

***digital* HDTV Grand Alliance System**  
**Results of Laboratory Testing**  
at the  
**Advanced Television Test Center**

**Technical Subgroup/ACATS**  
**October 31, 1995**

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## **Tests Conducted at ATTC**

- **Transmission**
- **Objective**
- **Digital Specific (Henderson Task Force)**

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## **Transmission Tests**

- **Transient Peak/Average Power Ratio**
- **Susceptibility to Random Noise**
- **Susceptibility to Multipath**
  - **Random Noise in the Presence of Static Multipath**
  - **Co-Channel NTSC in the Presence of Static Multipath**
  - **Single and Multiple Multipath - Static & Dynamic**
- **Susceptibility to Interference (ATV/NTSC, NTSC/ATV, ATV/ATV)**
  - **Co-Channel**
  - **Upper-Adjacent Channel**
  - **Lower-Adjacent Channel**
  - **UHF Taboo Channels**
- **Susceptibility to Discrete Frequency Interference**

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## **Transmission Performance vs ACATS Targets**

- **Transmission system robustness met all 18 Targets - on average**
- **Interference into NTSC met 11 of 12 Targets - based on video**

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## Upper-Adjacent Channel ATV-into-NTSC Interference

- Appearance varied from set to set
- Color beat was dominant on some sets
  - Use of precision offset at appropriate carrier frequency can minimize visibility
- BTSC audio became impaired at lower interference level than video
  - Spectrum planning must be based upon audio impairment
- Wide spread among 24 TV sets for this non-linear mechanism
  - Planning should not be based upon median levels
- RF mask required to define transmitter output filtering requirements

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## **Objective Tests**

- **Image Resolution**
  - **Luminance and Chrominance**
  - **Static and Dynamic**
- **Dynamic Artifacts**
- **Transient Response**
  - **Luminance and Chrominance**
  - **Horizontal, Vertical, and Diagonal Step Response**
  - **Temporal Response**
- **Audio/Video/Captioning Latency**

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## **Objective Performance vs ACATS Targets**

- **1080I resolution matched or bettered 7 of 12 Targets**
- **720P resolution matched or bettered 9 of 12 Targets**
- **Latency met Target except for Video-Audio in 720P mode**

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## Resolution of the Digital HDTV Grand Alliance System

	Target Specification			Measured Value*		
	H	V	D	H	V	D
<b>1080 x 1920 Interlaced</b>						
Static Luminance (c/aph)	430	350	550	460	400	540
Static Chrominance (c/aph)	215	175	275	250	140	260
Dynamic 5 rpm, Luminance (c/aph)	345	195	395	500	200	540
Dynamic 5 rpm, Chrominance (c/aph)	170	95	195	135	100	135
<b>720 x 1280 Progressive</b>						
Static Luminance (c/aph)	290	325	435	320	275	400
Static Chrominance (c/aph)	145	160	215	180	180	230
Dynamic 5 rpm, Luminance (c/aph)	230	260	345	300	210	360
Dynamic 5 rpm, Chrominance (c/aph)	115	130	170	170	160	183

\*Circled values did not meet Target.

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## **Conclusions from Transmission & Objective Tests**

- **Robust transmission system**
- **Acceptable NTSC interference levels**
- **Improved interlaced-scan performance**
- **Much improved progressive-scan performance**
- **Objective and subjective tests correlate well**

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## **Tests Conducted by Task Force on Digital-Specific Tests**

- **Free-Form Viewing**
- **Scene Cuts & Video Coder Overload**
  - **Isolated**
  - **Non-Isolated**
- **Threshold Characteristics**
- **Random Noise**
  - **Video & Audio**
- **Impulse Noise**
- **Susceptibility to Random Noise in Video Source**
- **Motion Compensation Overload**
- **Time Varying Channel Impairments**
- **Film Mode**
- **Video Quality/Auxiliary Data Tradeoff**
- **Effects of Concatenation**
- **1035 to 1080 Transconverter Tests**
- **Long Form Viewing**
  - **Video, Film, Audio**
- **Live Camera Scenes**
- **Comparative Assessments of Unimpaired Image Quality**

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## **Summary of Digital-Specific Test Results**

- **Video quality clearly superior to that of any previous system.**
  - **True for still images, motion sequences, computer graphics, & film.**
- **Compression artifacts - quantization noise & blockiness - significantly lower than previous systems, visible only on most difficult images.**
  - **New images added. Many were more challenging for digital compression than first-round images.**
  - **Saturated reds showed more compression noise in 1080I than in 720P.**
  - **Source noise enhanced in 720P.**
- **Scene cut performance much improved.**
- **Interlaced and Progressive image quality quite comparable, unlike earlier systems.**
- **Video/Auxiliary Data Tradeoff: Some capacity for auxiliary data, but care required with complex motion/stressful video.**

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