HARRIS®

ATSC Mobile Digital Television

Complete Solutions for New Viewership and Revenue Opportunities

Mobile DTV Basics

Mobile DTV is an exciting approach to delivering high-quality, large-scale multimedia content services to mobile and video devices such as mobile phones, portable media players, laptop computers, personal navigation devices and automobile-based "infotainment systems."

For ATSC broadcasters, Mobile DTV represents a significant new revenue stream, as well as a new way to reach new audiences. Implementation costs are relatively low. Mobile DTV's "one-to-many" broadcast model delivers streaming and on-demand multimedia content at a lower cost per viewer than all other schemes that rely on "one-to-one" data transmission, such as packet cellular video.

With Mobile DTV, consumers can tune in to live, local news, traffic information, weather, sporting events or entertainment programs from wherever they may be, using a variety of mobile and video devices. Additionally, Mobile DTV can be used to deliver on-demand programming, public safety information and revenue-generating data-delivery services, such as digital signage.

Without the need for additional broadcast spectrum, ATSC A/153, the technology standard for Mobile DTV, enables local TV stations to deliver live, digital content by overlaying the signal upon their current DTV infrastructure. This standard uses a physical layer based on technology jointly proposed by Harris with technology partners LG and Zenith.

Mobile DTV is "in-band," meaning the service is delivered as part of the terrestrial transmission within the same, existing 6 MHz channel used for current DTV programming. The Mobile DTV system splits the 19.4 Mb/s of capacity into a slice for delivery to DTV receivers and a slice for Mobile/Handheld (M/H) Broadcast that can be received on new Mobile DTV-capable receivers.

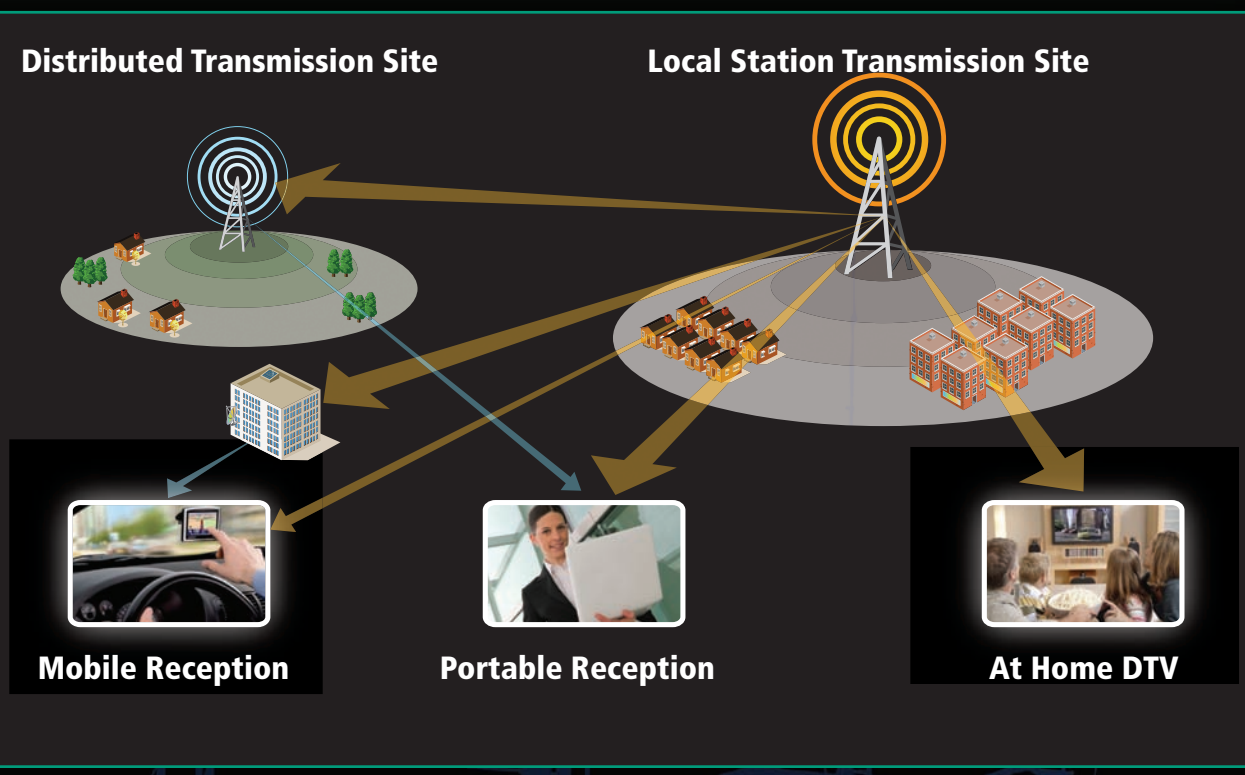
The Harris® MPH™ Mobile DTV solution spans the entire mobile delivery chain, comprising content management, transmission infrastructure and digital signage implementations, as well as test, monitoring and control. The MPH platform leads the industry with a unique, long-term service design, permitting easy upgrade to the latest profit-generating Mobile DTV enhancements. Though it performs best with Harris ATSC transmitters, MPH is also compatible with third-party products.

Harris is the clear leader for delivering content to mobile devices. From content management to infrastructure to transmission and monitoring and control, Harris offers proven workflows that add up to interoperable, intelligent and cost-effective Mobile DTV operations.

Mobile Benefits in Brief

Mobile DTV reaches viewers in places and in ways that other technologies, such as cable and 3G wireless, cannot. The operational and financial benefits include:

- Leveraged investment in ATSC transmission
- Sales and traffic deal management
- Delivery of robust DTV signals to Mobile DTV receiving devices
- Extension of local branding to mobile users
- Redirection of local news, weather, sports and traffic information to consumers on the go
- Addition of multiple program streams of mobile content per station, with each stream independently transmitting any combination of video, audio and text
- An Electronic Service Guide (ESG) that supports rapid channel changing, video-on-demand, banner ads, voting, e-commerce, audience measurement and more
- New revenue opportunities based on subscription, advertising and sell-through transactions



Mobile DTV uses the same broadcast spectrum and transmission infrastructure as its primary DTV programming. Distributed Transmission Systems (DTS) and other methods are used to improve and expand DTV and Mobile DTV coverage.

Profit
by Giving Consumers What They Want

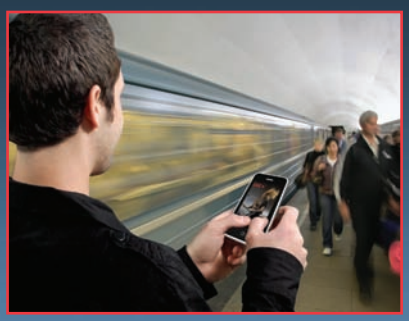
Mobile DTV provides an open pathway for what consumers want — information, communication and entertainment — in more places, at more times and with more control. Mobile DTV should not be confused with mobile video, the rather broadly defined product category that encompasses any sort of video delivered to mobile devices. Mobile DTV brings traditional programmed, scheduled, local and network content to mobile devices.

Market research, actual trials and commercial launches confirm that traditional broadcast and network television content will drive mass adoption of portable video use. Surveys, as well as hard data from actual consumer trials, indicate that consumers relate to a full-channel simulcast of TV signals much more readily than customized or menu-driven short-form content. The power of the local, digital broadcast spectrum to deliver TV content will transform the category from video snacking to TV viewing.

Local broadcasters currently create news, weather, traffic and sports programming that can easily be repurposed for Mobile DTV. Together with highly promoted and branded network content, local content will be fundamental to the mass appeal and adoption of mobile TV — as it has been for the past half century for every major advance in television technology, such as cable, video-on-demand and digital-video-recorders. Similar to the history and development of cable TV content and services, the mass appeal and adoption of Mobile DTV will provide the base upon which to successfully launch add-on premium, enhanced and interactive services.

U.S. and international trial data clearly show that Mobile DTV adds to current TV viewership by making it easier to watch TV mid-day (when Internet viewing peaks) and morning and evening rush. The data reveals robust, frequent usage and viewership among both men and women, particularly younger men and women. Mobile DTV plays right to the needs of young people, as they quickly form new habits around technology that brings content to them where and when they want it. Mobile DTV also immediately makes local and network TV content accessible, hence relevant, to young people, a coveted audience for advertisers.

Additionally, Mobile TV expands opportunities for reaching consumers with the content and messages in which they have interest, such as instant and localized public safety, disaster and weather alerts.



A Full Range of Receivers for True Mobility

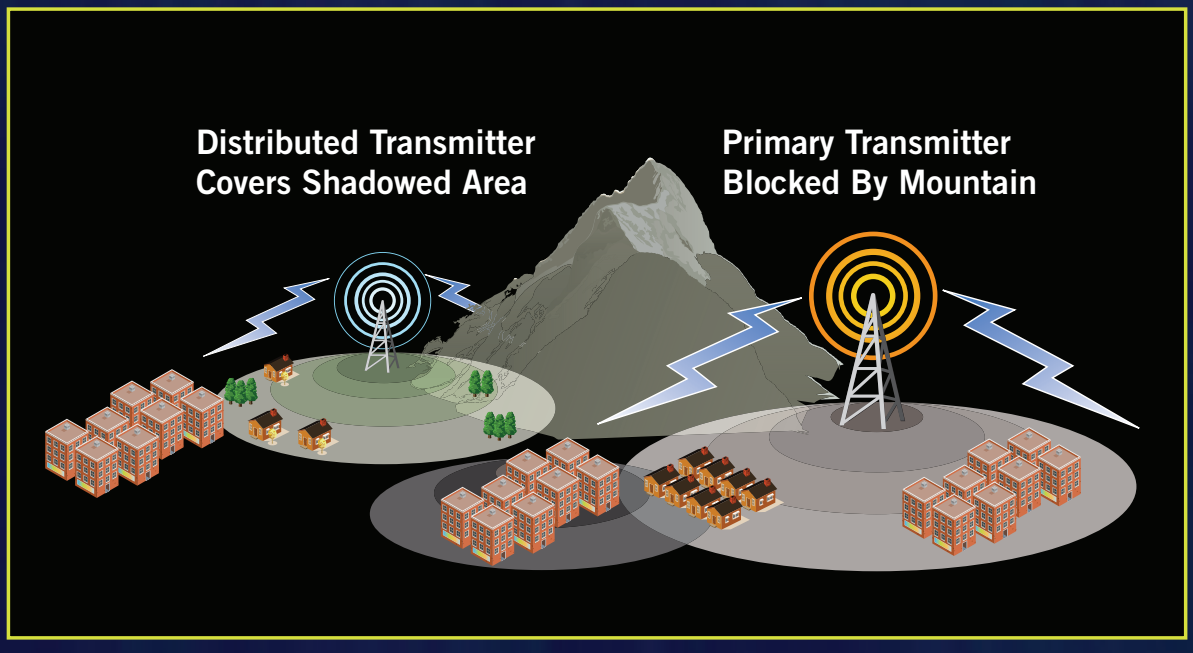
Viewers can access Mobile DTV programming from the widest range of devices of any multimedia delivery system. It's projected that, by 2012, there will be 130 million Mobile DTV-capable handsets and 25 million portable Mobile DTV receivers deployed. Here's what they'll likely be using:

- **Mobile Phone**
  Almost always on hand, the mobile phone is an essential device for connecting to millions of viewers.
- **Portable Media Player**
  Live, local broadcasts make the traditional mode of watching video on the go even more mobile.
- **Netbook and Laptop Computers**
  The laptop is the perfect device for bundling broadcast television with a large-screen viewing area.
- **WiFi-Enabled App Phones**
  With a wealth of new applications released daily, many consumers are turning to the iPhone, iPod Touch Android, BlackBerry and similar devices as their go-to source for communication, information and entertainment.
- **Gateway Device**
  Several companies have introduced devices to "receive and relay" Mobile DTV programming. Tivit, for example, takes the broadcast signal and transmits it to WiFi-enabled handhelds or even home networks. Cydle combines the functions of smartphone charging dock and Mobile DTV receiver with a built-in battery for portable viewing.
- **Navigation Device**
  On the road or in the park, GPS systems are increasingly popular devices, now used by millions for their day-to-day activities.
- **Automobile-Based**
  Whether factory-installed or after-market, Mobile DTV is the perfect addition to the family vehicle.

More Viewers
for More Revenue

To get the most benefit from Mobile DTV, stations will want to maximize their coverage to increase the population of potential viewers. In addition to filling gaps in currently licensed service areas, stations have the opportunity to expand their coverage area through a network of low-power transmitters and/or partnerships with affiliated stations. The goal is to retain viewers for as long as possible as they commute to work, head to the beach, run Saturday errands and engage in their other lifestyle activities.

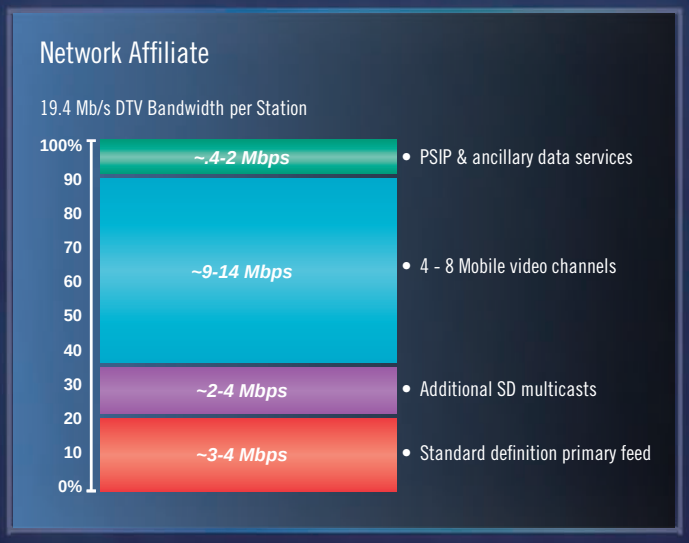
Harris has the expertise and product portfolio to help you improve your footprint efficiently and economically using standalone, low-power transmitters and sophisticated solutions, such as distributed transmission systems and multi-frequency networks. The Harris white paper, *Coverage Enhancement for Mobile DTV*, explains these issues further and describes our unique ability to engineer and deliver coverage improvement strategies.

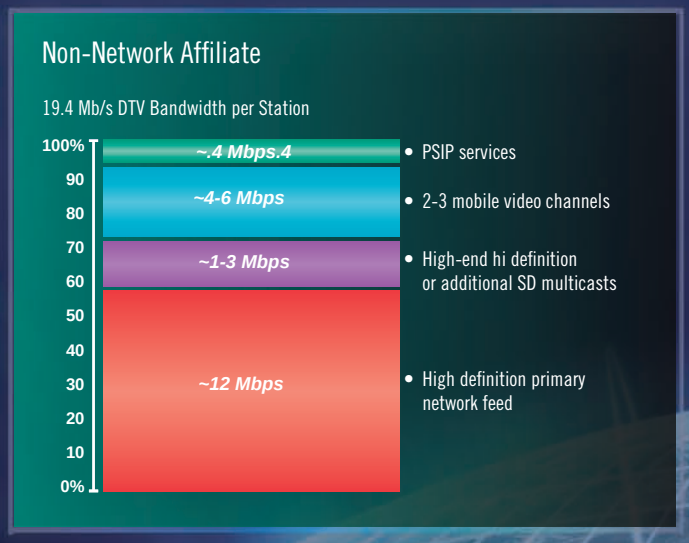


Mobile DTV Technology Tools

Bandwidth Flexibility for Mobile Transmission

Digital TV allows for bandwidth flexibility, providing a number of possibilities for broadcasters to divide bandwidth and distribute channel usage. The illustrations below show examples of channel usage for mobile operation.





Mobile DTV Technology Tools

Mobile DTV Performance Capabilities

Mobile DTV enables broadcasters to deliver consistent performance and functionality across a range of service requirements:

- **Video Quality**
  Excellent viewing experience using H.264 video encoding now, and even better resolution (up to 480p) in the future.
- **Audio Quality**
  Assured through the use of AAC-HE audio coding. This high-quality audio allows stations to consider audio-only programming, such as local sports, to attract additional audiences at low cost.
- **Mobile Reception**
  Clear, consistent reception in vehicles traveling at speeds greater than 100 miles per hour. The system processes the mobile program stream(s) with additional forward error correction and data redundancy to help ensure successful reception.
- **Efficient/Flexible Use of Spectrum**
  Mobile DTV provides for robust delivery of programming. The IP-based payload supports both streaming and non-real-time file delivery, while enabling cross media compatibility. Bandwidth flexibility enables eight 630 kbps data streams that can each support multiple services.
- **Backward Compatibility**
  One hundred percent backward compatibility with all existing/deployed ATSC consumer equipment/receivers. Compatibility eliminates the risk of DTV service disruption and reduces additional equipment cost for broadcasters.
- **Device/UI Parameters**
  With only a single receiving antenna required, design options are maximized and ease of use is enhanced. Convenience features (e.g., ESG, time-shifting and storage) are part of the system architecture.
- **Power Savings**
  Significant mobile/handheld receiver power savings result from bursted transmission that maximizes receiver battery life by allowing receiver RF circuitry to be cycled on part-time.
- **Service Protection**
  Viewer identification, access control and paid service offerings are all available options.
- **Automatic Viewer Transfer**
  As a receiver leaves a station's coverage area, it can seek adjacent signals to hand-off viewers to signals with the same or similar programming. Station collaboration allows viewers to stay with a single program over a large geographic region.

Electronic Service Guidance

Service guides have been proven to increase customer satisfaction. Richer information means the user spends more time in the guide or Mobile DTV application. For broadcasters, this is an opportunity for advertising and co-promotion, interstitial content, adjunct content delivery, links to additional content and interactivity.

Mobile DTV offers three service guide levels:

Signaling

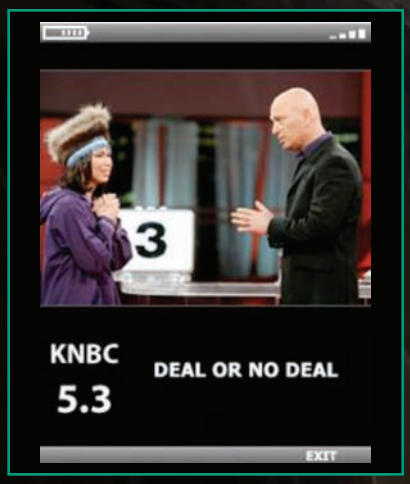
Channel information, including major/minor number, short name and service category, is scanned and cached. "What's On Now" data can include program title, genre, ration and duration.

Announcement

Announcement enhances the user experience with channel icons and more complete program titles and descriptions, along with information on upcoming programs.

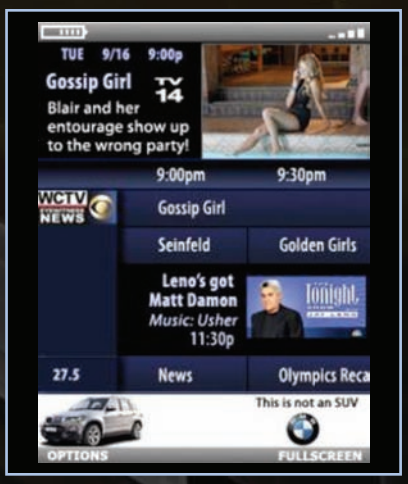
Electronic Service Guide

The ESG system provides program guide and system announcement information about the programs that are in the mobile service to enable easy channel change. Basic features include delivery of channel icons, complete program titles, description, ratings and upcoming program information. Advanced system features add channel previews, Web links, banner advertising, news and information summaries, interactivity, online transactions and non-real-time data delivery. The result is a variety of exciting ways to monetize your content and open new revenue streams.



Basic Signaling

Additional information via Announcement



Time grid ESG

Business Model Opportunities

A study by market research firm In-Stat reveals that consumers are increasingly willing to view ads as part of a mobile media experience, highlighting the potential for a smooth transition of local broadcasting's free-to-air value proposition to mobile. The potential for subscription-based services is also strong, as demonstrated by markets around the world.

With the availability of these new programs for "consumers on the go," broadcasters can develop new formats for their marketplace, or augment their existing format by adding a mobile version of their main channel. This offers advertisers new opportunities to reach mobile consumers.

Additionally, offering 24-hour news, traffic and weather feeds to mobile users can leverage new broadcast brands. Broadcasters are local community stakeholders, and the sky is the limit for what they can offer to viewers, such as expanded sports coverage for avid high school and college fans, or a music-based children's channel for backseat viewers in the family minivan. Mobile DTV can reignite and excite audiences — plus, the added channels can translate into additional revenue with an expanded product available for sale.

Partnerships for Growth

If a station does not have extensive local programming or production capabilities, there are a large number of program providers who can offer high-quality content services that can be easily automated for playback and minimize a station's operational requirements. Stations can also benefit from leasing out bandwidth and providing a delivery "pipe" for content providers.

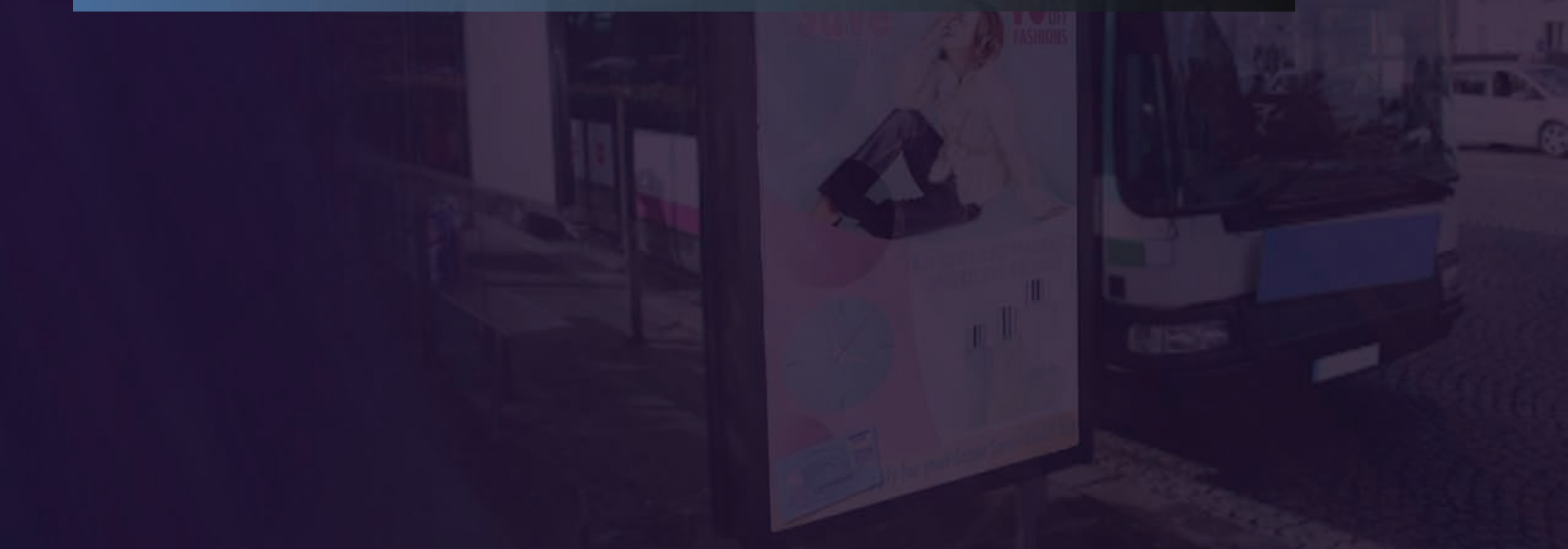
Broadcasters in a given market could also partner to operate a global network with each station contributing content, bandwidth, management and/or advertising sales. A consolidated presentation would encourage viewers and lay the groundwork for individual stations to expand their own Mobile DTV offerings. Such "networks" could also cross multiple markets.

Partnerships with traditional competitors may also reap rewards. Stations may want to tap the resources of cable operators — subscriber management, billing and collection, national content, cross-platform service bundles — to supplement their local content, sales and Mobile DTV bandwidth. Wireless operators may be approached in the same way, and those providing national content via MediaFLO may be motivated to partner with a DTV station to offer joint content on a dual-mode receiver platform with a common program guide.

Mobile DTV Applications

Attract new customers and generate new revenue streams through new interactive applications, including premium content, weather, traffic, news and more.

- **Sports Polling**
  Innovative surveying enables interaction with the user by recording their input on custom polls.
- **Local Weather Updates**
  Weather applications keep the user informed of outside conditions.
- **Info-Service (Transportation)**
  Engage viewers by offering current road conditions.
- **Service Guide (Audience Measurement)**
  Interactive features have the capability to measure and record audience viewing data.
- **M-Commerce Capabilities**
  Optimize air time by connecting to the viewer with interactive programs that allow for mobile retail.
- **Interactive Advertising Insertion**
  Personalize advertisements that deliver the most marketable products to the specific viewer.
- **Digital Signage**
  Deliver content to digital signage when the platform is moving. Buses, trams, airport shuttles and other forms of public transportation can have geolocation-based advertising, informing passengers of nearby restaurants and shops.
- **Non-Real-Time Services**
  Enable the delivery and local storage of content in the Mobile DTV receiver for playback/display at a later time. For example, local advertiser information can be sent in advance; when a device determines that the viewer is nearby, the promo is displayed. Another example might involve the Mobile DTV receiver in the vehicle gathering content for playback on a trip.



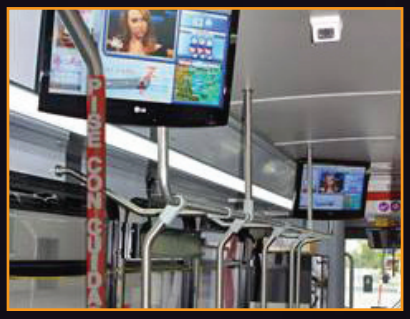
The ATSC Mobile DTV Standard

The Advanced Television Systems Committee (ATSC) approved the A/153 ATSC Mobile DTV Standard on October 15, 2009, less than four years after the standards-setting process commenced. This standard uses a physical layer based on technology jointly proposed by Harris, LG and Zenith. From the beginning, Harris was intensely involved in the development efforts, which involved participants from all over the world and across television and mobile device industries.

The A/153 ATSC Mobile DTV system achieves the robustness necessary for mobile reception by adding extra training sequences and forward error correction. The Mobile DTV system converts the current 8-VSB emission into a dual-stream system without altering the emitted spectral characteristics. It does this by selecting some of the MPEG-2 segments (corresponding to MPEG-2 transport packets in the current system) and allocating the payloads in those segments to carry the Mobile DTV data in a manner that existing legacy receivers ignore.

The standards-development process enabling broadcasters to deliver television content and data to mobile and handheld devices using the DTV broadcast signal began in April 2007. A number of committees were formed to work in three primary elements:

- **Physical Layer**
  Encompassing backward-compatible additions to the DTV emissions stream to facilitate mobile and handheld reception
- **Management Layer**
  Including signaling, announcement, file delivery and other functions such as conditional access and content protection
- **Presentation Layer**
  Focused on the video and audio formats and compression systems



Harris tested the first Mobile DTV station using the technology that would later become the ATSC standard in February 2007 in Columbus, Ohio. A significant milestone for the ATSC Mobile DTV process was an Independent Demonstration of Viability (IDOV) field test conducted in the first quarter of 2008 in San Francisco and Los Angeles. These tests, supervised by the Open Mobile Video Coalition (OMVC), compared the performance of the system proposed by Harris, LG and Zenith with that of competing technical schemes using transmitters from Harris and other manufacturers.

R&D markets (model stations) in several cities were also established at that time to support test prototypes of mobile receivers under actual transmission conditions. In August 2009, Harris participated in the conformance testing of the physical layer with 14 receiver vendors, as well as the first device interoperability testing conducted by the OMVC and the Consumer Electronics Association (CEA).

The working-draft standard developed within the ATSC in late 2008 moved rather quickly through the ATSC standards process. ATSC's full membership of the ATSC A/153 standard was formally approved on October 15, 2009. Harris continues to be actively involved in industry activities related to Mobile DTV development and compatibility, such as the *CEA ATSC Mobile DTV Plugfest*.

Opportunities & Challenges Ahead

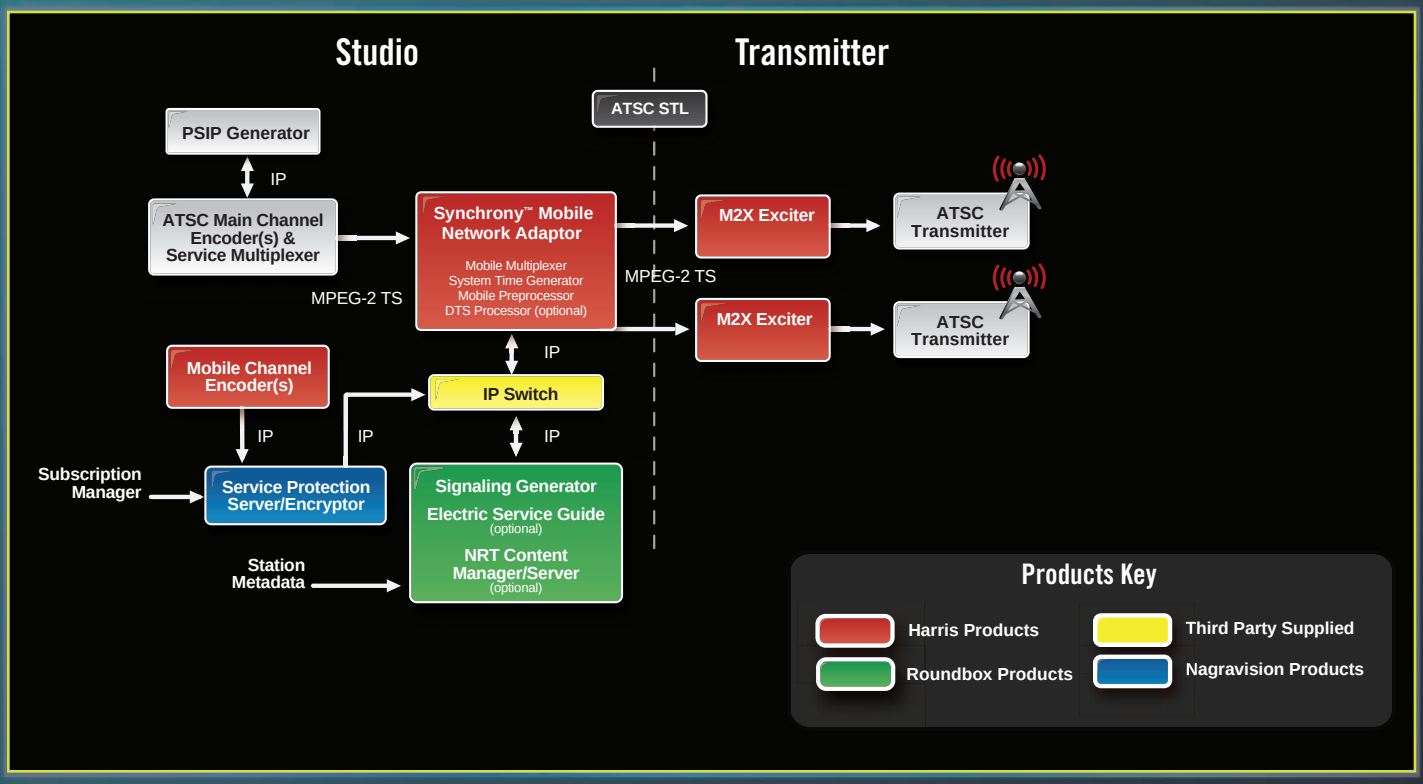
A successful commercial launch of Mobile DTV requires resolutions to several issues.

First, broadcasters need to develop and select business models that will attract consumers, while also becoming economically viable. Is this service free-to-air, subscription-based, pay-per-view or a combination of those? Will broadcasters in a market develop a unified service offering? If service is based on subscription, will it travel from market to market? What is the mix of content offered — local, national or both?

Second is the need for broadcasters to build relationships with partners. If the Mobile DTV service is based on subscription or pay-per-view, what type of partner is needed to manage this activity? It could be a wireless carrier, a local cable operator or a service management provider. There are several major wireless carriers that already have wireless video services, while others are partnering with broadcasters. Mobile DTV was designed to reach both one-and two-way devices. Offering service on a platform with a return channel, such as a mobile phone, enables enhanced interactive services, audience measurement and a much wider consumer base.

A third issue is identical to that of DTV in the early days. It is the chicken-and-egg problem of signals on the air versus receiver availability. Most receiver manufacturers and sales channels will want the assurances of broadcasters that service will be available before they commit to ordering, building and stocking receivers. Fortunately, a wide variety of receiver choices have been announced with consumer product available right now.

Integrating Mobile DTV—
The Harris Advantage



This is the advanced system architecture of ATSC DTV. Enabling Mobile DTV to the fullest capacity allows you to considerably increase your viewership and revenue opportunities.

The process of integrating Mobile DTV transmission with an existing ATSC plant is not difficult, as the Mobile DTV architecture provides full compatibility with all industry-standard ATSC equipment. Additionally, the system is compatible with all current microwave and fiber STL systems.

Harris has the right products — at the right price — to help stations implement Mobile DTV, along with coverage enhancement strategies to maximize the population of potential viewers. More than a provider of transmitters, Harris is the only vendor capable of offering Mobile DTV solutions that enable service providers to create and deliver complex cross-delivery advertising campaigns, programming playout and other network-based services across a seamless transmission network.

Everything stations need for Mobile DTV and coverage enhancement exists within the MPH™ Mobile DTV portfolio of products and via our exclusive partnerships with other technology leaders. The Harris MPH Mobile DTV solution consists of the following (assuming the use of existing ATSC encoding, multiplexing, PSIP and transmitter):

NetVX™ Mobile DTV Encoder

The NetVX encoding module is used to compress a single audio and video stream into the transmission format needed for Mobile DTV. The encoder compresses signals using H.264 for video and AAC+ HE for audio, and outputs the resulting stream on IP, which is then encapsulated with other signals. In addition to encoding audio and video, NetVX also supports EIA 708 closed captioning.

Each frame, incorporating a power supply and controller, supports up to six encoders.

Synchrony™ MNA Distributed Transmission and Mobile Network Adapter

The Synchrony MNA system provides a variety of functions to enable ATSC broadcasters an efficient means of expanding their main channel and mobile digital broadcast services. As a key component of the complete MPH Mobile DTV solution, Synchrony MNA seamlessly brings together main channel HD and SD, mobile audio/video streams and supporting content data into a complete service multiplex. Additionally, it enables the creation of distributed transmission systems (DTS) in which multiple transmitters operate on the same frequency to improve coverage.

A single unit can be configured as mobile multiplexer, a DTS adapter or both. The broadcast studio requires only one Synchrony MNA to address several vital concerns for broadcasters — taking advantage of the opportunities afforded by mobile television and datacasting, expanding digital coverage to reach new markets and filling coverage gaps created by digital coverage patterns.

NetVX™ Mobile DTV Encoder

Synchrony™ MNA Distributed Transmission and Mobile Network Adapter

Integrating Mobile DTV—
The Harris Advantage

Apex M2X™ Multimedia Exciter with ATSC Mobile DTV Postprocessor

The Apex M2X multimedia exciter enables analog broadcasters to transition to digital via a simple software update and DTV broadcasters to carry out multichannel broadcasting of HDTV, DTV and Mobile TV channels. This world-class exciter provides a flawless digital signal with complete technical and regulatory compliance for all digital and analog transmitters.

To ensure you're fully prepared for the future, the Apex M2X supports a wide range of global digital standards, including ATSC, ATSC M/H and a range of analog TV standards, including NTSC. And you can have confidence in your investment knowing that Harris digital exciters have logged more hours in real-time broadcast than all others combined.

For digital operations, the exclusive Real-Time Adaptive Correction (RTAC™) technology incorporated in the Apex M2X enables the exciter to more fully utilize the transmitter power amplifier, yet maintain spectral mask compliance of the digital signal. The only available system with simultaneous, linear and nonlinear, adaptive, memoryful precorrection, RTAC provides the highest level of correction to all types of RF amplifiers — keeping your station well within compliance and maximizing your coverage.

Roundbox Mobile DTV Server

Offered exclusively to ATSC broadcasters by Harris, the Roundbox Mobile DTV Server enables the centralized management of broadcast applications, services and network policies. As part of the complete Harris Mobile DTV system, it functions as the signal generator, as well as being able to manage service guide announcements and non-real-time services. The Roundbox Mobile DTV server is capable of ingesting and delivering Mobile DTV announcement data and feeds for Mobile DTV widgets.

The standards-based Roundbox Mobile DTV Server is designed for reliability and also has unique capabilities to manage bandwidth and optimize your network for delivering video and data applications. It has a modular architecture for adding additional capabilities.

Nagravision Conditional Access Solutions

Stations seeking revenue using Mobile DTV for subscription programming, pay-per-view, one-time broadcast and interactive services must have confidence that for-fee content is accessed only by those who have paid for it. Harris has partnered with Nagravision to provide a high level of service protection as an integrated element of the MPH Mobile DTV solution.

The technology provided by the Nagra Media Mobile Conditional Access Solutions ensures that the correct conditional access is granted to customers, based on the channels they have purchased. In addition, it provides broadcasters with the ability to choose from a wide range of for-fee models and offer customers a choice of ways to pay for the content they want. Multiple subscription levels, impulsive pay-per-view, pay-per-time and free promotional time are all within the capabilities of the system, along with offline purchasing that does not require interaction through a mobile network carrier.

iSET Data Services for Traffic and EAS

The MPH Mobile DTV solution provides end-users with the most accurate traffic information and emergency alerts, thanks to data broadcasting applications from our partner iSET.

iSET technology allows information to be delivered to customers based on their exact location within the broadcast service area of a TV station. Local traffic data, as well as travel and tourist information, are communicated by map location. This feature also provides location-aware advertising opportunities. Emergency Alert System (EAS) notifications are communicated the same way. Customers receive relevant notifications — such as weather advisories or public safety alerts — based on geographic location.

For stations adding or replacing DTV-capable transmitters, the new Harris Maxiva™ UHF and Platinum™ VHF transmitters address a wide range of power levels — making sparing and support logistics easier. These products also feature market-leading Harris PowerSmart™ technology — offering greater power density for smaller space requirements and lower power requirements for lower cost of operation. When Harris products are identified with the PowerSmart label, you have the assurance of technology that delivers a dramatic increase in power density and energy efficiency.

As the digital transmission leader, Harris offers field-proven systems and a range of support options from standard 24/7 telephone technical assistance and parts, to installations, training, full system design and field maintenance contracts.

Maxiva Transmitter

Apex M2X™ Multimedia Exciter with ATSC Mobile DTV Postprocessor

Roundbox Mobile DTV Server

iSet

ONE Company for Workflow Solutions Throughout the Media Chain

Harris is the ONE company delivering interoperable workflow solutions across the entire media delivery chain — providing today's broadcaster with a single, integrated approach to capitalize on the benefits of IT and mobile applications. By providing unparalleled interoperability across our product portfolio, Harris is able to offer customers integrated solutions that improve workflows, save money, enable new revenue streams and provide a migration path to emerging media business models. To meet the evolving needs of broadcast, distribution, government agencies and entertainment businesses, Harris is the ONE answer for change.

Service and Support

At Harris, we are committed to customer service excellence. It is our goal to provide the highest level of support by applying a simple rule: We take ownership of helping our customers succeed. Our support teams consist of innovative technical experts who support all situations regarding product performance, integration and operational processing. We are adept at providing proven solutions, making workflows better and ensuring reliability of the product and system. At Harris, our experienced and dedicated teams stand ready to help you meet your goals for premium product performance, 100% up-time and reduced maintenance investment.

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For more information on the complete line of radio and television transmission products, please visit www.broadcast.harris.com.

Some of the information in this document has been provided by the Open Mobile Video Coalition www.openmobilevideo.com

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