Sony Mobile. For more details about all LTE user devices download the **Status of the LTE Ecosystem report** from the GSA homepage www.gsacom.com

ABOUT GSA

GSA (Global mobile Suppliers Association) represents GSM/EDGE/WCDMA-HSPA/HSPA+, LTE/LTE-Advanced and future 5G suppliers. GSA brings together a global industry community of telecoms professionals through its website, reports, information papers and practical activities to inform, influence, educate, explain and promote the opportunities enabled by mobile broadband systems. The GSA website www.gsacom.com has over 70,000 registered users for knowledge gathering and information sharing of key facts, trends and analysis, and over 25,000 connections on our social network platforms - LinkedIn, Twitter and Facebook. Over 1 million GSA reports, presentations, information papers, maps, charts and other resources were downloaded from www.gsacom.com in under five years.

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