INTRODUCTION

Mobile TV around the world uses various standards including MediaFLO™, DVB-H, CMMB, ISDB-T, ISDB-Tb, DVB-SH and T-DMB. These various technologies have been deployed with differing levels of success and for different reasons. Some European markets have DVB-H deployments, ISDB-T is used in Japan, T-DMB in Korea and China is developing CMMB technology. The US market currently only has a commercial deployment of MediaFLO™ technology for mobile TV. Terrestrial TV broadcasters are unable to offer services to mobile receivers using the current ATSC DTV standard (A/53), which was not designed for use with moving receivers.

For television broadcasters, the path from analog to digital over the air (OTA) transmission has been fraught with enormous challenges, arguably making it as momentous an event as any in the history of broadcasting. Viewed at the highest levels, it is simply the final stage in the "digitization" of television, which began years ago with image capture and has continued through editing and production to delivering the results in one of several high-definition digital formats. Cynics might add however that most of this new, high-definition content is actually delivered to viewers not free and over the air but for a fee via cable, fiber, or satellite. Taking this view, the event could mostly be an additional financial burden to broadcasters incurred to serve a dwindling, audience. In addition, only fixed receivers will be able to receive the standard ATSC content, since the standard does accommodate the conditions present when the receiver is in motion, leaving millions of potential viewers in the dark.

However, thanks to the rapid development of complementary digital television technology targeted at people "on the move", this is likely to prove a highly pessimistic view. ATSC Mobile DTV, the standard for which is nearly complete and ready to emerge from Candidate Standard status, provides broadcasters with the chance to increase viewers and potentially create a brand new revenue source from its digital OTA investment. The goal of this white paper is to provide an overview of Mobile DTV at a high level, including the development of the Mobile DTV standard, the requirements for implementing Mobile DTV in the U. S. market, a discussion of the Mobile DTV standard, the single frequency networks (SFNs) that could be needed in many areas to provide high quality of mobile service, and some of the first encoding, multiplexing, transmission, and test equipment.
How We Got Here

Mobile DTV in the U.S. is emerging rapidly, following behind standard ATSC digital television broadcasting and driven by the sheer magnitude of potential mobile viewers and the perceived benefit of creating advertising and fee-based premium content via OTA. In fact, at the latest Consumer Electronics Show, a group of 63 broadcasters announced their commitment to have Mobile DTV service on the air in over 20 US markets by the end of 2009. If these “early adopters” are successful, it is almost certain that many others will quickly join them.

Of course, delivery of video programming to mobile users is not new, since video delivery services have been available to mobile phone subscribers in the U.S. for several years. However, it is important to differentiate between these services and Mobile DTV. Current fee-based video services do not include programming from local television stations for various reasons, the most formidable of which is the complexity and cost of licensing agreements, although there are other factors including available bandwidth and the difficulty for a nationwide network to serve many local markets. Rather, the content is currently limited and tightly controlled. In contrast, Mobile DTV will be offered free, at least in its initial basic form, and has many potentially lucrative differentiators:

- The amount and type of programming can be extensive and highly diverse, since the broadcasters are generally also the content providers.
- Since Mobile DTV will be free, anyone whose mobile device supports it can view it, much like incorporating a WiFi transceiver in a mobile phone or notebook computer, rather than as a paid addition to another service (like cellular data plans).
- Mobile DTV offers the unique ability to provide local TV content, complemented by programming not available anywhere else.
- The basic infrastructure for delivering Mobile DTV is already in place throughout North America and can be deployed rapidly.
- Advertising can be localized and tightly targeted at specific audiences, and different from that offered to fixed subscribers.
- The type of devices that can be designed to receive Mobile DTV includes smartphones, netbook computers, media players, factory-installed additions to automotive “infotainment” systems, and perhaps other types yet to be created.
- Once Mobile DTV has become established, broadcasters can offer premium content available for a fee, creating a new subscriber revenue stream.

Taken together, these and other advantages make Mobile DTV well worth the investment by broadcasters in most areas. The question then becomes: How difficult and expensive is it to incorporate Mobile DTV within the framework of typical ATSC broadcast infrastructure? Fortunately, the answer is that Mobile DTV is comparatively inexpensive to deploy, and this can be amortized over a very short time if its inclusion yields greater overall market penetration for the broadcaster and almost immediately if subscription-based additional services are offered (and received enthusiastically by consumers). The elements required to deploy Mobile DTV are being developed simultaneously, from chipsets to user equipment on the consumer side, to encoders, multiplexers, exciters, and transmitters on the broadcaster side.

Freedom of Choice

Most new OTA-based services have at least
one major hurdle to overcome: the cost and availability of spectrum. Mobile DTV does not face this challenge because it is an “in-band” system that rather than requiring additional spectrum uses a portion of a 6-MHz channel and 19.39 Mb/s of capacity possessed by the standard ATSC service. The ATSC Mobile DTV service can be launched without any additional action required from the FCC. This provides broadcasters with enormous flexibility when provisioning their systems, allocating resources to the standard ATSC service as well as to Mobile DTV commensurate with their business models, which are expected to vary greatly from broadcaster to broadcaster.

For example, if a broadcaster decides to support one SDTV and one HDTV channel, it would likely have additional capacity for one or more Mobile DTV channels. However, some broadcasters are not offering HDTV service, which considering the far greater bandwidth required to transmit a high-definition signal, offers the opportunity to provide numerous Mobile DTV channels along with perhaps two SDTV channels. In addition, broadcasters that own multiple networks have even greater ability to divide additional resources to provide more Mobile DTV channels along with their SDTV and HDTV services. The choice is entirely the decision of the broadcaster.

The Mobile DTV concept also offers broadcasters the opportunity to consider themselves less as proprietary “islands” and more as part of a network of services provided by multiple broadcasters within a given service area. This of course, would require an entirely different approach than has been the norm for broadcast television, in which broadcasters are simply competitors sharing nothing but a portion of the electromagnetic spectrum. However, if there is money to be made in creating alliances of some kind, innovators in the industry surely will embrace them.

At this early stage of development, with no final standard yet in place, no system deployments, and no available user equipment, it is far too early to see how the Mobile DTV scenario will “play out” in the coming months and years. Suffice it to say that once the service goes “live”, the experience will deliver almost immediate feedback about the content that is best received.

Mobile DTV in Perspective

First and foremost, Mobile DTV allows broadcasters to provide programming with resolution that is more than adequate for mobile applications, with resolution up to 416 x 240 pixels using H.264 (MPEG 4) compression up to 30 frames per second and a data rate up to 820 kb/s. It can provide high-quality reception even in vehicles moving at speeds up to 100 mph, thanks to additional forward error correction and data redundancy built into the standard. Mobile DTV is also backward compatible with ATSC consumer equipment/receivers. It is also significantly less complex to implement from a hardware perspective than most new services, since unlike the coming generation of wireless data services (like LTE and WiMAX) that require complex Multiple Input Multiple Output (MIMO) technology to deliver their rated performance, Mobile DTV requires only one receiving antenna. In addition, the programming guide, time-shifting, and storage, for example, are included in the fundamental system architecture, and “bursty” transmission technology reduces the amount of power required by the Mobile DTV receiver in mobile devices, increasing viewing time on a battery charge.

As for the user equipment itself, there are current examples in existing products devoted to other mobile video services that provide a reasonable profile of what the first Mobile DTV-enabled devices will be like. Smartphones, which while hardly ideal for viewing video, today have larger displays than their predecessors, thanks to advances in display and power management technologies including the use of LEDs rather
than cold cathode fluorescent lamps (CFLs) for LCD backlighting. In fact, most current smartphones, lead by Apple’s groundbreaking iPhone and now many others, have displays that are nearly the size of the device itself. As millions of iPhone owners can attest, watching even full-length movies on these small devices can be surprisingly pleasant.

Notebook and netbook computers are obvious candidates for Mobile DTV, since implementing this capability within them is far less difficult than in smartphones. Falling somewhere in between, portable media players are likely to contain Mobile DTV receivers, and have larger screens than smartphones and smaller overall footprints than notebooks computers. Even stand-alone GPS navigation devices can be equipped for Mobile DTV service. Navigation coupled with local weather, traffic, and news content provides significant added value beyond their core GPS location capability.

Last, but surely not least, is the market potential for incorporating Mobile DTV in vehicles. There are currently millions of vehicles in the U.S. in which entertainment systems not only include the ability to watch programs on DVDs but OTA television broadcasts as well. However, they will all very soon “go dark” since none are ATSC compatible. Even if they were cobbled together with a standard ATSC converter, the result would be much the same, since they would only be able to reliably receive standard ATSC service when the vehicle is stationary.

However Mobile DTV, while not breathing life into existing analog NTSC television entertainment systems in vehicles, provides auto manufacturers with the ability to offer Mobile DTV as an option on a wide array of vehicles – not just luxury brands, since implementation cost should not be prohibitive. This market alone is potentially enormous, since even in today’s constricted sales environment, hundreds of thousands of new vehicles (or more) could be sold within a year’s time that have onboard Mobile DTV capability. Manufacturers of mobile audio and video systems have already begun development of Mobile DTV products for both OEM and aftermarket applications.

**The Mobile DTV Standard**

Development of the Mobile DTV standard, in contrast to how standards-setting typically unfolds, has been proceeding at a rapid pace. The standards-development process itself only really began in April, 2007. However, this could only take place after the pioneers in Mobile DTV, including Rohde & Schwarz, had devoted several years of intensive development to produce a comprehensive blueprint for implementing mobile DTV. In the case of Rohde & Schwarz, this also included development of measurement solutions that are essential for manufacturers and broadcasters to develop and evaluate their components, devices, and systems.

The components of the standard made their way through various committees to create the standards for Mobile DTV’s three core ingredients:

- The physical layer that includes backward-compatible enhancements to the DTV transport stream to enable mobile and handheld reception
- The management layer that encompasses signaling, announcement, file delivery, and functions such as conditional access and content protection
- The presentation layer that deals with video and audio formats and required compression schemes

The first major benchmark for actual Mobile DTV in action occurred during a Demonstration of Viability (IDOV) field test that was conducted in San Francisco and Las Vegas early in 2008.
under the supervision of the Open Mobile Video Coalition (OMVC), an alliance of U.S. commercial and public broadcasters formed to accelerate the development and rollout of mobile DTV products and services.

This demonstration compared the two leading candidates for Mobile DTV: the MPH (Mobile-Pedestrian-Handheld) system jointly developed by LG Electronics and Harris Corporation and the Advanced -VSB (A-VSB) system jointly developed by Samsung Electronics, Co. and Rohde & Schwarz. Participating broadcasters volunteered the use of their transmitting facilities for the trials, and measurements were conducted by an independent consulting firm. The demonstration consumed more than 90 hr. and 700 Mb of mobile data collected throughout the San Francisco Bay area, along with 50 hr. and 300 Mb in the Las Vegas area.

For the San Francisco Bay area trials, three DTV stations were used and mobile and pedestrian tests were performed over a 15-day period. Simultaneous measurements were made of all three channels using vehicle-attached and handheld antennas. In the Las Vegas trials, three DTV stations were also used. Mobile and pedestrian measurements were collected over a 10-day period. The results of the field trials demonstrated the viability of both systems. A draft standard that incorporated elements of both was then written by a group within the ATSC, after which the industry began testing it through product development, and the draft was elevated to its current Candidate Standard status.

After the Candidate Standard period, the ATSC will vote to elevate it to Proposed Standard status and send it for approval to the full ATSC membership. If the ballot returns a two-thirds majority approval, it will become a full standard. This process is expected to be completed early in the third quarter of 2009. While the specific implementation approaches taken by the champions of the competing organizations (such as Rohde & Schwarz and Samsung) will offer product differentiation, the result will be that the consumer will enjoy the desired result: high-quality Mobile DTV reception.

**ATSC Mobile DTV in a Nutshell**

As an “in-band” service, Mobile DTV shares channels with the standard ATSC service using a portion of its 19.39 Mb/s bandwidth, with delivery via IP transport. It uses modified MPEG-4 Part 10 AVC and SVC video coding and MPEG-4 Part 3 HE AAC v2 mono- and stereophonic audio coding via MPEG-4 AAC, Spectral Band Replication (SBR) and Parametric Stereo (PS) coding tools. The complete system is shown in Figure 1.

Extra training sequences and forward error
correction (FEC) are added to the physical layer of the ATSC system to accommodate the unique characteristics (such as high Doppler rate) that are encountered in mobile environments. M/H (mobile/handheld) data is partitioned into Ensembles that each contains one or more services. The Ensembles use an independent RS Frame (an FEC structure) and can provide different levels of error protection depending on the application. M/H encoding includes FEC at both the packet and trellis levels, plus the insertion of long and regularly spaced training sequences into the M/H data, along with reliable control data for use by M/H receivers. The M/H system provides burst M/H data transmission that allows the user equipment to reduce the power consumption of the tuner and demodulator in order to optimize battery life.

In the physical layer system, the M/H data is transferred by a time-slicing mechanism to improve the receiver’s power management ability. Each M/H Frame time interval is divided into five subintervals of equal length, called M/H Subframes. Each M/H subframe is divided into four subdivisions of 48.4 ms in length (the time required to transmit one VSB frame). These time intervals are in turn divided into four M/H Slots, producing a total of 16 M/H Slots in each M/H Subframe. The M/H data to be transmitted is packaged into a set of consecutive RS Frames that form the M/H Ensemble.

The data from each RS Frame to be transmitted is split into blocks called M/H Groups that are organized into M/H Parades that carry the M/H Groups from up to two RS Frames. The number of M/H Groups belonging to an M/H Parade is always a multiple of five and the M/H Groups in the M/H Parade go into M/H Slots that are equally divided among the M/H Subframes of the M/H Frame.

The RS Frame is the basic data delivery unit in Mobile DTV transmission and incorporates the IP datagrams. The number and size of each RS Frame are determined by the transmission mode of the M/H physical layer subsystem. The Fast Information Channel (FIC) is a separate data channel whose purpose is to efficiently deliver essential information for rapid M/H Service acquisition.

An M/H Service is a package of IP streams transmitted (such as TV and audio services) through M/H multiplexing that forms a sequence of programs controlled by the broadcaster from which a schedule can be created. There are basically two types of streams that can be delivered this way, the first being content streams such as music or video and the second being a stream that is a portion of the service guide and includes keys for service protection and logos.

The services available from a broadcaster are “announced” via the Announcement subsystem using a Service Guide, which is a special M/H service. An M/H receiver determines available Service Guides by reading the Guide Access Table for M/H (GAT-MH), which lists the Service Guides present in the M/H broadcast, gives information about, and provides access to the service provider for each guide. It is a modified OMA BCAST Service Guide and is delivered using one or more IP streams. The main stream delivers the Announcement Channel, and other streams are used to deliver the guide data.

The Application Framework enables the broadcaster of the audio-visual service to author and insert supplemental content to define and control various additional elements to be used in conjunction with the M/H service. It defines auxiliary graphical components, layout for the service, transitions between layouts, and composition of audio-visual components with auxiliary data components. It also lets the broadcaster send remote events to modify the presentation and control the presentation timeline, and enables coherent rendering of the service and its layout on a variety of device...
classes and platforms.

Service Protection refers to the protection of content during its delivery to a receiver, is designed to provide subscription management, and establishes no controls on content after delivery to the receiver. It is based on the OMA BCAST DRM Profile in which there are two modes of protection, interactive and broadcast-only. In interactive mode, the receiver supports an interaction channel to communicate with a service provider to receive service and content protection rights. In broadcast-only mode, no such interaction channel is used by the receiver. Requests are made by the user to the service provider by “outside” means such as calling the company or accessing its Web site.

The diverse elements of the system are grouped into functional units called elementary subsystems. These correspond to the M/H protocol stack shown in Figure 2. Recognizing that the mobile market is subject to rapid technology change, the standard accommodates the need for continued viability of the system as changes occur. As there are many technological elements of the system, they were grouped into functional units called elementary subsystems. A Mobile DTV system must be able to provide a wide array of signaling capabilities to ensure it functions effectively alongside its ATSC counterpart, and can accommodate changes such as a new elementary subsystem (for example Digital Rights Management) and allow one encryption method to replace another. It must also be able to simultaneously accommodate multiple generations of service.

The signaling approach is hierarchical, with the physical RF layer considered the bottom of the stack and much of the RF signaling is integral to the data structure in the other parts of the standard. At the bottom-most layer is a 1-bit signaling method, and a major change to the entire physical layer can be signaled by use of another such bit. Other signaling for the RF layer is implemented with a simple version field in key data structures, each of which enables signaling of changes in higher data structures. In general, at higher layers more signaling capability is established reflecting the increasing likelihood of change in those layers as time progresses.

To implement Mobile DTV within an existing ATSC system, broadcasters require Mobile DTV-capable encoders, multiplexers, and exciters for each channel. The Mobile DTV transport stream is multiplexed into the primary ATSC at a specified amount of bandwidth, depending on the mix of ATSC and Mobile DTV channels the broadcaster wishes to provide. For example, each 6 MHz channel can accommodate a maximum of 19.39 Mb/s of programming. If the broadcaster decides to provide one SDTV and one HDTV channel (the latter with 1080i resolution), they would collectively require about

![Figure 2. The M/H protocol stack.]( Figure 2. The M/H protocol stack.)
15 Mb/s, leaving the remaining capacity for up to two Mobile DTV channels depending on their datarate.

This flexibility in the use of bandwidth is a key advantage of Mobile DTV, since it and standard ATSC channels can be “mixed and matched” in various combinations and datarates to optimize use of each channel’s resources. These combinations can also be altered with little difficulty to provide specific numbers and types of Mobile DTV channels at different times, such as a dedicated traffic and weather channel in the morning and early evening, and other channels during the day. The broadcaster has the ability to create program material dedicated exclusively to the tastes of mobile users as well, or virtually any other programming it chooses.

The Importance of Single Frequency Networks (SFNs)

While digital OTA broadcasting brings many benefits, its initial implementation also brings one large problem, which has been rather accurately (and graphically) labeled the “digital cliff”. While NTSC (analog) viewers will see a gentle degradation of signal quality as the receive conditions deteriorate, the same is not true for viewers of digital signals. After the transition to digital ATSC transmission, that person would experience either a perfect reception or no reception at all — imagine that they are positioned “over the cliff” and into a valley where no reception is possible. This is caused by the fundamental characteristics of digital transmission and was probably first experienced by most people when wireless communications networks entered their second (digital) generation, as weak, noisy analog reception was replaced by dropped calls. The remedy in this case was to fortify coverage by adding sectors to cell sites, by adding traditional cell sites, or by adding micro (and now pico and femto) cells.

The same situation, which was long considered inevitable by virtually everyone in both industry and government, has in fact occurred in the analog to digital television transition, causing, along with other issues, a four-month delay in the ATSC rollout and widespread consumer angst. The primary proposed solution to this significant problem is the use of various means for enhancing coverage, of which the SFN is the most practical and cost-effective (Figure 3). SFNs are not needed in all geographic areas for ATSC because viewers can (usually) remedy the situation by using high-gain, directional antennas. However, they are a virtual necessity for Mobile DTV in urban and other areas in which continuous coverage is not possible because of the effect of buildings or terrain on reception. Unlike fixed legacy ATSC user equipment, Mobile DTV equipment uses only small, low-gain antennas, which are made even less efficient by the inherent characteristics of the mobile environment.

Figure 3. A simplified drawing of a single frequency network.
distribution channel to feed each transmitter in an SFN. The channel can be a conventional studio-to-transmitter link (STL) for distributed transmitters or a different broadcast channel from that on which the transmitters operate (in the case of distributed translators). It should be noted that the FCC does not require use of the A/110 standard for synchronization in its official rulemaking on this subject, but instead allows for innovation and development by manufacturers to create alternative synchronization methods. For example, there are opportunities to synchronize Mobile DTV systems using less complex and more flexible methods than those described in A/110.

To reinforce the point about the speed at which Mobile DTV standards development has occurred, there is no mention in the 2004 standard about Mobile DTV at all. However, some of the basic concepts and requirements it contains can apply to both standard and Mobile DTV. The FCC has chosen not to specifically define the mechanisms for synchronization of transmitters emitting 8-VSB signals in accordance with the ATSC DTV Standard, but to allow room for innovation and improvements to this technology in the future. Sound SFN design must incorporate a means of adjustment for transmitter timing and other transmission characteristics through additional information carried within the specified packet structure.

In an SFN, multiple towers (rather than a single tower) send the same program content at exactly the same frequency and time. This makes efficient use of frequency resources, allows frequency and coverage planning to be flexible and accurate, and can mitigate the problems associated with mobile reception. The concept is similar to the “cellular” approach upon which all wireless communications are based, in that a given geographical area is not covered with a single base station but with multiple base stations whose coverage areas coincide.

SFN signals arrive at different times because of distance-dependent propagation delays, so SFNs take the range of individual transmitters into consideration and allow a delay to be selected for each transmitter to provide synchronous operation. For example, adding 91.45 ft. to the reception path produces a delay equal to the symbol time, so intersymbol interference is inevitable (although tolerated to some degree by the receiver). Both ATSC and Mobile DTV transmitters periodically insert known training data, which is used by the symbol-restoring equalizer in the receiver.

From a high-level view, creating an SFN is a relatively straightforward procedure, assuming the broadcaster can gain access where towers can be placed, which in many cases is not trivial. However, deploying the network requires significant expertise in frequency and coverage planning, and is typically undertaken either by veteran broadcast engineers with field installation experience, by broadcast consultants, or both. In addition, optimizing and maintaining the performance of the SFN, and ensuring that it provides the desired coverage and is always synchronous requires considerable expertise and dedicated test equipment as well.

From Testing to Transmission

From any vantage point, Mobile DTV is at an early stage, proceeding rapidly and simultaneously in every respect, from development of broadcast Mobile DTV infrastructure and user equipment, to broadcaster business models, and even the standard itself. As with all emerging technology, the availability of test equipment to evaluate equipment at the earliest stages of product development is critical in ensuring its success. The test procedures themselves remain a work in progress, although the fundamental challenges are obvious, since Mobile DTV is essentially an enhancement to standard ATSC, and similar requirements apply. However, the
Mobile DTV standard is different in ways that allow equipment to function in a dynamic rather than static environment, which present new challenges for test equipment manufacturers and their users. These are complemented by measurements that must be made to SFNs, if they are employed by the broadcaster.

The position of Rohde & Schwarz as a pioneer in creation of Mobile DTV has allowed the company to address these test and measurement issues as well as those relating to the exciters, multiplexers, and transmitters that will be employed to implement Mobile DTV. For example, Rohde & Schwarz is demonstrating Mobile DTV-capable test equipment at the National Association of Broadcasters Show, including its R&S®SFU TV Signal Generator (Figure 4). This versatile instrument enables manufacturers of consumer electronics equipment to develop and qualify receiver chips and other devices, and is an “all-in-one” generator for all TV standards, including Mobile DTV. It produces unrivaled RF and baseband signals in combination with a comprehensive menu of interfering signals such as noise, multipath, spurious, and adjacent channels.

In addition, the R&S®ETL TV Test Receiver (Figure 5) is the first instrument to feature a specific measurement tool to align ATSC Mobile DTV SFNs, and has an echo delay measurement resolution of 1 ns. It is designed for installing, commissioning, and maintaining Mobile DTV transmission systems.

Rohde & Schwarz has also created a complete product family, including the software-definable R&S®SX800 exciter (Figure 6), the R&S®AEM100 emission multiplexer (Figure 7) and the R&S®AVE264 MPEG-4 encoder, devoted to ATSC Mobile DTV and SFN operation that allows U.S. broadcasters to immediately begin transmission of ATSC Mobile DTV services. The R&S®SX800 is a frequency-agile exciter that has already been proven for both ATSC and NTSC as part of medium-power air-cooled, and high-power liquid-cooled Rohde & Schwarz transmitter systems, as well as in transmitters from other manufacturers. It supports digital and analog TV broadcasting standards including ATSC, MediaFLO™, DVB-T/H, and ISDB-Tb, and now ATSC Mobile DTV SFN operation is supported for all mentioned standards (wheredefined). Existing DTV transmitters that use the R&S®SX800 exciter can easily be updated for ATSC Mobile DTV. Rohde & Schwarz also offers an upgrade kit for implementing the R&S®SX800 into transmitter series prior to the R&S®NX8000 platform (for example R&S®NV7000).

The R&S®AEM100 emission multiplexer also supports Mobile DTV and SFN operation, and can be easily integrated into existing installations, leaving the standard ATSC multiplexer in place. It includes the IP encapsulator, making it an
excellent choice for broadcasters that wish to begin Mobile DTV operation on an affordable scale. The R&S® AVE264 real-time, MPEG-4 video/audio encoder was designed exclusively for mobile TV systems and operates in constant bit rate (CBR) or variable bit rate (VBR) modes. This encoder can be teamed with the R&S multiplexer to operate in statistical multiplex mode, which ensures efficient use of the transport stream.

Rohde & Schwarz also offers these products in combination with third-party headend products such as PSIP, ESG, and service-protection servers as a complete ATSC Mobile DTV solution, making the company a single source for all elements required in new installations or for retrofitting existing transmission systems, regardless of their manufacturer.

**Summary**

Mobile DTV holds the promise being an exceptional opportunity for the broadcast, consumer electronics, and auto industries, and a source of information and entertainment to consumer “on the go”. For broadcasters, it provides the ability to leverage its unique asset, local content, to provide a source of programming (and potentially advertising and subscription revenue) to a new audience, as well as to deliver content that may be obtainable to viewers in no other way. For manufacturers of electronic products, it will allow them to create types of mobile devices dedicated to mobile television reception, as well as to endow existing product types with a new feature that could spark an upsurge in demand. For auto manufacturers, Mobile DTV makes possible a new entertainment option on all types of vehicles.

Numerous surveys have indicated that consumers are very interested in receiving video content, and local programming in particular, especially if it is offered free of charge and is available with a wide array of content choices. However, at such an early stage in Mobile DTV’s history, it is impossible to just how well received it will be. Thanks in part to Rohde & Schwarz, it won’t be long before this question is answered.

For additional information visit http://www.rohde-schwarz.com/technology/atsc_mobile_dtv
Headend, transmission and T&M for ATSC Mobile DTV

**Headend**
The R&S®AEM100 multiplexer for ATSC Mobile DTV service combines the functions of IP encapsulation with multiplexing to enable broadcasters to offer new services inside their existing ATSC transport stream. The R&S®AVE264 mobile TV encoder operates in CBR or VBR mode. This real-time MPEG-4 encoder can be teamed with the R&S®AVP264 to operate in statistical multiplex mode, making sufficient use of the available data rate.

**Transmission**
The R&S®Sx800 is a software configurable television exciter that features adaptive pre-correction for linear and non-linear distortions. The exciter can be adapted to different operating standards and modes, including ATSC Mobile DTV and Single Frequency Networks (SFN). Exciter retrofit packages are available to allow use of the R&S®Sx800 in transmitters produced by other manufacturers.

**Transmission**
The R&S®Nx8000 family of transmitters is comprised of both liquid (R&S®NV8600) and air-cooled (R&S®NV8300/R&S®NW8200) transmitters for high and medium power applications. All R&S®Nx8000s feature the R&S®Sx800 television exciter for excellent signal performance and flexibility across both VHF and UHF. The R&S®Nx8000 transmitters are very energy efficient with redundant architecture for maximum reliability.

**Transmission**
The R&S®SCx8000 is the ultimate in efficient design. It consists of the new exciter R&S®SX801 and up to two amplifiers with integrated cooling, combiner and splitter. All major TV standards, including ATSC Mobile DTV are supported with the same hardware. Innovative redundancy concepts and a minimum number of devices make the system highly reliable. Its modular design enables the system to be a stand-alone device, in existing racks and outdoor cabinets.

**Test & Measurement**
The R&S®ETL TV Analyzer performs 8VSB testing and optional MPEG monitoring in a single unit. It combines TV test receiver and spectrum analyzer functionality while providing high measurement accuracy. Both digital and analog TV standards can be integrated in a single instrument. The R&S®ETL TV Analyzer uses realtime demodulation throughout.