# Mobile HD voice: Global Update report

Global mobile Suppliers Association

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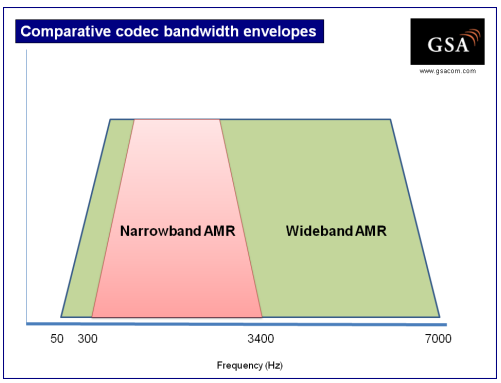
## GSM/3G MARKET/TECHNOLOGY UPDATE

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.

**164 mobile operators commercially launched HD voice service in 88 countries**

***130 on 3G/HSPA networks***
***17 on 2G/GSM networks***
***63 on LTE networks (VoLTE)***

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

*HD voice service is commercially launched in Afghanistan, Albania, Armenia, Australia, Austria, Bahrain, Bangladesh, Belarus, Belgium, Bulgaria, Cambodia, 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, Tanzania, 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 (launched in South Korea) 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:

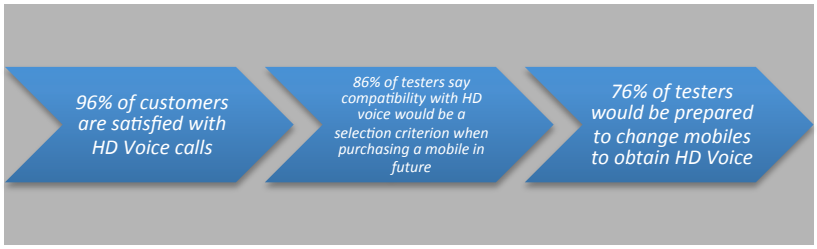
**Ecosystem - user devices**

- 370 VoLTE-capable devices (with carrier and frequency variants) including 342 smartphones are announced (GSA)

**USA**

- AT&T announced 27 million VoLTE customers (Q4 2015)

Orange France studies confirmed:

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### *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 as confirmed in this report.

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.**

## 63 operators have commercially launched VoLTE HD voice service in 35 countries

See the table on the following pages

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

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. In South Korea, Minister Yang Hee Choi announced on 23 November 2015 VoLTE calling interconnection activation between all three mobile network operators. Many other operators and nations are seeking interoperability for HD voice users as quickly as possible. Other IPX providers include Aicent, BICS, BT, iBasis, TI Sparkle, TSIC, and Tata Communications.

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 Available on the GSMA (GSM Association) website

http://www.gsma.com/network2020/hd-voice/join-the-momentum-around-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

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| OPERATOR | HSPA network | GSM network | LTE network | COUNTRY | HD voice service 1st launch date |
|---|---|---|---|---|---|
| Orange Moldova | ☑ | | | Moldova | 09.09.2009 |
| Orange France (VoLTE launched 25.01.16) | ☑ | | ☑ | France | 19.07.2010 |
| Orange Armenia | ☑ | | | Armenia | 24.02.2010 |
| Orange UK | ☑ | | | UK | 01.09.2010 |
| SFR | ☑ | | | France | 09.2010 |
| Orange Spain (Catalonia region) | ☑ | | | 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 (initially HSPA, with GSM from 27.04.2011) | ☑ | ☑ | | Russia | 10.11.2010 |
| Orange Luxembourg | ☑ | | | Luxembourg | 08.12.2010 |
| CSL Limited | ☑ | | ☑ | Hong Kong | 12.2010 |
| Turkcell (VoLTE launched 01.04.16) | ☑ | | ☑ | Turkey | 17.01.2011 |
| TIM (VoLTE launched 21.12.15) | ☑ | | ☑ | Italy | 27.01.2011 |
| WIND Mobile | ☑ | | | Canada | 02.2011 |
| Vodafone Turkey (VoLTE launched 01.04.16) | ☑ | | ☑ | Turkey | 01.04.2011 |
| Orange Mauritius | ☑ | | | Mauritius | 07.04.2011 |
| Orange Réunion | ☑ | | | Réunion | 2011 |
| Orange Romania (VoLTE launched 14.09.15) | ☑ | | ☑ | Romania | 13.05.2011 |
| 3 UK (VoLTE launched 15.09.15) | ☑ | | ☑ | UK | 05.2011 |
| Orange Dominicana | ☑ | | | Dominican Republic | 06.2011 |
| Du | ☑ | | | UAE | 06.2011 |
| M-TEL | ☑ | | | Bulgaria | 14.06.2011 |
| Telstra (VoLTE in 2015) | ☑ | | ☑ | Australia | 24.06.11 |
| Orange Uganda | ☑ | | | Uganda | 07.07.2011 |
| T-Mobile Poland | ☑ | ☑ | | Poland | 17.08.2011 |
| Orange Kenya | ☑ | | | Kenya | 25.08.2011 |
| T-Mobile Austria | ☑ | | | Austria | 29.08.2011 |
| Mobitel | ☑ | | | Slovenia | 06.09.2011 |
| VIP Serbia | ☑ | ☑ | | Serbia | 12.09.2011 |
| Orange Switzerland | ☑ | | | Switzerland | 13.09.2011 |
| T-Hrvatski Telekom | ☑ | Planned | | Croatia | 14.09.2011 |
| TDC | ☑ | | | Denmark | 26.09.2011 |
| A1 Telekom (VoLTE launched 30.11.15) | ☑ | | ☑ | Austria | 10.2011 |
| T-Mobile CZ | ☑ | | ☑ | Czech Republic | 26.10.2011 |
| DT (VoLTE launched 11.01.16) | ☑ | ☑ | ☑ | Germany | 02.11.2011 |
| 3 Austria | ☑ | | | Austria | 16.11.2011 |
| Si.mobil | ☑ | | | Slovenia | 15.12.2011 |
| Bell Mobility (VoLTE launched in February 2016) | ☑ | | ☑ | Canada | 24.01.2012 |
| Swisscom (VoLTE launched 24.06.15) 2G in 2015 | ☑ | ☑ | ☑ | Switzerland | 01.02.2012 |
| Dialog Axiata | ☑ | | | Sri Lanka | 14.02.2012 |
| 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 | ☑ | | | UK | 08.2012 |
| SK Telecom | | | ☑ | South Korea | 08.08.2012 |
| LG U Plus | | | ☑ | South Korea | 08.08.2012 |
| Orange Jordan | ☑ | | | Jordan | 11.08.2012 |
| MTS | ☑ | | | Russia | 12.09.2012 |
| Telus | ☑ | | | Canada | 21.09.2012 |
| Meo | ☑ | | | Portugal | 28.09.2012 |
| Rogers Wireless | ☑ | | ☑ | Canada | 10.2012 |

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| | | | | | |
|---|---|---|---|---|---|
| KT | | | ☑ | South Korea | 08.10.2012 |
| Smart | ☑ | | | Philippines | 22.10.2012 |
| Bouygues Telecom (VoLTE launched 25.11.15) | ☑ | | ☑ | France | 11.2012 |
| DTAC (VoLTE launched 15.10.15) | | ☑ | ☑ | Thailand | 11.2012 |
| Ooredoo | ☑ | | | Qatar | 27.11.2012 |
| 3 Denmark | ☑ | | | Denmark | 20.12.2012 |
| Airtel | ☑ | | | Nigeria | 22.12.2012 |
| Orange (Partner) | ☑ | | | Israel | 25.12.2012 |
| T-Mobile US (HSPA first, VoLTE launched 22.05.14) | ☑ | | ☑ | USA | 08.01.2013 |
| Axis - Axiata | ☑ | | ☑ | Indonesia | 22.01.2013 |
| DNA (VoLTE launched 14.03.16) | ☑ | | ☑ | Finland | 28.01.2013 |
| Chunghwa Telecom | ☑ | | | Taiwan | 05.02.2013 |
| Orange CI | ☑ | | | Ivory Coast | 28.02.2013 |
| Airtel | ☑ | | | Kenya | 05.03.2013 |
| Airtel | ☑ | | | Malawi | 05.03.2013 |
| Airtel | ☑ | | | Rwanda | 05.03.2013 |
| StarHub (HSPA first, VoLTE launched 28.06.14) | ☑ | | ☑ | Singapore | 07.03.2013 |
| Telenor (VoLTE launched 20.01.16) | ☑ | | ☑ | Norway | 19.03.2013 |
| G-Mobile | ☑ | | | Mongolia | 20.03.2013 |
| Mobily | ☑ | | | Saudi Arabia | 03.2013 |
| STC | ☑ | | | Saudi Arabia | 03.2013 |
| Netcom | ☑ | | | Norway | 04.2013 |
| Cosmote | ☑ | | | Romania | 15.04.2013 |
| AIS (VoLTE launched 25.03.16) | ☑ | | ☑ | Thailand | 06.05.2013 |
| Orange Slovakia | ☑ | | | Slovakia | 16.05.2013 |
| Cosmote | ☑ | | | Greece | 11.06.2013 |
| Cmogorski Telekom | ☑ | ☑ | | Montenegro | 24.06.2013 |
| Vodafone (VoLTE launched December 2015) | ☑ | | ☑ | Australia | 25.06.2013 |
| Magyar Telekom | ☑ | | | Hungary | 01.07.2013 |
| Vodafone | ☑ | | ☑ | Germany | 26.07.2013 |
| Bite | ☑ | | | Lithuania | 31.07.2013 |
| Bite | ☑ | | | Latvia | 05.08.2013 |
| Kyivstar | | ☑ | | Ukraine | 08.08.2013 |
| Telenor | ☑ | | | Hungary | 29.08.2013 |
| Telenor Serbia | ☑ | ☑ | | Serbia | 16.09.2013 |
| Vodafone | ☑ | | | New Zealand | 07.11.2013 |
| MTS | ☑ | | | Belarus | 11.12 2013 |
| Viva | ☑ | | ☑ | Kuwait | 25.12.2013 |
| Orange | ☑ | | | Mali | 01.2014 |
| 2 Degrees | ☑ | | | New Zealand | 21.01.2014 |
| Orange Sonatel | ☑ | | | Senegal | 14.02.2014 |
| TeliaSonera | ☑ | | | Sweden | 01.03.2014 |
| Telefonica O2 (VoLTE launched April 2015) | ☑ | | ☑ | Germany | 12.03.2014 |
| Nawras | ☑ | | | Oman | 22.03.2014 |
| Inwi | ☑ | ☑ | | Morocco | 24.03.2014 |
| Tele2 | ☑ | | | Sweden | 25.03.2014 |
| Viva | ☑ | | | Bahrain | 29.03.2014 |
| Zain | ☑ | | | Bahrain | 31.03.2014 |
| EMT | ☑ | | | Estonia | 06.05.2014 |
| 3 HK | | | ☑ | Hong Kong | 15.05.2014 |
| Altel | ☑ | ☑ | | Kazakhstan | 15.05.2014 |
| Etisalat | ☑ | | | Sri Lanka | 22.05.2014 |
| AT&T Mobility | | | ☑ | USA | 23.05.2014 |
| T-Mobile | ☑ | | | Netherlands | 27.05.14 |
| SingTel | | | ☑ | Singapore | 31.05.2014 |
| NTT DoCoMo | | | ☑ | Japan | 06.2014 |
| Beeline (VoLTE launched 12.08.15) | ☑ | ☑ | ☑ | Russia | 16.06.2014 |

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| | | | | | |
|---|---|---|---|---|---|
| Robi Axiata | ☑ | | | Bangladesh | 22.06.2014 |
| Vodafone | ☑ | | | Netherlands | 02.07.2014 |
| Orange | ☑ | ☑ | | Poland | 28.07.2014 |
| Smartone | | | ☑ | Hong Kong | 08.2014 |
| AMC | ☑ | | | Albania | 08.08.2014 |
| Ooredoo | ☑ | | | Myanmar | 15.08.2014 |
| MTN | ☑ | | | South Africa | 20.08.2014 |
| Telenor (VoLTE launched 30.11.15) | ☑ | | ☑ | Denmark | 03.09.2014 |
| Vodafone | ☑ | | | UK | 11.09.2014 |
| Verizon Wireless | | | ☑ | USA | 15.09.2014 |
| Vodafone | ☑ | | | Albania | 08.10.2014 |
| Tele2 | ☑ | | | Lithuania | 15.10.2014 |
| Vodafone | ☑ | | ☑ | Spain | 15.10.2014 |
| Tele2 | ☑ | | | Latvia | 14.11.2014 |
| KDDI | | | ☑ | Japan | 12.2014 |
| Softbank | ☑ | | ☑ | Japan | 12.12.2014 |
| Polkomtel / Plus | ☑ | | | Poland | 22.12.2014 |
| Megafon | ☑ | ☑ | | Tajikistan | 25.12.2014 |
| Digi | ☑ | | | Malaysia | 2014 (est) |
| Elisa | ☑ | | | Estonia | 05.01.2015 |
| Beeline | ☑ | | | Uzbekistan | 24.02.2015 |
| Beeline | ☑ | | | Kyrgyzstan | 04.03.2015 |
| Vodafone | ☑ | | | Malta | 30.03.2015 |
| M1 | | | ☑ | Singapore | 08.04.2015 |
| Vodacom | | | ☑ | South Africa | 10.04.2015 |
| Slovak Telekom | ☑ | | | Slovakia | 21.04.2015 |
| Ambit Microsystems | | | ☑ | Taiwan | 15.05.2015 |
| FarEasTone | | | ☑ | Taiwan | 10.06.15 |
| Swisscom | | | ☑ | Liechtenstein | 10.06.2015 |
| AWCC | ☑ | ☑ | | Afghanistan | 15.07.15 |
| Vodafone | | | ☑ | Italy | 16.07.15 |
| Optus | ☑ | | | Australia | 20.07.2015 |
| SEATEL | | | ☑ | Cambodia | 26.07.15 |
| Taiwan Star Mobile | | | ☑ | Taiwan | 07.2015 |
| China Mobile | | | ☑ | China | 18.08.15 |
| China Mobile Hong Kong | | | ☑ | Hong Kong | 08.09.2015 |
| Vodafone | | | ☑ | Portugal | 28.09.2015 |
| Vodafone | ☑ | ☑ | | Czech Republic | 08.10.2015 |
| Gabon Telecom | ☑ | | ☑ | Gabon | 27.10.15 |
| Smile | | | ☑ | Uganda | 23.11.15 |
| Evolve Broadband (date estimated) | | | ☑ | USA | 2015 |
| KPU Telecommunications | | | ☑ | USA | 2015 |
| Taiwan Mobile | | | ☑ | Taiwan | 26.01.16 |
| Tele2 | ☑ | | | Russia | 09.02.16 |
| Smartfren | | | ☑ | Indonesia | 19.02.16 |
| Smile | | | ☑ | Nigeria | 08.03.16 |
| Smile | | | ☑ | Tanzania | 08.03.16 |
| Vodafone | ☑ | | | Qatar | 20.03.16 |
| Tele2 | | | ☑ | Netherlands | 29.03.16 |
| China Unicom (VoLTE launched March 2016) | | | ☑ | China | 03.2016 |
| EE | | | ☑ | UK | 03.2016 |
| Turk Telecom | | | ☑ | Turkey | 01.04.16 |
| | | | | | |
| Total = 164 HD voice operators (enabled by W-AMR) Excludes MVNOs, Trunked Radio Systems | 130 on 3G/HSPA networks | 17 on GSM networks | 63 VoLTE on LTE networks | 88 countries | |

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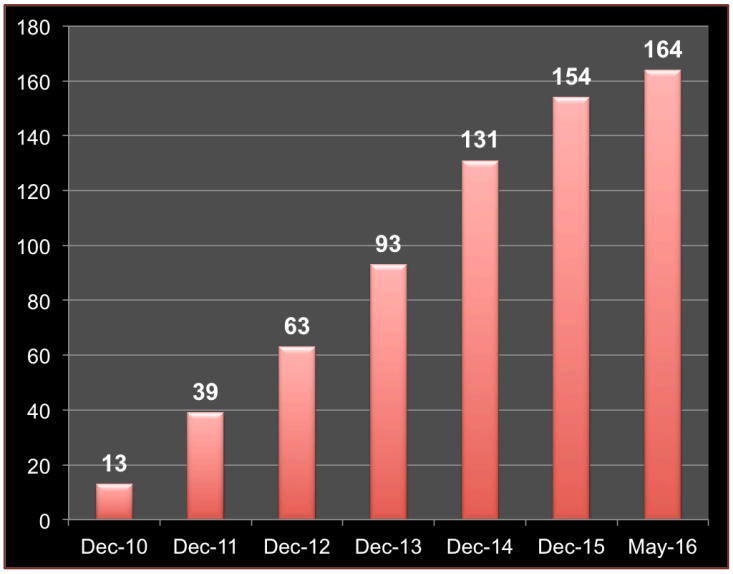
## HD voice (W-AMR) on LTE networks (VoLTE)

LTE systems are all-IP, optimized for data transfer. LTE does not include any circuit switched capability as used on previous technologies for voice and SMS services. Since voice and SMS generate in the region of 60-70% of operator revenues globally, voice service is needed on LTE networks and is a priority for many LTE operators as network coverage improved (increasingly nationwide) and as penetration and usage of LTE smartphones increased. In the first phase of voice evolution, voice calls are handled in a circuit switched network using CSFB (circuit switched fall back). The LTE data connection "falls back" to a legacy 2G/3G voice network connection prior to initiation of a voice call. This solution was favoured by many LTE operators initially, with VoLTE as the goal. Some LTE operators launched voice service with VoLTE in one step. With the VoLTE solution (GSMA spec. VoLTE IR.92, based on 3GPP standards), subscribers are able to use HD voice and other richer communication services using LTE smartphones. An operator needs an IMS (IP Multimedia System) core network and the LTE radio access network and Evolved Packet Core must also support VoLTE (usually achieved by software upgrade).

Also see ***SNAPSHOT: VoLTE Global Status*** available for free download at www.gsacom.com




*HD voice service launches (W-AMR on GSM, WCDMA-HSPA or LTE networks) 2009 – 2016*

*Source: GSA reports*

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

HD voice compatible user devices incorporating W-AMR are mainstream. Several hundred products have been launched in the market by the leading smartphone brands and others, especially for use on 3G/HSPA networks, and increasingly for use on 4G/LTE systems. 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 and provides product details in GSA's GAMBoD user devices database. Initially operators deployed VoLTE for delivering HD voice service for LTE users. As stated in GSA's Status of the LTE Ecosystem report published on April 7, 2016 a total of 370 VoLTE-capable devices (counting carrier and frequency variants) including 342 smartphones are announced across all price points. For more details about all LTE user devices download the *Status of the LTE Ecosystem report* from www.gsacom.com

### *ABOUT GSA*

*GSA (Global mobile Suppliers Association) represents GSM/EDGE/WCDMA-HSPA/HSPA+, LTE/LTE-Advanced, LTE-Advanced Pro 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 26,000 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. Register for free downloads of reports, information papers, maps, charts, etc. at http://www.gsacom.com*

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