

Digital broadcast TV— Coming soon to a mobile phone near you



The face of mobile entertainment is rapidly changing with the advent of live digital TV (DTV) services for cellular phones. Thanks to advances in technology, consumers will have the opportunity to watch live television shows, get traffic reports or watch sporting events—all on the go.

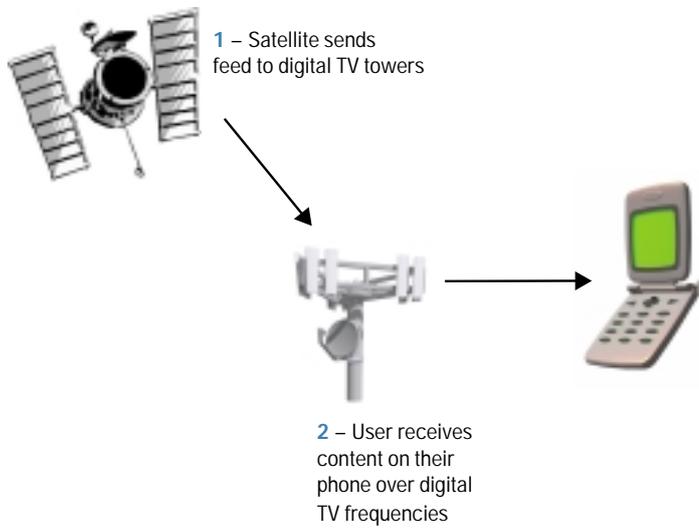
O V E R V I E W

The TV services on mobile phones that consumers are most familiar with today is streaming TV over the cellular network, similar to how you would stream video over the Internet. MobiTV™ offered in the United States on some Sprint PCS Vision phones is one such service, which offers streaming of live or recorded TV over the cellular network. There is a downside to streamed DTV services over the network, it uses voice bandwidth, therefore lowering the overall capacity of the network for all users. While services like MobiTV are innovative, the real break-through will come from LIVE broadcast TV. Users will enjoy the same entertainment experience from the living room TV set, but delivered anywhere in real-time on your mobile phone.

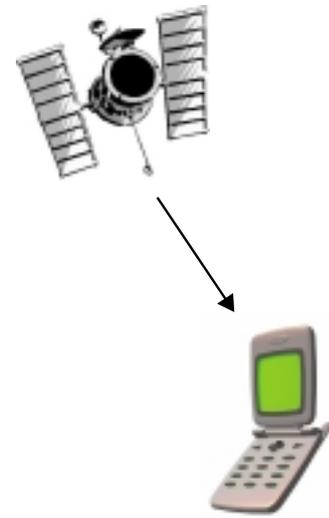
What will broadcast mobile DTV services of the future look like? The consumer experience will be similar to having digital cable or satellite quality programming on a mobile phone using a DTV broadcasting standard over a separate air interface. Users will be able to watch a variety of live television programs, traffic reports, movie clips, music videos, listen to digital music or view a variety of entertainment and content options. Mobile DTV will offer high quality live broadcast TV (20-30 frames per second) paired with full audio for a mobile viewing experience unlike anything available today. In addition, other services will be available such as a menu/guide system and pay per view channels to enhance the viewing experience.

How it works—two options for delivery

1a: Satellite to digital TV tower, terrestrial broadcast to handset



1b: Satellite sends feed directly to handset



So, how are consumers going to get these great services? There are several delivery methods under consideration. As shown in figure 1a, formatted TV content to DTV towers will come from satellite. Consumers will then receive the content on their mobile phone terrestrially from the tower over regional specific DTV frequencies. This is the likely method for transmission for DTV in regions such as Europe, North America and parts of Asia Pacific.

Another option is currently offered in Korea (figure 1b) where the satellite sends the feed directly to the phone. With direct feed from the satellite users can have problems with in-building transmission. Plus there are other options for taped sitcom or show delivery where a provider can download the content ahead of time using satellite, Internet or other transmission means.

Regardless of delivery method, live broadcast TV will happen in real-time with only very slight delay—similar to how satellite feeds are received on a TV set today. Cellular operators will be able to bundle services to offer packages for various user interests, be it sports, entertainment and more.

Market projections

Early field testing and roll-out of mobile broadcast DTV is already taking place in several areas of the world, with consumer trials underway. Europe, Japan and the U.S. have trials underway in select cities, and Korea has DTV offerings using a direct link from the satellite to the phone. By 2006, larger consumer trials are expected in all areas of the world, with wide availability of mobile broadcast TV services expected in 2007, making it a pivotal year for the DTV market.

In 2007, infrastructure is expected to reach a robust build-out, fostering mass deployment in major regions of the world. By 2007, DTV standards are also expected to be more bullet-proof thanks to trials being held today in Germany, Japan and the U.S.

Mobile DTV trials are expected to be especially popular in countries and cities with public transportation. Safety issues arise with commuters watching TV while trying to drive their cars. However, public transportation creates an opportune time for cellular operators and content providers to fill with their services. Mobile broadcast DTV during the commute hour has the potential to change "prime time" from 7 or 8 pm when people arrive home from work to 5 or 6 pm when they are tuning in on their train, subway or bus ride home.

DTV roll-out timing

2004	Early field tests in specific cities
2005	Early consumer trials of DVB-H and ISDB-T worldwide
2006	Larger consumer trials /initial deployment
2007	Mass deployment of consumer DTV services

Standards for DTV over mobile phones

As with cellular phones, different standards for digital TV broadcast will be adopted around the world. While no single standard will be used worldwide, the clear standards winners will be those that are open and non-proprietary. Just as open standards fueled the cellular phone market, so too will open standards for the DTV market. Open standards allow better interoperability between devices, creating a market with wider application and services development. Ultimately, this will allow consumers to create the right mix of services for their needs.

DTV handset standards

System	ISDB-T	DVB-H	DMBX
Region/Country deployment	Japan	Europe/US	Korea
Codec Video/Audio	MPEG-2 (H.264) MPEG-2 (AAC)	H.264 (expected) MPEG-2 (BC)	H.264 MPEG4 (BASC)
Frequency/Channel Max bps	6 MHz 23 Mbps	8 MHz 31 Mbps	6 MHz 9.2 Mbps
Modulation	OFDM (13-seg/ch)	COFDM	COFDM
Optimized Power Reduction for Handset	Mobile use 1 seg. only	Time Slicing	None

DVB-H

Europe's DTV broadcast standard is Digital Video Broadcast-Handheld (DVB-H). DVB-H is an open standard specified by the DVB Organization and was created specifically for broadcasting TV content to handheld devices. DVB-H is a version of the DVB-T standard being used for digital service to TV sets in Europe. DVB-H reduces power consumption through time slicing and has been designed around small screen and antenna sizes to give reliable, high-speed reception.

In the United States, Advanced Television Systems Committee (ATSC) is the current DTV standard for TV sets. However, it is an older standard that is unsuitable for mobility. Trials in the U.S. and other parts of the world will likely use the DVB-H standard.

ISDB-T

Japan has chosen Integrated Services Digital Broadcasting—Terrestrial (ISDB-T). ISDB-T is the same system that will be used in Japan to deliver DTV services to the home, allowing greater economies of scale for providers, with minimal service interruption for consumers.

DMB

Korea offers mobile broadcast TV services using the Digital Multimedia Broadcasting (DMB) standard, which provides a direct satellite to mobile phone feed. This method has some limitations since it requires line of sight and is not suited for in-building or underground travel.

DVB-H and ISDB-T both employ an Orthogonal Frequency Division Multiplexing (OFDM) air interface technology, and each includes a technique for power reduction in the tuner. In laymen's terms, this means DVB-H does this through time-slicing so that the tuner can be switched off most of the time and is only on during short transmission bursts. ISDB-T uses a segmented band of thirteen OFDM sub-bands. This allows the tuner to operate over a reduced input bandwidth and also conserves power. OFDM is a very good choice for a mobile TV air interface. It offers good spectral efficiency, immunity to multi-path, good mobile performance, and it works well in single-frequency networks such as those planned for mobile TV.

Challenges

The broadcast mobile DTV market will create new challenges and opportunities for handset OEMs and cellular operators. Operators will be challenged to offer the right mix of services at prices the market is willing to bear. The new service also will push operators to work closely with aggregators and content providers. They will also be challenged to secure content and support digital rights management efforts in the industry to protect copyrighted content. New and different sources of revenue will include standard TV programming as well as advanced options like pay per view and interactive reality TV.

The greatest challenge will lie with the handset OEMs and silicon providers on how to balance increased functionality with what consumers have come to expect from their mobile phones—longer battery-life, small designs and reliable voice service. With the average commute time currently at 30-40 minutes one way, a handset has the potential to be used continuously for 1.5 hours each day, not including additional phone calls or standby time. Current tuners for digital TV sets do not offer the low battery consumption required to give consumers the battery life they expect in a mobile phone. The additional processing power needed for live broadcast TV will also affect power consumption and must be taken into account. As digital broadcast TV moves to mass market, it is possible a phones' battery life could be measured in TV-time, not just talk-time and standby-time.

Mobile DTV will possibly affect the look of the mobile phone. Today's phones typically have one keypad and screen. DTV enabled phones could have multiple displays—one for TV viewing and the other for regular phone and internet services, in addition to the outside display to which we have become accustomed with clam-shell phones. Another consideration is antenna design. Consumers will be unwilling to go back to the days of long, non-retractable antennas. Small antenna designs must be able to receive the live broadcast in all on-the-go scenarios, whether traveling on a train through a tunnel or sitting still at a desk in an interior office of a high rise. Handset manufacturers will have to meet all these needs while continuing to make a smaller phone and lowering the price.

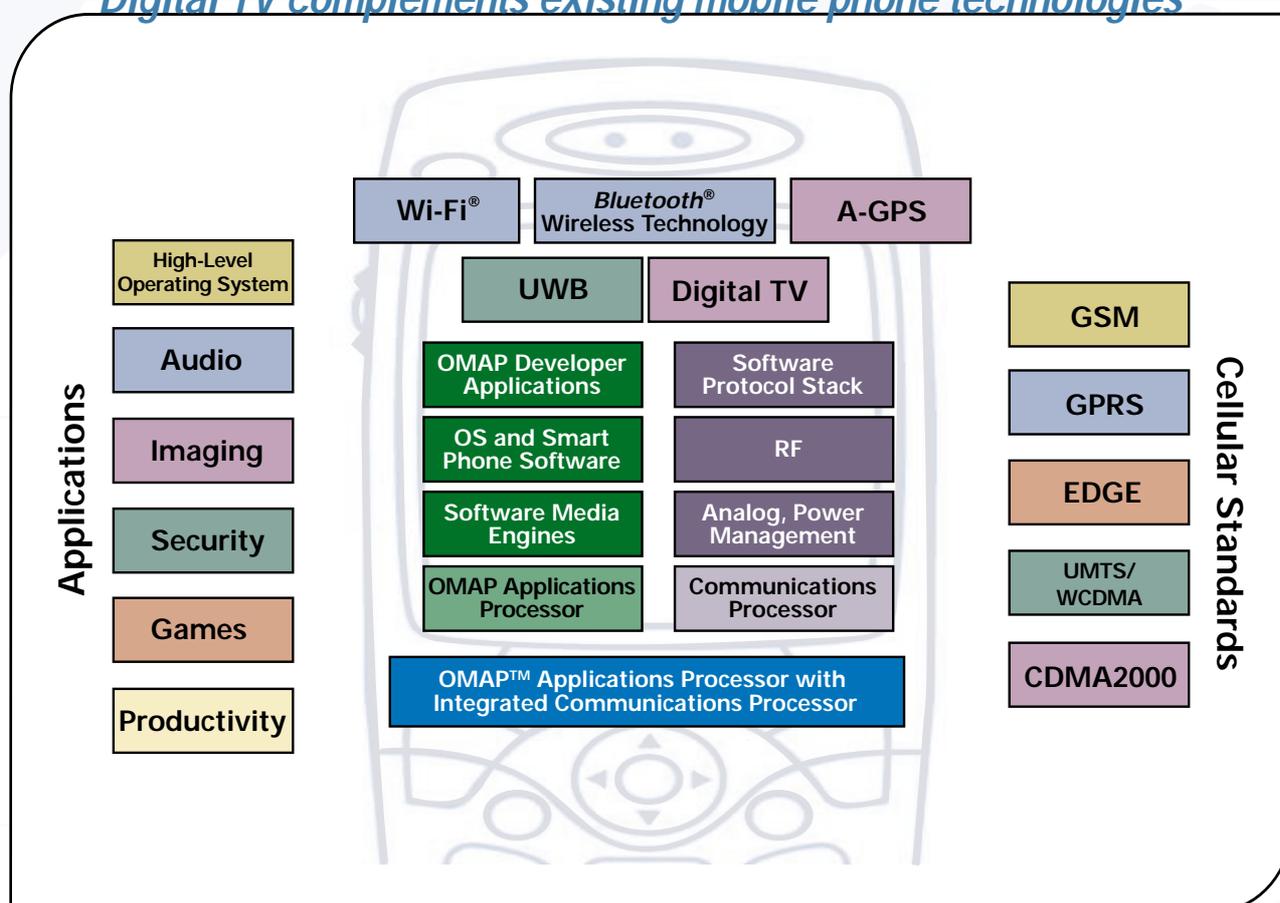
TI's role in mobile DTV

As new silicon and software solutions emerge to support this market, one question that arises is what form they should take—module card or embedded solution. Both options are valid depending on the manufacturers' needs. Module cards offer a drop-in type solution that can decrease time to market. However, module cards require more board space than an embedded solution, increasing the overall size of the phone in a market that is driving the size down. Embedded solutions overcome the size issue, but increase the complexity of the design, thereby moderately increasing time-to-market.

Texas Instruments Incorporated (TI) has been in the wireless market for over 15 years and is the leading manufacturer of wireless semiconductors today. In addition to its wireless expertise, TI provides signal processing technology to meet the demands of the consumer electronics (CE) market, including products for digital still cameras, audio players, digital radio, digital TV and more.

Specifically for mobile DTV, TI has been a player in the analog and streamed TV over cellular network market segments. TI has gained valuable knowledge in the analog mobile TV market with decoders that are being used in deployments today. Likewise, TI's OMAP™ processors are already providing robust streaming capabilities over 2.5G and 3G cellular networks to deliver news clips, downloaded shows and sports highlights to consumers' mobile phones.

Digital TV complements existing mobile phone technologies





Taking advantage of its wireless and CE market experience, TI is now developing a single-chip broadcast DTV design that will combine the tuner, demodulator and processor on one chip to meet the needs of the DVB-H and ISDB-T markets. Using TI's Digital Radio Processor (DRP) technology, the single chip DTV solution will greatly reduce the power consumption and size of DTV handsets. This new DTV solution interfaces with TI's OMAP processor technology to deliver crisp, clear TV broadcasts to mobile phones worldwide.

The mobile broadcast DTV market is an exciting new area with tremendous growth opportunities for the wireless industry and consumers alike. Broadcast TV on a handset combines two of the greatest consumer products of all time—the TV and the mobile phone— and makes the TV experience mobile. And, TI is at the heart of it.

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