# History of Radio and Television Broadcasting

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Outline
Class focus is on Technology and Innovations
Format : Capture, Storage and Distribution of Audio and Video
Day 1: Radio and Sound, Day 2: TV and Video, Day 3: Modern Radio/TV

Audio Spectrum : 15 Hz to 20 KHz

## Microphones

Microphone Patterns
- Unidirectional, Bidirectional, Omnidirectional

Carbon and Crystal Microphones
300 Hz – 3.5 KHz limited but best for voice
Telco took advantage of limited bandwidth to avoid crosstalk
Used in PA, telephones and Radio

Dynamic Microphones
200 Hz – 12 KHz best for voice
Rugged, often used in TV since many were low profile
Used in PA, TV some in Radio

Ribbon Microphones
50 Hz – 15 KHz wide bandwidth good for voice and music
Ribbon quite delicated, easily fractured
Used in Radio and TV studios

Condenser Microphones
15 Hz – 20 KHz best bandwith for all purposes
Very rugged despite being highly sensitive
Used mainly in recording studios

Shotgun Dolly Boom mics

20 Hz – 10 KHz often unidirectional mostly for TV voice pickup
Used in TV studios and field settings
Fish pole boom used in TV and Film shoots especially in the field
Dolly used in studios for TV and Film

Handheld mics

20 Hz – 10 KHz mainly for flexible voice pickups
Often used in TV game show applications

Lavalier mics

20 Hz – 10 KHz mainly for voice
Used in TV for variety shows and news broadcasters

## Sound Recording

### Transcription Recording

Early Wax Cylinders and Disks used acoustic-mechanical lathes
Electrified microphones made amplification possible

Sound recording mastering of records and programs

Transcription Applications in Radio
- Programs
- Commercials
- Music

Movie Sound Storage
- Early film sound recorded optically
- Transitioned to magnetic film for production
- Continued using optical sound into late 20th century

### Magnetic Audio Tape Recording

Magnetophone Audio Recorder
- Earliest magnetic tape system invented in Germany
- Purchased by Bing Crosby after WWII
- Prototype for Ampex 300 first commercial audio recorder
- First audio tape produced in U.S.A. by 3M.

Magnetic Audio Tape
- Format: ¼ inch wide, 1.5 mil thick
- Speeds: Broadcast: 7.5 ips, Sound Recording: 15 ips
- Duplication speeds: 30 and 60 ips; later: 120 and 240 ips

## Ampex Tape Recorders

### Multitrack Recording

- Required by sound recording reduce multiple generations
- 16 tracks on 2” tape, up to 32 with improved head technology

### Radio Applications of Audio Tape

- Programs
- Commercials, PSAs, Promos
- IDs, Beds and Bumpers
- Tape Delay
- Call In Packages
- Off-Air Recording Logs

### Tape Loops

- Sound beds and sound effects for Radio
- MacKenzie technology – similar to Laff Machine in TV

### Cartridge tape

- Continuous tape loop and automatically cued itself
- Portable “sound in a box”
- Different sizes for spots, songs and programs

### Tape Cartridge Systems

- Cartridge Carousel
- Cartridge Stack

### Schafer automation

- Music on reel-to-reel tape; each cut cued optically
- Spots, Ids and Time announcements on carts
- Music reel cuts could be played in random sequence
- Audio sources could be played in various sequences

## Radio Automation Today

- Modern Radio Automation is entirely software based
- Runs on standard desktop computer systems
- Examples: KWVF 102.7 Santa Rosa, Calif. & SiriusXM Radio

## VoxPro

- Based on IBM PC
- Replaced reel-to-reel audio tape for call-in packages
- User interface similar to tape control interface
- Last reason to have reel-to-reel audio tape in DJ control booths
- Gently introduced Radio DJs and Program Directors to computers

## Radio Transmission

Frequency Spectrum

Radio Transmission
- AM Spectrum 538 – 1700 KHz, Channel spacing 10 KHz
- FM Spectrum 88 – 108 MHz, Channel spacing 200 KHz
  - FM Maximum deviation: 150 KHz

AM Transmission

FM Transmission

## Early Radio Networking

Radio Bicycle Networks
- Programs recorded on Transcription for non-connected affiliates
- Continued by NER and NPR until 1980s.

Regional Radio networks
- Earliest radio networks were regional
- NBC Blue and Red – Live only in the Northeast
  - Separate originations in the West from San Francisco
- NBC Blue -> NBC Gold; NBC Red -> NBC Orange

Transcontinental Radio Networks
- Network circuit from New York to San Francisco one way
  - Network circuit eventually made reversible
  - Shared by NBC Red and Blue networks
- Hollywood's rise changed focus from San Francisco to Hollywood
  - NBC Red network circuit to Los Angeles
- Eventually two-way circuits only between LA and New York

Round-Robin Networks

A closed loop network with multiple transmission points
Usually administered by Telco Long Lines
Some networks controlled their own transmit points : NPR ex.

Networking Impacts on Network Productions

Networks move to Hollywood
NBC – Radio City West -> TV -> Color: Color City Burbank
CBS – Don Lee Network (KHJ) -> KNX -> TV: Television City
ABC – NBC Blue -> ABC -> TV: Prospect & Talmadge Studios

NBC Radio Networks 1939

CBS Radio Network 1939

**Networking Technology**

Transmitting multiple programs == multiple phone calls
Multiplexing allowed multiple channels on same cable or carrier

Multiple Carriers allowed multiple channel groups on same media
Multi-Channel RF Transmission allowed channel groups on radio

Long Line From Cable to Microwave

Original circuits were repurposed voice grade cable bundles
Broadcast circuits later travelled with voice grade circuits
Signals later multiplexed on wide band cables instead
Cables replaced by point-to-point terrestrial microwave towers

Satellite Networking

- Geosynchronous satellites are stationary platforms in space
- Transponders receive and transmit on specific frequencies
- Satellite transmissions are point-to-point line of sight

Satellite Applications

- TV Field Remotes
- TV and Radio Networking Between Network Centers
- Radio Networking Direct to Stations
- Satellite Broadcasting Direct to Subscribers

# Television

## Beginnings of Television Networks and Stations

Early Television stations were experimental
Early Television networks mainly live broadcast
Live telecasts mostly East coast only
Non-interconnected affiliates received recorded programs

First TV Broadcast NBC 1928 Flying Spot Scanner: "Felix The Cat"
First TV News Broadcast on NBC Feb 16, 1949 John Charles Daley
First Live Coast to Coast Telecast NBC 1951 President Truman

## NTSC Video Format

525 Lines, 2 Fields, 1 Frame, 30 Frames / Second
Foreign 25 Frames/Second formats: PAL and SECAM

Video scanning tubes

Iconoscope – very low quality used only for a short time
Image orthicon – standard for studio and field work in 20th century
Vidicon – Film chain broadcast and Industrial video standard
Plumbicon – Norelco competitor to Image Orthicon from RCA

## RCA Black and White Cameras

TK-15 early studio and field camera – tube based very hot
TK-44 later transistorized camera – cooler and lighter weight

Telecine

Vidicon cameras captured still slide and motion picture films
Had to transfer 24 fps film to 30 fpm video

**Color Wars : CBS Field Sequential System**

Incompatible with existing monochrome
Used a Mechanical color wheel
Required television sets required
CBS proposed color broadcasts on UHF – failed marketing

Color Wars : NBC Compatible Color System

Compatible with existing monochrome
Used Multiple scanning tubes
More electronics
Eased transition to color

NTSC Color video

Color Burst signal on each frame carries color information
Monochrome receivers ignore the color information
Vectorscope used with Color Bar chart to align color cameras

RCA TK42 Color Camera

Transistor, second generation RCA Color camera
Used 3 3 ½" Image Orthicon tubes.
Synthesized monochrome signal

RCA TK44 Color Camera

Third generation RCA Color Camera
Used 3 ½" Image Orthicon tubes for Color and 1 for monochrome
Dedicated monochrome signal, higher resolution

Color cameras

RCA, Norelco PC-70, later Sony HDC 8000

**Camera Mounts**

Pedastal mount for studio use, Tripod for field and studio use

Camera Cranes

Dolly Boom crane inherited from motion pictures
Used often for studio audience shots and dramatic studio shoots

**Camera Miniaturization**

RCA Walkie-Lookied introduced at 1958 Policitcal Conventions
Imagawa Handi-Lookie Japanese competitor
First examples of wireless portable analog video camera
Later RCA CCD-1 digital video broadcast camera late 1990s

**Video Recording**

**Kinescope**

Impact of Kinescope Recording on Film
By May 1949, television networks were using 250,000 feet of film every week in New York City alone.
By 1954, TV networks were using more film on a weekly
than all the Hollywood studios put together.

Kinescope Options

16mm B&W Negative, 16mm B&W Reversal

Inexpensive compared to 35 mm
Fast turnaround as it was developed in-house

Optical Film Sound track vs Magnetic Film Sound track

35mm Color, 16mm Monochrome

For color since 16mm stock conventionally low resolution
Expensive stock and longer development time

NBC Lenticular Kinescope System

Used special film to record color on black and white stock

Extra: The Edsel Show (CBS)

**Film Production for TV**

Initially an alternative to Video production
"Multicam" technique for audience shows
Later, CBS and ABC competed with Color Film
I Love Lucy Show
Gunsmoke

**Video Tape Recording**

Early Videotape: VERA at BBC

Typical of longitudinal attempts recording video at high speed

Quadrature Tranverse Video Recording

Tape recorded transverse with heads rotating at 14,400 rpm
Tape speed a leisurely 15 ips, conserved tape stock
Tracks: Audio, Video, Cue Track and Control Track
Intended for Time Zone Tape Delay broadcasts

Early 2" Quad VTRs

Ampex VR-1000A first commercial videotape machine
Funded by Bing Crosby
Copied by RCA to produce their TRT-1A one year later
Tube based systems, monochrome only

Later 2" Quad VTRs

Ampex VR-2000B, first transistorizes commercial videotape
TRT-70 RCA's first transistorized videotape machine
Monochrome and color

Time Zone Delayed Broadcasts

Time Zone Delay broadcasts were the reason videotape was first introduced, very similar to Kinescope recordings.

Bing Crosby's motivations to support videotape development similar to his motives to support audio tape development.

First Network VTR Delay

CBS November 1956 "Douglas Edwards and the News"

Early VTRs at NBC Burbank 1964

By 1964 NBC Burbank had 4 Ampex VR1000As and 8 RCA TRT-1As

Sarnoff wanted NBC to be the Color Network

NBC engineers modified VTRs at Burbank for Color TV

First Color VTRs in the world; others had to wait for manufacturers

NBC Burbank Tape Delay Schedule supported daytime and nighttime

Videotape Cartridges similar to audio cartridge tape systems

## Post Production

## Editing Videotape

Physical Editing
- Used Smith Guillotine Videotape Splicer
- Cutting video did not sync cut with audio track
- Initially limited utility

Videotape ~~Manual~~ Kamikaze Assembly
- Playback machine transferred scenes to Assembly master tape
- Manual control of the edit led often led to disasters

Program Assembly
- Ideal process: make edit decisions from a copy of the master
- Conform the picture master one edit decisions were made
- Conform the sound tracks to the picture master

NBC Double System Editing
- Similar to motion picture editing process
- Used master videotape as the “negative”
- Kinescope work print used to make cutting decisions
- Magnetic sound track used to conform production audio
- Videotape master picture conformed after all editing decisions
- Audio dubbed from mag track to video master after editing

ESG – Editing System Guide cue tracks
- Used to sync videotape master, work print and magnetic sound

Laugh In - NBC
- Artie Johnson segment idea from editor: Art Schneider
- Major scenes: Monologue, Blackouts, Party, Vignettes, Wall
- Over 150 edits per show – usual in TV Variety shows was 50.

Videotape Editec Assembly

Ampex answer to Assembly editing

Automatically made Assembly edited using Cue Track cues

SMPTE Timecode

Invented by EEMCO, standardized by SMPTE

Used today in Sound recording, Motion Pictures and Television

Tells you where you are on reel; time of day scene was shot

Timecode Editing

Uses SMPTE timecode to locate scenes and takes on reels

**Portable Videotape Recording**

AMPEX VR3000 – 2" early portable videotape recorded

**Helical Scan Videotape**

Less expensive, Reversible, Enabled Slow motion and Stop motion

Applications: Editing and Electronic Journalism

Ampex Helical VTR: AMPEX VPR-1 Helical

Other Helical Videotape Systems

**Video Laserdiscs**

Expensive ,Reversible, Slow motion, Stop motion

Applications: Editing and Replays

**Early Computerized Editing**

1971 CMX-600 Editor

1976 Ampex EDM-1

Avid Media Composer

## Transmission

Video Transmission Spectrum - TV Transmission Band Channels

VHF Channels 2 – 6, 54 – 88 MHz
VHF Channels 7 – 13, 174 – 216 MHz
UHF Channels 14 – 69, 470 – 806 MHz

Channel Bandwidth: 6 MHz
Audio Carrier offset: 1.25 MHz, Video Carrier offset: 5.75 MHz

## Distribution

Microwave Terrestrial TV Networking

Satellite Cable TV Networking

Satellite TV Networking Direct to Stations

Public Media Interconnect Timeline

Satellite TV Networking Direct to Stations

Satellite TV Networking Direct to Stations

Public Media V5 and V6 Interconnects

New PBS Interconnection Rollout
Retain 2 of 3 existing satellite transponders : East &West
Retire 1 satellite transponder for offline playout.
Later, move East and West live feeds to terrestrial fiber optic
Significant reduction to ongoing satellite costs

## Digital Media Impacts

### Technology Drivers

As the 20th century moves into the 21st century, the trends of Miniaturization and Computerization continue to influence and drive new technology for media.

The most significant trend is the introduction of Digital Media, enabled by technology innovations in computer technology.
The need for a common exchange mechanism for audio and video drove new digital formats. Those formats in turn made possible seamless media technology content integration across diverse platforms.

### Digital Media

Analog vs Digital
Analog media differs from Digital media in a variety of ways.
The most fundamental difference is in how the two represent the input signals, whether sound or light.
Analog media makes copies of the input signal. Each time an analog system creates a new generation of an audio or video signal, the new copy contains everything in all previous generations. This means that any distortion or noise inherited from prior generations propagates to the new generations. The result is that the quality of the analog signal degenerates as more generations are created.

Analog media signals are stored and transmitted as a continuous range of values. Every possible amplitude and phase of every possible frequency in the required bandwidth of the audio or video signal must be available at all times. This is more than is required, but it is a very

simple way to store and transmit signals. The result is that there must always be sufficient bandwidth to accommodate any signal at any time.

Digital media works by creating a digital description of the input signal, whether audio or video. This digital description contains only sufficient information to recreate the audio or video signal on demand when required. Since the description is digital in nature, it is stored and conveyed as binary digits or “bits”. The descriptions can therefore take on only specific values for any given input signal. And it is possible to perform mathematical error checking on the digital descriptions to determine if anything was lost in storage or transmission. This enables error correction capabilities not available in analog media.

**Digital Art**

Analog media can only be altered by making some form of copy of an original signal. To alter analog sound, the original sound must be passed through a device that changes the sound in some way and then recorded as a new copy on analog audio media. To alter analog video, the original video must be put through a device that alters the video and then recorded as a new copy on analog video media.
Since digital signals are stored as digital data descriptions, it is possible to alter those descriptions directly if desired. Such changes to the digital descriptions will affect how those descriptions are rendered when the digital descriptions are decoded back to analog sound or video for listeners or viewers respectively.

Digital audio and video editing is accomplished by altering the digital data descriptions of original audio and video signals.

**Digital Capture**

For the most part, microphones remain analog devices. The challenge of translating sound pressure waves to electrical signals is still an analog process.

Cameras produce digital outputs directly in the digital video world. Most cameras use CCD technology that produces digital signals directly.

The signals must be encoded to digital format before it can be processed, stored or transmitted. This is accomplished by digital encoder technology both for audio and video.

**Digital Storage**

The sound and video recording industry today uses mostly hard disk storage technology, similar to that found in computer systems. The move is more to Solid State Device (SSD) technology with no moving parts, high reliability and long-term persistence.

While SSD and similar technologies afford good long term storage solutions compared to tape and film, archival storage for decades still demands etched solutions like CDs and DVDs.

These solutions are used consistently in sound recording, motion picture production and radio and television production.

**Digital Distribution**

Internet technology has been, without doubt, the key driver of late 20th century and 21st century media distribution.

The sound recording, motion picture, radio and television broadcasting industries have all uniformly moved to multiple tiers of Internet based digital media technology.

Sound recordings are now available as digital audio streams. Radio sound is now likewise available as real time digital audio streams. Motion pictures are now distributed as digital video streams as are television programs.

All digital media, whether distributed on disk media or on networked media, contain mixed-media content. It is common for sound recordings to be provided with text liner notes and images. Radio and television broadcasts contain extra embedded information about the broadcasts. Motion picture disk and networked media streams often contain extra scenes, interviews with production team and cast members and other bonus content. All of this is possible because of the extra capacity afforded by digital media technology.

## Digital Production

Shooting Format of Top 100 U.S. Films

In the past few decades, there has been a decided shift in the way theatrical motion pictures are captured. In earlier years most every theatrical motion picture was shot on film. Rarely was video capture contemplated much less used in motion picture production.

In more recent years, most all theatrical production shoots are done on high-definition video. The use of film as th primary shooting stock has almost completely vanished. Some motion picture directors of photography still use film to obtain specific visual looks and feels. But evolving production techniques and digital video manipulation capabilities are rendering almost all use of film stock unnecessary.

Furthermore, digital video offers new types of special effects that are simply not possible with analog motion picture film stock. Limitations of traditional motion picture printing process special effects have been completely bypassed by modern digital video effects systems, which in turn obviate the use of digital technology over traditional film.

Video Formats
Standard definition formats were 4:3 aspect ratios.
Standard definition format required that motion picture frames had to be rephotographed to capture the effective working area of each frame since original motion picture frames had much larger aspect ratios than standard definition television frames could accomdate. This had the impact of altering the visual scene as envisioned by the motion picture film director.

High definition formats are various and extensible.
Motion picture frames can be displayed directly on dynamically adjustable digital video and film frames can be compressed dynamically as well, thus removing the need for making scene-altering decisions and thus preserving the intentions of motion picture directors.

CCD Video Capture
Modern Charge-Coupled Device (CCD) technology enables direct capture and conversion of light to electronic digital signals. The face of the CCD is photo-sensitive, similar to a photographic emulsion.
The main difference is that the CCD face is composed of millions of pixels that are sensitive to various fundamental colors of light.
These can be addressed directly on the CCD chip, which eliminates the need to scan the photosensitive surface, unlike the traditional electron scanning beams in traditional video cameras and monitors.

**Production Special Effects Evolution**

Motion Picture Glass Matte
One of the earliest techniques for shooting a synthetic scene in motion pictures was Glass Matte photography. A larger, often quite difficult to build, scene was painted on glass with space left through which a live action scene could be shot by a film camera. The resulting camera negative was a composite shot that could be developed directly.

The main issue with this form of matte photography was that no changes could be made to the scene once it was photographed.

The next major innovation in matte photography was the introduction of a blackened area where the clear glass had been. This left the camera negative clear in the blackened areas. The live action was photographed through a glass matte with all the painted areas in the original matte painting blacked out. When the two rolls of footage were combined in the printer, the composite scene rendered the final effect. The major advantage of this dual matte technique was that the matte painting could be produced after the live action photography had been completed.

The glass matte technique was not restricted to films of yesteryear, although the technique is less often used in the 21st century. Two well-known example are the “Star Wars” films and “Raiders of the Lost Ark”.

Process Photography

Motion Picture process photography involved putting live action in front of a projection screen upon which another scene was rear projected. This technique required a specially equipped sound stage. The camera shutter photographing the live action scene in front of the screen had to be shutter synchronized with the rear screen projector shutter. This was originally accomplished with a mechanical linkage between the camera and the projector and required special stage construction.

Most action films of the late 20th century used process photography including the “James Bond” films. Perhaps one of the most famous films of the mid-20th century that used process photography was Hitchcock’s “North by Northwest”, starring Cary Grant.

In time, directors wanted a more flexible way to shoot process shots. With the advent of color photography, it became possible to use a specifically colored background to insert background scenes during printing. The area inserted was governed by the parts of the original live action frame that did not contain the background color. Thus it was possible to have dynamically changing background scenes and frames. Typically blue screens were used in motion picture production for this purpose.

The concept of blue screen process photography found its way to television in the analog media through ChromaKey technology.
The technology took advantage of the way in which different colors are processed in video chains. This made it possible to add backgrounds to live action or studio shots. The most typical example in the early analog video days were backgrounds in local and network news casts and weather reports.

The introduction of digital video made it possible to extend background capabilities in a variety of ways. An early approach simply used the ChromaKey concept, identifying those areas of a digital scene frame that contained a particular color. But the capabilities extended even further, since it was possible to identify dynamically changing areas in digital video frames as background “layers”.

The concept of layering had been introduced in analog video as Chyron technology, usually used to layer text over live action shots.
Now with digital video multiple layers could be introduced either in live production or in post-production or both.

One of the most interesting capabilities today used in both television and motion picture production is the Digital Studio. The entire “Suze Orman Show” was produced in a studio that is almost entirely painted green. Every detail of the set and the backgrounds are digitally

generated. There are no physical sets of any kind. Only the live performers are not digital. Once the initial cost of building and equipping the digital studio is recovered, this is one of the least expensive ways of shooting video.
It is used today both in television and in theatrical motion picture production.

Local TV uses digital layers extensively. The earliest examples appeared in Asian television. The technology made its way across Europe and England in the late 1980s and '90s and found its way to the U.S. in the early 20th century. One of the first cable channels to use the technology was Bloomberg News cable television. Today it is used by most every television outlet, whether broadcast, cable or Internet.

**Digital Cinema Today**
Perhaps one of the most dramatic, and for many lay people surprising, change is in theatrical film production and distribution. As noted, almost all motion picture production toady is shot on video originals. Virtually no film stock is shot any more.

But the motion picture theater technology has also changed. Not only are motion pictures not shot on film, but they are likewise not distributed on film either. Today almost all major theatrical motion pictures are distributed on digital video media. Delivery to theaters is principally via Internet technology. Modern motion pictures are file transferred to theaters, stored on digital disk technology and projected by laser-powered electronic projectors. There are no film reels anywhere.

## TV Digital Capture

### Hubcasting

Also known as “Central Casting”, Hubcasting is a new approach to running local television and radio stations.
Traditionally, television stations had studios with production control rooms where local programs were produced. They had a separate “master control” where programs were put on the local broadcast air. Even when there was no one else at the station, there was always at minimum a master control operator loading film or videotapes, and switching the on-air video and audio sources.

However, Internet and new high-speed communications technology infrastructures offer a new more cost-effective way to manage the traditional master control operations at the local station level.

In a hubcasting scenario, all station content originates from the hub facility which is often located in another city and state. The signal is sent via satellite, microwave relay or fiber optic relay to the local station for local broadcast. The transmitter has to be in the local coverage area for technical reasons. The hub facility also sends the same signal to cable providers and streams video to the Internet if desired. Only live to air programming actually originates at the station. All promos, local commercial (even those shot at the local studio facilities) and all prerecorded local programs (like the Hampton Roads Show on WAVY) are sent by Internet or other relay link to the hub facility for broadcast. So when you are watching a hub station, you are actually watching a signal that originates from somewhere else in the country usually.

We are fortunate in the Williamsburg market to have examples of all the major Hubcasting options in use today.

The following table shows various local area TV stations, the channel(s) they broadcast on, their network affiliations and their companies of ownership.

Local Hubcasting

| | | | |
|---|---|---|---|
| WTKR | 3 | CBS | HUB Tribune Broadcasting |
| WGNT | 7 | CW | WTKR Tribune Broadcasting |
| WAVY | 10 | NBC | NexStar |
| WVEC | 13 | ABC | No hub |
| WHRO | 15 | PBS | Public Media |
| WVBT | 43 | FOX | NexStar |

WTKR is a local CBS affiliate, acts as a hub for Tribune Broadcasting. It is the only station in the local market that does so. WTKR therefore is controlling other stations signals as well as its own. Among those stations is WGNT, a local CW network affiliate.

WAVY is a local NBC affiliate and operates as well as WVBT a local FOX affiliate. It is owned by the NexStar Broadcast Group who operates a hub remotely. So all the broadcast content except for live local new originations, comes from the NexStar hub and not the WAVY studios.

WVEC is a local ABC affiliate. It is one of the only commercial stations in the market that operates in the traditional manner, having its own local master control facilities. It has no joint master control function.

WHRO is a local PBS member station. It is moving to a new Public Media Hub center in the near future.

## Digital TV Standards

## Digital TV Distribution

| **NTSC** | **ATSC** |
|---|---|
| Standard for Analog | Standard for Digital |
| SD Quality, no HDTV | HDTV Quality |
| 4:3 Ratio | Adaptive Wide screen formats |
| Monaural Sound (1.0) | 5.1 Surround Sound |
| Lower bandwidth | |

ATSC vs NTSC Channel Spectrum
The ATSC HD TV digital signal broadcast is essentially the digital data describing all the digital video, audio and text content. The signal is decoded by the receivers using the adaptive CODECs allocated for digital television.

The NTSC SD TV segregates the video luminance, video color and audio signals around the single pilot carrier of the channel. There is no capability in this bandwidth to add any additional signals.

ATSC Digital Broadcast TV Channel
The audio, video, text information is multiplexed and encoded into the standard digital TV signal before it is distributed, whether broadcast, netcast or cablecast. Receivers reverse this process by decoded and then de-multiplexing the various different signals for presentation to viewers.

Note that multiple programs can be carried on a single digital television channel. The same thing is true of digital HD Radio channels as well.

## Media Unification

We have charted the evolution of Radio and Television Broadcasting from the earliest days to the present time. We saw that initially Radio and TV employed quite different technologies although there was some general common ground in sound capture for example.

The evolution of Broadcast technology was inspired by and in turn inspired innovations in technology in the fields of Sound Recording and Motion Pictures.

With the coming of the miniaturization, computerization and digital media, the media industry technologies have unified tremendously over the past century.

Today, audio and video capture systems are nearly identical across the various media industries – motion pictures use the same technology as television and all media industries capture sound in the same ways. Storage is standardized on digital media and technologies that emerged from the information technology industry. Likewise distribution channels are shared with broadcasting, netcasting, and cablecasting differing only in the ways the signals are presented to listeners and viewers.