

ATSC: Digital Television Update

Robert Graves

Advanced Television Systems Committee

*ITU Interregional Seminar on the
Transition from SECAM to
Digital TV Broadcasting*

Kiev, Ukraine

November 13, 2000

a — t — s c

Advanced Television Systems Committee

Advanced Television Systems Committee

- ❑ Technical Standards for Digital Television (DTV)
- ❑ DTV Implementation Activities
- ❑ Membership Organization -- International
 - Open to all organizations with a related interest
 - Broad, cross-industry participation
 - Broadcasters, cable, satellite, computer, movie & telecom service providers
 - Consumer electronics, computer & professional equipment companies
- ❑ Over 200 Members
 - Growing

a — t — s — c

Advanced Television Systems Committee

Options for DTV Business Models

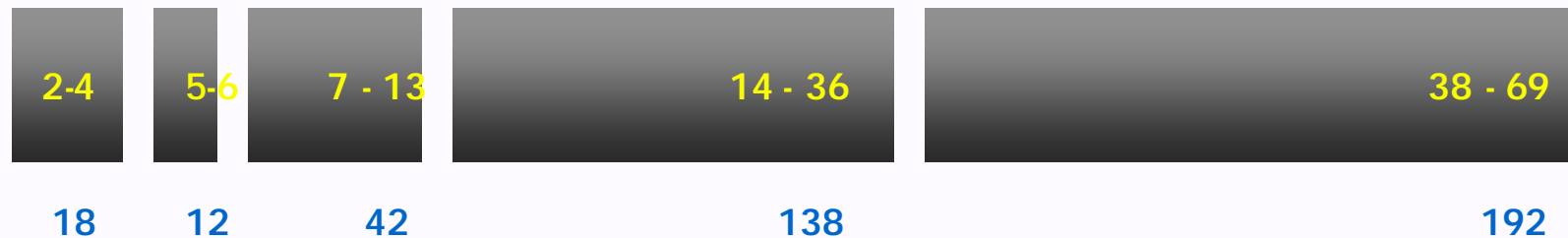
- HDTV (one or two programs)
- HDTV + SDTV (e.g., weather, news, alternative program)
- Multiple programs of SDTV
- Data services
 - Program-related or not
 - Interactive or one-way
- Combinations of HDTV, SDTV, data services
- Programs or data to mobile receivers?
 - Severe trade-off against deliverable bit rate
- Broadcast to TVs, PCs, or convergence products
- Free-to-air vs. pay services
- Impact of potential government requirements
 - Minimum HDTV requirements?

a — t — s — c

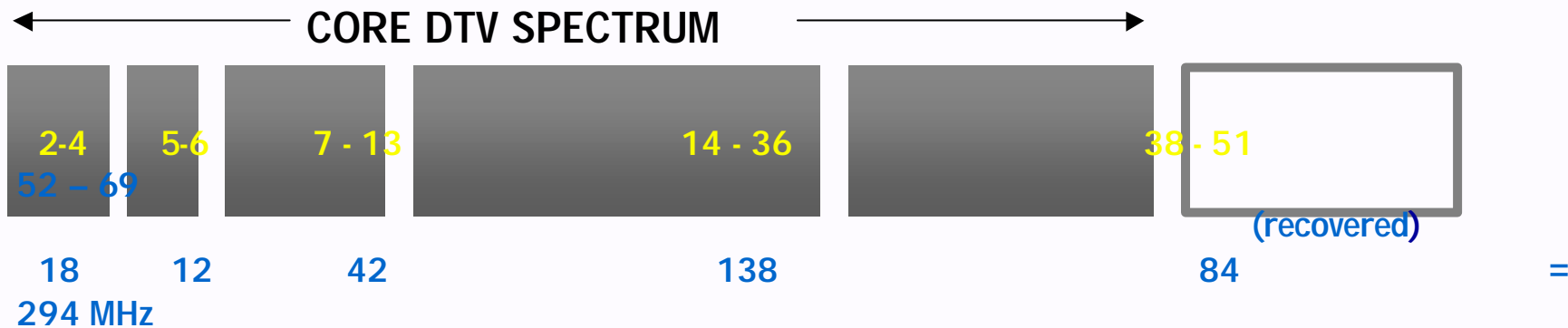
Advanced Television Systems Committee

Spectrum Efficiency

CURRENT NTSC CHANNEL DISTRIBUTION

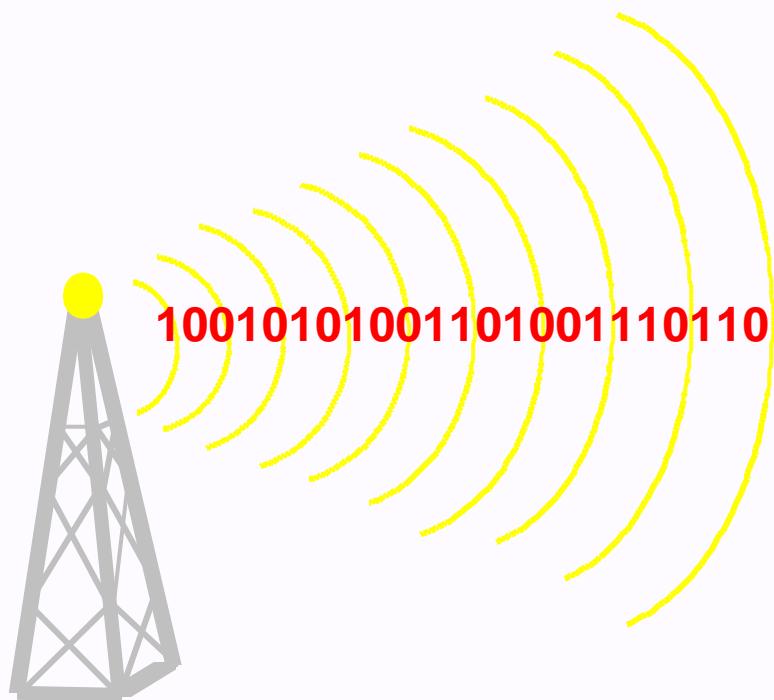


DTV CHANNEL ALLOCATION - END OF TRANSITION



108 MHz RECOVERED

Progress in DTV Deployment



- ❑ Current requirement:
 - 120 Stations
 - 30 Metropolitan Areas
- ❑ Actual deployment, as of November 2, 2000
 - 160 Stations
 - 56 Metropolitan Areas
 - Covering 65% of U.S. TV Households

*Source: U.S. National Association
of Broadcasters*

A Range of Consumer Products



Set-Top Box



Integrated Receiver



Computer

All can decode and display HDTV & SDTV

a — t — s — c

Advanced Television Systems Committee

Terrestrial & Satellite Set-Top Boxes



\$549

a — t — s c

Advanced Television Systems Committee

Integrated Receiver with HDTV Display



Starting at \$2,000

a — t — s — c

Advanced Television Systems Committee

Plug-in PC Card

+



\$200 - \$300

+

a — t — s — c

Advanced Television Systems Committee

Manufacturers of ATSC Receivers*

- ATSC receivers are available from over 20 manufacturers including:

Zenith/LGE

Sony

Panasonic

Samsung

Sharp

CreativeLabs

Philips

Thomson

Happauge

Funai

Tatung

Toshiba

Sanyo

Skyworth

Zinwell

Prima

Digitra

DSC

Mitsubishi

Televue

MonoVision/Chun Yun

Hughes Network Systems

- Prices have fallen approximately 50% in two years, expected to fall 50% more in next two years

* *Including VSB Demodulator*

a — t — s — c

Advanced Television Systems Committee

Sales of DTV Products

- ❑ Sales to date (as of September 30, 2000)
 - HDTV-capable displays ~440,000
 - DTV receivers & set-tops ~90,000

- ❑ DTV receiver penetration by 2006
 - Abundant DTV Programming 50%
 - Average DTV Programming 30%
 - Minimal DTV Programming 15%

Based on Consumer Electronics Association data

U.S. Consumers Are Satisfied

- *“DTV is meeting and even exceeding consumer expectations.”*
 - Gary Shapiro - President and CEO, Consumer Electronics Association
- National Consumer League survey* shows overwhelming satisfaction with DTV products
 - 96% consumers satisfaction with picture quality
 - 89% consumer satisfaction with audio quality
 - Biggest concern is lack of compelling HDTV programming

* Conducted May 31-June 14, 2000

HDTV Broadcasting in the U.S.

- ❑ CBS
 - Full primetime evening schedule
 - NCAA Final Four, Masters Golf, U.S. Open Tennis, NFL football games/Super Bowl
- ❑ ABC
 - Feature films
 - '99-'00 NFL football games
- ❑ NBC
 - *The Tonight Show With Jay Leno*
 - *The Titanic*
- ❑ PBS
 - Special programs, repeated frequently
- ❑ Local Stations
 - Local programs, including news and DTV/HDTV education programs
- ❑ DirecTV & Dish Network
 - HBO, Showtime
 - Pay-per-view programming
- ❑ Cable networks (only a few systems so far)
 - Feature films
 - Selected sports events

a — t — s — c

Advanced Television Systems Committee

High-Definition Television

- ❑ No longer a question of whether HDTV will be successful
- ❑ Will it be a primary service of terrestrial broadcasting?
 - Satellite
 - Cable
 - DVD



a — t — s — c

Advanced Television Systems Committee

Transmission & Reception Issues

- ❑ Driven by broadcasters, not consumers
- ❑ Issues
 - Adequacy of indoor reception
 - Receiver implementation shortcomings vs. modulation standard problems
 - Increasing interest in mobile services
- ❑ FCC
 - Rejected proposal to add COFDM as an option
 - VSB receiver improvements will resolve problems
 - Adding COFDM would create incompatibility, customer confusion, delay
 - Testing VSB receiver improvements in Washington & Baltimore

Transmission & Reception Issues (cont.)

□ Industry

- ATSC Task Force assessing RF System Performance
- Broadcaster industry organizations conducting tests, soliciting and funding VSB improvements

a — t — s c

Advanced Television Systems Committee

ATSC Task Force on RF System Performance

- ❑ Formed March, 2000
- ❑ Examining technical issues re RF system performance
- ❑ Developing recommendations to ATSC Executive Committee for technical initiatives
- ❑ ~ 100 members and non-members participating
- ❑ Work areas include:
 - Existing and emerging broadcaster requirements - complete
 - Uniform field test procedures – complete
 - Assessments of current 8-VSB performance and prospects for improvement – nearly complete

VSB Enhancements

- ❑ In response to new broadcaster requirements, in June 2000 the ATSC began formal standards activity to develop enhancements to VSB in parallel with ongoing DTV implementation
- ❑ Goal is to provide broadcasters with further flexibility to offer different types of service, such as reception by mobile receivers
- ❑ Work Plan (T3/S9, Chaired by John Tollefson, PBS)
 - Define market and technical requirements
 - Issue a formal Request for Proposals (RFP)
 - Analyze proposals
 - Select technical approaches and refine details



Advanced Television Systems Committee

Performance of Newer VSB Receivers

- ❑ Today, 8-VSB receivers handle ghosts twice as long – better reception and easier antenna pointing
- ❑ By 2002, VSB receivers will --
 - Handle pre-ghosts 8 times as long
 - Cancel stronger ghosts (up to 95%)
 - Handle faster moving ghosts (60 Hz)
- ❑ Any multipath performance gap as compared to COFDM systems is rapidly being closed

Bandwidth Aggregation

- ❑ New organizations aggregating portions of broadcast station bandwidth on a national basis
 - Geocast
 - iBlast
 - Broadcasters Digital Cooperative
 - SpectraRep
- ❑ Some proposals facilitate broadcaster provision of ancillary services; others simply lease “excess” data rate capacity
- ❑ Traditional single network affiliation for broadcast stations not necessarily the case for DTV

Reactions by the FCC and Congress

- ❑ “Broadcasters may not sell what they don’t own”
- ❑ Law requires that ancillary services not impair ability to provide DTV services, including HDTV
- ❑ Consumers must be given a fair chance to adopt HDTV
- ❑ More robust reception and ancillary services must not sacrifice FCC’s goal to replicate analog TV coverage
- ❑ DTV channel assignment plan may not be changed—delays are intolerable

New Initiatives Proposed by FCC Chair

Congress should:

- Eliminate the law that allows broadcasters to use two channels if receiver penetration benchmarks are not met
- Direct the FCC to require that all new TV sets sold after January 1, 2003 be capable of receiving DTV signals
- Require that as of January 1, 2006, broadcasters pay a fee for use of their analog channel
- Use spectrum fees to support public broadcast stations' transition to DTV and educational programs

a — t — s — c

Advanced Television Systems Committee

Enhanced TV

Data Broadcasting

DASE

- DTV Application Software Environment
- Software layer (middleware) allows programming content and applications to run on a “common receiver”

Interactive Services

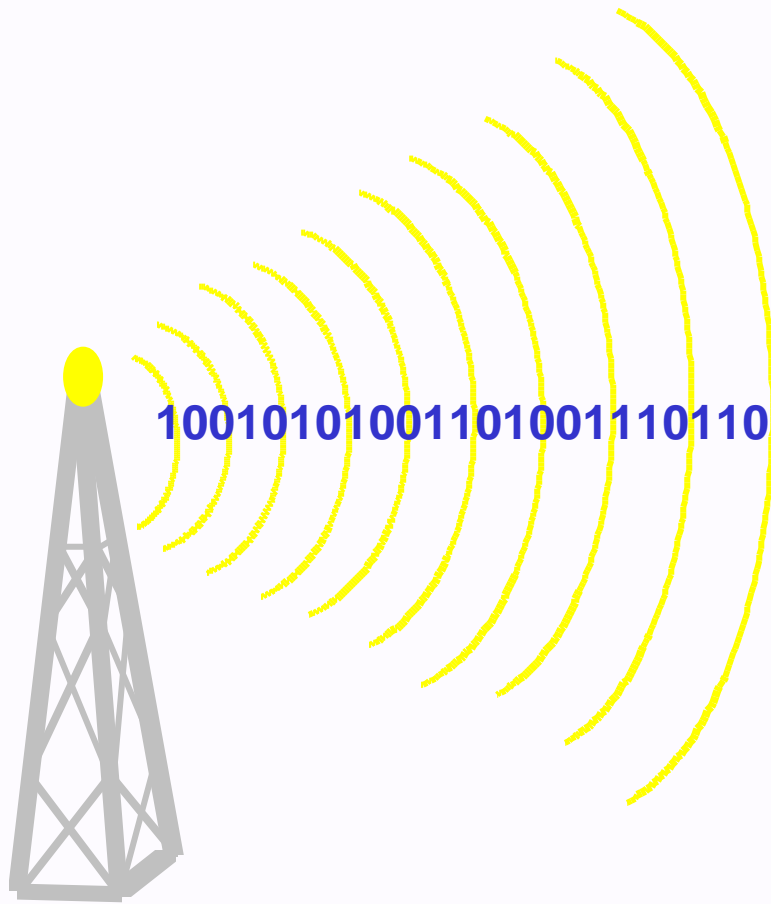
Directed Channel Change



a — t — s — c

Advanced Television Systems Committee

Data Broadcasting Standard



- ❑ Supports program-related or stand-alone Data Services streams
- ❑ Standard includes:
 - Profiles and levels to match a wide spectrum of data receiver capabilities
 - Multiple encapsulation options
 - Announcement of delivery schedules of Data Services streams in an ATSC multiplex
 - Application Signaling for discovering Data Services applications and the network resources they use
 - Buffer models for delivery of data elementary streams

a — t — s — c

Advanced Television Systems Committee

A Range of Target Receivers



Set-Top Box



Integrated Receiver



Computer

a — t — s — c

Advanced Television Systems Committee

Data Broadcasting Spec. - Harmonization

- Portions of the specification are aligned with DVB
- Portions are aligned with U.S. cable standard (synchronous data delivery)
- Additional mechanisms are provided to support functions not addressed by either standard
 - Packetization format for delivery of streaming asynchronous data
 - Application Signaling for discovery and binding of Data Services
 - PSIP-based announcement of Data Service schedules
 - Support for delivery of synchronized data modules (bounded data)
 - Buffer model for synchronized data to establish a delivery contract between servers and receivers
 - DSM-CC network resource descriptors to support dual-tuner receivers and receivers with a cable or DSL modem for Internet access

Slide courtesy of

The Intel logo, consisting of the word "intel." in white lowercase letters on a blue square background.The ATSC logo, featuring the letters "a", "t", "s", and "c" in a bold, black, sans-serif font, with horizontal lines connecting the "t" to the "s" and the "s" to the "c".

Advanced Television Systems Committee

Amendment to PSIP Standard (A/65)

❑ Directed Channel Change (DCC)

- An optional capability that allows broadcasters and system operators the ability to send a trigger that will cause a DCC-capable receiver to switch to a different virtual channel based upon the interest of the viewer
- Virtual channel changes may be based on parameters defined by the viewer, such as:
 - Postal, Zip or Location Code
 - Program Identifier
 - Demographic Category
 - Content Subject Category
- Potential applications include:
 - Customized programming service
 - Commercials based upon demographics
 - Localized weather & traffic reports
- Status: **Approved**

a — t — s — c

Advanced Television Systems Committee

Directed Channel Change Example



M	24
M,F	62,59
M	19
F	41
F	
M	
M,F	41



All Homes



Home #1



Home #2



Home #3



Home #4

ATSC Comments on SET/ABERT Tests

- ❑ Low power, low transmit antenna, small coverage area (<30 km)
- ❑ SET/ABERT data does not support rejection of VSB
 - Lab tests show substantial advantages for VSB
 - VSB outperformed DVB 2k in only statistically meaningful field tests
 - Limited data on ISDB and DVB 8k are inadequate for conclusions
 - Latest data only on 27 selected sites, did not include best VSB receiver
- ❑ Data suggests VSB failures due to *long* ghosts, not *strong* ghosts
 - 3rd & 4th generation VSB receivers expected to improve performance
- ❑ Only complete side-by-side tests of VSB, ISDB, and DVB 8k would be valid
- ❑ Channel planning must be an integral part of decision
 - Interference, not multipath, key issue for São Paulo
 - ATSC/VSB offers substantial advantages for channel assignments
- ❑ Technical *and* economic factors should be considered
- ❑ See www.atsc.org for details, including similar comments from Campinas State University professors

Key ATSC Technical Advantages

❑ VSB transmission system

- For equal data rate, COFDM requires more than twice as much power as VSB to achieve equal coverage, causing much more interference into analog service, making DTV channel assignments much more difficult
- VSB's additional 2.5 dB advantage in peak-to-avg. ratio means COFDM transmitters would require much higher procurement and operation costs
- VSB offers better impulse noise performance than DVB-T, a crucial difference for the ability to use VHF channels
- Continuing VSB receiver improvements will eliminate multipath performance gap

❑ Dolby AC-3 multi-channel audio

- Consistently better performance than MPEG Layer-II at equal bit rates
- AC-3 is already the *de facto* worldwide standard, now available as an option with DVB

a — t — s — c

Advanced Television Systems Committee

Key ATSC Economic Advantages

- ❑ ATSC has been implemented using all-format decoders
- ❑ ATSC has a strong focus on HDTV (no plans in Europe!)
- ❑ Consumers in ATSC countries can immediately take advantage of two or more years of progress in driving down the prices of receivers
- ❑ Larger markets provide economies of scale
 - SECAM countries can benefit from large DTV markets in the Americas and much of Asia
 - Implementing ATSC will mean a greater variety of components, equipment and products from more suppliers at lower prices, especially for HDTV receivers and all-format DTV decoders

a — t — s — c

Advanced Television Systems Committee

ATSC Around the World

- ❑ In **U.S.**, 160 stations in 56 cities, reaching 65% of households
- ❑ Canada DTV Inc. planning service rollout in **Canada**
- ❑ Test broadcasts under way and at least one commercial ATSC station in operation in **Mexico**
- ❑ **Argentina** chose ATSC in 1998
 - Compelling reasons for retaining ATSC in any review by new government
- ❑ ATSC working hard in **Brazil**
- ❑ Excellent prospects in **Chile** and the rest of **South America**
- ❑ Service launches planned for 2001 in **Korea** and **Taiwan**
- ❑ ATSC active in **China, Hong Kong, Philippines**, etc.
- ❑ ATSC stands ready to help address **SECAM countries'** needs

Conclusions

- ❑ DTV implementation is well under way in the U.S.
- ❑ ATSC offers full DTV solutions for SECAM countries
 - HDTV, SDTV, data services, or combinations
 - Work under way to standardize enhancements, including mobile
- ❑ VSB offers significant coverage advantages
 - Much greater ability to accommodate sufficient DTV channel assignments
- ❑ New VSB receivers are rapidly closing any multipath performance gap
- ❑ ATSC offers a good choice for SECAM countries
 - Significant technical advantages
 - More equipment at lower prices

ATSC: Digital Television Update

Robert Graves

Advanced Television Systems Committee

*ITU Interregional Seminar on the
Transition from SECAM to
Digital TV Broadcasting*

Kiev, Ukraine

November 13, 2000

a — t — s c

Advanced Television Systems Committee