Analog Protection System

A Presentation to the Analog Reconversion Discussion Group

March 5, 2003
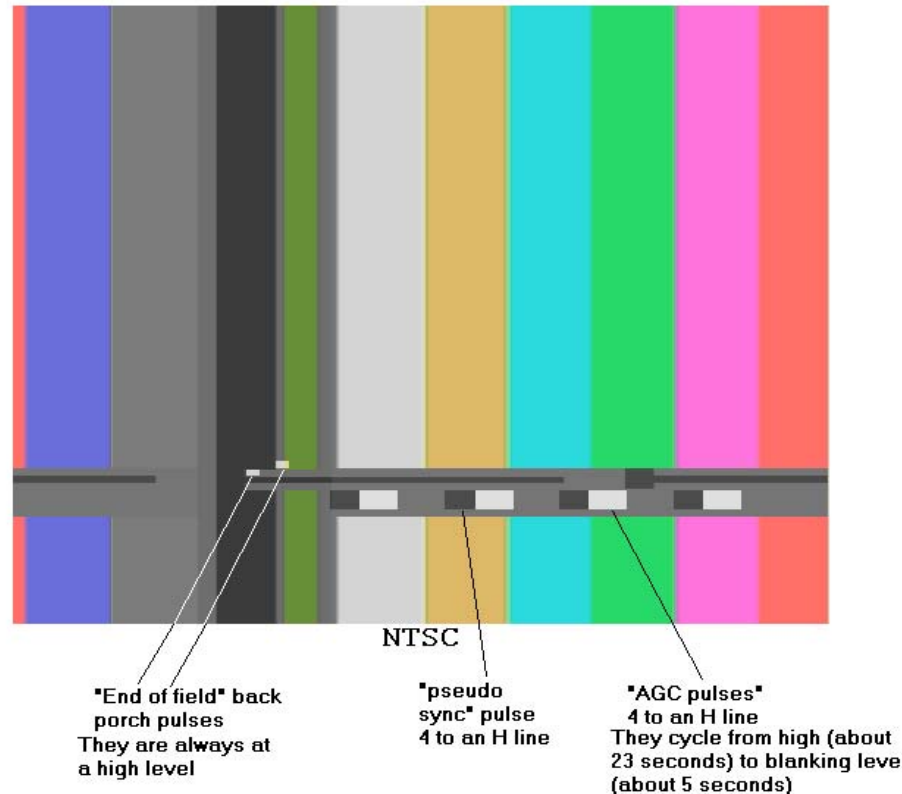
What is the Macrovision Analog Protection System?

➢ **A way of signaling that a video signal is protected**

  • **Allows restriction on copying and redistribution**

➢ **A method of forcing copies to be degraded or inhibited when copies are made of video signals containing the Macrovision signals**

  • **AGC (Automatic Gain Control) process**
  • **Color Stripe process**
    – **2-line Color Stripe**
    – **4-line Color Stripe**
  • **Controlled to provide:**
    – **AGC   [Trigger bits = 1]**
    – **AGC + 2-stripe [Trigger bits = 2]**
    – **AGC + 4-stripe [Trigger bits = 3]**
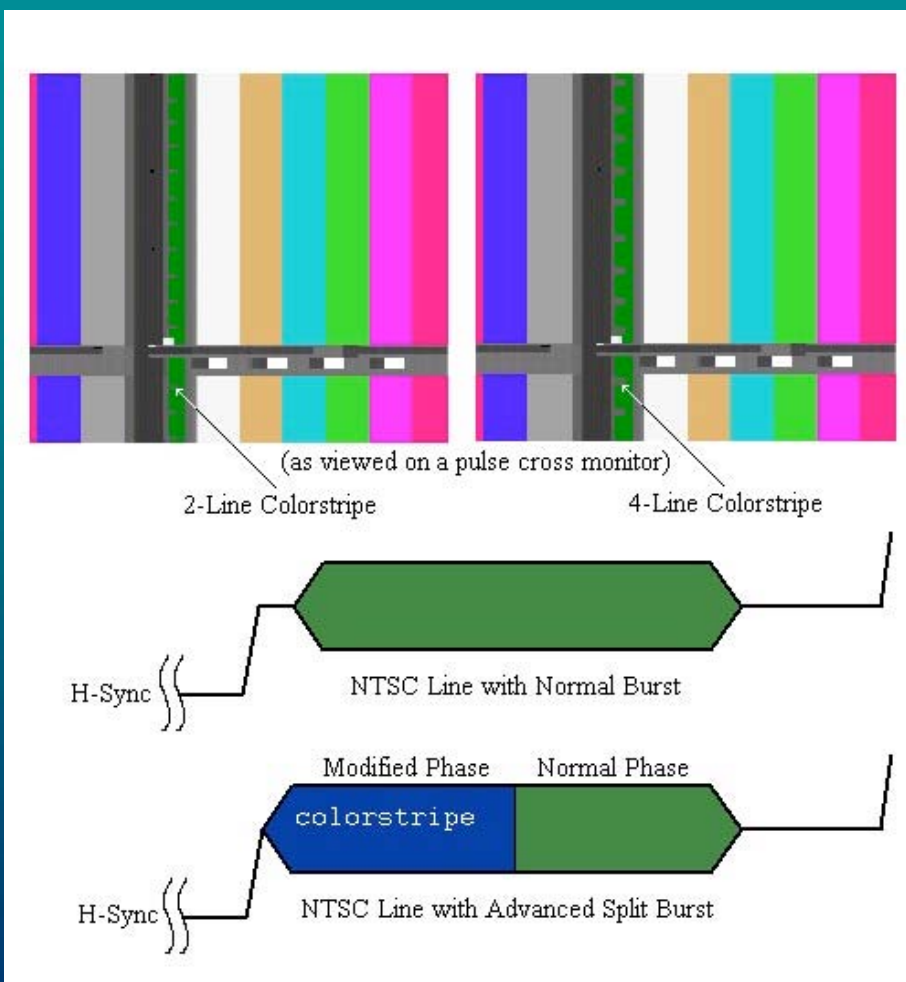
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How does AGC Work?

➢ **Pulses added to analog video signals designed to:**
- **Signal that a video work is copyrighted and shouldn't be copied**
  - **DV-CAM, consumer DVD recorders**
- **Negatively impact the AGC circuit of recording devices**

NTSC

"End of field" back porch pulses
They are always at a high level

"pseudo sync" pulse
4 to an H line

"AGC pulses"
4 to an H line
They cycle from high (about 23 seconds) to blanking level (about 5 seconds)

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How does ColorStripe Work?

➢ **Variations in the color subcarrier** of a composite analog video signal to disturb the sub-carrier circuit of analog VCRs

➢ **Not removed in black boxes**

(as viewed on a pulse cross monitor)

2-Line Colorstripe   4-Line Colorstripe

H-Sync   NTSC Line with Normal Burst

Modified Phase   Normal Phase

colorstripe

H-Sync   NTSC Line with Advanced Split Burst

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How is the Analog Protection System Activated?

➤ **Digital Devices**

  • Alterations to the analog video signal are made in a chip that converts the digital video to analog within a consumer's equipment

  • DVD Players

    – Trigger bits are added during DVD authoring to indicate that APS should be applied to DVD players analog outputs or consumer analog video outputs on a PC while playing back a protected DVD-Video disc.

  • Set Top Boxes

    – Trigger bits are incorporated into Conditional Access Entitlement Control Messages (ECM) in the stream delivered to a consumer's STB.

➤ **VHS**

  • Alterations to the analog video signal are added in a Macrovision-provided "processor box" used by duplicators.

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Why is Macrovision's APS Relevant to ARDG in Digital Devices?

- ➤ **Record Control**
  - **Inhibit** recording of video that is sourced from DVD, or STBs (effectively "**Copy Never**")
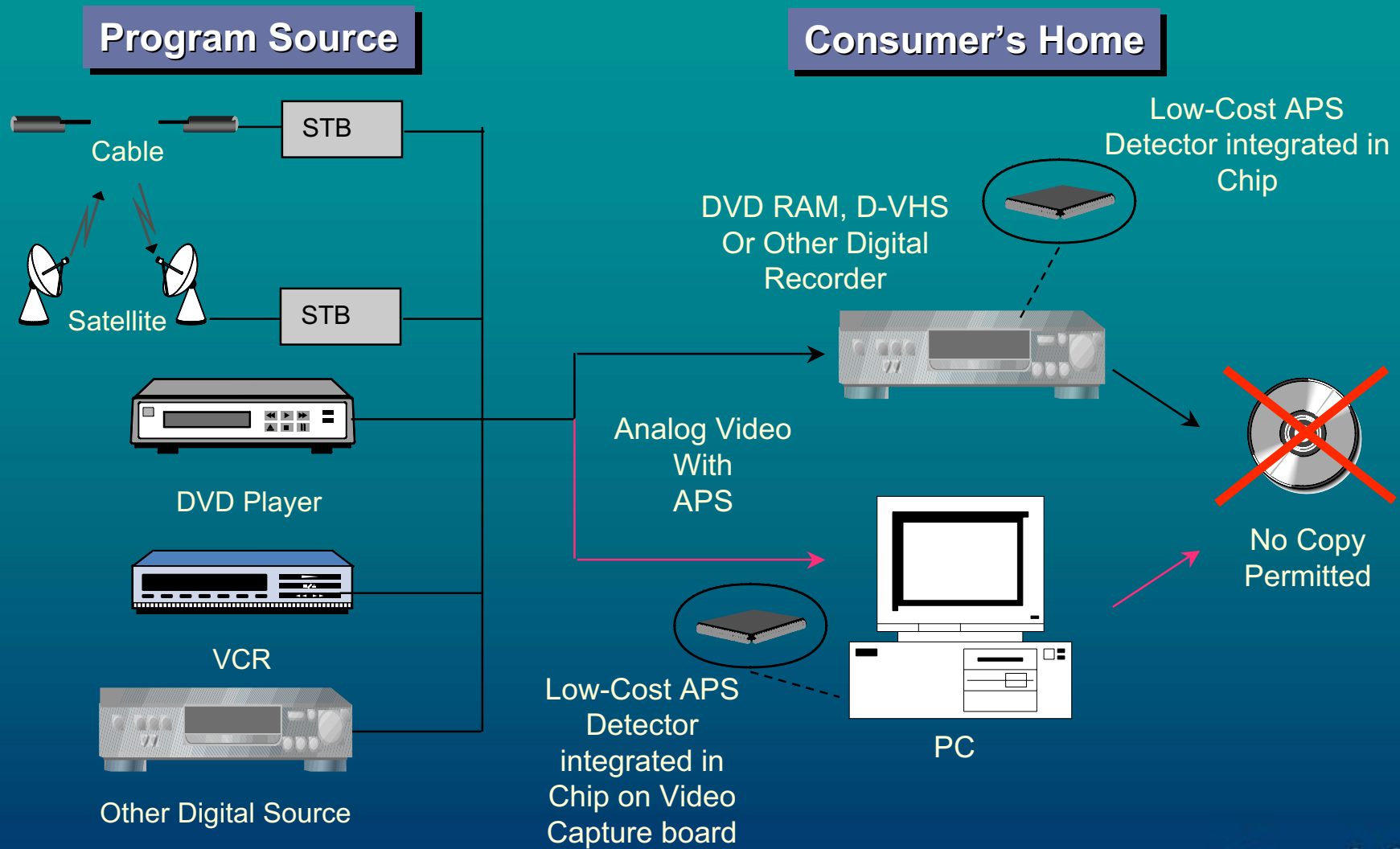
- ➤ **Re-encode of APS**
  - PVRs **detect** APS at input, calculate APS trigger bits, **and re-encode** on analog outputs
    - Maintains effectiveness in inhibiting copies to removable media.
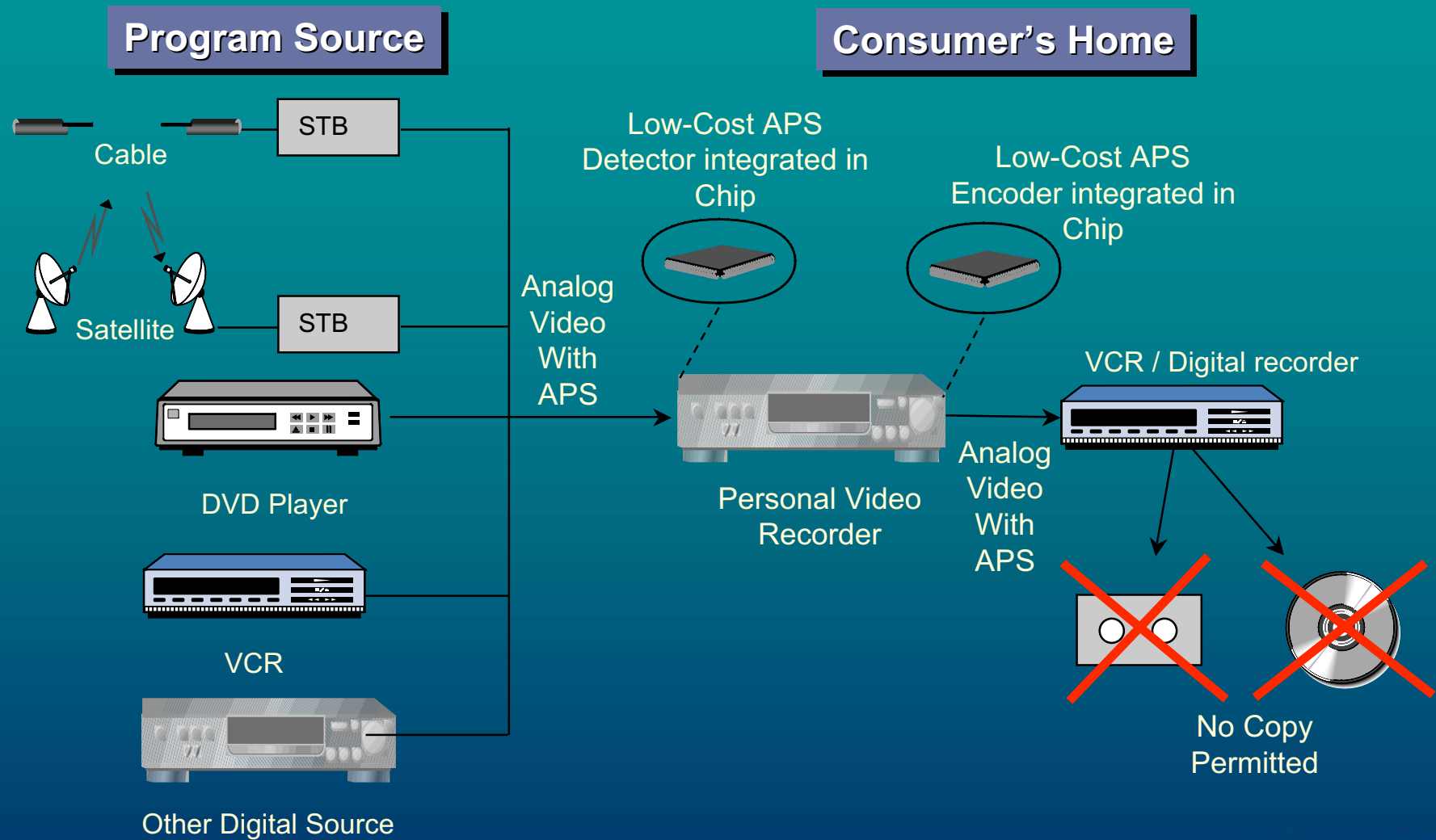   - Alternatively, some PVRs inhibit storage to hard disk

- ➤ **Redistribution Control**
  - Some PVRs **detect** APS at input **and restrict** release of content to unprotected network connections

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System Overview - Record Control with APS

Program Source

Cable

STB

Satellite

STB

DVD Player

VCR

Other Digital Source

Consumer's Home

Low-Cost APS Detector integrated in Chip

DVD RAM, D-VHS Or Other Digital Recorder

Analog Video With APS

No Copy Permitted

Low-Cost APS Detector integrated in Chip on Video Capture board

PC

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System Overview – Detect and Re-encode

Program Source

Consumer's Home

Cable

STB

Satellite

STB

DVD Player

VCR

Other Digital Source

Analog Video With APS

Low-Cost APS Detector integrated in Chip

Low-Cost APS Encoder integrated in Chip

Personal Video Recorder

Analog Video With APS

VCR / Digital recorder

No Copy Permitted

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System Overview - Redistribution Control
with APS

Cable

STB

Satellite

STB

DVD Player

VCR

Other Digital Source

Low-Cost APS Detector Integrated in Chip

Personal Digital Recorder

Analog Video With APS

Protected Digital Video

Low-Cost APS Detector Integrated in Chip

PC

Internet
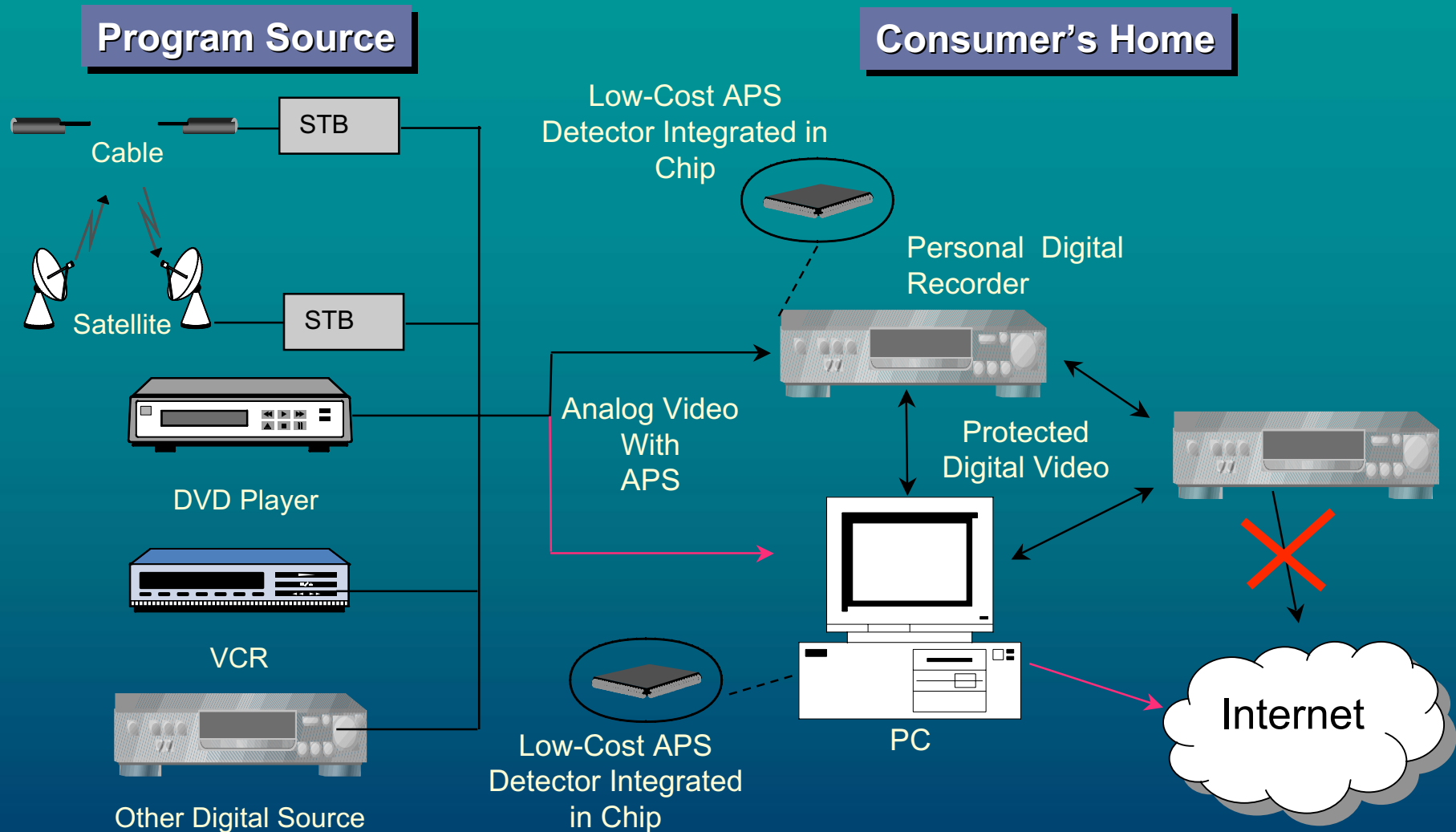
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Relationship between APS and Watermarking

- **Macrovision APS**
  - **Impacts recordings** made by variety of recorders
  - **Widely implemented**
  - **Circumvention easier** then with watermarking

- **Video Watermarking**
  - Provides for **"Copy One Generation"**
  - No effect on non-compliant devices
    - But survives transmission through non-compliant devices
  - Playback control **impacts** compliant **players** when copy made using non-compliant recorder
  - Additional layer of security when **deCSS** hack employed

- **APS & Watermarking are Complementary**
  - Impact different device populations
  - Feature set is different
  - As fundamentally different technologies, require distinct and different skills and tools to circumvent
    - Increases cost and complexity to circumvent both

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Conclusion

- ➢ **APS solves many ARDG problems**

- ➢ **APS has well established infrastructure**

  - • **Licenses**
  - • **Chips**
  - • **Authoring tools**
  - • **Transmission tools**
  - • **Technical support**

- ➢ **Only technology universally implemented today**

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