ONE Company. ONE Direction. The Future.

ATSC Mobile DTV Overview
Jay Adrick, VP Broadcast Technology
assured communications

aka

“ATSC M/H”

“MPH”

“ATSC Proposed Standard A/153”
ATSC DTV Broadcast System

ATSC M/H System

19.4 Mbps of Spectrum

A portion of digital transport is used for traditional TV signal

Remaining digital transport is used to deliver mobile signals

M/H chip and module

ILLUSTRATIVE EXAMPLE OF SPECTRUM SPLIT

Mobile phone
Portable media player
Laptop computer (dongle)
GPS device
Automobile-based TV

Consumers receive mobile TV signal on many different devices via ATSC M/H chip and module

DTV stations transmit mobile TV signal with addition of ATSC M/H system
What is ATSC M/H

- Optimized Mobile / Pedestrian / Handheld (MPH) transmission and reception system

- Embellishment to ATSC DTV standard

- Mobile DTV service within broadcasters’ existing DTV channel assignment and transmission infrastructure

- No outside service providers required but perhaps desired

- 100% backwards compatible addition to ATSC main transmission

- Transmitted spectrum identical to 8-VSB, so no additional FCC authorization
ATSC M/H Features

- Robust physical layer
  - High immunity to drop-outs and burst noise
  - No need for receiver antenna diversity
  - Up to 12.5 db system gain over regular ATSC channel
  - High-Speed reception – up to 300 km/h

- Data efficient and completely scalable
  - 3.667 Mbps of ATSC TS could provide up to 980 Kbps mobile/handheld service
  - Scalable coding

- Power savings for handheld devices due to bursted transmission
  - Allows receiver RF circuitry to be ON part-time to save battery life
\textbf{ATSC M/H Features}

- **IP based mobile payload**
  - Supports stream and non real time file delivery
  - Enables cross media compatibility
  - Utilizes efficient AVC h.264 video coding and AAC-HE audio coding

- **Each RF channel is capable of delivering up to 8 mobile IP data streams with 630 kbps IP payload**
  - While maintaining 4.7 Mbps program in the main stream
  - Each IP stream can support multiple services…Video+Audio, Audio only, Service Guide, NRT services, etc.

- **System supports service protection which enables**
  - Viewer identification
  - Access control
  - Paid service offerings
ATSC M/H Features

- Electronic Service Guide system based on OMA – Bcast standard supports a variety of features
  - rapid channel changing
  - video on demand
  - banner advertising
  - Datacasting & podcasting
  - voting
  - E-commerce

- Easy integration into ATSC broadcast systems
  - Encoder(s), signaling, ESG and Mobile adaptor at studio
  - No changes/additions to the STL
  - Replacement exciter at transmitter
ATSC M/H Major Layers

Presentation Layer
- Audio and Video Codecs
- Captioning

Management Layer
- Transport
- Streaming and Non-Real Time File Transfer
- Electronic Service Guide

Physical Layer
- RF Transmission and Forward Error Correction;
  Compatibility with Legacy 8-VSB Receivers/Decoders
ATSC M/H Layer Stack

Presentation
Management
Phy

STKM
LTKM.
SMT
ETC.
FLUTE
ALC
RME
ESG
NTP
RTCP
RTP
IPv4
RS Frame
M/H Payload FEC (SCCC)
ATSC 8-VSB
ATSC M/H Layer Stack
Acronyms Deciphered

Presentation
Management
Physical

User Datagram Protocol

Internet Protocol version 4
Reed-Solomon Frame

Advanced Television Systems Committee 8-Level Vestigial Sideband Modulation
Current status within ATSC

- A ballot was issued in September to elevate the Proposed Standard to Full Standard Status.
  - Ballot closes 11:59PM 10/15/09
- Tomorrow ATSC A/153 is a STANDARD
Next Steps to Standardization and Commercialization

- OMVC establishes model station systems in Atlanta and Seattle
  - Atlanta WATL-DT and WPXA-DT On Air now
  - Seattle KONG-DT and KOMO-DT On Air now
- OMVC/CEA lab testing for transmission system to receiver interoperability
  - Completed August 2009
- SFN testing in Atlanta in conjunction with EchoStar
  - November December 2009
- Trial Market established in Washington DC – January 2010
  - 7 stations provide bandwidth
  - Local and national content
  - Carrier participation
  - Multiple receiver types provided to sample audiences
Next Steps to Standardization and Commercialization

• Early adopters sign on
  – At CES and NAB 2009, More than 75 stations in over 25 markets announced commitment to sign on before the end of 2009
  – OMVC announced that stations initial business model will be “free to air” replication of current stations program services

• Further development of business models

• Further development of partners
  – Content providers
  – Mobile phone carriers
  – Cable
  – Consumer sales channels
Prototype Consumer Receiving Devices
**Consumer Devices**

- DTV Mobile broadcasts can reach many varieties of devices with video capabilities
  - Mobile phones
  - PDA’s
  - Laptops
  - Screens in vehicles (cars, buses, trains)
  - Portable DVD players
  - Handheld gaming devices
  - Other PMP’s
  - Even Fixed TV’s

- Broadcasters have not agreed on the specifics of devices or the relative importance of device classes
  - First devices are not likely to be Cell Phones
LG Maize Mobile Phone

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Dell Netbook Computer

Expected to be available 1Q 2010
List price under $400
Kenwood In-Car Receiver

Infotainment system designed for back seat viewers

Kenwood is a leading aftermarket automotive entertainment system supplier and an ATSC M/H supporting partner.
In Car Infotainment System

Over 12 Million vehicles equipped with TV monitors and a 2+ Million annual growth rate
LG Personal Media Player

Personal media player supporting live ATSC Mobile DTV with downloadable content and flashcard media.
Samsung Mobile Phone Platform
Mobile DTV Business Models
Economic Impact

• Number of M/H DTV Receivers by 2012
  – Cellular Handsets – 130 million
  – Portable M/H Receivers – 25 million

• Incremental Additional Viewing – 1 hour/week

• Average Value of Additional Viewing Hours

• Growth of OTA Advertising through 2012

• Additional Advertising Revenues to
  – OTA Television Industry: $2 billion
  – Local Television Stations: $1.1 billion
  – Impact on Total Station Values: $750 Million to $9.1 Billion

NAB commissioned study - 2008
Possible Partnerships

Market Based Broadcasters

• Broadcasters in a local market ban together to form an LLC to operate a mobile network
  – Each station contributes one or more of the following:
    • Content
    • Bandwidth
    • Management
    • Sales
  – Partners share in revenue or net profit based on contribution formula
Possible Partnerships

Group Based Broadcasters

• Multiple groups with properties in multiple common markets form a single LLC to operate networks
  – Similar factors to previous example
  – Model has potential for centralized network operations center
Possible Partnerships

Broadcasters and Cable

• Broadcasters in a market team up with the local cable operator
  – Cable partner provides subscriber management, billing and collection, national content, local ad sales and operates network
    • Ability to tap existing resources for above
    • Bundled services…Cable, internet, Telephone and Mobile video
  – Broadcasters provide local content, bandwidth and sales
Possible Partnerships

Broadcasters and Wireless Operators

• Broadcasters in a market team with local operator of wireless network
  – Wireless operator manages subscribers, billing and collections, provides back channel supporting interactive capability including on line purchasing
  – Wireless operator may also have MediaFLO as partner
    • Broadcasters provide local content providing balance to national service
    • Dual mode receiver platform and common program guide
  – Broadcasters monetize service through local advertising
ATSC M/H Broadcast System Architecture
ATSC M/H Station Architecture

• ATSC M/H A/153 standardizes the characteristics of the emitted M/H signal and describes the functionality that resides within the signal.
  – A/153 does not standardize the method of implementation
  – It does guarantee transmission to receiver interoperability

• The following description of M/H station implementation reflects the product architecture that is being developed by Harris and our team partners.

• Other manufacturers may implement their products using another method.

• Currently, there is limited interoperability between some manufacturers
  – Interface interoperability will be developed through ATSC S5 activity
ATSC M/H Transmission System

**SynchronyMNA**
- Main service multiplex
- M/H service multiplex

**Pre-Processor**
- M/H frame encoder
- Block processor
- Group formatter
- Packet formatter
- Signaling encoder
- Packet timing & PCR adjustment

**Packet mux**

**Transmitter**
- Modified data randomizer
- Systematic/non-systematic RS encoder
- Data interleaver
- Parity replacer
- Modified trellis encoder
- Non-systematic RS encoder

**Post-Processor**
- Parity replacer

**Legacy 8VSB Processing**
- Sync mux
- Pilot inserter
- Pre-equalizer filter (optional)
- 8-VSB modulator
- RF up-converter

**Field sync, Segment sync**
System Architecture - ATSC Only

Studio

- PSIP Generator
  - IP
  - ATSC Main Channel Encoder(s) & Service Multiplexer

ATSC Only

Transmitter

- ATSC STL
  - MPEG-2 TS
- Existing ATSC Exciter
  - ATSC Transmitter
System Architecture with Basic ATSC M/H

Studio

- PSIP Generator
- ATSC Main Channel Encoder(s) & Service Multiplexer
- M/H Channel Encoder(s)
- Signaling Generator
- Station Metadata

Transmitter

- ATSC STL
- MPEG-2 TS
- ATSC Transmitter

Products Key
- Transmission Products
- Networking Products
- Partner Products
- Third Party Supplied

M2X Exciter w/ M/H Preprocessor
- Mobile Multiplexer
- System Time Generator
- M/H Preprocessor

Synchronous Mobile Network Adaptor
- IP Switch
- IP

ATSC Main Channel Encoder(s) & Service Multiplexer
- IP
- MPEG-2 TS

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System Architecture with Advanced ATSC M/H

Studio

PSIP Generator

ATSC Main Channel Encoder(s) & Service Multiplexer

IP

MPEG-2 TS

ATSC STI

PSIP Generator

ATSC Main Channel Encoder(s) & Service Multiplexer

Synchronous Mobile Network Adaptor
Mobile Multiplexer System Time Generator M/H Preprocessor

IP Switch

Station Metadata

M2X Exciter w/ M/H Preprocessor

ATSC Transmitter

MPEG-2 TS

Products Key
Transmission Products
Networking Products
Partner Products
Third Party Supplied

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System Architecture with Advanced ATSC M/H

Studio

- PSIP Generator
- ATSC Main Channel Encoder(s) & Service Multiplexer
- M/H Channel Encoder(s)
- IP Switch
- Signaling Generator
  - Electronic Service Guide (optional)
  - NRT Content Manager/Server (optional)
- Station Metadata

Transmitter

- ATSC STL
- M2X Exciter w/ M/H Preprocessor
- ATSC Transmitter

ATSC Products Key
- Transmission Products
- Networking Products
- Partner Products
- Third Party Supplied

Products

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**System Architecture with Advanced ATSC M/H & SFN**

**Studio**
- PSIP Generator
- ATSC Main Channel Encoder(s) & Service Multiplexer
- M/H Channel Encoder(s)
- M/H Channel Encoder(s) & Service Multiplexer
- Signaling Generator
- Electronic Service Guide (optional)
- NRT Content Manager/Server (optional)
- Station Metadata

**Transmitter**
- Synchronous Mobile Network Adaptor
  - Mobile Multiplexer
  - System Time Generator
  - M/H Preprocessor
  - SFN Processor
- ATSC STL
- MPEG-2 TS
- IP Switch
  - IP
- M2X Exciter
  - w/ M/H Preprocessor
  - ATSC Transmitter
- ATSC Transmitter

**Products Key**
- Transmission Products
- Networking Products
- Partner Products
- Third Party Supplied
System Architecture with Full ATSC M/H & SFN

Studio

- PSIP Generator
- ATSC Main Channel Encoder(s) & Service Multiplexer
- M/H Channel Encoder(s)
- Service Protection Server/Encryptor (optional)
- Station Metadata
- Subscription Manager
- Signaling Generator
- Electronic Service Guide (optional)
- NRT Content Manager/Server (optional)

ATSC STL

Transmitter

- ATSC Transmitter
- M2X Exciter w/ M/H Preprocessor
- M2X Exciter w/ M/H Preprocessor

- ATSC Transmitter
- Products Key
  - Transmission Products
  - Networking Products
  - Partner Products
  - Third Party Supplied

- Synchronous Mobile Network Adaptor
  - Mobile Multiplexer
  - System Time Generator
  - M/H Preprocessor
  - SFN Processor

- IP Switch
- MPEG-2 TS

- MPEG-2 TS
- IP

- IP

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**ATSC M/H Encoder**

- **Function:** Compresses and encodes audio/video program content into low bit rate IP packetized data streams for transmission to ATSC M/H enabled receiving devices

- **Requirement:** One encoder for each real time program stream that is to be transmitted over the ATSC M/H system. Redundancy should be considered at n:1 level

- **Detailed Specifications:**
  - **Video**
    - Encoding format – MPEG4 h.264 base profile v1.3
    - Resolution – 416 x 240  Progressive scanning
    - Aspect ratio – 16 x 9  (Wide Screen)
    - Source video – Could be 1080I, 720P, 480P (ws) or 480I (ws)
      - Recommended to start with 16 x 9 format or convert prior to encoding
      - Encoder should respond to AFD (Automatic Format Descriptor)
    - Closed captioning – CEA 708 format
ATSC M/H Encoder

• Detailed Specifications cont’d:
  – Audio
    • Encoding format – HE AAC v2.0 (High Efficiency Advanced Audio Codec version 2.0)
    • Sampling Frequency – 16, 22.05, 24 KHz. with SBR & 32, 44.1, 48 KHz. w/o SBR  SBR = Spectral Band Replication
    • Audio format – Mono or Stereo (capable of supporting parametric surround)
    • Source audio – analog or AES digital
  – Output
    • Packetized IP over UDP (User Datagram Protocol) with RTP (Real-time Transport Protocol)
    • RTP supports:
      – Payload-type identification - Indication of what kind of content is being carried
      – Sequence numbering - PDU sequence number
      – Time stamping - allow synchronization and jitter calculations
NetVX ATSC M/H Encoder-Mux

NetVX platform incorporates modules for:
- M/H real-time stream encoding
- M/H IP encapsulation
- M/H Multiplexing
- M/H Emission Control with Vidium s/w program
- Also capable of ATSC encoding and multiplexing
**Function:** Multi function platform that supports preprocessing of the M/H data, multiplexing of the processed M/H data into the ATSC transport stream, generation of FIC, TPC and Service ID signals, transmission of signaling tables, generation of ATSC system time and synchronization/timing adjustment of the ATSC transport for distributed transmission networking. The ATSC Mobile DTV processing and distributed transmission timing are each treated as an application. Three functional configurations are available:

- ATSC Mobile Processing only
- Distributed Transmission only
- ATSC Mobile Processing with Distributed Transmission

The SynchronyMNA is initially available with M/H preprocessor and distributed transmission (SFN) configurations. Integrated mobile multiplexing, system time and basic signaling generation (FIC – TPC) will become available in Fall 2009. The NetVX platform supports those functions which are not currently available in SynchronyMNA.
• **Requirement:** One system per station. Redundancy should be considered on a 1:1 level. Application options to be selected depending on system architecture

• **Detailed Specifications:**
  
  – Inputs
    • SMPTE 310M/ASI (selectable) for ATSC Transport Input
    • Ethernet port for ESG, Signaling Generator, Content protection and NRT system
    • Ethernet port for system configuration, monitoring and control
    • GPS antenna
  
  – Outputs
    • SMPTE 310M/ASI selectable X 4
Purpose: Rapid service scan, rapid service access

- For each Ensemble
  - What Services (virtual channels) it contains
  - Whether it contains copy of GAT and/or SLT
  - Ensemble “protocol” version (structure of RS-Frame, etc.)

- For each Service
  - Service ID
  - Status (normal/hidden, on/off air)
  - Whether or not it is access-controlled
  - Whether it is part of a multi-Ensemble service, and if so whether it is essential to a meaningful presentation
Transmission Parameter Channel

- Purpose: Carries data group and coding information
  - Subgroup, slot and parade numbers
  - Reed Solomon framing (inner code) numbers
  - SCCC (Outer code) details
  - FIC version number
APEX M2X ATSC M/H Exciter

- **Function:** Generates ATSC 8VSB main service signal modulation while processing M/H content with RS coding, trellis coding, serial concatenated coding and adds training signals for enhanced M/H reception.

- **Requirement:** One exciter per transmitter is required. Redundancy should be considered on a 1:1 level.

- **Detailed Specifications:**
  - **Inputs**
    - SMPTE 310M or ASI Transport stream (selectable)
    - Optional GPS antenna used for precise frequency or DTS (SFN) operation
    - External 10 MHz and 1 PPS reference
    - RF samples for adaptive correction
    - Ethernet for configuration, monitoring and control
  - **Output**
    - 8VSB modulated RF signal on assigned channel
      - .250 Watt maximum output power
APEX M2X ATSC M/H Exciter

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**Function:** Basic system provides metadata that is essential to mobile channel and program selection and change. This information includes channel ID and number, current program title and rating plus information that associates service elements.

The Signaling Generator platform is the basis for adding on an OMA Electronic Service Guide with basic ESG or advanced ESG system features such as channel previews, web links, banner advertising, news and information summaries, interactivity, on line transactions and non real time delivery of data.

**Requirement:** Basic signaling information is required for each station operating with ATSC M/H. Redundancy should be considered since receiver tuning is dependant on the tables generated by the Signaling Generator.

A/153 specifies a Service Signaling Channel (SSC) in each ensemble:
- SMT – Service Map Table (analogous to VCT)
- GAT – Guide Access Table (sources of Service Guide data)
- CIT – Cell Info Table (supports hand-offs when roaming)
- SLT – Service Labeling Table (supports fast frequency scan)
- RRT – Rating Region Table (standard A/65 RRT)
Other Tables from Signaling Generator

- NTP (Network Time Protocol) for Wall Clock Time
- GAT (Guide Access Table)
  - Accommodates multiple Service Guide (SG) data providers
  - Gives provider name and Service ID of each SG data service
- CIT (Cell Information Table)
  - Supports hand-off between transmitters when roaming
  - Tells about adjacent transmitters with same/similar services
- SLT (Service Labeling Table)
  - Allows receivers to display useful service list after brief RF scan
  - Gives service names in one ensemble; no need to visit all of them
- RRT (Rating Region Table)
  - Standard A/65 RRT
• Server Hardware Components
  – Platform: rack-mountable, minimum 2.0Ghz dual-core processor, minimum 80G hard-drive
  – OS: Red Hat Linux
  – Availability Options
    • Standard-Availability
    • High-Availability Configuration

• Server Software Components
  – Signaling Data Generator
    • Creates the tables that are sent to the Signaling Table Transmitter
  – Service Provisioning Interface
    • System configuration primarily from operator input.
  – Program Metadata Collector
    • Collects metadata from multiple sources
      – Listing Services…Gemstar, Tribune
      – Operator input
      – Main channel PSIP collected from Mobile Mux
Electronic Service Guide System

- **Function:** The Electronic Service Guide System (ESG) or (EPG) provides program guide and system announcement information about the programs that are in the mobile service to enable easy channel change capability. 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, on line transactions, non-real-time data delivery and a variety of exciting features which could be monetized.

- **Requirement:** Providing an Electronic Service Guide for the mobile DTV system is optional however the addition of an ESG greatly enhances the user experience. Redundancy should be considered if extensive commercial or revenue supported services are being provided.

- **Detailed Specifications:**
  - Extensive software based system running on a server
  - External information interfaces…TMS, TV Guide, station automation, traffic, etc.
    - Supports PMCP
  - Client work stations supported by Internet browser connection
ESG Relationship with Signaling

• Some overlap with Signaling layer:
  – IP multicast parameters
  – Title
  – Start time/duration
  – Genre category
  – Content advisory

• When there’s conflicting info, receiver shall use Signaling
  – Service Signaling Channel always takes precedence over Announcement

• ESG and Announcement is not mandatory

• When used, it must be compliant with the following:
  – M/H Service Guide is compliant OMA BCAST Service Guide, as further constrained by A/153 Part 4

• More than one ESG is permitted
  – Receiver technology will support aggregation of guides
Mobile DTV Service Guidance

- Lessons from CATV & Satellite
  - #1 branding + discovery tool
  - 10% of total viewing time
  - 20% of total service satisfaction

- ATSC-M/H enables multiple service guide models
  - “Signaling”
  - “Announcement”
  - Time/Grid ESG
  - Models can be mixed & matched within a single market... And within a single device
• **Richest User Experience**
  – Achieves parity with CATV, Satellite, DVR, MediaFLO, DVBH…
  – But... requires either aggregated broadcasting or a back channel
Time Grid Guide = Ecosystem
Opportunity For Mobile Operators

• Mobile Operators are in a fantastic position to provide time/grid guidance
  – Their devices inherently have backchannels!
  – Time/Grid ESG = opportunity to embrace the service in a rich, branded way
  – OMA-BCAST supports many operator-centric features within guide
    - Integrated unicast services + Application integration + SMS interactivity
Mobile DTV Widgets
Mobile DTV Widgets

- ATSC Mobile DTV currently focuses on Television services...
- “Mobile DTV Widgets” add Non Real Time (NRT) data services to the mix
- Delivers the web-like, on-demand content experience consumers expect... But over broadcast networks!
Mobile DTV Widgets
User Experience

KRBX is transmitting “Gossip Girl” program info and a catalog of data services including news, sports, weather, and traffic info.

When a user tunes to a supporting station, ATSC-M/H announcement data informs the receiver that a catalog of “widgets” are also available. The widget catalog provides widget icons and descriptions for the UI.
When a user selects the Headline News widget, the user interface displays a list of currently available article headlines.
Selecting a headline brings up a detailed view of the associated news article with a full-size image and article text.
Widgets + Guide = A New Media Portal

• Delivering the best of Broadcast + Mobile + Web
  – Mobile DTV is far more capable than analog broadcast
  – Mobile receivers are far more capable than terrestrial TV’s
  – Broadcast has unique, durable advantages delivering content to mobile devices

• A new discovery model
  – Internet: Portal → Media
  – Mobile DTV: Media → Portal
• Just as Mobile DTV easily leverages existing broadcaster DTV video...

• Mobile DTV Widgets easily leverages existing broadcaster web content
  – Assures immediate synergies between widgets & existing content production operations

• Content available through broadcaster web sites is often already in suitable format for distribution
  – RSS / ATOM new feeds
  – Video clips
  – Traffic images
Mobile DTV Widgets
Extensible to Many Service Types

- Mobile DTV Widgets leverage popular, flexible, content formats
  - RSS
  - HTML
  - Audio / Video Clips
  - Still Images

- These content types enable a wide variety of non-real-time (NRT) content services
  - News, Weather, Sports
  - Media Clips / Podcasts
  - Horoscopes
  - Traffic maps
  - Music clips
  - Event listings
  - Promotions…
**Mobile DTV Widgets**  
**Open Standards Based**

- DTV Widgets are based on the OMA Dynamic Content Delivery (DCD) specification and is being adapted within ATSC S13-1 (NRT) for DTV networks.
- NRT standardization approach reuses core building blocks from ATSC A/153 (M/H) including FLUTE file distribution and OMA BCAST Service Guide.
- Current Status: Tentative Decision reached in S13-1; Final standard in ~Q4 2009.
Widgets + Guide = New Ad Reach

- Widgets = local station content outside of the 6:00 news hour
  - Consumers can access content outside of the TV schedule
  - Content of arbitrary depth can be published

- New internet + video advertising inventory 100% owned by broadcaster
  - TV station internet ads recently crossed $1B threshold
  - Ads can be targeted to specific content (‘Traffic brought to you by BMW’)
Mobile DTV Widgets
Competitive Landscape

• DTV Widgets address some key competitive threats & opportunities for the ATSC Industry

• Users are increasingly familiar with widgets from other sources & networks

• ATSC DTV Widgets can leapfrog other, competitive models & broadcast networks
  – Power, reach & transport cost advantages over 3G/4G
  – Broadcaster programmed, local content is key
Non Real Time Content Delivery

Mobile Datacasting
Datacast – Leveraging Broadcast for “More than TV”

Videocast

- Single Live Game
- 30 FPS
- CD Audio

1 x 250kbps

Part of “Basic Mobile” Package?

Datacast

- Every Live Game
- Real-time Events
- Audio Alerts

1 of 25 x 10kbps

Premium Service ($5/mo?)
### Potential Datacast Applications

<table>
<thead>
<tr>
<th>Application</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Wallpaper</td>
<td>Background distribute Real time headlines</td>
</tr>
<tr>
<td>Real-time Sports Datacasting</td>
<td>Real time headlines</td>
</tr>
<tr>
<td>Stock Ticker - Real-time + Filtering</td>
<td>Local Datacast – Maps</td>
</tr>
<tr>
<td>Local Datacast – Maps + Traffic</td>
<td>Broadcast Storefront - Background distribute content teasers</td>
</tr>
<tr>
<td>Visual Radio</td>
<td></td>
</tr>
<tr>
<td>Real time TV “play along”</td>
<td></td>
</tr>
<tr>
<td>Sports “play along”</td>
<td></td>
</tr>
<tr>
<td>Homeland Security Alerts</td>
<td></td>
</tr>
<tr>
<td>“Hot or Not” real-time, group play along</td>
<td></td>
</tr>
</tbody>
</table>
Station Planning Factors
Planning your DTV service and mobile business models

Some Basics

- The FCC requires all digital broadcasters to provide at a minimum 1 SD NTSC quality free-to-air program service
- ATSC transport has 19.39 Mbps payload capability
- ATSC program guide (PSIP) requires about 0.5 Mbps
- Typical SD service in MPEG2 requires 3-4 Mbps
- Typical HD service in MPEG2 requires 10-14 Mbps
- M/H mobile channels are scaleable in number and require about 2 Mbps of the ATSC transport per ensemble
**DTV Spectrum Allocation**

### 19.4 Mb/s DTV Spectrum per Station

- **~0.4-2 Mbps**
  - Standard definition primary feed
- **~3-4 Mbps**
  - Additional SD multicasts
- **~2-4 Mbps**
  - 4 – 8 Mobile video channels
- **~9-14 Mbps**
  - PSIP & ancillary data services
- **100%**
  - Standard definition primary feed

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Illustrative

Independent
19.4 Mb/s DTV Spectrum per Station

- ~12 Mbps
- ~4 - 6 Mbps
- ~1 - 3 Mbps
- ~.4 Mbps

- High definition primary network feed
- 2-3 mobile video channels
- High-end hi def... or additional SD multicasts
- PSIP services
More Basics

- M/H mobile program streams are scaleable in quantity and robustness,
- Supports different types of content aimed at different types of receiving environments
  - Entertainment to the backseat consumer
  - News, weather, sports, traffic to the handheld and mobile consumer
Planning your DTV service and mobile business models

More Basics

• M/H mobile program streams can be free-to-air on all enabled mobile devices

  OR

• M/H mobile program streams can be offered on a subscriber supported basis

  OR

• They can be offered in a combination of both
More Basics

- Mobile/handheld reception is based on different planning factors than terrestrial DTV reception
  - Receive antenna height 45” to 6 ft. vs. 30 ft.
  - Receive antenna gain -10db to -3db vs. 0db

- Field testing has shown that the “radio horizon” is the limit to reliable mobile/handheld coverage
  - Typically line of sight from TX antenna to horizon
Rule #1

- UHF ATSC M/H transmission will typically out perform High Band VHF. Low Band VHF is not recommended

- Why:
  - Propagation is better suited to penetrate buildings
  - Spectrum noise level is much lower at UHF and very high at Low Band VHF
  - Receiver antenna performance is degraded at VHF compared to UHF
Planning your DTV system to support mobile services

Rule #2

- Transmission antenna locations that are at the highest possible location and closest to the population center to be served will typically perform the best.

Why: Mobile/handheld reception is highly dependant on “line of sight to the radio horizon”.
Rule #3

• Develop your facility to operate with maximum authorized ERP by using lower transmission antenna gain and higher transmitter power levels

Why: Higher antenna gain will often result in shadowed areas for reception. The goal is coverage saturation…not distance.
Rule #4

- Plan your transmission antenna system to include both horizontal and vertical polarization components.

Why: Mobile/handheld reception is highly dependent on vertically polarized receiving antennas. You will get maximum mobile/handheld coverage if you are also transmitting in the vertical plane.
What is the Right Type of Antenna?

Expected margin improvement over horizontal polarization in a heavy scatter, depolarized environment when transmitting to a linearly polarized receiver:

- Elliptical Polarization, 33% Vertical Same Antenna
- Circular Polarization Same Antenna
- Separate H and V Antennas

Margin Improvement (dB)
Experiment Results

Greatest Margin Occurs at 33% Vertical Component

More than 4 dB of margin improvement with 20% < Vpol < 50%

Optimum Range

Full CP

Horizontal Polarization Baseline

Vertical Polarization Baseline

Marginal Improvement (dB)

% Vertical Polarization
Rule #5

- Plan for system redundancy from the beginning of M/H operation

Why: ATSC M/H Mobile service is truly a wireless business. If you are off the air or limited in power, your mobile viewers will be lost. No cable TV distribution will support your wireless viewer base.
Rule #6

- Consider the use of “single frequency networking” (SFN) with multiple transmitters to provide coverage to areas that may be shadowed due to terrain or man made obstructions.

Why: Larger coverage area for the viewer without having to change channels to continue reception.
Single Frequency Network

- Single Frequency networks provide seamless coverage from multiple transmitters
- Ideal to overcome terrain shielding situations, or building penetration in urban areas
- Key for good mobile TV coverage
ATSC Mobile DTV Overview

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